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Citizens Radio Service (CB)

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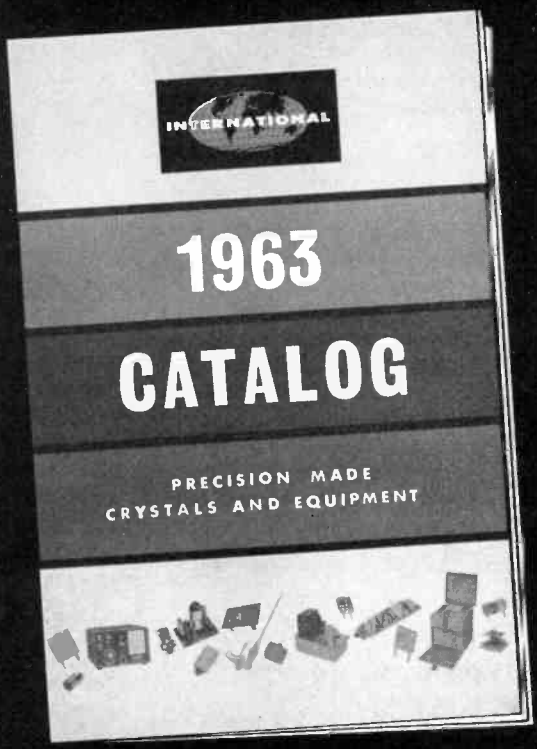

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POPULAR ELECTRONICS

COMMUNICATIONS 1963 HANDBOOK

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ROBERT E. TALL

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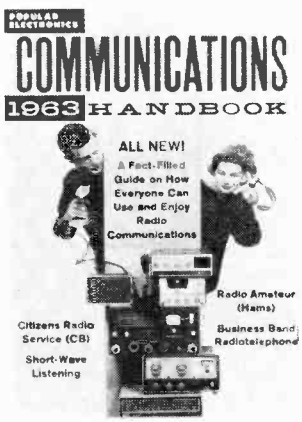

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CIRCLE NO. 9 ON READER SERVICE CARD

POPULAR ELECTRONICS

COMMUNICATIONS 1963 HANDBOOK

This fetching couple is just toying around with some equipment you might find in use at a CB, SWL, or ham radio station. From top to bottom: Knight-Kit C-22 CB transceiver; Hammarlund CB-23 transceiver; National's Model 140 combination SWL and ham short-wave receiver with speaker; Hallicrafters HT-40 ham radio transmitter; and a short-wave receiver kit—Model R-100—sold by Allied Radio.

Photo by Bruce Pendleton

23 crystal controlled channels with "spectramatic tuning"
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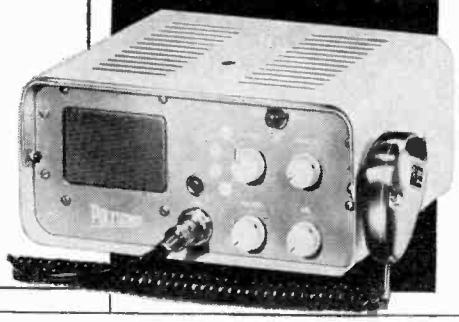

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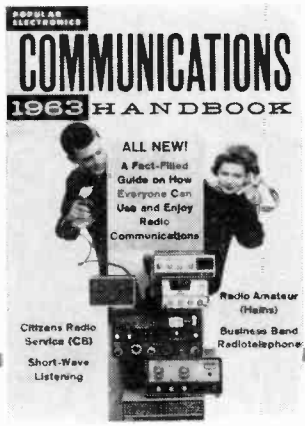
Foreword



THE word "communications" has many meanings for those interested in the world of electronics. On one hand, it might indicate a cold-war propaganda broadcast beamed from behind the Iron Curtain on the short waves. Or it could signify two radio "hams" thousands of miles apart exchanging technical information on the performance of a new antenna. It might mean a husband and wife discussing a food shopping list over the radio channels reserved for the Citizens Radio Service. Or, a dry cleaner could be checking on an urgent pickup via Business Radio.

Communications—or more specifically, radio communications—is in the midst of a period of explosive growth. There have been short-wave listeners for decades, but at no time in the brief history of radio has the desire to "communicate" been so prevalent. Radio amateurs, or hams, with their technical knowledge, have served this country well during three wars and provide a reservoir of ably qualified communications technicians. Citizens Radio, popularly called "CB," though less than five years old, has placed low-cost two-way radio communications at the disposal of hundreds of thousands of households. The Business Radio Service, a catch-all classification for businessmen who can use radiotelephony, has saved millions of dollars annually in gasoline, delivery truck wear and tear, etc.

This year several thousand short-wave listeners will become radio hams. An equal or greater number of CB'ers will also find hamming more to their liking. Some CB'ers will invest in business radio equipment to achieve much communications privacy. And while this is taking place, another half million will be sitting back and wondering if one or more of these four areas of radio communications deserve further investigation. It is to them that this, the 1963 Communications Handbook, has been dedicated.

Within these pages, four authorities in their respective fields have carefully spelled out the "basics" in CB, short-wave listening, ham radio, and the Business Radio Service. A course has been carefully charted through each chapter to enable the reader to get started and to keep going. Much of the information presented here has never appeared in print before, and even the old-timer will find this a worthwhile reference book.

Regardless of whether you are just looking and thinking about radio communications, or are deeply involved in it on a daily basis, we hope you enjoy the 1963 Communications Handbook.

OLIVER P. FERRELL

CITIZENS RADIO SERVICE

By MATT P. SPINELLO

18W4689

Telstar and Mariner II notwithstanding, probably the most exciting communications development in this decade has been personalized two-way radio for the average citizen—communications involving no great outlay of cash and virtually no technical "know-how."

As to how this new service came about, let's let Ivan H. Loucks, Chief, Amateur and Citizens Radio Division of the Federal Communications Commission, trace its development.

"The Federal Communications Commission was established by an Act of Congress, commonly known as the Communications Act of 1934. By that Act, the Commission is charged, among other things, with the administration of the radio spectrum so that its use will meet the criteria of public interest, convenience, and necessity. To accomplish this objective, the Commission has set up three categories of radio stations called 'services' which fall into three main groups.

"The first grouping is called the Broadcast Services and includes AM, FM, and TV broadcasting stations. The second grouping, called the Public Radio Service, includes stations operated by our communications common carriers to carry our domestic and international telephone and telegraph communications. The third grouping is called the Safety and Special Radio Services and includes nearly all the private and non-Federal Government use of radio, such as by taxicabs, police, firemen, truckers, amateur radio operators, and citizens in general.

"Each of the Safety and Special Radio Services was created by the Commission to fulfill a definite communication requirement.

For example, the Police Radio Service was created to provide communication facilities for use in the conduct of police functions, and the communications in that service are restricted to those necessary for that purpose.

"The Citizens Radio Service was intended to provide for necessary short-distance radio communications in connection with the business or personal activities of its respective licensees. While the permissible communications in the Citizens Radio Service are considerably broader in scope than in most of the other Safety and Special Radio Services, there was no intention to permit the operation of radio in this service solely for the amusement of the operator, or as a hobby in and of itself. Such communications or uses have been prohibited in the

Ivan H. Loucks is Chief of the Amateur and Citizens Radio Division of the Federal Communications Commission, Washington, D.C.

Citizens Radio Service as well as in all of the other Safety and Special Radio Services with the exception of the Amateur Radio Service where, of course, they have been provided for."

While the Amateur Radio Service has always managed to attract sizable numbers of technically minded men and women, personalized two-way radio communication received its biggest impetus with the establishment of the Citizens Band service. Evidently this was just what the public had been waiting for, because as soon as the service was authorized thousands upon thousands of license applications poured into Washington, and many thousands of dollars poured out of the pockets of would-be Citizens Banders into the coffers of CB equipment makers. Here was a communications system which the average person could handle and one which was priced within his range.

That there was a need for such a service cannot be denied and, despite several drawbacks, Citizens Band operation is growing in popularity by leaps ad bounds. Because there must be good reasons for such popularity, let's take a look at the Citizens Band today—its applications, the equipment, its strengths and its weaknesses, and its future.

● **What CB Radio Is.** In a large corner of the world of electronics, over a million Americans have become dependent upon one area of the communications spectrum. This dependency was created by a *need.*

You may not be aware that the rush order phoned in to the grocer arrived much sooner than usual because of his use of Citizens Band radio. The swiftness by which an ambulance was dispatched to the scene of a bad accident on a country road possibly was due to CB equipment. The lady across the street applauding the locksmith who arrived in a matter of minutes to liberate Junior from the bathroom may not have been aware that the expert had been dispatched by CB radio. The accomplishments of CB radio have been many, but its potentialities are unlimited, and within the reach of all.

An aggressor to this country might find chaos minimized a thousand-fold due to the communications networks already organized by CB clubs and volunteers. They are linked to such governmental agencies as civil defense, police, and sheriff's departments across the country. Hundreds of lives have already been saved due to quick-thinking CB operators and organized networks.

For the commercial CB user, the reasonable price range and easy licensing procedure open the door to less upkeep, more profit, and better service to the public. For the personal user, mobile CB establishes contact with home, camp site or boat, and is a tremendous safety feature to be added to camping, hiking, or hunting.

● **How It Began.** The Citizens Radio Service was set up on a regular basis in 1947 by the Federal Communications Commission, the governing body for all communications in the United States. At that time, operating frequencies were made available only in the 460-470 megacycle band in the ultra high frequency (UHF) region. However, the Citizens Band lay practically dormant and unrecognized for about eleven

For short-range communications (2-30 miles), nothing comes close to the low cost of Citizens Radio. This girl uses a Raytheon base station transceiver.

years—for two reasons. First, the equipment available was much too expensive, even for the established businessman. Secondly, the limited range dimmed the hopes of mobile-to-base communications, restricting contacts to "immediate area" use (½-2 miles).

In September, 1958, the FCC made 23 new frequencies available. These frequencies were in the former amateur radio 11-meter band and they opened the door for practical and reliable two-way radio communications. Attractively priced equipment, a range of from 2 to 30 miles, and permissible contacts with any other Citizens Radio station for the purpose of exchanging necessary and useful communications turned CB radio into a valuable communications tool for the professional man, small businessman, farmer, and the just-plain citizen.

The CB Picture

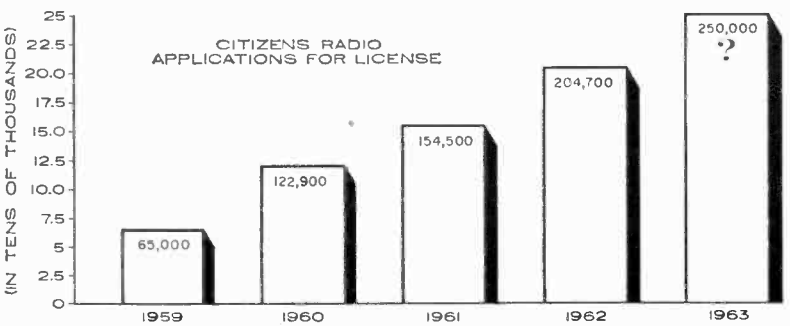
● **How It Grew.** In less than two years, CB license applications poured into Washington at the rate of 11,000 a month. By the end of the 1960 fiscal year, there were over 125,000 licenses. Of this total, more than 105,000 were in the Class D (for business or personal use) category. And by January, 1963, the number of CB licenses had mounted to 350,000.

This phenomenal growth in two-way radio licensing prompted electronic equipment manufacturers to jump on the Citizens Band wagon. By 1959, approximately ten manufacturers were producing CB units both in kit and assembled form; today nearly 100 models and types are offered. From pocket transceivers to kits that even Junior can assemble—to multi-channeled units as deluxe as the pocketbook will afford, there is a unit and accessories available to fill any requirement.

This then is the Citizens Band! Operated properly, it promises reliable, low-cost, two-way communications between you and your family, your business, boat, or camp site. It could save your life—you can count on it. Welcome to CB!

● **Rules and Regulations.** Before applying for a license in the Citizens Radio Service, you are required to read and understand the provisions of a current copy of the Federal Communications Commission's Part 19, the Citizens Radio Service Rules & Regulations. This volume may be purchased by sending $1.25 to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Since the FCC established the Citizens Radio Service to serve the public's "interest, convenience and necessity," Part 19 was



The growth of Citizens Radio is shown in this bar chart. Experts anticipate that over 250,000 license applications will be filed in 1963.

Classes of CB Licenses

devised to insure that every station would be operated in a manner which would maintain these principles. Part 19, divided into five subparts from sections 19.1 to 19.107, covers the service from top to bottom—from license application to antenna—in detail. The do's and don'ts of CB radio are explicitly outlined from the standpoint of the laws regarding the service, and will leave you well educated.*

● **Eligibility.** The FCC states that the Citizens Radio Service is intended for personal or business short-distance radio-communication, signaling, and radio control of objects or devices such as model airplanes. Any citizen of the United States who is 18 or more years of age (or 12 years for a Class C station) may obtain a station license in this service if his application meets the requirements of Part 19 (as revised) of the Commission's Rules governing the Citizens Radio Service. Partnerships, associations, trusts, or corporations meeting the citizenship requirements of the Communications Act of 1934, including any state, territorial, or local governmental entity, or any organization or association—including Civil Defense and Civil Air Patrol organizations—operating by authority of such governmental entities, may also be licensed in this service.

● **Shared Frequencies.** The frequencies available to stations in this service are shared among licensees. During periods of normal operation, there is no protection afforded to the communications of any station in this service from interference which might be caused by proper operation of other authorized Citizens Radio stations, or by stations in other radio services properly operating on the frequencies shared with the Citizens Radio Service.

● **Restrictions.** Citizens Radio stations may not be used for any purpose contrary to any law, or for broadcasting to the public in any way, or for unnecessary or frivolous communications. Also, they may not be used as links in the physical circuits of other radio services, although they may be used for the mechanical control or turning on and off of stations in other services.

No charge can be made for messages carried over CB stations, or for any other types of communications transmitted by such stations, or for the use of licensed equipment by persons other than the licensee. The licensee is responsible at all times for the operation of stations licensed to him.

● **Classes of Service.** Of the four classes of service available in the Citizens Radio Service, each is intended for a particular purpose and assigned an individual frequency band.

● **Class A.** This class is used almost exclusively by commercial operators. Unlike the Class D service, where there is a choice of 23 individual frequency channels, licensees under Class A operation are assigned specific frequencies. In this class 60 watts input to the transmitter is permissible, but suitable operating equipment is costly. For example, $600 for a Class A transceiver and $100 for a base station antenna are not uncommon prices. Emissions are limited to FM and AM radiotelephone, while tone signals may be used to establish contact. (This class of communications service is a close relative of Business Radio —which is discussed in the last section of this Handbook.)

● **Class B.** The growth of Class B was stunted practically from the beginning due to its ultra high frequency assignment. Operating at 465 megacycles, with 5 watts of power to the transmitter, stations in this class have extremely limited range.

● **Class C.** This is a special class for radio-control fans. Class C users share 27.255 mc. with Class D users, a situation which has caused confusion among many Class D licensees in the past. Thirty watts input to the transmitter is allowable on this frequency, but only for the purpose of radio-control operation by a Class C licensee. Although Class D licensees may use the same frequency for voice transmission, they are limited to 5 watts input—as they are on all other frequencies which come under their classification. However, due to the large number of Class C radio-control units on 27.255 mc., Class D voice communica-

*As this book goes to press, the FCC has proposed some modification of these Rules. The proposed changes would impose certain limitations on CB users that are not spelled out in Part 19. Read POPULAR ELECTRONICS for details.

tion is not recommended. Class C units may emit AM tone or off-on carriers for remote control; they may not transmit voice intelligence.

● **Class D.** The Class D service is intended for business or personal use. Moderately priced equipment is available, operable on 11 meters, with a choice of 23 separate channels—from 26.965 mc. to 27.255 mc. With 5 watts input as the maximum power allowable, stations under this classification have been known to communicate with their mobile units over distances of 2 to 30 miles. This range is largely dependent upon terrain, the type of equipment used, and antenna location. Mobile-to-mobile operation may vary from 2 to 8 miles; mobile-to-fixed-location from 5 to 15 miles; and fixed-location-to-fixed-location from 20 to 30 miles. Equipment under this classification may be operated on AM radiotelephone only. Tone signals may be used to establish contact.

● **The Class D Frequencies.** Any one of the available 23 frequencies may be used by a Class D licensee for transmitting or receiving. Each frequency is designated by a channel number. Citizens Band transceivers (transmitter-receiver combinations) are generally available with crystal sockets for one, three, five, twelve, and—recently—twenty-three individual crystals, one for each frequency.

● **Specific-Purpose Channels.** Since the advent of Class D CB, it has been the desire of many CB'ers to establish certain frequencies that would be monitored by all. After much haggling over a three-year period as to which channels should be used for what, several thousand licensees—along with many of the CB clubs across the country—agreed upon the following channels to be used for specific purposes:

Channel 7: General "inter-station" use
Channel 9: National Calling Channel for all stations; also the working channel for fishing and other commercial vessels
Channel 13: Non-commercial (pleasure) vessels
Channel 15: National transportation services; hotels, motels, service stations, restaurants, etc.
Channel 20: Boy Scouts of America
Channel 22: Civil Defense organizations

Channel Numbers

The benefits possible from this type of cooperation by Citizens Band users on a national basis are obvious. Where the "inter-station" channel might vary according to the amount of traffic in an area, monitoring each of the others where applicable definitely adds to the value of CB radio for individually and collectively operated systems alike.

Although the specific channels listed above are "unofficially" used and accepted by many licensees, their use is not compulsory. However, what more assurance could a person traveling cross-country need than the knowledge that someone nearby is monitoring channel 15 if he should need directions, a place to eat or sleep, or a couple of gallons of gasoline? What better peace of mind than the realization that a

CITIZENS BAND CHANNELS

Channel Number	Frequency (mc.)	Class
1	26.965	D
2	26.975	D
3	26.985	D
24	26.995	C
4	27.005	D
5	27.015	D
6	27.025	D
7	27.035	D
25	27.045	C
8	27.055	D
9	27.065	D
10	27.075	D
11	27.085	D
26	27.095	C
12	27.105	D
13	27.115	D
14	27.125	D
15	27.135	D
27	27.145	C
16	27.155	D
17	27.165	D
18	27.175	D
19	27.185	D
28	27.195	C
20	27.205	D
21	27.215	D
22	27.225	D
A	27.235	BRS*
B	27.245	BRS
23(C)	27.255	BRS, C, D
D	27.265	BRS
E	27.275	BRS

*Business Radio Service

flip of the transmitter switch on channel 9 could bring an ambulance, patrol car, or any other emergency vehicle, usually in a matter of minutes.

Thus, the advantages of Citizens Band Radio go far beyond the scope of business or personal use, as has been proven time and again by ailing CB-equipped vehicles many miles either side of a telephone!

● **Call-Signs.** Upon receipt of a Class D Citizens Band license from the Federal Communications Commission, a glance to the upper right-hand corner will meet with what might appear to be a strange grouping of letters and numbers. This will be your CB call-sign—or serial number—for the next five years, unless you move within that period. After a short time, this call will become as familiar to your 5-watt vocabulary as your phone number or address.

From September 1958 to December 1960, call-signs were assigned with different prefix numbers for each radio district of the country, as shown on our Call Area Map. These serial-number call-signs were made up of one or two digits and one or two letters, followed by a four-digit serial number (18W4689, midwestern Illinois; 2W1665, New York area, etc.).

● **"W"-Calls.** The "W" calls were intended to be issued through December, 1960. However, due to the jet-like speed with which citizens applied for licenses, several areas ran out of "W" calls before the end of 1960. These areas turned to "A" calls, until the Federal Communications Commission put a new "Q" system into effect on January 1, 1961. The "Q" calls were to be assigned until the end of 1961, when "R" calls would be assigned for 1962, "S" calls for 1963, and so on, until "W" was reached again in 1967.

Unfortunately these serial-number call-signs bore no resemblance to call-signs issued in accordance with international radio agreement. For this reason, the FCC decided to take all future CB station serial numbers from the international call-sign series available for assignment to stations in the United States. However, stations already licensed were to continue using the call-signs they had been issued, until their licenses expired.

● **"K"-Calls.** As of July 1, 1961, for Class A stations, and as of January 1, 1962, for Class B, C and D stations, the call-signs assigned to stations licensed in the Citizens Radio Service were to consist of three letters followed by four digits and, as before, the digits were to be assigned in numerical order from 0001 to 9999, (KCB1122 and KJA1234, for example).

The first letter of each prefix in the new call-sign (the letter "K") thus indicated a U. S. licensed station. The next two letters have various uses for FCC record and enforcement purposes.

Serial numbers beginning with KAA through KAF were to be assigned in sequence to Class A stations and might be reassigned to the same stations indefinitely, upon proper application for renewal or modification. Such continuity, however, was not possible in the case of Class B, C, or D stations, where the large number of applications and licenses forced the Commission to adopt streamlined administrative procedures in order to handle the workload. This meant that modified, reinstated, or renewed Class B, C, or D licenses would each carry a *new* call-sign. The call previously issued would be superseded and could no longer be used to identify the station.

As of 1962, all new Class B station licenses were issued a KAG prefix; all Class C licenses, the prefix KAH; and Class D station licenses in the various FCC Radio Districts, the prefixes KBA through KJE. Call-fusing? Don't panic! Applying for a Class D license now will get you a "K-call," even though you may still hear other parts of the alphabet on the air for the next few years.

● **Interference.** Citizens Band users must expect and tolerate interference not only from other legally operating Citizens Radio stations but sometimes from stations legally operating in other radio services. Licensees of Class A stations must apply for a new authorization before shifting frequencies to avoid interference; licensees of Class B, C, or D stations may shift to any of the frequencies available to stations in their respective classes without further authorization. (See page 12 for information on the various classes of stations.)

● **Application Form.** In order to maintain a Citizens Band communications system for business or personal use, a station license must be obtained from the Federal Com-

munications Commission at Washington, D.C. Form 505 "April, 1962," or "October, 1962," (see "The CB License" below) is used to apply for a new, renewed, or modified license.*

Form 505 must also be used for a change of address, or for a change in the number of transmitters or any other information shown on the license, or for authority to transfer control of the licensee corporation. If a license is lost, a duplicate may be obtained by applying for it on FCC Form 505, with a statement as to how the original was lost.

● **The CB License.** Unlike an Amateur Radio license which requires that technical theory and mastery of Morse code be digested by the applicant, a Citizens Band license requires only that an eligible applicant be 18 years old or older and have a valid reason for using the CB channels. A recent revision of the license application has eliminated the previous notarization requirement.

Most manufacturers pack license application Form 505 with their CB equipment, and while many of the old forms—dated September 1958—may still be in circulation, they must not be used to apply for any Citizens Radio Service license. This form is obsolete! You may be sure you are applying on the correct form by looking in the upper left-hand corner of the application. The new form can only be used by applicants for Class B, C, and D stations; Class A applicants must now use FCC Form 400.

*A new Form 505 will be used after July 1, 1963. It will be simplified for electronic data processing. Copies were not available at printing.

Call area subdivisions of the General Radio Service of Canada and the Citizens Radio Service in the U.S.A. The slanted letters in the U.S. areas are prefixes to be issued by the FCC throughout 1963; the straight letters are prefixes issued during 1962. The numerals pertain to the system of call-sign assignments made in the very early days (1959) of the Citizens Radio Service.

License Form

● **Filling Out Form 505.** Applications for the Class D Citizens Band license outnumber all other requests. Therefore, a step-by-step procedure is given below to help the typical would-be "individual" CB'er fill out the application. The item numbers match those on the new Form 505 and the work sheet that comes with it. When you receive your application material, rip off the work sheet and fill it out as indicated here, using a pencil so that possible mistakes can be easily erased.

ITEM 1. Put an "X" in Box D.

ITEM 2. Write in the number of transmitters you plan to operate within the next five years under this license.

ITEM 3a. Write in your full legal name. Married women should write their own names (i.e., Jane Jones, not Mrs. John Jones).

ITEM 3b. Insert your permanent address in this box. If you would like to have your license mailed to some other place, turn the work sheet over and in the large box entitled "Remarks and Additional Data" insert the mailing instructions—giving complete details.

ITEM 4. Mark the box labeled "Individual."

ITEM 5a. In almost all cases, you will either own or plan to purchase transceivers; if this is so, mark the box labeled "Yes."

ITEM 5b. Since you have answered *Item 5a* with a "Yes," skip this item.

ITEM 6. Insert the county and state for the address given in *Item 3b* in the appropriate boxes. If you are in doubt as to the county in which you live, a phone call to any local or state government office will get you the information.

ITEM 7. In this item, the FCC wants you to state that you have read and understood the FCC rules* governing the station you want to operate, that you intend to operate your station according to these rules, and that you will control your station yourself at all times. So, the answers to *Item 7a, b,* and *c,* should be "Yes," "Yes," and "No," in the order given.

ITEM 8. If you have never been convicted of a crime for which you were fined $500 or more or were sentenced to six months or more in jail, put an "X" in the box labeled "No."

ITEM 9. If you now have a Class D station license, you are required to give the call-sign and state why you are filling out this form. You might be filing the application "to change permanent address," or "to add new mobile units," or for just about any other reason that would make the statements on your original application no longer true. New applicants or holders of expired Citizens Band licenses can just write "Not applicable."

ITEM 10. Most CB'ers buy equipment approved by the FCC for Class D operation; if such is the case with you, just forget about this item.

● **Finishing Up.** Now the work sheet is almost complete. All that remains for you to do is read the statements under "I CERTIFY THAT:" near the bottom of the sheet, sign the work sheet, and insert the date on the line indicated by the arrow. Your signature should agree with the name given in *Item 3a*; no other signatures are needed for "individual" applications. Then mark the box labeled "INDIVIDUAL APPLICANT" under your signature.

When you fill out the actual application, use a *typewriter.* Carefully copy everything from your work sheet onto the application, sign it, go over it to be sure that you have made no mistakes, and mail it to the FCC. Address the envelope: "Federal Communications Commission, Gettysburg, Pa." DON'T detach the carbon paper from the copies of the form—the FCC still has a use for it in processing your application.

Some CB old-timers may say, "It's just too simple to be true," and "Don't you have to tell them *why* you want a CB license?" One of the reasons for creating the new Form 505 was to reduce the complexity of the application.

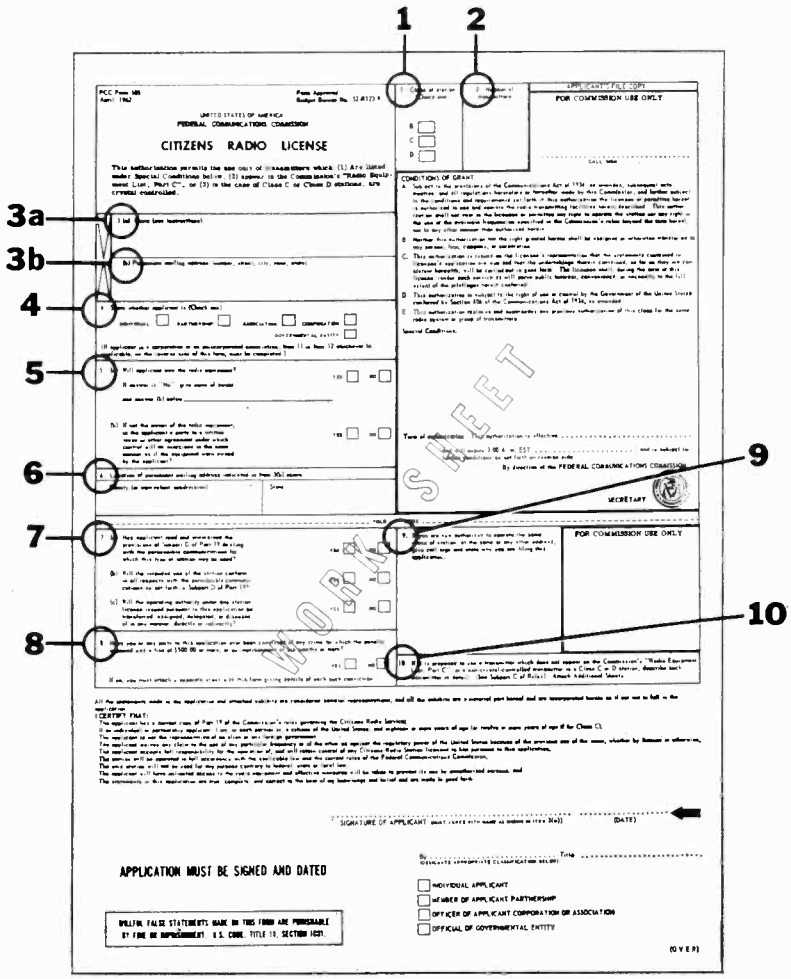
● **Instruction Sheet.** The FCC supplies an instruction sheet with each Form 505 which covers all possible contingencies that may come up. Read the instruction sheet very carefully, and fill out the work sheet as it tells you to. If you have any questions, phone the nearest FCC field office (see p. 100, bottom). And if it is just over your head, see your lawyer—especially if

*Remember that you are required to read and understand the provisions of a current copy of Part 19, the Citizens Radio Service Rules. This is in Volume VI, FCC Rules and Regulations. To purchase Volume VI, send $1.25 to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

you represent a company or corporation that wants to use CB radio.

● **Warning.** Many CB'ers, tired of waiting for their licenses to arrive, but with their equipment completely installed, are tempted to take to the air with fictitious call-signs, and in some cases a mere "Phil calling Harry"! Beware—uncle has a headset, an excellent receiver, and many ears on all 23 channels. Uncle Sam, that is! Being caught at this practice could result in loss of license, fine, imprisonment, or all three, depending on the offense!

Remember, have a copy of Part 19, FCC Rules & Regulations in your possession, read it, and make sure that you understand it, *before* you apply for your license. When your license arrives, post it near your base station where it may be examined by the proper authorities if the occasion should ever arise. FCC Form 452-C (Transmitter Identification Card—see illustration on next page) or a photocopy of your license should be attached to each mobile unit you will be using under your call-sign. These forms are included with many units manufactured today. And additional forms are available from any FCC office.



This is a copy of the CB license application Form 505 which must be filled out completely and mailed to the Federal Communications Commission, Gettysburg, Pa. Make sure that the form is dated "April, 1962," or "October, 1962." DO NOT USE any other form.

Buying Equipment

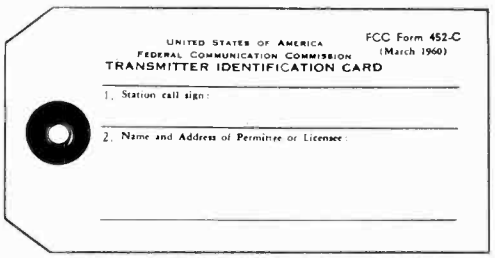
● **Which Transceiver Shall I Choose?** Buying the proper CB equipment for its intended use naturally has its rewards. Stepping off on the wrong foot can be costly to your pocketbook and may even nullify the purpose for which the service was instituted.

First, it should be unnecessary for a licensee to purchase CB equipment that will transmit messages on all 23 channels if, for instance, the equipment is to be used on a limited basis within the boundaries of a factory encompassing only a square block. This type of coverage might easily be handled by a transceiver employing just one crystal in its transmitter, with an antenna that would only permit short-range communications—thus eliminating long-distance interference from other CB units.

However, a one-crystal transmitter would be very ineffective to the CB'er expecting to keep in touch with the office while ten miles away from the base station in the mobile, especially in heavily CB-populated areas. The same would hold true for a boat-to-beach operation, or any communications system where distance and possible channel interference are involved.

Although it is not necessary to have any technical knowledge or to be able to define such terms as "superregenerative" or "Ohm's law," a familiarity with what different types of equipment are designed to do will aid you in the correct choice of equipment, proper operation of the equipment, and in getting the utmost service from both the equipment and the Citizens Band.

There are many factors to be considered when buying a transceiver. A wise move would be to examine the specifications in the CB Equipment Guide & Directory*, then decide which type of CB gear you can afford that will do the job for the intended operation.


UNITED STATES OF AMERICA
FEDERAL COMMUNICATION COMMISSION
FCC Form 452-C
(March 1960)
TRANSMITTER IDENTIFICATION CARD
1. Station call sign:
2. Name and Address of Permittee or Licensee:

This identification tag should be attached to each CB transceiver. Patterned after FCC Form 452-C, it is supplied by manufacturers with their equipment.

The evolution of CB transceivers is shown by two Knight-Kits (Allied Radio) introduced in 1960 and 1963. Top: the newest kit has double-conversion receiver, multiple channels, maximum utility power supply. Bottom: the older kit, with poor selectivity receiver and only one crystal-controlled channel.

● **Transmitter Section.** All transmitters for the Class D service must meet certain technical requirements. These include a maximum input power of five watts to the plate of the final r.f. amplifier stage and an operating frequency tolerance of .005%. Since this type of protection is afforded by FCC regulation, you can turn to such considerations as practicality of operation.

Does the unit have available 1, 2, 3, 5, or more channels for transmitting? How many will you require? Is the transmitter rated at five watts input with a maximum of 100% modulation to assure you of the most transmitting power allowable by the FCC?

The transmitter section of a CB transceiver consists of an r. f. oscillator and r. f. amplifier. It utilizes the power supply and audio system of the receiver section. Because of this simplicity in transmitter cir-

*Published annually as part of the August issue of POPULAR ELECTRONICS.

cuitry, many CB transmitters are similar in design.

While it would seem most important and desirable to get every milliwatt of power possible out of the limited 5-watt maximum input awarded Class D CB transmitters, greater emphasis should actually be placed upon the effectiveness of the receiver section of the unit.

● **Receiver Section.** How well signals from low-power transmitters are received—and the range over which they can be received—depends on the receiver's sensitivity and ability to receive a signal satisfactorily through interference. Superregenerative receivers have poor selectivity compared with superheterodyne types. Dual-conversion superheterodyne circuitry is now considered the ideal combination.

While some CB units do not use an r.f. amplifier in the receiver section, its absence would leave your receiver totally unable to amplify weak signals. A good indication of how sensitive a receiver in question might be can be determined by the number of tuned circuits between the antenna and first detector.

An equally important section of a CB receiver is its intermediate-frequency amplifier. It also helps determine the selectivity of the receiver, and generally the selectivity of a single-conversion receiver will not be adequate without at least two i.f. stages.

A "squelch" circuit will completely silence the receiver, eliminating background noise when the tuned channel on the set is not in use. It will permit audio to cut through only when the received signal exceeds a preset level, such as a call being transmitted on the tuned channel.

Since many CB installations are mobile, a noise-limiting circuit will help to minimize ignition and electrical interference, a common trouble-maker on the 11-meter, 27-mc. band.

What about tuning? Will you want to be able to tune all 23 receiving channels, or just those channels on which you intend to operate through crystal-control selection? Or will you have a need or a desire to switch from crystal-control tuning to all-channel tuning? Any of these combinations are available in most CB transceivers. The choice will be yours.

● **Power Supply.** There are three common power supplies available for CB equipment—for operation on 6 volts d.c., 12 volts d.c., and 117 volts a.c. While some units will operate on a single source, others are combined for 6 volts d.c./117 volts a.c., or 12 volts d.c./117 volts a.c. operation. The ideal—and most versatile—arrangement is the universal three-way power supply which will operate the equipment on any of the three voltages that may be needed.

Before purchasing your CB transceiver, check your needs against the features above. Investigate the construction of the unit. Will it take whatever minimal abuse may be necessary through mobile use? Will it fit well in appearance with its surroundings in your home, car, or business vehicle? Finally, will the equipment do the job?

● **Base Station Antennas.** The antenna for your CB base station will generally fall within one of the four following categories: ground plane; coaxial; beam; and hybrid. Your choice of antenna will to some extent determine the range of your signal.

Mayor Orville Slutzky, Hunter, N.Y., packs along his 5-watt Cadre CB transceiver, which weighs less than 8 pounds. Because of its high power—compared to that of the small hand-held transceivers—Mayor Slutzky can stay in contact with his office, or his home, at a distance of up to about 20 miles.

Base Station Antennas

Obviously, it is advantageous to mount any antenna as high as the Part 19 Regulations allow. Also, the antenna should be mounted well in the clear and as far away from buildings, trees, chimneys, and other obstructions as is practical. Not only will a nearby obstruction detune your antenna, but it may also "shadow" your signal so that coverage in the direction of the obstruction is forfeited.

All antennas used in the CB service should be fed by the best possible grade of coaxial cable. Generally speaking, carefully follow the installation instructions and the antenna manufacturer's suggestions as to coaxial cables when you install your antenna. Keep the run of the coaxial cable as short as possible.

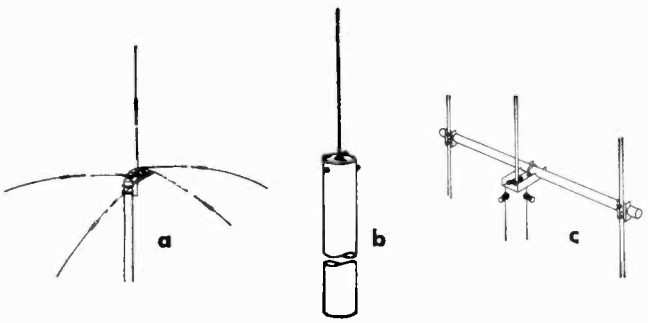
Many well-equipped CB operators count on using special test equipment to get an idea of how well the CB antenna is "matched" to the transceiver. Matching techniques have been covered in detail in POPULAR ELECTRONICS.

● **The Ground Plane Antenna.** The antenna most commonly used by CB'ers is the vertical ground plane. It consists of a 108″ vertical radiator mounted and insulated from a "plane" of three or four similar-length rods. This antenna is easy to assemble and install. However, it requires considerable free space so that the horizontal rods will not touch or intersect a nearby obstruction.

A variation of the basic ground plane antenna is to mount additional ground plane radials nine feet below the base of the vertical radiator. This additional "skirt" improves the radiation characteristics of the ground plane antenna, but at the same time greatly increases the necessary "air space" required to keep everything "in the clear."

● **Coaxial CB Antennas.** If, instead of arranging the ground plane elements as mentioned above, you bent them down so that they "wrapped around" the coaxial feed line, you would have a reasonable facsimile of the coaxial antenna.

Consisting of two vertical 108″ elements, the coaxial antenna is ideally suited for use at a CB base station. It usually consists of a vertical radiator whose base is separated and insulated from an aluminum skirt about 2″ in diameter and 108″ long. The skirt is connected to the braid shield on the coaxial cable feed line, while the center conductor of the coaxial cable goes directly to the vertical radiator. This arrangement insures that the antenna is well matched to the feed line and that the losses between the coaxial line and coaxial antenna are minimized.



The ground plane (A) is probably the most common CB base station antenna. Consisting of a vertical radiator and four horizontal elements, it is easy to assemble and requires no tuning adjustments. A coaxial antenna (B) is also easy to assemble and has the advantage of not requiring the horizontal elements of a ground plane. The 3-element beam (C) is directional; unless you want to work only in one direction, it must be rotated.

The only disadvantage of the coaxial antenna is that it requires a heavy-duty supporting pole inside of the 2″-diameter skirt. This supporting pole must keep both the skirt and vertical radiator in the clear and away from all obstructions.

● **Beam Antennas.** Citizens Banders usually employ vertical antennas because they permit omni-directional radiation; that is, the signal will be of equal strength in every direction of the compass around the antenna. If special elements are placed at critical distances from the vertical antenna, however, the radiation can be "beamed."

The most common CB beam antenna consists of three elements, including the radiator. One of the other elements is a reflector and acts to increase the signal strength in

the direction away from the reflector. On the same vertical plane as the reflector, but at another critical distance, is a "director." This third element will "lead" or "pull" the radiation in the favored direction.

A three-element CB beam antenna is quite bulky and must be mounted so that it can be rotated—if CB signals are to be aimed in all directions of the compass. The usual three-element beam will give a power gain equivalent to five times that of the ordinary ground plane or coaxial antenna.

Where CB communications are to be established between two fixed points, the beam antenna is of great advantage.

● **Hybrid Antennas.** Due to the height limitation on CB antennas imposed by Part 19, a number of antenna manufacturers have developed vertical radiators that have some power gain but also radiate an omnidirectional pattern. These antennas are generally more expensive than either the simple ground plane or coaxial antenna, but they do have the obvious advantage of increasing the power of the radiated signal without the necessity of rotating the immense structure of a beam antenna.

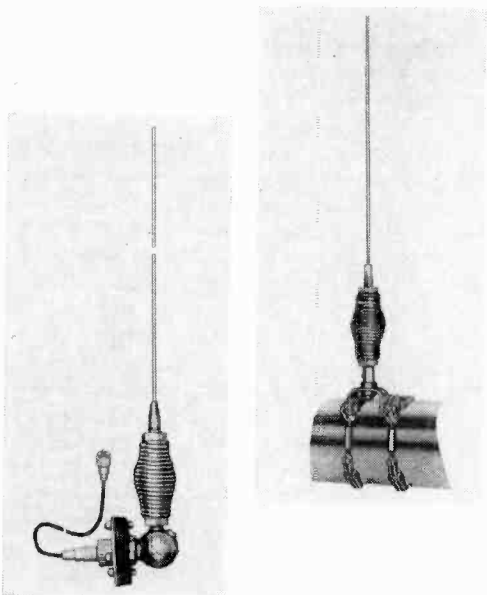
At this writing, the most popular antennas of this particular nature are the "Magnum-27" manufactured by Antenna Specialists, and the CLR Colinear Ground Plane and "Verti-pole," both manufactured by Hy-Gain. The "Magnum-27" and the Colinear Ground Plane each have a claimed power gain of between four and five times; the "Verti-pole" will just about double the effective radiated power. All three are easy to mount and are rapidly replacing the ground plane and coaxial antennas in metropolitan areas for CB base stations.

● **Mobile Antennas.** As with base station antennas, there are a variety of mobile antennas, although the most popular is undoubtedly the 102″ whip antenna. The whip is made from either stainless steel or a special wire-encased fiber glass section. A whip of this length needs a standard spring-and-base mount and is usually located on the body or rear bumper of a car.

Short-length fiber glass antennas are also available for cowl mounting. These antennas are specially wound of insulated wire so that the resonance point is in the 27-mc. Citizens Band.

You should also investigate the possibility of using diplexers, which enable the CB'er to utilize one antenna for both 27-mc. operation and AM broadcast reception. Diplexers are most suitable for use with antennas that are cowl-mounted.

Mobile antennas suffer from the effects of the metal automobile body. An antenna mounted on the right rear bumper tends to propagate its strongest signal diagonally across the car and out toward the left front fender. The same effect applies if the antenna is mounted on the left rear bumper, although the maximum radiation would be out across the right front fender.



Mobile whip antennas should be spring-mounted to protect both car and antenna. Two methods of attaching base springs are shown here. The mount at left requires a hole in the body of the car. At right is a chain support wrapped around the bumper.

The best antenna installation for mobile CB would be to mount the antenna on top of the car body or roof. This is reasonably unattractive and difficult if a full-length 108″ radiator is to be used, but at this writing a number of manufacturers are investigating the possibility of shortened antennas for rooftop mounting.

● **Installation Practices.** Installing your CB equipment in the home or office, in a truck or auto, or even in a cabin cruiser,

demands *no* technical knowledge. But the fixed, or base, station (i.e., the one in the home or office) will require the least amount of installation time. The reason: mobile rigs (i.e., those in cars, boats, etc.) must be mounted much more securely—and usually in closer quarters.

● **Base Station Installation.** Ideally, a fixed station may be placed atop a table, desk, kitchen counter, or the like—the compact size of most CB transceivers affords the user many choices of location. Manufacturers have purposely taken into consideration the size, shape, and finish of CB equipment—it is intended to serve its purpose visually as well as functionally in any area, from the garage to the living room.

If the fixed station's antenna lead-in will be fed through a window, try to locate the transceiver between the window and the nearest a.c. outlet. If running the lead-in to the unit will entail drilling through a wall, be *sure* to choose a location close to an a.c. outlet. In this case, it is important to remember that a tubular insulator (usually ceramic and available at most electronic distributors), should be used at the wall. Any space left after insertion of the lead-in cable should be filled in with sealing or caulking compound.

Unless the transceiver is fully transistorized, care should be taken to avoid blocking its ventilation holes. Heat from the unit must be allowed to dissipate, since excessive amounts of heat can be damaging to components. In applications where ventilation will not be a problem, equipment can be flush-mounted within the confines of a cupboard or desk.

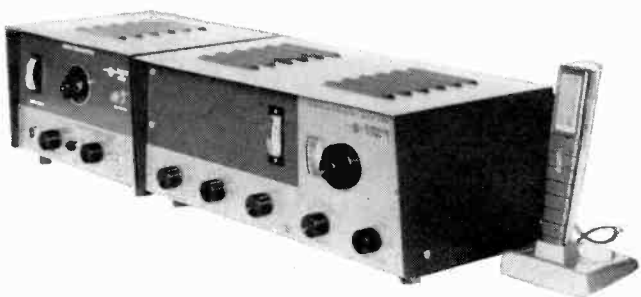
● **Grounding.** Besides grounding the outdoor antenna mast, it is a good idea to be sure the transceiver itself is grounded. This will not only contribute to personal safety, but may well save your transceiver if lightning should strike your antenna. Also, although it may not add anything measurably to your signal, it could aid considerably in noise reduction. While the shield of the coaxial cable from the antenna is grounded to the set chassis, the unit itself should be grounded from the ground terminals on the rear of the chassis to a nearby water pipe or ground rod driven into the earth at least three feet deep.

In addition, the antenna mast or support can be connected to ground by #10 or larger copper wire. In feeding either of these ground wires to a cold water pipe or ground rod, clamps (of the type used by telephone installers) should be employed to assure positive contact between the wire and the grounding rod or pipe.

Manufacturers' instruction sheets supplied with most equipment will usually spell out the answers to any questions regarding how and where the equipment should be grounded.

● **Mobile Installations.** The most practical of all vehicular installations is under the dash, usually as close to the driver as possible. But care should be taken to keep both the unit and the mike cable clear of the right foot's path to the brake and gas pedal.

Center-mounting the CB transceiver under the dash works out to best advantage in most cases. Controls can be seen by both



Two extremes in base stations: a Heathkit GW-12A (above) having only one crystal-controlled transmit and receive channel; and a Browning base station (right) featuring a separate 23-channel transmitter and fully tunable receiver with all the trimmings.

the driver and passenger, and may be operated by either from where they are seated. Some units have been mounted on top of the dash, but only where the shape of the transceiver will not impair vision. Mounting the unit on the rear deck has worked out to be a more practical arrangement in many truck installations due to the short distance from the seat to the fire wall, and the almost non-existent dashboard.

Most CB transceivers come packaged with mounting brackets for mobile installation, but in some cases you will have to purchase them (for a nominal sum). Some makes have the bracket already attached to the unit. In the under-the-unit position, the bracket acts as a pair of feet to tilt the unit upward; in the middle position, it becomes a handle by which to carry the equipment; moved to the top, it's ready for mobile mounting.

If the glove compartment is centrally located, there is a chance that the holes in the mounting bracket will match those already used to hold the compartment door-hinge in place. In many cases, the same screws will hold the bracket and the compartment door; if not, holes can be easily drilled under the dash to hold the bracket separately.

● **Power Connections.** Once the transceiver is mounted, power may be supplied to it in several ways—some good—others better! Almost all CB transceivers are supplied with two power cords, one for the a.c. hookup at a fixed station, the other for d.c. connection in a vehicular installation. This means that the equipment has been built to be used with either source of power, and is switched from one to the other by plugging in the appropriate plug on the rear of the unit and connecting it to the proper source of power. While manufacturers' instructions usually lend a hand in this department also, let's take a quick rundown of the three most common types of connections in the mobile installation.

(1) Some CB transceivers are supplied with a "d.c." cable that has a cigarette lighter receptacle plug at one end—the same type that you find attached to auto trouble-shooter lights, electric shaver battery packs, etc. This method of powering a CB rig is generally accepted for temporary installations only, for the following reasons: There can be a noticeable loss in power and signal strength, both at the transmitting and receiving level since the wires from the receptacle to the battery are not heavy enough to supply full power to the CB equipment. Loss of power may also occur at the plug within the receptacle since it is not a solid connection, and vehicle movement will make it even less so. Finally, power is always supplied to the cigarette lighter receptacle, which could result in a dead battery within a few hours if the rig were accidentally left on.

(2) Connecting the "hot" (usually red) lead to the ignition switch in the vehicle, with the ground (often black) lead to a good firm body connection will assure the operator of killing all power to the equipment each time he turns off his motor and removes his keys. However, this type of

This mobile installation using a Globe Star transceiver is located in a 1963 Dodge "Power Wagon." It is being used by Charles Kiefer for a special test run from Palm Springs, California, to Mexico City.

Boat Installations

connection will also produce some loss due to the smaller cable and the extra connection involved between the unit and the battery.

(3) Running the d.c. power cable supplied with the transceiver directly to the battery terminals promises best possible performance of the three examples mentioned here. In fact, use of even heavier cable will feed more power directly to the equipment. While here again we have the possibility of forgetting and leaving the unit "on" all night, we have to consider that any losses that can be avoided in the mobile rig can mean added *miles* in range. It then becomes a matter of choice as to whether we can trust our memories, or sacrifice the range by tying in the ignition switch.

● **Boat Installations.** Many of the same practices used in installing CB equipment aboard autos or trucks will serve the water-going CB'er as well. A bit of caution should be exercised, however, in placing the unit where it will not be plagued by moisture—especially salt spray.

The power supply for the transceiver will, of course, depend upon whether the boat is equipped with a 6-, 12- or 32-volt battery; a 110-volt d.c. generator, or no power source at all. Power supplies can be matched for most of the examples given here, covering a large percentage of the equipment on the market. Should this be a problem, however, a 12-volt storage battery can be used to operate a 12-volt rig, provided that the battery is maintained and kept at full charge when not being used to power the equipment. Also, a CB unit such as the Cadre 510, which is fully transistorized and carries its own battery supply and antenna, might be the ideal solution where mismatches in power supply requirements—or the absence of power—create a barrier.

Although a written record of your CB activities is not required by law, it can be very valuable. The operator shown here is recording the time of a contact he just made with a mobile/marine CB station.

In choosing an antenna for a boat, a stainless steel whip, a loaded coil whip, or a fiber glass whip will suffice to complete the installation. On a larger cabin craft or vessel, a ground plane or hybrid antenna might be used.

A most important point to consider in using a mobile whip on a boat is that, unlike the auto's body which acts as the ground plane to the antenna system, a wooden or fiber glass boat is minus this vital link. However, the problem is easily rectified in short order.

Try connecting a 9′ length of #12 (or larger) copper or aluminum wire to the ground terminal of the antenna's body mount, then running it horizontally (perpendicular to the whip). This will establish the ground plane, and complete the antenna system for proper and effective operation "aboard ship"! The wire may be fastened to the inside or outside of the hull, or allowed to trail behind the boat, making physical contact with the water.

● **Interference.** There are several types of interference to be dealt with in the Citizens Radio Service. But none of them are troublesome enough to squelch the efficient operation of a CB system if the causes are understood and corrective measures taken.

● **TV, Radio, P.A. Systems.** Television sets, public address systems, phonographs, intercoms, tape recorders, and radios are a few of the electronic devices that have at one time or another been victimized by a non-scheduled CB broadcast. If you receive a complaint, don't fret. Your equipment may, or may not, be causing the interference.

Interference to TV sets, for example, is caused by two factors, the first being harmonic radiation. This usually affects TV Channel 2, since the second harmonic of all CB transmissions falls within this channel. If your transmitter is causing Channel 2 interference, you can be pretty sure your

equipment is not operating properly—either your transmitter output or TVI (television interference) trap is improperly adjusted. In most cases, you can make the necessary adjustments by consulting the instruction manual that came with your transceiver.

The second type of interference is caused by improper design or malfunction of the equipment which is the "victim" of the interference. A corroded or poor solder joint could be acting as a detector and rectifying your signal. Or the leads on a public address amplifier may be just the right length to act as coils tuned to the Citizens Band.

Some of the older TV sets use an intermediate frequency in the 27-mc. band, and poor circuit design could cause the CB signal to be picked up in that section of the set. This type of TVI is easily identified since it is received on *all* TV channels. The prescription here is for the person owning the TV set to have a "high-pass filter" installed at the set's antenna terminals.

Be polite when you must tell the person suffering from the interference that his trouble may be due to poor design in his own equipment. By no means should you attempt to make any of the adjustments necessary to the other person's equipment yourself—this would only make you a "dead duck" to be blamed for any future malfunctions that might occur. Let a qualified TV or radio technician do the job.

● **Special Types of Interference.** Medical diathermy equipment, commonly used in hospitals and clinics, is licensed to operate within the frequency band extending from 26.96 to 27.28 mc. This can result in an overpowering hum and hash being received around CB channels 13 and 14, so stay clear of these channels if you are within range of such equipment.

The "guttery" growls heard occasionally are caused when two or more transmitters are simultaneously operating on the same channel and their crystals are not exactly on "zero-beat." Higher pitched whistles are due to heterodyning from stations operating simultaneously on adjacent channels. Since CB is on a shared-channel basis, nothing can be done about the "growls," but the "whistles" can be curbed by improved receiver selectivity.

Radio-control devices may cause interference around channels 3-4, 7-8, 11-12, 15-16, 19-20 or on channel 23. These devices include model airplanes, traffic lights, garage door openers, etc.

● **Skip Interference.** Caused by ionospheric reflection, "skip" interference will allow you to "listen in" on CB conversations as far as 2000 miles away from your station. "Skip" is a seasonal interference which reaches a peak in June and July, and again in December. It will come from the direction of the greatest CB activity within the area involved.

But be sure you go no further than the "listen" stage. Contacting, or attempting to contact, another station on "skip" is a direct violation of the FCC Part 19 Rules & Regulations.

● **Operating Procedure.** Citizens Band Radio has many advantages over other types of two-way radio services. Lower priced equipment; simplified licensing, with no technical knowledge or tests involved; and a choice of 23 different channels—these are but a few of a score of reasons thou-

This unique communications laboratory on wheels was developed by e.c.i., Electronics Communications, Inc., Mt. Vernon, N.Y. It is used to demonstrate the e.c.i. "Courier" CB transceiver. That's a scaled-up model mounted on top of the laboratory.

sands have chosen CB for their personal or business communications system. But "first place" on the list of advantages afforded the licensed CB'er could easily be awarded to "ease of operation"!

Rising equipment standards have produced a high rate of transmitter and receiver stability without the need for frequent adjustment. Inexpensive test equipment makes the possibility of transmitter error even slimmer, while the tuning and retuning of the receiver section of yesteryear are long gone. Most of all, actually placing a call properly is a simple matter.

● **Typical Call.** The following example might be considered representative of the type of calls transmitted by thousands of CB'ers daily across the nation. The method of contact and procedure throughout the call, up to the second of signing clear with one another, might also be considered typical—practically standardized.

BASE STATION: "18Q3003, 18Q3003, unit 1 to unit 2. Over."

MOBILE STATION: "This is 18Q3003, unit 2. Over."

BASE: "Where are you located at present? Over."

MOBILE: "Oxford Street & Ellis Avenue. Over."

BASE: "Have you finished the last job? Over."

MOBILE: "Yes I have. Over."

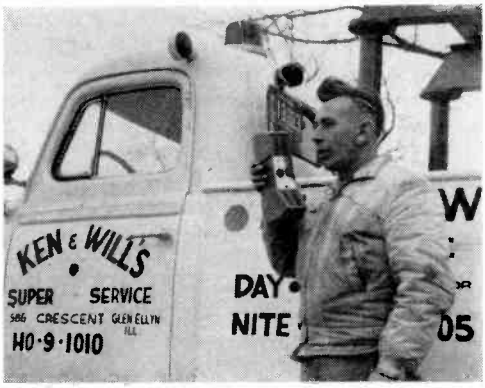
BASE: "Report to the gentleman waiting in front of 1435 Latham Place. He's locked out of his car. Over."

MOBILE: "Okay. Over."

BASE: "18Q3003 unit 1. Out and clear."

MOBILE: "18Q3003 unit 2. Out and clear."

Here, obviously, is a locksmith contacting his mobile service unit, instructing its operator to proceed to a given address to open a locked vehicle. He has saved time and money by nabbing his mobile unit before it returned to the base station, and at the same time he has shortened the period of waiting for the customer. By merely pushing the mike button on his CB base unit, transmitting on a preselected channel monitored by both the base and mobile units in his system, the locksmith has easily and effectively delivered an assignment.



Within the past year, a new type of CB transceiver has put in an appearance—the 1-watt hand-held portable unit. This tow truck operator is using a new Knight-Kit (Allied Radio) to contact his base.

● **The "10-Code."** The conversation above, as short and to the point as it already is, can be shortened even more by making use of the POPULAR ELECTRONICS "10-Code." This method has become quite desirable when traffic in a given area is heavy, or when speaking each word of the proposed message will entail a lengthy tie-up of the channel in use. It has proven equally effective when a mobile unit is near the end of his transmitting or receiving range, as numbers can be more readily understood than individual words or lengthy sentences.

Let's consider the same message then, incorporating the POPULAR ELECTRONICS 10-Code:

BASE STATION: "18Q3003, 18Q3003, unit 1 to unit 2. Over."

MOBILE STATION: "This is 18Q3003, unit 2. Over."

BASE: "10-20, please."

MOBILE: "Oxford & Ellis. Over."

BASE: "10-24?"

MOBILE: "10-4."

BASE: "10-22 1435 Latham Place—locked out."

MOBILE: "10-4."

BASE: "18Q3003 unit 1. Out and clear."

MOBILE: "18Q3003 unit 2. Out and clear."

If we were to get technical and run a stop-watch on both of these examples, we would find that—at the average rate of speech, and assuming contact was made immediately—the first call would consume 30 to 35 seconds, while the second example using the 10-Code would trim the time on the air to 20 seconds. While this is no great savings on a message of such short length, we can realize a definite advantage in using the 10-Code for a message that might contain five minutes of information, i.e., by packing it into just four minutes.

Use of this code expedites message handling, clearing the channel for use by others. And it works in both directions. You will be just as delighted to know that someone else who uses the same channel you've chosen does so properly, quickly, and courteously, clearing the channel for your use, or for anyone else who may be standing by.

It's not necessary to memorize the 10-Code. It is practical, however, to mount a copy of it as close to your transceiver as possible for quick reference. With the wife of the family standing by as the base station in most personal CB applications, the CB unit is usually found in the kitchen. The 10-Code might be mounted on a cupboard door below the FCC license, or on the wall closest to the equipment. In the office, it might be located on a desk top, or in some other convenient place.

A handy mounting place in the mobile unit would be on the overhead visor. Since it is dangerous to transmit while driving, and against the law in many states, a mobile CB vehicle should pull completely off the road, and come to a dead stop, before originating or answering a CB call. With the 10-Code mounted on the visor, an upward glance makes for easy reference—it eliminates searching and fumbling for the code that you thought was on the seat right beside you the last time you needed it.

● **"Break-Break."** While it might take until the expiration date of your CB license to pinpoint the original source of this system, the "break-break" has become an ultra-effective means of gaining access to any of the CB channels in time of need. Although CB'ers actually don't know who started the "breaker" system, they were fast to realize

POPULAR ELECTRONICS CITIZENS BAND "10-CODE"

General Station Operation

10-1 Receiving poorly.
10-2 Signals good.
10-3 Stop transmitting.
10-4 Okay—Affirmative—Acknowledged.
10-5 Relay this message.
10-6 Busy, stand by.
10-7 Leaving the air.
10-8 Back on the air and standing by.
10-9 Repeat message.
10-10 Transmission completed, standing by.
10-11 Speak slower.
10-13 Advise weather and road conditions.
10-19 Return to base.
10-20 What is your location? My location is ——.
10-21 Call —————— by telephone.
10-22 Report in person to ————————.
10-23 Stand by.
10-24 Have you finished? I have finished?
10-25 Do you have contact with ———————— ?

Emergency or Unusual

10-30 Does not conform to Rules & Regulations.
10-33 Emergency traffic this station.
10-35 Confidential information.
10-36 Correct time.

Accident and Vehicle Handling

10-54 Accident.
10-55 Wrecker or tow truck needed.
10-56 Ambulance needed.

Net Message Handling

10-60 What is next message number?
10-64 Net is clear.
10-66 Cancellation.
10-68 Repeat dispatch on message.
10-69 Have you dispatched message ————.

Personal

10-82 Reserve room for ——————.
10-88 Advise present phone number of ————.

Technical

10-89 Repairman needed.
10-90 Repairman will arrive at your station ——.
10-92 Poor signal, have transmitter checked.
10-93 Frequency check.
10-94 Give a test without voice for frequency check.
10-95 Test with modulation.
10-99 Unable to receive your signals.

Break-Break!

its usefulness soon after the birth of the band. Today it is an accepted part of Citizens-Band'ry from Maine to California.

As you may have guessed, the "break-break" means just that—a "breaking" into a conversation between two other CB units of like or different stations—with a definite reason for doing so. Without interrupting either party during actual conversation, a "breaker" (the logical title given a person breaking in) takes advantage of the time between transmissions—after the first party has finished a statement with "over," and before the second party begins to transmit.

While this might sound a bit split-second-ish, the one or two seconds of "dead air" between such transmissions is ample time for the "breaker" to make his plea, and for either or both parties to "receive" him. Once this has been done, the party who was to have begun the next part of the conversation will usually acknowledge the "breaker," at which point he will put in his bid for the channel. This action will be followed by a signing-off of the two parties previously engaged in conversation. Then the "breaker" may place his call.

Of course, there is nothing like the voice of a charming young lady as a "breaker" on a CB channel.

As an example, let's set up what might be considered a typical conversation between two parties whom we'll call Station A and Station B, who will then be joined by Station C, the third party who desires use of the channel now being used by A and B. The main point to keep in mind is that Station C intends to request use of the channel because he has important or semi-urgent information to dispatch to one of his sister units. Logically, he has monitored the conversation of Stations A and B, and feels that his message warrants a request for the channel over the call presently in progress.

STATION A: "So check the TV lead-in at the Jones' home, Phil. It could be the cause of the interference since everything else in the set checked out okay. Over."

STATION B: "10-4, Harry. I'll swing back that way and check it out. Do you want to give me that list of tubes now that you wanted me to pick up at the distributor's? Over."

STATION C: "BREAK-BREAK!"

STATION A: "There's a 'Breaker' in there, Phil. Stand by. Go ahead 'breaker'."

STATION C: "This is 18A6201 with an important message for Dr. DeWert who is mobile and will soon be out of range as he is leaving the city. May I have the channel?"

STATION A: "10-4, we'll clear! Call me when you finish the job at the Jones' home, Phil! 18W2523 unit 1 out and clear."

STATION B: "10-4, Harry. 18W2523 unit 2 out and clear."

Now, let's regress a bit. While monitoring Stations A and B, Station C realized that the important part of the call had been completed when Station B stated that he'd return to the Jones' home to check out the antenna. It was when Station B asked Station A about the tube list that Station C felt this would be information which might take a long time to deliver—information that could be passed on after he (C) had reached the doctor. Station C's message would be of no value unless delivered soon; B's request could be filled almost any time.

Since Class D Citizens Band channels must all be used on a shared basis, a verbal tool like the "break-break" becomes a near-necessity. And with proper use and applied courtesies, it becomes a welcome helper on our overcrowded party-line service.

● **Important Points to Remember.** When you operate on the Citizens Band, keep in mind the following important points.

(1) Station identification must be given by both parties at the beginning of and upon completion of each complete contact, regardless of whether the call lasts 30 seconds or a full 5 minutes. Identify the station when signing on, transfer the information back and forth until it is complete, then sign off the station via each unit involved.

(2) Make your questions brief and to the point. Long transmissions with involved questions will tend to confuse the other party, making it hard for him to remember all that you may have asked. Since he can't interrupt you on two-way radio as he might on the telephone, it is to your advantage to toss him one question at a time.

(3) Stay within the five-minute time limit set forth in Part 19 of the Rules and Regulations. If you have additional information that must be relayed to your station and have used up your time, clear the channel for two minutes to allow others to place their calls, then contact your station again once they have cleared and another two minutes have passed.

(4) Make use of the 10-Code for speed, intelligibility, and successful communications.

(5) Use the "break-break" procedure *only* when it is actually necessary to acquire the band. Do not "break" merely to say "hi" to Dave and Gus just because you happen to hear them on the air.

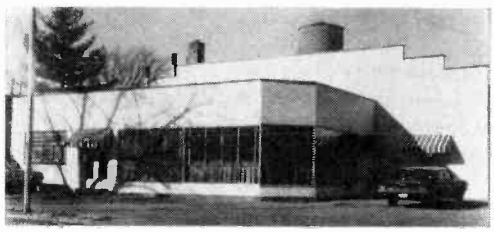
(6) Speak clearly, distinctly, with the microphone approximately two inches from your lips. And speak in a normal tone—shouting will only create distortion.

● **Hand-Held Transceivers.** Battery-operated "handie-talkies" weighing less than a pound seemed as far-fetched 15 years ago as a trip to the moon. Today they are as common to the Citizens Band as the telephone is to a teen-ager.

Immediately after the birth of CB, many "talkies" were placed on the market priced from under $50.00 to as high as $150.00 per unit. Sizes ranged from a little larger than a king-size cigarette pack to as large as the old army version of hand-held two-way radio.

These pint-sized units come under the jurisdiction of Part 15 of the FCC regulations, which allows certain types of communications devices to be operated without a license. This means that anyone can use these little transceivers without a license, provided that they meet the standards set forth by the Commission.

● **100-Milliwatt Units.** Under Part 15, the "talkies" are limited to 100 milliwatts of power or less, must be crystal-controlled, and can only be used with single-element whip antennas whose length does not exceed 60 inches. The communications range of these units stretches from as close as a couple of blocks to 10 miles, in some rare cases,



From this unimpressive building in Gettysburg, Pa., have come tens of thousands of CB licenses. The Federal Communications Commission began using extra facilities in southern Pennsylvania about three years ago to handle the avalanche of applications.

depending upon the conditions where the transceivers are used. Large buildings and steel structures in densely populated areas limit the range to a matter of city blocks, whereas, out in the open or across water, the same equipment can be used to communicate over several miles.

Quite contrary to the belief by many that these "little jobs" are merely toys, "talkies" have been put to use by the thousands, completely divorced from any playful relationship. Hunters, farmers, boating enthusiasts, etc., have become dependent upon these miniature transceivers. They are called upon to aid officials in organizing parades. They warn of traffic jam-ups, and inform officials where first aid is needed.

Civil Defense organizations have long recognized the advantages of "talkies" dur-

ing search parties for lost children, traffic direction at accident scenes, and at many other important functions where communications have become a must. Police units, the Civil Air Patrol, sheriff's departments, and hundreds of licensed CB'ers within Citizens Band clubs have practically claimed hand-held transceivers "essential to their operation"!

A miniature transceiver may be used with 5-watt CB transceivers if it will match up to the specifications in Part 19 of the Citizens Radio Service Rules & Regulations. And, of course, a call-sign would have to exist between the two units conducting communications.

● **1-Watt Units.** So popular are the 100-milliwatt "talkies" that manufacturers' foresight (brought about by the almost limitless applications of these smaller and lesser powered units) has prompted them to produce "walkie-talkies" with an input of 1 watt. Although the circuitry of these units demands a larger housing, they are still quite portable, with most of them boasting a 5-mile range "talkie-to-talkie." This could very well mean 10-mile coverage from a base station (5-watt unit) to a 1-watt "talkie."

At any rate, "handie" or "walkie," the "talkies" are here to stay, and from all indications are contributing as much to the protection of life and limb—and aid in public service events—as their 5-watt big brothers.

● **Citizens Band Clubs.** The newcomer to the Citizens Band who may feel a little "out in the cold" regarding the operation of his station, who may feel as though several minor problems are "ganging up on him," and who may have several "unknowns" that need answering, can join one of the over 300 CB clubs scattered across the country.

Basically, the clubs are the same. They organize to help one another solve technical, operational, traffic and violation problems; and to get to know one another. It stands to reason that a growing friendship "in person" can only further the courtesy habit "on the air"!

Several CB clubs have emergency rescue squads ready and waiting to lend a hand where needed, squads that have been supplied with first-aid equipment and hand-held transceivers in addition to their regular CB gear. Other groups have actively engaged in civil defense drills, many with organized teams equipped to handle disaster victims of any category. Still others have become permanent members of sheriff and police patrols aiding in searches for lost children, downed aircraft, and even criminals. But regardless of whether or not a club is actually connected with a civic or governmental agency, the members are most willing to offer their communication services in time of need.

In fact, the CB clubs across the nation have become a giant public service tool. They give unselfishly of their time, their vehicles, their equipment, and their abilities. The FCC recognizes properly organized and operated CB clubs with the feeling that they "may render a service to everyone." The Commission also appreciates the clubs' abilities to police themselves.

● **CB Jamborees.** Many CB clubs have some of the swingin'est jamborees and get-togethers you could ever imagine! Such events include name-entertainment, equipment displays by leading manufacturers,

Working in close cooperation with the Winnebago County Sheriff's Office, CB'ers helped reduce possible vandalism with their "Pumpkin Patrol." Shown at the left with Sheriff's Deputy Al Robertson are Ray Fritz, 18W6125; George Partch, 18W6400; and Matt Spinello, 18W4689.

technical seminars, authoritative lectures by FCC officials, talks by CB and ham technicians, plenty of chow, and the chance to meet CB'ers from all over the country.

Normal club gatherings usually include a general business meeting to thrash over old and new business, receive reports from committees, discuss grievances—and then refreshments are served. Other extra-curricular activities cover picnics; Halloween, Thanksgiving and Christmas parties; tours to various communications installations; and guest speakers. The CB clubs are a busy lot! And they're a proud lot! Joining one of them will provide you with a CB education inexpensively earned.

● **Public Service Activities.** Now that we are organized, what can we do to help? This is a question often raised by new CB clubs, especially in areas where communications facilities are scanty. The club members are eager to extend "a hand with a mike" wherever they can serve collectively with their newly organized communications convenience. Thus, how they may become known as a "public service organization" creates one of the primary goals and objectives of CB clubs from Maine to California.

● **Earthquakes and Floods.** Earthquakes, floods, hurricanes, and tornadoes are all crippling, frightening catastrophies where mobile and hand-held Citizens Band equipment is sometimes the only means of communication on a large scale. With power lines down, or power supplies for a given area or entire city disabled, a score of mobile units spaced from the disaster area to rescue facilities may well provide the help needed to keep physical injury and panic at a minimum. By relaying information to proper authorities, first aid equipment and supplies may be directed to those most in need. And traveling mobile CB units can act as "spotters," moving about the area in vehicles or on foot, in constant contact with rescuers.

There are countless applications in this area of service alone. The effectiveness of CB for such applications has already been proven by scores of rescue teams and volunteers during the storm season on the East Coast of the United States.

● **Fires and Accidents.** Usually directed by police officers, civil defense, or local authorities, CB'ers have been credited above par for their participation in areas where the co-ordination or control of mass audiences has been necessary to the success of the operation at hand. At fire or explosion scenes, to which the general public seems magnetically drawn, CB'ers are a welcome sight to those already fully occupied with rescue and salvage duties. With a temporary CB control operator working at the scene, other CB'ers have aided in the handling of traffic from as close as the disaster itself to many miles surrounding it.

At accident scenes, quick-thinking Citizens Band passersby have contacted base stations for help, then aided victims, when possible, standing by until authorities arrived. Often, CB'ers cruising in the area have joined the calling CB'er at the scene to direct traffic and avert the possibility of further mishap.

● **Parades and Special Events.** In the last four years, mobile CB units and their operators have become an important segment of

(*Continued on page* 36)

Another important CB public service activity is Civil Defense. The FCC is currently investigating possible uses for CB if all other forms of radio communications should be destroyed. Going over procedures are Duane Omark, 18A4229; Ray Fritz, 18W6125; and Andy Hendel, 18Q0299.

Citizens Band Clubs

The particular channel monitored by a club has been

Walker County CB Club
Route 6, Box 50-B
Gorgas, Ala.

Citizens Radio Club of Walker County
Route 6, Box 50-A
Jasper, Ala.

Citizens Band Radio Club
Montgomery, Ala.
(Channel 9)

Central Arkansas CB Radio Club
P.O. Box 534
Little Rock, Ark.

Newfoundland CB Club
Suite 24—Box 6
St. Johns, Nfld., Canada

Southern California Assistance Unit
P.O. Box 115
Bellflower, Calif.

Citizens Radio Associates
12753 Brooklake St.
Los Angeles 66, Calif.

5 Watt Wizards CB Radio Club of San Bernardino Valley
P.O. Box 3364
San Bernardino, Calif.
(Channel 9)

Southern California 11-W CB Association
P.O. Box 17296
San Diego 17, Calif.
(Channel 9)

Cherry Vale Tracking Team
620 Yale
Boulder, Colo.

Shoreline Chapter #1, CB Association of Connecticut
Box 178, RFD #1
Essex, Conn.
(Channel 11)

1W Airline CB Club
53 Bretton Rd.
Middletown, Conn.
(Channel 3)

Central Connecticut CB Association
P.O. Box 286
New Britain, Conn.
(Channel 11)

Norwalk CB Radio Association
Box 693
Norwalk, Conn.

Broward Citizens Radio Club
P.O. Box 8092
Ft. Lauderdale, Fla.
(Channel 9)

Metropolitan Dade Citizens Radio Club
Miami, Fla.
(Channel 9)

Citizens Radio Club, Inc.
P.O. Box 5606
Pensacola, Fla.

Dixie Communication Club
P.O. Box 136
Decatur, Ga.
(Channel 15)

Middle Georgia Citizens Radio Club
P.O. Box 372
Macon, Ga.

The Rebel Communication Association
P.O. Box 1467
Marietta, Ga.
(Channel 21)

The Channel Eleven Tube Poppers
Rt. #1, Box 32
Royston, Ga.

Citizens Radio League
341 Frederick Ave.
Bellwood, Ill.

Corn Belt Citizen Banders
216 Robinhood Lane
Bloomington, Ill.

ILLINI Class "D" Radio Club
1520 Hedge Rd.
Champaign, Ill.
(Channel 5)

Citizens Radio League of Chicago
3905 N. Troy St.
Chicago 18, Ill.
(Channel 9)

Midwest DX-SW Radio Club
2100 W. William St.
Decatur, Ill.

Carroll County Sheriff CB Radio Patrol
Lanark, Ill.

Northwest 5 Watters
7 North Ridge
Mount Prospect, Ill.

Citizens Radio League
Box 28
Northlake, Ill.
(Channel 21)

Ottawa Five Watters
P.O. Box 84
Ottawa, Ill.

Celestial Citizen Banders, Inc.
1604 Charlotte St.
Pekin, Ill.

Tri-County CB Club
217 Washington St.
Prophetstown, Ill.

Static Pushers CB Radio Club
2923 21st St.
Rockford, Ill.
(Channel 9)

CB Pioneers 5 Watt Radio Club
R.R. #1, Box 63
Elkhart, Ind.

Wabash Valley CB Club
420 Shelby St.
Vincennes, Ind.
(Channel 11)

Wabash Valley CRL, Inc.
P.O. Box 911
Terre Haute, Ind.

Cedar Rapids Citizens Radio Club—QRM
Route 1
Cedar Rapids, Iowa
(Channel 7)

Across the Country

listed in cases where this information is available

Little Soo CB Club
221 No. 11th St.
Cherokee, Iowa
(*Channel 11*)

Winnebago County Emergency CB Net
346 W. G St.
Forest City, Iowa

Citizens Radio Club of Wichita
Box 2638, Munsey Station
Wichita 8, Kansas

5 Watt Club
Glasgow, Ky.
(*Channel 11*)

Ohio Valley CB Club
1221 Loeb St.
Henderson, Ky.

Kentucky-Indiana SB Radio League
212 Bolivar St.
Owensboro, Ky.

Emergency Communications Organization
East Baton Rouge Sheriffs' Dept.
P.O. Box 533
Baton Rouge 1, La.
(*Channel 9*)

MCRA
Box 235
Cohasset, Mass.

Metropolitan Citizen Radio Association
496 Main St.
Hingham, Mass.

Pioneer Valley 5 Watters
Box 989
Holyoke, Mass.

Cape Cod CB Radio Club
Box 131
Kingston, Mass.

The 11/27 Radio Club
Millis, Mass.
(*Channel 11*)

Plymouth County CBers, Inc.
71 Bates St.
N. Abington, Mass.

Channel Jammers
47 Pine St.
Swampscott, Mass.

C-Bags
21 Starrett Rd.
West Lynn, Mass.

Cereal City Citizens Radio Club
27 Richards Pl.
Battle Creek, Mich.
(*Channel 3*)

Citizens Radiophone Association
3306 Kanter
Detroit 11, Mich.
(*Channel 2 and 20*)

Saginaw Valley CB Association
1417 Passolt St.
Saginaw, Mich.

Twin Ports Mobile Emergency Unit
230 N. 18th Ave., W.
Duluth 6, Minn.

Jackson Citizens Band Radio Club
342 No. Gallatin St.
Jackson, Miss.

North Area Emergency Radio Team
4507 No. Charlotte
Kansas City, Mo.
(*Channel 21*)

The 99'ers CB Radio Club
1020 Hartley
Lincoln, Nebr.

Tri-County Emergency Communication Network
Box 102
Dover, N. H.
(*Channel 20*)

5 Watt Whips of Lowell
Anders Lane
Nashua, N.H.

CB Socialites
Main St.
Plaistow, N. H.
(*Channel 9*)

Blair House Communications
1116 St. George Ave.
Avenel, N.J.

Jersey 5 Watters
113 Dailey Ave.
Hillside, N.J.

United CB'ers
79 Garden St.
Hoboken, N. J.

South Jersey Citizens Club
P.O. Box 99
Stratford, N. J.

Citizens Band Radio Relay League
1511 Rose Terr.
Union, N.J.

Cape May Country CB Club
Box 121
Wildwood 1, N. J.
(*Channel 9*)

Albuquerque Citizens Radio Association
Box 7495
Albuquerque, N. Mex.

Capital District CB Radio Club
46 Continental Ave.
Cohoes, N.Y.

Sullivan Trail CB
92 Oakwood Ave.
Elmira Heights, N. Y.
(*Channel 11*)

Queens Chapter Citizens Band Relay League
86-51 Broadway
Elmhurst 73, L.I., N. Y.

Nassau CB Club
Bethpage Bowling Center
4115 Hempstead Turnpike
Bethpage, L.I., N. Y.
(*Channel 8*)

Mid-Hudson CB Club
85 Mansion St.
Poughkeepsie, N.Y.

MCEU CB Club
1203 Butternut St.
Syracuse 8, N.Y.

Niagara Frontier CB Club
209 Fletcher St.
Tonawanda, N. Y.
(*Channel 22*)

Durham CB Radio Club
Box 8124, No. Durham Station
Durham, N. C.

Citizens Band Clubs continued

Confederate CB Corps
Shelby, N.C.

South-Lynd Radio Club
Lyndhurst City Hall
5301 Mayfield Rd.
Cleveland 24, Ohio
(Channel 9)

Central Ohio CB Association
Box 92
Columbus 16, Ohio
(Channel 9)

27 Meggers CB Club
1553 Algiers Drive
Mayfield Heights 24, Ohio

Roundtable CB Club
23625 Clifford Dr.
N. Olmstead, Ohio

27 Meggers CB Club
1814 Beaconwood
So. Euclid 21, Ohio

11 O-M Club
Box 111
Toledo 1, Ohio

Citizens Radio Service Club
224 So. Fayette St.
Washington C.H., Ohio

Mid-State Minutemen Citizen Band Radio Club of Oklahoma, Inc.
P.O. Box 783
Stillwater, Okla.
(Channel 9)

Blue Mountain 10-20's
318 N.W. 6th
Pendleton, Ore.

Oregon Grapevine, Inc.
Box 4261
Portland 8, Ore.

Montgomery County Jr. CD Organization
9 S. Chestnut
Ambler, Pa.

C B Rangers
Box 284
Butler, Pa.
(Channel 9)

Western Area Citizens Band
VA Hospital, Box 62
Butler, Pa.
(Channel 9)

Johnstown CB's
Box 852
Johnstown, Pa.

Lycoming CB Radio Club
Box 247
Montoursville, Pa.
(Channel 4)

Allegheny Kiski 5 Watters
1141 Sixth Ave.
New Kensington, Pa.
(Channel 9)

Tri County Citizens Radio Association
824 Regina St.
Philadelphia 16, Pa.

Allegheny Valley CB Club
Box 7819
Pittsburgh, Pa.

Five-Eleven Radio Club
868 Glass Run Rd.
Pittsburgh 36, Pa.
(Channel 9)

Keystone 11 Meter League
P.O. Box 45
Pottstown, Pa.
(Channel 19)

Punxsutawney CB Club
111 Lane Ave., Box 32
Punxsutawney, Pa.

QUI-CO Citizens Radio League
112 No. Ninth St.
Reading, Pa.
(Channel 11)

Buxmont Citizens Radio League
49 Ridge Ave.
Sellersville, Pa.
(Channel 11)

Mason Dixon CB Club
Route 3
Shippensburg, Pa.

Tri-County Citizen Radio Association
167 Acorn Dr.
Warminster, Pa.

CB'ers of Lower East Tennessee
520 First St.
Athens, Tenn.

Johnson City CB Club
Box 3191
Carroll Reece Barnhouse
Johnson City, Tenn.

Memphis RCB Radio Club
410 Malvern Place
Memphis, Tenn.

Greater Dallas Citizens Band Club
P.O. Box 6023, Terminal Annex
Dallas, Texas
(Channel 15)

Citizens Band Radio Club of Fort Worth
Box 9697
Fort Worth 7, Texas
(Channel 11)

Galveston County CB Radio Club
1015½ 45th St.
Galveston, Texas

Caddo District Citizen Band Club
Marshall, Texas
(Channel 4)

Heart of Texas CB Club
3816 Parrott
Waco, Texas
(Channel 11)

Virginia Citizen Radio Association
Box 471
Annadale, Va.

CB 5 Watters of Virginia
232 Powhatten Parkway
Hampton, Va.
(Channel 9)

Evergreen Area CB Association
9220 Holly Drive
Everett, Wash.

14W Association of Seattle
15816-28th Avenue N.E.
Seattle 15, Wash.

Manitowoc County Communicators
1511 Kuhl Street
Manitowoc, Wisc.

Racine Citizens Band Club
1832 Ridge Drive
Racine, Wisc.

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Featuring Tests Never Before Available To The Hobbyist

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- Four specially designed tests to check distortion in stereo cartridges.
- Open-air recording of moving snare drums to minimize reverberation when checking stereo spread.

Why We Make the Model 211 Available Now

Although there are many stereo test records on the market today, most critical checks on existing test records have to be made with expensive test equipment.

Realizing this, HiFi/STEREO REVIEW decided to produce a record that allows you to check your stereo rig, accurately and completely, just by listening! A record that would be precise enough for technicians to use in the laboratory—and versatile enough for you to use in your home.

The result: the HiFi/STEREO REVIEW Model 211 Stereo Test Record!

Stereo Checks That Can Be Made With the Model 211

- ✓ **Frequency response** — a direct check of eighteen sections of the frequency spectrum, from 20 to 20,000 cps.
- ✓ **Pickup tracking** — the most sensitive tests ever available to the amateur for checking cartridge, stylus, and tone arm.
- ✓ **Hum and rumble** — foolproof tests that help you evaluate the actual audible levels of rumble and hum in your system.
- ✓ **Flutter**—a test to check whether your turntable's flutter is low, moderate, or high.
- ✓ **Channel balance** — two white-noise signals that allow you to match your system's stereo channels for level and tonal characteristics.
- ✓ **Separation**—an ingenious means of checking the stereo separation at seven different parts of the musical spectrum—from mid-bass to high treble.

ALSO: ✓ Stereo Spread
✓ Speaker Phasing
✓ Channel Identification

PLUS SUPER FIDELITY MUSIC!

The non-test side of this record consists of music recorded directly on the master disc, without going through the usual tape process. It's a superb demonstration of flawless recording technique. A demonstration that will amaze and entertain you and your friends.

All Tests Can Be Made By Ear

HiFi/STEREO REVIEW's Model 211 Stereo Test Record will give you immediate answers to all of the questions you have about your stereo system. It's the most complete test record of its kind—contains the widest range of check-points ever included on one test disc! And you need no expensive test equipment. All checks can be made by ear!

Note to professionals: The Model 211 can be used as a highly efficient design and measurement tool. Recorded levels, frequencies, etc. have been controlled to very close tolerances — affording accurate numerical evaluation when used with test instruments.

DON'T MISS OUT—ORDER NOW AND SAVE $1

The Model 211 Stereo Test Record is a full 12" disc, made from the finest virgin vinyl. For a limited time only, it is being sold by COMMUNICATIONS HANDBOOK for $3.98. Starting July 1, 1963, we will sell this record for $4.98. **Order now and save $1.** Make sure you don't miss out on this special offer. Fill in and mail the coupon, together with your check ($3.98 per record) today!

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Stereo Test Record
Communications Handbook—Dept. S D
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Please send me _____ test records at $3.98 each. My check (or money order) for $_____ is enclosed. I understand that you will pay the postage and that each record is fully guaranteed.

Name _____
(Please Print)

Address _____

City _____ Zone _____ State _____

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(Special price offer of $3.98 expires on June 30, 1963) CH 63

the holiday parades staged across the country. While not actually a part of the festive decorations or the marching feet, CB'ers have worked from the sidelines to aid in the coordination and professional appearance of such events. With a CB control coordinator detailed to the parade marshall, individual parade units are informed of changes, hold-ups, and "triggering" time. CB operators with hand-held transceivers on rooftops along the route inform division leaders of "bunching-up" or "lagging" parade units so that such eyesores may be corrected quickly from the ground. In addition, some clubs employ mobile cruisers qualified to administer first aid to those overcome by heat or suffering from injury.

Several CB clubs are assisting in Boy Scout camping trips, hikes, and jamborees. In the case of a hike, placement of several mobile units along the way not only keeps the entire entourage in contact, but the CB vehicles themselves can be used in case of accident. When the hike includes overnight camping, the CB'ers stay "on guard" for any possible emergency that may necessitate their use.

Believe it or not, the fact that the CB channels are frequently crowded is often an advantage so far as emergency communications are concerned. The crowded conditions also mean that the channels are well-monitored, so a call for help can scarcely go unnoticed. Most CB clubs set aside a special channel for calling and monitoring. When known, these channels have been included in the club listing which appears on pages 32, 33, and 34.

During the recent oral polio vaccine immunizations across the country, scores of CB'ers lent a hand by delivering additional amounts of the vaccine to areas that ran short. Some aided in traffic control; others were dispatched to deliver those who were without transportation to and from the place of immunization.

● **Police and CD Activities.** Once informed of the organization of a group of Citizens Band'ers, most authorities are eager to accept and utilize their voluntary efforts. Those CB'ers who have joined civil defense organizations have been taught first aid, rescue and search procedures, and have become a part of searches for lost persons, victims of drowning, etc. On the police and sheriff's level, CB'ers have patrolled cities and entire counties in search of runaways or escapees from institutions. Over a dozen quick burglar arrests have been credited to mobile CB'ers who were eye witnesses.

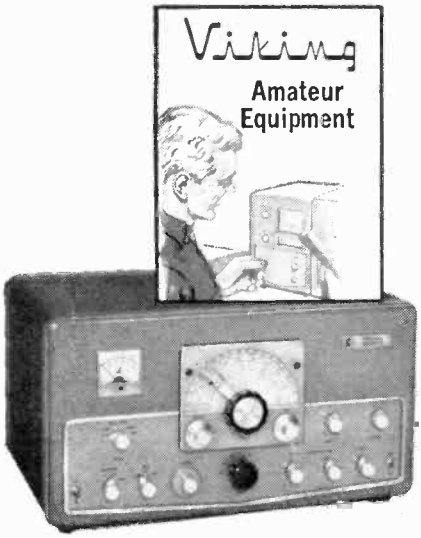
Every Halloween, anywhere from 5 to 100 mobile CB vehicles patrol the streets of many cities to help squelch any signs of vandalism. In many cases, it's over before it starts, just from the sight of the mobile whip, or the microphone raised to the mouth.

The aid of CB communications is also enlisted by Civil Air Patrol officials during the search for downed airplanes, where survival of the occupants may hinge upon locating the craft within minutes.

● **Case Histories.** The "On the Citizens Band" column, a monthly feature in POPULAR ELECTRONICS, constantly reports the widespread voluntary action by Citizens Band'ers in various types of public service "assists" throughout the country. The following are just a few of the ever-mounting number and types of assists executed by CB clubs and rescue units from coast to coast.

Millis, Mass. On a summer evening, from 6:30 p.m. to 2:30 a.m., approximately 20 members of the *11-27 Radio Club* assisted in tracking an escaped convict around the Norfolk prison area. On another evening, several units aided in the apprehension of two young ladies who had escaped from a nearby reformatory.

Boulder, Colo. Through a 10-33 (emergency) call from 10 miles in the mountains, a series of relays on the part of the *Boulder*



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Priced within easy reach of any business—designed for use in the 25 to 50 mc. range! The "Messenger 202" and the "Personal Messenger" pack the power to punch your signal across the miles with the crisp authority that gets things done! Both units are type accepted for use in the Industrial, Public Safety, and Land Transportation Services—both provide everything you could need or want for the majority of industrial or business applications. Complete descriptive literature available from your distributor, or use the coupon below.

4 feature-packed "Messengers" and Selective Call System outperform 'em all! Compact, hand-held 100 milliwatt or 1 watt "Personal Messengers" are rugged and reliable—have 11 transistors, 4 diodes! Twice the sensitivity and 40% more range than similar units with conventional circuitry—more output than similar units with same rated inputs! The performance proved Viking "Messenger" and new "Messenger Two" are ideal for both base station and mobile use! High efficiency design makes full use of maximum legal power. Excellent receiver sensitivity and selectivity. Automatic "squelch" control—5 or 10 channel coverage—easy to install anywhere!

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CIRCLE NO. 16 ON READER SERVICE CARD

CB Club Action

County Citizens Radio Club members brought an ambulance and rescue to an injured club member within 20 minutes.

Seattle, Wash. Members of the *14W Association of Seattle* were lauded for the excellent assist they gave following a jet plane crash on the opening day of the Seattle World's Fair. Mobile CB vehicles dotted the roads for several miles from the mountainside crash scene, forming a relay of information to the authorities.

Stillwater, Okla. The *Mid-State Minutemen* assisted at a national "fly-in" student pilot match. With four mobile units, two walkie-talkies, and two base station units in the airport tower, CB'ers helped FAA officials organize taxi procedures, direct planes, and keep confusion down to a minimum.

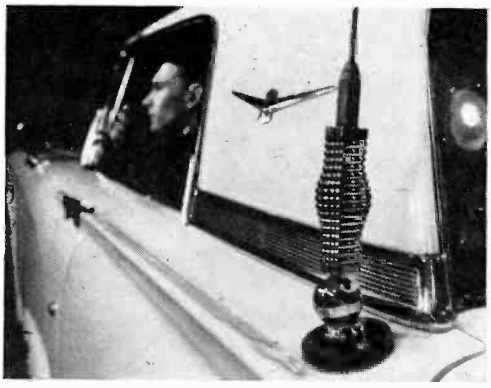
Chicago, Ill. One evening not very long ago, a *Citizens Radio League* member stood at the scene of an accident directing traffic in pouring rain after having placed a CB call for asistance. Two nights later another *CRL* club member handled a relay to the authorities when a car crashed through a guard rail and dropped down to ground level on the Congress Expressway in Chicago. In both instances a "breaker" was involved, with each of the men receiving prompt cooperation.

Plaistow, N. H. Members of the *CB Socialites* helped find a 7-year-old boy lost in the woods. The *Socialites'* emergency unit (SEMU) was quick to join in the search with local and state police, sheriff's personnel and fire departments from the surrounding area. Within a short time, they, in turn, were joined by over 200 CB mobile units representing almost a dozen clubs from nearby communities. After 13 hours, the boy was carried out of the woods, rain-soaked, cold, and frightened—but safe!

Boulder, Colo. The *Cherryvale Trackers* place themselves "on call" throughout the state of Colorado. Besides 21 pieces of CB gear, including mobile, base, and hand-held units, this unusual rescue team makes use of a proven bloodhound and two pack mules. Other modes of transportation include vehicles for rugged terrain, and an airplane. The response time of the *Cherryvale Trackers* to any call is 15 minutes, with transport facilities available on less than 90 minutes notice. The team is completely self-sustaining on missions lasting up to five days. In less than two years, these CB'ers have participated in over two dozen rescues.

Champaign, Ill. The quick thinking of a member of the *Illini Class "D" Radio Club*, while returning an injured football player to his home from an out-of-town game, really paid off. The boy became quite ill during the ride, and the CB'er radioed ahead; they were met by a doctor and an ambulance on arrival. Emergency aid was given, and the boy was delivered to a nearby hospital.

● **Individual Club Action.** The examples of service performed by the CB associations mentioned here, and by the over 300 other CB clubs in the United States, are just a few of a vast number of public services executed daily. An interesting point to note is that most of these services have been "created" and executed by an individual CB club first, and have then spread across the nation.



Municipal authorities in hundreds of communities have praised CB'ers for their help in apprehending criminals. And the lives of many people involved in automobile accidents have been saved due to prompt response a CB'er gets to an emergency call.

Considering the public service record of the CB clubs as a whole, it would seem only fitting and proper to assume that the clubs agree wholeheartedly on one point. Perhaps it could be summed up in what might stand as a national motto: "Service to the Nation through CB Communication!"

● **REACT.** We have cited many examples of how CB'ers help their fellow citizens outside the limitations and scope of their basic and personal need for CB. In numerous communities, these CB'ers have grouped together to form emergency disaster or

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CIRCLE NO. 25 ON READER SERVICE CARD

rescue teams. But, such groups naturally develop along purely local levels, and there is need for coordination on either a statewide or national basis.

The Hallicrafters company of Chicago, Ill., one of the oldest manufacturers of communications equipment, has undertaken to develop a national service facility for CB'ers. It has been given the name Radio Emergency Associated Citizens Teams, and is popularly known as REACT.

REACT does not replace the community service organization of an already existing CB club, nor does it interfere with established routines. REACT is a planned system which a club may adapt to its own use and procedures. Where there is no CB club in existence, REACT may be put into effect without the time-consuming and complicated planning such an organization needs.

While REACT's plan is oriented strictly toward local community problems, there are major advantages that stem from its national organization. Such a national headquarters is in a position to accumulate information on emergency techniques from hundreds of communities and pass them along to local chapters.

● **Local Teams.** A REACT team may be established in any community where CB'ers exist and submit an application to national REACT headquarters. The requirements are short and to the point. A local team is organized as follows:

1. National REACT headquarters appoints a local REACT headquarters to coordinate all services.

2. A pre-membership meeting is held by interested individuals to establish the following essential structure:

(a) Election of officers (optional).

(b) Agreement upon a particular CB channel to be used exclusively, or primarily, for emergency calls (mandatory).

(c) Agreement upon a monitor station or monitoring system capable of immediate response 24 hours a day, 7 days a week. Monitors are chosen to suit local conditions and can be individuals, gas stations, hospitals, taxi companies, police, local REACT headquarters, or any combination thereof (mandatory).

(d) The establishment of a membership list, list of local authorities, and emergency services, with their CB calls and telephone numbers.

3. Application is then submitted by letter to national REACT headquarters by the local headquarters, including a listing of all essential information agreed upon above.

4. Upon acceptance of a local REACT application, the national headquarters will forward for member distribution:

(a) Individual membership cards.

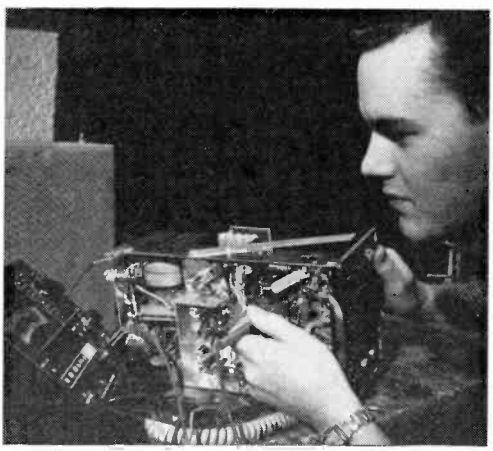
(b) Metalized REACT decals for vehicle identification.

(c) Periodic REACT bulletins from national headquarters.

5. A program of local publicity, prepared by the national REACT headquarters, is then released to acquaint the particular community with REACT and its services.

The REACT program must be considered an excellent public service vehicle, both on the part of its creators, and its members. As this is being written, close to 3000 inquiries have been processed and over 200 local REACT headquarters have been established in the United States. Those interested in the REACT program should write for further information to: National REACT Headquarters, Fifth and Kostner Avenues, Chicago 24, Ill.

Although it is sponsored by the Hallicrafters company, REACT has no commercial motivations.



Both American and Canadian operators must have their transmitting equipment serviced by a properly licensed technician. Modest tuning adjustments by a CB'er are permitted, but under no circumstances should a transmitter's crystal oscillator be tampered with. CB'ers can be fined by the FCC for off-frequency operation and other offenses.

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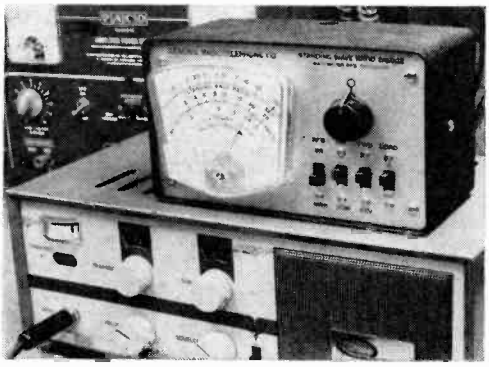
CIRCLE NO. 1 ON READER SERVICE CARD

Checking Performance

● **Test Equipment.** There is no black magic involved in keeping your CB system in tiptop shape. Many technical maintenance tricks have been made unnecessary by the creation of CB test equipment which is easily operated by the non-technically trained. Considering the total investment you have already placed (or intend to place) in your CB system, a little test equipment is relatively inexpensive. Its functions, however, can be worth hundreds of "dollars and hours" of effective, efficient operation on the Citizens Band.

Although CB transmitters are allowed a maximum input power of 5 watts, the output to the antenna is quite a bit less. Due to the design of the final amplifier of any CB transmitter, the maximum possible output is a little more than 3 watts. Thus, a mis-match between the transmitter, the feedline and the antenna, in addition to



Sitting atop this Olson RA-530 "Spotter" is a General Radiotelephone Model 615 test meter. It can be used to measure power output, feedline performance, and field strength of your own radiated signal. The model 615 meter is typical of the many "combination" test instruments available to the cb'er.

poor mechanical connections and line losses, might leave you with an end result of less than 2 watts output. Obviously then, you must get the most out of your antenna in order to obtain the strongest signal. Here is where the field strength meter, the power output meter and the dummy load lend a hand.

● **Dummy Load.** By following the procedures in the instruction book supplied with all CB transceivers, a dummy load can be used to check the output of the transmitter. The dummy load is so named because it is used to temporarily substitute for the characteristics of the antenna and coaxial transmission line when connected to the CB transmitter. The load is usually made up of a #47 pilot light bulb with the proper plug attached.

With the load plugged into the antenna socket, the transmitter is tuned until the lamp glows at maximum brilliance. While the eye will mark this type of tuning fairly closely, photo enthusiasts with an exposure meter can bring the process to a fine point by measuring the amount of light with the meter while tuning. After the tuning is completed, talking into the microphone should make the bulb glow even brighter. If this is not the case, the transmitter is not properly tuned.

Although this method of tuning is preferred for an initial tune-up, eliminating the possibility of illegal interference to other stations, it should only be considered a means of showing that the transmitter is emitting a maximum signal. To determine *on-the-air* output power, we must first establish a proper matching of transmitter output, the coaxial cable, and the antenna. Once the transmitter has been dummy-loaded to make sure of proper operation, the next tuning steps should be taken using a power output meter or field strength meter.

● **Power Output Meter.** This is a piece of equipment which is connected to the output of the CB transmitter. Here, a small part of the signal across the built-in dummy load is rectified and fed to a calibrated meter, and thus "the power output" is determined.

Most of these units will measure the power output of the transmitter and the power that is reflected backward in the coax cable by the antenna. Making both of these measurements with the same meter is accomplished by reversing the input and output cables, or by manually switching the equipment from the meter panel. Full instructions are supplied with each type and make of meter.

● **Field Strength Meter.** Although field strength meters (FSM's) may be purchased in many shapes and sizes, all perform the same basic function. With this piece of gear, the operator can determine when maximum power is being radiated by the CB antenna.

No, we don't do it with mirrors

How can we now put a low $159.95* price tag on this popular Raytheon Ray-Tel TWR-2 CB unit and still include the same desirable features?

We don't do it with mirrors! It's simply that increased demand and universal acceptance of this rugged, top-performing unit have meant increased production, lowered components cost, and a streamlined production operation—all generating savings we can pass along to you and your customers.

From its sensitive dual-conversion superheterodyne receiver for maximum coverage, selectivity and sensitivity—to full range automatic volume control, automatic tuning, noise-free standby and "on-the-nose" frequency trim tabs, this TWR-2 unit by Raytheon packs top operator value.

Two national automotive manufacturers—convinced of Ray-Tel's unbeatable quality and reliability—have approved the TWR-2 as optional accessory equipment for their vehicles.

Citizens Band radio is a profitable, fast-growing business that you should be in. For proof, prices and full particulars—including detailed Ray-Tel spec sheet and schematics—contact your nearby local Franchised Raytheon Distributor.

RAYTHEON

*Suggested list price

CIRCLE NO. 30 ON READER SERVICE CARD

CB in Canada

The FSM uses a small portion of the actual signal radiated by the antenna, rectifies it with a crystal diode, and applies this current to a sensitive meter. With the antenna connected to the transmitter, the FSM (with its own self-contained antenna) is placed some distance from the CB antenna, and adjustments made to the transmitter output.

Many manufacturers have incorporated several testing devices into one piece of gear. While some CB'ers may not need more than a FSM or power output meter, others will welcome a test package enabling them to measure actual power output in watts, check crystal activity, and even permit a check on modulation quality through plug-in earphones. Here again, the choice will depend upon the individual requirements of the user.

As mentioned earlier, this type of equipment is not only well worth the price, but will afford the user the secure knowledge that he is getting the utmost efficiency from his initial CB investment.

● **CB in Canada.** The widespread interest in the Citizens Radio Service in the United States aroused the attention of the Canadians, who immediately realized the benefits that could be derived from such a service in their own country. In fact, before the Canadian authorities had time to create the *General Radio Service,* public demand had become so great that the Department of Transport (the equivalent of our FCC) boosted the original date on which they had planned to put the service into effect from July 1, 1962, to April 1, 1962.

Canada's GRS and our Citizens Radio Service are both intended to permit the licensing of low-priority private radiotelephone systems in the 27-mc. band—for personal, small business, and light industry communications. Operators of GRS radio stations are not required to hold radio operator certificates. However, to be eligible for a station license, applicants must be business companies incorporated within the Commonwealth, or British subjects or landed immigrants not less than 18 years of age and having a need for direct radio communication with similarly licensed *Canadian* stations.

The GRS stations are not permitted to communicate with radio stations in any other service, and may be used only for communications concerning the business activities and personal affairs of the licensees. Furthermore, GRS transmissions may not be directed to any person or station located beyond the ground-wave coverage of the station. Licensing of equipment for GRS costs the applicant $3.00 per unit; the license is valid for three years following the first day of April of the fiscal year in which it is issued.

Operational regulations for the Canadian GRS are much the same as our FCC Part 19 Rules and Regulations, with the exception of the frequencies allocated to the Canadian users. While 23 channels are available to CB'ers in the U.S., only 19 may be used by Canadian licensees, ranging from 27.005 to 27.225 mc. (U.S. CB channels 4 through 22).

● **Transceiver Specifications.** The close similarity between the Canadian GRS and the American Citizens Radio Service ends when equipment standards for transmitters and receivers are taken into consideration. Apparently using some of the experiences of the FCC as a guide, the D.O.T. has created very rigid transceiver specifications. In fact, all equipment must secure a "type-approval" subject to D.O.T. Specifications No. 136.

This means that transmitters may have an input power reading of 5 watts, or less, or a carrier power output of 3 watts or less. Also, spurious or harmonic output from the transmitter must not exceed 30 microwatts of r.f. power using a standard output termination load.

According to the receiving section of Specifications No. 136, a superregenerative circuit is not permitted, and receiver radiation must be limited to a value that "shall not exceed 20,000 picowatts at any frequency."

● **Antenna Requirements.** As for antennas, the regulations in Canada are very similar to those proposed by the FCC. The tip of the antenna itself may not exceed 20 feet above the structure upon which it is mounted without special permission having been granted beforehand by the D.O.T. The power gain of GRS antennas has been limited to 3 db—rated in reference to a half-wave dipole. Furthermore, an additional form must be completed by the operator if:

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SLEEVE MONOPOLE MOBILE CB ANTENNAS

Lower angle of radiation gives stronger signals and greater range.

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Exceptionally wide bandwidth with low VSWR. 50 ohm match.

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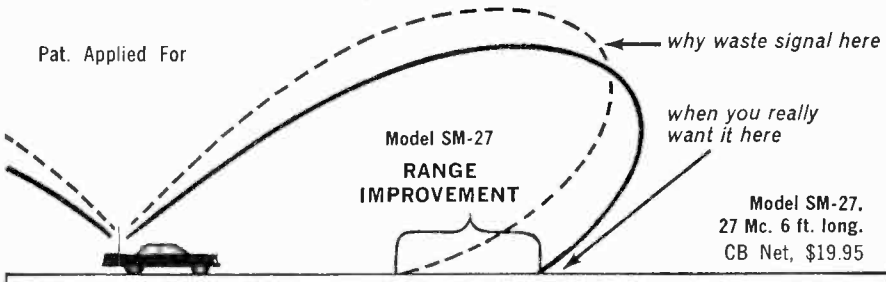

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CB Net, $19.95

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CIRCLE NO. 4 ON READER SERVICE CARD

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TR-70B MOBILE

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Receiver performance is legendary -

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1. The antenna is to be erected *within 3 miles* of the center of any land or water airport; or,

2. The structure is to be erected between 3 and 6 miles distant from the center of a land or water airport,

(a) if it is erected on an existing structure and exceeds 20 feet in height above that structure or,

(b) if it is self-supporting and exceeds 75 feet in height above ground level and 20 feet in height above any terrain features or existing structures within a radius of 1000 feet; or

3. The structure is erected more than *6 miles distant* from the center of a land or water airport,

(a) if it is erected on an existing structure and exceeds 30 feet in height above that structure or,

(b) if it is self-supporting and exceeds 75 feet in height above ground level and 30 feet in height above any terrain features or existing structures within a radius of 1000 feet.

● **More Information.** Details on elegibility to secure a GRS license as a Canadian citizen may be obtained from any of the D.O.T. offices listed on p. 131. Canadian GRS calls begin with the letters XM; a map showing the general division of these calls by territory appears on p. 15.

There is no provision for CB operators and GRS operators to communicate with one another, or to cross the border and operate in the adjacent country. Mobile CB stations crossing the Canadian border from the U.S. may frequently find their equipment sealed, or disabled, so that use in Canada is not possible. This provision is unlike the reciprocity that exists between the FCC and the D.O.T. with regard to radio amateur equipment. Possibly at some future date a CB reciprocity will exist.

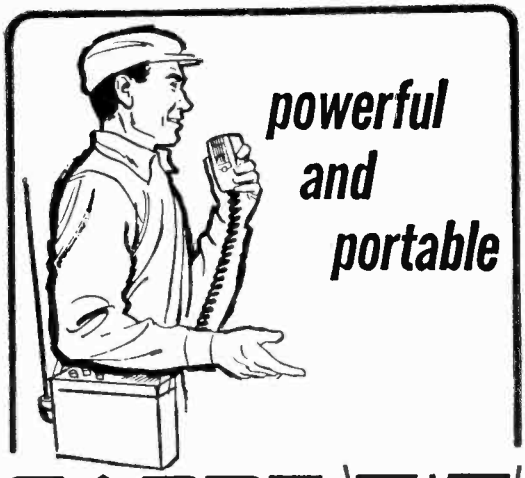
● **The Future of CB.** Not since the early days of wireless has it been possible for the ordinary citizen to have two-way radio communications for strictly personal use. And even then, the growth of radio communications was cut off because of the lack of technical information, and eventually the necessity to pass an International Morse Code examination. We are not revealing a secret when we say that the 23 channels of the Class D Citizens Band have literally been pounced upon by hobbyists, tinkerers, and those just naturally excited about getting "on-the-air!"

It is not our purpose to argue the legalistic definition of "for business or personal use" propounded by the FCC, or whether this term can also be defined as "for business or *pleasure* use." It certainly cannot be denied that there is pleasure in operating one's personal two-way radio system. Nor can it be denied that there is pleasure in trying out various types of equipment, investigating different types of communication systems, and determining the range of a particular radio station.

Active participation in the Citizens Radio Service has unwittingly done more to enlarge our nation's reservoir of electronic technicians than any other single planned or presently operating educational program. It has been pointed out that if only one out of every ten CB operators is sparked into a further study of electronics or is stirred into becoming a commercial operator or getting a ham ticket, our country as a whole will gain immeasurably.

CB is here to stay, and within five years it will undoubtedly be depended upon as much as the telephone or family auto. It will continue to grow, with engineers improving equipment to meet public demands, and with the FCC taking steps to make the necessary legal adjustments to assure the ultimate of service. We also feel that CB'ers will increasingly learn to work hand in hand for the betterment of their communities—just as they have been doing in the past four and a half years.

● **Credits.** The organization of the material for this chapter was made possible through the combined efforts of many individuals. Dave McCullough, 18Q5130, was responsible for several photos, and Bill Nicholls, W9QQB, rendered important technical advice. A local CB equipment distributor, J & M Electronics, Rockford, Ill., made available its equipment and facilities. Others who contributed include: Dave Beggin, Roger DeWert, Guy Fiorenza, Catherine M. Kegal, Donald Meinders, Harlan Meyer, Mary Ploger, Patrick Richards, and Richard Worf.



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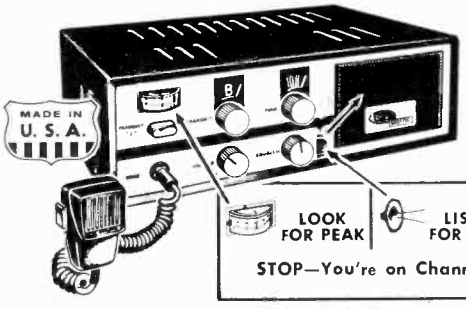

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SHORT-WAVE LISTENING

By HANK BENNETT

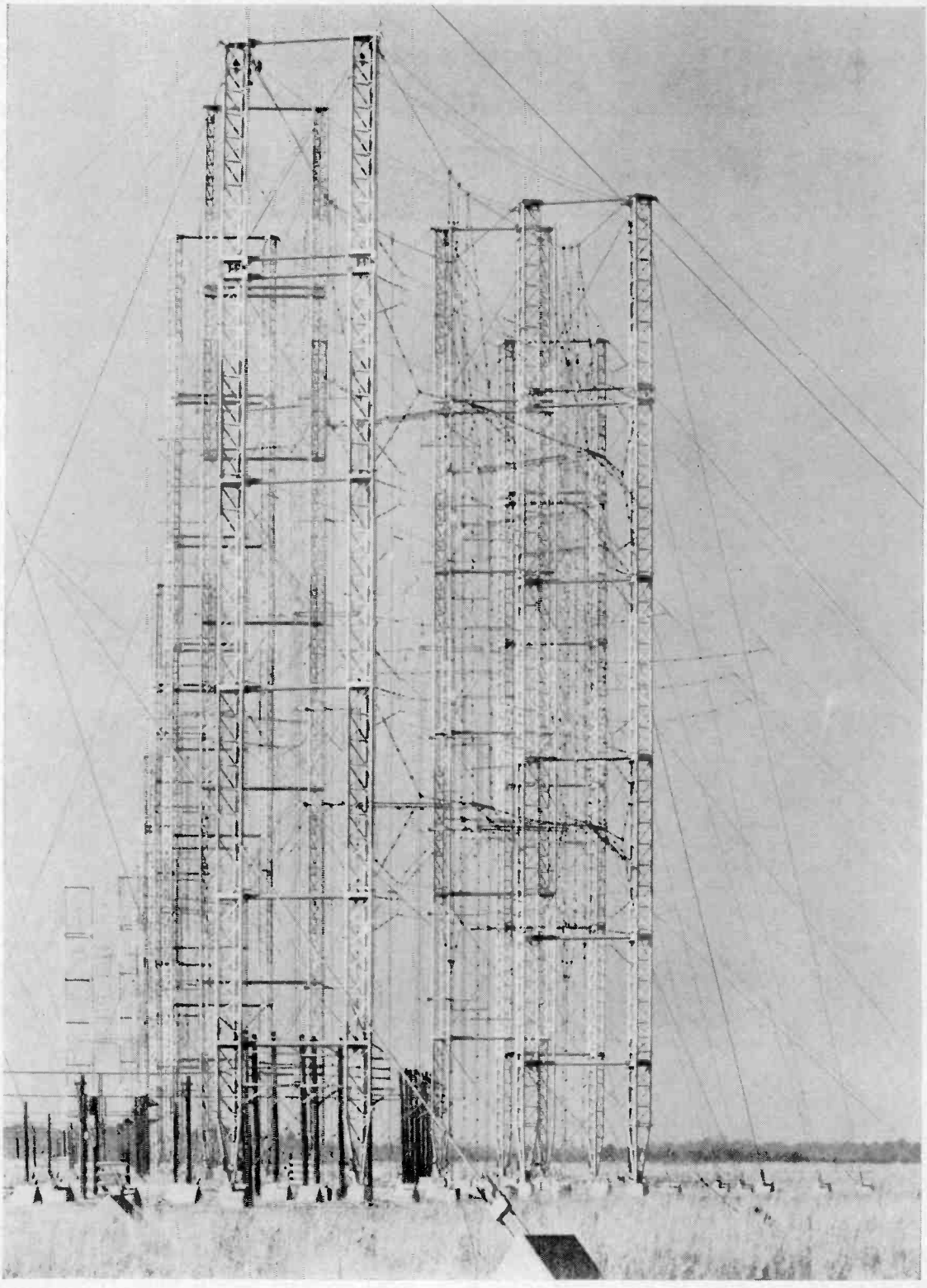
W2PNA/WPE2FT

MONITORING or "listening in" on the radio spectrum is one of the most universal and intriguing hobbies known to man. In the six decades since the time of Marconi —the first serious short-wave listener—people in every country on earth have indulged in the pastime of monitoring radio signals.

Oddly enough, not as many people pursue this hobby as you might expect. However, since World War II, public interest in short-wave listening has doubled. With radio waves acting as the communications medium for everything from submarines to satellites, the public has become increasingly aware of the fact that today's and tomorrow's news is taking place under their noses and that they only need a receiver to hear history being made.

In general, it's not necessary to have a lot of expensive equipment to pursue this hobby, although it goes without saying that the better the radio receiver, the more you will be able to hear. There's no reason for dashing out to the nearest radio shop and plunking down a wad of cash for a piece of communications equipment. If you're a beginner, you won't know how to operate it. If you don't consider yourself a beginner, you can still have lots of fun and many pleasurable moments with nearly any sort of radio receiver. Those little a.c.-d.c. sets that are sitting on the shelf tuned to your favorite local station; that old console in the basement or attic; even the radio in your car—they are all built for the purpose of receiving radio signals in a certain range of frequencies. Just how much you can actually hear depends entirely on you.

● **Getting Started.** You need no experience, no license, and no one's official sanction to become a radio spectrum monitor. But first, let's introduce some of the commonly accepted names and abbreviations. Any and



all "radio spectrum monitors" are referred to as "SWL's." Although this abbreviation once applied solely to someone who was a "short-wave listener," the term SWL now means anyone who monitors the air waves—whether on the short waves or elsewhere.

A variant of SWL is "DX'er," which means someone who listens for distant (DX) radio stations. Since this is one of the prime purposes of listening to the short-wave bands, the two terms, or abbreviations, are basically interchangeable.

There are also "specialty" listeners. Thus, a "BCB DX'er" would be someone who listens particularly to distant stations on the regular AM Broadcast Band. An "FM DX'er" would be the same type of SWL, but one especially interested in picking up distant FM broadcast stations.

You may not hear much on your first try, perhaps only a station or two outside your local area. On the other hand, you might just be lucky enough to hear something that can be called real DX. You may get a thrill at hearing the weather forecast for Chicago —if you happen to live in California. You might be amazed to hear your favorite ball team in action—from a station that is broadcasting the game for the benefit of its local fans. You could, with a little effort, tune in London's famous "Big Ben" or the National Anthem of the Soviet Union. You might even hear setting-up exercises being aired by a station halfway around the world at a time when you would normally be on your way *to* bed rather than just getting up.

From the comfort of your living room, with your feet propped on a footstool, you can travel from one end of the world to the other without any of the problems of tickets, passports, and making connections. Short-wave listening is a hobby that can enrich your life by increasing your knowledge of geography, current events, and history.

In this chapter we will outline the basics of successful short-wave listening, what you can hear—and where on the dial, the language of the SWL, and other hints and tips to increase your enjoyment and improve your chances of successful SWL'ing.

We should point out here that SWL'ing is basically and primarily a hobby. It is strictly for fun. You may ask why you should invest money to buy equipment to pursue such a hobby. The answer would be the same for any enjoyable hobby, be it golf or stamp collecting—for fun and relaxation, with no idea of monetary return.

◀ Antenna towers of the Voice of America short-wave station now on the air in Greenville, N. C.

Washington Post photo by D. Chevalier

● **Reporting Your "Finds."** The average person is of the opinion that a letter to a radio station is bound to go unread and that all correspondence—whether praise or pans —goes into the wastebasket. On the contrary, if your letter is not outright abusive, your communication will *not* go unnoticed. It could, in fact, conceivably lead to a change in station policy with regard to programming and transmitting frequencies. This is especially true in the case of short-wave stations, which depend almost entirely on their listeners' comments in setting up their programs.

This, then, is one of the primary purposes of SWL'ing—to keep stations informed as to how good a job they are doing. Some stations do have paid monitors in various countries but most depend on listeners' reports. Such reception reports may range from a few words to a lengthy discussion of the transmission, but we will cover this phase of the hobby a little later.

Many SWL's regularly report their short-wave "adventures" to the editors of short-wave columns for publication. A prime example of this can be found in POPULAR ELECTRONICS' "Short-Wave Report," which appears monthly and depends almost entirely on letters from listeners for the material that is carried in the column. Of primary interest to such editors is the relaying of information on new stations and of frequency and/or schedule changes.

Letters which contain listings of everything the listener hears—the kind that the newcomer to the hobby is apt to send—are often of secondary importance, although sometimes the editors are able to pick up tips on new or rarely heard stations that the listener has had the luck to capture.

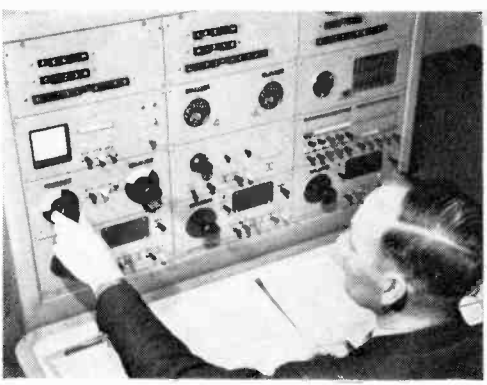
The veteran SWL, on the other hand, constantly tunes the various bands (or he may devote all of his listening time to just one short-wave band, or to a specific range of frequencies) and in the process becomes accustomed to hearing certain stations at certain times, on certain frequencies. He can tune in a signal and know after listening

for just a few seconds whether it is one of his "regular" stations or a new one. It might be a station that has altered its frequency slightly; it could be a change in schedule; or it might be a new station on the air for the very first time. A veteran can locate and log these stations while beginning SWL's have to depend on reading his reports in various short-wave columns. As newcomers to the hobby become more adept, they learn to discriminate between the usual and the unusual.

● **What Equipment to Use?** The line-up of equipment will, of course, start with a receiver. It can be just about anything capable of separating radio waves. According to all reports, SWL's are using sets ranging from old floor models and table radios, to the smaller and more compact a.c.-d.c. sets, to the professional line of communications receivers. One monitor is even using a slightly modified crystal set!

Keep in mind, if you are all set to go out and buy a special receiver for your hobby, that you will *not* find a set capable of tuning all of the radio frequencies for a couple of dollars. For approximately $15.00 up to around $30.00 or so, you can find a transistor radio complete with earphone and, perhaps, a pull-out antenna that will give you a start on your hobby.

● **Transistor Portables.** Such receivers will have a narrow dial spread which may make it a bit difficult to separate stations enough to pull distant stations in between settings. However, a transistor set will almost always be capable of tuning the standard broadcast band—from 540 kilocycles up to 1600 kilocycles. This is called the standard broadcast band to distinguish it from other frequency ranges in the long-wave and short-wave areas. It is also called the "medium-wave" band because it lies between the long waves and the short waves in the frequency spectrum.



Countless SWL's thrill to the resonant tones of "Big Ben" in London. This engineer adjusts volume level of Big Ben's chimes before they go out over the air waves from the British Broadcasting Corporation.

In selecting a transistor radio, remember that since most of them are battery-powered, there may be times when the batteries will fail and put you out of business temporarily. Don't let this discourage you too much, though. It's handy to have such a set for private listening via the earphone even though most daylight reception will be confined to local stations. After dark, however, you may be able to tune in some of those distant stations. In this instance, by "distant," we are speaking of a couple of hundred miles or so to perhaps a thousand miles—under good conditions and with careful tuning.

Transistor portables with two, three, or four "bands" are available, but have a higher price tag than broadcast-band-only sets. A "band" is one tuning range; thus, the AM broadcasting part of the radio spectrum occupies the first band. A two-band portable may have its second range covering from, say, 2 to 5 megacycles. Another portable might have its second band located in the 5 to 12 mc. range. A purchaser of a two-band set with the 2 to 5 mc. range might be bitterly disappointed to find that he couldn't hear broadcasts from Europe or Asia—stations don't broadcast in that band for reception in North America. Those who select a receiver with the second band in the 5 to 12 megacycle range will be much better off—they can hear such foreign broadcasts.

Some transistor portables have a low-frequency band (200 to 400 kc.) for listening to aircraft and marine weather reports, or a band for FM broadcasting (92 to 108 mc.). You can generally recognize these portables by their collapsible dual whip antennas.

● **Table Models.** For a slightly higher investment, perhaps on the order of $20.00 up to $50.00, you can find a number of good table model sets. You can get one from your favorite mail-order supplier or from a nearby appliance or electrical shop. And many department stores carry a representa-

tive group of small receiving sets. It's just a matter of taking your pick.

Check the set out carefully before making your selection. Keep in mind that, generally speaking, the more tubes the set has, the better it will perform. You could choose one of the larger table models, for instance. Such sets usually have a greater dial spread and you will find it somewhat easier to get in between the local stations.

You should also check the available frequency ranges. You might just happen to find some sets that cover two bands. These usually include the standard broadcast band and perhaps one short-wave band. If you are interested in good music, uninterrupted during periods of heavy static, you'll appreciate having a set which will bring in FM stations—but you won't find distant stations nearly as readily as you would on a set with a short-wave band.

● **More Elaborate Sets.** Shopping further, you'll find some good-to-excellent receivers in the price range between $75.00 and $100.00. These will usually include more elaborate circuitry and additional features that will provide considerably better performance. They will incorporate more circuits (or stages) and more tubes, the dial spread will be broader, and the tonal quality will undoubtedly be better. Here, again, you may have a choice of the broadcast band plus another band (usually FM or short-wave), and you may even get a receiver with several short-wave bands.

Although console radios have more or less disappeared from the scene, you might keep your eyes open for a real bargain in one of these older sets.

● **Professional Communications Receivers.** If you have tried out short-wave listening and find that you enjoy it, you will probably start thinking in terms of professional communications equipment. Such receivers are handled by wholesale radio parts distributors and stores specializing in amateur radio gear. Most mail-order catalog firms carry quite a few makes and models, and descriptions of these sets can be found in their catalogs.

We suggest that you shop carefully for your receiver. Many dealers have set up listening booths where you can work with the receiver before you buy it. Most of these shops are staffed with knowledgeable sales personnel who will be glad to point out the various features of the equipment. If they don't have manufacturers' brochures on all the equipment, they will be glad to give you a maker's name and address so that you can write direct for technical details. Some of the better known firms making communications equipment include: Hallicrafters, Hammarlund, Globe, Gonset, and National. There are others as well, but those named will give you some idea of the companies in the field.

You will find that communications receivers are an entirely different breed as

Sample QSL cards verifying reception of overseas short-wave broadcast stations.

far as appearance and performance are concerned. You will find a difference in price, too! Such receivers can run into hundreds of dollars. But don't despair—most of these companies also put out low-priced "baby sisters" to the big sets. You can buy a communications-type receiver for as little as $70.00 and, if you are technically inclined and think you can put a receiver together from a collection of parts, you can have

yourself a communications-type receiver for even less money.

● **Receiver Kits.** Enterprising "do-it-yourself" enthusiasts who want to expand into short-wave listening can combine two hobbies by building a receiver from a kit. In addition to working on a fascinating project, you can save quite a bit of money by assembling your own set.

Four-band, general-coverage receiver kits cost from $25.00 to $40.00. Slightly more advanced kits start at $60.00 and run as high as $110.00. If you went out and bought a completely factory wired receiver with the identical features of one of these kits, it would set you back from $25.00 to $75.00 *more*. One manufacturer offers a partially assembled kit for about $75.00; the most difficult circuitry is pre-assembled.

Heath Company, Allied Radio, and Lafayette Radio all furnish receivers in kit form. The kits come complete with parts, assembly diagrams, and step-by-step instructions on how to put the units together. We should, in all honesty, point out that you ought to have some familiarity with soldering techniques and know how to use various light hand tools before attempting to assemble a kit of this type.

● **Advantages of Communications Sets.** As we said before, communications receivers will have many features not found in smaller transistor a.c.-d.c. or console sets. They will incorporate circuits to enable you to listen to Morse code, have two volume or gain controls, provide for crystal selectivity and phasing, include a separate bandspread dial in addition to the main tuning dial, have an antenna trimmer and automatic volume control.

Sound like too much to handle? Perhaps so, if you are strictly a beginner. In that case, you should wait to invest in a communications receiver until you are more familiar with SWL techniques. Start off gradually and take your time. Move up slowly and grasp each step in turn. Almost without realizing it, you'll be able to talk "SWL," and you'll be on your way to becoming a full-fledged member of the "club."

● **Onward to Ham Radio.** Another good reason for exercising care in buying your

Here is a sampling of the many short-wave receivers of interest to the SWL. From the top down: a Gonset 212 general-coverage receiver costing about $110.00; the popular Hammarlund HQ-100A with built-in clock timer, at about $200.00; the Hallicrafters SX-62A all-wave FM/AM receiver with continuous tuning from 540 kc. to 109 mc., and costing about $430.00; a semi-kit receiver distributed by Lafayette Radio for about $65.00; the National NC-190 with separate bandspread dials for SWL's and hams for about $220.00; and the Knight-Kit R-100A general-coverage or ham receiver for about $100.00.

first communications-type receiver is that many SWL's go on to become amateur radio operators ("hams") with their own transmitting stations. The receiver needed by a ham operator is much more "critical" than that used by the SWL. The ham may spend up to $500.00 for his receiver—only to have it capable of tuning *just* the ham bands. The experienced SWL can invest half that amount and have a receiver that will meet his hobby needs for years to come.

The Amateur Radio section of this Handbook will enable you to take a good look at ham radio. Written by Herb Brier, W9EGQ, it contains an excellent treatment of the requirements for a ham license.

● **What About Antennas?** The average person usually has the impression that to be a successful SWL or DX'er it is necessary to have a long and complicated antenna attached to your receiver. This is not entirely true. Because of the nature of the beast, the higher the frequency you are trying to receive, the shorter the antenna needed to do the job. Thus, while a good antenna for the standard broadcast band *might* be upwards of a couple of hundred feet long (providing that it is "tuned" to the exact frequency you wish to receive), the corresponding antenna for a frequency of 144,000 kc. (the two-meter amateur band) need be only about 39 inches long.

In theory, an antenna cut to any specified length is good only for the exact frequency to which it is tuned. In practice, however, that same antenna will be found to be quite satisfactory for general-coverage reception. You do not need a fancy or expensive antenna for SWL'ing.

Most transistor sets don't have external antenna connections, since they rely on built-in antennas of the "loopstick" type for practically all reception requirements. Some of the more elaborate models, and many of those of the multi-band variety, have a telescoping antenna which may be pulled out to increase set sensitivity. Some SWL's report that they have been able to increase the sensitivity of their transistor sets by wrapping a few coils of wire around the case.

Table model a.c.-d.c. sets are almost always equipped with a built-in loop antenna and a few provide a terminal for connecting an external antenna. If your set does have such an external antenna connector, you might try hooking on a piece of wire of random length. You'll be surprised at the increase in volume. What is happening is that the antenna is bringing more radio waves into the set, so that the internal circuits do not have to work quite as hard to produce the signal for you to hear.

The larger console models usually do have an external antenna connection, and with the antenna described above it is possible to pull in many reasonably distant stations during periods of darkness.

Communications receivers, on the other hand, *must* have an external antenna. These professional receivers are virtually useless without one. Here again, a random length of wire will give you *some* reception. But for really good reception, and a chance at distant stations, you should have an outdoor antenna, placed as high off the ground as you can get it. But enough about antennas for now; we'll discuss them in detail later on.

● **Broadcast-Band DX'ing.** DX'ing on the standard broadcast band can be as exciting as working the short-wave and amateur bands. We make this statement knowing full well that it would be much easier for you to hear Munich, Germany, on the short-wave band than on the broadcast band, or Wellington, New Zealand, on the amateur band rather than the standard broadcast band. Whereas signals on the short-wave and amateur bands can be transmitted over vast distances with relatively low power, the signals from stations on the standard broadcast band have to be far stronger to travel the same distance. However, with careful tuning, you may be able to log a

Radio-TV Station Guide

A comprehensive listing of AM/FM-TV broadcasting stations in North America is now published by Howard W. Sams & Co., Inc. Called "North American Radio-TV Guide," it sells for $1.95 at most radio parts jobbers. Frequencies, power, network affiliation, and hours of operation are carefully itemized.

This listing was formerly published by the Vane A. Jones Company. It does not contain police, fire, or short-wave broadcasting information.

number of low-powered stations on the broadcast band at amazingly long distances.

The standard broadcast band, that range on which you'll find your favorite local stations, extends from 540 to 1600 kilocycles. You can tune in many channels on your transistor set, your a.c.-d.c. receiver, or console. Many of the communications receivers also cover this band.

● **European Stations.** Broadcast stations in North America operate on frequencies that are 10 kilocycles apart. European stations operate on 9-kc. intervals, starting at 539 kc. Thus, it stands to reason that some of those larger European stations might just happen to come through between the American channels. Of course, we don't believe that you'll be able to sit down and tune between 840 and 850 kc. and pick up Rome on 845 kc. just like that, but we are saying that the possibility exists. You must have the patience to tune for it night after night, perhaps weeks on end, before you will be fortunate enough to hear something that might be Rome. It takes a lot of practice to be able to dig out a weak signal from the split channels.

The majority of European stations can be heard only from about sunset, local time, to roughly midnight. After that, the signals will gradually be returning to the distance levels usually reached during daylight hours. Remember that when it is midnight along the Atlantic Coast, it is already 5 a.m. in London and starting to get light. That is the time, then, to change your direction and start hunting for western stations; those signals will be traveling in darkness, and your chances of picking them up will be greater than they would be for stations to the east of you.

East Coast DX'ers often report reception of European stations; West Coasters may well tune in Honolulu, Alaska, even Japan and South Pacific areas. With a sharp receiver, a good antenna, and a lot of patience, DX'ers at virtually any point in the United States stand a reasonably good chance of hearing stations several thousand miles away.

● **Good Bets for Beginners.** One of the most easily heard stations in the eastern two-thirds of North America is *Radio Americas*, operating on a split frequency of 1165 kc. This station, which beams anti-Castro programs to Cuba, is located on Swan Island in the Caribbean Sea and is most often noted in Spanish after dark. Careful tuning will enable you to hear the familiar *Radio Americas* identification. Many DX'ers report hearing this station on a variety of receivers, ranging from communications sets down to car radios and small transistor receivers. If you can locate WWVA, Wheeling, W. Va., on 1170 kc., and WJJD, Chicago, or KSL, Salt Lake City, on 1160 kc., carefully tune in between and listen for a Spanish-speaking station. That will be *Radio Americas*.

Another station that you might try for is PJA6, *Radio Victoria*, which is located just off the north coast of South America on the Dutch island of Aruba. It operates on 905 kc. and transmits almost entirely in English. The station features many evangelical programs. Here, again, after dark is the only time that you'll be likely to hear it.

● **Other Likely Prospects.** Canadian stations can be heard in most areas of the United States with little difficulty. One of the strongest signals in eastern and midwestern areas comes from CKLW, Windsor, Ontario, operating on 800 kc. Don't mistakenly assume you have a Detroit station, though—they often give their identification as "CKLW, Detroit" for their mail-order

Broadcasting Stations of World

The U.S. Government Printing Office has for sale four lists (entitled "Broadcasting Stations of the World," Parts 1-4) of all known radio broadcasting and TV stations. They may be ordered from the Superintendent of Documents, Washington 25, D.C.

Part I: a listing according to country and city ($2.25).

Part II: a listing according to frequency ($2.00).

Part III: a listing according to call letters, station name, or slogan ($2.00).

Part IV: a listing of FM and TV stations ($2.00).

The above lists do NOT include stations operating in the United States. Also, at this writing, the lists are up-to-date only to September 1, 1961.

TIME CONVERSION WITHIN U.S.A.

Universal Time (Greenwich Mean Time) (*hours*)	Eastern Daylight Time	Eastern Standard or Central Daylight	Central Standard or Mountain Daylight	Mountain Standard or Pacific Daylight	Pacific Standard Time
0000	8:00 p.m.	7:00 p.m.	6:00 p.m.	5:00 p.m.	4:00 p.m.
0100	9:00 p.m.	8:00 p.m.	7:00 p.m.	6:00 p.m.	5:00 p.m.
0200	10:00 p.m.	9:00 p.m.	8:00 p.m.	7:00 p.m.	6:00 p.m.
0300	11:00 p.m.	10:00 p.m.	9:00 p.m.	8:00 p.m.	7:00 p.m.
0400	Midnight	11:00 p.m.	10:00 p.m.	9:00 p.m.	8:00 p.m.
0500	1:00 a.m.	Midnight	11:00 p.m.	10:00 p.m.	9:00 p.m.
0600	2:00 a.m.	1:00 a.m.	Midnight	11:00 p.m.	10:00 p.m.
0700	3:00 a.m.	2:00 a.m.	1:00 a.m.	Midnight	11:00 p.m.
0800	4:00 a.m.	3:00 a.m.	2:00 a.m.	1:00 a.m.	Midnight
0900	5:00 a.m.	4:00 a.m.	3:00 a.m.	2:00 a.m.	1:00 a.m.
1000	6:00 a.m.	5:00 a.m.	4:00 a.m.	3:00 a.m.	2:00 a.m.
1100	7:00 a.m.	6:00 a.m.	5:00 a.m.	4:00 a.m.	3:00 a.m.
1200	8:00 a.m.	7:00 a.m.	6:00 a.m.	5:00 a.m.	4:00 a.m.
1300	9:00 a.m.	8:00 a.m.	7:00 a.m.	6:00 a.m.	5:00 a.m.
1400	10:00 a.m.	9:00 a.m.	8:00 a.m.	7:00 a.m.	6:00 a.m.
1500	11:00 a.m.	10:00 a.m.	9:00 a.m.	8:00 a.m.	7:00 a.m.
1600	Noon	11:00 a.m.	10:00 a.m.	9:00 a.m.	8:00 a.m.
1700	1:00 p.m.	Noon	11:00 a.m.	10:00 a.m.	9:00 a.m.
1800	2:00 p.m.	1:00 p.m.	Noon	11:00 a.m.	10:00 a.m.
1900	3:00 p.m.	2:00 p.m.	1:00 p.m.	Noon	11:00 a.m.
2000	4:00 p.m.	3:00 pm.	2:00 p.m.	1:00 p.m.	Noon
2100	5:00 p.m.	4:00 p.m.	3:00 p.m.	2:00 p.m.	1:00 p.m.
2200	6:00 p.m.	5:00 p.m.	4:00 p.m.	3:00 p.m.	2:00 p.m.
2300	7:00 p.m.	6:00 p.m.	5:00 p.m.	4:00 p.m.	3:00 p.m.

business. Let the "C" in the call letters be your clue to the true location of the station.

You may be more interested in hearing at least one station from each of the 50 states than a number of stations all from one area. We agree that you'll find this no easy task. Honolulu, for example, might be a rough one to log. We suggest that you try for KULA, 690 kc., some time just before sunrise in your area. It has been heard in New Jersey with a good signal! For Alaska, you might monitor the 730 or 900 kc. frequencies. Some DX'ers will say that it is much easier to log these two far-flung states than it is to log some of the continental states such as the Dakotas, Montana, Idaho, and Nevada. Western DX'ers will find it equally rough to log Delaware, Vermont, New Hampshire, and South Carolina, to name a few. There are tricks to logging them, though, and the basic one—it will sound familiar to you by this time—is to tune for them after dark.

● **Night-Time Listening.** You'll find that you have to put up with a lot of "all-night" stations; and if you happen to live in an area where "all-nighters" are common, you may as well forget trying to log anything else on those channels. However, keep this in mind: nearly all of the all-night stations are off the air for at least a short period each month, primarily for maintenance work on their equipment. A few telephone calls to those stations might give you some idea of when you could tune those usually busy channels and perhaps come up with a station several hundred (or thousand) miles away.

Many broadcast stations operate during daylight hours only. Still, many DX'ers have logged these stations with relative ease at some time between midnight and 6 a.m. "Daytime" stations are frequently required to go on the air for test purposes, and this is done during their normally silent hours (stations may go on the air for specific purposes at times other than their regular hours). This, then, is the time to log these stations. You may tune across the broadcast band in the middle of the night and hear a variety of tone signals. Hang on to one of them for a little while; the station is per-

Nighttime Listening

forming tests of some sort, perhaps a frequency measurement test for the Federal Communicataions Commission, but an identification will definitely be given before the station closes down.

A few years ago we took part in an early morning test program by a local daytime station. During the test we invited listeners to call the station; we were interested in knowing how far the signal was traveling. We received only one call, and that from a disgruntled person who had a clock radio wired up to activate when the local station came on at its normal operating time. With the station going on in the middle of the night, we woke him up, and he let us know about it!

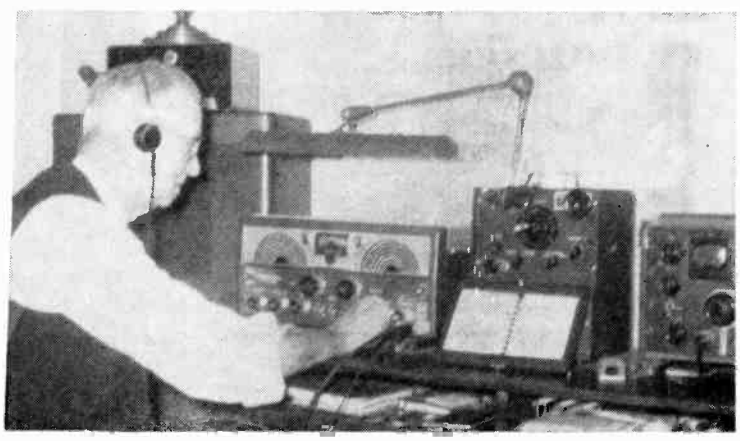
Stations that operate during all-night hours, whether for tests or their regular programming as a 24-hour station, often ask listeners to call in, to take part in discussions, or just to let the station know how far the listener is from the station. Now and then the station may offer a small token of appreciation for the call from the most distant listener. However, don't listen all night just for the purpose of "making out," for such awards are infrequent.

If you are a devotee of fine music, you'll find that many stations offer excellent programming during the hours of darkness, particularly after midnight. Station WGN, Chicago, on 720 kc., is a good example. This 50,000-watt station can be heard in nearly all parts of the United States after dark.

● **Sunset and Sunrise.** A good time to listen, if you don't happen to be a night owl, is that period during late afternoon when daytime and nighttime conditions are partially intermingled. During this period many local stations—daytime stations—will be signing off, leaving the channel clear for reception of other daytime stations farther west. With darkness still not in your area, you may be able to log stations nearly a thousand miles away. Another good time is that period from about an hour before sunrise to an hour after sunrise. Many of the daytime stations have not as yet come on the air and you may be able to make some really fine catches, especially if you are trying for stations that are still in areas of darkness.

If you are just starting out as an SWL, you'll likely begin on the broadcast band. You will find that there is more to be heard than we could possibly hope to cover here. In the course of your listening, we suggest that you send reports off to the stations that you hear; let them know where their signal is going and how you like their programs. Send a complete report showing times heard, program details, and information on how well their signal is being received—and you may receive a verification in return. Many DX'ers verify stations on the broadcast band exclusively, and their verifications total well up into the thousands.

● **Reporting and Verification.** The *World Radio-TV Handbook* classifies listeners who send reports to stations as being in one of three categories: (1) those who listen for pleasure, (2) those who listen in order to learn a language or to gain a better understanding of other countries, and (3) those who listen for the purpose of collecting QSL



Most DX'ers use a pair of earphones to dig for that rare station down in the noise. Grady C. Ferguson, Charlotte, N.C., is no exception as he tunes his Hallicrafters SX-100 receiver. To the right of this receiver is a war surplus BC-221 frequency meter used to calibrate the receiver tuning dial and measure the frequency of new DX catches. Also on the right is a pre-World War II short-wave receiver, the Hallicrafters SX-28.

cards or verifications. We would like to discuss the last category in detail since it is the most complex.

Verifications, or QSL's as they are usually called, are cards or letters sent to the listener by the station after the listener has submitted satisfactory proof of reception. Some QSL's have become virtual collectors' items over a period of time. Many QSL's are bright and colorful; others may seem dull to a recipient—but they are all QSL's and serve their purpose.

These QSL's may be no more than just a few words on a card or in letter form or they may be elaborate affairs. Some may be accompanied by station schedules or, in a few isolated cases, by souvenirs from the country of the verifying station.

If you send a report to a station and you qualify under categories (1) or (2) above, your report will rarely contain technical information that might be helpful to the station. You will probably be commenting on some program in particular or asking for further information on the language courses offered by the station. However, if you are sending a report in the hope of getting a verification, you should pay close attention to some of the details to be included in your report.

● **Reporting for QSL's.** To obtain a QSL from any given station, it is necessary for the listener to report reception over a period of time, preferably one-half hour. But this time period can be lengthened or shortened as conditions dictate. It would be rather ridiculous, for example, to try to compile a 30-minute report if the station signs off 15 minutes after you tune in. However, if conditions warrant, longer reports are always in order and are, accordingly, more useful to the station—especially if the reports are honest and include the right sort of information.

● **What to Include in Your Report.** Aside from knowing exactly what station you have tuned in, you should try to determine the frequency of transmission as closely as possible. In cases where a station has several transmitters operating simultaneously on continguous frequencies, you should indicate the specific transmitter to which you were tuned. A report showing the comparative signal strength of the other transmitters might also be appreciated by the station. If a station is transmitting the same program on two or more frequency bands and you can hear the other signals, you might also include a report on them, showing comparative signal strength and readability qualities.

Your report should show entries for each selection of music playing (title or brief description of it), a short resume of certain news items, names of sponsors (if any), and any other peculiarity which will verify your tuning. Beside each entry in your report, you should list the time, at least to the exact minute, and to the half minute if you can check that accurately. All SWL's should try to obtain clocks with sweep second hands. Clocks are also sold with built-in time conversion scales.

International Broadcasting List

A 244-page book containing a list of all AM, FM, TV, and short-wave broadcast stations is published annually in Denmark. It is called the "World Radio TV Handbook" and is available in North America in an English-language edition. The book contains call-signs, frequencies, transmitter power, addresses, programs, and hundreds of other items important to the short-wave listener.

The English-language edition is sold through mail order (Gilfer Associates, Box 239, Park Ridge, N.J., $3.25) and by numerous radio parts jobbers and distributors.

● **Time Conversion.** When reporting the reception of a DX radio station, it's best to indicate reception time in a standard manner. Broadcasting stations in North America —both AM and FM—announce the correct time and the station call letters. This is the time that should be included in your report. When the exact time at the broadcasting station is unknown—particularly during summer and daylight saving time—give the report in your (the listener's) time. This will eliminate confusion—if you clearly state your system of reporting. The station can then make the suitable time conversion and verify the reception.

Since short-wave stations may be scattered throughout the world, it has become

Times Around the World

Listed below are the differences between local Standard Time and Universal Time (UT) in a great many countries. A plus sign indicates the number of hours that local Standard Time is "ahead" of Universal Time; a minus sign indicates the number of hours that local time is "behind" UT. Differences between local Daylight Saving Time and UT are also shown. Greenwich Mean Time (GMT) and UT are interchangeable for the purposes of this list.

COUNTRY	Standard Time	Daylight Saving
Aden	+ 3	
Afghanistan	+ 4½	
Alaska	— 8	
Albania	+ 1	
Algeria	+ 1	
Argentina	— 3	
Australia		
Victoria		
New South Wales,		
Queensland,		
Tasmania	+10	
N. Territory		
S. Australia	+ 9½	
W. Australia	+ 8	
Austria	+ 1	
Bahamas	— 5	
Barbados	— 4	
Belgium	+ 1	
Bermuda	— 4	
Bolivia	— 4	
Brazil		
Eastern	— 3	
Manaos	— 4	
Acre	— 5	
Brunei (N. Borneo)	+ 8	
Bulgaria	+ 2	
Burma	+ 6½	
Cambodia	+ 7	
Canada		
Newfoundland	— 3½	— 2½
Atlantic (Labrador, Nova Scotia, Quebec)	— 4	— 3
Eastern (Ontario)	— 5	— 4
Central (Manitoba)	— 6	— 5
Mountain (Alberta)	— 7	— 6
Pacific (Br. Columbia)	— 8	— 7
Yukon	— 9	— 8
Ceylon	+ 5½	
China		
People's Rep.	+ 8	
Taiwan	+ 8	+ 9
Colombia	— 5	
Congo, Rep. of Leopoldville	+ 1	
Elisabethville	+ 2	
Congo Rep.	+ 1	
Cook I.	—10½	
Costa Rica	— 6	
Cuba	— 5	
Curaçao	— 4½	
Cyprus	+ 2	
Czechoslovakia	+ 1	
Dahomey	+ 1	
Denmark	+ 1	
Dominican Rep.	— 5	
Ecuador	— 5	
Egypt	+ 2	+ 3
El Salvador	— 6	
Ethiopia	+ 3	
Falkland I.	— 4	
Faeroes I.	UT	
Fiji I.	+12	
Finland	+ 2	
France	+ 1	
Germany	+ 1	
Gibraltar	+ 1	
Gilbert I.	+12	
Ghana	UT	
Great Britain	UT	+ 1
Greece	+ 2	
Greenland		
Thule area	— 4	
Angmagssalik	— 2	
Guadeloupe	— 4	
Guam	+10	
Guatemala	— 6	
Guiana (Br.)	— 3¾	
Guiana (Dutch)	— 3½	
Guiana (French)	— 4	
Guinea	UT	
Haiti	— 5	
Hawaii	—10	
Honduras	— 6	
Honduras (Br.)	— 6	
Hong Kong	+ 8	+ 9
Hungary	+ 1	+ 1
Iceland	— 1	UT
India	+ 5½	
Indonesia		
N. Sumatra	+ 6½	
Java, Borneo, Bali	+ 7½	
Celebes	+ 8	
Iran	+ 3½	
Iraq	+ 3	
Ireland (Eire)	UT	+ 1
Israel	+ 2	
Italy	+ 1	
Ivory Coast	UT	
Jamaica	— 5	
Japan	+ 9	
Jordan	+ 2	
Kenya	+ 3	
Korea	+ 9	
Kuwait	+ 3	
Laos	+ 7	
Lebanon	+ 2	
Liberia	— ¾	
Libya	+ 2	
Luxembourg	+ 1	
Madagascar	+ 3	
Malaya	+ 7½	
Mali	UT	
Malta	+ 1	
Marshall I.	+12	
Martinique	— 4	
Mexico	— 6	
Monaco	+ 1	
Mongolia (Outer)	+ 8	
Morocco	UT	
Mozambique	+ 2	
Nepal	+ 5.40	
Netherlands	+ 1	
Neth. Antilles	— 4½	
New Caledonia	+11	
New Guinea (Australian)	+10	
New Hebrides	+11	
New Zealand	+12	
Nicaragua	— 6	
Nigeria	+ 1	
Norfolk I.	+11½	
Norway	+ 1	+ 2
Pakistan		
West	+ 5	
East	+ 6	
Panama	— 5	
Papua	+10	
Paraguay	— 4	
Peru	— 5	
Philippines	+ 8	
Poland	+ 1	+ 2
Portugal	UT	+ 1
Puerto Rico	— 4	
Rhodesia	+ 2	
Ruanda-Urundi	+ 2	
Rumania	+ 2	
Samoa I.	—11	
Sarawak	+ 8	
Saudi Arabia	+ 3	
Senegal	UT	
Seychelles	+ 4	
Sierra Leone	UT	
Singapore	+ 7½	
Solomon I.	+11	
Somalia	+ 3	
S. Africa (Union of)	+ 2	
Spain	+ 1	
Sudan	+ 2	
Surinam	— 3½	
Sweden	+ 1	
Switzerland	+ 1	
Syria	+ 2	
Tanganyika	+ 3	
Tahiti	—10	
Tasmania	+10	
Thailand	+ 7	
Trinidad	— 4	
Tunesia	+ 1	
Turkey	+ 2	
Uganda	+ 3	
Uruguay	— 3	
U.S.S.R.		
Moscow, Leningrad	+ 3	
Sverdlovsk	+ 5	
Tashkent	+ 6	
Vatican	+ 1	
Venezuela	— 4½	
Vietnam (Rep.)	+ 8	
Virgin I.	— 4	
Windward I.	— 4	
Yemen	+ 3	
Yugoslavia	+ 1	
Zanzibar	+ 3	

the custom to report reception in terms of Greenwich Mean Time (GMT), or as they refer to it in this Space Age, Universal Time (UT).

To equate our 24-hour day with the geographic picture of the surface of the earth, remember that an increment of one hour occurs with each 15° "increase" in longitude. And Greenwich Mean Time is simply the time at the point of 0 longitude, which happens to pass through Sussex, England. (The word "Greenwich" in the term results from the fact that the Royal Greenwich Observatory is located in Sussex).

The 24-hour clock system is used and understood around the world. In this system, the hours from 1 a.m. to 11 a.m. are expressed as 0100 to 1100. Noon, or midday, is referred to as 1200. From 1 p.m. to 11 p.m., times are expressed as 1300 to 2300. Midnight is popularly referred to as 0000, although there are occasional references to midnight as 2400 hours. If a broadcasting station states that there will be a transmission between 1330 and 1515, you can readily interpret this to mean that the station will be on the air from 1:30 p.m. to 3:15 p.m.

The table on page 57 will enable you to convert from Universal or Greenwich Mean Time to Standard or Daylight Saving Time throughout the United States. A separate table on page 60 shows the difference between local time in various countries and Universal or Greenwich Mean Time. When known, Daylight Saving Time has been indicated.

● **Reception Details.** You should provide a strength and readability report. A more comprehensive résumé of this technique will be given later but, for now, keep in mind that stations are very much interested in knowing how they are being received in your locality. They want to know how their signals performed over the time period covered by your report. They'd also like to know how their signals compared with those from other known stations in the same frequency range.

How was the signal from the standpoint of readability? Was it completely readable or were there times (indicate the times) when it was difficult to understand? Did you notice any peculiar effects on the signal such as atmospheric interruptions, fading, static, or other interference? If there was interference, was it from another station? What station? Did the signal seem to be distorted or "mushy"? What did you like best about the programs? What did you like the least?

All of these points should be covered in your report. Remember that a report is of little value to the station receiving it unless it contains needed information. Merely listing times and items heard does not make for a good report, although some stations will verify on just those points alone. But why take a chance?

Complete information, as outlined above, does make for a good report, and will increase your standing in the eyes of the station; it will enable the station to plan for future programming; it will enable the station to adjust its schedules if reception is particularly bad over a long period of time in your area; and it will enable the engineering staff to realize more fully just what the signal is doing and what they can do to improve it.

One of the rarest QSL cards of all time, this is a verification for a reception report of "Sputnik I." The signal was picked up on about 19.995 mc. Soviet satellites still transmit on or about this frequency, but are now too difficult to identify positively.

In your report, you might include a brief comment on the equipment you are using. Mention the make and model of your receiver, number of tubes, and the length and type of antenna system. Indicate your general location with respect to some well-known city. Briefly mention the weather

Report Preparation

and temperature in your area at the time of reception.

● **Preparing the Actual Report.** All of this information should be put into a letter. *Never* send reports on postcards—they just can't accommodate enough information to be of value to a station. If you have your own SWL card, you might include it with your report, but don't use it strictly *for* the report.

Be courteous in your request for a verification. Some people will *demand* a QSL and wonder why a station discards their reports. It is much more effective to *suggest* that the station verify the report ". . . if it is found to be correct and of use to your engineering staff." This is very important when writing to a non-broadcaster, or station that doesn't usually verify reports.

ENGLISH

Dear friend:

I had the pleasure of hearing your fone/CW signals on.....meters at.....GMT on / / . At the time, you called/worked ..... Your signals were SINPO ..... I would very much like to have your QSL. My receiver is a....., and my antenna is.....meters long.

73,

SPANISH

Querido amigo:

He tenido el gusto de oir sus telefonicas/CW señales en.....metros a.....GMT del / / . Quando usted llamó/operaba ..... Sus señales eran SINPO..... Me gustaria muchisimo tener su QSL. Mi receptor es un.....y mi antena tiene..... metros de largo.

73,

FRENCH

Cher ami:

J'ai eu le plaisir de recevoir vos signaux téléphoniques/CW sur.....mètres à..... GMT le / / . A l'heure où vous appeliez/fonctionniez..... Vos signaux étaient SINPO..... J'aimerai obtenir votre QSL. Mon recepteur est un.....et mon antenne a.....mètres de long.

73,

The proper way to word a reception report to any radio amateur appears in English (letter at top) and in Spanish and French translations (center and bottom, respectively). See the June, 1962, issue of POPULAR ELECTRONICS for full details on how to send reception reports in foreign languages.

When sending reports, it is always proper to include return postage. Bear in mind that the station is doing you a favor by QSL'ing; it is under no obligation to do so. Some stations state that return postage is not required but most stations will appreciate receiving it. Many stations are government-owned, in which case return postage isn't needed. However, when in doubt, it is always best to include it. Return postage for foreign countries can be sent in the form of an International Reply Coupon (IRC), available at your local post office.

● **The Reporting Codes.** Through the years there have been a number of reporting codes in use and, as a matter of fact, most of them are still current. Here is a brief rundown on these codes.

International Reply Coupons (IRC's)

The best way to insure that a radio station will QSL your report is to prepay the postage for the reply. This is best done by buying an International Reply Coupon at any U.S. post office for 15 cents and including it with your report. Practically every nation will exchange an IRC for postage to cover the cost of mailing a one-half ounce (surface mail) letter back to the country where the IRC was purchased. IRC's are obtainable in all countries that honor this form of exchange. If you receive an IRC, the U.S. post office will give you an 11-cent stamp for it—unless the IRC is from Canada or Mexico, where a 5-cent stamp is all that is required to return a letter.

● **QSA-R.** This is one of the earlier types of codes that was used mostly in amateur radio. The *QSA* meant "The strength of your signal is ..... (1 to 5)" and the *R* stood for readability on a scale of 1 to 9. The latter may have been an abbreviation of the more proper *QRK* signal which means "The readability of your signal is. . . ." As with most codes, the higher the number, the better the report. Thus "QSA 5, R9" was music to the ears of the operator.

In later years, the *R* was replaced by *S*, through general usage, although its meaning remained the same. During this transition, the *QSA* was shortened to *Q*. A typically good report of that era would have been "Q5 S9."

● **QSA-QRK.** While the stations in the amateur radio service used the *Q-S* code, the short-wave broadcast stations and their listeners generally used the *QSA-QRK* code. This was similar to the *QSA-R* code with the exception that the *QRK* numbers only went to 5 while the *R* and *S* numbers went up to 9.

● **Q-S and RST.** The two best known codes in the amateur service today are the *Q-S* code (used among phone stations) and the *RST* code (used by c.w. operators). The letters "RST" stand, respectively, for *R*eadability, *S*trength, *T*one. The readability portion ranges from 1 to 5 and strength and tone each range from 1 to 9. In the tone portion, *9* indicates a pure d.c. note—a good signal —free from ripple or chirp, while *1* indicates an almost Bronx-cheer type of signal. This code is covered in more detail in the Amateur Radio section of this Handbook.

● **555.** The British Broadcasting Corporation asks its regular monitors and listeners to report using the *555* code. This is broken down as shown in the accompanying table.

● **SINPO.** The newest code on the scene is the *SINPO* code, and this method of reporting is gaining popularity in the short-wave field while remaining virtually unknown among amateur radio operators. Many short-wave outlets, notably *Radio Japan*, are leading the movement towards general usage of *SINPO* and are asking their listeners to report to them in that code. All numbers after the letters range from 1 to 5. The *SINPO* code, with Q-code equivalents, meanings, and ratings, is given in the table below.

SINPO is now the most widely understood code among stations and we urge readers to familiarize themselves with this code and make use of it when reporting to short-wave stations. A typical report for a station that is coming in loud and clear should read: *SINPO 55555* (not S5I5N5P5O5).

No matter what reporting code you favor, always try to be honest with yourself when evaluating the signal that you are monitoring. The more detailed your report, the more value it will have for the station receiving the report and the more credit you will reflect on the SWL hobby as a whole.

THE 555 CODE

Signal Strength	Interference	Overall Merit
0 Inaudible	0 Total	0 Unusable
1 Poor	1 Very severe	1 Poor
2 Fair	2 Severe	2 Fair
3 Good	3 Moderate	3 Good
4 Very good	4 Slight	4 Very good
5 Excellent	5 None	5 Excellent

● **Radio Signal Propagation.** The remarkable success of Marconi's experiments in 1901 thoroughly upset the scientific world, for Marconi had succeeded in transmitting radio signals over many thousands of miles. It could easily be shown that radio waves should act like light waves; they should leave the antenna of a radio transmitter and travel on a straight line out to the horizon. The reception of radio signals far beyond the

S	I	N	P	O
Signal Strength (*QSA*)	Interference (*QRM*)	Atmospheric Noise (*QRN*)	Propagation Disturbance (*QSB*)	Overall Merit (*QRK*)
5 Excellent	5 None	5 None	5 None	5 Excellent
4 Good	4 Slight	4 Slight	4 Slight	4 Good
3 Fair	3 Moderate	3 Moderate	3 Moderate	3 Fair
2 Poor	2 Severe	2 Severe	2 Severe	2 Poor
1 Barely audible	1 Extreme	1 Extreme	1 Extreme	1 Unusable

Postal Information

RADIO amateurs and short-wave listeners have the opportunity to gain a fair knowledge of geography and postal rates throughout the world. It is very important to affix the proper postage on all QSL cards and letters addressed to overseas radio stations. Those with improper postage are immediately returned to the sender; the stamps are cancelled on the envelope or card, and instructions are given not to use the same envelope or card again. Obviously, it is also important to have the correct address. Scattered throughout this book are numerous references as to where you can obtain specific addresses of all sorts of radio stations.

QSL CARDS

The cheapest way to send a reception report, or QSL card, overseas is by post card rate. All post cards travel out of this country via surface mail (steamship, or where applicable, train or truck). In general, the basic cost of mailing a QSL card is 7 cents. There are a few exceptions: the rate to Alaska, Canada, Canal Zone, Mexico, Puerto Rico, and United States possessions is only 5 cents.

You can speed up the delivery of your QSL card by sending it via airmail. This will cost you 11 cents. Be sure that the address side of your card bears the printed slogan "VIA AIRMAIL" in large, bold letters beneath the stamp. The exceptions to the 11¢ rate are: Alaska, Canada, Canal Zone, Mexico, Puerto Rico, and U.S. possessions, for which the charge is only 7 cents.

FIRST CLASS LETTERS

Letters to overseas radio stations can be sent via ocean steamer for much less than via airmail if the country you want to reach is in Africa, Asia, or Oceania. Delivery of the letter will take much longer, however; you can figure on about 2½ days of travel time for each 1000 miles. The basic overseas surface mail rate is 11 cents for the first ounce and 7 cents for each additional ounce, or fraction thereof.

If you anticipate writing many letters to overseas stations, it's a good idea to purchase some lightweight envelopes and thin paper to keep your mailing costs down.

AIRMAIL LETTERS

An airmail letter to an overseas station receives surprisingly fast delivery. The rate depends upon how far the letter has to travel. The basic rate for airmail letters to Europe and South America is 15 cents for the first half ounce, and 15 cents for each additional half ounce. The rate to countries in Africa, Asia, or Oceania is 25 cents for the first half ounce, and 25 cents for each additional half ounce.

To compare first class surface and airmail rates, consider what it would cost to send a 2-ounce letter from the United States to Tanganyika, for example. The surface rate is 11 cents for the first ounce and 7 cents for the second ounce—a total of 18 cents. The same letter sent via airmail would be 25 cents for each half ounce—or a total of $1.00. The delivery time in each case, from New York City, would be approximately 2½ days for airmail and 2½ weeks for ship mail.

AEROGRAMMES

There is a special way to send an airmail letter to any part of the world for only 11 cents and that is by means of the aerogramme or "air letter sheet." The aerogramme is a sheet of paper that you write your message on, then carefully fold and seal into the shape of an envelope. The outside of the aerogramme has an imprinted 11¢ airmail stamp.

One word of caution: you cannot insert any extra papers within a sealed aerogramme, nor can you write anything on the outside of the aerogramme other than the name and address of the person to whom it is being sent and your own name and address at the upper left. But the space provided in the interior —and on the side flaps—is large enough to contain several hundred words. In many cases you will find this method of reporting to overseas broadcasting stations the most economical one.

horizon, and in fact a quarter of the way around the earth, just could not be accounted for in the first decade of this century.

Various physicists and scientists suggested that there must be some sort of a "mirror" in the upper atmosphere that would reflect radio waves around the curvature of the earth. By 1925, the existence of this so-called mirror had been established. The "mirror" is actually an electrified region of very thin air that is now termed the "ionosphere."

By the early 1930's, it had been experimentally proven that the ionosphere's capability to reflect radio waves depended upon the intensity of ultraviolet radiation reaching it from the sun.

● **Ultraviolet Radiation.** Since the intensity of ultraviolet radiation reaching the ionosphere is subject to considerable variation, the radio frequencies that the ionosphere is capable of reflecting are also subject to wide variation. These frequencies vary from day to night, from one season of the year to the next, between one location and another, and in addition, from year to year over an 11-year cycle.

These year-to-year changes are now referred to as the 11-year "sunspot" cycle. As the number of sunspots increases, more ultraviolet radiation in emitted by the sun. With more radiation impinging upon the ionosphere, the maximum frequency that can be reflected increases from 15-20 mc. to 40-45 mc.

Sunspot Cycle

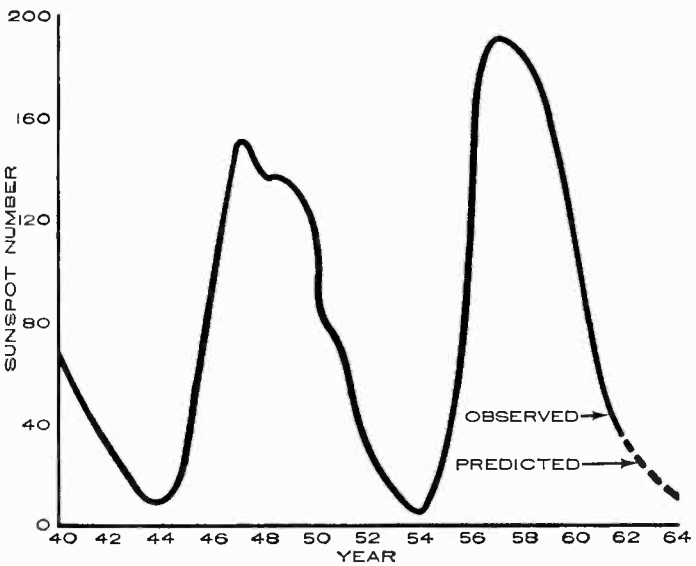
● **Ionospheric Layers.** As we ascend in height from the earth's surface, we find that the ionosphere is broken down into three well-defined regions. Within each region are one or more layers. For the sake of convenience, each region bears an arbitrary designation: D, E, and F.

The lowest region in the ionosphere contains the D layer, and it occurs at a height of between 30 and 35 miles. This layer is of little use in propagating radio signals, but instead is thought to be responsible for absorbing radio signals during unusual sunspot flare-ups.

The next layer, at a height of about 60-65 miles, occurs in the E region. The ionization in this layer closely follows the angle of the sun and reaches a maximum at "sundial" noon, dropping to nearly zero during the night hours.

Above the E region is the F region, which is divided into two individual layers. The F1 layer is at a height of about 125 miles, on an average, while the F2 layer is at a height between 150 and 250 miles. Radio signals that must travel over great distances are reflected almost entirely from one of these two layers.

The intensity of ionization of all four ionospheric layers decreases during the night hours. The uppermost one, the F2 layer, is more highly ionized than any of the others and, under normal circumstances, it will re-



Sunspot activity has been recorded since the days of the earliest Chinese astronomers. In the middle of the 19th century, it was discovered that sunspots varied from year to year over an 11-year cycle. This cycle is directly related to radio signal propagation, higher frequencies being usable only when the sunspot number is highest. We are now on the descending slope of the greatest sunspot number peak in history. The minimum sunspot number is expected to be reached in mid-1965.

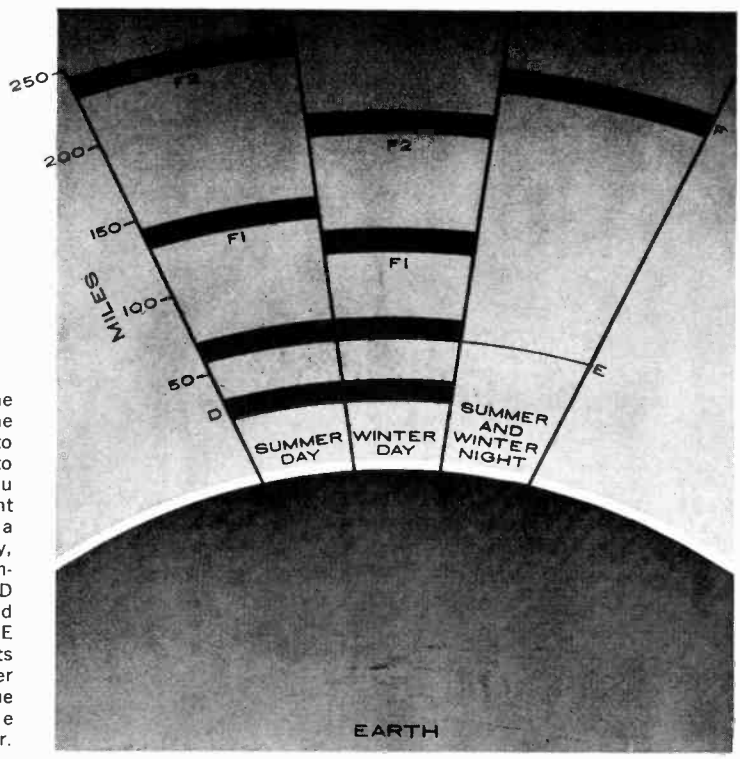
flect considerably higher radio frequencies. Since the atmosphere is thinner at this great height, the de-ionization rate is slower and the F layer (a nighttime combination of F1 and F2) continues to exist for many hours. This makes around-the-clock long-distance communications frequently possible on the lower frequencies in the short-wave spectrum.

● **Monthly and Seasonal Variations.** Short-wave listeners will soon find that the higher radio frequencies in the short-wave band go dead after local sunset. They will also find that during the winter the sun is closer to the earth than during the summer and, as a result, ionization is more intense. Hence, usable short-wave frequencies during the day in the winter are quite high. At night, the usable frequencies dip to very low values because the winter nights are longer and there is more time for de-ionization to take place. In the summer, the ionosphere is heated by the sun and tends to expand. As a result, the ionosphere is less dense during a summer day than during a winter day, and reflected frequencies are very much lower.

Of course, the intensity of ionization will always depend upon the angle of the sun in the sky. It can be seen that ionization will vary with latitude, and it is always more intense near the equator where the sun is more nearly overhead much of the time. To the short-wave listener, this means that it will be easier to hear Miami from San Diego than it will be to hear New York City from Seattle, since the former path is further south and closer to the high-density ionization regions of the F layer.

● **Ionospheric Storms.** In addition to all the "normal" variables pertaining to the ionosphere, there are certain abnormal variations which are generally of short duration and are almost always called "sunspot disturbances." These ionospheric storms or sunspot disturbances have a significant impact on radio signals.

The effects of the sunspot disturbances are more noticeable if the radio signal must cross in or near the polar regions. A visible effect of these severe ionospheric disturbances is the *aurora borealis* which may be infrequently seen in states as far south as



The height and density of the four principal layers in the ionosphere vary from day to night and from season to season. In this drawing you can see the average height of the four layers during a summer day, a winter day, and either a summer or winter night. Notice that the D region is absent at night and that the density of the E region is reduced. The heights of the F layers are greater during the summer days due to the expansion of the atmosphere in warm weather.

Maryland, Missouri, Utah, or Colorado.

In addition, there are sudden ionospheric disturbances, or blackouts, and sporadic-E propagation—sometimes referred to as "short skip."

● **Simple Antenna Systems.** Sensitivity of a modern-day communications-type receiver permits use of a simplified antenna system. Most SWL's who want to tune from 540 kc. to 30 mc. can obtain adequate reception with a "long-wire" antenna.

Every communications-type receiver comes with an instruction manual and this manual will make recommendations as to a suitable antenna. Most manufacturers suggest that the first SWL antenna be a length of antenna wire between 50 and 75 feet long and strung in the clear between 25 and 40 feet above ground level. A supporting rope is attached to one end of the antenna while the other end is connected to the short-wave receiver. The flat-top section of the antenna can be erected between house and garage, house and tree, or even between two upright poles. Each end of the antenna should be insulated from its anchorage by a glass or porcelain insulator.

It's a good idea to insert a lightning arrester at the point where the antenna lead-in enters the house, so as to avoid possible damage to equipment and property in case of a direct or near-miss lightning discharge. The other side of the lightning arrester must, of course, be properly grounded. Instructions on how to be sure that you have a good ground will be included in the lightning arrester package.

At the receiver, the new SWL will notice that most antenna input connections consist of three terminals. Where a single wire is used—such as above—the second and third terminals are tied together—electrically speaking—and may or may not be connected to an external ground wire. In most receivers the two antenna terminals will be simply lettered "A" and the single ground terminal will have the letter "G."

For about $15.00, the SWL can purchase a special dipole (a two-element antenna) that will electronically tune all of the major short-wave broadcast bands between 11 and 49 meters. These antennas have been reduced to an overall length of about 40 feet and contain a number of "wave traps" which tune the antenna to all the major short-wave broadcast bands. The feeder line from such an antenna comes from the center of the flat-top section and consists of two wires very closely spaced. These wires go directly to the two terminals lettered "A" on the receiver or one may go to a single letter "A" and the other to the letter "G," when only two terminals have been provided.

● **Directive Antenna Systems.** The experienced SWL who wants to concentrate on one or two short-wave broadcast bands, or possibly one or two ham radio bands, is advised to consider investing in some sort of tuned antenna or rotary beam. An antenna tuned to a specific band has much greater sensitivity, although the SWL must take into consideration the fact that such an antenna will be directive—favoring signals from broadside the antenna flat-top section rather than signals coming in from the ends of the antenna.

This spectacular display of aurora borealis was photographed by Dr. C. W. Gartlein. Although aurora is an every-night occurrence in the arctic regions, when it is visible in latitudes as far south as New York City and Chicago it generally indicates very disturbed radio receiving conditions.

A rotary beam will permit the SWL to take advantage of these directivity effects by increasing signal pickup in a favored direction and reducing signal pickup off the sides and back of the beam antenna. A discussion of beam antennas appears in the Amateur Radio section on page 118.

Vertical antennas are also used by SWL's. Several manufacturers have recently introduced a vertical antenna which is similar to the 40′ dipole mentioned above. This antenna receives equally well in all directions and sells for about $30.00. It is also tunable to two or three ham or short-wave broadcast bands.

Call-Sign Allocations

The call-signs (prefixes) of radio stations throughout the world have been established by international agreement. In general, the first two letters, or numeral and letter, are the key to identification. Using this list, the SWL will be able to tell at a glance what country he is monitoring—particularly if the station is a ham or ship station.

AAA-ALZ	United States
AMA-AOZ	Spain
APA-ASZ	Pakistan
ATA-AWZ	India
AXA-AXZ	Australia
AYA-AZZ	Argentina
BAA-BZZ	China
CAA-CEZ	Chile
CFA-CKZ	Canada
CLA-CMZ	Cuba
CNA-CNZ	Morocco
COA-COZ	Cuba
CPA-CPZ	Bolivia
CQA-CRZ	Portuguese Colonies
CSA-CUZ	Portugal
CVA-CXZ	Uruguay
CYA-CZZ	Canada
DAA-DMZ	Germany
DNA-DQZ	Congo (Rep.)
DRA-DTZ	Bielorussian See
DUA-DZZ	Philippines
EAA-EHZ	Spain
EIA-EJZ	Ireland
EKA-EKZ	U.S.S.R.
ELA-ELZ	Liberia
EMA-EOZ	U.S.S.R.
EPA-EQZ	Iran
ERA-ERZ	U.S.S.R.
ESA-ESZ	Estonia
ETA-ETZ	Ethiopia
EUA-EZZ	U.S.S.R.
FAA-FZZ	France
GAA-GZZ	United Kingdom
HAA-HAZ	Hungary
HBA-HBZ	Switzerland
HCA-HDZ	Ecuador
HEA-HEZ	Switzerland
HFA-HFZ	Poland
HGA-HGZ	Hungary
HHA-HHZ	Haiti
HIA-HIZ	Dominican Republic
HJA-HKZ	Colombia
HLA-HMZ	Korea
HNA-HNZ	Iraq
HOA-HPZ	Panama
HQA-HRZ	Honduras
HSA-HSZ	Thailand
HTA-HTZ	Nicaragua
HUA-HUZ	El Salvador
HVA-HVZ	Vatican City
HWA-HYZ	France
HZA-HZZ	Saudi Arabia
IAA-IZZ	Italy
JAA-JSZ	Japan
JTA-JVZ	Mongolian Rep.
JWA-JXZ	Norway
JYA-JYZ	Jordan
JZA-JZZ	N. Guinea
KAA-KZZ	United States
LAA-LNZ	Norway
LOA-LWZ	Argentina
LXA-LXZ	Luxembourg
LYA-LYZ	Lithuania
LZA-LZZ	Bulgaria
MAA-MZZ	United Kingdom
NAA-NZZ	United States
OAA-OCZ	Peru
ODA-ODZ	Lebanon
OEA-OEZ	Austria
OFA-OJZ	Finland
LKA-OMZ	Czechoslovakia
ONA-OTZ	Belgium
OUA-OZZ	Denmark
PAA-PIZ	Netherlands
PJA-PJZ	Neth. Antilles
PKA-POZ	Indonesia
PPA-PYZ	Brazil
PZA-PZZ	Surinam
QAA-QZZ	Int'l Abbreviations
RAA-RZZ	U.S.S.R.
SAA-SMZ	Sweden
SNA-SRZ	Poland
SSA-SSM	Egypt
SSN-STZ	Sudan
SUA-SUZ	Egypt
SVA-SZZ	Greece
TAA-TCZ	Turkey
TDA-TDZ	Guatemala
TEA-TEZ	Costa Rica
TFA-TFZ	Iceland
TGA-TGZ	Guatemala
THA-THZ	France
TIA-TIZ	Costa Rica
TJA-TRZ	France
TSA-TSM	Tunisia
TSN-TZZ	France
UAA-UQZ	U.S.S.R.
URA-UTZ	Ukrainian U.S.S.R.
UUA-UZZ	U.S.S.R.
VAA-VGZ	Canada
VHA-VNZ	Australia
VOA-VOZ	Canada
VPA-VSZ	British Colonies
VTA-VWZ	India
VXA-VYZ	Canada
VZA-VZZ	Australia
WAA-WZZ	United States
XAA-XIZ	Mexico
XJA-XOZ	Canada
XPA-XPZ	Denmark
XQA-XRZ	Chile
XSA-XSZ	China
XTA-XTZ	France
XUA-XUZ	Cambodia
XVA-XVZ	Vietnam
XWA-XWZ	Laos
XXA-XXZ	Portuguese Colonies
XYA-XZZ	Burma
YAA-YAZ	Afghanistan
YBA-YHZ	Indonesia
YIA-YIZ	Iraq
YJA-YJZ	New Hebrides
YKA-YKZ	Syrian Republic
YLA-YLZ	Latvia
YMA-YMZ	Turkey
YNA-YNZ	Nicaragua
YOA-YRZ	Rumania
YSA-YSZ	El Salvador
YTA-YUZ	Yugoslavia
YVA-YYZ	Venezuela
YZA-YZZ	Yugoslavia
ZAA-ZAZ	Albania
ZBA-ZJZ	British Colonies
ZKA-ZMZ	New Zealand
ZNA-ZOZ	British Colonies
ZPA-ZPZ	Paraguay
ZQA-ZQZ	British Colonies
ZRA-ZUZ	Union of S. Africa
ZVA-ZZZ	Brazil
2AA-2ZZ	United Kingdom
3AA-3AZ	Monaco
3BA-3FZ	Canada
3GA-3GZ	Chile
3HA-3UZ	China
3VA-3VZ	Tunisia
3WA-3WZ	Vietnam
3YA-3YZ	Norway
3ZA-3ZZ	Poland
4AA-4CZ	Mexico
4DA-4IZ	Philippines
4JA-4LZ	U.S.S.R.
4MA-4MZ	Venezuela
4NA-4OZ	Yugoslavia
4PA-4SZ	Ceylon
4TA-4TZ	Peru
4UA-4UZ	United Nations
4VA-4VZ	Haiti
4WA-4WZ	Yemen
4XA-4XZ	Israel
4YA-4YZ	Int'l Aviation
5BA-5BZ	Cyprus
5CA-5CZ	Morocco
5HA-5IZ	Tanganyika
5JA-5KZ	Colombia
5LA-5OZ	Liberia
5NA-5OZ	Nigeria
5PA-5QZ	Denmark
5RA-5SZ	Malagasy Rep
5TA-5TZ	Mauritania
5UA-5UZ	Niger
5VA-5VZ	Togo Rep.
5WA-5WZ	Western Samoa
5XA-5XZ	Uganda
6AA-6BZ	Egypt
6CA-6CZ	Syria
6DA-6JZ	Mexico
6KA-6NZ	Korea
6OA-6OZ	Somali Rep.
6PA-6SZ	Pakistan
6TA-6UZ	Sudan
6VA-6WZ	Senegal
6XA-6XZ	Malagasy Rep.
7AA-7IZ	Indonesia
7JA-7NZ	Japan
7SA-7SZ	Sweden
7ZA-7ZZ	Saudi Arabia
8AA-8IZ	Indonesia
8JA-8NZ	Japan
8SA-8SZ	Sweden
8TA-8YZ	India
8ZA-8ZZ	Saudi Arabia
9AA-9AZ	San Marino
9BA-9DZ	Iran
9EA-9FZ	Ethiopia
9GA-9GZ	Ghana
9KA-9KZ	Kuwait
9LA-9LZ	Sierra Leone
9MA-9MZ	Malaya Fed.
9NA-9NZ	Nepal
9OA-9TZ	Leopoldville
9UA-9UZ	Ruanda

DX'ers who tune the standard AM broadcast band may find that the old-fashioned loop antenna will work extremely well in ferreting out signals that might not otherwise be heard. Such loops can be awesome structures and may consist of numerous turns of wire strung out on a four- or six-foot square frame.

For listening to the long-wave stations and for everyday DX'ing on the AM broadcast band, a flat-top antenna with a single wire lead-in is satisfactory—if the flat-top section can be made between 75 and 150 feet long. Such flat-top antennas have a slight directive effect off the ends of the wire where the lead-in is connected.

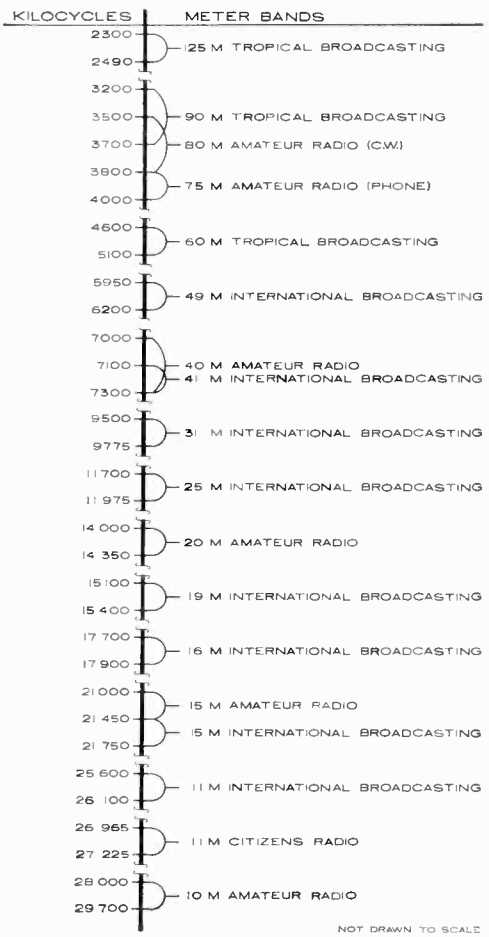
● **Indoor Antennas.** Most transistor portable receivers have built-in antennas and some have extensible four- or six-foot rod antennas. These antennas are adequate for receiving nearby AM broadcasts and will even bring in a fair sprinkling of broadcasts from the major short-wave transmitters in Europe or Africa. Ardent short-wave enthusiasts who can't erect an outdoor wire have occasionally used such diversified household items as bedsprings, window screens, etc., as antennas.

One DX'er we know uses *Reynolds Wrap* aluminum foil in 9′ sections, placing two sections so that they are on opposite walls of the same room. He then connects a wire from each section to the two "A" terminals of his communications receiver. He claims that short-wave reception with this antenna is equal to that possible with a 50′- to 75′-long outdoor antenna.

● **The Short-Wave Bands.** International short-wave broadcasting stations are grouped together in special bands. These bands have been established by international treaty and their boundaries rather universaliy observed. The chart at right shows the relationship of the various broadcasting (and amateur radio) bands to frequency. A station transmitting on 9750 kilocycles is said to be operating in the 31-meter broadcast band, while a station on 3500 kc. would lie in the 90-meter tropical broadcasting band.

When you tune in to the 9-mc. band, for instance, your first impression will probably be that there is a lot of noise, static, and general interference. How are you supposed to hear anything through that racket?

As mentioned before, the short-wave bands are narrow and there are a lot of stations in each band—all fighting to be heard. You will have to learn your first lesson: *turn the dial very slowly*. Just the slightest turn of the knob may find you racing through several hundred kilocycles, thereby skimming past the signals of stations which are coming in at good strength. Keep your volume control at a point that will enable you to hear what is coming through, but don't turn it up full. Some stations operate



Frequency and wavelength subdivisions in the short-wave bands. On the right-hand side of the vertical bar in each case is the "colloquial" name used in referring to a particular band. On the left-hand side are the upper and lower frequency limitations for each band, which have been set either by international treaty or through accepted usage. These subdivisions apply mainly to frequency allocations and assignments in North and South America.

with a great deal of power and don't need much help from the volume control to be heard.

You may find two or three stations fairly close together, all with strong signals. Try to work your way in between these strong signals, since you will undoubtedly find others signals in the background—some very weak. One weak signal could be coming from a point on the globe you didn't dream possible to receive. Stay with it; like all short-wave stations, it will eventually get around to identifying itself. Of course, there is a chance that it will fade out completely before you learn its identity, but try again the next day at the same time when the signal may be stronger.

From this building in Melbourne, Australia, emanate short-wave broadcasts in seven languages. Radio Australia is playing an important role in good neighbor policies in Africa, Asia, and Pacific Oceania. Its short-wave transmissions in English, French, Indonesian, Thai, Manadarin, Japanese, and Vietnamese reach about 1,000,000,000 possible listeners.

Keep a log of some sort of the stations you hear, noting carefully the exact time a station was heard and the exact setting of your dials. This way, you can return to the same spot at a later date with reasonable assurance of hearing the same station again.

Listen carefully to the announcements given by a station for they may provide a clue as to the operating habits of the station. Program previews (future schedules) are given periodically by many of the stations.

We'd like to stress also that, due to ionospheric disturbances, conditions for reception will change from day to day and from one season to another.

The difficulties we have covered above are but a few of the problems that you will encounter while listening to short-wave broadcast stations. But we hasten to point out that through no other medium can you be assured of such items as news, music, and cultural programs—*directly from the countries involved.* Your first attempt at SWL'ing should be taken slow and easy, and you will find it a rewarding experience. You'll soon discover, as so many thousands have before you, that short-wave listening is one of the most fascinating hobbies around!

● **Short-Wave Stations.** While tuning the standard broadcast, amateur, coastal, and other stations, is all part of "short-wave listening," perhaps the greatest interest centers on the short-wave broadcast stations themselves. There are several points which should be made regarding the differences between tuning short-wave stations and those in the standard broadcast bands.

We have mentioned that American stations on the broadcast band operate on channels 10 kc. apart, while European stations are 9 kc. apart. Short-wave stations do not follow this pattern. American stations, for instance, may operate several transmitters in a given short-wave band and perhaps none in another band. And the several stations in one band may be as much as 100 kc. (or more) from one another.

Another great difference is in the schedules of short-wave stations. The American broad-

During World War II, William N. Roemer, Bowling Green, Ky., spent countless hours copying prisoner-of-war announcements from Nazi Germany. The messages were then passed along to relatives by mail or telephone. Visible in this photo is a war surplus frequency meter, a recorder, a National HRO receiver, and a preselector.

Best Bets for North American SWL's

Reports from DX'ers located all over North America indicate that the short-wave stations listed below can be heard at virtually any point. Listeners should keep in mind, however, that many of the stations change frequency and/or scheduling at periodic intervals. The times shown do not necessarily indicate complete schedules for these stations but, rather, periods during which reception should be at its peak.

STATION	LOCATION	FREQUENCY (*kc*)	TIMES (*EST*)
Radio Australia	Melbourne, Australia	15,315, 11,840 11,710, 9570, 7190 9580	1500-1700 0200-0400 0715-0814
Radio Peking	Peking, China	9480	2000-2100
Radio Brazzaville	Brazzaville, Congo	15,190	1400-1500
HCJB	Quito, Ecuador	15,115, 11,915, 9745, 6050	[1]
YSS, R. Nacional	San Salvador, El Salvador	9555	1300-2300[2]
BBC, London	London, England	21,470 15,300 12,095 12,040, 11,750 9580, 6110 9510 9410 7230 6195	1100-1245 1030-1245 1200-1500 1800-1930 1800-2000 1730-2000 1200-1745 1730-2000 1730-1930
Radio Fiji	Suva, Fiji Islands	4755	0200-0400
Radio Deutsche Welle	Cologne, West Germany	9605	1920-2000
Radio Ghana	Accra, Ghana	11,800 6070	1330-1415 1200-1245
Radio Budapest	Budapest, Hungary	9833	1900-2000
Voice of Indonesia	Djakarta, Indonesia	9585	1400-1500
Israel B/C Service	Tel-Aviv, Israel	9009	1515-1545
Radio Roma	Rome, Italy	9575, 11,905	1930-1950
Radio Abidjan	Abidjan, Ivory Coast	11,820	1600-1630
Radio Japan	Tokyo, Japan	11,780 11,705, 15,135 9605	1250-3130 1830-1930 1100-1130
Radio Nederland[3]	Hilversum, Netherlands	15,445, 17,810 9715, 9630 9715, 6085 6035, 5985	0900-0950 0155-0250 1625-1720 2025-2120
VLT6	Port Moresby, New Guinea	6130	0200-0400
Radio New Zealand	Wellington, New Zealand	11,780, 9540	0200-0345
Radio Bucharest	Bucharest, Rumania	9590, 7195	1800-1930
Sierra Leone B/C Service	Freetown, Sierra Leone	3316	0200-0300
BBC-FES	Singapore	11,955	1100-1150
Radio South Africa	Paradys, South Africa	15,085	1200-1400
Radio Nacional de Espana	Madrid, Spain	9360 9360 9360 9360	1520-1550 2215-2300 2315-0000 0015-0100
Radio Switzerland	Berne, Switzerland	11,865, 9535, 6165 11,865, 9535, 6165 9665, 6055	2030-2130 2330-0015 1345-1500
Radio Ankara	Ankara, Turkey	9515	1815-1900
Radio Moscow	Moscow, U.S.S.R.	7320, 7130	1730-2000
Vatican Radio	Vatican City	11,740, 9645	1315-1329
Windward Islands B/C Service	St. Georges, Grenada	9498 9550 3280	1740-2000 to 2115 1900-2000

1. Almost always. 2. In Spanish. 3. Heard weekdays only (no Sunday broadcasts).

cast stations generally fit into one of three categories: daytime only, day and evening, and 24-hour operation. Short-wave stations may operate for only short periods at any one time. For instance, transmissions from *Radio Vatican* rarely exceed 15 minutes in length, while *Radio Moscow*'s transmissions may run continuously for six hours or more.

Radio wave propagation also plays a big role in short-wave broadcasting. On the standard broadcast band, American stations can usually be heard with a fair degree of reliability at any given time; short-wave stations may be loud and clear one day and completely inaudible the next. This is due primarily to the unique characteristics of the short-wave frequencies themselves. The short waves are affected by such things as sunspots and northern lights to a much greater degree than are the lower frequencies. But, by the same token, when conditions are reasonably good, the signal from a short-wave station may travel to nearly all corners of the world.

The short-wave bands are quite narrow and there are literally hundreds of stations operating in each of the bands. You will find that transmissions from international short-wave stations are generally free from commercial advertising since most such stations are government-operated. You'll note, however, that many stations in Latin America are privately owned and often carry numerous commercials.

● **Frequency Allocations.** A complete breakdown of frequency allocations for North and South America, based on international treaty, is shown on page 73. This chart shows how the radio frequency spectrum from 160 kc. to 328,600 kc. is divided according to need. Exclusive bands are allocated to marine and aeronautical services, as is a special band around 136,000 kc. for satellite telemetry. Allocations for Europe and Asia are a bit different and feature more broadcasting frequencies and fewer bands for amateur radio.

This DX'er is the editor of the bulletin issued by the Canadian DX Club. Living in Richmond, British Columbia, David Bennett uses a variety of receiving equipment and tape-records programs off-the-air.

● **Non-English-Speaking Stations.** We've often had complaints from SWL's whose only language is English that it is rough, if not impossible, to identify stations that don't use English. We agree that this can be trying, especially if you are interested in logging numerous countries. There are tricks, however, and some of them may well pay off in new countries logged.

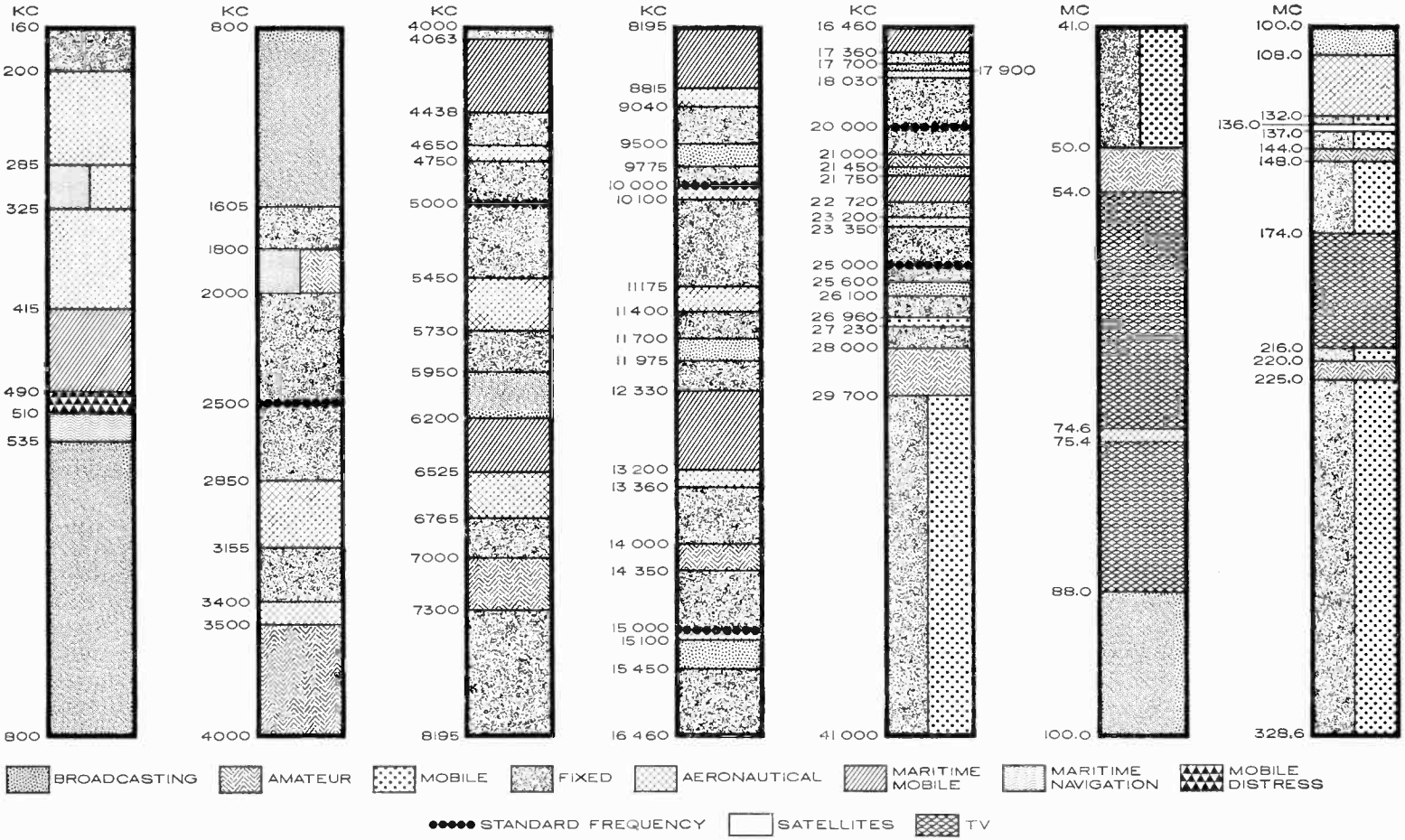
Let's assume, for example, that you are listening, unknowingly, to an Arabic transmission from *Radio Cairo*. During that period they may have no English at all, but they do have an Arabic identification; and if you know how it might sound in Arabic,

The Famous Berne Lists

Allocation and use of radio frequencies has been the subject of numerous international treaties. To coordinate and implement these treaties has been the task of the International Telecommunications Union, Geneva, Switzerland.

Member nations of the ITU regularly report new station licensees, frequency changes, ownership, etc. This information is then made available in a wide variety of booklets, lists, and other publications. A catalog of ITU publications can be obtained directly from the General Secretariat of the ITU, Geneva.

Of particular interest to the SWL are the Berne Lists—technically known as the "International Frequency List." Now in 3 separate volumes, the lists are quite expensive—and quite voluminous. Much of the frequency and station information appearing in this Handbook was taken from the August 1961 list (and supplements) costing 185 Swiss francs (about $35.71).



This is how the radio frequency spectrum is divided in North and South America from 160 kilocycles to 328.6 megacycles. Slightly different frequency allocations exist in Europe and Asia, although these differences are mostly confined to the higher frequencies (above 30 mc.)

you can log the station without understanding a word of the language. In cases like this, you could send your report in English and it would undoubtedly be acknowledged. Cairo's Arabic identification might be written as "Aqui Kahira" but, phonetically, it comes out more like "Ahkki Ka-hero."

The identification for London in their Spanish transmissions to Central and South America would be written as "Habla la

Speaking excellent English, Knut Johansen announces a program change over short-wave station Radio Norway.

BBC de Londres," and it's pronounced much like it looks. A typical identification from Paris, in French, is "Ici Paris" which, when spoken, sounds like "Ee-see Pa-ree."

● **Slogans and Interval Signals.** There are also many stations, English and otherwise, which identify by slogan rather than by call-sign. Say you happen to be tuned to 4970 kc. and listening to someone in Spanish. If you suddenly hear what sounds like "rahd-yo room-bos," you could positively identify the station as YVLK in Caracas, Venezuela. On the other hand, if you have your dial set at 11,880 kc., and you hear "ek-ees ay aht-chay-aht-chay," you can translate that as XEHH and know that you have Mexico City coming through your speaker.

Some stations use interval signals as a means of identification. An interval signal is a sound or series of sounds broadcast to fill a slight gap in air time between programs. Such interval signals vary from the chirp of a nightingale to a rather monotonous several-noted musical signal. Rome, for instance, uses the nightingale chirp. Abidjan, Ivory Coast, uses "talking drums." Australia is noted for its reproduction of the notes of the kookaburra bird. Budapest features a few notes from the old Hungarian folk song "From the Tisza, Past the Danube." Cairo's interval signal is the playing of camel bells, while that of *Radio Indonesia* is a tune played on a Hammond organ.

Armed Forces Radio & Television

If you overhear popular sport programs being rebroadcast in the international short-wave broadcast band, you are probably listening to a station of the U.S. Armed Forces (AFTRS).

About 16 hours of "home-style" entertainment are broadcast to servicemen in Asia every day. The frequencies most often used are 5,965; 6,040; 9,700; 11,870; 15,210; and 17,280 kc. The call letters of the transmitting stations are KCBR, in each case, followed by a numeral.

A similar service is aimed at the Caribbean area for about 3 hours per day on 11,790 and 15,310 kc.

Reports are QSL'd if the listener is outside the continental United States. Address: AFTRS, 1016 N. McCadden Place, Los Angeles 38, Calif.

These three ladies handle letters and postcards from listeners to Radio Prague. Jean Novakova (right) is MC of the "Listeners Club," which acknowledges reception reports. Paula Slavikova (center) and Cecile Krizova (left) reply to letters and requests for literature or music to be broadcast on the short waves.

Peter Skala, known to SWL's through his program on the activities of Czechoslovakian radio amateurs, is also in charge of the Short-Wave Propagation Department of Radio Prague. Peter uses a European-style short-wave receiver, many of which have a slide-rule tuning dial covering each band.

By identifying these and other interval signals, it is possible to log a number of new countries. Bear in mind that the interval signal is usually found between programs, at station breaks, and quite often in the few moments just before the start of a scheduled transmission.

Virtually all of the above-mentioned slogans and interval signals can be found in the "World Radio TV Handbook"—complete with a portion of the musical score in many cases.

● **Soviet Jammers.** Early in 1948, the Soviet Union began to intentionally "jam" medium-wave and short-wave transmissions. The stations being jammed all had something in common—programs aimed at an audience behind the Iron Curtain. Many more jamming transmitters took to the air in 1950, and it was quickly determined that these new jammers were located in countries sympathetic to Soviet ideals. At the peak "jamming season," it was believed that nearly 2000 transmitters were available to Soviet authorities for jamming all or parts of foreign broadcasts. Oddly enough, English-language broadcasts are rarely jammed by the U.S.S.R.

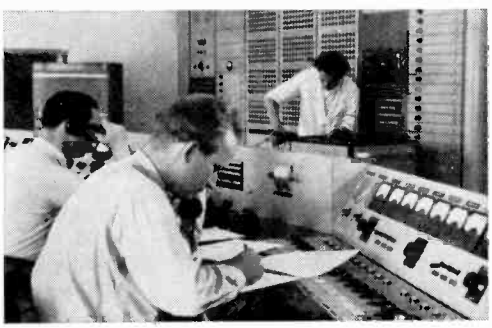
Jamming transmitters can be heard in the short-wave bands at all hours of the day and night. The sound is a characteristic repetitive clanging or a raw buzzing. An experienced listener can frequently hear the broadcast being jammed underneath the high-powered signal of the jamming transmitter.

Jamming

The director of the *Voice of America* has reported that jamming of the *VOA* Soviet-language broadcasts ceased on September 15, 1959, the day that Premier Khrushchev began his visit to the United Nations. Since that time, Soviet jamming has been on a selective basis, and Latvian, Lithuanian, Estonian, Armenian, Polish, Czech, Slovak, Rumanian, Bulgarian, and Hungarian broadcasts are continuously jammed. Free World broadcasts in the Russian or Ukranian languages are jammed on a selective basis, depending on subject matter. The director of the *VOA* estimates that 30% of all Free World broadcasts in these two languages is subject to jamming. As might be expected, most of the selective jamming involves news programs and political commentaries.

Poland apparently dismantled many of its jammers in 1956-57. Nevertheless, some jamming of Polish broadcasts from the Free World continues from jammers probably located in the Soviet Union and Czechoslovakia. German-language broadcasts are rarely jammed on the short-wave bands, but are almost continuously jammed on the medium- and long-wave bands.

Four years ago, jamming of English-language broadcasts to the Far East began from transmitters obviously located on the China mainland. Today, the English broadcasts throughout the Far East are free from interference, but heavy jamming persists on all Chinese-language programs radiated by the *VOA* transmitters in the Far East.



Anti-Communist programs flow from this Radio Free Europe control center in Munich, Germany, to five target satellite countries: Bulgaria, Czechoslovakia, Hungary, Poland, and Rumania. RFE uses 29 transmitters to counteract jamming of its programs; if one frequency is jammed, the Communist-bloc listener has a choice of 10 or 12 other frequencies.

Ham Band DX'ing

● **Tuning the Ham Bands.** DX'ing on the ham bands is an excellent way to nourish your interest in amateur radio as well as give you a chance to log a number of countries, via the ham bands, which have no short-wave broadcasting stations. In addition, radio amateur groups frequently make expeditions to out-of-the-way countries or islands that are not usually represented by regularly operating amateur stations. Such activities provide good DX'ing, and if you are fortunate enough to hear them, can result in your logging a rare country and even having it QSL'd.

The main ham bands for DX'ing around the globe are the 10-, 15-, 20-, and 40-meter bands. The 2-, 6-, 75-, and 160-meter bands are principally used by hams in North America to contact stations within a 50 to 500 mile range.

● **Ham Transmission Methods.** Radio amateurs use four methods of communicating in the short-wave bands: straight AM phone similar to that used by broadcasting stations; single-sideband (SSB); c.w. or Morse code transmissions; and radioteletype. Phone, SSB, and c.w. will usually come in equally well on the average communications-type short-wave receiver. (All of our previous suggestions regarding careful tuning, incidentally, are even more urgent when it comes to tuning the overcrowded ham bands.) Complete details on how to receive SSB signals have appeared in POPULAR ELECTRONICS.

Reception of code signals can offer you excellent practice if you want to become a radio amateur eventually. If you know the International Morse Code, pay particular attention to the Novice c.w. bands (see page 110 for details). Notice how slowly some of these Novices transmit; you will probably discover that you can transmit at that speed and obtain your own license. Many foreign hams use code to leap the language barrier, since the abbreviations and internationally recognized Q signals permit an exchange of information without one ham knowing the language of the other.

Phone, c.w., and SSB signals are frequently spotted in the ham bands through a gentlemen's agreement covering which mode of operation is to be used in what segment of the band. For example, you will find that the first 100 kc. (21,000 to 21,100 kc.) of the 15-meter band is used exclusively for c.w. However, there are both c.w. operators and some foreign hams on phone between 21,100 and 21,250 kc. The segment between 21,250 and 21,400 kc. is occupied by American AM phone stations; both American and foreign SSB stations try to stay within the limits of 21,400 to 21,450 kc. On the 20-meter band, it is c.w. for the first 100 kc., mainly foreign phone from 14,100 to 14,200 kc., American phone from 14,200 to 14,260 kc., and both foreign and American SSB stations from 14,260 to 14,350 kc.

● **QSL'ing Ham Radio Stations.** If you hear a foreign ham radio station and would like a verification of your report, you will need to consult the "Radio Amateur Callbook" for the ham's name and address. To insure that your report will be verified, include as much useful information as is practical. Definitely list the date and time in a manner that the ham can understand—even if it means converting your local time to GMT or UT. Particularly state the band and frequency, if known; the call letters of stations being called or worked; and his signal strength, readability, and degree of interference from noise or other stations. Finally, give the ham detailed information on the type of receiver and antenna you are using.

Military Air Transport Service

A vast world-wide radio communications network is used by the U.S. Military Air Transport Service (MATS). At this writing, MATS employs four frequencies for the major portion of its radiotelephone communications. These frequencies are: 4724.5; 6730.5; 11,228.0, and 13,215.5 kc.

Operating on these frequencies are such stations as: Croughton (England); Goose Bay (Labrador); Espargos (Guantanamo); Guam; Harmon (Newfoundland); Hickam (Hawaii); Johnston Island; Kindley (Bermuda); Lajes (Azores); Kwajelein; Midway; Okinawa; Ramey (Puerto Rico); Sidi Slimane (Morocco); Soendrestroem (Greenland); Thule (Greenland); Tokyo; and Wheelus (Libya).

International Airlines Weather

Any time of day or night that you tune to one of four frequencies—3001.0; 5559.0; 8828.5; or 13,264.5 kc.—you can hear weather reports for the principal cities around the North Atlantic. From Shannon, Ireland, on the hour and half-hour, the reports are on European cities. At 15 and 45 minutes after the hour, New York broadcasts east coast weather. At 20 and 50 minutes after the hour, Gander, Newfoundland, broadcasts the weather in northern Canada and Greenland.

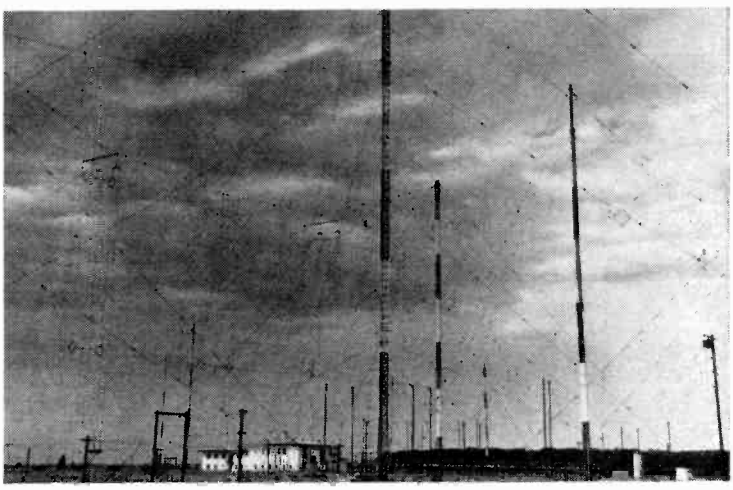
A similar service exists for the international airlines operating in the Pacific Ocean. The frequencies used are 2980.0; 5574.0; and 8905.0 kc. At 5 and 35 minutes after the hour the reports originate in San Francisco; at 10 and 40 minutes in Tokyo; at 15 and 45 minutes in Hong Kong; at 20 and 50 minutes in Anchorage; and at 25 and 55 minutes after the hour in Honolulu.

Always enclose an International Reply Coupon (IRC) or a mint stamp of the country to which the report is being sent. Don't expect the ham to pay postage for doing *you* a favor. Remember, this is a private individual and not a government-subsidized activity. If possible, also include a 6½" x 4¼" self-addressed envelope. This will enable the foreign ham—if he wants to verify your report—to send you his QSL without having it scuffed up in the mail.

● **International Airline Traffic.** Listening to the radio signals from airplanes in flight and the various airports and control centers located throughout the world falls into two categories. Concentrating on radiotelephone signals, airplanes and airports communicate with one another within a range of about 50-75 miles using the very high radio frequencies. International airline flights use particular frequencies around 5600, 6600, 8900, and 13,300 kc. Information on specific frequencies and geographical areas is shown on the next page.

Listeners to these international airline frequencies soon discover that airliners in distant parts of the world can be heard and that many countries that have no international short-wave broadcasting stations can be "logged" on these channels. For example, it is easy to intercept the airline control stations in Guadeloupe, Martinique, Curaçao, and the Cayman Islands, especially on the East Coast. Listeners out west hear Canton, Guam, Midway, Wake, and Norfolk Islands in the Pacific.

Most of these airline messages are to be found on the 6- and 8-mc. bands. Although the transmitting power of most of these stations is relatively low, when compared to a broadcasting station, the signals may be heard over thousands of miles. The best time to hear these stations seems to be late afternoon and early evening for the European and African transmitters. The stations in the Pacific and Far Eastern areas can



From this wilderness of radio antennas radiate the anti-Communist programs of Radio Free Europe. These antennas are located at Biblis, one of the three major transmitting sites, which is roughly 200 miles northwest of Munich, West Germany. Other transmitters are located at Lisbon, Portugal, and at Holzkirchen, 18 miles south of Munich. Supported by the American people through contributions to the Radio Free Europe Fund, RFE broadcasts on the long waves, medium waves, and short waves.

usually be tuned in during the early morning or shortly after sunrise, up to about 8:00 a.m., local U.S.A. time.

Ground stations in the aeronautical services usually identify themselves by city or island name. A few will use the name of the airport, for example, Maiquetia (Caracas, Venezuela), Boyeros (Havana, Cuba), and Piarco (Trinidad). Airplanes in flight identify themselves by the company name or initials, followed by the flight number. All of the transmissions on the frequencies shown in the accompanying table are in English, although you may occasionally hear signals on the same frequencies in French, Spanish, or Portuguese.

The best way to log aeronautical stations consistently in the short-wave bands is to tune slowly across one of the three radiotelephone bands until you find an active channel, or a frequency where stations are in contact with one another. Leave your receiver spotted to this frequency and you will be surprised to find that perhaps 10 or 20 different stations can be intercepted in about an hour. As you may suspect, most airline transmissions are quite short and the messages passed back and forth are uttered rapidly and are full of the international phonetic code.

Airline Frequency/Area Chart

FREQUENCY (kc.)	AREAS
5499.0	Southeast Caribbean, Oceania, Southeast Africa, Canada
5506.5	East Africa, West Pacific, Brazil, Poland
5521.5	West Africa, Canada
5536.5	West Pacific, Brazil, Mexico, Canada, USSR
5551.5	Canada, USA, Spain, Italy (Control)
5566.5	East Caribbean, India, USSR
5581.5	Eastern South America. USSR
5589.0	Europe, Mediterranean, USA
5596.5	Brazil
5604.0	Middle East, Canada
5611.5	Alaska
5619.0	Argentina, Mexico, Philippines
5641.5	North Atlantic, South Pacific
5671.5	North Atlantic
6537.0	Central Caribbean, Africa
6567.0	Caribbean, Europe, Alaska
6582.0	Europe, Canada, India, Mexico
6612.0	Australia, Brazil, Canada
6664.0	Western South America
8820.0	West Africa, Western South America
8837.0	Caribbean, Canada
8845.5	Middle East, South Pacific, Eastern South America
8862.5	North Atlantic, West Pacific, Argentina
8871.0	Europe, Far East, Africa
8879.5	South Atlantic, Canada
8888.0	North Atlantic
8913.5	North Atlantic
8930.5	Brazil, Far East
8939.0	Australia, India
8956.0	East Africa
10,021.0	Central America, USA
11,299.5	Europe
13,264.5	North Atlantic, USSR
13,274.5	South Atlantic, Canada
13,284.5	North Atlantic, Far East
13,304.5	West Africa, East Pacific
13,314.5	Argentina, Chile, Columbia
13,324.5	North Atlantic
13,334.5	East Africa, Middle East
13,344.5	Caribbean, Eastern South America, South Pacific, USSR
13,354.5	West Pacific, North Atlantic

● **International Airport Weather.** The table on page 77 lists the frequencies used by the eight stations scattered around the globe that continuously broadcast airline weather conditions.

In the North Atlantic area, radio transmitters in Shannon, Ireland; Idlewild, New York; and Gander, Newfoundland; operate simultaneously on four frequencies. By staying tuned to any one of the four frequencies, a patient listener can get the word on weather conditions as far south as Washington, D.C., and as far north as Frobisher, Baffin Island. The Shannon station comes in best on 8828.5 or 13,264.5 kc.; this station gives the weather conditions for the principal cities of Europe.

In the Pacific area, a similar network is on the air and broadcasts simultaneously on three different frequencies.

● **DX'ing the Specialty Bands.** To hear radio signals below 550 kc. or above 40 mc., you will generally need a separate receiver—chiefly because "special" receiver circuitry techniques are required to insure efficient reception. The various "specialty" bands are discussed below.

● **The Long-Wave Band.** In North America, the long-wave band is used principally for aeronautical navigational radio stations and ship-to-shore c.w. transmissions. In Europe, the long-wave band (145-350 kc.) is used by super-high-power AM broadcasting stations. Unlike the AM broadcasting stations in North America whose power out-

60 Minutes on 600 Meters

If you copy c.w., tune with me around 500 kc. It is 0300 GMT and the band is boiling with signals from freighters, luxury liners, and coastal stations. The first c.w. call and reply we hear is:

WSL WSL WSL DE KAKB KAKB MSG HW K
KAKB WSL 454 UP
UP

WSL, a shore station, is called by an American ship with call letters KAKB. Station KAKB has a message (MSG) for WSL and wants to know what working frequency to send it on, so he asks "HW," meaning "how?" WSL answers with a brief call and tells KAKB to go "up" to 454 kc., one of the seven working frequencies assigned to ship radio traffic.

Shouldn't WSL have said "down"? After all, 454 is below 500! But in the old days operators spoke in terms of wavelength (meters) rather than frequency (kilocycles). The ship must shift to a longer wavelength, thus going up in meters!

KAKB has understood, because he repeats "UP." We quickly retune to 454 kc. where KAKB calls WSL, who replies on his assigned working frequency of 418 kc.

(On 454 kc.) **WSL WSL DE KAKB K**
(On 418 kc.) **KAKB WSL GE QRV K**

WSL answers the call and says, "Good evening, I am ready to copy, over."

(On 454 kc.) **GE HR MSG NR 1 CK 9 SS ATLANTIC VICTORY 7 0233 GMT BT JONESHIP NEWYORK BT ETA AMBROSE 1700 8TH ADVISE DOCKING BT MASTER AR CFM FIGS 1700 8TH NIL K**

Translation: "Good evening, here is my message number 1, nine words, from the SS Atlantic Victory, date the seventh, time 2:33 a.m. GMT, to 'Joneship New York'" (a special abbreviated cable address). The text means that estimated time of arrival at Ambrose Lightship (off New York Harbor) is 5 p.m. the eighth, advise me where I am to dock. The message is signed by the master of the ship, then numbers in the text are repeated or confirmed (CFM).

(On 418 kc.) **KAKB WSL R QSL NR 1 NIL TU SU SK**

WSL says, "Roger, I acknowledge receipt of your message number one, I have no messages for you (NIL), thank you (TU), see you later (SU), end of transmission (SK)."

The time is now 0302 GMT, and we retune to 500 just in time to hear:

NMA NMA NMA DE 5LCX 5LCX AMVER HW K 5LCX 5LCX DE NMA NMA 440/448 K

A Liberian ship has called NMA, Coast Guard Radio, Miami, to deliver an "AMVER" message. NMA replies, stating his own working frequency (440) and directing the Liberian to use 448 kc.

(On 448 kc.) **BT TO AMVER NY BT NORTHERN-DAWN 5LCX 1 43R5N 70R1W 070200 RL 41R6N 69R7W RL VIA WINDWARD PASSAGE RL 15R7 COLON 120900 BT**

"AMVER" means Atlantic Merchant Vessel Report. Ships of 55 nations voluntarily send their routing information to the U.S. Coast Guard AMVER center in New York. There it is fed into an IBM 305 "RAMAC" computer. If an emergency at sea arises, the computer can calculate the positions of each of the 800 or more ships carried in its "plot," then indicate which ships are closest to the distress area.

This ship is advising the computer of its name, call-sign, position in latitude and longitude at the beginning of its voyage (the R means a decimal point), the date (07) and time (0200) of its departure, its sailing route (RL means thumb line, a certain geographic track between two points) through the Windward Passage in the West Indies, to its destination, Colon, in Panama.

NMA QSL's the message and will teletype it to the New York computer office.

At 0306 GMT, we hear a distant signal:

CQ CQ CQ DE HOEH HOEH PART 1 NSS WX PSE 500 K

A Panamanian ship missed part of the weather (WX) broadcast from NSS, the U.S. Navy station, and wants someone to repeat it for him. He asks ships to please (PSE) reply on 500. He sends "500" as a "5" and two long dashes, so it sounds like "5TT."

At 0308 GMT, a 25-word-per-minute call is heard on 500:

WCC GBTT QTO NY QTC 7 UP B
UP

The "Queen Mary" (GBTT) calls the RCA shore station at Chatham, Massachusetts, advises that she has just sailed from New York (QTO NY) and has seven messages (QTC 7) to send. GBTT is a regular customer so they don't bother to specify working frequencies. We find WCC on 436 and GBTT on 444 kc. He sends a string of six messages without breaking. The seventh message is an "OBS" or weather observer message:

BT OBS NR & CK 11 SS QUEENMARY 7 0030 GMT BT OBSERVER WASHINGTON BT 07231 34516 73974 61083 30985 33497 28453 00864 13847 BT

This is a detailed weather report condensed into a special brevity code and sent to the U.S. Weather Bureau.

The "Queen Mary" finishes the string and WCC comes back with a snappy "QSL 1 THRU 7 NIL SU SK"

At 0315 GMT, 500 suddenly dries up for a full minute, then someone tunes his transmitter. Immediately there is an angry chorus from several stations:

SP SP SP

The abashed sender shuts up. He should have known better than to send in the international silent period (SP) which extends from 15 to 18 and 45 to 48 minutes past every hour. No one sends at these times in order that any weak distress signals may be heard. At precisely 0318 we hear:

TTT TTT TTT DE NOC NOC FLOATING MINE SIGHTED IN POSN 2653N 4028W AT 062100Z BT QSW 466

TTT is the international safety signal being sent by Coast Guard Bermuda. A floating mine is adrift in the sea lanes. Its position (POSN) is given, the dashes or decimals being omitted. The warning will be repeated on 466 kc. (QSW 466), NOC's working frequency.

After the second silent period, ending at 0348, we hear CQ from WSL announcing a "TFC LIST" to be sent on 418 and high frequencies. This is an alphabetical list of call-signs of other ships who should call WSL and pick up waiting messages.

But now a weak signal is in the background on 500:

KLC KLC KLC DE DZMA DZMA MEDICO K

"MEDICO" means that there is a medical emergency aboard this Philippine ship and he is requesting advice from shoreside medical authorities. If the sickness cannot be resolved with advice, the Coast Guard will query the AMVER computer, find out what ships carrying doctors are in the area, and try to arrange a rendezvous.

All in all, you couldn't ask for a more interesting or active hundred kilocycles. But remember, federal law forbids the disclosure of intercepted messages to anyone other than the addressee—this is a responsibility that the SWL is honor-bound to assume, and comply with the law. —Scott Gibson

put is generally limited to a maximum of 50,000 watts, European stations may radiate signals with 250,000 to 1 million watts output. High-power output is desirable at these frequencies in order to overcome the noise level and the summertime static. Also, in the long-wave band, many European AM stations are directing their transmissions across the Iron Curtain to the Soviet satellites.

If you have a receiver that will cover this frequency range, and are able to string up a long-wire antenna (at least 50 feet high and 100 feet long), you will have a fair chance of intercepting some of the following stations during the early evening hours in the winter. Tune particularly for the *Voice of America* station in Munich on 173 kc. This is one of the European transmitters radiating 1 million watts. The *VOA* shares time on this station with the West German programs of *RIAS*. These all-German programs are directed particularly to listeners in East Germany.

Another station frequently heard in North America is *Radio Luxembourg*. Its 500,000-watt transmitter operates on 233 kc. and programs an all-French mixture of pop music, jazz, news, and "soap opera" commercials.

The British Broadcasting Corporation transmits its "Light Program" on 200 kc. with a power output of 400,000 watts. France is represented by a transmitter on 165 kc. with a power output of 500,000 watts. East German and Soviet Union transmitters also populate the long-wave band. Numerous DX'ers have intercepted Berlin on 185 kc. or 263 kc.; this station relays Moscow continuously. Soviet stations are located at Kiev, Leningrad, Minsk, and Moscow. The most powerful Soviet transmitter is on 172 kc. and radiates a power of 500,000 watts.

Canadian Radiotelephone Directories

Two ship and land station directories are published annually in Canada. The publisher is Radiotelephone Directories of Canada Ltd., 119 West Pender St., Vancouver 3, B.C. One edition is for East Coast and Great Lakes stations, the other for West Coast stations. The lists include all shipping, logging camps, and land stations on maritime frequencies (2015, 2142, 2212 kc., etc.). Prices: only $1.00 per copy for either the West Coast or Great Lakes Directory.

Coastal Radiotelephone Stations

Operations from ship to ship are conducted on 2638 kc. (Channel 1) and 2738 kc. (Channel 2). Cape Cod Canal ships and operations on the Chesapeake and Delaware Canal can be heard on 2350 kc. The frequency of 2182 kc. is a world-wide channel set aside for safety and general calling.

Location of Station	Call-Sign	Shore Frequency	Weather and Marine Reports (Local Time)	Ship Answering Frequency
Boston, Mass.	WOU	2506	0520, 1120, 1720, 2320	2406
New York, N.Y.	WOX1	2590	1050, 2250	2198
	WOX2	2522	1050, 2250	2126
Wilmington, Del.	WEH	2558	0030, 1230	2166
Ocean Gate, N.J.	WAQ	2558	1050, 2250	2166
Norfolk, Va.	WGB	2538	0600, 1800	2142
Quantico, Va.	WHF	2538	1200, 0000	2142
Charleston, S.C.	WJO	2566	1130, 2330	2390
Jacksonville, Fla.	WNJ	2566	0030, 1230	2390
Miami, Fla.	WDR	2514	1100, 2300	2118
Tampa, Fla.	WFA	2550	1100, 2300	2158
New Orleans, La.	WAK	2598	1200, 0000	2206
Galveston, Texas	KQP	2530	1330, 2000	2134

AMVER System Frequencies

The following table lists the Coast Guard shoreline and ocean stations accepting AMVER messages. All traffic is via c.w.

Call	*Location*	*Frequency (kc.)*
NMF	Boston, Mass.	472
		8734
NMY	New York, N.Y.	486
		8710
		4361
NMH	Washington, D.C.	12718.5
		17002.4
NMN	Norfolk, Va.	466
		8734
NMV	Jacksonville, Fla.	457
		8734
NMA	Miami, Fla.	440
		8710
NOF	St. Petersburg, Fla.	440
NMG	New Orleans, La.	428
		4361
		8710
NOY	Galveston, Texas	457
NJN	Argentia, Nfld.	457
		6477.5
		8734
		12718.5
NOC	Bermuda, B.W.I.	466
NMR	San Juan, P.R.	466
		4361
		8710
		12718.5
4YB	56°30′W/51.00°N	466
4YC	52°45′W/35°20′W	466
4YD	44°N/41°W	466
4YE	35°N/48°W	466

All of the above stations continuously guard the ship radio frequency at 500 kc., plus maritime h.f. bands at about 4, 8, and 12 mc.

● **Coastal Stations.** If you aren't a Morse code enthusiast, you might be interested in tuning the coastal radiotelephone stations. These stations operate in the band of frequencies ranging from 2400 to 2600 kilocycles. A monitoring check will find Boston on 2406 and 2506 kc.; Mobile, Ala., on 2430 and 2572 kc.; Tampa on 2466 and 2550 kc.; and Nassau, Bahamas, on 2558 kc. You'll be able to identify these stations by the 'buzz-buzz' tone which sounds very much like the busy signal of a land line telephone.

You will also hear the telephone company marine operators accepting calls by radio from ships at sea for relay over regular telephone lines to any point in the United States and Canada. The ship operators will be transmitting on other frequencies; to hear *them*, you should tune to the 2100-2200 kc. band.

Another service provided by the telephone company marine operators is the transmission of weather and marine information reports. These broadcasts are usually made in the band between 2500 and 2600 kc. Along the Atlantic and Gulf coasts, these weather broadcasts are in straight text, but in some other areas they are coded for rapid voice transmission.

● **Great Lakes Weather Codes.** Ships in the Great Lakes are advised of weather conditions through means of a special 5-digit

Great Lakes Coastal Telephone Stations

All of these stations operate on 2514 kc.

Location of Station	Call-Sign	Time of Weather Broadcast
Lorain, Ohio	WMI	0002, 0602, 1202, 1802
Chicago, Ill.	WAY	0009, 0609, 1209, 1809
Rogers City, Mich.	WLC	1216, 1816
Buffalo, N.Y.	WBL	1223, 1823
Duluth, Minn.	WAS	0027, 0627
Port Washington, Wis.	WAD	0023, 0623
Kingston, Ont.	VBH	0440, 1040, 1640, 2240
Midland, Ont.	VBC	0400, 1000, 1600, 2200
Port Arthur, Ont.	VBA	0430, 1030, 1630, 2230
Port Burwell, Ont.	VBF	0350, 0950, 1550, 2150
Sarnia, Ont.	VBE	0410, 1010, 1610, 2210
Sault Ste. Marie, Ont.	VBB	0420, 1020, 1620, 2220
Toronto, Ont.	VBG	0340, 0940, 1540, 2140

voice code. These broadcasts are made in lieu of detailed verbal weather reports.

The code runs like this: the first two numerals indicate the wind direction at the weather observing station; the second two numerals tell the wind velocity; and the last digit is a terse summary of the general weather forecast. The wind direction group is: 0—calm; 1—northeast; 2—east; 3—southeast; 4—south; 5—southwest; 6—west; 7—northwest; 8—north; and 9—variable. The forecasting code is: 0—fine; 1—cloudy; 2—thundersqualls; 3—showers; 4—rain; 5—fog; 6—Lake "steam"; 7—light to moderate snow; 8—freezing rain; and 9—heavy snow.

To interpret this code, take the example of a broadcast which states simply, "Lake Superior 44215." This means that the winds are out of the south (first 2 digits), their velocity is 21 miles per hour (second 2 digits), and the weather outlook is for fog.

An evening of listening—especially during the summer months—is a most rewarding experience. Numerous SWL's specialize in DX'ing this band, not particularly for

U.S. Navy Time Signals

Five U.S. Navy radio stations, scattered around the world, broadcast time signals on the schedule shown below. Each station starts its time signal transmission five minutes before the indicated hour, and terminates it exactly on the hour. All times given are EST.

TIME	NSS	NPG	NPM	NPN	NBA
0500	*	*	*	*	
0700	*				
1000					*
1100	*	*	*	*	
1300	*				
1500					*
1700	*	*	*	*	
1900	*				
2200					*
0100	*	*	*	*	
0400					*

In addition, Station NBA broadcasts continuously on 18 kc., except from 1800 to 0200 EST Wednesday night and Thursday morning.

Frequencies

NSS (Annapolis, Md.) operates on 162.0; 5870.0; 9425.0; 13,575.0; 17,050.4, and 23,650.0 kc.

NPG (San Francisco, Calif.) operates on 114.9; 4010.0; 6428.5; 9277.5; 12,966.0; 17055.2; and 22,635.0 kc.

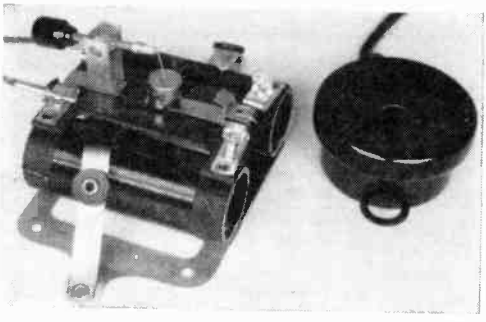
NPM (Honolulu, Hawaii) operates on 131.05; 4525.0; 9050.0; 13,655.0; 17,122.4; and 22,593.0 kc.

NPN (Guam) operates on 484.0; 4955.0; 8150.0; 13,530.0; 13,530; 17,530; and 21,760 kc.

NBA (Canal Zone) operates on 18.0; 147.85; 5448.5; 11,080.0; and 17,697.5 kc.

Foreign Standard Frequency Broadcasts

Call	*Location*	*Frequency (kc.)*
	AFRICA	
ZUO	Olifantsfontein, South Africa	5.0
	ASIA	
ATA	New Delhi, India	10.0
JJY	Tokyo, Japan	2.5, 5.0, 10.0, 15.0
ZLFS	Lower Hutt, New Zealand	2.5
	EUROPE	
FFH	Paris, France	2.5, 5.0, 10.0
HBN	Neuchatel, Switzerland	2.5, 5.0
IAM	Rome, Italy	5.0
IBF	Turin, Italy	5.0
MSF	Rugby, England	2.5, 5.0, 10.0
OMA	Prague, Czechoslovakia	2.5
	Moscow, USSR	10.0, 15.0
	SOUTH AMERICA	
LOL	Buenos Aires, Argentina	2.5, 5.0, 10.0, 15.0, 20.0, 25.0



For low-cost operation, you can't beat the galena crystal set of the 1920's. This popular version with two sliders on the tuning coils could receive AM broadcasting stations 10 miles away—if it was connected to a long-wire antenna and a "water-pipe" ground. The single earphone is a low-resistance type that was widely used by telephone companies.

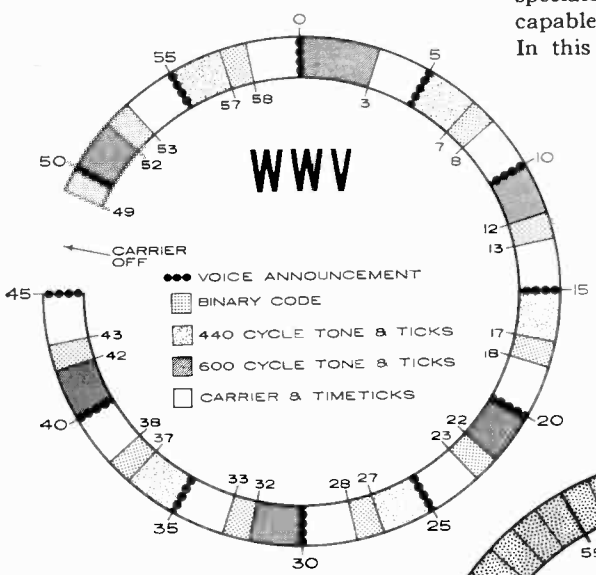
QSL's, but for the thrill of hearing everyday events taking place hundreds or thousands of miles away.

● **Time Signals and Standard Frequencies.** In this space-age technology, scientists throughout the world must rely on known standards of time and frequency measurement. For this purpose special frequencies have been set aside in the radio spectrum for the sole use of standard time and frequency broadcasters. A list of standard frequency radio transmissions appears on the facing page. Information on U.S. Naval Observatory time signals is also outlined on the facing page.

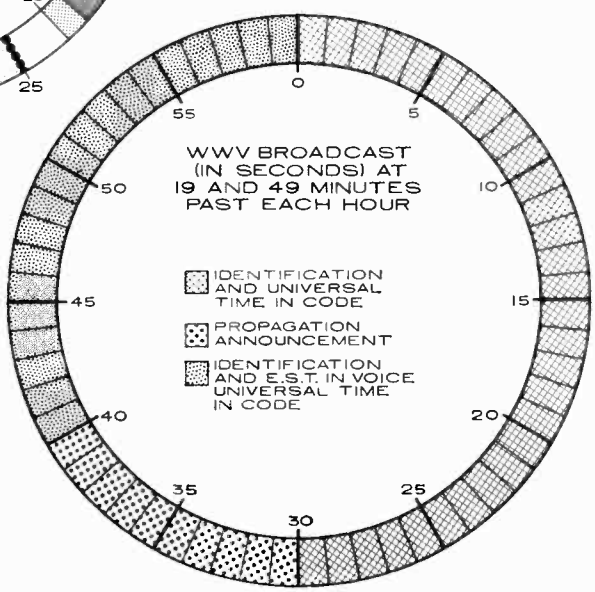
SWL's find many uses for signals from standard frequency stations, the primary one being to check the calibration of their receivers. Time signals are also important, and take on a wholly new aspect when the SWL can set his household clocks according to the Greenwich Observatory or Washington, D.C., time.

North American SWL's find station WWV well worth listening to. The WWV transmissions, which are radiated on standard frequencies, not only include time ticks and tone signals, but they provide a propagation warning of radio receiving conditions.

● **VHF Aeronautical Band.** A very popular specialty receiver now on the market is one capable of tuning between 108 and 132 mc. In this frequency range, we find all of the



Twenty-four hours a day, radio station WWV, located outside of Washington, D.C., transmits signals on 2.5, 5.0, 10.0, 15.0, 20.0, and 25.0 mc. The accuracy of any of these radiated frequencies is within one part in 10 billion! The wheel at left shows what happens during one hour of transmitting time. Note that different tones are alternated and that the carrier goes off the air after the voice announcement just before 45 minutes past the hour.



The wheel at right represents, in seconds, Station WWV's broadcast at 19 and 49 minutes past the hour. During this broadcast only, a propagation warning is given on short-wave receiving conditions. This warning is sent in Morse code and consists of the letters "N" (normal), "U" (unsettled), or "W" (useless), followed by a numeral grading the conditions from 9 (excellent) to 1 (useless). Thus, "N7" would mean that good receiving conditions will exist.

voice transmissions between airplanes in flight, radar ground controllers, and airport towers giving landing, take-off, and taxiing instructions. With a very simple antenna, you can pull in transmissions from airport towers and radar controllers at distances of 20 to 30 miles. Although the VHF band is pretty much limited to "line-of-sight" transmissions, don't be surprised if you can pick up airplane signals that are 100 to 150 miles away.

Most commercial jet flights are at altitudes above 25,000 feet. This offers a radio distance range of about 200 miles! Low-flying aircraft—at altitudes of only 5000 feet—can be heard 70 to 90 miles away. Even small airplanes at altitudes of only 1000 feet can be received regularly over distances of 50 miles. All of these transmissions are AM and the signals are usually very loud.

Most major airports in North America have five or more frequencies in use at the same time. New York City's LaGuardia Airport uses 118.9 mc. for flights approaching from the east and 125.7 mc. for flights approaching from the west. Departing flights from LaGuardia are contacted on 120.4 mc. while planes taxiing on the ground are controlled on 121.7 mc. Local flights in the vicinity of LaGuardia are controlled on 118.7 mc. In addition to these frequencies, LaGuardia also has an instrument landing beacon on 109.9 mc. and a VOR beacon on 115.4 mc.

● **152 to 174 Mc.** Outside of the Citizens Band, the greatest concentration of transmitters is to be found in this section of the VHF spectrum. This is the part of the radio spectrum where short-range (less than 50 miles) two-way communications take place. All the transmissions are voice transmissions and a high percentage are frequency-modulated (FM).

The FCC classifies the stations operating in this part of the spectrum as belonging to the Public Safety Group (police, fire, special emergency, etc.), Industrial (public utilities, manufacturing, business, etc.), Land Transportation (railroads, motor carriers, taxicabs, etc.), and Government. Police and fire department transmissions are probably the most interesting thing to listen for in this band. While some stations have their base and mobile transmitters on the same

Aviation Station List

The Seabrooke Printing Co., Inc., is the only distributor of an Aviation Service callbook. Authorized by contract with the Federal Communications Commission, Seabrooke publishes a frequency/station/location/power listing. This listing is revised on a regular basis and may only be purchased as a complete volume at a rate of 3.9¢ per page. At press time the Aviation List consisted of 245 pages. For details on purchasing, write: Seabrooke Printing Co., Inc., 514 10th Street N.W., Washington 4, D.C.

VHF/UHF Radio Registries

A four-volume set of callbooks embracing the tens of thousands of stations operating in the VHF and UHF part of the radio spectrum is available from Communication Engineering, P.O. Box 629, Mineola, N.Y. They may be ordered individually, or as a complete set. A special supplement to each volume is also sold on a subscription basis. Details should be obtained from the address above.

The Registry of Industrial System stations is sold for $7.00; Transportation Systems for $5.00; Business Radio for $7.00; and Public Safety Systems for $6.00.

New Industrial Licensees

A weekly listing of new industrial, public safety (police, fire, etc.), and land transportation licensees is published in Washington, D.C. The listing includes frequency assignments, ownership, and number of mobile units. This information is incorporated in a weekly newsletter entitled "Industrial Communications." Edited by Robert E. Tall, the newsletter is sold by subscription only for $50.00 per year. For further information, write Washington Radio Reports, Inc., 1327 F St., Washington 4, D.C.

frequency, many police and fire department networks will be operating on two or more frequencies. Police and fire base station transmitters in the major metropolitan areas have so much traffic to handle that cities the size of New York often have different frequencies assigned to different sections.

Don't forget that the FCC strictly prohibits divulging information intercepted by such "eavesdropping." Also, many communities have local ordinances prohibiting the installation of VHF receivers in automobiles. Listening at home is okay, but check your state and local laws before "monitoring" police or fire calls from your car.

● **Listening to the Satellites.** Since 1957, one of the most adventure-packed activities of the SWL has been intercepting the telemetry signals from U.S. and Soviet satellites.

The satellites launched by the Soviet Union have been the easiest for the average SWL to monitor. Satellite tracking stations in the Soviet Union are all tuned to a 20-kc. band that lies between 19,990 kc. and 20,010 kc. Every Soviet satellite—including those with Cosmonauts aboard—carries at least one telemetry and tracking transmitter which operates continuously near this 20-mc. frequency. The signals from the Soviet satellites are usually weak, but very distinctive. Each satellite transmitter has the characteristic sound of Soviet telemetry—a continuous "beep-beep-beep-beep."

Satellites launched by the United States in 1958 and 1959 contained a beacon or telemetry transmitter operating around 108.0 mc. It had been the intention of American space authorities to utilize a special 60-kc.-wide spectrum between 107.970 and 108.030 mc. for satellite transmissions. However, as the American satellite program racked up more and more successful shots, the need for additional frequencies arose. In 1960 and thereafter, satellites began transmitting beacon and telemetry signals in the 136.0 to 137.0 mc. band.

American and Soviet satellites also transmit on other frequencies. For example, special applications require four or more frequencies when an American "Transit" satellite—a U.S. Navy navigational satellite—is launched. And the Soviet Union transmits TV pictures from the Cosmonaut satellites; in general, frequencies around 143.0 mc. are used for these transmissions.

● **Identifying Satellites.** Transmitters in both Soviet and American satellites are frequency-controlled with great accuracy. *Radio Moscow* usually announces the frequencies employed in their satellite transmissions. Frequencies of American satellites are given in a monthly column in POPULAR ELECTRONICS.

The motion of a satellite through the heavens creates a Doppler effect that will vary the received frequency. To tune for a satellite, set your receiver for normal c.w. reception and use medium or wide i.f. selectivity. As the satellite approaches, the tone from the beacon or telemetry transmitter will sound slightly higher than when the satellite has passed overhead and is moving out of your range. This change in audible tone can be as much as 7000 cycles.

The SWL in continental North America will usually hear a satellite for only about 15 to 18 minutes during each orbit. Low-orbit satellites (those less than 250 miles high) can usually be heard for several successive passes as the orbit moves across the SWL's sky. Satellites usually take between 85 and 110 minutes for a complete circuit of the globe.

In the 136-137 mc. satellite band, the SWL has a good chance of hearing one or more of the "Tiros" weather mapping satellites. To make the "Tiros" family easier to track, several of these satellites operate on the same beacon or telemetry frequency.

The satellite called "Ariel" is a joint British-American satellite. "Ariel's" beacon

SPACEWARN Broadcasts

The Voice of America transmits a special series of space and satellite news broadcasts on the short waves. Transmitted six days a week—Tuesday through Sunday between 0330 and 0335 UT (GMT), or Monday through Saturday between 2230 and 2235 EST, the broadcasts contain information on new satellite launchings including details on telemetry frequencies. The programs are in English and are heard via WLWO (6155 and 9650 kc.), WBOU (9750 kc.), WDSI (11,890 kc.), and WBOU (11,905 kc.).

SWL Clubs

and telemetry sounds like the clanking of chains with audible signals out to 15,000 cycles. The Canadian-U.S. satellite, called "Alouette," operates on two frequencies and passes overhead every 105.5 minutes at an altitude of about 600 miles; it has an assortment of beeps and clanks in its beacon telemetry transmissions.

● **SWL Clubs.** As with most hobbies, special clubs have sprung up in Europe and North America for the purpose of providing an outlet for SWL news and activities. The oldest—and possibly one of the largest clubs—is the Newark News Radio Club, 215 Market St., Newark 1, N. J. This club issues a monthly mimeographed bulletin of about 60 pages which contains detailed up-to-the-minute information on standard broadcasts, short-wave broadcasts, FM, TV, amateur, and other SWL'ing activities. The dues are $5 a year and a sample bulletin may be obtained by sending 25 cents in coin to the club.

The American Short Wave Listeners Club, 3510 Garfield Ave., Kansas City, Mo., is one of the newer clubs that is quite active and well-organized. This club also publishes a monthly bulletin containing last-minute information and tips on DX'ing activities. Dues are $3 a year, and a sample bulletin may be obtained from the club for 15 cents in either stamps or coins.

The National Radio Club, RD #1, Lake City, Pa., is one of the world's largest clubs devoted exclusively to AM broadcast-band DX'ers. Details on its monthly news letter and membership requirements may be obtained by writing directly to the club.

In Canada, the Canadian DX Club, c/o Bill Graham, 946 Lawrence Ave., E. (Apt. 5), Don Mills, Ontario, is that country's largest and most active organization. Their monthly bulletin contains technical items, information on contests, and has a well-read classified advertising section. The dues are $3.50 a year, or $5 a year if the bulletin is sent via first class mail.

There are two active short-wave clubs in England which welcome associate members in North America. They are the International Short Wave Club, 100 Adams Gardens Estates, London S.E., 16, and the International Short Wave League, 12 Gladwell Rd., London N., 8.

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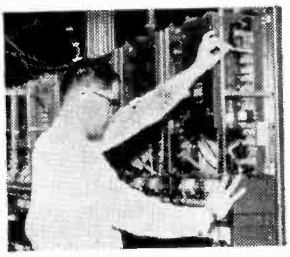

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The Fun of SWL'ing

Numerous other clubs, both large and small, are scattered throughout the world. As your interest in SWL'ing increases, you'll probably find it both pleasurable and profitable to join one of these groups.

● **In Closing.** It is virtually impossible for anyone to begin a hobby from scratch and become a wizard overnight. Fortunately, short-wave listening does not require exhaustive training and unusual skills to achieve noteworthy results. Within hours after you turn on your first receiver, you will find your listening horizons broadening at a pace you might heretofore have thought impossible.

As you progress further into SWL'ing, you will find out for yourself that there is more to be heard than just a bare handful of radio stations. Not only will you pick up direct broadcasts from many foreign lands, but you will intercept the conversations of radio amateurs discussing the latest electronic techniques; ships working coastal stations; overseas airlines and weather forecasts; airplanes in flight; and possibly—if you're one of the lucky ones—an astronaut in orbit; as well as time signals, police or fire calls, radiotelephone relays, etc.

The radio spectrum is crowded and there is an almost endless list of stations that you can tune in with the simplest receiver sitting alongside your favorite armchair. You can travel by radio waves from one continent to another, from the side of the world where it is daylight to the other side where it is dark.

Undoubtedly you will get that urge to let a short-wave broadcaster in another part of the world know that you have heard his station. Practically every short-wave broadcasting station will be grateful for your reception reports and/or letters and post cards of praise, criticism, or suggestions. Collecting QSL cards (and incidentally, foreign postage stamps) is a by-product of short-wave listening.

● **Become an SWL.** Your initial investment in short-wave listening does not need to be a large one. It is strongly suggested that a beginner in this hobby start with a modestly priced receiver. Those who want to combine two hobbies should investigate the monetary savings afforded through the purchase of a short-wave receiver in kit form. A kit will provide an excellent opportunity for you to become acquainted with the various electronic components used in building transmitters, TV sets, computers, etc. Seeing a receiver come alive before your eyes from a collection of resistors, capacitors, tube sockets, knobs, and wire is something you are not likely to forget.

Settle back and try your hand at this intriguing hobby. You will find never-ending interest by merely turning a few knobs that protrude from the front of a metal or wooden cabinet. In essence, you will be doing virtually the same thing your parents or grandparents did many years ago with crystal sets. But more than likely your equipment will be able to tune in tens of thousands of stations. Your problem will not be to hear them, but to separate and identify the stations.

But then, it's difficult to even visualize what our world would be like without the means of communications afforded all of us through the radio waves.

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Containing all the basic principles of radio and electronics in easy-to-understand form.

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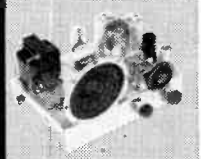
15 KITS

to build a Multimeter, AM Receiver and Signal Generator. Kits contain new parts for experiments, integrated so as to demonstrate what you learn in the lessons and to help you develop technical skills. Each kit is fun to put together!

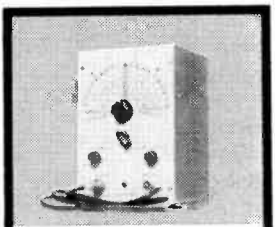
MULTIMETER

A sensitive precision measuring instrument you *build* and *use* on the job. Big 4½" meter with 50 microamp meter movement. 20,000 ohms-per-volt sensitivity d-c, 6,667 a-c.



AM RECEIVER

Have the satisfaction of building your own radio receiver with this high-quality 6-tube superheterodyne set. Big 5" speaker, fine tone!



SIGNAL GENERATOR

A "must" for aligning and trouble-shooting receivers. Build it for your own use. 170 KC to 50 MC fundamental frequencies for all radio and TV work.

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Unique triple conversion SSB receiver that features 11 crystal controlled fixed frequency positions in addition to the VFO. 115/230v, 50/60 cycle flexibility plus ±3 KC vernier tuning control for crystal positions assures unexcelled coverage of RTTY, MARS, C.A.P., WWV, and CD net frequencies. Outstanding for amateur, commercial, or industrial service.

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CIRCLE NO. 13 ON READER SERVICE CARD

AMATEUR RADIO

By HERB S. BRIER
W9EGQ

RADIO AMATEURS—who are more popularly known as "hams"—can be found in every far-flung corner of the globe. These ardent radio enthusiasts communicate with each other via their own two-way radio stations. They transmit and receive their radio signals in narrow bands of frequencies interspersed throughout the short-wave radio spectrum—bands which have been set aside for the use of radio amateurs by international agreement. A bar chart showing the frequency relationship of the amateur bands to short-wave broadcasting, aeronautical, and commercial stations, etc., appears on page 73.

Amateur radio stations are located in homes, automobiles, boats, and airplanes. The portability of amateur radio equipment has reached such a high art that every major scientific expedition to the darkest part of Africa or South America, or the snowy wilderness of the Antarctic, has included one or more radio amateurs. Some years ago, radio amateurs flying with General Curtis Lemay, then Commander of the Strategic Air Command, proved the value of a specialized form of voice communications—which was later adopted by all of the Command stations of the U.S. Air Force.

Actually, there is much more to ham radio than just talking to other hams. Nevertheless, this talking to other hams, this so-called "rag-chewing," serves a very useful purpose. It is one of the most direct and personal means of communications between citizens of different countries. In fact, ham radio represents one of the few contacts that citizens of the Soviet Union have with countries beyond the Iron Curtain.

(Continued on page 95)

Amateur Radio--Is It For You?

LEGAL DEFINITIONS are usually dry, lifeless things of little interest to the casual reader. But I should like to quote from one, found at the beginning of the rules established by the Federal Communications Commission to regulate the activities of radio amateurs: "The term 'amateur operator' means a person interested in radio technique solely with a personal aim and without pecuniary interest, holding a valid license issued by the Federal Communications Commission authorizing him to operate licensed amateur stations."

Behind the doors of this definition lies one of the most fascinating and yet most useful spare-time pursuits ever to hold man's rapt attention. Amateur radio has had a unique history of public service. Since its earliest days more than a half-century ago, it has contributed a steady stream of breakthroughs in radio communications, many of them of major significance. It has furnished untold thousands of key personnel to our armed services in times of national emergency. It has helped immeasurably in periods of local disaster—floods, hurricanes, fires—to save lives and alleviate suffering. And it has made many other contributions toward the public welfare—always on a voluntary basis and without financial reward of any sort.

Herbert Hoover, Jr.
W6ZH
President, American
Radio Relay League

On a more personal level, the desire to find out why things do or do not work, to improve on existing techniques, and to explore the unknown is one of the great lures of amateur radio. To build a piece of equipment, test it out, change a part or two, and then use it to talk to another similarly inclined and similarly skilled individual halfway down the block or halfway around the world, gives an unmatched sense of satisfaction. Multiplied over and over, such personal triumphs have played a far larger part in bringing our civilization from the era of crystal sets to the age of satellites and space than many people might suspect. In the United States and Canada alone, it is estimated that more than a million individuals have entered the amateur fraternity during the past 50 years. Many of them have been youngsters of school or college age. Amateur radio has aroused their scientific curiosities for the first time, and led most of them on into careers in electronics, communications, or other branches of engineering and science.

At the outset, amateur radio poses a challenge. There is much to learn, and a whole new set of skills to master before the newcomer wins his license. But the rewards are well worth the work. If the mysteries of radio communications beckon you, if you like building things with your own hands and working with tools, if you have an inclination or desire to serve your fellow man, community, and country, if you would like to make scores of new friends of varied backgrounds, ages, and nationalities —then amateur radio is for you.

—Herbert Hoover, Jr.

(Continued from page 93)

● **DX'ing.** Radio amateurs tend to find a certain activity within their own hobby that interests them the most. Some become DX'ers—hams who are primarily interested in establishing two-way communications (called "contacts") with other ham stations in every nation of the world. With a day-to-day birth of new nations, principally in Asia and Africa, this has become quite a task. The DX'er's challenge is also heightened by the fact that radio amateurs in numerous foreign countries are limited as to the amount of radio equipment that they have available. Only a few score DX'ers have managed to make contacts with radio amateurs in over 250 different nations.

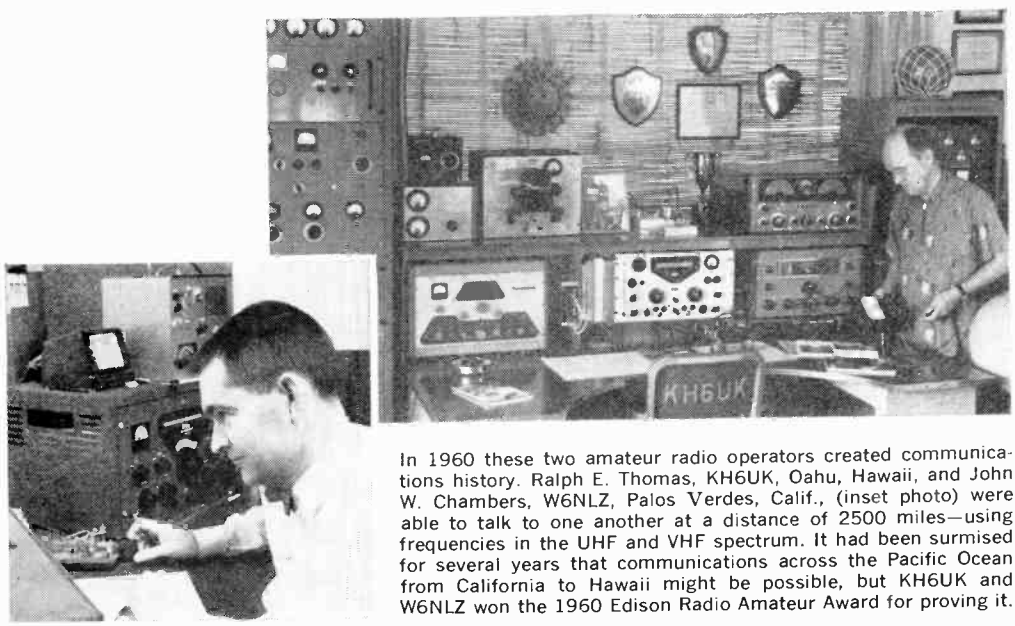
Some DX'ers will also look for other challenges, and strive to contact hams in special "zones"—an arbitrary division of the world into 40 parts or sections. Other DX'ers are attempting to contact as many different hams in as many different nations and subdivisions of these nations as possible.

● **Experimenting.** Another group of hams within the framework of amateur radio are experimenters and equipment builders. These hams may build their own TV stations, or experiment with esoteric forms of communications, such as facsimile and radioteletype. The ingenuity of ham experimenters was demonstrated on a world-wide basis in 1962 by the famous "OSCAR" satellites. Through the courtesy of the U.S. Air Force, radio amateurs were able to piggy-back two satellites in space. The weak beacon signals from the twosome were heard around and around the world until their batteries wore out.

● **Public Service.** Still other hams concentrate on the public service aspects of amateur radio. They recall the day when a ham was a proficient operator rattling off dash-dot telegraphy at 20-25 word-per-minute clips. This specialized undertaking—called "brass pounding"—is still going strong, and the "brass pounders" offer their services to the general public—especially between men in the armed services overseas and their families and loved ones at home.

● **CD Network.** Radio amateurs have also been organized—and sanctioned by the Federal Communications Commission—into a civilian defense communications network. Time and time again, this network has provided emergency communications during floods, forest fires, hurricanes, typhoons, and other natural disasters, when normal communications circuits have temporarily failed or been greatly overloaded.

But, in all things the radio amateur does, he never forgets that amateur radio



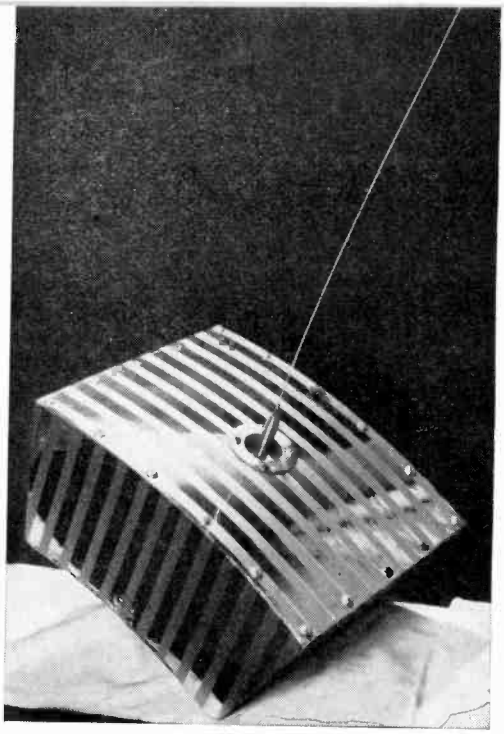
In 1960 these two amateur radio operators created communications history. Ralph E. Thomas, KH6UK, Oahu, Hawaii, and John W. Chambers, W6NLZ, Palos Verdes, Calif., (inset photo) were able to talk to one another at a distance of 2500 miles—using frequencies in the UHF and VHF spectrum. It had been surmised for several years that communications across the Pacific Ocean from California to Hawaii might be possible, but KH6UK and W6NLZ won the 1960 Edison Radio Amateur Award for proving it.

is a hobby, he never receives money or other compensation for his experiments or public service work—just the praise of his neighbors, such as you and me.

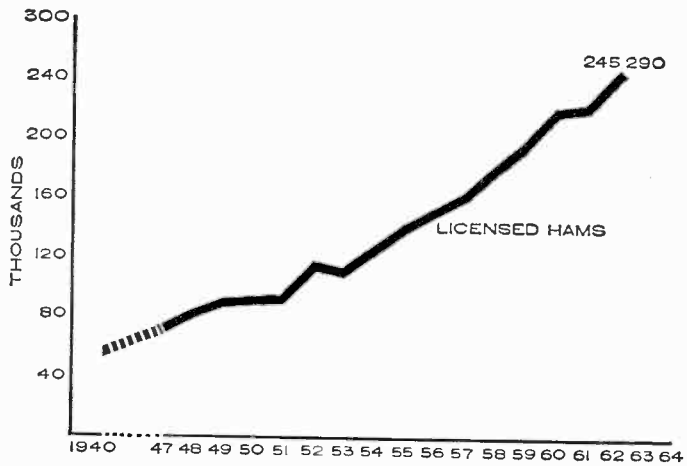
● **Becoming a Ham.** The proverbial "doctors, lawyers, and Indian Chiefs" are only a few members of the radio amateur family. School children, housewives, beauty contest winners, TV personalities, butchers, prize-fighters, wrestlers, stock-brokers, nuns, generals, princes, bedridden invalids, and even sightless individuals are active participants in this wonderful hobby. In fact, name any group of people between the ages of seven and ninety, and some are bound to be numbered among the world's 400,000 hams.

Regardless of nationality, every radio amateur has proven his ability to operate a radio transmitting station. This basic requirement is necessary and is spelled out in several international treaties. Unlike the CB'ers discussed in the first chapter of this Handbook, hams are permitted to operate in many countries with up to 1000 watts input to their transmitters. Also, most are allowed to shift or vary the frequency of their transmissions to best suit communications over distances of many thousands of miles.

Since hams may construct any or all of their radio station equipment, the governments of their respective nations are anxious to insure that such equipment is always in good operating condition and that it doesn't interfere with vital communications services or broadcasting. For this reason, most governments require that a ham be technically qualified and have a full understanding of the "electronics" of his radio station. In addition, a license is issued only after the applicant has demonstrated his proficiency in code telegraphy and his knowledge of certain laws, rules, and regu-



This is "OSCAR II," the second satellite built by radio amateurs and launched by the U. S. Air Force (in conjunction with its "Discoverer" program). The 2-meter ham-band signals of the "OSCAR II" were heard by hundreds of listeners. The black-and-silver striping makes for better thermal control while the satellite is in space.



The number of amateur radio operators has tripled in the years following World War II. The kink in the ascending line in this graph, around 1952, is due to the public interest in the then new Novice and Technician classes of radio licenses.

lations pertaining to the international use of the radio waves.

In the United States, the Federal Communications Commission will issue an amateur license free of charge to any citizen (born or naturalized) who passes the appropriate radio amateur examination. Licenses are now available to new applicants in five classes—Novice, Technician, Conditional, General, and Extra Class. (There is a sixth class of license in existence—the Advanced Class—which is available on a renewal basis only.) The Novice and Technician classes were established to permit more people to become hams, and to grow—technically speaking—within their own hobby. Many hams that are now on the air started out as Novices and worked their way up the license ladder.

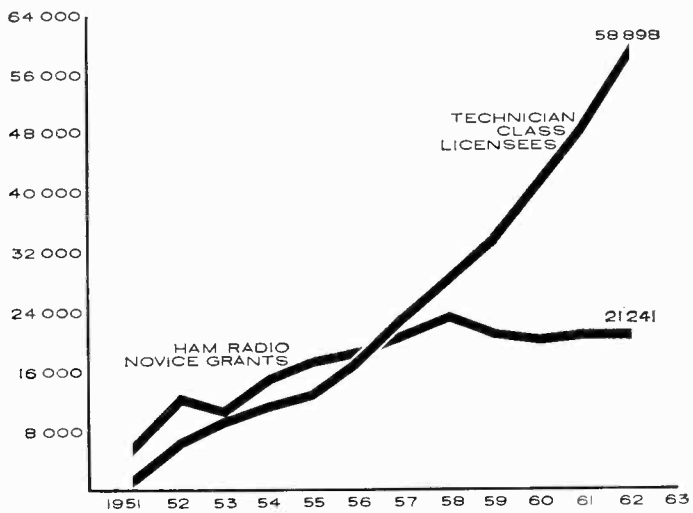
● **Novice License.** The intention behind the formation of this class of license was to permit a technically qualified radio experimenter to "get on the air" and improve his code telegraphy sending and receiving ability. The Novice license holder is permitted to operate in small segments of the 2-, 15-, 40-, and 80-meter ham bands. A drawing on page 69 shows the relationship of these bands to the broadcasting services. The transmitter power that the Novice may use is limited to 75 watts and his transmitter must be rigidly controlled in frequency—by means of a crystal.

To qualify for a Novice license, an applicant must not have previously held any class of U.S. amateur radio license. As issued, the license is good for only one year and is not renewable. In other words, the Novice license corresponds to an automobile driver learner's permit.

Applicants for the Novice privileges must pass a simple written examination and a 5-wpm (word per minute) code test. As outlined further along in this chapter, the Novice license is available only by mail, and the examination must be under the direct supervision of another radio amateur holding a General Class or higher grade license, or of a person holding a commercial radiotelegraph license.

● **Technician License.** The Technician Class license was established to permit experimentation with electronic transmitting equipment in the higher frequency bands. It was assumed in establishing this class of license that the Technician would have little need or use for an extensive knowledge of code radiotelegraphy.

To qualify for a Technician license, you must pass the standard written examination for a General Class license. This examination is considerably more difficult than that for the Novice license, but most applicants pass it readily after a few months of spare-time study. Incidentally, you can apply for a Novice and a Technician license at the same time, or for a Novice license first and then a Technician license at a later date. Of course, as mentioned before, you cannot apply for a Novice license after you have secured a Technician license.



Novice licenses are only good for one year and may not be renewed. In the past few years, about 21,000 new applicants have passed the simple 5 word-per-minute test. A Technician license is good for five years, and is rapidly becoming a very popular license among new amateurs.

How To Apply

The code requirement for this grade of license is also 5 wpm, and the test consists of 25 five-letter words. During the receiving test, the applicant must copy at least 25 consecutive letters accurately. No punctuation marks or numerals are included in this examination.

The Technician license is also issued through the mail, and the examination must also be under the direct supervision of an amateur holding a General Class or higher license, or of someone holding a commercial radiotelegraph license.

● **General License.** A General Class radio amateur license grants the applicant all operating privileges, and requires the successful completion of the same written test as

Photographed just before he passed his General Class license exam, this is Luis Cabrera, WP4BBN, of Hato Rey, Puerto Rico. Luis was active in the 1962 "Novice Roundup" sponsored by the ARRL. In this annual contest, which is held each winter especially for Novice licensees, Luis contacted some 170 different fellow Novices.

is given for the Technician license. However, the code requirement is 13 wpm, as opposed to the 5-wpm requirement in the Novice and Technician grades.

The applicant for this license must personally appear at an examination point maintained by the Federal Communications Commission. The addresses of these examination points are given separately.

● **Conditional License.** The FCC recognizes that many applicants for radio amateur licenses cannot conveniently reach the examination points. Therefore, if you live more than 75 airline miles from the nearest examination point, or are unable to travel because of some physical handicap, you can obtain all General Class operating privileges by mail.

In order to take the necessary tests, you must provide yourself with code examination facilities and request that another radio amateur with a General Class or higher grade license (or some other duly qualified individual) supervise the code test. The written exam must also be supervised and witnessed.

● **Extra Class License.** When you have held an amateur license of the General or Conditional Class for two years, you may apply for an Extra Class license. The requirements are an ability to send and receive code radiotelegraphy at 20 wpm and to pass a new written examination dealing with advanced amateur radio techniques. At present, except for prestige, there is nothing to be gained by qualifying for this class of license.

● **Applying for Your License.** When you're ready to try for your Novice, Technician, or Conditional license, write to the nearest FCC field office (see addresses on pages 100, 101 and 102) and request application form 610 and the written examination for the class of license you wish to apply for. You'll receive the necessary material by return mail, and you'll have 15 days in which to complete the examination.

If you live within 75 miles of a point where amateur exams are given at least four times a year and are applying for a Conditional license through protracted inability to travel, it's wise to include a doctor's certificate with your request. In any event, you'll have to enclose such a certificate with your actual license application.

After receiving your papers (application form, sealed written exam, and answer sheet), fill out the application form—which is completely straight-forward—and make arrangements with a local ham holding a General Class or higher license to give you the code test. (Anyone who has held a commercial radiotelegraph license or who has been employed in the service of the United States as an operator of a manually operated radiotelegraph station may also give the code test, on the condition that he has held such a post within the past five years.)

The code test consists of two parts: a 5-minute receiving test at a specified speed (which you must copy for at least one minute without error), and a sending test. The Novice (as well as the Technician) code test contains no numerals or punctuation marks; but the General/Conditional test includes both, with each counting as two letters.

Assuming that you pass the code test, your examiner will fill in the code examiner's certification on the back of the application form, and you're ready for the written exam. (If you fail the code test, this fact is also recorded on the form, and it and the unopened written examination are returned to the FCC. But don't be too upset; if you do fail, you can study a bit more and try again in 30 days.)

If the code examiner is over 21, he can also witness the written examination for you; otherwise, any adult can do so. Hand the application form—which shows that you have passed the code test—and the *unopened* written examination to him. He will open the envelope and hand the contents (several pages of multiple-choice questions—20 for the Novice exam; 50 for the Technician/Conditional exam) back to you.

After signing each page of the examination and the answer sheet, you select an answer to each question from the five possible answers listed, and black in the corresponding square on the answer sheet.

When you've finished, the witness will certify that you completed the examination in his presence without help. He will then place the questions, answer sheet, and the application form in a large stamped envelope (which you have supplied) and mail it to the Federal Communications Commission, 334 York St., Gettysburg, Pa.

If you pass, your license and call letters will arrive in a few weeks. By the way, don't waste your time requesting a special set of call letters—they're issued in alphabetical order. The map on page 123, however, will tell you in which call area you are located.

● **General Class Examination.** Exactly the same procedure is followed when you take the General Class examination, except that an FCC representative conducts it. All you have to do is appear at the specified place at the scheduled time with a supply of sharpened pencils in your hand.

If the exact date and time of the next examination at the examination point most convenient for you is not shown on pages 100 or 101, write to the Engineer-in-Charge of the district for the information. As a matter of fact, it's a good idea to double-check ahead of time anyway, even when dates and times are given, because they are always subject to change.

(Continued on page 102)

The electronics industry is populated with amateur radio operators in high offices or key positions. This is Stuart Meyer, President of Hammarlund Mfg. Co., Inc. Stu, W2GHK, spends considerable time on the ham bands testing—of all things—Hammarlund ham equipment. Hammarlund has been in the ham and business radio fields for over 25 years.

Where Amateur Radio

Semi-annually, the Federal Communications Commission announces the dates, times, and locations where examinations may be taken for radio operators licenses. This listing has been prepared from the FCC schedule for January through June, 1963. The number shown in parenthesis after the city and state stands for the U. S.

Amarillo, Texas (10) Annually, between July and December; no spring examination.

Albuquerque, N. J. (15) 11:00 a.m., April 6

Anchorage, Alaska (23) By appointment only. Apply to 53 U. S. Post Office Bldg.

Atlanta, Ga. (6) 8:30 a.m., Tuesdays and Fridays.

Bakersfield, Calif. (11) In May; date and time not set.

Baltimore, Md. (4) 8:30 a.m., Mondays and Fridays; or by appointment.

Bangor, Me. (1) 9:00 a.m., May 8.

Beaumont, Texas (9B) By appointment only. Apply to P.O. Box 1527.

Billings, Mont. (14) 1:00 p.m., in May; date not set.

Birmingham, Ala. (6) 1:00 p.m., March 6 and June 5.

Boise, Idaho (13) In April; date and time not set.

Boston, Mass. (1) 8:30 a.m., Wednesdays, Thursdays, and Fridays.

Buffalo, N.Y. (20) 9:00 a.m., 1st and 3rd Friday of each month.

Charleston, W. Va. (19) In March and June; dates and times not set.

Chicago, Ill. (18) 9:00 a.m., every Friday.

Cincinnati, Ohio (19) In February and May on two days; not set at this writing.

Cleveland, Ohio (19) In March and June on two days; not set at this writing.

Columbus, Ohio (19) In April on two days; not set at this writing.

Corpus Christi, Texas (19) 9:00 a.m., March 7 and June 6.

Dallas, Texas (10) 9:00 a.m., Tuesdays.

Davenport, Iowa (18) In April; date and time not set.

Denver, Colo. (15) 8:00 a.m., 1st and 2nd Thursdays of month.

Des Moines, Iowa (17) In June; date and time not set.

Detroit, Mich. (19) 9:00 a.m., Wednesdays and Fridays.

El Paso, Texas (10) 9:00 a.m., June 13.

Fairbanks, Alaska (23) In May; date and time not set.

Fort Wayne, Ind. (18) In May; date and time not set.

Fresno, Calif. (12) In March and June; dates and times not set.

Grand Rapids, Mich. (19) In April; date and time not set.

Great Falls, Mont. (14) No spring examination.

Hartford, Conn. (1) 9:00 a.m., March 13.

Hilo, Hawaii (21) No spring examination.

Honolulu, Hawaii (21) 9:00 a.m., daily

Houston, Texas (9) 9:00 a.m., every Tuesday.

Indianapolis, Ind. (18) In May; date and time not set.

Jackson, Miss. (8) 9:00 a.m., June 5.

Jacksonville, Fla. (7) 9:00 a.m., April 18 and April 19.

Jamestown, N. D. (16) No spring examination.

Kansas City, Mo. (17) 8:30 a.m., every Thursday and Friday.

Klamath Falls, Ore. (13) In May; date and time not set.

United States

Address all communications to the

Dist. No. 1: 1600 Customhouse, Boston 9, Mass. The states of Conn., Maine, Mass., N.H., Rhode I., and Vt.

Dist. No. 2: 748 Federal Bldg., 641 Washington St., New York 14, N.Y. In the state of New York, the counties of Albany, Bronx, Columbia, Delaware, Duchess, Greene, Kings, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Schenectady, Suffolk, Sullivan, Ulster, and Westchester; in the state of New Jersey, the counties of Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union, and Warren.

Dist. No. 3: 1005 New U.S. Customhouse, Second and Chestnut Sts., Philadelphia 6, Pa. In the state of Pennsylvania, the counties of Adams, Berks, Bucks, Carbon, Chester, Cumberland, Dauphin, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Perry, Philadelphia, Schuylkill, and York; in the state of New Jersey, the counties of Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, and Salem; in the state of Delaware, the county of Newcastle.

Dist. No. 4: 415 U.S. Customhouse, Gay and Water Sts., Baltimore 2, Md. The state of Maryland, except the part lying in Dist. 24; in the state of Virginia, the counties of Clark, Fairfax (except the part in Dist. 24), Fauquier, Frederick, Loudoun, Page, Prince William, Rappahannock, Shenandoah, and Warren; in the state of Delaware, the counties of Kent and Sussex; in the state of West Virginia, the counties of Barbour, Berkeley, Grant, Hampshire, Hardy, Harrison, Jefferson, Lewis, Marion, Mineral, Monongalia, Morgan, Pendleton, Preston, Randolph, Taylor, Tucker, and Upshur.

Dist. No. 5: 402 Federal Bldg., Norfolk 10, Va. The state of Virginia, except the parts lying in Dist. 4 and 24; and the state of North Carolina, except the part lying in Dist. 6.

Dist. No. 6: 718 Atlanta National Bldg., 50 Whitehall St., Atlanta 3, Ga. The states of Georgia, South Carolina, and Tennessee; the state of Alabama, except the part lying in Dist. 8; in the state of North Carolina, the counties of Ashe, Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Cleveland, Graham, Haywood, Henderson, Jackson, McDowell, Macon, Madison, Mitchell, Polk, Rutherford, Swain, Transylvania, Watauga, and Yancey.

Dist. No. 7: 312 Federal Bldg., Miami 1, Fla. The state of Florida, except the county of Escambia (in Dist. 8).

Dist. No. 8: 608 Federal Office Bldg., 600 South St., New Orleans, La. The states of Arkansas, Louisiana, and Mississippi; in the state of Texas, the city of Texarkana; in the state of Florida, the county of

Examinations Are Given

Radio District in which the city is located. For more specific information, write to the District FCC Engineer-in-Charge of the Radio District in which you live. (See complete listing below.) In any case, it is advisable to check with the FCC Engineer-in-Charge for possible changes in the schedule given here.

Knoxville, Tenn. (6) 1:00 p.m., March 20 and June 19.

Lihue, Hawaii (21) No spring examination.

Little Rock, Ark. (8) 1:00 p.m., May 1.

Los Angeles, Calif. (11) 9:00 a.m. and 1:00 p.m., every Wednesday.

Louisville, Ky. (18) In May; date and time not set.

Marquette, Mich. (16) 9:00 a.m., May 8.

Memphis, Tenn. (6) 8:30 a.m., April 4.

Miami, Fla. (7) 9:00 a.m., every Thursday.

Milwaukee, Wis. (18) In April; date and time not set.

Mobile, Ala. (8M) Wednesdays, by appointment only. Apply to Room 419, U.S. Court & Customhouse.

Nashville, Tenn. (6) 1:00 p.m., May 1.

New Orleans, La. (8) 8:30 a.m., every Monday.

New York, N.Y. (2) 9:00 a.m., Tuesdays through Fridays.

Norfolk, Va. (5) All day every Friday.

Oklahoma City, Okla. (10) 9:00 a.m., April 19.

Omaha, Nebr. (17) In April; date and time not set.

Philadelphia, Pa. (3) 8:30 a.m., Mondays, Tuesdays and Wednesdays.

Phoenix, Ariz. (11) In April; date and time not set.

Pittsburgh, Pa. (20) In May; date and time not set.

Portland, Me. (1) 9:00 a.m., April 9.

Portland, Ore. (13) 8:45 a.m., every Friday.

Rapid City, S. D. (15) 11:00 a.m., May 11.

Roanoke, Va. (5) In April; date and time not set.

St. Louis, Mo. (17) In May; date and time not set.

St. Paul, Minn. (16) 8:45 a.m., every Friday.

Salt Lake City, Utah (15) 11:00 a.m., June 7.

San Antonio, Texas (9) 9:00 a.m., May 2 and May 3.

San Diego, Calif. (11SD) Wednesdays, by appointment. Apply to Fox Theater Bldg., 1245 7th Ave.

San Francisco, Calif. (12) 9:00 a.m., every Friday.

San Juan, P.R. (22) 9:00 a.m., every Friday.

San Pedro, Calif. (11SP) 8:00 a.m., every Wednesday.

Savannah, Ga. (6S) By appointment only. Apply to P.O. Box 77.

Schenectady, N.Y. (2) 9:00 a.m. and 1.00 p.m., June 12 and 13.

Seattle, Wash. (14) 9:00 a.m., every Friday.

Sioux Falls, S.D. (16) 10.00 a.m., March 19 and June 18.

Spokane, Wash. (14) 1:00 p.m., in April; date not set.

Syracuse, N.Y. (20) In April; date and time not set.

Tampa, Fla. (7T) By appointment only. Apply to Room 201, 221 N. Howard Ave.

Tucson, Ariz. (11) In April; date and time not set.

Tulsa, Okla. (10) 9:00 a.m., April 17 and 19.

Washington, D.C. (24) 9:30 a.m. and 1:00 p.m., Tuesdays and Fridays.

Wichita, Kan. (17) In March; date and time not set.

Williamsport, Pa. (20) In March and June; dates and times not set.

Wilmington, N.C. (5) 9:00 a.m., in June; date not set.

Winston-Salem, N.C. (5) 9:00 a.m., in May; date not set.

Radio Districts

District FCC Engineer-in-Charge

Escambia; in the state of Alabama, the counties of Mobile and Baldwin.

Dist. No. 9: 324 U.S. Appraisers Bldg., 7300 Wingate St., Houston 11, Texas. In the state of Texas, the counties of Angelina, Aransas, Atascosa, Austin, Bandera, Bastrop, Bee, Brooks, Bexar, Blanco, Brazoria, Brazos, Burleson, Caldwell, Calhoun, Cameron, Chambers, Colorado, Comal, DeWitt, Duval, Dimmit, Edwards, Fayette, Fort Bend, Frio, Galveston, Gillespie, Goliad, Gonzales, Grimes, Guadalupe, Hardon, Hays, Harris, Hidalgo, Jackson, Jasper, Jefferson, Jim Hogg, Jim Wells, Karnes, Kennedy, Kendall, Kerr, Kinney, Kleberg, LaSalle, Lavaca, Lee, Liberty, Live Oak, Matagorda, Madison, Maverick, McMullin, Medina, Montgomery, Nacogdoches, Newton, Nueces, Orange, Polk, Real, Refugio, San Augustine, San Jacinto, San Patricio, Sabine, Starr, Travis, Trinity, Tyler, Uvalde, Val Verde, Victoria, Walker, Waller, Washington, Webb, Wharton, Willacy, Williamson, Wilson, Zapata, Zavala.

Dist. No. 10: Room 401, States General Life Insurance Bldg., 708 Jackson St., Dallas 2, Texas. The state of Texas, except that part lying in Dist. 9 and in the city of Texarkana; the state of Oklahoma.

Dist. No. 11: Mezzanine 50, 849 S. Broadway, Los Angeles 14, Calif. The state of Arizona; in the state of Nevada, the county of Clarke; in the state of California, the counties of Imperial, Inyo, Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura.

Dist. No. 12: 323-A Customhouse, 555 Battery St., San Francisco 26, Calif. The state of California, except the part lying in Dist 11; the state of Nevada, except the county of Clarke.

Dist. No. 13: 201 U. S. Courthouse, 620 S.W. Main St., Portland 5, Ore. The state of Oregon; the state of Idaho, except the part lying in Dist. 14; in the state of Washington, the counties of Wahkiakum, Cowlitz, Clark, Skamania, and Klickitat.

Dist. No. 14: 806 Federal Office Bldg., 1st Avenue & Marion, Seattle 4, Wash. The state of Montana; the state of Washington, except the part lying in Dist. 13; in the state of Idaho, the counties of Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai, Latah, Lewis, Nez Perce, and Shoshone.

Dist. No. 15: 521 New Customhouse, Denver 2, Colo. The states of Colorado, Utah, and Wyoming; in the state of Nebraska, the counties of Banner, Box, Butte, Cheyenne, Dawes, Deuel, Garden, Kimball, Morrill, Scottsbluff, Sherida, and Sioux; in the state of South Dakota, the counties of Butte, Custer, Fall River, Lawrence, Meade, Pennington, Shannon, and Washington.

(Continued on next page)

United States Radio Districts

(Continued from previous page)

Dist. No. 16: 208 Federal Court Bldg., 6th & Market St., St. Paul 2, Minn. The states of Minnesota and North Dakota; the state of South Dakota, except the part lying in Dist. 18; in the state of Michigan, the counties of Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, and Schoolcraft.

Dist. No. 17: 3100 Federal Office Bldg., 911 Walnut St., Kansas City 6E, Mo. The states of Kansas and Missouri; the state of Iowa, except the part lying in Dist. 18; the state of Nebraska, except the part lying in Dist. 15.

Dist. No. 18: 826 U.S. Courthouse, 219 S. Clark St., Chicago 4, Ill. The states of Illinois and Indiana; in the state of Iowa, the counties of Allamakee, Buchanan, Cedar, Clayton, Clinton, Delaware, Des Moines, Dubuque, Fayette, Henry, Jackson, Johnson, Jones, Lee, Linn, Louisa, Muscatine, Scott, Washington, and Winneshiek; in the state of Wisconsin, the counties of Brown, Columbia, Calumet, Crawford, Dane, Dodge, Door, Fon du Lac, Green, Iowa, Jefferson, Keewanee, Kenosha, Lafayette, Manitowoc, Marinette, Milwaukee, Ozaukee, Oconto, Outagamie, Racine, Richland, Rock, Sauk, Sheboygan, Walworth, Washington, Waukesha, and Winnebago; the state of Kentucky, except that part lying in Dist. 19.

Dist. No. 19: 1029 New Federal Bldg., Detroit 26, Mich. The state of Ohio; the state of Michigan, except the part lying in Dist. 16; the state of West Virginia, except for the part in Dist. 4; in the state of Kentucky, the counties of Bath, Bell, Boone, Bourbon, Boyd, Bracken, Breathitt, Campbell, Carter, Clark, Clay, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Gallatin, Garrard, Grant, Greenup, Kenton, Harlan, Harrison, Jackson, Jessamine, Johnson, Knott, Knox, Laurel, Lawrence, Lee, Leslie, Letcher, Lewis, Lincoln, Madison, Magoffin, Martin, Mason, McCreary, Menifee, Montgomery, Morgan, Nicholas, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Scott, Wayne, Whitley, Wolfe, and Woodford.

Dist. No. 20: 328 Post Office Bldg., Ellicott & Swan St., Buffalo 3, N. Y. The state of New York, except the part in Dist. 2; the state of Pennsylvania, except the part in Dist. 3.

Dist. No. 21: 502 Federal Bldg. (or P.O. Box 1021), Honolulu 13, Hawaii. The state of Hawaii and outlying Pacific possessions, except Alaska and adjacent islands.

Dist. No. 22: 322 Federal Bldg. (or P.O. Box 2987), San Juan 12, Puerto Rico. Puerto Rico and the Virgin Islands.

Dist. No. 23: Room 53, U.S. Post Office and Courthouse Bldg. (or P.O. Box 644), Anchorage, Alaska. The state of Alaska and adjacent islands.

Dist. No. 24: Room 106, 718 Jackson Pl., N.W., Washington 25, D.C. The District of Columbia and 10 miles beyond the boundary of the District of Columbia in each direction.

REGIONAL OFFICES

Dist. 6S: 214 Post Office Bldg. (or P.O. Box 77), Savannah, Ga.

Dist. 7T: Room 201, Spradin Bldg., 221 N. Howard Ave., Tampa, Fla.

Dist. 8M: 419 U.S. Courthouse & Customhouse, Mobile 10, Ala.

Dist. 9B: 301 Post Office Bldg. (or P.O. Box 1527), 300 Willow St., Beaumont, Texas.

Dist. 11SD: Fox Theater Bldg., 1245 7th Ave., San Diego 1, Calif.

Dist. 11SP: 356 W. 5th St., San Pedro, Calif.

Dist. 23J: 6 Shattuck Bldg., Third & Seward St. (or P.O. Box 1421), Juneau, Alaska.

(Continued from page 99)

● **Learning the Code.** Many prospective hams consider having to learn the code in order to obtain a ham license a waste of time, because they plan to operate phone exclusively when they get their licenses. Nevertheless, international regulations require that everyone must learn the code to get a license. Fortunately, the task is not nearly as difficult as most people believe, although it does take time. Furthermore, learning the code *does* have several definite advantages.

For example, a code transmitter is simpler and less expensive than a phone transmitter of equal power; in addition, a code transmitter will "get through" under conditions that make phone transmissions useless. Finally, code operation has a fascination of its own, and many thousands of hams use it in preference to phone.

● **Personal Instruction.** Undoubtedly, the best way to learn the code is with the aid of a good teacher, either individually or in a code class. Listed on pages 106 to 108 are many ham clubs which offer amateur code (and theory) lessons. If you live near one of them, no more need be said. Otherwise, you may be able to find a ham in your neighborhood willing to give you a hand.

The preferred method of learning the code goes something like this: The teacher sends a letter in code on his key at a speed equivalent to approximately 15 words per minute, followed by a voice announcement of the letter sent. After several repetitions to implant the letter in your mind, the teacher keys the letter a few times without the voice announcement. Additional letters are introduced in the same manner, while the teacher constantly repeats the previously introduced letters. For your part, you write down every letter (*never* the dots and dashes) you recognize.

Because the individual letters are sent rapidly, you are forced to learn them by their overall sound—not by individual *dih*'s and *dah*'s. The long space between letters gives you time to write down each letter. Assuming lessons of an hour's duration, five or six letters can usually be learned thoroughly in the first lesson. A couple more can then be added in each subsequent lesson.

By the time you learn the alphabet using this method, you'll probably be able to

copy the code at a speed in excess of 5 wpm. From this point on, only regular daily copying practice—half an hour a day is fine—will bring your copying speed up to the General Class level. Of course, with a Novice license, you can get this practice on the air while making actual contacts.

Incidentally, while there are no numerals or punctuation marks required in the Novice code test, you had better learn the numerals at least. After all, it's impossible to copy addresses, call letters, or signal reports without them.

● **Recorded Code Courses.** Virtually as good as a personal code teacher are the code courses recorded on phonograph records, magnetic tapes, or on punched-paper tapes for use on special code machines.

Aids in Learning the Code

Many would-be Novice hams have mastered the code requirement, necessary to obtain a license, through the use of lessons on LP recordings. These lessons are well-organized and should be investigated if you have trouble learning the code. Try: "International Code Training System" ($6.95, Howard W. Sams); "Sight-N-Sound Code Course" ($9.50, John F. Rider); or the mail order courses available from Allied Radio and Lafayette Radio Electronics.

However, it's easy to memorize such a course sufficiently to allow you to anticipate what's coming next, giving you an exaggerated idea of your copying ability. This problem can be alleviated to some degree when two or more students are studying together by each getting a different course and exchanging them frequently.

● **Other Methods.** Lacking a teacher or a recorded code course, you can memorize the code from a printed chart or cards and get your copying practice by listening on your short-wave receiver. Just remember that a dot is never a dot—it's a *dih*, except when it's the final sound in a character, in which case it's a *dit*. Similarly, a dash isn't a dash, but a *dah*. (*Dit* and *dah* approximate the actual sound of the code.) Also, when learning a character, such as *A*, don't say *dih* space *dah* but snap the whole character out as a unit—*dihdah*.

Unfortunately, memorizing the code by sight and being able to copy it well by ear are many hours of practice apart. Nevertheless, this is the way a large percentage of hams learn the code.

Every night of the year, W1AW, the headquarters station of the American Radio Relay League, Inc., 38 La Salle Rd., W. Hartford, Conn., transmits code practice at 9:30 p.m. local time (EST in winter, EDST in summer) on the following frequencies: 1.805, 3.555, 7.085, 14.1, 21.075, 28.08, 50.7, and 145.8 mc. On Sunday, Monday, Wednesday, and Friday, the transmitted speeds are 5, 7½, 10, and 13 wpm. On the remaining nights, the speeds are 15 to 35 wpm.

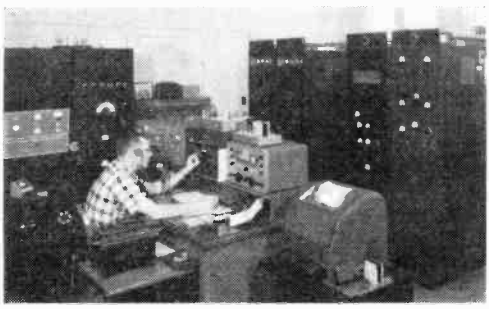
Station W1AW is audible throughout the United States (and other parts of the world) on one or more of its transmitting frequencies; 3.555, 7.085, and 14.1 mc. are received

Evening classes of free code instruction are held each Monday by the Allied Radio Corp., Chicago, Ill. Of the group that started last September, some 60 students have since received Novice ham tickets. The instructors at these Allied classes are empowered to give Novice exams.

Learning To Send

best in most sections of the country. You can identify the station by the transmission of "QST QST QST DE W1AW W1AW W1AW," repeated in code for several minutes before the start of the actual code practice.

Other ham stations also send code practice on the air, although their schedules change rather frequently; a request to the ARRL (address on p. 103) will bring the latest list of these volunteer practice stations to you. Of course, you can also copy other hams in regular communications for practice. But whatever the method used, you're ready for the FCC code test when you can consistently copy at a speed 2 or 3 wpm faster than the test speed; without this "cushion," nervousness, etc., may cause you to fail the test.



ARRL Photo

Code lessons are transmitted nightly by amateur radio station W1AW. Located in Newington, Conn., W1AW is the official headquarters station of the American Radio Relay League. Seated at the operating console is Chuck Bender, W1MPR. A radioteletype printer is in the foreground, while the unit at Chuck's immediate left is the automatic code keyer.

● **Learning to Send.** When you're able to receive the code at a speed of 6 or 7 wpm, you can turn your attention to the task of learning to send. Diddling with a key before this time may actually retard your progress because, in sending, you must think of the individual *dih*'s and *dah*'s—just the opposite of what you must do in receiving. In addition, you won't as yet have learned how good sending actually sounds.

Good sending depends entirely on timing. A *dah* is equal in length to three *dih*'s, while the space between *dih*'s and *dah*'s in a letter is equal in length to a *dih*. Similarly, the spacing between letters in a word is equal to three *dih*'s, and the spacing between words is equal to seven *dih*'s. Concentrate on these fundamentals, and you're sure to develop a good "fist." Don't worry about speed, except to curb your natural tendency to try to send faster than you can receive.

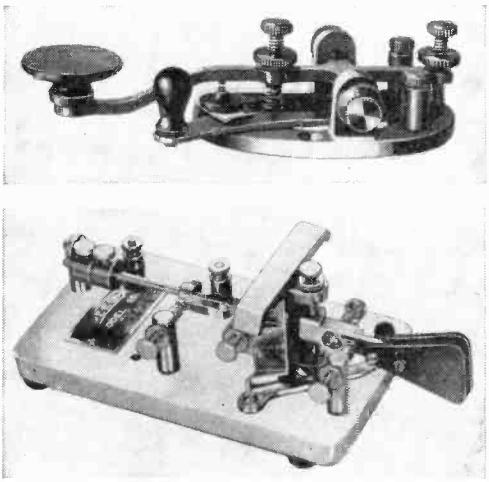
● **Key and Code Oscillator.** Of course, you'll need a key and a code practice oscillator of some kind to practice sending. Get a good key to start with; it will make sending easier, and you can use it later on with your transmitter. In code oscillators, you have a wide choice—both transistor and tube types, either with built-in speakers or designed for use with headphones. In addition, some code oscillators can be used to monitor your own sending when you get on the air —a very valuable feature, by the way.

● **Placing the Key.** Adjust your key so that its contacts meet squarely and are spaced approximately $\frac{3}{64}$" apart with a moderately heavy spring tension at first; then place the key on the table in line with your shoulder but back from the table edge far enough to permit your entire forearm to rest on the table when your fingers touch the key knob. Place your first two fingers on the knob, allowing your thumb and other fingers to fit naturally on either side of it. To send, arch your wrist slightly; manipulate the key with your wrist, using your slightly curved fingers to carry the motion to the key.

As with learning to receive, the secret of good sending is regular practice. But it's unwise to make any one session too long.

● **Using a Bug.** After you've gained a little proficiency with your "straight" key, you'll probably want to graduate to a "bug" or semi-automatic key, or even a fully automatic electronic keyer, for sending the code. The bug makes dots automatically by means of a weighted, vibrating spring, while the operator makes the dashes manually. With a keyer, both dots and dashes are made automatically; the operator controls the number of each by the time he holds the actuating lever to the right for dashes or to the left for dots—and he also supplies the spaces between letters and words.

Once mastered, sending with a bug or keyer requires less effort than sending on a straight key. However, it also takes a great deal more skill—skill which is obtained only through practice. It is strongly recommend-



The brass pounder's key shown in the top picture has changed very little in 50 years. The semi-automatic key shown below it makes its own dididih's.

ed that you wait until you can send and receive code at 15 wpm before trying either bug or keyer.

● **Reading Matter.** To prepare for the FCC amateur technical examinations, one invaluable aid is the *Radio Amateur's License Manual*. The *License Manual* contains complete study guides—including answers to the study-guide questions—plus the complete text of the FCC amateur regulations, and other valuable information.

With the *License Manual* and the booklet *How to Become a Radio Amateur* (both booklets are published by the American Radio Relay League at 50 cents each), you can probably learn enough to pass the Novice examination after only a few hours. However, it would be wise to study at least the introductory chapters of one of the several valuable amateur handbooks available before taking the exam.

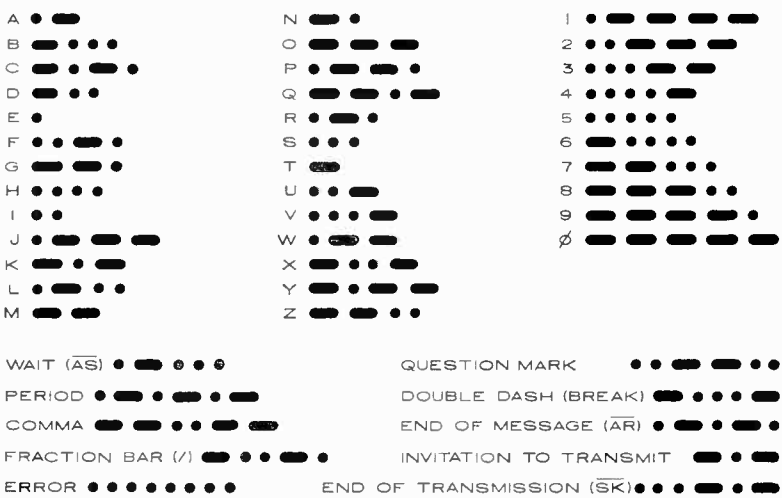
The information you pick up will make passing the Novice examination easier. Furthermore, you will have taken an important step toward passing the Conditional/General/Technician written exam. As already mentioned, this examination is quite a bit more comprehensive than the Novice exam. Even so, most prospective hams acquire the knowledge required to pass it in a few months of spare-time study.

● **Getting Help.** Many of the ham clubs listed on pages 106-108 sponsor theory courses as well as code classes. As mentioned previously, if you're not in the vicinity of a club, your ham neighbors will be glad to give you a helping hand.

To find a local ham, check first with the fellows behind the counter at a radio parts jobber. Generally, one or more of these store clerks will be hams, or will know where the local ham club is located and who to contact for code lessons.

● **Code vs. Phone.** Many prospective hams are interested only in phone operation "because it's more fun to talk than to pound

(*Continued on page* 109)



Where You Can Obtain

Many amateur radio clubs throughout the United States offer code and/or theory courses for prospective hams. The clubs are listed here alphabetically by state and city, and the person named in each case is the one to contact for further information. Some of these clubs may have recently finished their courses, and

Decatur Amateur Radio Club
C. V. McDaniel, K4SMF
P. O. Box 9
Decatur, Ala.

The Desoto Amateur Radio Club
Lamar Gilbert, K4ZTT
Route 1, Box 244
Rainesville, Ala.

Anchorage Amateur Radio Club
Nancy Walden, KL7ANG
P. O. Box 211
Anchorage, Alaska

Citrus Belt Amateur Radio Club
Marvin West, WA6IYN
P. O. Box 266
Colton, Calif.

Dunsmuir Amateur Radio Club, Inc.
R. Rains, W6IOM
P. O Box 692
Dunsmuir, Calif.

Fresno Amateur Radio Club, Inc.
Frank Jones, K6CBK
P. O. Box 783
Fresno, Calif.

Hayward Radio Club, Inc.
Ted Lindner, K6HGO
P. O. Box 113
Hayward, Calif.

Coachella Valley Amateur Radio Club
G. E. Manderochide, WV6RUV
81-452 Helen
Indio, Calif.

Antelope Valley Amateur Radio Club
Vince Capasso
P. O. Box 1221
Lancaster, Calif.

Mount Shasta Amateur Radio Club
Nancy Dillon
P. O. Box 1222
Mount Shasta, Calif.

Desert Radio Amateur Transmitting Society
Donald R. Kramer, WA6UVW
P. O. Box 2773
Palm Springs, Calif.

Tehama County Amateur Radio Club
Robert Schafer, W6SBH
1263 Washington St.
Red Bluff, Calif.

North Shores Amateur Radio Club
Chuck Albert, WA6QBN
3206 Clairemont Drive
San Diego 17, Calif.

Santa Barbara Amateur Radio Club
Les Morton
620 Castillo St.
Santa Barbara, Calif.

San Fernando Valley Radio Club
Elayne Smith, WA6IZO
P. O. Box 3151
Van Nuys, Calif.

Denver Radio Club, Inc.
P. O. Box 356
Denver 1, Colo.

Manchester Radio Club
Dick Groff, K1AAF
14 Lucian St.
Manchester, Conn.

Oak Hill School Amateur Radio Club
Miss Elizabeth Lombardi, K1E1C
212 Soundview Ave.
Shelton, Conn.

Waterbury Amateur Radio Club
William E. Williams
30 Norman St.
Waterbury, Conn.

Kent County Amateur Radio Club
Charles Thomas, K3OPF
152 Kings Cliffe Trailer Park
Dover, Del.

Mantee Amateur Radio Club
J. D. Felsenheld, K4BY
3404—27th St., W.
Bradenton, Fla.

Everglades Amateur Radio Club Inc.
Maurice W. Cook, W4QDS
900 N. W. 9th Court
Homestead, Fla.

Biscayne Amateur Radio Club
Lester D. Cox, K4RNG
P. O. Box 517
Miami 61, Fla.

Orlando Amateur Radio Club
Evalyn Shea, K4UIZ
736 Alfred Drive
Orlando, Fla.

Panama City Amateur Radio Club
Mrs. Richard F. Ackerman, WA4FJF
Quarters C, USNMDL
Panama City, Fla.

St. Petersburg Amateur Radio Club
Joseph Tayler Monfort, WA4APB
P. O. Box 4026
St. Petersburg, Fla.

Tampa Amateur Radio Club, Inc.
Earl Miller, K4HFF
943 Cimmeron Drive
Tampa 3, Fla.

Sowega Amateur Radio Club
William J. Countryman, K7JKN
Lot 12, Pinegrove Trailer Park
Marine Corps Supply Center
Albany, Ga.

Amateur Radio Club of Savannah
B. L. Newton, WN4CEL
522 Talmadge Ave.
Savannah, Ga.

The Maui Amateur Radio Club
Akio Saito, KH6ATU
314 W. Niihau St.
Kahului Maui, Hawaii

Pocatello Amateur Radio Club, Inc.
Mrs. Frances Thompson
P. O. Box 52
Pocatello, Idaho

Magic Valley Radio Amateurs
Ben Mauldin, K7LLA
316—3rd Ave., N.
Twin Falls, Idaho

Allied Novice Amateur Course
George Bercos, W9WOV
Allied Radio Corp.
100 N. Western Ave.
Chicago 80, Ill.

Montgomery County Amateur Radio Club
D. A. Hoover, W9VEY
401 E. Wood St.
Hillsboro, Ill.

Illinois Valley Radio Association
Fred Duffy, Jr., K9DBE
242 Fourth St.
La Salle, Ill.

Litchfield Amateur Radio Club
William Conlon, K9KOD
City Hall
Litchfield, Ill.

Rochelle Township High School Radio Club
Neil Schafer
Rochelle Township High School
Rochelle, Ill.

Code and/or Theory Lessons

others may be in the middle of their current courses. If so, you can sign up for the next scheduled course. In the meantime, join the club—and your fellow club members will undoubtedly give you a hand on an individual basis. There are also a number of clubs in Canada which hold similar code and/or theory courses.

Experimental Amateur Radio Society
Donald L. Jackson, W9BQC
2811 Custer Ave.
Rockford, Ill.

Sangamon Valley Radio Club
Donald Novack, K9ZKJ
P. O. Box 572
Springfield, Ill.

The Staunton High School Radio Club
Van W. Mountain
The Staunton High School
Staunton, Ill.

Wheaton Community Radio Amateurs
John Whitaker, K9MHP
318 E. Lincoln Ave.
Wheaton, Ill.

Goshen Amateur Radio Club
C. A. Andresen, W9WDQ
616 S. Fifth St.
Goshen, Ind.

Highland CD Radio Group
William Swiss, W9HVY
3824 Wicker St.
Highland, Ind.

Sullivan County Radio Amateur's Club
William Donnley
309 East Jackson
Sullivan, Ind.

The Calumet Amateur Radio Club
Charles J. Hanusin, K9GSV
2021 Indianapolis Blvd.
Whiting, Ind.

Davenport Radio Amateur Club
Robert J. Ward, KØSRL
920 E. 14th St.
Davenport, Iowa

Iowa Great Lakes Amateur Radio Club
Robert L. Smith, KØPLH
Box Q
Milford, Iowa

Central Kansas Radio Club
Robert L. Neal
343 Woodlawn
Salina, Kans.

Middlesex Amateur Radio Club
Antonio P. Milone, K1OGA
19 Mount Vernon St.
West Roxbury, Mass.

Midland Amateur Radio Club
Dr. Lynn Hooker, K8AZB
7264 Hospital Rd.
Freeland, Mich.

Muskegon Area Amateur Radio Council
Frank J. Olimski, K8YDN
P. O. Box 545
Muskegon, Mich.

Mueller Brass Co. Employees Brass Founders Amateur Radio Club
George E. Hayner, K8AZC
1925 Lapeer Ave.
Port Huron, Mich.

Twin Sault Radio Club
F. Bruce Hoornstra, K8JUX
1105—5th Ave., E.
Sault Ste. Marie, Mich.

Rochester Radio Amateur Club
Margie Balk
1122—1st St., N. W.
Rochester, Minn.

The Saint Paul Radio Club
James F. Garrity
Box 512
St. Paul, Minn.

Baldwyn Amateur Radio Klub
Lanny Outlaw, K5ANE
413 West Main
Baldwyn, Miss.

North Missouri Amateur Radio Club, Inc.
William Hart, KØZQY
808 Richard St.
Princeton, Mo.

St. Louis Amateur Radio Club
De Witt B. Stone Sr., KØTOJ
2333 Parkridge Ave.
St. Louis 17, Mo.

Hi-Line Radio Club
J. E. Woodwick, K7BQN
1163 Grant Ave.
Havre, Mont.

Nashua Mike & Key Club
Robert G. Bosback, K1CXP
P. O. Box 94
Nashua, N. H.

Freehold Regional High School Radio Club
Barry Sagotsky, WA2KRC
Freehold Regional High School
Freehold, N. J.

Nutley Amateur Radio Society
Bill Derrick, W2LWO
12 Whitford Ave.
Nutley, N. J.

Gloucester County Amateur Radio Club
Della M. Parker, W2AFZ
305 E. Olive St.
Westville, N. J.

The Mike & Key Club of Ithaca
William Keith
201 W. Clinton St.
Ithaca, N. Y.

Cornell Amateur Radio Club
Bobbi Lester
G-4 Barton Hall
Cornell University
Ithaca, N. Y.

Long Island Tri-Banders Amateur Radio Club
Paul Price, WA2OFY
P. O. Box 181
Massapequa, L.I., N. Y.

Tu-Boro Radio Club
Roy Ulasinski
87-13—87th St.
Woodhaven 21, L.I., N. Y.

Port Jervis CD Radio Club
Harold Aughton
3 Neversink Ave.
Port Jervis, N. Y.

Eastern Suffolk Radio Club
Robert J. Freeman
N. McGee St.
Southampton, N. Y.

Watertown Radio Club
c/o George Bonadio
Bonadio's Liquor Store
12 Public Square
Watertown, N. Y.

Buckeye Shortwave Radio Assn.
Joseph M. Feicht, K8KEG
345 Watson St.
Akron 5, Ohio

Ashtabula Amateur Radio Club
Charles R. Cox, K8TUO
Post Office Alley c/o C D
Ashtabula, Ohio

The Canton Amateur Radio Club
Henry McLaughlin, W8OYV
1508 Navarre Road, S. W.
Canton 6, Ohio

Code or Theory Lessons continued

Scioto Valley Amateur Radio Club
Albert L. Bell
821 Woodhill Dr.
Chillicothe, Ohio

Amateur Radio Club of the Ohio State University
Box 3052
Ohio State University
Columbus 10, Ohio

Cuyahoga Falls Radio Club
James A. Miller, K8EIO
2851 Northland St.
Cuyahoga Falls, Ohio

Fort Hamilton Amateur Radio Association
Thomas W. Baden, K8OMB
1221 Park Ave.
Hamilton, Ohio

Lancaster and Fairfield County Amateur Radio Club
Dr. Paul Magnuson
126 South Broad St.
Lancaster, Ohio

Tusco Radio Club
Lee Turney
121 E. 2nd St.
Uhrichsville, Ohio

Jackson County Amateur Radio Club
MARS Director
Altus AFB, Okla.

Lawton-Ft. Sill Amateur Radio Club
Jesse W. Hines, K5CBG
P. O. Box 892
Lawton, Okla.

Lehigh University Radio Society
Gerald J. Agin, K2KLA
University Center, Box 62
Lehigh University
Bethlehem, Pa.

Abington Amateur Radio Club
William Weight
342 Melrose Ave.
Clark's Summit, Pa.

Coke Center Radio Club
Harry S. Dolde
818 Morrell Ave.
Connellsville, Pa.

Lancaster Radio Transmitting Society
A. C. Jacoby, W3OY
136 Springhouse Rd.
Lancaster, Pa.

Mt. Airy VHF Radio Club
F. D. Brick, W3SAO
829 West Fishers Ave.
Philadelphia 41, Pa.

The 807 Society of Central High School
c/o Central High School
Ogontz & Olney Aves.
Philadelphia 41, Pa.

Carnegie Tech Radio Club
Dept. of Electrical Engineering
Carnegie Institute of Technology
Pittsburgh 13, Pa.

Reading Radio Club
A. J. Brailer, W3UQC
418 Woodward St.
Reading, Pa.

York Amateur Radio Club
Russell Woodrow, W3NGN
1107 Whiteford Rd.
York, Pa.

Newport County Radio Club
Seamen's Church Institute
Newport, R. I.

Rock Hill Amateur Radio Club, Inc.
William L. Jennings
P. O. Box 90
Rock Hill, S. C.

The Black Hills Amateur Radio Club
Elmer Meyer
715 San Marco
Rapid City, S. D.

The Sioux Falls Amateur Radio Club
Lucille Wardell, KØWEN
1306 Sunset Drive
Sioux Falls, S. D.

The Frye Amateur Radio Club
Mrs. Joyce H. Lawson, K4QNI
3741 Cuscowilla Trail
Chattanooga, Tenn.

Beeville Amateur Radio Klub
Virgil Parsons, W5UVO
Star Route 1
Beeville, Tex.

Houston Amateur Radio Club
Ronald Marosko, K5LLL
3340 Luca St.
Houston 21, Tex.

Kingsville NAAS Amateur Radio Club
John R. Dover
Special Services NAAS
Kingsville, Tex.

Orange Amateur Radio Club
W. J. Gage, W5ICL
211 Camellia Ave.
Orange, Tex.

Electronic Tech and Amateur Club
Stewart O'Dell, K5VHH
c/o Union Carbide Chemicals Co.
P. O. Box 471
Texas City, Tex.

Central Vermont Amateur Radio Club
E. Reg Murray, K1MPN
3 Hillcrest Dr.
Montpelier, Vt.

Virginia Highlands Amateur Radio Club
Richard D. Shupe, W4CBM
P. O. Box 413
Dublin, Va.

Northern Virginia Radio Club
Harold Wilcox, W4OP
206 S. West St.
Falls Church, Va.

Grays Harbor Amateur Radio Club
Effie Link, W7SEU
119 S. Washington St.
Aberdeen, Wash.

The Twin City Radio Club
Charles Wilson, W7NLX
916 W. Park St.
Pasco, Wash.

Valley Amateur Radio Club, Inc.
Fred Nelsen, K7DQV
P. O. Box 12
Puyallup, Wash.

Richland Amateur Radio Club
George R. Larson
P. O. Box 73
Richland, Wash.

West Seattle Amateur Radio Club
John E. Middlekauff, K7JBZ
3824—48th Ave., S. W.
Seattle 16, Wash.

Spokane Radio Amateurs
Burrill Bresemann, K7BEO
West 2504 La Crosse Ave.
Spokane 13, Wash.

Walla Walla Amateur Radio Assn.
Isaac W. Carson, W7LJK
P. O. Box 941
Walla Walla, Wash.

Apple City Radio Club
Albert Freeman, W7ETO
1031 Lindy St.
Wenatchee, Wash.

Milwaukee Radio Amateurs' Club, Inc.
John F. Czarneski, K9PSU
2439 South 17th
Milwaukee 15, Wis.

Washburn County Radio Club
Mrs. Bernice Houlder
Box 303
Spooner, Wis.

(*Continued from page* 105)

a key." But, as we have already learned, you must master the code to qualify for a ham license, and code does have its advantages. An important one which hasn't been mentioned yet is that "c.w." (as code is usually called—for continuous-wave telegraphy) has a bandwidth of 100 cycles or less compared to 3 to 8 kc. for amateur phone signals. Consequently, many c.w. signals can operate in the space occupied by a single phone station.

The frequency space factor explains why interference is so bad in the phone bands; this heavy interference, combined with c.w.'s superior getting-out ability, is why many General Class hams stick with c.w. rather than phone.

Of course, phone has its points, too, especially for casual chit-chatting (called rag-chewing in ham terminology). By a conservative guess, about 99% of all operation on the ham frequencies above the 6-meter band is on phone. Incidentally, some phone men insist that they can work anything on phone that any c.w. operator can work. They may be right, but it takes a lot more equipment to do it.

Possibly the biggest advantage of c.w. for Novices is that using it exclusively gives them the greatest opportunity to build up their copying speed to the 13 wpm required for a General license.

● **The Ham Bands.** Although the Novice and Technician Class license holders are restricted somewhat as to where and how they can operate, the General Class license holder can pump out c.w. or phone signals on any ham band. The general characteristics of each band are itemized below.

● **160-Meter Band.** Prior to World War II, 160 meters (1.8 to 2.0 mc.) was one of the most popular radiotelephone bands. Hams could be heard at any hour of the day or night, and numerous stations made two-way contacts over a range of 500 to 1000 miles. During World War II, the 160-meter band was taken over by the military and used for Loran navigational radio signals. Some of these Loran stations are still in operation and their heavy buzzing tones can be heard along the Atlantic, Gulf, and Pacific coast lines.

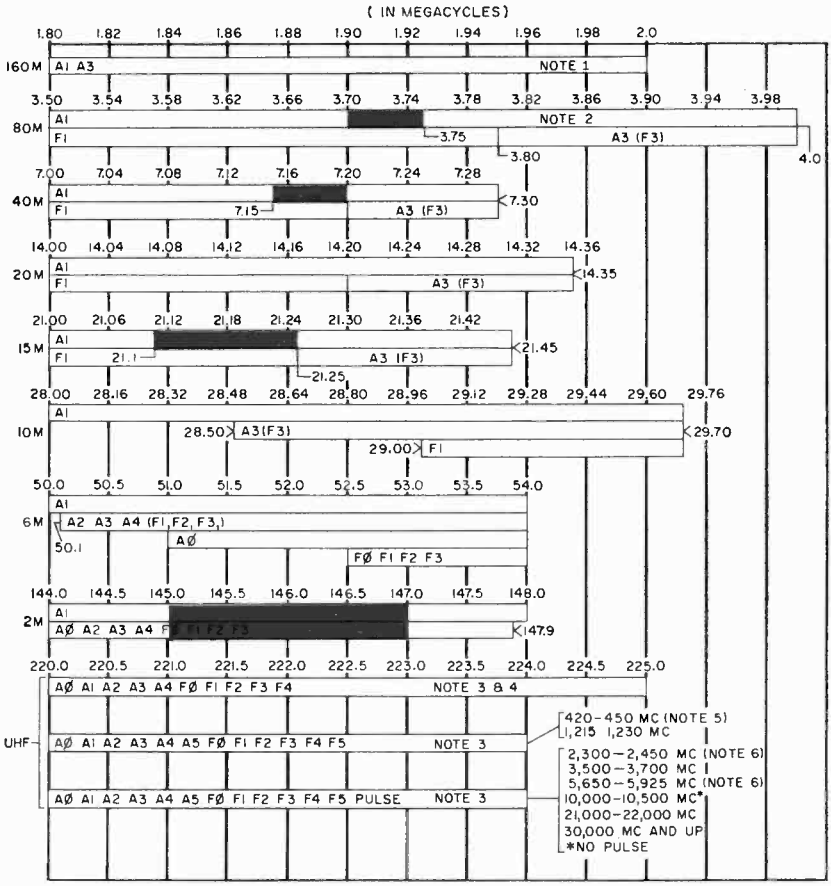
Hams are permitted limited operation on 160 meters and several old-timers manage to garner a few foreign DX contacts in the mid-winter DX season. The 160-meter band is extremely popular in Europe—where it is called "The Top Band," and where there is no Loran interference.

If you are interested in this band, keep in mind that you will need a lot of space for your antenna.

● **80-Meter and 75-Meter Bands.** A distinction is generally drawn between the 80-meter (3.5 - 3.8 mc.) and the 75-meter (3.8 - 4.0 mc.) bands, since the former is used exclusively for c.w. and the latter is used primarily for phone. Many General Class licensees operate in the 75-meter phone band during the day when interference is apt to be slight, then switch to c.w.

Physical disabilities never seem to bother the high-spirited radio amateur operator. Although confined to an iron lung, Cliff Corne, K9EAB, Peoria, Ill., has been awarded scores of certificates attesting to his operating proficiency on both c.w. and phone.

Permissible Signals in the Ham Bands



TRANSMISSION SYMBOLS

AØ Carrier with no modulation
A1 Carrier on-off for keying (c.w.)
2A Carrier modulated with audio tone on-off for keying (i.c.w.)
A3 Amplitude-modulated radiotelephony (AM)
A4 Carrier modulation for purposes of facsimile transmission (FAX)
A5 Carrier modulated for television picture transmission (TV)

FØ Carrier with no modulation
F1 Telegraphy through carrier-shift keying techniques (FSK)
F2 Telegraphy through audio tone frequency shift keying (RTTY)
F3 Frequency modulation radiotelephony (NBFM)
F4 Facsimile transmission via FM
F5 TV picture transmission via FM

NOTES

1 Amateur operation is restricted so that no interference is caused to the Loran service. Check your local FCC office for details.

2 The frequency range of 3900-4000 kc. is not available to hams in Pacific Ocean areas (Samoa, Wake, Guam, etc.)

3 Interference to radar installation must be avoided.

4 Restrictions apply to hams in southwestern areas. Check with the FCC office in Dallas, Texas, for details.

5 The 50-watt power limitation on this band is to be removed in 1963.

6 A portion of each band is shared with industrial, scientific and medical services.

The color bars in the chart above represent Novice bands: c.w. operation is permitted on 15, 40, and 80 meters; phone or c.w. in the 2-meter band

in the 80-meter band during the evening hours.

From the standpoint of ham equipment, the 80-meter c.w. band is the easiest one for the Novice licensee to get started on; Novices are permitted to operate on 3.7 - 3.75 mc.

From sunset to sunrise, a medium-power ham station is assured of being heard over distances between 200 and 1000 miles. On nights when the static level is low and competing station interference at a minimum, the Novice or the General Class license holder can work much greater ranges. Daytime signals are quite weak and the distances spanned are generally under 100 miles.

That weird looking typewriter in the foreground, in case you didn't know, is a Braille-writer. The fact that Bob Gunderson, W2JIO, is blind hasn't stopped him from becoming a well-known ham. Bob was awarded General Electric's Edison Award in 1955 for his outstanding contributions in keeping the Braille Technical Press going—the only electronics journal for the blind.

● **40-Meter Band.** This is probably one of the most popular bands (7.0 - 7.3 mc.) available to today's hams. Unfortunately, it's fighting for its life, as it is being encroached upon by international short-wave broadcasting stations operating in Europe, Africa, and Asia.

This band also has a small subdivision (7.15 - 7.2 mc.) available to Novice license holders.

During the day, a medium-power transmitter can reasonably be expected to work stations between 200 and 500 miles away. As the evening hours approach, the "skip" increases—often making it impossible to work nearby stations, but making it very easy to work greater distances (500 - 1500 miles). Signal propagation is discussed in the SWL section of this Handbook.

During many winter evenings, you will find yourself unable to hear stations that are closer than 1000 - 1300 miles. Very low power stations—including those of Novice licensees—will be at a disadvantage unless their antennas are something extra-special. Phone transmissions on the high end of the 40-meter band are not as common as they were a few years ago—due principally to the interference from the super-high-power international broadcasting transmitters.

● **20-Meter Band.** Year in and year out, this ham band (14.0 - 14.35 mc.) is the most reliable for DX'ing. One of the reasons is the concentration of hams on this band from all points around the globe. Also, this is one of the few bands set up exclusively for radio amateurs and which has very little commercial and broadcasting interference problems. Twenty meters is also the band for the ham who likes to build or use the most powerful transmitter permitted by his license.

On the average, this band is open during the daylight hours for signals that are 1000 to 2500 miles away. Shortly after sunrise and shortly before and after sunset, the 20-meter band really comes alive, and c.w. or phone signals can be heard from many points on the other side of the globe.

● **15-Meter Band.** As the sunspot cycle declines, radio propagation conditions on this band (21.0 - 21.45 mc.) become erratic. Nevertheless, it includes the "DX band" for Novices (20.1 - 21.25 mc.), and is also used and enjoyed by many General Class license holders who can only afford low-power transmitters. Skip distance effects are quite pronounced and even low-power signals are generally quite strong.

During the daylight hours, this band is reasonably well populated, although the major portion of the signals will all be from points well beyond 800 - 1000 miles

away. During certain hours of the day, it is not unusual to hear DX signals from around the world slightly stronger than those on the 20-meter band.

The 15-meter band has another advantage—a rotary beam directional antenna small enough to be quite practical can be used here, and it will insure some degree of consistency in results for the embryonic DX'er. But unless there are a few hours of "short skip," the 15-meter band is normally "dead" for DX after dark.

● **10-Meter Band.** During the peaks of sunspot activity, the number of DX stations—mostly phone—that can be heard on the 10-meter band (28 - 29.7 mc.) is literally astonishing. Unfortunately, we are now rapidly approaching a minimum of sunspot

An active ham in Hobart, Ind., is Leo Hoy, K9UUB. He spends most of his time on either 6 or 2 meters.

activity and the 10-meter band is generally dead for hours—or even days—on end. What little DX activity can be heard is generally along the paths between stations that are north and south of one another. There is considerable mobile activity on this band by hams with transceivers in their automobiles.

Short-skip effects on the 10-meter band are also quite pronounced, and many extremely strong signals can be heard during the months of May, June, July, and December.

● **6-Meter Band.** This ham band (50 - 54 mc.) is just below TV Channel 2. It has many of the characteristics of TV propagation—consistent 60 - 75 mile coverage, with occasional DX transmissions out to 200 - 250 miles.

Numerous General and Technician license holders use this band for DX'ing. Pronounced short-skip effects are also observed here similar to those mentioned above for the 10-meter band, and DX enthusiasts have reported working 40 or more states by patiently listening for these golden "short-skip" opportunities. The 6-meter band is also growing in importance for the radio amateur with mobile equipment.

● **2-Meter Band.** This is the only band (144 - 148 mc.) in which the Novice license holder is authorized to use phone (on 145 - 147 mc.). It has a very reliable range of between 25 and 40 miles for typical Novice equipment. General Class license holders can regularly contact stations that are 75 - 125 miles distant.

Because of the limited DX range, most 2-meter ham station activity is concentrated in or near the larger metropolitan areas. Nevertheless, serious radio amateurs, through use of elaborate equipment and special high-gain antennas, have compiled fantastic DX records on 2 meters—including spanning the Pacific Ocean between Hawaii and California and contacting stations in up to 40 different states!

● **1¼-Meter Band.** Although this band is not presently as heavily populated as it will be in the forseeable future, ham activity on 1¼ meters (200 - 225 mc.) is increasing. Considerable experimentation with equipment and antenna designs is performed at this wavelength because of the small physical size of high-gain antennas.

In addition to the above bands, radio amateurs are also allocated bands around 420; 1215, 2300, 3500; 5650; 10,000; 21,000; and 30,000 mc. On the latter bands, many hams have been experimenting with television.

● **Choosing Your Equipment.** Having a transmitter capable of sending signals hundreds and thousands of miles is one thing that separates ham radio from other electronic hobbies. Thus, a prospective ham naturally thinks first of a transmitter when planning to equip his station. Actually, however, as the old ham saying puts it, "You can't work them, if you can't hear them"—so a good receiver is the first prerequisite of an efficient ham station. Be-

sides, you can use your receiver for SWL'ing, code practice, and "learning by listening" to hams on the air while you're studying.

● **The Ham Receiver.** To do its job, a ham receiver must have *sensitivity* enough to bring in very weak signals; it must have sufficient *selectivity* to separate dozens of signals on almost the same frequency; it must have enough *stability* so that, once tuned in, the desired signal stays tuned in—even if the receiver is jarred, or the power line voltage changes. Finally, it must have a mechanical tuning system good enough to permit the desired signal to be tuned in easily.

Getting high sensitivity in a ham receiver is relatively simple, at least on the lower frequency ham bands. But the other requirements are the stickers. Take selectivity, for example. On the AM broadcast band, stations are spaced 10 kc. apart; in addition, different stations in the same listening area are always separated by 30 - 40 kc. Consequently, 10- to 15-kc. selectivity is more than adequate for normal AM broadcast-band reception. In the ham bands, however, every ham picks his frequency "catch as catch can," and signals are stacked together like toothpicks in a box. As a result, ham receiver bandwidths of 250 cycles (or less) for c.w. and 3000 cycles (3 kc.) for phone reception are desirable. To obtain these levels of selectivity, many tuned circuits or special filters are required.

With such high orders of selectivity involved, it's easy to see why stability and ease of tuning are *must* requirements in a ham receiver. Both can always be obtained at a price. Add other desirable features, such as a good noise limiter, an effective automatic volume control (a.v.c.), and a good signal-strength ("S") meter, and it's no wonder that good ham receivers are in the $150-plus class.

● **Choosing the Receiver.** In general, short-wave wave receivers selling for less than $75.00 in ready-to-operate form or under $50.00 in kit form really don't have sufficient selectivity and sensitivity to qualify as true "communications receivers." Nevertheless, many are capable of providing reasonably good results, especially on the 3.5- and 7-mc. bands during the less-crowded operating hours. Although usable on the higher frequencies, their performance drops off rapidly above the 14-mc. band.

Ham Band Receivers

Each time you go up another notch in price for a receiver, you obtain noticeably better performance. But somewhere between $250.00 and $300.00, the ratio of improvement in performance for dollar spent decreases. Therefore, most hams choose receivers in this approximate price range, although there is no denying that the deluxe models (selling at prices up to $750.00) possess features well worth having—if your pocketbook can stand the strain.

Above the lowest-price classes, you'll find that there are both "ham-band-only" and "general-coverage" receivers available. If you're not interested in what goes on outside the ham bands, you'll get more performance per dollar from a strictly ham-

Communications receivers having strictly ham-band coverage are available with many price tags. Here are two favorites. The Hallicrafters SX-140 (top) sells for $89.95 as a kit, $114.95 wired and tested; the speaker is $12.95 extra. Shown below the SX-140 is the Hammarlund HQ-170A which sells for $379.00, including the clock. The SX-140 tunes all ham bands from 6 through 80 meters, while the HQ-170A tunes all of these plus 160 meters.

What Transmitter?

band-only receiver. On the other hand, if you like to listen to other services, including the standard AM broadcast and shortwave bands, select a general-coverage receiver.

● **Frequency Coverage.** Most general-coverage receivers tune up to 30 mc., providing coverage of all ham bands through 28 - 29.7 mc. (10 meters). The ham-band-only receivers usually cover the 3.5-, 7-, 14-, 21- and 28-mc. ham bands, although some of them also cover the 50-mc. band.

These popular transmitter kits for the Novice ham range in price from $49.95 to $79.95. All of them are capable of operation on any ham band from 80 down to 10 meters. All have some provision for phone operation—after the Novice has passed his General Class examination. From top to bottom: the Heathkit DX-60; the EICO Model 720, the Knight-Kit T-60; and the E. F. Johnson Viking "Adventurer."

The easiest (and probably the most efficient) way to extend a receiver's coverage to the 144-mc. band (and to 50 mc. where necessary) is with a crystal-controlled converter. The converter changes the frequencies of the incoming signals to frequencies within the tuning range of the receiver, which is then tuned in the regular manner to receive the 50- or 144-mc. signals. Many ham receivers have their dials calibrated for 50- and 144-mc. reception when used with such an outboard converter.

● **Recommendation.** Obtain the very best ham receiver you can afford from the very start. Chosen wisely, it will serve you well for many years. You need have no fear of choosing the wrong one, if you consider all of the points mentioned above. And in general, any communications receiver on the market is a good buy for the money.

● **Choosing a Transmitter.** If you are a Novice and your big aim is to obtain a General Class ticket as soon as possible, choosing a transmitter is easy. Select any of the 50- to 75-watt, crystal-controlled c.w. transmitters covering the ham bands between 3.5 and 30 mc., and you can hardly go wrong.

With such a transmitter, you can get on the three lower Novice bands with a minimum of expense. And you'll have the assurance that there won't be enough difference between your signal and the signal from any other transmitter operated in accordance with the Novice regulations for even an expert to detect. When you have your General Class license in your hand, you can "splurge" on a more elaborate unit.

● **General Class Unit.** Once you get your General license, you can either add a variable frequency oscillator (VFO) or a modulator to your Novice transmitter—or trade it in on a better transmitter. In choosing a General Class transmitter, don't worry too much if your pocketbook shrivels up at the price of a high-power one. Transmitter power is something like horsepower in an automobile; a car with a 375-horsepower motor is fine, but the Fords and Ramblers get there, too. With a good VFO, which you can use with any class of amateur license except the Novice license, you can almost always find a little hole in the interference (QRM) to slip your signal into.

If you plan to operate phone and econ-

omy is most important, you can obtain an excellent low- or medium-power, amplitude-modulated (AM) transmitter for approximately $75.00 to $250.00—depending on the power and whether you select a kit or a ready-to-operate unit.

For increased efficiency, however, you will undoubtedly want to choose a single-sideband (SSB) transmitter; in SSB, the power-consuming "carrier" is removed from the signal before it is transmitted, and then reinserted at the receiver. Although the cost of even a low-power SSB transmitter is higher than the cost of an AM transmitter, a separate linear amplifier can be added to it later to increase power for much less money than it would take to increase the power of an AM unit.

● **"Triple-Threat" Transmitters.** There are no single transmitters that will cover all the ham bands, but there are a number of 6-band phone/c.w. units available that cover all the ham bands between 3.5 mc. and 54 mc. With such a transmitter, a new Novice can operate on the Novice c.w. bands; on 50 mc., when he earns his Technician license; and on all frequencies within its coverage when the coveted General Class license arrives.

For Technicians and other operators interested in the 50- and 144-mc. bands exclusively, low-power single-band "transceivers" can be had for about $45.00 (kit) and $57.50 (ready-to-operate), complete with microphone and built-in power supply. Accessory power supplies for operation from an automobile storage battery are available for them, too. Connected to a simple antenna in an average location, the range of these units is 5 to 10 miles; a beam antenna will increase this range by two to four times, and an occasional DX contact is always a possibility.

More sophisticated transceivers featuring more selective and sensitive receiver functions, greater transmitter output, built-in VFO's and built-in multi-purpose power supplies, are available at correspondingly higher prices. In addition, separate VHF transmitters are sold, starting at about $75.00 for a 20-watt unit. We've already mentioned the fact that converters can be used to extend the coverage of low-frequency receivers to the VHF region.

● **Build or Buy?** Most new hams buy their major ham equipment in kit or wired form, because such gear usually costs no more than "home-brew" gear of equal performance (not to mention appearance). In fact, the kits, which sell for 20 to 40% less than the wired units, are appreciably less expensive than the home-built gear.

The kits come complete with all components and with all chassis holes drilled; in addition, the accompanying step-by-step instruction manuals make assembly a matter of simply following directions. Of course, you have to know how to solder to complete the job; but the manuals usually even tell you how to do that!

Actually, it's a good idea for an inexperienced builder to assemble at least one electronic kit. In this way, you learn how to identify electronic components, such as fixed and variable resistors, capacitors, chokes, coils, transformers, etc. This knowledge might turn out to be more important in the long run than the money you save by assembling the kit.

Chicago Tribune

Learning how to tune a single-sideband receiver is Giana Brenmark, a bookkeeper for an insurance company. As a member of the Allied Radio Corp. code class, she has an excellent opportunity to become a Novice license holder in 14 weeks. The next class at Allied Radio starts on April 15, 1963, and the last one this year will begin on September 9.

If you would like to build your gear "from scratch," there are plenty of construction articles in the various monthly magazines which cover ham radio, as well as the various amateur radio handbooks.

● **Choosing a Microphone.** To operate on phone, you'll obviously need a microphone. Getting the right one isn't too difficult, if you follow a few simple suggestions.

First, you do not want a high-fidelity

microphone—for two reasons. One is that the output of such microphones is normally relatively low and may be insufficient to drive the audio system in your transmitter. Second, in amateur radio, we're interested only in transmitting the important voice frequencies, which extend upwards to around 3000 cycles. And since audio systems in transmitters ordinarily chop off the frequencies above 3000 cycles, the extreme high-frequency response of a hi-fi microphone is just wasted in ham service. Then, too, such a mike's very good low-frequency response may make your voice sound excessively boomy.

● **Crystal Microphones.** Where economy is important, the inexpensive crystal microphones do a good job. However, they are usually quite lightweight in construction for steady, day-after-day service. In addition, cheap crystal microphones tend to deteriorate gradually, thereby losing their sensitivity. Furthermore, all crystal microphones are easily damaged by temperatures above 120°F; for example, the sun shining on a crystal microphone through a car window on a warm day may make it as useless as a lollipop for our purposes.

● **Ceramic Microphones.** Ceramic microphones are very similar in performance to crystal microphones; however, they are not nearly as susceptible to heat and abuse as the crystal type.

● **Dynamic Microphones.** The dynamic microphone is the most rugged of the types available, but it's also more expensive than either the crystal or ceramic type. And in our experience, at least, it is false economy to buy an "economy model" dynamic microphone.

● **Other Considerations.** Virtually all ham transmitters are designed for high-impedance microphones. This presents no problem so far as crystal and ceramic microphones are concerned, since they are inherently high-impedance devices. Dynamic microphones, however, come in both high- and low-impedance types; so it's important to get the type your transmitter requires.

It is recommended that you obtain a directional-type microphone, to minimize the possibility of normal room noises being picked up and transmitted over the air.

Finally, ham transmitters come with a variety of microphone chassis connectors. Microphones, in turn, come with a variety of connector types. Therefore, check the transmitter instruction manual before ordering your microphone, to make sure that the two units match. Of course, if necessary, the microphone plug can always be replaced.

● **Choosing Your Antenna.** A ham's antenna system is truly the gateway through which the transmitted signal starts its perilous journey through space to far-away places. And, needless to say, it's also the means through which incoming signals, weakened by their long journey through the ether, are delivered to the receiver. Thus, your antenna will play a large part in determining the results you'll obtain from your ham station.

● **Simple Antennas.** Until you decide on a permanent antenna installation, a good first antenna can consist of an 85′ length of #12 or #14 enameled antenna wire. Scrape the enamel from one end of the wire for a few inches to connect it to your antenna change-over switch (used to transfer the antenna from the receiver to the transmitter). Run the wire out of the radio room window, up to the roof, and out to a pole on your garage or to any other convenient support.

For lowest losses, bring the antenna wire through the window frame via a lead-in insulator, and support the wire away from the wall of the building on long, TV-type stand-off insulators. Put a standard antenna insulator on the far end of the wire, using a length of rope or wire to fasten the antenna to its support. If the support happens to be a tree, place a long, strong door spring between the insulator and the tree to take up the sway of the tree.

The disadvantages of this antenna as a permanent one is that the whole length (including the part that is brought into the station) radiates energy. Therefore, much of the precious r.f. power from your transmitter is pumped into utility wires, rain gutters, etc., instead of into space where it will do the most good. Nevertheless, such a "sky wire" usually does a surprisingly good job on the 80- and 40-meter bands, and even on 20 and 15 meters upon occasion.

A much better antenna is a ½-wave type cut for the frequency you intend to work, mounted as high as possible and fed in the center with standard 50- to 75-ohm coaxial or "twin-lead" transmission line. The table below gives the lengths for the centers of the seven most popular amateur bands.

A ham antenna of this type has been given the jaw-breaking title of "matched-impedance center-fed dipole." Also called a "doublet," it can be mounted horizontally or as an "inverted-V" antenna. When it is mounted horizontally, two supports of the same height are required.

Lengths of ½-Wave Antennas

(cut for centers of ham bands)

FREQUENCY	LENGTH	FREQUENCY	LENGTH
3.725 mc.	125′8″	28.85 mc.	16′2″
7.175 mc.	65′2″	52.0 mc.	9′0″
14.175 mc.	33′2″	146.0 mc.	3′2½″
21.175 mc.	22′1″		

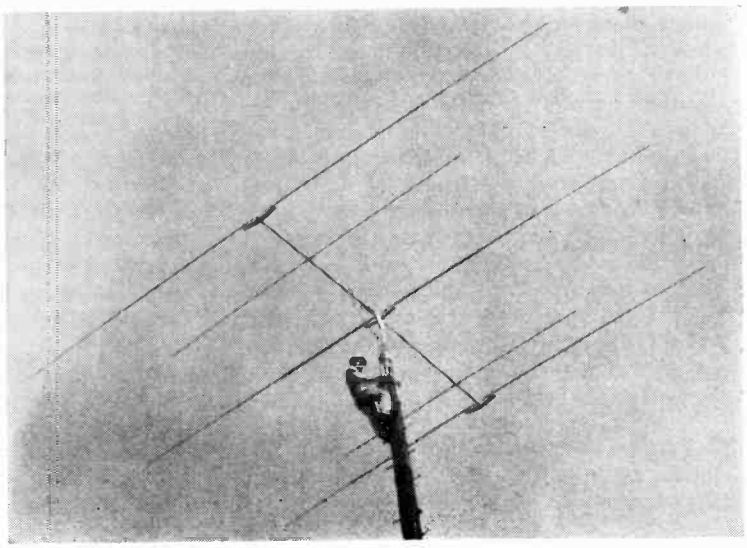
The "inverted-V," in contrast, uses a high pole in the center, and the ends come down to much lower supports. One successful 80-meter "inverted-V" design places the center 35′ high and the ends 6′ high.

An obvious advantage of the "inverted-V" is that it requires only one high support, which can be a simple guyed TV antenna mast or 2″ x 2″ on the roof of the house. The ends can be terminated at any convenient structure or at short, unguyed lengths of pipe or 4″ x 4″'s. Another advantage of the inverted-V is that it requires less space than a horizontal antenna for the same frequency; on 80 meters, the difference is approximately 15 feet. Many users insist that their "inverted-V's" outperform horizontal antennas of the same (center) height.

● **Multi-Band Antennas.** A simple matched-impedance dipole is normally a single-band antenna. The reason is fairly simple: when a dipole is operated at even multiples (2, 4, etc.) of its design frequency, a large "mismatch" develops between the antenna and the feedline. As a result, most of the power fed into the antenna system surges up and down the feedline, instead of being radiated into space to tickle the eardrums of far-off hams.

Thus, an 80-meter dipole doesn't work very well on 40 or 20 meters, nor does a 40-meter dipole work well on 20 meters. But things are slightly different on 15 meters. As it happens, 21 mc. is the *third* harmonic of 7000 kc., or an *odd* multiple; therefore, a 7.0-mc. dipole usually does a pretty good job on the 21.0-mc. band.

● **Multi-Band Dipoles.** Fortunately, it's possible to produce a dipole that will work efficiently on several bands. One method is to install weather-sealed resonant circuits



When you spot an antenna like this one, you can bet it belongs to an active ham. Atop the 50′ telephone utility pole is Mike Hrindak, W9EHH, Gary, Ind. This rotary beam is designed to function on 10, 15 and 20 meters.

(commonly called "traps") at predetermined spots in the antenna. These "traps" act as insulators at the frequency to which they are tuned, and they have little effect on the operation of the antenna at other frequencies. For example, if a pair of 7.0-mc. traps are inserted in an 80-meter dipole about 32′ 6″ to either side of the center insulator, the antenna will work like a ½-wave antenna on both frequencies.

● **Antenna Height.** The height of an antenna above the earth determines its "angle of radiation." To achieve the low angles necessary for best long-distance results, you should strive for a minimum height of 30 feet, with additional height up to at least 65 feet desirable for peak performance over the greatest distances.

● **Vertical Antennas.** Amateur antennas can be erected vertically, as well as horizontally. Compared with a horizontal antenna, a vertical can be operated "against ground" or against an artificial "ground plane," causing the "ground" to act as an "electrical mirror" and double the antenna's effective length. As a result, a vertical antenna is usually only half the length of an ungrounded horizontal antenna intended for the same frequency. Also, a vertical antenna (one which isn't too long) radiates most of its power at the low angles desirable for DX work.

On the other hand, ground losses are usually more troublesome with vertical antennas than with horizontal antennas. Also, when a vertical is mounted close to the ground, more of its power is likely to be absorbed by nearby objects than would be from a horizontal antenna mounted above them. On the higher frequency bands above 7.0 mc., however, the length of a vertical antenna becomes short enough so that it can be installed on the roof of the building and operated as an artificial "ground plane." The ground plane usually consists of four wires, each the same length as the antenna, tied together under the base of the antenna and extending away from the antenna like the spokes of a wheel.

● **Vertical or Horizontal?** Properly installed, both vertical and horizontal antennas work well. However, over short distances—say up to a 100 miles or so—a horizontal antenna doesn't receive signals well from a vertical antenna, and vice versa. For this reason, antenna polarization is important on the ham bands above 50 mc., where most communications are over short distances. On these frequencies, your best bet in antennas is to "follow the crowd."

● **Beam Antennas.** By adding other elements in front of and behind simple antennas to act as "reflectors" and "directors," their effectiveness can be increased three to ten times (or more) in one direction at the expense of reduced effectiveness in other directions. The result is similar to the way a magnifying lens and a polished reflector transform the rather puny glow of a flashlight bulb into a beam of light.

The lengths and spacings of these additional elements from the radiating element determines whether they act as reflectors or directors. A reflector is usually about 5% longer than the antenna element, and a director is 5% to 6% shorter. The more elements used, the greater the "gain" of the antenna becomes, the bigger it gets, and the more critical it is to adjust.

These youthful ham operators manned the Miami, Florida, Red Cross Station K4IWT during a simulated emergency. On the air for 52 hours with never less than two operators on duty, the team at K4IWT won much praise. The three hams are K4JWM, K4YSN, and K4FMA. K4YSN, age 13 and blind, handled intercity traffic to and from the U.S. Weather Bureau for about 20 hours.

● **Multi-Band Rotary Beams.** By adding resonant circuits ("traps") to the various elements, effective two- and three-band rotary beams have been developed which cost little more than single-band beams.

Their physical size makes rotary beams

for the ham frequencies below 14.0 mc. rather rare, but single-band or tri-band beams for 10, 15, and 20 meters are quite common, with three or four elements preferred. Above 50 mc., the majority of fixed-station installations include rotary beams, usually with five elements on 50 mc. and about ten on 144 mc.

● **Rotating the Beam.** A heavy-duty TV antenna rotator will handle a small 10-, 15-, and 20-meter tri-bander beam. For larger antennas, especially in areas where the weather is severe, special heavy-duty rotators designed for turning amateur beams are recommended.

● **Tuning a Communications Receiver.** Since a good communications receiver is a more sophisticated piece of gear than an ordinary table-model AM broadcast receiver, it may easily have as many as 20 controls. And all of these controls will have a significant effect on the ability of the receiver to fulfill its intended purpose. This doesn't mean that you have to adjust every control every time you want to tune in another signal. But you do have to know when and how to use every control; otherwise, you will have wasted the money you paid for the receiver.

Getting the "feel" of your receiver's controls is easiest if you start with steady signals. So let's begin practicing on the AM broadcast band and later transfer operations to the ham bands.

Start with the controls in the following positions: sensitivity control (sometimes called "r.f. gain" or "i.f. gain") full *on;* automatic volume control (a.v.c.) *on;* beat-frequency oscillator (BFO or equivalent) *off* or at *phone;* standby/receive switch at *receive;* selectivity control at minimum *(broad,* or highest number); Q-multiplier, notch filter, etc., *off;* bandspread dial indicator at 100 on its logging scale; automatic noise limiter (ANL) *off;* antenna trimmer at mid-scale; and audio gain (volume) control approximately one-quarter-turn clockwise.

(Should your receiver not have one of the controls mentioned here, simply skip the discussion relating to it. But make sure that it isn't actually present under a different name.)

Tune in a signal by adjusting the main tuning dial for maximum deflection of the receiver's S-meter or for the clearest voice or music accompanied by the least amount of background noise. Then, peak the antenna trimmer for maximum S-meter reading.

Now tune in a different signal. Although signal strength may vary greatly (as indicated by the S-meter), you'll notice that the receiver's a.v.c. circuit holds the speaker volume relatively constant.

Experiment with the bandspread dial. A broadcast signal that occupies roughly one division on the main dial will occupy many divisions on the bandspread dial. This "fine-tuning" feature is invaluable on the short-wave bands, where a single dial division represents many kilocycles on the main dial. In fact, in normal operation, the main dial will be set to a predetermined position for the desired band, and all tuning will be done on the bandspread dial. This extra control literally "spreads" the desired band over most of its calibrated scale.

● **Using the R.F. Gain Control.** Reduce the r.f. gain control almost to minimum, and advance the audio (a.f.) gain control almost full on. Then, use the r.f. gain control to regulate the volume as you tune from station to station. You should notice that the receiver tunes more sharply than before, because its r.f. gain can no longer auto-

Year after year, Stan Surber, W9NZZ, has devoted the greater part of his spare time to the public service aspects of ham radio. In 1953, Stan won the Edison Award for his message handling to and from weather men isolated inside the Arctic Circle. Every day W9NZZ can be heard contacting stations on Alert, Resolution, and other Arctic Islands.

matically increase to maximum through the action of the a.v.c. circuit as you tune away from a signal.

Controlling r.f. gain manually in this manner often permits copying a weak signal which would be covered up by a strong, adjacent signal if the r.f. gain control were full on. Don't worry if the receiver S-meter doesn't function properly under these conditions; you can always pop the r.f. gain up long enough to get an S-meter reading when the interfering station signs off or stands by.

● **Code Reception.** Tune in a broadcast station right on the nose. You'll note that when there's no voice or music being transmitted, there is little or no sound from the speaker. Now snap on the beat frequency oscillator (BFO) switch and adjust the BFO pitch control until you hear a clear whistle from the speaker. This is how code signals are received. Although they contain no modulation of their own, they produce an audible "beat note" in the speaker when they are mixed with the signal from the receiver's BFO. (The sender turns his transmitter on and off to make the dot-dash characters.)

Abbreviations Used by Amateur Operators

AA	All After	**N**	No
AB	All Before	**NM**	No More
ABT	About	**NR**	Number
ADR	Address	**NW**	Now
AGN	Again	**OM**	Any Male Ham
BCI	Broadcast Interference	**OW**	Wife of Ham
		PSE	Please
BCL	Broadcast Listener	**R**	Received Okay
		RPT	Repeat
BK	Break	**RTTY**	Radioteletype
C	Yes	**SIG**	Signature; Signal
CK	Check		
CL	Call; Closing Down	**SKED**	Schedule
		TFC	Traffic
CUL	See You Later	**TNX**	Thanks
CW	Radiotelegraphy	**TU**	Thank You
DX	Distant, Distance	**TVI**	Television Interference
FB	Fine Business		
GA	Go Ahead	**UR**	Your; You're
GB	Goodbye	**VY**	Very
GE	Good Evening	**WA**	Word After
GM	Good Morning	**WUD**	Would
GN	Good Night	**WX**	Weather
HI	Funny (Ha-Ha)	**XMTR**	Transmitter
		XTAL	Crystal
HR	Here; Hear	**XYL**	Wife
HV	Have	**YL**	Young Lady
HW	How	**73**	Best Regards
LID	Poor Operator	**88**	Love and Kisses

Incidentally, you'll find two settings of the BFO pitch control an equal distance on either side of the center "zero-beat" position that will produce the same beat note; either position can be used.

● **Selectivity.** Inexpensive ham receivers can usually separate signals of the same strength spaced about 10 kc. apart. More expensive ones usually have several degrees of selectivity, ranging from around 5000 cycles (5 kc.) down to 250 cycles or less. For voice work, 5-kc. selectivity gives natural reproduction; 3-kc. selectivity doesn't affect quality too much; 2-kc. selectivity degrades quality noticeably, although intelligibility remains good. But higher degrees of selectivity reduce speech intelligibility markedly. For code reception, however, selectivities up to 100 cycles or better can be used—if the receiver's stability and dial are good enough to handle such razor-sharp tuning.

Probably the best way to become adept in using high selectivity is to operate your receiver with its selectivity control well advanced even when interference isn't heavy. In this way, you learn how to use it at times when you don't have to concentrate on copying the desired signal through heavy interference. This also prevents the frustrating experience of losing the desired signal as you advance selectivity to combat interference.

● **Crystal Calibrator.** To insure that its calibration is correct, a good communications receiver usually contains a 100-kc. crystal calibrator. This is actually a 100-kc. oscillator controlled by a precisely ground 100-kc. crystal. Harmonics of the calibrator produce signals every 100 kc. across the receiver dial up to 30 mc. or higher.

To use the calibrator with a general-coverage receiver, set the main dial pointer to the "band-set" position for the amateur band you're interested in. Then, turn on the calibrator and carefully tune the bandspread dial until you hear the calibrator signal, and note the frequency indicated on the bandspread dial. If it isn't exactly on a 100-kc. point (3.5, 3.6, 14.2 mc., etc.), move the main dial pointer a trifle, and repeat the process until you tune the calibrator signal exactly on a 100-kc. point.

In ham-band-only receivers, the procedure is essentially the same, except that

a "calibrate" control is used to put the dial precisely on calibration.

A crystal calibrator is most useful in determining the amateur band edges precisely on your receiver. You can then use your receiver to check to see that your transmitter frequency is safely inside the band edges. By the way, 100-kc. calibrators are available as accessories for use with receivers not so equipped.

● **Automatic Noise Limiter.** About the only thing to be said about a receiver's noise limiter is to turn it on when the noise is bad, and leave it off when it isn't. Against sharp, pulse-type noises—that from an automobile ignition system, say—a noise limiter is fairly effective. But the same limiter may be useless against steady grinding noises from another source.

● **Tuning a Transmitter.** Actually, tuning a ham transmitter is usually an easier task than tuning a communications receiver. The best way to learn how is with a dummy antenna connected to the transmitter's output terminals. An ordinary light bulb makes an excellent dummy antenna for the purpose, because it quickly shows the effects of your adjustments—the brighter the bulb, the greater the output.

A 50- or 60-watt, 117-volt light bulb is satisfactory for use as a dummy antenna for a typical 50- to 75-watt Novice transmitter. And a number of #47, 6.3-volt pilot bulbs connected in series or parallel will serve very well as a dummy antenna for a very low-power 2- or 6-meter transceiver.

Your transmitter instruction manual will contain a step-by-step procedure for tuning your transmitter. And, with the dummy antenna, you can practice what the manual tells you to do without putting a signal on the air to cause unnecessary interference to others. By the way, never operate the transmitter without a load of some sort, or you will be liable to damage it.

Once you have learned how to tune the transmitter with the dummy antenna, you're ready to tune up your transmitting antenna. Although the dial settings of the output circuit may change a trifle, the tuning procedure will be the same. WARNING: you can tune your transmitter to a dummy antenna while waiting for your license to arrive, but it's illegal to make any transmitter adjustments with the radiating antenna connected until you have the license in your possession.

● **Getting on the Air.** Now that you have your Novice license posted in a prominent place on the shack wall (or at least safely in your possession) and your transmitter is ready to go, how about getting on the air? We'll start on 80-meter c.w.

Turn on both the transmitter and receiver and allow them to warm up while you prepare your logbook. Sign the logbook, enter your call letters, transmitter power, frequency (band), mode—phone or c.w., and the date. With these preliminaries out of the way, double-check your transmitter frequency—the FCC takes a dim view of out-of-band operation!

Now tune around the band for a few minutes to get an idea of what's coming through. Suddenly, you'll hear a call something like this near your transmitter frequency: "CQ CQ CQ DE WN1ABC WN1-

ARRL Photo

Radio amateurs are proud of their "spokesman," the American Radio Relay League. The ARRL is the largest amateur organization in the world. Besides representing hams in Washington, the ARRL maintains a well-equipped laboratory in its West Hartford, Conn., headquarters. In this room many advanced electronic projects are built and tested prior to their publication in the ARRL journal—called "QST."

ABC WN1ABC CQ CQ CQ DE WN1ABC WN1ABC WN1ABC CQ CQ CQ DE WN1-ABC WN1ABC K." This means, of course, that WN1ABC wishes to work (contact) anyone hearing his "CQ."

You decide to answer the call; so you quickly enter the time and WN1ABC in your logbook. When WN1ABC concludes his "general call" with "K," you flip your send/receive switch to the "Send" position and send: "WN1ABC WN1ABC WN1ABC DE WN9EGQ WN9EGQ WN9EGQ AR," and flip the send/receive switch back to "Receive." But there is WN1ABC answering another station. You sigh almost in relief. What would you have done if he'd answered you?

Chances are you'll react just like all other hams do when you experience that indescribable thrill of making *your* first contact. Your heart will pound, and chills of excitement will run up and down your back; your hands will be shaking so much that you'll hardly be able to press the key. But you'll have a smile of mingled joy and disbelief on your face. ("Listen, Ma! He's answering me!")

Some hams get so "shook up" the first time someone answers them that they sit in front of their rigs unable to move. After the first few contacts, the chills and shakes disappear, but the thrill of making contacts over one's own station never leaves entirely.

Radio Amateur Callbooks

An alphabetical listing of amateur radio stations (by call letters) is published four times a year. The call letters and the names and addresses of all the hams in the 50 states are contained in one volume (about 525 pages) costing $5.00. A second volume lists the call letters (arranged by country) and the names and addresses of the 100,000 hams outside of the U.S.A.; this volume costs $3.00. Revised editions of both volumes are available after March 1, June 1, September 1, and December 1.

The publisher is Radio Amateur Call Book, Inc., 4844 West Fullerton Ave., Chicago 39, Ill.

● **Making Contacts Correctly.** No matter what type of operating procedure you employ, the "law of averages" says that you'll make an occasional contact—probably more or less by accident. But standard procedures will do the job much better.

To call "CQ," meaning "I will answer calls from any station hearing me," send *either* of the following *at the same speed that you want to be answered at:* "CQ CQ CQ DE WN9EGQ WN9EGQ WN9EGQ CQ CQ CQ DE WN9EGQ WN9EGQ WN9-EGQ CQ CQ CQ DE WN9EGQ WN9EGQ WN9EGQ K," or "CQ CQ CQ CQ CQ DE WN9EGQ WN9EGQ CQ CQ CQ CQ CQ DE WN9EGQ WN9EGQ CQ CQ CQ CQ CQ DE WN9EGQ WN9EGQ K."

The "DE" between the CQ's and the call-signs is Latin for "from." And the "K" is the c.w. procedure signal for "Go ahead; I will now listen."

The first call given above is a standard "3 x 3 x 3" CQ; however, some experienced op's (operators) prefer the second one, a "5 x 2 x 3" CQ, because it increases the percentage of the time that the letters "CQ" are actually being sent. Furthermore, if conditions won't permit copying a call-sign sent twice, the chances of a successful contact are not very good anyway.

If one CQ isn't successful, additional ones can be called. But don't lengthen your call on the theory that more operators will hear you. The trouble is that the average ham will wait no more than a minute for you to stand by. After that, he'll likely tune away looking for someone else, or call CQ himself.

On General Class phone, you can say "Calling CQ CQ CQ *This is* (or *From*) W9EGQ W9EGQ W9EGQ . . . *Over,*" and you can use words from the phonetic alphabet to identify the individual letters of your call-sign, if you wish. In place of "CQ," you can also say "Calling any 2-meter, 75-meter, etc., phone station." Most phone operators include their locations when calling CQ.

Note carefully that your own call letters *always* come last; this is to permit the FCC monitoring stations to do their job more efficiently.

● **Directional CQ's.** To contact a station in a certain area or direction, call CQ in the normal manner, but insert the name of the

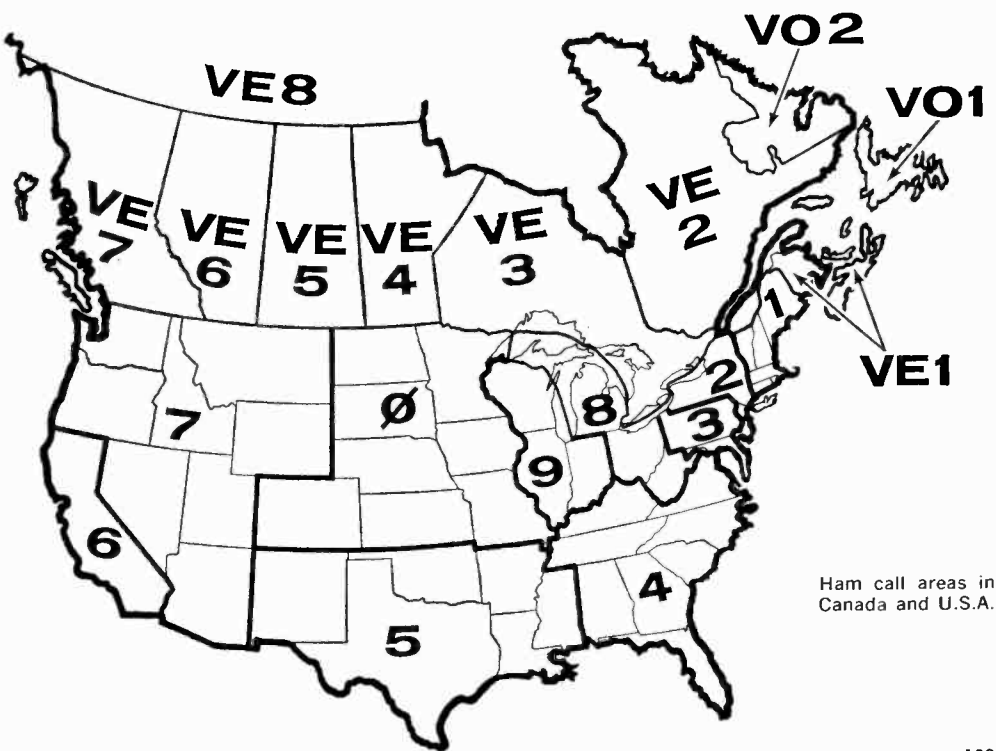
place or direction desired immediately before the "DE" on each round. In this way, an operator hearing your CQ just as you are standing by will know your wishes. Unless you have a real power-house signal, directional calls usually aren't as productive as tuning around until you hear a station from the desired area and then calling it.

● **Getting Better Results.** Before calling CQ, always check your transmitting frequency, both as a mark of courtesy and of good sense. If there are already strong signals on the frequency, your chances of attracting or hearing a reply aren't going to be very good. If you can't shift to another frequency, listen to the conversation already in progress; if it appears to be of the type that won't be ruined by having other stations join it, you may try to "break" into the contact. On c.w., this is done by sending a snappy "BK DE W9EGQ" just as one of the stations stands by or during a momentary pause in the conversation. On phone, the procedure is the same, but you say "Break from W9EGQ."

Don't make yourself obnoxious by breaking into every contact you hear without first listening. As an extreme example of poor "break-in" procedure, we once actually heard a ham break into an emergency net while the operators were relaying names of the dead and wounded being removed from a disaster area. Since he wanted to ragchew, it was only too obvious that he hadn't listened first!

● **Answering CQ's.** In answering a CQ, a short call such as "W1DEF W1DEF W1DEF DE W2GHI W2GHI AR" is normally sufficient. If the CQ'er doesn't respond to it, one of three things is probably happening: he isn't listening on your frequency; he's listening to another station; or you're just not getting through at the moment. At any rate, if you don't get an answer to one short call, you can always listen a moment to make sure that the called station hasn't answered someone else, and then call again. If you stand by after a call and discover the called station already talking to someone else, you can be pretty sure that your calls are too long.

If you read the above example of how to answer a CQ carefully, you probably no-



Ham call areas in Canada and U.S.A.

ticed that it ended with "AR," not "K." This is one of those little things that distinguishes a crack operator from a mediocre one; the "AR" indicates that a call has been made, but a two-way contact has not yet been established. A good operator is also careful to use the sign-off signal "SK" correctly as discussed below. (The line over the two letters in each case means that you shouldn't leave a space between them, but run them together as though they were one letter instead of two letters.)

R-S-T SIGNAL REPORTS

The standard amateur method of giving signal reports is through the use of the "RST" system in accordance with the following tables:

READABILITY (R)

1 Unreadable
2 Barely readable, occasional words distinguishable
3 Readable with considerable difficulty
4 Readable with practically no difficulty
5 Perfectly readable

STRENGTH (S)

1 Faint; signal barely perceptible
2 Very weak signal
3 Weak signal
4 Fair signal
5 Fairly good signal
6 Good signal
7 Moderately strong signal
8 Strong signal
9 Extremely strong signal

TONE (T)

1 Extremely rough, hissing signal
2 Very rough a.c. signal
3 Rough, low-pitched a.c. signal
4 Rather rough a.c. signal
5 Musically modulated signal
6 Modulated signal, slight whistle
7 Near d.c. signal, smooth ripple
8 Good d.c. signal, trace of ripple
9 Purest d.c. signal

If the signal has the steadiness of crystal control, add "X" after the RST report; add "C" for a chirp; and "K" for a keying click.

A typical report might be: "RST579X," meaning "Your signals are perfectly readable, moderately strong, have a perfectly clear tone, and have the stability of a crystal-controlled transmitter.

In phone operation, use the words "Readability" and "Strength," and the first two sets of numbers.

● **Interpreting What You Hear.** The first transmission after contact is established will probably go something like this: WN1ABC DE WN9EGQ R TNX FER CL UR SIGS RST579 RST579 HR IN GARY IND. NAME HERB. WAT SA AR WN1ABC DE WN9EGQ K," and WN1ABC will reply more or less along these lines: "WN9EGQ DE WN1ABC R FB HERB UR SIGS RST589 IN LITTLE RHODE ISLAND. MI NAME CHUCK. XMTR DX20 AT 40 WATTS. ANT LONG WIRE. WX CLR. AR WN9EGQ DE WN1ABC K."

At first glance, much of the above looks completely unintelligible. But to any experienced ham, it is crystal clear. In using code, every letter of every word would ordinarily have to be pounded out; to save time, therefore, c.w. operators lean heavily on abbreviations. These abbreviations are a mixture of phonetically spelled words, words with all the vowels omitted, words with the letter "X" replacing part of them, first letters of commonly associated words, and combinations of the above.

Another group of time-savers are Q-signals, in which, by international agreement, a single three-letter Q-signal expresses an entire thought. For example, "QRM?" means "Are you troubled by interference?" or, without the question mark, "I am troubled by interference." (The question is formed by following the Q-signal with a question mark.)

Getting back to our sample contact, after signal reports, locations, and names are exchanged, the contact may last as long or as short a time as the operators involved wish. This is the correct way to terminate a contact: ". . . NM HR 73 AR WN1ABC DE WN9EGQ SK."

When you send "SK," it means the contact is finished; you have made your last transmission and *do not expect the other station to transmit again, either.*

● **Giving Signal Reports.** The first thing you'll want to know when you contact another station is how well you're being received. There is a standard manner of giv-

ing such reports—the "RST" system. Although this system is straightforward, some hams are nonetheless guilty of giving inaccurate reports.

● **Readability.** When a signal is perfectly readable *without difficulty,* it is *R*(eadability)*5*; if it is readable with practically no difficulty, it rates an *R4*. Similarly, it rates *R3* when it is readable with much difficulty, *R2* when partially readable, and *R1* when completely unreadable. Thus, it's pretty silly to tell a ham that he is "R5" and then ask him to repeat almost everything he says.

● **Signal Strengths and S-Meters.** An extremely strong signal—say from a local a few miles away—is said to be *S*(trength)*9*, and a very weak signal that can be just barely distinguished from the background noise of the receiver is *S1*; all other strength reports should fall in between these two limits. However, many hams, especially on phone, give exaggerated signal-strength reports.

The explanation for much of this exaggeration lies in the receiver's S-meter—a device for giving a visual indication of the strength of received signals. The trouble is that many S-meters indicate "S6" to "S9" with no signal being received. And when a signal *is* tuned in, the S-meter swings far past "S9." As a result, S-meter reports frequently are a bit generous.

This doesn't mean that S-meters are pointless—they make wonderful tuning indicators, and they're valuable for indicating the *relative* strengths of different signals. But extremely high S-meter readings should be taken with a pinch of salt.

● **Tone Reports.** From a legal point of view, the *T*(one) part of a report is most

Selected Q Signals

The following internationally recognized Q signals are commonly used in amateur radio. To ask the indicated question, follow the Q signal with a question mark.

QRG What is my exact frequency in kilocycles? Your exact frequency is_____ kilocycles.

QRK What is the readability of my signals? The readibility of your signals is_____ (1 to 5).

QRL Are you busy? I am busy (with_____).

QRM Are you troubled with interference? I am troubled by interference.

QRN Are you troubled by static? I am troubled by static.

QRQ Shall I send faster? Send faster (_____wpm).

QRS Shall I send more slowly? Send more slowly (_____wpm).

QRT Shall I stop transmission? Stop transmission.

QRU Have you anything for me? I have nothing for you.

QRV Are you ready? I am ready.

QRX When will you call again? I will call again at_____on_____kc.

QRZ Who is calling me? You are being called by_____.

QSA What is the strength of my signals? The strength of your signal is_____ (1 to 5).

QSB Does the strength of my signals vary? The strength of your signals varies.

QSD Is my keying correct? Are my signals distinct? Your keying is incorrect; your signals are indistinct.

QSL Can you acknowledge receipt? I am acknowledging receipt.

QSO Can you communicate with_____ direct (or through_____)? I can communicate with_____ direct (or through_____).

QSP Will you relay to_____? I will relay to_____.

QSV Shall I send a series of VVV? Send a series of VVV.

QSY Shall I change to_____kilocycles without changing the type of wave? Change to_____kilocycles without changing the type of wave.

QTC How many messages do you have to send? I have_____messages to send.

QTH What is your location (position)? My location (position) is_____.

QTR What is the exact time? The exact time is_____.

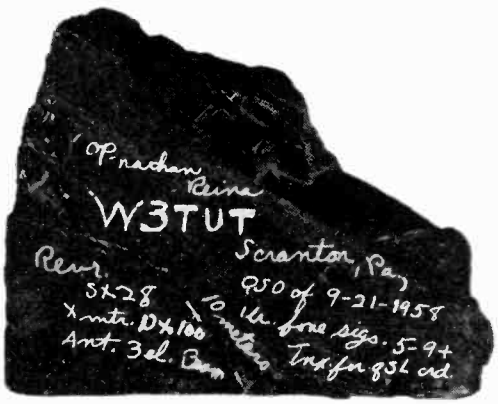
Unofficial Q Signals Adopted by the ARRL

QRRR Official ARRL "land SOS." A distress call for emergency use only.

QST General call addressed to all radio amateurs.

important. The FCC amateur regulations specify that all ham signals on frequencies below 144 mc. must be as stable and pure as the state of the art permits. On c.w., such a signal produces a clear, unvarying tone from the receiver's speaker; on phone, such a signal is perfectly free of hum and other extraneous noises. In other words, it is *T9*.

Giving a ham a "T9" report when his signal is rough or unsteady certainly is not doing him or anyone else a favor. Sooner or later, hams with such signals get citations from the FCC monitors calling attention to their poor signals. The first reaction of the average ham getting an FCC report for a poor signal—although he should have



Here is a QSL "card" received by John Agee, K5ODN, from W3TUT. Qualifying as one of the most unusual QSL "cards" in existence, this piece of anthracite coal was mined 1100 feet down in W3TUT's home town, Scranton, Pa.

checked his signal for himself—is disbelief. After all, all his reports from other hams were "T9"!

Now that you're familiar with the standard method of giving signal reports, let's get back to our sample contact.

● **Exchanging QSL Cards.** You will undoubtedly want a confirmation of your first contact. So you send "PSE QSL," which means "Please send me a written confirmation of this contact."

Being a new ham, you'll have to send your address, too, so the other operator will know where to mail his QSL card (it takes at least one issue for a new station to ap-

North American QSL Bureaus

A majority of QSL cards from DX stations are distributed through the various branches of the ARRL QSL Bureau. To receive your cards, you must keep a supply of stamped, self-addressed envelopes on file with your call area QSL Manager.

W1 George L. DeGrenier, W1GKK, 109 Gallup St., North Adams, Mass.

W2 North Jersey DX Assn., P.O. Box 303, Bradley Beach, N.J.

W3 Jesse Bieberman, W3KT, P.O. Box 400, Balacynwyd, Pa.

W4 Thomas M. Moss, W4HYW, P.O. Box 20644, Municipal Airport Branch, Atlanta 20, Ga.

W5 Brad A. Beard, W5ADZ, P.O. Box 25172, Houston 5, Texas

W6 San Diego DX Club, P.O. Box 6029, San Diego 6, Calif.

W7 Salem Amateur Radio Club, P.O. Box 61, Salem, Oregon

W8 Walter E. Musgrave, W8NGW, 1245 E. 187th St., Cleveland 10, Ohio

W9 Ray Birren, W9MSG, 702 Spring Rd., Elmhurst, Ill.

WØ Alva A. Smith, WØDMA, 238 E. Main St., Caledonia, Minn.

KP4 Joseph Gonzales, KP4YT, P.O. Box 1061, San Juan, P.R.

KH6 John Oka, KH6DQ, P.O. Box 101, Aiea, Oahu, Hawaii

KL7 Alaska QSL Bureau, Box 6226, Airport Annex, Anchorage, Alaska

KZ5 Ralph E. Harvey, KZ5RV, Box 407, Balboa, Canal Zone

Canadian

VE1 L. J. Fader, VE1FQ, P.O. Box 663, Halifax, N.S.

VE2 George C. Goode, VE2YA, 188 Lakeview Ave., Point Claire, Montreal 33, Que.

VE3 R. H. Buckley, VE3UW, 20 Almont Rd., Downsview, Ont.

VE4 D. E. McVittie, VE4OX, 647 Academy Rd., Winnipeg 9, Man.

VE5 Fred Ward, VE5OP, 899 Connaught Ave., Moose Jaw, Sask.

VE6 W. R. Savage, VE6EO, 833 10th St., Lethbridge, Sask.

VE7 H. R. Hough, VE7HR, 1291 Simon Rd., Victoria, B.C.

VE8 George T. Kondo, VE8RX, c/o Dept. of Transport, P.O. Box 65, Fort Smith, N.W.T.

VO1 Ernest Ash, VO1AA, P.O. Box 8, St. Johns, Newfoundland

VO2 Douglas B. Ritcey, VO2UA, c/o Dept. of Transport, Goose Bay, Labrador

pear in the *Radio Amateur Callbook*). Of course, if *his* call is in the *Callbook,* you can mail your QSL card first, permitting the other operator to get your address from your card. Actually, sending your card first is likely to net you more cards than if you wait for the other fellow to send his QSL first.

A QSL card needn't be elaborate. But it should be neat and include the following information: date and time of the contact; call letters of the station worked; signal report; frequency (band); and mode—c.w., AM phone, SSB, etc.

You can order your QSL cards from one of the printers listed in the classified ads in the back of this Handbook. They'll send you samples upon a request accompanied by a dime or quarter to cover handling and postage.

● **QSL'ing DX Contacts.** When you work a foreign DX station, always express the time of the contact in GMT, using the 24-hour clock system. Also known as Universal Time (UT), GMT is five hours ahead of EST, eight hours ahead of PST. And don't forget to add "one" to the month's date after you pass midnight (2400 hours).

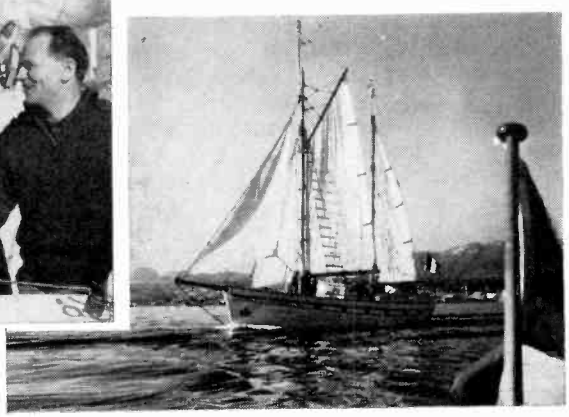
You have two or three choices in mailing DX cards: you can send your card to the address in the DX edition of the *Callbook;* send it via the DX operator's National QSL Bureau; or, lastly, via his QSL Manager—if he has one. In the event that the DX station does have a QSL Manager, you'll be told to "QSL VIA W2CTN" or some other U.S. ham. Send your card to the manager, include a stamped, self-addressed reply envelope, and the return card will usually arrive very quickly.

For highest speed and the greatest percentage of returns to QSL cards mailed to the DX station's *Callbook* address, send your card airmail. In addition, include a self-addressed reply envelope and an International Reply Coupon (IRC) obtainable at any post office.

If there is no specific mailing address, send your QSL card via the DX station's National QSL Bureau. Actually, the Soviet Union and some other "iron curtain" countries don't even print the addresses of their hams. Therefore, you *must* use the QSL Bureau for hams in these countries.

The only disadvantage of using QSL Bureaus is that cards routed through them travel rather slowly; it often takes six months for a card to reach its destination. Since many DX stations do not QSL run-of-the-mill U.S. contacts until they receive a card, and the return trip may take another six months, a full year may elapse before a coveted card arrives via a QSL Bureau.

● **Receiving DX QSL's.** The bulk of incoming DX QSL's for U.S. hams arrives via



This is the "Constance" and its crew. Otherwise known as the F2TF/MM, this vessel is now at sea on a round-the-world cruise. Arm and Cahard (far right, in photo) is the radio operator. Hams and SWL's can participate in a contest by contacting or monitoring the "Constance." Valuable prizes will be awarded. For details, write to The French Broadcasting System, 972 Fifth Ave., New York 21, N.Y.

the ARRL QSL Bureaus. To receive your cards, you must keep a 9½" x 4⅛" stamped envelope (Post Office #8 size) on file with your call area QSL Manager (the addresses are listed on page 126). Put your address in the normal place on the envelope, and print your call letters in the space usually occupied by the return address. The bureaus forward cards every month—to stations with envelopes on file.

● **Phone Operation.** There's no real difference in working stations on phone as compared with c.w. except that not having to spell everything out on phone eliminates the necessity of using c.w. abbreviations. Under difficult conditions, however, it is sometimes useful to employ phonetic words on phone to get your call letters or difficult words across.

International Phonetic Alphabet

A—ALPHA	**M**—MIKE	**Y**—YANKEE
B—BRAVO	**N**—NOVEMBER	**Z**—ZULU
C—CHARLIE	**O**—OSCAR	**0**—ZE-RO
D—DELTA	**P**—PAPA	**1**—WUN
E—ECHO	**Q**—QUEBEC	**2**—TOO
F—FOXTROT	**R**—ROMEO	**3**—TH-UH-REE
G—GOLF	**S**—SIERRA	**4**—FOWER
H—HOTEL	**T**—TANGO	**5**—FI-IV
I—INDIA	**U**—UNIFORM	**6**—SIX
J—JULIET	**V**—VICTOR	**7**—SEV-EN
K—KILO	**W**—WHISKEY	**8**—AIT
L—LIMA	**X**—X-RAY	**9**—NIN-ER

There are several phonetic alphabets in use, but for uniformity, the International Phonetic Alphabet is recommended.

An example will show how to use the phonetic word list. Assume that you're W9EGQ and that you're calling W1ABC. "W1ABC W1ABC W1ABC This is W9EGQ —Whiskey Nin-er Echo Golf Quebec . . . Over." Of course, you would repeat the call as often as necessary to establish contact.

Note that it isn't necessary to give the called station's call letters phonetically (the operator already knows them—it's yours that he's interested in). Also, once your call letters are acknowledged, it's a waste of time to keep repeating them phonetically. But phonetics can be extremely helpful during a contact in getting difficult words across.

● **Signing Your Call Letters.** On both phone and c.w., FCC regulations require that you sign your call letters and give the reason for putting your transmitter on the air (test, CQ, etc.) at the beginning and end of every transmission, and every ten minutes in between. However, in a series of alternate transmissions between two or more stations in communication with each other, in which no single transmission exceeds two minutes in length, call-signs need be transmitted only every ten minutes.

All transmissions must be logged, too. This requirement includes unsuccessful CQ's and "test" transmissions as well.

● **Working New States and DX.** When you first get on the air, every contact you make will be a new experience. Later, you'll undoubtedly want to work new states and foreign countries for the thrill of it, as well as to qualify for one or more of the various certificates and awards offered in recognition of certain operating achievements. Best known of these awards are Worked All States (WAS) and Worked All Continents (WAC) offered by the ARRL, but there are literally hundreds of others available.

By far the most effective way to work new states and countries is by listening, listening, and more listening. Resolutely pass up localities that you have worked before. When you locate a station you need calling CQ, return the call in the normal manner. If it answers another station, don't tune away; wait until their contact is over, and call again—and again. Don't just listen for stations calling CQ; you can often spot new ones already in contact. By waiting them out, you stand an excellent chance of working them. But don't be surprised to discover that dozens of other hams have the same idea when an exotic DX station is involved.

Actually, it's usually the competition of many stations calling DX—not the inability to put a signal into the DX station's locality —that makes working DX such a challenge.

● **Improving Your Results.** No one "gets out" as well as he thinks he should; nevertheless, if you seem to have undue trouble making contacts for the type of equipment you have, it's a good idea to take a critical

look at your operating. Possibly you aren't sending well. Check your spacing between letters and words. Do you unconsciously speed up and run them all together in an uncopiable mess? If so, this is as good a method as you can find to cut the effectiveness of your CQ's almost to the vanishing point.

If your signals are weaker than the average, because of a makeshift antenna, low power, or a poor location, you'll normally have better results by answering CQ's than by calling them. By the same token, it's usually a waste of time for any low-power U.S. ham to call "CQ DX." Foreign hams get so many answers to their own CQ's that they seldom answer U.S. CQ's.

If you've been doing all your operating in the crowded evening hours, try getting up early a few mornings. You'll probably be pleasantly surprised at the lack of interference and the clarity of signals at this time of the day.

And, finally, if your rig is crystal-controlled, a couple of extra crystals will pay off handsomely. A difference of just a kilocycle or two in frequency will often get you out from under a strong interfering signal.

● **Amateur Radio in Canada.** Amateur radio matters in Canada are under control of the Department of Transport (DOT), Ottawa, Ontario, which has regional offices located in the principal cities, as listed on page 131. You will usually conduct your business with the nearest DOT office.

To become a radio amateur in Canada, you must satisfy the following requirements: be at least 15 years old; be a citizen by birth or naturalization of Canada or of any other British Commonwealth country; or be a landed immigrant to Canada. (A "landed immigrant" is any immigrant who has been in Canada less than six years and who possesses a landed-immigrant card or a passport stamped "Landed Immigrant" by a Canadian immigration official.) In addition, you must be physically able to operate the equipment in your proposed amateur station. Finally, you must pass a required examination.

There are two classes of amateur operators in Canada—*Amateur* and *Advanced Amateur*. Technically, when you pass the examination, you will not receive an operator's license; rather you will receive a "Certificate of Proficiency in Amateur Radio" or in "Advanced Amateur Radio," which remains valid indefinitely unless revoked for cause or voluntarily relinquished. But you must have an amateur station license before you can operate your own amateur station. The station license is renewed annually upon the payment of a $2.50 annual license fee.

● **Certificate Requirements.** To qualify for an Amateur Certificate, you must pass a 10-wpm code test and a written/oral examination on amateur radio theory and on the Canadian amateur regulations. As part of the examination, you will be required to draw the schematic diagrams of a simple transmitter and receiver and of associated amateur gear; the oral examination will consist of questions regarding the diagrams, or regarding the equipment you propose to

A serious sweepstakes and contest operator, Larry LeKashman, W9IOP, built this bank of transmitters to enable switching between any one of five ham bands—at the turn of a single control. Each transmitter has a kilowatt input and is usable for either c.w. or SSB. The exciter and one receiver are Hallicrafters' products, the second receiver a Collins 75A4. Larry is vice president of Electro-Voice, a major manufacturer of microphones and hi-fi loudspeakers.

use in your amateur station—if they are not the same.

An Amateur Certificate authorizes full code privileges on all Canadian amateur bands, and all privileges (except TV) on the amateur frequencies above 50 mc. Also, after six months of experience, as shown by your station logbook, you can apply for authorization to use phone between 28.1- and 29.7 mc. by displaying the logbook to a regional Radio Inspector. He will authorize the operation if he considers your experience and equipment satisfactory.

After establishing proof of 12 months of amateur experience, you may take the Advanced Amateur examination; upon passing it, you will be authorized to use phone in all the Canadian amateur phone bands.

● **Taking the Tests.** When you are ready to take the examination for the Amateur Certificate, make an appointment with your regional DOT office. Appear at the office at the appointed time with your birth certificate or similar valid proof of your age and citizenship, fill out the application form, pay your 50-cent examination fee (required with every examination), and take the tests.

First comes the code receiving test, which may be given via headphones or over a loudspeaker. To pass it, you must copy the code at a speed of 10 wpm for three consecutive minutes (150 letters) without error or omission. Numbers and simple punctuation marks are included in the code test; each number or punctuation mark is counted as two letters.

After hurdling the receiving test, you face the sending test. To pass it, you must send 150 letters correctly in a 3-minute period. If you make a sending error, you can correct it by sending the error sign (eight dots), then continue from the last correctly sent letter. You will still pass the test, as long as you send the prescribed 150 letters within a 3-minute period. It is not wise, however, to send at an excessive rate of speed on the theory that you will then be certain to send the required 150 letters in the allotted time, in spite of errors. The quality of your sending is also evaluated in determining whether you pass or not.

After you pass the code test, you will be given the written/oral examination, on which you must earn a grade of 75% or better, plus a grade of 50% or better on your diagrams. If you pass, you may immediately apply for your amateur station license.

Incidentally, in bi-lingual DOT offices, you may take the amateur examinations in either English or French, and have your license and certificate issued in the same language. In single-language offices, only English is used.

Should you fail part of the written/oral examination, you can set up a re-examination date with the Radio Inspector. Depending upon his opinion of how soon you will be able to pass the failed portion, the new date may be set for a few days later, or it may be deferred for some months.

● **The Station License.** As we said earlier, amateur station licenses are issued annually in Canada, and the annual license fee is $2.50. All licenses expire on March 31, and there is no reduction in fee for a license issued for only a part of a year—say, from October through March. But if you apply for your station license in the first quarter of the new year, you can request that its term start on April 1. Your station license must be prominently displayed in your station.

It is illegal to possess a reasonably complete radio station in Canada without a station license or some other official authorization; it is, therefore, illegal to have your station all set up and waiting for your station license to arrive. Get the license first.

● **Special Conditions.** If a physical handicap prevents you from appearing at a DOT office to take the examination, write to the nearest regional office and other arrangements can be made.

Also, an applicant in a remote area, who feels that he is qualified to operate an amateur station but is unable to appear for the examination, may apply for a provisional station license by filling out an amateur station license application form completely (including the affidavit on the back). Upon approval of the application, a provisional station license will be issued until the next March 31.

At that time, if the applicant has still been unable to take the examination, the provisional station license can be renewed —upon the payment of the regular $2.50 license fee—for a period up to 12 months

from the date of issuance of the original provisional license. Beyond that time, no further extensions are granted until the applicant qualifies for a certificate of proficiency.

● **Studying Aids.** Of course, learning the code is the same the world over; therefore, the suggestions on learning the code on page 103 are fully applicable. The technical level of the questions in the Canadian Amateur and Advanced Amateur examinations is about the same as in the U.S. General Class examination.

However, the Canadian examinations include questions on amateur receivers, storage batteries, and even a question or two on motor generators—subjects which are not mentioned in the U.S. examination. Consequently, the prospective Canadian amateur can't depend on a U.S. amateur study guide, such as the *ARRL License Manual*, as a completely accurate guide in preparing for an examination (although the *License Manual* is very helpful, as far as it goes).

We strongly recommend *The Radio Amateur Licensing Handbook*, by J.E. (Jim) Kitchin, VE7KN, Regional Supervising Radio Inspector, Department of Transport, Canada, to all prospective Canadian amateurs. Published by Radiotelephone Directories of Canada, Ltd., 119 West Pender St., Vancouver 3, B.C., it costs $2.00, and

Exam Locations

WHERE CANADIAN RADIO AMATEUR EXAMINATIONS ARE GIVEN

Examinations for Certificates of Proficiency are conducted at the offices listed below, and all pertinent information may be obtained from them.

Calgary, Alta.
Inspector, Radio Regulations,
404 Public Bldg.

Edmonton, Alta.
Regional Director, Air Services,
Federal Bldg., 9820 107th St.

Grande Prairie, Alta.
Inspector, Radio Regulations,
Room 202, Richmond Bldg.,
10118 Richmond Ave.

Kelowna, B.C.
Inspector, Radio Regulations,
434 Bernard Ave.

Prince Rupert, B.C.
Inspector, Radio Regulations,
No. 2, Wallace Block,
305 Fulton St.

Vancouver, B.C.
Regional Director, Air Services,
739 W. Hastings St.

Victoria, B.C.
Inspector, Radio Regulations,
Room 404, Belmont Bldg.,
805 Government St.

Brandon, Man.
Inspector, Radio Regulations,
Room 204, Post Office Bldg.

Winnipeg, Man.
Regional Director, Air Services,
Room 706, General P. O. Bldg.,
266 Graham Ave.

Moncton, N.B.
Regional Director, Air Services,
Federal Bldg.,
1081 Main St.

Saint John, N.B.
Inspector, Radio Regulations,
Customs House,
Prince William St.

St. John's, Nfld.
Inspector, Radio Regulations,
Room 632, Sir Humphrey Gilbert
Bldg., Duckworth St.

Halifax, N.S.
Inspector, Radio Regulations,
Dominion Public Bldg.

Sydney, N.S.
Inspector, Radio Regulations,
Room 251, Federal Bldg.,
Dorchester St.

Hamilton, Ont.
Inspector, Radio Regulations,
Room 629, Canadian Govt. Bldg.,
150 Main St., W.

London, Ont.
Inspector, Radio Regulations,
Rooms 406-408, Dominion Public Bldg., 450 Richmond St.

Kingston, Ont.
Inspector, Radio Regulations,
Room 273, Federal Bldg.

Kitchener, Ont.
Inspector, Radio Regulations,
Dominion Public Bldg.,
15 Duke St.

North Bay, Ont.
Inspector, Radio Regulations,
Room 408, New Federal Bldg.,
101 Worthington St., E.

Ottawa, Ont. (Ottawa Area Field Office)
Inspector, Radio Regulations,
Room 405, Garland Bldg.,
142 Queen St.

Port Arthur, Ont.
Inspector, Radio Regulations,
Room 330, Dominion Public Bldg.

Sault Ste. Marie, Ont.
Inspector, Radio Regulations,
Room 302, Federal Bldg.,
Queen & East Sts.

Toronto, Ont.
Regional Director, Air Services,
25 St. Clair Ave., E.

Dorval, Que.
Regional Director, Air Services,
Regional Administration Bldg.,
Montreal Int'l. Airport

Montreal, Que. (Field Office)
Inspector, Radio Regulations,
Room 725, 305 Dorchester St., W.

Port Alfred, Que.
Inspector, Radio Regulations,
101 Du Pait Ave.

Quebec, Que.
Inspector, Radio Regulations,
Public Bldg., 390 Dorchester St.

Sherbrooke, Que.
Inspector, Radio Regulations,
Federal Bldg.,
315 King St., W.

Three Rivers, Que.
Inspector, Radio Regulations,
Public Bldg.

Regina, Sask.
Inspector, Radio Regulations,
Room 308, Post Office Bldg.

Saskatoon, Sask.
Inspector, Radio Regulations,
Room 413, Federal Bldg.

World-Wide Radio Amateur

Prefix	Zone	Country
AC3	22	Sikkim
AC4	23	Tibet
AC5	22	Bhutan
AP	21, 22	Pakistan
BV	24	Formosa
BY(C)	23, 24	China
C9	24	Manchuria
CE	12	Chile
CEØA	12	Easter I.
CEØZ	12	Juan Fernandez I.
CM/CO	8	Cuba
CN	33	Morocco
CP	10	Bolivia
CR4	35	Cape Verde I.
CR5	35	Port. Guinea
CR6	36	Angola
CR7	37	Mozambique
CR9	24	Macao
CR10	28	Port. Timor
CT1	14	Portugal
CT2	14	Azores I.
CT3	33	Madeira I.
CX	13	Uruguay
DJ, DL	14	Germany (West)
DM	14	Germany (East)
DU	27	Philippine I.
EA	14	Spain
EA6	14	Balearic I.
EA8	33	Canary I.
EA9	33	Spanish Sahara, Ifni, Rio de Oro
EAØ	36	Spanish Guinea, Rio Muni
EI	14	Ireland
EL	35	Liberia
EP, EQ	21	Iran
ET2	37	Eritrea
ET3	37	Ethiopia
F	14	France
FA	15	Algeria
FB8	39	Amsterdam, Crozet, St. Paul, Kerguelen I.
FC	15	Corsica
FG7	8	Guadeloupe
FH8	39	Comoro I.
FK8	32	New Caledonia
FL8	37	French Somaliland
FM7	8	Martinique
FO8	32 3	French Oceania Clipperton I.
FP8	5	Miquelon & St. Pierre I.
FR7	39	Reunion I.
FS7	8	St. Martin
FU8	32	New Hebrides
FW8	32	Wallis & Futuna I.
FY7	9	French Guiana
G	14	England
GC	14	Channel I.
GD	14	Isle of Man
GI	14	Northern Ireland
GM	14	Scotland
GW	14	Wales
HA	15	Hungary
HB	14	Switzerland
HC	10	Ecuador
HC8	10	Galapagos I.
HE9L	14	Liechtenstein
HH	8	Haiti
HI	8	Dominican Rep.
HK	9	Colombia
HKØ	7	San Andres & Providencia
HM, HL9	25	Korea
HP	7	Panama
HR	77	Honduras
HS	28	Thailand
HV	14	Vatican City
HZ	21	Saudi Arabia
I	15	Italy
IS	15	Sardinia
IT	15	Sicily
JA	25	Japan
JT1	23	Mongolia
JZØ	28	Netherlands New Guinea
K	3, 4, 5	U.S.A.
KA	25	Japan (U.S. personnel)
KB6	31	Baker, Canton, Enderbury, Howland, & Phoenix I.
KC4US	13	Antarctica
KC6	27	Caroline I.
KG1	40	Greenland (U.S. personnel)
KG4	8	Guantanamo Bay, Cuba
KG6	27	Guam, Marcus I.
KG6I	27	Volcano I.
KG6S	27	Saipan I.
KG6T	27	Tinian I.
KH6	31	Hawaiian I.
KJ6	31	Johnston I.
KL7	1	Alaska
KM6	31	Midway I.
KP4	8	Puerto Rico
KP6	31	Palmyra & Jarvis I.
KR6, KR8	25	Okinawa (Ryukyu I.)
KS4	7	Swan I.
KS4B	7	Serrana Bank & Roncador Cay
KS6	32	U.S. Somoa
KV4	8	Virgin I.
KW6	31	Wake I.
KX6	31	Marshall I.
KZ5	7	Canal Zone
LA	14	Norway; Svalbard; Jan Mayen I.
LU	13	Argentina
LX	14	Luxembourg
LZ	20	Bulgaria
M1	15	San Marino
MP4	21	Bahrein I., Das I., Muscat, Oman, Qatar, Trucial Oman
OA	10	Peru
OD5	20	Lebanon
OE	15	Austria
OH	15	Finland
OHØ	15	Aland I.
OK	15	Czechoslovakia
ON	14	Belgium
OX	40	Greenland
OY	14	Faeroes I.
OZ	14	Denmark
PA, PI	14	Netherlands
PJ	9	Netherlands Antilles
PJ2M	8	Sint Maarten
PK	28	Indonesia
PX	14	Andorra
PY	11	Brazil
PYØ	11	Trinidade & Martim Vaz I., & Fernando de Noronha I.
PZ	9	Surinam (Netherlands Guiana)
SL, SM	14	Sweden
SP	15	Poland
ST	34	Sudan
SU	34	Egypt
SV	20	Crete; Greece
SV5	20	Dodecanese I.
TA	20	Turkey
TF	40	Iceland
TG	7	Guatemala
TI	7	Costa Rica
TI9	7	Cocos I.

Prefixes and Zones

Prefix	Zone	Country
TL8	36	Cent. African Rep.
TN8	36	Rep. of Congo
TR8	36	Gabon Rep.
TT8	36	Tchad Rep.
TU2	35	Ivory Coast
TY2	35	Dahomey Rep.
TZ	35	Mali Rep.
UA1, 3, 4, 6	16	European Russian Socialist Federated Soviet Rep.
UA2	16	Kaliningradsk
UA9/Ø	18, 19	Asiatic Russian S.F.S.R.
UB5	16	Ukraine
UC2	16	White Russian S.S.R.
UD6	21	Azerbaijan
UF6	21	Georgia
UG6	21	Armenia
UH8	18	Turkmen
UI8	17	Uzbek
UJ8	17	Tadzhik
UL7	17	Kazakh
UM8	17	Kirghiz
UN1	16	Karelo-Finnish Republic
UO5	16	Moldavia
UP	15	Lithuania
UQ	15	Latvia
UR	15	Estonia
VE	1, 2, 3, 4, 5	Canada
VK	29, 30	Australia
VK2	30	Lord Howe I.
VK7	30	Tasmania
VK9	28	New Guinea, Papua, Norfolk, Nauru, Christmas, & Cocos-Keeling I.
VKØ	30	Antarctica, Heard, & Macquarie I.
VO1	5	Newfoundland
VO2	2	Labrador
VP1	7	Br. Honduras
VP2	8	Anguilla; Antigua, Barbuda; Br. Virgin I.; Dominica; Granada & Dependencies; Montserrat; St. Kitts, Nevis; St. Lucia; St. Vincent & Dependencies
VP3	7	British Guiana
VP4	9	Trinidad & Tobago I.
VP5	8	Jamaica; Turks & Caicos; Cayman I.
VP6	8	Barbados
VP7	8	Bahama I.
VP8	13	Falkland I.
VP8, LU-Z	13	S. Georgia I; S. Orkney I.; S. Sandwich I.
VP8, LU-Z, CE9	13	S. Shetland I.
VP9	5	Bermuda I.
VQ1	37	Zanzibar
VQ2	36	N. Rhodesia
VQ4	37	Kenya
VQ8	39	Cargados Carajos; Chagos I.; Mauritius; Rodriguez I.
VQ9	37	Aldabra I.; Seychelles
VR1	31	Br. Phoenix I.; Gilbert, Ellice, & Ocean I.
VR2	31	Fiji I.
VR3	31	Fanning & Christmas I.
VR4	28	Solomon I.
VR5	30	Tonga I.
VR6	32	Pitcairn I.
VS1	28	Singapore
VS4	28	Sarawak
VS5	28	Brunei
VS6	24	Hong Kong
VS9	2	Aden & Socotra; Maldive I.
VS9K	2	Kamaran I.
VS9, MP4M	2	Sultanate of Muscat and Oman
VU	22	India
VU4	22	Laccadive I.
VU5	26	Andaman & Nicobar I.
W	3, 4, 5	U.S.A.
XE	6	Mexico
XE4	6	Revilla Gigedo I.
XT2	35	Rep. of Upper Volta
XU	26	Cambodia
XW8	26	Laos
XZ	26	Burma
YA	21	Afghanistan
YI	21	Iraq
YJ	32	New Hebrides
YK	20	Syria
YN	7	Nicaragua
YO	20	Rumania
YS	7	El Salvador
YU	15	Yugoslavia
YV	9	Venezuela
ZA	15	Albania
ZB1	15	Gibraltar
ZB2	15	Malta
ZC5	28	British N. Borneo
ZD1	35	Sierra Leone
ZD3	35	Gambia
ZD6	37	Nyasaland
ZD7	36	St. Helena
ZD8	36	Ascension I.
ZD9	38	Tristan da Cunha & Gough I.
ZE	38	S. Rhodesia
ZK1	32	Cook I.
ZK2	32	Niue
ZL	32	New Zealand
ZL1	32	Kermadec
ZM	32	W. Samoa
ZP	11	Paraguay
ZS	38	Rep. of South Africa
ZS2	38	Prince Edward & Marion I.
ZS3	38	Southwest Africa
ZS7	38	Swaziland
ZS8	38	Basutoland
ZS9	38	Bechuanaland
3A2	14	Monaco
3V8	33	Tunisia
3W8	26	Vietnam
4S7	22	Ceylon
4W1	21	Yemen
4X4	20	Israel
5A	34	Libya
5H3	33	Tanganyika
5N2	35	Nigeria
5R8	39	Malagasy Rep. (Madagascar)
5T5	35	Mauritania
5U7	37	Niger
5X5	37	Uganda
6O	37	Somalia Rep.
6W8	35	Senegal
7G1	35	Rep. of Guinea
9G1	35	Ghana
9K2	21	Kuwait
9M2	28	Federation of Malaya
9N1	22	Nepal
9Q5	36	Republic of the Congo
9U5	36	Ruanda, Urundi

contains 110 pages which cover the Canadian amateur situation thoroughly. Its 75 study questions covering the Amateur examination, 54 questions covering the Advanced Amateur examination, 17 questions on Canadian regulations, and nine examples of the types of diagrams asked for in the examinations form a complete study guide for the Canadian amateur tests.

Of course, you will also need a technical handbook, in order to acquire the knowledge required to answer the study questions and to master the diagrams. But with a good study guide, the job is half done. Also, local hams will be glad to help you all they can.

● **Public Service Activities.** As we have said before, not all ham radio is rag-chewing, experimenting, or chasing DX; there are many hams who are interested in the "public service" aspects of amateur radio. One form of public service is handling messages from friends and neighbors to their friends or relatives in other parts of the United States or even overseas in the service of the United States.

Imagine the thrill, for example, of picking up your telephone and delivering a message to an anxious mother announcing that her son was on his way home from Okinawa after a two-year stay. Of course, not all messages handled by amateur radio are of this type; many of them are just friendly greetings. On the other hand, in time of emergency—flood, tornado, earthquake, etc. —the messages may be of the highest importance, concerning rescue operations as well as the health and welfare of those in the disaster area.

The following is a message in the standard amateur message form:

NR. 1 W9EGQ 8 GARY, IND., JANUARY 2

MR. RICHARD ANYMAN
1415 SOUTH ST.
ROCKFORD, W. VA, PHONE AA123456

THIS IS A MESSAGE IN STANDARD AMATEUR FORM—

HERB

It contains four main parts: preamble, address, text, and signature. The preamble contains the message number, the call letters of the station originating the message, the "check" or the number of words in the text of the message, the place of origin, and the date (the time can also be included, if desired). The address should be complete and the phone number should be included if available. The text is the reason for sending the message, and the signature tells who sent it.

● **Traffic Nets.** It's possible to deliver messages "directly" to their destination by means of normal, random contacts, but most "traffic" is handled via scheduled traffic nets. There are hundreds of these nets on both phone and c.w. in all the popular ham bands.

Participating in such a net is the best way to learn how to handle messages accurately and rapidly under actual conditions. With such training, you'll be prepared to bring help if a sudden disaster should leave *you* as the only means of communication from the disaster area. Don't think it can't

Upcoming Hamfests

A chance to meet radio amateurs and possibly see ham equipment in action is afforded by the ARRL Division Conventions or "hamfests." The following conventions have been officially scheduled at the time this is being printed. Write to the addresses given for further information.

New England Division Convention
Swampscott, Mass., April 26 - 28
Eugene Hasting, W1VRK
28 Forrest Ave.
Swampscott, Mass.

West Gulf Division Convention
McAllen, Texas, June 7 - 9
Earl N. Englerth, W5LRT
1306 Whitewing Drive
McAllen, Texas

Rocky Mountain Division Convention
Albuquerque, N.M., July 5 - 7
Kenneth D. Mills, W5WZK
3813 Los Arboles, N.W.
Albuquerque, New Mexico

ARRL National Convention
Cleveland, Ohio, Oct. 4 - 6
Jack Siringer, W8AJW
2972 Clague Rd.
Cleveland 26, Ohio

Southwest Division Convention
San Diego, Calif., Oct. 11 - 13
Don G. Dearth, K6BPL
747 Armada Terrace
San Diego 6, Calif.

Electro-Voice Model 717 Noise-Cancelling Microphone $19.50 List (less normal trade discounts)

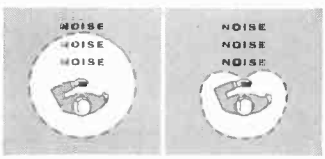
Plug a new E-V 717 into your transceiver and get up to 15 db more protection against noise pickup. Not just big noise, but every sound that reduces the effectiveness of your signal. Even the effect of poor acoustics is reduced by the 717.

How does the 717 cut down on lost messages, repeated calls and wasted time and money? It has a sound-cancelling port on the back that rejects sound arriving at the rear of the microphone. Random noise pickup is reduced up to 67%.

How does the 717 sound? Crisp, smooth and peak-free for highest efficiency and articulation. There's plenty of output for any transceiver on the market. And *no noise!* But don't take our word for it. Test the new E-V 717 on your rig today. We guarantee you'll like how you're heard. Electro-Voice, Inc., Dept. 432CH, Buchanan, Michigan

CIRCLE NO. 7 ON READER SERVICE CARD

HERE'S HOW THE 717 STOPS NOISE



Ordinary microphone pickup pattern

E-V 717 noise-cancelling pickup pattern

Electro-Voice®
SETTING NEW STANDARDS IN SOUND

happen; several hams find themselves in this situation quite unexpectedly every year.

If you would like to join a traffic net in your area, drop a note to the ARRL, 38 La Salle Rd., West Hartford 7, Conn., and request the ARRL Net Directory. It lists the names, frequencies, and operating schedules of hundreds of amateur nets.

In the United States, there are no restrictions on the types of messages that may be handled via amateur radio, except that they be in good taste and that there be no material remuneration of any kind for handling them. Internationally, however, it's strictly forbidden to handle messages of any type for third parties by amateur radio—unless special arrangements have been made between the United States and the other country to authorize that such messages be handled. (This prohibition includes "phone patches," by the way.)

● **Phone Patches.** Radio amateurs have taken advantage of the tacit approval of land-line telephone companies to "patch" ham signals to the house down the street, or to an acquaintance in the next town. This free long-distance telephone service is used primarily to boost the morale of military servicemen stationed thousands of miles from home.

Not every ham is as lucky as Lenore Conn, W6NAZ, shown here with Ralph Edwards, m.c. of the TV show "This Is Your Life." Lenore was honored for her tireless efforts in arranging phone patches between servicemen stationed in Arctic outposts and their families. This well-deserved tribute was accompanied by the gift of a complete Collins ham station. Also seen in the photo are K6DUE and W2LLZ.

As you will see below, the U.S. military services (Air Force, Army, and Navy) have a ham-affiliated radio system and frequently provide the means for a licensed ham to operate from his post. On Arctic and Antarctic expeditions, much of the burden of personal communication with the members and their families is borne by ham radio.

If a serviceman is anxious to talk to his mother or wife, he asks the military ham operator to try and contact someone close to his home and to be sure that the stateside ham has a phone patch. If a contact can be made, the ham calls the family on the telephone and electrically connects the ham rig to the telephone so that the family can talk directly to the son or husband. The ham does not charge for this service, and the telephone charges are reversed to the family. The telephone companies look the other way—feeling that communication with such distant stations would be too expensive for the family and that no revenue is actually lost to the company, and, most important, it is in the public good.

Phone patches are an important part of the active ham's life, but they must be made correctly or else there will be unintentional interference to the telephone lines. Numerous articles on phone patches have appeared in print, and there are a number of commercially available patches.

● **Military Affiliate Radio System (MARS).** The U.S. Air Force, Army, and Navy all have special programs in which licensed radio amateurs operate their stations on regular military frequencies. The purpose of the MARS programs is to acquaint hams with military operating procedures and to provide an auxiliary and emergency communications system.

Exact requirements for joining any of the MARS programs vary slightly, but the main requirement for membership is the possession of a valid amateur license, and a real interest in the MARS program. Although you can't belong to more than one MARS program at a time, there's no military obligation involved in being a MARS member.

As mentioned above, it's strictly forbidden for U.S. amateurs to handle third-party messages of any kind via ham radio with most foreign countries. But messages to U.S. servicemen and their dependents stationed in foreign countries can usually be

handled through MARS channels. The words "via MARS" are inserted in the preambles of such messages when they are transferred to the amateur bands for relay and delivery. In practice, messages are freely exchanged between the various MARS programs and the amateur traffic nets.

For further information about the MARS program of your choice, write to:

Air Force: Chief Air Force MARS
Room 1-217, Tempo "E" Bldg.
4th & Adams Dr. S.W.
Washington 25, D.C.

Army: Chief Army MARS
Room 5B960, The Pentagon
Washington 25, D.C.

Navy: Chief Navy MARS
Room 5D564, Office of Naval Communications (OP-945N),
The Pentagon
Washington 25, D.C.

● **Call-Letter License Plates.** When you receive your permanent class of amateur license—Technician, Conditional, or General Class or equivalent—you can obtain license plates for your automobile containing your call letters in place of the regular number-letter combination in any state of the union (except Kentucky, Massachusetts, and New Jersey) and in Canada. In South Dakota, in fact, even Novice licensees are eligible to obtain call-letter license plates.

Of course, to be eligible for call-letter license plates, you must actually be the owner on record of the car for which the plates are intended. (If you should happen to deal with a clerk in a branch office of your state automobile license bureau who professes to know nothing about call-letter license plates, write to the state office of the license bureau for the necessary forms.

● **Operating Other Stations.** There are two ways in which you can get into trouble while operating someone else's station. One is to visit a prospective ham who has a station (but no license) and make a few contacts using your own call-sign. The other is to visit another ham and operate his station on an amateur frequency or mode of transmission not authorized by his *station* license or your *operator* license.

The first situation is strictly illegal—no class of operator license authorizes anyone to operate an unlicensed station. In the second instance, while any ham can operate another amateur station, he can do so only under the *minimum* privileges authorized by the two licenses. For example, a Novice can operate a General Class amateur's station, but only under the Novice regulations. And when a General Class ham visits a Novice station, *he* must observe the Novice regulations.

● **Mobile and Portable Operation.** On c.w., you identify mobile or portable operation by following your station call letters by the slant bar symbol (-..-.) and the number of the call area in which you are operating. On phone, your call letters should be followed by the announcement of the geographical area in which the portable or mobile operation is taking place. For example, ". . . This is W3DEF operating mobile three miles east of Bethseda, Maryland."

Special rules govern mobile operation aboard a vessel on the high seas or an aircraft on an international flight. They require sending "/MM" or "/AM" after your call letters on c.w. and announcing "Maritime Mobile" or "Aeronautical Mobile" at the end of each phone transmission. In addition, on both phone and c.w., the name or the number of the vessel or aircraft and its approximate geographical location must be given at the conclusion of each contact.

These special rules apply only to operations on or over international waters. In the United States, mobile operation on boats and aircraft is treated just like mobile operation on land.

If you plan to operate a mobile or portable station for more than 48 hours without returning to your home address, you must give prior notice in writing to the Engineer-in-Charge of the radio district in which operation is intended.

● **Operating in Canada.** A U.S. amateur holding a Conditional or higher class license can operate a fixed, mobile, or portable station in Canada—with permission. To obtain it, write to the Telecommunications Division, Department of Transport, Ottawa, Ont., Canada, for application blanks which, when filled out, approved by the Department of Transport, and returned, constitute an "endorsement" of the U. S. license for operation

in Canada. Similarly, Canadian amateurs may write to the Secretary, Federal Communications Commission, Washington 25, D.C., for authorization to operate in the United States.

When operating in the other's country, both U.S. and Canadian amateurs are governed by the host country's amateur regulations. In addition, U.S. amateurs must notify the Engineer-in-Charge of the radio district where their fixed stations are located when they operate in Canada. (Regulations 12.90 (b) (3) and 12.91.)

● **Certificate Hunting.** The exchange of QSL cards to confirm radio communications between two hams is a commonly accepted practice of good operators. The Novice or new General Class ham (with very few exceptions) wants to swap QSL cards with every station he contacts. Those hams blessed with more luck, better equipment, or more patience quickly earn the ARRL-sponsored WAC (Worked All Continents) or the WAS (Worked All States) certificates. Fifteen years ago, hams were content to rest on these laurels, or go after comparable certificates offered by amateur radio societies in Europe, Asia, or Africa.

Within the past eight to ten years, however, the whole certificate award picture has changed. There are now approximately 400 certificate awards offered by various ham clubs in the U.S.A. Numerous other awards have also been arranged for hams working a specified number of foreign stations. Detailed information on awards can be obtained from the *Directory of Certificates and Awards* published by Clif Evans, K6BX, Box 385, Bonita, Calif.

● **Certificates Available.** Has anyone ever called you a "knucklehead"? Well, all you have to do is work five members of the Tusco Amateur Radio Club of Urichsville, Ohio, on the ten-meter band, and you can earn a certificate to prove that you are. Work another ten members and you can earn a gold star for your "knucklehead" award. Data from your log and "handles" (names) of the hams you have contacted should go to W8NCF, 110 Jay St., Urichsville, Ohio.

Want to be an "admiral"? Work members of ten different amateur radio clubs in Nebraska in a single calendar year, and the Governor of Nebraska will commission you an admiral in the "Great Nebraska Navy." Send log extracts and two five-cent stamps to Amateur Radio Clubs of Nebraska, Box 626, Omaha, Nebr.

Radio clubs in practically every state of the Union, including Alaska and Hawaii, issue simple awards of the above type. As you might guess, these awards are quite easy to obtain from your own particular state and from neighboring states. They are progressively more difficult to obtain as you move further away from "home base" (QTH).

● **Credits.** Thanks for assistance in compiling this chapter go to F.E. "Ed" Handy, W1BDI, Perry Williams, W1UED, and Ellen White, W1YYM, of the ARRL staff. Ed Neal, W4TIC, at GE, provided background material on the Edison Award. At CQ, Frank Anzalone, W1WY, and Clif Evans, K6BX, also furnished valuable data. Ex-POPULAR ELECTRONICS "staffer," Dick Flanagan, helped coordinate manuscript preparation, and is largely responsible for its format.

BUSINESS RADIO SERVICE

By ROBERT E. TALL

WITH the Citizens Radio Service demonstrating the mass need for two-way radio communications and its appeal to the general public, many thousands of people have trained their sights on the next step up the ladder—the Business Radio Service.

Many CB licensees came to depend upon the extra "arm" that radio communications gave them in their business activities. However, the growth of CB—totally unexpected by both the Federal Communications Commission and the electronics industry—was phenomenal. During peak operating hours, the 23 CB channels are now a "shambles," and the possibility of sandwiching an urgent business message in between hurried personal calls is remarkably remote.

From the standpoint of the well-established "priority" two-way mobile radio services administered by the FCC—fire, police, forestry, highway, manufacturers, motor carriers, etc.—the Business Radio Service could also be considered congested. But with seven times as many channels available as for the Citizens Radio Service, plus the possibility of higher antennas and much greater transmitter power, the Business Radio Service is the obvious solution to the crowded-channel problem for many communications users.

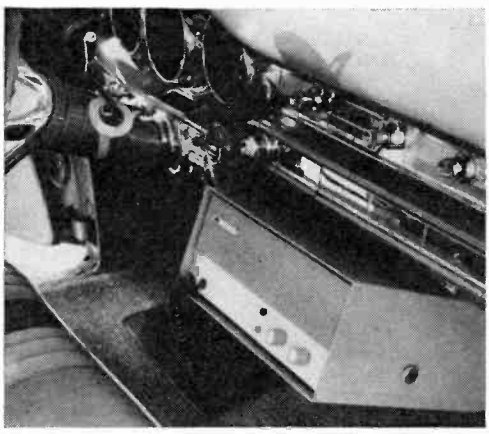
Supplementing other radio services where there are assigned frequencies for many types of commercial functions, the Business Radio Service is open to five categories:

(a) Any person engaged in a commercial activity.
(b) Educational or philanthropic institutions.
(c) Clergymen or ecclesiastical institutions.
(d) Hospitals, clinics, and medical associations.

(e) A subsidiary corporation proposing to furnish a non-profit radio communications service to its parent corporation or to another subsidiary of the same parent where the party to be served is engaged in one of the activities just listed in (a), (b), (c), and (d).

● **Licensing.** As this is being written, there are some 45,000 licenses outstanding in the Business Radio Service, and new license applications are being processed at a rate of 1400 per month. This service is available to all businessmen without restriction as to the type of message transmitted by the licensee—as long as the messages are "necessary to the accomplishment of the business activity concerned."

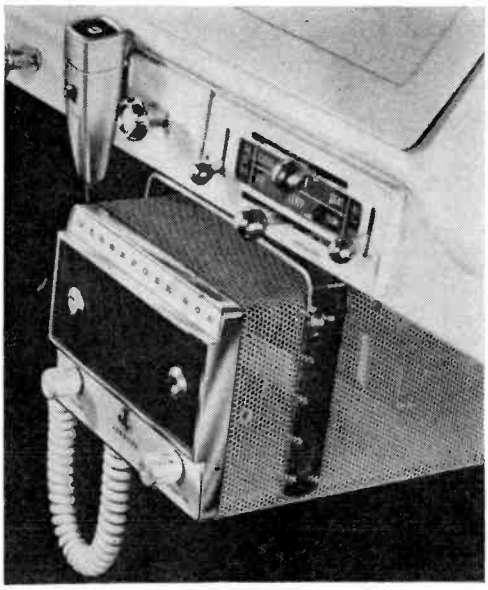
Home-built or kit-type equipment, used extensively by CB'ers, may *not* be employed in the Business Service. Equipment for both base stations and mobile stations must be on the Federal Communications Commission's list of "Radio Equipment Acceptable for Licensing." This means that the user should buy his equipment from a recognized supplier and have the supplier make the necessary technical installation.



The Kaar TR505 transceiver can be used for Class A Citizens Radio or for the Business Radio Service. This unit is one of the lower-priced sets for the 450-470 mc. band. It has a power output of about 3-35 watts and a list price in the $500.00 range.

The first step to take in moving to the Business Service is to get a copy of Volume V of the FCC Rules and Regulations, available from the U.S. Government Printing Office, Washington 25, D.C. A license may be obtained by filing FCC Form 400 in accordance with the instructions in Part 11 of Volume V. The time required to process licenses at this writing varies between six and seven weeks, depending upon the Commission's work load.

● **Comparison to CB.** The Business Radio Service is split into three distinct frequency bands. One band, in the lower VHF region, includes 33 channels strung out between 27.235 and 43.000 mc. Another band, in the higher portion of the VHF region, consists of 21 channels between 151.625 and 157.680 mc. The third Business Service band is in the ultra high frequencies and consists of 110 channels between 461 and 470 mc. shared with many other services.



Some CB equipment manufacturers are also producing transceivers for the Business Radio Service. This is the E.F. Johnson "Viking 202," suitable for BRS use between 25 and 50 mc. Sold for about $200.00, it consists of a 10-tube AM circuit.

The greater bulk of the available Business Service frequencies are authorized for a maximum power input not to exceed 180 watts. Some five channels in the 27-mc. band (adjacent to the CB channels) are restricted to 30 watts maximum input. Several isolated frequencies in the various Business Service bands are restricted to a maximum input power of 3 watts.

Frequencies Available for Business Radio

Band	Frequency (mc.)	Power Limits (watts)	Frequency (mc.)	Power Limits (watts)
LOW VHF BAND	27.235	30 (shared channel)	35.08	180
	27.245	30 (shared channel)	35.10	180
	27.255	30 (shared channel)	35.12	180
	27.265	30 (shared channel)	35.14	180
	27.275	30 (shared channel)	35.18	180
	27.39	500	35.70	500
	27.41	500	35.72	500
	27.43	180	35.88	180
	27.45	180	35.90	180
	27.47	180	35.92	180
	27.49	180	35.94	500
	27.51	3	35.96	500
	27.53	3	35.98	500
	33.14	3	42.96	180
	35.02	3	42.98	3
	35.04	180	43.00	180
	35.06	180		
HIGH VHF BAND	151.625	180	151.955	600
	151.655	180	152.300	600 (shared channel)
	151.685	180	152.360	600 (shared channel)
	151.715	180	152.420	600 (shared channel)
	151.745	180	154.540	180
	151.775	180	154.570	3
	151.805	180	154.600	3
	151.835	180	157.560	600 (shared channel)
	151.865	180	157.620	600 (shared channel)
	151.895	180	157.680	600 (shared channel)
	151.925	600		
UHF BAND	461.05 to 469.95	110 channels with various power limits; most channels shared with other services		

Business Radio Service users may transmit with either narrow-band FM or regular AM modulation. The frequency stability required of Business Radio transmitters is considerably higher than that required in the Citizens Radio Service. As might be expected, the Commission's inspectors cast a far more critical eye on Business Radio Service licensees than on CB licensees, particularly with regard to overmodulation, excessive power input, improper antenna erection, frequency instability, etc.

● **Frequency Sharing.** A common misunderstanding among new users of two-way radio communications is that a "private channel" is available to all who apply. This misunderstanding is probably a result of the fact that the frequencies for the AM, FM, and TV broadcasting services have been very carefully allocated. In all probability, however, a new user of the Business Radio Service will find it necessary to share his channel with several other users within a radius of 15-20 miles. The degree of sharing naturally varies across the country according to population. It ranges from considerable crowding (possibly 75 users per channel in Los Angeles County) to very light sharing in the open farmlands of Iowa and Nebraska.

There are several methods available to the Business Radio Service user to achieve some measure of freedom from interference. The most common is to equip the transceivers with a so-called "Selective Calling" system. Using this method, the base station can dial or otherwise signal the receiving equipment in the mobile. The mobile station will have the receiver active, but the speaker will be muted until the proper calling signal turns it on. To some extent, this system is comparable to direct telephone-style dialing.

Frequency congestion may be somewhat lessened after November 1963. On this date the FCC has decreed that all two-way radio systems in the Business Service must be using "narrow-band" transmissions. This has also been referred to as "channel-splitting" and will effectively open up many new channels to the Business Service.

● **Signal Coverage.** The Business Radio Service offers greatly expanded signal coverage not only through somewhat less crowding and more power output from the transmitter, but particularly because the antenna may be mounted at much greater

Industrial User Groups

This is a list of organizations that coordinate and promote two-way mobile radio communications in various specific areas. Membership information can be obtained directly from the addresses given below. Users are urged to investigate possible membership in these organizations as a means of protecting or furthering their use of the radio spectrum.

AAR Association of American Railroads
L. E. Kearney, Communications Engineer
59 E. Van Buren St., Chicago 5, Ill.

ANPA American Newspaper Publishers Association
Stanford Smith, General Manager
750 Third Ave., New York 17, N. Y.

API American Petroleum Institute Central Committee on Communication Facilities
E. H. Wilder, Chairman
Sun Oil Co., P. O. Box 2831, Beaumont, Tex.

ATA American Taxicab Association
Miss Emily Dayton Rockett
51 Symphony Rd., Boston 14, Mass.

ATA American Transit Association
Van Court Lucas
355 Lexington Ave., New York 17, N. Y.

ATA American Trucking Associations, Inc.
William P. Ender
1616 P St., N. W., Washington 6, D. C.

CMRU Committee on Manufacturers Radio Use
Victor G. Reis, Chairman
Bethlehem Steel Co., Room 641, Bethlehem, Pa.

EIA Electronic Industries Association Land Mobile Communications Section
William J. Weisz, Chairman
1721 De Sales St., N. W., Washington 6, D. C.

FCCA Forestry Conservation Communications Association
Ray Littlejohn, President
State Commission of Forestry, P. O. Box 357, Columbia, S. C.

FIRC Forest Industries Radio Communications
Robert W. Olin, Chairman
P. O. Box 5153, Eugene, Oregon

IMSA International Municipal Signal Association
Robert S. Jolliff, President
City Hall, Wichita Falls, Tex.

NATO National Association of Taxicab Owners
H. I. Gwilym
803 Leader Bldg., Cleveland 14, Ohio

NCUR National Committee for Utilities Radio
C. O. Diller, Chairman
Lone Star Gas Co., 301 Harwood St., Dallas, Tex.

NMRS National Mobile Radio System
A. J. Spooner, President
921 N. W. Fourth, Oklahoma City 1, Okla.

SIRSA Special Industrial Radio Service Association
Claude McDoulett, President
Halliburton Co. Engineering Department, Duncan, Okla.

heights than are permitted the CB operator. Of course, the user must abide by local building ordinances which will frequently restrict the location and height of antenna towers. Such restrictions should be inspected by your Business Radio supplier's representative before you sign a contract for the system.

Where extreme signal coverage is required, the antenna as well as the base station can be located on top of a hill, or other tall building, and remotely controlled. Arrangements can be made to accomplish this remote control through the use of a leased telephone line, or even a separate radio circuit.

● **Costs.** Transceivers for base station or mobile use in the Business Radio Service can be purchased outright, or leased from one of the major manufacturers. As this is being written, a base station with associated equipment can be made available at a lease figure of as little as $40.00 a month. Mobile stations to operate in the same system will cost the user around $8.00 a month.

It is noteworthy that several manufacturers of CB equipment are now making Business Radio Service transceivers. E. F. Johnson, one of the first such companies to enter the BRS market, is offering its Viking "Messenger 202" industrial transceiver at a price of about $200.00. This unit is FCC type-accepted to operate in the 25-50 mc. band.

Complete base station installations using the maximum rated power for a particular channel may, however, cost upwards of $2500.00. Mobile transceivers for such a system would cost $450.00 - $600.00.

● **In Closing.** Two-way radio communications for business purposes is rapidly proving to be a valuable adjunct to our commercial community. One manufacturer of equipment for the Business Radio Service points out that his customers save as much as 20% of their daily car mileage by using radio communications. Many users have reported that they can handle much more business without adding additional vehicles and drivers. Although much the same can be said for CB, the Business Radio Service also assures its users of (1) more consistent signal range, (2) more privacy, and (3) considerably less channel sharing.

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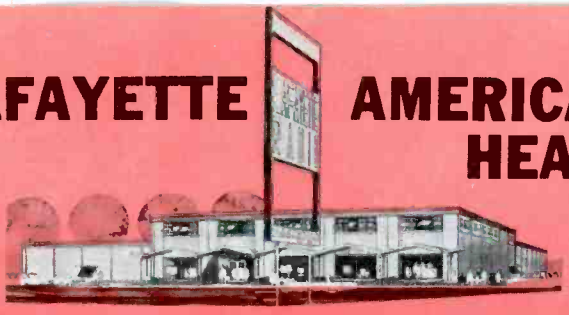

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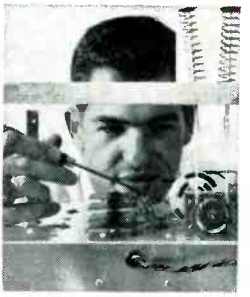

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