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1966 HANDBOOK

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SHORT-WAVE LISTENING

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All About Antennas—Making Reports
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BUSINESS RADIO

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Radio Paging—Radio Common Carrier
Advantage Over CB—Repeater Stations

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Getting Started—Getting a License
250 Clubs That Will Help with Code
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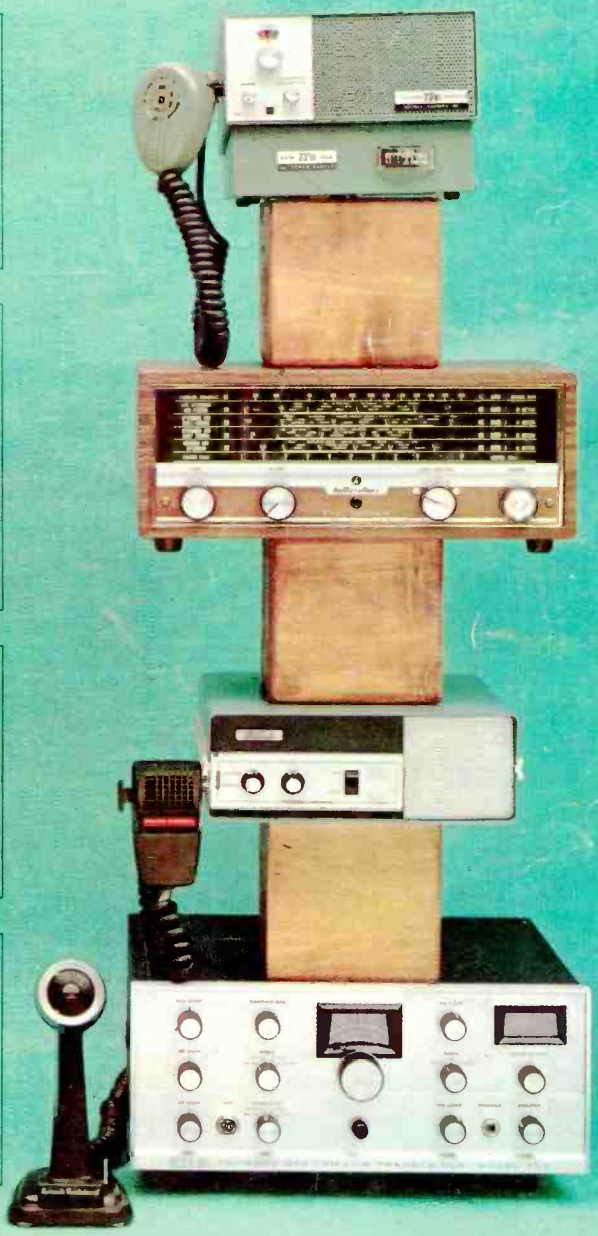

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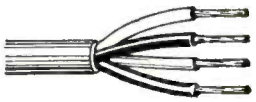

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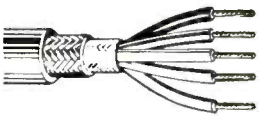

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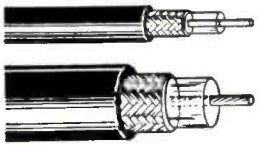

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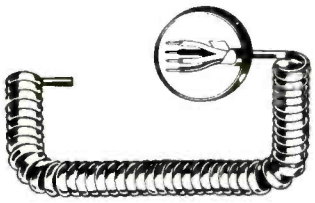

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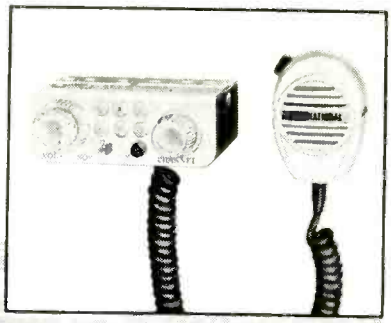

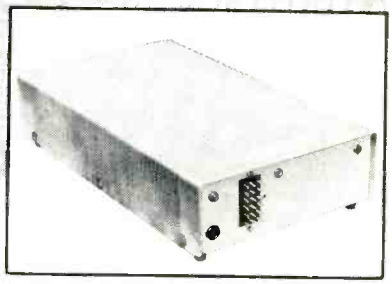

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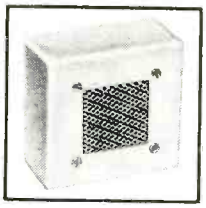

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1966 COMMUNICATIONS HANDBOOK

By

HANK BENNETT, W2PNA/WPE2FT
HERB S. BRIER, W9EGQ
MATT P. SPINELLO, KHC2060
LEO G. SANDS

PUBLISHED BY

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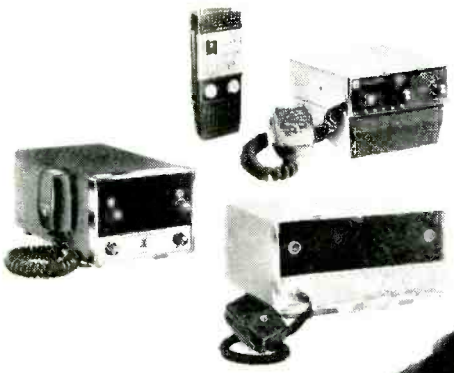

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CONTENTS

9 SHORT-WAVE LISTENING HANK BENNETT, W2PNA

Getting Started—10; Professional Communications Receivers—13; Receiver Kits—13; Onward to Ham Radio—14; Broadcast-Band DX'ing—14; Good Bets for Beginners—15; Nighttime Listening—16; Radio Signal Propagation—18; Monthly and Seasonal Variations—19; Ionospheric Storms—19; Simple Antenna Systems—20; Directive Antenna Systems—21; Indoor Antennas—21; The Short-Wave Bands—22; Frequency Allocations—23; Slogans and Interval Signals—25; Reporting and Verification—26; Time Conversion—27; Reception Details—28; Preparing Actual Report—28; Times Around the World—29; The Reporting Codes—30; Best Bets for North American SWL's—31; Tuning Ham Bands—36; Call-Sign Prefixes—37; QSL'ing Ham Stations—38; DX'ing Specialty Bands—39; Coastal Stations—40; VHF Aeronautical Band—40; Countries for DX Awards—42; SWL Clubs—44.

47 AMATEUR RADIO HERB S. BRIER, W9EGQ

Becoming a Ham—49; Types of Licenses—50; Call-Signs—51; License Fees—51; Applying for License—51; Learning Code—55; Where Amateur Radio Examinations Are Given—55; Where You Can Obtain Code or Theory Lessons—58; Learning to Send—62; Ham Bands—63; Choosing Equipment—65; First Transmitters—66; Sampler of Equipment for Ham Newcomer—69; Mobile Operation—72; Buy or Build—73; Amateur Receiver—73; Simple Antennas—77; Multiband Antennas—77; Tuning a Transmitter—79; Getting on the Air—80; Making Contacts Correctly—80; Phone Operation—80; Permissible Signals in the Ham Bands—81; International Phonetic Alphabet—82; Selected Abbreviations—82; Interpreting What You Hear—83; Giving Signal Reports—83; R-S-T Signal Reports—84; Exchanging QSL Cards—84; QSL Bureaus—86; Amateur Radio in Canada—88; Taking Canadian Tests—88; Third-Party Messages—89; Where Canadian Examinations Are Given—90; Public Service Activities—90; MARS—92; Operating in Canada—94; Certificate Hunting—94.

97 CITIZENS RADIO SERVICE MATT P. SPINELLO, KHC2060

Various Uses of CB Radio—98; CB Radio Today—99; How CB Grew—99; Rules and Regulations—100; Eligibility—100; Restrictions—100; Classes of Service—101; Specific-Purpose Channels—101; Call-Signs—102; Application Form—102; CB License—103; Form 505—103; What Equipment to Use—106; Base Station Antennas—107; Beam Antennas—108; Hybrid Antennas—109; Mobile Antennas—109; Boat Installations—112; Operating Procedure—113; "10"-Code—114; CB Clubs—118; Public Service Activities—124; CB in Canada—128; REACT—131; HELP—134.

137 BUSINESS RADIO LEO G. SANDS

Comparison to CB—137; Business Bands—138; Equipment—139; Communicating Range—139; Remote Control—139; Mobile Relay Systems—140; Selective Signaling—143; Radio Paging—143; Business Radio Definitions—144; Licensing—145; Common Carrier Services—146; Employment Opportunities—147.

149 ELECTRONICS MARKETPLACE

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CIRCLE NO. 6 ON READER SERVICE CARD

FOREWORD

SOME TIME AGO, as Chairman of the Subcommittee for the Citizens Radio Service of the National Industry Advisory Committee, I attended a meeting at the offices of the Federal Communications Commission. The Committee had been charged—by the late President John F. Kennedy—with the responsibility for developing preparedness programs involving all of the radio services during local, regional, or national emergencies.

One of the National Committee's programs sounded the death knell of CONELRAD and substituted the EMERGENCY BROADCASTING SYSTEM. Through the use of the EBS plan, the President of the United States can be "on the air" during a national emergency (from coast to coast) within five minutes of notification. Subcommittees within the Committee are working out plans to take fullest advantage of the capabilities of the other radio services (ham, CB, police, aviation, etc.).

During the discussion of certain details concerning national emergencies, it was forcefully brought to mind that practically no citizen in the United States is ever more than one mile from a communication facility. Truly, we live in a world that surrounds us with radio broadcasting. Over half a million transmitters are in use every day in the U.S.A. alone. The only way to escape radio broadcasting of some sort is to hide in a steel vault, or bury yourself in a coal mine.

The 1966 Edition of the COMMUNICATIONS HANDBOOK reflects the expansion of short-wave listening. Having passed through the doldrums of low sunspot numbers, the 11-year sunspot cycle is on the upgrade—and as the number of sunspots increase, so does the breadth of the short-wave bands. Frequencies that were dead a year ago now sound crowded as signals from the other side of the globe come pouring in. Yes, interest in SWL'ing is rapidly expanding, and we hope that those who are just getting started will find this book of vital interest.

The natural step from SWL'ing is ham radio, and the Amateur Radio Service is thoroughly covered in the second chapter of the 1966 Edition. Citizens Band Radio (in the third chapter) has not lost any of its spark, but has settled down into a very important two-way, short-range, low-cost communications service. Although some channels are crowded in certain areas, CB is still growing and the end is not in sight.

Business Radio is the second most rapidly expanding radio service, and in the 1966 Edition more space (in the fourth chapter) has been devoted to details on licensing, equipment, and usage.

The cover illustration shows (reading from top to bottom) a Squires-Sanders 23'er (CB), Hallicrafter's new "Legionnaire" (SWL), Pearce-Simpson's Model 301 (Business), and EICO's new 753 Tri-Band SSB/AM/CW rig (amateur radio).

OLIVER P. FERRELL, *Editor*

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CIRCLE NO. 10 ON READER SERVICE CARD

1

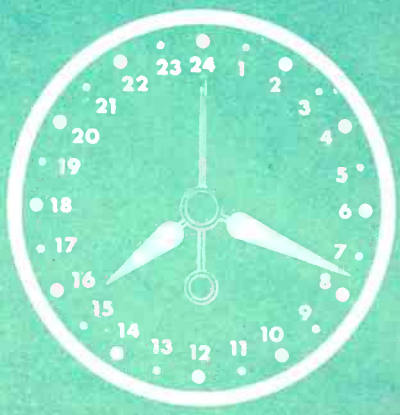
SHORT-WAVE LISTENING

By HANK BENNETT
W2PNA/WPE2FT

RADIO listening, many years ago, could best be described as a by-product of amateur radio. At the inception of radio and in the days when the early experimenters took to the air for the first time, people were intrigued at the idea of hearing a human voice come out of a maze of wires, crystals, and large tuning capacitors. Of course, in those days, receiving equipment left a good deal to be desired. A person who really wanted to be the hit of the neighborhood constructed a galena crystal set. This was usually little more than an oatmeal box with a hundred turns of cotton-covered wire wrapped around it, a crystal, a cat's whisker, and a pair of earphones. When the cat's whisker hit the right spot on the crystal, a local station just might come in. Other basic components included a long wire antenna and a water pipe ground. And for every station that was on the air, whether it was a broadcasting station, an amateur station, or one of those "wireless stations" that non-believers spoke of in hushed tones, there were many people building equipment and tuning in.

Today we have complex equipment, both for broadcasting and receiving. Gone are the days of the crystal sets and the single-tube receiver. Now you can push a button to activate a 100,000-watt broadcast station. A listener merely snaps a switch, turns up the volume, and listens to his favorite program.

The Armed Services learned during World War II that the shortwave listener (commonly called SWL) had some knowledge of radio theory and/or Morse code at the time of his induction. Those qualifying were



pressed into immediate service for monitoring, and others attended service schools to further their radio education. Since that time the SWL has become invaluable. Numerous distress calls have been picked up by SWL's and relayed by telephone to appropriate authorities. Short-wave listeners often work in conjunction with the Weather Bureau, thus performing a service to their local communities. Frequently on hand at the annual American Radio Relay League Field Day outings, SWL's assist at nearly everything from erection of antennas, to maintainence of generators, to serving as cook or logbook keeper.

Educational authorities now recognize the potential value of the SWL and have set up listening posts or amateur stations (or both) in high schools for use either in an elective course or as part of a hobby program. Many SWL's have been hired by broadcast stations for part-time work as news announcers or disc jockeys. Numerous others are taken on by electronics manufacturers as stock men or junior technicians and, in some cases, the employers foot the bill for additional schooling.

But best of all, the SWL is now able to tune in foreign broadcasts, very likely in a better fashion than the licensed amateur radio operator. The SWL has equipment ranging from a small portable transistorized radio to a setup that takes second place to none. (This writer was recently informed by one manufacturer that the majority of his highest priced receivers are purchased by short-wave listeners!) The SWL also has an antenna-ground system that will do a commendable job, even though it may not be tuned electrically as perfectly as that of the ham operator.

Yes, the SWL of today is a semi-professional in his own right. He is looked upon by his friends as something special, by his community as a definite asset, by future employers as a potential electronics technician. No longer is the short-wave listener merely a by-product of another hobby. He is a member of one of the largest and fastest-growing hobbies in the world.

Read on—and we'll try to show you how you, too, can become a short-wave listener. But before doing so, we should point out in passing 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.

● **Getting Started.** In the United States you need no previous experience, no federal or state license, and no one's official sanction to become a "radio spectrum monitor"—or "SWL." Incidentally, although this abbreviation once applied solely to someone who was a "short-wave listener" in the strictest sense of the word, the term SWL now means anyone who monitors the air waves—whether they be short waves, medium waves, or even long waves. A variant of SWL is "DX'er," which once generally referred to a person who preferred to tune in the distant stations. Nowadays, a DX'er is regarded as someone who has considerable experience in the hobby and who has the patience, the ability, and the overall know-how to tune in not only the distant stations, but those which are not generally heard by the average person.

Nearly 200 hours of broadcasting originate in the studios of Radio New York Worldwide. One of the studio control rooms is shown at the right and the news room at the left. Transmitters of Radio New York Worldwide are at Scituate, Mass. Beam antennas are aimed at audiences in Europe, Africa, and Latin America.

There are also *specialty* listeners. A "Utilities DX'er," for example, is someone who listens particularly for distant stations on the "off-beat" short-wave frequencies. In this category are included aero, ship-to-shore, point-to-point, police and forest fire stations, and many others, which operate on the VHF or short-wave channels located in between the standard short-wave broadcasting bands. Other specialized listeners include those who do all of their listening on the FM channels, the standard broadcast band, TV channels, or the amateur bands.

When you first start to "listen," you may not hear much, perhaps only a station or two outside of your local area. On the other hand, you might just be lucky enough to hear something that can be called real DX. You might even get the urge to travel if you were to hear a weather forecast calling for "clear and warm tonight, fair and mild tomorrow with a high of 78 degrees"—especially if you were snowbound in Buffalo. Assuming that you did take that trip to warmer climes, wouldn't you be pleased to be able to pull in one of your home-area stations?

With a little effort, you should be able to tune in the famous "Big Ben" clock chimes from London, or the haunting call of the kookaburra bird which is one of the trademarks of *Radio Australia*. Or how would you like to listen to setting-up exercises, complete with musical accompaniment and commercial advertisements for products of which you have never heard—at a time when you should be asleep? This would signify a transmission from South Africa. Some SWL's report that they have tuned in on short-wave stations in revolt-ridden areas where there is shooting going on nearby—they can hear the rifle fire!

Actually, from the comfort of your living room 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.

● **Reporting Your "Finds."** One of the primary purposes of SWL'ing is to keep broadcasting stations informed as to how good a job they are doing. Some short-wave stations have paid monitors in various countries but most depend on freely given listeners' reports. Such reception reports may range from a few words to a lengthy discussion of a transmission.

Many SWL's report their short-wave "adventures" to POPULAR ELECTRONICS' "Short-Wave Listening," which appears monthly and depends almost entirely on letters from listeners for the material that is carried in the column. Of primary interest is the relaying of information on new stations and of frequency and/or schedule changes.

The veteran DX'er 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, as mentioned before) 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 minutes 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 reports of others in the 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 receiving radio waves.

Keep in mind, however, if you are all set to go out and buy a special receiver, that you will *not* find a set capable of tuning all of the radio frequencies for a couple of dollars. For approximately $15 up to around $30 or so, you *can* get a transistor radio complete with earphone and a pull-out antenna that will give you a start on your new hobby.

● **Transistor Portables.** These receivers have a narrow dial spread which may make it 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 AM broadcast band to distinguish it from other frequency ranges in the long-wave and short-wave areas. It is also called the

Various international short-wave broadcasting stations mail advance program guides to American audiences. Pictured above are a few of the attractive pamphlets presently being distributed. Listeners can usually be put on a program mailing list by sending in a detailed reception report to the broadcasting station.

"medium-wave" band because it lies between the long waves and the short waves.

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. There are many stations operating in that band, especially between 2200 and 2300, 3200 and 3500, and 4700 and 5200 kc., but they are all located in the tropical regions of the world and many of them are relatively low-powered. They broadcast specifically to their own areas and none of them is beamed to North America. (The only exception is the transmission from London to North America at about 1800-2200 EST on 3952.5 kilocycles and even this is seasonal and dependent on ionospheric conditions.) All is not lost, however, for there are many ship-to-shore stations operating between 2100 and 2600 kilocyles as well as the 75- and 80-meter amateur bands which go from 3500 to 4000 kilocycles. The National Bureau of Standards operates WWV on

5000 kilocycles and, for code enthusiasts, there are countless numbers of stations to be heard including amateurs, government, coastal and point-to-point stations.

Those who select a receiver with the second band in the 5 to 12 megacycle range will be able to hear the 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 the latter portables by their collapsible dual whip antennas.

● **Console Radios.** This type of receiver has largely disappeared from the scene. Nevertheless, you can often pick up a console in working condition for less than ten dollars in such places as the Salvation Army or Goodwill Industries outlet stores, church rummage sales, or even though the classified advertisements in your local newspaper. These sets often were made to cover a short-wave band as well as the AM broadcasting band.

● **Table Models.** For a slightly higher investment, perhaps on the order of $20 up to $50, you can find a number of good table model receivers. You can get one from your favorite mail-order supplier or from a nearby appliance or department store.

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 AM 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 any foreign stations.

● **More Elaborate Sets.** Shopping further, you'll find some good-to-excellent receivers in the price range between $75 and $125. 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, and the dial spread will be broader. 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.

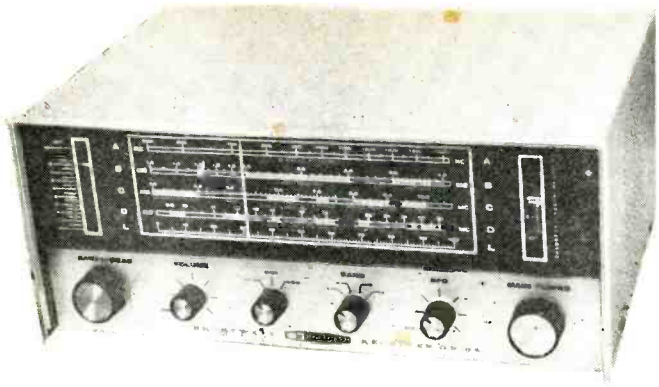
● **Professional Communications Receivers.** If you have tried out short-wave listening and find that you enjoy it, you will probably start thinking in terms of professional communications equipment. Such receivers are handled by radio parts distributors and stores specializing in amateur radio gear. Most electronics 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. A few 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. Some of the better known firms making communications equipment include: Allied Radio, Hallicrafters, Hammarlund, Heath, Lafayette Radio Electronics, and National. There are others as well, but those named will give you some idea of the companies in the field. Also, scan POPULAR ELECTRONICS for ads and editorial material on receivers.

You will find that communications receivers are an entirely different breed as 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 models similar to the big sets. You can buy a communications-type receiver for as little as $100 and, if you are technically inclined and think you can put a receiver together from a collection of parts, you can have one 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 to $40. Slightly more advanced kits start at $60 and run as high as



The Heathkit Model GR-64 short-wave receiver kit is sold for $37.95. Tuning from 550 kc. to 30 mc., this receiver covers all of the broadcast and short-wave spectrum. Construction is simplified through the use of printed circuit boards and carefully detailed wiring instructions.

$110. 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 to $75 *more*. One manufacturer offers a partially assembled kit for about $75; the most difficult circuitry is pre-assembled.

Heath Company, Allied Radio, and Lafayette Radio Electronics all manufacture receivers in kit form. The kits come complete with parts, assembly diagrams, and step-by-step instructions on how to put the units together.

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

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'ing 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 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 sometimes more "critical" than that used by the SWL. The ham may spend up to $500 or more 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.

On the other hand the SWL may, if he is so inclined, invest a great deal of money in a really super, all-purpose, general-coverage unit. Such an instrument is the new National HRO-500. This receiver has no less than 60 tuning ranges of 500 kc. each and the overall frequency coverage is from 5 to 30,000 kc. (.005 to 30 mc.). It sells for $1295.00!

● **Broadcast-Band DX'ing.** DX'ing on the standard broadcast band can be as exciting as listening to 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 radiated power of stations on the standard broadcast band has to be far greater for the signal to travel the same distance. However, with careful tuning, you may be able to log a number of low-powered stations on the broadcast band at amazingly long distances.

The standard AM 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. There are numerous stations in Latin America and South America that operate on so-called split frequencies, that is, on channels in between those of North America and Europe. Thus, it stands to reason that some of the larger European and Central and South American stations might just happen to come through between the North American channels.

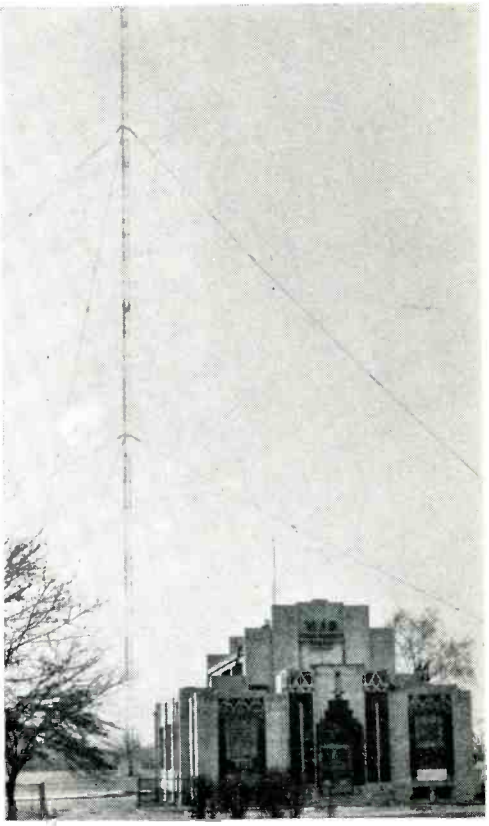
Of course, we don't believe that you'll be able to sit down and tune between 840 and 850 kc. and pick up Rome on 845 kc. just like that, but we are saying that the possibility exists. You must have the patience to tune for it night after night, perhaps weeks on end, before you will be fortunate enough 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 one hour before local sunset to perhaps three hours after sunset in your area. Another time to try to catch them is from about 2 to 4 a.m., EST; during these hours many of the American stations are off the air while the Europeans have already begun operations for a new day. After 4 a.m., the signals will gradually drop to the very weak levels reached during daylight hours. Keep in mind that when it is 2 a.m. on the East Coast it is 7 a.m. in London. 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 Coast'ers may tune in Honolulu, Alaska, even Japan and South Pacific areas. With a selective, sensitive 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 broadcast-band 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 PJB, *Trans World Radio,* operating on 800 kilocycles. This station relays many programs from *Radio Nederland* and operates with the tremendous power of 525,000 watts! Reports from many West Coast DX'ers also indicate good reception of this station at times. It carries an English-language newscast around 8:30 p.m. EST, with English continuing until 10 p.m. You'll be able to hear the well-known *Radio Nederland* personality, Eddie Startz, with his world-famous "Happy Station Program" on Sunday evenings from 7:40 to 8:30 p.m. Station PJB is considered a good DX catch, in spite of the high power, for it is located on the island of Bonaire in the Netherland Antilles, some 35 miles off the north coast of South America.

Another fairly easy catch is *Radio Americas,* operating on 1165 kc. This station, which beams anti-Castro programs to Cuba, mostly in Spanish, is located on Swan Island in the Caribbean Sea and is most often noted after dark. Careful tuning will enable you to hear the familiar *Radio Americas* identification. If you can locate



Station WJR, one of the best and most frequently heard BCB stations, gets its start from this building and antenna. WJR operates on 760 kc. with 50 kw.

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*.

If you should be fortunate enough to hear a French-speaking station on 1035 kc., it most likely will be 4VEH, Cape Haitien, Haiti; it operates until mid-evening with programs mostly in French and/or Creole although there are some English programs. Another station, on 834 kc., will be from Belize, British Honduras; there is usually a *Voice of America* newscast at 9 p.m. EST. *Radio Victoria* is being reported at times on 905 kc., where it is best noted during evening hours; this 10,000-watt station is located in Aruba, Netherland Antilles.

● **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 business. Let the "C" in the call letters be your clue as to the true location of the station. Listeners within the primary service area of CKLW (around Detroit) very likely will be unable to hear PJB, Bonaire.

Another Canadian station that can be picked up fairly well, at least in eastern areas, is CBA on 1070 kc. This 50,000-watt station is located in Sackville, New Brunswick, but the location of the station is virtually always given as "CBA, Maritimes" to indicate that its primary service area is that of the maritime provinces of Canada.

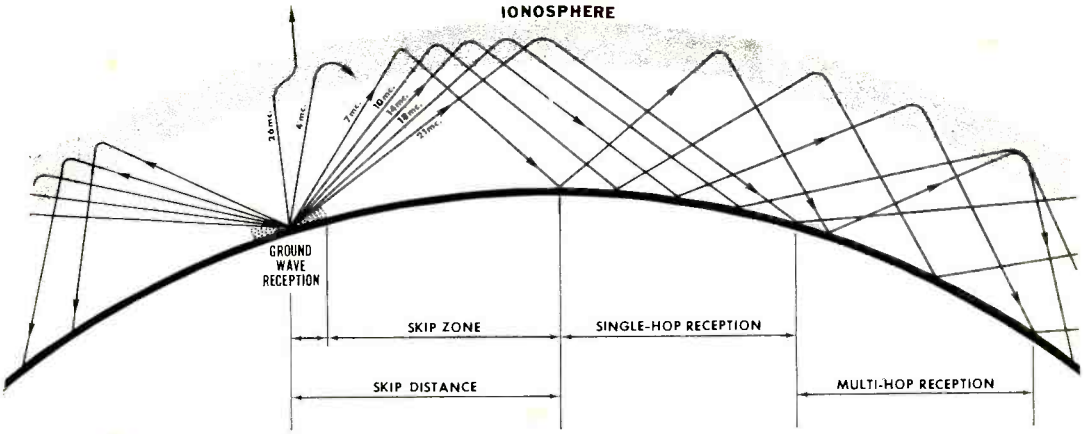
You may be more interested in hearing at least one station from each of the 50 states than a number of stations all from one area. We agree that you'll find this no easy task. Hawaii, for example, might be a rough one to log. We suggest that you try for: KORL, 650 kc.; KULA, 690 kc., KGU, 760 kc.; or KAHU, 940 kc. They are all rated at 10,000 watts. Look for them just before sunrise in your area. For Alaska, you might listen for KFAR, 660 kc., KFQD, 730 kc., or KFRB, 900 kc., also rated at 10,000 watts. Some DX'ers 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 find it equally rough to log Delaware, Vermont, New Hampshire, and South Carolina, to name a few.

West Coast DX'ers might try for either of the two 1,000,000 watt-stations located in the Pacific. One is in the Philippines and broadcasts to China and Southeast Asia on 1140 kc., while the other, on Okinawa, is beamed to East Asia on 1178 kc. Two additional *Voice of America* stations which have been heard by many are beamed to the Caribbean from Marathon (1180 kc.) and Sugar Loaf (1040 kc.), both in Florida. As with most of the stations that we have mentioned here, there are tricks to logging them and the basic one is to tune for them during periods of darkness.

Experienced listeners are reporting reception of the stations listed below. Most of these reports come from listeners in Eastern areas, although some are being received from the West Coast. Try for these stations from sunset (local time) to mid-evening. The Europeans may also be found from about midnight until 3 a.m. EST. The following stations are listed by frequency in kilocycles:

540	XEWA, San Luis Potosi, Mexico
584	Madrid, Spain
644	St. John's, Antigua
647	London, England
655	YSS, San Salvador, El Salvador
660	2YC, Wellington, New Zealand
700	HCJB, Quito, Ecuador
746	Hilversum, Netherlands
764	Sottens, Switzerland
764	Dakar, Senegal
782	Mirimar, Portugal
795	Black Rock, Barbadoes
818	Cairo, Egypt
836	Nancy, France
840	Castries, St. Lucia
845	Rome, Italy
880	1YC, Auckland, New Zealand
944	Toulouse, France
1015	YSC, San Salvador, El Salvador
1043	Dresden, East Germany
1050	XEG. Monterrey, Mexico
1120	TGRR, Guatemala City, Guatemala
1160	Strasbourg, France
1196	Voice of America, Munich, Germany
1235	ZBM1, Hamilton, Bermuda
1286	Johannesburg, South Africa
1358	Ibadan, Nigeria
1375	St. Pierre & Miquelon
1466	3AM2, Monte Carlo, Monaco
1500	Fort-de-France, Martinique
1540	ZNS, Nassau, Bahamas

● **Nighttime Listening.** If you happen to live in an area where AM broadcast-band "all-nighters" are common, you may as



The conditions portrayed in the simplified drawing above are those found on a typical winter morning. A high frequency (such as 26 mc.) is not reflected back to earth but passes out through the top of the ionosphere. A low frequency (such as 4 mc.) is reflected but, because of the ionic density, much of the signal is absorbed before it can emerge from the ionosphere. Frequencies between 7 and 21 mc. are reflected at different angles because, for a given amount of ionic density, the higher frequencies must travel further in the ionosphere before being reflected back to earth. The highest frequency that can be propagated depends not only upon the ionic density, but also upon the angle at which the high-frequency wave front strikes the ionosphere. Since the earth is curved, this angle may be impossible to attain: as shown here, the useful reflection frequency spectrum is between 7 and 21 mc. Note how the "skip zone" is created, and how receivers in the multiple-hop reception zone may be able to pick up signals arriving from a variety of single, double, and triple hops, depending upon frequency.

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 and perhaps come up with a station a 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. 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 performing tests of some sort, perhaps a frequency measurement test for the Federal Communications Commission, but an identification will definitely be given before the station closes down.

● **The Skip Effect.** Why are some stations heard at loud volume while others, even though they may be considerably stronger in power, may not be heard as well? Let's take, for example, two stations on the standard AM band. One may be only a few miles away and be rated at 250 watts while the other may be 100 miles away but rated at 50,000 watts. The small station is designed to serve its immediate local area. If you are within that small area you will hear the station with a reasonably good signal. The larger station is designed to serve a territory ranging in size from a portion of a state to perhaps several states. The high power of this station enables it to cover the area with relatively good signal strength all the time.

But what happens when several high-powered stations separated by hundreds of miles operate simultaneously on the same frequency. In order to minimize interference and to "protect" each other's territories, the stations will employ directional antennas. Signals will be concentrated away from the other high-powered stations. One example of this can be found in areas north and south of New York City. A 50,000-watt station serving New York City can rarely be heard at a point 100 miles south of the transmitter; but on the northward side it can be tuned easily, during daytime hours

as well as after dark, for 300 miles or farther. This is done, particularly during the nighttime hours, for the express purpose of protecting the service areas covered by a station in Mexico. Another example is on 1220 kc. where a midwestern station has to beam its signal *northward* (into Canada!) in order to protect the service area of another powerful Mexican station.

On the short-wave bands, this practice of "protecting" is virtually unknown. High-powered stations behind the Iron Curtain, for instance, will fight it out, watt for watt and decibel for decibel, with equally high-powered stations in free countries. This forces the short-wave listener to use every trick known to separate the signals into readable transmissions.

The signal of a low-powered station travels much farther on a short-wave band than it could on the AM band. This simple but truthful statement will help to explain why stations many thousands of miles away can be heard when there are good receiving conditions. For example, a small short-wave station (500 watts) in Port Stanley, Falkland Islands, has been in operation for a number of years for the benefit of persons living in that far-off land at the bottom of South America. It has been heard and verified by DX'ers in North America.

On the short-wave bands (above 6000 kc.), you may be able to hear a 50,000-watt station from a point that is 5000 miles away. But you will not be able to hear a *Voice of America* station that might be as near as 100 miles and radiating twice the power. Why not? Short-wave stations depend on the phenomenon known as "skip" to carry their signals over great distances. The signal of the station that is 5000 miles away has traveled far into the upper heavens and come back to earth in the manner of a great arc; the nearby station's signal is doing the same thing but because of the closeness of the station you won't hear it. The signal from the nearby station is arcing high over your location and landing a thousand miles away from you.

● **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 was thought 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 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 low-density atmosphere that is 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 is emitted by the sun. With more radiation impinging upon the ionosphere, the maximum frequency that can be reflected increases from between 15-20 mc. to 40-45 mc.

At the minimum of sunspot activity, the higher frequencies (17,000 to 25,000 kc.) are not used for general short-wave broadcasting as much as the lower frequencies (6000 to 15,000 kc.). The lower frequencies are more dependable for day-to-day broadcasting on a regular basis although interference is sharply increased since a large number of stations operate on fewer channels.

● **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.

Eddie Startz is one of the real veterans in short-wave broadcasting. His cheery voice and manner have been identified with Radio Nederland (PCJ were the call letters years ago) for over 34 years. Eddie is still going and his English-language broadcasts—"The Happy Station Program"—are on Sundays.

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 reflect 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 find that the higher radio frequencies in the short-wave band go dead after local sunset. This is not true, however, of the normal short-range communications maintained by utility and commercial stations (police, trucking, taxi, railroad, etc.); these stations, while utilizing very high frequencies (VHF), do not have to transmit over great distances. The listener 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 Maryland, Missouri, Utah, or Colorado.

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

● **What About Antennas?** The average person 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 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 want to receive), the corresponding antenna for a frequency of 144,000 kc. (the two-meter amateur band) need be only about 39 inches long.

When transmitting, an antenna cut to any specified length is good only for the exact frequency (or the 3rd harmonic) to which it is tuned. On "receive," 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 portable 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 multiband variety, have a telescoping antenna which can be pulled out to increase set sensitivity.

Table model a.c.-d.c. sets are almost always equipped with a built-in loop antenna; only 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.

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.

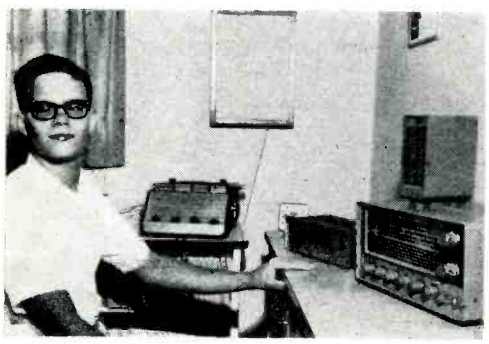
Communications receivers, on the other hand, *must* have an external antenna. These professional receivers are virtually useless without one. Here again, a random length of wire will give you *some* reception. But for really good reception, and a chance at distant stations, you should have an outdoor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

● **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 the antenna lead-in enters the house 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 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 con-



POPULAR ELECTRONICS has issued the identification WPE4IAX to Steve Kennedy, Sarasota, Fla. Details on the WPE Monitor Registration program are given near the end of this chapter. Steve is now under way collecting veries using a Lafayette KT-340 receiver and a Pilot "Mark IV" FM tuner.

sist of three terminals. Where a single wire is used—such as the 50′-75′ wire discussed on the preceding page—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 signal ground terminal will have the letter "G."

For about $15, the SWL can purchase a special dipole (one length of wire divided into two sections) 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 a coax cable or 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.

For about one dollar more, the SWL can purchase a dipole antenna kit that will cover the amateur bands from 80 to 10 meters. This antenna has an overall length of 69 feet and one inch. For additional information, write to Hank Bennett, P.O. Box 333, Cherry Hill, N. J. 08034, and ask for a copy of the dipole antenna leaflet. Please enclose return postage with your request for the leaflet.

● **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.

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.

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 end 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.

Generally speaking, the most popular and probably the easiest indoor antenna to install is the type that is made from bell wire or ordinary radio hookup wire and fastened with tape around the baseboard of a room or, perhaps, around the ceiling edges. In all-steel buildings, however, this procedure will do little to really improve reception and it will probably pick up much of the noise caused by electrical disturbances within the building. As a last resort, a random length of wire hanging from a window, outside of the building,

Dave Lund, WPEØAUO, is employed in the news department of Station KSCJ. With his Hallicrafters SX-99 receiver, Dave has worked 150 countries.

will considerably improve reception. But be sure that your hotel or apartment building does not have rules that firmly state that you cannot have even this type of antenna.

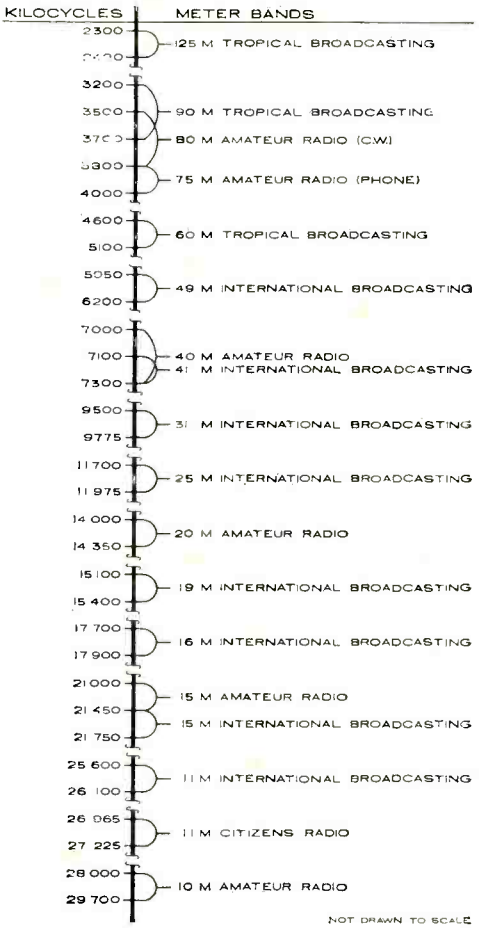
● **Shielded Lead-In.** Outside antennas, too, can pick up many neighborhood electrical disturbances. To overcome a portion of the problem, at least with an outside antenna, you should consider using a shielded lead-in. That portion of the antenna that runs from the antenna proper to the receiver should be made from shielded or coaxial cable which is readily available at your radio parts distributor. This cable has a wire running through the center, over which is placed a layer of insulation and a layer of shielded braid, which will usually have another covering of insulation. The center wire should go from the antenna to your receiver; the shielded braid should be grounded to the receiver. This will help to eliminate many local electrical noises although it probably won't filter all of them out.

● **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 universally 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 racket like that?

The short-wave bands are quite narrow and there are literally hundreds of stations in each band—all fighting to be heard. *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 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 other 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



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.

try again the next day at the same time when the signal may be stronger.

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.

Listen carefully to the announcements given by a station for they may provide a clue as to the operating habits of the staton. Program previews (future schedules) are broadcast 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 the short-wave broadcast bands. 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 Broadcast Stations.** Although 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 AM 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.

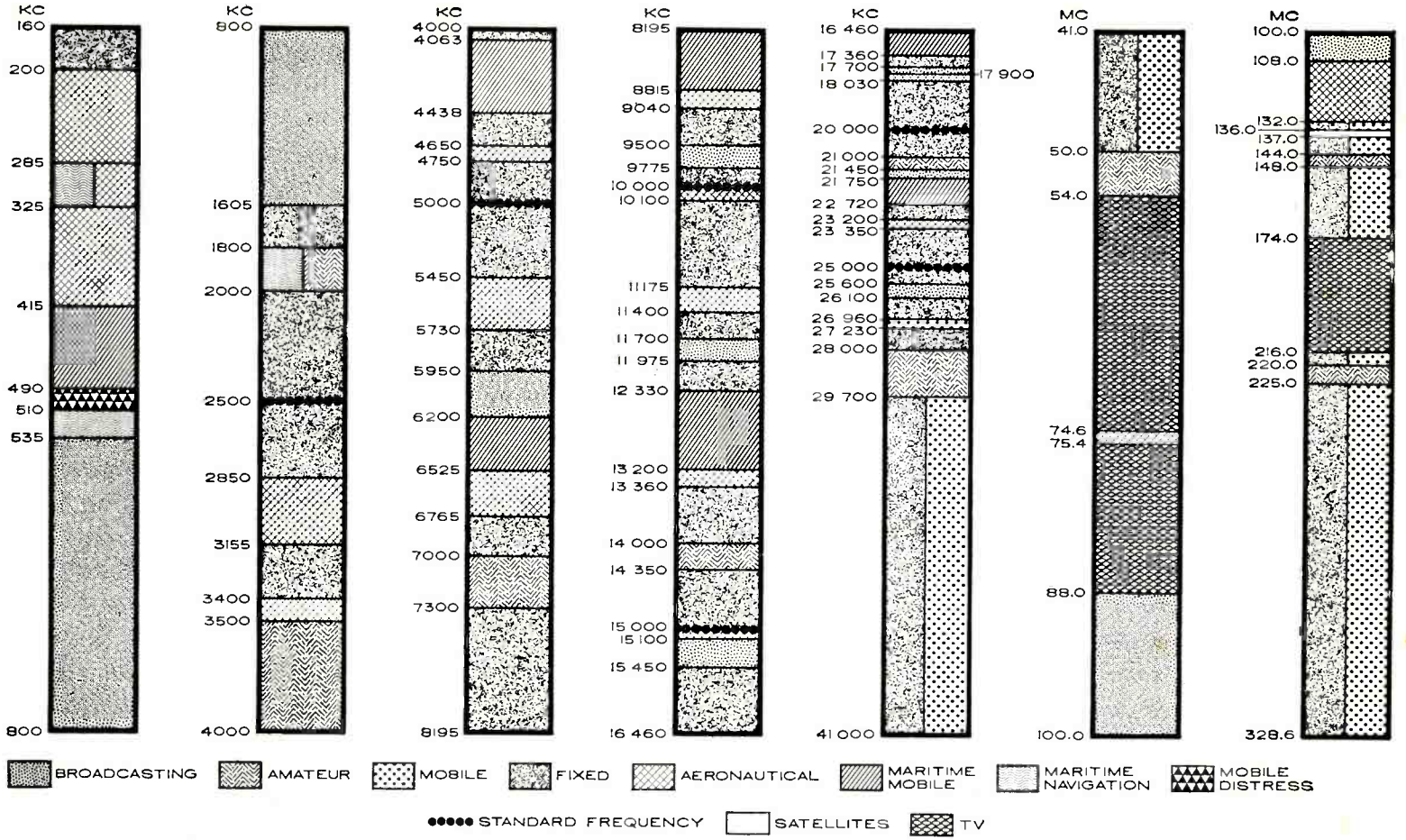
Another great difference is in the schedules of short-wave stations. The American broadcast-band stations generally fit into one of three categories: daytime only, day and some evening, and 24-hour operation. Short-wave stations may operate for only short periods at any one time. For instance, transmissions from *Radio Vatican* rarely exceed 45 minutes in length, while *Radio Moscow*'s transmissions may run continuously for six hours or more. Many stations in Latin and South America operate as short-wave relay stations for broadcast-band stations and usually follow the same schedule as that of the parent station.

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 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.

As noted before, the short-wave bands are narrow and there are a great many 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. The exceptions are many stations in Latin America that 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 given on page 24. 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.

● **Non-English-Speaking Stations.** We've often had complaints from SWL's whose only language is English that it is rough 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 that you can use, however, and some of them may well pay off in new countries logged.



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.)

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, 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 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 Paree."

● **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.

An almost foolproof way to identify a station when you do not understand the language being used is by means of the "interval" signals. An interval signal is a sound or series of sounds broadcast to fill the gap in air time between programs or to fill in for several moments prior to the actual start of a new broadcast. Interval signals vary from the song of a nightingale to a rather monotonous several-noted musical signal. Rome, for instance, is the station that uses the call of the nightingale. "Talking drums" can be heard from Abidjan, Ivory Coast. Australia may use a version of "Waltzing Matilda" played on a music box, the chimes of the Elizabeth Street Post Office, or the reproduction of the notes of the kookaburra bird. Cairo's interval signal is the playing of camel bells, while that of *Radio Indonesia* is a tune which is played on a Hammond organ. *Radio Canada* plays the first four notes of "O Canada," their national anthem, while *Radio Netherlands* gives a portion of an old Dutch folk song entitled "Merk toch hoe sterck" played on a carillon or celeste. From Freetown, Sierra Leone, you will hear a military band play "The Rain Is Coming," and if you are lucky enough to tune in the Malagasy Republic you will hear "O . . .Raketaka" played on a valiha, which is a typical Malgache instrument made of bamboo, the detached fibres being used as strings.

A clandestine station, location unknown but possibly in Iran, features a recording of "Kiss Me Honey" for the opening and closing interval signals as well as for the entire program. There is not a single spoken word to be heard from this station; it is used to jam another clandestine station. You may be able to hear the "Kiss Me Honey" station around 11,700 kc. during the time period from about 1:00 to 1:50 p.m. EST but you will have to tune sharply and listen carefully for it.

A few of the more popularly reported interval signals are shown below and may help the newcomer to the hobby to more readily identify some of his first catches.

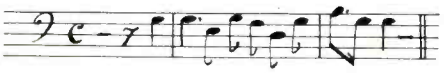
"This is Sofia, Bulgaria calling." The interval signal is the beginning of a Bulgarian song which starts with the words "Dear Homeland."

The foreign service of Radio Moscow plays this tune:

Radio Luxembourg has a piano rendition of a portion of a Luxembourgian popular song.

The shortest musical interval signal that we've been able to locate to date is one used by *Radio Angola,* CR6RZ, Luanda, Angola, on 4955 kc.

"This is *Radio Deutsche Welle,* the Voice of Germany." The motif is from "Fidelio" by Beethoven and is played on a celeste.



"This is *Radio Ghana.*" The interval signal consists of the first few notes of the national anthem, played on a guitar.

The Far East Broadcasting Corporation, Manila, Philippines, plays a portion of the hymn "Jesus Saves" on a vibraharp.

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 1966 *World Radio TV Handbook*—complete with a portion of the musical score in many cases.

● **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 cards or verifications.

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 either category (1) or (2), 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. However, if conditions warrant, long 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 contiguous 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 résumé 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.

● **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 are scattered throughout the world, it has become 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° change 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 generally understood and accepted 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 trans-

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.

mission 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 27 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 29 shows the difference between local time in various countries and Universal or Greenwich Mean Time. When known, Daylight Saving Time has been indicated. Some SWL's may prefer an electric clock with either a 24-hour system or separate rotating face to quickly identify the time anywhere in the world.

● **Reception Details.** You should provide a signal 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 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.

In your report, you might include a brief

In good taste for the SWL is a card featuring his POPULAR ELECTRONICS WPE identification (see page 41). You can get these cards in a wide variety of colors and designs from QSL card printers.

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

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 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.

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	

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.

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.

● **Tape-Recorded Reports.** In recent years tape-recorded reports have proven to be very effective in obtaining QSL's. The stations receiving them are able to accurately judge just how their signals are being received. It is a method of reporting that undoubtedly is far superior to the more conventional written report provided that the listener records the transmission *exactly as it is being received.*

When recording, do not change any of the receiver settings regardless of how the signal may be received unless the volume rises to the point where overload to your recorder might occur. The station is keenly interested in knowing how their signal strength and readability varies over a period of time, how their signal is affected by other stations or by electrical disturbances.

Here's the QSL card of the Voice of Nigeria, Lagos. This station operates on 11,900 and 15,255 kc.

The report should be as long as possible; reports on tape of less than 10 minutes are of little value. We suggest that you try to get a 20-minute recording as a bare minimum. Leave sufficient "leader" tape on both ends of the tape. Should you record the transmissions from the same station on two separate days, use one track of the tape for one day and the second track for the second transmission.

Should you find that you have reason to speak on the tape, do so only after you have completed the actual recording. Also, in taping your report, be sure to run your recorder at either standard speed: 3¾ or 7½ inches per second.

A written note should accompany the tape giving your name, address, date and time of recording (indicate both the starting and completion time as well as the time zone that you are using), the speed of the recording, the make and model of your receiver and recorder, the antenna, and a courteous request that the station consider your recording for verification purposes.

Do not haphazardly send taped reports to just any station; some of them will not even want them. The stations that are known to accept taped reports are Rome, Wellington (N.Z.), Tokyo, Moscow, HCJB (Ecuador), XEWW (Mexico), LRA32 (Argentina), Madrid, Delhi, Montreal, Vatican City, Berne, and some others. Many of these stations have made requests for such tapes.

When sending taped reports, keep in mind that it costs more to send a roll of tape through the mail than it does a one-ounce letter. Be sure that you include sufficient IRC's to cover the postage the station will have to use to send back the tape.

It has been noted in the past year or two that some stations will, upon request, record a program of music of their country on the roll of tape before returning it to you. But should you make such a request, be doubly certain that your report to them is a good one, i.e., one that will definitely be useful to the station receiving it.

● **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.

● **QSA-R.** This is one of the earlier types of codes that was used mostly in amateur radio. The *QSA* meant "The strength of

BEST BETS FOR NORTH AMERICAN SWL'S

Reports from all over North America indicate that the short-wave stations listed below will be heard during the winter of 1965-66. 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*)
LRA	Buenos Aires, Argentina	11,780, 9690, 6090	2200,0100 [1]
Radio Australia	Melbourne, Australia	17,840, 15,220	1955-2300
		9580	0714-0815
Radio Sofia	Sofia, Bulgaria	9700	1900-2130
Radio Peking	Peking, China	11,945, 9480, 7450, 7035	2000-2200
		15,115, 11,820, 9457, 7080	2200-0000
Radio Brazzaville	Brazzaville, Congo	15,370, 11,930	1400-1500
HCJB	Quito, Ecuador	15,115, 11,915, 9745, 6050	1730-2330
YSS, Radio Nacional	San Salvador, El Salvador	9555	1300-2300 [2]
BBC, London	London, England	17,870, 17,790, 17,740	1500-1745
		15,410, 15,300, 15,260, 15,140, 15,070	1500-1930
		12,095, 11,780, 11,750	1615-2230
		9580, 9510	1745-2230
		7130	1700-2230
Radio Deutsche Welle	Cologne, West Germany	11,925, 11,795, 9735	1010-1050
		9640, 6175	2030-2150
		9745, 6145	0000-0040
Radio Ghana	Accra, Ghana	6110	2200-2245
Radio Budapest	Budapest, Hungary	9833, 7215, 6234	1930-0000
Israel B/C Service	Jerusalem, Israel	9725, 9625, 9009	1545-1615
Radio Roma	Rome, Italy	11,905, 9630	1930-1950
Radio Abidjan	Abidjan, Ivory Coast	11,820	1330-1400
Radio Japan	Tokyo, Japan	15,135, 11,780	1830-1930
Radio Amman	Amman, Jordan	9560	2000-2100
Radio Nederland	Hilversum, Netherlands	15,425, 11,730	1535-1550 [3]
		9685	2300-2350 [4]
		800 (medium-wave)	1940-2030 [4]
VLT6	Port Moresby, New Guinea	6130	0200-0400
Radio New Zealand	Wellington, New Zealand	9540, 6080	0100-0345
Emissora Nacional	Lisbon, Portugal	6185, 6025	2100-2300 [5]
Radio Bucharest	Bucharest, Rumania	11,940, 11,810, 9590, 9510, 6190, 6150	2030-2330
Sierra Leone B/C Service	Freetown, Sierra Leone	3316	0200-0300
Radio South Africa	Paradys, South Africa	9650	0000-0130
Radio Nacional de Espana	Madrid, Spain	11,715, 9615, 6140	2000,2100, 2200 [5]
Radio Sweden	Stockholm, Sweden	15,195	0900-0930
		11,805	2045-2230
Radio Switzerland	Berne, Switzerland	9665, 9535, 6120	2015-2315
Radio Ankara	Ankara, Turkey	15,165	1630-1730
Radio Moscow	Moscow, U.S.S.R.	[6]	1700-0100
Vatican Radio	Vatican City	9645, 7250, 5985	1950-2005
Windward Islands B/C Service	St. Georges, Grenada	5010	1500-1715
		3280	1730-2115

1. Monday to Friday. 2. Spanish transmission. 3. Tuesday and Friday only. 4. Except Sunday; relayed via Trans World Radio, Bonaire, Netherland Antilles. 5. Transmissions are 30 to 45 minutes in length. 6. Many frequencies in the 49-, 41-, 31-, and 19-meter bands.

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

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 recent 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 is now "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 CW 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 chapter 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 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 shouuld read: *SINPO 55555* (not S5I5N5P5O5).

● **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

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

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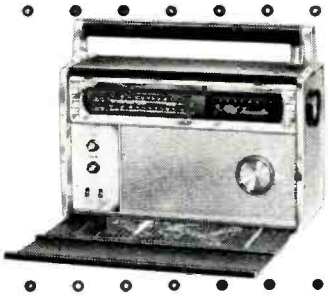

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CIRCLE NO. 9 ON READER SERVICE CARD

John Casazza, Staten Island, N.Y., used the modest equipment shown to track ham satellite OSCAR III. The receiver is a National NC-140 fed by a Tecraft converter tuned to the 2-meter band. Signals were recorded on a Wollensack tape recorder.

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 often be heard in the short-wave bands at nearly all hours of the day and night. The usual sound is a characteristic repetitive clanging or raw buzzing. Even the jamming transmitters, for the most part, identify in Morse code, and the usual means of identification is two letters or one number and one letter. One uniquely different jamming station is the often-heard "Kiss Me Honey," mentioned earlier in this chapter. An experienced listener can frequently hear the broadcast being jammed underneath the high-powered signal of the jamming transmitter.

The director of the *Voice of America* reported that jamming of the *VOA* Soviet-language broadcasts ceased on September 15, 1959, the day that deposed Premier Khrushchev began his visit to the United Nations. Further information was released during 1964 indicating that the Communist jamming of the British Broadcasting Corporation's programs beamed to Europe had ceased. The Bulgarian-language broadcasts were said to be the last to be subjected to jamming. The Russian-, Albanian-, and Romanian-language programs had been free of jamming since the summer of 1963; the Czech-, Slovak-, Hungarian-, and German-language programs have been in the clear since April, 1964. Poland apparently dismantled many of its jammers in 1956-57. At one time it was estimated by the director of the *VOA* that as much as 30% of all Free World broadcasts in Russian or Ukrainian had been subjected to jamming. As might be expected, most of the selective jamming involved news programs and political commentaries.

Nevertheless, there is still a considerable amount of jamming taking place on the short-wave bands. Some reports indicate that German-language programs on the medium- and long-wave bands are being subjected to heavy jamming.

Six 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.

● **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); CW or Morse code transmissions; and radioteletype. Phone, SSB, and CW 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.)

Reception of code signals can offer you excellent practice if you want to become a radio amateur. If you know the Interna-

INTERNATIONAL CALL-SIGN PREFIXES

The call-signs of radio stations throughout the world have been established by international agreement. The first two letters, or numeral and letter, are the key to identification. Using the list below, the SWL can tell at a glance what country he is monitoring.

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-DTZ	Germany
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-EWZ	Bielorussia
EXA-EZZ	U.S.S.R.
FAA-FZZ	France & Territories
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 & Territories
HZA-HZZ	Saudi Arabia
IAA-IZZ	Italy & Areas Under Mandate
JAA-JSZ	Japan
JTA-JVZ	Mongolian Republic
JWA-JXZ	Norway
JYA-JYZ	Jordan
JZA-JZZ	West New 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
OKA-OMZ	Czechoslovakia
ONA-OTZ	Belgium
OUA-OZZ	Denmark
PAA-PIZ	Netherlands
PJA-PJZ	Netherlands Antilles
PKA-POZ	Indonesia
PPA-PYZ	Brazil
PZA-PZZ	Surinam
QAA-QZZ	International 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 & Territories
TIA-TIZ	Costa Rica
TJA-TJZ	Cameroon
TKA-TKZ	France & Territories
TLA-TLZ	Central Africa
TMA-TMZ	France & Territories
TNA-TNZ	Brazzaville
TOA-TQZ	France & Territories
TRA-TRZ	Gabon
TSA-TSZ	Tunisia
TTA-TTZ	Chad
TUA-TUZ	Ivory Coast
TVA-TXZ	France & Territories
TYA-TYZ	Dahomey
TZA-TZZ	Mali
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	Upper Volta
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 Arab 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 South 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
3XA-3XZ	Guinea
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	International Civil Aviation
4ZA-4ZZ	Israel
5AA-5AZ	Libya
5BA-5BZ	Cyprus
5CA-5GZ	Morocco
5HA-5IZ	Tanganyika
5JA-5KZ	Colombia
5LA-5MZ	Liberia
5NA-5OZ	Nigeria
5PA-5QZ	Denmark
5RA-5SZ	Malagasy Republic
5TA-5TZ	Mauritania
5UA-5UZ	Niger
5VA-5VZ	Togolese Republic
5WA-5WZ	Western Samoa
5XA-5XZ	Uganda
5YA-5ZZ	Kenya
6AA-6BZ	United Arab Republic
6CA-6CZ	Syria
6DA-6JZ	Mexico
6KA-6NZ	Korea
6OA-6OZ	Somali Republic
6PA-6SZ	Pakistan
6TA-6UZ	Sudan
6VA-6WZ	Senegal
6XA-6XZ	Malagasy Republic
6YA-6YZ	Jamaica
7AA-7IZ	Indonesia
7JA-7NZ	Japan
7RA-7RZ	Algeria
7SA-7SZ	Sweden
7TA-7YZ	Algeria
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 Federation
9NA-9NZ	Nepal
9OA-9TZ	Leopoldville
9UA-9UZ	Burundi
9XA-9XZ	Rwanda Republic

Unassigned

6ZA-6ZZ	9HA-9JZ
7OA-7QZ	9VA-9WZ
8OA-8RZ	9YA-9ZZ

tional Morse Code, pay particular attention to the Novice CW bands (see page 81 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 other's language.

Phone, CW, and SSB signals are frequently spotted in the ham bands through a gentleman'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 CW. However, there are both CW 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 CW 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; call letters of the station 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 your receiver and antenna.

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.** You can listen to radio broadcasts from airplanes in flight and at the various airports and control centers located throughout the world in either of two parts of the radio spectrum. 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 (112-132 mc.). International airline flights use frequencies in the short-wave bands, such as 8905, 8896.5, 8871, 8862.5, 5641.5, 2980, and 2966 kc.

Listeners to 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, Curacao, and the Cayman Islands. Listeners on the west coast report hearing Canton, Guam, Midway, Wake, and Norfolk Islands.

Although the transmitting power of most of these stations is relatively low when compared to a broadcasting station, the signals can be heard at great distances. The

Radio Japan will verify reception reports using one of the four QSL cards at the left. A QSL serves two purposes. It acknowledges that your report was correct and simultaneously tells you something about the country itself.

For the avid short-wave listener there could be nothing better than this high-performance international broadcast-band receiver. Tuning only the broadcasting frequencies in nine bands, the Squire-Sanders SS-IBS sells for about $1000.

best time to listen seems to be in the late afternoon and early evening for the European and African transmitters. Stations in the Pacific and Far Eastern areas can usually be tuned in during the early morning or shortly after sunrise, up to about 8 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.

The best way to log aeronautical stations is to tune slowly across one of the three radiotelephone bands (8.8; 5.6; or 2.9 mc.) 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 find that perhaps 10 or 20 different stations can be intercepted in about an hour. Most airline transmissions are quite short and the messages passed back and forth are rapid and are full of the international phonetic code.

● **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 surrounding the North Atlantic Ocean. From Shannon, Ireland, on the hour and half-hour, the reports are for European cities. At 15 and 45 minutes after the hour, New York broadcasts east coast U.S.A. 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 Pacific Ocean areas. 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 after the hour, in Tokyo; at 15 and 45 minutes after the hour, in Hong Kong; at 20 and 50 minutes after the hour, in Anchorage; and at 25 and 55 minutes after the hour, in Honolulu.

● **"Short-Wave Listening."** This seems as good a time as any to mention that POPULAR ELECTRONICS publishes a column on SWL'ing activities every month. It contains up-to-the-minute news on the latest and hottest DX catches—including frequency and program details. Look for it!

● **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 for aeronautical navigation radio stations and ship-to-shore CW transmissions. In Europe, a portion of the long-wave band (145-350 kc.) is used by super-high-power AM broadcasting stations. Unlike the AM broadcasting stations in North America where power output is almost always limited to a maximum of 50,000 watts, European stations may radiate signals with 250,000 to 1 million watts output. High power 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 the long-wave band, 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 stations during the winter early evening hours.

Most often reported 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 East Berlin on 185 kc. or 263 kc.; this station continuously relays Moscow. Soviet homeland stations are located at Kiev, Leningrad, Minsk, and Moscow. The most powerful Soviet long-wave transmitter is on 172 kc. and radiates a power of 500,000 watts.

● **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 from 2400 to 2600 kc. 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. 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 operator 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 voice code. These voice code broadcasts are transmitted in lieu of detailed verbal weather reports.

The code runs like this: the first two numerals indicate the wind direction at the weather observation 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 numeral 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; 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 two digits), velocity is 21 miles per hour (second two digits), and the weather outlook is for fog.

An evening of listening—especially during the summer months—can be a most rewarding experience. Numerous SWL's specialize in DX'ing this band, not particularly for QSL's, but for the thrill of hearing everyday events taking place hundreds or thousands of miles away.

● **The VHF Aeronautical Band.** A very popular specialty receiver now being sold is one capable of tuning between 108 and 132 megacycles. In this frequency range are all of the short-range 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 (very high frequency) 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 trans-

missions 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 Kennedy Airport uses 118.9 mc. for flights approaching from the east and 125.7 mc. for flights approaching from the west. Departing flights from Kennedy are contacted on 130.4 mc. while planes taxiing on the ground are controlled on 121.7 mc. Local flights in the vicinity of Kennedy are controlled on 118.7 mc. In addition to these frequencies, Kennedy also has an instrument landing beacon on 109.9 mc. and a VOR beacon on 115.4 mc.

● **The VHF Police/Fire Band.** Outside of the Citizens Band, the greatest concentration of transmitters is to be found in the 152-174 mc. section of the VHF spectrum. This is the part of the radio spectrum where most 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.); 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 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 boroughs.

● **Monitor Registration.** Several years ago POPULAR ELECTRONICS began issuing Monitor Registration Certificates to anyone with a sincere interest in some form of short-wave listening. Along with the certificate, the applicant is issued a personalized identification sign. Application blanks for these certificates appear periodically in POPULAR ELECTRONICS.

In 1963 a Monitor Awards Program was instituted. The primary aim of the program was to give recognition to those monitors

(*Continued on page* 44)

SPECIAL "FREQ." LISTING

Press (Newspapers)

173.225, 173.25, 173.275, 173.3, 173.325, 173.35, 173.375 mc.

U.S. Army Engineers

2182, 2350, 2738, 2784, 5327.5 kc.

Canadian Forestry

5410, 5915 kc.

Civil Air Patrol

2374, 4467.5, 4507.5, 4585 kc., 26.62, 143.91, 148.14 mc.

U.S. Coast Guard

2182, 2662, 2670, 2678, 2686, 2694, 2702, 3123, 3241, 3253, 4403, 5695.5 kc., 157.1 mc.

American National Red Cross

47.42 mc.

United States Weather Bureau

2182, 2430, 2852, 2776, 3352.5, 3357.5, 3367.5, 3402.5, 4090, 5925, 6977.5 kc., 30.02, 30.34, 34.02, 162.55 mc.

National Park Service

2158, 2604, 2770, 2776, 2822, 3215, 3237, 3363, 5150, 5287.5 kc.

Department of Agriculture Forestry Service

3187, 3219, 3250, 3253, 3261, 3273, 3325, 3357, 3397.5, 3445 kc.

Aeronautical Radio Frequencies For Emergency Use

121.50, 140.58, 282.80 mc.

Zone and Interzone Police (CW and SSB)

2804, 2808, 2812, 5135, 5140, 5195, 7840, 7935 kc.

Royal Canadian Mounted Police

1650, 1708, 2256, 2326, 2562, 2788, 2826, 3325, 3430, 3455, 4475, 4775, 4785, 4805, 4895, 5445, 6425, 9130 kc.

Royal Canadian Army

3394, 4570, 5435, 11,500 kc.

U. S. Navy

2716 kc.

International Police (Interpol)

4632.5, 6792, 10,390 kc.

Space Shot Frequencies (all freq's. approx.)

5190, 5258, 6969, 7578, 9005, 10,160, 10,613, 12,432, 15,016, 15,020, 15,026, 15,968, 20,700 kc.

—PREPARED BY TOM KNEITEL

COUNTRIES LIST FOR DX AWARDS

The following is a complete listing of countries that you may claim to help you qualify for one of the POPULAR ELECTRONICS *DX Country Awards. Prospective applicants are urged to keep it handy, close to their receivers, for reference purposes. This list may differ in many instances from other published lists. However, we believe it will give the SWL an excellent opportunity to enlarge his personal log of countries heard.*

1 Aden, Hadhramaut & Socotra Islands
2 Afghanistan
3 Aland Island
4 Alaska
5 Albania
6 Aldabra & Cosmoledos Islands
7 Algeria
8 American Samoa
9 Amsterdam & St. Paul Islands
10 Andaman & Nicobar Islands
11 Andorra
12 Angola
13 Anguilla Island
14 Antarctica
15 Antigua & Barbuda Islands
16 Argentina
17 Armenia
18 Ascension Island
19 Asiatic Russia
20 Auckland & Campbell Islands
21 Australia
22 Austria
23 Aves Island
24 Azerbaijan
25 Azores
26 Bahama Islands
27 Bahrein Island
28 Bajo Nuevo Island
29 Baker, Canton, Enderbury & Howland Islands
30 Balearic Islands
31 Barbadoes
32 Basutoland
33 Bechuanaland
34 Belgium
35 Bermuda
36 Bhutan
37 Bolivia
38 Bonin & Volcano Islands
39 Bouvet Island
40 Brazil
41 British Guiana
42 British Honduras
43 British Phoenix Island
44 British Virgin Is.
45 Brunei
46 Bulgaria
47 Burma
48 *Burundi
49 *Cambodia
50 Cameroun
51 Canada
52 Canal Zone
53 Canary Islands
54 Cape Verde Islands
55 Cargados Carajos Island
56 Cayman Islands
57 *Central African Republic
58 Ceuta & Melilla (Spanish Morocco)
59 Ceylon
60 *Chad
61 Chagos Island
62 Chatham Island
63 Chile
64 China
65 Christmas Island (Indian Ocean)
66 Christmas, Fanning, & Washington Is. (Line Islands)
67 Clipperton Island
68 Cocos-Kneeling Island (Australia)
69 Cocos Island (Costa Rica)
70 Colombia
71 Comoro Island
72 *Congo Republic (Brazzaville)
73 Congo, Republic of (Leopoldville)
74 Cook Islands
75 Corn Island
76 Corsica
77 Costa Rica
78 Crete
79 Crozet Island
80 Cuba
81 Cyprus
82 Czechoslovakia
83 *Dahomey
84 Denmark
85 Dominica Island
86 Dominican Republic
87 *East Germany & East Berlin
88 East Pakistan
89 Easter Island
90 Eastern Caroline Islands
91 Ecuador
92 Egypt
93 El Salvador
94 England
95 Estonia
96 Ethiopia
97 European Russia (Moscow)
98 Faroe Islands
99 Falkland Islands
100 Fernando de Noronha Island
101 Fiji Islands
102 Finland
103 Formosa (Taiwan)
104 France
105 Franz Josef Land
106 French Guiana
107 French Polynesia (Tahiti, etc., exc. Marquesas Is.)
108 French Somaliland
109 French St. Martin
110 *Gabon
111 Galapagos Island
112 Gambia
113 Georgia
114 *Ghana
115 Gibraltar
116 Gilbert, Ellice, & Ocean Islands
117 Glorieuse Island
118 Greece
119 Greenland
120 Grenada and Dependencies
121 Guadeloupe
122 Guam & Cocos Islands
123 Guantanamo Bay
124 Guatemala
125 Guernsey & Dependencies (Channel Islands)
126 *Guinea
127 Haiti
128 Hawaii
129 Heard Island
130 Honduras
131 Hong Kong
132 Hungary
133 Iceland
134 Ifni
135 India
136 Iran
137 Iraq
138 Ireland
139 Isle of Man
140 *Israel
141 Italy
142 *Ivory Coast
143 Jamaica
144 Jan Mayen Island
145 Japan
146 Java
147 Jersey Island (Channel Islands)
148 Johnston Island
149 Jordan
150 Juan de Nova & Europa Islands
151 Juan Fernandez Island
152 Kalimantan (Indonesian Borneo)
153 Kaliningradsk
154 Kamaran Island
155 Kazakh
156 Kenya
157 Kerguelen Island
158 Kermadec Island
159 Kirghiz
160 Kure Island
161 Kuwait
162 Kuwait-Saudi Arabia Neutral Zone
163 Laccadive Island
164 *Laos
165 Latvia
166 Lebanon
167 Liberia
168 Libya

Countries marked with an asterisk in the listing above are valid for credit only if heard on or after the dates indicated below.

48	Burundi	July 1, 1962
49	Cambodia	July 21, 1954
57	Central African Republic	August 13, 1960
60	Chad	August 11, 1960
72	Congo Republic	August 15, 1960
83	Dahomey	August 1, 1960
87	East Germany & East Berlin	October 7, 1949
110	Gabon	August 17, 1960
114	Ghana	March 6, 1957
126	Guinea	October 2, 1958
140	Israel	May 15, 1948
142	Ivory Coast	August 7, 1960
164	Laos	July 21, 1954
179	Mali	June 20, 1960
190	Mauretania	June 20, 1960
199	Mt. Scopus U.N. Ter.	May 15, 1948
211	Niger	August 3, 1960
215	North Korea	June 25, 1950
216	North Viet Nam	September 1, 1954
244	Rwanda	July 1, 1962
259	Senegal	June 20, 1960
267	Somalia	July 1, 1960
270	South Korea	June 25, 1960
274	South Viet Nam	September 1, 1954
308	Upper Volta	August 5, 1960
317	W. Germany, W. Berlin	October 7, 1949

Applicants are urged to be careful in listing countries, particularly those which have changed names in recent years. For example, British North Borneo is now Sabah; Celebes & Molucca Islands are now Sulawesi & Maluku; Indonesian Borneo is now Kalimantan; Netherlands New Guinea is now West Irian & Biak Islands; and Madagascar is now Malagasy. New changes will be published in POPULAR ELECTRONICS' *Monthly Short-Wave Report.*

169 Liechtenstein
170 Lithuania
171 Lord Howe Island
172 Luxembourg
173 Macao
174 Macquarie Island
175 Madeira Island
176 Malagasy (Madagascar)
177 Malaya
178 Maldive Island
179 *Mali
180 Malpelo Island
181 Malta
182 Manchuria
183 Manihiki Island (Danger Island)
184 Marcus Island
185 Mariana Islands (Rota, Saipan, Tinian Is., etc.)
186 Marion & Prince Edward Islands
187 Marquesas Island
188 Marshall Islands
189 Martinique
190 *Mauretania
191 Mauritius
192 Mexico
193 Midway Island
194 Moldavia
195 Monaco
196 Mongolia
197 Montserrat Island
198 Morocco
199 *Mt. Scopus U. N. Territory
200 Mozambique
201 Nauru Island
202 Navassa Island
203 Nepal
204 Netherlands (Holland)
205 Netherlands Antilles (Aruba, Bonaire, & Curacao Islands)
206 New Caledonia
207 New Guinea, Territory of
208 New Hebrides
209 New Zealand
210 Nicaragua
211 *Niger
212 Nigeria
213 Niue Island
214 Norfolk Island
215 *North Korea
216 *North Viet Nam
217 Northern Ireland
218 Northern Rhodesia
219 Norway
220 Nyasaland
221 Oman Sultanate (Muscat)
222 Oman, Trucial, & Das Islands
223 Palmyra & Jarvis Islands
224 Panama, Republic of
225 Papua Territory
226 Paraguay
227 Pelagian Island & Pantelleria
228 Peru
229 Philippine Islands
230 Pitcairn Island
231 Poland
232 Portugal
233 Portuguese Guinea
234 Portuguese Timor
235 Puerto Rico
236 Qatar
237 Reunion Island
238 Revilla Gigedo Island
239 Rhodes & Dodecanese Islands
240 Rio de Oro (Spanish Sahara)
241 Rodriguez Island
242 Romania
243 Roncador Cay & Serrana Bank
244 *Rwanda
245 Ryukyu Islands (Okinawa)
246 St. Helena Island
247 St. Kitts & Nevis Islands
248 St. Lucia Island
249 St. Pierre & Miquelon Islands
250 St. Vincent Island
251 Sabah (British North Borneo)
252 San Andres & Providencia Islands
253 San Marino
254 Sao Tome & Principe Islands
255 Sarawak
256 Sardinia
257 Saudi Arabia
258 Scotland
259 *Senegal
260 Seychelles Islands
261 Sicily, Eolian, & Ustica Islands
262 Sierra Leone
263 Sikkim
264 Singapore
265 Sint Maarten, St. Eustatius, & Saba Islands
266 Solomon Islands (British)
267 *Somalia
268 South Africa
269 South Georgia Island
270 *South Korea
271 South Orkney Island
272 South Sandwich Island
273 South Shetland Island
274 *South Viet Nam
275 Southern Rhodesia
276 South West Africa
277 Spain
278 Spanish Guinea
279 Spitzbergen (Svalbard)
280 Sudan
281 Sulawesi, Maluku, & Lesser Sunda Islands (Celebes & Molucca Is.)
282 Sumatra
283 Surinam
284 Swan Island
285 Swaziland
286 Sweden
287 Switzerland
288 Syria
289 Tadzhik
290 Tanganyika
291 Tanna Tuva
292 Thailand
293 Tibet
294 Togo
295 Tokelau (Union) Islands
296 Tonga (Friendly) Islands
297 Trinidade & Vaz Islands
298 Trinidad & Tobago Islands
299 Tristan da Cunha & Gough Islands
300 Tromelin Island
301 Tunisia
302 Turkey
303 Turkmen
304 Turks & Caicos Islands
305 Uganda
306 Ukraine
307 United States of America
308 *Upper Volta
309 Uruguay
310 Uzbek
311 Vatican City
312 Venezuela
313 Virgin Islands
314 Wake Island
315 Wales
316 Wallis & Futuna Is.
317 *West Germany & West Berlin
318 West Irian & Biak Islands (Netherlands New Guinea)
319 West Pakistan
320 Western Carolina Islands
321 Western Samoa
322 White Russia
323 Willis Islands
324 Yemen
325 Yugoslavia
326 Zanzibar

The countries listed below have been deleted from this all-time countries list, but credit may be taken for reception (and verification) on or before the dates given.

D1	British Somaliland	June 30, 1960
D2	Damau & Diu	December 19, 1961
D3	Danzig	September 1, 1939
D4	Eritrea	November 30, 1962
D5	French Equatorial Africa	August 16, 1960
D6	French India	October 31, 1954
D7	French Indo-China	July 20, 1954
D8	French West Africa	August 6, 1960
D9	Germany	October 6, 1949
D10	Goa	December 19, 1961
D11	Gold Coast	March 5, 1957
D12	Italian Somaliland	June 30, 1960
D13	Karelo-Finnish Republic	July 15, 1956
D14	Korea	June 24, 1950
D15	Kwantung Peninsula	September 2, 1945
D16	Manchukuo	September 2, 1945
D17	Newfoundland & Labrador	March 31, 1949
D18	Palestine	May 14, 1948
D19	Ruanda-Urundi	June 30, 1962
D20	Saarland	December 31, 1956
D21	Spanish Morocco (except Ceuta and Melilla)	April 6, 1956
D22	Tangier	October 28, 1956
D23	Trieste	October 25, 1954
D24	Viet Nam	August 31, 1954

DX AWARDS PROGRAM

Holders of WPE Monitoring Certificates are eligible to apply for awards that may be affixed to the certificate itself. Three awards are now open—one for 25-150 verified countries, one for 20-50 verified states, and one for 6-12 verified provinces. Details on joining the WPE Monitor Program will be found in the March, May, July, September, November (1966) and January (1967) issues of POPULAR ELECTRONICS. Award application forms appear in the February, April and November 1965 issues of POPULAR ELECTRONICS. To qualify for an award, the steps listed below must be followed.

1 Each applicant must be a registered WPE Short-Wave Monitor and must enter his call letters on the application form (or facsimile).

2 Each applicant must submit a list of stations (any frequency or service) for which he has received verifications, one for each state, country or province heard. The list should contain 25, 50, 75, 100, or 150 countries if applying for a country award, or 20, 30, 40, or 50 states if applying for a state award, or 6, 8, 10 or 12 provinces if applying for a province award. The following information must be furnished in tabular form and in alphabetical order by country, state, or province for each verification.
   (a) Country, state, or province heard
   (b) Call-sign or name of station heard and verified
   (c) Frequency
   (d) Date the station was heard
   (e) Date of verification (postmark dates are acceptable)
   (f) For the states award only, indicate whether the broadcast was a normal transmission for the class of station received, or a test.

   All of the above information should be copied from the station's verification. Don't list any verification you can't supply for authentication on demand.

3 All pertinent verifications, whether QSL cards or letters, should be carefully packaged and stored by the applicant until such time as instructions are received to send in some or all of them for checking purposes. Instructions on how and to whom to send the verifications will be given at that time. Failure to comply with these instructions will disqualify the applicant.

4 A fee of 50 cents (in U. S. coin) must accompany the applicant's list of verifications to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible for any of the awards. Applicants outside of the United States may send 60 cents (U. S.) in coins of their own country if they so desire. However, please do NOT send any International Reply Coupons (IRC's) or personal checks when applying for an award.

5 Apply for the highest DX Award for which you are eligible. If, at a later date, you become eligible for a higher award, then apply for the new award, following these rules and regulations as before.

6 Mail your verification list, fee, and the application form (or facsimile) to: Hank Bennett, Short-Wave Editor, POPULAR ELECTRONICS DX AWARDS, P. O. Box 333, Cherry Hill, N. J. 08034. Include in the envelope only those items which are directly related to your entry for the award. Do not include an application for a Short-Wave Monitor Certificate (you are NOT eligible for any of the awards until you have a Short-Wave Monitor Certificate in your possession).

who, through their ability and activity, were able to verify a certain number of countries. The program has five grades, with awards being made for verification of reception of 25, 50, 75. 100. and 150 countries.

Since the inception of this program, thousands of DX'ers have applied for, and received, their awards. The awards, printed in blue and gold, are affixed to their Registration Certificates.

In 1964 another series of awards was originated. In this series, similar awards, printed in red and gold, are given to those monitors who have verified reception of a station (any frequency or service) in 20, 30, 40, or 50 *states*. A resume of rules and regulations covering the country and state awards program is given at left.

In 1965 a third series of awards was announced. In this series the awards are printed in green and gold and are given to those monitors who have verified reception of a station (any frequency or service) in 6, 8, 10, or 12 Canadian provinces. A complete resume of rules and regulations for this series—and an application form—will be found in the January, 1966, issue of POPULAR ELECTRONICS.

● **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 can be obtained by sending 25 cents in coin to the club.

The *North American Short-Wave Association*, 1503 Fifth Ave., Altoona, Pa., 16602, issues "Frendx," a monthly bulletin devoted to the usual DX'ing activities as well as card-swapping. tape corresponding, etc. The dues are $3 yearly in North America, $4.50 elsewhere. A sample bulletin is 25 cents.

Two clubs that are devoted to broadcast-band DX'ing are the *National Radio Club*, P. O. Box 63, Kensington Station, Buffalo, N.Y. 14215, and the *International Radio Club of America*, P. O. Box 5181, Terminal Annex, Denver, Colorado 80217. Both clubs publish 34 bulletins each year,

and both have dues of $4.00. The latter will send you the bulletins by first class mail for $6.00. A sample NRC bulletin is 25 cents.

In Canada, the *Canadian DX Club*, c/o Fred Woodley, 160 Tecumseh Ave., East, London, Ontario, is that country's largest organization. The monthly paper, "Cadex," is 30-35 pages in length. A flash sheet is issued during peak DX seasons between regular issues. The dues are $4 yearly or $4.60 with the flash sheet. A sample bulletin is 15 cents or one IRC.

Also in Canada is the *Canadian International DX Club*, 616 Stewart St., Winnipeg, Manitoba. The "CIDX Messenger" generally consists of 12-16 pages and contains editorials, Branch Chapter Reports, Swapper & Awards columns, Monitor & Hock Shop, plus current reports. The dues are $3 yearly; a sample bulletin is 10 cents.

In England there are two excellent publications. The *International Shortwave Club*, 100, Adams Gardens Estates, London, S 16, England, has a monthly four-page (legal-size) bulletin devoted to short-wave broadcasting but covering some ham radio activities. The yearly dues are $1.50 (when the bulletin is sent via surface mail) or $2 (airmail).

The *International Short Wave League*, 12 Gladwell Rd., London, N8, England, has a monthly bulletin of about 30 pages that covers the broadcast and amateur bands with additional regular features for the licensed amateur and the VHF enthusiast. The yearly dues are $3 (surface mail) or $9 (airmail). If you want to join either of these British clubs, we suggest you make payment with an International Money Order.

● **Miscellaneous Information.** Listed below are some valuable publications of interest to the SWL.

International Broadcast List

The most useful publication for the active SWL is the *World Radio TV Handbook*. Over 300 pages in length, this book is published annually in Denmark and contains a list of all AM, FM, TV, and short-wave broadcasting stations. Included are call-signs, frequencies, transmitter power, addresses for QSL cards, program details, and hundreds of other miscellaneous items which are important to the short-wave listener. The English-language edition is sold via mail order (Gilfer Associates, Box 239, Park Ridge, N. J. 07656; $4.95). A summer supplement is also sold.

AM Broadcast List

Published by O.L. Johansen, the *World Medium Wave Guide* is a frequency list of all AM broadcasting stations operating between 520 and 1629 kc. The listing is corrected periodically with special inserts. Price, $2.10, from Gilfer Associates.

Canadian Directories and Handbook

Two ship and land station radiotelephone directories are published annually in Canada. These lists are $1 each and include all shipping, logging, and land stations that operate on the maritime frequencies.

The *Radio Amateur Licensing Handbook*, written by J. E. Kitchin, Regional Superintendent, Radio Regulations, Department of Transport (Retired) and revised by Inspector N. J. Smith, Regional Supervising Examiner, tells how to obtain an amateur license in Canada. This book sells for $2.00

The above publications can be purchased from Radiotelephone Directories of Canada, Ltd., 3570 West 22nd Ave., Vancouver 8, B. C., Canada.

Books for the Short-Wave Listener

William I. Orr, W6SAI, has written two books that are proving to be of interest to the SWL. *Better Shortwave Reception* is beamed towards the person who is just starting in the hobby. There are many 'do-it-yourself' projects that tell how to align and maintain your receiver; DX tuning hints for listeners interested in ham band reception; wiring diagrams for a Q-multiplier, preselector, calibrator, etc. The price is $2.85. *S-9 Signals* contains information on inexpensive antennas for radio amateurs, with sufficient data to enable all antennas to be cut for the major short-wave bands. Price, $1.00.

How to Listen to the World

Printed in Denmark, *How to Listen to the World* is a popular basic text about how to start your SWL'ing hobby. Written by the previous publisher of the *World Radio TV Handbook*, it contains general information on station activities not usually found in such convenient fashion. Price, $2.75. Order from Gilfer Associates, the North American distributor (Box 239, Park Ridge, N.J. 07656). ■

2

AMATEUR RADIO

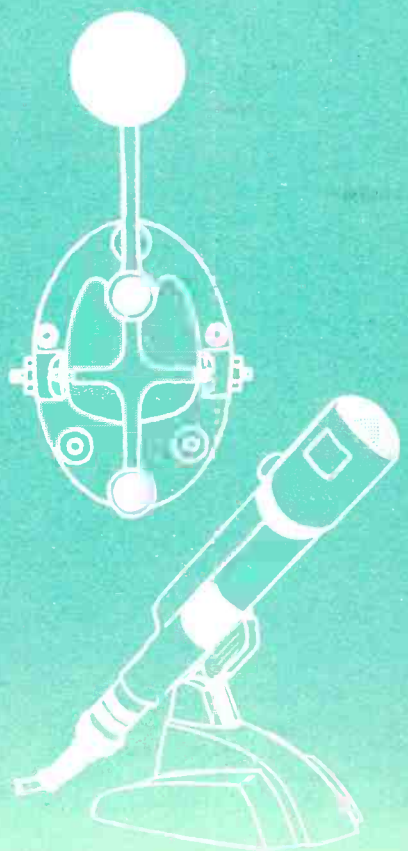
By HERB S. BRIER
W9EGQ

THE Federal Communications Commission classifies amateur radio as a "service" with the fundamental aims of improving the communications art, promoting world peace and understanding, providing emergency communications, and giving the United States a reservoir of self-trained electronic technicians.

All conscientious radio amateurs subscribe to the above ideals. But most of the time amateur radio is an electronic magic carpet which expands our horizons to include the entire world—a world in which we have a half-million friends. When we operate our amateur stations from our homes or automobiles, our cares drop away. We are one with the King of Bhutan, a presidential candidate, a missionary in a remote African jungle, a lonely soldier in an overseas outpost, or with other people just like ourselves located five miles away or five thousand miles away.

The following pages explain in detail all the facets of amateur radio, and how you, too, can enjoy this hobby. But before going any further, let us inject a word of warning: every amateur on the air has earned his license by passing an official examination ranging from a very simple one for the Novice license to a very comprehensive one for the Extra Class license. And this is the only path open to you to become a radio amateur. There are no short-cuts.

Now, having issued this warning, let us hasten to assure you that it is not at all difficult to pass the examinations connected with the licenses most radio amateurs aim for. Welcome to the club.



● **From Country to Country.** The 400,000-plus licensed radio amateurs of every conceivable race, color, and creed, stretching from pole to pole and completely encircling the globe, may or may not be professional electronics engineers or technicians. Very often, the livelihood of these people (commonly known as "hams") is far removed from electronics. From kings to princes to mail carriers and brick layers, however, they are highly skilled, technically qualified individuals that know the why's and wherefore's of radio communications. Amateur radio is their hobby; they accept no compensation for efforts expended in learning radio theory, or providing communications services in times of disasters to fellow citizens. It is a selfless hobby, offering greater rewards (so the radio amateurs say) than any other spare-time activity.

Amateur radio stations are found in homes, automobiles, boats, and airplanes. Amateur radio equipment is so useful and portable that for many years every major scientific expedition to the unexplored parts of Africa, Asia, South America, and the frozen Arctic and Antarctic regions has included radio amateurs and their equipment.

Some years ago, radio amateurs traveling with General Curtis LeMay (himself an active amateur), then Commander of the Strategic Air Command, proved the value of a specialized form of voice transmission called "single sideband," which was later adopted by all the Command stations of the U.S. Air Force. The first news of the disastrous 1964 Alaskan earthquake was flashed via amateur radio and virtually all the communications in and out of the disaster areas were handled by amateur radio during the critical hours immediately after the quake and tidal waves.

Obviously, 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.

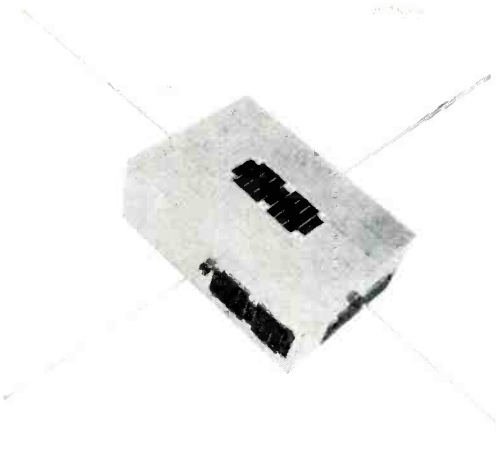
Many amateurs chat regularly with amateurs in other countries, becoming such good friends that they and their families exchange personal visits, adding to international good will. And when we speak of the "romance" of amateur radio, we sometimes mean that literally. Not all hams are men, and it is fairly common for unattached "OM's" (male operators) and "YL's" (young lady operators) to meet over the air, then meet in person, and later get married and start raising their own family of ham operators.

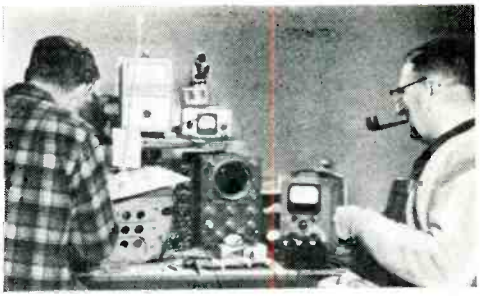
● **DX'ing.** Radio amateurs tend to find a certain activity within their hobby that interests them the most. Some become DX'ers —hams who are primarily interested in establishing two-way communications (called "contacts") with other ham stations in every nation of the world. With a day-to-day birth of new nations, principally in 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. In many of the less technically developed countries, there are few, if any, amateurs.

In order to overcome the latter handicap, various amateur groups and equipment manufacturers sponsor "DX-peditions" to send well-equipped, skilled ham operators to these "rare" countries and isolated islands to give as many as possible of the world's ham DX'ers the opportunity of working a "new" country. A few dozen DX'ers have managed to make contacts with radio amateurs in over 300 different countries!

● **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, lasers, and radioteletype. The ingenuity of ham experimenters was demonstrated on a worldwide basis by the famous "OSCAR" satellites. Through the cooperation of the U.S. Air Force, radio amateurs have piggybacked three satellites into space. The first two OSCAR's transmitted weak beacon signals which were heard around the world until their transmitter batteries wore out.

In March, 1965, OSCAR III, a much more sophisticated, 36-pound satellite was launched. As it whirled through space, it received and retransmitted 2-meter amateur radio signals, permitting hundreds of two-way long-distance contacts, otherwise impossible, to be made. The OSCAR-Project design group is now hard at work on OSCAR IV, which is expected to break all the communications records set by OSCAR III.





The U.S. Air Force has launched three satellites built by radio hams. Dubbed OSCAR for "Orbiting Satellite Carrying Amateur Radio," the first two satellites were simply beacons. OSCAR III was a translator satellite that simultaneously rebroadcast signals intercepted in the 2-meter band. Solar cells recharged the batteries of OSCAR III. W6VKP and W6VMH (above) designed and built much of the OSCAR III gear.

● **Public Service.** Still other amateurs concentrate on the public service aspects of amateur radio. They offer their services and equipment to transmit and receive messages free of charge for the general public—especially between men in the service of the United States overseas and their loved ones at home. Not only are these message-handling services valuable in themselves; they are even more valuable in the training they provide for handling vital messages in emergencies.

The greatest pride of every ham is the knowledge that, time and time again, amateur radio has provided emergency communications during earthquakes, forest fires, floods, hurricanes, and other disasters when normal communications circuits have failed or have been greatly overloaded. Most of this emergency work has been done as a purely voluntary amateur effort through the Amateur Radio Emergency Corps (AREC), sponsored by the amateurs' national organization, the American Radio Relay League, Inc. (ARRL), in cooperation with the American Red Cross and other public agencies.

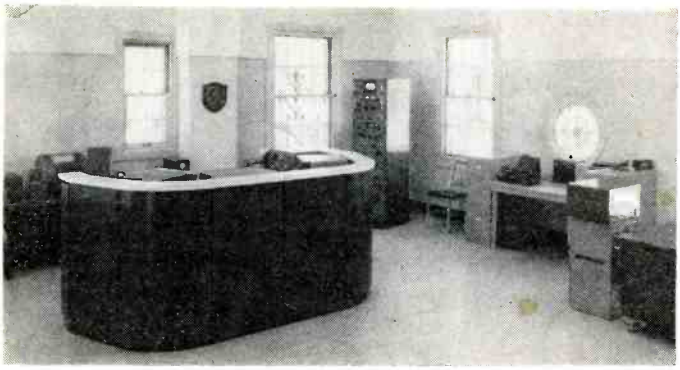
In addition, radio amateurs work with civil defense agencies through the Radio Amateur Civil Emergency Service (RACES), organized under special Federal Communications Commission regulations that will permit qualified radio amateurs to operate their stations even in war time (when all nonessential radio services are closed down) as part of the nation's over-all Civil Defense plans.

● **Becoming a Ham.** The proverbial "doctors, lawyers, and Indian Chiefs" are only a few members of the radio amateur family. The 1964 Republican presidential candidate, Senator Barry Goldwater, K7UGA, is an active radio amateur, and so is Andy Devine, WA7DEG, of radio, TV and movie fame. Others include school children, housewives, beauty contest winners, butchers, prize-fighters, wrestlers, stock-brokers, nuns, generals, and princes. Bedridden invalids, and even blind individuals are active participants in this wonderful hobby.

Regardless of nationality, every radio amateur must prove 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 another 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 vary the frequency of their transmissions within certain bands 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.

For this reason a ham must be technically qualified and have a full understanding of the "electronics" of his radio station. In addition, a license to transmit is issued only after the applicant has demonstrated



The headquarters ham station of the American Radio Relay League operates under the call of W1AW. It is located at 225 Main St., Newington, Conn.; all hams passing through this area are urged to visit the League headquarters.

his proficiency in code telegraphy and his knowledge of certain laws, rules, and regulations which currently pertain to the international use of the radio waves.

In the United States, the Federal Communications Commission will issue an amateur license to any citizen (born or naturalized) who passes the appropriate radio amateur examination. Licenses are now available to applicants in five classes—Novice, Technician, Conditional, General, and Extra Class.

● **Novice License.** The purpose of the Novice Class license is 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. Novices are limited to a maximum transmitter power input of 75 watts (plenty of power to work all over the United States and many foreign countries), and their transmitting frequencies must be controlled by precisely ground—but inexpensive—quartz crystals.

To qualify for a Novice license, an applicant must not have previously held any class of U.S. amateur radio license. 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 an adult holding a General Class or higher grade of amateur license or a commercial radiotelegraph license. An adult in the service of the United States as the operator of a manually operated radiotelegraph station may also supervise the examination.

● **Technician License.** The Technician Class license was established to permit experimentation with electronic transmitting equipment in the higher frequency bands.

To qualify for a Technician license, you must pass a 5-wpm code test and the standard written test for a General Class license. The written examination is 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. But you cannot obtain a Novice license after you have obtained a Technician license.

The Technician license is issued by mail under the same conditions set forth for the Novice examination.

● **General License.** A General Class radio amateur license currently grants the licensee all available operating privileges for five years. Acquiring this license requires passing the same written test as for the Technician Class license. However, the code requirement is 13 wpm, as opposed to the 5-wpm requirement of the Novice and Technician licenses.

The applicant for a General Class license must personally appear at an examination point maintained by the Federal Communications Commission. Both the written and code tests are given by FCC personnel.

● **Conditional License.** If you live more than 175 miles from the nearest FCC examination point or are unable to travel

because of protracted physical disability, or if you are living overseas, you can obtain General Class operating privileges by passing the standard General Class examination under the supervision of a volunteer examiner following the procedures governing the Novice and Technician exams.

● **Extra Class License.** When you have held a General or Conditional Class license for two years, you may apply for an Extra Class license. The requirements for this license are an ability to send and receive the code at a speed of 20 wpm and to pass a comprehensive written examination covering advanced amateur radio techniques. At present, except for the prestige involved (and any amateur who earns this license has a right to feel proud), there is nothing to be gained by qualifying for the Extra Class license. But, as explained below, this situation may soon be changed.

● **License Changes.** In a sweeping revision of the amateur regulations in 1951, the Novice, Technician, and Extra Class amateur licenses were introduced. Also, General and Conditional Class license holders were granted phone privileges on all amateur bands. Before the 1951 change, the Advanced Class license was required to use phone on 75 and 20 meters (there was no 40-meter phone band nor a 15-meter amateur band in those days). Since then, the Advanced Class license has been issued on a renewal basis only and has offered no operating privileges over those of the Conditional/General Class licenses.

In the spring of 1965, the FCC proposed another revision and updating of the amateur licensing structure. Although there will undoubtedly be modifications before the new regulations go into effect in a year or so, the FCC proposes to: (1) grant all amateur privileges only to Extra Class licensees; (2) create a new "First Class" license which will grant full amateur operating privileges, except the right to use radiotelegraphy in the lower 50 kc. of the 80-, 40-, 20-, and 15-meter amateur bands—this license will replace the old Advanced Class license; (3) permit General and Conditional Class licensees to operate radiotelephones in half of the 80-, 40-, 20-, and 15-meter phone bands, in all but the lower 250 kc. of the 50-mc. (6-meter) band, in all but the lower megacycle of the 144-mc. (2-meter) band, and in all other phone bands —in addition, they will have full radiotelegraph privileges, except in the lower 50 kilocycles of the 80-, 40-, 20-, and 15-meter bands; and (4) issue the Novice Class license for a 2-year, non-renewable period but without the right to operate phone on two meters. Except for the loss of the right to operate in the lower 250 kc. of the 50-mc. band, there are no changes proposed for the Technician licensee.

To qualify for the new First Class license, as it now stands, the amateur must have one year of operating experience and pass both a 16-wpm code test and a written examination half way in difficulty between the present General/Conditional/Technician examination and the Extra Class examination.

● **Call-Signs.** If the new regulations are adopted as proposed, Novice and General Class call-signs will be unchanged. Conditional call-signs will begin with the letters WC or WD, and Technician call-signs will begin with WT or WU. First Class and Extra Class licensees will have call-signs consisting of one or two letters before the call area numeral and two letters after the numeral. The prospect of having their call-signs changed worries many presently licensed amateurs more than any of the other proposed changes.

Don't be concerned about these proposed changes. It will be one year after any changes are adopted before they start going into effect and two years before they go fully into effect. The proposals will not force any licensed amateur to leave the air. Rather, the new regulations are designed to offer amateurs an incentive for gradually improving their knowledge and skills by granting those who do so more operating frequencies.

● **License Fees.** No fee is charged for a Novice license, but a $4 fee is charged the applicants for other classes of amateur licenses and for license renewals. Application fees are not refunded, even if the applicant fails to qualify for the license he applies for. License modification—such as a change of address—entails a $2 fee, and upgrading a license—say from Technician to General Class—requires the $4 fee.

● **Applying for Your License.** When you are ready to apply for your Novice, Technician, or Conditional Class license, care-

FCC FORM 610
JANUARY 1964

UNITED STATES OF AMERICA
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

FORM APPROVED
BUDGET BUREAU NO. 52-R069.16

APPLICATION FOR AMATEUR RADIO STATION AND/OR OPERATOR LICENSE

DO NOT WRITE IN THIS BLOCK

GENERAL INSTRUCTIONS

1. THIS APPLICATION IS DIVIDED IN TWO PARTS. PART I IS BELOW AND PART II ON THE REVERSE. COMPLETE THE PART THAT DESCRIBES YOUR REQUEST.
2. USE TYPEWRITER OR PRINT CLEARLY IN INK.
3. APPLICATION MUST BE SIGNED AND DATED.
4. SEND ONE COPY OF APPLICATION AND REQUIRED EXAMINATION PAPERS TO FEDERAL COMMUNICATIONS COMMISSION, GETTYSBURG, PENNSYLVANIA, 17325.
5. ENCLOSE APPROPRIATE FEE WITH APPLICATION, IF REQUIRED. SEE SPECIAL INSTRUCTION A.

SPECIAL INSTRUCTIONS

A. FEES—Enclose appropriate fee with application, if required. DO NOT SEND CASH. Make check or money order payable to Federal Communications Commission. (See Part 97, Volume VI of FCC Rules to determine whether a fee is required with this application.)

B. CRIMINAL CONVICTION INFORMATION—If you have answered "Yes" regarding criminal convictions, furnish the following:
   (1) For each such conviction, give these details—
      (a) The nature of the offense, the date of the conviction, and the name and address of the court;
      (b) The sentence imposed, including the fine and imprisonment; if execution of the sentence was suspended in whole or in part, state to what extent it was suspended;
      (c) The dates of commencement and termination of actual imprisonment, if any;
      (d) If released on parole, give the dates of commencement and termination of parole, and state whether or not parole was successfully completed without incident; if presently on parole, give name and address of parole officer;
      (e) State whether or not radio facilities were used in committing the offense; if such facilities were so used, describe how they were used.
   (2) A statement as to the nature and duration of your present employment or business activity, and the name and address of your employer.
   (3) A description of the proposed use of Amateur Radio if the requested license were to be issued.

PART I—FOR NEW AMATEUR RADIO STATION AND/OR NEW OPERATOR LICENSE. DO NOT use this part to modify or renew an existing license or to change operator privileges. (See Part II)

1 NAME OF APPLICANT
LAST NAME | FIRST NAME | MIDDLE INITIAL

2 MAILING ADDRESS
NUMBER AND STREET
CITY | STATE
ZIP CODE | COUNTY

3 BIRTHPLACE AND DATE
CITY AND STATE | MONTH DAY YEAR

4 WITHIN TEN YEARS PREVIOUS TO THE DATE OF THIS APPLICATION, HAS THE APPLICANT BEEN CONVICTED IN A FEDERAL, STATE, OR LOCAL COURT OF ANY CRIME FOR WHICH THE PENALTY IMPOSED WAS A FINE OF $500 OR MORE OR AN IMPRISONMENT OF SIX MONTHS OR MORE? (See SPECIAL INSTRUCTION B above) — YES ☐ NO ☐

5 A. IS APPLICANT APPLYING FOR AN OPERATOR LICENSE?
B. (If yes, give class (Novice, Technician, Conditional, General, or Extra))
C. Give Current Call Sign or Control No. (If any)

6 A. DOES APPLICANT HAVE ANY OTHER AMATEUR RADIO APPLICATION ON FILE WITH THE COMMISSION THAT HAS NOT BEEN ACTED UPON?
B. (If yes, state its purpose and date submitted)

7 A. IS APPLICANT APPLYING FOR A STATION LICENSE?
(If yes, complete this item. If no, proceed to certification)
B. CHECK ONE:
☐ INDIVIDUAL STATION *(Available only if applicant is applying for or has an operator's license)*
☐ CLUB STATION *(Applicant must be a duly appointed trustee for a bona fide amateur radio organization and must have an operator's license of other than novice class)*
☐ STATION FOR RECREATION UNDER MILITARY AUSPICES
☐ ADDITIONAL STATION _____ (Individual, Club)

8 A. IS APPLICANT REQUESTING A CALL SIGN PREVIOUSLY HELD IN THIS CALL SIGN AREA? (See SPECIAL INSTRUCTION A above)
B. Give Call Sign

9 STATION LOCATION *(If the same as the mailing address write "SEE ITEM 2")*
NUMBER AND STREET
CITY | STATE | COUNTY

10 REMOTE CONTROL POINT
A. NUMBER AND STREET
CITY | STATE
B. REMOTE CONTROL WILL BE BY
☐ WIRE ☐ RADIO *(Submit information required by Section 97.43(b)(6) of the Commission's Rules)*

11 ANTENNA — YES ☐ NO ☐
WILL THE ANTENNA STRUCTURE EXCEED AN OVERALL HEIGHT OF 170 FEET ABOVE GROUND LEVEL OR ONE FOOT ABOVE THE ESTABLISHED AIRPORT (LANDING AREA) ELEVATION FOR EACH 200 FEET OF DISTANCE, OR FRACTION THEREOF, FROM THE NEAREST BOUNDARY OF SUCH LANDING AREA? *(If yes, you must complete and file herewith FCC FORM 401-A, except as may be otherwise provided in Section 97.45(a) of the Commission's Rules)*

12 STATION CONTROL
WILL THE PREMISES OF STATION LOCATION AND OF REMOTE CONTROL POINT, IF ANY, BE UNDER YOUR CONTROL AT ALL TIMES DURING LICENSE TERM? *(If no, submit explanatory statement in less than 14C is applicable)*

13 FOR CLUB STATION APPLICANTS
A. OFFICIAL NAME OF CLUB
B. CLUB STATUS *(Attach a certified copy of the constitution or the organization papers and by-laws)*
☐ CORPORATION ☐ UNINCORPORATED ASSOCIATION
C. IS ANY OFFICER OR DIRECTOR OF YOUR CLUB AN ALIEN, OR ARE MORE THAN ONE-FIFTH OF THE MEMBERS OF YOUR CLUB ALIENS? — YES ☐ NO ☐
D. SIGNATURE AND TITLE OF CLUB OFFICER CERTIFYING APPLICANT AS TRUSTEE TO APPLY FOR AND HOLD STATION LICENSE IN BEHALF OF CLUB

14 FOR STATION APPLICANTS UNDER MILITARY AUSPICES
A. EXACT IDENTIFICATION OF MILITARY UNIT OR GROUP TO OPERATE AMATEUR STATION
B. DOES THE APPLICANT ACCEPT RESPONSIBILITY FOR INSURING THAT THE STATION WILL BE OPERATED ONLY BY A LICENSED AMATEUR OPERATOR? — YES ☐ NO ☐
C. THE STATION WILL NOT BE USED BY THE U.S. GOVERNMENT. APPROVAL TO ESTABLISH AN AMATEUR STATION ON U.S. GOVERNMENT PREMISES IS HEREBY GRANTED
_____ (Signature of official in charge)
_____ (Title or authority to approve)

CERTIFICATION

I CERTIFY that all statements and attachments herewith are true, complete and correct to the best of my knowledge and belief and are made in good faith; that I am a citizen of the United States; that I am not the representative of any alien or foreign government; that I waive any claim to the use of any particular frequency or of the ether as against the regulatory power of the United States because of the previous use of the same whether by license or otherwise; that the station to be licensed, if any, will be inaccessible to unauthorized persons; that if trustee of a club station, I will immediately submit the license for cancellation upon termination of my trusteeship.

_____ _____
(Applicant's Signature) (Date)

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND IMPRISONMENT. U.S. CODE, TITLE 18, SECTION 1001.

THIS BLOCK FOR FCC USE ONLY

	CODE	EXAM	SCREEN	SIGN	BB	
Y						
N						

Amateur License Application Form 610, which must be used in applying for a station and/or operator's license, looks like this. The reverse side of the form is used to change the address of a licensed station.

fully follow these procedures: Write to the Federal Communications Commission office nearest you (you'll find the address in your phone book) and request Amateur License Application Form 610.

Carefully choose a person to act as your volunteer examiner. When your Form 610 arrives, the volunteer examiner will give you your code test. It consists of two parts—a 5-minute code transmission at the specified speed (5 wpm for the Novice and Technician licenses; 13 wpm for the Conditional license) which you must copy for at least one minute (60 consecutive seconds) without error or omission, and a sending test. The Novice/Technician code test contains no punctuation marks or numerals; the Conditional/General test contains both, with each one being counted as two letters.

If you fail the code test, the examination stops immediately without further ado. But if you pass, you fill out your Form 610 and give it to the volunteer examiner. Also, if you are applying for a Technician or Conditional Class license, you hand the examiner your $4 license fee in the form of a check or money order payable to the Federal Communications Commission. (No fee is required of Novice license applicants.)

The volunteer examiner will then write a letter to the Federal Communications Commission, stating that you passed the code test under his supervision and requesting the necessary material for giving you the written examination. In addition, his letter will state his qualifications to act as a volunteer examiner and will include both his and your names and mailing addresses. After signing the letter, the examiner will mail it, your application Form 610, and your license fee (if any) to the Federal Communicataions Commission, Gettysburg, Pa. 17325 within 10 days of the time when you passed the code test. A suggested form for the examiner's letter to the FCC appears on this page.

Upon receipt of the letter, the FCC will mail the necessary examination papers directly to the volunteer examiner, who will be responsible for conducting the examination and returning the papers to the FCC. If for any reason you fail to take the examination within the specified time (normally within 20 days of the time it was mailed by the FCC), he will return the unopened examination envelope to the FCC. Your application fee will not be returned, however.

In conducting the written examination, the examiner will open the sealed envelope containing the examination and will hand the contents (20 multiple-choice questions for the Novice test or 50 multiple-choice questions for the Technician/Conditional Class test) and the answer sheet to you.

After signing each examination sheet 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 have finished the examination, the examiner will certify that you com-

Examiner's name
Examiner's street address
City, State, and Zip Code
Date

Federal Communications Commission
Gettysburg, Pa. 17325

Gentlemen:

I, ..., have been asked by ....., ..., ..., (insert applicant's name and mailing address) to act as his volunteer examiner for his ..... (insert Novice, Technician, or Conditional) Class amateur operator license examination. His completed #610 application form and license fee (if required) are enclosed. Mr. ..... demonstrated to me his ability to send and receive the radiotelegraph code at a speed of ..... words per minute on ..... (insert date).

Please send me the necessary material to administer the ..... Class examination to Mr. .....

I am over 21 years of age and (add one of the following) I hold an amateur operator license of the ..... (insert General, Advanced, or Extra) Class, dated ....., and my amateur call-sign is ..... (or) I hold commercial radiotelegraph license number dated ..... (or) I am employed at ..... in the service of the United States as the operator of a manually operated radiotelegraph station.

To the best of my belief and knowledge all the above information is correct.

Examiner's signature .....
Examiner's name and permanent address (print clearly) .....
.....
.....

Although the examiner's letter need not be precisely in this form, the above sample contains all of the material required by the Federal Communications Commission from a volunteer examiner requesting the written examination material for the Novice, Technician, or Conditional Class license exam as described on this page.

pleted the examination in his presence without help. He will then place the material in a large stamped envelope (furnished by you) which he will mail to the Federal Communications Commission, Gettysburg, Pa. 17325.

If you pass the examination, your license and assigned call letters will arrive in a few weeks. If you should fail the exam, don't feel too bad; you can study a little more and try again 30 days later. In fact, if you fail a by-mail exam, you can appear before an FCC examiner and try for your General license without any waiting period at all.

● **General Class Examination.** Exactly the same procedure is followed when you take the General Class examination as for the by-mail exams, except that an official FCC representative conducts it and the written examination follows the code test.

If you take the examination at a regular FCC office, it is not necessary to make a prior appointment; nevertheless, it is a good idea to write ahead of time for your Form 610 application blank and the suggested date on which you should appear, because published dates are sometimes subject to change.

Should you plan to take the examination at any of the other points where the FCC conducts amateur exams quarterly, semi-annually, or annually, it is necessary to write in advance to the Engineer-in-Charge of the FCC District in which the examination is to be held for your Form 610 and exact information as to where and when the exam will be held. You mail the filled-in 610 application form and your application fee back to the Engineer-in-Charge at least a week ahead of the scheduled examination date. You will then be told where and when to appear to take the examination.

● **Hardship Conditions.** If you are applying for a Conditional Class license because a permanent physical handicap makes it extremely difficult or impossible for you to travel to the examination point, obtain a doctor's certification of your physical condition and give it to your volunteer examiner so that he can include it with your application blank and his letter to the FCC.

● **Special Call-Signs.** Except under very special circumstances, all amateur call-signs are issued in sequence. There are two exceptions to this rule. An old-timer who previously held a "2-letter" call, such as "W9AA," will be re-issued his old call-sign (if he passes the exam) provided that it is not currently assigned; otherwise, the nearest unassigned 2-letter call-sign will be assigned. If you previously held an amateur call-sign which is not now assigned and has not been assigned in the past five years, you may apply for reassignment of your old call-sign.

A bona-fide amateur radio club may apply for the call-sign of a deceased club member as a new call-sign for the club's amateur radio station in his memory. Also, an amateur group may apply for a special unassigned temporary call-sign for an amateur station installed as an exhibit at a fair, convention, or similar gathering.

Under any of the above conditions, a formal application for the special call-sign accompanied by a $20 fee must be filed.

If you hold other than a Novice license, you will automatically retain your present call-sign when you renew your license, provided that your renewal application is made before your current license expires. A one-year grace period after the license expires is allowed. After this period, the call may be reassigned to another applicant.

If a Novice qualifies for a higher grade license *before* his current license expires, he will be issued a "counterpart" call-sign—the same suffix letters with a different new prefix. For example, if the current WN9EGQ (if there is one) earned a higher grade license, he would be assigned call letters like WB9EGQ. Once a Novice license expires, however, its call-sign is immediately available for reassignment, and there is no hope of a previous holder obtaining its counterpart (except by accident) even if at some later date he qualifies for a higher grade license.

● **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 treaties require that everyone must learn the code to get a license. Fortunately, the task is not nearly as difficult as most people believe. Furthermore, learning the code does have several definite advantages.

For example, a code transmitter is simpler and less expensive than a phone trans-

WHERE AMATEUR RADIO EXAMINATIONS ARE GIVEN

General and Extra Class amateur examinations are offered at the Federal Communications Commission's district offices listed below at the times shown. The number in parentheses following the city is the district number. Listed at the bottom of the page are other cities where General and Extra Class examinations are offered quarterly (Q), semiannually (S), and annually (A). The number of the FCC district in which the city is located follows in parentheses. Write to the Engineer in Charge, Federal Communications Commission, of the appropriate district for precise information on the time, date, and exact location of the next scheduled examination. You may take the examination at any of the listed locations, but you must make prior arrangements with the district office. No prior arrangements are necessary for examinations at the district offices themselves unless otherwise stated. No examinations are given on legal holidays, and when a legal holiday falls on a Saturday, all Federal offices are closed the day before.

Alabama, Mobile (8M) 439 U.S. Court & Custom House. Wednesdays, by appointment.

Alaska, Anchorage (23) 55 U.S. Post Office Bldg. and Court House. By appointment.

California, Los Angeles (11) Mezzanine 50, 849 S. Broadway. Wednesdays at 9 a.m. and 1 p.m.

California, San Diego (11SD) Fox Theater Bldg. 1245 7th Ave. Wednesdays, by appointment.

California, San Francisco (12) 323-A Custom House, 555 Battery St. Fridays at 9 a.m.

California, San Pedro (11SP) 1300 Beacon St. Wednesdays at 8 a.m.

Colorado, Denver (15) 521 New Custom House, 19th between California & Stout Sts. First and second Thursday of month at 8 a.m.

District of Columbia, Washington (24) Room 204, 521 12th St., N.W. Tuesdays and Fridays. Code test at 9 a.m. and 1 p.m.

Florida, Miami (7) 51 S.W. First Ave. Thursdays.

Florida, Tampa (7T) 738 Federal Office Bldg., 500 Zack St. By appointment.

Georgia, Atlanta (6) 2010 Atlanta Merchandise Mart, 240 Peachtree St., N.E. Tuesdays and Fridays at 8:30 a.m.

Georgia, Savannah (6S) 238 Post Office Bldg. By appointment.

Hawaii, Honolulu (21) 502 Federal Building. Tuesdays, Wednesdays, Thursdays, at 8 to 9:30 a.m. and by appointment.

Illinois, Chicago (18) 1872 New U.S. Court House & Federal Office Bldg., 219 S. Dearborn St. Fridays at 9 a.m.

Louisiana, New Orleans (8) 829 Federal Office Bldg., 600 South St. Mondays at 8:30 a.m.

Maryland, Baltimore (4) 415 U.S. Custom House, Gay & Water Sts. Mondays and Fridays, 8:30 to 10 a.m., and by appointment.

Massachusetts, Boston (1) 1600 Custom House. Wednesdays, Thursdays, and Fridays, 8:30 to 10 a.m.

Michigan, Detroit (19) 1029 New Federal Building. Wednesdays and Fridays at 9 a.m.

Minnesota, St. Paul (16) 208 Federal Courts Bldg., 6th and Market Sts. Fridays at 8:45 a.m.

Missouri, Kansas City (17) 3100 Federal Office Bldg., 911 Walnut St. Fridays at 8:30 a.m. to 11 a.m.

New York, Buffalo (20) 238 Federal Bldg., Ellicott & Swan Sts. First and third Friday of month at 9 a.m.

New York, New York (2) 748 Federal Bldg., 641 Washington St. Tuesday through Friday (examination must be started before noon).

Oregon, Portland (13) 441 U.S. Court House, 620 S.W. Main St. Fridays at 8:45 a.m.

Pennsylvania, Gettysburg 334 York St. By appointment.

Pennsylvania, Philadelphia (3) 1005 New U.S. Custom House. Mondays thru Wednesdays, 9 to 10 a.m.

Puerto Rico, San Juan (22) 322-323 Federal Bldg. Fridays at 9 a.m.

Texas, Beaumont (9B) 301 Post Office Bldg., 300 Willow St. Tuesdays, Wednesdays, Thursdays, 9 a.m., and by appointment.

Texas, Dallas (10) 1314 Wood St. Tuesdays at 9 a.m.

Texas, Houston (9) New Federal Office Bldg., Room 5636, 515 Rusk Ave. Tuesdays, 8 to 10 a.m.

Virginia, Norfolk (5) 405 Federal Bldg. Fridays, 9 a.m. to 4:30 p.m.

Washington, Seattle (14) 806 Federal Office Bldg., First Ave. & Marion St. Fridays. Code test at 9 a.m.

OTHER EXAMINATION POINTS

Albuquerque, N. M. (S) (15)
Amarillo, Texas (A) (10)
Bakersfield, Calif. (A) (11)
Bangor, Maine (A) (1)
Billings, Mont. (A) (14)
Birmingham, Ala. (Q) (6)
Boise, Idaho (S) (13)
Charleston, W. Va. (Q) (19)
Cincinnati, Ohio (Q) (19)
Cleveland, Ohio (Q) (19)
Columbus, Ohio (Q) (19)
Corpus Christi, Texas (Q) (9)
Davenport, Iowa (Q) (18)
Des Moines, Iowa (Q) (17)
El Paso, Texas (A) (10)
Fairbanks, Alaska (S) (23)
Fort Wayne, Ind (Q) (18)
Fresno, Calif. (Q) (12)
Grand Rapids, Mich. (Q) (19)
Great Falls, Mont. (A) (14)
Hartford, Conn. (S) (1)
Hilo, Hawaii (A) (21)
Indianapolis, Ind. (Q) (18)
Jackson, Miss. (S) (8)
Jacksonville, Fla. (S) (7)
Jamestown, N. D. (A) (16)
Klamath Falls, Oreg. (A) (13)
Knoxville, Tenn. (Q) (6)
Lihue, Kuai, Hawaii (A) (21)
Little Rock, Ark. (Q) (8)
Louisville, Ky. (Q) (18)
Marquette, Mich. (A) (16)
Memphis, Tenn. (Q) (6)
Milwaukee, Wis. (Q) (18)
Nashville, Tenn. (Q) (6)
Oklahoma City, Okla. (Q) (10)
Omaha, Neb. (Q) (17)
Phoenix, Arizona (Q) (11)
Pittsburgh, Pa. (Q) (20)
Portland, Maine (S) (1)
Rapid City, S. D. (A) (1)
Roanoke, Va. (S) (5)
St. Louis, Mo. (Q) (17)
Salt Lake City, Utah (Q) (15)
San Antonio, Texas (Q) (9)
Schenectady, N.Y. (Q) (2)
Sioux Falls, S. D. (Q) (16)
Spokane, Wash. (S) (14)
Syracuse, N.Y. (Q) (20)
Tucson, Ariz. (S) (11)
Tulsa, Okla. (Q) (10)
Wailuki, Maui, Hawaii (A) (21)
Williamsport, Pa. (Q) (20)
Wilmington, N.C. (S) (5)
Winston-Salem, N.C. (Q) (5)

mitter 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.

As a matter of interest, the international amateur regulations do permit the FCC to issue no-code amateur licenses for frequencies above 144 mc. However, there is no evidence at present that the FCC has any intention of ever issuing such a license.

● **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 the following pages 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.

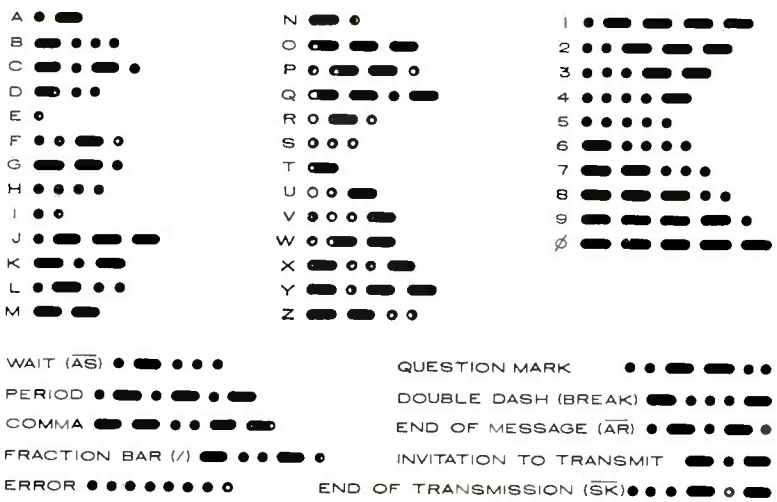
The preferred method of learning the code goes something like this: The teacher taps out a letter in code on his code practice oscillator at a speed equivalent to approximately 15 words per minute, followed by a voice announcement of the letter sent. After several repetitions to implant the letter in 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 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 *dit*'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, 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 rec-



Morse code is not as fearsome as it looks at first. Transmission and reception of punctuation is not required to pass a Novice ham examination. Special letter groups such as AS and SK are transmitted without spacing between letters; when written or printed, these groupings are identified by a bar drawn over the two letters.

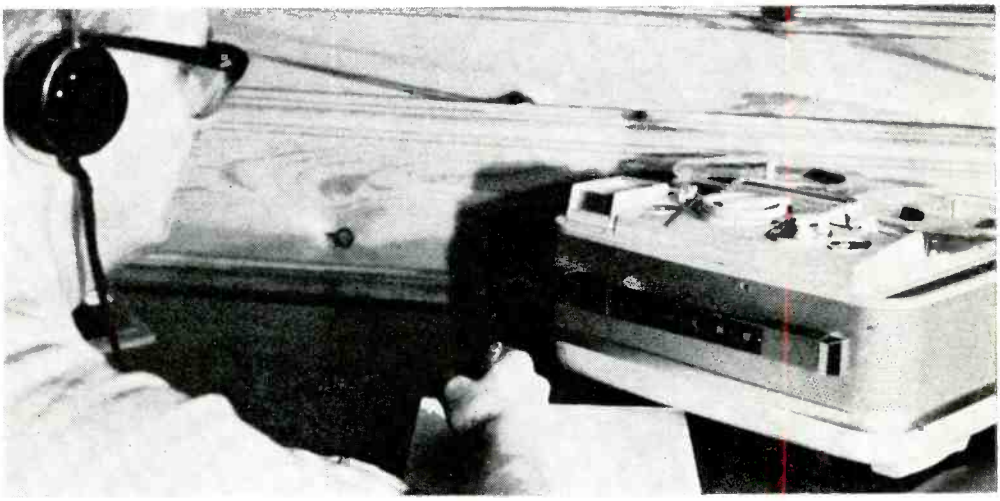
ords, magnetic tapes, or on punched-paper tapes for use on special code machines. However, it's easy to memorize such a course sufficiently to allow you to anticipate what's coming next, giving you an exaggerated idea of your copying ability. This problem can be alleviated to some degree when two or 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 *dit*. Similarly, a dash isn't a dash, but a *dah*. (*Dit* and *dah* approximate the actual sound of the code.) When learning a character, such as *A*, don't say *dit* space *dah* but snap the whole character out as a unit—*didah*.

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.

One very good way to get the necessary practice to build up your copying speed is to copy the daily code-practice transmissions from W1AW, the ARRL headquarters station, at 9:30 p.m. local time (EST in the winter, EDT in the summer). Frequencies used are 1.805, 3.555, 7.085, 14.1, 50.7, and 145.8 mc. On Sunday, Monday, Wednesday, and Friday, the transmitting speeds are 5, 7½, 10, 13, 20, and 25 wpm. On the other nights, the speeds are 15, 20, 25, 30, and 35 wpm. In addition to these sessions, W1AW also transmits an "early" code-practice session between 7:30 and 8:00 p.m. at speeds of 10, 13, and 15 wpm. Incidentally, even after you get your Novice license, copying W1AW's code-practice sessions regularly will speed up the process of increasing your code speed to the 13-wmp General Class requirement.

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 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 before the start of the actual code practice.



A tape recorder is valuable to the beginner or Novice class ham aspiring for a license or higher grade. Playback of your own sending points out obvious errors in character formation and spacing. Practice tapes are available from a few manufacturers; you can make your own by picking code practice stations off the air.

Other ham stations also send code practice, although their schedules change rather frequently; a request to the ARRL 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. You're ready for the code test when you consistently copy at a speed 3 wpm faster than the test speed; without this "cushion," you may fail the test.

(*Continued on page* 62)

WHERE YOU CAN OBTAIN CODE AND/OR THEORY LESSONS

The amateur radio clubs listed below offer code and/or theory courses for prospective hams. They are listed alphabetically by state and city, and the person named (wherever possible) is the one to contact for further information. Some of these clubs may have recently finished their courses and others may be in the

Birmingham A.R.C.
Box 603
Birmingham, Ala.

Huntsville A.R.C, Inc.
Wm. C. Probus, WA4DBQ
2607 Woodview Dr., S.E.
Huntsville, Ala.

Montgomery A.R.C.
W. P. Sides, W4AUP
Fleming Rd.
Route 1, Box 88
Montgomery, Ala.

Valley A.R.C.
Ray Tucker, K4SDN
c/o Research Div.
Shawmut, Ala.

Alabama & Georgia A.R.C.
William Byrd, WA4EXB
Route 2, Box 128
Tuskegee, Ala.

Anchorage A.R.C.
Grace Dillion, KL7DLA
Box 211
Anchorage, Alaska

Arizona A.R.C.
Dean Norris, K7TNW
4515 E. Montecito
Phoenix, Ariz.

Fort Smith A.R.C.
J. P. Freeman W5HOT
1800 South "T" St.
Ft. Smith, Ark.

Anaheim A.R.A.
James R. Fountain, K6AFP
Box 2242
Anaheim, Calif.

South Bay A.R.S.
Box 73
Bonita, Calif.

LERC A.R.C.
Wm. G. Welsh, WA6TVL
2814 Empire Ave.
Burbank, Calif.

West Valley A.R.A.
Edw. H. Wall, WA6LUQ
Box 784
Campbell, Calif.

Indian Wells Valley A.R.C., Inc.
Box 5421
China Lake, Calif.

Mount Diablo A.R.C.
John Howell, WA6MIE
Box 1122
Concord, Calif.

Tehama County A.R.C.
Ian M. Evans, K6SKG
324 West St.
Corning, Calif.

Dunsmuir A.R.C.
R. Rains, W6IOM
Dunsmuir, Calif.

Fullerton R.C.
Paul Broden, WB6CDY
Box 545
Fullerton, Calif.

Orange County A.R.C.
Dave Yap
8542 Orinda Circle
Huntington Beach, Calif.

Inglewood A.R.C., Inc.
Box 441
Inglewood, Calif.

Lakewood R.C.
C. B. Mitchella, WB6AEV
5442 Harco St.
Long Beach, Calif.

Edison A.R.C.
Robt. H. Lyon, WA6DTG
Box 351
Los Angeles, Calif.

Palo Alto A.R.C.
C. C. Noyer, K6PDI
Box 911
Menlo Park, Calif.

Estero R.C.
Mrs. Edith Barnes
Box 56
Morro Bay, Calif.

Oroville A.R.S.
A. W. Fuller, W6AF
Box 326
Oroville, Calif.

Santa Barbara A.R.C.
John Whitaker, WB6IAK
Box 273
Santa Barbara, Calif.

General Dynamics Convair Rec. Assn. A.R.C.
Fred W. Franz, WA6HVB
Box 11023
San Diego, Calif.

Helix A.R.C.
Wes Dey, W6YST
5695 Regis Ave.
San Diego, Calif.

North Shores A.R.C.
David E. Atkinson, WB6MRK
3117 Briand Ave.
San Diego, Calif.

National City A.R.C.
Doug. Decker, Jr., WA6TAD
5901 Streamwood Dr.
San Diego, Calif.

San Francisco R.C.
George Spindler, W6HSA
2571 38th Ave.
San Francisco, Calif.

San Gabriel Valley R.C., Inc.
Stanley Fedora, WA6IDV
Box 45
San Gabriel, Calif.

Marin A.R.C.
Jim French, WB6KHI
712 Fifth Ave.
San Rafael, Calif.

Marina A.R.C.
Sec-Treas.
Box 2112
Torrance, Calif.

Tulare County A.R.C., Inc.
John Williams, K6VWV
1413 E. Alpine
Tulare, Calif.

Satellite A.R.C.
Edward W. Woodward, WB6IPI
Box 1615
Vandenberg AFB, Calif.

San Fernando Valley R.C.
Technical Chairman
Box 3161
Van Nuys, Calif.

Western Slope R.C.
E. Fleming, WØHMK
328 Gunnison Ave.
Grand Junction, Colo.

Weld County R.C.
Dennis Quirk, WAØELB
2524 13th
Greeley, Colo.

Lamar A.R.C.
Lee Robinson, WØIDX
105 E. Elm
Lamar, Colo.

Westchester A.R.A.
Michael J. Kulesh, K1ONJ
46 High St.
Byram, Conn.

Cromwell A.R.S.
Gordon Russell, WA1BCJ
13 Grace Lane
Cromwell, Conn.

Eastern Conn. A.R.A.
Millie Beaudreau
Box 155
Danielson, Conn.

Shoreline A.R.C.
Julius E. Heck, K1LBG
Town Hall
Essex, Conn.

Meridien A.R.C.
Dave Swedock, K1WJL
77 Oak St.
Meridien, Conn.

South Eastern A.R.A.
C. Whitaker, W1LAZ
384 Dawson St.
New Bedford, Conn.

Central Connecticut A.R.C.
Chester Gorski, K1MYQ
25 Hatch St.
New Britain, Conn.

Tri-City A.R.C., Inc.
Jack Horner, W1AIP
Crocker House Hotel
New London, Conn.

A. R. Emergency Corps of Norwalk
Ralph W. Baord, K1FJV
42 Eagle Rd.
Norwalk, Conn.

Shelton Emergency R.A.
James Geddes
62 Wakeley St.
Shelton, Conn.

Stratford A.R.C.
John Peleponuk, WN1CDM
Boothe Memorial Park
Stratford, Conn.

CQ R.C.
William P. Baldyga, K1YGS
142 Torrington Hts Rd.
Torrington, Conn.

Kent County A.R.C.
Howard H. Klemetz
23 Saxton Rd., Kent Acres
Dover, Del.

Delaware A.R.C.
Arthur F. Wildblood, K3NHL
Meeting House Rd.
Hockessin, Del.

First State A.R.C.
George A. Moyer, Jr., W3URR
11 Orchard Lane
Wilmington, Del.

Manatee A.R.C., Inc.
J. D. Felsenheld, K4BY
3404 27th St. West
Bradenton, Fla.

Hialeah A.R.C.
Roland Livernois, WA4EJP
17131 N. W. 46th Ave.
Carol City, Fla.

Daytona Beach A.R.A.
Frank R. Miley, WA4SYH
Box 1608
Daytona Beach, Fla.

Eglin A.R.S.
Frank M. Butler, Jr., W4RKH
Box 1773
Eglin AFB, Fla.

Tamiani A.R.C.
Lyman B. Widney, K4YHU
Box 476
Englewood, Fla.

Ft. Pierce R.C., Inc.
Earl Snyder
Box 5
Ft. Pierce, Fla.

Everglades A.R.C., Inc.
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Jacksonville, Fla.

West Palm Beach R.C.
Winslow Hall, WA4KKW
420 10 Ave. North
Lake Worth, Fla.

Orlando A.R.C.
Evalyn Shea, K4UIZ
736 Alfred Dr.
Orlando, Fla.

middle of their current courses. In either event, you can sign up for the next scheduled course. In the meanwhile, join the club—your fellow club members will undoubtedly help you obtain your license. There are also amateur radio clubs in Canada that offer similar code and/or theory classes.

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Chicago, Ill. (apply in person)

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1114 Frank Ave.
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Dale Squires, K3HCT, Rochester, Pa., is sold on the use of CW. Dale frequently tunes the Novice bands to help beginners improve operating procedures. K3HCT has Hallicrafters and Heathkit equipment.

● **Learning to Send.** When you're able to recieve 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 *dit*'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 *dit*'s, while the space between *dit*'s and *dah*'s in a letter is equal in length to a *dit*. Similarly, the spacing between letters in a word is equal to three *dit*'s and the spacing between words is equal to seven *dit*'s. Concentrate on these fundamentals and you're sure to develop a good "fist." Don't worry about speed, but curb your natural tendency to attempt 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 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 by used to monitor your own sending when you get on the air—which is a very valuable feature, by the way.

● **Placing the Key.** Adjust your key so that its contacts meet squarely and are spaced approximately 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.

Contrary to what many beginners believe, learning to send *well* requires just as much skill as learning to receive the code. Try to get a skilled old-timer to evaluate your code sending, or make a tape recording of your "fist," and evaluate it for yourself.

● **Using a Bug.** After you've gained proficiency with your "straight" key, you'll probably want to graduate to a "bug" or semiautomatic 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 dots or to the left for dashes—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 recommended that you wait until you can send and receive code at 15 wpm before trying either bug or keyer. Of some interest to amateurs trying for a higher class license is the fact that you can take the FCC sending test using a "bug" or keyer—if you bring your own.

● **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.

Besides the general handbooks on amateur radio, there are also many specialized manuals and handbooks available, covering subjects like antennas, mobile operation, single sideband (SSB), and VHF operation, which are valuable additions to any ham's bookshelf. The catalogues of most electronic supply houses list these books.

● **Code vs. Phone.** Many prospective hams are interested only in phone operation "because it's more fun to talk than to pound 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 "CW" (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 CW signals can operate in the space occupied by a single phone station.

Of course, phone has its points, too, especially for casual chit-chatting (called "rag-chewing"). As a guess, about 99% of all operating on the ham frequencies above 50 mc. is on phone. Although some phone men insist that they can work anything on phone that any CW operator can work, even on these frequencies, the record-breaking contacts, such as "moon-bounce" contacts, are almost always made on CW.

Possibly the biggest advantage of CW 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 Novice and Technician license holders are restricted somewhat as to how and where they can operate, General (and Conditional) licenses can pump out CW and phone signals on any ham band. The general characteristics of each of the bands are itemized below. It is emphasized, however, that short-wave propagation conditions are constantly changing, sometimes gradually, and other times very abruptly.

Overly simplified, radio waves—like light waves—travel in straight lines, and would quickly disappear in endless space unless they were "bent" or reflected in some manner. The *ionosphere*—an electrified region created by the sun's ultraviolet radiation between 50 and 250 miles above the earth —does most of the reflecting by acting as a giant radio wave "mirror." Its reflecting properties change with every change in the sun. At higher frequencies conditions in the lower atmosphere (1-10 miles up) also affect radio propagation conditions.

For these and other reasons, trying to predict propagation conditions is something like weather forecasting—not the most accurate science in the world. But from the amateur's viewpoint, the very uncertainty as to whether his next contact will be with a new friend across town or with an old friend halfway around the world is one of the great fascinations of amateur radio.

● **160-Meter Band.** Prior to World War II, 160 meters (1.8 to 2.0 mc.) was a very popular radiotelephone band. During the war, however, this band was taken over by LORAN stations (long-range navigation stations). Some of these LORAN stations are still in operation along the Atlantic, Pacific,

Standing behind this bank of Hallicrafters equipment is Domenico Petti, HV1CN, in Vatican City, Rome, Italy. His visitors (left to right): Father Ralph Bastion, K9LED, and Trav Marshall, K9EBE.

and Gulf coasts, and their raucous buzzing tones, centered on 1850 and 1950 kc., can easily be heard.

Present-day hams share the 160-meter band with these LORAN stations in a rather complicated arrangement of frequencies and power to prevent harmful interference to the LORAN service. You can find out what the situation is in your state from the nearest FCC office.

Although this band does not see as much activity as in the old days, many hams enjoy medium-distance phone and CW contacts on 160 meters. Furthermore, dedicated CW DX chasers manage to make a handful of foreign DX contacts each winter.

● **80-Meter and 75-Meter Bands.** A distinction is generally made between the 80-meter (3.5 to 3.8 mc.) and 75-meter (3.8 to 4.0 mc.) bands, since the former is used for CW (and RTTY) operation in the United States, and the latter is primarily a phone band. The Novice band is 3.7 to 3.75 mc. From the equipment standpoint, the 80-meter band is probably the best one for a new ham.

From sunset to sunrise, a low or medium-power ham station can expect to work distances between 200 and 1000 miles. On good winter nights, much greater distances can be covered. Daytime ranges are usually under 100 miles. Many low-power hams operate 75-meter phone in the daytime when interference is apt to be slight, and switch to 80-meter CW during the evening hours.

● **40 Meters.** The 40-meter (7.0 to 7.3 mc.) band is one of the most popular ham bands for both Novice and General Class operators. The Novice CW assignment is 7.15 to 7.2 mc., and the phone assignment is 7.2 to 7.3 mc. Unfortunately, the 40-meter band is fighting for its life, as it is being encroached upon by international short-wave broadcast stations in Europe, Africa, and Asia.

During the middle hours of the day, a medium-power ham station can expect to work distances between 200 and 500 miles. As the evening hours approach, the "skip" increases, making it easy to work more distant stations (over 500 to 1500 miles), but it may be impossible to work nearby stations.

On many winter evenings, in fact, 40-meter "skip" may increase to such an extent that it is impossible to hear any stations within the United States (except those on ground-wave less than 100 miles away).

● **20 Meters.** Year in and year out, the 20-meter (14.0 to 14.35 mc.) band is the most reliable band for DX'ing. It suffers comparatively little from commercial interference; except for the 14.3- to 14.35-mc. segment (whch is shared with a few, low-power Russian stations), it is an exclusive ham band. As a result, the 20-meter band is loaded with DX-minded phone and CW hams from every part of the globe. And because the DX competition is so great, this band has an abundance of very efficient, high-power stations using elaborate beam antennas.

On the average, the 20-meter band is open for distances between 700 and 2500 miles during daylight hours; in addition, it is frequently possible to contact stations halfway around the world. After dark, the band may go completely "dead," except for local contacts, especially during the winter.

● **15 Meters.** From 1960 to 1964, as the 11-year sunspot cycle approached its minimum point, radio conditions on the 15-meter (21.0 to 21.45 mc.) amateur band were quite erratic. But we are now beyond the minimum point, and radio propagation conditions on the 15-meter amateur band are improving rapidly.

When 15 meters is good, it is very good, but when it's bad, it's very bad. This band includes the Novice "DX band" (21.1 to 21.25 mc.) It is also the last stronghold of low-power General Class phone (both AM and SSB) and CW DX'ers.

"Skip" effects are quite pronounced on 15 meters, and even low-power signals are quite strong when conditions are favorable. On good days, the band is relatively heavily populated with signals from beyond the 800- to 1000-mile range. And when conditions are right, DX signals are slightly stronger than on 20 meters. But, except for unpredictable periods of "short skip," the band is usually dead after sunset for other than local work.

An important advantage of the 15-meter band is that it is the lowest frequency amateur band on which an effective beam antenna is practical for the average ham. Such an antenna will boost the effective power of even a low-power station sufficiently to give the embryonic DX'er some consistency in his results.

● **10 Meters.** During years of peak sunspot activity, the number of DX stations—mostly on phone—that can be heard on the 10-meter (28.0 to 29.7 mc.) amateur band is truly astounding. However, as the current sunspot cycle went through its minimum period, the 10-meter band was dead for DX for days in a row.

Propagation conditions are now on the upward swing; and, while it will probably be at least another year before 10 meter DX bursts into full bloom, a fair amount of DX in now being heard and worked in the United States—much of it from a southerly direction. In addition, short skip effects are quite pronounced, permitting many extremely strong signals over distances up to 1000 miles (and sometimes more) to be worked, especially during the months of May. June, July, and December.

Even more than 15 meters, 10 meters is primarily a daytime band, although it is very popular in many areas of the country for local mobile and nighttime rag-chewing.

Bill Richardson, K6VVM, accepts from Ray Meyers, W6MLZ, a complete SSB ham station. The station is to be used by the Braille Institute of America. W6MLZ acted as spokesman for the Single Sideband Amateur Radio Association is making this presentation. All the controls are marked in Braille.

● **6 Meters.** The 6-meter (50-54 mc.) band is located just below TV Channel 2, and it has many of the characteristics of TV propagation—consistent 60 to 75 mile coverage with occasional DX transmissions out to 200 to 250 miles.

Pronounced short-skip effects are also observed on this band. Watch for short-skip openings and other unusual propagation conditions to work 6-meter DX. Quite a few DX'ers have 40 or more states and even a few foreign contacts in their logs.

As the new sunspot cycle approaches its maximum, the opportunities to work DX on 6 meters will sharply improve.

● **2 Meters.** The 2-meter (144 to 148 mc.) band is the only ham band on which Novices can use phone—between 145 and 147 mc. It has a very reliable range of 25 to 40 miles for stations using typical equipment and at least triple this for more elaborate stations, especially those with multi-element, high-gain antenna systems. Very few stations use high power here, so Novices are pretty much on an equal footing with other hams on 2 meters.

Because of this band's normal limited DX range, most 2-meter activity is concentrated in and near the large metropolitan areas. Nevertheless, serious 2-meter workers have posted fantastic DX records, including spanning the Pacific Ocean between California and Hawaii, and working over 40 states. In addition, California to Finland and similar distances have been spanned on 2 meters via "moon bounce." And all transmissions between amateurs via the OSCAR III satellite were made on 2 meters.

● **1¼ Meters.** Although the 1¼-meter (220 to 225 mc.) band is not as heavily populated as it will be in the foreseeable future, activity is increasing. Much antenna experimenting is done on this band, because of the small size of the antennas used.

In addition to the above bands, radio amateurs are also allocated bands of frequencies around 420, 1215, 2300, 3500, 5650, 10,000, 21,000, and 30,000 mc. There is considerable amateur TV activity in the 420-mc. band, and the 1215-mc. band has been used in amateur "moon-bounce" experiments, in which over-the-earth distances of 3000 miles have been covered by bouncing signals off the moon.

● **Choosing Your Equipment.** When it comes to choosing equipment, the new radio amateur is in the same position as a youngster with a dime to spend in a candy store. There are so many goodies to choose from! Should his first transmitter work on both CW and phone? What bands should it cover? How much power should it have?

What about the ham receiver? Should it cover only the ham bands, or should it cover the frequencies in between these bands as well?

How good is amateur equipment assembled from kits. How difficult are kits to assemble? How about really home-built equipment?

Of course, the type of license held and the ultimate aim of the individual amateur have a large bearing on the answers to these questions. But the information below and on the following pages will help you make an intelligent choice.

● **First Transmitters.** A Novice whose aim is to obtain his General Class license as soon as possible has clear guide lines for choosing his first transmitter. It must be crystal-controlled, key well, and operate on the 80-, 40-, and 15-meter Novice bands within the 75-watt Novice power limit. From a receiving signal standpoint, a 50- to 60-watter is virtually as effective as a 75-watter, and the 20-watt transmitter is received only one "S" unit weaker than the 75-watter. With such transmitters, the average Novice can work around 30 states and make a few foreign country contacts; many Novices with good antennas work all 50 states and much more DX.

All except the simplest 1-tube transmitters cover the 20- and 10-meter (and sometimes the 6-meter) bands in addition to 80, 40, and 15 meters. Some of them also include a screen modulator for low-power AM phone. Obviously, a transmitter covering five or six bands with a built-in modulator makes an excellent first transmitter for a Novice or General Class operator. A General can add an external VFO for still greater versatility.

If you want to start out with something a little more elaborate, there are transmitters available with either optional crystal or built-in VFO control and a rated power input up to 150 watts or so. A transmitter with a rated power input of 150 watts can usually be throttled down to 75 watts for Novice work, and the VFO can be held in reserve for the eventual General license.

● **Phone Transmitters.** Conventional amplitude-modulated (AM) phone transmitters transmit a "carrier" and two sidebands. In contrast, a single-sideband transmitter suppresses the carrier and one sideband and concentrates all its talk power in the remaining sideband. At low power levels, an AM transmitter costs less than an SSB transmitter. But the SSB signal occupies less than half the frequency space (something like CW) and is up to eight times as effective as the conventional AM signal. And at power levels over 100 watts, SSB transmitters are less expensive than AM transmitters.

We cannot recommend spending a great deal of money on AM equipment for the amateur frequencies below 30 mc. Nevertheless, if you have a General license and want to try phone and cannot afford an SSB transmitter, you can still get a lot of pleasure on AM phone—especially during the less crowded operating hours.

For Novices who would like to buy a combination CW/SSB transmitter there are one or two that can be crystal-controlled, as indicated in the equipment list on pages 69 to 71, and a number of other transmitters are relatively simple to modify for crystal control. If you're interested, contact the manufacturers for information.

● **Single-Sideband Transceiver.** A recent development in the amateur equipment picture is the SSB transceiver. Such units range in price from approximately $120 for a single-band kit (plus $40 to $60 for a power supply kit) to over $2000 for a deluxe, multiband unit. Besides covering more bands, the deluxe units usually feature AM and CW operation in addition to SSB.

Many transceiver components are used on both "transmit" and "receive" functions. This double-duty use of components can reduce the cost of one of the simpler transceivers to about that of a good receiver or low-power transmitter. However, the cost of a transceiver capable of performing all the functions of a separate receiver and transmitter is approximately the same as the combined cost of the latter two units bought separately.

Possibly the greatest operating convenience of a transceiver is that it normally transmits and receives on exactly the same frequency. Oddly enough, however, this same feature is the transceiver's greatest disadvantage in the eyes of the dedicated DX chaser. Foreign phone stations frequently operate outside the U.S. bands to escape the heavy U.S. phone interference. Thus, to work them, the transceiver operator must tune to the DX station's fre-

(*Continued on page 72*)

SAMPLER OF EQUIPMENT FOR THE HAM NEWCOMER

Manufacturer	Model	Type	Function	Transmitter Control	Bands	Mode	Power, etc.	Price
Allied Radio								
100 N. Western Ave.	R-55A	Kit	Receiver		BCB/6 m.	AM/CW	8 tubes	$ 59.95
Chicago, Ill.	R-100A	Kit	Receiver		BCB/10 m.	AM/CW/SSB	9 tubes	99.95
("Knight-Kit")	T-60	Kit	Transmitter	Xtal	80/6 m.	AM/CW	60 watts	49.95
AMECO Equipment Corp.	AC-1T	Kit	Transmitter	Xtal	80/40 m.	CW	15 watts	19.95
178 Herricks Rd.	TX-62	Wired	Transmitter	Xtal	6/2 m.	AM/CW	75 watts	149.95
Mineola, L.I., N.Y.	TX-86	Kit	Transmitter	Xtal	80/10 m.	AM/CW	90 watts	89.95
	PS-3	Wired	Power supply for TX-86				117 volts	44.95
	CN Series	Kits	Converters		6, 2, or 1¼ m.			34.95 and up
	PS-1K	Kit	Power supply for CN series				117 volts	10.50
Conar Division of National Radio Institute	400	Kit	Transmitter	Xtal	80/40/15 m.	CW	25 watts	32.50[1]
3939 Wisconsin Ave. Washington, D.C.	500	Kit	Receiver		80/40/15 m.	AM/CW/SSB	4 tubes	37.50[1]
R. L. Drake Company Miamisburg, Ohio	R-4	Wired	Receiver		80/10 m.	AM/CW/SSB	19 tubes	379.95
EICO Electronic Instrument Co., Inc.	720	Kit	Transmitter	Xtal	80/10 m.	CW	90 watts	89.95[1]
	723	Kit	Transmitter	Xtal	80/10 m.	CW	60 watts	59.95[1]
1311-01 39th Ave. Flushing, N.Y.	722	Kit	VFO for 720 and 723		80/10 m.			44.95[1]
	730	Kit	Modulator for 720 and 723					59.95[1]
Galaxy Electronics		Wired	CW Monitor for any transmitter				Solid-state	29.95
10 S. 34th St.		Wired	Microphone Compression Amp.				Solid-state	24.95
Council Bluffs, Iowa		Wired	"Rejector" Audio Notch Filter				Solid-state	34.95

(Continued on next page)

SAMPLER OF EQUIPMENT FOR THE HAM NEWCOMER

Manufacturer	Model	Type	Function	Transmitter Control	Bands	Mode	Power, etc.	Price
Gonset, Inc.	900A	Wired	Transceiver	VFO	2 m.	AM/CW/SSB	20 watts	399.50
Altec Lansing Corp.	901A	Wired	Power supply for 900A				117 volts	73.50
1515 S. Manchester Ave.								
Anaheim, Calif.	910A	Wired	Receiver	Xtal	6 m.	AM/CW/SSB		399.50
	911A	Wired	Power supply for 910A					73.50
	G50	Wired	Transceiver	Xtal/VFO	6 m.	AM		367.30
Hallicrafters	HT-46	Wired	Transmitter	VFO/Xtal	80/10 m.	CW/SSB	100 watts	295.00
5th & Kostner Ave.	SX-130	Wired	Receiver		80/10 m.	AM/CW/SSB	7 tubes	179.95
Chicago, Ill.	SX-146	Wired	Receiver		80/10 m.	AM/CW/SSB	9 tubes	249.95
	SR-42	Wired	Transceiver	Xtal	2 m.	AM	12 watts	189.95
	SR-46	Wired	Transceiver	Xtal	6 m.	AM	12 watts	189.95
Hammarlund Mfg. Co.	HX-50A	Wired	Transmitter	Xtal/VFO	80/10 m.	AM/CW/SSB	200 watts	495.00
73-88 Hammarlund Dr.	HQ-110A/VHF	Wired	Receiver		160/2 m.	AM/CW/SSB		299.00
Mars Hill, N.C.	HQ-170A/VHF	Wired	Receiver		160/2 m.	AM/CW/SSB		429.00
Heath Company	DX-60A	Kit	Transmitter	Xtal	80/10 m.	AM/CW	90 watts	79.95
Benton Harbor, Mich.	HG-10	Kit	VFO for DX-60	VFO	80/2 m.			34.95
("Heathkit")	HR-10	Kit	Receiver		80/10 m.	AM/CW/SSB	7 tubes	79.95
	HW-29A	Kit	Transceiver	Xtal	6 m.	AM	5 watts	44.95
	HW-30	Kit	Transceiver	Xtal	2 m.	AM	5 watts	44.95
	SB-110	Kit	Transceiver	VFO	6 m.	SSB/CW	180 watts	320.00
	HD-11	Kit	Q-Multiplier		450-460 kc.		117 volts	14.95
International Crystal	AOD-57	Wired	Transmitter	Xtal	6 m.	CW	5 watts	69.50
Mfg. Co., Inc.	AOA-144	Wired	Amplifier		2 m.	CW		39.50
18 N. Lee St.	AMD-10	Wired	Modulator for above units					24.50
Oklahoma City, Okla.								
E. F. Johnson Co.	Ranger II	Kit	Transmitter	Xtal/VFO	160/6 m.	AM/CW	65-75 watts	249.50
Waseca, Minn.	Ranger II	Wired	Transmitter	Xtal/VFO	160/6 m.	AM/CW	65-75 watts	359.50
	250-23-1	Wired	"Match Box" Antenna Coupler				275 watts	64.95
Lafayette Radio Electronics	HA-225	Wired	Receiver		15/54 mc.	AM/CW/SSB	14 tubes	129.95
111 Jericho Turnpike	HA-350	Wired	Receiver		80/10 m.	AM/CW/SSB	11 tubes	174.95
Syosset, L.I., N.Y.	99-2501	Wired	VFO		80/10 m.		117 volts	34.50

	99-2536	Wired	VFO		6/2 m.		117 volts	29.95
	650	Wired	Transceiver	Xtal	6 m.	AM	Solid-state 2.5 watts	119.95
National Radio Co., Inc. **37 Washington St.** **Melrose, Mass.**	NC-190	Wired	Receiver		BCB/10 m.	AM/CW/SSB	10 tubes	239.95
Polytronics Laboratories, Inc. **88 Clinton Rd.** **West Caldwell, N.J.**	PC-2 AC/DC	Wired	Transceiver	Xtal/VFO	2 m.	AM	18 watts	$349.50
	PC-6 AC/DC	Wired	Transceiver	Xtal/VFO	6 m.	AM	18 watts	329.50
Squires-Sanders, Inc. **Martinsville Rd./** **Liberty Corner,** **Millington, N.J.** **("Clegg")**	22'er	Wired	Transceiver	Xtal	2 m.	AM	18 watts	239.50
	99'er	Wired	Transceiver	Xtal	6 m.	AM	18 watts	179.95
	Thor VI	Wired	Transceiver	Xtal/VFO	6 m.	AM/CW	60 watts	399.95
	Inter-ceptor B	Wired	Receiver		2/6 m.	AM/CW/SSB		495.00
		Wired	HF Tuner		80/10 m.			129.95
The Equipment Crafters **Box 84** **Hackensack, N.J.** **("Tecraft")**	TR-20/50	Wired	Transmitter	Xtal	6 m.	AM/CW	20 watts	65.95
	TR-20/144	Wired	Transmitter	Xtal	2 m.	AM/CW	20 watts	65.95
	PTR-2	Wired	Power supply for above				117 volts	39.95
	50	Wired	Converter		6 m.		117 volts	54.95
	144	Wired	Converter		2 m.		117 volts	54.95
Utica Communications Corp. **2917 W. Irving Park** **Chicago, Ill.**	650	Wired	Transceiver	Xtal/VFO	6 m.	AM	22 watts Less VFO	189.95 169.95
Vanguard Electronic Labs. **19-48 99th Ave.** **Hollis, N.Y.**	300	Wired	Converter		6 m.		Solid-state	10.95
	300	Wired	Converter		2 m.		Solid-state	12.95
Whippany Laboratories, Inc. **1275 Bloomfield Ave.** **Fairfield, N.J.**	Li'l Lulu	Wired	Transmitter	VFO	6 m.	AM/CW	17 watts	225.00
	Li'l Lulu	Wired	Receiver		6 m.	AM/CW/SSB		250.00
World Radio Laboratories **3415 Broadway** **Council Bluffs, Iowa**	TC-6A	Kit	Transceiver	Xtal	6 m.	AM	5 watts	39.95
	TCA	Kit	Power supply for TC-6A				117 volts	15.95
	CA-27	Wired	Microphone Compressor Amp.				Solid-state	14.95
	MM-100	Kit	Antenna Tuner		80/10 m.	AM/CW	100 watts	10.95
	SS-3	Kit	Q-Multiplier		455 kc.		117 volts	15.95

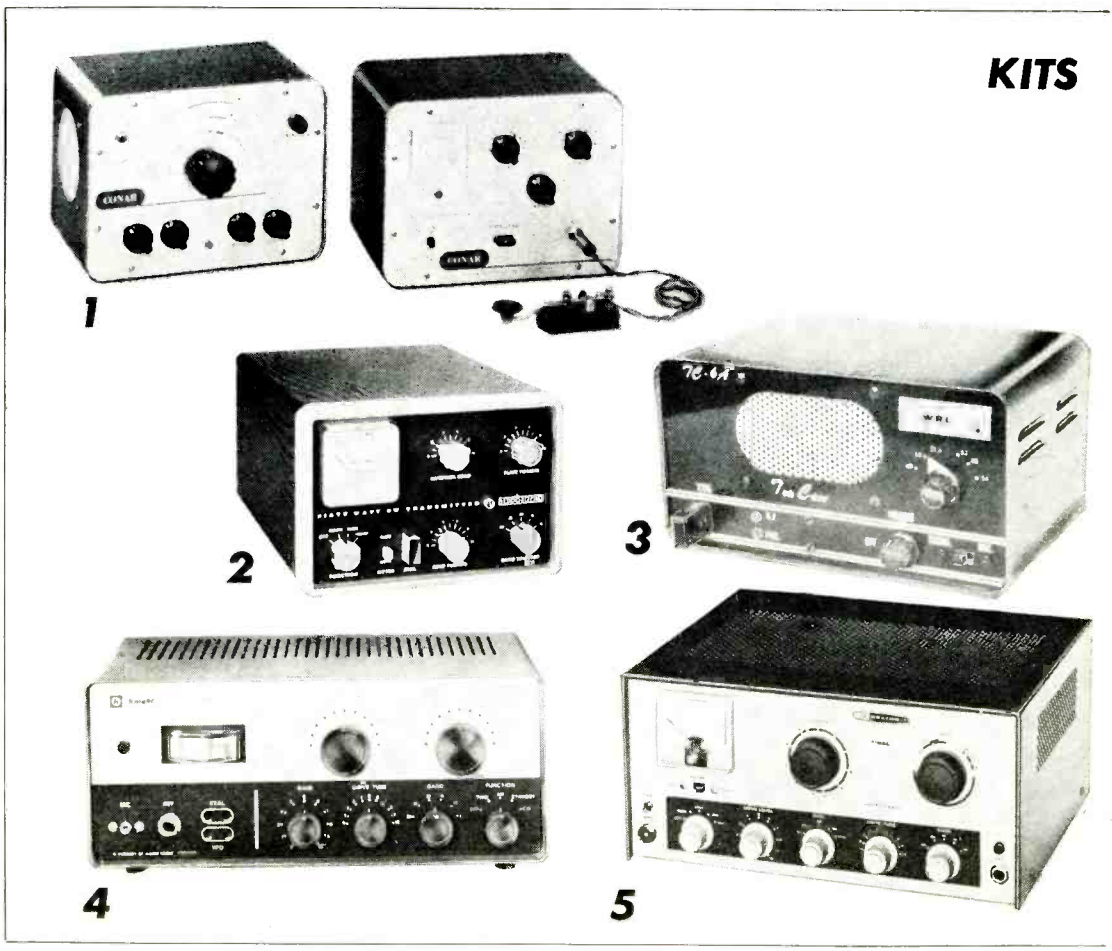
1. *Available from manufacturer as a wired unit at increased price.*

quency to receive and then back into the U.S. phone band to transmit—an inconvenience to say the least. Also if you touch up the receiver tuning to copy a station better, you automatically change your transmitting frequency the same amount although some of the more expensive transceivers allow tuning the receive frequency a kilocycle or two without shifting the transmitting frequency. In addition, some of them can be equipped with an accessory VFO to permit transmitting and receiving on widely separated frequencies. Finally, some separate receiver-transmitter combinations can be operated in the "transceive" mode or independently as desired.

● **Mobile Operation.** One of the attractions of modern transceivers is the ease with which one of them can be used as a mobile station in an automobile, plane or boat with a d.c. power supply operated from the vehicle storage battery. Then, by bringing the transceiver into the house and plugging it into a power supply operated from the power line, the same unit can double as the home station.

For public-service-minded hams, mobile operation has a tremendous advantage: with their mobile stations, they are always equipped to supply emergency communications even when commercial power fails.

● **Fifty Mc. and Higher.** Above 50 mc., there is seldom much difference between the equipment used by the Novice, Technician, or General Class licensee. Much of the activity is on AM phone in the 50- and 144-mc. bands with crystal-controlled transmitters. Power input is seldom much over 50 watts. In fact, most amateurs work these bands with 5- to 20-watt transceivers.



The majority of VHF/UHF gear works on only one band; and, except for Novices who cannot work on 50 mc., local conditions often determine whether the 50-mc. or 144-mc. band is most popular. While the normal range is somewhat greater and there are occasional chances of working "short skip" DX on 50 mc., these advantages may be counterbalanced where there is a TV Channel 2 by the possibility of generating neighborhood TVI (television interference).

Single-sideband operation is a recent addition to the VHF/UHF bands, but it is increasing as equipment becomes more readily available. We doubt, however, that SSB will immediately achieve the popularity on these frequencies that it has on the lower-frequency bands.

● **Buy or Build.** The advantages of factory-assembled and guaranteed equipment are obvious. But any kit on the market today will perform exactly as it is supposed to, if it is carefully constructed according to the instructions furnished. While we would not recommend tackling a $300-$500 kit as your very first project, we have no hesitation in recommending that you try your hand at a small kit—if you like to build things.

Speaking of building things, many hams prefer to build their own equipment from the bare chassis up. They do this more for the pleasure they get from doing the building than for any money they might save. Various magazines, such as POPULAR ELECTRONICS, and amateur handbooks publish many projects for the home builder.

● **The Amateur Receiver.** The four "musts" in a good communications receiver are selectivity, sensitivity, stability, and ease of tuning (especially for tuning in SSB signals). To combat the heavy interference in the amateur bands below 30 mc., optimum selectivity runs under 5 kc. for AM phone, 2 to 3 kc. for SSB, and under 500 cycles for CW, although 2- to 3-kc. selectivity does quite well on all three modes.

Optimum selectivity is obtainable in several ways. One method is to use double (or triple) conversion, ending up with an intermediate frequency (i.f.) in the 50- to 100-kc. region. Another method is to use a crystal or mechanical filter in the i.f. amplifier. Also used are low-cost electronic "Q-multipliers," attached to a 455-kc. i.f. amplifier. Available in kit form for around $15, a Q-multiplier can make a dramatic improvement in the effective selectivity of a communications receiver.

In choosing a ham receiver, buy the best one you can afford. If you don't care particularly what goes on outside of the amateur bands (in the foreign broadcast bands), select a ham-band-only receiver. But don't sell the general-coverage receiver too short; even the inexpensive ones do a pretty good job, especially on 80 and 40 meters.

● **Frequency Coverage.** Most communications receivers cover the ham bands up to 30 mc. A few cover the 50- and 144-mc. bands as well. Probably the most efficient way to extend the frequency coverage of a communications receiver is with a crystal-controlled converter. The converter changes the frequencies of the desired signals to frequencies within the tuning range of the re-

1 The Conar Novice ham station consists of two units: a receiver tuning only the 80-, 40-, and 15-meter bands, and a 25-watt input transmitter.

2 EICO's compact Model 723 draws an input of 60 watts—ideally suited for Novices. An AM phone modulator can be added to the rig at a later date.

3 Technicians can jump on 6 meters for only a few dollars if they build the WRL "Tech-Ceiver 6A." This transceiver kit draws about 5 watts input.

4 This Knight-Kit can be used on six different bands—80 through 6 meters. Drawing 60 watts input, the T-60 has built-in phone modulator for Generals.

5 The 90-watt input of the Heathkit DX-60A can be dropped to the Novice limit of 75. A controlled carrier modulator is used for phone operation.

Note: Not shown here is the popular E.F. Johnson "Ranger II" with coverage from 160 to 6 meters, 65-75 watts, phone-CW.

ceiver, which is then operated in the normal manner. Some ham receivers have their dials calibrated for 50- and 144-mc. reception with outboard converters.

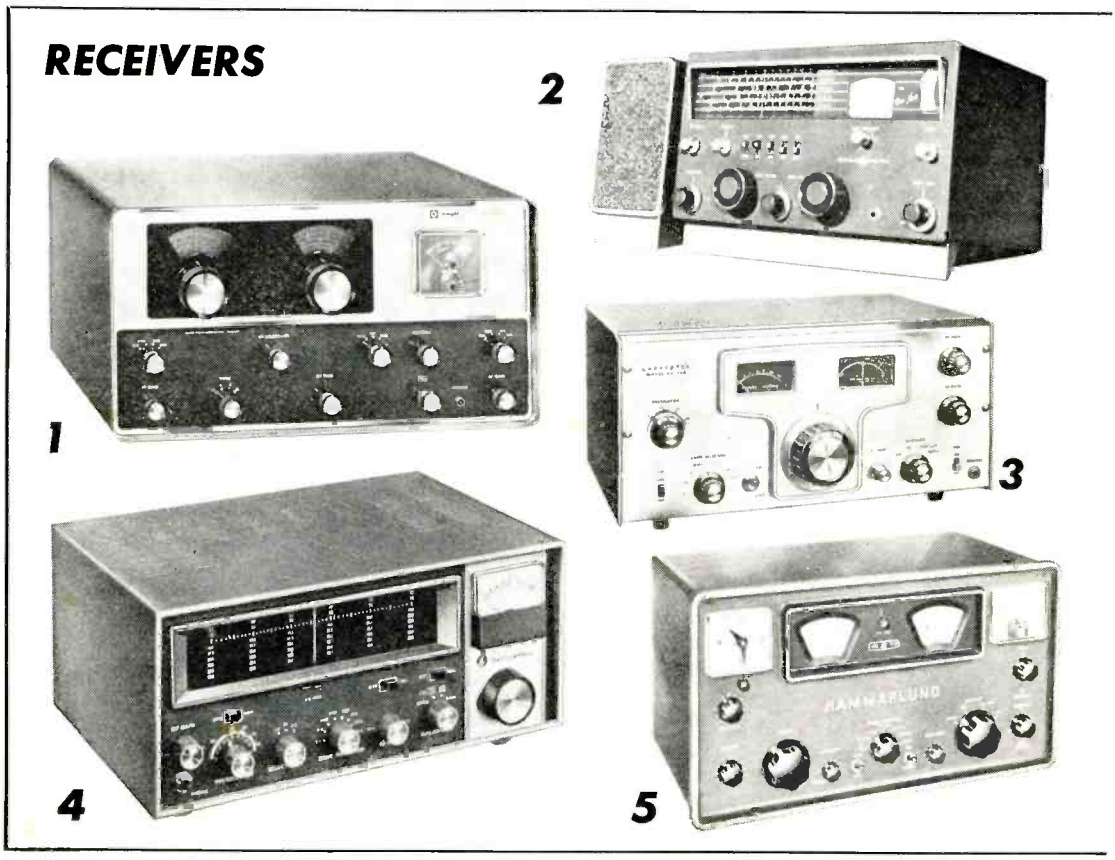
● **Tuning a Communications Receiver.** Since a good communications receiver is a more sophisticated piece of gear than an ordinary table-model AM broadcast receiver, it has many controls. And all of the controls will have a significant effect on the ability of the receiver to fulfill its intended purpose. 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.

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. If the receiver is a ham-band-only type, try tuning the 75-meter phone band first, preferably at a time when interference is not too heavy.

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 is set to a predetermined position for the desired band, and all tuning is done on the bandspread dial. This extra control literally "spreads" the desired band over most of its calibrated scale. In ham-band-only receivers, each band is permanently spread across the dial.

● **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 automatically increase to maximum through the action of the a.v.c. circuit as you tune away from a signal.

Controlling the r.f. gain of a receiver in this manner often permits copying a weak signal which would be covered up by a strong adjacent signal, if the r.f. gain were full on. Also this is usually the best way to control the sensitivity of low- and moderate-priced communications receivers when receiving CW and SSB signals with the BFO 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.

● **Code Reception.** Tune in a broadcast (or other AM) 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 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.)

● **Receiving SSB Phone Signals.** Single-sideband (SSB) signals are also received with the BFO turned on. If your receiver instruction manual doesn't describe clearly how to tune them in, the following method can be used. First, tune in the SSB signal (recognized by its pure "gibberish" sound) for maximum gyration of the receiver S-meter or loudest signal from the loudspeaker with the receiver BFO off. Then retard the setting of the r.f. gain control, and turn on the BFO and carefully adjust its pitch control for maximum intelligibility of the signal. At one critical setting of the pitch control, the signal should become perfectly readable. Note this setting.

The great majority of all SSB signals heard on a given ham band will be received best with the BFO pitch control at the same setting. On another band, however, another setting will probably be required.

1 The Knight-Kit R-100A is one of the few general-coverage receiver kits usable on the ham bands. Features include bandspread on 10-80 meters and a built-in Q-multiplier. The S-meter is $12.95 extra and a crystal calibrator is also available, at $10.95.

2 National Radio's NC-190 is tipped back to put the operating controls at a more convenient angle. Tuning from the broadcast band through 10 meters, the ham bands are spread on half of a rotary dial and six short-wave broadcast bands on the other half.

3 Tuning the ham bands only, the Lafayette HA-350 is a crystal-controlled double-conversion receiver of excellent selectivity and stability. A product detector has been built in for ease of SSB reception. Upper or lower sideband choice is made from panel.

4 Released in the fall of 1965 was the new Hallicrafters SX-146 amateur band receiver. Five hundred kc. segments of the ham bands are spread linearly over a slide rule dial; SSB reception and variable selectivity are but two of the more important features.

5 The Hammarlund HQ-110A is unique among ham-band-only communications receivers in that the dial is precalibrated for the 6- and 2-meter bands. Outboard converters feed appropriate low frequencies into the receiver to take advantage of the dial.

Which of the two pitch control settings is required depends upon whether the received station is transmitting upper or lower sideband signals. Current amateur practice is to use lower sideband on frequencies below 7300 kc. and upper sideband on the higher frequencies, although there is no hard and fast rule about this.

Incidentally, many operators fool around too much with the BFO pitch controls when receiving CW and SSB signals. Assuming that a receiver is well warmed up and is reasonably stable, once the pitch control is adjusted properly, it should seldom require readjustment.

● **Crystal Calibrator.** To insure that its calibration is correct, a top-quality communications receiver usually contains a crystal calibrator, controlled by a precisely ground 100-kc. crystal. Harmonics of the calibrator produce signals every 100 kc. across the receiver dial.

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. Kits are sold by several mail order houses and construction projects appear in POPULAR ELECTRONICS.

● **Automatic Noise Limiter.** Simple noise limiters work fairly well against certain types of noise in AM reception but are usually ineffective in reducing noise during SSB and CW reception. Noise "silencers" which are effective in SSB and CW reception are quite complicated and expensive.

● **Choosing a Microphone.** To operate phone, you will obviously need a microphone. Your best bet is a "communications" microphone—one designed to pass the es-

TRANSCEIVERS

A Clegg 99'er is capable of 5 to 6 watts output. Built-in receiver circuitry is double-conversion for maximum selectivity. Frequency changing is accomplished from a panel-mounted crystal socket.

Hallicrafters' SR-46 is rated at a power input of 12 watts. Splitting the 6-meter band into two segments, it has four crystal positions or may be driven by VFO.

sential voice frequencies with maximum intelligibility. The exact type of microphone chosen is largely a matter of personal preference. The crystal and ceramic types are relatively inexpensive, while the dynamic types are more rugged but more expensive. Carbon microphones, such as those used in telephones, are seldom used in amateur stations, primarily because they require a d.c. energizing source.

● **Choosing Your Antenna.** A ham's antenna system is the gateway through which the transmitted signal starts its journey through space. It's also the means through which incoming signals, weakened by their long journey, 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 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 your tree to compensate for the sway of the tree.

For lightning protection, install a porcelain-insulated, single-pole, double-throw knife switch inside or outside the house where the antenna wire enters the house, and connect the antenna wire to the blade of the switch. Connect one switch terminal to a wire running in as direct a path as possible to a ground rod driven six to eight feet in the earth, and connect the other terminal to the antenna change-over switch (or relay). Make a habit of throwing the switch to the ground side when you leave the shack, and you will never have to worry about a stroke of lightning damaging your equipment.

One disadvantage of the single-wire antenna is that its whole length (including the part that is brought into the station) radiates energy. Therefore, much of your precious r.f. power is pumped into utility wires, rain gutters, etc., instead of into space where it will do the most good. Another disadvantage is that such antennas do not provide a good match for a transmitter with a fixed output coupling system unless an external "antenna coupler" is used between the transmitter and the antenna.

In spite of its handicaps, however, such a "sky wire" usually does a surprisingly good job on the 80- and 40-meter bands, and even—on occasion—on 20 and 15 meters.

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 transmission line. The table below gives the lengths for the centers of the seven most popular amateur bands. These lengths will normally be satisfactory for operation over each band.

A ham antenna of the latter type has been given the jaw-breaking title of "matched-impedance center-fed dipole." Also called a "doublet," it can be mounted horizontally

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″		

or as an "inverted-V" antenna. When it is mounted horizontally, two supports of the same height are required.

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.

● **Multiband 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.

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 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.

● **Multiband 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 (commonly called "traps") at predetermined spots in the antenna. These "traps" cause the antenna to work like a ½-wave dipole on two or more frequencies. Such multiband antennas and the "traps" themselves are available commercially.

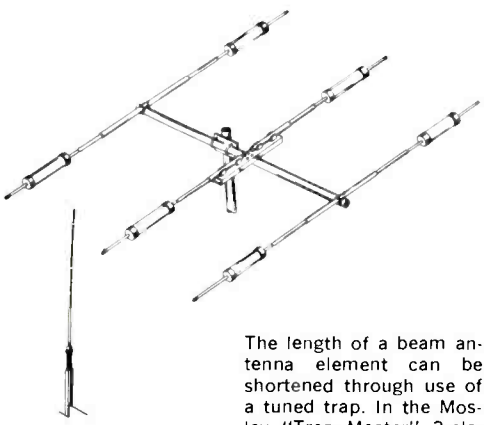
There is an interesting safety feature in antennas fed with coaxial cable: if the outer shield of the cable is firmly grounded just before the transmission line enters the radio shack, the installation meets insurance underwriters laboratory rules for lightning protection.

● **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. Many hams feel that an antenna height of 45 to 50 feet is about optimum, considering results versus construction difficulties.

● **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.

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. Fortunately, a multiband vertical for 7 mc. and higher is short enough (around 27′ long) to be placed on the roof of a building and operated against 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 it like the spokes of a wheel.

● **Vertical or Horizontal?** Properly installed, both vertical and horizontal antennas work well. However, on the VHF/UHF bands 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



The length of a beam antenna element can be shortened through use of a tuned trap. In the Mosley "Trap Master" 3-element, 1-kw. beam (above), maximum element length is only 28 feet. This antenna can be used on 10, 15, or 20 meters.

Not every ham has the room to install a beam antenna, so a good substitute is the all-band vertical. WRL markets an 18′-high vertical (left) which can be tuned up on any frequency between the 10- and 80-meter 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.

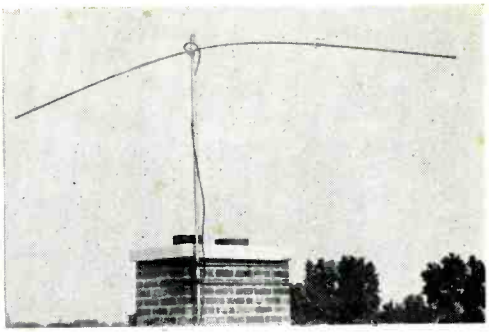
● **Multiband Rotary Beams.** By adding resonant circuits ("traps") to the various elements, effective two- and three-band rotary beams have been developed.

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.

● **"Quad" Antennas.** Another beam antenna popular among amateurs is the "cubical quad" antenna. In it, the elements are bent in the form of squares supported by bamboo or fiberglass spreaders. In appearance, a quad antenna resembles a huge box kite (16′ square for 20 meters) before the paper is applied.

● **Rotating the Beam.** A heavy-duty TV antenna rotor 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 Transmitter.** Actually, tuning the average transmitter is easier than tuning a communications receiver. The best way to learn is with a dummy antenna connected to the transmitter's output terminals. A specially-designed dummy antenna is best, but a 50- or 60-watt, 117-volt light bulb is satisfactory for use with a typical 50- to 75-watt Novice transmitter, because it quickly shows the effects of your adjustments—the brighter the bulb, the greater the output. A half dozen #47, 6.3-volt pilot bulbs connected in two strings of three and then the two strings connected in parallel with very short leads makes a satisfactory dummy load for very low power 6- and 2-meter transceivers.



For portable or home station use, this compact loaded dipole has much to offer. At 40 meters the overall length is only 16 feet. Manufactured by Mark Products, Skokie, Ill., it sells for $29.95.

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 your 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.

● **Standing-Wave-Ratio Meter.** The output circuits of modern transmitters are generally designed to work into a 50- to 75-ohm load, and most antenna systems are designed to present this type of load to the transmitter—either directly or through a matching network. In general, the closer the match between the antenna and transmitter, the better they work. By connecting a standing-wave-ratio (SWR) meter between the transmitter and the antenna system, it is possible to measure the degree of match, as well as

to monitor continuously the relative power output of the transmitter.

● **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 CW.

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 CW, 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: "CQ CQ CQ DE WN1ABC WN1ABC WN1ABC CQ CQ CQ DE WN1ABC WN1ABC WN1ABC CQ CQ CQ DE WN1ABC WN1ABC WN1ABC K." This means of course, that WN1ABC wishes to work (contact) anyone hearing his "CQ" (general call).

You decide to answer the call; so you quickly enter the time and WN1ABC in your logbook. When WN1ABC concludes 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.

Bernie Ostrofsky, W9HTF, Gary, Ind., divides his time between CW and SSB, rag-chewing or DX chasing. His Drake TR-3 transceiver drives a high-power, home-built final amplifier, and he has a multi-trap dipole and a 3-element tri-band beam.

You sigh almost in relief. What 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!")

● **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—you'll have many more contacts.

To call "CQ," meaning "I will answer calls from any station hearing me," send *either* of the following *at the speed at which you want to be answered:* "CQ CQ CQ DE WN9EGQ WN9EGQ WN9EGQ CQ CQ CQ DE WN9EGQ WN9EGQ WN9EGQ 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."

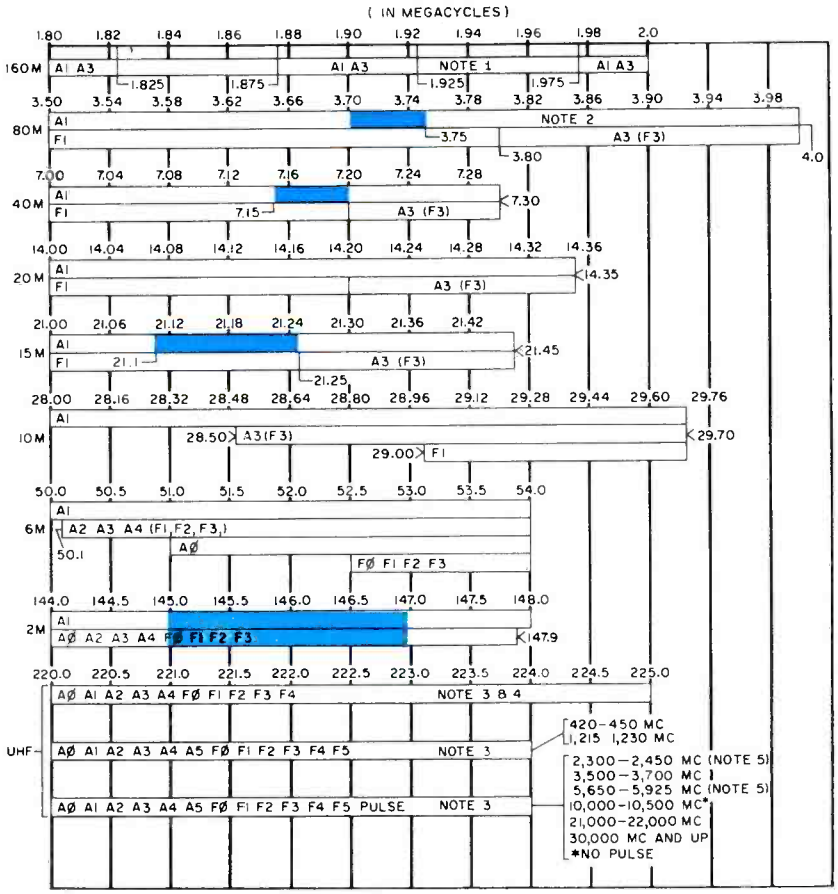
The "DE" between the CQ's and the call-signs is Latin for "from." And the "K" is the CW procedure signal for "Go ahead; I will now listen."

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 increase their number 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 tune away looking for someone else, or call CQ himself.

● **Phone Operation.** On phone, you can say "Calling CQ, CQ, CQ. This is (or from) W9EGQ, W9EGQ, W9EGQ . . . Over." You can also say, "Calling any 2-meter, 75-meter, etc., phone station." Most operators mention their locations when calling CQ.

PERMISSIBLE SIGNALS IN THE HAM BANDS



TRANSMISSION SYMBOLS

- **AØ** Carrier with no modulation
- **A1** Carrier on-off for keying (CW)
- **2A** Carrier modulated with audio tone on-off for keying (ICW)
- **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. A portion of each band is shared with industrial, scientific and medical services.

The color bars in the chart above represent Novice bands: CW operation is permitted on 15, 40, and 80 meters; phone or CW in the 2-meter band

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

You can also use words from the phonetic alphabet to identify the individual letters of your call-sign. There are a number of phonetic alphabets in existence; but for consistency, we recommend the International Phonetic Alphabet reproduced above. It is used like this: "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.

● **Signing Your Call Letters.** On both phone and CW, FCC regulations require that you give the reason for putting your transmitter on the air (test, CQ, etc.) and sign your call letters 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.

Note that your own call letters *always* come last.

● **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 frequency, listen to the conversation already in process; if it appears to be the type that won't be ruined by having another station join it, you may try to "break" into the conversation. On CW this is done by sending a snappy "BK DE W9EGQ" just as one of the stations stands by or during a pause in the conversation. On phone, say "Break from W9EGQ."

Just shouting "Break break" without signing your call letters is technically illegal (making an unidentified transmission) and most amateurs will ignore such a call. Also, DX stations in particular have discovered that saying "Go ahead breaking station" is an invitation to confusion, because every operator who was patiently waiting his turn immediately begins to call.

● **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

SELECTED ABBREVIATIONS

The following list of abbreviations used by CW (code) operators is not complete, but it does include most of the common ones.

AA—all after	**N**—no
AB—all before	**NIL**—nothing
ABT—about	**NR**—number
AGN—again	**OM**—old man
AM—amplitude modulation	**OP**—operator
ANT—antenna	**PWR**—power
BK—back, break	**R**—received, are
BN—between	**RCVR**—receiver
BUG—semi-automatic key	**RIG**—transmitter
C—yes	**RPT**—repeat, report
CHOP—chief operator	**SRI**—sorry
CQ—general call	**SSB**—single sideband
CUD—could	**TKS, TNX**—thanks
CUL—see you later	**TU**—thank you
CW—radio code	**U**—you
DX—distance	**UR**—your
ES—and (&)	**VY**—very
FB—fine business	**WUD**—would
GA—go ahead, good afternoon	**WX**—weather
	XMTR—transmitter
HI—laughter	**XYL**—married woman
KC—kilocycle	**YF**—wife
LID—poor (inconsiderate) operator	**YL**—young lady
	73—best regards
MNI—many	**88**—love and kisses

a moment to make sure that the called station hasn't answered someone else, and then call again. When you stand by after making a call and you discover the called station already talking to someone else, you can be pretty sure that your call was too long.

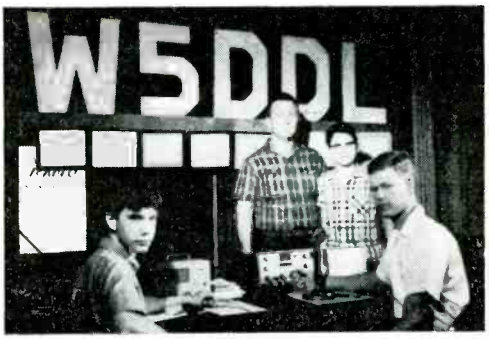
Most hams listen first on their own frequencies for answers to a CQ. When there are lots of stations on the band, calling more than 10 kc. from their frequencies is normally not productive, unless the caller specifies where he is listening for replies. When activity on a band is light, however, most hams scan more of the band listening for replies.

If you read carefully the example of how to answer a CQ, you probably noticed that the answer ended with "AR," but after contact was established, each "over" ended with "K." The "AR" means that a call has been made but a contact has not yet been established; a "K" at the end of a call indicates that a two-way contact has been established. "K" at the end of a "CQ" simply means "Go ahead."

The proper use of these procedure signals, as well as "SK" (discussed below) is one of the things that distinguishes a crack operator from a mediocre one. (The line over "AR" and "SK" indicates that they are sent as a single character with no space between letters.) Sometimes you'll hear a call ended with "KN"; this means that the calling operator wants an answer from the called station and from no one else.

● **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 PWR 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, CW 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.



At the Louisiana Gulf Coast Sports Show, the Lafayette Amateur Radio Club sponsored this exhibit. Members (left to right) Nicky Pugh, K5QXJ, Mike Comeaux, WN5NGL, Al Sewal, Jr., K5DPH, and Steve Broussard, WN5NKE, kept station in operation.

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." On phone, however, most good operators avoid the excessive use of CW abbreviations, because "saying it with words" is more accurate.

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. To terminate a contact, one operator sends ". . . AR WN1ABC DE WN9EGQ SK," and the other op responds with "SK DE WN1ABC."

When you send "SK," it means that the contact is finished; you have made your last transmission, and *you do not expect the other station to transmit to you 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 giving such reports—the "RST" system.

Many hams have a tendency to give exaggerated *R* (readability and *S* (strength) reports; so take extremely good reports with a generous pinch of salt.

From a legal point of view, the *T* (tone) part of a report is most 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. Such a signal produces a clear, unvarying tone from the receiver's speaker. In other words, it is *T9*. As signal quality decreases from this perfect level, the tone report goes down; a *T1* signal is rough and raucous indeed.

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. (Or if they are lucky, they will receive a friendly warning from one of the ARRL's volunteer "Official Observers" suggesting that they check out their rigs *before* they get an official FCC citation.) The first reaction of the average ham on getting a citation for having a poor-quality signal is sheer disbelief; he really accepted all those *T9* reports other hams gave him.

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.

● **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 appear 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 will 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—CW, AM phone, SSB, etc.

Of course, your QSL card should also include your call letters, transmitter location, and your name and complete mailing address. As many hams are trying to work as many U.S. counties as possible, you might also include the name of your county on your card.

● **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). For example, 10:00 p.m., EST, November 1, becomes 0300, GMT, November 2.

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;*

YOUNG HAMS HAVE THEIR DAY

The combination of a 5-watt transceiver (a Heath-Kit "Sixer") and an 8-element beam hasn't been a hindrance to Frederick Holzapfel, WA4REJ, Memphis, Tenn.—he worked 17 states on "short skip."

When Jerry Sheldon, WN9MET, Wausau, Wisc., was still a Novice, he had to throttle down his E. F. Johnson "Valiant" transmitter to 75 watts input. Nevertheless, Jerry managed to work 29 states.

(Above) John Stensby, WA4RES, Huntsville, Ala., uses a home-built transmitter and an RME 6900 receiver. While holding a Novice license, John worked 25 states on 80 meters. His brother is WA4RER, and their father just caught the ham bug.

(Right) Another Novice who has a home-built transmitter is John Babbitt, WN2LUX, Houghton, N.Y. His receiver is a Hallicrafters SX-99. A Heathkit receiver serves as a stand-by.

This fellow is one of the first VE contacts for many U.S. hams. John Wood, VE5DX, Oxbow, Saskatchewan is shown with his Knight-Kit transmitter and Lafayette HA-225 all-band communications receiver.

With this complete Heathkit Novice station, Rick DuPuy, WN8OCG, Portsmouth, Ohio, racked up a nice station total on 40 and 80 meters. Rick's antenna farm consists of several favorite inverted V's.

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 whatever his call letters are. Send your card to the manager, include a stamped, self-addressed reply envelope, and the return card will usually arrive very quickly—if the DX operator has done his part by sending the necessary log information to his QSL manager.

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.

By the way, use special lightweight envelopes to airmail cards overseas. You'll have to pay extra postage to many countries if your letter weighs more than half an ounce.

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 publish 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 can easily elapse before a coveted card arrives via a QSL Bureau.

NORTH AMERICAN QSL BUREAUS

A majority of QSL cards from DX stations are distributed via the ARRL QSL Bureaus. To receive your cards you must keep a supply of stamped, self-addressed "business-size" envelopes—with your call letters in the upper left-hand corner—on file with your call area QSL Manager.

W1 George L. DeGrenier, W1GKK, 109 Gallup St., North Adams, Mass. 01247

W2 North Jersey DX Assn., P.O. Box 303, Bradley Beach, N.J. 07720

W3 Jesse Bieberman, W3KT, P.O. Box 204, Chalfont, Pa. 18914

W4 F.A.R.C. W4AM, P.O. Box 13, Chattanooga, Tennessee 37401

W5 H. L. Parrish, Jr., W5PSB, P.O. Box 9915, El Paso, Texas 79989

W6 San Diego DX Club, P.O. Box 6029, San Diego, Calif. 92106

W7 Willamette Valley DX Club, Inc., P.O. Box 555, Portland, Oregon 97207

W8 Walter E. Musgrave, W8NHW, 1245 E. 187th St., Cleveland, Ohio 44110

W9 Ray P. Birren, W9MSG, Box 510, Elmhurst, Ill. 60128

WØ Alva A. Smith, WØDMA, 238 E. Main St., Caledonia, Minn. 55921

KP4 Joseph Gonzales, KP4YT, P.O. Box 1061, San Juan, P.R.

KH6 John H. Oka, KH6DQ, P.O. Box 101, Aiea, Oahu, Hawaii 96701

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 John Ravenscroft, VE2NV, 135 Thorn Rest Ave., Dorval, Quebec

VE3 R. H. Buckley, VE3UW, 20 Almont Rd., Downsview, Ontario

VE4 D. E. McVittie, VE4OX, 647 Academy Rd., Winnipeg 9, Manitoba

VE5 Fred Ward, VE5OP, 899 Connaught Ave., Moose Jaw, Saskatchewan

VE6 Karel Tettelaar, VE6AAV, Sub P.O. 5, N. Edmonton, Alberta

VE7 H. R. Hough, VE7HR, 1291 Simon Rd., Victoria, B.C.

VE8 George T. Kondo, VE8RX, c/o Dept. of Transport, P.O. Box 339, Fort Smith, N.W.T.

VO1 Ernest Ash, VO1AA, P.O. Box 6, St. John's, Newfoundland

VO2 Douglas B. Ritcey, Dept. of Transport, Goose Bay, Labrador

● **Receiving DX QSL's.** The bulk of incoming DX QSL's for U.S. hams arrives via the ARRL QSL Bureaus. To receive your cards, you must keep a $9\frac{1}{2}$" x $4\frac{1}{8}$" stamped envelope (Post Office #8 size) on file with your call area QSL Manager. 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.

● **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 the station you need 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 some in new states or countries 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. And probably there is nothing that separates the "lids" (poor operators) from good operators faster than a DX "pile up." The difference is basically simple: the good operator makes his calls when he is sure the DX station is listening for other calls; the poor operator seems to spend most of his time calling while the DX station operator is listening to someone else or is transmitting himself.

● **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.

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.

Alec Hugh, 6Y5AH, Kingston, Jamaica, likes to rag-chew and is a certificate collector. Operating on 20 meters, Alec has a 100% Heathkit station which includes a DX-35 transmitter and "Mohawk" receiver.

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 rarely 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 many principal cities throughout Canada. You will usually conduct your business with the nearest DOT office.

To become a radio amateur in Canada, you must 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. 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 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 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 (TV by special authority) 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 12 months of amateur experience, you may take the Advanced Amateur examination (which includes a 15-wpm code test) and upon passing it, you will be authorized to use phone in all the Canadian amateur phone bands.

● **Taking the Canadian 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 punctu-

ation 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.

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. Usually at least a two-month waiting period is required before you can take the exam again.

● **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 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 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.

THIRD-PARTY MESSAGES

International regulations specifically forbid international radio communications in behalf of "third parties" via amateur radio unless special arrangements have been made by the individual governments to authorize such communications. The United States has negotiated agreements with the countries listed below to permit "unimportant" third-party messages to be exchanged between them. Most of the agreements also permit "emergency" messages to be exchanged—if the emergency messages are transferred from amateur to commercial channels as soon as possible.

Bolivia	Cuba	Mexico
Brazil	Dominican Republic	Nicaragua
Canada	Haiti	Panama
Chile	Honduras	Paraguay
Colombia	Israel	Peru
Costa Rica	Liberia	Venezuela

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.

● **Studying Aids.** 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

Dan Damrow, W9GQY, Oaklawn, Ill., spends his days at Argonne National Laboratory. After hours, Dan can be found on almost any band, on SSB, or CW. A favorite communications method is the radioteletype (RTTY) and strip keyer seen under his left elbow.

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,
411 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,
Winnipeg 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., 405 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.
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., Post Office

Regina, Sask.
Inspector, Radio Regulations,
Room 414, Post Office Bldg.

Saskatoon, Sask.
Inspector, Radio Regulations,
Room 412, Federal Bldg.

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guide, such as the *ARRL Licence Manual*, as a completely accurate guide in preparing for an examination (although the *License Manual* is very helpful, as far as it goes).

We recommend *The Radio Amateur Licensing Handbook*, by J.E. (Jim) Kitchin, VE7KN, Regional Supervising Radio Inspector (retired), Department of Transport, Canada, to all prospective Canadian amateurs. Now in its eighth, enlarged edition, the *Handbook* is distributed by R. Mack and Co. Ltd., 1387 SW Marine Drive, Vancouver 14, B.C., for $2 a copy. It thoroughly covers the Canadian amateur license requirements.

● **Public Service Activities.** 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 op-

erations 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. 1R 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—

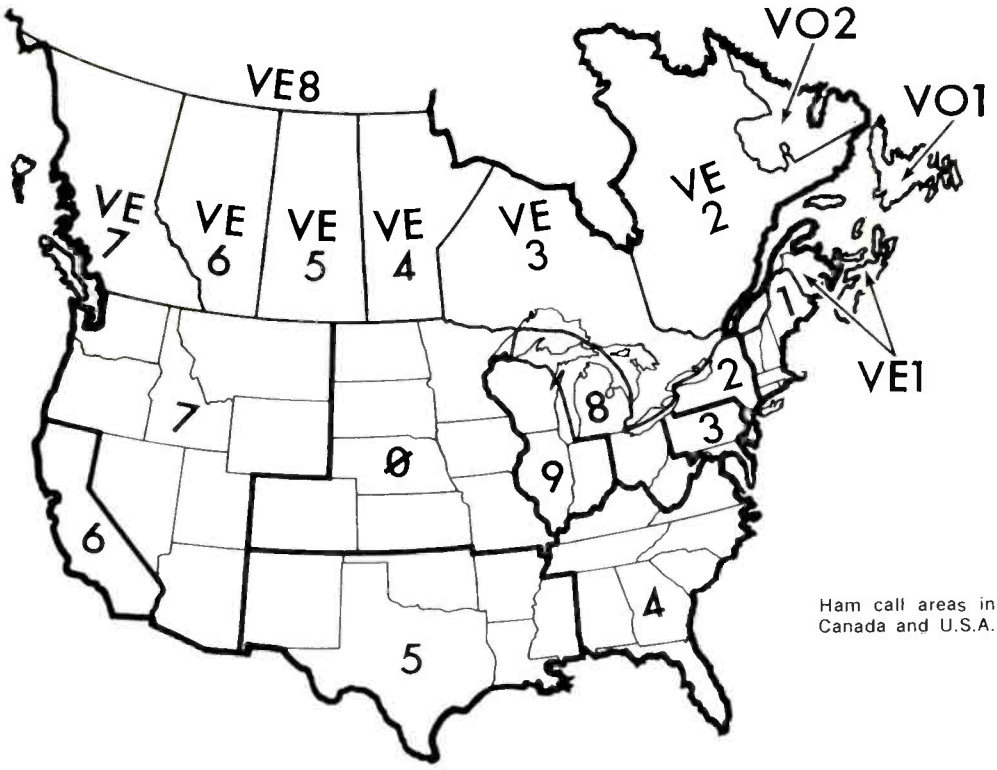
HERB

It contains four main parts: preamble, address. text, and signature. The preamble contains: the message number; letter "R" or "P" indicating the "precedence" of the message (ordinary routine messages are identified by "R," while more important messages or those with a time limit receive the "P" for "priority" classification); 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 relay 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 CW 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 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, 225 Main St., Newington, Conn. 06111, and request the ARRL Net Directory. It lists the



Ham call areas in Canada and U.S.A.

BANNED COUNTRIES

The United States has no objection to its amateurs talking to any country. A few countries, however, have filed objections to their amateurs engaging in international communications. As a result, international law requires the FCC to forbid U.S. hams to contact these countries. The latest list of such countries includes:

Cambodia (XU)
Indonesia (JZØ, PK)
Thailand (HS)
Viet Nam (3W8)

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 miles from home.

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 to contact a ham with a phone patch close to his home. 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 is a variety 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.

As already mentioned, it is strictly forbidden to handle third party messages with most foreign countries, but it is often possible to handle messages for U.S. military personnel and their families stationed in overseas posts via the MARS system. When such messages are transferred to the amateur bands for relay and delivery, the phrase "via MARS" is inserted in the message preamble.

For further information about the MARS program of your choice, write to the following:

Chief MARS Army
Room 5B960, The Pentagon,
Washington, D.C. 20330

Chief MARS Navy
Room 5D564, The Pentagon,
Washington, D.C. 20330

Chief MARS USAF
Room 5B543, The Pentagon,
Washington, D.C. 20330

The main requirements for becoming a MARS member are being at least 16 years old, and having a valid amateur license and a genuine interest in MARS activities. There is no military obligation involved, but you cannot belong to more than one MARS program at a time.

● **Operating Other Amateur Stations.** Your amateur license authorizes you to operate other amateur stations—with the owners' permission, of course. The FCC's latest interpretation of its regulations on operating

another amateur's station is that the visiting operator use his own call-sign and portable operating procedures (outlined below) if he is in actual control of the equipment. *Control* for this purpose means the ability to monitor the station's operations and to terminate operation immediately for any impropriety or malfunction. Where a club station is involved, however, the club member operating the station is considered to be acting as an agent of the station trustee to whom the call letters are assigned; consequently, the club call letters are to be used.

In any event, you must have your original license in your possession when you operate any amateur station (including your own). In addition, the scope of your operating is limited by your license. Thus, if you are a Novice, you can operate an amateur station owned by an Extra Class licensee, but only in the Novice bands with a crystal-controlled transmitter operating at a power of no more than 75 watts.

● **Mobile and Portable Operation.** On CW, you identify mobile or portable operation by following your station call letters by the slant bar symbol (DN) 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 (or portable) three miles east of Bethesda, Maryland"—not ". . . W3DEF slant three."

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 CW and announcing "Maritime Mobile" or "Aeronautical Mobile" at the end of each phone transmission. In addition, on both phone and CW, the name or the number of the vessel or aircraft and its approximate geographical location must be given at the conclusion of each contact to satisfy the FCC regulations.

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.

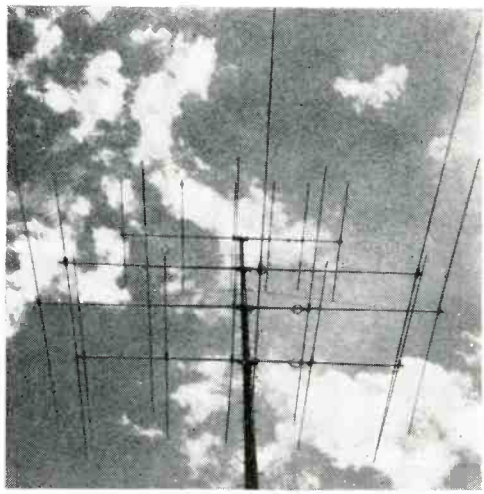
About 15 years ago hams on 6 meters switched from vertical to horizontal antenna polarization, which complicated matters for mobile stations—since verticals are naturals on cars. One solution was the development of the halo. This is a Hy-Gain HH6BA.

● **Operating in Other Countries.** Until the middle of 1964, a U.S. law prevented licensed foreign amateurs from operating in the United States (except Canadian amateurs, through a special arrangement). As a result, few foreign governments would allow U.S. amateurs to operate in their countries. But now, under a new U.S. law passed by Congress in 1964, the State Department has concluded bilateral agreements with several foreign governments to allow licensed amateurs to operate in the countries involved.

As this is written, the countries with which the United States has bilateral (or reciprocal) amateur operating agreements are: Australia, Belgium, Bolivia, Canada, Costa Rica, Dominican Republic, Ecuador, Luxembourg, and Portugal. U.S. amateurs

wishing to operate in any of these countries (except Canada) should contact that country's embassy in Washington or a consulate in one of the larger cities. The ARRL will make time-saving suggestions on filling out the necessary forms.

Licensed amateurs in the above countries wishing to operate in the United States may apply for authorization on FCC Form 610A, available from any FCC office. The filled-in application and a photocopy of the applicant's current amateur operator license should be submitted to the FCC's Washington office at least 60 days prior to the date operations are desired to commence.



Eye-catching array of beams used by Barry Goldwater, K7UIG. From top to bottom: 6 elements on 10, 3 elements on 40, 4 elements on 20, and 5 elements on 15—all on Hy-Gain's RP-75 rotating pole.

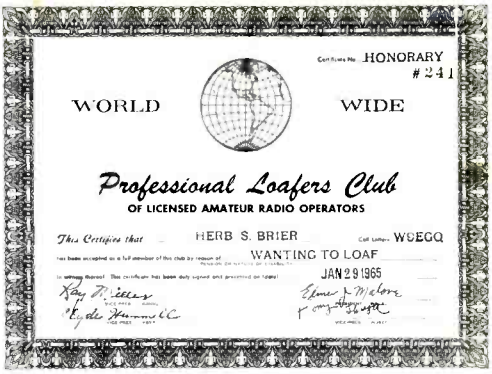
● **Operating in Canada.** To obtain permission to operate in Canada, request Form 41-2052 from the Telecommunications Division, Department of Transport, Ottawa, Ontario, Canada. When the form is filled in and approved by the DOT, it constitutes an "endorsement" of your U.S. amateur license for operation in Canada. Novice licenses cannot be so endorsed.

● **Certificate Hunting.** Exchanging QSL cards to confirm radio communications is an accepted practice among hams. One reason for collecting QSL cards is to qualify for the operating awards offered by various amateur organizations. Hams blessed with more luck, better equipment, or more pa-

tience than others soon qualify for the ARRL-sponsored WAC (*Worked All Continents*) or WAS (*Worked All States*) certificates. Before 1950, hams were content to rest on these achievements or to go after comparable certificates offered by amateur societies around the world.

In recent years, however, the whole certificate and award picture has changed completely. There are now well over 450 awards offered by ham clubs in the United States. And ham clubs in approximately 60 countries offer over 250 additional awards.

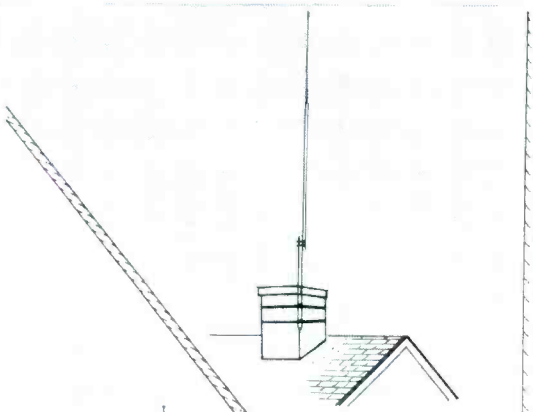
● **Certificates Available.** The certificates available range from the ultra simple—such as the "Ding Dong Daddy of Dumas" award offered by the Dumas Amateur Radio Club, P.O. Box 4000, Dumas, Texas, to hams working four club members—and similar awards offered by other ham clubs in all the 50 states and the Canadian provinces, up to awards like the ARRL's *DX Century Club* (DXCC) award for two-way contact with 100 or more different countries. In fact, you can even earn certificates attesting to the number of certificates you have collected!



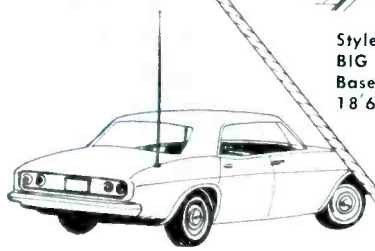
The Professional Loafers Club is composed of disabled, pensioned, or retired radio amateurs. Elmer J. Malone, W9LXL, is president of the P.L.C.

Receiving many of the minor operating awards entails little more than sending a list of the stations claimed to have been worked with a small fee (often $1) to a particular club; the certificate will soon arrive. But qualifying for the major awards offered by national amateur organizations throughout the world usually requires written proof (which is carefully scrutinized) before a certificate is issued. ■

Enjoy using "THE LONG RANGERS"

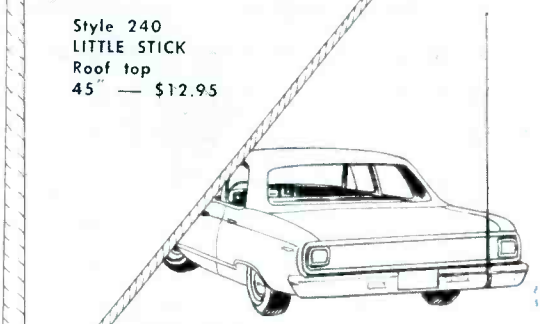


Style 176
BIG STICK
Base station
18'6" — $34.62



Style 173
Versatile VIP
Top loaded
4' — $5.75

Style 240
LITTLE STICK
Roof top
45" — $12.95



Style 10-3
THE WHIP
Full quarter wave
96" — $7.50

Shakespeare fiberglass WONDERSHAFT CB ANTENNAS

Choose the versatile VIP, the WHIP, or combine the LITTLE STICK with the BIG STICK for a "talking team." You'll pride yourself on the outstanding performance, the rugged good looks and easy installation of these WONDERSHAFTS. Look for the WONDERSHAFT trademark. It's the mark of distinction for all CB'ers . . . a guarantee of superior quality and performance. — The CB line of WONDERSHAFT antennas includes mobile, base station and marine units. Ask your dealer, or write direct to Columbia Sales Office, C/P Corporation.

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RFD 3 • COLUMBIA, S. C. • Telephone 787-8710 area code 803

CIRCLE NO. 5 ON READER SERVICE CARD

3

CITIZENS RADIO SERVICE

By MATT P. SPINELLO
KHC2060

IN THE PAST seven years, the Citizens Radio Service has skyrocketed into the world's largest radio communications facility. Millions of 5-watt transceivers are in use and every day hundreds of new stations go on the air. All of these radio stations are operated by just plain "average" citizens—using two-way radio communications in their everyday activities.

Governed by the Rules & Regulations promulgated by the Federal Communications Commission, the Citizens Band is (in legal jargon) intended for "personal and/or business, short-range communicating." To qualify as a license holder of a CB radio station, you need only file your intention with the FCC, pay the necessary license fee, and await assignment of your personal call letters. The range of a CB station is restricted by the power and frequency. Only 23 channels are used by some 750,000 CB'ers on a share-and-share alike basis. Although you might think that party-line interference would be intolerable, CB'ers have not found it so. Cooperation in keeping transmissions short and to the point is a sign of the courtesy of CB'ers.

Strangely enough, restricting CB'ers to so few radio channels has produced an interesting paradox. CB'ers have a kinship and will go to great lengths to help one another. There is always someone monitoring the CB channels—a call for assistance always brings forth a dozen or more responses. Overnight, CB'ers have become invaluable communications "assistants" in times of distress or disaster. This public service aspect of CB has opened up a new

horizon, and hundreds of lives and millions of dollars have already been saved. Demonstrations of the willingness of CB'ers to help are legion, but here are a few of the instances which have been reported in the past few months.

● **Recent CB "Assists."** An important act of public service was performed by REACT members of the Pueblo Citizens Band Club, *Pueblo, Colorado.* A tornado with heavy rain threatened several adjacent communities with flood waters. The CB'ers warned families to evacuate to shelters, then set up a chain of communications to relay flood information to other communities. They also established a communications control center at Red Cross headquarters and stationed mobile CB units at bridges to warn motorists. Some bridges had cracked under the strain of high water; others were being flooded.

The Pueblo group handled emergency messages that day and through the night including one involving a boat rescue of children who had been cut off by the flood. The next day additional communications were arranged to back up amateur radio emergency systems. The Civil Defense director of Pueblo County contacted CB control asking for assistance due to a loss of communications within their link. The REACT members quickly set up a relay system from Pueblo to Colorado Springs (40 miles north) to pass information and inquiries regarding missing persons.

Many of the CB volunteers in this emergency action worked for 25 hours without sleep or a break. Afterwards, the same group assisted in cleaning up the areas hit and reporting on flood damage.

Earlier in 1965 a tornado had ripped through *Crystal Lake, Illinois,* leaving six dead and many injured and homeless. Landline communications was wiped out. CB'ers were quick to recognize the need for their assistance, and three Citizens Band clubs teamed up to establish a communications network in the Crystal Lake area: The Tri-County Five Watters (an Illinois/Wisconsin association); the Marengo (Illinois) Rescue Squad; and the Cary Grove Rescue Squad.

Together these clubs put 50 mobile units on the road, acting as runners delivering needed items, as spotters to report emergency situations, and as patrol vehicles to help keep vandalism at a minimum.

By the next day the Tri-County Five Watters had assumed control of a communications central setup in the Crystal Lake High School. Their duties included the manning of Red Cross phones, Civil Defense radio equipment, and their own CB network.

Both men and women manned the CB mobile units and the communications central setup for more than a week following the disaster. More than 1000 additional CB'ers in the area and in adjoining states volunteered their services. The CB operators were highly commended for their efforts to ease the heavy burden placed on Northern Illinois residents following one of the worst disasters ever to strike the area.

And when the Mississippi river flooded the *Winona, Minnesota,* area last year, a 24-hour CB radio network was established at the local Civil Defense center. More than 20 mobile units were stationed along an 8-9 mile dike area. All work on the dikes, as well as the dispatching of men, sand bags and bulldozers was done via CB radio. Once constructed, the dikes were patrolled by mobile units until the flood threat cleared.

Amateur radio operators were on hand at CD headquarters to handle communications between Winona and other cities up and down the Mississippi. Local radio station KWNO participated with a 24-hour programming setup to relay CD information to the public. By utilizing CB radio at the emergency site, with relays passed to CD headquarters, then spread to various communities via amateur and AM radio, the three radio services established a complete communications warning and alerting system. Cooperative efforts of this type confirm the idea that CB, linked with the Amateur Radio Service, could provide communications person-to-person, city-to-city, and state-to-state in a national disaster.

● **Various Uses of CB Radio.** Regardless of the initial purpose for which a CB system is installed, the CB'er can find an almost unlimited number of additional applications for his investment If, for example, a two-way system has been installed for dispatching delivery or repair trucks, the same equipment can bring help to a driver who has a mechanical breakdown.

The owner of the same organization might find it useful to have CB equipment installed in his car. He can then communi-

cate with his office or any one of his trucks. Moreover, CB equipment installed in his home will add a personal link. He can then be reached by his office, his trucks, or his home.

The same man may also find it convenient to bring two or more CB units on vacation trips or on hunting trips. A temporary base station installed in a lake cottage can keep the occupants in touch with Junior out on the lake with the 100-horse cruiser, or with hunters in the woods carrying CB walkie-talkies.

Citizens Band radio permits the family, employees, and other responsible persons the licensee may delegate to communicate within the network of equipment he has installed into his individual system. The uses are limited only to a person's imagination, as long as his brainstorms are within the permissible applications of the Rules and Regulations set forth by the FCC.

● **CB Radio Today.** In addition to being used between offices, stores, homes and cars, CB radio enables CB-equipped boats to communicate with home, similarly equipped vessels, the yacht club, marina, etc. CB'ers can inquire as to weather conditions or where the fish are biting, or even make reservations at CB-equipped hotels, restaurants and repair stations. And CB costs far less than a marine radiotelephone installation. It requires a smaller antenna. And recent developments eliminate the need for an expensive ground plate installation on the boat.

A CB transceiver used in aircraft has its own advantages; it can be installed quickly, can give a 100- to 150-mile range from altitudes of 5000 and 10,000 feet, and permits the convenience of a direct radio link to home or office.

This is Citizens Band radio today as it is known to about 750,000 licensees who have purchased upwards of three million transceivers. If you are merely interested in electronics and would like to keep in touch with your home while in your auto, you should investigate the possibilities of Citizens Radio.

● **In The Beginning.** The Citizens Radio Service was set up on a regular basis in 1947 by the Federal Communications Commission under Classes A and B. At that time, operating frequencies were made available only in the 460-470 megacycle band in

A prime attraction of CB is the very low cost of a complete two-way radio installation. This company installed Olson CB transceivers in five service trucks and at the base station.

the ultra high frequency (UHF) region. The equipment was effective over relatively short distances, restricting contacts to "immediate area" use of ½ to 2 miles. Also, the equipment available was much too expensive, even for established businessmen.

The need for low-cost personal and business radio communications still remained; in fact, with the country becoming more electronics-conscious during the late 1950's, the need for, and interest in, a practical Citizens Radio Service became pressing.

In September, 1958, the FCC made 23 new frequencies available to the Citizens Radio Service. These frequencies were in the 11-meter band and they opened the door for practical and reliable two-way radio communications. The results were: 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. In its new band, CB radio became a valuable communications tool for the professional man, small businessman, farmer, and the just-plain citizen.

● **How CB Grew.** In less than two years, CB license applications poured into Washington at the rate of 11,000 a month. By

Citizens Band radio serves three useful functions at this marina. It helps boats find the marina, aids in maintaining security, and is used to call for transportation from dockside to lodge. The equipment in this cart is a Johnson "Messenger III."

the end of the 1960 fiscal year, there were over 125,000 licenses issued. And at the close of 1965 more than 745,000 licensees were using the 11-meter Citizens Radio Service.

There were approximately ten manufacturers producing CB transceivers in 1959, both in kit and factory-assembled form. Today, over 200 models and types are offered, from half-pint 1- and 2-channel walkie-talkies to full 5-watt, 23-channel transceivers as deluxe or as functional as requirements demand or the pocketbook will allow. Antenna types and accessories have been developed to accommodate every possible problem for base or mobile installations.

● **Rules and Regulations.** All Citizens Radio Service applicants are required to read and understand a copy of the Federal Communications Commission's Part 95, the Citizens Radio Service Rules and Regulations, *before* being licensed. Licensees are also required to maintain a current copy of Part 95 by subscription. The Rules can be purchased by sending $1.25 to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Future rule changes and information sheets are forwarded to the subscriber until notice of expiration is received from the FCC, at which time the licensee must renew his subscription.

Part 95 of the Rules was devised to insure that every station would be operated in such a manner that the service would continue to serve the public's "interest, convenience and necessity."

● **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 model-control station) can obtain a station license in this service if his application meets the requirements of Part 95.

Partnerships, associations, trusts, or corporations meeting the citizenship requirements of the Communications Act of 1934, such as special police groups and rescue squads, and including any state, territorial, or local government entity, or any organization or association—including Civil Defense and Civil Air Patrol organizations —operating by the authority of such governmental entities, can also be licensed in this service.

● **Shared Frequencies.** The frequencies available to stations in this service are shared among licensees. 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.

● **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 communications 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 relayed by 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 for the operation of stations licensed to him.

Citizens Band stations may not be used for hobby communications, i.e., operation of a station just to be "on the air," nor

may a licensee of the Citizens Radio Service communicate with foreign "CB" stations despite the fact that they may be received by the Citizens Radio station.

● **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. While 48 channels are assigned to the Class A service within the frequency band of 450-470 mc. (UHF), only one assigned frequency may be used by an operator. In this class, 60 watts input to the transmitter is permissible, and there are no limitations on antenna height. Repeater stations may also be employed under a Class A license for greater range (see "Business Radio" chapter). Class A equipment prices are in the vicinity of $600 per unit, not including the antenna or tower. Emissions are limited to FM and AM radiotelephone; tone signals may be used to establish contact.

CLASS B. Class B operators may communicate on any one of 49 channels allocated between 460 and 470 mc. (UHF). However, the range is much shorter than on the Class D frequencies (see below) due to the characteristics of the ultra high frequency band. Transmitter input power is limited to 5 watts and the radiating section of the antenna being used must not be more than 25 feet above the equipment. Licenses are granted to AM and FM radiotelephone stations, control signals may be used, and signaling is permissible. Remote control or repeater stations may not be used. The growth of Class B was stunted practically from the beginning due to its extremely limited range.

CLASS C. This is a special class for radio-control fans. Class C licensees share 27.255 mc. with Class D users. Thirty watts input to the transmitter is allowable on this frequency, but only for the purpose of radio-control operation by Class C licensees. Although Class D licensees may use the same frequency for voice transmission, they are limited to 5 watts input. However, due to the large number of Class C radio-control units on 27.255 mc., Class D voice communication is not recommended. Class C units may emit AM tone or off-on carriers for remote control; they may not transmit voice.

CLASS D. The Class D service is intended for business or personal use. Prices for equipment start at a moderate level and increase with added features needed or desired. All equipment in this class is operable on 11 meters, with a choice of 23 separate channels—from 26.965 to 27.255 mc. With 5 watts input as the maximum power allowable, stations under this classification have been known to communicate with mobile units over distances of 5 to 150 miles. This range is largely dependent upon terrain, the type of equipment and antenna used, and the location of the antenna. Mobile-to-mobile operation may vary from 5 to 40 miles; and fixed-location-to-fixed-location from 25 to 75 miles. All equipment under this classification may be operated on AM radiotelephone (SSB included) but not FM. Tone signals may be used to establish contact.

● **Specific-Purpose Channels.** Thousands of CB'ers across the country have adopted specific channels to be used for various purposes. Likewise, hundreds of CB clubs have named specific channels for monitoring, some of them with a 24-hour CB oper-

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

ator on guard to aid stranded or misguided motorists in the area, and for assisting in any way possible during emergencies encountered by individuals, communities, or wherever CB radio can lend a hand.

Channel 9 is now generally accepted as the "National Calling and Emergency Channel." This would indicate that most CB'ers monitor ("listen to") channel 9 at some time. To use channel 9 as a *Calling Channel,* a licensee places his call on that channel. When he has contacted his party, however, they switch to an unused channel to conduct their business. Thus, the only conversation on channel 9 involves a brief calling period. The channel is then clear for others to place their calls.

There are four definite advantages to using a channel in this manner, especially on a national basis: (1) The more users monitoring the channel, the better the chance for an emergency caller to receive help from any one of possibly 200 CB'ers in an average-size town, or within 15 to 20 miles of a community. (2) Using the channel strictly for calling and emergency transmissions eliminates having to listen to conversations by others that do not involve those monitoring the channel. (3) Under this cooperative plan, a person can be sure of contacting his party immediately without waiting for one, two, or three callers who may also be expecting to use the channel next. Accumulated transmission time of the users next in line could mean an additional 15-minute wait. (4) Use of channel 9 as an emergency aid channel for travelers has been given "semi-official" approval by the Federal Communications Commission.

Channel 13 is used by most non-commercial pleasure boats in the United States. As an accepted "water-going" channel, it puts boaters in touch with one another and with their own individual cottages or mobile units on the shore. Many CB'ers have also taken on the responsibility of monitoring the waterways for distress calls on channel 13, and although the FCC has not given "official" recognition to this practice—adopted on a voluntary basis by the CB'ers—it has accepted and encourages the use of "13" for boaters.

Use of CB equipment by owners of larger craft, those required to carry marine radiotelephones, can consider the installation of CB radio an added safety feature. The CB system enables the captain to conduct his personal and business communications via CB, keeping his marine equipment clear for safety and distress messages.

Channel 22 is generally used by Civil Defense groups employing the aid of CB'ers during emergency assists such as floods, searches for missing persons, and traffic control at community events. However, the CB'ers working with these agencies in time of emergency may not use their own call-signs, but are given temporary use of the Civil Defense call-sign issued by the FCC.

As mentioned, the channels listed here are *generally* accepted by most Citizens Band operators across the country. Channel selection, however, varies in different parts of the country. Many CB clubs have posted signs on the main highways leading into the cities in which they operate to indicate which channel in a particular city is monitored as an aid to travelers. If you're in doubt, and in trouble, start with channel 9 and work from there!

● **Call-Signs.** "License number," "serial number" and "call-sign" are all terms applied to the combination of letters and numbers that will appear on your license as issued by the FCC. The latter, "call-sign," is the most accepted version used by all the services. Your particular call will be assigned to you for use on the Citizens Band for the next five years, unless you move or find a need for more units in your CB system than were requested in the original application. Your single license will cover all of the units within your system; the total number of transceivers you feel you might be using during the five years should be stated on the first application.

● **Interference.** CB'ers must expect and tolerate interference not only from other CB stations but from stations legally operating in other radio services. Licensees of Class A stations must apply for a new authorization before shifting to other frequencies; licensees of Class B or D stations may shift to any of the frequencies available to stations in their respective classes without further authorization.

● **Application Form.** In order to set up a Citizens Band communications system, a station license must be obtained from the Federal Communications Commission, Washington, D.C. Form 505 "Revised May 1963" is used to apply for a new, renewed, or modified license.

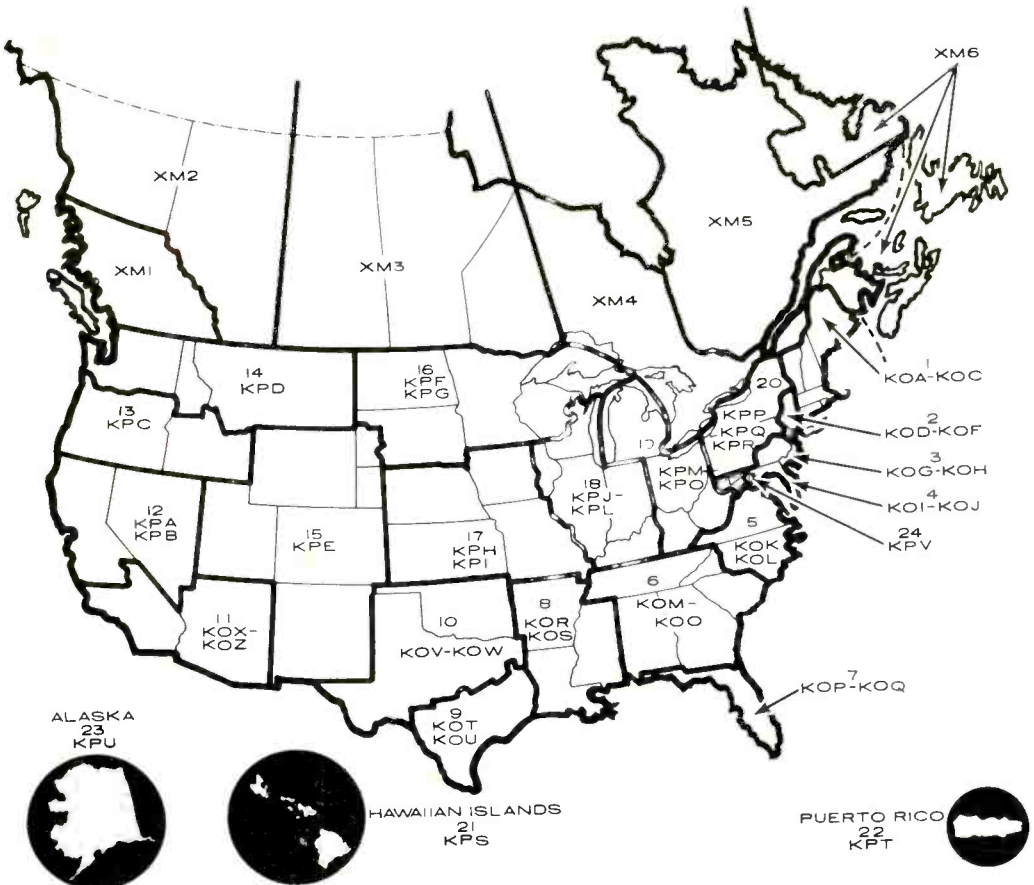
Form 505 must also be used for changes of address, for a change in the number of transmitters (mobile units) or any other information shown on the license, or for authority to transfer control of the licensee corporation. If a license is lost, a duplicate can be obtained by applying for it on FCC Form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

● **The CB License.** Regulations for obtaining a Citizens Band license require only that an eligible applicant 18 years or older have a valid reason for using the CB channels.

IMPORTANT: Most manufacturers include license application Form 505 with their CB equipment. There have been several types of CB license applications issued since the advent of CB in late 1958; a few old forms—dated prior to May, 1963—are still in circulation. Only one form is accepted at this time—the current form. The upper left-hand corner of your application MUST read, "FCC Form 505, *revised May 1963.*" (This form is for use by applicants for Class B, C and D stations; Class A applicants must use FCC Form 400.)

● **Filling Out Form 505.** All Class B, C, or D station licenses applied for must be accompanied by a check or money order for $8, made payable to the Federal Communications Commission.

A step-by-step procedure is given below to help the CB applicant complete the necessary paper work. The item numbers match those on Form 505 (see p. 104). On receipt of the application material, remove the work sheet attached to the form and fill it out as indicated here, using a pencil so that mistakes can be easily erased.



Tentative call-sign prefixes for the Citizens Radio Service and General Radio Service of Canada for allocation in 1966 are shown on this map. The FCC changes the last two letters of each prefix each year. It is possible that the call letter assignment procedures will be modified in 1966 and new call letter prefixes issued. At writing, Canadian prefixes have not been altered since 1963.

FCC FORM 505
REVISED MAY 1963

UNITED STATES OF AMERICA
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

FORM APPROVED
BUDGET BUREAU NO. 52-R123.10

APPLICATION FOR CLASS B, C, OR D STATION LICENSE IN THE

CITIZENS RADIO SERVICE

DO NOT WRITE IN THIS BLOCK

1. Application for Class A station license must be filed on FCC FORM 400.
2. Complete on typewriter or print clearly.
3. Be sure application is signed and dated. *Mail* application to Federal Communications Commission, Gettysburg, Pa., 17325.
4. Enclose appropriate fee with application, if required. DO NOT SUBMIT CASH. Make check or money order payable to Federal Communications Commission. (See Part 19, Volume VI of FCC rules to determine whether a fee is required with this application.)

1 NAME OF APPLICANT

BUSINESS NAME (OR LAST NAME, IF AN INDIVIDUAL)

FIRST NAME (IF AN INDIVIDUAL) | MIDDLE INITIAL

2 IF AN INDIVIDUAL OPERATING UNDER A TRADE NAME, GIVE INDIVIDUAL NAME; OR IF PARTNERSHIP, LIST NAMES OF PARTNERS (*Do not repeat any name used in item 1.*)

LAST NAMES	FIRST NAMES	MIDDLE INITIAL

3 MAILING ADDRESS

NUMBER AND STREET

CITY | STATE

ZIP CODE | COUNTY OR EQUIVALENT SUBDIVISION

4 CLASSIFICATION OF APPLICANT (*See instructions*)

☐ INDIVIDUAL ☐ ASSOCIATION ☐ GOVERNMENTAL ENTITY

☐ PARTNERSHIP ☐ CORPORATION ☐ OTHER (*Specify*):

5 CLASS OF STATION (*Check only one*)

☐ CLASS B ☐ CLASS C ☐ CLASS D

6 IS THIS APPLICATION TO MODIFY OR RENEW AN EXISTING STATION LICENSE?

☐ YES (*Give call sign*): ☐ NO

7 DO YOU NOW HOLD ANY STATION LICENSE, OTHER THAN THAT COVERED BY ITEM 6, OF THE SAME CLASS AS THAT REQUESTED BY THIS APPLICATION?

☐ YES ☐ NO

8 TOTAL NUMBER OF TRANSMITTERS TO BE AUTHORIZED UNDER REQUESTED STATION LICENSE

(*Number*)

		YES	NO
9	DOES EACH TRANSMITTER TO BE OPERATED APPEAR ON THE COMMISSION'S "RADIO EQUIPMENT LIST, PART C," OR, IF FOR CLASS C OR CLASS D STATIONS, IS IT CRYSTAL-CONTROLLED? (*If no, attach detailed description: see subpart C of Part 19*)		
10	A. WILL APPLICANT OWN ALL THE RADIO EQUIPMENT? (*If no, answer B and C below*)		
	B. NAME OF OWNER		
	C. IS THE APPLICANT A PARTY TO A WRITTEN LEASE OR OTHER AGREEMENT UNDER WHICH THE OWNERSHIP OR CONTROL WILL BE EXERCISED IN THE SAME MANNER AS IF THE EQUIPMENT WERE OWNED BY THE APPLICANT?		
11	HAS APPLICANT READ AND UNDERSTOOD THE PROVISIONS OF PART 19, SUBPART D, DEALING WITH PERMISSIBLE COMMUNICATIONS FOR WHICH THIS CLASS OF STATION MAY BE USED?		
12	WILL THE USE OF THE STATION CONFORM IN ALL RESPECTS WITH THE PERMISSIBLE COMMUNICATIONS AS SET FORTH IN PART 19, SUBPART D?		
13	WILL THE STATION BE OPERATED BY ANY PERSON OTHER THAN THE APPLICANT, MEMBERS OF HIS IMMEDIATE FAMILY, OR HIS EMPLOYEES? (*If yes, attach a separate sheet listing the names and relationship of all such persons and give a detailed reason for their operation of your station*)		
14	IF APPLICANT IS AN INDIVIDUAL OR A PARTNERSHIP, ARE YOU OR ANY OF THE PARTNERS AN ALIEN?		
15	IS APPLICANT THE REPRESENTATIVE OF ANY ALIEN OR ANY FOREIGN GOVERNMENT? (*If yes, explain fully*)		
16	WITHIN 10 YEARS PREVIOUS TO THE DATE OF THIS APPLICATION, HAS THE APPLICANT OR ANY PARTY TO THIS APPLICATION BEEN CONVICTED IN A FEDERAL, STATE, OR LOCAL COURT OF ANY CRIME FOR WHICH THE PENALTY IMPOSED WAS A FINE OF $500 OR MORE, OR AN IMPRISONMENT OF 6 MONTHS OR MORE? (*See instructions. If yes, attach a separate sheet giving details of each such conviction*)		
17	IF APPLICANT IS AN INDIVIDUAL OR A PARTNERSHIP, ARE YOU OR ANY PARTNER LESS THAN 18 YEARS OF AGE (LESS THAN 12 YEARS OF AGE IF FOR CLASS C STATION LICENSE)?		

18 **IF THE PRINCIPAL LOCATION WHERE THE STATION WILL BE USED IS DIFFERENT FROM THE MAILING ADDRESS (ITEM 3), GIVE THAT LOCATION.** (*DO NOT GIVE POST OFFICE BOX OR RFD NO.*)

NUMBER AND STREET

CITY | STATE

IF LOCATION CANNOT BE SPECIFIED BY STREET, CITY, AND STATE, GIVE OTHER DESCRIPTION OF LOCATION

DO NOT WRITE IN THIS BOX

SCREENING ☐ Y ☐ N

SIGNATURE ☐ Y ☐ N

SIGN AND DATE THE APPLICATION ON REVERSE SIDE

19. IF APPLICANT IS A NONGOVERNMENTAL CORPORATION, ANSWER THE FOLLOWING ITEMS.

		YES	NO
A	IS CORPORATION ORGANIZED UNDER LAWS OF ANY FOREIGN GOVERNMENT?		
B	IS ANY OFFICER OR DIRECTOR OF THE CORPORATION AN ALIEN?		
C	IS MORE THAN ONE-FIFTH OF THE [illegible] RECORD OR MAY IT BE [illegible]		

20. IF APPLICANT IS AN UNINCORPORATED ASSOCIATION, ANSWER THE FOLLOWING ITEMS.

		YES	NO
A	IS ANY OFFICER OR DIRECTOR OF THE ASSOCIATION AN ALIEN?		
B	ARE MORE THAN ONE-FIFTH OF THE VOTING MEMBERS OF THE ASSOCIATION ALIENS OR REPRESENTATIVES OF ALIENS, FOREIGN GOVERNMENTS OR REPRESENTATIVES THEREOF, OR CORPORATIONS ORGANIZED UNDER THE LAWS OF A FOREIGN COUNTRY?		

ITEM 1. Enter your business name or *legal* last name here. (If the license is for business purposes, print in the firm name.) On the second line, enter your first name and middle initial. Married women should use their own names (i.e., Julie Jones, *not* Mrs. John Jones.)

ITEM 2. If you will be operating under a trade name, you should enter your own name here; or, if in a partnership, you must list the names of your partners in the spaces provided. (Do not repeat any name used in Item 1.)

ITEM 3. Insert your *mailing* address in this box. If you are doubtful as to the county in which you live, you can phone any local or state government office for the correct information.

ITEM 4. Place an **X** in the appropriate box.

ITEM 5. Place an **X** in the box marked "Class D."

ITEM 6. If you are applying for a CB license for the first time, put an **X** in the box marked "NO." If you are reapplying for a license because you have moved, are adding more units to your system, or if your present license has expired, put an **X** in the box marked "YES" and enter your present call-sign on the line below.

ITEM 7. If this is your first request for licensing, place an **X** in the box marked "NO."

ITEM 8. Enter the number of transceivers you will use in your CB system. Two units make a complete two-way radio system; if you plan to add additional equipment to your facilities before your five-year license expires, you should include these in the number to be authorized at this time. Reapplying for the use of more transmitters after a license has been issued will require an additional $8 fee.

ITEM 9. Most CB'ers purchase equipment approved by the FCC for Class D operation; if such is the case with you, mark the box marked "YES" with an **X**. If you are in doubt, ask your supplier—he should know!

ITEM 10. In almost all cases, you will either own or plan to purchase transceivers; if this is so, mark the box labeled "YES." If you will not own the equipment, you must fill in items "B" and "C" below the question.

ITEM 11. Here the FCC wants to know that you have read and understood the provisions of Part 95 concerning the permissible communications for which you will be using your station. You must have a copy of Part 95 in your possession before operating your CB station.

ITEM 12. This question asks you to attest that you will be operating your CB system in accordance with the Rules and Regulations set forth in Part 95.

ITEM 13. If persons other than your immediate family or employees will be operating your equipment, you must list their names and relationships on a separate sheet of paper with a detailed reason for their operation of your station.

ITEM 14. Answer this question with a "NO" unless you are (or, if a partnership, one of your partners is) an alien.

ITEM 15. This question is answered with a "NO" also, or you must give a detailed explanation on another sheet.

ITEM 16. Give an "appropriate" answer here. If your answer is "YES," you must answer the three lengthy questions asked under this item contained in the FCC's Specific Instructions attached to Form 505.

ITEM 17. Your answer here must be a truthful "NO" to be eligible for a CB station license.

ITEM 18. If the location from which you will be using your station is different from your mailing address, you must enter the station address on these lines.

ITEM 19 and 20. If either of these items pertains to you, take your time in answering them fully and correctly. If there is any doubt in your mind as to how they should be answered, consult an attorney.

NOTE: We have made reference to "Part 95" in several of these items. The 505 form, however, indicates "Part 19." Part 95 supersedes the former Part 19, but the same Part 19-type application form is still being used. Just be sure you have the proper form, as indicated.

Finally, the FCC asks that you attest to seven statements listed on the bottom of the form by signing on the signature line, dating the form, and checking one last box applicable to your position in applying for a license. Read the statements, understand them, and approve of them before signing; you'll save yourself a lot of possible grief in the future!

Now check over all your answers on the work sheet. When you are sure they're correct, transfer this information to the actual application form. Be sure to sign the application properly when it is completed.

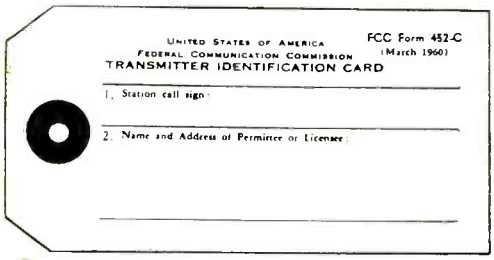
(Non-signature, errors, or omissions will force the Commission to return the application, without license! Moreover, you will have to submit an additional $8 fee with your corrected or reapplied application.) Mail the form with your check or money order to the Federal Communications Commission, Gettysburg, Pa. 17325.

You will also find an order blank for Volume VI, Part 95 of the Rules & Regulations, attached to your application form. If you do not already have a copy, put your name and address on this form and mail it to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, together with a check or money order for $1.25. With this subscription, you will receive the current FCC Rules & Regulations for CB and all subsequent additions, changes, or corrections—automatically.

Remember, you must have a copy of Part 95 in your possession (and have read and understood the rules) *before* you can operate your station under your issued call-sign.

WARNING: The waiting time for issuance of a CB license has been cut considerably; it is not worth taking the chance of jeopardizing the privilege you are requesting by using your transmitter before receiving your call-sign. And *don't* use a friend's call! Getting caught could result in loss of license, fine, imprisonment, or all three, depending on the offense!

When you receive your license, post it near your base station where it can be examined by the proper authorities if the occasion should ever arise. FCC Form 452-C (Transmitter Identification Card) 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 most units manufactured. Additional copies are available from any FCC office.


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.

● **What Equipment to Use.** The variety of CB equipment available today makes the important step of buying the right transceiver an easy one. Advancements in circuitry, operating conveniences and plus-features—all summed up in approximately 200 different units on the market—make it possible today to choose the station setup that will best suit the need of the user.

There are several factors to be considered when buying CB transceiver equipment. It is not necessary to have any technical knowledge of transceivers, but a familiarity with what different types are designed to do will help you to make the correct choice, and to get the utmost service from both the equipment and the Citizens Band.

● **Transmitter Section.** Transmitters for the Class D service must meet certain technical requirements. These include a maximum input power of 5 watts to the plate of the final r.f. amplifier stage and an operating frequency tolerance of .005%. Since these requirements are regulated by the FCC, you can be sure they are met in all equipment on the market, and therefore you can turn your attention to such considerations as convenience of operation and extra features offered.

The majority of CB transceivers transmit a straight amplitude-modulated (AM) signal. But there are several models available that reduce the strength of the carrier and place slightly more power into the sidebands which contain the modulation components. These latter signals are referred to as "DSB" (double-sideband with reduced carrier). One manufacturer offers a single-sideband suppressed-carrier transceiver which is referred to as "SSB."

The power output rating varies with different manufacturers, but is generally between 2.5 and 3.5 watts. There are also quite a few transistorized CB transceivers (mostly hand-held "walkie-talkie" types) with input power ratings of 1 or 2 watts; these units can only be used by appropriately licensed CB'ers and are not to be considered in the class of the license-free hand-helds with inputs of 100 milliwatts (1/10 watt) or less.

● **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

This Amphenol-Borg CB transceiver is similar to many that can be connected to selective calling adapters. More and more business users of CB radio install selective calling devices to screen out transmissions from other stations on the CB channel. With selective calling, the receiver is dead until it is activated by a special tone signal transmitted from the base station.

ability to receive a signal satisfactorily through interference. The better the sensitivity rating given a receiver (usually below 1 microvolt), the better the chances are to receive distant transmissions. The superregenerative receivers of yesterday had very poor selectivity compared with the superheterodyne types offered today. Superheterodyne circuitry also allows the use of crystal-controlled tuning; superregenerative units do not.

As the need for more and more selectivity becomes desirable, many CB equipment manufacturers offer transceivers of the "dual" or "double" conversion superhet variety. This type of unit requires additional circuitry, and as a general rule you will find double-conversion superhets $20 to $30 more expensive than a comparable transceiver with a single-conversion receiver. If interference in your area is heavy, or if you will have a need for long-distance communications, the double-conversion unit can be well worth the extra tab.

A "squelch" circuit will completely silence the receiver, eliminating background noise when the tuned channel is not in use. A built-in "noise-limiter" is also a must to minimize electrical and ignition interference.

As for tuning, you must decide whether you will want to tune all 23 receiving channels or just a few channels on which you intend to operate through crystal-control selection. Most equipment offered today includes a combination of the two; your choice in most cases will involve the number of crystal-controlled channels you will need. Present-day CB gear is usually available with crystal sockets for 1, 2, 5, 6, 8, 11, 12 or 23 channels.

● **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. A few of the available units operate on a single source (i.e., 12 volts for permanent mobile operation, and 117 volts for permanent base station use). 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 offered with most equipment which will operate on any of the three voltages that may be needed. Transceivers so equipped can be switched from mobile to base operation as required or desired.

Before purchasing your CB transceiver, check your needs against the features mentioned above. Investigate the construction of the unit. Is it sturdy--will it take whatever minimal abuse may be necessary through mobile operation? Will it fit well in appearance with its surroundings in your home, car, or business vehicle? And, finally, is the gear equipped to do the job required?

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

It is advantageous to mount any antenna as high as Part 95 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 coax cable short.

● **Ground Plane Antenna.** While the vertical ground plane antenna is gradually being replaced by several types of improved versions, it was used by most CB'ers at one time. It is still readily available and can be effectively used over average distances. This type of antenna consists of a 108″ vertical radiator mounted and insulated from a "plane" of three or four similar-length rods. It is easy to assemble and install, but it requires considerable free space so that the horizontal rods will not touch or intersect a nearby obstruction.

● **Coaxial CB Antenna.** Comprised 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 feedline, 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 feedline and that the losses between the coaxial line and coaxial antenna are minimized.

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.

● **Collinear Antenna.** One of the most popular base types today is the collinear antenna. Extending nearly to maximum 20-foot height, it relies on a fancy coil and matching network to make the antenna perform as if it were 36 feet high. But its value is not so much in length as in the effect on radiation patterns. A signal leaving the collinear is extremely low in angle. Most energy is concentrated under 1 degree—almost flat out. The ground plane radiates at 5 or more degrees, aiming much of its signal skyward. The collinear offers solid gain in all desired directions. It makes a 5-watt signal sound like 10 watts to the distant station. Illegal? Not at all. As long as power multiplication occurs in the antenna, not the transmitter, it can go to any theoretical limit.

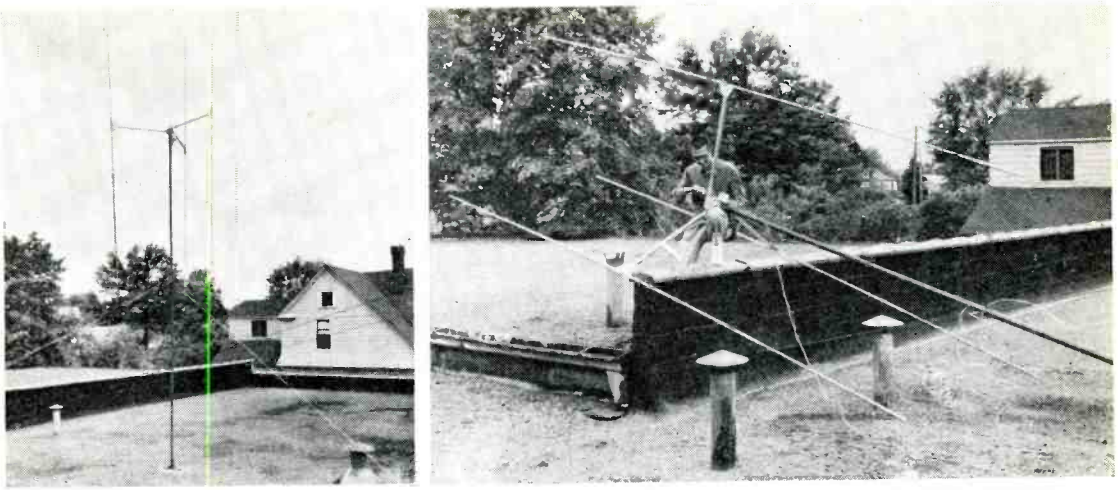
The collinear antenna provides just about the highest gain you can get while still remaining in the nondirectional class. The power increase occurs over 360 degrees. Collinears, too, provide a distinct advantage in receiving. Since elements are grounded to the mast (through a coil), static tends to be short-circuited. The 27-mc. signal remains unaffected.

● **Beam Antennas.** By placing special elements at critical distances from a vertical antenna, the full strength of the incoming or outgoing signal can be "beamed" in one direction, rather than dividing the signal in an omnidirectional pattern through the use of a single-element vertical antenna.

The more common CB beam antennas consist of three or five elements, including the radiator. Other elements make up the reflector portion to increase signal strength in the direction away from the reflector. On the same vertical plane as the reflector elements, but at another critical distance, directors are used to "lead" or "pull" the radiation in the favored direction.

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

This Mosley V-27-GP antenna is perched atop the administration building of the Calvary Cemetery in St. Louis, Mo. Mobile units maintain continual contact with the superintendent's office, using Citizens Band radio throughout the cemetery's 425 acres.



The three vertical elements of this Antenna Specialists "Scanner" represent an altogether different approach to CB beam antennas. The elements are not rotated but, as the photos show, can be rigidly mounted in place. A relay switching network rotates the beam pattern by operating one vertical dipole as the radiator and the remaining two as reflectors. Thus, the beam pattern may be swung 120 degrees—eliminating signals from undesired stations and reinforcing signal strengths from another compass direction. Switches to control the relay network can be placed at the operator's elbow.

five-element beam about 10 times the gain of the ground plane or coaxial unit.

The beam antenna is of great advantage where CB communications are to be established between two fixed points, and where there is enough room for installation.

Two major antenna manufacturers have triggered off what could be an important trend in directional antennas. It's the beam that doesn't rotate. Elements remain fixed in place; the signal swings electronically. Hy-Gain's "Co-Phaser" is a small control box that can impart a beam effect to any two identical CB antennas mounted 9 feet apart. Inside the box are lengths of coaxial cable and an elaborate switching system. The cables act as transformers to match up the two antennas. Also, they provide a time delay in the signal going to one antenna. This creates an out-of-step condition between elements, and signals add and cancel in different directions. The operator can choose one of three major patterns by switching the front-panel selector.

Let's say the two antennas are mounted along an east-west line. For one switch position, the signal is more than doubled in power to the east. Another position produces the same effect to the west. In the final position, identical signals are transmitted to the north and south. Depending on the particular installation, the CB'er can select his major areas of maximum power. And pattern switching is fast—there's no waiting for a mechanical rotator to swing around.

Another entry in the electronic beam field is the "Scanner" by Antenna Specialists. The array consists of three 17½-foot elements. These verticals are connected to relays housed at the top of the mast. As the CB'er switches his control box, the relays activate one of the elements. Now, the two other elements become reflectors to focus the signal in the desired direction. In this manner, the pattern, not the elements, can be shifted around the compass. It covers 120 degrees at a time. To inform the CB'er of the active direction, three neon indicators are located on the control-box panel. In each of the three directions, the 5-watt signal is multiplied to about 30 watts.

● **Hybrid Antennas.** 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 increase the power of the radiated signal.

● **Mobile Antennas.** There are a variety of mobile antennas available. Although the

most popular at one time was the standard 102″ whip, this is rapidly being replaced by shorter, equally efficient versions. Whips are made from either stainless steel or a special wire-encased fiberglass section. Newer models vary in length and may be installed attached to the bumper, the body or deck, or in place of the existing AM broadcast antenna. If you do not care to drill holes in the body of the vehicle, you may want to consider the use of a diplexer which will enable you to use one antenna for both CB and AM broadcast reception.

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 with the maximum radiation extended across the right front fender. The ideal mobile antenna installation, therefore, would be in the center of the roof or car body. Several of the newer short-length versions are very effective here since the signal is spread in an omnidirectional pattern, the body of the car acting as a ground plane.

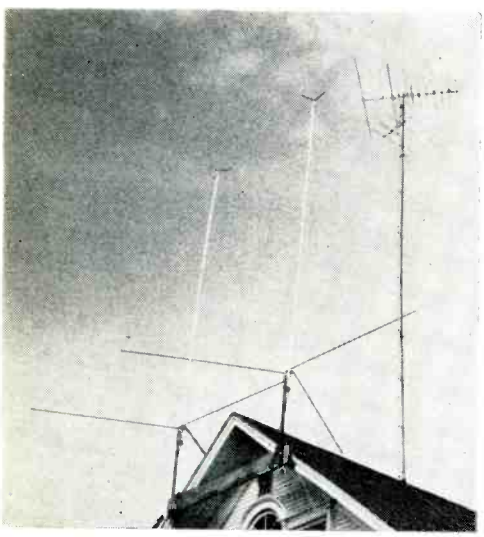
● **Installation Practices.** Installing your CB system in the home or office, in a truck or auto, or even in a cabin cruiser, demands *no* technical knowledge. Fixed—or base—stations (i.e., those in the home or office) will require the least amount of installation time since most units need only be attached to the proper voltage source and antenna connections to be operable. Mobile rigs must be mounted much more securely, usually in closer quarters, and some vehicles will require the installation of suppression to quiet ignition interference.

● **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 today affords the user many choices of location. And manufacturers take into consideration the size, shape and finish of CB equipment, so that it may serve its purpose visually as well as functionally in any area—from the garage to the living room.

It is sometimes advantageous to use a cowl antenna for both mobile CB and auto AM reception. This is a typical coupling harness sold by New-Tronics. An isolation network keeps the Citizens Band signal out of the car's AM radio, and vice versa.

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. In drilling from the inside out, drill the hole in a downward position so that moisture from the outside cannot work its way in. Also, any space left after insertion of the lead-in cable should be filled in with a 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, the equipment can be flush-mounted within the confines of a cupboard or desk.



These Hy-Gain CLR-2 antennas are fed from the CB transceiver through a "Co-Phaser," a device which alters phase relationship between antennas. As phase is changed, so is the 4 db directional gain.

● **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 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 types used by telephone installers) should be employed to assure positive contact between the wire and the grounding rod or pipe.

● **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 brake and gas pedal.

Center-mounting the transceiver under the dash works out to best advantage in most cases. Controls can be seen by both the driver and passenger, and may be operated by either from where they are seated. Some units can be mounted on top of the dash, but only when the shape of the transceiver will not impair vision.

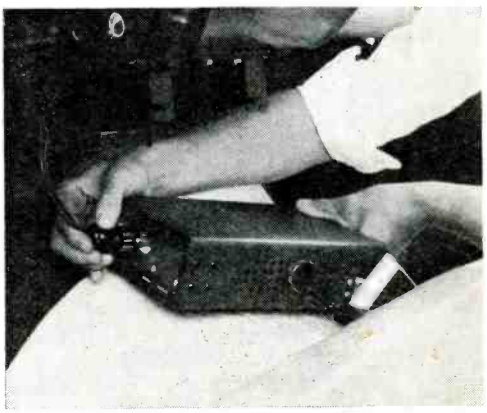
If the glove compartment is centrally located, there is a chance that the holes in the transceiver's mounting bracket will match those already used to hold the compartment door-hinge in place. In many cases, the same screws will hold the bracket and the compartment door; if not, holes can be drilled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

● **Power Connections.** Once the transceiver is mounted, power may be supplied in several ways—some good—others better! Almost all universally powered 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 indicates that the equipment has been built to be used with either source of power, and is switched from one to the other merely by plugging in the appropriate cable on the rear of the unit and connecting it to the proper source. Although manufacturers' instructions usually lend a hand in this department also, let's take a quick rundown of the three more common types of connections in the mobile installation.

(1) A few CB transceivers are still supplied with a d.c. cable that has a cigarette lighter receptacle plug at one end—the same type used on auto troubleshooter 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 since the wires from the receptacle to the battery are usually not heavy enough to supply full power to the equipment. Loss of power may also occur at the plug within the receptacle since it is not a solid connection. 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, and 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 connection will also produce a loss of power due to the increased load through the ignition switch.

(3) Running the d.c. power cable supplied with the transceiver directly to the battery terminals or fuse block promises the best



Solid-state CB transceivers have reduced battery drain to bare minimum. This compact Heathkit GW-14, about to be installed under the dash, has a 14-transistor, 6-diode circuit for 23-channel operation.

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 must consider that any losses that can be avoided may mean added *miles* in range. It then becomes a matter of choice—we either have to 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. Caution should be exercised, however, in placing the unit where it will not be plagued by moisture—especially salt spray.

Choice of a power supply for the transceiver will depend upon whether the boat is equipped with a 6-, 12- or 32-volt battery; a 117-volt a.c. generator; or no power source at all. Equipment power supplies can be matched for most of the examples given here. Should the power supply present a problem, however, a 12-volt storage battery can be used to operate a 12-volt d.c. rig, provided that the battery is maintained and kept at full charge when not being used to power the equipment.

There are several fully-transistorized CB transceivers on the market which operate from 117-volt a.c., 12-volt d.c., or self-contained battery pack sources. Any of these units could be the ideal solution where mismatches in power supply requirements—or the absence of power—create a barrier. Also, lightweight, transistorized equipment can be used "on board" temporarily, carried ashore and used in the field on its own supply, and taken into the cabin or home and used on a.c. power.

In choosing an antenna for a boat, either a stainless steel whip, a loaded coil whip, or a fiberglass whip will suffice to complete the installation. On a larger cabin craft or vessel, a ground plane or hybrid antenna might be used. Manufacturing improvements have also produced antenna types that no longer require an expensive ground plate installation; they can be installed without technical knowledge and are highly effective transmit/receive types.

● **Interference.** There are several types of interference that plague the Citizens Radio Service, but none troublesome enough to squelch the efficient operation of a CB system if the causes are understood and proper corrective measures taken.

● **TV, Radio, P.A. Interference.** 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 nonscheduled CB broadcast. Don't panic if you receive a complaint. Your equipment may, or may *not*, be what is 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 supplied 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 resonate at the Citizens Band.

Some of the older TV sets use an intermediate frequency in the 27-mc. band, and this poor circuit design will 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.

By no means should you attempt to make any of the adjustments necessary to the other person's equipment yourself—you'd only be setting yourself up as 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. Use of this equipment can result in an overpowering raucous hum and hash being received around CB chan-

The author of this chapter has made numerous radio and TV broadcasts to inform the public about the worthwhile public service aspects of CB radio. These shots from a TV screen were taken during a broadcast over Station WREX-TV, Rockford, Ill. The interviewer is Jane Neubauer, hostess of the "Tete A Tete" show.

nels 13 and 14. It's best to stay clear of these channels if you are within range of diathermy 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 with slightly off-frequency crystals. 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 temporary 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.

You may certainly listen to these transmissions, and even log them if you care to, but by no means should you attempt to transmit a message to any station more than 150 miles from your own station. Contacting, or attempting to contact, another station on "skip" is a violation of the FCC Part 95 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 thousands have chosen CB for their personal or business communications system. But "first place" on the list of advantages afforded the user could easily be awarded to "ease of operation!"

● **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: "KHC3022, KHC-3022 base to mobile. Over."
MOBILE STATION: "This is KHC3022 mobile. Over."
BASE: "What's your present location? Over."
MOBILE: "I was just leaving 1800 Rural Street. Over."
BASE: "Have you finished the last job I gave you? Over."
MOBILE: "Yes I have. Over."
BASE: "Report to the gentleman waiting in front of the Police Department. He's locked out of his car. Over."
MOBILE: "Okay. Over."
BASE: "KHC3022 base; out and clear."
MOBILE: "KHC3022 mobile; 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 transmitting on a preselected channel monitored by both the base and mobile units in his system, the locksmith hss easily and effectively delivered an assignment.

● **The "10-Code."** The conversation above, as short and to the point as it already is, can be snipped even more by making use of the POPULAR ELECTRONICS "10-Code." This method has become quite desirable when radio 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 the transmitting or receiving range, as numbers can be much more readily understood than can individual words or lengthy sentences.

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

BASE STATION: 'KHC3022, KHC-3022, base to mobile. Over."
MOBILE STATION: "This is KHC3022 mobile. Over."
BASE: "What is your 10-20?"
MOBILE: "1800 Rural."
BASE: "Are you 10-24?"
MOBILE: "10-4."
BASE: "10-22 Police Department — locked out."
MOBILE: "10-4."
BASE: "KHC3022 base; 10-10."
MOBILE: "KHC3022 mobile, 10-10."

If we were to get technical and run a stopwatch 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 duration, there is a definite advantage in using the 10-Code for a message containing five minutes of information: it can be packed into just four minutes. Use of this code expedites message handling, thus clearing the channel for others.

It is not necessary to memorize all of the 10-Code. It is practical, however, to mount a copy of it as close to your transceiver as possible for quick reference. If the CB unit is 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."** The slogan "break-break" has become an ultra-effective means of gaining access to any of the CB channels in time of need. As you may have guessed, the "break-break" means just that—a "breaking" into a conversation on a channel between two other CB units—with a definite reason for doing so. Without interrupting either party during actual conversation, a "breaker" (the 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.

Although a bit split-secondish, the one or two seconds of "dead air" between 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 can 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.

As an example, let's consider what might be a typical conversation between two parties whom we'll call Station A and Station B, who will then be joined by Station C—the breaker. 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 mobile 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 climb up the tower at the Jones' home, Phil. It could be one of the connections near the rotor since everything indoors checks out all right. Over."

STATION B: "10-4 Marv. I'll swing back that way and check it out. Do you want to give me that list of tubes now that you asked 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'."

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.

STATION C: "This is 18A6201 with an important message for Dr. Katz 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! 18W-4689 base is out and clear.

STATION B: "10-4, Marv. 18W4689 mobile is 10-10.

● **Important Rules To Remember.** When operating on the Citizens Band keep in mind the following ten important rules:

(1) Station identification must be given by both parties at the beginning of and upon completion of each contact, regardless of whether the call lasts 30 seconds or a full 5 minutes.

(2) Use channels 9, 10, 11, 12, 13, 14, and 23 for *interstation* communications. All other channels are for use only by stations carrying your own call-sign. Channel 9 may be used for emergency aid to travelers; this practice now has "semi-official" FCC approval.

(3) Make your questions brief and to the point. Long transmissions 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.

(4) Stay within the 5-minute limit set forth in Part 95 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 5 minutes to allow others to place their calls, then contact your station again once they have cleared and another 5 minutes have passed. This rule does not apply to units of the same station or to emergency communications.

(5) Use *your* equipment and a *different* call-sign if you qualify as a member of a duly licensed group activity such as a volunteer fire company, CD service, etc. You are then a mobile unit of the primary licensee.

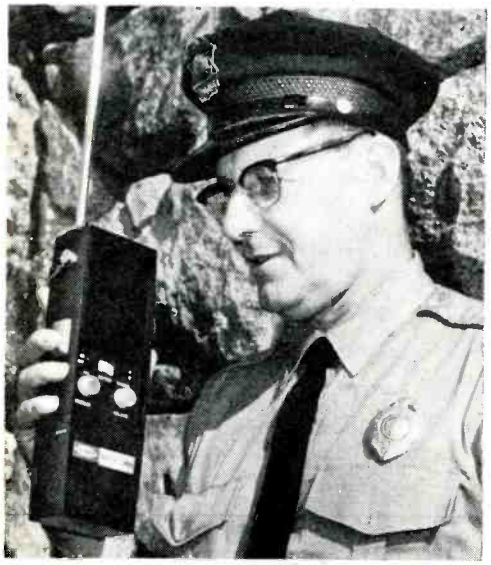
(6) You may continue to operate and use your old call-sign after moving to a new permanent address. However, you must apply within 30 days for a new call-sign, and be sure to notify the FCC of your temporary address.

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

(8) Use the "break-break" procedure *only* when it is absolutely necessary to use the channel. Don't "break" merely to become a third party to a conversation already in progress.

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

(10) Be prepared to use any CB channel in case of emergency. Part 95.85 of the Rules permits a waiver of all restrictions where immediate safety of life or immediate protection of property can be demonstrated.



Use of walkie-talkies is not restricted to childish "fun 'n games." This Raytheon TWR6 is being used by a plant security guard. It has a range of ½-1 mile.

● **Hand-Held Transceivers.** Citizens Band "walkie-talkies" in many cases are more useful and more in demand than 5-watt, full-sized units, depending upon the situation and requirements of the activity at hand. "Talkies" range from $10 to as high as $150. Some of the lesser priced units are marketed as easily assembled kits; they are manufactured for the hobbyist, tinkerer, or gadgeteer who'd rather do it himself for pleasure or savings. Many kits are designed for the youngster to assemble with a little coaching from dad.

Some pint-sized transceivers come under the jurisdiction of Part 15 of the FCC regulations, which allows certain types of communications devices to be operated without a license. There are two classes of "talkies" to consider, the choice depending upon the range the unit will need to cover, its stability, and features required.

● **100-Milliwatt Units**. Under Part 15, one class of "talkies" is limited to 100 milliwatts input power or less, must be crystal-controlled, and can only be used with a single-element whip antenna whose length does not exceed 60 inches. They need not be licensed as long as the circuitry meets FCC requirements and communications are limited between units of the same classification. A 100-mw. transceiver may be used with a 5-watt CB unit, however, if the lesser-powered unit meets the specifications set forth in Part 95 of the Rules & Regulations; during communications of this type, a call-sign must be used between the two units.

The range of 100-mw. units may stretch from a couple of blocks to 10 miles, in some rare cases, depending upon the conditions where the transceivers are used. Large buildings, steel structures, and even trees in densely populated areas limit the range to a matter of city blocks, whereas in open country or over water the equipment can be used to communicate over several miles.

Uses of "walkie-talkies" are practically limitless. Boy Scouts on camping trips can be in instant contact with one another during hikes or while exploring large expanses of woods. Farmers have found a need for the low-powered rigs in the field; a "talkie" tucked in a shirt pocket or slung over the shoulder provides instant communications with a farmhouse many acres away. Telephone messages can be relayed immediately, saving time and expense. Hunters are kept in contact through hand-held units while laying out plans to trap unwary two- and four-legged creatures not so CB-fortunate. Firefighting teams find this equipment a must where large buildings threaten to separate the Chief from individual groups; in many instances a spotter handles the control station and directs the rescue and fire squads to the most vulnerable areas.

Civil Defense organizations, Civil Air Patrol groups, sheriff's departments, police, and thousands of licensed CB clubs and individuals have put the "mini-watters" to good use in search parties for lost children, traffic control at accident scenes, parades, and largely attended events. Many organizations have claimed that their operations would be crippled without "walkie-talkie" equipment.

● **High-Powered "Talkies."** Many hand-held transceivers are used as a portable addition to an already existing network of 5-watt units. For those who need greater range between portable and stationary 5-watt units, there are several 1-, 1.5- and 2-watt "talkies" available; and several manufacturers have managed to dwarf a full 5-watt unit down to the "talkie" size. The important thing to remember is that any unit employed in the system with an input rating higher than 100 milliwatts (1/10th watt) must be licensed and use a call-sign.

All types of higher-powered "talkie" units available today can be hand-carried and are not much heavier in weight than 100-mw. units. Additional features increase the price tag on many of the units but are well worth the difference if the extras are helpful to the application. Most units are equipped for operation on one channel; some are available for two- and four-channel use. Many hand-helds are equipped with a squelch control to keep the unit completely silent between calls. Some are equipped with a.c. recharging facilities to guarantee optimum use of the battery pack. Others also include adapters for using the unit on a.c. voltage with an external antenna, making some of this equipment almost as effective as a 5-watt base station.

● **CB Clubs.** Six years ago CB clubs were organized basically to help individuals solve technical, operational, air-traffic, and violation problems. As CB moves into its eighth year, these activities are still important club functions but the foremost efforts of practically every CB club are directed more and more towards serving the public during emergencies.

Many CB clubs have emergency rescue squads standing by on 24-hour call on an alternating roster similar to those used by volunteer firemen groups. The average motorist would be surprised to learn how much extra gear many of these squads require each member to carry in addition to his regular CB transceiver, a walkie-talkie, and the first-aid knowledge he has received with other club members through official Red Cross training.

(*Continued on page* 124)

CITIZENS BAND CLUBS ACROSS THE COUNTRY

Skip-Riders CB Club
1957 Obrig Ave.
Guntersville, Ala.

Citizens Radio Asst. Club, Inc.
P.O. Box 1715
Huntsville, Ala.

Madison County Rescue
807 Linwood Dr.
Huntsville, Ala.

Franklin County CB Club
P.O. Box 341
Russellville, Ala.

Dixie Five Watters C.B. Club
P.O. Box 211
Piedmont, Ala.

Southern Ariz. CB Assn.
3941 N. 4th Ave.
Tucson, Ariz.

Ozark 5 Watters
1223 Turner St., Rt. 4
Fayetteville, Ark.

Harrison CB Club
Box 792
Harrison, Ark.

Ouachita Valley Citizens Radio
Rt. 7, Box 151
Hot Springs, Ark.

Arkansas River Valley CB Club
401 N. St. Joseph
Morrilton, Ark.

Arkansas CB Radio Club
1303 South Utah
Pine Bluff, Ark.

Radio Asst. No. Orange Cty.
R.A.N.O.C.
P.O. Box 2333
Anaheim, Calif.

Kern County Citizens Radio Assn.
1104 Virginia St.
Bakersfield, Calif.

Pomona Valley 11 Meter Assn.
13129 Cozzens Ave.
Chino, Calif.

The 10-99 Club, Inc.
3124 Van Buren Ave.
Costa Mesa, Calif.

San Gabriel Valley REACT
P.O. Box 1275
Fleetwood Annex
Covina, Calif.

Citizens Band Radio Club of Fresno
614 N. Sierra
Fresno, Calif.

California CB Assn., Inc.
P.O. Box 4026
Hayward, Calif.

Southern Calif. Assistance Unit
P.O. Box 127
La Mirada, Calif.

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

So. Calif. CB Broadcasters
2329 Hause Blvd.
Los Angeles, Calif.

REACT of Orange County
P.O. Box 26
Midway City, Calif.

Monterey County 5 Watters
4123 El Bosque Dr.
Pebble Beach, Calif.

High Desert Rats CB Club
c/o The Printed Circuit
P.O. Box 656
Pomona, Calif.

Citizens Emergency Mobile Patrol
P.O. Box 924
Reseda, Calif.

Sacramento Area CB
2040 Florin Rd.
Sacramento, Calif.

5 Watt Wizards CB Radio Club of San Bernardino Valley
P.O. Box 2592
San Bernardino, Calif.

So. Calif. 11-W CB Assn.
P.O. Box 17296
San Diego, Calif.

S. Alameda Co. 11 Meter RC
16155 Via Owen
San Lorenzo, Calif.

11-27 Club of Ventura Co.
P.O. Box 1102
Ventura, Calif.

S. California 11 Meter League
P.O. Box 793
Wilmington, Calif.

Cherry Vale Tracking Team
620 Yale
Boulder, Colo.

Denver Metro Radio Club
P.O. Box 9181
S. Denver Sta.
Denver, Colo.

Pueblo CB Radio Club
Communications Officer
Pueblo, Colo.

Aurora CB Radio Assn.
P.O. Box 341
Aurora, Colo.

Radio Rescue Service, Inc.
55 Bedford Ave.
East Hartford, Conn.

Citizens Communication Ser.
P.O. Box 1002
Hartford, Conn.

Norwalk CB Radio Assn.
Box 693
Norwalk, Conn.

Southern Conn. CB Assn.
37½ Spring Hill Ave.
Norwalk, Conn.

She-Bac CB Club
379 Pine Tree Dr.
Orange, Conn.

CB Assn. of Conn.
1353 Elm St.
Stratford, Conn.

Naugatuck Valley CB Radio Club, Inc.
P.O. Box 3186
Waterbury, Conn.

Delaware Valley CB Assn.
P.O. Box 1986
Wilmington, Del.

Delray Peach Radio Club
Box 832
Delray Beach, Fla.

Cape Canaveral CB Club
2790 North Ala Hwy.
Eau Gallie, Fla.

Gateway Monitors
Feldman Road-Flying "B"
Jacksonville, Fla.

Citizens Radio Operators Org.
P.O. Box 1272
Jacksonville, Fla.

Northeast Fla. CB Radio Assn.
1501 Hendricks A
Jacksonville, Fla.

Cape Canaveral CB Club
Box 69
Merritt Island, Fla.

Dade County REACT. Inc.
9216 Dickens Ave.
Miami Beach, Fla.

Florida React Headquarters
975 S. Shore Dr.
Miami Beach, Fla.

Metropolitan Dade Citizens Radio
1362 N.W. 102nd St.
Miami, Fla.

Shoreline Radio Club
2601 Vinson Ave.
Sarasota, Fla.

Spaceport Radio Club
Box 2488
Satellite Beach, Fla.

MCEU
Box 9516
Treasure Island, Fla.

Athens Contact Club of Athens
215 Meadowview Rd.
Athens, Ga.

Atlanta Contac Radio Assn.
P.O. Box 8236, Sta. F.
Atlanta, Ga.

Atlanta REACT
5901 Bakers Ferry Rd. SW
Atlanta, Ga.

S. Georgia C.Bee s Club
Box 1654
Brunswick, Ga.

Citizens Comm. Club of Ga.
1482 Gaines Ave.
College Park, Ga.

Valley Five Watters
2060 Comer Ave.
Columbus, Ga.

Dixie Communication Club
P.O. Box 136
Decatur, Ga.

Gwinnett Communications Club
RFD #4
Lawrenceville, Ga.

Middle Ga. CB Club
642 Bowden St.
Macon, Ga.

Griffin Citizens Comm. Club
105 Westwood Way
Morrow, Ga.

Channel 11 Tube Poppers
Rt. 1
Royston, Ga.

Chattooga County CB Club
Rt. 1
Summerville, Ga.

Aurora "5" Watters
P.O. Box 653
Aurora, Ill.

Circle Radio League, Inc.
P.O. Box 88
Alton, Ill.

CB Hi Lighters, Inc.
802 Hammond Ave.
Aurora, Ill.

Corn Belt Citizen Banders
216 Robinhood Lane
Bloomington, Ill.

Blackhawk CB Club of Ogle Cty.
Rock River Terr.
Byron, Ill.

Citizens Radio League of Chicago
4818 N. Natchez Ave.
Chicago, Ill.

5 Watt Wizards
10933 S. Pulaski
Chicago, Ill.

11 Meter Mid Americans
14225 S. State St.
Chicago, Ill.

Mont. Clare CB Club
2042 Roscoe St.
Chicago, Ill.

REACT—The Chicago Monitors
2856 N. Campbell
Chicago, Ill.

So. Shore Radio Club
3028 E. 80th St.
Chicago, Ill.

CB EARS
8116 S. Richmond St.
Chicago, Ill.

W.C.R.A. Inc.
4818 N. Natchez Ave.
Chicago, Ill.

Four Points Radio Organ.
Box 344
Chicago, Ill.

Kickapoo 5 Watters
Class D Radio
720 Sheridan
Danville, Ill.

O.W.L. Club (Ogle-Lee Whites)
715 S. Galena Ave.
Dixon, Ill.

Du Page Citizens Banders
1005 Ogden Ave.
Downers Grove, Ill.

Tri-County 10-23 CB'ers, Inc.
P.O. Box 1052
Joliet, Ill.

Mighty Modulators Radio Club
Box 174
LaSalle, Ill.

Illini Class D Net
9 Jefferson
Mansfield, Ill.

Tri-County Five Watters, Inc.
Rt. 1 Box 193
Marengo, Ill.

Communications Unlimited
c/o Bob Ort
Mark, Ill.

Channel Hoppers
65 DeWitt Ave.
Mattoon, Ill.

Morrison Communicators
400 S. Heaton
Morrison, Ill.

Western Ill. CB Booster Club
808 S. 6th
Monmouth, Ill.

Citizens Radio League
CB News & Views
Box 28
Northlake, Ill.

Goodfellows CB Radio Club
Box 82
Northlake, Ill.

Illinois Valley Citizen BC
P.O. Box 141
Peoria, Ill.

Mid America Rescue Squad of Ill.
14801 Blaine
Posen, Ill.

Illini Class D Radio Club
407 W. Park St.
Urbana, Ill.

Rock River Valley CB Club
2923 21st St.
Rockford, Ill.

Chicago Citizens Radio League
9136 N. La Cross
Skokie, Ill.

Springfield CB Club
P.O. Box 1825
Springfield, Ill.

Tri County CB Club
404 W. 15
Sterling, Ill.

Iowa-Illinois CB Club
Box 100
Silvis, Ill.

Cuilmette CB Club
P.O. Box 173
Wilmette, Ill.

N.E. Ind. 11 Meter Radio Club
P.O. Box 25
Auburn, Ind.

Inter State CB Club
Howard Affholder, Pres.
Berne, Ind.

Bartholowmew Co. CB Radio Club
R.R. 5
Columbus, Ind.

11 Meter League
930 Monroe St.
Elkhart, Ind.

Maumee Valley CB Assn.
4816 Reed St.
Ft. Wayne, Ind.

Maumee Valley CB Radio Assn., Inc.
P.O. Box 1031
Ft. Wayne, Ind.

REACT—The 11 Meter Comm. Sq. Inc.
6311 Donna Dr.
Ft. Wayne, Ind.

Central Ill. CB Club of Kentland, Ind.
806 E. 5th St.
Fowler, Ind.

Dekalb Cty CB Radio Club
c/o Norman Runion
1405 W. Quincy
Garett, Ind.

Northwestern Ind. CRA Inc.
c/o First Fedl. Sgs. & Loan Bldg.
3rd & Center Sts.
Hobart, Ind.

Beacon Club
1018½ Cedar
Indianapolis, Ind.

Sunday CB Club
3426 N. Elizabeth
Indianapolis, Ind.

Citizens Radio Network, Inc.
Box 66
Rushville, Ind.

Tri Communication CB Club
R.R. 1
Lapel, Ind.

Mississinewa CB Radio Club
3924 S. Wisc. St.
Marion, Ind.

CB Friends
Morocco, Ind.

Rush City C.B. Radio Club
R.R. 1
Rushville, Ind.

Lakeland CB Club
Box 36, Wawasee Village
Syracuse, Ind.

Terre Haute CB Club
c/o T.H. Police Dept.
Terre Haute, Ind.

Wabash Valley CB Club
P.O. Box 911
Terre Haute, Ind.

Wabash Valley CB Club
420 Shelby St.
Vincennes, Ind.

Quad County CB Club
610 Washington St.
Walkerton, Ind.

Orange Cty CB Radio Club
West Baden Springs, Ind.

Mississippi Valley CB Club
2125 S. 12th St.
Burlington, Iowa

Cedar Rapids Ci Club-QRM
c/o Duayne C. Wol
Rte. 1
Cedar Rapids, Iowa

Little Soo CB Club
221 N. 11th
Cherokee, Iowa

Citizens Radio Assn.
1519 Cummins Pkway.
Des Moines, Iowa

N.E. Iowa CB Club
1735 Michigan Dr.
Evansdale, Iowa

Southeast Iowa CB Radio Pat.
R.R. 3, Box 208
Fairfield, Iowa

Central Iowa Citizens Radio Assn.
c/o Harry Allen, Jr.
Marshalltown, Iowa

Muscatine 5 Watters
Box 154
Muscatine, Iowa

Wapello Cty CB Assn.
835 E. Main
Altumwa, Iowa

Tri State Fleawatters, Inc. CB Radio Club
1415 S. Cleveland St.
Sioux City, Iowa

Sunflower CB Radio Assn.
6308 W. 81 Terr.
Overland Park, Kan.

Wichita CB Club
Box 441
Wichita, Kan.

Ohio Valley CB Club
418 7th
Henderson, Ky.

Laurel 11 Meter Club
c/o John W. White
London, Ky.

Hopkins Cty. Radio & Rescue Assn.
613 Hall
Madisonville, Ky.

Cenla CB Radio Club
4207 Earl Dr.
Alexandria, La.

Greater Baton Rouge Cit. Comm. Assn.
3116 N. Acadian Thruway
Baton Rouge, La.

Five Watt Wonders CB Club
4105 Williams Blvd.
Kenner, La.

The 20-5's
516 Wallace Dr.
New Orleans, La.

Greater Baton Rouge Cit. Comm.
510 Bluebell St.
Port Allen, La.

Contraband CB Club
P.O. Box 621
Sulphur, La.

The Pine Tree 11 Radio Club
Auburn, Maine

10-24 Radio Club
12 Deering St.
Bath, Maine

Androscoggin Valley CB'ers
Mexico, Maine

11 Meter CB Club
c/o Fr. Joseph Tonaselli
3600 Claremont St.
Baltimore, Md.

The Holiday Citizens Banders of Md.
P.O. Box 5004
Baltimore, Md.

Chesapeake CB Radio Club
Crisfield, Md.

Queen City 5 Watters
711 N. Mechanic St.
Cumberland, Md.

Eastern Shore CB Club
Little Manor Ct. Rt. 50
Ocean City, Md.

The Chesapeake CB'ers
Crisfield Lane
Princess Anne, Md.

The Bay State Five Watters
4 Herbert Rd.
Arlington, Mass.

Plymouth Cty. CB'ers of Brockton
237 East St.
Brockton, Mass.

Squares of Round Table
381 Main St.
Charlestown, Mass.

Worcester Cty. Citizens Radio
31 George St.
Charlton, Mass.

Moby Dick Radio Comm. Club
Amer. Legion Hall
Fairhaven, Mass.

Mohawk Radio Assn.
23 W. Main St.
Erving, Mass.

23 Citizens Band Radio Club
7 Concord St.
Fitchburg, Mass.

Monadnock CB Assn.
29 Lawrence
Fitchburg, Mass.

Mass. 23 CB Club
9 Summer St.
Lacminster, Mass.

23 CB Club
145 Main
Maynard, Mass.

59 CB Radio Club & Emerg. Team
106 Florence St.
Melrose, Mass.

Mt. Greylock Mobil-Ears
P.O. Box 63
N. Adams, Mass.

New England CB Council
RD 1, Box 582
Tewksbury, Mass.

Southern New Eng. Citiz. Radio
Box 312
Webster, Mass.

Westfield 5x5 CB'ers
Box 10-4 Parcel Post Sta.
Westfield, Mass.

Wareham Mobiliers
c/ Lonnie Snell
West Wareham, Mass.

Worcester Co. CB Assn.
25 Townsend
Worcester, Mass.

Cereal City CRC
P.O. Box 91
Battle Creek, Mich.

CB Chatter Box
Don W. Cartright
44 New England Ave.
Battle Creek, Mich.

Twin Cities CB'ers
2120 Irving Dr.
Benton Harbor, Mich.

CB Communicators
Berrien Springs, Mich.

Northeastern Mich. CB Club, Inc.
c/o Less Evens
Cass City, Mich.

Crossroads CB Club
2695 E. Maple Rd.
Clare, Mich.

Tri County CB Club
Coloma, Mich.

Metro 11 Meter Club
7284 Drexel
Dearborn, Mich.

Citizens Radiophone Assn.
Gridleak
3306 Kanter
Detroit, Mich.

MCEU, Inc.
Kalamazoo, Mich. Chapter
6151 Abbey St.
Kalamazoo, Mich.

Lapeer Cty. CB'ers
280 E. Nepessing St.
Lapeer, Mich.

Suburban Mobile Radio Assn.
P.O. Box 2
Madison Hts., Mich.

The Macomb CB'ers Club
P.O. Box 55
Mt. Clemens, Mich.

Central Mich. Quinn Watters
Box 140, Rt. 2
Reed City, Mich.

Voice of Dundee CB Club
915 River Acres Dr.
Tecumseh, Mich.

Citizens Radio League, Inc.
4601 Cedar Ave. S.
Minneapolis, Minn.

Monroe Cty. CB Rangers Radio Club
115 Highland
Aberdeen, Miss.

By County CB Radio Club
Durant, Miss.

Meridian Citizen Band Club
P.O. Box 1389
Meridian, Miss.

CITIZENS BAND CLUBS ACROSS THE COUNTRY

Signal Tracers
P.O. Box 1084
Tupels, Miss.

Relay Knights
c/o Marc Leavey
9412 Adelphi Rd.,
Apt. 202
Adelphi, Mo.

Eldon Midway CB Radio Club
Kenneth Miller
Brumley, Mo.

Prairie Queen CRB
N. Hickman St.
Centralia, Mo.

Northeast Mo. CB Club
310 Jefferson
Kirksville, Mo.

Sedalia Citizens Band Radio Club
P.O. Box 171
Sedalia, Mo.

Mars CB Club
P.O. Box 3441
Maplewood, Mo.

Greater St. Louis CB Assn.
9304 Cravois Ave.
St. Louis, Mo.

Air Ways CB Club
c/o 307 Linda Lane
Wentzville, Mo.

Midland Empire CB Radio Club
210 S. 34th St.
Billings, Mont.

Greater Omaha CB Radio Club
1219 Arthur St.
Omaha, Nebr.

South Central Nebr. CB'ers Radio Club
R.R. 2, Box 112
Sutton, Nebr.

Silver State Citizens Band Assn.
P.O. Box 3102
Reno, Nev.

The North Country C. Bees
Berlin, N. H.

Granite CB Club, Inc.
Box 57
Laconia, N. H.

Manchester Radio Aid, Inc.
335 Lake St.
Manchester, N. H.

Seacoast Search & Rescue CB Radio Club
Portsmouth, N. H.

South Jersey CRC
New Freedom Rd., Box 287
Berlin, N. J.

MCEU
384 Lakeview Ave.
Clifton, N. J.

D.V.C.R.L.
Delaware Valley Citizens Radio
P.O. Box 327
Haddonfield, N. J.

Watchung Range Radio Club
126 Watchung Dr.
Hawthorne, N. J.

Jersey 5 Watters
CB Radio Operators
284 S. Twentieth St.
Newark, N. J.

Tri County Emer. Radio Assn.
129 W. Holly
Pitman, N. J.

United CB'ers
214 Summit Cross
Rutherford, N. J.

Bridgeton Ears CB Radio Club
c/o Geo. Williamson
804 Parsonage Rd.
Seabrook, N. J.

Coastal Communications League
12 W. Johnson Ave.
Somers Point, N. J.

Penn Jersey CB Radio League
6 Audrey Pl.
Trenton, N. J.

Seacoast Citizens Radio Club
114 N. Suffolk Ave.
Ventnor, N. J.

S. Jersey 5 Watters
S. Main Rd.
Vineland, N. J.

Dvert CB Club
513 Westminster Rd.
Wenonah, N. J.

Albuquerque Citizens Radio Assn.
5 Minute Times
Box 354
Albuquerque, N. Mex.

Raton Comm. Club
121 Tenaja
Raton, N. Mex.

Twin River CB Club
100 Steuben St.
Addison, N. Y.

Webutuck Citizens Radio Assn.
Amenia, N. Y.

Batavia Citizens Banders
131 Pearl St.
Batavia, N. Y.

N. Bellerose Five Watt Soc.
80-56 249th St.
Bellerose, N. Y.

Southern Tier Citizens Band Radio Club
86 S. Wash. St.
Binghamton, N. Y.

CB Radio Relay League, Inc.
2265 65th St.
Brooklyn, N. Y.

Buffalo CB Radio Club
22 Goodyear Ave.
Buffalo, N. Y.

Niagara Frontier CB Club
277 Athens Blvd.
Buffalo, N. Y.

Grape Belt CB Radio Club
420 Swan St.
Dunkirk, N. Y.

Cohoes Area CB Rebels, Inc.
55 Rensselaer Ave.
Cohoes, N. Y.

Flushing Citizens Radio Club
35-11 164 St.
Flushing, N. Y.

Town & Country Radio Club
Box 343
Lakeville, N. Y.

Nassau CB Club
308 S. 8th St.
Lindenhurst, L.I., N. Y.

CBRRL
P.O. Box 1264
Long Island City, N. Y.

Nassau County Civil Def.
220 Plandome Rd.
Manhasset, N. Y.

Citizens Radio Assn. of Rock., Inc.
P.O. Box 295
Nanuet, N. Y.

CB Club
1875 3rd Ave.
New York, N. Y.

Lower East Side Emerg. Radio Teams
4 Stuyvesant Oval
New York, N. Y.

Washington Hts. CB Assn.
175th St. & Audbow Ave.
New York, N. Y.

Citizens Emerg. Radio Patrol
321 Miller St.
North Tonawanda, N. Y.

Chanango County CB Radio Club
61 Mitchell St.
Norwich, N. Y.

Krystal Cracher Club
445 S. Willow
Oneida, N. Y.

Chenango County CB Radio Club
P.O. Box 141
Oxford, N. Y.

Citizens Radio Club
28 Buffard Dr.
Rochester, N. Y.

Citizens Emer. Radio Club, Inc.
P.O. Box 824
Rome, N. Y.

Electric City CB Club
16 N. Brandywine Ave.
Schenectady, N. Y.

CB Radio Relay League, Inc.
Staten Island Chapter
c/o Shannon Doty
694 Henderson Ave.
Staten Island, N. Y.

National 11 Meter League
84 Grandview Ave.
Staten Island, N. Y.

N.Y. State CB Radio Club
Rockland Cty. Chapter
11 Hunter Pl.
Stony Point, N. Y.

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

Long Island Channel Masters CB Club
9 Lincrest St.
Syosset, L.I., N. Y.

The Crystals CB Club
2897 Ardsley Rd.
Wantagh, N. Y.

Finger Lakes CB Club
32 E. Kendig St.
Waterloo, N. Y.

New York City CB League
85-47 80 St.
Woodhaven, N. Y.

Bancombe Cty. Rescue Squad, Inc.
P.O. Box 599
Ashville, N. C.

Gaston County CB Assn.
37 Ranlo Ave.
Gaston, N. C.

Wayne County CB Assn.
1009 E. Walnut St.
Goldsboro, N. C.

Land O'The Sky Radio Club
P.O. Box 1596
Hendersonville, N. C.

Lake City CB Club
P.O. Box 656
Marion, N. C.

McDowell Cty. Rescue Squad
P.O. Box 656
Marion, N. C.

Coastal Carteret Comm.
512 Fisher St.
Morehead City, N. C.

Little Rotunda CB Club
P.O. Box 74
Polkville, N. C.

Carnation City CB Club
Alliance, Ohio

19'ers Citizens Radio Service
98 Pershing Ave.
Akron, Ohio

Lake Erie CB Assn.
2497 110th St.
Cleveland, Ohio

Sandusky County CB Radio Club
229 Ott St.
Clyde, Ohio

Northern Ohio Knob Twisters
1117 Hickory
Crafton, Ohio

The Nineteeners
612 Loomis Ave.
Cuyahoga Falls, Ohio

Ladies Butler Cty. CB Assn.
817 Ross Ave.
Hamilton, Ohio

S.W.O.C.B.A.
P.O. Box 231
Lebanon, Ohio

455 CB Club
219 W. 36th
Lorain, Ohio

South-Lynd Radio Club
1276 Roselawn Rd.
Lyndhurst, Ohio

11 Meter Emer. Ser. of Ohio
I.A.A.P. Chapter 162
P.O. Box 2603
Mansfield, Ohio

Sheriff's Huron County Emerg.
Box 201
Norwalk, Ohio

Ohio Michigan Screw Driver Club
P.O. Box 38
Pemberville, Ohio

Mahoning County CB Radio Club
12 Boardman-Poland Rd.
Poland, Ohio

Lake Erie CB Assn.
414 Columbus
Sandusky, Ohio

Bow Fin Citizens Radio Club
Rte. 1
Van Buren, Ohio

Channel Coordin. Comm.
Box 22
Van Wert, Ohio

5 Watters of Lake Co.
P.O. Box 489
Willoughby, Ohio

The Citizens Radio Club
c/o Mearl Williams, Pres.
Worthington, Ohio

Harper Cty. Comm. Club
Box 1348
Buffalo, Okla.

Cherokee County CB Club
Rt. 1, Box 74
Park Hill, Okla.

Sand Springs Okla. CB Radio Club
Box 155
Sand Springs, Okla.

Williamette CB Assn.
205 E. 15th Ave.
Albany, Oreg.

Oregon Grapewine, Inc.
P.O. Box 3543
Portland, Oreg.

Lancaster County CB
1114 Hillcrest Rd.
Akron, Pa.

Fay West CB Club
Rt. 1
Armhurst, Pa.

Clearfield CB Radio Club, Inc.
309 Merrill St.
Clearfield, Pa.

Blair Cambria C R Assn.
1218 4th Ave.
Duncansville, Pa.

Lower Providence 5 Watt Club
Box 19
Eagleville, Pa.

Erie CB Radio Assn.
1314 W. 30th St.
Erie, Pa.

Conemaugh Valley Comm. Assn.
110 Vogel St.
Johnstown, Pa.

Lancaster Cty. Radio Club, Inc.
P.O. Box 236
Lancaster, Pa.

Citizens Band Radio League
Rt. 2
Lebanon, Pa.

Lewistown Circle Eleven Club
c/o Leon Rhodes
McVeytown, Pa.

Lawrence Cty. CB Radio Club
Box 404
New Castle, Pa.

Allegheny Kiski 5 Watters
1141 Sixth Ave.
New Kensington, Pa.

Buxmont Citizens Radio League, Inc.
8081 Temple Rd.
Philadelphia, Pa.

5-11 Radio Club
868 Glass Run Rd.
Pittsburgh, Pa.

Volunteer Emer. Serv. Unit
405 B.F. Jones Law Bldg. Annex.
311 Ross St.
Pittsburgh, Pa.

Fay West CB Club
101 Chestnut St.
Scottdale, Pa.

CB Ser. Club of West.
Rt. 4, Box 260A
Washington, Pa.

Narragansett Bay CB Radio Club
Am. Legion Bldg.
Spring St.
Newport, R. I.

Little Rhody CB'ers
96 Sterling Ave.
Providence, R. I.

Northern Rhode Island REACT
581 Pound Hill Rd.
Woonsocket, R. I.

Coastal Carolina CB Radio Club
4142 O'Hear Ave.
Charleston, S. C.

Tri Cty. Transceivers CB Club
Rt. 2
Landrum, S. C.

Sioux Empire Citizens Comm. Assn.
1100 Sunset Dr.
Sioux Falls, S. D.

Donelson CB Radio Club Inc.
P.O. Box 2301
Donelson, Tenn.

Knox County 10-4 Club, Inc.
P.O. Box 4013
Knoxville, Tenn.

Hillbilly CB Club of Blout Co.
P.O. Box 206
Maryville, Tenn.

Nashville CB Radio Club
2313 Castlewood Dr.
Nashville, Tenn.

Colorado County CB Radio Club
Rt. 1, Box 128
Cat Spring, Texas

Greater Dallas CB Club
P.O. Box 6023, Terminal Annex
Dallas, Texas

Texas REACT Team
9929 Bethany Dr.
Dallas, Texas

The Ten-Ten CB Club
114 N. Seaman
Eastland, Texas

CB Radio Club of Ft. Worth
3759 Bright
Ft. Worth, Texas

Comm. Corps of Harris Cty. Inc.
3911 Daphne
Houston, Texas

11 Meter CB'ers
205 Leago Dr.
Houston, Texas

Houston CB Club
1831 Crystal Ct.
Houston, Texas

G-So Club of the Gulf Coast
P.O. Box 5042
Houston, Texas

Con Tex Live Wires CB Club
Shady Lane Trl. Pk.
Killeen, Texas

Caddo Dist. CB Club
P.O. Box 792
Marshall, Texas

Great Oil Basin REACT Club
Box 6454
Odessa, Texas

Plano CB Club
1601 Lorrie Dr.
Richardson, Texas

Bexar Cty. Radio Assn.
Box 14152
San Antonio, Texas

Associated 2-Way Radio Patrol Team
Box 2624
San Antonio, Texas

Arklatex Two Way Radio Club
Rt. 2, Box 252 H
Texarkana, Texas

Utah CB Assn.
P.O. Box 2011
Salt Lake City, Utah

Rutland CB Club
Box 88
Castleton Corner, Vt.

Lake Champlain CB Radio Club
178 Intervale Ave.
Burlington, Vt.

Otter Valley Citizens Radio Club
Larry Hobson, Pres.
P.O. Box 669
Rutland, Vt.

Henry Co. CB Club
Russells Dr. Inn
Bassett, Va.

Arfax CB Club
P.O. Box 551
Falls Church, Va.

Central Va. CB Radio Club
Route 2, Box 202A
Lynchburg, Va.

Tidewater Emerg. Radio & Resc.
P.O. Box 9662
Norfolk, Va.

Virginia State CB Radio
P.O. Box 1
Richmond, Va.

Apple Valley CB Club
435 Fairmont Ave.
Winchester, Va.

Tacoma CB Radio Assn.
Search & Rescue
P.O. Box 573
Centralia, Wash.

Olympia CB Club
1314 E. Fourth St.
Olympia, Wash.

Sage & Sand 11 Meter Band
12 First Ave. W
Kennewick, Wash.

CB Minutemen of Wash., Inc.
2411 S. 260th
Kent, Wash.

14 W Association of Seattle
G. H. Mooney, Pres.
15816-28th Ave. NE
Seattle, Wash.

Tacoma CB Radio Assn.
2929 Milton Ave.
Tacoma, Wash.

Tri County Citizens D Banders
Rt. 3, Box 173
Bridgeport, W. Va.

Citizens Comm. Assn.
P.O. Box 4227
Charleston, W. Va.

Kyova Citizens Radio Club
2821 Fourth Ave.
Huntington, W. Va.

Apple Valley CB'ers
Rt. 4
Martinsburg, W. Va.

Pomeroy Bend CB Club
Box 425
New Haven, W. Va.

Parkersburg Ares CB Club
1904-9th Ave.
Parkersburg, W. Va.

Tri County CB'ers
807-38th St.
Fredericksburg, W. Va.

Channel Chappers CB Radio Club
834 Grant Ave.
Beloit, Wis.

The Packerland Radio Club
949 Christiana St.
Green Bay, Wis.

Kenosha CB Club
4218 57th St.
Kenosha, Wis.

Lakeland Citizens Radio Net. Inc.
3838 Busse St.
Madison, Wis.

Manitowoc City. Comm.
1511 Kuhl St.
Manitowoc, Wis.

Milwaukee CB Club, Inc.
P.O. Box 1277
Milwaukee, Wis.

Waukesha County CB Club, Inc.
Rt. 1
Oconomowoc, Wis.

Winnebago County CB Radio Club
1317 S. Main St.
Oshkosh, Wis.

Sheboygan County CB Club
7 Eastman St.
Plymouth, Wis.

Racine CB Club
1832 Ridge Dr.
Racine, Wis.

Chain Gang CB Club, Inc. Area 18
c/o Mrs. Lillian Woznickzka
Rt. 2, Box 202—Oakwood Shores
Salem, Wis.

Central H.S. Radio Club
2476 S. 75th St.
West Allis, Wis.

Southcentral Alaska Chapter of MCEU, Inc.
P.O. Box 4-1661
Anchorage, Alaska

Chateauguay Genl. Radio Club
1 St. Francis Blvd.
Chateauguay, P.Q., Canada

Kawartha Genl. Radio Ser. Club
1297 Barlesan Rd.
Peterborough, Ont., Canada

South Western Genl. Radio Assn.
26 Grosuenor St.
London, Ont., Canada

Saskatchewan Citiz. Radio Club
218-27 St. West
Saskatoon, Sask., Canada

Straffordville Channel Jammers
Straffordville,
Ont., Canada

Metro CB Club
61 Dalrymple Dr.
Toronto, Ont., Canada

Tupper High Comm. Club
950 E. 22nd Ave.
Vancouver, B.C., Canada

Newfoundland CB Club
Suite 24, Box 6
St. Johns, Newfoundland

New Zealand Radio DX League
G.P.O. Box 3700
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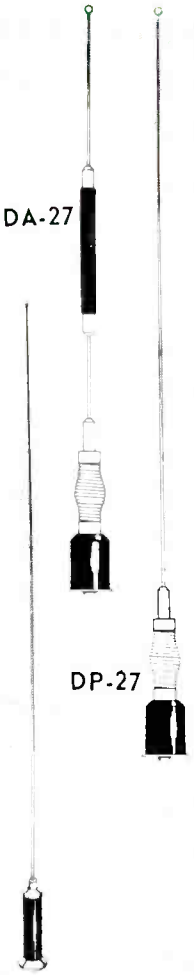

NEW...ALL NEW...is the Demon DA-27..... a 'Devil of a Performer'! This antenna with overall length of 17" is constructed of durable, flexible stainless steel. Tuning is possible through a simple whip adjustment allowing antenna peaking at desired frequencies. Loading is accomplished through coil in center of whip.

Another NEW mobile antenna is the Deputy-DP-27...a Badge of Dependability with overall length of 43¾". Whip is constructed of strong, flexible stainless steel, incorporating a special whip adjustment allowing antenna peaking at desired frequencies. Loading is accomplished within base section.

Expertly styled, the Devant-2 mobile companion for the Famous base station Devant-1 antenna features the ultimate in trim, slim-line construction. Whip incorporates Top Grade stainless steel requiring no tuning for efficient mobile performance.

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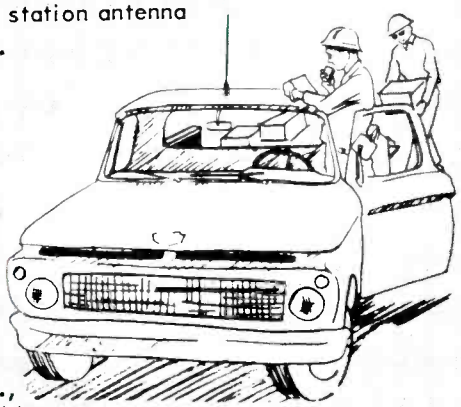

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CIRCLE NO. 17 ON READER SERVICE CARD

The "jamboree" is a phenomenon unique to CB licensees. Hundreds, even thousands, of CB'ers go long distances just to attend a two-day jamboree. New equipment is shown, lectures given, and plenty of old-fashioned jawing and rag-chewing take place.

One group, for example, Manchester (New Hampshire) Radio Aid, Inc., requires that all private mobile units be equipped with a first-aid kit, flares, a flashlight, shovel, gloves, pen and paper, a compass, a blanket, fire extinguisher, watch, rope, extra gasoline, a jug filled with water, and a wood block.

Many CB clubs are actively engaged in Civil Defense drills, some with organized teams equipped to handle disaster situations of almost any category. Still others have become unofficial members of sheriff patrols lending aid 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, there is yet a club to be found whose members are not willing to offer communication services in time of need. The FCC recognizes that properly organized and operated CB clubs ". . . may render a service to everyone." The Commission also appreciates the clubs' abilities to police the CB channels.

But it isn't "all work and no play" for club and rescue team members. Clubs from coast to coast produce interesting club publications, not only for the benefit of their own members, but to let other CB clubs across the country in on what they are doing with CB two-way radio; what they propose for future activities; and membership information. Business meetings may include anything from how the "highway committee" is progressing with planting monitor signs at each of the city's main highway entrances, to working out arrangements with a local charity group to assist in collecting clothing and toys for the local children's home. And of course no one ever complains about the "social" hour following the business meetings. Coffee cups are filled and refilled and chit-chat is hashed and rehashed until the night watchman pushes the last CB'er out the door!

● **Public Service Activities.** Earthquakes, floods, hurricanes and tornadoes have temporarily left many parts of our country without power and CB or ham radio as the only means of large-scale radio communications.

Usually coordinated by police officers, Civil Defense, or local authorities, CB clubs have been credited above par for their participation in areas where the control of mass audiences has been necessary to the success of the operation at hand. At accident scenes, quick-thinking CB'ers have contacted base stations for help, then aided victims, when possible, standing by until authorities arrived.

Police and sheriff departments have become more aware of the volunteer efforts of CB'ers over the last three years and are putting them to use in many areas. Several police and sheriff departments have installed permanent CB systems within their stations, monitored 24 hours a day so that CB'ers can report accidents, fires, burglary attempts, etc., from their own mobile units. CB'ers have patrolled cities and entire counties in search of runaways or escapees from institutions. Many quick burglar arrests have been credited to mobile CB'ers who were eye witnesses. Every Halloween, thousands of mobile CB vehicles patrol the streets of many cities to help squelch any signs of vandalism.

And Civil Defense organizations claim thousands of CB'ers among their search and rescue teams. Those CB'ers who have joined CD groups have been taught first aid, rescue and search procedures, and have become a part of searches for lost persons, drowning victims, etc.

● **Civil Air Patrol.** Thousands of CB'ers never gave a second thought to raising both feet off the ground until the FCC allocated 26.62 mc. to the Civil Air Patrol. Experienced CB operators, realizing the scope of public service possibilities as CAP members, have been quick to join the CAP. This not only qualifies them to add that 26.62-mc. crystal to their equipment to be used in

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search and rescue operations; it also gives them a chance to get a well-rounded education in search and rescue procedures from the air and on the ground, gives them first-aid training, and exposes them to the experience of a national service organization that has been around for over 22 years. What's more, CAP membership furthers the interests and education of the air-minded who might not otherwise be able to afford training or flight time.

CAP CB stations utilizing 26.62 mc. are licensed under Subpart S, Part 9, of the FCC Rules & Regulations. They may communicate only with other CAP radio stations and *may not* talk with stations licensed in other services, either direct or cross-band. All operators on the CAP frequencies must be members of the Civil Air Patrol.

The air-minded CB'er will find a multitude of interesting reasons for joining the CAP, established as the official Civilian Auxiliary of the United States Air Force. About one-half of today's CAP members are adults, and about one-half teen-agers (cadets). Women and girls account for some 20 percent of the members. Among activities engaged in by CAP units throughout its 52 wings (each state, the District of Columbia, and Puerto Rico), are such programs as jet aircraft, guided missiles, and air traffic management.

The CAP has a working agreement with state Civil Defense agencies for assistance in the event of a national emergency. The patrol engages in national search and rescue work, during which it logs more than half of the flying hours of the combined military services and civilian agencies participating.

Members of the Civil Air Patrol man thousands of light aircraft. Communications instructions given CAP members cover many different types of equipment operating on various frequencies with assigned purposes. During search and rescue operations the CAP members utilize either 2 meters or their near-Citizens Band frequency of 26.62 mc., where, unlike CB'ers, they may use a full 5-watt *output*. As for communications on an area basis, many CAP units initiate two "air" roll calls a day for relaying of CAP and Air Force traffic.

● **Special Police Groups.** Within the last 3 years several CB clubs and individual CB'ers have become affiliated with police departments, placed more or less on a

As this is being written, no decision has been made by the FCC regarding the Highway Emergency Location Plan (HELP). In a formal petition, the Automobile Manufacturers Association requested the FCC to set aside two new CB channels for the HELP program. These channels would be simplex-operated—mobile transmitters on one channel and fixed-station transmitters on the other. Channel use would be restricted to emergency calls, notices of traffic congestion, bad road conditions, etc. The HELP program is derived from REACT, as discussed in this chapter.

stand-by basis, prepared to be of service if and when needed. However, on a more organized plane, many Civil Defense groups have become closely related with the police through squads known as Civil Defense Auxiliary Police Corps. These groups are made up of licensed CB'ers who became active members of Civil Defense groups and then joined the special squad. Trained to the teeth in several phases of police work, their CB/CD police duties may include patrolling during Halloween, assistance at fire or accident scenes, traffic control at parades, or assisting in any emergency requiring coordinated efforts of trained personnel.

Wherever such Civil Defense groups are available, a police squad may be organized

through the request of the local police chief. Membership is on a voluntary basis, of course, and CB'ers furnish their own two-way radio equipment, automobiles, uniforms, patches, and insurance. Many of the members get a 20-hour training course in medical self-health, taught by a Red Cross instructor and a registered nurse. Regulations require that to remain a member of the police corps squad members must continue active participation not only in Civil Defense meetings but in auxiliary police gatherings as well. Their communications while on the job usually consist of passing information on to a control center via their own CB equipment: the message is then relayed to the proper authority.

● **CB in Canada.** Canada's General Radio Service 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 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 95 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 CB 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 Canadian Department of Transport has created very rigid transceiver specifications. In fact, all equipment must secure a "type-approval" subject to DOT 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. 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:

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 ex-

isting structures within a radius of 1000 feet.

◑ **More Information.** Details on eligibility to secure a GRS license as a Canadian citizen may be obtained from any of the DOT offices. Canadian General Radio Service calls begin with the letters XM; a map showing the general division of these calls by territory appears on page 103.

There is no provision for CB operators and GRS operators to communicate with one another across the border. But in 1964 the DOT established a new service known as the "Tourist Radio Service," making any licensed U.S. CB'er eligible for a temporary license to use his CB equipment while visiting or traveling in Canada.

There is no fee for the service but the license is not transferable and must be in the operator's possession at all times while he is in Canada. It remains valid for a period of one year, at which time it must be renewed if the operator expects to continue using CB equipment over the border.

Applications for "TRS" licensing should be sent to the nearest office to the Port of Entry at which the applicant will enter the country. Address your request to the Regional Superintendent, Radio Regulations, Department of Transport, at one of the following locations:

PORTS OF ENTRY	REGIONAL OFFICE
British Columbia	739 West Hastings St. Vancouver 1, B.C.
Alberta	Federal Building 9820 107th St. Edmonton, Alberta
Saskatchewan, Manitoba, Ontario, east including Port Arthur	Winnepeg General P.O. Bldg. 266 Graham Ave. Winnipeg 1, Manitoba
Quebec	Regional Administration Bldg. Dorval, Quebec
Ontario, excluding Port Arthur and west	25 St. Clair Ave. East Toronto, Canada
New Brunswick, Nova Scotia, Prince Edward & Newfoundland	Federal Building P. O. Box 42 1081 Main St. Moncton, New Brunswick

The DOT requires the name and address of the U.S. CB'er, class of service (Class D), his CB call-sign, and the period of time he intends to be in Canada. Application should be made at least 30 days prior to entry. Each CB'er will be permitted to use only the Canadian GRS channels 4 through 22,

and will be bound by Canadian regulations.

Other rule changes within the General Radio Service in Canada have been issued in favor of walkie-talkies or any CB equipment with a final input of 100 mw. or less. Kits, home-brewed or manufactured units that had previously been banned, may now be used on any frequency between 26.97 and 27.27 mc. The equipment need not be licensed and is exempt from the use of call-signs, D.O.T. approval, and age restrictions.

● **National Emergency Associations.** REACT is the abbreviation and the "go" word for Radio Emergency Associated Citizens Teams. The association is sponsored by the Hallicrafters Company with National Headquarters in Chicago, Illinois. REACT was established in 1962 as a nationwide affiliation of Citizens teams organized to provide communications in local emergencies through CB radio. Since its inception, the organization has grown to over 850 active teams with more than 30,000 members.

REACT teams are designed to furnish radiotelephone communications with REACT headquarters; to promote close cooperation with all forms of radio communications; and to allocate a specific "emergency" channel and promote its proper use. The teams are encouraged to maintain and foster proper communications; operate and maintain equipment in accordance with FCC regulations; and locate and report sources of radio interference.

The heart of the individual REACT team make-up is the mandatory monitoring of a designated emergency channel 24 hours a day. Since September, 1964, channel 9 has been the REACT national emergency channel. Local teams may, at their discretion, also utilize a secondary emergency channel of their choice to suit local conditions, but "9" *must* be maintained as the primary contact 24 hours a day, 7 days a week.

REACT emphasis is wholly on local problems, local solutions, and local autonomy. Each team is free to organize and operate according to the precise needs of its own community. There are no national dues or assessments of any kind, and membership materials, including *The National REACTer* bimonthly bulletin, are furnished in the public interest by Hallicrafters, which administers the entire national program.

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Transmitter Crystal Switch, Plug-in
2-Meter Simple Superhet

Besides their own communications gear, the majority of REACT teams either own, or have available on a team basis, substantial emergency equipment such as portable generators, power boats, aircraft, inhalators, and special emergency vehicles.

REACT National Headquarters recently announced the appointment of its first full-scale, fully-equipped CB Monitor to cover an entire major metropolitan area. The regional monitor, dubbed as the National Capitol REACT Monitor, in Wheaton, Maryland, is the result of an idea by Noel Nelson, REACT coordinator for the Washington area. Seven Washington area teams handled most of the preliminary organizational work including construction of the monitor desk and installation of all equipment.

The new Wheaton station provides coverage over an area of approximately 15,000 square miles. Of the 784 contracts logged in its first 20 days of operation, more than 50 percent were bona fide calls for automotive assistance or emergency help; 54 of these calls—better than two per day—involved either automobile accidents or fires. Six hundred man-hours were logged during this period, 504 of which were actual monitoring hours.

The first full-scale metropolitan REACT monitoring station was recently set up in Washington, D.C. Answering a call for assistance is the national REACT director, Pete Kreer. This new CB installation provides coverage of 15,000 square miles.

REACT teams across the country have handled an estimated 30,000-plus individual local emergencies since the beginning of

the program. Individuals or clubs who are interested in working with such a program can get the full story by writing to REACT National Headquarters, Dept. H66, 5th and Kostner Aves., Chicago, Illinois 60624.

● **National Motorists Safety Plan.** In 1965 the Automobile Manufacturers Association petitioned the FCC for the establishment of a new radio service for the motoring public. The service would be appropriately titled Highway Emergency Locating Plan Radio Service (HELP). The AMA's proposal did not ask the FCC for changes in the existing Class D Radio Service, but requested that all citizens legally authorized to operate a motor vehicle in the U.S. be eligible for a license to operate in the HELP Radio Service.

At the present time HELP is using channel 9—the accepted national emergency channel—in its program, but wants the FCC to allocate new CB frequencies of 27.235 mc. and 27.245 mc., adjacent to present channels, exclusively for use by the HELP Radio Service.

The AMA's plan in promoting the HELP program is to encourage the development of a nationwide communications network to aid motorists in distress. Motorists requiring aid could call on channel 9, where they could be heard by 24-hour monitors within a 5- to 25-mile range of the equipment. The monitoring stations would include volunteer citizens teams, police agencies, road service stations, and hospital emergency rooms.

At the start of the program, the HELP monitoring organization consisted of more than 20,000 owners of Citizens Band radio equipment (primarily REACT teams). In addition, the more than 1,000,000 vehicles now equipped with CB radios constitutes an enormous potential of mobile monitoring stations that could relay information to nearby base stations in time of emergency.

The AMA states that public acceptance of the HELP plan has been excellent and that the number of equipment installations and monitoring stations is rapidly increasing. Many of these monitoring stations include police agencies, road service organizations, hospital emergency services, garages with towing facilities, etc.

The AMA believes that the HELP program will afford an opportunity for safety engineers to develop specialized radio

equipment to solve other highway problems. Furthermore, the AMA feels that even with millions of **HELP** installations in operation on the requested channels, there would still be unused message capacity because the equipment would only be employed by individual motorists for short periods during emergencies and because the range of the equipment itself is limited.

Finally, the AMA feels that there is a tremendous potential for specialized radio equipment to provide traffic information, local roadway reports, and instructions to motorists. Such usage could contribute directly to increased vehicle safety and to more efficient utilization of the highways.

● **Club Listing.** The Citizens Band club list on pages 118-121 has been prepared from the *active* CB club directory file compiled and edited monthly at the POPULAR ELECTRONICS "On the Citizens Band" desk. Information received during the past 18 months has indicated that over 1000 known CB clubs across the U.S. and Canada are actively engaged in club activities, social functions and voluntary public service. From this master directory we have chosen for listing here the 400 or so CB clubs that have furnished the OTCB column with written verification of past and present activities; this includes emergency drills, actual search and rescue operations, innumerable public service assists, and CB get-togethers throughout the country.

To be sure of a listing in this annually published directory, all CB clubs (those listed *and* those not listed) should furnish us with up-to-date information on present membership totals, current officers, and voluntary activities in emergency and public service areas; on rescue, emergency, CD and CAP teams trained for specific purposes; and on the latest activities engaged in or planned. Pictures of club activities or emergency team efforts that can be used for illustrative purposes either in POPULAR ELECTRONICS or in future issues of the COMMUNICATIONS HANDBOOK will be welcome. Also, we would like to see a sample membership card, club decal, and set of the organization's constitution and bylaws. All material should be sent to Matt P. Spinello, KHC2060, POPULAR ELECTRONICS, One Park Avenue, Dept. HB-66, New York, N.Y. 10016. ■

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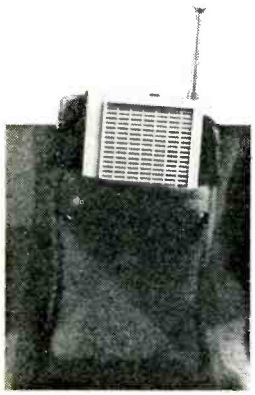

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CIRCLE NO. 29 ON READER SERVICE CARD

4

BUSINESS RADIO

By LEO G. SANDS

BUSINESS USE of two-way radio communications is expanding at an unprecedented rate. In the Business Radio Service alone, which is only one of several business licensing categories, some 50,000 new systems are being installed each year. Since each system could employ from one to several hundred mobile units and one or more base stations, and in some cases a repeater station, the soaring sales volume of business radio equipment has attracted new manufacturers to the field.

Any commercial or legitimate business enterprise is eligible for a station license in the Business Radio Service as well as the Citizens Radio Service. Some, depending upon the nature of the business, are eligible for licenses in other categories such as Special Industrial, Relay Press, Motion Picture, Forest Products, Power, Petroleum, Taxicab, Railroad, Auto Emergency, Motor Carrier, and Special Emergency.

More than 3,000,000 transmitters have been licensed in the Safety and Special Radio Services. Until 1947, the use of mobile radio communications was limited to public safety organizations. After 1947, the FCC authorized railroads and taxicabs to use two-way radio, and mobile radio became a fair-size business. However, it did not really boom until the Business Radio Service was established in 1957, opening up the use of two-way radio to all kinds of businesses.

● **Comparison to CB.** In other than the so-called CB band (23 channels in the 27-mc. band), business licensees are authorized to operate on one specifically assigned

channel, but subject to some sharing with other licensees. A second channel can be authorized upon adequate showing of need.

Class D CB stations are limited in power to 5 watts input, whereas in the business bands the maximum limit is 600 watts on certain frequencies. The height of a class D CB antenna is limited to 20 feet above an existing structure or formation, but there is no limit on the antenna height of business radio stations except as restricted by aircraft hazard considerations.

Only radiotelephony may be used by Class D CB stations, employing either AM or SSB (single sideband). Business stations may employ AM, SSB or FM, and can be authorized to transmit voice, facsimile and teletypewriter signals.

While CB stations may intercommunicate with other CB licensees on certain channels, business stations may ordinarily communicate only with units under the control of the same licensee. CB stations can be used for both personal and business communication, but only business matters can be transacted on the business bands.

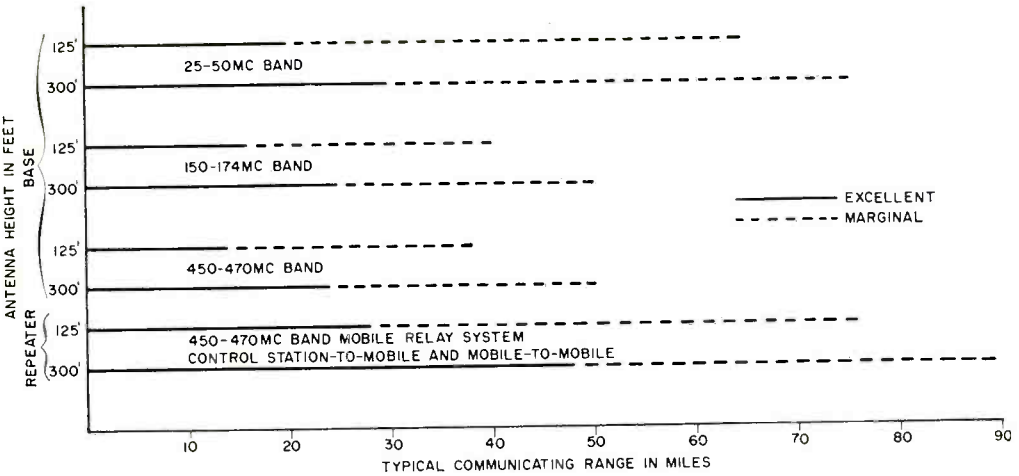
The "other" citizens band (460-470 mc.) is used mostly for business. Although this band is available for personal communication, it is not widely used for this purpose. The relatively high cost of 460-mc. equipment ($595 and up per mobile unit) tends to suppress personal exploitation. In the 460-mc. band, there are 49 channels, available on an assigned frequency basis to Class A stations (up to 60 watts input) and on a share-and-share-alike basis to Class B stations (up to 5 watts input).

● **The Business Bands.** More than 400 channels are available to business enterprises in the 25-50 mc., 72-76 mc., 150-174 mc., 406-413 mc., 450-470 mc. and 952-960 mc. bands under licenses in the Business Radio Service, and 72 channels in the Citizens Radio Service. Numerous other channels are available to those eligible in other radio services.

Intercommunication between mobile units (vehicles and portable units) and base stations (at fixed locations) is permitted in the 25-50 mc., 150-174 mc., and 450-470 mc. bands. Point-to-point communication between fixed stations is permitted on certain frequencies in the above three bands, and in the 72-76 mc., 406-413 mc. and 952-960 mc. bands on a restricted basis. In addition, the 12,000-mc. microwave band is available to the Business Radio Service for multi-channel telephony, data, and closed-circuit television transmission.

In spite of the large number of channels, congestion exists in some metropolitan areas. The FCC and the radio industry are exploring means to provide more business radio channels. The channels in the 25-50 mc. and 150-174 mc. bands have already been split by narrowing the band occupancy of the transmitted radio signals. Transmitters operating in these bands are required to employ AM, SSB, or narrow-band FM (±5-kc. deviation). In the 450-470 mc. band, wide-band FM (±15 kc.) is still permitted, but the feasibility of using narrow-band FM in this band has already been demonstrated by one manufacturer.

If these illustrations look like those in the CB chapter, you have immediately recognized many of the similarities between these two methods of communications. This Pearce-Simpson 301 equipment is rated at 30 watts. In the mobile unit the remote control head has been mounted under the dash and the power supply is in the trunk of the car. The base station photo shows the identical unit in one cabinet. Pearce-Simpson (Box 800A, Biscayne Annex, Miami, Fla. 33152) will send you a booklet enlarging on the theme of this chapter if you are interested in a Business Radio installation.



The communicating range in the VHF band varies according to frequency, antenna height above the surrounding terrain, receiver sensitivity, and effective radiated power. If sensitivity and effective radiated power are the same, and only frequency and antenna height are varied, the communicating range of VHF signals is approximately that shown above. Note that the range of "excellent" coverage in the 25-50 mc. band is somewhat above that in the 450-470 mc. band. However, with the use of a repeater station (at an ideal elevation), the communicating range of 470-mc. signals can be extended to nearly 50 miles.

Consideration is being given to the allocation of an unused UHF television channel to the Land Mobile Radio Services. It has also been proposed that in areas where no interference to TV reception would result one or more unused VHF television channels could be made available to mobile radio.

● **Equipment.** Until a few years ago, most business radio equipment (except CB) employed FM. In order to offer equipment at lower cost, some manufacturers recently introduced AM equipment for operation in the 25-50 mc. band. For example, E. F. Johnson has a 10-watt unit priced at around $200.00. Lafayette Radio has introduced a 5-watt combination CB business transceiver operable on all 23 class D CB channels plus two 25-50 mc. band business channels, priced at $220.00. Pearce-Simpson and others offer 30-watt AM sets at somewhat higher prices.

The bulk of the equipment, however, is FM units which range in price from around $300 for a 15-watt transceiver to nearly $1000 for a solid-state mobile unit. Many of the lower priced units, such as the Hartman 1500 (150-174 mc.) and the Hammarlund Outercom FM 50 (150-174 mc.) and FM-60 (25-50 mc.) can be used either as a base station or mobile unit. Equipment designed specifically for base station use ranges in price from around $300 to more than $2500.00.

● **Communicating Range.** Range in all three mobile bands is mainly determined by effective antenna elevation and to a lesser extent by transmitter power. Noise, in the 25-50 mc. band in particular, can drastically reduce an otherwise optimum range. Gain-type antennas are now widely used in the 150-174 mc. band and base-to-mobile range is on the order of 15-35 miles (4-6 miles mobile-to-mobile). The base-to-mobile range in the 450-470 mc. band is 10-25 miles, sometimes greater (4-6 miles mobile-to-mobile). The 25-50 mc. band is generally used to get coverage of a county, the 150-174 mc. band for metropolitan area coverage, and the 450-470 mc. band for city coverage. Because UHF signals are easily reflected, the 450-470 mc. band is often preferred in cities where large buildings serve as signal reflectors. Furthermore, noise levels are much lower at the higher frequencies than in the other mobile bands. And, by means of repeater stations, which are permitted only in the 450-470 mc. band, the communications range and solidity of coverage can be greatly enhanced.

● **Remote Control.** When the control point of a proposed base station is at a poor radio

location, and it is not feasible to provide means for placing the antenna high enough to achieve the desired coverage, a remotely controlled base station is often installed. The transmitter, receiver, and antenna are installed on a hilltop or on the roof of a tall building, and are connected to the remote control unit by means of a leased telephone circuit (at a cost of $3-$5 per mile, per month, when circuits are available) or a 952-960 mc. band radio link (cost of equipment ranging from $1500 to $4500).

In New York City, for example, numerous base station antennas can be seen on the tops of many of the tallest skyscrapers. A few miles to the north, another antenna farm is located on a 500′ tower at Alpine, New Jersey, which was formerly used by Major Edwin Armstrong's pioneer FM broadcasting station. In addition to remotely controlled base stations, the tower supports the antennas of several mobile relay system repeater stations.

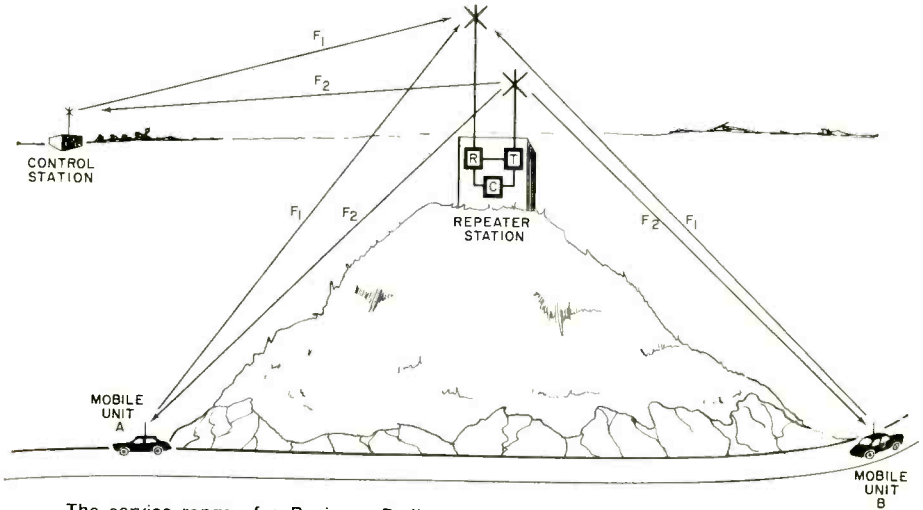
● **Mobile Relay Systems.** In a conventional mobile radio system, the base-to-mobile range is considerably greater than the mobile-to-mobile range. All mobile units and the base station usually transmit and receive on the same channel (single-frequency simplex). All communication between mobile units and the base station, and between mobile units, is direct. But in a mobile relay system which is permitted only in the UHF band, all of the transmissions are relayed through an automatic repeater station.

All mobile units and stations at fixed locations (called control stations) are equipped for two-frequency simplex operation, transmitting on one channel (*f1*) and receiving on another (*f2*). Since their receivers are tuned to *f2*, they cannot receive transmissions on *f1* and direct communication between mobile units and between control stations and mobile units is not possible.

Instead, all transmissions on *f1* from mobile units and control stations are intercepted by the receiver of the repeater station. When the repeater station receives a signal on *f1*, the repeater station transmitter is automatically turned on. It retransmits the signal on *f2* to all of the mobile units and control stations whose receivers are tuned to *f2*.

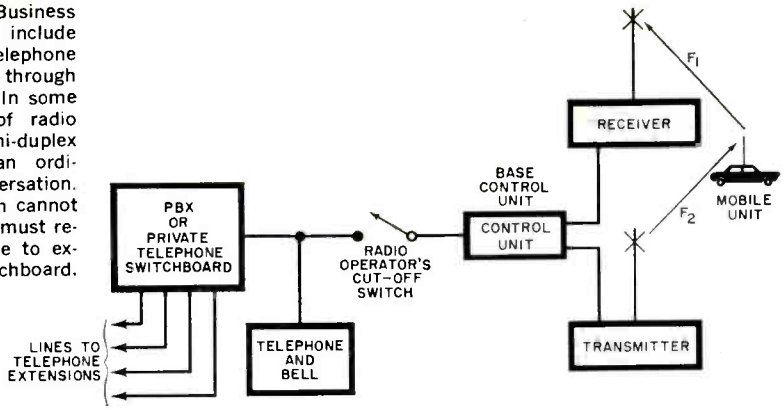
The repeater station increases the communication range if its antennas are high above the surrounding terrain. Ordinarily, in the UHF band, direct mobile-to-mobile range is 5 miles or less. But when a repeater station is used, which can transmit to and receive from mobile units up to 35 miles away, intercommunication between two mobile units 70 miles apart is possible.

Mobile relay systems date back almost 20 years. G. E. Smith, president of Communications Company, Inc. (COMCO), designed the first mobile relay system for the Coral Gables, Florida, police department. A short time later, in 1948, the author de-



The service range of a Business Radio system may be vastly increased through the use of a mountain-top repeater station. In this system, mobile-to-mobile and control-to-mobile activate the repeater receiver (R), transmitter (T), and control unit (C).

A fully integrated Business Radio system might include connections to any telephone (landline) extension through the base station PBX. In some installations a pair of radio channels permit semi-duplex operation—just like an ordinary telephone conversation. A mobile in the system cannot call long distance and must restrict telephone service to extensions of his switchboard.



signed a mobile relay system for the Chicago, South Shore and South Bend Railroad, employing two repeater stations, which enabled the dispatcher at Michigan City to communicate with trains and maintenance trucks operating between Chicago and South Bend.

Today, mobile relay systems are widely used wherever maximum area coverage is required. Some repeater stations are shared by several mobile radio system licensees. All enjoy the benefits at minimum price since they jointly share the cost of owning and maintaining the repeater stations. Inadvertent operation or unauthorized use of a repeater station by non-participating mobile radio systems can be prevented by equipping the station with a decoder (see below). This "electronic lock" restricts access of the repeater to mobile units and control stations equipped with encoders.

● **Man-to-Man Communication.** Walkie-talkies have been available for many years for extending communication to the man on foot. However, the lack of a portable FM transceiver for the 450-470 mc. band prohibited maximum utilization of the capabilities of UHF-band mobile radio systems. Recently, Motorola introduced an FM Handie-Talkie (registered trade-name) for the 450-470 mc. band. While the direct range between two such units is quite limited, considerable distances can be spanned when communicating through a repeater station.

● **Selective Signaling.** Ordinarily, mobile units must monitor their radio channel continously in order to intercept calls. To eliminate the need for aural monitoring, selective signaling equipment is installed. An encoder is installed at the base station and a decoder is attached to each mobile unit. To signal a particular mobile unit, the base station operator pushes buttons or dials a number. The loudspeaker of the called mobile unit is turned on or a bell is rung. In the event the vehicle is unoccupied at the time, a "leave word" lamp glows until turned off manually.

Two-way selective signaling is also used. It enables mobile units to signal each other and to alert operators at various base stations. When both two-way dialing and two-frequency simplex or duplex transmission are employed, a mobile radio system can be integrated into a PBX telephone system.

● **Radio Paging.** Another facet of business radio is enjoying a boom. Throughout the country, one-way radio paging systems are being installed to individually signal persons carrying pocket paging receivers. The receivers are of two basic types. One sounds

Typical of the handy combination mobile unit/base station/1-channel transceivers is Hammarlund's "Outercom," usable for 6-12 or 117 volt operation.

an audible alarm when it intercepts a coded tone signal. The other type also sounds an alarm and then permits the wearer to hear a voice message.

Radio paging has many uses. Persons on foot or in cars can be signaled from a distant base station. Upon hearing the alarm, the wearer steps into the nearest telephone booth and calls his office or takes other prearranged action. In plants, stores and hospitals, supervisors can be signaled and instructions can be transmitted to them. At theatres and other public gathering places, doctors and others anticipating calls can be loaned a "pocket pager" and signaled if they are wanted.

BUSINESS RADIO DEFINITIONS

Assigned Frequency	A channel assigned to a station on its license
Authorized Frequency	A channel on which a station is authorized to transmit
Base Station	A station at a fixed location used primarily for communicating with mobile units
Control Station	A fixed station used for communicating with mobile units and other control stations through a repeater station
Dispatch Point	A secondary remote control point which can be disabled by the authorized operator at the main remote control point
Duplex Operation	Simultaneous transmit and receive (like land-line telephone)
Fixed Station	A station at a fixed location used primarily for communicating with other fixed stations, not necessarily under the control of the same licensee
Mobile Unit	Vehicle-mounted and portable stations, including those used temporarily at fixed locations
Operational Fixed Station	A station at a fixed location used primarily for communicating with other fixed stations under the control of the same licensee
Remote Control Point	The point at which a remotely controlled base or fixed station is under the control of its authorized operator
Repeater Station	A fixed station which receives signals from mobile units and control stations, or from operational fixed stations, on one frequency and retransmits the received intelligence on another frequency
Simplex Operation	Sequential transmit and receive (you transmit, I receive; then I transmit, you receive)

CB-BUSINESS RADIO COMPARISON

	Class D Citizens Radio	Business Radio
Antenna height limit	20 feet	none
Power limit	5 watts	30-600 watts
Total number of channels	23	173
Relay stations	no	yes
Personal communications	yes	no
Business communications	yes	yes
Communicate with other licensees	yes	no
Remote control of base station	no	yes
Teletype, data transmission	no	on some channels
Mobile unit price range	$60-$350	$200-$1000
Base station price range	$60-$350	$200-$2500
Interconnect with telephone switchboard, etc.	no	yes

● **Point-to-Point Systems.** A number of channels are available in the various bands for operation of fixed stations for point-to-point communication. At frequencies below 952 mc., transmission capacity is limited to one voice channel, or up to 16 teletypewriter or data channels when authorized by the FCC. In the 952-960 mc. band, transmission of up to five voice channels is feasible. However, only those eligible in the Business Radio Service can use this band for remote control of base stations and alarm systems. Up to several hundred voice, telegraph and data channels, as well as television, can be transmitted under a Business Radio Service license on certain microwave bands above 10,000 mc.

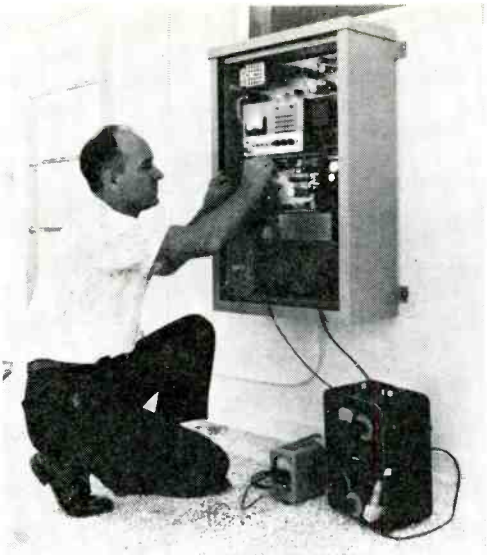
● **Licensing.** No operator's license is required by a user of mobile radio equipment.

Business radio systems must be covered by an FCC station license in the Business Radio Service. To apply for a station license to cover one base station and/or any number of mobile units (except for Class B and D CB), only a single application (FCC Form 400) need by submitted, along with a check for $10.00. A separate Form 400 and another check are required for a repeater station and additional base stations.

The Form 400 license application forms can be obtained from any FCC field office or directly from the Federal Communications Commission, Washington, D.C. 20554. Instructions for completing the applications are included with the forms. However, an applicant should obtain and read the applicable parts of the FCC Rules and Regulations, Volume V, which covers the Citizens and Business Radio Services. This volume is available for $2 from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

● **Common Carrier Services.** In addition to private radio communications systems, businesses can avail themselves of the land-line telephone services (communications common carriers). Mobile telephone service (MTS) is available in most cities. Subscribers' vehicles are equipped with a mobile transmitter-receiver, dial signaling

Radio paging is also called "one-way signaling." The wearer of this receiver hears a tone signal when the correctly coded radio signal is transmitted.



Repeater stations are generally self-contained like this COMCO Model 684. Transmitter/receiver needs no attendant and only occasional servicing/tune-up.

devices, and a telephone handset. Subscribers are able to place and receive telephone calls through the worldwide telephone network. The equipment may be purchased by the subscriber ($550-$1500) or leased from the telephone company ($25-$55 per month). Local calls cost about 30 cents and regular tolls are charged for long-distance calls. Improved mobile telephone service (IMTS) is becoming available in some areas; IMTS subscribers have access to more channels and can be signaled as they roam from one area to another.

There are also numerous so-called radio common carriers (RCC) which provide radio message relaying and signaling services to their subscribers on a per-call or monthly fee basis. Subscribers can furnish their own equipment or lease it from the common carrier.

● **Employment Opportunities.** The mobile radio industry, whose sales have been reported to be running as high as $175,000,000 per year, is creating new employment opportunities for those with training in electronics. Manufacturers seek lab technicians, engineers, and field installation and service supervisors. Large users of two-way radio, such as railroads and pipelines, employ technicians to service their equipment. And hundreds of independent mobile radio

service shops are adding technicians to their payrolls to service the equipment of small business users of two-way radio. In addition, countless technicians earn money during spare-time hours servicing mobile radio equipment for neighborhood business men. The basic requirement is a second class radio telephone operator license.

Loizeaux Concrete, Elizabeth, N.J., uses a Hallicrafters two-way FM system for communications between ready-mix and service and the base station.

● **System Planning Assistance.** The prospective user of a private two-way radio system does not have to plan his own system. Manufacturers' sales engineers and independent mobile radio dealers are anxious to provide this type of assistance, often without charge. Mobile radio dealers and factory sales offices are listed in the yellow pages of telephone directories under "Radio Communication Equipment and Systems." Information about mobile telephone service can be obtained from the local telephone company. Information about RCC services can be obtained by calling companies listed in classified telephone directories under "Radio Paging and Signal Services."

● **Benefits.** One user pointed out that "two-way radio does not cost—it pays." For the operator of a fleet of vehicles, two-way radio can be a profitable investment. Operating costs can be reduced by making better utilization of manpower and minimization of non-productive vehicle miles. Business income can be increased by rendering better service and by serving more customers. In fact, two-way radio has become as indispensable to many businesses as the telephone. ■

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READER SERVICE NO.	ADVERTISER	PAGE NO.
29	Amphenol Distributor Division, Amphenol Corporation	136
1	Antenna Specialists Co., The	SECOND COVER
2	B & K Manufacturing Co.	131
3	Belden	1
28	Browning Laboratories, Inc.	130
4	Burstein-Applebee Co.	130
5	C/P Corporation Division of the Shakespeare Company	96
30	E.C.I. Electronics Communications, Inc.	125
6	EICO Electronic Instrument Co., Inc.	6
7	Electro-Voice, Inc.	135
8	Hallicrafters	THIRD COVER
9	Heath Company	33, 34, 35
10	Hy-Gain Electronics Corporation	8
11	International Crystal Mfg. Co., Inc.	2
12	Johnson Company, E. F.	4
13	Kaar Electronics Corporation	129
14	Kuhn Electronics Inc.	148
15	Lafayette Radio Electronics	67, 68
16	Mark Products	46
31	Maxwell Electronics Corporation	147
17	Mosley Electronics Inc.	122, 123
18	Multi-Elmac Company	134
19	Olson Electronics Incorporated	148
20	Pace Communications Corp.	128
22	Pearce-Simpson, Inc.	127
21	RCA Electronic Components and Devices	FOURTH COVER
32	Sonotone Corp.	126
23	Squires-Sanders, Inc.	133
24	Telex/Acoustic Products	95
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