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THE COMPLETE SHORT WAVE LISTENER'S HANDBOOK

by Hank Bennett

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About the Author

Hank Bennett has been associated with radio in one form or another nearly all of his life. He originally began to "twiddle the knobs" at about the age of 8. In 1939, he obtained his first amateur radio license with the callsign of W2PNA and it is still in effect.

After military service in World War II as a radio operator with the 250th Signal Operations Company and, for a short time, with the 13th Photo Intelligence Detachment, he joined the Franklin Institute Laboratories, Philadelphia, for research and development. Later, he became associated with Schaevitz Engineering as a supervisor in the transformer test department. Currently, he is employed as a Post Office letter carrier in Cherry Hill, New Jersey.

In 1949, he was asked to accept the editorship of the shortwave department of the Newark News Radio Club, a job which he still holds today. For a number of years, he was DX editor for Popular Electronics Magazine and presently is chief operator for the WDX Monitor Registration Program.

With sincere thanks...

It is with sincere appreciation and pride that I dedicate this book to those people who provided the inspiration needed to write this handbook. I'm grateful to the many members of the various radio clubs who pitched in with pages and pages of material on their favorite shortwave band. If I neglected to mention any of them throughout the book, I apologize. I'm most grateful to my son, James, not only for his beautiful dictionary, but for picking up and doing many of the chores that were rightly mine. Special thanks go to my daughter, Mrs. Marion McAllister, for a superb job of proofreading, and to her husband, Bruce, who put up with it all while I "borrowed" his wife for that purpose.

Spiritual guidance was provided by Monsignor Bernard F. Hewitt who also provided a few ideas of his own for the handbook. To my mom, dad, and sister I owe thanks for remembering me in spite of the fact that I haven't seen much of them in the six months that it took me to compile this handbook. Finally, a very special vote of thanks and a big kiss to my most patient wife, Amelia, who has become accustomed to serving the meals on tray tables while I had the dining room table heaped high with reams and reams of paper. Lastly, this book is dedicated in loving memory to Aunt Butch. She had looked forward to reading the first copy while the ink was still wet after having given me the initial inspiration to take on a job of this size, but she passed away before I was able to complete it.

Preface

Shortwave listening is one of the world's most popular hobbies. It ranks right up there with the more popular and better known hobbies such as collecting stamps, coins, matchbook covers, and rocks, and photography, model building, as well as other interesting and fascinating hobbies. The unusual feature about shortwave listening, though, is the fact that, despite its popularity, the "whys and wherefores" of the hobby are either virtually unknown or widely misunderstood by the average person.

The abbreviation, SWL, of course, stands for shortwave listening and, it is this form in which we will tell our story—it is what I would prefer to call an "active" hobby as opposed to many of the other hobbies which are categorized as "passive" in nature. To further explain this, the reader must agree that, with many other hobbies, you have collections of things which are representative of something that has happened in the past. Good examples of this point include rocks, coins, and stamps, any of which are fine hobbies for those who enjoy them. The prized specimens in any of those groups can be from many ages in the distant past. With SWL, on the other hand, you have a hobby in which the action is here and now. If someone is broadcasting from 10,000 miles away, you stand a reasonably good chance of hearing it now, rather than later on when the transmission is finished and the station is off the air. It is a hobby where something is happening every minute of every hour of every day.

Hank Bennett

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Chapter 1

Introduction to Shortwave Listening

ORIGIN OF THE HOBBY

It is extremely difficult to determine exactly when shortwave listening really began. But in order for it to happen in the first place, there had to be someone broadcasting on the air and someone else to hear it.

When was this first broadcast? Through the years, I have learned of quite a few of the so-called "first broadcasts." There was a first broadcast by Morse code, one by a voice transmitter, and one by what are now commercial broadcasting stations, along with numerous other "firsts." The first interception of messages between two parties could easily go back to the dark ages, when warring natives of one clan listened in to messages being passed between various groups of their opponents. These messages were, of course, sent by tom-toms or other primitive methods of communication. Similarly, smoke signals in the day of the Indian could easily be intercepted by persons other than for whom the message was intended.

These are farfetched examples of shortwave listening, no doubt, but it only serves to prove that then, as now, whenever a message is being sent from one person to another, there is usually someone else listening. This is perhaps the basic concept of SWL, since the shortwave listener does just that: listens. He listens to messages being transmitted from one person to another; he listens to broadcasts that are beamed to specific whole populations; and, in some cases, where broadcast stations operate in a public service vein, the shortwave listener may be listening expressly for messages that are, in fact, intended for him. This occurs in various remote areas where the broadcasting station is the only means of communication into places where telephone and telegraph lines have not yet reached. Such messages might include news of births, deaths, or birthday greetings.

The first generally accepted transmission by wireless was that made by Marconi back in 1896, and this was for an overall distance of about one and three quarter miles. The following year, a transmission was made from a shore station to a ship at sea, some 18 miles away. Broadcasting, such as we generally know it today, came into being around the year 1920, although some of the stations may have been on the air as much as a year or two earlier. Technically speaking, then, we have to state that the first SWL (the last letter in our hobby serves the dual meaning of listening and listener) was the first person to have heard one of those early broadcasts back in 1896. However, the generally accepted form of SWL didn't really come into being until after World War I, and only on a very limited scale at that.

The years of World War II saw the hobby of shortwave listening really come into its own, as more and more people learned of the existence of the high-powered foreign broadcasting stations, which operated on shortwave frequencies that enabled the foreign stations to be heard with relative ease (considering their distance) in many parts of the world. It was so easy for the average person to tune to his favorite local radio station for the latest news of war developments, but it was far more interesting, and challenging, to try and tune in foreign broadcast stations on shortwave that had English language newscasts, thereby enabling the listener to hear the very latest news of the war from the European or Asian countries that were actually engaged in the conflict. This direct news was often hours ahead of the newscasts on local home stations.

This is not intended to be any form of criticism of the news and wire services, since those good people were doing everything possible to get the news relayed despite a tremendous overabundance of news and, at times, faulty equipment or poor transmitting and receiving conditions. In the years since World War II, the facilities of the news and wires services have so greatly improved that a hot news item can be flashed around the world literally in seconds. Not to be outdone by their sister services, however, the radio broadcasters have also installed much larger and far more powerful transmitters which enable them to be heard much more easily by far greater numbers of people.

Since the days of World War II, shortwave listening has really come into its own with millions of people, in every country of the world, turning to the shortwave frequencies in an effort to hear not only news from other countries but programs of good music and programs describing the cultures and customs of other countries. This was and is true even in those countries where listening to shortwave frequencies by private citizens is highly frowned upon—sometimes with dire consequences should the listener be caught. It might tax the imagination of some of our American readers to realize that shortwave listening is a sin against the state in some countries, and, additionally, many countries impose an actual licensing fee for radio receivers! Quite a contrast to our North American way of being permitted to listen to anything we wish on any number of unlicensed and untaxed radio receivers!

WHAT SWLs HEAR

There is so very, very much that the average person can hear even if he has nothing more elaborate than a simple table model radio receiver with only one shortwave band on it. By careful tuning, the listener can hear not only shortwave programs, but such a varied fare as airplane pilots talking to their respective terminals, ships on the high seas or in the inland waterways, airline stations that give nothing but weather conditions and forecasts for all areas within their operating range, amateur radio operators (better known as "hams") discussing the latest radio and electronic techniques or news of their personal activities or, especially among the lady ham operators, the swapping of cake recipes or fashion designs.

The ham band channels are always interesting when an area has been hit by a hurricane, tornado, blizzard, or flooding problem, for the hams are right in there giving assistance to the authorities and aiding in rescue operations through the means of their own personal equipment and at no financial charge to anyone. Even their own time is freely volunteered and donated. Millions of personal messages are transmitted each year for the general public by the radio hams and these messages are delivered by the fastest means available, usually by telephone, sometimes in person, and, if all else fails, by mail service from the nearest point to the addressee. Again, no charge for this fine service. A simple "thank you" is all that is necessary from the addressee, and, wouldn't you know, some people do not even have the common courtesy to offer that.

The listener, if he has any knowledge of Morse code, can also hear countless other types of transmissions: ship to shore, airlines, hams, military stations on tactical maneuvers, weather broadcasts, hurricane reports, and seemingly spy-type transmissions.

Also, we know of many people who have high-frequency shortwave police and fire receivers in their homes and private cars. The basic purpose among the latter, especially, is for excitement, and as often as not these people only add to the confusion and do little in the way of actual assistance. Moreover, in virtually every city and town in our country, it is illegal to have a high-frequency police and fire receiver in your car unless it is accompanied by a letter of permission from the police or fire chief of the community in which the unit is located. Such permission is generally very difficult to obtain unless the applicant is a member of a police or fire organization or other bonafide group working in the specific interest of local civil defense. I was unable to obtain a letter of permission for a mobile unit even for the purpose of gathering material for this book. Further, we're told that authorities in our local area are vigorously apprehending and prosecuting those persons who have such equipment in their automobiles without specific permission. So check first before you do it! Those persons, on the other hand, who do have the equipment for reception of police and fire frequencies in their cars on an approved basis are often the first on the scene at accidents or fires and are able to render at least minimal first aid until such time as recognized authorities can get to the scene.

WHY SWLs LISTEN

Why people listen to shortwave is something that is generally known only to the person doing the listening. He may have nothing better to do with his spare time. He may be a shut-in with little else to do, in which case the radio can be a valuable companion. The listener may be a prisoner doing a long stretch behind bars. And he may well be an average, everyday person, who is interested in knowing more about shortwave listening, what it is all about, and why.

Foreign Station Programing

In today's society, many students tune in to the shortwave broadcast stations in order to gather material for their school or college classes. In my many years of shortwaving and writing various shortwave columns, I know from personal experience that students having classes in such subjects as civics or political science usually fare better than others in their classes simply because they are able to take in new items that they hear on the shortwaves before going to school in the morning, but which are not in the newspapers until the afternoon or evening editions are published.

I can vividly recall a personal event of this type from my own high school days. The only trouble was that at that time (nearly 35 years ago) shortwave listening was brushed off by most instructors as a poor source of information, at best, and in short order I became the laughing stock of the class. At the time, there were only two other students that I knew of, in a class of over two hundred, who were interested in radio. Gradually, the instructors, in reading the evening newspapers or listening to local newscasts, began to realize that perhaps my information was good, if not excellent, material after all. More than once following that, I had the pleasure of having various school instructors visit our home for demonstrations of shortwave listening. Over the past 20 years or so that I have been writing shortwave columns, many interested people have written in to offer their information, and I know, as a matter of fact, that a fair percentage of them are people from the teaching profession.

The foreign broadcasting stations also realize the very great importance of shortwave radio, not only for the dissemination of news, music, and cultural programs, but for the transmission of language lessons. Government-operated stations in most of the major foreign countries have regularly scheduled language lessons which are translatable to the language of the country to which the specific broadcast is beamed. Japan, for example, has lessons in the Japanese language, with English translations, in their beam to North America. Holland has "Dutch By Radio" and West Germany has language lessons in German; both are accompanied by English translations. There are numerous others as well, and the language lessons are not limited simply to those with English translations.

Many of these language lessons are produced and aired by recognized specialists and widely utilized by students. Further, the stations offering the various language courses by radio usually also offer free textbooks or lesson guide books to anyone who is interested in taking these courses by radio in the privacy of their own home. Your instructor, while many thousands of miles away, is nonetheless in the room with you, giving what very nearly amounts to personalized tutoring. For at least a basic fundamental of a foreign language, I can highly recommend these radio lessons.

Differences Between SWLs and Hams

The average person nowadays, though, seems to have a built-in bit of knowledge that, to him, means that anyone with a shortwave radio of any kind is automatically a ham radio operator. This is one of the most erroneous impressions that I have ever run up against. Actually, there are at least two separate and distinct classifications of radio listeners.

The ham radio operator is a federally licensed person who is authorized to engage in two-way communications, on certain specified frequency ranges, with other similarly licensed operators. The SWL cannot do any type of transmitting or broadcasting, since he does not hold a government license or permit to do so. But he may certainly listen to anything he wishes and at any time that he cares to do so.

Oftentimes the average person, when encountering an SWL, will ask the SWL why he doesn't get a license and actually get on the air for two-way contacts. For the SWL to reply that he doesn't want to might give the impression that he's too good for that sort of thing; for the SWL to say that he can't would leave a strong impression with the average person that he (the SWL) is too dumb to get a license. Both impressions are totally incorrect. In my own 30 years of being a ham radio operator, I have had the opportunity of meeting large numbers of SWLs, and I know for a positive fact that the great majority of them prefer to simply listen, rather than engage in on-the-air communications. Like the baseball fan who'd rather watch than play, radio is a spectator sport to the SWL.

Admittedly, there are many SWLs who cannot get a license, but it usually is not due to any lack of ability. Given sufficient time to learn the federal rules and regulations and the intricacies of oscillators, amplifiers, buffer stages, and other circuits, any really interested person can be nearly qualified for a license.

Perhaps the major stumbling block is the Morse code. To obtain a ham radio license, every applicant must have a working knowledge of Morse code, both sending and receiving, and to some persons this poses a nearly insurmountable task. I'm not ashamed to admit that I had to take the Morse portion of the ham radio examination no less than four times before I passed it. (But I can send and receive at 30 words per minute or better now.)

I work with a local church men's group that conducts a Bingo game every Tuesday evening, and I've often been asked to fill in as a caller of Bingo numbers. But no thank you! There's a world of difference between sitting in my own radio shack and yakking over a microphone with someone that I may or may not know and sitting in a hall full of people and trying to call numbers over their microphone.

For the most part, though, the average SWL is perfectly content to be a listener, and believe me, some of them are real addicts! The SWL, more often than not, continues to be actively engaged in the hobby and many of them eventually go on to the ham radio portion of the hobby. Conversely, I know of a number of ham radio operators who, for various reasons of their own, have elected to let their ham radio licenses lapse, after which they once again become active SWLs. In most cases, it was learned that they found a preference for the one-way aspect of the hobby. Experience has also proven that many ham radio operators continue to be active SWLs. This fact is confirmed by the considerable number of ham radio operators who, through the years, have reported on shortwave station reception to my columns and to the shortwave stations themselves in the form of reception reports.

"Secret" Communications

Earlier in the story, I made the statement that an SWL "may certainly listen to anything he wishes and at any time that he cares to do so." A word of caution might well be inserted here in regard to that statement.

Federal regulations guarantee the secrecy of certain types of transmissions, notably ship-to-shore communications, where plain language on-the-air contacts may be heard between persons on board a ship and persons (relatives or business associates usually) at their homes or places of business. This type of communication is made by radio from the ship to the shore station and from there it goes into the public telephone lines, but oftentimes both ends of the conversation can be heard. These communications are of a strictly private nature and must be treated as such by the SWL. There is no law against listening to this type of contact, but there are very definite laws against repeating or revealing to any other person the nature of the contact or any portions of the conversation. We urge you to be particularly mindful of this federal regulation if you should happen to tune in on any of these private services.

SWLs AND WHAT THEY CAN DO

What good is an SWL when it really gets down to facts? To begin with, the SWL is generally a more conversant person on world affairs. The SWL is indispensable in times of emergencies to, if nothing else, act as a leg man between ham stations that are engaged in rescue communications and the nearby authorities.

The SWL is often the disc jockey or newsman on your favorite local radio or TV station. The SWL may be the local police, truck, or taxi dispatcher. He might even be a Catholic priest. (Further on in this book you will find an excellent segment on broadcast band DXing that was authored in part by a priest in California.) The SWL might even be a postal letter carrier, as I am.

It has always been interesting to learn of the various occupations in which SWLs are engaged. A couple of years ago, my family and I were parked alongside the roadway near Cherry Valley, New York, watching a small waterfall. Our van-type automobile bore my ham radio callsign (W2PNA) on the license plates. A few moments later, we were approached by the driver of a passing truck who had noticed the callsign license plate. After tooting and waving, he continued on his way to a local sanitary landfill with his fully loaded garbage truck. On another occasion, many years ago, when I was "commuting" between New Jersey and Michigan by Greyhound bus for the purpose of courtship, I happened to be carrying a wet-cell portable receiver with me that covered only the standard broadcast band. It made life a bit more pleasant during the long 750-mile trip. The driver of one Greyhound bus happened to spot my portable; I was virtually at the end of the waiting line and thought for sure that I would either have to stand in the bus or wait for the next one. The driver came back and asked me if the radio was working. When I replied that it was, he asked if I would like the front seat which, in this particular model of bus, was in front of the door, and which was usually reserved for mail or a priority shipment. We both enjoyed the beautiful music from the "All Night Showcase" with Franklyn Mac Cormick from WGN in Chicago.

During World War II, one of my SWL friends, who (to the best of my knowledge) never held a ham radio license in his life, and who, as a result, could only listen, did a magnificent job of tuning in the foreign shortwave broadcasts from the capitals or chief cities of the Axis countries; he used several receivers so that he could tune in two or more stations at any one time. He faithfully monitored every possible transmission in an effort to learn the names of Americans who had been taken as prisoners of war. Reportedly, he was often able to notify military authorities or family members of the general whereabouts of missing servicemen before the military officials themselves were even able to get the information. I often wonder what happened to this fine gentleman who thus so ably served his country in a nonmilitary manner. He lived in one of the south central states and certainly should have received some sort of commendation from his appreciative government. In the course of time, we have lost track of him. Should this book eventually find its way into his life, we would certainly like to hear from him once again!

But please do not let me give you a wrong impression of SWL. Basically and primarily it is a hobby where idle time can be put to most interesting use, often with intriguing results. It is a hobby where contentment can be found in the fine music programs or the interesting discussion or request programs that are being continually aired by stations in foreign lands. It is a hobby that needs only you to make it come into being. You do not have to depend on anyone else to help or assist you for the most part.

It's a hobby that takes up no more space than that which is occupied by your own little table model receiver. What becomes of it in due time is up to you. If you become fascinated with the hobby and you find that a preselector here, an antenna tuner there, perhaps another receiver, or two, or three (and believe me, this does happen!), and various other items of associated equipment are accumulated, you may quickly learn that your little table in the corner needs a shot in the arm, so to speak—like an entirely separate room or perhaps half of the basement, perhaps a closet. (No kidding, I know of one listener who had to have all of his equipment as well as himself in an oversized broom closet because his dear wife thought so very little of the hobby and insisted that it be kept out of sight.)

The SWL does not have to be someone who lives in a private home. He can be an apartment dweller, someone in an upstairs flat, someone on a large ranch or estate, or a resident of a hotel or a transient motel occupant. He can be a resident of a condominium, a penthouse, or, as we've said, a conventional private home. There are no restrictions of any kind on federal, state, or local levels regarding shortwave listening other than insuring the privacy of message transmissions of stations in telephone service, as was explained earlier. Residents of large apartment complexes may, however, find some private restrictions when it comes to having an outside antenna. Many apartment projects will not permit any type of outside antenna, so the listener must resort to other means (sometimes amusingly fiendish) of having some sort of outside antenna so that his receiver will function more efficiently. But we'll go more into that problem in detail later on in this book.

GETTING STARTED

A person does not have to possess a large bankroll to become an active SWL hobbyist. Consider that in today's society, many SWLs are school kids with very limited funds of their own, yet they are able to take part in this great hobby. Senior citizens can do it, too, without any great strain on their pensions. Of course, as we have previously stated, if you find yourself getting more and more involved in the hobby, and you wish to add more and better equipment to your listening post, you will have to lay out the funds for it, just as you would have to do for any hobby. But for the average person, you perhaps, it takes nothing more than a simple radio receiver with a shortwave band on it.

If you don't already have a suitable receiver in your attic, collecting dust, check out some of those church or rummage sales. Garage and yard sales are always good bets, too. You'll often be able to find good operating equipment with a lot of fine, usable life left in it, and the cost will often be little more than you'd pay for a few pounds of hamburger and, with luck, even less. I would suggest, though, that if it is not convenient to actually try out a radio that you are considering purchasing at a rummage sale or equivalent, you give it a good examination visually. Check to see if parts such as tubes, the tuning capacitors, or the speaker, are missing. Check for obviously cut or broken wires. More often than not, radio receivers that are offered at church sales, and the like, are pieces of equipment that were cast aside like an old shoe when a new television set came into the home. The radio receiver is probably in good working order, but there is the equal chance that it could have been cannibalized for parts, so at least give it a good looking over. And should you find one that has parts missing, it might be in your best interest to pass it up, since it could cost more to get it into working order than you would even pay for it. But if it looks good, if it works, and if it is cheap, buy it!

With very little effort and a good bit of enthusiasm, you'll find that it's a simple matter to turn your radio receiver on and to find a station that is somewhere other than in your own local area. You may be able, within your first couple of hours, or less, to hear stations on the standard AM broadcast band that are "local" to someone a couple of hundred miles away or, if you have a shortwave band on your set, a station that is many thousands of miles distant. Perhaps you'll wind up on a ham radio channel, more or less by accident, and you will hear someone talking who is miles and miles away from you. (You could hear your next door neighbor, or the guy up the street with that weird looking antenna contraption on the top of his house.) You'll begin to realize that maybe, just maybe, there really is something to shortwave listening after all. And if you can hear one distant station, you'll want to hear another, and another. And you're on your way to becoming a shortwave listener, perhaps the greatest and most wonderful hobby in existence today.

In my 30-plus years of shortwaving and hamming, I've often been asked how I got started, and this is one story that has never been told. Perhaps it might be best left that way, but to let the newcomer to the hobby know that I, too, had to start from scratch, permit me to give you some of the highlights.

I found my beginning in shortwave listening (though I didn't realize it at the time, of course) somewhere around 1932. At that time, WJZ in New York City was one of the favorite spots on our broadcast band dial for the evening entertainment in our home. "Amos 'n Andy" headed up the first of several 15-minute comedy and drama shows. These followed the late afternoon and early evening fare, on various local stations, of news, comedy, sports, and the ever-present (at the time) children's programs ("Little Orphan Annie," "Singing Lady," "Tom Mix," "Bobby Benson," and "Captain Tim's Stamp Program").

WJZ was at 760 on the dial, as was WBAL in Baltimore, and the two stations were only a couple of hundred miles apart; our home was roughly halfway between the two. The two stations were largely synchronized during evening hours for everything except station breaks; this was necessary since they were both 50,000-watt stations. During the daylight hours, there was far less chance of them interfering with each other. During the synchronized transmissions, WJZ would announce their call letters and locations, and this was immediately followed by the announcement, much weaker in the background, "WBAL, Baltimore" as that station identified.

The next step, seemingly, was to tune the dial off to one side or the other and try to find other stations. My parents would stand by patiently (usually) while I tuned the old home radio at every station break and they, too, were surprised when I pulled in KOMO in Seattle, Washington, entirely by accident. On another evening, we were all fascinated to hear the song "Till We Meet Again" coming from a station that was obviously not local to our area. It announced as "CJCB, Sydney" and it took a bit of geographical work at that time to pinpoint the station as being in Sydney, Nova Scotia, Canada. Curiously enough, in the following 40 years, I have never again been able to log KOMO.

In the years that followed, Christmas gifts often included a table model, five-tube receiver or perhaps one of a slightly larger variety. And in the usual manner, each one had to be followed by one a little bigger and more sophisticated. I finally decided to try and support my own hobby, so with permission of my parents I went to work in a bowling alley in my junior high school years, doing the work the hard way, picking up and setting the pins by hand, since our alley was not equipped with automatic pin setters, and in due time I saved enough money for the first major purchase of my young life.

I came home with a nine-tube Hallicrafters S-20R Sky Champion receiver that had the standard broadcast band and all of the shortwave bands up to 44,000 kilocycles (or kilohertz instead of kilocycles now). It had seven knobs and three switches on the front panel, plus a jack for headphones. And it is still standing by me faithfully some 30 years later. Aside from a few new tubes from time to time, it is still a wonderfully active piece of equipment. But, you guessed it; I went on to even larger and more expensive receivers. Currently, I keep abreast of shortwave listening with four receivers: the old original Sky Champion, a Hammarlund HQ-129X, which has much the same frequency coverage as the older unit, a National HRO-50T1 which is used mainly for longwave and ultrashortwave reception, and an old U.S. Signal Corps surplus BC–348-R, which is used primarily for monitoring the Newark-Elmira Air Radio (EWR, Newark, 379 kHz; ELM, Elmira, 375 kHz) for weather conditions throughout the American northeast.

My own personal pride and joy, though, is a completely intact and still operable Westinghouse crystal set. It is better than 50 years old and it still pulls in local stations with remarkable ease and clarity. My greatest

DX achievement on the old set occurred a number of years ago when WLW, Cincinnati, Ohio, operated with the super power of 500,000 watts on a test basis after midnight with the experimental callsign of W8X0, on 700 kHz. Many were the nights when I'd go to bed, put the headphones on, and listen to the big bands of the 1930s until I fell asleep. It became common practice for my mother to tiptoe into my bedroom, carefully remove the headphones before I strangled myself, and set them on my bedside table.

For those readers who may never have heard or seen one of these old crystal sets, they consisted of nothing more than a tuning coil, a "cat-whisker," a piece of galena as a detector (a small piece of hard coal would work just as well) and four binding posts, one each for antenna and ground connections and two for headphone connections. There were no tubes, no batteries, or any other kind of electrical power—nothing, in fact, other than the minute electrical impulses that were transmitted by nearby stations and brought into the set by the outside wire antenna and "found" by touching the catwhisker to the detector at exactly the right place. Being in a heavily populated area, several stations could be heard. The best were WIP and WCAU, both in Philadelphia, but with transmitters at nearby New Jersey locations, and even more local but lesser powered WCAM in Camden, New Jersey. These three stations operated at 610, 1170, and 1280 kHz, respectively. By varying the tuning coil with the large tuning knob, I could usually get one station above the others; although, normally, the others could still be heard in the background.

To show you how other local stations could be heard, despite much higher operating frequencies, it was easy to hear police calls from our local law enforcement agency office. The station operated on the unheard of high frequency (at that time) of 33,500 kHz and their callsign was W3XFG. Of course, my home was less than one city block from their antenna, so it was easy to hear them. W3XFG later became WQNG and nowadays is known as KEB356 and their operating frequency is 156.21 MHz.

The crystal set was contained in a highly polished brown box, some 10 inches square, with clasp. When the hinged top was lifted, there was the radio receiver all set to go as soon as connections were made to the four binding terminals.

Many of today's small transistor sets work on very nearly the same principle, except that they employ transistors and a small battery to increase the number of stations that can be heard, as well as to greatly amplify the signals so that the programs may be heard without headphones.

But the primary purpose of this book is not to acquaint you with my past history. It is my intent to help you, the person who may have heard about shortwave listening and wondered what it is all about, to become at least generally knowledgeable about our great hobby. I hope to give you many, if not all, of the answers to the questions that you are bound to ask about the hobby, but not necessarily in a technical manner. We cover receivers, antennas, Q codes, frequencies, propagation, harmonics, how to keep a logbook and why, how to prepare and send reception reports to the stations that you hear in order to obtain their "QSL," and many, many other interesting and informative points. I might add that in the preparation of this handbook, in order to make it a true representation of our hobby, I enlisted the aid of a number of associates with whom I have had the pleasure of working and corresponding over a period of years, some of whom are recognized experts in certain categories. I am truly grateful and equally proud of their efforts and contributions and hope that you, the newcomer to the hobby, will find this book as interesting as we have tried to make it.

Chapter 2

Terminology

It might be well, before we go any further, to give you a brief explanation of some of the terms that are most generally used in shortwave listening, in order that you can proceed with a better understanding of some of the things that we in the hobby rather take for granted.

As a starter, let not the term "shortwave listener," abbreviated as "SWL," be confusing to you. In the strictest sense of the term, it is meant to designate someone who spends his time listening only to the actual shortwave frequencies. This, then, would seemingly not include anyone who listened to the frequency range that you will find on an average home or car receiver and on which you will find your favorite local stations. That range is generally known as the "broadcast band" or, to a lesser degree, as the "medium waves." In recent years, however, the term SWL has been generally accepted to mean anyone who tunes to any frequency as long as it comes in over a radio receiver. This would include the standard broadcast band and even that relatively unknown range of frequencies called the "long waves." Permit us to go ahead, then, and define an SWL as anyone who tunes any frequency for the purpose of trying to hear other than strictly local stations.

FREQUENCY

If you happen to own any of a wide variety of two-band receivers of recent make, chances are that you will have the standard broadcast band and an FM band. The broadcast band will probably be marked with frequencies in "kilohertz" or "kHz" and the FM band in "megahertz" or "MHz." (Older receivers use kilocycles, kc, megacycles, mc.) These two bands are located at vastly different portions of the radio spectrum. The standard broadcast band runs from 540 to 1600 kHz, while the FM band runs from 88 to 108 MHz (or 88,000 to 108,000 kHz). Your first lesson, then, in learning about kilohertz and megahertz is that 1000 kilohertz (kHz) equals one megahertz (MHz). One of the British shortwave stations operates on 6050 kHz or 6.050 MHz. Station HCJB in Quito, Ecuador, utilizes the frequency of 15,115 kHz or 15.115 MHz.

In the past few years the terms "cycles," "kilocycles," and "megacycles" have been gradually replaced by the more modern terms "hertz" (Hz), "kilohertz" (kHz), and "megahertz" (MHz), respectively, after the famed German physicist Heinrich Rudolph Hertz (1857-1894), one of the pioneers in electronics who contributed substantially to our understanding of electromagnetic radiation. Adoption of the "hertz" nomenclature is comparatively recent, and we'll be using it throughout this book. Most of the international shortwave broadcast stations are using the new terms now and if you happen to stay up late enough to hear your favorite local station sign off, chances are that they will be using the new terms, too.

WAVELENGTH

"Wavelength" is a term that you may often hear the foreign shortwave broadcast stations use, but is rarely used on the local broadcast band. **Wavelength** is the physical length of one alternation (or wave) of a transmitted signal, usually expressed in meters; **frequency** is the number of waves the transmitter produces in a one-second period. If you are familiar with a relatively simple mathematical formula, you will be able to determine the wavelength if you know the frequency and vice versa.

For the sake of convenience, the "magic number" that is used to compute the formula is 300,000, the distance in kilometers that light (or radio waves) will travel in a one-second period. The actual nearest whole number that is more mathematically correct is 299,820. The former is generally used where the wavelength or frequency to be determined does not have to be exact, but for those who desire a more accurate answer, use 299,820. Here's how it works: The BBC station that we mentioned as operating on 6050 kHz (frequency) is also operating on 49.55 meters (wavelength). Simply divide the known frequency in kilohertz into 299,820 and your answer will be the wavelength in meters. Conversely, when the wavelength in meters is known, divide that figure into 299,820 and your answer will be the frequency in kilohertz.

Example (when the frequency is known):

$$299{,}820/6050 = 49.55$$

The known frequency is 6050 kHz. The answer is 49.55 meters for the wavelength. For accuracy, this computation should be extended out to two decimal points.

Example (when the wavelength is known):

$$299{,}820/49.55 = 6050$$

The known wavelength is 49.55 meters. The answer is 6050 kHz for the frequency. For accuracy, you should use a wavelength with two decimal places when this information is known.

The reason that we mention all of this is because many shortwave receiver dial segments are marked with a heavier base line, and this, in turn, may have a figure sometimes above but usually under the line. This indicates that this particular segment is a certain meter band, such as 49, 25, or 19. Thus, when you hear a station announce on shortwave that it will be operating in the "49-, 25-, or 19-meter band" it will give you at least an approximate idea where you should tune the receiver in order to hear the station. Foreign broadcasting schedules may also list their operating frequencies in wavelength rather than in kilohertz; here again, the meter bands as shown on your shortwave dial will give you a rough idea where to tune in order to hear the station. Local broadcast stations generally express their frequency only in kilohertz.

DX

The term DX sometimes causes confusion to the newcomer to the hobby. It is simply a radio abbreviation meaning "long distance." If you hear a station many miles away, you are hearing DX. This in turn makes you a DXer, or someone who is able to tune in distant stations. DXing is the process of trying to hear those distant stations. The generally accepted but unwritten rule in the hobby is that nearly anyone can be an SWL, but it takes practice, patience, and experience to really become a DXer.

Some of the shortwave broadcast stations have "DX programs" which are programs of timely information concerning other shortwave stations that are aired in regular shortwave-column style. Many DXers report their loggings to the stations that carry these DX programs and the stations, in turn, broadcast this information for the benefit of other listeners who may have been trying in vain to hear a certain station.

GMT

Virtually every shortwave station that is on the air (with the exception of some of the stations in Latin American countries that operate on the so-called "tropical bands" and which beam programs almost exclusively to local audiences) expresses clock time in Greenwich Mean Time (GMT). Greenwich, England, former site of the Royal Observatory (it's now in Edinburgh, Scotland) is on the prime meridian (zero degrees longitude) and it is from this point that time around the world is calculated. We shall go into world time zones in a later chapter, but let it suffice for the present to say that GMT is used and recognized in every country of the world and we shall use GMT in this book.

BCB, CW, ID, IS, AND IRC

Other abbreviations that you may find from time to time include BCB, CW, ID, IS, and IRC. Let's decipher these for you briefly. The term BCB is the standard 540-1600 kHz broadcast band that is included in virtually every radio receiver built. It is on this band that you will find your favorite local station.

The term CW stands for "continuous wave," which is another lesser known way of expressing Morse code. A station that operates exclusively with dots and dashes is a Morse station, or a CW station.

The term ID is the abbreviation meaning "identify" or "identification," as, for example: the ID of my ham radio station is W2PNA.

The letters IS mean "interval signal." This is a common signal, used almost entirely by the shortwave broadcast stations, with no two alike, that enables a person who is trying to hear a specific station to more easily find the station in the crowded shortwave bands. The IS is generally given for upwards of a few moments before an actual scheduled transmission is to take place, thus allowing the listener to zero in on that particular station.

An example or two: A South African shortwave station has a sometimes lengthy IS that precedes the beginning of each of their scheduled transmissions to North America. This particular IS consists of the call of the Bokmakierie bird accompanied by the first several bars of the tune "Ver in die Wereld Kitty" played on a guitar. Once you hear this beautiful and almost haunting melody, you'll always recognize it as the IS of Radio RSA in Johannesburg. The Vatican City stations have as an IS the carillon melody "Christus Vincit" on the celeste with accompaniment from an orchestra. Radio Australia employs an IS, also on the celeste, of the tune "Waltzing Matilda," while the foreign service of Radio Belgrade, Yugoslavia, has the first few bars of the "Internationale." From the other side of the world, the Cook Islands station features native Cook Island drum beats as their IS; Radio New Zealand has the call of the New Zealand bellbird every few seconds; Radio Peking, China, uses the first 19 notes from "The East Is Red" followed by the entire tune. If you tune in to the shortwave broadcast bands and hear what seems to be a tune, a bird call, or some unusual sounding drum beats repeated over and over for several minutes, stay tuned for you'll probably shortly hear an announcement (perhaps in English and perhaps not) of the opening transmission from a specific station.

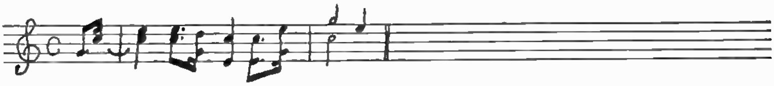
Numerous countries in Central and South America have more private, commercial stations on the air than they have government stations; thus, interval signals will not be heard in nearly the abundance as is the case with European, African, and Asian stations.

Another term commonly used among SWLs is IRC. It stands for international reply coupon, a post office currency that is recognized and used by all countries that belong to the International Postal Union. When sending reception reports to foreign stations, you should send return postage as a matter of courtesy, but when you send your own postage stamps to a foreign country they cannot use them, of course. So you hop over to your friendly local post office and purchase whatever quantity of IRCs that you want (at the time of writing they were 15 cents each) and send one or two with your report. The station in the foreign country that receives them can, in turn, redeem them at its own local post office for whatever amount of postage is required for a surface-mail one-ounce letter. We have more on IRCs and postage in a latter chapter.

Q SIGNALS

A wide variety of "Q" signals are in use both in ham radio and the SWL hobby. These Q signals are universally used and recognized regardless of the language of any given country. A few samples would include the following: QRM means interference from another station or a man-made source; QRN means interference from lightning static or atmospheric noises; QRA and QTH both stand for address or location, but QRA is generally used to indicate a city location, while QTH is more often used to indicate a specific street address, an RFD or post office box address; QSA means signal strength; QRK means signal quality; QRT means to sign off or close down, and QSB represents the signal for fading.

One of the most widely used Q signals in the SWL and DX field is QSL. A QSL is the reply that you receive from a radio station after you have submitted a reception report to them and they have found it to be correct.



Radio Sofia, Bulgaria, uses a portion of the "Youth March," played on an organola, as an IS.

Part of an old Finnish folk melody is used by Radio Finland, Helsinki.

The IS of the Swiss Broadcasting Corporation, Berne, is the tune "Luegid vo Barg und Tal," a traditional Swiss-German folk song, played on a music box.

Fig. 2-1. Interval signals such as these serve to identify foreign broadcast stations.

The QSL can be in card or letter form and some DXers have very large and extensive collections of QSLs from stations in all corners of the world. Some collections are valued so highly that the owners keep them securely protected in a safe deposit box. At any given hobby convention, picnic, or outing there will always be some members or friends present with their collections of QSL cards and letters for others to gaze at and

The first bars of the National Anthem, played on the guitar, is the IS of the Ghana Broadcasting Corporation, Accra.

The IS of the shortwave outlet from Tehran, Iran, is an Iranian melody played on a vibraphone.

Radio Amman, Jordan, has this clarinet and piano IS.

Radio Lebanon, Beirut, has, as their IS, the guitar rendition of the opening notes of the Lebanese National Anthem.

drool over. Some hobbyists, myself included, would rather have a bonafide QSL from that elusive station in the Falkland Islands than a brand new receiver.

ABBREVIATIONS

You will also hear a number of abbreviations on the air that are used by shortwave broadcast stations to indicate their ownership or affiliation.

If you should hear an announcer say, with a British or Oxford accent, "This is the news from the ABC," you would know that you were listening to the ABC, the Australian Broadcasting Corporation. The Armed Forces Network is AFN and AFRTS is the Armed Forces Radio and Television Service. The BBC is, of course, the British Broadcasting Corporation; BFBS stands for British Forces Broadcasting Service; CBC is the Canadian Broadcasting Corporation; AIR is All-India Radio. Others that you may hear in tuning include: NHK for Nippon Hoso Kyokai in Tokyo, Japan; ORTF, which is the Office de Radiodiffusion-Television Francaise (France and her possessions); RAI for Radiotelevisione Italiana (Italy); RFE for Radio Free Europe; RRI for Radio Republik Indonesia; SABC for South African Broadcasting Corporation, and VOA for Voice of America.

EQUIPMENT TERMS

Before we move away from terminology and into another subject, let me point out that something that you listen with is a receiver, not a common ordinary radio. The transmitting version is a transmitter, or rig. Where you do your listening is, in polite terms, referred to as a listening post. More often than not it is more familiarly known as a shack. The person doing the listening, in addition to being an SWL or a DXer, is the operator. Headphones are better known as earphones. Last but not least, the wire outside of your house that brings in the signals is an antenna, not an aerial. A more comprehensive list of abbreviations used in the SWL hobby will be found in the Appendix.

Chapter 3

Radio Receivers

In Chapter 1, I briefly mentioned radio receivers. In this chapter I will go into greater detail on receivers ranging from the "oldies" and second-hand receivers to portables, and finally, to the receivers that are used by many of the active DXers. Those in the latter category are usually referred to as "communications receivers" and can run, pricewise, almost as high as anyone would want to pay. It might be well to mention here that, as with virtually any product or service, what you get is commensurate with what you pay. An SWL with a low-priced receiver will learn that, for the most part, he will not be able to receive distant signals with the same sharpness or signal strength as his brother hobbyist who has a high-priced receiver. The expensive units have additional circuits, more tubes or transistors, more refinements, and better overall performance than their lesser-priced relatives.

This is not to make the reader reach the conclusion that I am pushing the high-priced sets; I simply mention this to make you aware of the situation as it exists. In fact, quite to the contrary, a fellow who possesses a low-priced receiver with a really good, efficient antenna, may well be able to give the guy with a more valuable receiver a good run for his money because he can take advantage of the always changing atmospheric and propagation conditions. I know of one fine gentleman, who, a few years ago, purchased one of the best communications receivers on the market at the time. But a lot of good it did him, at least at first. When I paid him a visit a couple of months later, he had not yet even learned how to turn the thing on! I assume that he has since been able to learn the fundamentals of operating his receiver, since some of the reports that he has been turning in to his favorite club bulletin would indicate that he is going strong.

Another point to keep in mind, too, is that no matter how fine a receiver you have, and how good an antenna you have, you may still have the misfortune of being unable to hear some of those rare and exotic stations. Goodly numbers of my club bulletin reporters continually submit loggings of some of the harder-to-hear stations such as All-India Radio, Indonesia, Formosa, Tahiti, Afghanistan, and Nepal. And they obviously do it with relative ease. But with all of my so-called experience and dubious wisdom, and a fairly good lineup of equipment, in my nearly 40 years of shortwave listening I have yet to hear the French station in Papeete, Tahiti. Nor have I ever had the good luck to hear Nepal or Afghanistan. Yet, when the first Russian Sputnik was circling the globe every hour and a half or so, it was easy to tune it in. And more than once, with my miserable little 25-watt ham radio transmitter, I have worked two-way contacts with fellow hams in Norway, Sweden, and Germany. It has been suggested, with tongue in cheek (I hope), by one of my hobby associates, that in order to finally hear and log Tahiti, I should perhaps complete the writing of this book, then buy a copy and learn how to DX all over again. A good point, perhaps.

OLD RADIO RECEIVERS

Before console television receivers became available, the chief entertainment in the average home was that provided by the console radio receiver. Every home had at least one and those fortunate enough to have two or more might well have classified themselves as being very well to do. These old sets had, for the most part, large cabinets, lots of tubes, and the capability to tune to at least one band of shortwave frequencies. One old-time set that is still in the family archives had a dozen tubes in it—with 11 of them identical!

Some of the old sets were battery-powered, but not with the kind of batteries that we use in our present-day transistor sets. These old sets used regular automotive-type wet-cell storage batteries that had to be recharged after nearly every use.

The old sets ranged in size from an armload to some of two-man size, but a good bit of the interior was no more than emptiness plus a chassis that, in relationship to the size of the cabinet, was often laughable. There were table model units and floor model units; they were equipped with, in addition to the radio itself, a record player (more than likely called a "Victrola"), with some space for the storage of the old 78 rpm records, and perhaps folding doors that, when closed, made the unit appear to be more of a fancy storage cabinet than what it was.

But don't snicker too loudly when you read this, friend, because many of the old sets, with their now outmoded tubes and simple circuits, could often give very good accounts of themselves. It was on one of these old sets, as detailed in Chapter 1, that I heard that station in Seattle and which I haven't heard since with all of my modern-circuited receivers.

Of course, in fairness, it should be mentioned that in the days of old, a radio receiver simply didn't have to work nearly as hard for the distant stations to be heard, because 30 years ago there were only a relative handful of "local" broadcasting stations as compared with a 1974 total of just over 4300; therefore, station interference was next to nothing in those days. On a reasonably clear channel, with fair to good atmospheric conditions, distant stations on the local broadcast band could be heard with relative ease. Today, nearly every American broadcast channel, with the exception of a few scattered "clear-channel" frequencies, has upwards of several to dozens of stations operating on the same frequency. The large majority of them are "local" stations with less than one thousand watts of power, or "regional" stations with 1000 or 5000 watts of power. These stations are not on the air for the purpose of serving other than local or regional areas; but, nevertheless, many of them operating on any one frequency provide plenty of interference for the listener who is trying to hear one of the distant stations. In today's society, it is a real challenge for a listener on one coast to hear a station on the other coast, even on the clear-channel frequencies, for under good conditions, local broadcasting stations in Latin America and even in South American areas and Europe may be heard. And yet, DXing on the broadcast band is still being done by more DXers than ever.

If you have one of those old radio receivers in your attic or if you know where you can obtain one that you know is in at least some kind of working order, by all means get it. You may find that it will still give an amazing amount of good to excellent reception and, for sure, it'll fill in the hours until you're able to purchase a more sophisticated piece of equipment. Some of the better known manufacturers of the old sets include Zenith, RCA, Magnavox, and Atwater-Kent, as well as others. None of these sets were equipped with a bfo (beat-frequency oscillator, a gadget that enables you to tune in code stations), but some did have a "wide-sharp" type of selectivity control. One of the very few commercial receivers ever to find itself in a console cabinet was Hammarlund's Super Pro (Models SP-110X and SP-120X). It was available in the late 1930s.

Probably the biggest disadvantage of having one of these older sets is that tubes for them are hard to obtain unless you happen to be friends with a ham radio operator who has an accumulation of junk. Specialized parts are almost impossible to get. Modern-day tubes can be made to work in these sets, but new tube sockets and some rearranging of circuit wiring must be done in order to accommodate them.

Most of the old sets had an rf stage (one of the amplifier circuits) and their sensitivity was usually better than that of an ordinary table radio. Many sets had a large loop antenna inside the cabinet for the standard broadcast band, but if any given set also had a shortwave band on it, a long outside antenna was a must and binding post connection terminals were usually provided for that purpose.

I would like to recall a scene of many years ago before electrically operated radios came into being. One of our neighbors had the good fortune of being first in the neighborhood with a radio, even if it was a wet-cell battery-powered affair. It had no loudspeaker, so headphones were required. My parents used to tell me, when I was a youngster, how different folks from the area were invited each evening into the home of the "people with the radio set." Each one would take turns listening on the headphones to the melodies from the huge pipe organ in the Wanamaker store in Philadelphia. The station, and for all I know it may have been the first in the area, was WOO. In the years that have passed, the Wanamaker station was phased out and the call letters assigned to one of the many radiotelephone stations that handle commercial traffic on the East Coast. I'm told, however, that the department store and the beautiful pipe organ are still there.

BUYING A USED RECEIVER

If the price of a new receiver with the features you want is too high, you should consider the purchase of a good second-hand receiver. When properly maintained, a good receiver will suffer little deterioration in performance over a very long time. Most people sell their receivers because they are moving up to more expensive equipment. A good receiver can give over 20 years of service if properly cared for. Some

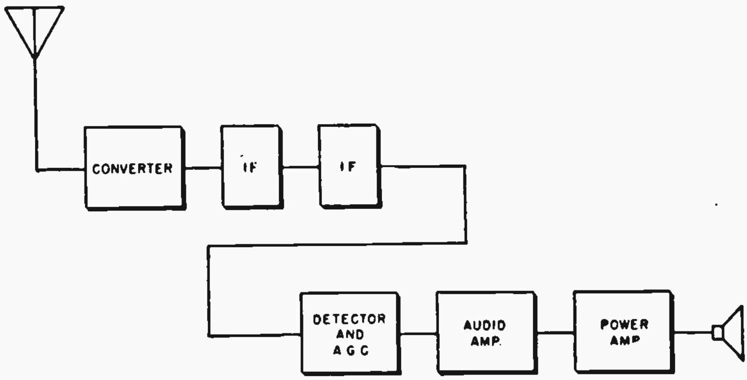


Fig. 3-1. Block diagram of a simple BCB table radio.

receivers made in the 1930s are still in use by many DXers and give good performance in spite of their age. A receiver that is 10 to 15 years old can often be obtained for the same price as a new unit that is only one third the size from the standpoint of the number of circuits. The older set will have come down in price, of course, due to its age.

Two general types of sets are available—the general coverage and the ham bands receivers. The first type usually covers the frequency range of 540 kHz to 30 MHz, using anywhere from four to seven tuning ranges, or in many smaller segments in the PTO receiver. (The abbreviation PTO stands for permeability tuned oscillator. It is tuned by moving a powdered iron slug in and out of a coil. The coil, slug, and drive gear are manufactured to very precise standards and the PTO itself tunes only a small band of frequencies of 200 kHz, 500 kHz, or 1000 kHz width, depending on the manufacturer.) The latter type covers only the amateur radio bands, usually 160, 80, 40, 20, 15, and 10 meters, which include the frequencies of 1800-2000, 3500-4000, and 7000-7300 kHz, and 14 -14.35, 21 -21.45, and 28 -29.7 MHz, respectively. If you listen only to amateurs, this is fine, but you will be unable to get any of the shortwave broadcast stations other than those which operate within the ham band frequencies or on the extreme edges of those ranges. To get international broadcasts in any quantity, you will need a general coverage receiver.

Since most of the older receivers use tubes in their circuitry, the number of tubes in a set can be a rough guide to the beginner as to the performance capability of any given receiver.

The small receivers usually have from four to six tubes. Medium-sized receivers have around 10 tubes and sold originally, when new, within the price range of about $170 to $300. The deluxe receivers usually have 12 tubes or more and sold from $350 or more when new. See Figs. 3-1 through 3-4. Remember, when we talk of the size of a receiver, we are speaking about the amount of features and circuits, not necessarily about cabinet dimensions.

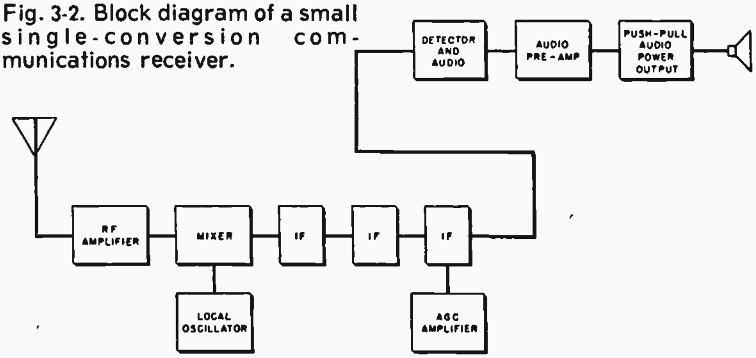
When you have decided how much to spend on a second-hand receiver, there are two main sources of supply. The available amateur radio magazines (QST, CQ, and 73 for example) have classified ads in their back pages containing many pieces of equipment for sale. The best way is to locate a dealer in new and used equipment. The larger stores often have many rows of equipment on display. Look over the receivers that are within the price range that you have in mind and pick out one or two that appear to be in good condition. A good-looking set often had an original owner that took good care of his equipment. Check the tuning controls to assure that none of them are "frozen" and make sure that there is not too much play in the dial drive linkage. Ask if you may try out the receiver. Many dealers will let you purchase a set and take it home for a 10-day trial period, while some shops have partitioned "quiet rooms" where you can give the set a good workout. These quiet rooms usually have regular antenna and ground connections so that any receiver can be given a fairly honest tryout. If you are not satisfied, they simply refund your money in full or, if you wish, put it toward another receiver.

As far as brands are concerned, any well known manufacturer will do. Three of the older companies who have made excellent receivers are Hammarlund (founded 1910), National (founded 1914), and Hallicrafters. It is possible to ascertain the manufacturer of a receiver simply by looking at its model number. The prefix before the number is almost always the same. Two additional companies that specialize in PTO receivers are Collins Radio and the R. L. Drake Company.

For those who feel that you are somewhat mechanically minded with a wee bit of scientific know-how thrown in, you might enjoy making your own receiver. The Heath Company of Benton Harbor, Michigan, makes a number of receivers and other pieces of electronic equipment in kit form. Several years ago I had the pleasure of visiting this company, with my son, James. We went in, unannounced, during their off season for tourists and visitors. At the time, however, I was still writing a shortwave column for one of the large electronic hobby publications and it was on the basis of this that we stopped at their large and beautiful plant. We were shown every possible courtesy and given a complete tour of their manufacturing facilities. Before leaving, my son was the owner of a brand new GR-54 receiver, in kit form, as a gift from his parents.

Together, we spent a few hours on several evenings constructing the kit, although Jim did all of the work involved, from mounting the parts to

Fig. 3-2. Block diagram of a small single-conversion communications receiver.



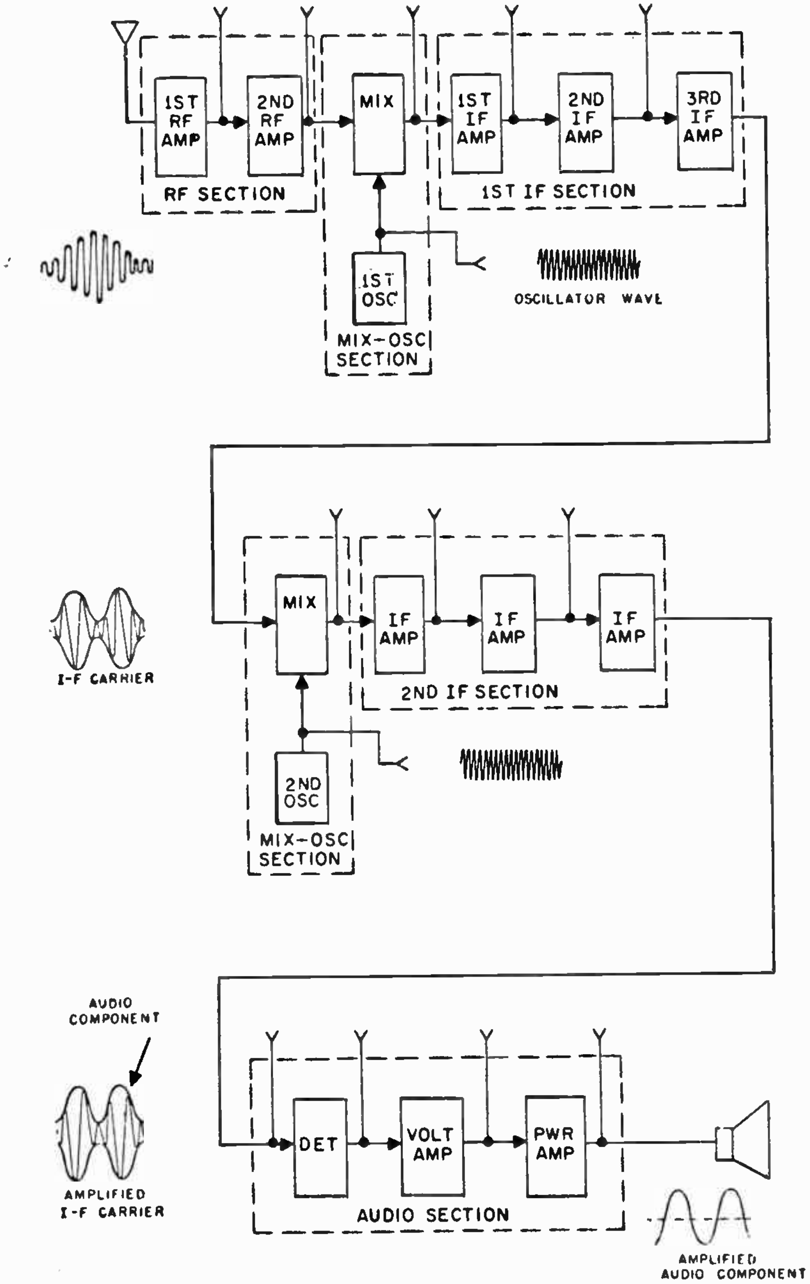


Fig. 3-3. Block diagram of a large dual-conversion receiver typical of those made in the 1950s.

soldering and wiring. His only difficulty (and mine!) was with the completion of the dial cable assembly and, admittedly, amidst frustration, we had to seek help from one of Heath's local factory outlets. (I've since been told by some of my more technically minded friends that if I had read the directions correctly, it would have been a simple matter.) I might add, though, that the kit contained all of the parts that the manual said should be there (plus a few extra nuts and bolts) and the directions themselves were in plain language with picture diagrams that obviously were written for a newcomer to the hobby. A good receiver was built and it runs rings around some of my more expensive but older equipment.

The R. L. Drake Company also has two receivers; one is a tube-transistor combination and the other an all-solid-state receiver with more operating features; the latter is, of course, more expensive.

Old military receivers are available in surplus stores from time to time. But beware—their condition can range anywhere from excellent to deplorable, and it is wise to give one a thorough checkover before you purchase it.

Listed below are medium-sized and larger receivers which can be found in second-hand stores today. All of these sets were made after 1935, all are general coverage receivers, and almost all of them have ten or more tubes.

Late 1930s: Hammarlund HQ-120X, SP-110X; National NC-100, HRO Senior.

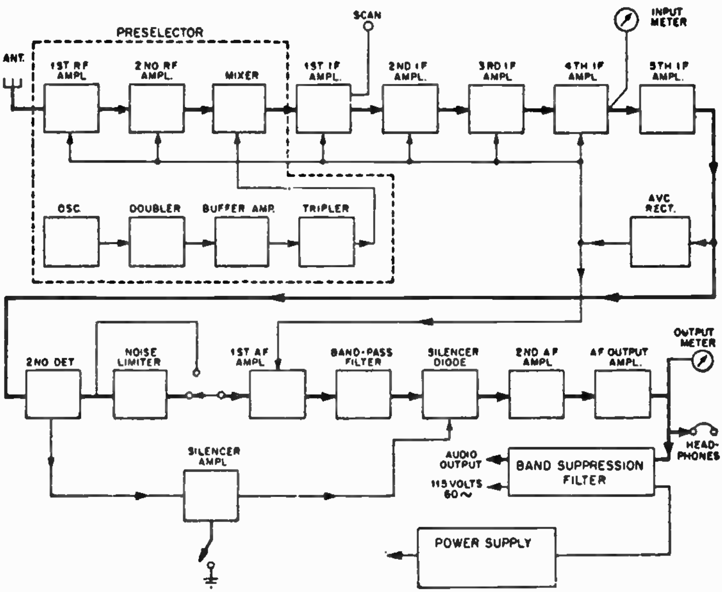


Fig. 3-4. Block diagram of a current typical PTO receiver.

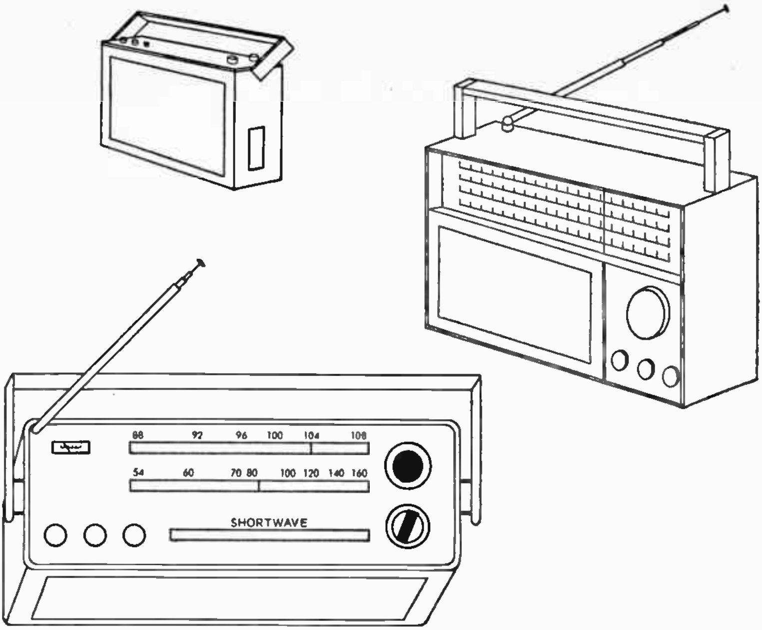


Fig. 3-5. Multiband portable receivers come in a variety of sizes.

1940s: Hallicrafters SX-28, SX-42; National NC-183, NC-200, NC-240D, HRO-5, HRO-7; Hammarlund HQ-129X, SP-400X; Collins 51-J.

1950s: Hallicrafters SX-62A, SX-62B, S-85, S-86, SX-88, SX-96, SX-99, SX-100; Hammarlund HQ-140Z, HQ-140XA, HQ-150, HQ-160, SP-600 series; National NC-125, NC-183D, HRO-50T1, HRO-60; Collins 51-J3, 51-J4, R390 series.

1960s: Hallicrafters SX-100, SX-110, SX-122A, SX-130, SX-133; National NC-105, NC-121, NC-140, NC-190, NC-400, HRO-60, HRO-500 (note: the HRO-500 is an all-solid-state receiver); Hammarlund HQ-100A, HQ-145A, HQ-145X, HQ-180A, SP-600 series; Collins 51-S1.

Receivers available as of 1970-1972 are: Radio Shack DX-150A; Hallicrafters S-120A, SX-122A, SX-133; Hammarlund HQ-180A, HQ-200, SP-600; Drake SPR-4, SW4-A, DSR-1, MSR-1; Collins 51-S1.

All of the above are designed for SWL or general coverage use. Most of the Hallicrafters receivers having an X in the type number indicate that the unit has a built-in crystal oscillator.

PORTABLE RECEIVERS

Portable receivers come in all shapes and sizes ranging from shirt-pocket size to 25-pound heavyweights costing several hundred dollars. See Fig. 3-5. Using a very small portable for DXing can be somewhat frustrating, because the dial calibrations are often woefully inadequate for an approximate frequency determination.

For best results, a medium to large portable would be fine for DXing. The larger set usually has a larger calibrated dial and it is easier to approximate an unknown station's frequency with them.

For DXing the BCB or FM bands, an AM-FM portable would be most suitable. Medium-sized sets of this type can be obtained for around $35 and up. Sometimes a discontinued model will go on sale and can be obtained at a reduced rate. The AM-FM sets go up to about $150 in price. More expensive sets are physically larger to accommodate a big speaker for superior tonal quality and music reproduction. These receivers, as a rule, are also more sensitive and selective and are better calibrated than their lower-priced counterparts.

For DXing shortwave or public service bands, there are vast numbers of sets on the market. They range in price from $25 to $800 and have from 2 to 23 bands. For the beginner, the low-priced set will be fine for a start. If the set has only one band of shortwave, it usually will be somewhere between 4 and 20 MHz. Six major international broadcast bands are included within this range (6000-6500, 7000-7500 kHz, and 9.5-10, 11.5-12, 15-15.5, and 17.5-18 MHz) and will provide plenty of listening.

The one big disadvantage is that if all this were on one band, individual stations would be almost impossible to tune in unless some sort of hit-and-miss method were used. This is where you will start looking for a larger set. For a small increase in price, some portable sets have a fine-tuning control that allows smooth tuning through a small range of frequencies. This is roughly similar to the bandspread control that is described further on in this chapter.

The next step is the multiband portable. Here, the shortwave range is broken up into several bands. The stations are farther apart on the dial and much easier to tune. In the deluxe sets, each band may be devoted to one and only one range of frequencies for the international broadcast stations. Such receivers include the Zenith Transoceanic Models R-3000-Y and R-7000-Y, Sony CRF-160 and CRF-230, Nordmende Globetraveler Models III, IV, and PRO, and Panasonic RF 5000. These receivers start at about $50 and go up to $800. They have performance features that can approach communications receiver quality, especially the more expensive ones. Some models, notably the Nordmende PRO, Zenith R-7000-Y, and Sony CRF-230, have a bfo for single sideband and code reception. They also have better image rejection than less expensive portables. Some of these sets use dual conversion on the shortwave bands and images present little trouble to reception. Another advantage is that these big portables have large speakers in them that produce superior tone and musical quality.

For these portables to operate at their peak performance, large currents must be drawn from their batteries. Almost all of the sets mentioned use from five to ten D cells to supply power to the circuitry. The powerful audio amplifiers used to drive the big speakers can draw currents that can drag down battery performance. For that reason the ordinary zinc-carbon cells in any store will not be suitable if the set is to be used a great deal on its batteries.

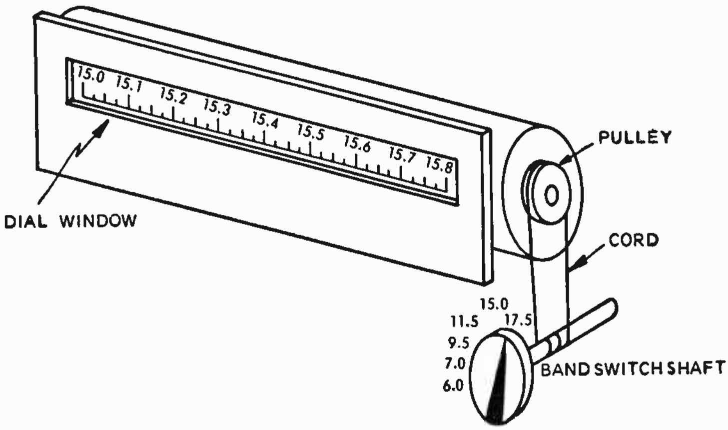


Fig. 3-6. Drawing of a rotary-drum slide-rule dial. The bandswitch changes dial scales. This type of dial is widely used in deluxe portable shortwave receivers and communications receivers.

Special batteries, called "alkaline" batteries, are designed to supply large currents for long periods of time and should be used in these sets, because they will hold up better and be less expensive in the long run. Alkaline cells are available in sizes AAA, AA, N, C, AND D.

Rechargeable "nickel-cadmium" D cells are also available. They are very expensive and operate at a somewhat lower voltage, but can be recharged over 150 times.

Mercury D cells are also available, but they are so expensive that a set of ten cells would cost $50, and they are not rechargeable. They are used mostly in electronic instruments and last about half again as long as a comparable size alkaline cell; however, they do not work well at low temperatures.

If you plan to use your portable inside the house all of the time with the ac cord plugged into a wall outlet, take the batteries out of the set. Batteries may leak as they age while unused, especially if they have been exhausted by previous use. Leaking batteries can destroy a set if left inside it too long.

Even though your portable has a handle on it, don't bang it around. Such abuse may knock it out of adjustment or actually damage it. Some of the very expensive sets use real wood for the cabinets and should be cared for accordingly. Don't let the portable get wet and don't permit sand or dirt to get into it. Treat it with care and it will give you much listening pleasure.

COMMUNICATIONS RECEIVERS

Communications receivers are designed with performance in mind. They have the appearance, usually, of a piece of equipment built within a steel cabinet, often with modified square corners, as opposed to general home-use receivers, which come in any number of shapes and styles. Communications receivers start at about $75 in price and go on up to many thousands of dollars. The more expensive the receiver the better the performance.

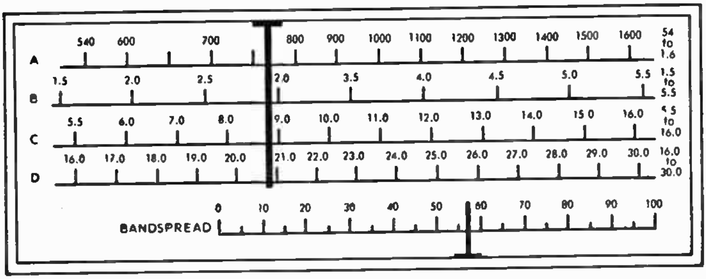


Fig. 3-7. This slide-rule dial is found on the typical four-band small receiver.

Several styles of dial calibrations are available. Popular in the low-priced field is the slide-rule dial with a vertically mounted pointer moving sideways across it. See Figs. 3-6 and 3-7. Since a well calibrated dial of this type takes up a great deal of front panel space, circular dials are used when more room is required for additional controls. These dials usually have a stationary pointer, mounted vertically or horizontally, and the round dial with its calibrations move behind it. The more expensive receivers usually use round dials of this type.

The "digital readout" dial is found in the very expensive, super deluxe receivers. The two most popular are the mechanical and the electrical. The mechanical type has a readout that closely resembles that of a car odometer. See Fig. 3-8. The electrical type uses gas-filled readout tubes, light-emitting diodes, or special filamentary lamps. These receivers can pinpoint a station's frequency to less than 100 Hz (that's one-tenth of one kilohertz!).

Two main types of tuning circuits are used. The conventional superheterodyne, with the variable high-frequency oscillator operating X number of kilohertz above the received station's frequency, has been around since the earliest days of radio. This system is used in the most inexpensive AM table radios to some very expensive communications receivers. The big receivers must have components with good mechanical rigidity and low sensitivity to temperature changes.

The superheterodyne system does not lend itself well to operating at very high frequencies when poor stability is a major consideration. Also,

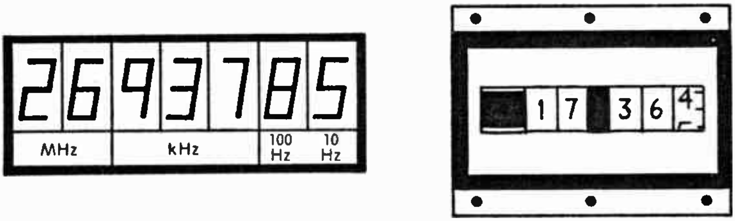


Fig. 3-8. Drawings of electronic and mechanical tuning readouts.

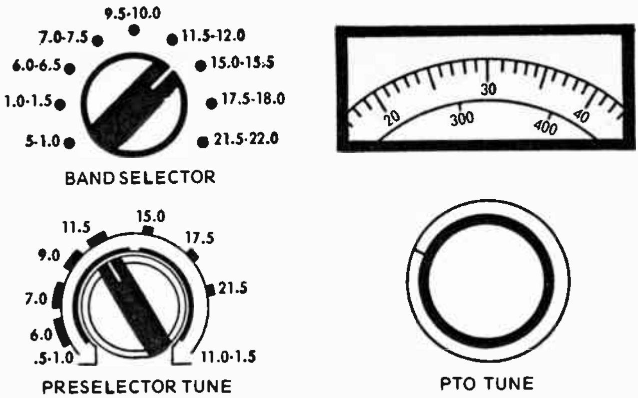


Fig. 3-9. Dial and control settings of a PTO receiver tuned to 11.830 MHz.

there is little tolerance to dirty contacts in band-changing switches and dirty tuning capacitor wiper arms. In good receivers, these troubles have been eliminated to a great extent, but a severe blow or great temperature change will still make them drift off frequency. For this reason, the permeability tuned oscillator (PTO) was developed, as mentioned earlier in this chapter.

The design of the PTO makes for very linear tuning. The dial calibrations are the same distance apart across the entire band being tuned, rather than being crowded together at the top end of the band as is common in conventional receivers. The PTO also provides an extremely accurate dial readout, typically one calibration mark for each kilohertz. See Fig. 3-9. Another big advantage is that the PTO, due to its precise machining, is relatively insensitive to vibration. Many receivers using this tuning system can sustain a drop of a foot or more with no noticeable change in the frequency being tuned. Temperature-compensating devices wired into the associated circuitry around the PTO make thermal drift insignificant or nonexistent.

Since the PTO tunes only one band of frequencies, some means must be made for tuning different bands. The output of the PTO is made to heterodyne with switchable frequency standards within the receiver. These are usually quartz crystals switched into a common oscillator. As an example, suppose the PTO frequency is variable from 5000 to 5500 kHz, the i-f (intermediate frequency) is 4000 kHz, and the band we want to tune is 15 to 15.5 MHz. To do this, we need a signal variable from 19 to 19.5 MHz to produce the required 4000 kHz i-f. Thus, a 24.5 MHz crystal is switched in to heterodyne with the signal from the PTO. When the PTO is tuned to 5500 kHz, a 19 MHz difference is obtained; when it is tuned to 5000 kHz, a 19.5 MHz difference is obtained. This process is called premixing. As the PTO is tuned down, the dial reading of the receiver goes up by the same amount. This combination of the stable PTO and crystal-controlled oscillator provides a rock-stable high-frequency oscillator signal to provide the 4000 kHz i-f. Drift and stability are not much different on the high-frequency bands than from the low-frequency bands. The dial calibrations are the same distance apart regardless of what band of frequencies the listener wants to tune.

The dial on the PTO usually has only one or two sets of numbers. Some have calibrations on the tuning knob itself. If the PTO tunes a 500 kHz range, provisions are made for 500 different dial settings for calibration. A separate switch changes the crystals and rf (radio-frequency) trimmer capacitors for different bands. Since it is usually impractical to gang-tune the PTO and the rf and mixer stages, a separate preselector control is provided to do this job. See Fig. 3-9. The PTO receiver has its price, however. It usually starts at around $300 and goes up, because the PTO itself contributes a good portion to the price of the set.

Going back to conventional receivers, two tuning dials are usually provided—the main tuning and the bandspread. See Fig. 3-10. As the frequency tuned goes up, it becomes increasingly difficult to tune carefully through a narrow band of frequencies, since they are too crowded together. Thus, a bandspread control is provided.

The bandspread is a type of fine-tuning control and is electrically coupled to the main tuning control. Its purpose is to slow down the tuning rate of the receiver when this control is used. It tunes only a small range of frequencies, typically from 5 to 15 percent of the range covered by the main tuning dial. In the better receivers, the bandspread dial is usually the same size as the main tuning control, so the stations are a great deal farther apart on the bandspread dial, thus making the receiver easier to tune. Due to its unusual design, the bandspread control is not needed on the PTO receiver.

Built up around the tuning mechanism just described are the amplifier and mixer circuits. Since receivers have to be sensitive to weak signals, one or two amplifier stages are provided to boost the signal strength from the antenna. Since the tuning range of most receivers is from 540 kHz to 30 MHz, the amplifiers are designed to work well anywhere between these limits. The amplified signal is fed into the mixing circuits where it is converted to the i-f.

The i-f stage is where a great deal can be done to improve reception. Usually, from two to four stages of amplification are used in the i-f system. This is the part of the receiver where most of the set's selectivity is determined. Combinations of coils, capacitors, mechanical filters, or crystal filters are used to select the width of the passband. Controls on the front are provided for determining the amount of selectivity desired. The i-f stages can contribute to a major portion of the cost of a big receiver.

After the i-f stages, the signal is detected and fed into the audio system along with the bfo (beat frequency oscillator) signal. (The bfo signal is switched in when Morse code or single-sideband signals are to be received.) Most receivers have a conventional audio system designed to drive one speaker. Communications receivers are not usually designed to provide large amounts of power or to meet fancy high-fidelity characteristics. In the communications receiver, the high performance of the front end and the i-f system are the major considerations only.

The less expensive a communications receiver, the poorer its performance, as a rule. Unlike ordinary radios and television sets, the buyer does not pay for a fancy cabinet on these receivers. The front on all such

Fig. 3-10. Communications receiver front panel view. Notice the main tuning and bandspread dials.

sets costing over $100 or so is designed to be functional. In the under $70 class, many of the tube-type receivers are nothing more than the standard five-tube superheterodyne circuit with several additional sets of coils and a bandswitch to tune the shortwave bands. They give only marginal performance for the serious listener. Their sensitivity and selectivity are poor, stability is even worse, and high-frequency image rejection nonexistent. The dial seems full of signals because half of them are spurious responses. To make up for their bad performance, these sets often have flamboyantly styled cabinets and advertising to match to trap the unwary buyer. Solid-state receivers in this class are much better in sensitivity, but their image rejection is still rather poor.

For the serious listener, a new receiver costing $150 or more will be adequate on the shortwave bands, but it may not have the sharp selectivity required for DXing the broadcast band. A receiver costing $300 will provide good performance on all bands. Its quality will be better and it will probably hold its alignment better and last longer than the cheaper sets.

Sets costing over $300 will provide excellent to superior performance for the most serious listener. The truly deluxe receivers start at about $500, and the sky is the limit—some sets cost well over a thousand dollars. Most of the PTO receivers are in this class. They come in tube-type, tube-transistor types, and in all-transistor designs. The more expensive receivers have the capability of digging down into the interference and plucking out a weak signal that could not be detected on a less expensive receiver. These large receivers have many controls, some of which are explained here. Some receivers have nearly all of the following controls; the less expensive sets do not have as many.

AF Gain—Another name for volume control. AF means audio frequency.

RF Gain—Radio-frequency gain; it controls the gain of the rf and sometimes the i-f amplifiers of the receiver.

BFO Frequency—This control varies the amount of frequency shift, from one side of the i-f to the other, of the beat-frequency oscillator. The bfo is switched on for Morse code and single-sideband reception.

Selectivity—Varies the i-f bandwidth, wide for best fidelity and narrow for best reception through interference.

Sidebands (upper, lower, both)—This control shifts the receiver's passband above or below the center of the i-f frequency. It is used for tuning single-sideband broadcasts. The "both" position is used for AM reception.

Antenna Trimmer—Usually found on conventional receivers, this control makes up for various loading effects of antennas on the rf stage tuned circuits. The control is tuned for the strongest signal reading.

S Meter—Indicates relative signal strength and also aids in tuning.

Noise Limiter—This control provides some rejection of burst-type static such as lightning discharges.

AVC or AGC—Automatic volume or gain control; it maintains near constant volume with changes in signal strength. It decreases sensitivity on strong signals, but automatically increases it on weak signals. Provisions are usually made to disable this circuit so the operator can vary the rf gain control to regulate the amount of sensitivity desired.

Tuning Range, Bandswitch—The rotary switch for changing bands. A five-band conventional receiver may have the following ranges (as an example): 0.54 to 1.6, 1.6 to 4.0, 4.0 to 10.0, 10.0 to 20.0, and 20.0 to 30.0 MHz. A PTO receiver may have 0.5 to 1.0, 1.0 to 1.5, 6.0 to 6.5, 7.0 to 7.5, 9.5 to 10.0, 11.5 to 12.0, 15.0 to 15.5, and 17.5 to 18.0 MHz ranges. Notice that all the PTO receiver ranges are the same (0.5 MHz), while the conventional receiver ranges are not.

Preselector—Usually found on PTO receivers, this control tunes all the rf and mixer stages, while the separate PTO takes care of the oscillator functions.

Calibrator—This is a separate crystal-controlled oscillator that produces markers throughout the range of the receiver, usually every 100 kHz. They sound like a strong signal with no program material (or modulation) on it. The dial is moved mechanically to coincide with the marker being heard.

T Notch or Slot Filter—This control is used for rejecting a nearby signal that is interfering with the received signal. It is especially effective in eliminating a heterodyne or "squeal" on the desired signal.

Chapter 4

Antennas

A number of years ago when the I was doing a bit of writing for another organization, and receiving many letters from listeners and readers as a result, this interesting question was asked by a young man in one of our large midwestern cities: "I live on the 15th floor of a 13-floor apartment building. My landlord says I cannot have an outside antenna. Do you have any suggestions?"

There was a temptation, to say the least, to answer this fellow in a sarcastic vein, but being in perhaps a bit of a charitable mood, I had to assume that he was in a state of confusion and that he actually lived on the 13th floor of a 15-floor apartment. But it was perplexing if it were true. How would you have answered him?

The subject of antennas can be highly complex. There are so many widely varied types and styles that it would be impossible, within the scope of this handbook, to explain all of them in a satisfactory manner. This chapter deals basically with antennas that can be used for short-wave listening—antennas that are relatively easy to construct and inexpensive. Additional information on antennas that will perform with more efficiency on the standard broadcast band, the amateur radio bands, FM and TV, will be found in the chapters dealing specifically with those phases of the hobby.

For anyone who is seriously interested in obtaining further, more detailed, and certainly more technical information on receiving and transmitting, we recommend **Understanding and Using Radio Communications Receivers** and **How To Be A Ham—Including Latest FCC Rules.**

LONGWIRE ANTENNAS

Probably the simplest outside antenna is a length of wire extended from a window nearest to your radio receiver to a tree, pole, or garage on your property (Fig. 4-1). A length of wire that is anywhere from 35 feet to 100 feet will give very good performance from 2 MHz to 30 MHz. The wire should be heavy enough to support its own weight and the tension exerted upon it, especially during periods of gusty winds. Leaving sufficient slack in the wire will prevent it from snapping apart if the tree support starts to sway in the wind. Number 16 wire (or heavier) is quite strong enough to withstand the elements. The wire need not be insulated, except where the supports come into contact with it. The lead-in, or feeder, wire should be insulated, however.

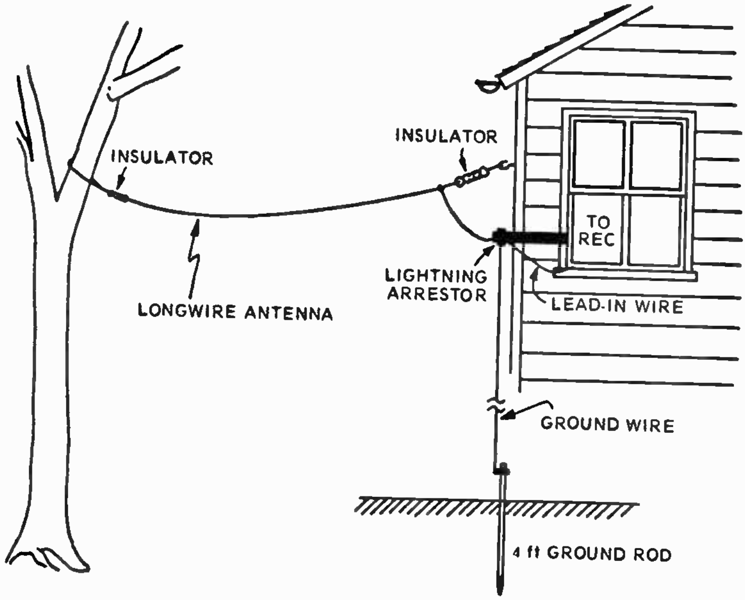


Fig. 4-1. Typical longwire antenna installation.

The generally accepted and best type of antenna wire is solid copper with an enamel or other type of protective coating. This is readily available in any radio parts shop that specializes in amateur radio. Another type that is also readily obtainable is stranded copper wire, and this can generally be found in any hardware store. It has no enamel coating, however, and will suffer deterioration from the elements to the extent that it will turn black in a short time. With both types, it is necessary to scrape off the enamel (on the solid wire) or the corrosion (on the stranded wire after it has been exposed to the elements for any length of time) before any satisfactory and tight connection can be made from the feeder.

As stated above, the antenna wire itself need not be of an insulated type. By that we mean "bell wire" or similar types that have a cloth or stringy-type of covering over the wire. This can be used for the antenna, of course, but it is not the best.

The feeder wire can be "bell wire" or any suitable type of insulated wire. The connection from the feeder to the antenna should be as tight as possible. The best idea, of course, is to solder the two together. Make sure, before soldering, that both wires are bright and clean.

The antenna wire, itself, should not touch the supports on either end. If you use screw eyes as fasteners to your house and a tree, or pole, place a glass or porcelain insulator on both ends so that the antenna wire will be free and clear. Also make sure that the antenna does not touch anything else, either, such as tree branches. You'd be surprised how much unnecessary noise you can pick up in your receiver when a stray branch rubs against your antennas. Needless to say, make sure your antenna is completely in the clear from any nearby power lines.

A lightning arrestor should be installed on every outdoor antenna and a heavy ground wire must be run from the lightning arrestor to a good earth ground contact. Such a ground contact could be a heavy metal pipe or rod driven a minimum of four feet into a spot that is almost perpetually moist. Again, make a good connection from the ground wire to the ground rod. If you can't do a good solder job here, try drilling a hole through the top of the rod and attaching the ground wire with a nut and bolt and plenty of muscle.

A lightning burst relatively nearby can induce considerable voltage into the antenna—a direct hit is not necessary to achieve this. The lightning arrestor will drain the major portion of this electrical charge to ground. Suffice it to say that it is not wise to do any listening during an electrical storm. Additionally, the antenna should be disconnected and the receiver unplugged.

Lightning arrestors are fairly inexpensive and the trouble and problems they can prevent make this item a must. Any radio store will have them, as will many hardware stores.

DIPOLE ANTENNAS

A random-length longwire antenna, such as has been previously described, does not give equal performance on all frequencies. Antennas can be "cut" or made for best operation on an often-used frequency or specific shortwave band. The "dipole" antenna is a good example (Fig. 4-2).The diopole is a wire of a specific length with an insulator on either end. The wire is cut exactly in half and another insulator placed there, giving you, in effect, two half lengths. A two-wire feeder line (Fig. 4-3) is required for this and one of the best is coaxial cable (although we know of DXers who use TV twinlead for a dipole feeder). A 72-ohm coaxial cable provides a good match between a dipole antenna and most communications receivers (usually around 75 ohms).

The overall length for a dipole antenna for any given frequency can be determined by dividing the frequency in megahertz into the figure 468 (or the frequency in kilohertz into the figure 468,000). The resulting answer will be the overall length in feet. In your calculations, if your answer goes beyond an even number of feet into one or two decimal places, keep

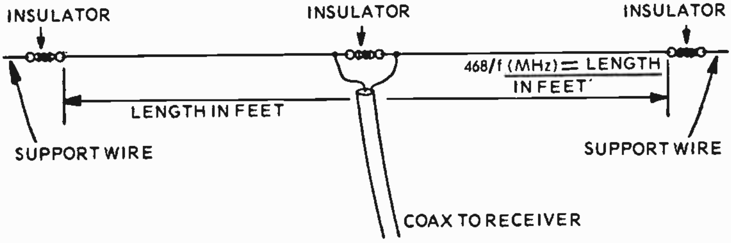


Fig. 4-2. Drawing of a dipole antenna.

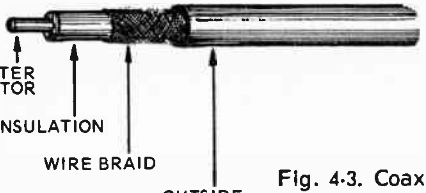


Fig. 4-3. Coaxial cable is used in many cases for dipole antenna feedlines.

in mind that the figures after the decimal are in tenths or hundredths of feet—not in inches. Coaxial cable can be purchased with varying "characteristic impedance" ratings. Always remember to buy 72-ohm cable for direct connection to the center of a simple dipole. Also, you'll probably notice that a dipole is just a bit (5 percent) less than half the wavelength of the frequency you're shooting for. So you can also compute antenna length with the wavelength formula—halving wavelength and deducting 5 percent; but your measurement will be in meters rather than feet.

A dipole antenna will also work well at three times the frequency for which it was made. An antenna cut for the 6 MHz international shortwave band will also work well at 18 MHz, the upper end of the 16 meter international shortwave band.

Dipoles can be made that will operate on several bands by adding "wave traps" at various points along the length of the antenna. These trap dipole antennas are available commercially from at least two companies and are designed with the SWL in mind.

BEAM ANTENNAS

Beam antennas, often used for amateur radio operation, can also be made for the SWL. These antennas can be used with rotators, since their directivity (sensitivity to a signal from a given location) is not the same around a 360-degree radius for the receiving setup (Fig. 4-4). A good beam antenna teamed up with a good receiver is an unbeatable combination for the SWL.

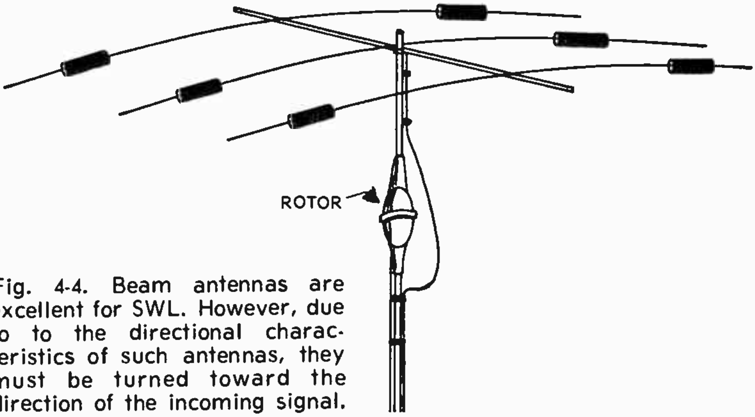


Fig. 4-4. Beam antennas are excellent for SWL. However, due to to the directional characteristics of such antennas, they must be turned toward the direction of the incoming signal.

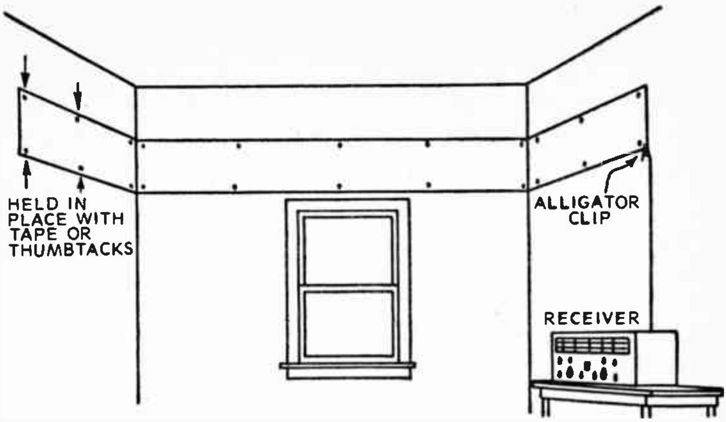


Fig. 4-5. Aluminum foil attached to the walls will serve as a good indoor antenna.

The operator can turn the antenna's rotor so the antenna can be pointed toward an incoming signal for best reception. Since the beam antenna also has more gain than a dipole, signals will appear much stronger at the receiver when a beam is used. The multielement outside color TV antenna works in much the same way; it has gain and must be pointed toward the signal source for best reception.

INDOOR ANTENNAS

For those who live in apartments or school dormitories, it is well known that most landlords take a very dim view of antennas sprouting from the windows of their buildings. Nor, in many cases, will you be permitted to erect an antenna on the roof or from any point of the roof to another nearby object. At least two solutions are available. Put up an outside antenna with very thin wire that cannot be seen from the ground, or put up an antenna indoors. Considerable experimenting should be done with indoor antennas to find one that will give the best performance. Many modern apartment buildings have large sliding windows with metal frames around the perimeters. This metal frame, if not grounded, can make an excellent shortwave receiving antenna. In some buildings, the metal covers over the radiators are not grounded to the plumbing system and one of these can serve as an antenna.

A large expanse of aluminum foil along one or two walls often works very well (Fig. 4-5). Connecting a feeder line to it, however, is not easy, since you cannot satisfactorily solder to aluminum. Either tape the feeder line to the aluminum or attach an alligator clip to the feeder line and then clip it to the aluminum foil. Metal bed frames have also been used for antennas. Some older buildings have attics, and a length of wire can often be strung through the rafters. One must use ingenuity with indoor antennas and experiment until one design is found that gives the best performance.

Chapter 5

Frequencies

The dial on an average, ordinary table model home radio usually tunes to only one band of frequencies—the standard AM broadcast band of 540 to 1600 kHz. This same frequency range is found on virtually all automobile receivers, all transistor pocket-sized sets, and practically every radio made. This is, of course, the frequency band on which you get your local news program, weather, sports, music, and commercials. The average person, whom it is assumed actually knows little or nothing about shortwave listening, tunes to this band almost solely for the purpose of entertainment of one kind or another, or for updated reports on news events and weather conditions.

The average person may often be of the opinion that the only stations that are operating are those which he can hear easily and with no effort. Likely as not, his knowledge of radio listening is confined to a half dozen or so stations that are within his immediate listening range. Beyond that, he may subconsciously assume that there are other stations broadcasting; but, as a local resident, he has no reason to tune them in because they are not local enough, really, to be heard well. Then, too, as in the case of many of our fine farmers, stations outside of the local area are tuned in simply because the local area is not overly saturated with "local" stations. Even at that, his "outside" stations may be nothing more than the big 50 kW stations in the big city nearest to him.

Be that as it may, there are thousands of American standard broadcast band stations on the air that the average person has never heard of and probably never will. But those stations are on the air and you, the newcomer, can hear great numbers of them if you have the time, the desire, and the patience.

STANDARD BROADCAST BAND (540 to 1600 kHz)

The American broadcast band is divided up into channels 10 kHz wide. By this, we mean that one station operating on 1150 kHz, for example, will have no other American station operating any closer in frequency than 1140 or 1160 kHz in the area in which it is located. Thus, when you go to trying your hand at broadcast band DXing, you will have to stay on the exact even frequencies that end in zero.

In other parts of the world, however, the separation between channels are often 9 kHz apart (for example, 818, 827, 836, and 845 kHz). This is particularly true in many European and Asian areas. To the south, stations in many Central American and South American countries generally adhere to the 10 kHz separation, although a number of them do operate on split channels (775, 854, 1307, and 1462 kHz, as examples).

The serious listener, as well as newcomers to the hobby, can actually hear some of these foreign broadcast stations if the listener has a receiver that is sharp enough to cut through the interference. Most average receivers, however, and this includes the millions of small transistor portables, simply do not have sufficient bandwidth (selectivity) or sensitivity to do this, especially in populated areas. Listeners in remote areas, where broadcast stations are few and far between, stand a much better chance of hearing non-American stations during evening hours. One of the easiest stations to hear, especially in eastern and southern states, is the Belize, British Honduras, station on 834 kHz. After dark, reception will often gain the listener a mixture of programing in both Spanish and English. One of the easiest European stations to hear during the night hours is the Rome (Italy) transmitter on 845 kHz (but it won't be nearly as easy for you to tune it in as it is for me to tell you about it). Rome's nighttime program of good music with newscasts on the hour (occasionally in English) is a good bet if you're both a serious listener and a devotee of good music. This broadcast band is discussed in much more detail in a later chapter.

LONGWAVE BAND (Below 500 kHz)

Lower in frequency than the broadcast band is the longwave band that runs from 540 kHz downward to 50 kHz and even lower. This particular band is relatively unknown in North America because of the lack of any of the usual broadcasting stations operating within that range. However, in Europe, Africa, the Mid-East, Asia, and the Pacific areas, the longwave band is full of a number of standard broadcast stations, some of which operate with unusually high power. For example, stations in Brasov, Rumania (155 kHz), Saarlouis, West Germany (180 kHz), and Monte Carlo, Monaco (218 kHz) all operate with 1200 megawatts (that's 1,200,000 watts)! A station in Tipaza, Algeria, on 251 kHz, has an output power of 1500 megawatts. One other, in Urumchi, Sinkiang Province, China, reportedly on 1525 kHz, is said to be broadcasting its foreign service with 2000 megawatts. This latter station has been received by several listeners in wide areas of the United States. There are many other stations, as well, with power ratings that go down to as low as 100 watts and a scattered few with even lower power ratings for strictly local coverage. But there are no longwave broadcasting stations in the Western Hemisphere.

The longwave broadcasters can be heard in the United States, but for the most part it isn't easy. You will need a receiver that covers the frequency range, to start with, and there aren't too many of them around. Then you should have a fairly high longwire antenna. A couple of hundred feet of antenna wire just might be sufficient with good receiving conditions, but if you can get one up that is even longer, all the better. I cannot make any claim as to ever having heard any of the longwave broadcast stations myself, although I did log a number of them when I was with the military in World War II and stationed in France and Germany.

Then, too, there are numerous other services that utilize the longwave band. Probably the most predominant among the various services are the airline beacons. Virtually all of them use a Morse code identification, so if you hear any of the beacons and you don't know the code, you won't be much better off than you were at first. The Morse identifications are usually given quite slow, though, and with a copy of the Morse code at hand, you just might be able to identify some of those beacons.

The coastal stations also operate in the longwave band, but most of the activity is confined to between 400 and 500 kHz. This is nearly all in Morse, too. It's in this range that I monitor during the hurricane season, because the storm reports that are aired from the coastal stations are usually upwards of a couple of hours ahead of the local newscaster.

There are other services operating on longwave, too, and a full resume of activity on this little-known band can be found in the chapter dealing with that phase of the hobby. I might add, before passing, that 500 kHz is one of the international distress frequencies and it is here where you might hear an SOS—again, if you are able to copy Morse code. And in the short space between 500 and 540 kHz, there are several airline beacons operating. I've logged a few of them, all located in southeastern Canada.

SHORTWAVE BANDS (1.6-30 MHz)

The vast areas of frequencies between 1600 kHz and 30 MHz contain a wide variety of services. The two largest users of this frequency space are the international shortwave broadcast stations and amateur radio operators. The frequency ranges covered for ham radio usage are thoroughly outlined and discussed in the chapter on ham radio.

The shortwave bands that are used for broadcasting, either on an international basis or for local service, and a variety of frequencies that are used for other purposes are as follows. In most cases, the frequencies are generally approximate.

1600-2300 kHz

From 1600 kHz to about 2300 kHz, there is very little to be heard during daylight hours. At night, the 160-meter ham radio band may be heard; the LORAN (long range air navigation) stations with their odd sounds that resemble a buzz-saw with problems; a few Central American airline beacons around 1700 kHz; a coastal station or two on Morse, and a few ships in the 2100-2200 kHz on voice might be picked up. The 1610-1750 kHz segment at one time was very heavily used by state police transmitters and 2380 to 2490 kHz by municipal police transmitters, but just about all of them have moved to much higher frequencies.

2300-2500 kHz

The first of the shortwave broadcast bands is generally within the frequency range of about 2300 to 2500 kHz. This is one of several so-called "tropical bands," so named because most of the stations operating within these bands are located in the tropical regions of the earth. It's also known as the 120-meter shortwave band. The newcomer to the hobby likely will find little in this band, even during night hours, because of distances being covered for the frequencies in use, as well as interference from various Morse outlets, not to mention copious quantities of just plain lightning static in the warm months.

3200-3500 kHz

Higher in frequency is another of the tropical bands, this one running from 3200 to near 3500 kHz. Again, it is called a tropical band because of the locations and coverage areas of the stations within this band. This is the 90-meter band. You'll be likely to hear a number of stations in this range on any given evening, barring heavy static. Two of the English-speaking stations that you will most likely encounter are Radio Belize, British Honduras (the shortwave outlet of the station mentioned earlier in this chapter as being on 834 kHz), and Radio Grenada, Windward Islands, both operating at the time of writing on 3300 kHz (although Radio Grenada's nominal frequency is 3280 kHz). Listeners in western and midwestern areas often report hearing any of the numerous Papua and New Guinea stations that operate in this range, with the best bet for reception being around dawn, local time.

3500-4000 kHz

While the 3500-4000 kHz range is assigned to amateur operators in North America, it is a different story in other parts of the world. Given good receiving conditions, you might well hear the BBC from London on either of their two 75-meter frequencies of 3952.5 kHz or 3975 kHz, and the South African stations on 3952, 3965, 3980, or 3997 kHz. Listeners in western areas might also be able to hear Tokyo, Japan on 3925 or 3945 kHz; again, the best times are around dawn, local time. Most of the broadcasting activity is within that portion of the ham voice band from 3900 to 4000 kHz, although there are a scattered few others that are lower in frequency. One of those which is being reported at the time of writing is from Dili, Portuguese Timor, on 3668 kHz. Reception is being reported in western states around 1330 GMT and it is in Portuguese. Another one which is not within the top 10 of the easiest stations to hear, but which does rate as a rare country from the standpoint of radio, is HCVG8 in the Galapagos Islands. On 3520 kHz, reception is being reported from such widespread places as California, Texas, Indiana, and Connecticut. The 3900-4000 kHz band for broadcasting is known as the 75-meter band, while the ham radio designation for the 3500-3800 kHz segment is 80 meters and for 3800 to 3900 kHz as 75 meters.

4000-5100 kHz

Between 4000 kHz and 4700 kHz, there are a few stations here and there, but the next usually recognized shortwave broadcast is the 60-meter band, another of the tropical bands, and this includes frequencies roughly from 4700 kHz to 5100 kHz. Like the other tropical bands, you'll hear a great deal of local foreign language broadcasts, largely Spanish, and not a whole lot of English. If you'd like to try for Radio Australia on this band, listen on 4920 kHz around 1200-1350 GMT. They should be broadcasting a mixture of pop music and local announcements, and it will be in English. This is VLM4, Brisbane, and it's one of their regional outlets.

Coastal Stations

From the standpoint of shortwave frequencies, we have covered from 1600 to 5100 kHz so far. Let's return for a few moments to the area around

2400-2600 kHz. In this particular range, there is a good bit of voice communication taking place in the form of ship-to-shore transmissions. The coastal stations are what you will most likely hear, since many of the ships, which will be harder to hear in many cases, are operating a bit lower in frequency. The coastal stations usually identify as "This is the New York marine operator"; "This is the Nassau marine operator"; and so on.

You will probably hear something that sounds like a busy signal on your telephone. Under normal operating procedure, with the coastal station on one frequency and the ship on another, you will hear only one-half of the transmission, that is, the transmission being made from the coastal station. During the periods when the ship is transmitting, the busy signal is noted. At times, however, it may be noticed that you can actually hear both sides of the conversation.

By the way, in a radiotelephone contact of this type, the ship will call into any of the many coastal stations that dot the coast. The coastal station will accept calls for any telephone number in the country after ascertaining the name and call letters of the ship for billing purposes. Within a few seconds, the call will be handled just as it is when you make a long-distance telephone call. The people that you can hear over the coastal stations may be in any part of the country. Again, at this point, it is well to remind you, as we did in Chapter 1, of the federal laws regarding this type of transmission. There is no law that forbids you to listen to these communications, but there are hard and fast rules that forbid you to repeat or to reveal any portion of those conversations to anyone who is not authorized or entitled to have the information.

Other shipping channels may be found in the 2600 and 2700 kHz range with voice communications from ships on inland waterways.

"Standards" Stations

On 2500 kHz, especially at night, you may hear WWV, the National Bureau of Standards station in Fort Collins, Colorado. They transmit time signals and various other bits of information, and they identify in both Morse and voice. But don't tune for it in the daytime unless you are within a few hundred miles of Fort Collins, because the signal cannot travel that far on that particular frequency.

On 3330 kHz, you may hear a Canadian time station from the Royal Observatory in Ottawa, Ontario. They identify on voice as CHU in English and French, with the time for each minute and time ticks. Further up the dial, you may again hear WWV on 5000 kHz. If conditions are very good, you may also hear any of several other time and standard frequency stations that are operating on 5000 kHz, such as MSF, Teddington, England, LOL, Buenos Aires, Argentina, or WWVH, a sister station of the National Bureau of Standards in Maui, Hawaii. There are others as well. For a complete resume of standard frequency and time stations, please check the chapter that is devoted to them.

5100-6200 kHz

Continuing on up from 5100 kHz, you may find that you'll be hearing shortwave broadcast stations at various places between 5100 kHz and 5900 kHz and, indeed, there are stations in there. But the next recognized international shortwave band is the 49-meter band, and this includes frequencies from about 5900 to 6200 kHz. Within this range, you'll hear a great deal of activity, especially during late afternoons and at night. There isn't too much to be heard here during daylight hours, unless you are within range of several of the Canadian shortwave relay stations that operate on 6005, 6010, 6030, 6070, 6080, and 6130 kHz, among other frequencies. In the 49-meter band you will hear nearly any language that you would want, and if you have no schedules of the shortwave stations, simply check slowly through the band every little while and you're bound to hear some English without much effort.

6200-7100 kHz

Between 6200 kHz and about 7100 kHz, you may again hear some shortwave broadcast stations that are apparently operating outside of the recognized shortwave broadcast bands. This is true, and if you're lucky, you may find yourself listening to some pretty good DX. Peking, China, Pyongyang, North Korea, and other stations in Inner Mongolia, Vietnam, and Pakistan operate in this range.

7100-7300 kHz

The next recognized shortwave broadcast band is the 41-meter band from 7100 kHz to 7300 kHz. Here, as with the 75-meter band, you will find dual usage of these frequencies by American ham operators and foreign broadcast stations, and quite often, especially during dark hours, there is interference aplenty. By international agreement, this sharing of these particular frequencies is permitted, but problems do exist when one ham station is trying to work another one mile away and a broadcast station with 100,000 watts opens up on the same frequency; by the same token, the avid SWL, in trying to monitor one of the shortwave stations, especially those with lesser power, as often as not has to put up with seemingly unending amounts of Morse code or ham stations on voice. Just slightly above the top edge of the 41-meter shortwave band (7300 kHz), there are a few additional shortwave broadcasters to be heard quite well, because of the lack of ham radio QRM. Also, in the midst of all of this is another outlet of Canada's Royal Observatory station CHU on 7333 kHz, with their time signals and once-each-minute voice identifications in French and English.

7400-9000 kHz

From around 7400 kHz on up to 9000 kHz, there are many outlets listed for shortwave broadcast stations, and a majority of them are used for various services from Radio Peking, China. Voice stations from airline terminals and planes may also be heard at times in the 8800 kHz and 8900 kHz areas. Many of the other frequencies in between 7400 kHz and 9000 kHz are utilized by the coastal stations in the ship-to-shore service for long-distance Morse communications. Teletype stations will also be found in this range, along with a few press stations and perhaps a scattering of military tactical stations, all of which are operating in Morse.

9000-9800 kHz

Just above 9000 kHz, on 9009 kHz to be exact, you may hear transmissions from the Tel Aviv, Israel, shortwave broadcast station. A portion of their transmission is in English; look for it around 2030-2115 GMT. It'll be beamed to Europe and Africa, but it's often reported in the United States.

From 9000 kHz to 9500 kHz, there are a few scattered shortwave broadcasters, generally from Tirana, Albania; Peking, China; Madrid, Spain; and London, England.

At this point, the 31-meter shortwave broadcast band enters the picture; it extends from about 9500 kHz to about 9800 kHz. Good for listening and DXing most any time of night, this band also offers many good listening opportunities during daylight hours. Perhaps one of the very easiest stations for newcomers to hear is the well known Voice of the Andes, HCJB, Quito, Ecuador, on 9745 kHz. They have a habit of booming in loud and clear, and well they should, since they have an antenna that is atop the Andes Mountains with 50,000 watts of power going into it.

9800 kHz to 11.7 MHz

From 9800 kHz to 11.7 MHz, there are, again, a good many broadcasting stations that operate outside of the recognized bands. There are several Soviet stations between 9800 and 9850 kHz, stations in Peking between 9860 kHz and 10 MHz, and even the BBC in London has a foreign service outlet on 9915 kHz. On 10 MHz you will again find one or a number of standard frequency and time stations with their incessant time ticks and propagation broadcasts. Hanoi, North Vietnam, has several outlets listed between 10 and 10.21 MHz, with assorted others, such as Peking, Alma-Ata, Moscow, New Delhi, and Djakarta, occupying frequencies between 10.2 MHz and 11.7 MHz.

11.7-12 MHz

The 25-meter shortwave broadcast band begins at 11.7 MHz and runs on up to about 12 MHz. Like the 31-meter band, this is an excellent band for DXing at nearly any time. It is in this band that Radio Tahiti operates on 11.825 MHz, and I wish that I had a logging for this one in my own records! You might have better luck than I. Try for them between 0300-0700 GMT. Most broadcasts are in French and Tahitian, but friends tell me that you'll recognize them by their beautiful South Sea melodies. Tuning in this 25-meter band during evenings, you will undoubtedly hear a lot of powerful signals. Most of them will be originating from Moscow, London, or our own Voice of America, but with careful tuning, you will probably be able to hear Radio RSA in Johannesburg, South Africa, perhaps one of the outlets of ETLF in Addis Ababa, Ethiopia, or Radio Japan.

12-12.5 MHz

More out-of-the-band broadcasts show up between 12 MHz and 12.5 MHz, but none of them is specifically beamed to North America. With their antennas beamed elsewhere, their signals will not be nearly as easy to hear. Most of them are located in the Soviet Union or China.

12-15 MHz

The frequencies between 12 MHz and 15 MHz are used largely by Morse stations for any of a wide variety of communications. Ham radio operations are conducted from 14 to 14.35 MHz, and you will hear voice contacts in a part of this range. Patience and careful tuning here may well net you some good DX, since this is one of the favorite long-distance bands for the hams. If you'd like to set your clock, you might try for the last of CHU's three outlets on 14.67 MHz, WWV on 15 MHz, or perhaps VNG in Melbourne, Australia, on 12 MHz.

15-15.5 MHz

Another international shortwave band opens up for us at about 15 MHz and runs on up to about 15.5 MHz and, again, we have those few stations that operate just outside of the band on both ends. In my opinion, this is perhaps one of the best bands for daytime DXings, and there are a great number of countries to be heard here if you have the time and the patience to dig them out.

Perhaps it should be mentioned that, when tuning any of the shortwave bands, except the tropical bands, the newcomer should not be disheartened if he does not hear anything in English. The majority of foreign broadcasts are of relatively short duration, but they may have a number of transmissions within their specified operating schedule and any one of these could suddenly pop out in English. If you hear a station operating in a language that you do not understand, stick with it for a short time (usually 15 minutes to a half hour). In many cases, the station will give at least an English identification. Radio Denmark, Copenhagen, is a good example of this. On 15.165 MHz, they have over 13 hours of broadcasts daily with no English except for identifications. Radio Tahiti, the one that eluded me for these many years, on 15.17 MHz, has no English either, except for a listed English newscast at 1745 GMT on Wednesday. And that time is not conducive to easy listening for North American Listeners.

15.5-17.9 MHz

The various Morse services again take over in the frequency range of 15.5 to 17.7 MHz. But again, there are a few broadcasters here and there, with perhaps the most widely reported one being Radio Pyongyang, North Korea, on 16.32 MHz.

The 16-meter international broadcast band begins at 17.7 MHz and goes on up to around 17.94 MHz. This band is also good for daytime DXing, but often is seemingly dead at night. Morning DXers might look for Radio Japan on 17.825 MHz or Radio Australia on 17.715 MHz. A good DX catch might also be Radio Bangladesh in Dacca on 17.935 MHz.

21.45-26.05 MHz

There are still two more shortwave broadcast bands at higher frequencies and these are the 13-meter band at 21.45 MHz to 21.75 MHz, and the 11-meter band at 25.6 to 26.05 MHz. Reception on both of these bands is best during daylight hours, but virtually nothing can be heard during the dark hours. Radio Kuwait has been widely reported on 21.605

MHz and Radio Norway has a fairly dependable transmission on 25.73 MHz. The latter has an English program on Sundays that is known as "Norway This Week," and it is one of the best bets for logging that country. Try for it at 1230, 1430, 1630, or 1830 GMT. (Remember, GMT is five hours ahead of eastern standard time, so that would make those times 7:30, 9:30, or 11:30 a.m. or 1:30 p.m., EST).

Above 30 MHz

Above 30 MHz, there are also additional voice transmissions, but most of the communications receivers go little past that frequency and virtually no ordinary home receiver will even come close to it. However, if you have one of the communications receivers that go up to 40 to 45 MHz, you still run a chance of hearing a bit more activity. There are paging stations, for example, at various points between 30 and 45 MHz and most of these are run on a nonstop tape basis with periodic changes for new or additional information.

Under exceptional propagation conditions, the lucky listener might even have the good fortune to tune in the audio portion of British or French television stations. Several years ago, while vacationing in Michigan and, later, back home in New Jersey, I managed to log, for hours on end, the audio channels of the BBC television outlets in Crystal Palace and Divis, both operating on British television channel 1 (41.5 MHz for audio), and Cannes, France, on French television channel 2 (41.25 MHz for audio), and even succeeded in obtaining a fine letter of verification from the Crystal Palace station. Many of the programs noted on the BBC stations, by the way, were reruns of old American serials. Imagine hearing the "Lone Ranger" on 41.5 MHz!

This fairly well rounds out the general resume of activities on various frequencies from longwave to 30 MHz. There are other voice transmissions that can be heard, of course, between the activities on the ham bands and in the 11-meter citizens band; but, for the most part, any other voice transmissions that you hear will be of a more or less unscheduled, irregular basis. Additionally, there are thousands of Morse stations that can be heard at just about any point on your receiver if you can translate the dots and dashes into recognizable words.

Chapter 6

Propagation

In the minds of many radio hobbyists, "propagation" (the science concerned with the effects of natural phenomena upon "wireless" transmissions) is a complex field populated by abstract mathematicians and sophisticated computers. To a certain extent this is true, although the enthusiast with a firm grasp of the general, and not too complicated, fundamentals is in a much better position to receive maximum pleasure and enjoyment from his activity. This chapter, based on an article written by Jack White of Gresham, Oregon, long considered by many in the hobby to be one of the foremost experts on propagation in the United States, is an attempt to introduce the subject by skipping rather lightly over a few of the highlights covered in nearly every high school general science course, and then relate them to radio signal transmission.

HOW RADIO WAVES TRAVEL

The first question which almost always arises is: "How does the signal travel across space without using a wire or some other conductor?" This reaches right to the heart of the matter, with an understanding of the answer being rather important to all that follows. Although it cannot actually be seen by the eye, there is a conductor.

Magnetic Fields

As we are all aware, the earth can be likened to a giant magnet in many respects, with a force field extending thousands of miles outward into space. One of the classic classroom science experiments is to place a sheet of paper sprinkled with iron filings on top of a small magnet and observe the filings as they arrange themselves into a pattern indicating the "lines of magnetic force." (See Fig. 6-1.) If it were possible to do so, a similar experiment involving the earth as the magnet would produce identical results on a much larger scale. It is this force field of the earth that conducts a radio signal from transmitter to receiver.

To set up sort of an illustrative example of how this works, we will use a battery, a small flashlight bulb, some wire, and a pocket compass arranged in a circuit as shown in Fig. 6-2A. The lamp is connected to the battery to provide a uniform flow of current, and the compass is placed at some point a short distance from one of the connecting wires.

Before completing the connections, no electricity will pass through the circuit and the compass needle will point in a northerly direction. Completing the hookup will allow electricity to flow, as indicated by the

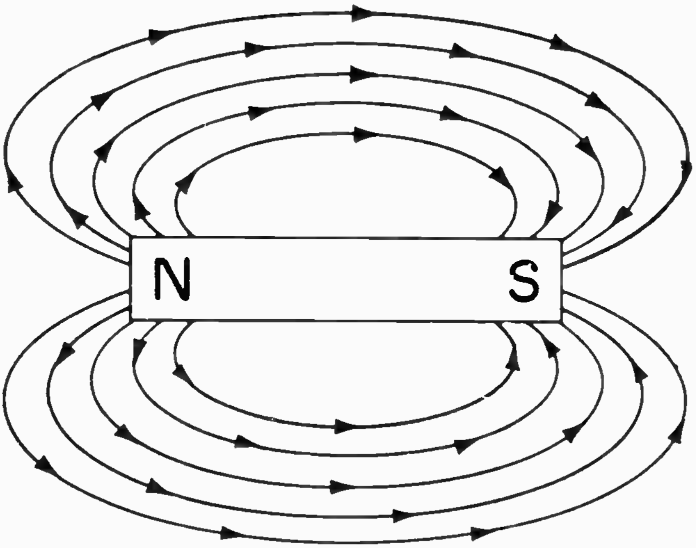


Fig. 6-1. A magnet produces a field of force as shown.

lamp, and the compass needle will turn until it aligns itself with the nearest circuit wire (Fig. 6-2B), thereby indicating that electric energy is also capable of producing a "force field" of its own. If the connections at the battery terminals are reversed (Fig. 6-2C), thereby changing the "polarity" of the circuit, it will be observed that the compass needle will rotate 180 degrees and point in the opposite direction from the arrangement in Fig. 6-2B. From this simple experiment we can conclude that: (1) An electric current produces an unseen force that is capable of "denting" the magnetic field of the earth, and (2) the direction of current flow determines the direction of the "dent."

Proceeding a little further, if the current in the experimental circuit could be caused to change polarity quite rapidly, as would be the case if alternating current were applied in place of the battery (Fig. 6-2D), the compass needle would be observed to vibrate at a point midway between those shown in Fig. 6-2B and 6-2C, since the change of current direction would be too rapid for the needle to cover the entire 180^0 arc each time. The number of vibrations that occurs during a specific time span is called their "frequency," and will exactly coincide with the rate of electrical polarity changes in the circuit.

Earth's Magnetic Field

This is the fundamental behind "electromagnetic" transmissions, or the means by which radio and TV signals are sent across distances without wires. As an electric current is applied in one direction, the earth's magnetic field yields to the electric field until the polarity is reversed; once the current changes direction, the magnetic field begins to regain its strength until the electric field reaches a strength of zero (at the instant that polarity changes). It will then begin to give way in the opposite direction. Thus, an actual energy transfer has taken place through an application of the "action and reaction" principle, and this transferred energy is radiated outward in "waves" from the source in a manner similar to other radiant energies like sound, light, or heat.

Applying this to radio, let's assume the lamp circuit in Fig. 6-2 to be a transmitter, one of the connecting wires an antenna, and the compass needle the antenna of a receiver. Through electronics, sound vibrations are integrated into an alternating current (called the "carrier"). The polarity change, or frequency, of this alternating current or carrier may be many thousands of times per second. As was demonstrated, this current passing through the circuit wire (a transmitting antenna) sets up an electromagnetic field radiating outward until it is picked up by the compass needle (receiving antenna). By almost exactly reversing the transmission process at the receiver, the original sound vibrations are reproduced electronically.

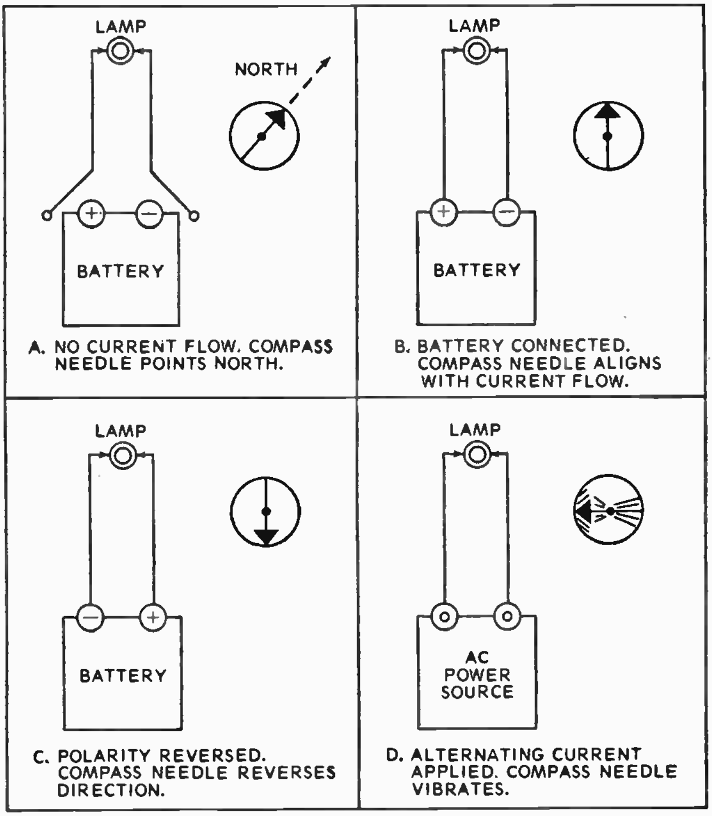


Fig. 6-2. An electric current also produces a magnetic field as indicated by the movement of the compass needle.

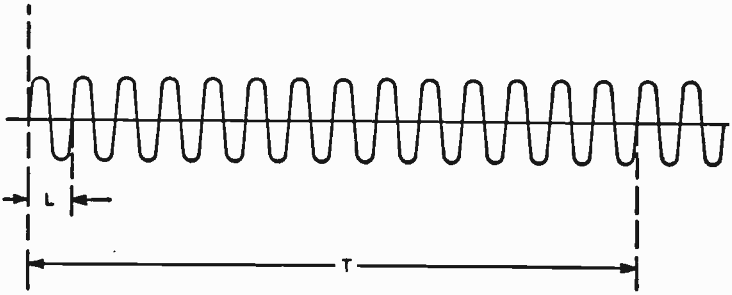


Fig. 6-3. Basic wave dimensions.

FACTORS AFFECTING PROPAGATION

Even considering the foregoing to be an oversimplified explanation, it would seem, then, that the only major factors involved in long-distance radio communication would be the power-producing capability of the transmitter and the sensitivity of the receiver. Unfortunately, there is quite a bit more to it, and much of it relates to another, and much greater, form of radiant energy transfer; but first, a little more about electromagnetic signals is in order.

Electromagnetic Signal Characteristics

The transfer of energy across space is certainly not an uncommon or unique occurrence. Both sound and light are similarly conducted. Actually, there are a great many characteristics that are shared by sound, light, and electromagnetic energy; and, by using the more familiar forms as practical examples, much about radio signals can be uncovered.

All three energy forms result from the generation of vibrations that are transmitted across space—only the speed of the transfer or the "frequency" of the vibrations are different. (In the case of sound, there is also a factor related to media density: complete vacuum, no sound; this is explored more fully a little later.) Traveling normally, the speed of sound is 1100 feet per second, while that of both light and radio signals is 186,000 miles per second. However, it is in the area of "frequency" where

Table 6-1. The Radio Frequency Spectrum.

Frequency Range	Classification	Abbreviation
10 to 30 kilohertz	Very low frequency	VLF
30 to 300 kilohertz	Low frequency (sometimes called "longwave")	LF
300 to 3000 kilohertz	Medium frequency (sometimes called "medium wave")	MF
3 to 30 megahertz	High frequency (often called "shortwave")	HF
30 to 300 megahertz	Very high frequency	VHF
300 to 3000 megahertz	Ultrahigh frequency	UHF
3000 to 30,000 megahertz	Superhigh frequency	SHF

the most important characteristic differences occur for the purpose of this explanation. Figure 6-3 represents a radiated energy wave. The horizontal line is a reference having exactly half the wave above it and half below; the line also indicates the point at which the polarity of an electromagnetic wave changes from positive to negative, and vice versa. Dimension L is the length of one complete "cycle," and the number of cycles (hertz) occurring within a given time unit (T) is the "frequency" of the wave as discussed earlier.

Sound—at least that which is discernible to the human ear—ranges roughly from 15 to 15,000 cycles per second or hertz (abbreviated as Hz). Electromagnetic waves begin around 15 MHz, but extend upward to 10^{18} Hz and higher, whereupon light-wave frequencies are approached. Therefore, in terms of "frequency," radio waves cover the entire spectrum between sound and light. With this relationship established, it follows that electromagnetic transmissions employing frequencies near the lower range display characteristics more related to sound waves, and radio signals in the upper frequency range more closely resemble light emissions. Roughly based upon these changing performance characteristics, which is discussed in detail a little later, the radio-frequency spectrum has been divided into several segments, each having somewhat different propagational or transmission characteristics (Table 6-1).

Again comparing sound and light, let us assume the reader is in one of two adjacent rooms that are both dark and quiet. A person enters the room next door, switches on the light, and slams the door. The reader is fully aware of the sound, but is unable to perceive the light. This means that the sound of the door slamming was actually transmitted through the separating wall, while that same partition also blocked all the light. Applying this to radio signals, it can be seen that the higher the signal frequency, the more nearly the effective distance and area of reception will be limited to a "line-of-sight" path.

Now, let us consider a light passing through a glass prism. As we have seen many times, the light traveling through the prism will be split into a band of colors resembling a rainbow. This is caused by the fact that each color component making up the light beam has a different frequency; therefore, each color is "refracted" at a slightly different angle (Fig. 6-4). From this we learn that energy waves having different frequencies behave differently when encountering the same media.

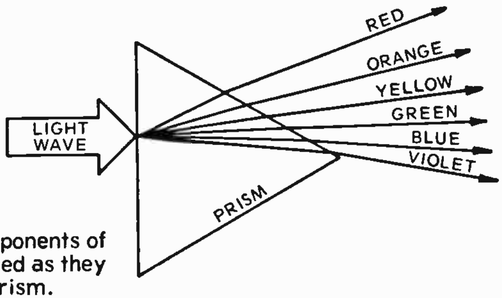


Fig. 6-4. Individual components of a light beam are refracted as they pass through a glass prism.

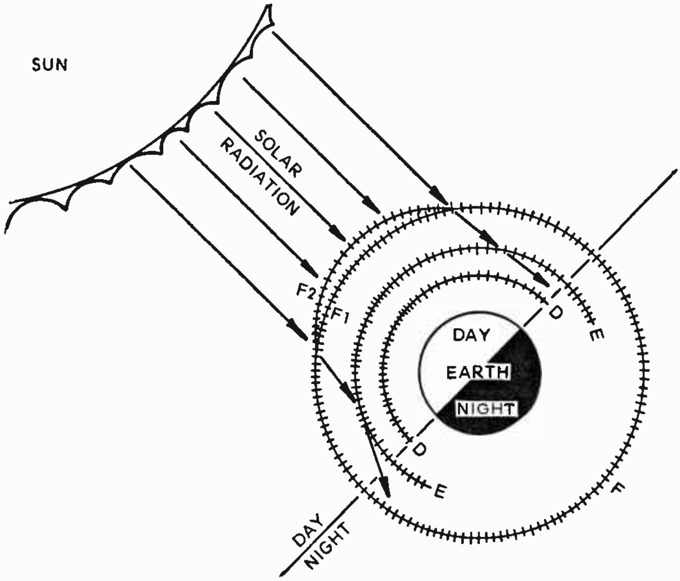


Fig. 6-5. Solar radiation components are refracted in upper atmosphere to form ionospheric layers.

The Atmosphere

Returning again to the earth and its magnetic field, a sort of parallel can be drawn to the example of the prism above. The sun is a source of many varied energy forms, some of which are well above the frequency of light (ultraviolet, X-rays, gamma rays, heat, etc.). The atmospheric blanket surrounding the earth acts very much like the prism of the example by refracting some of the sun's radiation (fortunately only those forms that are more harmful to plant and animal life) away from the earth, while allowing others to pass on through to the surface. Along with this refraction process, some of the sun's radiant energy is trapped in the outer regions of the atmosphere, and this forms another refractive media which affects certain radio signals.

The atmosphere itself is composed of many gases and microscopic solids. As the sun's more active radiation components strike the outer reaches and are refracted elsewhere, a reaction takes place upon these gases and particles, causing, in some cases, what is known as "ionization"—the gain or loss of electrons from the molecular structure of a substance. For this reason, the atmospheric region that is located from roughly 80 to 300 miles above the surface of the earth, where the phenomenon takes place, is called the "ionosphere."

Referring to the example of a prism refracting light waves, we can see that as each different light component passes through the refractive media, the lines of travel become separated and clearly defined. So it is with the ionosphere; each of the sun's various energy rays track somewhat differently, with some being absorbed, which accounts for a "layering" of the region (Fig. 6-5).

At the daily peak of the sun's direct radiation upon a given location, there are normally four ionospheric layers present. These have been assigned the notations of D, E, F_1, and F_2, (there are no A, B, or C layers). As a given point on the earth rotates into the daily darkness period, the solar radiations received are, of course, diminished, leaving usually only a single layer, the F region, remaining at an altitude of roughly 200 miles. Therefore, the concentration and "density" of the ionosphere at a given point within the region is directly proportional to the amount of solar energy applied.

In addition to the 24-hour day-night relationship between earth and sun, we are also aware that seasonal changes take place, which bring more local daylight hours in the summer and less in the winter (most pronounced at the poles and unnoticeable at the equator). This, of course, has a significant bearing upon the composition and activity of the ionosphere at any certain point as the seasons change. However, the net result is not exactly what might be expected. Full daylight ionospheric density is greater during the winter months than in the summer! Considering this to be a somewhat singular exception to a general rule of thumb, it can be assumed that the relative degree of ionospheric density at any hour or season at some given point is determined by the direct action of the sun.

Sunspots

Along with daily and seasonal changes in the earth-sun relationship, there is one more cyclical factor that has a profound effect upon ionospheric composition: sunspots. Actually, there are gigantic eruptions of energy occurring on the surface of the sun. The energy produced by these eruptions is radiated outward. When this radiation strikes the atmosphere, sharply increased ionization takes place, which increases the practical density factor. Although considerable research has been conducted on this particular phenomenon through the years, it has been so far unsuccessful in establishing any concrete pattern for these outbursts, other than a very general daily activity cycle of roughly 11 years.

Sunspots appear to occur completely at random. Dozens may be noted on a particular day, followed by a period of several days when there are barely any at all. However, continued observations have uncovered that while daily occurrences may vary widely, there is a pattern of sorts to the cumulative mean totals over extended periods. Figure 6-6 illustrates the present sunspot cycle, with values beyond mid-1974 being estimated on the basis of statistical probability as determined from previous cycles. During peak years of the sunspot cycle, then, it may be expected that overall ionospheric density values will be increased.

This just about concludes the high-spot tour into the world of science. The time has come to put all of this together and find out how it pertains to the practical world of radio communications. We shall attempt only to fit the pieces in a very general way, because to become involved in specifics would mean crossing over into the aforementioned domain of mathematicians and computers, and the going could get a little sticky to say the least.

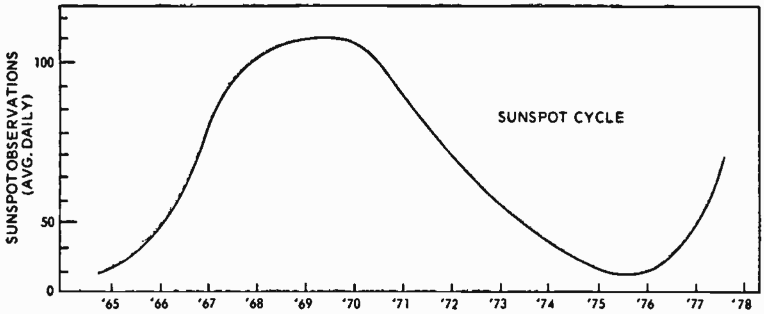


Fig. 6-6. Curve representing the current sunspot cycle.

Signal Frequency

Earlier, it was learned that "frequency" somewhat determines the behavior of electromagnetic (radio) waves. Those with low frequencies display characteristics more similar to sound, while higher values act more like light. Let's look at this a little more closely.

Groundwaves. The span of VLF (very-low-frequency) and LF (low-frequency) waves, being nearest to sound, can be transmitted through a "heavy" medium. Radio signals in this range are used to communicate with submerged submarines, and some rather classified work is presently under way to complete a national emergency radio system which actually transmits VLF signals through the earth. In the atmosphere, such signals carry fairly well in the lower altitudes due to the "heavier" air, and will bend to follow a path around the earth's curvature for distances well beyond the horizon. At higher altitudes, the air thins out, presenting a less dense medium, and the signal dissipates. This latter effect is to be expected because there can be no sound transfer within a vacuum. For this reason, the propagation of VLF and LF signals is said to be conducted by "groundwave" (Fig. 6-7A).

Skywaves. At the other end of the radio spectrum, we have frequencies of the VHF (very-high-frequency) classification and higher. Being more near light in characteristics, these generally behave on a "line-of-sight" basis. Radio waves in this range are most often reflected from solid obstacles encountered along the signal path, and are generally unable to follow the earth's curvature for any great distance beyond the horizon. Because of these properties, VHF and higher frequencies are especially suitable for the more sophisticated forms of long-distance radio communications involving relays and satellites, as well as the obvious short-range applications (Fig. 6-7B).

The remaining span of MF (medium-frequency) and HF (high-frequency) particularly the latter, usually accounts for most of the long-distance radio communications conducted without the aid of relays, and constitutes by far the most popular area for the radio hobbyist. High-frequency (HF; most often called "shortwave") waves have certain characteristics which allow them, under the proper set of circumstances, to be "bounced" off one of the ionospheric layers mentioned earlier and redirected earthward again, often several times. With the ability to reach great distances via this ricochet process, it is said they are propagated by "skywave."

Atmospheric Refraction

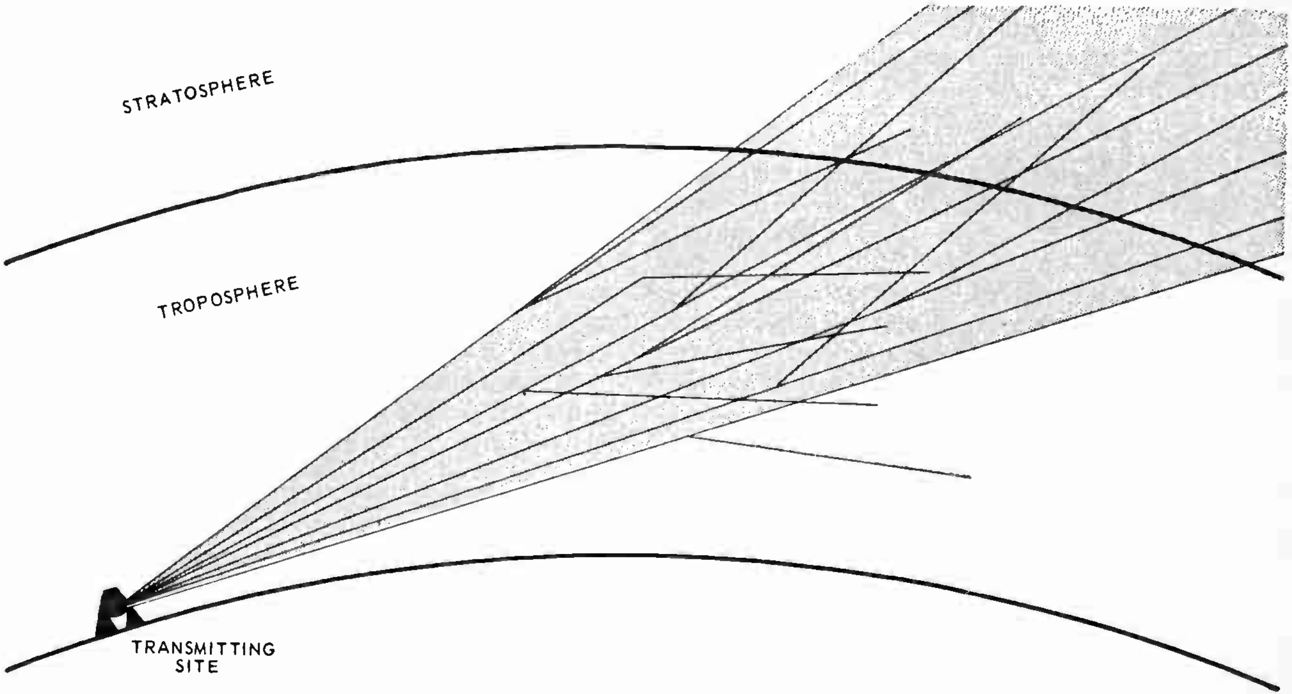
The composition and density of the ionosphere at any particular point the signal might encounter is the product of several factors connected to direct solar activity on that spot. Therefore, it can be seen that the radio-wave refractive properties of the ionosphere will likewise vary in a similar and related manner. When the density is high, only a fairly small range of signal frequencies will be successfully bounced earthward to complete a long circuit.

To understand exactly how this works, Fig. 6-8 illustrates the earth and ionosphere in both daytime and nighttime situations. Since the outermost ionospheric layer, the F region, is exposed to the most active radiation, it is normally the most dense of the three; thus, it provides the more effective refractive medium when the others are present. Consider that a transmitter is sending five separate signals of different frequencies, as shown in Fig. 6-8. The frequencies range from high to low values (Z being the lowest, V highest).

During the daylight hours of maximum ionospheric density, only signal W will be satisfactorily refracted. Signal V is of too high a frequency and will be passed on out into space, as will all signals of a higher frequency. (This is the value of VHF signals used in satellite communications, since the signal must pass through the ionosphere with a minimum of refraction in this case.) Signals X, Y, and Z are of a frequency lower in value than W (more closely related to sound); therefore, they will become absorbed within the ionosphere, precluding the possibility of a practical "bounce."

Turning to the darkness portion of the illustration, it is seen that the lower ionospheric regions (which accounted for much of the signal-dampening effects upon X, Y, and Z) have now dispersed along with the decreased solar radiation. Likewise, the prime refractive region of the F layer has become somewhat reduced in density, but it still retains the ability to refract radio signals. In this case, both V and W are too high in value and pass into space, while X, Y, and Z, being of lower value, and with the absorbing factors removed, are returned earthward and are ready for one or more additional "hops."

The number of times any certain signal can be bounced back and forth between the earth and ionosphere is dependent upon the conditions it encounters across the path it travels. If darkness exists all the way, lower-frequency signals can, and do, travel great distances. On the other hand, if daylight is present over the entire path, the practical frequency range will have to be fairly high by comparison. The often present situation of partial daylight and partial darkness sometimes presents a rather ticklish problem to engineers who must set up communications under such conditions. In this case, the signal must be of low enough frequency to be refracted from all incidence points located in the ionosphere, while at the same time have a value sufficient to overcome absorption factors. Table 6-2 lists the reception characteristics of the various shortwave bands.



A

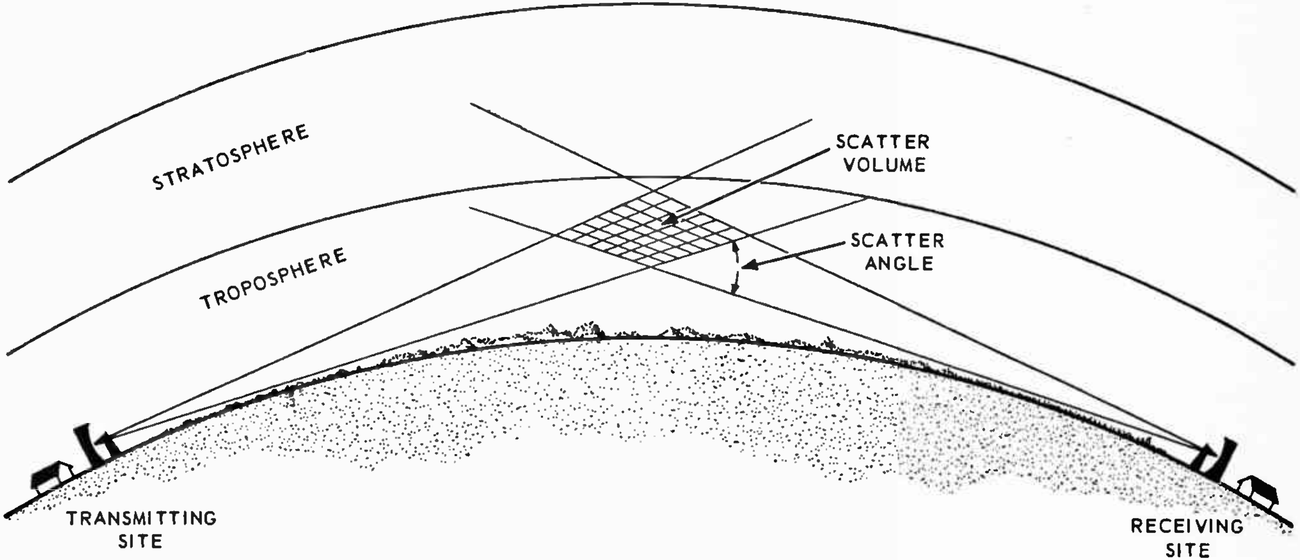


Fig. 6-7. The frequency of a signal has a definite bearing on propagation.

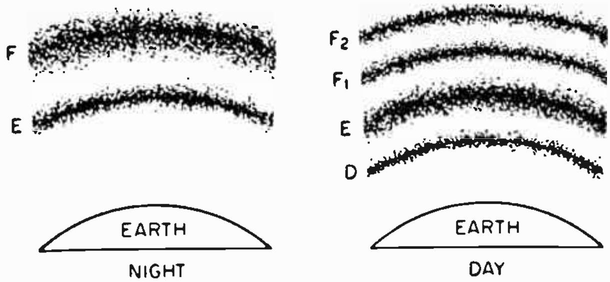


Fig. 6-8. Atmospheric changes from day to night also affect propagation. Signal frequencies range from high (v) to low (z).

Static and Noise

To complete the discussion of general factors involved in long-distance "skywave" transmissions, we can't overlook limits imposed by what is sometimes termed "static." Just as the lamp circuit in Fig. 6-2 demonstrated, any electrical source is capable of producing electromagnetic energy that can be propagated. Therefore, it becomes evident that a radio signal could "pick up" at least some of the errant energy it might encounter along the way, and actually integrate this right into its own wave.

"Man-made" noise results from the vast array of technological developments we have at our disposal. The results appearing at the speaker of a radio receiver range from the low hum of power lines or electrical appliances to all sorts of emissions created by automotive ignitions, neon lights, and literally thousands of other items. Generally speaking, such noise is related to the location of the receiver, and will be noted with considerably more severity in urban areas where the opportunity for a greater accumulation exists. Also, this type of "static" is often observed to affect reception of the different radio bands in a varying and somewhat random manner. Man-made noise comes in all sorts of frequencies, and the effect on any frequency band is dependent almost entirely on the specific interference source.

"Atmospheric" noise is something a little different. It results from natural causes of electrostatics within the air (hence the word "static") and behaves in a more predictable manner. At any time, there may be as many as several hundred thunderstorms or electrical disturbances taking place throughout the world. It follows that a radio signal passing through some of these areas can pick up a little of this unwanted energy and carry it along to the final destination at the receiver. Unlike the man-made variety, however, the frequency range involves mostly the lower bands of the radio spectrum; although, as the amount of atmospheric electrostatic potential increases, the span of radio frequencies affected will correspondingly rise upward.

Confirming what is almost common knowledge, meteorologists relate that atmospheric electrical disturbances are considerably more prevalent during the summer months and at a minimum during winter. In the equatorial region (where it is always summer), thunderstorms

Band	Summer	Spring-Fall	Winter
4750-5050 kHz (60-meter band)	Limited mostly to short- or medium-range reception during the darkness hours. "Local" reception possible only during daylight.	Fair to good for medium-distance reception, with some long-distance possible during maximum darkness.	Best time of the year for long-distance reception from dusk to dawn for darkness paths.
5950-6200 kHz (49-meter band)	Some long-distance reception possible from dusk to dawn. Good medium-range reception possible at the same time.	Good possibilities for long east-west paths, and medium-distance reception good to excellent during darkness.	Generally "open" to any portion of the world also in darkness from dusk to dawn.
7100-7300 kHz (41-meter band)	Usually follows a pattern similar to the 49-meter band above. This segment is "shared" with hams; therefore, reception of weaker distant stations may be more difficult due to some interference situations.		
9500-9775 kHz (31-meter band)	Best long-distance possibilities a few hours before midnight to the east, and again near dawn to the west. Normally fair to good during darkness.	Long "openings" good to excellent shortly after sunset until dawn. Medium distances good shortly after dark.	Good to excellent during the darkness period. Many large broadcasters may "beam" into North America during early evening.
11.7-11.975 MHz (25-meter band)	Good to excellent for long-distances from sunset to late evening, and again after sunrise. Broadcasters may "beam" into North America during early evening hours. Some short- and medium-range possibilities during daylight.	Excellent for long-distance during late afternoon and early evening. Some short- and medium-range reception possible throughout most daylight hours.	Long-distance reception reduced to late afternoon and early evening. Medium- to long-range reception fair to good around sunrise. Short-range during midmorning.
15.1-15.45 MHz (19-meter band)	Good to excellent for daytime reception and extending into early evening.	Medium-range reception for most of the day. Long-distance possible in late afternoon and early evening.	Distant reception during mid-morning and last afternoon. Short to medium during most daylight hours.
17.7-17.9 MHz (16-meter band)	Fair to good for distance to the south during maximum daylight; medium and short range from east or west.	Fair distance possibilities during peak daylight. Short and medium range throughout most of the day.	Fair to good long-range reception during peak daylight. Medium range good for most of the day.
21.45-21.75 MHz (13-meter band)	Short range only during peak daylight.	Some medium range from the south at midday. Short distances most of the afternoon.	Medium and short range during most daylight hours.

"Short" range: 300 to 1800 miles

"Medium" range: 1800 to 3500 miles

"Long" range: Over 3500 miles

Signal paths are measured by the shortest distance from transmitter to receiver, which is the "great circle" route (i.e., over the north pole from central Europe into western North America, etc).

The daylight-darkness relationship caused by the sun moves from east to west. Therefore, when a particular band "opens" for distant reception, the stations heard will lie to the east of the receiver; this pattern will shift westward as time progresses.

Table 6-2. General Performance Characteristics of the Various Shortwave Bands During "Normal" Years of Low Sunspot Activity.

occur at a rate almost four times greater than in most temperate locations. Thus it is that during local summer that the lower shortwave frequency bands produce considerably less long-distance reception than in winter. In the summer situation, the signal is at its theoretical weakest at the receiver, while the interfering "static" is at the maximum.

From the foregoing, the reader might assume that while the various elements involved in skywave transmissions could be somewhat complicated, the patterns and rates of their change should be fairly uniform; but, such is not always the case.

Observations conducted over many years have revealed that the amount of solar and other extraterrestrial radiation having an effect upon ionospheric composition varies greatly from day to day in a completely irregular manner. At times, great "flares," or outbursts of energy, will sort of supersaturate the ionospheric density, causing an instability that will significantly degrade signal quality for periods of up to several days. Other periodic bombardments of energy from similar sources completely outside of our solar system sometimes also account for ionospheric disturbances resulting in an occasional disruption of communications.

For the most part, such occurrences are not reliably predictable to any great degree of accuracy and may appear at any time, although there are certain cyclical periods when the chance of a severe disturbance appears to be considerably more likely. Very generally, the recorded incidence of occurrence is greater during years of high daily sunspot activity. Also, on a seasonal basis, it seems the equinox periods of spring and fall are somewhat more prone to produce a disturbance of major proportions. During years of low sunspot activity, some credence can be placed in a very approximate cycle of 25 to 30 days between periods of significant reduced reception conditions, but so far this theory still remains unestablished as a means of accurate prediction.

Technology is advancing the knowledge of electromagnetism and the ionosphere almost daily, but there is still much to be learned concerning its composition and effects upon the world below. Radio transmissions themselves are playing a large part in this research, and perhaps some day will be instrumental in conquering one of the earth's last remaining frontiers—certainly an interesting speculation for the hobbyist.

Chapter 7

Reception by General Continental Areas and Frequency

It is safe to assume that every last one of the readers of this handbook has, at one time or another, tuned across the standard AM broadcast band. Further, some also have spent some time, be it a lot or a little, in tuning across the shortwave broadcast bands, possibly without a great deal of luck. Still others have tuned across the amateur radio bands and the FM and TV bands. In the case of the TV bands, perhaps you have been intrigued when a picture came in on a channel where normally none was supposed to appear, at least in your area. Further watching of the mystery picture bore fruit as the station identified itself and you were amazed to learn that the picture was from a TV station several hundred miles distant. And somewhere in the back of your mind you recall having heard something about "propagation"—that seemingly intangible something that makes radio waves do things that aren't completely clear to you.

LONGWAVE FREQUENCIES

It's also a safe bet that very few of our readers have ever tuned the so-called "basement frequencies." The more appropriate terminology for this range of frequencies is "longwave," and it extends, on the high end, from 535 kHz (that is the extreme low end of the standard broadcast band) on downward to 10 kHz or lower. In this range, there are a variety of services available for listening and some of them are quite interesting.

Actually, the longwave range is virtually unknown to most North Americans; very few receivers on the market are equipped to tune that low, and of those that are available, only a handful will tune any lower than 150 kHz. In the event, however, that there are listeners who have equipment to tune all the way down to the two-digit frequencies, we will begin at 14 kHz.

Beacon or Range Stations

Nearly all of the stations that are audible on longwave in North America are beacon or range stations in the aeronautical or marine service and they operate on CW (Morse code). There are a few voice stations in the aeronautical service and these are almost entirely for either periodic or continuous aviation weather forecasts and reports for pilots who may be within the service area of the particular station.

These beacons are generally very low-powered stations that do nothing but repeat, over and over, their individual callsigns in CW. These are either two-letter or three-letter callsigns such as OM, DLH, MDW, MX, and EWR. Contrary to statements made in Chapter 8 regarding prefixes, the aero stations on longwave do not have to have either a W or a K as the lead letter in their callsigns.

In most cases, the callsign of a beacon or range station gives some indication as to its location, and if you don't have a listing of these stations, you can still get some general idea of where the stations are by their callsign. This is not, however, a hard and fast system. Listeners in upper central New York State could probably quickly identify the callsign ELM as being at the Elmira airport. But how about ELM's sister station in New Jersey? Its callsign is EWR and you might have to scratch your head awhile before coming up with a location of Newark. In some cases, the callsign is an abbreviation of the name of the airport rather than a direct indication of location. The MDW mentioned a bit ago is in Chicago at Midway airport.

The callsign identifications are given in CW, as we've said, but they are in such slow-speed Morse that they can be copied by listeners who are not even familiar with the code.

The power of most of the beacons is low; less than 50 watts in most cases. Their basic purpose is to guide incoming aircraft to the approach of the runway at the airport. The pilot can "home in" on the signal of the beacon to determine his angle and direction of approach to the airport. Thus, the overall range of the station does not have to be great and low power is deliberately used in order to hold down the overall coverage area. There are hundreds of these beacons on each frequency and pilots of the large airliners have enough problems in flight without having to try and dig through a lot of unnecessary QRM in order to find the homing signal that is necessary to his flight.

Voice Stations

For those of you who don't copy CW and don't care to try to identify the CW beacons, there are still a lot of voice stations that are operated by the Federal Aviation Agency which give regularly scheduled or continuous weather forecasts and reports. For most listeners, these are the only voice stations that you will hear on longwave unless you can pull in some of the European broadcasters, but more on these shortly.

A list of FAA stations offering continuous weather broadcasts on longwave appears in the Appendix.

All of the aviation weather stations operate in the 200 to 400 kHz range of the longwave band. The power ratings of the voice stations is mainly in the 100- to 300-watt range, although a few are powered at 400 watts. Only two are rated at a higher power and these are the stations in Galveston, Texas, on 206 kHz, and New Orleans, Louisiana, on 236 kHz. These two stations run 2000 watts each because their coverage areas include much of the Gulf of Mexico.

What is heard on these stations? Most of them have a transcribed (taped) weather report and forecast that includes such information as temperature, dew point, cloud cover, wind speed and direction, and altimeter (barometric) pressure. In most cities where there is a sizable airport, weather conditions are given for an area roughly within a 250-miles radius from the transmitter. The continuous broadcasts are repeated constantly and are updated every hour or so. These stations operate 24 hours daily.

In spite of the low power of these stations, they can be heard occasionally at great distances. Even in local daylight, reception is rather good due to the fact that propagation at these low frequencies is very good and there is rather low signal noise. Richard Pistek of Chicago, Illinois, who supplied a considerable portion of the aeronautical material for this chapter, can regularly hear the weather stations in St. Louis, Cincinnati, and Indianapolis—the first two are over 250 miles away and powered at only 200 to 250 watts. As a comparison, some of the standard AM broadcast stations in those cities with equivalent power cannot be heard in Chicago. This gives you an idea of propagation on longwave.

Tuning across the longwave band at night is something akin to the standard broadcast band; you will find very crowded conditions and many stations providing considerable amounts of interference. You will hear a maze of CW beacons, and among these you may find a voice weather station fading in and out gradually. There are no "clear channels" on longwave such as there are on the broadcast band (except for the two high-powered weather stations in Galveston and New Orleans, mentioned a few moments ago). The stations are designed for local coverage only, as are the stations assigned to the "graveyard frequencies" on the broadcast band. (Typical "graveyard frequencies" include 1340, 1400, and 1450 kHz, where dozens and dozens of stations share a common frequency and where the stations are powered at 1000 watts or less.)

In comparison to the broadcast band, where the stations are located on frequencies with separations of 10 kHz, stations on longwave operate on frequencies with only 3 kHz separation. This results in only slightly more crowding, however, because the dial spread becomes wider as the frequency decreases.

European Stations

In addition to the aero weather stations that operate on voice, there are also a number of European broadcast stations that operate on longwave. Some of them are unusually powerful, with power ratings in excess of one million watts. It would be thought that this super power is used for the express purpose of reaching out for abnormally far distances but such is not the case. The high power, of course, is used to provide a strong primary coverage area and a reasonably good regional coverage area. Further, the high power is required to overcome, at least partially, the fierce summertime lightning static that is so prevalent on this band. For great distances, however, such as the North American continent—at least on a regular basis—forget it. Some of the stations can be heard along the east coast on a quiet winter evening, perhaps, but the average listener will probably stand a better chance at hearing some of the lower-powered European stations on the standard broadcast band on split frequencies. As has been pointed out elsewhere in this book, Rome on 845 kHz with 540 kW, stands a much better chance of being heard on the east coast—and even inland—than does, for example, Algiers, Algeria, on 254 kHz, with 1500 kW. Among the high-powered Europeans, the following might be the first that you would likely hear:

Frequency	Location	Power in kW
155	Brasov, Rumania	1200
164	Allouis, France	600
173	VOA; Munich, Germany	1000
200	BBC, London, England	400
209	Reykjavik, Iceland	100
218	Monte Carlo, Monaco	1200
233	Radio Luxembourg	1100
251	Algiers, Algeria	1500
254	Lahti, Finland	200

One of the foremost longwave experts on the east coast, Hank Holbrook, of Chevy Chase, Maryland, prepared a resume of the longwave frequencies for inclusion in this chapter. Mr. Holbrook kindly broke his report into frequency segments in order to help the listener who may be new to longwave DXing.

14 to 21 kHz

Between these frequencies, you will find some of the world's most powerful stations operating on CW. Many of these stations are intended to give worldwide coverage. Some of the stations frequently heard in the eastern areas of the United States include GBR, Rugby, England, 16 kHz, 350 kW; nearer to 17 kHz is NPM, Pearl Harbor, Hawaii; NPG, San Francisco, can often be heard on 19 kHz with a very strong signal at any time of day or night.

At one time, when I was working with an electronics firm as an expediter, I happened to become aware of a test being made in one of the labs. Several of the engineers were experimenting on very longwave reception, but the receiver was hooked up to an oscilloscope instead of a loudspeaker. They had CW signals coming in on the oscilloscope, but no one could translate the CW signals. I was asked if I could offer any information on what the station was and where it was. Copying CW on a scope is a second cousin to copying Morse by light signals from one ship to another; top speed there is only six or seven words per minute. After several hectic and frustrating moments, the signal was definitely translated as the callsign of GBR on 16 kHz. This reception occurred in broad daylight with an antenna of several hundred feet in length.

21 to 110 kHz

There is some activity on CW in this range. VHP in Australia on 44 kHz with 200 kW; LBJ, Trondheim, Norway, on 58 kHz; and time signal station WWVB in Fort Collins, Colorado, on 60 kHz, have been heard and verified by Mr. Holbrook. Additionally, several radioteletype stations have been heard, but without special equipment for properly receiving them, they are useless for DX purposes.

110 to 150 kHz

Code CW activity picks up somewhat in this range. Stations such as NHY, Port Lyautey, Morocco, and CKN, Vancouver, British Columbia, on 133 kHz, and NBA in the Canal Zone, on 147 kHz, are frequently heard. Non-CW listeners are probably frightened by the thought of trying to copy a code station, but the stations in this band make it easy. In addition to the very slow speed CW identifications from the beacons, the "traffic" stations on these frequencies often send "running markers" consisting of a series of Vs followed by their callsign, and this can go on for hours on end. With a little practice, the non-CW DXer can identify the code identification sufficiently enough to make the sending of a reception report worthwhile. As we have pointed out at various other points in this handbook, however, don't send reports of the traffic being sent—this is a violation of the secrecy law. Confine your reports to reception of the V markers and, if the station verifies at all, you should be in luck.

150 to 200 kHz

There has been very little CW activity in this frequency range and there are only a handful of air navigational stations here. As a result, this particular segment is usually relatively free of QRM, therein making it a goldmine area for those who wish to try for some of the foreign broadcasting stations. While living in Bethesda, Maryland, Mr. Holbrook was able to log Deutschlandfunk, Mainflingen, West Germany, on 151 kHz; Brasov, Rumania, on 155 kHz; Allouis, France, on 164 kHz; Munich, West Germany, on 173 kHz; Europe I, Saar, West Germany, on 182 kHz; Oranienburg, East Germany, on 185 kHz; and the BBC station in Droitwich, England, on 200 kHz. Allouis, France, while not the most powerful station, is considered by Mr. Holbrook to be the best trans-Atlantic broadcast signal in the eastern United States on either longwave or medium wave. Upon occasion, on a cold winter day, this station has been heard on their 24-hour schedule from 4:00 in the afternoon until 4:00 the following morning (EST). Mr. Holbrook considers this station as an excellent barometer for trans-Atlantic DX between 150 and 1605 kHz.

201 to 410 kHz

This is without a doubt the favorite segment of the longwave band for most DXers. For the broadcast fan, there are a number of European, African, and Asian stations operating in this range. However, here in North America, there is very heavy QRM from navigational stations and herein lies the real challenge to the logging of the rare broadcasting DX. Stations that have been logged in Maryland include Azilal, Morocco, on 209 kHz; Radio Monte Carlo, Monaco, on 218 kHz; Warsaw, Poland, on 227 kHz; and Radio Luxembourg on 233 kHz. The verification letter from the latter is highly valued.

The meat of DX for many of the listeners in North America is the air and marine navigational stations which offer fascinating DX possibilities. It should again be stressed that since these stations identify in a very slow Morse code, they are relatively easy to log whether the listener has any knowledge of CW or not. The aeronautical and marine radio beacon stations generally transmit their callsigns over and over at a very slow pace. Some beacons follow their identification with a short or perhaps a long dash.

While most air navigational stations operate continuously, many marine beacons (generally heard from 286 kHz to 320 kHz) operate in sequence with two other beacons on their frequency. One beacon operates for one minute and is silent for the next two minutes while the other beacons take their turn at transmitting. From the aeronautical range station, you will receive either a series of the letter A (dot-dash) or N (dash-dot) or a steady tone, depending on your location from the range station. This pattern will last for 30 seconds; following this will be a pause for a few seconds during which time you will hear one or two identifications, again depending on your position from the station, given in slow CW.

Most United States range stations and a few beacons transmit voice weather announcements for several minutes commencing at 15 and 45 minutes past the hour, while Canadian range stations usually broadcast weather announcements at 25 and 55 minutes past the hour. There are a number of range stations now on the air which give continuous voice weather broadcasts.

The range station is being phased out and gradually replaced by the beacon. However, there are still a number of range stations in operation.

For DXing purposes, the beacon and range stations are a dream. From time to time, listeners have complained that they were simply unable to identify that elusive station they were hearing. Well, here is a band where the stations have nothing to do, seemingly, but tell you day and night who they are. If you have a weak signal that is way down in the noise level, the chances are good that if you stick with it long enough, you will be able to identify it and have a fine addition to your log. Most beacon and range stations in the United States and Canada operate with 400 watts or less. Many beacons operate with 50 watts or less. Mr. Holbrook has, at last count, 151 beacons verified that operate with 25 watts or less! And some of them are from good distances. Some of the more interesting navigational stations that Mr. Holbrook has verified on the beacon and range frequencies include:

OLF, Wolf Point, Montana, 404 kHz, 100 watts.

OV, Oakville, Manitoba, 412 kHz, 20 watts.

SGT, Stuttgart, Arkansas, 269 kHz, 90 watts.

ND-4, Vidauri, Texas, 400 kHz, 15 watts.

V, Sable Island, Nova Scotia, 296 kHz, 50 watts.

RMY, Ramey Air Force Base, Puerto Rico, 278 kHz, 25 watts.

UP, Upernavik, Greenland, 399 kHz, 2500 watts.

Latin American beacons often put in a solid signal in many areas of North America. Most of them have a greater distance to cover than the stations in the more densely populated United States; therefore, they operate at higher power. Some of the more interesting beacons from South America that have verified include:

PB, Paramaribo, Surinam, 315 kHz, 3000 watts.

BLA, Barcelona, Venezuela, 336 kHz, 450 watts.

SCO, Pisco, Peru, 355 kHz, 500 watts.

UIL, Guayaquil, Ecuador, 365 kHz, 1000 watts.

The beacon and range stations are not too difficult to report for verification purposes. If you receive a beacon and can identify it, jot down the length of time it takes to transmit each identification, and the number of seconds between each identification. For the range station include information as to what you heard. Did you receive their A or N signal or their plain tone signal? If you pulled in their voice weather announcements, be sure to tell them what was heard. Most verifications from these stations are prepared cards, since the operators have little time for correspondence. However, some fine verification letters have been received from the navigational stations.

410 to 500 kHz

In this segment of the longwave band are the ship and coastal stations. The listener should have a fairly good knowledge of CW before tackling these stations, since most operations are on CW at speeds of anywhere from 12 to 30 words per minute. If you have an ear for CW, you will find that there are thousands of stations available to you. Both ship and coastal stations operate on 500 kHz, one of the international distress and calling frequencies. A ship may call a coastal station or another ship on this frequency. A coastal station usually calls or answers ships on this frequency and then if there is traffic to be exchanged, both the ship and coastal station move to a lower frequency that is known as a "working frequency." Most freighters and tankers operate with 200 to 600 watts of power output, while some passenger liners may use as much as 1000 watts. These stations usually have a daytime range of 400 to 600 miles; at night their range may double or even triple. Mr. Holbrook's most distant QSL in this frequency range is from MAYJ, the freighter Pando Head, at a location of 25:54 north latitude and 178:25 west longitude or about 200 miles sourth of the Midway Islands; this was on 500 kHz with 275 watts. Some interesting coastal stations that have been verified on 500 kHz include OZN, Prinz Christian Sund, Greenland; LPD, General Apacheo, Argentina; and NMO, Honolulu, Hawaii.

Good DX is entirely possible on longwave. A number of ship operators have stated that they have worked as far as 3000 miles under ideal conditions. One radio officer worked the eastern United States from 400 miles west of Hawaii; another operator heard a New York station on 500 kHz when he was off Capetown, South Africa. Some of the finest verifications that have been received are from ship stations. Long letters are not uncommon and often picture postals or photos of the ship and equipment are enclosed. Again, this word of caution: if you send reception reports to these stations, simply report the station they were working; do not give the actual content of the traffic being exchanged.

501 to 535 kHz

In this band there are a few beacons, a few range stations, and a few broadcasting stations. This segment is very similar to the 210-410 kHz portion. The best DX logged in Maryland by Mr. Holbrook includes NJ-2, Salton Sea Seaplane Base, California, on 522 kHz with 480 watts, and MAT, Matamoras, Mexico, on 512 kHz with 50 watts.

Those of our listeners who do not have any longwave equipment, as such, may still be able to make a logging or two of stations that are within this highest segment of the longwave band. There is a beacon with the callsign of NB, located at North Bay, Ontario, on 530 kHz with 250 watts, and this one has been heard by many North American DXers. There may still be one or two others operating at this extremely low edge of the standard broadcast band from Canada that can be picked up on some evenings.

There are also a few broadcast stations operating within this portion of the longwave band. They include TICAL, Radio Rumbo, Cartago, Costa Rica, on 525 kHz with 250 watts, and they really get out with that relatively low power! Two trans-Atlantic stations are Ain Beida, Algeria, on 533 kHz with 600 kW, and Beromunster, Switzerland, 527 kHz with 500 kW.

Longwave Equipment

If you are seriously interested in going into longwave DXing, the choice of a receiver is most important. You will need a unit that is both very sensitive and selective if you wish to "get out." (In SWL work, "get out" really means to get those weak and distant signals into readable sounds in your loudspeaker or headphones as opposed to "get out" in ham radio work which means, literally, to be able to have two-way contacts over great distances.)

The best bet is to look for surplus equipment if you can find something that isn't already worn out. Some of the receivers used by successful longwave DXers include the RBL, RBM, RAX, RAK, and Command series and others.

When choosing a receiver, try to stick to one which more or less concentrates on the longwave band. The tuning capability of some surplus receivers tends to be crammed because they try to cover longwave, medium wave, and shortwave together in one receiver, thus giving poor selectivity, which is all important in longwave work. Further, some surplus receivers operate normally on power other than the standard 115 volts ac, so it is wise to do a bit of careful searching before parting with your hard-earned cash. If you should find a suitable receiver that does not operate on 115 volts ac, you will have to do a considerable amount of rewiring or use a separate power supply that converts your 115 volts ac to the voltage required by the receiver. If there is a surplus dealer in your town or city, drop in and look over what he has to offer. If you know of no surplus dealer, watch the advertisements of surplus houses which are often listed in radio magazines.

From the standpoint of the currently available commercial receivers, other than surplus units, a few of the well known portables have a longwave band on them. For example, the Zenith Transoceanic has a longwave band, as do the German-made portables such as Grundig, Nordmende, and others. However, these portables also have other bands on them, including medium wave and shortwave; the advantage here is that you have an available receiver for other bands in the event that you tire of longwave. One of the longwave contributors, Mr. Pistek, uses a Zenith Transoceanic and a Grundig Satellite 20-band receiver for his longwave DXing; both of these units cover the entire longwave band from 150 to 400 kHz.

As far as antennas are concerned, the rule of thumb here is that the longer the antenna you use, the better results you will achieve. Keep in mind that since longwave is considerably lower in frequency than medium wave, the wavelength is considerably longer. Thus, a long antenna is needed to be efficient at these low frequencies.

From the electrical standpoint, at the frequency of 300 kHz, the wavelength is about 1000 meters, which would mean that an antenna would have to be 3000 feet long for a full wavelength at that frequency! However, this is far longer than most of us can afford to erect, so the important thing is to get as long an antenna as you can within the space that you have available for it. A regular longwire antenna is sufficient; a vertical antenna would give very poor results. Mr. Holbrook used a regular longwire, between 50 and 100 feet in length, of regular copper antenna wire, but he suggests that with a longer antenna he would probably have had even better results.

Returning to verifying for a moment, most of the aviation weather stations are very good at verifying correct reception reports and some of them will send a personal letter with information about their respective stations. And this will also give you a good chance to add a good many low-powered stations to your log and any number of low-powered station QSLs for your collection. In sending reception reports, once you have identified the station, simply address your report to Station Chief, Federal Aviation Agency, Flight Service Station, at the city involved. You should enclose return postage, of course.

Station Listing Sources

One drawback to longwave DXing is the expense of building an adequate library of station data. Unfortunately, no one book gives ample coverage to all utility stations. Listed below are some suggested publications dealing with different phases of longwave DXing which we feel will be important to those interested in tuning the lowest frequencies.

For listings of United States radio beacon and range stations, an excellent publication is the **Airman's Information Manual, Part III.** This book lists the majority of aeronautical beacons and range stations operating in the United States. The vast majority of beacons and all range stations are aeronautical; however, there are a number of marine beacons in operation and, if you are interested in these stations, the Coast Guard has publications known as **List of Lights and Other Marine Aids.** There are separate books for the Atlantic Coast (including the Gulf Coast stations), Great Lakes, and the Pacific Coast. These publications should not set your budget back too severely. For information on the **Airman's Information Manual, Part III**, and the U.S. Coast Guard books, write directly to the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

For a good list of Canadian beacons and ranges, you'll want a copy of **Air Navigational Aids**. For marine beacons, you'll need **Radio Aids To Marine Navigation** (one volume covers both Atlantic and Great Lakes areas, while the second volume covers the Pacific Coast). These publications are very reasonable. For information, please write directly to the Queens Printer and Controller of Stationery, Ottawa, Ontario, Canada.

For foreign radio beacons, a good source is the **Admiralty List of Radio Signals, Volume II**, available from Maryland Nautical Sales, 406 Water Street, Baltimore, Maryland 21202.

For foreign broadcasting stations, one of the best available publications is the **World Radio-Television Handbook**. It lists longwave, medium wave, and shortwave stations, along with addresses and a host of other information. Please write directly to Gilfer Associates, P. O. Box 239, Park Ridge, New Jersey 07656.

The Foreign Broadcast Information Service also publishes a comprehensive list of foreign broadcasting stations, including those on longwave. Complete information and prices should be obtained directly from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Do not write to the Foreign Broadcast Information Service.

Those who DX the ships and coastal stations may wish to obtain a copy of **Merchant Vessels of the United States**. At the time of writing, the price was $12.50 and well worth it. It lists stations by call and by name and gives addresses. This is also available from the Superintendent of Documents at the address given above. If you are interested in foreign ships and coastal stations, you'll need the following ITU publications: **Alphabetical List of Call Signs of the Maritime Mobile Service**, the **List of Ship Stations**, and the **List of Coast Stations**. These are available from Gilfer Associates, P. O. Box 239, Park Ridge, New Jersey 07656, or directly from the International Telecommunications Union, Geneva, Switzerland. Please write directly to either party for complete price and availability information.

A very inexpensive ($3 when this was written) publication listing ships and addresses is the **Great Lakes Red Book**, published by the Fourth Seacoast Publishing Company, Inc., 2256 26 Maple, St. Clair Shores, Michigan 48081.

By far, the most comprehensive source of listings of ships is the Lloyd's Register of Shipping, 17 Battery Place, New York, New York 10004. You will need the **Register of Ships** (which includes monthly supplements for one year, about $125) and the **List of Ship Owners** (about $15 per copy). This is an alphabetical listing of ships throughout the world. With this you should also have the **Alphabetical List of Call Signs for Stations of the Maritime Mobile Service**, listed above.

Utility DXers might also be interested in the **Utility DXers Handbook** (Editors Joel Handler and Paul Mayo). It's available for $3 from 401 Dewey, Evanston, Illinois 60202.

In conclusion, let us suggest that those of you who have receivers that are capable of tuning the longwave bands should give it a try. If you like low-powered stations, this band is for you. It will also do wonders for your QSL collection. Keep in mind that this is primarily a winter band; the summertime atmospherics are horrendous on these low frequencies. Whether you like CW or the voice stations, you're sure to find something of interest.

BROADCAST BAND DXING

On a winter evening a couple of years ago, Larry Godwin of Englewood, Colorado, was methodically checking the broadcast band for signs of anything unusual. As he passed 840 kHz, he noticed a station slightly higher in frequency. Careful tuning showed that the station was on 844 kHz and the programing seemed to be in a Polynesian dialect. Larry carefully adjusted his loop antenna and determined from the loop bearing that the station was, indeed, in the South Pacific.

From a shelf, Larry pulled down his well worn copy of **World Radio-Television Handbook**, the most complete listing of broadcast band stations in the world, turned to the Pacific section, and started checking. Soon he found that the only station listed on 844 kHz was a 50-watt station on Tarawa, in the Gilbert and Ellice Islands, just south of the equator and about six thousand miles from Colorado. Everything about the programing, including chimes on the hour, seemed to fit the description in the handbook, except for the listed power. The signal was just too strong for only 50 watts. Reaching for the telephone, Larry called several broadcast band DXers on the west coast. "I know what I'm hearing but I can't believe it!" Within the hour, word had spread up and down the coast that this station had increased its power to a point where it became fairly easy to hear in North America. In a few days, a whole group of DXers had logged a new country.

Such events don't happen every night, or even every month, but the excitement of such an event is enough to keep BCB DXers tuning the dials, season after season, looking for stations that weren't there yesterday. Within the past season, for instance, two South Korean stations were discovered several kilohertz away from their assigned frequencies. Reports from a DXer living in Japan indicated that the stations were following the examples of their North Korean neighbors in broadcasting on split frequencies, probably to attract a wider audience with less interference.

The Attraction of BCB DXing

What is so special about broadcast band DXing from the West Coast, or for that matter, from anywhere else? Broadcast band DXing to some is more difficult than shortwave DXing. They will argue for hours with their shortwave counterparts about the relative merits of these two aspects of the hobby. They feel that it is more difficult to hear distant stations on the broadcast band because radio waves do not travel as well on broadcast band frequencies as they do on shortwave. Broadcast band stations, realizing that their ordinary coverage is limited, aim their programs at local audiences, not at the international audiences of shortwave stations. Many broadcast band stations could care less about an occasional listener several thousand miles away. Not only does the BCB DXer have a harder time hearing distant stations, but he also faces the problem of trying to get verifications from reluctant stations.

Shortwave DXers, on the other hand, counter such arguments with the fact that there are many more stations on the broadcast band than on shortwave. A DXer could spend his entire life, as many do, in simply trying to log the several thousand stations in the United States alone. Many DXers feel that BCB DXing and SW DXing just cannot be compared directly, since there are so many features of each which are completely different.

Regardless of one's feelings on the controversy about the relative difficulty of BCB DXing and SW DXing, there is something about broadcast band DXing which has attracted hundreds of DXers to this branch of the hobby. Broadcast band DX is the oldest form of DX, going back to the days when the first commercial stations, such as KDKA, Pittsburgh, Pennsylvania, first went on the air in the early 1920s. The ordinary radio listener gets a thrill out of hearing a station hundreds of miles away; for many though, it is domestic BCB DX which introduces a youngster to the hobby.

For instance, when Father Jack Pejza of San Diego, California (contributor of this portion) was a high school student in that city, he regularly listened to WMAQ in Chicago and WWL in New Orleans. He even wrote to them to tell how well he was receiving them. However, knowing nothing about the hobby of DXing, he didn't expect to hear from them and eventually dropped out of the hobby after high school days were over. It wasn't until many years later, after he had picked up the hobby of shortwave DX, that he learned the proper technique of reporting to a station, and that stations did, in fact, send letters of confirmation, or verifications, in return for correct reports of reception. Then Father Jack learned about the DX clubs and the help that they could give in providing information about unidentified stations. It was only then that he returned to the broadcast band, now with the idea of trying to log foreign broadcast band stations.

With the large number of U. S. broadcast band stations, many DXers devote themselves to hearing as many of these stations as possible. While they occasionally will hear a station broadcasting in Spanish, they often pass over these stations, since they don't know the language. However, even with a minimal knowledge of foreign languages, it is possible to learn to identify such stations on the basis of slogans, types of music, and other clues picked up from experience. Once a DXer overcomes his reluctance to listen to a station which he can't understand, he is on his way to becoming a foreign DXer.

Equipment

Becoming a BCB DXer is, for many, much easier than becoming a shortwave DXer. Everyone has at least one radio receiver which will tune the broadcast band from 540 to 1600 kHz. Even some of the good BCB DXers still use nothing more than a small table radio. Such radios are not the best, however, for DXing. Their tuning generally is not accurate; they are not sensitive to weak signals, and cannot easily select between two adjacent channels, especially if one is a strong station. The casual listener really becomes a DXer when he graduates to a moderately priced communications receiver with better selectivity and sensitivity. He learns that an external antenna is almost a necessity.

In the early days of radio, loop antennas were quite common. Pictures of early receivers often show a diamond-shaped loop antenna perched above the set. However, as inexpensive table radios became available, the bulky loops gave way to small loops hidden in the back of the sets. Those interested in DX found that a longwire antenna produced a stronger signal in most cases than the untuned loops, and so longwire antennas became the ordinary antennas for DXers.

Then, about ten years ago, or around 1962, the loop antenna began to reemerge. Transistors were introduced to boost the signal so that it was comparable to that from a longwire. Loops were tuned so that a signal could be received with maximum efficiency. But probably the main reason that loops became popular again is because of their directional properties. With so many broadcast band stations on the air, practically every frequency is blanketed with local or semilocal stations. To hear DX, you must have some way of knocking down these signals so that weaker signals on the same or adjacent frequencies can be heard. The loop antenna has this ability; in certain directions it is quite insensitive to signals; therefore, a station can be "nulled" by proper position of the loop. Thus, it is possible for a DXer in Southern California to null KTWO in Casper, Wyoming, on 1030 kHz, in order to hear WBZ in Boston or XEQR in Mexico City.

The main disadvantage of the tuned loops of the 60s was their size. An average square loop was 30 to 48 inches on a side. With more people moving into apartments, experiments were begun with tuned ferrite rod antennas, similar to the ones found in most transistor radios. Because of their compactness, this type of antenna has become quite popular, despite the fact that they are not as efficient in nulling as a well built loop antenna.

Loop or ferrite rod antennas have another advantage over longwire antennas. Since they operate primarily on the magnetic component of the radio signal, much of the static associated with the electric component used by a longwire is eliminated.

While you can hear DX with an inexpensive receiver and a poor antenna, it becomes much easier to hear DX with a good receiver and an efficient antenna. Unfortunately, several of the topnotch communications receivers now being produced, such as the Heathkit SB-310 or the Allied SX-190, do not include the broadcast band in the range of frequencies they cover. Many BCB DXers are still using receivers produced ten or more years ago, such as the Hammarlund HQ-180, since there are few comparable receivers being produced today. One modern, solid-state receiver coming into wide use is the Drake SPR-4, which is compact, efficient, and portable.

Broadcast DXing in the U. S.

Because of the ordinarily limited range of BCB stations, West Coast DXers hear an entirely different group of stations than listeners in the Middle West or East Coast areas. Many of the stations heard are the same, of course, but distance to these stations often plays an important role in the strength of the signals. For instance, signals from Colombia have to bounce off the ionosphere only once to reach New England; to reach California, they must reflect twice. Since each bounce weakens the signal, West Coast DXers generally do not hear the weaker signals from the Caribbean or South America, signals which can be readily heard by the East Coast DXer.

This holds true for practically all signals from foreign stations received on the West Coast. For instance, Europe is only about 2500 miles from New England; from San Francisco it is over 5000 miles. Most Latin American stations, except for some in Mexico, are closer to the midwest than they are to a place even like San Diego, which is right on the Mexican border. Even while stations in the Pacific, such as those in Australia or Japan, are closer to the West Coast than they are to the rest of the country, they're still a greater distance from the West Coast than the majority of European stations are from the East Coast. Hawaii is about the same distance from Los Angeles as Europe is from New York City, but there are only a few stations in the 50th state, as compared with the scores of stations on the European continent. As a result, West Coast DXers are used to hearing weaker signals at only a few locations on the dial; when they visit the East Coast they are amazed at the myriad of European stations audible all over the band.

On the West Coast, the DXer has the opportunity to hear foreign DX from four areas: Latin America, Europe and Africa, the South Pacific, and Asia. (Broadcast band DXers, incidentally, do not consider Canada as a foreign country, but treat Canadian stations as "domestic" stations.)

Latin American Stations

The vast majority of foreign stations generally heard are Latin Americans. This is only natural, since the distances to these stations are generally less than to anywhere else in the world. For instance, strong Mexican border stations, such as XETRA, 690 kHz, or XEPRS, 1090 kHz, in Tijuana, Baja California, can be heard in the daytime even as far north as San Francisco. In the evenings, the dial comes alive with Spanish. By careful digging, one can hear U. S. rock tunes from XERPM in Mexico City, 660 kHz, marimba music from TGJ in Guatemala City, 880 kHz, or tropical music from YNX, Managua, Nicaragua, on 750, 1370, or 1420 kHz.

The easiest country in Latin America to log is, naturally, Mexico. In many cases, a person can hear a Mexican station without even realizing it. A number of powerful border stations broadcast entirely in English, directing their programs to Southern California audiences. XETRA, broadcasting good music 24 hours a day on 690 kHz, uses a slogan similar to "X-TRA, 50 kW over Los Angeles and all of Southern California," and identifies itself as a Mexican station only at intervals, and then in Spanish. XEPRS, "The Soul Express," pushes its 1090 kHz signal as far north as the Oregon-Washington border in the evenings, even with 50 kW KING in Seattle broadcasting on the same frequency. In keeping with its slogan, it has a format of hard-rock music, although it does switch to Spanish in the wee hours of the morning. Another Tijuana station, XEMO, 860 kHz, while not having the power of XETRA or XEPRS, still manages to regularly beam its evangelistic messages well up the West Coast. Calling itself "The Great Christian Beacon of the West," it broadcasts almost entirely in English.

Other powerful Mexican stations often heard on the West Coast are XEWA, San Luis Potosi, bothered only on its 540 kHz frequency by CBK in

Watrous, Saskatchewan, in the evening. XEPRM, 660 kHz is frequently heard in the evenings with programs consisting entirely of U.S. rock tunes, and is identified only by its Spanish IDs as Radio Juventud, XEX, 730 kHz, and XEW, 900 kHz, also in the capital city, broadcast more typical Mexican music. Two other border stations, XERF, 1570 kHz, Ciudad Acuna, Coahuila, and XELO, 800 kHz, Ciudad Juarez, Chihuahua, generally have mixtures of American evangelists and rock music.

During the author's early days of radio, there were several very powerful Mexican border stations that could be heard on the East Coast with ease during the evenings. Perhaps the two best known were XERA in Villa Acuna and XEAW in Reynosa. Both had formats almost entirely of country-western music or evangelistic programs with western music. Both had extensive advertising from American interests and both gave return addresses in Texas. XERA, in particular, had a tremendous amount of advertising for one Dr. John R. Brinkley who reportedly had a sure-fire cancer cure hospital in Arkansas. He was later forced to the air, and for a short time, operated from a ship in the Caribbean, so the story goes. These stations continually plugged such products as "Peruna" and "Kolorbak" and various kinds of cough and cold medicines. I'm sure that our older readers will remember.

At one time, during its glory, XERA operated with the super power of 500 kW and I still have the QSL confirming that fact. On another occasion, during one winter, XEAW operated on the same frequency as local 50 kW KYW in Philadelphia, and XEAW's tremendous signal overrode KYW for extensive periods in the evenings, even though KYW was, at best, only 20 miles away. These stations, along with XEPN, Piedras Negras, and a few others, were all eventually reduced in power by governmental action; one or two of the stations burned down and one of them reportedly blew up. It's been quite a long time since any of the Mexican border stations have put in a loud signal equal to those of the early 40s.

On that same frequency (800 kHz) occupied by XELO in Ciudad Juarez is PJB, broadcasting from Bonaire, an island in the Netherlands Antilles, off the coast of Venezuela. This 500 kW station is most commonly heard on the west coast in the early evenings, mixing with XELO, or all alone after midnight (Pacific Standard Time) with programs in Portuguese beamed to Brazil. Both Trans-World Radio and Radio Nederland use this transmitter as a medium-wave relay of their short-wave broadcasts.

Cuban stations are not the pests that they are for the East Coast listeners, but they do provide another easy opportunity for the West Coast DXers to log another Caribbean country. CMBC, Havana, is usually the station heard on 690 kHz when XETRA has a silent period. Like many Cuban stations, it carries "La Voz de Cuba" or Radio Encyclopedia programing. CMQ, also in Havana, is heard on the rare occasions when KFI, 640 kHz, in Los Angeles, is off the air for transmitter maintenance, generally for a few hours after midnight (PST) on the first Monday morning of each month. CMCI, 760 kHz, an all-news station, is commonly heard during KFMB's silent period on Monday mornings with its Reloj Nacional format. This can easily be identified by a time pip every minute. CMCA, Havana, can be received on occasion in the null of WCCO, Minneapolis, on 830 kHz. Sometimes it shows up only as a heterodyne, since it does have a tendency to be slightly off frequency.

Colombia is perhaps the most frequently heard country in South America itself, since it is the closest country to the west coast, and it has many powerful stations. HJKC, Emisora Nueva Mundo, Bogota, 850 kHz; HJBI, Ondas del Caribe, Santa Marta, 840 kHz; HJDK, La Voz de Antioquia, Medellin, 750 kHz; and HJFF, La Voz Amiga, Pereira, 1210 kHz, are the most widely heard stations. The first three of these belong to the CARACOL network, and frequently only a network ID will be heard. La Voz Amiga belongs to the TODELAR network, the second largest network in Columbia, but local slogans are also often heard.

Venezuelan stations have a harder time reaching the West Coast, because most of them are covered by all-night stations in the Midwest or on the West Coast. YVOZ, Radio Tiempo, Caracas, 1200 kHz, is most often reported when WOAI, San Antonio, Texas, goes off the air, as it typically does on early Monday mornings.

The recent earthquake in Managua, Nicaragua, provided DXers with the opportunity to hear a number of stations in that country broadcasting emergency information. The most powerful station in the country, the one most regularly heard practically any evening on 750 kHz, is YNX, Radio Equis ("Rahdyo Ek-ease"). This also can be heard early in the morning before KXL, Portland, Oregon, signs on.

WHAS, Louisville, Kentucky, on 840 kHz, recently decided to stay on the air all night; this makes reception of HOL80, Panama, more difficult but not impossible. With WHAS nulled down, Radio Libertad can be heard fairly easily on the West Coast.

One powerful station in Central America is not on what Americans would consider a "regular" frequency, but instead broadcasts on 834 kHz, commonly called a "split frequency" because of its position in between the 10 kHz separations of United States stations. Radio Belize, in British Honduras, is unlike most of the other stations in South or Central America, because it broadcasts in English most of the time. Its 20 kW signal reaches the West Coast quite easily in the early evenings, and a moderately good receiver can split it off between WCCO, 830 kHz, and WHAS, 840 kHz.

Among the countries on the list commonly heard by voices are El Salvador, YSS, on 655 kHz. It can be heard in the early evenings slightly below KBOI, Boise, Idaho, on 670 kHz. YSKL, 765 kHz, is audible if the DXer lives far enough away from San Diego or Denver to avoid interference from KFMB on 760 kHz or KOA on 770 kHz.

There are many other countries in Central and South America and in the Caribbean which can be heard, but the above are probably the first countries in Latin America to be heard. Many Costa Rican stations broadcast on split frequencies, making their reception easier. A new station, Radio Paradise, has begun broadcasting on 1265 kHz with 50 kW from the island of St. Kitts, in the Leeward Islands. It has been heard with religious programing throughout most of North America.

West Coast DXers have one advantage in DXing South America. In the summer, when many DXers stop listening because of heavy static from thunderstorms, and because of other activities, it is possible to hear stations from deep in South America which otherwise would not be heard. Because of the changing angle of the sun as it pursues its yearly course through the sky, sunrise occurs on the East Coast and in the Midwest of

North America before it occurs on the west coast of South America. Thus, interference from stations in these areas, as well as static from thunderstorms, is eliminated with sunrise. The darkness path between Chile or Argentina and the West Coast allows stations such as CB-18, Santiago, Chile, on 1180 kHz, to be heard. A few of the higher-powered South American stations have the strength to penetrate the higher noise levels of summer.

Trans-Atlantic Stations. Trans-Atlantic stations pose a special problem for West Coast DXers. The paths that signals from these stations must follow pass very close to the geomagnetic north pole in northern Canada. Surrounding the geomagnetic pole is a zone of highly charged particles in the ionosphere called the auroral zone. It is these particles which produce the visible "aurora borealis" that is seen in higher latitudes. Most radio signals are absorbed by the auroral zone and never reach the West Coast. It is only when there is a period of low geomagnetic activity that signals from Europe are able to penetrate to the West Coast.

Many BCB DXers listen faithfully to the reports on WWV from the Telecommunications Service Center at 18 minutes after the hour to find out what kind of geomagnetic activity is present. When the A index, representing the geomagnetic activity, begins to drop, as it typically does in late September, interest begins to rise, and DXers start examining the European frequencies for any signs of a breakthrough. Eventually, carriers can be detected on trans-Atlantic frequencies and, if luck holds out, bits and pieces of audio begin to show up as the signals flutter their way through the auroral zone. Sometimes enough can be heard to submit a report to the most likely station. However, usually there will be a geomagnetic storm sooner or later, and trans-Atlantic DX is lost again for another few weeks. Sometimes in years of high sunspot counts, with the subsequently increased geomagnetic activity, an entire season can go by without anyone on the West Coast reporting a single trans-Atlantic carrier.

Trans-Pacific Stations. With DX opportunities to the northeast limited to about ten days a year, the West Coast DXer naturally turns to the west; to stations in New Zealand and Australia, to Hawaii and Tonga, and the other islands of the Pacific, to Asiatic Russia and Japan and Korea. Sometimes a babble of Oriental languages confronts the DXer as he tunes the dial. At other times, the clipped accents of Aussies or Zedders are heard. The West Coast DXer has the opportunity to hear stations which are practically impossible to hear anywhere else in North America. In fact, some of the most widely heard Asiatic stations in the past few seasons have not even been heard as far inland as Riverside, California, about fifty miles from the coast. Despite this, the stations were heard very well by DXers living in cities nearer the Pacific Ocean.

In order to catch trans-Pacific DX, the listener learns that he must adjust his listening habits. Unlike stations on the higher shortwave bands, distant BCB stations cannot ordinarily be heard if a large portion of the signal path is in daylight. Absorption by the ionized D and E regions of the ionosphere effectively limit daytime reception to stations within a couple hundred miles. Once evening comes, the D region disappears and the radio waves can be refracted from the higher layers to be heard thousands of miles away. The East Coast DXer, for instance, starts

DXing for European stations around 6 p.m. (EST) as his location slips into darkness. The West Coast DXer, however, at his sunset, can hear only stations which are also in darkness, such as Latin Americans or eastern U.S. stations. To hear a station from the Pacific area, he must wait at least until sun has set at the transmitter site.

As an example, the earliest that a Hawaiian station can be expected to fade in is about 8 p.m. (PST), or shortly after sunset in Hawaii. Generally, it takes some time for the ionized regions of the ionosphere to recombine, so fade-in time is usually well after sunset at the transmitter. Thus, for places farther west than Hawaii, it is even later, usually after midnight on the West Coast, before such stations can be heard. Either a West Coast DXer must stay up until the trans-Pacific stations start to arrive (not a very practical solution for most of those who must get up for work or school the next day), or get up about 3 a.m. (PST), at the time that many trans-Pacific signals start to roll in. As the night progresses, some channels are blocked for a time by eastern or midwestern stations signing on, but as these stations move into sunlight, they are eliminated. Sometimes Pacific stations are best just before sunrise on the West Coast, and when conditions are good, some strong Asiatic stations, such as Peking, China, on 1040 kHz, can be heard even for a short time after sunrise on the West Coast.

The best time to look for trans-Pacific stations is on Sunday night, or actually early on Monday mornings. This is the traditional time for U. S. and Canadian stations to go off the air for a few hours after local midnight for transmitter maintenance. Some stations go off every Monday morning; others only once or twice a month. When they do go off, they give DXers an opportunity to hear stations which ordinarily are blocked.

Generally speaking, the best place to start looking for trans-Pacific stations is on the clear channels—frequencies which have only one or two stations on them in the whole North American continent. For instance, if WWL in New Orleans, Louisiana, has a rare silent period, then the frequency of 870 kHz is clear for reception of KAIM in Honolulu, or JOGB in Kumamoto, Japan.

Starting with the easiest countries for the Southern California DXer to log, the first ten Pacific and Asian countries a novice would probably log are Hawaii, Japan, Alaska, North Korea, Gilbert and Ellice Islands, China, U.S.S.R., Ryukyu Islands, New Zealand, and Australia. Other DXers, living elsewhere in the west, probably would rearrange this list. Someone living in Seattle would probably put Alaska on the top of the list.

The first Pacific station which most novice DXers hear is KORL in Honolulu. This 10 kW station, on 650 kHz, faces very little interference during Sunday evenings and Monday mornings from 10 p.m. to 2 a.m. (PST). The other two stations in English on this frequency are WSM, Nashville, Tennessee, and KYAK in Anchorage, Alaska. Both of these, however, feature country and western music, while KORL has sleepy to semiclassical music, with news on the hour.

Most Hawaiian stations broadcast on frequencies ordinarily covered on the mainland by clear-channel 50 kW stations. As a result, the Hawaiians generally show up only when the other stations are off the air, or, in some cases, when they are blocked by auroral conditions. The following list shows the more commonly heard Hawaiian stations and the interfering mainland stations:

Frequency	Hawaii	Interfering stations
650	KORL	WSM, plus adjacent channel QRM from KFI on 640 kHz.
690	KKUA	XETRA, Tijuana, Mexico; CBU, Vancouver, Canada.
720	KUAI	WGN, Chicago.
760	KGU	KFMB, San Diego.
830	KIKI	WCCO, Minneapolis.
850	KHLO	KOA, Denver.
870	KAIM	WWL, New Orleans.
1040	KHVH	WHO, Des Moines.
1130	KLEI	KSDO, San Diego; CKWV, Vancouver, Canada.
1210	KZOO	WCAU, Philadelphia; KGYN, Guymon, Oklahoma.

Most Hawaiians tend to be reported from late September to mid-November and from mid-February to early May. KIKI is sometimes audible when WCCO has been knocked out by an auroral storm. Minneapolis is the farthest northern city of those listed above; hence, WCCO is usually the first on the list to disappear.

Of the Asiatic countries, Japan is probably the easiest for most listeners to hear. In preparation for the 1968 Olympics, NHK, the government network, beefed up a number of stations to higher power. Since that time, stations such as JOIB, Sapporo, 750 kHz; JOUB, Akita, 770 kHz; and JOBB, Osaka, 830 kHz, have been heard regularly on the West Coast. Again, most receptions have been logged between 1:30 and 3:00 a.m. (PST) on Monday mornings.

While novices have difficulty in distinguishing Japanese from Chinese or Korean, NHK (Nippon Hoso Kyokai) makes identification a snap for English-speaking DXers by scheduling English language lessons at the time when these stations are most frequently heard. Lessons often consist of English phrases with the Japanese equivalent. A minute or two before the hour, NHK stations switch back into Japanese; then on the hour, usually just after a musical interlude, the characteristic interval signal of NHK, "Pip, pip, pip, PEEEP" shows up, followed by a young lady saying "NHK," followed by the call letters of the station in English. Since all NHK stations generally have the same program on simultaneously, it is possible to log a number of Japanese stations in one sitting by tuning up and down the dial for the same program.

Alaska is classed as a separate DX country because of its separation from the lower 48 states. It would seem to be an easy country to log, but very often isn't, except for DXers living in the northwest. The reason is auroral blocking. Signals from these far northern stations have to pass through the highly absorbent auroral zone most of the year, and thus their signals are weakened or completely absorbed. KFQD in Anchorage, on 750 kHz, is perhaps the most commonly heard station. It usually features rock music. KYAK, also in Anchorage, on 650 kHz, as mentioned earlier, carries a format of country and western music. Sometimes it is mistaken for WSM, Nashville, which has a similar format. Another station heard occasionally is KJNP in North Pole (near Anchorage), on 1170 kHz, with religious programing. Others include KICY, Nome, on 850 kHz, and KSRM, Soldotna, on 920 kHz, with religious programing. Alaska has no commercial shortwave stations, so for many DXers the broadcast band stations are the only way to log this country.

North Korea is a relatively easy country to log, since its stations are on split frequencies. The Second Network powerhouse in Pyongyang on 655 kHz is probably the most widely heard station, although the First Network station on 877 kHz in Wonsan is also noted frequently. The 877 kHz station, as well as the unit on 1005 kHz in Hamhung, has a tendency to drift in frequency a kilohertz or two from season to season. Very often, all that will be heard on the North Korean stations are long harangues in Korean, with martial music, and choruses with women's or children's voices.

As mentioned at the beginning of this section, VSZ1, with 10 kW from Tarawa, in the Gilbert and Ellice Islands, is frequently heard between 11 p.m. and 1 a.m. (PST). Quite often, programs consist of Polynesian music, with announcements made in native dialects by a woman announcer. The Gilbert and Ellice Island Broadcasting Service plans to install a 2000-watt transmitter on 580 kHz, but interference from domestic stations will probably prevent most U. S. DXers from hearing this station.

If ionospheric conditions are not good, sometimes only one Asiatic station can be heard. This is one of the most powerful stations in the world, reputedly one and one-half million watts, somewhere near Shanghai, People's Republic of China. It can be heard frequently just before sunrise on the West Coast after WHO, Des Moines, Iowa, has already been stilled by sunrise. This station has been reported in past years, even after sunrise and even on a car radio. As a foreign service station, it broadcasts programs in Chinese, Korean, and even English (beamed toward Australia). Other Chinese stations occasionally reported include the one in Nanchang on 835 kHz, with the Home Service, and the People's Liberation Army station in Fukien Province on 1020 kHz.

Last season (1971-1972), a new station broadcasting in Chinese showed up on 1529 kHz. Art Peterson of San Pablo, California, is said to be the first one to have heard it. He suspected that it was not from China and, at 3:30 a.m. (PST), his suspicions were confirmed when he heard the Kremlin bells, indicating that it was a Siberian station. It was identified as a foreign service outlet in Khabarovsk. There now seems to be some evidence that the station has shifted frequencies to 1475 kHz, where it had been operating before it was found on 1529 kHz. Another Russian station occasionally heard in North America has been heard under the North Korean station on 655 kHz, either on 655 kHz itself or possibly on 656 kHz.

Another powerful station which is often received on the West Coast is the million-watt Voice of America station on Okinawa, in the Ryukyu Islands, now a part of Japan again. The best time to listen for this station is on Monday morning from 5:30 to 6:00 a.m. (PST). In that interval, the station aims northeast toward Korea, and North America lies on the same path. This station can be identified by the "Yankee Doodle" interval signal on the hour and is generally followed by programs in Korean or Chinese. Sometimes this station, operating on 1178 kHz, can be detected only as a heterodyne, or whistle, against KOFI, Kalispell, Montana, on 1180 kHz.

New Zealand is a South Pacific country to be heard quite often from the West Coast. Station 1YC in Auckland, on 880 kHz, is one of the most commonly reported stations, usually from 12:30 to 1:30 a.m. (PST) on Monday morning when both KRVN, Lexington, Nebraska, and WCBS, New York City, are off. Others which are often heard are 1YA, Auckland, 760 kHz; 1YZ, Rotorua, 860 kHz; and 2YC, Wellington, 660 kHz. The best time of year to try for New Zealanders seems to be around the equinoxes in September and March, although these stations have been reported at other times during the year as well. The New Zealanders sometimes can be recognized by the heavy diet of classical music, as well as by the clipped accents on newscasts and commentaries.

Despite the large number of stations it has, Australia is not heard as frequently in North America, since it is farther away than any other Pacific country commonly heard. Consequently, signals are weaker and only rarely are they strong enough to be recognized. The only Australian station regularly reported is 4QD, Emerald, Queensland, 1550 kHz, with 50 kW, although 2NA, Newcastle, New South Wales, 1510 kHz, with 10 kW, does show up on occasion. Like the Zedders, the Australian stations can be recognized by the classical music programs that the Australian Broadcasting Commission carries.

It is strange that some other Pacific area countries with high-powered transmitters are not heard very often in North America. One such country is the Philippines. In recent years, the only station which has been reported is a Voice of America station in Poro. Even with its one million watts of power, this station, on 1140 kHz, has been heard only at sign-on time of 3:00 a.m. (PST) or an hour later at 4:00 a.m. Usually, all that can be identified is the "Yankee Doodle" theme, plus, perhaps, a little bit of Chinese.

One of the most elusive Pacific stations for many West Coast DXers is ZCO in Nuku'alofa, Tonga. Most frequently, this one is heard after KSWS, Roswell, New Mexico, on the same frequency of 1020 kHz, signs off. Even then, KDKA in Pittsburgh, Pennsylvania, usually overrides ZCO. When auroral conditions exist, KDKA is often weakened to the point that Tonga can be heard when it fades upward. Unlike most others, this one is heard best on Sunday mornings between 1:00 and 1:30 a.m. (PST). Monday mornings, usually the happy hunting time for DX, is eliminated in this case, since KGBS in Los Angeles is on the air then.

One last country to be mentioned is Thailand. Here the Voice of America also runs another million-watt station, this one in conjunction with the Royal Thai Government. The station, on 1580 kHz, has been reported in recent years with programs from both sources. Identifying the Voice of America segments is easier, of course. Again, Monday morning, with KDAY, Santa Barbara, California, off the air, is the best time to try for this one.

There are many other South Pacific and Asian countries which could be mentioned, but the above stations and countries are probably the best bets for a novice.

The West Coast BCB DXer is, in some ways, at a disadvantage because of the greater distances to the stations he hears and the in-convenient times he must listen. He must learn patience. Multiskip receptions from Australia or other distant Pacific locations have a tendency to fade in and out; sometimes a station will be audible only for a minute, and then fade out for several minutes before reappearing.

Despite the disadvantages of West Coast BCB DXing, the number of those attracted to this branch of the hobby is increasing. Quite apparently, DXers are willing to put up with the inconveniences in order to hear rare stations.

Father Jack Pejza is the foreign editor for the International Radio Club of America. As a high school student in San Diego, he used to listen regularly to stations in Chicago and New Orleans, but gave up this informal DXing when he went back east to study for the Catholic priesthood. After teaching physics for several years in a prep school near Philadelphia, he was transferred back to California, where he continued to teach at Villanova Prep School in Ojai, near Santa Barbara. It was here that he began once again to DX, at first on the shortwave bands, and then on the broadcast band.

In 1968, Father Jack became the editor of DX Worldwide, the foreign column of IRCA's weekly bulletin, **DX Monitor**. He has published numerous articles in the club bulletin on various technical aspects of the hobby. In 1972, he edited the **IRCA Foreign Log**, a 124-page compilation of reports submitted to **DX Worldwide**.

At present, Father Jack lives in San Diego where he teaches school at St. Augustine High School. He uses a Hammarlund HQ-180AC receiver, a 2½-foot loop antenna, and a 300-foot longwire antenna. In the course of five years of DXing, he has heard over 700 broadcast band stations. He now concentrates on foreign BCB DX and has heard over 250 foreign stations, mostly in Latin America, the Pacific, and Asia.

THE TROPICAL BANDS

In the United States, Canada, and Europe, we rely on AM and FM standard broadcasts for local news, music, sports, and cultural programs. Even in a country as large as the United States, the 4500 AM and 2500 FM stations are enough to cover most populated areas and give everyone a reasonably good variety of programs from which to choose. Though there are only a few hundred stations in Canada, they adequately cover the bulk of the population which lives in a narrow strip along the northern border of the United States. And in Europe, the governmental broadcast authorities have enough money and manpower to construct a sufficient number of AM and FM stations.

This is not the case, however, in the rest of the world. While AM and FM are in use, the practical range of these broadcasts, perhaps 50 miles during the day and up to a couple of hundred at night, is not enough to cover the vast nonurban areas of most nations. Transmitting equipment and studios are expensive; therefore, insurmountable problems are associated with covering a nation with AM and FM alone. For example, in the Republic of Zaire in West Africa, certain portions of the country are more than a thousand miles from Kinshasa, the capital.

So, in many areas (particularly the nonurban areas of farm and pasture land, jungle, mountain, desert and plain), shortwave radio is the only contact that people have with the outside world. This explains the continuing popularity of the tropical broadcast bands. There are four broadcasting bands spread out over the region of 2000 kHz to 6000 kHz, which are primarily used in the equatorial regions of the world: Africa, Asia, South and Central America.

In our present era, the governments of these nations realize that education and entertainment of their citizens is essential for the progress of the post-colonial age. Shortwave is ideal for this purpose, because radio signals are not deterred by natural obstacles, penetrating even to the most isolated areas. Lower shortwave frequencies, say, up to 8 MHz, are ideal for covering even a large country, for the range is at least a couple of hundred miles during the day, and many thousands of miles at night. So, in addition to the usual AM and FM wavelengths for the city folk, many official and commercial stations in these equatorial countries use the tropical bands to call their listeners. In Indonesia, in fact, these bands were used exclusively for domestic programs until 1971 when a couple of AM outlets were opened. Table 7-1 lists tropical band allocations.

There are some international broadcasts in these bands, notably from Communist stations, and, indeed, part of the 75-meter amateur band is allocated for European international broadcasting. But for the most part, these bands are inhabited by infinitely varied stations in the most exotic lands of the world: Nepal, Peru, Brazil, Nigeria, Solomon Islands, and Malaysia, to mention a few.

In many ways, these stations are much like our own local AM and FM stations. There are disc jockeys, hit records, commercials, network news, classical music, and sports. The only difference, other than in the language used, is that these broadcasts are found on the shortwave frequencies. On the other hand, there are very important functions fulfilled here. Cultural and educational programs are efficient ways of spreading knowledge and eradicating prejudice and doubt. National unity can be aided by something as innocuous as radio, because everyone is exposed to a common tongue and standardized speech patterns, important in many areas where tribal dialects hamper communication within a country.

Nature of Tropical Band Stations

The world of the tropical bands is completely different from that of the international broadcasters. The primary goal of a station like the

Table 7-1. Tropical Band Allocations.

	120 Meters	90 Meters	75 Meters	60 Meters
Europe, North Africa	None	None	3900-4000	None
Africa	2300-2500	3200-3400	None	4750-5060
Asia	2300-2500	3200-3400	None	4750-5060
Oceania	2300-2500	3200-3400	3950-4000	4750-5060
North America	None	None	3950-4000	None
South America and Central America	2300-2500	3200-3400	2900-4000	4750-5060

Voice of America is to present the views of the United States on national and world affairs, and to attract attention with interesting programs about national life. Thus, international stations are primarily interested in foreign listeners. Of course, most tropical band stations are solely interested in listeners in their own localities.

International broadcasting is strictly noncommercial, although one may well say that programs from, for example, Radio Canada International, are advertisements for the country as a whole! In contrast, many tropical band stations are commercial, and such products as Paul Revere cigarettes in South Africa, Mejoral in Brazil, as well as more familiar items like Coca-Cola and Alka-Seltzer can often be heard.

The broadcasts of an average large shortwave station like Radio Sweden are a marked departure from the normal broadcasts of the AM and FM bands. Considering the number of listeners, their varied languages and locations, Radio Sweden cannot have an all-day program in English in the same way that our local stations have continuous broadcasts. Instead, the program day is broken up into transmissions to various parts of the world, which have a carefully edited half hour or hour of news, commentary, and feature programs in each major language.

Most tropical band stations have relatively continuous broadcasts, such as we all know so well. Some break their broadcast day up into two periods, morning and evening, centered around 7 a.m. and 9 p.m. local times, when the audience is the largest. Moreover, tropical band stations may stay on their frequencies for decades, while international stations shift frequencies four times annually to compensate for changes in reception conditions, which are far more important on the higher bands.

Perhaps most startling of all is the meagerness of equipment in an average tropical band station. One typical Colombian broadcaster uses a circuit with two type 833 tubes modulating a pair of type 833 final amplifiers, developing a power of 1000 watts. Radio amateurs will remember that sort of setup from 15 or more years ago! One kilowatt is the average power for a tropical band station; 10 kW or larger transmitters belong to the biggest stations. Antennas are generally simple dipoles and inverted vees, and many a station has a studio consisting of a turntable, microphone, engineer's console, and cables to the transmitting equipment, all tucked into one room of a building on a crowded street! Compare this with the incredible diversity of equipment, the 100 kW transmitters, the giant log-periodic and the curtain array antennas, of a major international shortwave broadcaster like Radio RSA in Johannesburg, South Africa!

What, then, are the attractions of tropical band DXing for the foreign listener? These programs are not directed to him, since they are generally in languages he doesn't understand, and the signals are subject to all manner of interference. Well, these are the happy hunting grounds of the DX enthusiast, searching for the low-powered outlets in any of more than 130 countries around the world where stations operate on the tropical frequencies. The language whiz or philologist can monitor broadcasts in Portuguese, French, and Spanish. Or perhaps you would like to polish up your knowledge of Indonesian, Quechua, Swahili, Pidgin, Mandinka, Burmese, or Arabic? You can compare your accents with those of the native speakers on the tropical bands. Some stations even have special programs for their nationals abroad, since reception at night is often good for thousands of miles. One can hear local programs which give some of the flavor of life in faraway nations. Many DXers have become real connoisseurs of the indigenous highlife music of Central and West Africa, lilting Indonesian melodies, distinctive Andean flute and guitar music, and many other rhythms of the corners of the world.

Some people have even taken it upon themselves to learn more about the countries they have heard on the tropical bands; a positive contribution to brotherhood among people everywhere. And on very rare occasions, real history is made in the tropical bands, particularly in respect to natural disasters or political upheavals, so common among the developing nations of the world. And finally, there is the satisfaction of obtaining a QSL card or letter, a tangible memento of a faraway nation, and a true listening achievement.

Tropical Band Propagation

For the tropical band DX expert, propagation conditions are of great interest. He looks for signs of improved conditions which may bring in a rare station or new country for his logbook. Propagation is in constant flux, and the serious DXer understands the basic mechanics of reflection and reception of signals from thousands of miles away.

The ionosphere is composed, as many of you know, of several layers which have varying composition and character. There are a few variations which have a direct effect of tropical band reception. First is the action of the D layer, found at 30 to 50 miles above the surface of the earth. This layer is the least ionized of all, but it is important for tropical band reception in that is absorbs frequencies below 7 MHz or so. The D layer composition is directly dependent on the action of the sun. It is formed shortly after sunrise, peaks around noon, and rapidly dissipates after sunset. While it exists in a certain locality, tropical band reception is usually limited to only a couple of hundred miles, from, say, an hour or two after sunrise until a couple of hours before sunset. Any transmissions on the lower frequencies during these hours are simply absorbed by the D layer.

The primary layer of reflection in the tropical bands is the F2; one half of the F layer. During the day, the F layer splits into two distinct regions: the F1 layer, which at noon on a typical day is around 130 miles high, and the F2, which is found around 220 miles high during the day. As night approaches, these two layers gradually merge, until there is just the F2 layer, which continues to descend to a height of around 160 miles at midnight.

The distance which a radio wave is reflected on one hop (the skip distance) is dependent on a variety of factors. The height of the F2 layer is one, because the higher this layer is, the greater the distance of reception for a particular angle of radiation. In general, the skip distance is least at midnight and greatest around sunset and sunrise, at least until the absorption of the D layer nullifies the added height of the F layers. Typical values of skip distance for the tropical bands range from 100 to 1000 miles.

Obviously, these typical distances cannot account for receptions of many thousands of miles on the tropical bands. Multihop propagation is the mode of most long-distance reception. In fact, around sunrise and sunset, the increased height of the F layer just balances the absorbency of the D layer, and thus signals may travel 10,000 or more miles by a dozen or more hops. At times like these, one can savor the delights of picking up a low-powered signal on long path*, sometimes with the odd flutter of a signal passing through the auroral regions of the North and South Poles.

An important aspect of tropical band reception is the "darkness phenomenon." In general, reception of a thousand miles or more is not possible unless most or all of the transmission path is in darkness. This stands to reason, for if a significant part of the path is in daylight, the presence of the D layer means the signal will be absorbed. Because of this darkness phenomenon, a signal may fade within a matter of minutes as daylight breaks at the transmitting or receiving site, even though at the other end it may be midnight.

Propagation conditions are profoundly affected by changes and storms on the sun. Sometimes a huge solar flare can wipe out the entire radio spectrum, because the whole ionosphere turns into something like a giant D layer, and is so saturated that it absorbs all wavelengths.

But even disasters like this can give us new insight into the working of radio wave propagation. One recent theory holds that, during one of these gigantic solar storms, a narrow band of reflection still exists around the equator, where the magnetic field of the earth is the weakest. At these times, signals on the same latitude on the other side of the equator are audible. This may have indeed occurred in August, 1972, during one of the most spectacular auroras of recent years. In many areas, all shortwave signals were blocked, but several DXers along the northern U. S. border reportedly logged the very rare signal of the broadcasting station at Port Stanley, Falkland Islands, on 3958 kHz. This is not the first time the Falkland Islands station has been in the news. A DXer in Colorado heard it in the 1960s to the astonishment of everyone; even more perplexing, he received a verification for it.

At the time this happened, a report of this logging was made to the shortwave column of the **Newark News Radio Club**. As editor of this column, I included the item in regular form. Shortly thereafter, I was besieged by letters from club members who said, in no short order, that such a logging was impossible. After another brief period of time, the Colorado DXer reported receiving a verification from the station and, upon my request, he sent me a certified copy of the verification. In an attempt to pacify many club members who still felt it impossible, I personally wrote to the station, giving all of the facts, and asked them to confirm the fact that they had received a reception report from the Colorado DXer and had, in turn, issued a verification for the logging. The station quickly replied that they had, indeed, received an accurate and detailed report of the logging which included items of local area information which had never been published anywhere. They further stated that the QSL had been issued because the report was correct. Now, please, very carefully read the next three sentences. After the ensuing controversy over the possibility of logging such a rare station, the Stanford Research Institute in California concluded a study which showed that it was indeed entirely possible in a small area of the western

* Reception of signals by other than a direct shortest-distance route.

United States. Clearly, a novel mode of propagation via a hitherto unknown reflecting layer was responsible. Even today, there is room for studies of propagation, and observation by diligent DXers continues to be a major source of definitive information.

In the search for the elusive, low-powered, odd-houred station, the DXer often has to rely on intuition. Propagation reports from time-and-frequency stations WWV and WWVH are often helpful, but sometimes only an evaluation of conditions on the spot can alert the DXer to unusually good conditions. In these cases, he might note that a regularly heard station is coming in well, so perhaps another one that he wants to hear, which is located in the same area, will also be audible.

Some seasonal variations are well enough known that the listener has a good idea which continents or regions of the world will come in and when. These variations, taking place over a period of weeks or months, are primarily due to the changing characteristics of the F2 and D layers.

On the one hand, the D layer has less effect during local winter, when there are less hours of sunlight. Openings are longer and stronger from day to day. On the other hand, the F layers are lower in height during the winter, so the average skip distance is not as great as in the summer.

Although the F layers are higher during the summer, and the skip longer, the great increase of noise due to thunderstorms during these months nullifies any benefits. The crackle and crash of lightning strokes are all too well known to the tropical band DXer, and, even more so, the frustration of trying to hear stations through the noise. All in all, summer listening is less productive than that of other seasons, but you should never give up on DXing in the summer. Several times each summer, the signals will come in so well that they will override the local noise.

In addition to these seasonal variations, we must keep in mind the 11-year solar sunspot cycle. Because of high solar activity at the sunspot maximum, several factors combine to decrease the quality of reception: a more absorbent D layer, a high LUF (lowest usable frequency) on transoceanic paths, and a greater percentage of solar storms. During low parts of the sunspot cycle, the D layer is less absorbent, the LUF is lower, and solar disturbances are at a minimum. Conditions all around are more regular at these times.

Now, we'll take a look at each of the tropical broadcasting bands. Although conditions differ greatly from one part of the world to another, many stations are audible all across the globe.

Although tropical band stations generally do not shift frequencies, changes are made and the frequencies mentioned below may not be in use. At the time that this resume was prepared, however, the stations were on the frequencies as indicated.

120 Meters (2300-2500 kHz)

There are relatively few stations in this band and very few of them are audible for more than a couple of hundred miles. Generally, power ratings of 1 kW or less are used on 120 meters and the propagation at these lower frequencies discourages long-distance reception. Logging in North America of any of the South American, African, or Asian stations on this band is one of the supreme accomplishments of the DX hobby.

Reception is dependent on an excellent antenna, a favorable location, a good receiver, and lots of patience. The only regularly audible stations are WWV and WWVH, the National Bureau of Standards time and frequency stations in Colorado and Hawaii, respectively. These are found on 2500 kHz during the dark hours, but don't try to hear them during the daytime unless you are within a couple of hundred miles or so from either station. Occasionally, ZUO in Johannesburg, South Africa, another such station, will show up on 2500 kHz.

The 120-meter band is shared with marine services. You'll be able to hear stations like the Boston marine operator, for instance, on 2450 kHz, but these are more properly classified as utility stations. In between the marine stations, you may occasionally pick up tropical band stations like St. Denis, Reunion Island (in the Indian Ocean) or Radio Mount Hagen in New Guinea. They are on 2446 kHz (with 4 kW power) and 2450 kHz (with 2 kW power), respectively.

Daylight reception of the tropical band stations is never possible on the 120-meter band, since the D layer continues to exert its influence right up to sunset. Even at night, conditions are usually not good enough to propagate the low-powered signals. But veteran DXers keep an eye on the band, checking it now and again for a possible opening which might bring in a broadcaster. Such things are entirely possible and they do happen.

90 Meters (3200-3400 kHz)

This is the first band in which a number of stations are regularly audible. Outlets in all the equatorial regions may be heard, including Asia, Africa, and South America. Somewhat higher powers may be used by stations in this band and conditions are usually far superior to those on 120 meters; reception of signals from many thousands of miles is often possible. Again, a good antenna and receiver are necessary for successful DXing on this band.

Time station CHU, 3330 kHz, Ottawa, Ontario, Canada, is known to most listeners. This one has voice announcements in both English and French, reflecting the bilingual nature of our neighbor to the north. Stations in the exotic Far East, particularly Indonesia and the Pacific Islands, which are always sought after by the DXer, are occasionally found here. One may very well hear the latest American country and western music over Radio Rabaul, 3385 kHz, on New Britain Island, with announcements in English and Pidgin. Just two of the many frequencies of the People's Liberation Army Front Station, in Fukien Province, China, are 3200 and 3400 kHz, with Chinese commentaries and music.

African stations are active on 90 meters from Sierra Leone down to the tip of the continent in South Africa. Surprisingly, the signal of Radio South Africa is often the best on the band from that continent. In addition to some of the more common countries, very rare stations in Malawi, Burundi, Rhodesia, and the Niger Republic use 90 meters.

Finally, there are a multitude of signals from South and Central America. Brazil is well represented, particularly by Radio Olinda, 3375 kHz, in the state of Pernambuco, with rapid Portuguese patter and music. Radio Iris, Esmeraldas, Ecuador, is a strong performer on 3381 kHz with Spanish and typical Andean music. Radio Exitos, or Radio Success, 3365 kHz, certainly lives up to its slogan. This is a station in the Dominican Republic and is one of the best heard stations on this band.

Not all of the stations in the 90-meter band are in foreign languages. On 3300 kHz are two English-speaking stations; Radio Grenada in the

Windward Islands, and Radio Belize in British Honduras. Action Radio, Georgetown, Guyana, on 3290 kHz, which programs a lot of old jazz and blues music, mixes English with Indian languages. All in all, there are dozens of stations in 25 or more countries which the serious DXer can hear.

Propagation conditions on the 90-meter band are best during the night hours, but some reception may be possible during unusually fine conditions in the daylight hours. As we have mentioned before, conditions are good enough to allow some stations to come in the year round, but one has to wait for superior propagation to log the really fine DX that is possible on 90 meters.

Although good conditions are not unusual on 90 meters, a variety of interference must be expected. Summer thunderstorm interference, amateurs in the MARS (Military Amateur Radio Service), radioteletype (RTTY) stations, facsimile (FAX) transmitters, and other such annoyances, clutter up the band. Interference has increased notably even in the past few years, and some stations like Radio Niamey, Niger, on 3260 kHz, are very rarely audible because of the QRM from the utility stations.

75 Meters (3900-4000 kHz)

This band is shared with radio amateurs in the United States and Canada and the din of single-sideband (SSB) stations is many times overpowering. Less is known about this band than any other except 120 meters, mainly because of the ham radio interference. But signals are sometimes quite audible, especially above 3950 kHz, which is allocated for European use in international broadcasting.

Although there are relatively few stations on this band, some of them make quite interesting listening. In Europe the BBC, from London, is often audible on 3952.5 and 3975 kHz with programs in English and other languages; these are beamed to North Africa, Europe, and the Middle East. The transmitter site at Munich, the German Federal Republic, relays the Voice of America on 3980 kHz and Radio Free Europe on 3960 kHz.

In Africa, the outstanding 75-meter signals are from Lagos, Nigeria, on 3986 kHz with 100 kW; Radio South Africa is another well heard outlet on 3997 kHz. Both of these frequencies are used only seasonally, however. There are a few local broadcasters such as Radio Buea, Cameroun, with 8000 watts on 3970 kHz, Radio Pax, Mozambique, operated by the Franciscan Fathers on 3960 kHz, but these are rarely audible.

In Asia, this band is used somewhat more frequently, especially by the Chinese and Indonesian stations. Nihon Shortwave Broadcasting Company, Ltd. (NSB), Tokyo, on 3925 kHz, and Surabaja, Indonesia, on 3975 kHz, are two of these. Oceania has a sprinkling of stations with Radio Vila, 3945 kHz, New Hebrides, and the Solomon Islands Broadcasting Service, Honiara, on 3995 kHz, being among those which are avidly sought by DXers.

There are only four stations listed for operation in the Western Hemisphere on 75 meters. Escuelas Radiofonicas Populares, Riobamba, Ecuador, 3985 kHz, is one of three Ecuadorians here; the fourth is Godthaab, Greenland, on 3999 kHz, another distinct rarity.

60 Meters (4750-5060 kHz)

Now we move to the most active of the four tropical bands. Conditions generally allow reception for at least an hour (up to two hours in winter months) after sunrise and before sunset. Stations which are directly north or south of the listener are audible as soon as the sun sets, a situation which may not exist on the tropical bands where the D layer and LUF prevent reception until some time after the sun has set.

Not only are conditions better and openings longer in time and distance on 60 meters, but there are many more stations than on the other tropical bands. Several hundred may be on the air at any given time and they range from puny 100-watt signals to transmissions of 100 kW. Power ratings in general are larger and many of the best-known stations on 60 meters use 10 kW and more. A top DXer may be able to log 100 or more stations on the band during the course of a year, and even a table model shortwave receiver can pick up at least a couple of dozen.

Seventy-five or more countries crowd these frequencies from localities around the world. But the traditional emphasis on the band is on South America, and a dedicated corps of listeners all over the globe hunt for the multitude of interesting stations found on 60 meters. In North America, by reason of the sheer volume and number of Latin American stations, they are the focus of attention. For instance, the 1000-watt Santo Domingo station, Radio Mil, 4930 kHz, is a powerful voice from the Dominican Republic, with lively music, commercials, and baseball games. The rhythms of northern South America are well represented by Radio Barquisimeto, 4990 kHz, in Venezuela, and by Colombia's Radio Colosal, 4945 kHz, in Neiva, and many other stations in these two nations are well audible on even the simplest of receivers.

The nonstop Portuguese barrage of the excited futebol (soccer) announcer can be tuned in on 4865 kHz from Radio Clube do Para in Belem, Brazil. Quechua, Aymara, and other Indian languages are used on stations like Radio Jaen, 5005 kHz, in Jaen, Peru. Central America has a few stations, too, notably, Radio Progreso, 4920 kHz, in El Progreso, Honduras.

No survey of stations in the Western Hemisphere on 60 meters can be complete without mention of the many religious stations. A good example is HRVC, 4820 kHz, Tegucigalpa, Honduras, which has English programs as well as Spanish. La Cruz del Sur in Bolivia, Radio Luz y Vida in Ecuador, and another Bolivian, Radio Fides, are some of the other religious stations. Although not all of the programing may be totally oriented toward religion, they are generally better verifiers than other stations, which may be important for the DXer chasing down one of those elusive QSLs for a country like Bolivia.

There are a number of time stations on this band, centered around 5000 kHz. WWV and WWVH are here and generally dominate. But at times LOL, Buenos Aires, Argentina, or ZUO, Johannesburg, South Africa, are audible in North America. Some listeners may be able to hear other time signals from Italy, Russia, China, and Japan. Not only are the time stations useful for checking the time and frequency, but they are interesting DXing challenges.

Certainly, South America is not all that 60 meters has to offer. Moving to Africa, we can find many stations on the air. Most of the nations below the Sahara are represented here and some have excellent signals.

In contrast to South and Central America, where the two principal languages are Spanish and Portuguese, African stations use four principal languages of European origin, as well as local languages. French is predominant in the western areas of Africa, and such stations as Radio Bamako, Mali, 4787 kHz, or Bangui, Central African Republic, on 5038 kHz, can be tuned in fairly easily. Many of these French-speaking stations started out as tiny relay outlets of the giant Office de Radiodiffusion-Television Francaise (ORTF), retransmitting programs from Paris. Now, they are stations in their own right, and most have replaced the 4 kW ORTF transmitters with units of 30 kW and, in some instances, up to 100 kW. The 100 kW signal of Lome, Togo, is one of the best signals on the band, year in and year out, on 5047 kHz.

Arabic is also an important language. As a matter of fact, many of the old French colonies, Mauretania, for example, are predominantly Arab, and the stations in these areas combine French and Arabic programs. The unusual Arabic chanting from Nouakchott, Mauretania, 4850 kHz, or Omdurman, Sudan, on 5038 kHz, are soon recognizable by the experienced 60-meter DXer.

Another language used extensively is Portuguese. It would be fair to say that the Portuguese-speaking stations are the most sought-after in the tropical bands. Emissora Regional, in the Azores Island group in the Atlantic, on 4865 kHz, and Emissora Oficial, Bissau, Portuguese Guinea, 5045 kHz, are two well heard stations that broadcast in this language. But from there on, the going is distinctly tough! There are a handful of Portuguese-language outlets in Angola and Mozambique, and hearing and verifying them from virtually any location in the world is a true DX achievement. Radio Clube do Huambo, Nova Lisboa, 5060 kHz, and Radio Clube do Lobito, Lobito, 4937 kHz, are the best heard Angolans, and the "B" program of Radio Clube de Mozambique, Lourenco Marques, is audible at times on 4923 kHz. But none of these is heard without much difficulty. If you feel up to it, and conditions are good enough, you can dig down for Radio Clube da Huila, Radio Clube da Cabinda, and others, all on poor frequencies with much utility QRM, low power ratings, and with generally poor antenna systems.

Finally, there are the English stations. Already mentioned was Radio Clube de Mozambique, whose "B" program is partially in English, although their other programs are in Portuguese. Radio South Africa, again, holds forth with fine signals on 4945 and 4965 kHz. The former frequency carries the Springbok Radio commercial program, with the familiar pop tunes and commercials. Ever since the United States government banned ads for cigarettes, Springbok has been the only place to hear them. Today, you can hear them encouraging you to light up a Paul Revere or a Wingfield. Another well heard station is Radio Accra, Ghana, which has the National Program on 4915 kHz and the commercial broadcast on 4980 kHz.

In addition to these languages, programs in local vernaculars are often heard. Swahili, Hausa, Afrikaans, Mandinka, and other exotic lingoes are used by stations in Africa. Most of the stations on the continent are government-controlled, so there is a special purpose in using these isolated languages.

Although European stations are not officially allocated any of the 60-meter band, Radio Tirana in Albania, does use a rather variable frequency around 5064 kHz for its domestic service. And there are a number of Russian regional stations, including Vladivostok on 5015 kHz, Moscow on 4920 kHz, and others. Some DXers prefer these domestic programs to those of the international service of Radio Moscow. This is due mainly to the interesting light music programs that are presented.

Moving along to Asia, we find a multitude of stations, many of which are not listed in any standard reference book. Many Chinese stations use these frequencies in both domestic and international transmissions. There are many Indonesians, and two in particular, Jogjakarta, 5047 kHz, and Kendari, 5054 kHz, are well heard around the world. These and several other Indonesians are part of the loose confederation of Radio Republik Indonesia, a governmental authority. But for the most part, these stations are far from the central broadcast authority in Djakarta, and assume whatever course they like. There are, as well, a number of totally independent stations, many located in isolated areas, which have not been charted by DXers and are not listed in a book like the World Radio-Television Handbook. Indeed, Asia in general is still a relative unknown as far as broadcasting goes.

Of course, other Asian nations are active on 60 meters, including India, Burma, the Khmer Republic (Cambodia), Sinapore, Brunei, and Bangladesh. Here are some of the most sought-after stations in the world. Hearing and verifying them can be just as difficult as the low-powered Angolans.

Two stations, though, are relatively easy to hear, both in what is technically known as Oceania, and both are part of the Australian Broadcasting System: VLT4, Port Moresby, Papua, on 4890 kHz, and VLM4, Brisbane, Australia, on 4920 kHz. They are best heard at local sunrise or sunset around the world and they are happy to receive reception reports from listeners.

This is just scraping the top of the complicated situation. It can be months before a DXer sorts out the various stations heard and the usual times for reception from different regions. But no other band can match it for the excitement and thrill of local programs from around the world. You can get a glimpse of the local tempo of life in faraway lands if you can tune in between the RTTY* stations and other utilities. This type of listening is just not possible on the international shortwave broadcast bands.

In-Between Stations

Although all of our attention so far has been devoted to the tropical bands themselves, it is sometimes useful to remember that there are stations which are found in between. These are principally Russian home service relays, innumerable out-of-band Chinese outlets, a handful of wandering Ecuadorians, and uncounted renegade Indonesians. There is some distinctly rare DX as well, such as Radio Clube do Cabo Verde (Cape Verde Islands) on 3883 kHz; Dili, Portuguese Timor, on 3668 kHz; or the Tay Bac regional program of North Vietnam on 4068 kHz. Of course, we can't forget powerful Radio Sutatenza which, in addition to its huge 300 kW transmitter on 810 kHz in the AM broadcast band, has two high-powered shortwave outlets on 5075 and 5095 kHz. This station is run by the Accion Cultural Popular, a cultural development movement in Colombia.

* International abbreviation for radioteletype.

Finally, there is the excitement of harmonic DXing. As has been previously mentioned, the equipment used by stations in the tropical countries is not the best and it is entirely possible to log standard AM broadcast band stations on integral harmonics of their broadcast frequencies. Thus, a station on 1500 kHz in the broadcast band might also be heard in the shortwave region on either 3000 kHz or 4500 kHz or both! These harmonics are usually very weak, and unless you live near the equator, there is little likelihood of hearing very many. We have further material on harmonics toward the conclusion of this chapter.

Preparing for Tropical Band DXing

Many times, the art of DXing the tropical bands is written up in glowing terms. One thing that we cannot stress too much is that successful DXing on these frequencies is not easy. But many DXers feel all the more satisfied with their accomplishments because of the difficulty involved. And this is not to say that the beginner cannot have fun on the tropical bands; one of the greatest joys of shortwave listening is in discovering all the unusual stations that one can hear on these frequencies.

The average SWL, used to the powerful signals of the international bands, is reluctant to try listening on the tropical bands. After all, they might say, why bother to dig under the horrible static and overpowering radioteletype stations to pull through a barely audible signal in a foreign language? Meeting up with the lifestyle in another corner of the world, attaining the special sense of accomplishment in hearing a station that the veteran DXer logs, improving one's technique of listening for the ID and reportable program details—these are the answers given year after year by the devotees of the tropical bands.

Proficiency in DXing the tropical bands is dependent on experience. A veteran can sweep across the 60-meter band, say, and just by looking at the frequency, tell you what station he has tuned in. Of course, the beginner won't be able to do that, but learning all of the "ins and outs" of tropical band listening is a lot more enjoyable than, perhaps, learning and mastering the intricacies of calculus!

In addition to familiarizing yourself with the kind of propagation and stations to be found, you will soon meet up with a number of obstacles: interference, noise, hash, QRM, or whatever you prefer to call it. Lightning static is a major headache, except in the winter months; during the summer months it may obliterate all but the strongest stations with its constant crashes. Radioteletype, facsimile, and other utilities are found throughout the tropical frequencies and are sometimes so wide that they cover two or three broadcasting channels.

Because of these annoyances, the DXer in a hurry won't have too much luck. Patience is essential; eventually, the wildest of your DXing dreams may be fulfilled. Sometimes—almost miraculously, it seems, for the harried DXer—the interference will lift, the signals will be unusually strong, and you will have a chance for a fine DX catch.

Of course, your equipment will determine, in a large way, how well you come out in tropical band DXing. The best receiver that you can afford is recommended, for on the tropical frequencies, selectivity and sensitivity are most important for catching weak signals and separating them from nearby interference. A good dial readout and smooth tuning are also a great help. If you are primarily interested in the lower frequencies, don't neglect the used receiver market, even for receivers that may be 20 years old or more. The old tube sets will often out perform the newer transistorized units, and at a substantial saving.

Even if you can't afford a super-deluxe hotshot receiver, you can afford to do something about your antenna. If it must be indoors, get as much wire as possible strung around. If it is outside, height and distance from surrounding objects are important. For sure, if you suffer from power line noise, keep it away from utility poles. Line noise is a curse of the tropical band DXer. It can cover up many stations with its constant buzz. Shielded coaxial cable feedlines may reduce nearby noise from cars, washing machines, and the like. Finally, a ground is often a good way to improve reception, in addition to being a safeguard for equipment during lightning storms. And don't be afraid to experiment with different antenna configurations. Extra microvolts will pay off in stronger signals and more stations.

Other accessories are useful, too. Crystal calibrators help determine the calibration points of your receiver and a frequency meter will enable you to read out the exact frequency. Antenna tuners and preselectors are fine, too, especially if you have to use an indoor antenna. Even if you can't afford such luxuries, make sure to get a good set of headphones. Not only will they reduce the noise in the room around you, but your family and neighbors won't be on your back about those strange squeals and buzzes coming from your room at all hours! A fancy set is not necessary, since shortwave listening is by no means a hi-fi hobby.

A most important part of DXing is your logbook. Especially on the tropical bands, where stations use the same frequencies year after year, a good log is invaluable for keeping a record of your listening for later reference. Either commercial forms or your own design are fine, as long as they fulfill your requirements.

Finally, it is highly recommended that you join a good club which has adequate coverage of shortwave broadcasting and, especially, the tropical bands. Yearly dues range from $5 and up, and the amount that you invest in a good club or two is money well spent. You can find out what other members are hearing and verifying, you may participate in competitions, and you will get the lowdown on all the stations that are being heard and reported to the club editors. Members of the Newark News Radio Club are fortunate in having Fred Heutte of Washington, D.C. as a fellow reporter. Mr. Heutte contributed a goodly portion of material on the tropical bands for this handbook.

Reception Reports

Wnat about reception reports for the tropical band stations? Pretty much the same applies to these stations as to the international broadcast stations, as outlined in Chapter 14, although there are certain problems here that are not found with the international stations.

First, the typical tropical band stations are not really interested in reports from foreign listeners. They may, perhaps, like to hear from transoceanic listeners, although their primary coverage area is local or regional, and they already know what kind of a signal coverage they have in those areas. To many of the tropical band stations, a verification is nothing more than a souvenir and they are not taken as seriously as DXers often wish they were. Some of the stations may do nothing more than say "Thank you for your report" with, undoubtedly, good intentions, but yards and yards of copy have been thrashed out over these words, for they neither actually confirm a report as being correct, nor deny it as being incorrect.

If possible, write your reception report in the language of the broadcast. Spanish and Portuguese work best in South America; French and Portuguese in West Africa; Indonesian or Vietnamese in Southeast Asia. As a last resort, use English, in the hope that someone at the station knows it, but try to make your report as simple as possible without distorting the facts.

Avoid using the SINPO codes when writing to a tropical band station. The staff may not have any conception of what these codes are for, and saying it with words is the simplest way to avoid the problem. Be as factual and concise as possible, but don't forget courtesy. After all, the station is doing you a favor if it sends you anything at all!

Small souvenirs like picture postcards are greatly appreciated; if you are a stamp collector, send along a small selection of used stamps for which you may have no need. In return, stations often send fine personal letters, magnificent pennants, and the like. But don't expect too much in the way of a QSL. A date, frequency, and statement of verification are often the most you can get out of the tropical band stations.

You would also do best to send your letter by registered airmail, since mail service is often so erratic in most parts of the world. Letters arriving by surface mail may be months old and these will be worth little more than the paper on which they're written. Unless you know otherwise, always include return postage; mint stamps are fine if you can get them, and IRCs are okay if the postal service of the country to which the report is being sent is a member of the International Postal Union.

Despite all the precautions you take, QSL return is never exceptionally good from the tropical band stations. Consider yourself lucky if you can get returns of 60 percent or more. But with patience, the DXer can build up a magnificent collection of verifications from every corner of the world, all garnered from tropical band DXing. It is encouraging to note the increasing numbers of DXers who tune these bands and it is hoped that you are soon one of their number, investigating yet another of the fascinating aspects of shortwave radio.

DXING NORTH AMERICA

The beginning DXer should have very little trouble in listing the countries of the North American continent. The countries are big and the radio facilities are first rate. Canada, on the north, is the second country in size in the world. They have a good radio organization, as we will point out later in this section.

In the United States, we find powerful transmitters placed from North Carolina in the east to California in the west. There are government-operated stations and also some good private operations. We hope to bring some of these to the attention of the novices, for a short period of time spent tuning through any of the regular shortwave bands should bring him good signals and plenty of identifications in English.

If the beginning DXer has an ear for Spanish, he can get some good listening from Mexico, and he will be sure to hear Radio Havana from Cuba in both Spanish and English. There will be times when he will wish that there were not so many of these rightly called powerhouses on the air, especially when he starts to tune for some of the smaller or more distant stations.

The beginning DXer should not be discouraged nor disheartened when he tunes through the international shortwave broadcast bands for the first time. A first trip through nearly any of the bands will find a number of extremely strong signals and chances are good that they will be originating from somewhere in North America. It might even seem to you that there isn't anything else to be heard. The trick is to get in between some of these loud signals, and, with very slow and careful tuning, you should be able to start picking up signals from stations that are outside North America. You really shouldn't have any trouble, because there are a great many signals from overseas points that are nearly as strong at times as those originating in our part of the world. Good friend and monitor Grady Ferguson has compiled a list of North American stations that are on the air and we shall begin with our neighbor to the north.

Canadian Stations

The largest and most powerful broadcasting organization in Canada is Radio Canada International. They provide good signals to listeners in North America, Europe, Africa, Latin America, and the South Pacific, and their programing is good. Reception reports should be sent to P. O. Box 6000, Montreal 101, Quebec, Canada. Their latest bulletin describes their new offices and studios in the following manner:

"Dwarfing the steeples of old Montreal, Maison de Radio Canada is one of the world's largest and most modern broadcasting complexes. It has a 23-story hexagonal tower for offices, while production is at ground and lower levels.

"Messengers must use scooters to cover miles of corridors. For convenience of access to production areas, Radio Canada International is on the first four floors of the tower. Below are radio and TV master control, telecine, and VTR rooms. Lanes leading to the seven TV studios are as wide as city streets.

"Here also are the 26 radio studios and accompanying services. Cutting through three floors is one of the largest color TV studios in the world. Radio Canada International's mailing center is also in this area. A restful haven amid the electronic sophistication is the flower-bordered employees' outdoor patio."

Programs from this complex are relayed to three 50 kW transmitters located at Sackville, New Brunswick, on the Canadian Atlantic coast. Their last bulletin listed 29 frequencies in use and an offering of nine broadcasts in English, six in French, and other programs in some nine assorted languages. Frequencies range from as low as 5960 kHz to a high of 21.595 MHz. The beginner would probably enjoy their broadcast to the Canadian North country usually heard in the evenings on 9625 kHz. These are in English and Eskimo at 0058-0706 GMT on 11.72 MHz and 5960 kHz, as well as on 9625 kHz, and at 2158-2250 GMT on 11.72 MHz and 9625 kHz.

Other Northern Service programs in English and French are aired at 1055-1215 GMT, 1515-1530 GMT, and 1630-1700 GMT, again, on 11.72 MHz and 9625 kHz.

The latest schedule also shows service to North America and the Antilles at 1217-1313 GMT in English on 15.315 and 11.27 MHz and 5970 kHz, and a 1315-1343 GMT in French on 15.315 and 11.72 MHz.

A proper reception report to the fine people at radio Canada International will usually bring a very prompt reply. They have a listeners club which was organized some 10 years ago and which now has over 12,000 members. They have a program on Saturday by the Shortwave Club that is of real interest to DXers.

Other stations which are not as powerful include: CFCX, Montreal, 6005 kHz; CJCX, Sydney, Nova Scotia, 6010 kHz; CFVP, Calgary, Alberta, 6030 kHz; CFRX, Toronto, Ontario, 6070 kHz; CKFX, Vancouver, British Columbia, 6080 kHz; and CHNX, Halifax, Nova Scotia, 6130 kHz. Oddly enough, CKFX is still listed in the newest edition of the **World Radio and TV Handbook** as being rated at only 10 watts power, although some DXers will claim this is in error. Nonetheless, the station is very rarely reported by listeners more than a few hundred miles distant. All of these smaller stations, by the way, relay medium-wave outlets, even to the callsigns of the medium-wave parent, and you really have to stay with the shortwave outlets awhile to catch the actual shortwave identification. But they are given from time to time. The best times to hear these relay stations are in the early morning or in the evening.

Greenland

Gronlands Radiofoni, 3900 Godthab, broadcasts on a number of frequencies, but always in Danish or Greenlandic. The newcomer may have a rough time trying to identify this one! The listed frequencies are 3999, 5960, 9575, and 9655 kHz and 11.745 MHz with a power of 10 kW. The 11.745 MHz frequency is the most often reported as being heard in the United States.

United States

There should be no difficulty for the novice to log a number of stations in the U. S. as the Voice of America. Reception reports should be sent to the U. S. Information Agency, Washington, D. C. 20547. They will verify all correct reports, but only non-American listeners will also be sent their broadcasting schedule.

This organization has some 40 transmitters in use in the U. S. alone, plus numerous others scattered around the world; transmitting power ranges from 50 kW to 500 kW. Frequencies in use range from 5995 kHz to 26.04 MHz and they have programs directed to different parts of the world with material that would be of interest to those areas. They are listed to use 50 outlets and in many languages.

It is suggested that the beginning DXer learn to identify the VOA stations by their tuning signal before sign-on. This would prevent him from listening for an identification from a foreign country when he is, in fact, listening to a language program from the Voice of America. They have many of these programs.

American Forces Radio and Television Service provides the best of American-style radio and television recorded programs to military personnel outside of the continental United States where U. S. commercial radio or TV are not available. Reception reports should be sent to AFRTS at Room 301, 1117 North 19th Street, Arlington, Virginia 22209.

They can be found at various frequencies between 5995 kHz and 21.5 MHz. They make prompt use of the news as given over the American ABC, CBS, NBC, and Mutual Networks. Further, when the DXer is located away from the major network facilities, it is possible to listen to the "Game of the Day" and other sports events; such programs are devoid of the usual commercial advertisements. It is suggested that the DXer build up a list of frequencies where he can tune in AFRTS.

Their interest is in the military people, but there is no reason why others cannot also profit from their operations. It is interesting to hear them build up their news programs giving items by number.

Radio New York Worldwide, Inc. (WNYW), with offices and studios at 485 Madison Avenue, New York, New York 10022, transmits over four stations (two each of 50 kW and 100 kW power) located at Scituate, near Boston, Massachusetts. Their programs are in English and Spanish, and can be heard well in most locations. Their frequencies range from 5985 kHz to 21.525 MHz and operations open at 1700 GMT and close at 0230 GMT. This is one of the better commercial shortwave operations in the United States. They are affiliated with the Columbia Broadcasting System and provide a variety of news, commentaries, and business news. Reports to them have always been handled promptly and with full information useful to the SWL.

World Inter-National Broadcasters (WINB), P. O. Box 88, Red Lion, Pennsylvania 17356. Rev. John M. Norris is the president and major stockholder. WINB began operation in October, 1962, and is usually heard with religious programs paid for by various organizations. They operate on 17.72 MHz at 1745-1945 GMT and on 15.185 MHz at 1946-2215 GMT. Both transmissions are made on their 50 kW transmitter located a short distance from the studio. Reception reports to them usually bring a prompt and proper QSL.

International Broadcast Station KGEI announces as being in San Francisco, but reception reports go to P. O. Box 887, Belmont, California 94003. They transmit on a number of frequencies with good signal strength. Look for them on 15.28 and 11.88 MHz and 9670 kHz, but keep in mind that they broadcast only in Spanish (except for station identifications) intended for Latin American countries.

Cuba

Radio Havana, P. O. Box 7026, Havana. The novice DXer can hardly miss signals from their powerful transmitters, and they broadcast in English as well as in Spanish. Official information coming from this country is very scanty, indicating that they do not wish to furnish information about their stations. Monitoring reports have located them on 17.815, 17.715, 15.14, 11.93, 11.815, and 11.76 MHz and 9680 kHz, with 11.76 MHz being the most widely reported frequency at most any time of the day. Some sources would indicate that they are not very prompt in verifying reception reports.

This concludes the total list of shortwave broadcasting stations in North America. While the total of actual stations is not great, it would, nonetheless, be quite a feat if the listener were able to verify each of the stations on all of their numerous frequencies. It would be interesting to know if anyone has been able to achieve this.

DXING LATIN AMERICA

To the newcomer to the hobby, it might seem reasonable to expect that the easiest stations to hear on shortwave broadcasts might be those from the foreign countries that are nearest to us. The cold and hard truth is that this is not always the case.

The larger international broadcasters, those that specifically beam English-language transmissions to North America, as well as those foreign stations that have foreign-language programs, also beamed specifically to North America, are largely located in Europe, Africa, Asia, and the South Pacific.

Our good neighbor to the north, Canada, beams an English-language program to North America on a daily basis, but there is a glaring lack of anything similar from most areas of Latin America.

By the way, the dictionary definition of "Latin America" is, "all of the countries south of the Rio Grande River that derive their languages from the Latin." In SWL work, the term "Latin America" is generally accepted as all of that area between North and South America, commonly known as Central America, as well as a good portion of the Caribbean Islands. In actual fact, however, it would include all of Central and South America.

The average newcomer to shortwave listening may be of the opinion that it is a matter of relative ease to turn on a shortwave receiver to one of the international shortwave bands and to be able to pick up the latest news in English from Lima, Caracas, Montevideo, San Jose, or any of a number of other Latin American countries. This is not what you will be able to do. There are a few scattered English programs to be heard on shortwave from areas to the south of our southern border, but they are very few. Far fewer, in fact, than the novice listener might realize, especially when you consider the large number of stations operating in those areas.

The great majority of shortwave stations in Latin America are not on the air for international purposes. They are mainly interested in serving the people of their respective countries and, to a lesser degree, to their neighboring countries. With this in mind, nearly all of the transmissions that you will hear will be in Spanish or Portuguese. There are, as we've said, some scattered English programs and perhaps a few in other than Spanish or Portuguese, and we will give you a resume of them shortly.

By far, most of the Latin American stations operate in the tropical bands of 120, 90, 75, and 60 meters. These are discussed at length earlier in this chapter.

Contrary to what was stated a few paragraphs ago concerning the fact that it is easier to hear European, African, Asian, or South Pacific stations than it is to hear those to the south of us, it is, nonetheless, a fact that one of the strongest and most widely heard, as well as most easily heard, stations in the world is in South America. It is this one station that many newcomers to the SWL hobby will hear equally as well, if not better—and possibly sooner—than other powerhouse stations in London, Moscow, Johannesburg, Melbourne, and Tokyo. The station is HCJB in Quito, Ecuador. The station is located high atop the Andes Mountains, near the two-mile level, and, as the station advertises, it is at "latitude 00 degrees" or directly on the equator. HCJB transmits with 100 kW on frequencies in the 31-, 25-, and 19-meter bands and with 50 kW in the 16-meter band, as well as on other frequencies which are not beamed to North America. It is a missionary station, operated by the world Radio Missionary Fellowship, Inc., and they broadcast in no less than 14 languages. HCJB is in its 40th year of broadcasting.

English news is scheduled, as we write this, at 1400 and 1500 GMT on 11.93, 15.115, and 17.88 MHz, at 0000, 0030, 0100, 0200, 0500, and 0530 GMT on 11.745 MHz, and on 9560 kHz after 0100 GMT and 15.115 MHz at 0100-0230 GMT only. A number of missionary programs in English can also be heard, among them, "Morning In The Mountains" and "Call Of The Andes." A program that is very popular with shortwave listeners, "DX Party Line," is listed for Tuesday at 0300 and 1930 GMT and on Wednesday at 0900 GMT.

In addition to English, HCJB also has programs in most of the major languages of the world as well as a few that are probably unknown to most of our readers, including Quechua (both the Ecuadorian and Peruvian-Bolivian varities) and Paez. HCJB also has a 30 kW transmitter on the standard broadcast band, at 700 kHz, and it has been reported in North America, but only on rare occasions. There is no English listed for this frequency. All reception reports can be sent in English to HCJB, Casilla 691, Quito, Ecuador.

Argentina also has some English that is beamed to Europe, North Africa, and the Near East at 2300-0000 GMT on 11.71 MHz and to North America at 0300 and 0600 GMT on 6090 and 9690 kHz and 11.78 MHz. Reports may be sent to the International Service, Radiodiffusion Argentina al Exterior, Sarmiento 151, Buenos Aires, Argentina. Best bets: 9690 kHz and 11.71 MHz, both with 100 kW. A good DX catch, if you can tune it in, is the 11.78 MHz outlet; it is a Radio Belgrano transmitter of only 7500 watts, but it has been reported in North America.

Guatemala has an English-language program scheduled for 0300 to 0430 GMT daily on 5955 kHz in the 49-meter band. This is another missionary station that is fairly easily heard in the United States. Your reception reports may be sent to Apartado 601, Guatemala City.

Faro del Caribe (Lighthouse of the Caribbean) is the identifier of TIFC, San Jose, Costa Rica. On 6037 and 9645 kHz, they are scheduled from 1000 to 0410 GMT with English toward the end of the broadcast period at 0310-0410 GMT (Saturdays 0258-0435 GMT, Sundays 0258-0430 GMT). Reports for TIFC are mailed to Box 2710, San Jose.

Mexico, our nearest neighbor to the south, has very little English on the international shortwave bands. As this is written, the only noted English is during an occasional identification from XEUDS, operated by the University of Sonora in Hermosillo. This is on 6115 kHz. Another possibility, again with English noted mainly on station breaks, is from XERMX, Radio Mexico, Mexico City. This station is listed for 9705 kHz and 11.77 MHz at 1400-1600 GMT, 17.835 MHz at 1400-0200 GMT, 21.705 MHz at 1400-0300 GMT, and on recently new 15.385 MHz around 2300 GMT.

Brazil also has a little English, according to information received. They are reportedly operating an external service on 11.72 and 15.445 MHz on an experimental basis and on a 24-hour schedule. Monitoring has revealed that the same station, Radio Nacional Brasilia, in Brasilia, has been heard with this service at 2255-2310 FMT on 9665 kHz.

Tiny Guyana, on the northeast coast of South America, not to be outdone by some of her larger and more powerful neighbors, also has English listed on two 49-meter band frequencies: Guyana Broadcasting Service, identifying as "Action Radio," is on 5950 kHz with a schedule at 1244-1944 GMT; Radio Demerara is listed on 5980 kHz, with a schedule at 0910-0245. Both are in Georgetown and both are in English.

Central America

For our readers who can understand or translate Spanish and Portuguese, here is a resume of stations that have been heard recently.

Costa Rica. There are two stations in this country that are reported frequently: TIRS, Radio Atenea, is on 6150 kHz. Try for them around 1200 GMT with news. TIHBG, Radio Reloj, is on 6006 kHz. This one features time ticks in the background. Both are in San Jose and both have been heard between 1100 and 1215 GMT.

El Salvador. This tiny country, with only a Pacific Ocean shoreline, is best heard on 5980 kHz just after your local sunrise time. They have been monitored with a newscast in Spanish at 1305 GMT.

Guatemala. Many years ago, this country featured some of the finest marimba music that could be found on shortwave. A listener could easily spend a pleasant afternoon listening with solid enjoyment. Currently, the best bet is TGWA, La Voz de Guatemala, Guatemala City, on 6180 kHz. You might be able to find it around 1930 GMT.

Honduras. There are only a few shortwave stations operating here with about half of them located, frequency-wise, in the tropical bands. The others, all in the 49-meter band, are dominated by HRMH, La Voz del Junco, Santa Barbara, 6075 kHz, best heard around 1745 GMT, and HRLP, Radio Americas, Tegucigalpa, on 6050 kHz, noted around 1130 GMT with time checks, music, and sports.

Mexico. In addition to the two stations mentioned earlier, recent monitoring would indicate the best bets to be XEWW, La Voz de la America Latina, Mexico City, on 9515 kHz at 1445 GMT with sports results, commercials, and recordings, and XEQM, Radio Sistema, Merida, on 6105 kHz at 1250-1310 GMT with a morning breakfast-type program with news and music. One of our monitors counted 15 time checks in one ten-minute period recently.

Nicaragua. YNTP, Radio Mar, Puerto Cabezas, is normally assigned 9580 kHz, but it has been reported recently as being on 9595 kHz at 1545 GMT with time checks and commercials. It may have since moved back to its listed frequency. YNM, Radio Nacional, in Managua, is the big voice of this country with 100 kW on 11.875 MHz. Their smaller sister outlet on 5940 kHz (listed with only 500 watts) has suddenly been heard well at 0300-0600 GMT with a baseball game; official news has not yet been received, but the signal would indicate a possible power increase on this frequency.

Panama. This is a real tough country to log on shortwave broadcast. Our listings currently show only two stations operating and one of them has never been reported. The other, little better, is HOU31, La Voz del

Baru, in David, on 6045 kHz. This little whisper is rated at only 1000 watts and with an irregular schedule at best. We wish you luck in logging this one!

South America

Bolivia. This land-locked country in the central part of South America is another one that isn't easy to hear. Reports from our monitors indicate the best way to log this country is via the tropical band station, La Cruz del Sur, on 4875 kHz. Their schedule is 1000-0300 GMT, and the best times to listen are just before your local sunrise or just after your local sunset.

Brazil. This country is well represented on shortwave with at least four stations in addition to the one mentioned earlier, and they are being reported often and with signals ranging from fair to excellent. Try these: Radio Rural, Rio de Janeiro, on 15.105 MHz at 2230-2300 GMT with music and talks; Radio Guiaba, Porto Alegre, on 11.785 MHz around 0945 GMT; Radio Nacional Brasilia, Brasilia, on 11.72 MHz at 2230-2315 GMT with music; and Radio Cultura, Sao Paulo, on 9740 kHz at 1115 GMT with a religious talk. These Brazilian listings are for all-Portuguese transmissions.

Chile. Just north of the midway point in this elongated Pacific Coast country lies Santiago, home of two stations that are currently being heard. Both in Spanish, they are Radio Presidente Balmaceda, 9590 kHz, heard with news to 0958 GMT and around 2315 GMT with commercials and sports, and Radio Portales, on 9570 kHz, with music heard at 2300-2320 GMT.

Colombia. This should be fairly easy for the Spanish buffs, since the country is on the north coast of South America. Three stations have been monitored in recent days, all in Spanish, and all on the 49-meter band. HJIE, La Voz del Llano, is in Villavicencio, a suburb of Bogota, the capital, and operates on 6115 kHz. Try for it around 1030-1045 GMT. HJDV, Radio Vision, is in Medellin, on 6105 kHz, and they are often good at 1115-1130 GMT. A newer station is HJTF, Ondas Del Darien, Turbo, on 6085 kHz. This is a tiny country village of just over 1000 persons located approximately 50 miles from the Panamanian border. They have been heard at 0040-0050 GMT with lively music, but reports list the station as having an echo effect at times.

French Guiana. Another good catch, if you can log it, is Cayenne on 6170 kHz (although it has been reported everywhere from 6160 kHz to 6240 kHz). Their latest schedule lists transmissions at 1500-1730 (Sunday from 1200-2030 GMT) and it's only a 4000-watt station, so tune carefully. This will be in French.

Paraguay. Like Bolivia, this country is another land-locked area. Stations in this country, as monitored in recent days, are ZPA5, Radio Encarnacion, on 11.945 MHz; it has been heard from 2215 to 2230 GMT with music. They also have a big voice on 5273 kHz, where the 100 kW Radio Nacional has been heard well at 0100-0130 GMT with a sportscast. Both stations are in Asuncion and both are in Spanish.

Peru. Shortwave broadcasts from Peru are not always the easiest to hear, but if you want to try your hand at it, tune for Radio Del Pacifico, Lima, on 9675 kHz, at 1200-1230 GMT; you'll hear hymns and announcements; Radio Nor Peruana, in Chachapoyas, on 9655 kHz, is good at times until they sign off at 0000 GMT; and Radio Tropical, Tarapoto, on

9710 kHz, noted at 1259 GMT sign on. Geography experts might let us know where Tarapoto is located, for it is not to be found on any map or atlas at Monitor and DX Headquarters.

Uruguay. There are a number of stations operating on shortwave from this southern South American nation. The best bet at present seems to be CXA10, Radio El Espectador, Montevideo. It is scheduled from 1000 to 0300 and it is in Spanish. Try for it on 11.835 MHz.

Venezuela. Like Colombia, this is the other large northern coast country and they have a wide variety of stations on shortwave with most of them being on the tropical bands. Of those that are on higher frequencies, the easiest to hear may be YVOS, Radio Occidente, Tovar, on 9750 kHz, and noted around 2230 GMT, and YVLM, Radio Rumbos, Caracas, on 9660 kHz, around 0230 GMT with a sporting event when last heard.

The Caribbean

Cuba. Official information from stations operating within this island nation appears to be unavailable at present. Based entirely on our monitoring, we have heard English from two transmitters: 15.14 MHz at 2000-2230 GMT and 11.93 MHz at 0300-0400 GMT. Both stations had the "Voice of Vietnam" program. Don't be confused if you should hear this because it is simply a program relayed from Havana. An older listing shows 100 kW transmitters on 11.76, 15.23, 15.365, and 17.855 MHz, and most of these are being heard at one time or another.

Dominican Republic. According to one unofficial listing of stations in this country, there are no transmitters operating any higher than the 60-meter tropical band. Many of our monitors indicate a strong outlet on 9505 kHz with the identification of Radio-Television Dominicana in Santo Domingo. You may be able to hear it without too much difficulty between 2000-0000 GMT.

Haiti. This country, located on the western portion of the same island on which the Dominican Republic is situated, has an evangelistic station that is well heard despite its low power. Radio 4VEH operates transmitters on 2450 kHz (4VSO), 6120 kHz (4VE), 9770 kHz (4VEH), 11.835 MHz (4 VEJ), and 15.28 MHz (4VWI). All are less than 1000 watts power, except 11.835 MHz (2500 watts) and 6120 kHz (2000 watts). 4VEH, 4VEJ, and 4VWI are the units most often reported. Their English is scheduled on weekdays at 1100-1215 GMT on 9770 kHz and 11.835 MHz, at 1215-1400 GMT and 0130-0330 GMT on all frequencies; Sundays at 1100-1500 GMT, 1700-2100 GMT, and 0130-0330 on 9770 kHz and 11.835 MHz. Another station that is often reported is 4VC, Voiz de la Revolution Duvalieriste, Port-au-Prince, on 9475 kHz. This station broadcasts mainly in French and Creole.

Martinique. This French West Indies country is heard on shortwave over their 4000-watt transmitters on 3315 kHz at 1000-1200 and 1800-0230 GMT, 4895 kHz at 1200-2200 GMT, and on 5995 kHz at 1200-2300 GMT. They have home service news in French at 1030, 1130, 1700, and 2300 GMT.

Netherland Antilles. Five hundred thousand watts is a lot of power being sent out from an antenna. If you have heard a station on 800 kHz in the standard broadcast band that has announced as Trans World Radio or, at times, as Radio Nederland, you have logged the powerful signal being transmitted from Bonaire in the Netherland Antilles. They have a number of shortwave outlets, too, but the power ratings range from 50 kW to 260 kW (for Trans World Radio) and 300 kW (for Radio Nederland's relay transmitters). As I'm writing this, Trans World Radio is scheduled in English at 0030-0130 GMT to the East and Far East and at 1100-1235 GMT to North America, both on 11.815 MHz; and at 1235-1430 GMT (also to North America) on 15.255 MHz. They have a DX program entitled "DX Special" that is aired, as of the current schedule, on Thursday at 0045 and Saturday at 1205 GMT.

Windward Islands. Radio Grenada is the recently new identifier for the stations on 9550 kHz (1545-1930 GMT), 11.975 MHz (0000-0215 GMT), and 15.105 MHz (2000-2135 GMT). The programing is in English and the transmitters, located at St. Georges, are rated at 5000 watts.

Country hunters will not find any shortwave broadcast stations in operation in the Bahamas, Barbados, Guadelupe, Jamaica, Puerto Rico, Trinidad and Tobago, and the American or British Virgin Islands. Nor are there any in the Leeward Island chain including Anguilla, Antigua, Montserrat, or St. Kitts. However, DXers who want to try and log St. Kitts might look for the new Radio Paradise on 1265 kHz in the standard broadcast band. This 50 kW station is now on the air and being heard quite well in many areas of the east.

Additionally, if you'd like to add the British Turks and Caicos Islands to your log, you might try and tune in the Cable and Wireless station on Grand Turk. They operate VSI8 with 750 watts and they have a short English news period listed for 1930 GMT. But take it from us: this one will definitely not be easy.

Again, we remind you that shortwave stations change frequencies or schedules with seeming disregard for their listeners. Most of the stations listed in this section are fairly stable, but there will still be changes made. The listings are merely for your assistance in trying to log some of the countries listed.

DXING EUROPE

Europe is an ideal "middle ground" for the beginning DXer to cover. It's between the Voice of America and the BBC, which he was so excited to hear when he first turned on his set, and the rare African and Asian stations that are the hard-core DXer's holy grail. For in Europe the listener will find many powerful stations, most of which can be easily heard with a minimum of equipment. Every European country, with the exception of Liechtenstein, San Marino, and Andorra, operate at least one shortwave stations.

The European stations will probably provide the beginning listener with most of his first 25 or 30 countries heard and verified. And there is a good possibility that the beginning listener, who may have begun DXing only with the ambition to hear all the countries and rare stations he can, without being concerned with the actual radio programs, may find himself an avid fan of some of the programs he finds on the European stations. For he will discover that the European stations provide, perhaps, the most diversified programing in the world, and he is almost certain to find a program covering whatever he is interested in.

It is not surprising that Europe, having been the birthplace of radio, is now the most "radio-minded," and the most international broadcast minded, continent in the world. Radio technology has come a long way from Guglielmo Marconi's experiments with radio at the turn of the century. Today, stations with transmitters with 500 kW or even 700 kW are becoming commonplace, while the once-powerful transmitters of 100 kW are being drowned out in the airwaves.

The combined stations in Europe broadcast to more areas in the world in more languages than do stations on any other continent. European stations alone account for about 50 percent of all English-language broadcasts to the United States and Canada. And English is not the only language that is broadcast to North America by these stations. They also broadcast in many other languages. The foreign-language transmissions are intended mainly for minority groups and for countrymen living abroad. The European stations are trying to reach all the people they can!

Besides broadcasting in many languages, programing is also varied, as previously pointed out. A listener can hear all kinds of music, from jazz, to classical, to native folk music. He can listen to language lessons and programs on stamp collecting, farming, and, yes, even programs on shortwave listening. He can hear news slanted anyway he prefers, and talks on subjects from education to hydroelectric dams. And this writer, at least, believes that the programs found on shortwave radio are generally much more varied and interesting than what is found on television. (And most shortwave radio stations don't have commercials!)

We can only get an overall picture of European DX by talking about the European stations in general. Europe is composed of several countries, with several types of governments, and in order to get a clearer

Fig. 7-1. Members of the BBC's Latin American Service doing a contemporary play.

Fig. 7-2. Alex Hamilton of the BBC "World of Books."

view, we should look at the individual countries and stations more closely. Doug McClellan, of Alamogordo, New Mexico, is the Europe-Africa DX editor of the American Shortwave Listeners Club, and he graciously provided us with the following list of goodies.

Great Britain

We turn first to one of the largest and most popular, as well as one of the oldest shortwave stations in the world: The British Broadcasting Corporation, or BBC. The BBC recently celebrated its 40th anniversary as an international broadcaster, having started its external service in December of 1932. In 1938, it began broadcasting in its first foreign language, Arabic. World War II brought about a tremendous increase in the number of languages broadcast, and today the BBC broadcasts in 39 languages. The BBC, in its "world service," broadcasts an extraordinary selection of programs. One can hear music programs of all kinds, quiz shows, radio plays, and talk shows on many different subjects. The BBC's biggest attraction is its news. The BBC has extensive news coverage which many people believe to be the most accurate and unbiased in the world. Accuracy and unbiasedness throughout all of the BBC's programing is insured by a ruling board of governors that is made up of representatives of many different political, labor, and other interests.

The BBC's programs reach the peoples of the world from transmitters in Britain and from relay stations on the Ascension Islands, Malta, Cyprus, Oman, and Malaysia (the Malta and Oman stations are being used only for medium-wave broadcasts). They are also building a new relay station in the West Indies for transmissions to the Americas.

Holland

Radio Nederland Wereldomroep is even older than the BBC, dating back to March, 1927, when the then Philips Radio Laboratories began broadcasting to the Dutch West Indies over station PCJ with 27 kW. Today, Radio Nederland is among the top three stations in terms of worldwide popularity. They broadcast enjoyable, informative, and completely nonpolitical programs. One well known program is "DX Jukebox," a very highly respected program for the SWL. But their "Happy Station Program," heard every Sunday in both English- and Spanish-language versions, is perhaps the most popular program in the world. It is almost as old as the station itself. Run for over 40 years by Eddie Startz, who became a virtual legend in his own time, "Happy Station Program" has light entertainment for the whole family. Today, it is run by Tom Meijer (Meyer), who still carries on the "Happy Station" high quality. Radio Nederland also has a relay station on Bonaire, in the Netherlands Antilles, and has a newly built relay transmitter in the Malagasy Republic.

West Germany

Deutsche Welle (Voice of Germany) is another major European broadcaster. They broadcast in 33 languages to all parts of the world,

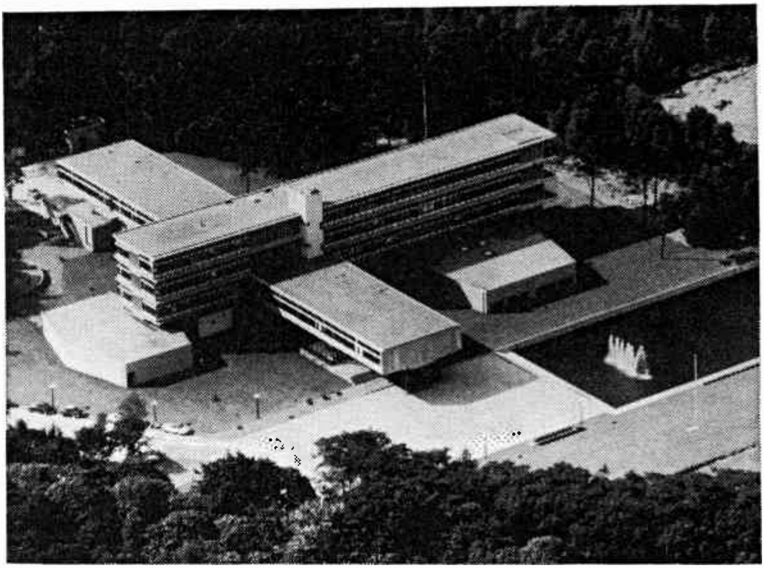


Fig. 7-3. Radio Nederland's studio in Hilversum, Holland.

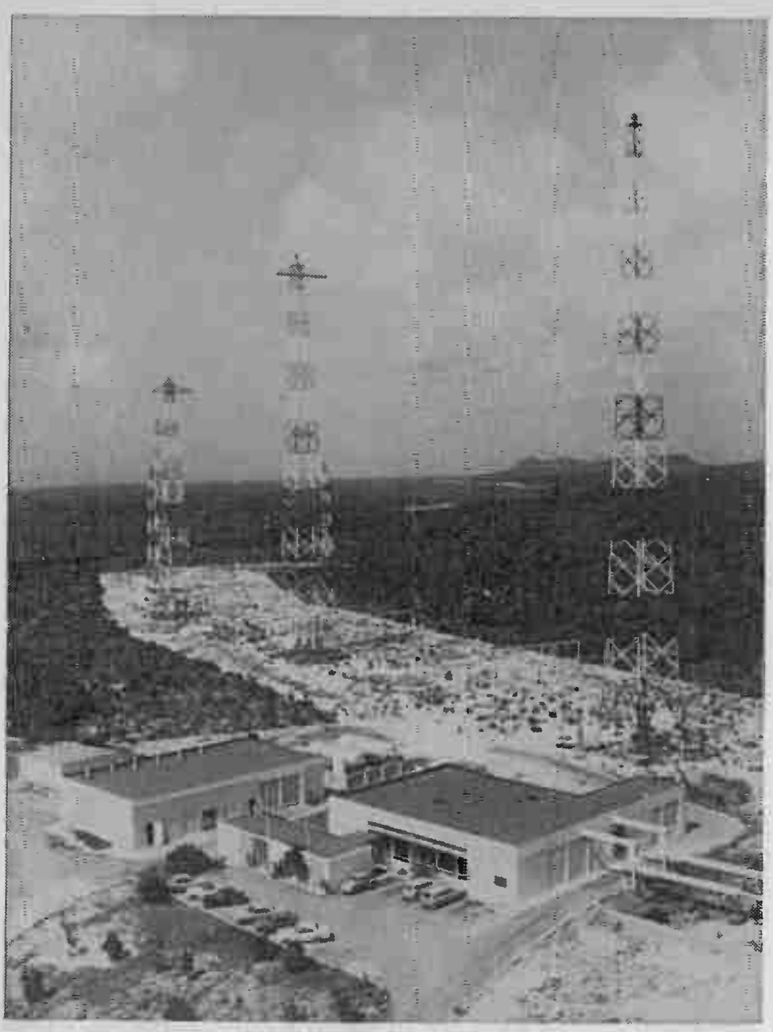


Fig. 7-4. Radio Nederland's relay station at Bonaire, Netherland Antilles. Its signal is well heard throughout North America.

including one language that is a curiosity among international broadcasters—Sanskrit. They also broadcast extensive German-language programs to all parts of the world. In addition to new 500 kW transmitters in Germany, Deutsche Welle has relay stations at Kigali, Rwanda, and Sines, Portugal. Thus, they are well heard all over the world, including the United States, where they are a popular station.

USSR

Radio Moscow is certainly the biggest station in the world, offering the most extensive coverage of any station. It broadcasts in over 80 languages, including such exotic languages as Foula, Oriya, and Quecha, and is capable of reaching more people in the world than any other station. And yet, for all its trying, Radio Moscow doesn't win many popularity polls. Although it is a popular station in some parts of the world, many people find its programs, which consist mainly of hard-hitting propaganda, rather dull.

Besides Radio Moscow, the USSR has many regional stations that are run by some of the Republics that make up the USSR. These stations broadcast programs of music and information about their Republic. These stations broadcast over Radio Moscow transmitters, and thus do not necessarily broadcast from transmitters inside their own Republic. Two regional stations that are well heard in the United States are Radio Kiev, from the Ukraine, and Radio Tashkent, from Uzbekistan.

Other Stations

There are, of course, many other stations than those listed above. All of the Russian satellite countries have their own stations, and they mainly broadcast the same type of hard-hitting propaganda that is popular with Radio Moscow. There are many nonpolitical stations, such as the Swiss Broadcasting Corporation and Radio Sweden, which have built up large audiences with their varied and informative programs. The Office de Radiodiffusion-Television Francaise, although it does not currently broadcast in English to North America, is popular for its music programs. Radio Luxembourg is one of the growing number of commercial stations and, although it does not broadcast specifically to North

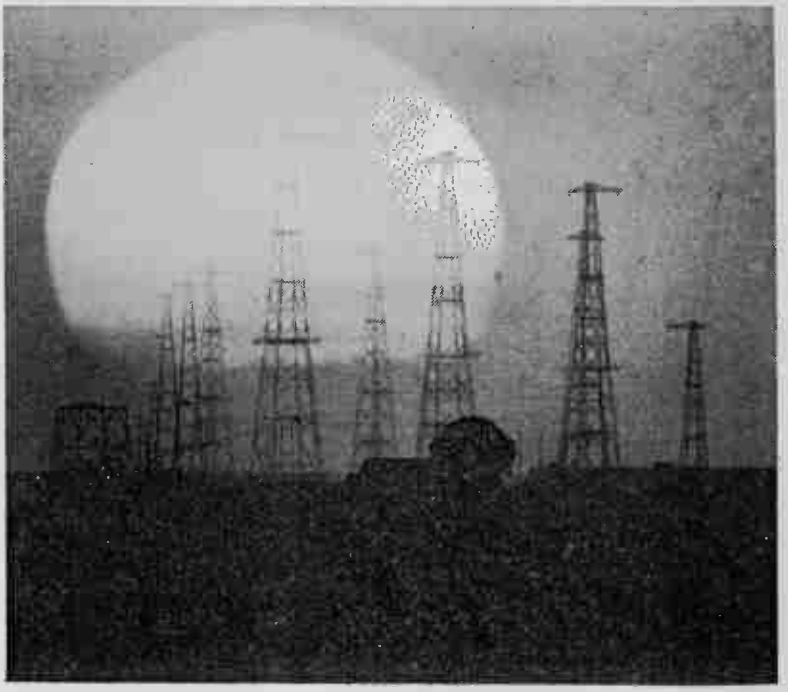


Fig. 7-5. Deutsche Welles new 500 kW transmitting antennas at Wertachtal.

Fig. 7-6. Swiss Broadcasting Corporation center in Berne.

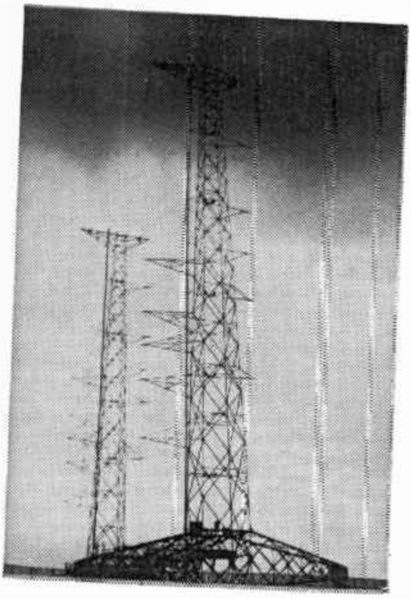


Fig. 7-7. Swiss Broadcasting Corporation's 500 kW transmitting antenna at Sottens.

America, can be easily heard here. Radio Nordsee International is a "private" pop music broadcaster, transmitting off the coast of Holland, and it too, can be easily heard in the United States. Radio Nacional de Espana recently built a new 700 kW transmitter, making it one of the most powerful stations in the world. Although it broadcasts primarily in Spanish to Latin America, it does have some English programing to North America, where it is popular for its Spanish folk music. Vatican Radio broadcasts short (20 minutes or so) religious programs in many languages. Europe is also an active continent for "clandestine" stations, stations which are politically oriented and which are usually antigovernment. Such stations are usually low powered, and they use erratic frequencies and broadcasting times.

Besides these stations, which are powerful and easily heard, there are also small, low-power stations throughout Europe that are challenging for even the most experienced DXer to hear. Radio Kukesi, in Albania, is one of these rare stations, operating on a variable frequency of 6660 kHz with a power of only 200 watts. Norsk Rikskringkasting, from Norway, has an outlet at Tromso on 7240 kHz. This station is said to be the northernmost shortwave station in the world, and it operates with a power of 10 kW.

Thus, Europe, with its wide variety of stations, is an exciting continent to listen to, offering a reward to any shortwave listener, whether he be after a new country to add to his log or just a good music program.

When to Listen

The best time to hear a shortwave station is when the signal path from the station to the listener is partly or totally in darkness. Such a condition occurs between Europe and North America during the North American evening. During this time, from about 2300 GMT on the East Coast and about 0200 GMT on the West Coast, to about 0600 GMT, more European stations can be readily heard than at any other time. But, although this is the time during which propagation conditions are most favorable, the propagation conditions are not the main reason why the

Fig. 7-8. M. McMahon, head of the English program of the Swiss Broadcasting Corporation.

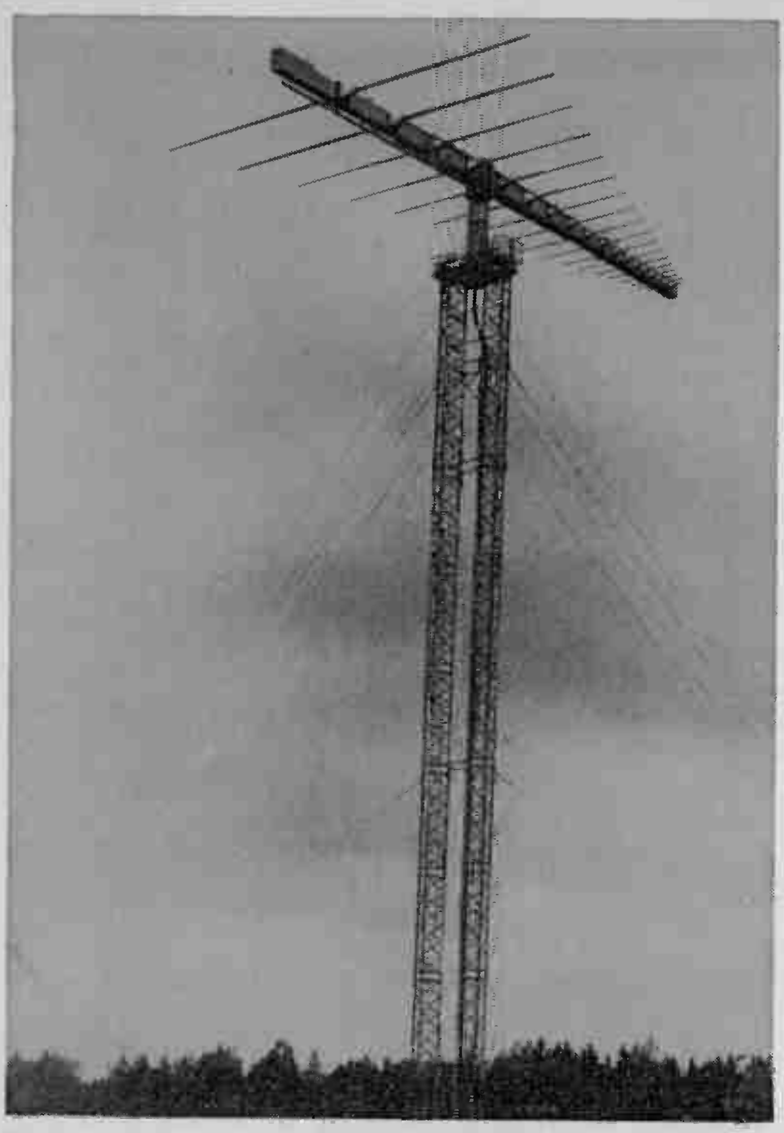


Fig. 7-9. Radio Sweden's new 500 kW transmitting antenna at Karlsborg.

Europeans can be heard so easily. The reason is simply because this is the time when most of the Europeans are broadcasting specifically to North America, since evening is as much of a "prime time" for radio as it is for television.

In fact, propagation conditions play the least important part for European reception than for reception of any other continent. A listener does not have to wait for a certain time before he can hear European

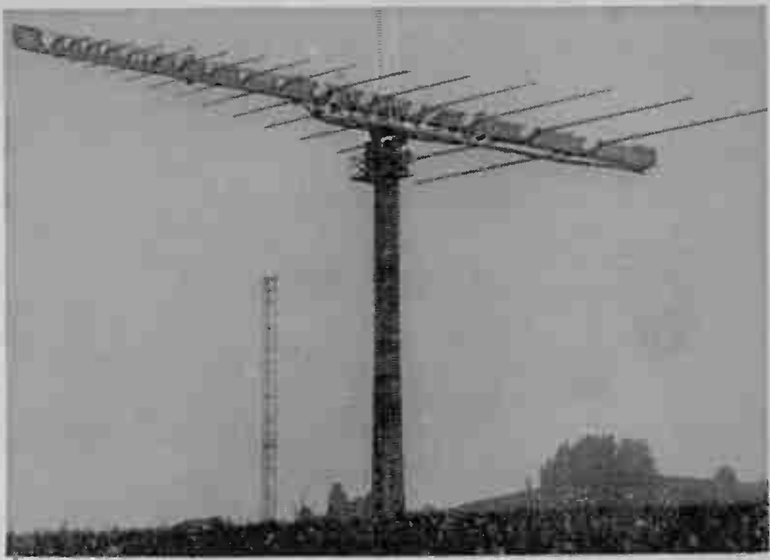


Fig. 7-10. Antenna of the 250 kW transmitter of the Swiss Broadcasting Corporation.

Fig. 7-11. The foreign language correspondence department of Radio Portugal.

stations like he does with most African or Asian stations. A listener can be assured of hearing several Europeans at any time of the day that he happens to be listening to the shortwave bands. The reason for this is that the European stations are all so powerful. A 100 kW or 250 kW station can usually get through to any part of the world at any time of day. Thus, although some times are better than others for hearing European stations, no time is really a bad time.

Hopefully, the reader has now tried his hand at DXing European stations, and may now want to know where he can get more information on this. The most helpful aids are the up-to-date program schedules. These can be gotten free of charge from the individual stations involved. A reference guide like the World Radio-Television Handbook, which lists schedules for all stations in the world, is an excellent aid for any DXer, and highly recommended. It is also a good idea to join one or more of the many shortwave clubs around the United States and Canada, for they have up-to-the-minute information on the frequently changing station schedules, as well as useful information to help the listener in all phases of DXing.

European "Best Bets," Country by Country

All transmissions listed are in English and directed to North America, unless otherwise noted. We cannot guarantee the accuracy of

Fig. 7-12. Transmitters of ORU, Brussels, Belgium.

this listing for any specified period of time, since stations change frequency or schedule, usually on a seasonal basis. A + sign indicates broadcasts to the North America East Coast; an x indicates broadcasts to the North American West Coast.

Country	Times (GMT)	Frequencies (kHz)
Albania	0130-0200	6200, 7300
	0230-0300	6200, 7300
	0330-0400	6200, 7300
Austria	0030-0045 (not Mon.)	6155, 9770+
	0115-0200 (Thurs. only)	6155, 9770+
	2305-2315	9550, 15,235
Belgium	0050-0100	9550, 15,235
Bulgaria	0000-0100	9700
	0400-0430	9700
Czechoslovakia	0100-0157	5930, 6105, 7345, 9540, 9740, 11,990
	0300-0400	
Denmark	1200-1245	15,165 (Danish only)
Finland	0300-0330	9585
	1400-1430	15,185
	2300-2330	15,185
France	1730-0000	15,120 (French only)
German Democratic Republic	0100-0145	9730+, 11,890+
	0230-0315	9730+, 11,890+
	0330-0415	5955x, 6080x, 6165x
German Federal Republic	0130-0250+	6010, 6040, 6075, 9545, 9690
	0435-0555x	6075, 6145, 9545, 9765
Great Britain	1030-1615	17,790, 15,070
	2000-0330(A)	15,260
	2200-0415	6110
	2300-0415(A)	9510
(A) Atlantic relay, Ascension Island,		plus many other transmissions.
Holland	0200-0230(B)+	11,730
	0500-0620(B)x	11,730, 9715
	2130-2250	11,730, 9715
(B) Bonaire relay, Netherlands Antilles.		
Hungary	0100-0130	21,685, 17,845, 15,165, 11,910, 9833, 7220, 6175
	0300-0330	15,165, 11,910, 9833, 7220, 6175
	0415-0445	15,165, 11,910, 9833, 7220, 6175

Country	Times (GMT)	Frequencies (kHz)
Italy	0100-0120	11,810, 9575
Luxembourg	0000-0200	6090 (Not beamed to N. A.)
Monaco	0725-0850	7290 (Not beamed to N. A.)
Norway (all transmissions on Sunday—Monday GMT only)	0000-0030+	9645
	0200-0230x	9550
	0400-0430	9550x, 9610+
	0600-0630	6130+, 9645x, 21,730x Plus others
Poland	0200-0320	6135, 11,815
Portugal	0200-0245	6025, 11,935
	0300-0345	6025, 11,840
	0345-0430	6025, 11,935
Rumania	0130-0230	5990, 6060, 6150, 6170, 9570, 11,940
	0300-0330	5990, 6060, 6150, 6170, 9570, 11,940
	0430-0500	5990, 6060, 6150, 6170, 9570, 11,940
Spain	0200-0445	11,925, 6065
Sweden	0030-0100+	11,975
	0200-0230+	11,975
	0330-0400x	9715
	1400-1430+	17,815
Switzerland	0145-0215	6015, 6120, 9535, 11,715
	0430-0500x	6015, 9750
USSR	2300-0500+	6175, 7105, 7150, 7245, 9610
	0330-0700x:	7175, 9735, 9780, 11,690, 15,180 Plus many others
Vatican City	0050-0110	5995, 9615, 11,725, 15,420
Yugoslavia	2200-2215	9620, 6100 (Not beamed to N. A.)

DXING AFRICA

The continent of Africa, known also as the "dark continent," is a favorite DX area for a great many SWLs, both beginners and experts. In fact, many veteran DXers make Africa their "specialty" area, since there are many stations to be heard, both powerful international stations and low-power, domestic home service stations. With very few exceptions, every country in Africa is represented with a shortwave station that, with patience and luck, may be heard in North America.

Africa is a continent of over 50 countries, and in that great expanse there is a wide variety of languages, cultures, and religions, which are reflected in the type of programing that you will hear from the different stations. Several countries operate high-powered transmitters and international services in numerous languages, with the desire to be heard abroad with news, entertainment, and cultural broadcasts (some examples are Radio Cairo, United Arab Republic; Radio RSA, Johannesburg, South Africa; ETLF, Addis Ababa, Ethiopia; Radio Ghana, Accra; and others).

But a larger percentage of the African stations are programed only for the local population and, as such, are not concerned with reception at points overseas. These stations broadcast primarily in the native language of their respective country and often use low- or medium-power transmitters on the lower frequencies (the international 49-meter band and two of the tropical bands, 60 and 90 meters) in order to cover their own country and neighboring areas only.

Indeed, these low-powered domestic shortwave stations are the ones which are sought after by DXers, since these are the stations that are the most difficult to hear. It is in the domestic services where the local programing and music of the country is heard, rather than on their international services. Especially on the 60-meter band (4700-5100 kHz) and the 90-meter band (3200-3500 kHz) are the majority of the domestic (home service) stations, and these are the major "hunting grounds" for the African DXer. However, for the most part, these low-frequency bands are useful to the DXer only during the winter DX season, when the atmospheric noise is considerably less and there are more hours of darkness. Darkness is necessary for these low-frequency signals to make it across the Atlantic.

Since Africa was colonized and settled by the major European powers, it is possible to still find traces of this influence over most of the continent and in the languages spoken on the African stations. The central and western parts of Africa were colonized by France and were formerly known as French West Africa and French Equatorial Africa. This includes the territory in countries such as Congo (Brazzaville), Central African Republic, Chad, and most of the countries lying westward to the Atlantic Ocean. From these stations, the majority of the programing is in French. The French-speaking stations, in their home service, play a lot of uptempo African music, which is similar to our "soul" music.

The Spanish also had colonies in Africa and you can hear programs in Spanish from such almost unknown places as the Spanish Sahara, Equatorial Guinea, and the Canary Islands. The Portuguese influence is found in Mozambique, Angola, and the Cape Verde Islands. Of course, Arabic is the predominant language used by North African stations in Egypt, Libya, Tunisia, and Morocco. There are a few British stations in Africa that broadcast programs in English: Kenya, Uganda, and Rhodesia, and a few in West Africa: Nigeria, Ghana, Gambia, and Sierra Leone. Broadcasts from a few of the Moslem countries in East Africa are interesting to hear with their chants and "wailing" type music; these stations are located in such obscure places as Zanzibar, Comoro Islands, Tanzania, and Somali. Out in the Indian Ocean, we find the island of Mauritius where Indian-type programing is featured. These stations are all heard in their own native languages, ranging from Swahili and Somali to French.

Since reception on 60 and 90 meters depends greatly on the signal path being near or in total darkness, there is a definite pattern to the reception of the Africans on those bands. Let's assume that you are a DXer living on the East Coast of the United States. In early afternoons during the winter months, a few signals from Africa will begin to show up as early as 2030 GMT (3:30 p.m. EST) on the 60-meter band. Occasionally, signals from East Africa will make a showing, and stations in Kenya and Uganda can be heard fading in. As time progresses and the sun begins to go down at your location, signals from Central and West Africa rise to good strength levels, and, depending on their sign-off times, stations are heard more strongly as nighttime falls. Most of the Africans have signed off by 0000 GMT, which is midnight in West Africa.

In the evening starting at about 0230 GMT and later, sunrise begins to sweep across Africa and this is the time to try for the East Africans and Indian Ocean stations such as Reunion Island and Madagascar. At 0300 GMT (which is 6:00 a.m. in Eastern Africa), stations in such places as Kenya, Tanzania, and Somali are beginning their broadcast day. As time moves on and the sun is rising further west in Africa, the SWL should try for the Congo stations and those in the Central African Republic, Rhodesia, and others. The last stations in Africa to sign on are those in the western bulge of Africa: Ivory Coast, Mali, Sierra Leone, Senegal, Mauretania, and Togo, to name a few. By this time, all of the East Africans have long since faded out, because at 0600 GMT it is already 9:00 a.m. in East Africa. Remember that the reception of stations on the low frequencies depends on the signal paths being in darkness.

Here are some of the African countries and stations which can be heard in North America with varying degrees of strength. We shall begin with a look at the more powerful and easily heard stations.

Union of South Africa

This country, in spite of its being over 8000 miles away, is very easily heard on even the simplest shortwave receiver, thanks to a very powerful Radio RSA in Johannesburg. This is perhaps one of the easiest African stations for the beginner to hear, and it is quite popular with SWLs. At the time of this writing, they have some 13 programs in English, and two of them are beamed to North America at 2215-2315 GMT on 11.97 MHz and 9695 kHz, and at 2330-0245 GMT on 11.97 MHz and 9695, 9560, and 6080 kHz. They also use the frequency of 15.22 MHz for this latter transmission, but it is mainly on a seasonal basis. There are also seven programs in English for Africa and the Middle East, and two each to Europe and Australasia. Other programs are in French, German, Dutch, Banto, and other languages. A good report to the station at P. O. Box 4559, Johannesburg, will usually bring a good reply.

Egypt

The United Arab Republic Broadcasting and Television Service, Cairo, is another easily heard station. Located in the Northeast part of Africa on a line with Norfolk, Virginia, this government operation has a listing of about 65 frequencies ranging from 5955 kHz to 21.74 MHz and it can usually be heard on some frequency at most any time. The majority of their programs are in Arabic, but the beginner might look for their English program to North America at 0200-0330 GMT on 9475 kHz, which is a clear channel just outside of the lower edge of the 31-meter band. They have a fine record library and good announcing. Reports on the North American Service should be addressed to: The American Service, P. O. Box 566, Cairo, Egypt. A program in English has also been noted on 17.92 MHz at 1315-1430 GMT.

Congo

Although the well known Radio Brazzaville (operated by the Office de Radiodiffusion-Television Francaise in Paris) has been taken over by the government and now identifies as La Voix de la Revolution Congolaise, it can still be heard with all-French programing in the afternoons on 15.19 MHz and 9715 kHz until the station's 2130 GMT sign-off.

Ivory Coast

Radio Abidjan or Radiodiffusion-Television Ivoirienne can be heard quite well at times on 11.92 MHz where they have a 100 kW transmitter. Most of their programing is in French, but English is listed at 1830-2000 GMT. They may occasionally be heard when they sign on at 0600 GMT on 11.92 MHz and 6015 kHz.

Angola

There are two high-powered stations in the capital city of Luanda which can be heard with all-Portuguese programing. Emisora Oficial can be heard from their 0500 GMT sign on 9535 kHz, and sometimes around 1500 GMT on 11.875 MHz. A Voz de Angola can be heard on 9660 kHz from their 0430 GMT sign on.

Canary Islands

Radio Nacional de Espana at Tenerife is easily heard any evening on 11.8 MHz relaying programs from Madrid to South America in Spanish. Thanks to its locations in the Atlantic, a clear frequency, and high power, this is one of the strongest African signals.

Ethiopia

Located in Addis Ababa is ETLF, operated by the Radio Voice of the Gospel, P. O. Box 654. This is part of the Lutheran World Federation Broadcasting Service. They broadcast over two 100 kW transmitters and list a total of 19 frequencies in use, ranging from 6065 kHz to 15.385 MHz. They schedule programs in 13 languages, with a number of transmissions in English. The best time at present seems to be 1330-1400 GMT on 15.19 MHz and again at 1930-2015 GMT on 11.955 MHz. A previous report to them brought forth a station QSL, full station information, and a good schedule of broadcasts.

Liberia

Radio Station ELWA, Box 192, Monrovia, is an operation of the Sudan Interior Mission. They list some 10 frequencies and their 50 kW transmitters do a good job. Their schedule shows some 10 programs in English with an equal number in French, plus an assortment of native-language programs. Check for them in English from 0630 to 0715 GMT on 11.95 MHz, from 2015 to 2100 GMT on 11.94 MHz, and 0600 to 0815 GMT on

4770 kHz. The Voice of America makes use of frequencies from 6015 kHz to 25.95 MHz with transmitting powers ranging from 50 kW to 250 kW. Since the programs are relayed from Washington, D. C., the listener will have to catch their local station identification at the end of a program. Reception reports should be sent to the VOA in Washington. They are in action most of the 24 hours.

Malagasy

Radio Nederland has a relay station in Tananarive in this country and it is a good opportunity for the novice SWL to log this not-often-heard country. The 300 kW transmitter broadcasts on some 14 frequencies between 6020 kHz and 21.51 MHz. When heard, a good report sent to Radio Nederland, P. O. Box 222, Hilversum, Holland, will certainly bring the proper QSL in return. The Dutch have been in the broadcasting business for a long time and they do a fine job.

Rwanda

West Germany has a relay station consisting of two 250 kW transmitters in the capital city of Kigali. They can usually be heard with ease on any of the ten frequencies between 7225 kHz and 17.765 MHz. Programs are broadcast in a number of languages and reception reports should be sent to Deutsche Welle, P. O. Box 10 04 44, Koln-1, Federal Republic of Germany.

Ghana

Ghana Broadcasting Corporation, P. O. Box 1633, Accra, has some nine transmitters, ranging in power from 20 kW to 250 kW, operating on a number of frequencies between 6130 kHz and 21.72 MHz, with ten programs in English. They are most easily identified by their type of dance music. The announcements are in English and service on reception reports seems to be better and more prompt than that of most African stations.

Nigeria

The Nigerian Broadcasting Corporation, Lagos, is listed as having nine English programs and appears to be best heard on 15.12 MHz between 1600 and 1930 GMT. Of course, other frequencies are used and their equipment and operation are good.

Morocco

Radiodiffusion Television Marocaine, 1 Rue Al Brihi, Rabat, has nine frequencies in use and three programs in English, six in French, and six in Spanish, with good power from their transmitters.

Tangiers

The Voice of America has ten transmitters, with powers ranging from 35 to 100 kW, operating from this northwest corner of Africa on frequencies ranging from 5955 kHz to 25.88 MHz with a multitude of programs that should not be hard for a beginner to log. Again, listen for the station identification at the end of various programs.

Central African Republic

Bangui is easily heard thanks to a new 100 kW transmitter on 5038 kHz. They can be heard with all-French programing in the afternoons until the 2300 GMT sign-off and again when they sign on at 0430 GMT. Lively uptempo African songs are featured.

Dahomey

Another French-speaking African station, this one can be heard until 2200 GMT, but it is better when they sign on at 0515 GMT on 4870 kHz.

Gambia

This English-speaking station is heard rather well for its low power of only 3100 watts, thanks to its West African coastal location. They sign on at 0630 GMT on 4820 kHz and go into Arabic for a half hour, then back into English at 0700 GMT.

Kenya

The Voice of Kenya at Nairobi can occasionally be heard at their 0300 GMT sign-on 4915 kHz with programs in the Swahili language, plus native music and singing. There may well be considerable interference from South American stations operating on the same frequency.

For those who would like to go after some of the more difficult stations, try these—some of them definitely will not be easy!

Cape Verde Islands

This Portuguese colony off the coast of Senegal in the Atlantic can sometimes be heard with all-Portuguese programs in the afternoons until 2300 GMT. Frequency is a varying 3883 kHz, which is right in the middle of the 75-meter amateur phone band and interference can be most severe!

Botswana

Radio Botswana at Gaberones can be heard at times on 4845 kHz following its 0400 GMT sign-on. Programing is in Setswana (native language) and English. There will likely be QRM from Latin American stations.

Malawi

Malawi Broadcasting Corporation at Blantyre can be heard at 0300 GMT when they sign on with programs in mixed English and native languages. Radio Chortis in Guatemala can and often does provide plenty of trouble, but try for it around 0400; it may be briefly in the clear. It's on 3380 kHz.

Zanzibar

Radio Tanzania Zanzibar, on this small island just off the coast of Tanzania, can be heard on 3339 kHz (just slightly above the Canadian time station CHU) at the 0330 GMT sign-on with typical Arabic and Moslem chanting.

Seychelles

Another group of islands, located in the Indian Ocean, can be heard quite well at times with English religious programing. At the time of this writing, they were on 11.955 MHz with English at 1730-1800 GMT.

Swaziland

This relatively new shortwave station, operating on an already crowded frequency of 6155 kHz, can be heard once in a while at their 0400 GMT sign-on with English commercial programs containing rock or country and western music. Interference is often provided by stations in Germany or Austria.

Comoro Islands

This very rare station in the Indian Ocean can sometimes be heard on 7260 kHz at their 0330 GMT sign-on with native Arabic-type chanting, but for the most part this frequency is covered by several more powerful stations. It'll take a good deal of digging down to uncover this one!

Chad

This former French West African country is definitely difficult to hear in spite of the fact that they use 30 kW power, the same as many of the other French African stations. Radiodiffusion Nationale Tchadienne in the capital city of Fort Lamy can sometimes be heard on 4904.5 kHz on a Saturday when they run until a later sign-off at 2300 GMT. They have typical African music and announcements in French. The signal from this station is often very weak even when others are booming in. They can also be heard after their 0430 GMT sign on with Arabic-type programs, but there is always heavy radioteletype QRM.

Reunion Islands

This group of French Islands in the Indian Ocean off the coast of Madagascar is always a difficult catch for any DXer. Operating with the low power of 4000 watts, the station can be heard at times on 2446 kHz in the 120-meter tropical band at their sign-on time of 0230 GMT. West Coast listeners may also be able to try it around their local sunrise on either 2446 kHz or 4807 kHz.

Tristan da Cunha

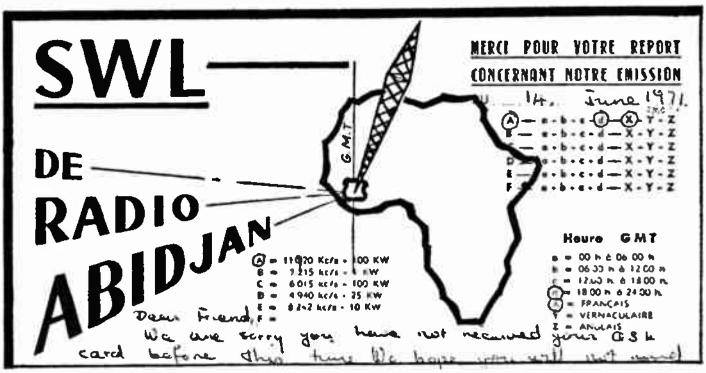
This is, without doubt, the rarest country to be heard from the African area, and it really isn't even fair to mention this one as even having a slim chance of being heard on this side of the Atlantic Ocean. Tristan Radio operates on 3290 kHz with only 40 watts! To the best of our knowledge, it has never been heard more than a few hundred miles from the station, which is located in the South Atlantic Ocean. This one may well represent the most supreme DX for any SWL to hear.

We hope that the stations listed above will be a guide to some of the broadcasts that can be heard from the African area. Needless to say, it is impossible to list all the stations operating in Africa. There are over 50 countries in Africa that may be heard, depending on the location of the DXer, his receiver and antenna, how much time he devotes to tuning for them, plus the always essential elements of patience and luck. Our cocontributors for DXing Africa, Richard Pistek of Chicago, Illinois, and Grady Ferguson, of Clover, South Carolina, have both done themselves up very well with the logging of African stations. Please bear in mind that the times and frequencies given are subject to change, but that they were all correct at the time that this handbook was prepared.

The great majority of these stations will QSL by either a fancy QSL card or letter and, for best results, reports should be prepared in the native language of the country whenever possible, since many of these stations are on the air primarily for their own local population and many of them may not have anyone on the station staff who can readily translate from English. It has long been felt that, in general, African stations issue very colorful QSL cards, possibly more so than many stations in other areas. Many stations send out beautiful multicolored cards for correct reception reports. For the complete list of addresses, you should have a copy of The World Radio-Television Handbook (Gilfer Associates, P. O. Box 239, Park Ridge, New Jersey 07656).

The current issue of the World Radio-Television Handbook lists a total of 57 African countries having broadcasting equipment. The list of Africans ends with Zambia and this one has been heard recently with a fine signal at 2020-2130 GMT on a frequency of 17.885 MHz.

Finally, we suggest that you give some serious thought to joining one or more of the several fine radio clubs that cater to the SWL hobby.



Radio Abidjan, Ivory Coast.

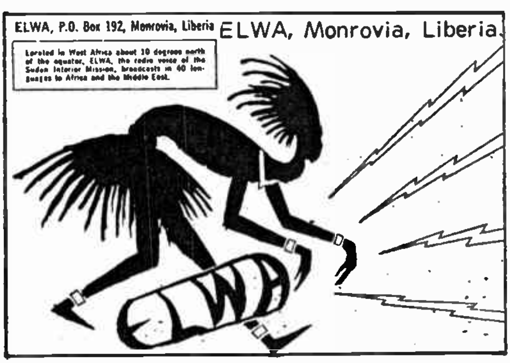


Fig. 7-13. Copies of verifications sent to Richard Pistek.

Radiodiffusion Television Marocaine, Rabat, Morocco.

Radiodiffusion Nationale du Mali, Bamako.

الإذاعة العربية السعودية
SAUDI ARABIAN BROADCASTING

Broadcasting Service of the
Kingdom of Saudi Arabia, Riyadh.

DXING THE NEAR EAST AND MIDDLE EAST

The area of the Near and Middle East, as anyone who has been following the news over the years knows, is a world political hotspot for several reasons. This area, rich with one of the world's largest oil reserves, is watched carefully by many of the world's powers. The Soviet Union has been trying to gain a foothold in this area in order to get some of this oil for herself. The United States has many American-owned and -operated oil refineries in the area. This area of the Near and Middle East is predominantly Arabic, except for the countries of Turkey and Iran, and the tiny state of Israel. Thus, this entire area remains a hotspot, and by occasional monitoring of the various stations in the area, it is possible to keep abreast of current developments.

Technically, this area includes all of the countries of the Southwest portion of Asia, from the eastern edge of the Mediterranean—Turkey, Syria, Israel, Jordan, and Lebanon—and the peninsula of Saudi Arabia, all the way east to Iran and Afghanistan. Most of the people here are Arabs with the exceptions of Israel, Iran (Persian), and Turkey.

In contrast to Africa, the Near and Middle East countries have a number of rather high-powered stations, many of which purposely originate foreign service broadcasts in languages other than their own native tongues for listeners overseas. Many of these stations have broadcasts in English, intended for Europe or North American listeners; this, coupled with the high power used by stations in the area, makes this a relatively easy area of the world to hear on shortwave radio.

Most of these stations, with very few exceptions, operate in the major international bands such as 31, 25, and 19 meters. Reception on these frequencies represents less of a challenge than many of the African stations. However, there remain a few countries and stations in the area which program only in their own native languages and operate on badly jammed frequencies, which makes them more difficult to hear than the rest. ("Jammed" is used in the sense that the frequencies have considerable interference on them as a result of many stations operating at the same time, rather than as a result of deliberate jamming by stations set up for this purpose.)

Almost all of these stations can be heard at some time of the day with programs in English. In their home service, designed for the local population, you can hear the typical Arabic format of (as we call it), "chanting," singing in Arabic, talks, native Arabic music, and similar programs.

Here are several stations in this area which can be heard with relative ease in North America, many of them with English-language programing:

Saudi Arabia

The Broadcasting Service of the Kingdom of Saudi Arabia can be heard easily all day on 11.855 MHz with programs in Arabic, French, and English; the English program is listed at 1700-1955 GMT.

Turkey

The Voice of Turkey in Ankara is very easily heard with an English-language program beamed to North America from 2200 to 2230 GMT. The frequency currently in use is 11.88 MHz.

Syria

Radio Damascus broadcasts an English-language program beamed to Europe. The reception is generally fair. The times and frequencies vary, but as we write this they are being heard on 15.29 MHz with their Arabic home service program after 0300 GMT.

Iraq

Radio Baghdad can be heard with an English program at 1930-2015 GMT on 9745 kHz, but this frequency is often swamped with QRM. In the summer months, look for this station with their home service programs in Arabic on 15.4 MHz around 0400 GMT and later.

Lebanon

This is one of the easiest-to-hear stations in this part of the world. Radio Lebanon in Beirut can be heard with a half hour of English beamed to North America at 0230-0300 GMT. This station has a habit of changing its frequencies often, but as this was written, they were on 9550 kHz.

If you have been successful in logging the above, perhaps you will want to go after a few that just might be considerably tougher. Try these:

Afghanistan

Radio Afghanistan, broadcasting from Kabul, is not heard too well in spite of the fact that fairly good power is used; their signals are consistently accompanied by QRM. However, you can occasionally hear English-language programs from Kabul at 1800-1830 GMT on 15.265 MHz.

Yemen

Radio Sanaa, located at the southern end of the Arabian Peninsula, can occasionally be heard with Arabic programing, including chanting on 5804 kHz after 0300 GMT or so. There may be sporadic interference from utility stations on nearby frequencies. Of all the stations in this general area, this one is the most difficult to verify.

Qatar

This small Arabic state, on the Arabian Peninsula across the Persian Gulf from Iran, has a high-powered shortwave station, yet is audible only with considerable difficulty. The Broadcasting Service, at the capital of Doha, may sometimes be heard with their Arabic home service programs from their 0230 GMT sign-on; the frequency is 9570 kHz and there is usually heavy interference from other stations at this time. A better time to hear this station is after the 1500 GMT sign off of Radio Australia, which then leaves 9570 kHz in the clear. West Coast listeners have the best chance of hearing them at this 1500 GMT time. All programs are in Arabic with typical chanting and music. And, of course, there are others.

Most of these stations (except Yemen, as mentioned above) are good verifiers and will send either a QSL card or letter for a correct report. Since most of these stations are high-powered international stations that have English at some time of their broadcast day, it is okay to report to them in English when applying for a QSL.

By listening to these stations, you will not only be able to keep up with developments in this "hotspot" of the world, but at the same time add to your logbook of countries heard and verified. This is only one of the many interesting DX areas to be explored in this hobby of adventuring around the world from your favorite easy chair.

DXING ASIA, AUSTRALASIA, AND PACIFIC ISLAND AREAS

The shortwave listener who chooses to concentrate on DXing Asia, Australasia, and the Pacific Islands areas can experience a wide variance of radio styles and formats which are indicative of the many different cultures represented in these vast geographical regions.

One can select from the occidental-oriented shortwave services of Australia and New Zealand, exotic Polynesian music from Papeete, Tahiti, or the Far Eastern stations, ranging from modern and industrial Japan to the widely heard voice of the People's Republic of China, Radio Peking.

The relative importance of these areas, particularly Asia, is indicated by the large number of broadcasters beaming transmissions to listeners in these regions. Politically, two of the World's giants, Washington and Peking, have invested millions of dollars or yuan, as the case may be, advocating their form of government. The Soviet Union has also established important relay stations on its Pacific coast and subsequently increased its audience for Radio Moscow.

The millions who live in Asia are considered prime targets for another prominent facet of international shortwave broadcasting—the religious stations. One of the World's largest Christian organizations is that of the Far East Broadcasting Company which has established an extensive system in the Philippine Islands. The FEBC directs its major efforts toward the continent of Asia. However, many of the broadcasts are audible in Canada and the United States.

The novice DXer will find several key broadcasters which will enable him to be not only informed on Asian events, but entertained as well.

Steve Pitts of Roseburg, Oregon, one of the top DXers on the West Coast, prepared the following resume of stations from Asia, Australasia, and Pacific Island areas especially for this handbook.

North Vietnam

Political motivation, as an intrinsic part of international broadcasting, is amply exemplified in the Democratic Republic of Vietnam. Radio Hanoi has become something of a household word as we have heard its transmissions quoted on the evening news, usually many hours after they were directly monitored by North American SWLs. Putting our own political beliefs aside, it is interesting to analyze Hanoi's style of direct and severe criticism of American policy versus the more subtle methods of our own Voice of America. Hanoi's shortwave voice will retain its significant role as Southeast Asia uneasily plots her perilous course into the future. You can listen for Hanoi on 10.04, 12.04, and 15.012 MHz at 1300 GMT as it broadcasts in English.

Ryukyu Islands

The importance of Asia accounts for the significance of the Ryukyus, or Okinawa as it is more commonly known, where the U. S. Information Agency counters Radio Hanoi with a VOA relay. The VOA's 100 kW transmitter is easily heard on 7165 kHz before local sunrise.

People's Republic of China

One of the real giants of the shortwave scene is that of Radio Peking, which also strays far from the usual international broadcasting style. During President Richard Nixon's trip to Peking, DXers were able to hear Radio Peking's unorthodox method of reporting this history-making news event. Absolutely nothing was mentioned of his arrival for some time after the official welcome. However, after the announcement was made, a noticeable deemphasis of previously harsh denunciations occurred. The "tone" of Peking's broadcasts gave valuable clues as to the nature of Mainland China's changing attitude toward the United States. As does Hanoi, Peking uses frequencies outside of the generally adhered-to international broadcast bands. English is currently in use on 12.055 and 15.06 MHz each evening. It should also be pointed out that, although it's one of the easiest to hear of foreign stations, Radio Peking does not verify as such, but, rather, chooses to send a very ambiguous acknowledgment which has frustrated thousands of QSL collectors for years.

Republic of China (Taiwan or Formosa)

Obviously, the changing world scene involving Mr. Nixon's trip to Peking and the subsequent admission of Mainland China into the United Nations is of vital concern to Taiwan. The official service of this small nation is the Voice of Free China which loudly proclaimed its outrage over expulsion from the U. N. Its own version of current events can be heard daily on 15.125 and 17.72 MHz at 0200 GMT. Unlike Peking, Taipei verifies with a very complete QSL.

Japan

The problems involving two Chinas is also of considerable concern to Japan, which wants to maintain favorable trade agreements with Taiwan but is also actively courting closer ties with Peking. As heard on Radio Japan, Tokyo adroitly avoided diplomatic insult to both parties during the United Nations reversal on Chinese membership. Radio Japan, however, is of far greater import than merely to serve as a window on China. This service has built a reputation for quality in all phases of broadcasting.

Radio Japan maintains an excellent news department and also is one of the easiest Asians to hear. Nippon Hoso Kyokai, as its broadcasting system is known, schedules a half-hour general service consisting of 15 minutes each of English and Japanese. These transmissions are best heard on the hour each morning on 9505 kHz. The North American Service is broadcast from 2345 to 0045 GMT on 15.445 and 17.825 MHz. The NHK also has one of the best relationships with its audience. Periodically, new QSLs are issued, with many in full color and among the most attractive of all issued by broadcasters. Complete program schedules, along with a newsletter, are also sent to reporting SWLs.

Japan can also be heard via an American Armed Forces station. The United States military presence remains at a substantial level in the Far East, and the Far East Network was initiated for servicemen in the region. The format is strictly American and not unlike just about any rock station stateside. Look for the Far East Network on 6155 kHz just before your local sunrise.

India

India is another important Asian nation and offers interesting listening over its official voice, All India Radio. The AIR station does not have a transmission to North America as such, but is nevertheless heard often on 11.81 MHz at 1400 GMT. India is another nation that is rapidly advancing toward achievement of a significant role in not only Asian, but global affairs as well. With Southeast Asia in a state of flux, and unrest still evident in Pakistan and Bangladesh, All India Radio will be a voice to heed.

As reported by former Peace Corpsmen and other visitors, India is plagued with tremendously complex governmental bureaucracies which extend, unfortunately, into the broadcasting organization. As a result, AIR's verification policy has been inconsistent at best. However, full QSLs indicating date, time, and frequency are currently being issued. The address is P. O. Box 500, New Delhi.

Pakistan

The world became painfully aware of this populous country formerly consisting of two parts during the intense war that saw the emergence of the new nation, Bangladesh. Pakistan had a comparatively well established radio service prior to the actual battles, and announcements from Radio Pakistan gave early indications of the severity of the fighting. Frequencies in use included 11.672 MHz, which was heard well in the United States. Many of the issues that were the origin of the fighting are still unresolved. Three separate countries, Pakistan, Bangladesh, and India, are deeply involved and continue to be a nucleus of world news. A shortwave radio and the knowledge of when and where to tune will prove invaluable in keeping track of current events in this region.

Bangladesb

January of 1972 saw the beginning of a new radio service on Radio Pakistan's old frequency of 15.52 MHz. This shortwave broadcaster preceded the actual formation of the country of Bangladesh by some time. The initial transmissions tended to drift off frequency and at one time were reported as high as 15.561 MHz! The cease fire and subsequent peace between Pakistan and Bangladesh has not curtailed the war of words which is still taking place. For listeners in North America, the time to listen is late afternoon and early evening for an English transmission on 15.52 MHz.

Republic of Korea

Another friendly shortwave broadcaster is the Voice of Free Korea, which has quite an extensive network. Like Radio Japan, VOFK issues very attractive full color QSLs with complete details of date, time, and frequency. Although not as powerful as the transmitters of Tokyo or Peking, efficient scheduling and judicious choices of frequencies make South Korea a regular, especially for West Coast DXers. Try 15.43 MHz at 0300 GMT or 0900 GMT for the English-language North American Service.

Korea, People's Republic

North Korea has remained a mystery to Westerners to even a greater degree than Mainland China. By our standards, the programs from the official voice, Radio Pyongyang, are as unusual as the country. However, dull and unappealing as the programs seem to be, the station makes up for it by original choices in frequency selection. Many SWLs have added this country to their log by tuning the receiver's dials to 16.32 MHz for a Spanish-language transmission at 0100 GMT. This frequency is completely out of the international broadcasting bands and, as a result, is easy to spot. It should also be pointed out that Radio Pyongyang has a very consistent QSL policy; it simply refuses to verify!

USSR

As astute students of political science know, "Russia" is a misnomer. Actually, this country is composed of separate states. Most clubs such as the Newark News Radio Club count these separate areas as separate countries. Asiatic Russia comes under this category and can be logged via Radio Moscow's Pacific North American Service at 0400 GMT on 15.18 MHz. This transmission originates from the USSR pacific coast.

Mongolia

A real challenge for any DXer is Ulan Bator, capital of Mongolia, which is located in the depths of Inner Asia. English-language transmissions have been logged on 11.86 MHz at 2200 GMT.

Iran

The exotic language of Farsi is what you will hear if you tune to Radio Teheran on 15.084 MHz. As does Hanoi and Peking, this service operates outside of the normal shortwave broadcast bands. For this reason, along with the unusual language, Iran is easy to spot.

Iran, along with Iraq, Afghanistan, and Lebanon, is considered by many DXers to be in the Middle East rather than as a part of major Asia. Others feel differently. With no attempt to prove a point one way or the other, Iran is included above; Iraq, Afghanistan, and Lebanon station information is included in the Middle East section.

Australia

Australia has provided enjoyable listening for over 30 years through its international service, Radio Australia. This station features reliable and unbiased news coverage, drama, and music from "down under." In polls conducted by the International Shortwave Club, Radio Australia is always near the top in popularity among SWLs. Excellent programing such as Keith Glover's "Mailbag" and Bob Padula's DX program accounts for the large listening audience. The North American Service is scheduled for 1300 GMT on 9580 kHz and has become a regular for many listeners. You should also try for the evening North American Service at 0100 GMT on 21.74 and 17.795 MHz. Radio Australia is easily distinguishable by the unique music-box version of "Waltzing Matilda" and the laugh of the Kookaburra bird which precede all transmissions.

The Australian Broadcasting Commission also has a shortwave domestic service with transmitters located in several major cities. Some of these are heard quite easily in North America, the easiest being Perth on 9610 kHz at local sunrise. The domestic service stations are not intended for foreign reception and, for that very reason, provide unusual listening opportunities. Sports activities are widely followed and the ABC broadcasts many events including horse racing.

Pápua Territory

A portion of New Guinea is a territory of Australia, and the ABC operates another domestic station in Port Moresby, which is widely heard on 4890 kHz with programing similar to Perth's VLW9.

New Zealand

A personal favorite of many DXers is Radio New Zealand broadcasting from Wellington on the North Island from one of the southernmost areas a listener will hear. The New Zealand Broadcasting Corporation has chosen not to join the rush to high-power equipment that allows the broadcaster to "blast" their signal to a given area by sheer force. Rather, Radio New Zealand concentrates on providing a high quality service for the Pacific regions. Beamed in only three directions with a small (by today's standards) 7500-watt transmitter, Radio New Zealand is nevertheless often picked up by North American SWLs, especially those residing on the west coast. The regional emphasis is evident in the number of special programs for local areas such as Samoa and the Cook Islands. A glimpse of New Zealand history is heard via regularly scheduled Maori music. Look for it on 11.78 MHz or 9540 kHz in the late evening. The 0600 GMT transmission to the Pacific Islands is received regularly in western North America. A distinctive interval signal consisting of the call of the New Zealand bellbird precedes all transmissions.

Philippines

Thanks to the voice of HCJB, Ecuador is a very common catch for the SWL. An almost identical situation applies to the Philippine Islands with the Far East Broadcasting Company. This missionary organization has established a comprehensive radio network for the entire area. Programs are mainly Gospel-oriented and a number of languages are utilized. The FEBC can be heard at 0900 GMT in English on 11.89 MHz.

Another Philippine station that has recently been reported is the Voice of the Philippines on 9580 kHz at 1300 GMT. The format of this station emphasizes the local culture and history of the islands. Although not as easily heard as the FEBC, the programs of the Voice of the Philippines provide entertaining listening.

Singapore

This tiny country has experienced a great deal of historical change and was, until recently, a part of Malaysia, but has since become independent. Radio Singapore is not as easy to hear as Radio Australia or some of the Asian broadcasters, but it can be heard around 1100 GMT on 11.94 MHz broadcasting in English. Radio Singapore is another friend to the SWL who collects QSLs.

Malaysia

An easy way to log this Southeast Asian country is to listen for the BBC relay on 11.75 MHz at approximately 1500 GMT. This is a new facility installed by the BBC to improve their world coverage. There is nothing new about the BBC's QSL policy, however; they still insist on sending a vague "acknowledgment" without mention of date, time, or frequency.

Tahiti

Officially classified as French Polynesia in some country lists, this exotic south sea island broadcaster has become highly popular with its unique Polynesian-flavored programs. For the DXer or the casual listener interested in entertaining programs, Radio Tahiti excels. Although English is not used, the distinctive drum beat and flute interval signal helps in identifying French Polynesia's radio service. French and Tahitian are the two languages you will hear, but the authentic Polynesian music crosses any language barrier. The average SWL in North America spends most of his time at the radio dials during the winter months—the rainy, snowy, cold, and windy months! The Polynesian music an atmosphere created by Radio Tahiti (and one's imagination) are enough to warm the heart of all travel agents specializing in South Sea vacations! Look for an influx of shivering DXers in Papeete soon!

The most often reported frequency is 15.17 MHz. You might also check 11.825 MHz which operates in parallel to the 19-meter frequency. The 4000-watt service on 6135 kHz would be a real catch especially for SWLs in eastern areas of the United States or Canada. The time to listen for this one is 0400 GMT and later.

New Caledonia

The French influence is quite evident in the South Pacific and reception of Radio Noumea could easily be mistaken for ORTF in Paris, since French is the exclusive language of this island broadcaster. However, the 20 kW transmitter "gets out" well and makes for fairly easy reception. Look for Radio Noumea at 0600 GMT on 7170 kHz or 11.71 MHz. The programs you hear will be similar to those of Paris and the Polynesian format will not be as noticeable as that of Radio Tahiti.

Hawaii

Although there are no active shortwave broadcasters (the Voice of America does have a standby transmitter) in Hawaii, it is easily logged by tuning to 10 or 15 MHz for reception of time station WWVH. The National Bureau of Standards operates this station, along with WWV in Fort Collins, Colorado, for the purpose of providing accurate time signals as well as exact frequency standards. Information on WWV and WWVH is presented in Chapter 15. The easiest way to distinguish WWVH is to listen for the female announcer who precedes WWV's male announcer in stating the time each minute.

Special Considerations

One of the attractions of DXing the shortwave broadcast bands is the unknown. Unlike the rock-solid reception of a local broadcast band station, little is taken for granted in international broadcasting. Sometimes Radio Singapore is there and sometimes it is not! In DXing Asia, Australasia, and the Pacific Islands, there are several important considerations. First is the phenomenon known as "polar flutter," which is the audible effect of distortion of radio signals as they cross the North Pole area. The resulting distortion hinders the quality of reception. For instance, Radio Japan's signals must cross this region, also known as the auroral zone, to reach eastern North America. Unusual sounding audio and rapid fading are the result of this problem. However, the western North American listener is not bothered by this difficulty as Radio Japan's signal path avoids this zone by traveling in a straight line below Alaska and Western Canada.

Generally speaking, the stations listed in this section are routine and semiroutine for the western DXer. Eastern readers may find them to be more of a challenge. As European reception is somewhat easier in the east, Asian and Pacific reception is easier in the west. An example would be that of Radio Tahiti which is extremely strong in Oregon and Washington, but logged with some difficulty in New Jersey.

The second consideration is that of frequency or scheduling changes. Some of the frequencies and times listed in this section may be obsolete by the time you get this handbook. The old saying, "You can't tell the ballplayers without a score card," is quite appropriate to shortwave DXing. You have to know where to look and at what time to listen. A reliable source of information is a necessity. The best way to establish such a source is to join a good, stable radio club. Monthly logs of members' reports are extremely valuable in learning just when and where to tune.

In conclusion, DXing Asia, Australasia, and Pacific Island areas will give the listener a far more accurate perspective of the many different countries in these regions than can be gained by any other method. Unless, that is, you can afford that trip to Papeete, and Melbourne, and Ulan Bator, and...!

DXING HARMONICS

Sprinkled throughout the shortwave range are signals that don't belong. Engineering standards prohibit them; stations responsible deny they exist; but DXers can hear them!

It is a fact of radio transmission that every transmitter radiates not only on the intended **fundamental** frequency, but also on harmonics. Modern transmitter design means that normally the harmonic signals are so weak (attenuated by 80 dB or more) that they can't be received beyond a few kilometers from the transmitting antenna.

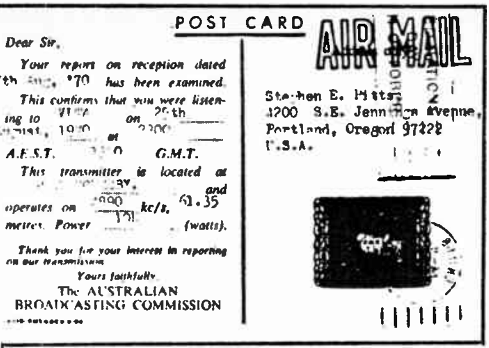
Fortunately for the DXer, there are so many radio transmitters in the world that at any given time, a goodly number will be sufficiently out of adjustment to produce harmonics strong enough to be heard at greater distances.

Fortunately? Yes. One's first reaction might be to condemn these signals of sloppy engineering, and in very rare cases, the harmonics may interfere with another station's legitimate fundamental. But for the most part harmonics offer the serious DXer a challenge without parallel.

What Are Harmonics?

How do we define what constitutes "good DX"? Distance is one obvious answer. But another is power; the lower it is, the better the achievement in being able to tune it in. Still another is intentionality. Only harmonics fit the third category; they alone are unintentional radiation. It's one thing to tune in a station that intends to broadcast on shortwave. It's quite another to succeed in receiving a station that is not even aware of its transmission on the frequency where it is heard!

Radio Tahiti, Papeete.



POST CARD

AIR MAIL

Dear Sir,

Your report on reception dated 7th ..., '70 has been examined.

This confirms that you were listening to ... on 26th ... 19.. at ... A.E.S.T. ... G.M.T.

This transmitter is located at ... and operates on ... kc/s, 31.35 metres. Power ... (watts).

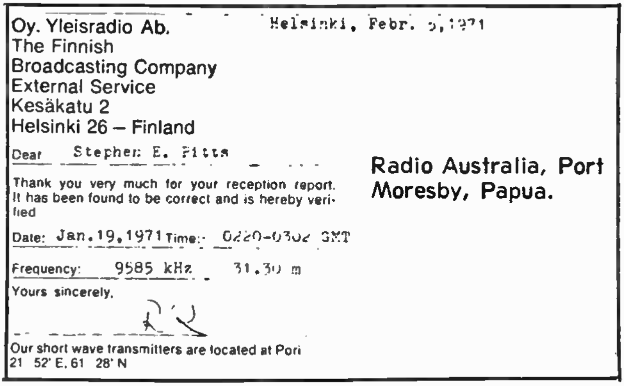
Thank you for your interest in reporting on our transmissions.

Yours faithfully

The AUSTRALIAN BROADCASTING COMMISSION

Stephen E. Pitts
1200 S.E. Jenn... Avenue,
Portland, Oregon 97222
U.S.A.

Finnish Broadcasting Company, Helsinki.



Oy. Yleisradio Ab.
The Finnish
Broadcasting Company
External Service
Kesäkatu 2
Helsinki 26 – Finland

Helsinki, Febr. 5, 1971

Dear Stephen E. Pitts

Thank you very much for your reception report. It has been found to be correct and is hereby verified

Date: Jan. 19, 1971 Time: 0220-0302 GMT

Frequency: 9585 kHz 31.30 m

Yours sincerely,

Our short wave transmitters are located at Pori
21 52' E, 61 28' N

Radio Australia, Port Moresby, Papua.

Fig. 7-14. Copies of verifications obtained by Stephen Pitts.

As for power, harmonic radiation is usually at a tiny fraction of the rated fundamental power, though occasionally a station seems to have completely mistuned its transmitter so that more power goes out on the harmonic than on the fundamental!

Before going any further, we should define exactly what a harmonic is, and what it is not. A harmonic is only an integral multiple of a fundamental frequency. This means it is exactly the second, third, fourth, etc. multiple of the normal frequency, and it usually shows up in a band not primarily allocated for broadcasting. But hearing a signal outside a broadcast band is by no means an indication that it is a harmonic. Many broadcasters operate there by "squatter's rights" or in outright violation of international treaties.

Your receiver may be at fault, too. Sad to say, but only the more expensive double-conversion models are relatively free of images. You see, the superheterodyne principle of converting all incoming signals to a single intermediate frequency has one defect in practice. A receiver with poor image rejection will repeat signals at a frequency separation of twice the i-f from their real location. Depending on the severity of the case, only the stronger signals on a given band may reappear at, say, 910 kHz below, or virtually all of them may. A good alignment job and a preselector (when properly peaked) may reduce this problem.

Another source of out-of-band programed audio is point-to-point relay of broadcast signals. Many of the larger international broadcasters which have relay bases outside their own country use this method to feed the signal for relay. Most often, reduced carrier sideband is used, but some may be on regular AM. Occasionally, a major sporting event is "blind broadcast" over point-to-point facilities for rebroadcast by a great number of independent local stations.

All of these are interesting topics in themselves, but have nothing to do with harmonics. For our purposes, they are only to be recognized for what they are and avoided.

If you have a good receiver, a quiet location, and if you regularly tune between the shortwave broadcast bands, you're bound to run across harmonics eventually. In contributor Glenn Hauser's experience, the harmonics tend to congregate in certain frequency ranges: above 23 MHz when sunspot counts are at their peak and below 4 MHz during sunspot declines.

Two factors account for this: the higher frequencies propagate best when conditions are optimum, and with the least amount of interference and noise. Also, different orders of harmonics from different bands overlap a great deal above 23 MHz (see Table 7-2 for the exact harmonic band frequency limits). The lower frequencies propagate best during winter when sunspot counts are low, and thousands of medium-wave stations provide the pool from which low-frequency harmonics rise and sink. Since we are now (as this is written) in a period more favorable for lower-frequency propagation, this section deals mainly with that aspect of harmonic DXing.

Medium-wave Harmonics

Medium-wave harmonics come and go at irregular intervals. So many variables are involved that it is impossible to predict just where to tune for which harmonics. The best technique is to perform a band scan several times during the night, becoming familiar with regular fundamental signals, and noting frequencies bearing programing for which you cannot otherwise account. Eventually, given a low local noise level and favorable propagation conditions, you should begin identifying harmonics from medium wave. If you live in a heavily populated area of the United States, you may get a few domestic medium-wave harmonics (besides those from nearby stations which may be caused by receiver overload), but the great majority seem to originate in Latin America where technical standards are much more lax. You are quite a bit more likely to hear a harmonic from a South American station running 1000 watts, than from a much closer North American 50 kW station which must of necessity keep its harmonics inaudible.

Table 7-3 should be used as a rough guide only. It shows most of the medium-wave harmonics contributor Glenn Hauser has received in a

Table 7-2. Shortwave Broadcast Band Harmonics,

kHz Range	Harmonic	Fundamental Meter Band
-4600		(none)
4600-5000	2	120
5000-6400		(none)
6400-6800	2	90
6800-6900		(none)
6900-7500	3	120
7500-7800		(none)
7800-8000	2	75
8000-9200		(none)
9200-10,000	4	120
9,500-10,120	2	60
9,600-10,200	3	90
10,200-11,500		(none)
11,500-12,500	5	120
11,700-12,000	3	75
11,900-12,400	2	49
12,500-12,800		(none)
12,800-13,400	4	90
13,400-13,800		(none)
13,800-15,000	6	120
14,200-14,600	2	41
14,250-15,180	3	60
15,180-15,600		(none)
15,600-16,000	4	75
16,000-17,000	5	90
16,100-17,500	7	120
17,500-17,850		(none)
17,850-18,600	3	49
18,400-20,000	8	120
19,000-19,550	2	31
19,000-20,240	4	60
19,200-20,400	6	90
19,500-20,000	5	75
20,400-20,700		(none)
20,700-22,500	9	120
21,300-21,900	3	41
22,400-23,800	7	90
23,000-25,000	10	120
23,400-23,950	2	25
23,400-24,000	6	75
23,750-25,300	5	60
23,800-24,800	4	49
25,300-27,500	11	120
25,600-26,800	8	90
27,300-28,000	7	75
27,600-30,000	12	120
28,400-29,200	4	41
28,500-29,325	3	31
28,500-30,360	6	60
28,800-30,400	9	90
29,750-31,000	5	49
29,900-32,500	13	120
30,200-30,900	2	19

(Note: the list can be extended well into the VHF range. Harmonics higher than 6th order are extremely rare, but are included for the sake of completeness.)

two-year period in southern Texas. You should not expect to hear them all the first time you tune across the band. If you're further from Mexico, for instance, your chances for many of the Mexicans are reduced. On the other hand, many parts of the United States are as close as, or closer than the author's location to Central America, the Caribbean, and South America. By the time you read this, some of the harmonics listed will have been detected by the station and corrected. But new, completely unexpected ones will have arisen to make up for them.

DXing low-frequency harmonics is, of course, closely related to medium-wave DXing. But these stations are in fact shortwave broadcasters, whether they know it or not! They prove that all broadcasting is interrelated, whatever the frequency, and offer and opportunity for the medium-wave-only DXer to get acquainted with shortwave, and for the shortwave-only DXer to DX "medium wave" without the extremely heavy interference the medium-wave stations cause one another within their fundamental band.

The author laments the attitude prevalent along some shortwave and some medium-wave DXers that medium-wave harmonics should be "included out" of their own specialty. An attitude more in keeping with the spirit of the DXing hobby is to accept the fact that they exist, and to regard them as prime DX targets. Ten watts of harmonic signal from 2000 km away is certainly of equivalent or greater "DX difficulty" than a thousand watts of fundamental signal on a similar frequency 20,000 km away!

Identifying Harmonics

When you hear a signal you think may be a harmonic, first measure the frequency. Then, divide by two and check your listings to see if any possibilities exist on half the frequency monitored. If this doesn't work, try dividing by three, and so on.

The great majority of medium-wave stations operate at multiples of 10 kHz; this means that their harmonics will appear at multiples of 20 kHz (second harmonics) or 30 kHz (third harmonics), and so on. It's simple to spot whether a particular measured frequency is divisible by 30. Simply add all the digits and see if their sum is divisible by 3. For example, take the frequency of 2330 kHz. $2 + 3 + 3 + 0$ equals 8, so 2330 is not evenly divisible by 3 and is not likely to be a third harmonic. But 2370 kHz, $2 + 3 + 7 + 0$ equals 12 and can be divided by 3, so it can be a third harmonic. Of course, some can be either seconds or thirds, such as 2340 kHz.

Lower-order harmonics are much more likely than higher ones, as you can see by comparing the proportion of seconds to thirds in Table 7-3. However, stations that put out more than one harmonic are more likely to be all even (2x, 4x, etc.) or all odd (3x, 5x, etc.).

If you live in a metropolitan area, you probably will receive unwanted mixing products in the 2 to 3 MHz area from local medium-wave stations. Some may be receiver-produced; others may be the result of external mixing. In either case, they are of no DX interest. You may find that you can get rid of some of them by changing antennas or altering the receiver's grounding system. Humidity and rainfall in the area may also cause some to appear or disappear.

You can figure out the most likely spots where mixing products will appear in your area. First, make a list of all the medium-wave frequencies in use that have strong local-quality signals on them. Then, add each of them to each of the others. Another possible relation is double one, minus another, and double one, plus another. Discarding the results which are negative, or lie outside the range that interests you, arrange all the others in frequency order. Now you have a list of your local mixes to be avoided when DXing. Most of them will be weaker at night, when stations reduce power and become more directional; those involving a daytime-only station will totally disappear.

If you have an antenna trimmer or tuner, you'll find that the mixing products don't peak at the same point as nearby fundamental frequencies while harmonics do. This is proof that the harmonic you are receiving is in fact being transmitted and received on the harmonic frequency.

Always check the fundamental frequency, too, once you have figured it out. In most cases, you won't be able to hear the harmonic station there at the same time—further proof that the harmonic exists. If you can hear it, you'll find that strength, fading, and interference conditions are quite different. The two signals are being propagated independently.

Many DXers like to "verify" their catches by sending reception reports to the station. In harmonic DX, however, this is not a good idea.

Table 7-3. Medium Wave Harmonics.

kHz	Harmonic	Fundamental	GMT	Station, Location
1600	2	800	0728	XELO, Ciudad Juarez, Chih. (now XEROK)
1700	2	850	0600	TGX, R. Ciro's, Guatemala City, Guatemala
1820	2	910	0700	YVRQ, R. Aeropuerto, Maiquetia, Venezuela
1980	2	990	0300	XEER, Ciudad Cuauhtemoc, Chih.
2000	2	1000	1300	XEFV, R. Rancherita, Ciudad Juarez, Chih.
2010	3	670	0100, 1300	XETOR, Torreon, Coah.
2020	2	1010	0340	XEVK, Torreon, Coah.
2060	2	1030	0100 *	XELJ, Lagos, Jal. (at sign-off time)
2090	2	1045	0200	TGSL, R. Sol, Santa Lucia Cotzumaguapa, Guate. (See also 3135 kHz.)
2140	2	1070	0400	HJAH, Emisora Atlantico, Barranquilla, Colombia
2160	2	1080	0555 *	HRVA, R. Tiempo, San Pedro Sula, Honduras
2160	2	1080	0100 *	XECN, Onda Juvenil, Irapuato, Gto.
2200	2	1100	0300	YNQ, La Lider, Managua, Nicaragua
2200	2	1100	0200	TGRS, R. Superior, Escuintla, Guatemala
2220	2	1110	1240	XERCN, Mexico City, Mexico
2240	2	1120	0100 *	XETR, R. Ritmos, Ciudad Valles, S.L.P.
2280	2	1140	1330, 2330	XEMR, La Nueva MR, Monterrey, N.L. (only while on day-time power and antenna)

2310	2	1155	1130, 0500	YSCF, Ondas Orientales, San Miguel, El Salvador
2340	2	1170	0455	R. Andala, Tolima, Columbia
2340	2	1170	1100, 0200 *	YVPX, R. El Sol, La Fria, Venezuela
2343	2	1170+	1200, 0500	TGRL, R. Landivar, Quetzaltenango, Guatemala (harmonic frequency varies)
2360	2	1180	1330	XEYV, R. Amor, Huatusco, Ver.
2380	2	1190	0630	HJCV, R. Cordillera, Bogota, Colombia
2400	2	1200	0500	HJNF, La Sultana del Valle, Cali, Colombia
2400	4	600	1000	La Voz de Cuba, Holguin, Cuba (see also 3600 kHz)
2460	2	1230	1330	KEEE, Nacogdoches, Texas
2480	2	1240	1308	KADS, Elk City, Oklahoma
2500	2	1250	0345	HIBC, La Voz del Progreso, San Francisco de Macoris, Dominican Republic
2520	2	1260	1200	XEZH, Salamanca, Gto.
2540	2	1270	0130	XENX, Mazatlan, Sin.
2600	2	1300	0045	XEXV, Leon, Gtr.
2620	2	1310	1300	XEBP, R. Alegria, Torreon, Coah.
2660	2	1330	0140	YNB, R. 15 de Septiembre, Boaco, Nicaragua
2660	2	1330	1103	HCLW5, R. Canal 1330, Cuenca, Ecuador
2679	2	1339.5	1300, 0330	XESL, Canal 134, San Luis Potosi, S.L.P.

Table 7-3. Con't.

2680	2	1340	0600	HRH6, R. El Mundo, San Pedro Sula, Honduras
2740	2	1370	0100	OAX1G, R. Tumbes, Tumbes, Peru
2798.5	2	1399.25	0100 *	XELH, Acaponeta, Nay.
2800	2	1400	0545	KNOR, Norman, Oklahoma
2820	2	1410	1055	HJFS, Ondas del Guali, Honda, Colombia
2860	2	1430	0100	TGAG, R. Huehuetenango, Guatemala
2860	2	1430	1045	HJBH, R. Magdalena, Santa Marta, Colombia
2880	2	1440	0700	HJEK, R. Reloj de Tulua, Colombia
2898	2	1449	1200, 0200	TGMS, R. Nacional Mazatenango, Guatemala
2900	2	1450	1200	XEJD, R. Tropicana, Poza Rica, Ver.
2909	2	1454.5	0300	YNTJ, Ecos de las Brumas, Jinotega, Nicaragua
2920	2	1460	1230, 0145	XEYC, R. Ysela, Ciudad Juarez, Chih.
2920	2	1460	0037	XEHE, Atotonilco, Jal.
2940	2	1470	0500 *	TGBH, R. Record (?), Guatemala
2940	2	1470	0800	XESM, R. Fiesta, Mexico City, Mexico
2940	2	1470	1100	KLCL, Lake Charles, Louisiana
2950	2	1475	0030	YNAG, R. Cosiguina, Chinandega, Nicaragua
2958	2	1479	0300	XETKR, Monterrey, N. L.
2960	2	1480	1214	XEPR, Poza Rica, Ver,

2960	2	1480	1130	TGIZ, R. Rumbos, Guatemala City, Guatemala
2980	2	1490	*1156	XEMK, R. Mexicana, Huxitla, Chis.
2980	2	1490	0100	XECJC, R. Impacto, Ciudad Juarez, Chih.
2980	2	1490	1214	XEZV, Puebla, Pue.
2980	2	1490	0504	KQTY, Borger, Texas
2980	2	1490	0423	KVOZ, Laredo, Texas
2980	2	1490	1020, 0130	WLOX, Biloxi, Miss.
2984	2	1492	1215	TGCO, La Voz Tropical, Coatepeque, Guatemala
3000	2	1500	0620	XERH, R. Tricolor, Mexico City, Mexico
3000	2	1500	0030	XEGN, Piedras Negras, Ver.
3030	2	1515	0200	YNCZ, R. Progreso, Leon, Nicaragua
3040	2	1520	0700	HJLQ, R. Minuto, Barranquilla, Colombia
3075	2(?)	1537.5(?)	0500	HRGT, R. Comercial, Tegucigalpa, Honduras
3079	2	1539.5	.0410*	HJHD, La Voz del Petroleo, Barranquilla, Colombia
3100	2(?)	1550(?)	1100	Cadena Azul, Guatemala
3120	2	1560	1245, 2330	KEGG, Daingerfield, Texas
3130	2	1565	0400	HJZT, R. Sensacion, Manizales, Colombia
3135	3	1045	0030	TGSL, R. Sol, Santa Lucia Cotzumalguapa, Guatemala (see also 2090)

Table 7-3. Con't.

3150	3	1050	0900	XEG, Monterrey, N. L.
3176	2	1588	0250	XEPT, Misantla, Ver.
3180	2	1590	0100	XEVOZ, R. Voz, Mexico City, Mexico
3199.7	2	1599.85	1100, 0430	HIFA, La Vox de las Fuerzas Armadas, Santo Domingo, Dominican Republic
3200	2	1600	1200, 0130	XERTP, San Martin Texmelucan, Puebla
3540	6	590	1043	La Voz de Cuba, La Julia, Cuba (see also 5310)
3600	6	600	1045	La Voz de Cuba, Holguin, Cuba (see also 2400)
4400	5	880	0400	TGJ, R. Neuvo Mundo, Guatemala City, Guatemala (see also 6159)
5310	9	590	0730	La Voz de Cuba, La Julia, Cuba (see also 3540)
5400	4	1350	2330	XEZD, Ciudad Camargo, Tams.
5580	6	930	2330	XEU, R. Nucleo Oro, Veracruz, Ver.
6159	7	880—	1900	TGJ, R. Nuevo Mundo, Guatemala City, Guatemala (see also 4400)

The asterisk before the time (such as *1156) indicates sign-on time. The asterisk after the time (such as 0410*) indicates sign-off time.

Even a single DX reception report, and certainly several of them, will lead any responsible engineer to get to work on the transmitter and clean it up. So suppress the urge to go after a QSL and be satisfied with sharing the harmonic DX with fellow DXers through club bulletins. You might get a QSL, if the engineer is candid enough to admit harmonic radiation, but in the process not only get the harmonic eliminated from your own DXing pleasure, but deprive other DXers of the chance to hear it!

Rest assured that if the harmonic causes harmful interference to some utility station, they will complain about it to the authorities. Let them look our for themselves.

DXers seeking new countries to hear may find harmonic DXing rewarding. Some countries with medium-wave stations only may occasionally become audible on shortwave via harmonics. United States DXers would do well to check the appropriate multiples of Bermuda, Bahamas, Jamaica, and other Caribbean island medium-wave transmitters.

The idea of working up a considerable total of states heard on shortwave broadcast may be a new one (though medium-wave, FM and TV DXers have long worked toward such a goal), but through DXing domestic medium-wave harmonics, you can far surpass the five currently active as conventional shortwave broadcast—that is the KGEI, WNYW, WINB, and Voice of America stations in California, Massachusetts, Pennsylvania, Ohio, and North Carolina.

Of course, not only medium-wave and shortwave broadcast transmitters produce harmonics. Various utility, amateur, FM, and TV stations do, too. Since utility bands are so broad, it is rather difficult to tell if a given signal is a harmonic. Occasionally, however, one will fall in a band where it obviously doesn't belong. The coastal stations in the 13 MHz band are sometimes heard on CW within the 11-meter broadcast band, for example. Many of the other coastal bands, however, are deliberately harmonically related in order to assure that coastal harmonics fall into another coastal band. Most amateur bands are set up the same way. The second harmonics of the FM band fall on the high television band (channels 7 to 13), but most television receivers are designed to reject such signals. DXing television harmonics is almost unknown as yet, due to the lack of tuners for the proper frequencies.

Getting back to shortwave, what else can you gain by DXing harmonics? You may well be the first to discover a new medium-wave station on the air! Brand-new stations are more likely to put out harmonics as they go through proof-of-performance tests. On certain receivers, it may be possible to measure the harmonic frequency with greater accuracy than the fundamental, if you can hear it at all, but you will know what the fundamental frequency must be with even greater accuracy. DXing harmonics allows you to hear some broadcasting stations that may be extremely difficult or impossible to hear on their fundamental frequencies due to scheduling, daylight paths, and other reasons. Harmonics are pilots to propagation conditions; if you can hear a harmonic from a certain area, you can rest assured that the band is "wide open" for all types of stations from that area!

By the way, harmonic DXers must rearrange their evaluation of the relative "DX-ness" of their catches. Hearing a Voice of America 250 kW station's harmonic, which amounts to, say, 25 watts, may be more of a feat than a Latin American 5 kW station which may be putting out 50 watts on its harmonic! But the best thing about harmonic DXing is that it is the only low-power DX specialty!

Chapter 8

Amateur Radio

In the radio spectrum, frequencies are assigned for amateur radio use. Amateur radio, commonly referred to as "ham radio," is a radio service of self-training, intercommunication, technical research, and development carried on by amateur operators. An amateur operator is any person who is interested in radio technique and who is in communications solely for personal enrichment and without any interest in profiting monetarily from its use.

There is something about amateur radio that inspires men and women, who have not opened a textbook in 25 years or more, as well as their children and grandchildren who detest math and science courses in school, to study to pass an examination for an amateur license. For most people, this presents itself as a real challenge.

Anyone can be an audio or hi-fi buff and run the risk of having a ruptured eardrum from listening to a piccolo solo through a high-powered audio amplifier. It is fun to be an SWL or to play "G-man" with small walkie-talkies over a distance of a few hundred feet. And the Federal Communications Commission will issue a citizens band (CB) license to anyone over the age of 18. Certainly, these and other fields of electronics can be enjoyable leisure-time pursuits, which is why many amateurs are active in more than one electronics hobby.

FUNCTIONS OF HAM RADIO

Through the pioneering efforts in electronics by the hams, new and better equipment and methods of communication have evolved. For example, there is now a satellite in orbit which is for the use of hams and which was largely designed and built by them.

Public service is one of the main aspects of ham radio. Through the help of hams, servicemen stationed in remote areas of the world have been able to talk with their families. In emergencies such as floods, earthquakes, and other disasters, ham radio is often the only means of communicating with the stricken area for several hours or even days. Amateur radio operators provide these services on their own time and with no compensation other than personal satisfaction. Worldwide, ham radio provides a means for people of all ages, who have a common interest in radio and radio communications, to meet on the air to exchange ideas and to help one another solve problems.

There is a thrill in tuning Radio Moscow or hearing "London Calling" and other overseas broadcast stations on a shortwave receiver. But doing so is not really that much of an accomplishment. The large broadcast stations use as much power as a good-sized city and their antenna systems cover acres and acres of ground to insure that every listener in the world can hear their messages, their music, or their propaganda. Contrast this situation with amateurs talking over their own stations with their friends in Rome, Paris, and other foreign points. The hams, operating from their homes, are often using a station that is no more powerful nor larger than a portable TV receiver. Frequently, their antennas are simple vertical rods or more-or-less horizontal wires.

The ability to "work" (communicate with) the world is what first attracts many people to amateur radio. It is not unusual for a Novice ham to work 30 to 50 states and even a greater number of foreign countries during his first year on the air. And many amateurs never get over the urge to compete with other DX chasers in contacting all corners of the earth. They spend much money and effort on high-powered equipment and elaborate antennas in order to be number one in hamdom. At the other end of the scale are operators who consider more than five watts as "superpower," so they concentrate on working the world with transmitter power measured in milliwatts.

Other amateurs are mostly interested in having friendly chats with their radio friends, whether they are ten or ten thousand miles away. Many are public service conscious. They join in nets to relay messages

Fig. 8-1. The world-famous mercy ship Hope, pictured against the New York skyline, is amateur radio equipped. Hundreds of messages have been handled over it for Hope personnel on its various missions of mercy to Asia, Africa, and South America.

Fig. 8-2. Yolanda Weisshapel, WA9CCP, Berwyn, Ill., past Illinois Amateur of the Year, is active on both code and phone, as well as radioteletype in the amateur bands and a member of Navy MARS (Military Affiliate Radio System). Her 12 BPL (Brass Pounder's League) cards were earned as Yolanda handled 13,366 messages—mostly to and from servicemen in Vietnam—in one year.

for the general public, particularly between men in the service of their country and their families at home, and to be ready to supply emergency communications in time of need.

Amateurs are also experimenters and builders. They like trying things for themselves. They like doing old things in new ways, new things in old ways, or new things in new ways. They experiment with radioteletype and slow-scan and fast-scan television. They bounce their signals off the moon and they take advantage of all kinds of natural phenomena to communicate over long distances that were impossible to cover a few years ago.

Getting Into Ham Radio

Amateur radio includes every class and age group from school children under 10 years of age through doctors, lawyers, kings, housewives, astronauts, nuns, lighthouse keepers, ambassadors, and TV and other entertainment personalities, up to the age of 90 or more. Incidentally, the average amateur is 24 years old when he qualifies for his first license, although one third of the newcomers are under the age of 16.

Undoubtedly, there is a fascination to amateur radio. There has to be, because every amateur on the air had to pass an appropriate code and theory examination in order to qualify for his license. (We wonder, by the way, who gave the King of Jordan his test—he is an active amateur). In the United States, the Federal Communications Commission (FCC), Washington, D.C., sets up and administers amateur licensing. The test consists of a code test and a written test on FCC regulations and radio theory.

There are several classes of licenses, each requiring tests of varying difficulty and operating proficiency. Each class of license also carries with it various operating privileges. All of this is discussed at greater length shortly. However, anyone who is interested in becoming a ham radio operator might do well to read "How To Be A Ham," by Ken Sessions, K6MVH (TAB Book 673). Any local ham operator, or a ham radio club will offer information and encouragement. Many ham clubs, by the way, conduct both code and theory classes for prospective hams and for those who wish to upgrade their licenses.

Many prospective amateurs have questioned why they have to pass a code test to obtain an amateur license when they plan to operate on "phone" (voice). Deep philosophical arguments can be advanced both in favor and against the code tests. But the most compelling reason for taking a code test is simply that the FCC will not issue a ham license until the applicant has taken and successfully passed the code test. The FCC has reportedly further stated that even if international regulations did not require a code test, they (the FCC) would still require it. Furthermore, knowing the code is not a useless accomplishment after you have your license. Watt for watt, the communication range of a code (CW) transmitter is far greater than that of a phone transmitter. It also costs less. And code has a fascination all its own, as shown by the many amateurs who prefer it to other modes of communications. Finally, the amateur Novice class license permits only code operation. The license is designed to allow new amateurs to get on the air and to operate while acquiring the knowledge to qualify for a higher grade license.

HAM RADIO AND THE SWL

So far we have discussed only hams and amateur radio. How does the SWL fit into all of this? For one thing, an SWL can be a great help to an amateur if the reports that he sends to the ham are complete and ac-

Fig. 8-3. Amateur stations and operators come in all sizes. Ronnie Pelrine, WN4KVN, Burlington, N. C., communicated with 44 states and 20 countries by amateur radio during his first four months on the air.

Fig. 8-4. Bill Krafts, K4KJD, Athens, Alabama, doesn't let arthritis keep him from enjoying amateur radio. He recommends the hobby to other physically handicapped people, too.

curate. Secondly, being an SWL can provide an individual with many hours of enjoyment in the pursuit of his hobby. In this chapter, which contains contributions by two of my friends, we shall examine ham radio in detail, thanks to the efforts of Herb Brier, W9EGQ, of Gary, Indiana, and amateur radio as it pertains to shortwave listening as viewed by Phil DeSilva of Lexington Park, Maryland. Through their combined efforts, we will look at SWL reports, QSL cards, callsigns, frequencies, types of licenses, the Morse code, Q signals, and many other interesting points.

There are two things that are of great importance to an SWL. They are, of course, a receiver and an antenna. As mentioned in Chapter 3, there are a great many receivers on the market with widely varied prices. Any radio supply house can provide you with a receiver, or you may be able to get one second hand through classified ads in your hometown newspaper or from a friend who is a ham. For ease of operation on the ham bands, the receiver should be equipped to receive single-sideband signals. It may have a built-in product detector or a beat-frequency oscillator. If your receiver does not contain one of these devices, all of the single-sideband signals that you receive will have the famous "Donald Duck" sound.

The other element essential to an SWL is an antenna. There are quite a number of antennas available commercially, but more of them are quite expensive. One of the best all-around receiving antennas is a random length longwire installed from 15 to 25 feet high. The length should depend on the space available, but the longer the antenna, the better it is for all-band use. If you have no outside space, or only limited space outside, there are several ways to erect or "jury-rig" an antenna. You can string the wire around the ceiling of your room, connect the lead-in ("feeder") wire to the guy wires of your TV antenna, connect the feeder to the rain gutters of your house, or use the clothes line if it has drying lines. Admittedly, these are not the best antennas, but they do work.

Now that you have a receiver and an antenna, all that is left is to set up a quiet place, a comfortable chair, and some free time. As you tune across the ham bands for the first time, it may sound to you like mass confusion and meaningless garble. But don't give up yet! As a starter, concentrate only on the strongest stations, those that you can hear clearly and distinctly. Even this may be difficult at times in some areas when you consider that in the United States alone there are about 290,000 ham radio operators!

CALLSIGNS

You may ask, "How do the hams themselves keep one another straight?" Well, the FCC has assigned each one of them a separate callsign. The ITU (International Telecommunications Union) has assigned each country in the world a block of letters to be assigned by each country's licensing authority to every station using radio communication. For example, all amateur callsigns in the United States

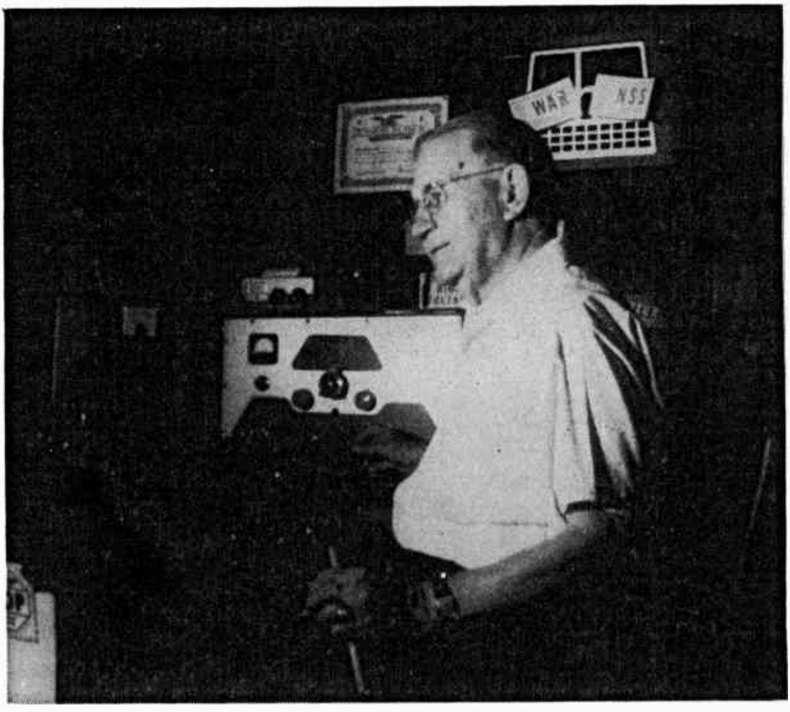


Fig. 8-5. Bill McArty, K9VHY, Logansport, Ind., waited until he was 69 years of age to get his first amateur license. He was still going strong on 80 and 40 meters past the age of 80.

Table 8-1. United States Radio Districts.

1st Call Area	4th Call Area	6th Call Area	8th Call Area
Rhode Island	Florida	California	Michigan
Vermont	North Carolina	7th Call Area	West Virginia
New Hampshire	South Carolina	Washington	Ohio
Maine	Virginia	Oregon	9th Call Area
Connecticut	Georgia	Nevada	Illinois
Massachusetts	Tennessee	Arizona	Indiana
2nd Call Area	Alabama	Utah	Wisconsin
New York	Kentucky	Idaho	10th Call Area
New Jersey	5th Call Area	Montana	Iowa
3rd Call Area	Texas	Wyoming	North Dakota
District of Columbia	New Mexico		South Dakota
Maryland	Louisiana		Colorado
Delaware	Mississippi		Nebraska
Pennsylvania	Oklahoma		Kansas
	Arkansas		Missouri
			Minnesota

In addition, Alaska, as the 49th state, bears the prefix KL7, while Hawaii, as the 50th state, has the prefix KH6.

begin with either the letter K or the letter W. This is followed by either a number (1 to 9, plus 0) or another letter. Next comes a number followed by two or three more letters. Some examples of callsigns in the United States could be: W1ABC, WA1ABC, K4AB, W6TGH, or WØGWR.

The United States is divided into ten call areas (see Table 8-1). If a station you hear has the callsign W6AAA, you know immediately that the station is in the United States (W prefix) and in California (sixth call area). Other countries don't always issue their callsigns in an orderly manner as the United States does, but you can tell what country you have heard by the prefix of the callsign. A complete list of countries of the world, with the prefix block or blocks assigned to them, appears in the Appendix, as well as the prefixes currently in use and the countries using them.

One thing to keep in mind is that a particular country may sometimes allow its hams to use different prefixes than the ones normally used. This may happen on special occasions when a different callsign would bring attention to the country or the event. For example, several years ago, the United States allowed a station in Bethlehem, Pennsylvania, to use the callsign WX3MAS during the Christmas season. Nigeria allowed its hams to use the prefix 916 during the month of its sixth birthday, and Australia used the prefix AX during its bicentennial year. So you can see that prefixes can and do change. If you hear a prefix that is strange to you, consult the list in the appendix to see which country it is.

Since amateurs have their own callsigns for identification, it would be nice if SWLs had their own callsigns, too. If you want, you can improvise your own callsign such as W3-SWL, but we do not recommend this, since the callsign W3SWL is a bonafide ham radio callsign. The author has for years supervised the issuing of SWL callsigns. One is issued to you and you alone; you can use it on your SWL cards and any other correspondence that you might send. More on this program appears in the last chapter under the heading WDX. The other SWL identifications that are recognized almost worldwide are the membership numbers issued by the International Shortwave League (1 Grove Road, Lydney, Glos., GL15 5JE, England), but they are for their members only. A typical callsign of this type, for an ISWL member living in the third amateur radio district of the United States, would be W3-12836; this belongs to Mr. DeSilva, one of the contributors to this chapter. Various clubs also issue callsigns of sorts to their members, but the WDX and ISWL systems are the most widely recognized by hams as being SWL callsigns.

Q CODE

Now that you can identify the country by its prefix, let's consider some of the other unusual things that you may hear. These are unusual only in the sense that you don't normally use them in everyday language. Through the years, hams have developed several shortcuts and abbreviations to help them communicate more rapidly, especially on CW. Many of these terms have carried over to voice communications. This coding is called the "Q code." A few of the more common Q signals are listed below, but a more comprehensive listing of those in general use appears in the appendix.

QRM "Is my transmission being interfered with?" Or, "Your transmission is being interfered with." It can mean either, depending on whether or not the question mark is used.

QRX "When will you call me again?" Or, "I will call you at (a specified) hours." More common usage: "Wait a minute; I'll be right back."

QSL "Can you acknowledge receipt?" Or, "I am acknowledging receipt." In SWL usage, a QSL is a verification from a radio station to a nonbroadcasting listener; in ham radio it is proof of contact between two stations. It is also used in some traffic nets (where messages have serial numbers) and it means exactly what is intended: "I acknowledge receipt (of message numbers so and so).

QSY "Shall I change to another frequency?" Or, "Change to another frequency or to (specified) kHz."

The Q code is not used exclusively by hams. Commercial press stations may also use Q signals and the military also uses them, but in both instances the two letters following the Q may differ from those in the ham radio service and the meanings will also be different. Once upon a time, the amateur QSV and the military QVF meant virtually the same thing: "Send Vs so that I may tune you in better." Further, the commercial stations also have a system of Z signals. For example, ZLS would mean "Lightning storm nearby"; ZSH would be "Static heavy here" and ZNN would be "Nothing received."

SIGNAL REPORTING CODES

Radio amateurs also use reporting codes for strength and readability as outlined in Chapter 14; but, for CW work, they also have a reporting code that is used in ham radio only. It is the RST system and the three letters stand, respectively, for readability, signal strength, and tone. Under R the numbers run from 1 (unreadable) to 5 (perfectly readable); under S the numbers run from 1 (faint; signals barely perceptible) to 9 (extremely strong signals), and under T the numbers run from 1 (60 Hz ac or less, very rough and broad) to 9 (perfect tone, no trace of ripple or modulation of any kind). The complete RST code is also presented in the Appendix. A perfect signal report that one ham might send to another would be RST599. Sometimes an x is added after the last numeral to indicate that the signal appeared to be crystal-controlled—steady and stable. Some voice hams use the R and S signals, where R standing for readability rating from 1 (poor) to 5 (perfect), and S for the strength rating from 1 (very weak) to 9 (loud and clear).

One thing to keep in mind in ham radio, and in DXing the shortwave broadcast bands, too, for that matter, is the matter of readability. The readability rating should reflect honestly how well a person can be heard regardless of the language he is using. You may not be able to understand the voice on the other end of the line due to the language used, but that is no reason to give a poor readability report. It is how well you receive the station and how much of the conversation is clear (free of atmospherics, interference, and other noise) that determines the readability of the station.

Many of the commercial communications receivers are equipped with an S meter. This meter is incorporated into the receiver to give a direct reading in units of the received signal strength. A reading of S9 is usually about midscale and the top half of the meter is usually calibrated in decibels. A signal that moved the meter to the 40 on the part of the scale that is marked in decibels would be rated at 40 dB over S9, which is an extremely strong signal! If your receiver does not have an S meter, you can only estimate the signal strength reading by comparing it with other signals coming from the same general area. Your estimate is truly valid only if both stations are transmitting with about the same amount of power.

It is entirely possible that sometime you will come across a signal that is perfectly readable, but so weak that the needle on the S meter is not moving. If there are no other stations nearby, and there is no static or other interference, it is quite possible to get a perfect readability signal from that very weak station.

Above all, don't try to "pad" your report; if the signal that you hear is only R3 and S3, say so. Many hams use the signal reports that they receive from SWLs as an indication of where their signal is going and what it is doing. A case in point: Mr. DeSilva recently received a QSL from a ham station in Morocco. A gentleman was there on vacation and doing a lot of ham radio work. In nine days of operating, he did not make a single contact with the United States. Mr. DeSilva's report to him was his only indication that his signal was, indeed, reaching into the United States. In cases such as this, the information you send is more reassuring than helpful, but it still is a very welcome note to the amateur.

HAM DX

You will often hear the term DX on the ham bands, and it means long distance, of course. Chasing DX on the ham bands is likely to be one of the most interesting, rewarding, informative, and, at times, utterly frustrating undertakings of your life. Unlike shortwave broadcast stations, hams do not follow a set schedule. DXing the ham bands requires a lot of patience, skill, and even more, luck.

Now that you have a very bleak picture of DXing on the ham bands, let's look at some of the ways to help you become successful at DXing. The first prerequisite is that you spend a lot of time listening. Admittedly, this is impractical for a lot of people and, while there is no replacement for experience and patience, there are several aids that you can use. One is a weekly sheet from England called the **DX News Sheet** (Geoff Watts, 62 Bellmore Road, Norwich NOR 72T, England) which contains information on both current and upcoming DX operations, a list of some of the active rare stations on the air, and information on contests, awards, and other items of interest. Other DX bulletins or news sheets are published by Gus Browning (**DXers Magazine**, Drawer DX, Cordova, S. C. 29039), the Long Island DX Association (P.O. Box 532, West Hempstead, N. Y. 11552), and the West Coast DX Association (77 Coleman Drive, San Rafael, Calif. 94901). There are also several radio clubs that conduct business by mail and some of them have very good ham radio columns. All of the bulletins contain essentially the same information and it is up to you to choose which one or ones you wish to subscribe to.

Some ham radio magazines, **QST** and **CQ** for example, have very good DX columns that are helpful to the SWL. Off-the-air information is some of the best that you can get, because it is often more up to date than information in the DX bulletins. The only drawback to this is that you aren't very often in the right spot on the dial at the right time to get the information.

Also helpful to the SWL are the DX nets. A net is a group of amateurs gathered together on the same frequency at a specified time. Sometimes the reason is for just conversion, or to exchange traffic messages, but there are times when it is for the express purpose of working DX stations. Information on these nets appears in all the publications mentioned previously. By using the aids mentioned, listening on the air for news, noting where DX stations normally operate, and using a lot of perseverance, in time you can climb well up toward the top of the SWL DX ladder.

SENDING QSL REPORTS

One of the more interesting sidelights of SWLing is the exchange of QSL cards with the hams that you log. A QSL card is a postcard printed with various bits of information that you send to a station to report that you have received his transmissions. When the amateur receives your card, he will (hopefully) send you his QSL card in return to confirm that the information you have sent him is correct. Please note that the amateur is in no way required to send you a card upon his receipt of your card. Some hams simply will not confirm reports from SWLs; other hams cannot be bothered to send QSLs to anyone. After several years of sending QSL reports, Mr. DeSilva found that he has about a 35-percent return rate; that is, about 35 percent of the cards that he has sent out have been answered by the ham to whom they were sent. Mr. DeSilva further saio that he had no idea how this compares with other SWLs or if it is a higher or lower rate than average.

There are several ways to get your report to the amateur. If you are interested in getting the highest return rate you can, then the best way is the direct method. In this way, you can send your card directly to the amateur you hear. You can locate his address in a publication called **The Radio Amateur Callbook**. This book comes in two sections, the United States and foreign. In it you will find most amateurs listed alphabetically by callsign. As the title denotes, the United States section contains only the names and addresses of the amateurs in the United States and its possessions and United States personnel in foreign countries where the FCC has the authority to issue licenses (principally Japan where the United States can issue licenses to United States military personnel for operation on U.S. military bases only). The other section of the callbook lists amateurs in most of the foreign countries that allow amateur radio. We say "most" of the foreign countries; some countries will not release the names and addresses of their amateurs to be published in the Callbook. These are mostly Soviet Bloc countries, but there are others as well.

In addition to listing the amateurs by callsign, these two books also give the amateur's name and mailing address. By using these two books, you can send your reports directly to the amateur. As you can see, this could quickly become expensive, especially if you send reports to hams in foreign countries. Recognizing this, amateur organizations have established, in almost every country, a QSL bureau to handle cards for the amateurs in that country. Now you can send your cards in bulk to the QSL bureau for that country at a lot less expense. A QSL bureau is nothing more than a clearing house for QSL cards. Most countries require that the amateurs in that country keep an SASE (self-addressed stamped envelope) on file with the bureau.

Let's follow the flow of cards through a bureau. In a given period you have logged, let's say, fifty English stations to whom you wish to send reports. To send your cards separately would cost you several dollars. Instead, you can package them all together and mail them to a single address, in this case, the RSGB (Radio Society of Great Britain) QSL Bureau. Upon arrival there, the cards will be sorted and the card for each station will be placed in the ham's envelope that is on file at the bureau. When the envelope is full, the bureau seals it and forwards it to the amateur. Upon receipt of the bundle of cards, the ham will verify the information on each card. If the information is correct, he will fill out one of his QSL cards stating that the information is correct and send it to you, usually via a bureau. Since the bureaus were established by amateurs for the use of amateurs, how does the SWL receive his card back through the bureau? For many years, Mr. Roy Waite (39 Hannum Street, Ballston Spa, N.Y. 12020) has run as SWL QSL bureau. The ARRL QSL bureau in the United States forwards all cards destined for SWLs to Mr. Waite.

The purpose of the ARRL QSL bureau is to serve as a clearing house for foreign amateur QSLs received by the ARRL and intended for American SWLs. Many foreign amateurs use the services of the ARRL

* American Radio Relay League, Newington, CT.

QSL bureau in replying to American SWLs. This holds true even though you may have enclosed return postage with your report in the form of mint stamps of the country or IRCs.

The ARRL SWL bureau operates one-way only and that is specifically for incoming foreign QSLs. The only requirements for using the services of the ARRL SWL bureau is that you keep one or more No. 10 (legal size) SASEs on file with the bureau. Each envelope should show your WDX callsign or other recognized SWL callsign in the upper left corner. There is no charge for the services of the bureau.

There is no guarantee that you will receive QSLs via the bureau, but if QSLs are received for you and an SASE is on file, they will be forwarded without charge. Anyone who desires any further information on the ARRL SWL bureau may contact Mr. Waite at the address given above.

The procedure outlined above is by far the least expensive if you send out large numbers of cards. The only drawback to it is the time involved. It can take anywhere from a few weeks to a couple of years to get a return card. We have seen return QSLs take as long as four and one-half years to arrive via the bureaus.

Another way of sending your cards, and usually you get a very high return, is via a QSL manager. A great many amateurs in foreign countries have hams in other countries handle their QSL cards for them. This usually happens when mail delivery to that country is slow or the ham is very busy and doesn't have the time to spend QSLing. Though there can be other considerations when sending your report via a manager, there are a couple of rules that you must follow. The most important is that you include an SASE with your card. The manager can then verify your report, fill out the card, put it into your SASE, and send it off to you with a minimum of time, effort, and expense. When sending reports via a manager, it is especially important to insure that your information is complete and accurate. A publication called **QSL Managers Directory** (Department B, Box 54222, Terminal Annex, Los Angeles, Calif. 90054) lists all of the stations that have QSL managers as well as the names and addresses of all of the managers. The **QST** and **CQ** magazines and most of the DX news sheets mentioned earlier also have listings of QSL managers, but the directory is the most complete listing of past and present managers.

In addition to the above methods of sending your cards, there are a couple of others. There are several QSL services that will handle your outgoing QSL cards for a small fee, usually less than a nickel per card. They will check the lists to see if the ham to whom you are sending the card has a manager and, if so, send the card on to him without an SASE, of course. If the ham has no manager, your card will be forwarded to the proper country bureau for distribution. The International Shortwave League, mentioned earlier, has both outgoing and incoming QSL services and you may forward your outgoing card via them. They will, in turn, forward the card on to the proper bureau. They will also take any cards received from foreign bureaus and forward them on to you. This service is only one of several provided by this club for only the cost of your membership fee which is $6 per year.

In summary, there are several ways to get your QSL cards to and from the stations. If you send your cards direct, always include an SASE and IRC with your card. This will not guarantee you a card in return, but it will help. The use of IRCs is fully explained in Chapter 14, but an additional word here may be in order. If you use IRCs for return postage, you will have to use two or more of them if you wish an airmail reply. One IRC provides (to the person receiving it in a foreign country) sufficient postage for a one-ounce letter to be sent back to you by surface mail. Return postage in the form of mint stamps is also a good bet, and these, too, along with information on the DX Stamp Service, are explained in Chapter 14. However, if you decide to use a QSL bureau or service, then you had better be prepared to wait a while longer for your cards and, meanwhile, keep an SASE on file with Roy Waite. Receiving QSLs from foreign amateurs is a lot of fun and very rewarding. It is proof positive that you are a real DXer.

Perhaps a word of explanation in self-defense would be in order here. In the above few paragraphs, we have rather pointedly mentioned sending cards to the hams when you are after their QSL. But further on, in Chapter 14, you'll see where we also say that you should not send card reports to the shortwave broadcast stations when you are after their verifications. In both cases we are right. Card reports to ham stations are usually quite sufficient, since the information required to report to a ham station is not nearly as great as that which is required for reports to the broadcasters.

In Chapter 17, we go into detail about cards that you send to the ham stations, including a rundown of information that you may have on your cards and a listing of some of the card printers who will be glad to make your cards for you.

AMATEUR LICENSE CLASSES

Now that we have thoroughly discussed ham radio and the part the SWL can play in it, let us examine the other side of the coin. Suppose, after reading all of this, you decide that you want to get into ham radio yourself, not as a listener, but as a two-way participant. It isn't easy, friend, but believe me, it is worth the effort.

Another case in point: several years ago the author had relatives visiting us in New Jersey from their home in Michigan. Word came through on the news broadcasts of a severe tornado in Kent and Muskegon counties. Try as we did, we simply could not get through by telephone, since the lines in Michigan and surrounding states were totally utilized largely for emergency communications. I doubted the ability of my peanut-whistle transmitter to get through, but I fired up the tubes, and, with the relatives gathered around, managed to break into the Michigan Emergency Net on 80 meters. Within minutes we were all relieved to know that the family homestead in Wyoming Township had been spared, but the nearby areas had damage ranging from severe to total.

By the same token, it should be mentioned that, at times, messages sent by the amateur relay and traffic nets can—and do, with the help of interference—become slightly misworded. This is not intentional, of course, and we certainly mean no criticism to those thousands of hams who devote untold time and energy in passing traffic messages. But you can imagine my chagrin, upon sending a message of love to Amelia, my one and only (while we were both still single), and have it addressed to and received by Louise—her sister!

Here is the rundown of licenses available to those who can qualify for them.

Novice License

A code test of five words per minute and a simple technical examination are required. No license fee is required and the license is available to any U. S. citizen who has not held a valid U. S. amateur license within a year. It is issued for two years and authorizes code operation on segments of the 80-, 40-, 15-, and 10-meter amateur bands. The maximum power permitted is 75 watts.

Technician License

A code test of five words per minute and a standard written amateur technical examination are required. The license is issued for five years and is renewable. It grants all amateur privileges on all amateur frequencies above 50.1 MHz, except between 144 and 145 MHz.

Novice and Technician licenses are issued by mail under the supervision of volunteer examiners who hold an amateur license of the General, Advanced, or Extra class, or who hold a second class commercial radiotelegraph license. There is no charge for a Novice examination, but there is a $9 fee (which may be raised to $10) attached to all other amateur license examinations.

General and Conditional Licenses

A code test of 13 words per minute, including numerals and punctuation marks, and the standard written test are required. These licenses, issued for five years and renewable, grant all amateur privileges on at least half the frequencies in each amateur band. The essential difference is that the General class test is administered under the supervision of an FCC official at an examination point; the Conditional class examination is issued by mail under the supervision of a volunteer examiner.

To be eligible for a Conditional class license, the applicant must live at least 175 miles from the nearest point at which FCC examinations are administered at least twice a year. Chronically ill applicants, who can certify their long-term inability to travel to an examining point with a doctor's statement, are also eligible for a Conditional license, no matter where they live. Members of the armed forces whose official duties prevent them from appearing at an examining point are also eligible for a Conditional class license.

Advanced License

A code test of 13 words per minute and the standard written test, plus an additional test on amateur phone operation, are required. Applicants already holding a General class license need only pass the additional written test to qualify for an Advanced class license. The Advanced class license grants all amateur privileges on all amateur frequencies, except in 25 kHz segments of the 80-, 40-, 20-, and 15-meter code bands and in 25 kHz and 20 kHz segments of the 75- and 15-meter phone bands respectively.

Extra Class License

A code test of 20 words per minute and a comprehensive written examination are required. Applicants must have held a General or Advanced license for at least one year to be eligible for an Extra class license. This license grants all amateur privileges on all frequencies.

HAM OPERATING PRIVILEGES

The amateur bands are narrow segments of frequencies starting at 1800 kHz and continuing up into the multigigahertz range. Each band of frequencies has its own general characteristics. As experienced SWLs know, however, in spite of the general characteristics of a band, an alert operator can span almost any distance on almost any frequency. The 160- and 80-meter bands have normal nighttime ranges of several hundred miles up to 2000 miles or so, yet worldwide DX is frequently worked on the 80-meter band and occasionally on the 160-meter band. The 40-meter band has a normal mid-day range of up to 500 miles to beyond 1500 miles at night. The 20-meter band is good for practically any distance between 400 and 12,000 miles at different times of the day and year. But frequently, the 20-meter band will go "dead" after dark during the winter months. The 15-meter band has many of the characteristics of the 20-meter band, although the average distance covered on it is slightly greater and results are considerably more erratic. By the time the 10-meter band is reached, propagation conditions are so erratic that communications are on an all-or-nothing basis. Under good conditions, signals from long distances roar in with great strength for hours at a time. Under poor conditions, signals are equally conspicuous by their absence.

The position in time of the 11-year sunspot cycle and the distance of the sun from the earth determine high-frequency radio propagation conditions, and the higher the frequency, up to somewhat above 30 MHz, the greater effect the sun has on it. And the stronger DX signals will exist when conditions are right. These facts explain the fascination of the 10-meter and 6-meter amateur bands. (The 6-meter band is the range of frequencies from 50 to 54 MHz.) Over a period of sunspot cycle, the 10-meter band is open for long-distance communications about half the time, while the 6-meter band is open only a small percentage of the time. But unpredictable ionospheric storms often suddenly fill up both bands with extremely strong signals from over long distances. The very unpredictable nature of the 10- and 6-meter bands is what makes them so thrilling. The state of the sunspot cycle has little direct effect on the amateur frequencies above 144 MHz (two meters), but many only partially understood phenomena in the atmosphere and lower space allow well equipped operators on these frequencies to communicate over astonishing distances.

EXAM PREPARATION

Certainly, the easiest way to prepare for an amateur license examination is with the aid of an already licensed amateur or in a study course sponsored by an amateur radio club. The amateur radio correspondence courses available from a number of radio schools are also excellent. But you can do the job alone with the aid of a recorded code course, a couple of inexpensive booklets, and a shortwave receiver.

The code course is to teach you the code by sound and the receiver is to give you a steady supply of code signals to copy for practice as you increase your code speed. Memorizing the code from a printed chart is also possible. Many students find it difficult, however, to translate the dits and dahs (dots and dashes) on a printed page into the sound of the code heard in a pair of headphones or on a loudspeaker. But this difficulty may be more imagined than real. Recent studies have indicated that regular practice is far more important than the method used to memorize the code in becoming proficient in receiving and sending it. In fact, regular practice is the only way to do the job.

With a receiver capable of tuning the amateur bands and equipped with a beat-frequency oscillator (bfo) to convert unmodulated code signals into audible signals from the speaker, you have an almost unlimited supply of code practice material. Twice daily, seven days a week, except for national holidays, W1AW, the headquarters station of the American Radio Relay League, Inc., transmits code practice material. The times are 7:30 and 9:30 p.m. EST (1930 and 2130 hours EST; 0030 and 0230 GMT) and at corresponding times in other time zones. The times are standard time in the winter and daylight time in the summer. W1AW's transmitting frequencies are 3580 and 7080 kHz, and 14.08, 21.08, 28.08, 50.68, and 145.68 MHz. Speeds on the early session run from five to 13 words per minute and, on the later session, from five to 35 words per minute. W1AW also repeats the late code practice transmission of the night before at 9:00 a.m. EST (0900 hours EST; 1400 GMT) weekdays. W1AW can be received over most of North America with strong signals.

A number of other amateurs send code practice on the 80-meter amateur band. Copying stations that are talking to each other is also excellent practice in learning to copy less-than-perfect sending. Best of all, once you obtain your Novice license, you can get much of your practice to qualify for the General class 13-word-per-minute codes test while making actual contacts on the air. By the way, even though not required in the Novice code test, do not neglect to learn the numerals; you will need them to copy signal reports and addresses on the air. Further, you will need to know the numerals and punctuation marks when you take your General test.

Some prospective amateurs hesitate to purchase a receiver until they have actually acquired their licenses. But without a receiver, a friend to send code to you, or an unlimited supply of code practice records or tapes, you have no way of practicing the copying of code. Recorded courses become memorized enough for the student to be able to anticipate the code character coming next so rapidly that they become useless for improving one's copying speed.

Always remember that it is much easier to send code than to be able to copy it into legible words. The general tendency is for all prospective hams to practice the sending of code rather than to copy it. Don't worry about sending it; by the time you can copy 13 words per minute, the knack of sending code will be almost second nature.

All United States amateur written examinations are based on the questions in the FCC amateur radio study guide. This guide is not easily obtained by individuals, but its questions, with answers added, form the backbone of the amateur study guides published by TAB Books, Blue Ridge Summit, PA. With these guides you won't need a text covering elementary radio and electronic theory. You can understand both the questions and answers in the study guides. The questions in the official examination are not quite the same as those in the study guides; so, unless you understand both the questions and answers, you will be in trouble. Excellent publications covering amateur radio theory are the Novice, General, Advanced, and Extra study guides published by TAB. Each is a separate book devoted to a specific license class.

AMATEUR EQUIPMENT

A builder and "horsetrader" can put a complete amateur CW station on the air for a surprisingly small sum of money by building the equipment described in amateur publications using components salvaged from old TV receivers, or by using surplus military gear. Or he may be able to "make a deal" for old but serviceable amateur gear that many oldtimers have stored away in their attics or basements. Kit transceivers and separate transmitters and receivers are chosen by approximately 50 percent of all newcomers. The transceivers are compact and convenient. Separate receivers and transmitters are somewhat more versatile, especially in matched pairs. They are usually more expensive, too. A number of the amateur supply houses also deal in used equipment taken in trade on newer items of equipment.

A factor to be considered in selecting a receiver for amateur work is the capability to receive single-sideband (SSB) phone signals, used almost exclusively in the amateur bands up to 30 MHz (10 meters). Medium-wave and shortwave broadcast transmitters employ standard amplitude modulation (AM). An amplitude-modulated signal contains a radio-frequency carrier which is varied in strength (amplitude) by the intelligence being transmitted. This modulation process adds two sidebands to the carrier; each contains the information being transmitted. At the receiver, the intelligence in the sidebands is delivered to the loudspeaker; the carrier, which contains no modulated information, is discarded.

In an SSB transmitter, a normal AM signal, complete with carrier and two sidebands, is generated at a low-power level. Then, because the carrier has already done its work, it is suppressed. In addition, both sidebands contain the same intelligence, and one of them is eliminated. The remaining sideband, which contains all the intelligence to be transmitted, is amplified and delivered to the transmitting antenna.

At the receiver, the incoming sideband is combined with a signal from a local oscillator (the receiver bfo) to establish a reference point in converting the rf sideband energy into audio signals. By suppressing the carrier and one sideband and transmitting the energy that would have been contained in them in the remaining sideband, the resulting signal occupies less than half the channel space of a conventional double-sideband AM signal. Furthermore, the SSB signal has nine times the communications efficiency of the latter signal. But SSB signals are unintelligible gibberish on a conventional AM receiver that does not have a bfo. In an SSB receiver, however, SSB signals are tuned in just like conventional AM signals, although tuning must be more precise.

In an older receiver with a bfo, tune in the SSB signal for the strongest signal from the loudspeaker, without regard to how horrible it sounds. Turn down the receiver rf gain control and advance the audio volume control to maximum, using the rf gain control to control speaker volume. Turn on the bfo and carefully adjust the bfo pitch control until the squawking from the loudspeaker turns into intelligible speech. This adjustment is very critical. But, once made, it will be correct for most SSB signals heard on that band, and all tuning is done with the regular dial. On another amateur band, a slightly different bfo adjustment may be required, depending on which sideband is usually transmitted on the new band. Normally, lower sideband is used on the 75-meter phone band and upper sideband on the higher frequency amateur bands.

Theoretically, any receiver with a bfo and capable of tuning to the proper frequency can receive SSB signals. In practice, however, the overall stability of the receiver and the precision with which it can be tuned determine its suitability for the job, because SSB tuning must be accurate within 100 Hz for the signal to be readable.

AMATEUR BANDS

The ITU (International Telecommunications Union) and the IARU (International Amateur Radio Union), the worldwide governing bodies of telecommunications and amateur communications, have assigned several frequency bands for amateur use. These frequencies are assigned on a worldwide basis, but each country may modify and restrict the use of these frequencies. As pointed out in Chapter 5, some of the ham bands are also used for shortwave broadcasting. The major amateur bands and a breakdown of license privileges for hams in the United States is as follows:

3500-4000 kHz (80 and 75 meters). 3500-3775 kHz for code and radioteletype; 3775-4000 kHz for code and phone. Novices may operate between 3700 and 3750 kHz. Generals and Conditionals may operate from 3525 to 3775 kHz (CW) and 3890 to 4000 kHz (phone). The Advanced class privilege is the same as General class, plus 3800-3890 kHz (phone). Extra class licensees may operate on all frequencies.

7000-7300 kHz (40 meters). 7000-7150 kHz for code and radioteletype; 7150-7300 kHz for code and phone. Novices may operate between 7100-7150 kHz. Generals and Conditionals may operate from 7025 to 7150 kHz (CW) and 7225 to 7300 kHz (phone). Advanced class operators may use the same frequencies as Conditionals, plus 7150-7225 kHz. Extra class operators may operate on all frequencies.

14-14.35 MHz (20 meters). 14-14.2 MHz for code and radioteletype 14.2-14.35 MHz for code and phone. Generals and Conditionals may operate from 14.025 to 14.2 MHz and 14.275 to 14.35 MHz. Advanced class operators may operate on the same frequencies as generals, plus 14.2-14.275 MHz. Extra class operators may operator on all frequencies.

21-21.450 MHz (15 meters). 21-21.25 MHz for code and radioteletype; 21.25-21.45 MHz for code and phone. Novices may operate at 21.1-21.2 MHz. Generals and Conditionals may operate from 21.025 to 21.25 MHz and 21.35 to 21.45 MHz. The Advance class privilege is the same as the General class, plus 21.27-21.35 MHz. Extra class license holders may operate on all frequencies.

28-29.7 MHz (10 meters). 28-28.5 MHz for code and radioteletype; 28.5-29.7 MHz for code and phone. Novices may operate from 28.2 to 28.3

MHz. Conditional, General, and Advanced class operators may use all frequencies.

50-54 MHz (6 meters). Phone and code in entire band. 50.1-54 MHz is open to Technician, Conditional, and General class licensees. All frequencies are open to Advanced and Extra class licensees.

144-148 MHz (2 meters). 144-144.1 MHz for code only. 144.1-148 MHz is open for all conventional transmission modes except wideband television. Licensees of Conditional class or higher may operate in the entire band. Technicians may operate above 145 MHz.

There are additional amateur bands at 220-225, 420-450, and 1215-1300 MHz, and even on higher frequencies as well; these bands are open to amateurs of all classes except Novices. Amateurs also share the 1800-200 kHz band (160 meters) with the LORAN navigation system, with the frequencies available and the power permitted governed by the distance of the amateur from the coastal LORAN installations. Novices are permitted a maximum transmitter power of 75 watts; all others may use up to 1000 watts.

By an unwritten agreement, United States hams do not normally operate CW in the voice portions of the various bands. It is legal to do so but it is very seldom done.

SELECTED EQUIPMENT FOR THE NEW AMATEUR

2-NT, code transmitter, up to 100 watts input, crystal control on amateur bands between 80 and 10 meters. Price is $164 from the R. L. Drake Co., 540 Richard Drive, Miamisburg, Ohio 45342.

DX-60B, 5-band CW and AM phone transmitter in kit form. It has up to 90 watts input and is crystal controlled. Price is $80 from Heath Co., Benton Harbor, Mich. 49022.

Ten-Tec, 5-band, crystal-controlled, 75-watt CW transmitter. The price is $110 from Ten-Tec, Inc., Sevierville, Tenn. 37862.

HW-16, for 80, 40, and 15 meters, is a code transceiver with up to 90 watts input. In kit form, it is $100 from Heath Company.

Each of the above units may be used with an external variable frequency oscillator (vfo) for increased flexibility.

AMATEUR RECEIVERS

Ten-Tec amateur CW and SSB receiver; covers 3500 kHz-31.5 MHz. It has headphone output. The price is $60.

Heathkit HR-10B is a 5-band amateur CW and SSB receiver in kit form. Price is $80.

Drake 2-C is a 5-band amateur AM, CW, and SSB receiver; price is $255.

DX-150B is a 5-band amateur and SWL receiver for AM, CW, and SSB. In solid state, the price is $140. Radio Shack stores all over the country stock this item.

The above selected list of equipment barely samples the range of gear that is available from the manufacturers already listed; there are many others, some of whom are:

KW Electronics, 10 Peru Street, Pittsburg, N. Y. 12901

Swan Electronics, Oceanside, Calif. 92057

Spectronics West, 1491 East 28th, Signal Hill, Calif. 90806

Spectronics East, Box 1457, Stow, Ohio 44224

In addition, there are many additional companies (**Henry Radio Co., Collins Radio, Hallicrafters**, and others) who manufacture items of amateur gear. They are too numerous to list here, but their advertisements appear regularly in the amateur journals.

Listing of the items above does not constitute a specific endorsement of the products by the author or publisher. It is simply a partial listing of items that are available. Please bear in mind, too, that prices and addresses are subject to unavoidable change.

We have tried in this chapter to give you an insight into ham radio SWLing and DXing. It is a varied but easy hobby that can provide you with countless hours of fun, enjoyment, and, believe it or not, education. If you don't care to send and receive QSL cards, you can still have the thrill of hearing people in foreign countries talk about themselves and their country. You can project yourself through ham radio to the very scene of world disasters and hear first-hand reports of people who are there or who were there when it happened. You can listen in on the efforts of a missionary or doctor deep in the jungle trying to obtain an emergency shipment of medicine to try and save a life; sometimes you can hear first-hand reports of people on historical expeditions. In short, it is a window on the world. Welcome to the world of ham-band shortwave listening. May you have many years of pleasure!

Chapter 9

Citizens Band Radio

The citizens band radio service was first established in 1958 by the Federal Communications Commission. Citizens band radio (commonly referred to as CB radio) was developed as a result of the high demand for a personal radio service that didn't require a skill in electronics to pass a test in obtaining a license. The uses for CB radio primarily include personal requirements, such as hunting, camping, and other activities; it also proves useful for businesses which require constant communications between the office and a mobile unit. Since its inception, citizens band radio has improved and undergone numerous developments in the field of two-way radio.

GETTING A LICENSE

Citizens band radio requires very little effort to acquire a license. The license indicates that one is fully authorized to operate his or her CB radio. The license bears your callsign and the expiration date of the license. The license is valid for five years and may be renewed. Anyone over 18 years of age is eligible to obtain a license, but before applying for a CB license, you must fully read and understand Part 95 of the Federal Communications Commission rules and regulations covering the use of the citizens band radio service. Part 95 of the rules and regulations can be purchased for $2.50 by writing to the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Once you have read and understand the contents of Part 95, you can write a letter to the nearest FCC field office and ask for form 505. This form should be filled out and sent to the Federal Communications Commission in Gettysburg, Pennsylvania 17325, along with a check or money order for $20.

INSTALLING AND OPERATING A SYSTEM

During the six weeks that it takes to receive your license, you could begin installing the radios and antennas and other necessary equipment. If you are considering installing a CB radio in a car, the time could also be utilized to your advantage. The best way to start out with CB radio is to listen to several people around your location and start getting used to writing down call letters. Once the license arrives, you will be legally qualified to use your transmitter. The license will bear your callsign and expiration date and it should be posted near the base radio. When you are operating your CB radio, you will have to use your callsign correctly and clearly. The following is an example of good radio usage:

Station A: "KXY-0001, unit 1 to unit 2."

Station B: "KXY-0001, unit 2."

Station A: "You have a refrigerator needing service at 4201 Elm Street."

StationB: "10-4. I'll be there within 30 minutes. Anything else for me?"

Station A: "Negative. KXY-0001, unit 1 clear."

Station B: "KXY-0001, unit 2 clear."

All communications should be kept as short as possible, so as not to tie up any one channel for a length of time. The 10 code (Table 9-1) will help in shortening your communications and should be used at appropriate times. Practicing the 10 code and being polite on the air helps to gain new friends via CB radio.

If you plan to use CB radio for business purposes, it would be wise to choose a normally vacant channel and monitor it throughout the day for your calls, rather than monitoring the general-call channel. Much time can be saved this way, since there is no need to select a channel and then switch back and forth over the channels. All 23 channels can be used by units of the same callsign; therefore, you have a wide range of channels from which to choose. This is the basic operation of business users employing CB radio and it will prove to be very efficient should you decide to use CB radio for business purposes.

Citizens band radio is also usable for sporting events and hunting trips. For the most part, hand-held walkie-talkies are used on these occasions. Walkie-talkies come in a variety of styles ranging from one watt with one channel to five watts including all 23 channels. The basic controls are still employed in walkie-talkies and the dependability and long life of these portable units is very good. Walkie-talkies are also very handy when a crisis occurs and portable radios are a necessity. Most walkie-talkies require 12 volts (dc) and are powered by eight penlight (AA) batteries which will last quite a while under normal usage.

There are other types of CB radios for automobiles and home use. The basic mobile radios are small enough to be easily mounted in a car, but an external antenna must be mounted on the car. Most mobile radios have all the necessary controls and are operable on all 23 channels. Most units also have a built-in noise limiter which eliminates the static caused by the engine of the automobile.

The antenna is mounted on the outside of the car in various ways. With many antennas, a hole has to be drilled through the automobile body for the antenna to be mounted correctly, but there are antennas that mount with the aid of a magnet to eliminate the need for drilling. The antenna itself is fairly simple in design and not too costly. An antenna performs best when mounted on the automobile roof, since it radiates signals omnidirectionally.

Table 9-1. Citizens Band 10 Code.

10-1	Receiving poorly	10-37	Wrecker needed at ______
10-2	Receiving well	10-38	Ambulance needed at ______
10-3	Stop transmitting	10-39	Your message delivered
10-4	Okay, message received	10-41	Please tune to channel ______
10-5	Relay message	10-42	Traffic accident at ______
10-6	Busy, stand by	10-43	Traffic tieup at ______
10-7	Out of service, leaving the air	10-44	I have a message for you
10-8	In service, subject to call	10-45	All units within range please report
10-9	Repeat transmission	10-50	Break channel ______
10-10	Transmission completed, standing by	10-60	What is the next message number?
10-11	Talking too rapidly	10-62	Unable to copy, use phone
10-12	Visitors present	10-63	Net directed to ______
10-13	Advise weather or road conditions	10-64	Net clear
10-16	Make pickup at ______	10-65	Awaiting your next message for assignment
10-17	Urgent business	10-67	All units comply
10-18	Anything for us?	10-70	Fire at ______
10-19	Nothing for you, return to base	10-71	Proceed with transmission in sequence
10-20	My location is ______	10-73	Speed trap at ______
10-21	Call by telephone	10-75	You are causing interference
10-22	Report in person to ______	10-77	Negative contact
10-23	Stand by	10-81	Reserve hotel room for ______
10-24	Completed last assignment	10-82	Reserve room for ______
10-25	Can you contact ______?	10-84	My telephone number is ______
10-26	Disregard last information	10-85	My address is ______
10-27	I am moving to channel ______	10-89	Radio repairman needed at ______
10-28	Identify your station	10-90	I have TVI
10-29	Time is up for contact	10-91	Talk closer to microphone
10-30	Does not conform to FCC rules	10-92	Your transmitter is out of adjustment
10-32	I will give you a radio check	10-93	Check my frequency on this channel
10-33	Emergency traffic at this station	10-94	Please give me a long count
10-34	Trouble at this station, help needed	10-95	Transmit dead carrier for five seconds
10-35	Confidential information	10-99	Mission completed, all units secure
10-36	Correct time ______	10-200	Police needed at ______

Antennas used for base radios are either mounted on a tower or on the roof of the house. The groundplane type of antenna is commonly mounted on the roof and connected to the radio with a length of coaxial cable. Another type of antenna is called a beam. The beam antenna requires a rotor to turn it to the direction desired. The beam has more receiving and transmitting gain than a groundplane type. The groundplane receives and transmits omnidirectionally, but the beam receives and transmits in a desired direction, allowing for more gain in the direction that the beam is headed. The beam is very good for talking over greater distances and the groundplane is usually for local communications.

Most mobile and base radios employ the same controls and functions. Base radios usually operate all 23 channels, but there are models which have a lesser number. Aside from the channel selector, there are controls for volume, squelch, and fine tuning. The squelch control silences any static, but still permits signals to be heard. The fine-tune control simply tunes in any station which is slightly off frequency. Another main feature is the illuminated meter found on most mobile, base, and sometimes on the walkie-talkie units. The meter has two main functions in most cases. It can be used to compare the signal strength of other CB stations, and the meter can measure how much power is being transmitted by measuring the output wattage. In some of the more costly radios, the meter serves several functions, such as measuring the percentage of modulation and showing the standing wave ratio between the antenna and the radio. Some of the less important controls include a couple of lamps and a CB-PA switch. The lamps are used for different functions on different radios, but usually lamps indicate that the radio is transmitting and that modulation is present. The CB-PA switch allows for switching between the radio itself and a public address system. Few CB operators use these minor controls, but they are valuable to a few people.

ACCESSORIES

There are various pieces of equipment which may be included in the CB radio shack to improve the performance of the radio system. A common piece of equipment found at a CB station is a modulator. The modulator is connected between the microphone and the transmitter for the purpose of increasing the modulation produced by the microphone. This increased modulation helps when there is a lot of static present. Another item used is a separate unit called a receiver preamplifier. This type of preamplifier increases the gain of the receiver by as much as 20 decibels. While the preamplifier increases the strength of the signals received, it also suppresses any static that may be present.

There are multiunits with several test functions in one unit. Such a unit is called a CB tester, which is connected between the transceiver and antenna. The CB tester has four main functions which are read by a meter located on the face of the unit. The first function measures the percentage of modulation that the microphone is producing. The meter is calibrated from zero to 100 percent and this function shows how much of a modulation increase is allowed until the maximum percentage is reached. According to the rules and regulations, more than 100 percent modulation is illegal. The second feature of the multiunit is the measurement of output wattage. The meter will measure the wattage obtained when the radio is transmitting. On the average, any reading from 3 to 3.5 watts is a good indication that the radio is transmitting to its fullest capability. A standing wave ratio (swr) measuring function is included and is used to match the CB radio with the antenna. A reading of 1.5:1 or less is good; but should an increase be noticed, it may be due to a misalignment somewhere in the antenna system. The final main function of the tester is that of a field strength indicator. This measurement is used in obtaining the greatest radiated power as indicated by the needle on the meter. This function is used while tuning the radio or antenna for maximum performance. These four functions are the main features found on most multiunits, and there are numerous minor functions which vary from unit to unit. These testers are very handy because they enable you to be sure your radio is transmitting and receiving efficiently. These testers may be left in the line permanently if one so desires.

CLUBS

Once on the air, you may find enjoyment in joining a local club. The largest and most active club across the United States is the Radio Emergency Associated Citizens Teams, commonly referred to as REACT. The main purpose of REACT is to give aid and assistance in emergencies and in disaster-stricken areas. Channel 9, which is the nationwide emergency channel, is only used for emergency purposes by REACT and CB operators. REACT has a large membership and usually has at least one member monitoring channel 9 at all times for emergencies. There are many other clubs that operate in the same manner as REACT and usually work together with REACT in handling emergencies.

As you become involved with CB radio more and more, you will become accustomed to meeting new friends by attending club meetings and coffee breaks. A coffee break is a large get-together of CB-minded people who enjoy using CB radio for any reason. Such affairs are usually well attended.

Citizens band radio is an ever developing communications system. Many developments in the electronic aspect of radio has started a progressive radio system. In the past few years, CB radio has been on the upswing. As equipment production increases, so does the use of CB radio. Since CB radio is expanding at an uncontrollable rate, something will definitely have to be done to provide for all the channel capacity presently needed. The use of single-sideband (SSB) has helped somewhat, but the price is rather expensive for citizens requiring a low-priced communications system. The 23 channels presently employed were ample in the beginning years of CB radio, but the increasing number of CB users is causing chaos in the radio service due to crowding. This problem is only troublesome in the largely populated cities, and if the developments continue with CB radio, there should be no reason why more channels should not be added.

Those readers who live in the greater Pittsburgh (Pennsylvania) area, as well as those CB operators who may be traveling through this area, are invited to listen for KCS-9640 of Beaver Falls. That is the callsign of Gene Patterson who gave us invaluable assistance on the subject of citizens band radio and Gene will be delighted to discuss CB radio with you.

Chapter 10

FM DXing

The author of this chapter, Bruce F. Elving, is the holder of a PhD degree from Syracuse University. His doctoral research was based on a study of FM broadcasting in the United States and Canada. Subsequently, he has been engaged in university teaching and FM station operations. As a DXer, he claims a world record as the first person to have received and verified at one location (the Duluth, Minn. area) over 1000 FM stations in the frequency range of 88 to 108 MHz. He is a former FM editor of the Newark News Radio Club, and is presently a member of the headquarters staff of the Worldwide TV-FM DX Association, and FCC-FM section editor of the club's monthly publication, **VHF-UHF Digest**. His interest in and knowledge of broadcasting and DXing led to his publication of the **FM Atlas and Station Directory** in 1972, which has been subsequently revised and reprinted.

After reading a few articles on FM reception and after talking with the town's self-appointed FM expert, Alphonse J. Fink decided the only hope he had of getting good FM reception was to take up residence high in the town's church steeple. After all, Alphonse was just like everybody else who had invested a sizable part of his paycheck in an FM radio receiver. He wanted to hear all the stations his little set would bring in, and to get reception of his favorite program without a lot of crackle, hiss, and gurgle.

Alphonse had grown up believing the words of an early mail order catalog which cautioned against buying an FM radio unless stations were locally available; he remembered reading the consumer publication that issued a caveat against purchasing an FM car radio (which alleged that FM can only be heard clearly at distances of up to 15 miles); and then when he broke down and finally bought an FM radio, there was the ominous warning in the instructions that were packed with the set: "Do not expect to receive other than your local stations on FM." The town's FM expert, Alva Winchwebber, proprietor of Alva's Radio-TV Sales and Service, claimed that you could only hear one or two stations, "and that depended on whether you lived on top of the hill or not, and on the weather."

So Alphonse, now the proud and somewhat confused owner of an FM radio, went to the town's church and convinced its clergyman, the Rev. Elbert Alexanderson, to let Alphonse take up residence in the church steeple where the altitude was high and the far-off FM signals would come in, if anywhere. Ostensibly, Alphonse would use the height advantage to enjoy the programing of the all-gospel FM station, a horizon and a half distant.

When Alphonse got to the top of the steeple, had a chance to kick away the pigeon droppings that adorned the floor, and then plugged in his new FM radio, he made an interesting discovery. Stations were coming in up and down the dial in beautiful refulgence. He soon forgot to listen only to the sacred-music-and-preaching station all the time. In fact, Alphonse stopped being the captive of any one station. To be sure, he discovered a wide diversity of stations specializing in classical music, easy-listening or middle-of-the-road music, rock, both vintage and modern, country and western music, educational stations with instructional programs, and plenty of talk and sports programs. And to his amazement, nearly all of these stations came in with perfect static-free clarity and fidelity as good as Alphonse's speakers would squeeze out. Never in the days of listening to AM radio (the older system) had Alphonse discovered such a wide array of clear, fade-free signals!

FM SKIP

But Alphonse, very early in his church-steeple listening career, made a significant discovery. Many of the stations were not just from the next county, but a few that Alphonse heard identify were over 200 miles away. This discovery soon started Alphonse on a quest of just what could be heard. Hearing the call letters and towns mentioned of scores of distant FM stations proved to be fascinating to Alphonse—especially when the programing of his favorite stations was not always appealing. In short, Alphonse, was bitten by the FM DX bug. He decided that once he had positively heard and identified all the stations coming in that this would be it—nothing more would be heard on FM that was new, and he could then settle back to listening to the same stations over and over.

There was, however, one thing that Alva (at the radio-TV service shop) told Alphonse that was true. Stations coming in did vary with the weather, or it seemed that they did. For example, when the sun was rising, Alphonse not only noticed increased pigeon activity, but enhanced FM reception from normally weak FM stations 90 to 300 miles away. Thus, during most mornings, Alphonse was able to log many new stations, due to the phenomenon known as "sun-up tropo," or an enhancement of the distance-carrying ability of FM signals from fairly close distances. At other times, especially during the summer and fall, there is tropospheric propagation, which can drastically increase the coverage areas of FM stations. Stations up to 900 miles away can occasionally be received, depending upon conditions, equipment used, and whether or not closer stations on the same frequency may be blocking the more distant station from coming in.

When tropo gets really good, which can be at any time of the day or night, in contrast to "sun-up tropo," which is a morning phenomenon, it helps to increase the number of hours you can tune in your radio. Alphonse discovered that if he listened after many of the nearby stations signed off at 11 p.m. or midnight, he could log many new stations on the same frequency. This was especially true on Monday mornings when even some of his normal 24-hours-a-day stations left the air for equipment maintenance. By using a few stations at the extreme of his listening range as a guide, Alphonse would know on which nights to stay up late and on which mornings to begin his DXing early. When those far-away stations were coming in with dramatically increased signals (and lack of background hiss), Alphonse knew that tropo was in, and it would be a good night to stay with the dials late in an effort to receive many new stations on the 88 to 108 MHz FM band.

Of course, Alphonse had plenty of DXing to do earlier in the evening or even at mid-day. During the tropo openings, DX abounds, and time can be spent profitably dialing between major local stations in the commercial part of the FM band, which runs from 92 to 108 MHz, or devoting an increased proportion of time in the educational part of the FM dial (88 to 92 MHz), where some of the stations may not operate fulltime and where there is the prospect of hearing some of the flea-powered 10-watt school stations, especially during the school year when there is not an academic vacation.

Alphonse soon discovered that he was never going to receive all the stations that would come in so that he could settle back and listen to the programs of a few predictable standbys. For his local listening needs, there were, of course, more than enough stations with dependable signals the year 'round. Yet Alphonse discovered many FM frequencies on which no one station dominated and where a variety of stations could be heard, depending upon conditions, including duct formation.

Ducts are like tunnels that trap an FM signal and send it long distances along the curvature of the earth, usually favoring just one very narrow or general direction. Ducts are a form of tropospheric enhancement that results in reception as far away as 800 miles, and they follow weather fronts. Some DXers study weather maps in an effort to predict ducting and they look for reception of stations in the direction indicated by the weather front.

As Alphonse became more attached to his hobby and detached from the world flourishing below the church steeple, he discovered another form of long-distance FM reception that was common in May, June, and early July: sporadic-E skip. Stations came in for short periods of time (usually for an hour or two) with amazing signal strength, many times overpowering some of the semilocals Alphonse occasionally listened to, and they were almost always at distances of 800 to 1500 miles, skipping over myriads of stations much closer. This kind of reception was almost always heard during daylight hours, especially from midmorning until early evening during the late spring and early summer. With skip coming in from different parts of the country at different times, there was seemingly no limit to the number of signals and stations Alphonse could hear.

One characteristic of skip is that it is usually so strong that a person with just a small FM set and an indoor antenna can still receive stations, and he does not have to take refuge high up in a church steeple, water tower, or airplane to enjoy such DX. Skip is caused by an ionization of electrons high in the earth's ionosphere, which makes FM signals reflect back to earth. The zone of ionization is about midway between the receiver and the station heard, and as any user of citizens band radio knows, it is a two-way condition. In other words, people in the area from which the stations are heard are able to receive stations from your area.

Because of the "sporadic" nature of skip, coming in very suddenly or disappearing almost instantly, and typically lasting only an hour or two and favoring just certain geographical areas at a time, the DXer has to be on hand when skip is coming in. Skip is almost impossible to predict, except that it helps to tune the band frequently during the months when skip is most likely and to do it several times a day. How the DXer recognizes skip reception and is able to differentiate it from what he normally can hear is of great importance to his DXing success, especially in areas having large numbers of local and semilocal stations; a subject to which further attention is given later in this chapter.

Our friend, Alphonse, finally gave up his steeple existence and took his small FM set home. To his delight, he discovered most of his favorite stations coming in at this much lower place, and occasionally some of the more distant stations he used to listen to in the steeple would make it. But Alphonse, being the intelligent, curious sort, soon grew tired of listening to the occasional skip and the fairly rare occurrences of trops that his small radio would bring in at the "low location," so he finally did what the really successful FM DXers have done through the years; he bought new equipment, including an outside FM antenna.

FM DX EQUIPMENT

The first thing that Alphonse bought was an antenna. It is a modest enough thing, with six crosspieces mounted on an aluminum boom; it is called a "yagi." This yagi of Alphonse's is very good for FM DX, since it is especially made for the 88 to 108 MHz FM band, and is not a compromise design such as are found in antennas designed to cover VHF-TV as well as FM radio. And the antenna's price, from a radio parts distributor or mail order catalog, was less than $25.

The big antenna, since it is directional and, therefore, favors signals coming from the front, has to be oriented in the direction of the desired station for best results. When DXing in cities having several strong transmitters nearby, the best results will generally be obtained when aiming your receiving antenna in a direction away from the local transmitters. This will result in less signal overload, and more noise-free channels on which to expect the weaker, distant stations to be heard.

Our friend, Alphonse, later bought an electronic antenna rotator so that the direction of the antenna's orientation could be controlled from his easy chair, while any tired pigeons or starlings overhead got a free 360-degree ride, courtesy of their former comrade. Manual antenna rotators with a control box where you have to apply constant pressure while the antenna is turning are the least expensive and offer a high degree of flexibility to the user. Some DXers, however, prefer the automatic rotators which you set and then forget. A good feature in the latter type of rotor, however, is silent operation and freedom from clicks, especially if you DX while others in the family may be trying to sleep. Headphones, too, are useful for this purpose.

To do the best possible job, the antenna should be mounted as high as practicable to clear chimneys, roof obstructions, trees, and nearby power lines; however, it need not be as high as the local church steeple. Many DXers simply mount their yagi antenna and rotator on a simple pole mast, perhaps screwed into the side of the house and adjusted so it clears the roof by five feet or so. Others go in for steel towers, mounted in a concrete base under the ground. Such towers are usually braced against the house, and rise to a height of maybe 100 feet, with the antenna and rotator mast mounted above the very top. With an extremely tall tower, it helps to have a lot of land, because space will have to be available for installing several sets of guy wires at various locations along the tower.

Connecting the antenna with the receiver is the lead-in, usually a double wire called "300-ohm twinlead." Twinlead is inexpensive, easy to install, and the brown version (in contrast to the white indoor version) resists weathering fairly well, and all FM receivers having provision for an outdoor antenna provide terminals for 300-ohm twinlead. DXers who live along busy streets or in areas having high incidences of air pollution or saltwater spray may find it advantageous to install 72-ohm coaxial cable for their lead-in. Coax is more thoroughly insulated and is less likely to pick up interfering noises, such as some car ignitions generate, than is twinlead. It is, however, more expensive, more difficult to install; and with most sets and antennas, you have to use a special transformer, or balun, to make the 72-ohm connection efficiently.

Some DXers who prefer not to get involved in using a directional antenna and a rotator at the outset get satisfactory results from a non-directional FM antenna, called a "turnstile." A turnstile receives equally well from all directions, but its gain is limited because of the lack of antenna elements that the yagi has—elements which serve to direct and

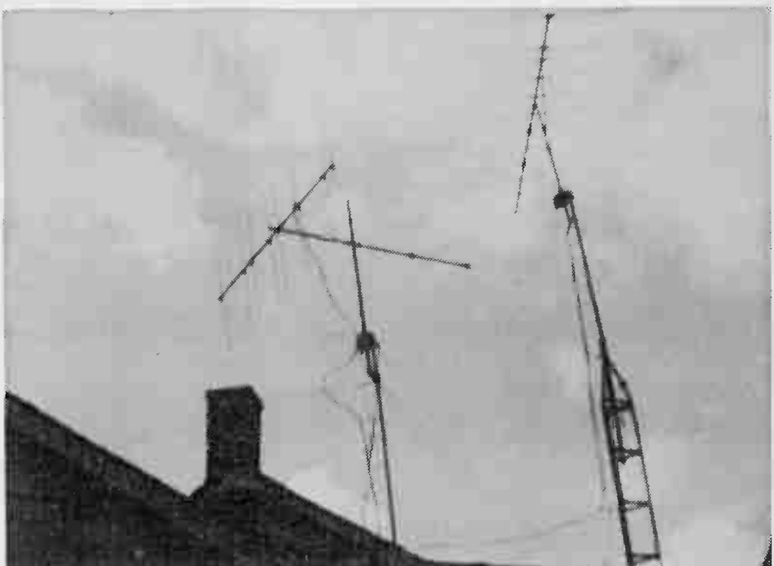


Fig. 10-1. Antenna installation of Bruce F. Elving, Duluth, Minnesota, showing yagi FM antenna (horizontally mounted). It is rotatable and mounted on a steel tower embedded in concrete. A smaller rooftop mast holds a rotatable yagi FM antenna which is vertically mounted so as to favor certain stations that transmit a vertically or circularly polarized signal for better automobile FM reception. Just below the rotator is seen a small S-type omndirectional antenna, which is used as a spare.

magnify incoming signals. Similar to the turnstile in function is the "S" antenna, which is a curved dipole in a lazy S shape and which clamps to an existing TV or FM mast. If you can afford it and have the roof or yard space, a tower with a rotating yagi FM (not FM-TV) antenna is recommended for FM DX listening.

Generally, almost any FM radio will receive DX, including small table radios. Some of these sets (and most of the portables) lack the provision for connecting outside antennas, however, so they must be used in extremely favorable places for DX to normally be heard, such as the church steeple, or in the middle of Lake Huron during a skip opening to southern Alabama. When you connect an outside antenna to an FM radio and you live within 10 miles of local FM or VHF TV stations, you may invite disaster, especially if the FM set employs ordinary transistors which are not "field-effect" types. Older tube-type radios, as well as the newer receivers having field-effect transistors, are less susceptible to signal overload from strong local stations than are some of the early transistorized FM tuners and cheaper grade FM gear sold today. Freedom from signal overload is experienced when all the FM stations, strong local and weak distant alike, are received only at their assigned positions on the dial. There should be no "recapitulating" of locals across the dial; no blocking of desired long-distance stations by a local station heard far away on the dial from where it should be.

In addition to good spurious signal or cross-modulation rejection, an FM receiver should have good selectivity. It is only within recent years that selectivity has been spoken of much, but the burgeoning number of stations has introduced a greater need to tune close to strong nearby signals in order to continue being able to listen to weaker signals close by on the dial. Most receiver specifications are stated in terms of "alternate-channel rejection," which means freedom from interference when tuned to a station two positions away from one which may cause interference. (If you are tuned to a station on 92.5 MHz and receive no annoying interference from a strong station on 92.9 MHz, your set is said to have good "alternate-channel rejection" and thus is fairly selective.) Good alternate-channel rejection (say, 60 dB or better in the published specifications of a receiver manufacturer) also results in above average "adjacent-channel" separation, or the ability of a set to tune to a station on 92.7 MHz with a strong signal present on 92.9 MHz. Of course, it is always more difficult to tune within 200 kHz than it is within 400 kHz of a strong signal, and this is a challenge of the highest order for almost all FM receivers. Practice in tuning helps here, especially in being able to slightly off-tune in order to hear the signal of the weaker signal 200 kHz from a powerful local.

Finally, among the major specifications of a modern FM receiver is sensitivity, or the ability to receive a weak signal. This criterion is placed last because most modern receivers or FM tuners have a sensitivity adequate to the task of the DXer, in the order of 2.5 microvolts of signal for 20 dB of quieting or better. The object of DX is not always to receive stations clearly, but to log stations in large numbers and from representative places. Thus, the FM DXer will occasionally suffer through marginal reception, or situations where stations are coming in two or three deep on a crowded channel, in order to fish out some excellent catches. Most DX, however, comes in with great clarity—more so than the stuff that takes a trained ear and a practiced hand to pull in.

Obviously, we are not going to endorse any specific brand of receiver, antenna, or other hardware, but there are certain features often found on modern receivers that add to a set's cost, which bear scrutiny from an FM DXing standpoint.

Most receivers sold today are, of course, stereophonic, which is important from its own standpoint; however, the stereo feature also has value to the DXer because it serves as a means of identifying stations. If, for example, you hear a "mystery" station on a certain frequency, and after consulting a station directory, you conclude it is one of two possibilities, and only one of the listed stations transmits in stereo, and your stereo light comes on, you can assume that you are, indeed, receiving that station. This method is not infallible, and it is best to be sure and wait until you hear the actual station identification on the hour or at such other time as the station may choose to identify and promote itself. The reasons for adopting such a wait-and-see attitude should be obvious: There may be errors in the guide you are using, previous monaural-only stations may have converted to stereo, or the stereo light may be triggered by a weaker station coming in just behind the one you are actually hearing. Because stereo reception tends to be noisier and weaker than monaural reception, some FM DXers prefer to kick their stereo-mono switch to the monophonic mode to reduce noise and interference when going after DX under marginal reception conditions.

A tuning meter to tell at what approximate signal level a station is coming in is helpful; not for tuning in the station as such (sufficing for this is either the ear or a center-of-channel meter when not attempting to tune in stations adjacent to locals), but for rotating the antenna. By turning the antenna to the point where the set's tuning meter registers maximum for the desired station, you have taken the guesswork from your antenna rotation. Without the tuning meter, and relying merely on hearing, "right on" antenna orientation can be exceedingly difficult.

Automatic tuning devices, found on a variety of expensive receivers, are fun to play with but add little to a set's ability to tune in DX. Most DXers prefer knob-type tuning over digital (keyboard) tuning, especially when they want to de-tune away from an adjacent-channel local station. In the event FM skip is coming in from Mexico, the DXer may wish to tune in even frequencies (such as 96.4 MHz) on which some Mexican stations operate, and which can only be found and tuned in readily with ordinary knob-type tuning.

Pushbuttons and devices making use of preselected punch cards inserted into the front of the receiver to change stations may be of great value, since they can be set to different frequencies and can be changed readily during skip or tropospheric openings. If you are in South Dakota, for example, and it's getting close to the 3 p.m. hourly identification time with skip pounding in from South Carolina, you could set pushbuttons on several South Carolina frequencies coming in at that moment. By alternately depressing the buttons, you might hear two or three station identifications in rapid succession—something that is difficult to do if you rely only on manual tuning, especially when desired stations happen to be located far apart from each other on the dial. During such rapid-fire DX openings, it is best to connect your receiver output to a tape recorder so that a lasting record of the reception will be available for later editing or for compiling program details of use in sending reception reports to the stations received.

For FM DXing, a receiver's muting switch should be turned off, because you will want to hear the background hiss between stations in an effort to receive desired DX that may be coming in just above the noise threshold. Similarly, when going after DX, a set's automatic frequency control should be turned off. Automatic frequency control (afc) should be used only as a means of perfecting tuning when listening to strong local and semilocal stations, but its use in DXing could cause an appreciable loss in selectivity.

As of this writing, there seems to be no advantage, from a DX standpoint, to pay extra for a receiver with four-channel capability. Whether the Federal Communications Commission ever approves a system of discrete four-channel broadcasting, or it remains a compromise matrix system, it is doubtful that four-channel as such, would result in any DXers being able to log and identify new stations. Indeed, like stereo, there may be an effective reduction in a station's coverage area when operating in the four-channel mode, and, instead of four or even two channels, a clear monophonic signal may be desired. Especially to be watched out for is the loss of control features, pushbuttons, or a reduction in FM performance, such as sensitivity and selectivity, that may attend the introduction of four-channel receivers.

When Dolby or other circuitry that promises to reduce the noise inherent in FM transmission and reception comes into widespread use, it would seem prudent to make the investment in such equipment for your own FM DX installation. If such circuitry improves FM station coverage through noise reduction, as it is claimed to do, then it stands to reason that DXers with the right equipment would receive similar benefits when trying to DX stations that broadcast with the Dolby-type equipment.

And if you are contemplating FM in the car, do not be misled by the rather spotty and incomplete testing of FM car radios that has been conducted by consumer organizations. Frequency modulation DX in the car is possible, and good stereo reception on stations within their normal coverage areas (which may extend as far as 100 miles) is indeed possible, especially when using original equipment car radios, or quality European FM-AM car radios (not converters) with a rod (not windshield) antenna. To realize FM reception at an advantage over AM in a car, all you have to do is drive up a high hill or mountain lookout, or, conversely, play your car FM radio in tunnels and under overpasses where even the strongest AM signals fail to come in.

Once you have an FM yagi antenna, a rotator, and a selective and sensitive receiver that will not overload in the presence of strong local signals, you can try your luck with "meteor scatter reception." This phenomenon results from the brief career of a meteorite (or shooting star) hitting the atmosphere and ionizing the air around as it burns out. Most MS bursts are of short duration, but occasionally during major meteor showers, reception at distances from 500 to 1200 miles may last for as long as a minute, and permit positive identifications of FM stations. This reception is usually weaker than skip and takes quite good equipment plus an open frequency.

DXers, particularly in the northern states, Canada, and elsewhere in the northern hemisphere, often experience "auroral" reception, or a rather distorted-sounding form of long-distance reception in which FM signals are bounced off the auroral curtain, or "northern lights." Even daytime aurora DX is observed, and it comes in best with the antenna pointed in a northerly direction. Most stations received by that mode are in a general southerly direction, and at distances up to 700 miles.

Other ways of conquering the distance problem in FM reception have been adapted from television technology. These include cable, sometimes called CATV, in which selected FM radio stations are offered to the cable-TV subscriber. These FM channels may either be sent over an unused TV channel or retransmitted by wire on the FM band, which requires a special hookup to the subscriber's FM radio. If they use cable at all, FM DXers also have a means of restoring their receiver to their own antenna in order to experience a wider variety of stations during DX openings.

In several areas, there are a number of FM translators. These are low-power devices which rebroadcast, on a locally unused channel, a more distant station in order to bring better reception to the local community. There are many communities, like Alphonse's hometown, that lack any local broadcast service and are cut off from reception of signals from the outside either by adverse terrain or distances from metropolitan centers. Translators may have up to 10 watts power and, with the gain realized from a directional transmitting antenna, can send up to 100 watts effective radiated power toward the community they are supposed to serve. In fact, the semidistant religious station that Alphonse and Rev. Alexanderson wanted to hear could, by means of the FM translator, be rebroadcast with a stereo signal strong enough for all the town's radios to pick up easily.

SOURCES OF STATION INFORMATION

An absolute must in going after DX is to have an accurate list of the stations that are on the air. Newspapers are notoriously inaccurate and incomplete, and just leaving your DX to chance can be a mistake. A good DXer uses a station directory, and when a DX opening is experienced, he can almost plan what he receives, even though the element of surprise is still present to some extent. A publication that is recommended for both the FM DX listener and the person who travels with FM is the **FM Atlas and Station Directory**, available at $2.50 per copy postpaid by third class mail in the United States, or $3 per copy by first class mail in the United States, Canada, and in foreign countries, from **FM Atlas**, Box 24-D, Adolph, Minnesota 55701. Revised periodically, the **FM Atlas and Station Directory** includes not only a handy station directory that lists all the commercial stations, educational stations, and FM translators of North America, showing stereo capability, polarization information, and program format data, but it has several pages of detailed regional maps showing FM cities and frequencies of the United States, Canada, and Mexico. With the help of these maps, the charting of directional FM openings or the quick referencing of stations while traveling becomes a simple matter.

Keeping up with the latest FM station information is possible by consulting the "FCC FM" column published in the monthly bulletin of the

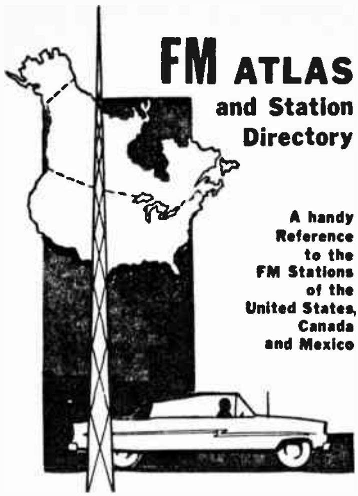


Fig. 10-2. Cover picture of the FM Atlas and Station Directory—a useful source of information to the FM DX enthusiast.

Worldwide TV-FM DX Association, P. O. Box 163, Deerfield, Illinois 60015. The organization serves a growing and active group of FM and TV DX enthusiasts, and it publishes an offset-printed bulletin, the **VHF-UHF Digest**, with sample copies selling for 75 cents. In this bulletin are published reports from member DXers, thus giving people in the DX hobby a chance to compare notes. There are columns devoted to DXing techniques and equipment, news of QSL, or stations verifying for those interested in that phase of the hobby, and columns devoted to the reporting of distance records for different stations and classes of channels.

Speaking of QSL, it should be noted that many FM DXers, in addition to taking note of the distant stations they receive for their own records, actually write to the new stations they hear in the hope that the station will write back and "verify" the DXer's report of reception. Such a reception report should contain full facts of the reception, including program material that the listener heard so that there can be no doubt to the person reading the letter at the station that, indeed, it was their station which was heard. Most FM stations are usually quite enthusiastic about receiving mail from listeners far out of their usual coverage area, and often send warm, complimentary letters of verification. It is not at all unusual for an FM station reply that the DXer's report represented the greatest distance to date that their station has been received.

Across the country, FM is becoming a popular medium for DXing, as our mythical friend Alphonse discovered. Just as FM radio itself is becoming more popular and the stations themselves more successful financially, so, too, are more and more people discovering the fascinations inherent in DXing the 100 channels of prime VHF radio DX activity that FM presents. There are now at least two DXers in the WTFDA who have over 1000 stations heard and verified from one location. Scores of others have heard more than 500 stations, and the number of successful and satisfied FM DXers continues to grow.

"Satisfied" is perhaps a poor choice of words. Name a person who enjoys his avocation. Is he ever "satisfied"? Perhaps like the fisherman who has not caught his limit, but who is out on a day when conditions are very good (fish biting), the DXer notes conditions to be outstandingly good. If he enjoys his hobby, chances are he'll continue at the radio dials until (a) conditions become normal; (b) other necessary activities, such as sleep, interfere; or (c) he has reached the happy state of having logged all that can be logged until another day.

A succession of experiences like this over a period of time will provide a pleasurable way of spending leisure time and will just **have to** result in some record-breaking DX. Try FM DX; you'll like it!

Chapter 11

TV DXing

Long before he became a professional broadcaster, Glenn Hauser was a confirmed DXer. An active member of numerous DX clubs, he finds all bands equally fascinating. Among his other activities, he edits the statistics section of the **Worldwide TV-FM DX Association** magazine, writes the **Short Waves** column for the **Denver** (Colorado) **Post**, and produces the North America DX Report broadcast by Radio Nederland. Mr. Hauser is the author of this chapter.

Nationwide networks and worldwide communications satellites tend to make us blasé about seeing television from faraway places. But there is nothing routine about doing it yourself!

Yes, with normal home receiving equipment, a little luck, and a basic understanding of VHF-UHF propagation, you can view distant television stations directly, without the help of microwave links and earth stations.

Frequencies above 30 MHz were once thought to be limited to line-of-sight transmission. This is the normal case: no DX at all. But our atmosphere provides a lot of exceptions. Unlike shortwave DXing, it is vital on VHF and UHF to be aware of the propagation mode involved in each DX reception, because each applies to particular frequencies, distances, seasons, etc. Fortunately, their characteristics differ sufficiently that you can tell them apart, once you have had a little experience. Let's look at the TV propagations one by one.

SPORADIC E SKIP

Sporadic E skip (Es) builds up from low frequencies on the shortwave bands to a certain maximum usable frequency (MUF) which often pokes into the television channels. The MUF can vary widely from one minute to the next and from one opening to another. Sporadic E skip always hits channel 2 first, since it embraces the lowest frequencies (54 to 60 MHz). It may stop there, or keep rising to channel 6, and on rare occasions to channel 7 (an 86 MHz gap separates channels 6 and 7). Nevertheless, it's a good idea to keep an eye on channels 7 or 8 during an Es opening reaching at least up to channel 4. High-band (channels 7 to 13) Es may prove to be less unusual than we think if TV DXers give it a chance.

In general, shortening distances of reception on the low band mean the opening is becoming more intense and the MUF is going up. Actually, Es at 1500 kilometers is much more frequent than at 1000 kilometers. The lower distance limit is about 800 kilometers, and the upper limit for a single hop is 2400 kilometers.

Reception by Es is caused by the ionization of patches in the E layer of the ionosphere, which is normally transparent to VHF signals, about 110 kilometers high. The patches refract back to earth distant television signals striking them at an appropriate angle. We don't know exactly what causes Es ionization; both solar radiation and surface weather may play a part. But don't pay any attention to the clouds in your sky; they have nothing to do with Es.

The Es patch is at the midpoint on a great-circle path between you and the station. It may be intense enough to bring in other stations at the same time slightly off this route. Some patches remain fairly stationary for hours at a time; others scoot along at several hundred kilometers per hour, thus providing you with one station after another. Members of the Worldwide TV-FM DX Association, by comparing notes, can often pin down the probable target area of unidentified stations, if several DXers were DXing through the same patch from different directions.

Double-hop Es is possible when two patches, you and a station 2500 to 5000 kilometers away are all in a straight line. However, there is usually interference from some other station at the midpoint, making it difficult to identify the more distant one. Over-water paths, then, are best for double Es, not only because there will be no midpoint interference, but also because water is a better reflector than land. Then, too, whichever patch has a lower MUF will determine the MUF of the double-hop path. This means that double Es is much more likely on channel 2 than channel

Fig. 11-1. KHQ-TV, channel 6, Spokane, Washington, received by Es over a 2025 km path at Enid, Okla. (All remaining photos in this chapter show signals received at Enid, Okla.)

Fig. 11-2. CKPR-TV, channel 2, Thunder Bay, Ontario, Ex, 1505 km.

6, and virtually unknown on channel 7. You can be prepared for a double-hop situation by picking out channel 2 and 3 cities in the 2500-5000 kilometer range and determining where the midpoints are. Whenever there is Es from the midpoint area, you know the possibility of double-hop exists. Triple- or quadruple-hop may be a once-in-a-lifetime experience.

Sporadic E skip openings are unpredictable beyond some broad generalizations. In the temperate latitudes, Es peaks in the summer months of June and July, with openings less frequent approaching the equinoxes. A secondary peak arises in December and January, as if some of the Es fury were "bleeding over" from the southern hemisphere summer peak. During the off season, and the winter peak, Es openings are most likely in the early evening hours. But during the summer, they may happen at any time of day, or start early and last all day, even past midnight.

The best way not to miss an Es opening is to leave your set on continually, tuned to the lowest open channel; or you can check it once or twice an hour, just before ID time. A VHF radio tuned to 35 or 43 MHz paging frequencies can also tip you off when Es is active, before it reaches television.

Sporadic E skip can be extremely strong, even interfering with nearby stations. Often, there is a lot of fading and interference, but at times a clear signal may approach local quality. Sometimes, Es may hover tantalizingly just below the TV band for hours, or build up rapidly to channel 6. Usually, it decays more slowly. Sporadic E skip seems to be a bit more prevalent over southern paths, and this becomes most noticeable outside the summer peak. The photographs in Figs. 11-1, 11-2, and 11-3 were all made during sporadic E reception.

TROPO RECEPTION

Tropo is another, but quite different, prime mode of TV DX propagation. It depends on lower atmosphere conditions in the troposphere; in other words, weather. Unlike Es, tropo is best on the higher channels, but there is no reverse downward progression of "minimum usable frequency." Tropo is best on UHF, if you have the equipment to take advantage of it, very good on the high VHF band, and definitely inferior on the low VHF band.

Temperature inversions and frontal passages can produce tropo. One typical condition is a large high-pressure area ahead of a cold front, especially with an influx of warm, moist air from the Gulf of Mexico. By correlating your own tropo DX with weather maps, you should become able to recognize the conditions likely to produce tropo in your area.

Quite long distances (the record is 2375 kilometers on UHF) may be possible when a duct exists along a front stretching in a straight line from you to the station. Sometimes, during mild winter spells, and in fall and spring, "Gulf tropo" blankets the entire Gulf coast up to 500 kilometers inland for a week at a time.

Terrain and elevation are no barrier to Es, but they are to tropo. For this reason, tropo isn't much good in the Rocky Mountain area, and it has

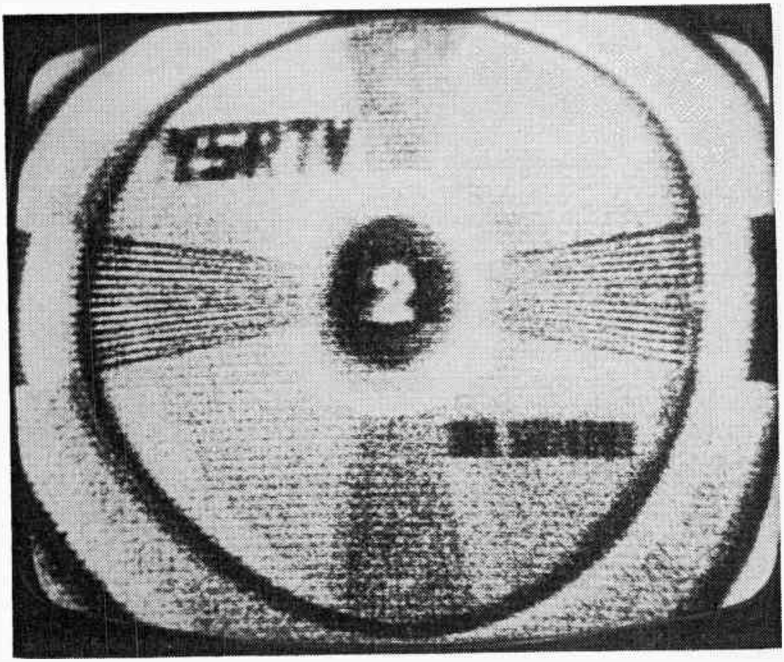


Fig. 11-3. YSR-TV, channel 2, San Salvador, El Salvador, Es, 1940 km.

Fig. 11-4. WJKS-TV, channel 17, Jacksonville, Florida, tropo, 1625 km.

never been known to happen across the mountains. West coast TV DXers are thus limited to tropo DX from their own general area, while anything in the eastern two-thirds of the United States is fair game for those living in that area. Mexican coastal areas and all of Cuba are also tropo possibilities.

Cold winter days mean no tropo; but if it warms up a little, keep your eyes open. Spring and fall months are best, when there is a relatively wide daily variation in temperature.

Inversions, and tropo DX, build up quickly after sunrise, and gradually "burn off" as the day progresses. After sunset, tropo often returns. Tropo may link up with other propagation modes, extending their range and confusing us when we try to assign just one propagation mode to such DX.

There is no minimum distance for tropo. Actually, the less sensitive your equipment, the closer you can notice tropo effects on nearby stations which are normally snowy. East of the mountains, distances of 1000 kilometers are not uncommon; UHF may surpass 1500 kilometers. The photo in Fig. 11-4 is evidence of such a case. Tropo ducting behaves similarly to Es in that it may skip a more distant signal past a nearer one on the same channel.

Tropo is the "quality" TV DX propagation—seldom with rapid fading; it allows program viewing from afar if you can keep yourself from constantly switching channels! At other times, it may provide a rather weak but constant signal for some hours. Color reception can be excellent via tropo, since little phase distortion takes place. We may think of tropo as an extension of groundwave; there's no definite dividing line between the two.

METEOR SCATTER

Meteor scatter (MS) is more predictable than other modes, since meteor showers peak around the same day each year, and the radiant point means certain directions are more favorable at different times of the day. A "shooting star" is actually an ionized trail in the E layer, quite capable of momentarily producing TV DX—even in the daytime when the trails are invisible.

Check astronomical references for dates of MS peaks; the major ones are in early August, mid-October, late November, and early December. Like Es, MS is best on the low band, but given enough gain, signals can be observed on the high band, too. Even on the low band, you can't expect much MS DX without an outdoor antenna. DXing MS is a good way to fill in the gaps left by Es and tropo in the 700-1300 kilometer range and to pick up new areas up to 2200 kilometers away.

Meteor scatter normally peaks around sunrise, though in major meteor showers this may be skewed. Since groundwave and tropo stations are usually strong enough to wipe out the weaker MS signals, most DXers resort to tuning for MS from midnight to dawn. You can

Fig. 11-5. WKZO-TV, channel 3, Kalamazoo, Michigan, MS, 1240 km.

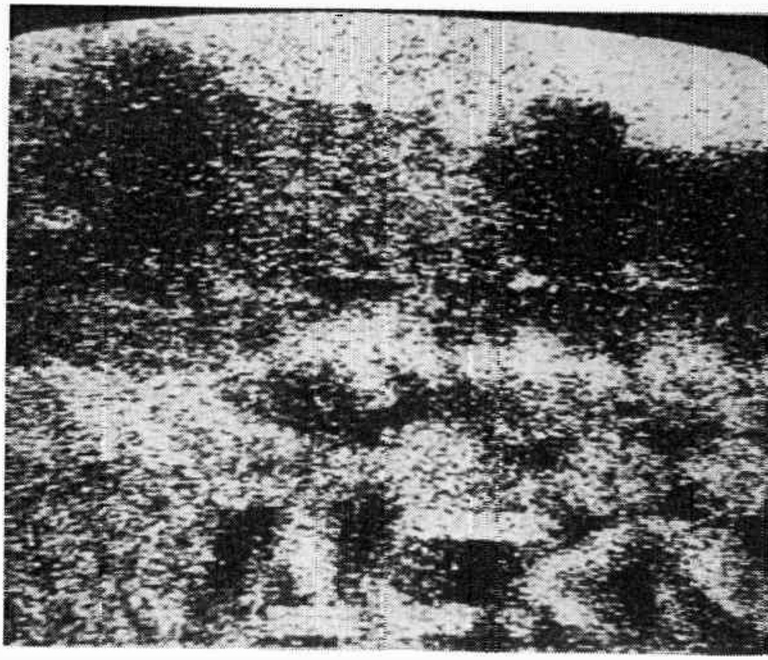


Fig. 11-6. AFKN-TV, channel 2, Seoul, Korea, F2, 3520 km.

make time zone differences work for you by checking for stations east of you around 4:00 to 5:00 a.m. and west of you from midnight on. (Times shown in this chapter are local times of the reader—not GMT.)

You have to be a confirmed DXer to enjoy MS; it lasts from a split second to seldom more than a minute, making it impossible to watch a program. Fortunately for the MS DXer, the wee hours are a good time to see stations running a test pattern bearing their call letters. A split second will suffice to identify the station, and perhaps even to photograph it, as was the case with the photograph in Fig. 11-5.

F2 SKIP

Spectacular transoceanic TV DX is possible with F2 skip, but isn't very likely until the sunspot count reaches another peak around 1980. At such times, the MUF can get up to 60 MHz, allowing American channel 2 to propagate, plus several lower channels in European, African, and Pacific areas. Occurring in a higher layer,of the ionosphere than Es,F2 also comes in longer hops, about 3500 kilometers each. It's the same mode responsible for around-the-world shortwave reception. In past F2 seasons, American DXers have pulled in BBC-TV (England) audio on 41.5 MHz and French TV audio on 41.25 MHz. These are AM transmissions, unlike most television audio, which is FM.

Reception peaks in the midmorning hours. Receiving video from non-American systems requires modifications beyond the scope of this chapter, or the purchase of a TV receiver having foreign standards of manufacture. With F2 reception, clear audio is possible, but video usually suffers from smearing, seldom any clearer than the photograph of AFKN in Fig. 11-6.

AURORAL RECEPTION

Auroras also produce DX, but only northern DXers can expect it. Like the aurora borealis itself, auroral DX flickers and wavers, making a video identification almost impossible, but audio may remain intelligible. You may find that an aurorally propagated signal doesn't come from the direction you would expect, but from as much as 90 degrees away from the direction of the station. Auroras occur most frequently around the equinoxes, but solar disturbances can produce them at any time. Aurora seems to affect both high- and low-band VHF signals equally well.

TRANSEQUATORIAL SCATTER

Transequatorial scatter compensates DXers in the extreme southern parts of the United States for their lack of aurora DX. It seldom reaches very far north of the tropic of cancer (23 degrees 27 minutes north latitude) but it can link up with Es or tropo, extending its range. It, too, occurs around the vernal and autumnal equinoxes, with video more disturbed than in any other mode. This is caused by the TE characteristics of rapidly fluttering MUFs. Again, audio may be quite readable. Normally, TE builds up after sunset and peaks around 2000 local time. Three thousand kilometers seems to be about the minimum distance, with reception coming from stations in the tropical and south temperate zones. The MUF reaches about 65 MHz.

Airplanes, lightning, and even the moon can also provide TV DX, but are either inconsequential or too rare to go into.

So there you have the basics of TV DX propagation. Always ask yourself which propagation is involved when you receive a DX station. Reports to club bulletins lacking this information are virtually worthless.

TV DX EQUIPMENT

With propagation taken care of, what about equipment? You can probably get some Es and some tropo on your present set—even with an indoor antenna. What constitutes the ideal TV DX receiver is a matter of opinion; you'll see a lot of discussion on this topic in the VHF-UHF Digest, monthly magazine of the Worldwide TV-FM DX Association (full information on this fine club appears in chapter 17). But for now, a few pointers on what to look for and what to avoid in a TV DX receiver. You need a good stable, clear picture, not just on local stations, but on snowy, marginal ones as well. The picture should stay locked in even as the signal fades down to nothing. Color really adds little to DXing, since there is usually interference and fading, and many of the gadgets available on color sets are of no help in pulling in a DX signal and some actually hinder the cause.

Antennas have the greatest bearing on how much DX you get and how well it comes in. You want the highest possible gain and directivity—unless you are within a few kilometers of local transmitters. If you can't install an outside antenna, you're severely handicapped. In general, the higher the antenna is above ground and above average terrain, the better—except that a lower antenna may eliminate or reduce interference from nearby stations during an Es opening. In any event, try to get it above nearby obstacles, such as power lines, trees, and buildings. It may also help to mount an antenna in vertical polarization for Es reception, because this is another way of reducing interference from nearby stations. All television in North America is horizontally polarized, but signals arriving by sporadic E are randomly polarized.

Mounting more than one antenna on the same mast, or on two masts within five wavelengths of each other, may result in interaction between the antennas. At times the interaction may allow you to increase the depth of nulls by close coordination of their directional settings; at other times, the interaction will reduce directionality and produce double images.

For UHF, a parabolic dish is a must. If you don't have a one-, or preferably a two-meter diameter dish, your UHF DX performance will fall below your VHF DXing. Most UHF tuners are inferior to VHF tuners, so you must make up for this with UHF antennas of higher gain. The larger the capture area of your dish, the less random fading your UHF signals will display.

Don't pick just any lead-in wire. DXers achieve every dB of gain possible, and a poorly chosen lead-in can eliminate the high gain your receiver and antenna may provide! Forget about the usual flat 300-ohm twinlead that is in popular use. If you can manage it, aluminum-coated 0.412 coax is best, but it is cumbersome (it can't take sharp bends) and it is expensive. The 75-ohm coax, such as RG-59U type, is adequate and easy to handle; of course, baluns must be used at both ends to match 300-ohm antennas and receiver inputs. But on UHF, this line has higher loss, so shielded 300-ohm foam-filled twinlead is better. Keep your lead-in as short as possible; don't allow extra unless you expect to need it in the near future. All types are very difficult to splice.

Naturally, with directional antennas, you'll need a rotator. Avoid the kinds that move only in 6- or 12-degree steps, since it is often necessary to position antennas with more precision.

You may think all this hardly applies to you, since you live in a metro area with several local TV stations. In fact, there are ways to reduce adjacent-channel interference a great deal, allowing DX on the "in-between" channels at your location. Columns in the VHF-UHF Digest explain these techniques.

The WTFDA organization can also provide you with an up-to-date book of station listings and maps showing all stations operating on each channel. By referring to such maps and references, you can usually narrow down the possible identity of any station, and by combining this with observed network programing, time zone, local ads, and offset interference, you may not have to catch a definite ID to know what you have picked up!

Offset interference is a peculiarity caused by the Federal Communication Commission's table of allocations, which was designed to reduce interference between various stations on the same channel. In reality, there are three variants of each television channel 10 kHz apart. If you know the identity of one DX or nearby station on a channel, the pattern of interference (horizontal bars) it causes with an unknown station can allow you to determine its offset. For example, you have an identified station on channel 2—, and another station comes in at the same time, producing many fine bars between them. This means the unknown station is on channel 2+. An intermediate number of bars means it's on channel 2 even; and less than 5 or so indicates both are of the same offset. Of course, this works in reverse. But when the known station is zero offset, or even, there is no visual way to tell whether another one showing the 10 kHz intermediate interference pattern is offset plus or offset minus.

As any televiewer knows, most network programs are seen at the same local clock time in eastern and Pacific zones, but one hour earlier in the central zone. This means that a program delayed three hours is probably coming from the Pacific zone. But there are a lot of variations to this, and those states remaining on standard time in the summer add to the possibilities. Stations in the mountain zone of the United States get by as best they can, as the "live" network feed may be too early and the Pacific feed too late for prime time. Many of them rearrange network programing completely, making heavy use of video tape delay. If you can get the name of a local advertiser, you may be able to identify the city by trying possible cities' telephone information.

When video is very weak, it may be best to discard it and concentrate on the audio. Most sets depend on a strong video signal to bring in the audio, but you can provide this strong video signal by injecting it yourself. This can be done with a signal generator, or by tuning a shortwave or FM receiver nearby so that a harmonic of its oscillator frequency falls on the video carrier frequency of the channel in question.

An example will make this more clear. Suppose you are receiving a weak signal on channel 4. The video carrier frequency is 67.25 MHz. Dividing by 2 we get 33.625 MHz. Subtract the i-f of your shortwave receiver, say 3.035 MHz. The frequency to tune is 30.59 MHz for video carrier injection on channel 4. The VCI (video carrier injection) technique is not cheating; it only allows a DX signal already there to come through the set. What is cheating is the set design which makes VCI necessary!

You'll thank yourself, and future propagation researchers will thank you if you keep a detailed log of all your TV DX. In addition to the obvious details, note the day of the week, the propagation mode, and distance. More than in shortwave and medium-wave DXing, the distance of a TV DX catch is very important in determining the quality of the DX. Most experienced TV DXers keep a running minute-by-minute log during openings (WTFDA publishes forms for this purpose) and then, when things settle down, type up a permanent log retaining all important information in a coherent manner. Each time a distant TV station is received is an important propagational event, and a record should be kept of it, even if it's been seen many times before.

Collecting verifications is less popular with TV DXers; nevertheless, most stations will verify a well done report; some even have printed QSL cards. But TV DXers can make their own equally valid "verifications" by photographing identification slides or recording station breaks.

If you have a box camera with fixed focus, try a few test shots to determine how close to the screen you can get without losing focus. High-speed film such as the ASA-400 should work best. If your camera's aperture, exposure time, and focus can be adjusted, try to fill the entire picture with the screen. Shoot at one-thirtieth second (or longer if the picture is quite steady). A flash will only wipe out the TV screen with its own reflection. You can also film the TV screen, or use home video taping equipment, to make sure you don't miss that ID slide. Once you've tried it, we think you'll agree that nothing beats not only hearing but seeing your DX. Good luck!

Chapter 12

Utility Stations

When someone uninvolved with shortwave radio hears about it, he or she probably thinks of the radio amateur stations or perhaps even the shortwave broadcasting stations such as the Voice of America or Radio Moscow. Seldom do thoughts of the utility stations come to the mind of the average person.

There is a reason for this ignorance, of course, and it lies in the definition of a utility station. Listeners and nonlisteners alike are often puzzled about what may properly fit or not fit into this category. Actually, it is all quite easy. In the hobby of shortwave listening, it is generally considered that whatever station does not fit into the category of being an amateur (ham) or broadcaster is a utility station. Utility stations are everywhere throughout the radio spectrum from as low as 10 kHz to as high as 30 GHz (that's 30 gigahertz or 30,000,000 kHz); they are above, below, and between the amateur and broadcast bands.

The utilities transmit useful information to small audiences requiring this assistance for scientific work, maritime and aeronautical communications and navigation, plus many more uses. None is intended for the general public. The list of types of utility stations is almost endless.

Most of the utility stations fall into one of four groupings. These are the most popular among DXers and it is these few that are discussed here.

So now you know that such a thing as a utility station does, in fact, exist. The first question asked by the newcomer would naturally be, we suppose, "Why listen to them if they are not broadcasting to us?" One reason is excitement; you can't deny that "being there" during a search-and-rescue mission is exciting. The fact that they do not broadcast to the general public is another reason for their popularity. It is more challenging to receive a utility station and, let's face it, many of them do seem to have a secretive and intriguing appeal to many people; in many cases, it seems to be a genuine look behind the scenes.

The lack of high power and regular schedules for many utility stations requires extra patience and effort in tuning, but don't let that deter you. The fun you get from monitoring these stations more than makes up for it. There are many, many more utility stations than there are broadcasters, and some are in such exotic places as Antarctica and the Fiji Islands.

Generally speaking, you'll need a communications receiver that is capable of tuning continuously from about the standard broadcast band

Fig. 12-1. Harold Sellers of Uxbridge, Ontario, at the controls of his receiver, a Trio 9R-59D communications set. In the background are an antenna switch, a 100 kHz crystal calibrator, and a tape recorder. Harold has been DXing the utility bands for over four years and has logged a wide variety of stations.

to around 30 MHz or so in order to really take advantage of the utility scene. Most portable sets and table model receivers, as a rule, do not cover much more than the major ham and shortwave broadcast bands.

The heretofore standard mode of transmission, amplitude modulation, is gradually being replaced by single-sideband transmission; and, unless your receiver has a beat-frequency oscillator (bfo), SSB will be an unintelligible garble. Good sensitivity and selectivity are also desirous. Since frequencies of the utilities are seldom announced and are often narrowly spaced, good receiver dial calibration is more than just something that would be nice to have; it's a necessity. However, for beginning in the hobby, even the cheapest shortwave set that will cover at least some utility bands will provide you with numerous instances of good DX.

In North America, and in many other countries, you may listen to the utilities freely. However, you cannot divulge or beneficially use any information heard which might be considered personal, private, or confidential. On the other hand, in Great Britain and Switzerland it is against the law to even listen to the utilities. Therefore, for our readers who may be in countries other than those just mentioned, it may be a good idea to write to the communications department of your government to ascertain how the law reads in your case.

MARITIME STATIONS

The more common bands on which to find marine or maritime stations are:

2 MHz band (see text)
4063-4438 kHz
6200-6525 kHz
8195-8815 kHz
12.33-13.2 MHz
16.46-17.36 MHz
22-22.72 MHz

These bands offer a wide variety of stations and plenty of action.

Below the standard AM broadcast band there is an important marine band that is used for Morse code (CW) transmissions. Most communications receivers lack this band, however, and we won't go into detail about it here, since it is adequately covered in chapter 7. Suffice it to say that the frequency of 500 kHz is the busiest channel there. Being an international distress and calling frequency, it is used in emergencies and for arranging contacts with other stations.

Coastal, shore, or marine operator stations are situated along the coastal areas and inland waterways. They guard distress frequencies, assist any vessel in difficulty, make both scheduled and unscheduled broadcasts concerning weather, navigation, and public correspondence (such as telegrams and telephone calls to ships at sea).

Both ships and coastal stations make use of frequencies in the 2, 4, 8, 12, 16, and 22 MHz bands for ship-to-shore, shore-to-ship, ship-to-ship, and shore-to-shore communications. Voice modes and CW are used, but small 70 kHz segments at each end of the high-frequency bands (i.e., above 4 MHz) are used for voice. Ships get the lower end of each band and shore stations the high end. Single sideband is gaining in use over conventional AM type of broadcasting for voice communications.

Coastal stations listen for ships on the lower segment on a so-called "pair" frequency, a listening frequency paired to their transmitting frequency in the upper 70 kHz segment. For example, WOM in Florida will transmit on 13.1545 MHz and listen on 12.3545 MHz. Notice that the "paired" set of frequencies both end in 54.5 kHz.

To keep a channel free of interference and to aid any ship in tuning that frequency in, a shore station may transmit either a type of interrupted whistle or an identification marker when not otherwise engaged in handling traffic (traffic meaning radiotelephone calls, phone conversations, and passing of messages between stations). An example of an ID marker is, "This is Roma Radio, Maritime Radiotelephone Service. This transmission is for receiver tuning." Signals such as these are repeated over and over many times and, in the case of this one from Italy, it is given in Italian and English.

On the HF (high-frequency) bands, some shore stations also send a taped message listing the frequencies they monitor and call letters of ships for whom they have traffic. WOM, Fort Lauderdale, Florida, is one of the most often heard examples of this. A ship will use one of the listed frequencies and estalish contact with the shore station. The ship operator may then suggest the frequency he wishes to shift to for the handling of traffic and then both stations move to that "pair" of listening and transmitting frequencies.

So far, only the high-frequency bands have been mentioned. Things are different in the 2 MHz region. Between 2000 kHz and 2850 kHz, most of the space is allotted to maritime use, but some of this is declining. Ships transmit between 2000 and 2450 kHz, while civil shore stations in North America are located between 2450 and 2600 kHz. Military and Coast Guard stations also make extensive use of the 2 MHz region.

Frequencies are paired here, too, but in an unpredictable arrangement. Contacts are arranged on 2182 kHz, which is another international distress and calling frequency. After contact is made, the stations shift to their chosen working frequencies. Both Civil and Coast Guard stations give advance notice of weather and navigation messages, to be heard on other channels, on 2182 kHz first. The U.S. Coast Guard also uses it for radio checks; that is, checking with other stations to learn how a signal is being received.

Since the two-frequency or paired-frequency system is used, you can only hear one side of a conversation directly on a frequency used for the exchange of traffic. However, some coastal stations rebroadcast the ship's transmissions to act as a busy signal. This can fool you if you don't know of this trick. Other stations may use the regular telephone busy signal to tell others that they are occupied at the moment. So if you hear both sides of the conversation on one channel, you know that you have the coastal station tuned in. Find the ship on its own frequency before trying to report it.

In order to cope with the heavy crowding on the 2 MHz band, caused largely by the boom in short-range transceivers on leisure craft, the Federal Communications Commission has passed some new regulations. By the end of 1977, only VHF-FM (very high frequencies with frequency modulation) can be used for short-range (15 to 20 miles) communications by ships and shore stations within United States territory. Civil, military, and Coast Guard stations and ships, as well as the merchant fleets, are all adapting to this and, as a result, the 2 MHz band is much quieter than it was a couple of years ago. This is especially so on 2182 kHz. The 2 MHz region will be reserved only for communications in excess of the short-range limit and, even at that, all stations in that frequency range will be required to use single sideband by 1977. In view of the fact that there will be no more AM broadcasting by ships and coastal stations as a result of the new regulations, it would seem that now is the time to catch a fleeting glimpse of the action that was once an eavesdropper's paradise in the 2 MHz band.

When identifying marine stations, it will help you to know that they use the same prefixes as ham operators. Shore stations have three call letters; ships, four call letters. The owners of some ships can be learned from the name of the ship. Some ship lines use a characteristic name series for their ships, such as "Gulf....." for ships of the Gulf Oil Company, and "Pioneer....." for ships of the United States Lines. These companies always use "Gulf" and "Pioneer" as part of their ships' names. Military and Coast Guard shore stations identify themselves by place names rather then by callsign. For example: "This is Coast Guard

Radio Station Miami." Civil stations may use either place name, callsign, or both, such as, "This is WMI, Lorain, calling." Tables 12-1 and 12-2 list U.S. and Canadian coastal stations. Table 12-3 is a sample of the larger U.S.C.G. stations, their callsigns and locations. Smaller stations fall into districts of the larger stations, resulting in callsigns like NMY56.

AERONAUTICAL STATIONS

While aircraft are flying over land, they use VHF channels, but transoceanic and transpolar flights operate on shortwave frequencies and on some of the most "vacant" bands! If you tune across an aero band, chances are good that you'll hear absolutely nothing!

International flying, which we can call air traffic, analogous to automobile traffic, has its rush hours or peak periods. For example, late evenings are the busiest for eastbound North American air traffic; therefore, a particular band is used to a significant amount only part of the day. Even then, it may be unused much of the time if there is no radio traffic to be handled on it. What you need to do is pick a frequency which should be busy at the time and "sit" on it. If you haven't the receiver calibration to pick out a specific frequency, try continuously scanning a narrow portion of a popular band. The bands used for international civil air traffic and for military air traffic are listed in Table 12-4. The 5, 8, and 13 MHz bands are generally the most often used and, thus, most popular with DXers.

The world is divided into zones and each is given its particular set of ground-to-air and air-to-ground (i.e., mobile) frequencies. Especially busy flight zones may have frequency blocks assigned for each route,

Table 12-1. U.S. Costal Stations on 2 MHz.

Astoria, Oregon	KFX	Memphis, Tennessee	WBN, WJG
Atlanta, Georgia	WAN, WAZ	Miami, Florida	WDR
Boston, Massachusetts	WOU	Mobile, Alabama	WLO
Buffalo, New York	WBL	New Orleans, Louisiana	WAK
Charleston, South Carolina	WJO	New York, New York	WOX
Chicago, Illinois	WAY	Norfolk, Virginia	WAE, WGB
Coos Bay, Oregon	KTJ	Pittsburgh, Pennsylvania	WCM
Corpus Christi, Texas	KCC	Portland, Oregon	KQX
Delcambre, Louisiana	KGN	Port Washington, Wisconsin	WAD
Detroit, Michigan	WFR, WFS, WFV	Rogers City, Michigan	WLC
Duluth, Minnesota	WAS	St. Louis, Missouri	WGK
Eureka, California	KOE	San Francisco, California	KLH
Galveston, Texas	KQP	Seattle, Washington	KOW
Jacksonville, Florida	WNJ	Tampa, Florida	WFA
Lorain, Ohio	WMI	The Dalles, Oregon	KLP
Los Angeles, California	KOU	Umatilla, Oregon	KIW
Louisville, Kentucky	WFN	Wilmington, Delaware	WAQ, WEH, WLF

Table 12-2. Canadian Costal Stations on 2 MHz.

Belle Isle, Newfoundland	VCM	Lakehead (Thunder Bay), Ontario	VBA
Burin, Newfoundland	VCP	Mt. Joli, Quebec	VCF
Burlington Bridge, Ontario	XL146	Montreal, Quebec	VFN
Canso Canal, Nova Scotia	VAX	North Sydney, Nova Scotia	VCO
Cape Hodes Advance, Quebec	VAY	Norway House, Northwest Territory	CFX2
Cape Race, Newfoundland	VCE	Nottingham Island, N. W. T.	VCB
Cardinal, Ontario	VDQ	Port Burwell, Ontario	VBF
Cartwright, Newfoundland	VOK	Quebec City, Quebec	VCC
Charlottetown, Prince Edward Island	VCA	Ramea, Newfoundland	CZA94
Chesterfield, Northwest Territory	VBZ	Resolution, Northwest Territory	VAW, VFR4
Churchill, Manitoba	VAP	Riviere du Loop, Quebec	VCD
Coral Harbor, Northwest Territory	VFU2	St. John, New Brunswick	VAR
Corner Brook, Newfoundland	VOJ	St. John's, Newfoundland	VON
Fort Franklin, Northwest Territory	CJV29	Sarnia, Ontario	VBE
Fox River, Quebec	VCG	Sault Ste. Marie, Ontario	VBB, VDX23
Frobisher, Northwest Territory	VFF	Seven Islands, Quebec	VCK
Gimli, Manitoba	CFX	The Pas, Manitoba	CFX5
Goose Bay, Labrador	VAZ, VFZ	Three Rivers, Quebec	VBK
Gore Bay, Ontario	VFG2	Tofino, Quebec	VAE
Great Whale River, Ontario	VAV	Toronto, Ontario	VBG
Halifax, Nova Scotia	VCS	Twillingate, Newfoundland	VOO
Harrington, Quebec	CJZ34	Vancouver, British Columbia	CFW300
Hay River, Northwest Territory	CJV40	Welland Canal, Ontario	VDX22
Inuvik, Northwest Territory	VFA6	Wiarton, Ontario	VBC
Kingston, Ontario	VBH	Yarmouth, Nova Scotia	VAU
Lachine Lock No. 5, Quebec	VAO	Yellowknife, Northwest Territory	CJM334

such as for westbound and eastbound flights in the North Atlantic zone. As stated, frequencies are assigned to the zones or flight route, not according to the station. Stations in several continents, but serving a common route, therefore, may be heard on a single frequency.

It should be noted that military and civil aeronautical communications use different bands or occupy adjacent portions of a band. Military stations are predominantly SSB. Civil stations are switching over to SSB, but still use AM much of the time. When a military aircraft is flying an international air route, however, you can listen for it on the civil aviation frequencies.

Aeronautical radio traffic generally consists of positional reports, weather reports or technical, business, or personal communications.

Table 12-3. United States Coast Guard Stations.

Argentia, Newfoundland	NJN	New York, New York	NMY
Miami, Florida	NMA	New London, Connecticut (Coast Guard Academy)	NOA
San Francisco, California	NMC	USCG Air Station, St. Petersburg, Florida	NOF
Boston, Massachusetts	NMF	Kodiak, Alaska	NOJ
St. Louis, Missouri	NML	Mobile, Alabama	NOQ
Honolulu, Hawaii	NMO	Galveston, Texas	NOY
San Juan, Puerto Rico	NMR		
Westport, Washington	NMW		

Position reports are given regularly and can help a DXer pinpoint the location of his airborne DX. Civil aircraft use longitude and latitude readings for position reports, but military aircraft may also use a coded designator to describe their geographical location. Times are given in Greenwich mean time (GMT) as identified by the code word "Zulu."

Table 12-4. Aeronautical Mobile Bands.

kHz	Key
2805-3025	C
3025-3155	M
3400-3500	C
3800-3900	M(a)
3900-3950	M(b)
4650-4700	C
4700-4750	M
4750-4850	M(a)
5430-5480	M(b)
5450-5480	C(c)
5480-5680	C
5680-5730	M
6525-6685	C
6685-6765	M
8815-8965	C
8965-9040	M
10,005-10,100	C
11,175-11,275	M
11,275-11,400	C
13,200-13,260	M
13,260-13,360	C
15,010-15,100	M
17,900-17,970	C
17,970-18,030	M
21,850-22,000	C
23,200-23,350	C

Key

C—Civil use

M—Military use

(a)—Used in Europe, Asian USSR, and Africa only

(b)—Used in all areas except Americas

(c)—Used in Americas only

Table 12-5. Samples of VOLMET Stations.

Aeradio Station	Time After the Hour	Frequencies Used (kHz)
Oakland	05-10, 35-40	2980, 5519, 8905, 13,344
Tokyo	10-15, 40-45	2980, 5519, 8905, 13,344
Hong Kong	15-20, 45-50	2980, 5519, 8905, 13,344
Honolulu	20-25, 50-55	2980, 5519, 8905, 13,344
Anchorage	25-30, 55-60	2980, 5519, 8905, 13,344
Sydney	00-05, 30-35	3432, 6680, 10,017
New York	00-20, 30-50	3001, 5652, 8868, 13,272
Gander	20-30, 50-60	3001, 5652, 8868, 13,272
Shannon	00-20, 30-50	2889, 5533, 8833, 13,312
Paris	25-35, 55-05	2980, 5575, 10,066

Some air forces and airlines use pseudo names for their identifications. Examples are: CANFORCE for Canadian Armed Forces; ASCOT for Royal Air Force Air Support Command; CLIPPER for Pan American Airlines; SPEED BIRD for British Overseas Airways Corporation; and EMPRESS for Canadian Pacific Airlines. Otherwise, the actual airline name is used and in all instances the flight number is also quoted as part of the identification. Ground stations identify by place name only, such as Gander, San Juan, or Dakar.

The VOLMET stations (Table 12-5) are perhaps the easiest and most often heard of all aero stations. These are located at major airports which give regular weather (VOLMET) forecasts for the larger airports in their areas. The reports are made twice each hour on AM and usually in English. VOLMET stations frequently identify themselves as Aeradios, such as "Shannon Aeradio."

In the United States and in the rest of the world, too, a huge and complex network of communications facilities is maintained for the coordination of the movement of thousands of aircraft every day. This provides a mass of potential DX. The Strategic Air Command (SAC) is also a common reception. SAC is America's airborne defense system and any one of several airborne stations are ready to take over from defense headquarters on the ground in the case of a military emergency. Code names are given to ground and air stations, as well as to frequencies. "Migrate," "Retail," and "Skyking" are several of the more commonly heard SAC identifiers.

FIXED STATIONS

The fixed service can include a large number of stations, depending on your definition of a fixed station. They are generally thought of as nonaeronautical, nonmaritime stations operating from fixed positions and are land-based stations that are on the air for the purpose of overseas telephone calls, telecommunications, and the like. Point-to-point (PTP) is another term that is used for these stations (Tables 12-6 and 12-7) because the transmissions take place from one fixed point to another fixed point. Commercial, government, and military PTP stations are all within this category.

Table 12-6. Shortwave Point-to-Point Bands. (Frequencies are in kHz.)

4000-4063	7300-8195	11,975-12,330	18,030-21,000
4438-4650	9040-9500	13,360-14,000	21,750-21,850
4750-5450	9775-9995	14,350-14,990	22,720-23,200
5730-5950	10,100-11,175	16,450-16,460	23,350-25,600
6765-7000	11,400-11,700	17,360-17,700	26,100-27,500

One would think that the undersea telephone cables that crisscross our globe, as well as the numerous satellites, would be sufficient to handle all the overseas and transcontinental telephone, telegraph, radioteletype (RTTY-FSK), and facsimile (FAX) traffic. In reality, this has not yet been achieved; much of it is still being transmitted by various methods over the shortwave frequencies. Nearly every country, big and small alike, has such a PTP station. This helps make it possible to DX countries that lack any normal international shortwave broadcast stations.

The favorite type of PTP reception is the test transmission. These broadcasts make it relatively easy to identify a station, and many stations have such transmissions. Here are four examples, two each of commercial and military stations.

(a) This is a transmission for station identification and circuit adjustment purposes from a station of All-American Cables and Radio. This station is located in Guantanamo Bay, Cuba.

(b) This transmission is broadcast for circuit adjustment purposes from a station of the American Telephone and Telegraph Company. This station is located near Fort Lauderdale, Florida.

(c) 1, 2, 3, 4, 5. This is radio station Alpha-Echo-Zulu broadcasting for station identification and receiver alignment.

(d) This is the Naval Communications Station, Honolulu, Hawaii, counting for transmitter identification and receiver alignment. 1, 2, 3, 4, 5, 5, 4, 3, 2, 1.

Table 12-7. A Few U.S. Military PTP Stations.

ACA	U. S. Army, Canal Zone
AEA	U. S. Army, Pirmasens, West Germany
AEZ	U. S. Army, Asmara, Ethiopia
AFA	U. S. Air Force, Andrews Air Force Base, Maryland
AGA	U. S. Air Force, Hickam Air Force Base, Hawaii
NAU	U. S. Navy, San Juan, Puerto Rico
NPM	U. S. Navy, Pearl Harbor, Hawaii

These messages are repeated over and over many times to allow the intended receiving station to adjust its equipment for the best reception, as stated in the transmissions. They can be called test tapes, voice mirrors, melody mirrors, or running markers. Some are partially or even totally characteristic musical notes. Many test transmissions are in English or in several languages with one of them being English. Both AM and SSB are used extensively, but SSB is favored by military stations. When the receiver has been correctly adjusted, the transmitter switches over to the traffic, and this is, at times, scrambled to insure privacy. The test message makes excellent content for a reception report when describing what you heard.

Most DXers also consider the standard frequency and time stations to be utility stations, but we have elected to discuss them separately at length and you'll find out about them in Chapter 15.

RECEPTION REPORTS AND QSLS

The subject of reception reports is thoroughly detailed in Chapter 14, but when it comes to the utility stations, the story is somewhat different. To many utility stations, reception reports are virtually useless. It is a much easier task to hear and log the stations than it is to be able to obtain verifications from them. They learn quickly from other stations how well their signal is being received and they do not keep a staff of people on duty simply for the purpose of checking reception reports and issuing QSLs to the senders of correct reports. When you obtain a QSL from a utility station, it is generally an act of friendliness and courtesy from a member of the station's staff. Therefore, when you send a report, you too, should show every act of friendliness and courtesy. Try to make your report as complete as possible. Earn the QSL; make the station actually want to reply! Most of them will if you will follow common sense and a few simple rules.

Some things can be reported and some cannot. Test transmission messages are okay, but traffic content itself is a strict no-no. This is due to the personal and private nature of the traffic content. The ITU (International Telecommunications Union) has express and specific regulations regarding the divulging and unallowed use of traffic. Some utility stations have gone so far as to completely cease sending out QSLs because of the numerous reports they have received containing details on traffic heard.

Report the date and time in GMT, the frequency as accurately as possible (be sure to honestly tell them if the frequency you have listed is only an approximation), the exact wording of the test transmission, the parties involved, the type of message or anything else that can serve as a description of what was heard but which does not involve the privacy of anyone. Also give a brief description of reception conditions including signal strength, interference, noise, fading, and the like, but avoid using reporting codes such as RST or SINPO, since these are usually understood best by the hams and the shortwave broadcast stations.

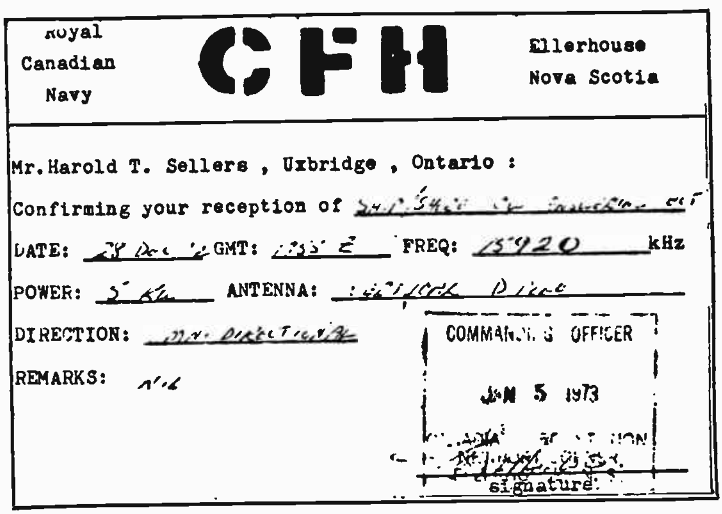
If you are not sure whether the utility station has its own QSL card or not, then send a prepared form card (PFC). This is a QSL card that you make up yourself with all of the pertinent information on it. All the station has to do, after checking your report and, hopefully, finding it accurate, is to fill in a few blank spaces, sign it, and return it to you. A QSL of this type is considered in the hobby to be a valid QSL. The PFC that you make can be in any style that you wish. The one shown in Fig. 12-2 was prepared by Harold Sellers of Uxbridge, Ontario. Mr. Sellers, by the way, was responsible for the preparation of a considerable portion of this chapter.

Return postage is often a necessary courtesy and should always be included. This is best done with mint stamps or IRCs, both of which are outlined in chapter 14. If you send IRCs, be sure to send two or three if you're after an airmail reply.

Sending small souvenirs is also a good idea, since it shows friendliness and a real desire for a verification. For instance, you might send a picture postcard or two; an even better bet would be a few postage stamps from your country. Even though the stations in foreign countries will be unable to actually use them, there are, without a doubt, one or several stamp collectors on the staff of the station. Make sure you send commemorative stamps!

Your report should not be submitted on a standard prepared reporting form. Write a friendly and personal letter to the station, neatly listing the details of your reception. When possible, it is preferable to write in the station's native language. Several of the large radio clubs have foreign-language reporting form model letters that are available to their members. Finally, send your report by airmail so that it is still fairly recent when the station receives it.

A breakdown of the stations that we have mentioned shows that the coastal stations are good verifiers, as is the Coast Guard. Most of them require your homemade PFCs, however, since very few of them have prepared QSLs. Ships will also verify quite well if you can get reports to them. Reports to ships should be sent in care of the radio officer. Military


Royal Canadian Navy

CFH

Ellerhouse Nova Scotia

Mr. Harold T. Sellers, Uxbridge, Ontario:

Confirming your reception of

DATE: GMT: FREQ: 15920 kHz

POWER: ANTENNA:

DIRECTION:

REMARKS:

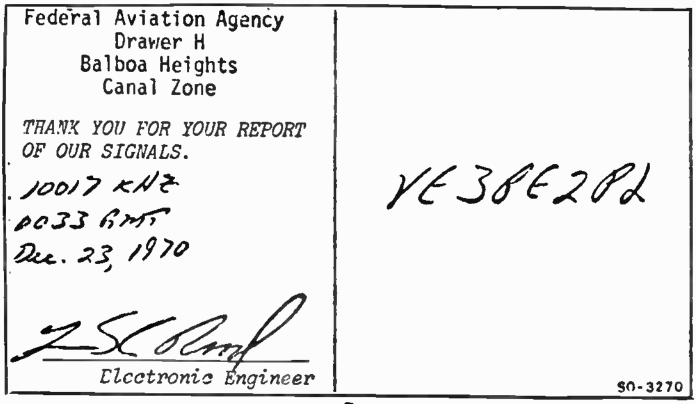
COMMANDING OFFICER

JAN 5 1973

signature:

Fig. 12-2. Copy of a prepared form card (PFC) sent by and returned to Harold Sellers, Uxbridge, Ontario, for verification of CFH, Royal Canadian Navy, Ellerhouse, Nova Scotia, 15.92 MHz.

A


Federal Aviation Agency
Drawer H
Balboa Heights
Canal Zone

THANK YOU FOR YOUR REPORT
OF OUR SIGNALS.

10017 KHZ
0033 GMT
Dec. 23, 1970

Electronic Engineer

SO-3270

B

Fig. 12-3. Copies of front and reverse sides of station QSL from WHZ, Federal Aviation Agency station in Balboa Heights, Canal Zone, on 10.017 MHz.

vessels can be reached through the fleet post offices in New York or San Francisco.

Aeronautical stations are not the best verifiers, but a number of them will QSL readily for return postage and your prepared card. VOLMET stations are excellent verifiers and many have their own cards.

Many PTP stations will confirm reports and a lot of them have very attractive cards (Figs. 12-3 and 12-4). However, as Cable and Wireless, Ltd. explains it, they are forbidden by certain regulations or company policy to QSL.

Time and frequency standard stations (Fig. 12-5) usually appreciate reports, especially detailed reports that cover several days. Scientists and engineers generally give your report a good going-over, so give as much detail as possible. Many of these stations have their own QSL cards.

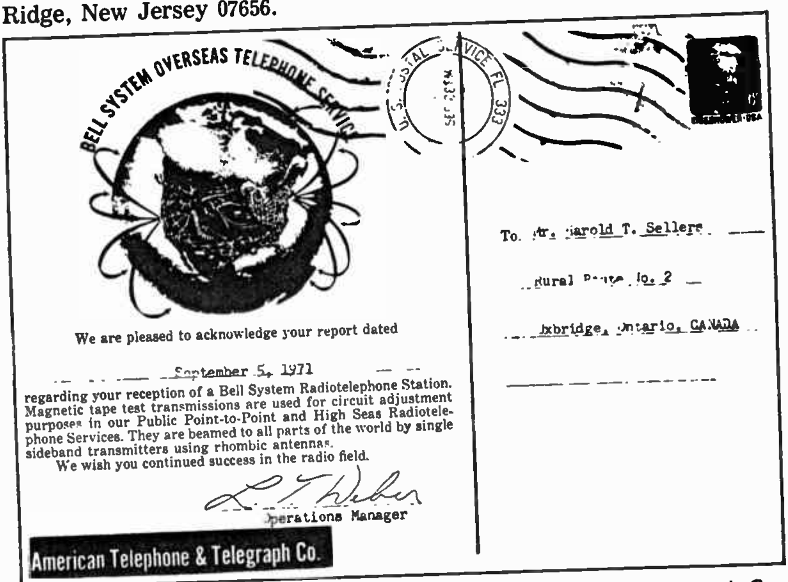
In the United States military, the Navy (Fig. 12-6) is perhaps the best verifier, while the Army is considered to be poor and irregular. The Air Force (Fig. 12-7) is also irregular and sometimes will not verify at all. At times, though, they will verify for frequencies of "common knowledge," that is, frequencies that can be found in references such as the ITU listings. SAC broadcasts are not confirmed at all. Military stations should generally be sent your prepared cards (Fig. 12-8).

We hope that your interest has been sparked and that you will give utility DXing a good try. We feel that you will not be disappointed. This chapter has barely scratched the surface of the fascinating world of the utility stations. There are so many ways to find fun by DXing the utilities that there is surely something for everyone.

The information here should give you a good start in your DXing, after which you may wish to join one or two good clubs and make friends with the utility editor. He wants to help you and he has a lot to offer. Among the clubs that have utility columns are the American Shortwave Listeners Club, the Canadian International DX Club, the Newark News Radio Club, and SPEEDX. Full information on these clubs is included in Chapter 17. You might also start to build a collection of reference sources; accordingly, we have included a listing of a few to get you started.

UTILITY REFERENCES

UTILITY DXers HANDBOOK. An excellent source of information on utility stations, including addresses and frequencies; 66 pages. Available for $3 from the SPEEDX Club or from Gilfer Associates, Box 239, Park Ridge, New Jersey 07656.



BELL SYSTEM OVERSEAS TELEPHONE SERVICE

We are pleased to acknowledge your report dated

September 5, 1971

regarding your reception of a Bell System Radiotelephone Station. Magnetic tape test transmissions are used for circuit adjustment purposes in our Public Point-to-Point and High Seas Radiotelephone Services. They are beamed to all parts of the world by single sideband transmitters using rhombic antennas.

We wish you continued success in the radio field.

Operations Manager

American Telephone & Telegraph Co.

To. Mr. Harold T. Sellers

Rural Route No. 2

Uxbridge, Ontario, CANADA

Fig. 12-4. Copy of QSL from the American Telephone and Telegraph Co. station.

Department of Commerce
NATIONAL BUREAU OF STANDARDS
RADIO STATION WWV
FORT COLLINS, COLORADO

2.5 MHz-40°40'55"N, 105°02'31"W	15 MHz-40°40'45"N, 105°02'25"W
5 MHz-40°40'42"N, 105°02'25"W	20 MHz-40°40'53"N, 105°02'29"W
10 MHz-40°40'48"N, 105°02'25"W	25 MHz-40°40'51"N, 105°02'27"W

This is to confirm your reception report of WWV

on 10.0 MHz. 0558-0601GMT 15 Aug 1971
Frequencies Date

Serial № 9143 John T. Stanley
Engineer-in-Charge

Complete Description of Services of NBS Radio Stations Given in Special Publication 236 Available from Government Printing Office – 25c

Fig. 12-5. Copies of front and reverse sides of a QSL from WWV, National Bureau of Standards, Fort Collins, Colorado.

U. S. COAST GUARD DX HANDBOOK. The only book on the USCG specifically for the DXer. Jam packed with all that you need to know about the Coast Guard, including frequencies, schedules, addresses, services, and stations. Price is $1.50 from SPEEDX.

CONFIDENTIAL FREQUENCY LIST. Written by a utility DXer and published by Gilfer Associates, this 64-page book covers a large variety of utilities, both common and uncommon types, and includes frequencies, stations, power ratings, and other items. A must for the beginner. Price is $2.95 from Gilfer Associates.

ITU BOOKS. A number of books by the International Telecommunications Union, Place des Nations, Geneva, Switzerland. These are very expensive, but they are also the ultimate in utility station lists. They are available directly from ITU or the United Nations Bookstore in New York City; Gilfer Associates also has them available. In any event, write for prices first. The list of books includes the following:

(1) **Fixed Stations of the World**—commercial and military PTP stations.

(2) **Coastal Stations of the World**—all coastal stations in the world, listed by country.

(3) **Alphabetical List of Callsigns VIIA**—Callsigns and locations of coastal stations and callsigns and names of ships.

(4) **Alphabetical List of Callsigns VIIB**—Callsigns and locations of all stations except amateur, experimental, and ships.

(5) **List of Ship Stations**—all ships.

DEPARTMENT OF THE NAVY
U. S. NAVAL FACILITY
FLEET POST OFFICE. NEW YORK 09552

NJ09552:200:tam
2000
Ser: 318
01 JUN 1970

Harold Sellers
R. R. 2, Uxbridge
Ontario, Canada

Dear Mr. Sellers:

Thank you for your letter and card of 27 March 1970. Yes, your reception of this station was correct. Although we do not normally transmit in the voice mode (except for communications coordination), we came up on this frequency to assist in the coordination of a search and rescue incident.

The equipment in use was a Collins Radio AN/URC-32 Transceiver coupled through a Collins AN/SRA-22 Antenna Coupler to a 35 foot whip antenna. The power out was in the neighborhood of 100 watts. With this power out we were a little surprised that you picked us up, even weak and broken.

Enclosed is a copy of a message describing the incident taking place at the time you intercepted ou signals. Also included are two brochures describing the island of Antigua.

Sincerely yours,

Kirk E. Evans

KIRK E. EVANS
LT USN
Operations Officer
By direction

Encl:
(1) NAVFAC ANTIGUA msg 311220Z MAR 70
(2) Two Antigua Tourist brochures

Fig. 12-6. Copy of an unusual QSL from the U. S. Navy station on the Caribbean Island of Antigua for reception of a search and rescue operation.

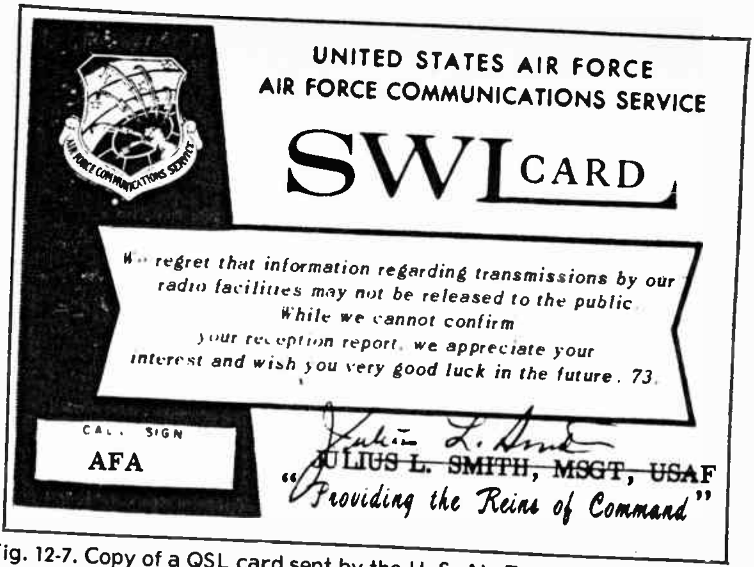


Fig. 12-7. Copy of a QSL card sent by the U. S. Air Force stating that they cannot verify reception reports.

(6) **List of Radiodetermination and Special Service Stations**—beacons, time signals, standard frequency, weather, navigational stations, and others.

(7) **List of Space and Radio Astronomy Stations**—satellites and other stations.

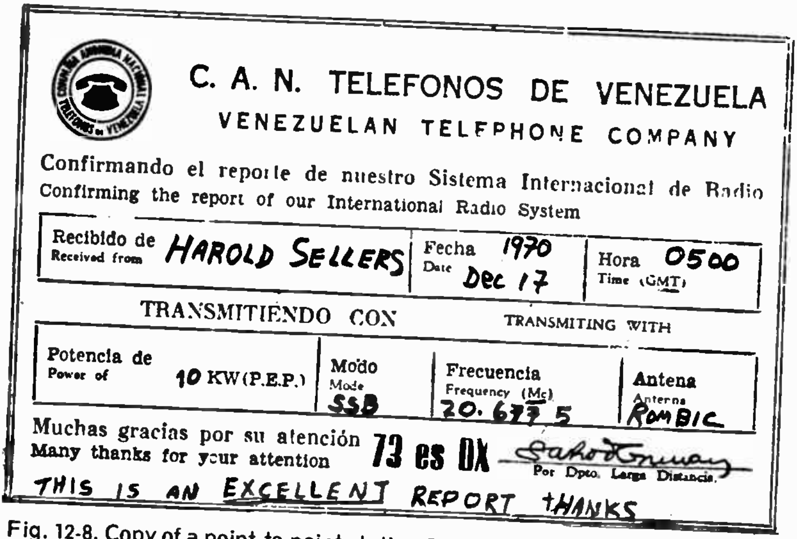


Fig. 12-8. Copy of a point-to-point station QSL card from Venezuela sent to Harold Sellers.

(8) **International Frequency List**, Volume 1 to 4d—all stations known to the ITU! This does not, however, include ships, amateurs, and experimental. This one is both very expensive and extensive.

U. S. NAVY AND COAST GUARD SCHEDULE. This is available at no charge from U.S. Oceanographic Office, Washington, D. C. 20390. It lists Navy and Coast Guard stations in the Pacific and Atlantic areas with callsigns, frequencies, and times.

WORLD RADIO-TV HANDBOOK. Mostly for the shortwave broadcast listener, it also has listings of time and standard frequency stations. Gilfer Associates has it for $6.95.

MERCHANT VESSELS OF THE UNITED STATES. This costs $12.50 and may be obtained from the U. S. Government Printing Office, Washington, D. C. 20402. It lists U.S. ships by name, owner, and callsign.

WEATHER SERVICE FOR MERCHANT SHIPPING. Lists of various weather broadcasts; cost is $1.25 from the Government Printing Office.

FCC REGULATIONS, Volume 4. Listing of maritime frequencies; available from U. S. Government Printing Office.

Chapter 13

Logbooks

Throughout the vast periods of time that man has inhabited the earth, events have been recorded for posterity in one form or another. Records have been kept in the form of "chicken scratching" on boulders, the method of recording events during the caveman era, or in the form of the ancient Jewish scrolls or in the writings of the Bible. A certain Mr. Columbus recorded the events of his seagoing voyages to what is now known as the Western Hemisphere. Records have been kept of virtually everything that has ever happened, and some of these old records are still in existence today, behind glass, in hermetically sealed museum display cases.

Other records and logs are kept by such people as your local police department, the post office department, automotive agencies, transportation companies, and school principals. You can still check with your government and learn about something that happened years ago through the medium of the National Archives.

So what does this prove? It proves only that it is worthwhile, and often times necessary, to keep a record—or log—of what has or is happening. More often than not, there will be reasons to check back for some vital piece of information and the written word is always far more dependable than the mental efforts of even the brightest scholar.

So it is with shortwave listening. A logbook will provide you with answers to the questions that pop up from time to time about the stations that you have heard in the past.

FCC RULES

The Federal Communications Commission requires absolutely that all United States amateur radio operators keep a log of every transmission. This includes stations called (with or without any answer), all CQs (general calls), and test transmissions. Logs must be kept whether the stations are portable, mobile, or at a fixed location. No deviation from this rule is permitted. Every broadcasting station in the United States must keep a log of all transmissions.

Included in this overall rule are provisions that the operator must list the callsign of the station called or actually worked; the beginning and ending time of each transmission; the date of each transmission; the frequency band used for the call or contact; the type of emission (single sideband, CW, voice, etc.); and power input, in watts, of the transmitter used. All of this information must be logged for every transmission. These logs must be kept on file by the station for a period of at least one year.

It is a different story with the SWL. The shortwave listener is not required to keep a logbook. I stress the word **required**. While a logbook is not required, the log is very important to an SWL because it is a record of his own hobby activities—the stations heard, the reports that have been sent, and the replies received. This information can be used in several ways. It can help you keep track of the countries that you have heard; it gives you the information you need for sending reception reports for QSL cards; and it can help you to establish propagation patterns. Again, while a log is not required, we do strongly recommend that you have and maintain an SWL logbook and we further urge that it be kept neat and legible.

LOG CONTENTS

While not readily admitted by anyone, we feel sure that virtually every last one of the veteran DXers have, at one time or another, hastily or sloppily scribbled something in his logbook for future reference, with good intentions of correcting the sloppiness later on. But later on never happened. As expected, the time came when someone had urgent need of information about a past event—only to find that the desired information was the same information that was hastily scribbled in—to be corrected later. Too bad; the entire event was lost to history simply because the operator didn't keep a neat, accurate, and legible logbook. Maintain your log in such a way that you can return to it years later and be able to extract information from it.

It is not really necessary to keep a log of every last thing that you hear. In other words, if you are just casually tuning across one of the bands and you happen to stop momentarily on a half dozen or so stations and spend only a moment or two for a brief glimpse of the program, it is not necessary to record all of that information. Of course, you can, if you wish, but you'll be spending more time writing than listening.

The general rule of thumb is that the logbook should contain material of any station to which you might wish to send a reception report. You may also record information, even though it may be for a brief logging, of stations that you do not normally hear—the stations that are generally heard only during ionospheric disturbances or stations that might be heard only when a stronger station, normally on the air on the same frequency at the same time, is off the air. On the other hand, if you aren't in the mood for writing reception reports on a given DX period, and only the normal stations are being heard, you might wish to make a few entries of the stations that you do tune in briefly, if only for information purposes. In this way, you can refer back to your log a few days or a few weeks later to see what area you might expect to receive at the time that you happen to be listening.

A logbook is also a good source of information in helping you plan your listening time. For example, if you want to try to hear a certain station in the Pacific, you can go back in your log for the past few weeks and determine what time that area was last coming in at your location. Chances are that unless a long period of time has elapsed since your last logging or unless there were (or are) some freakish propagation conditions, you will again hear the same general area at about the same time of day or night. These are only a few of the reasons for keeping a good

DATE TIME	STATION CALLED	CALLED BY	HIS FREQ. OR DIAL	HIS SIGNAL RST	MY SIGNAL RST	FREQ. MHZ	EMIS-SION TYPE	POWER INPUT WATTS	TIME OF ENDING QSO	OTHER DATA	QSLs	
										NAME	S	R

Fig. 13-1. A typical page from the logbook published by the American Radio Relay League. While designed basically for radio amateurs, it can be readily adapted to use by the SWL.

logbook and more will readily become apparent to you as you progress into the hobby.

LOG FORMS

A logbook can actually consist of almost anything. Some of our friends prefer the bound amateur radio logbooks that are sold by the American Radio Relay League through their headquarters in Newington, Connecticut 06111, or through any amateur radio parts store. Granted, these are designed for ham radio operators, but they can be readily adapted for use by SWLs and they provide a neat, bound, concise form. A sample page of the ARRL logbook appears in Fig. 13-1.

Others prefer to keep looseleaf notebooks of the kind generally available in dime stores. They are relatively inexpensive and a pack of paper for them will last you for quite a number of hours of DXing. The only disadvantage here is that you have to rule in your own lines and make your own headings. Then, after you have done that for awhile, you'll begin to wonder if you shouldn't have used another type of logbook.

We know of DXers who still use the looseleaf notebook for a logbook, but they design their own special type of page, with lines and headings and the whole bit, then have a local printshop make up a batch to order. This is fine after you have paid the bill which, generally, isn't that much anyhow. If the printer uses his own paper, he might, for a slight additional fee, be talked into punching your logbook sheets to fit your notebook. Others use much the same idea, and type all of the information on a mimeograph stencil, then run off copies on regular paper; mimeograph log sheets are perfectly suitable for the purpose. The big advantage here is the relative low cost involved, plus the fact that the used stencil can be removed from the mimeograph machine, carefully kept flat between sheets of paper towels, newspapers, or regular stencil folders, and reused at a later date for additional copies.

Others prefer the card file method, but many of the DXers we have talked to find that this system is cumbersome. It often takes too long to refer back to a past date. Of course, if you keep a log by stations, rather than basically by date or frequency, this is fine. You can quickly make signal comparisons of several loggings of one station at a glimpse.

Still others that we know, and these are in the minority, as will probably be obvious, keep a logbook with the help of a computer. Most of you have seen the readout sheets that seemingly come out for miles on end from a machine; the information on the readout is derived from a big stack of prepunched cards. This is fine and we certainly approve this method—if you have access to such equipment.

There are numerous other ways to keep a logbook, but these few that we have mentioned are probably those that are most widely used. Logbooks are almost in the same category as fingerprints—no two alike. It's entirely up to the individual as to what sort of records he wishes to maintain, if he wants to at all. Again, we point out that a logbook is not a requirement, but it certainly is a big help when you'd least expect it to be.

A typical SWL logbook sheet is shown in Fig. 13-2. This is a page from an SWL logbook that was offered to SWLs a number of years ago by the National Company, manufacturers of excellent communications equipment. We certainly found nothing wrong with it!

LOG SHEET

Date	Time	Station Heard	Phone or C W	Location (Q T H)	Program	Frequency or Band

Fig. 13-2. Sample page from a logbook published years ago by the National Company. It was designed expressly for the SWL.

The information to be actually recorded is, again, up to the particular individual. If you are tuning the shortwave broadcast band stations, you'll want to record the times that you heard a certain station, including date, frequency, a signal report for strength and readability, any notes pertaining to interference, and whatever program material you wish to include. As has been pointed out previously, information for reception reports will often come from your logbook—if you have recorded the information correctly. When recording information for reception reports, it is necessary to have your times exact for each entry of music, news, commercials, or whatever. Song titles, spot announcements, and perhaps the gist of a couple of news items is good information to record. Your time listings can be in your own local time if you wish, but a word of advice: if you are going to stay in the hobby, you should learn how to convert your own local time to GMT and record the times as such. Greenwich time is used universally and it should always be used when sending reception reports to any shortwave broadcast station.

Logs for ham-band listening can include the callsign of the station to whom you are listening, and the one to whom the ham is talking. Signal levels, date, time, frequency, and the rest should also be shown. However, it isn't necessary to include specific items at specific times (such as a music title at a certain time, as you would in a report to a broadcasting station) unless something unusual is mentioned by the ham that would more readily enable him to really believe that you were listening to him.

Those who prefer the standard broadcast band should follow the general suggestions as given for the shortwave broadcast stations, except that times can be in your own local time if you prefer, and reception reports, too, can be in your own local time if the reports are for domestic stations. Reports to overseas stations should, of course, be in GMT. All in all, we feel that you should do one of two things relative to the keeping of time: memorize the conversion of your time to GMT for all hours, or set your clock to GMT and leave it that way permanently.

All in all, we do firmly believe that every serious DXer should keep a logbook—a good one. It can be kept in any way that he prefers and can contain whatever information he wishes to record. But it should be kept, for it will provide you with an invaluable source of information later on when you least expect to need it.

Chapter 14

Reporting and Vertifications

Shortwave listening can be accomplished with any radio receiver that is capable of tuning the shortwave frequency spectrum—all or any part of a band of frequencies between 1600 kHz and 30 MHz. And, as mentioned in the first chapter, shortwave listening in the general sense is not confined only to those frequencies. It can also include the medium-wave frequencies of 540 to 1600 kHz, where local stations can be found, as well as on longwave from 540 kHz on down to 50 kHz or lower, even though the frequencies from 1600 kHz to 50 kHz are not considered to be shortwave. Even a novice SWL can tune in the larger overseas broadcasting stations—the BBC in London, Radio Nederland in Hilversum, Holland, Radio Australia in Melbourne, Radio Rome, Radio South Africa in Johannesburg, Radio Argentina in Buenos Aires, Cairo Radio, the Voice of America, and others. Can't you imagine the excitement of tuning and monitoring some of the low-power stations in Asia, Africa, South America, or some other distant land?

Shortwave listening is a hobby second to none for adventure and excitement. You can enjoy a challenge of tuning and listening to shortwave broadcasting stations around the world, from Europe, Asia, Africa, to the vast Pacific, South America, the North Atlantic, and points beyond.

You are probably wondering how to tune in a distant station when atmospheric static, interference from other broadcasting stations, and other peculiarities are often present. Remember, with patience and a determination to tune them, it can be done. Don't be discouraged if the station you are tuning is not heard the first time. Try again.

This chapter was prepared in part by a friend of many years, Mr. John Beaver, Sr., of Pueblo, Colorado, who is a longtime member and officer of the Newark News Radio Club.

REPORT PREPARATION

One of the purposes of shortwave listening is keeping the stations informed on how good a job they are doing. A report of reception to a station monitored can tell, in a few words, or in a more detailed discussion of the transmission, just how well the signals are received, and the overall quality of reception. Some of the shortwave broadcasting stations have paid monitors in select countries throughout the world, but most stations depend on reception reports sent them by listeners. This, then, will tell you how you can take part in this hobby in an active manner and, at the same time, join in with thousands of other letter writers who unselfishly give of their time to continually let the overseas broadcast stations know how they are being heard. Further, these reception reports often guide the station programers in the selection of future programs that appeal to most people.

A sincere, honest, and detailed report is of value to various departments of the station receiving a report of reception. The listener should keep this in mind when preparing a report on what was heard and just how well he received it through his radio set. A good report is welcomed. On the other hand, a poorly prepared and carelessly written report has little or no value to the station and the personnel who check and analyze reception reports against their station log.

A case in point: Several times throughout the years, I , as editor of one of the shortwave columns for the Newark News Radio Club, has received letters of complaint, from high-ranking officers of shortwave stations, stating that many listeners not only do not include even the sketchiest information such as date and time but, to compound a felony, they **demand** that the station verify their report. Reports of this type are of good use only to the post office because they sold the stamps that were placed on the envelope. From the standpoint of the report itself, I've replied to the stations and suggested that any such reports be immediately placed in the nearest trash can. Another complaint from the stations indicate that some people stoop so low as to actually copy certain items of program material—verbatim—that appear from time to time in the bulletins of various radio clubs. Some of these listeners were not aware, apparently, that a number of the shortwave stations also subscribe to these radio club bulletins!

So be honest with yourself when preparing a reception report. Write clearly and legibly. Remember, a little time spent writing a good report receives merit. If you have a typewriter, the job will be easier and neater than a handwritten report. However, when your report is handwritten, block letter printing is preferred for legibility.

An SWL sending reports of reception to stations is usually classified as being in one of four categories: (1) those who listen for pleasure and entertainment only; (2) those who listen to gain a better understanding of other countries or to learn a foreign language; (3) those who listen for the purpose of reporting and collecting verifications and QSL cards; and (4) those who listen, and monitor, for the purpose of reporting technical data of value to the engineering department of the station heard. A good listener can qualify in each category if he so desires.

Verifications, or QSLs as they are more popularly known, are cards or letters sent to the listener by the station, after the listener has supplied satisfactory proof of reception. Some QSL cards are very colorful; others are rather plain; but, they are all verifications and serve the purpose intended. Many QSLs have become rare collectors items down through the years, and some are no longer available; thus, they are irreplaceable to the owner.

Verifications may be no more than a few words on a card or in letter form. They may be quite elaborate and attractive. Some are accompanied by the schedule of the station. In a few cases, a souvenir from the country of the verifying station may be sent—a pennant or an item historically connected with the country. Some stations have been known to send the listener a small gift in return for a good reception report. Some years ago, I received a large bottle of a fine European wine, which was sent by ordinary parcel post and which arrived intact!

REPORT DATA

If the shortwave listener sending a report to a station qualifies only under categories (1) and (2) above, the report will seldom contain any technical information that might be helpful to the station. The listener most likely will comment on a particular program, ask for information about the country, and possibly inquire as to language courses which might be offered by the station. If the listener is really interested in getting a verification, he should note carefully and pay attention to details to include in his report of reception.

When reporting for verifications, it is important to remember that it is necessary to report reception over a period of time, at least one-half hour, when possible. This listening time period can, of course, be adjusted as conditions and transmission time of the station dictate. Longer reporting periods are preferred, and accordingly, are much more useful to the station, particularly if the report contains pertinent and technical information. It's not unusual for a listener to monitor and report on reception over a period of one, or even two hours, during a station's transmission time. However, many station schedules may run for a shorter period of time; therefore, the listener must judge for himself how long he can monitor the transmission of any particular station.

In addition to knowing exactly which station the listener has tuned in, he should determine as accurately as possible the frequency used by the transmitting station. Listen carefully to station announcements. These are a valuable aid. However, when no frequency announcement is given, and the language is not familiar to the listener, there are other methods of determining the frequency. A listing of stations by frequency is a valuable guide in this department. The listener would be wise to obtain one. The station in question could be operating on possibly two or three frequencies in a particular waveband during a particular period of time. It is very important to report on the right frequency when tuning a particular wavelength of the broadcasting band.

When a station has several transmitters operating at the same time on parallel frequencies, the report should indicate the specific transmitter being heard. Readability quality should also be noted for each frequency being reported. This is not difficult when the station is transmitting the same program on two or more frequencies through the shortwave broadcast band, and the listener is able to hear signals on parallel frequencies during the same time period.

Be sure to indicate the date and time period during which transmission was heard and the time zone being used in your report. Simply stating, for example, "I heard you at 12:00 hours," is not enough. If local time, or another time zone is used, specify which one so that the person analyzing your report can compute the time to match that of the station log.

The listener would do well to obtain a clock with a sweep second hand if he does not have one available to use. Clocks with built-in conversion scales can also be obtained, and are very useful when tuning and reporting on your listening adventures.

A good report of reception should show a listing of music selections heard (the title or a brief description of it), a short summary of news items, talks, or other programing heard, and any other information that will verify your tuning of a particular station. If the programing is in other than English, and the listener is not familiar with the language, he should listen carefully for anything that will assist him in reporting his reception and list this with the corresponding time that it was heard.

Program details are important and should be accurate and to the point. Reception reports received by the station are checked against the station log for the time period indicated, and insufficient information can rule the report of little or no value, and could possibly be discarded by station personnel. This is a great loss to both the station as well as to the listener sending in a report for an intended verification.

Remember, a report of reception is of little value unless it contains needed information. Merely listing times and program items does not necessarily make a good reception report, although there are a few stations who will verify on those points alone.

Reception details, in addition to programing, should include a report on the signal strength and the readability quality of a particular transmission being reported for verification. Keep in mind that the station is interested in knowing how well they are being received in your area. They want to know how their signals perform during the time period covered in the reception report.

They would also like to know how their signals compare with those of other known stations in the same frequency range. Did their signal tend to fade at intervals or was it strong and heard at an easy listening level? If there were intervals of fading, indicate how much and if it was a slow fade or of a rapid flutter quality.

A readability report should include just how the signal was received from the listening level standpoint. Was the signal completely readable, or were there times (list your comments on this) when the copy level was difficult to understand? Were the effects of static or other interference from stations on or near the station in question observed? If so, identify and list the station(s) if possible.

Complete and accurate information does make for a good report and will be appreciated by the personnel of the station that review the report from the listener. It will assist the station in future program planning, to adjust schedules and frequencies if reception is unsatisfactory over a period of time in the listener's area, and to enable the station's engineering department staff to have a more full realization of what their signal is doing and where improvements can be made. You, the listener, will benefit with better programing and better overall reception. The engineering department is vitally concerned with supplying the best signal and reception possible for your entertainment and enjoyment.

A listener may include comments on the programing heard, what he liked and what he didn't like, but remember to be constructive in your criticism. Don't unjustly criticize the program without some thought of offering suggestions of preference, rather than a particular program transmitted. Shortwave broadcasting stations serve thousands, if not millions, of listeners, and it is quite impossible to suit the ears of everyone who tunes in their programs. Constructive criticism and suggestions as to the preference of the listener are welcomed by the stations and enable their program planners and staff personnel to plan for future programs which will be most enjoyed by the majority of the listening audience.

Be sincere in the suggestions that you make and don't demand that a particular program be scheduled. If the listener has preference to a certain type of music, talks, features, or other programs, mention those that you prefer; favorites and the like; then, let the staff of the station be the judge as to what a majority of their listeners would like to hear during their transmission time periods.

In preparing the actual report, list all information in letter form. Do not send reports on post cards. They simply cannot accommodate enough of the necessary information to be of value to the station. If a listener has his own SWL card, he could send it along with his report. But do not use it strictly for reception reporting purposes.

Brief mention of the equipment used by the listener for monitoring should be included in your report. List the make and model number of your receiver with the number of tubes or transistors, and the type and length of antenna that you are using. You should also include a brief comment on your weather and temperature, but do not go into lengthy detail on it.

CODES

Reporting codes are very useful to the listener as well as to the station receiving the report. The listener will find this method of reporting to be simple yet comprehensive. Every report sent to a station for QSL purposes should include a strength and readability evaluation of some sort; just what type you happen to prefer is up to you, but we strongly suggest that you use one of the universally recognized codes. Through the years, there have been a number of reporting codes in use, but of all of them perhaps the best known and most widely used are the "QSA-R" code, the "555" code, and the "SINPO" code.

The QSA-R code is one of the earlier codes used mainly in ham radio. The QSA is one of the internationally known Q signals that mean, "The strength of your signals is... (1 to 5)"; R stands for "readability" and this scale runs from 1 to 9. The R is actually an abbreviation of the Q signal QRK, which means, "The readability of your signals is..." In both cases, the higher the number used, the better the signal is judged to be; thus, a report of QSA5 R9 is utter delight. In recent years, through general usage, the R has become better known as S and the perfect report here would be simply Q5 S9.

The 555 and SINPO codes have proven to be the most widely used as well as the most popular with the SWLs. A chart for each code appears in Tables 14-1 and 14-2. Let's break down these two codes so that you may see and better understand how they work. The 555 code is a system that is believed to have begun with the British Broadcasting Corporation. This code is simple and comprehensive. The novice listener, in particular, may well find this reporting code useful as a guide when tuning and monitoring any station for reporting purposes. The SINPO code is by far the most widely used. Many shortwave broadcast outlets ask their listeners and monitors to report to them in this code. We urge you to acquaint yourself with this code, since it is the one that you will most likely be using frequently.

Table 14-1. SINPO Code.

Signal Strength (QSA)	Interference (QRM)	Noise-Atmospherics (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

For example, a report to a station whose signal is loud and clear, free of interference and static, and no fade level, would be written SINPO 55555. Do not run the letters and numbers together in this fashion: S5 I5 N5 P5 O5. This will only tend to confuse the person who reviews your report. Another example of reception with a good signal, slight interference, slight static level, and a moderate fade level, would be written SINPO 44434, or a similar merit depending on the degree of interference, static, and fading of the signal. An additional example of a signal that was received with only a fair level, moderate interference, moderate static level, and a marked degree of fading would be written SINPO 33322. In conclusion, should the listener be monitoring for a station on a regular basis, and an occasion would come about when the signal of the station is not audible, due to interference or other adverse phenomena, the reporting code possibly would be written: SINPO 02321.

No matter which reporting code you prefer, always be honest with yourself when evaluating the signal received. The more detailed your report, the more value it will have for the station receiving it, and the more credit the listener will reflect on the SWL hobby overall. Careful preparation of the report will merit the listener the desired verification, or QSL.

The listener should remember at all times to be courteous in requesting a QSL. Some listeners have demanded that their report be verified, then wondered why the station, on occasion, discarded their reception report. The listener will find it much more effective to suggest that the station verify his report using the following example as a guide:

Table 14-2. 555 Code.

Signal Strength (QSA)	Interference (QRM)	Overall Merit (QRK)
5 Excellent	5 None	5 Excellent
4 Very good	4 Slight	4 Very good
3 Good	3 Moderate	3 Good
2 Fair	2 Severe	2 Fair
1 Poor	1 Extreme	1 Poor
0 Inaudible	0 Total	0 Unusable

"Should this report of reception on the dates, times, and frequency check accurately with your station log, and if it is found to be of value to your engineering staff, verification would be most sincerely appreciated."

This method is particularly important when writing to a station that is known for not usually verifying reception reports. They will often reply with a QSL if a report is well prepared and contains needed information—and if the listener is courteous in his request.

POSTAGE

It is always proper to include return postage when sending reports overseas. Remember, the station is not obligated to verify your report. Many stations indicate that return postage is not required, but the majority of them appreciate receiving it. Some stations in the shortwave spectrum are government-owned or operated, in which case return postage is not needed. When in doubt, it is always best to include it with your reception report.

Return postage for foreign countries can be sent in the form of international reply coupons (IRCs) and these are available from your post office. A few countries which do not belong to the international postal union will not honor IRCs and the postal clerk will have this list in his postal manual.

If you would prefer to send return postage in the form of mint (new and unused) stamps of the country in which the station is located, this is okay, too. But where can you obtain mint stamps of foreign countries? The DX Stamp Service is set up for exactly this purpose. Mr. G. N. Robertson, W2AZX, will gladly assist you with whatever stamps you may require. Write to him at 83 Roder Parkway, Ontario, New York 14519.

Above all, do not send U.S. stamps except as mementos when sending reception reports to any foreign country. They aren't valid in any country other than our own and you'll be wasting your money.

TIME

It is important to indicate reception time in a standard manner when reporting on reception of any broadcasting station. While the listener may prefer to use his own local time (if he does, this should be so noted in his report) he will find a time conversion chart a most useful object to have in his listening post.

Since shortwave stations are scattered throughout the world, it has become common practice to report reception in terms of Greenwich mean time (GMT) or, as it is now often called, Universal Time (UT).

To equate our 24-hour day with the geographic picture of the surface of the earth, keep in mind that an increment of one hour occurs with each 15 degrees change in longitude. Greenwich mean time is simply the time at the point of zero longitude, which happens to pass through Sussex, England. The word "Greenwich" results from the fact that the Royal Observatory was once located in Greenwich.

The 24-hour clock system is generally understood and accepted around the world. In this system, the hours from 1:00 a.m. to 11:00 a.m. are expressed as 0100 to 1100 hours. Noon is referred to as 1200 hours. From 1:00 p.m. to 11:00 p.m., the times are expressed at 1300 to 2300 hours. Midnight is referred to by some as 2400 hours, but is most popularly known as 0000 hours; this latter form is the preferred form when reporting to stations. A few other examples:

8:40 a.m. is 0840 hours
11:01 a.m. is 1101 hours
12:10 p.m. is 1210 hours
2:36 p.m. is 1436 hours
6:45 p.m. is 1845 hours
11:59 p.m. is 2359 hours
11:59 p.m. plus 2 minutes is 0001 hours

We have included a time conversion chart for many points around the world in the Appendix. With it you will be able to convert to and from GMT from the standard American time zones and from foreign points.

TAPE RECORDED REPORTS

In recent years, the practice of sending tape recorded reception reports has gained rapidly in popularity and it has been proven to be very effective in obtaining QSLs. The station receiving a taped report is able to judge far more accurately how well its signals are being received. This method of reporting is proving to be far superior to more conventional written reports of reception, if the listener records the transmission exactly as it is being received through his radio set. The station is not interested in hearing a recording of their transmission which has been altered by volume control, crystal filters, Q multiplier, or other circuit adjustments in your receiver. It is important to remember not to change any equipment settings on your radio when recording on tape regardless of how the signal is received, unless the volume of the signal rises to a point where overload to your recording equipment might occur.

The station is interested in knowing how their signal strength and readability quality varies over a period of time and how their signal is affected both by other stations and electrical or ionospheric disturbances. Care in recording, and carefully tuning your station before switching your recorder on, will merit a good report on tape and be of vital use to the engineering department of the station in question. Don't hurry, be patient, and record exactly what is being received through your radio set. This is very important. Don't rush. A carefully recorded report cannot be done haphazardly.

Before starting to record on tape, tune the station in as accurately as possible. Remember to adjust the audio gain (volume control) of the receiver so that it is sufficient for recording level. Keep in mind that a taped report should be long enough to be of value to the station. Taped reports of less than 10 minutes are of little use. A taped report of 20 to 30 minutes is suggested, to provide the station with the information that they desire.

Do not permit outside noise to be recorded on the magnetic tape. The listener must connect the recorder directly to the receiver headphone jack or from the speaker terminals by an input cable or patch cord. Never try to record programing directly through the microphone of the recorder. The chances are too great of picking up outside noise which will cause the tape to be useless for verification purposes.

Sufficient "leader" tape on each end of the magnetic tape should be provided. If the magnetic tape does not have leader tape when purchased, obtain a spool of leader tape and use extreme care in splicing it to each end of the magnetic tape. A poor splice could result in damage to the magnetic tape recording when played back on a recorder or when being rewound on the takeup reel.

When recording a transmission from the same station on two or more days, it is important to use one track for one day and the second track for the next day's transmission when recording of some length. Run the recorder at a standard speed: 3¾ or 7½ ips. Remember to specify the recording speed by printing this on the leader tape at the beginning of the first track recorded.

Should the listener have a desire for any reason to speak on the tape, he should do so only after completion of the actual taped report, preferably toward the end of the second track.

A written note should accompany the tape, giving name, address, date, and time of recording (indicate the starting and completion time as well as the time zone used), frequency monitored, speed of the recording, make and model of receiver and recorder, antenna system used, and a courteous request that the station consider the recording for verification purposes. Enclose return postage so the station can verify the taped report and return it to you. Check with your post office as to the amount of postage required to mail your tape recording to the country, and for the amount of postage required to insure return of your tape after the station has completed listening to your report.

While this summary of reporting and verification procedures is directed primarily to the shortwave listener, the information is applicable when reporting to other stations—those in the standard broadcast band, utility stations, and possibly FM and TV DX stations—if the interests of the listener should fall this way. This summary is intended as a guide to assist the listener in obtaining the QSL he desires from stations in all parts of the world.

In conclusion, the listener should remember that he will get out of his hobby only the effort he puts into it. When preparing a reception report, it is important to remember, again, that the listener owes it to himself to be honest and sincere in his efforts, whether reporting on tape or in writing. The suggestions set forth in this chapter will benefit not only the listener but the station as well. With this in mind, set your goal, and go to it. Good luck and happy listening!

Chapter 15

Time and Standard Frequency Stations

How many of us have had another member of their family ask this question and make the following statement: "What time is it? Every last clock in this house has different time on it!" Chances are good that it has happened to a good many of us, the author included. It is such a simple matter, really, to look at the clock on the wall or on the mantle and see what time the hands indicate. And I guess all of us assume that the clock is right. After all, that's what it's there for, isn't it!

Windup clocks have to be wound up whether they're ordinary alarm clocks or grandfather clocks. And just miss winding it once, and the next thing you know it has stopped dead. Of course, it's a simple matter to wind it again and start all over—but wait, I'll bet you didn't reset it to the right time. I mean the really honest-to-goodness correct time, correct, at least, to within a minute.

And if you have a home that is equipped with electric clocks, they're fine, too. That is, until you forget to pay the utility company or a lightning bolt knocks out a transformer. Or a heavy snow brings down the wires. Or the fuse blows. In due time, the power goes back on and the clock is an hour or so behind time. So simply reset it. But wait. Did I win bet number two? Did you really set it to the correct time? Or did you take a good guess and hope for the best?

It really doesn't matter a whole lot if your clocks are windup, electric, or any of the new-fangled methods of making a clock go. The point is that the clocks are there to tell time and they are supposed to be correct. If they aren't correct, you might as well not have them. Right?

Of course, it really doesn't matter too much if Dad is a bit late getting to work because the clock wasn't set to the right time. It doesn't matter a bit. Until payday, that is. And I guess it really isn't that important if the kids miss the school bus. All they lose is some education. Chalk up another point for the incorrect clock.

The guy that depends on a certain train or bus to get him to an important meeting can always catch the next one, if he misses by only a minute or two, the one he was supposed to be on. He really wasn't needed at that meeting anyhow; his junior assistant can fill in for him. And Junior can get all of the credit, too!

How about the man that is supposed to go on the air with 11 o'clock news; he'll look real good walking into the studio at 11:05! Believe me, it has happened!

I recently had the occasion to have to use public transportation in the great city of brotherly love, Philadelphia. For convenience and speed, I chose the world-renowned Broad Street subway with its noise, artfully decorated stations (by graffiti experts) and poor lighting. The subway also had speed, frequent service, and on-time service. I had to use this method of transportation for a lengthy period of time, so I was able to observe firsthand how time figured into the running of a subway. They have printed schedules, too, and they adhere to them! More than once, I missed my connection by a mere matter of seconds. Which is all well and good, unless you happen to be traveling the subway in the middle of the night when the trains run once an hour.

Around our town, and in a number of neighboring towns, the fire siren always blows at noon, or at some other specified time, to make sure it can be verified if the time doesn't match that of the station log. So in order to keep the right time, they take advantage of a relatively little-known group of stations that do nothing but broadcast the right time, day in and day out, year after year.

I can see the wheels going around in the head of some newcomer who picked up this book on a visit to a bookstore and read this far in this chapter strictly by accident. "C'mon, Hank, a station that broadcasts only time—all the time?" Heck, friend, you haven't heard anything yet. They even give you the time announcement in English! Now, if you'll kindly buy the book and take it home with you, I'll tell you how it is done.

TIME-AND-FREQUENCY STATION SERVICE

Time-signal and standard-frequency stations perform an invaluable service of assistance in today's world by means of their extremely accurate timekeeping and standard carrier frequencies. Much of modern technology would be impossible without accurate time and frequency standards for calibration and coordination. For example, space exploration would be impossible. DXers can benefit by setting their clocks with confidence by listening to a time station. You can also align electronic equipment by using the signals broadcast on standard frequencies of 2.5, 5.0, 10.0, 15.0, 20.0, and 25.0 MHz, which some time stations also occupy and control with great accuracy.

Most of these stations run by federal governments or at least governmental agencies; some are commercial and others are military. The U. S. Navy has had a number of such stations operating since the 1920s for adjusting the navigational equipment on board ships.

Some stations have voice announcements every one, five, or fifteen minutes between beeps on the second. Others, especially those operated by the military, use CW, but it is usually at a speed that is slow enough to allow someone with no knowledge of Morse code to copy down the dots and dashes for later translation. Some stations have no voice announcement at all.

NATIONAL BUREAU OF STANDARDS FREQUENCY AND BROADCAST SERVICE

The National Bureau of Standards first began transmitting standard radio frequencies on a regularly announced schedule from WWV in March, 1923. The transmitter was originally located at the National Bureau of Standards in Washington, D. C. and later removed to a location in Greenbelt, Maryland. The present location, Fort Collins, Colorado, was opened with the first broadcast at 0000 GMT on December 1, 1966.

Station	Location	Power (kW)	Frequency (kHz)	Schedule (GMT)	Notes
WWV	Fort Collins, Colorado	2.5 10 10 10 2.5 2.5	2500 5000 10,000 15,000 20,000 25,000	Continuous on all frequencies	Seconds 29 and 59 omitted. The second marker beginning the minute is 800 ms. All others consist of a 5 ms pulse of 5 cycles of 1000 Hz modulation. Male voice announcement.
WWVH	Kekaha, Kauai, Hawaii	2.5 10 10 10 2.5	2500 5000 10,000 15,000 20,000	Continuous on all frequencies	Seconds 29 and 59 omitted. The second marker beginningthe minute is 800 ms. All others consist of a 5 ms pulse of 6 cycles of 1200 Hz modulation. Female voice announcement.
WWVB	Fort Collins, Colorado	16	60	Continuous, except for scheduled maintenance on alternate Tuesday 1300-0000	Refer to N.B.S. publication 237 for complete resume.

Table 15-1. National Bureau of Standards Time Signals.

Station	Location	Power (kW)	Frequency (kHz)	Schedule (GMT)	Notes
NBA	Balboa, Canal Zone	150	24	During 5 minutes preceding every even hour except at 0000 and Monday maintenance (1200-1800)	150 kW reduced to 90 kW each Tuesday (1200-2000) for limited maintenance.
			147.85 5448.5 11,080 17,697.5	During 5 mintues preceding 0500, 1100, 1700, and 2300	
NDT	Yosami, Japan	50	17.4		Format is in planning stage.
NPG	Dixon, Calif.		3268 6428.5 9277.5 12,966	During 5 minutes preceding 0600, 1200, 1800, and 0000	
NPM	Lualualei, Hawaii		4525 9050 13,655 16,457.5 22,593	During 5 minutes preceding 0600, 1200, 1800, and 0000	
NPN	Guam, Mariana Islands		4955 8150 13,380 15,925 21,760	During 5 minutes preceding 0600, 1200, 180 and 0000	
NSS	Annapolis, Md.		21.4	Transmission temporarily suspended.	
			88 5870 8090 12,135 16,180	During 5 minutes preceding 0500, 1100, 1700, and 2300	On Tuesday at 1700, the frequency 185 kHz replaces 88 kHz.
			20,225 25,590	During 5 minutes preceding 1700 and 2300	
NWC	Exmouth, Australia	1000	22.3	During 2 minutes preceding 0030, 0430, 0830, 1230, 1630, and 2030.	

Table 15-2. U.S. Navy Time Signals.

In addition to WWV, the bureau also operates WWVB, also in Fort Collins, and WWVH, located at Kekaha, Kauai, Hawaii. WWV and WWVH operate on 2.5, 5.0, 10.0, 15.0, and 20.0 MHz. WWV also operates on 25.0 MHz. WWVB is a longwave outlet, operating on 60 kHz. In addition to giving the time and minute, WWV and WWVH have official announcements, propagation forecasts, geophysical alerts, and weather information for areas of the western North Atlantic (from WWV) and the eastern and central part of the North Pacific (from WWVH). These weather forecasts and warnings are given in voice during the 11th and 13th minute of each hour from WWV and during the 50th and 52nd minute from WWVH.

A sample weather broadcast such as might be received by mariners from WWV, as shown in the National Bureau of Standards publication No. 236, is as follows:

"North Atlantic weather, west of 35 degrees West at 1700 GMT: Hurricane Donna, intensifying, 24 North, 60 West, moving northwest, 20 knots, winds 75 knots; (another) storm 65 North, 35 West, moving east at 10 knots, seas 15 feet."

A partial schedule for WWV, WWVH, and WWVB appears in Table 15-1. For a complete brochure describing the numerous broadcasts offered by the station, write to the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. Please specify catalog No. C 13.11:236. The price is 25 cents.

NAVY TIME STATIONS

World time is a must in radio work and it is good that the SWL has this invaluable service available to him. With experience, the DXer will find the broadcasts from these stations of interest and much help. In addition to the National Bureau of Standards stations, there are a number of them that are operated by the U.S. Navy. See Table 15-2.

INTERNATIONAL TIME STATIONS

In addition to the stations operated by the National Bureau of Standards and the U. S. Navy, there are a multitude of stations scattered in various parts of the world that offer time signals. Many of these have been reported by monitors to the shortwave clubs in which they hold membership. Others, judging from the scarcity or total lack or reports, have obviously not been heard. The full list is presented in Table 15-3 and we leave it to you to see how many you can add to your own personal logbook. If any of our readers are seriously interested in sending reception reports to any of the time stations they hear, they can obtain complete addresses from the author, Hank Bennett, P. O. Box 333, Cherry Hill, New Jersey 08002. Return postage would be appreciated.

Station	Location	Power (kW)	Frequency (kHz)	Schedule (GMT)	Notes
BPV	Shanghai, People's Republic of China		5430 9368 5000 10,000 15,000	During 5 minutes preceding 1700, 1900, and 2100 During 5 minutes preceding 0600, 1100, 1300, 1500, 1700, 2100, and 2300 1000-1200 000-0345, 0600-0945 0400-0545	Rhythmic pulses at other times on 5430 and 9368 kHz. Second pulses given by modulation of the carrier during the 3 minutes following 0, 15, 30, and 45 minutes.
XSG			458 6414.5 8502 12,871.5	0300, 0900	ONOGO, then rhythmic time signals.
Note: Recent information concerning the transmission of BPV and XSG has not been available.					
BSF	Taiwan, Republic of China	2	5000	Between minutes 00-05, 10-15, 20-25, 30-35, 40-45, 50-55 from 0100 to 0900	Second pulses of 5 ms duration. Minute marker is pulse of 300 ms duration. During 29th and 59th minute, Morse code and Chinese voice announcement of time.
CHU	Ottawa, Canada	3 10 3	3330 7335 14,670	Continuous	Second pulses of 300 cycles of a 1 kHz modulation. Minute pulses are 500 ms long. A bilingual (French-English) announcement of time is made each minute.
DAM	Elmshorn, Fed. Rep. of Germany	10 15 5 10 5 15	8638.5 16,980.4 4625 8638.5 6475.5 12,763.5	1155-1206 2355-0006 (Sept. 21 to March 20) 2355-0006 (March 21 to Sept. 20)	New international system, then second pulses from 0.5 minute to 6.0 minutes. Minute pulses are prolonged.
DAN	Osterloog, Fed. Rep. of Germany	2	2614	1155-1206 2355-0006	Same as DAM (see above).
DAO	Kiel, Fed. Rep. of Germany	2	2775	1155-1206 2355-0006	Same as DAM (see above).

DCF77	Mainflingen, Fed. Rep. of Germany	38	77.5	Continuous, except second Tuesday of every month from 0400-0800.	Second marker 59 is omitted.
DGI	Oranienburg, Dem. Rep. of Germany	750	185	0559.5-0600 1159.5-1200 1759.5-1800	Second pulses of 100 ms duration for seconds 30-40, 45, 50, 58, 59, 60.
DIZ	Nauen, Dem. Rep. of Germany	5	4525	Continuous except from 0815-0945	Second pulses of 100 ms duration. Minute pulses prolonged to 500 ms. Hour pulses marked by prolonged pulses for seconds 58, 59, 60.
FFH	Chevannes, France	5	2500	Continuous from 0800-1625 except Saturday and Sunday.	Second pulses of 5 cycles of 1 kHz modulation. Minute pulses prolonged to 500 ms.
FTA91	Saint-Andre-de Corcy, France		91.15	During 5 minutes preceding 0800, 0900, 0930, 1300, 2000, 2100, 2230	Minute pulses are prolonged.
FTH42 FTK77 FTN87	Pontoise, France		7428 10,775 13,873	0855-0900, 2055-2100 0755-0800, 1955-2000 0925-0930, 1255-1300, 2225-2230	
GBR	Ruby, England	60	16	During 5 minutes preceding 0300, 0900, 1500, 2100	
HBG	Prangins, Switzerland	20	75	Continuous	Interruption of carrier, at start of every second, for 0.1 second. Another interruption follows the signal for the minute. The minutes are identified by a double pulse, the hours by a triple pulse and midnight by 4 pulses.
IAM	Rome, Italy	1	5000	0730-0830, 1300-1400 10 minutes every 15 minutes except Sunday. Advanced by one hour in summer.	Second pulses of 5 cycles of 1 kHz modulation. Minute pulses of 20 cycles. Announcements and 1 kHz modulation, 5 minutes before the emission of time signals.

Table 15-2. Time Stations Around the World

IBF	Torino, Italy	5	5000	During 15 minutes preceding 0700, 0900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800. Advanced 1 hour in summer.	Second pulses of 5 cycles of 1 kHz modulation. These pulses are repeated 7 times at the minute. Voice announcements (Italian, French, English) at start and end of each emission.
JG2AE	Koganei, Japan		8000	2069-1059 with interruptions between minutss 25 and 34.	Second pulses of 1600 Hz modulation. Minute pulses are preceded by a 600 Hz modulation.
JG2AS	Kemigawa Chiba C, 10 Japan	10	40	0000-0800, except Sunday. Interruptions during communications.	Second pulses of 500 ms duration. Second 59 is omitted.
JJY	Koganei, Japan	2	2500 5000 10,000 15,000	Continuous, except interruptions between minutes 25 and 34.	Second pulses of 8 cycles of 1600 Hz modulation. Minute indicated by 600 Hz modulation of 655 ms between seconds 59 and 60.
LOL1	Buenos Aires, Argentina	2	5000 10,000 15,000	1100-1200, 1400-1500, 1700-1800, 2000-2100, 2300-0000	Second pulses of 5 cycles of 1000 Hz modulation. Second 59 omitted. Announcement of hours and minutes every 5 minutes, followed by 3 minutes of 1000 Hz and 440 Hz modulation.
LOL2 LOL3	Buenos Aires, Argentina		8030 17,180	During 5 minutes preceding 0100, 1300, 2100	Minute pulses are prolonged.
LQB9 LQC20	Planta Gral. Pacheco, Argentina		8167.5 17,551.5	5 minutes before 2205, 2350, 5 minutes before 1005, 1150	Second 59 omitted, second 60 is prolonged. OK is transmitted if emission is correct, NV if not correct.
MSF	Rugby, England	0.5	60 2500 5000 10,000	Continuous except 1000-1400 on first Tuesday of each month for maintenance. Between minutes 0-5, 10-15, 20-26, 30-35, 40-45, 50-55	Interruptions of the carrier of 100 ms for the second pulses, of 500 ms for minute pulses. The signal is given by the beginning of the interruption. Second pulses of 5 cycles of 1 kHz modulation. Minute pulses are prolonged.
OLB5	Podebrady, Czechoslovakia	5	3170	Continuous except from 0500-1100 on first Wednesday of each month.	

OMA	Liblice, Czechoslovakia	2	50	Continuous except from 0500-1100 on first Wednesday of each month.	Interruption of carrier of 100 ms at the start of every second; of 500 ms at the start of every minute. The precise time is given by the instant when the amplitude is reduced by 50 percent. Pulses of 5 cycles of 1 kHz modulation (prolonged for the minutes). The first pulse of 5th minute is prolonged to 500 cycles.
		1	2500	Between minutes 5-15, 25-30, 35-40, 50-60 of every hour except 0500-1100 on first Wednesday of each month.	
PPE	Rio de Janeiro, Brazil		8721	During 5 minutes preceding 0030, 1130, 1330, 1930, 2030, 2330	Minute pulses are prolonged.
PPR	Rio de Janeiro, Brazil		435 8634 13,105 17,194.4	During 5 minutes preceding 0130, 1430, 2130	Minute pulses are prolonged.
RAT	Moscow, USSR		5000	Every hour between minutes 30-35, 41-45, 50-60	Second pulses (minute pulses prolonged). Rhythmic signals between minutes 1 and 6, at 0000 and every even hour.
RBU	Moscow, USSR		66 2/3	Between mintues 00-05 of every hour except 2300	Minute pulses prolonged.
RCH	Tashkent, USSR		2500	Between minutes 15-20, 25-30, 35-40, 45-50. From: (1) 0000-0400 and 1100-0000 January 1 to March 31 and September 1 to December 31 (2) 0000-0200 and 1600-0000 April 1 to August 31	Minute pulses prolonged.
			5000	Between minutes 15-20, 25-30, 35-40, 45-50. From: (1) 0530-1030 from January 1 to March 30 and September 1 to December 31 (2) 0230-1530 from April 1 to August 31.	
RID	Irkutsk, USSR		5004	Between minutes 15-20, 25-30, 51-60. From: (1) 0000-0130, 1140-0000 January 1 to March 31 and September 1 to December 31. (2) 0000-0100 and 1800-0000 April 1 to August 31.	Minute pulses prolonged. Rhythmic signals between minutes 1 and 6 at 0000 and every even hour.

			10,004	Between minutes 15-20, 25-30, 51-60. From: (1) 0140-1110 from January 1 to March 31 and September 1 to December 31. (2) 0140-1700 from April 1 to August 31.	Second pulses also transmitted between minutes 5 and 10 at 0100 and all odd hours.
RIM	Tashkent, USSR		5000	Between minutes, 15-20, 25-30, 35-40, 45 05. From: (1) 0000-0400, 1400-0000 January 1 to March 31 and September 1 to December 31. (2) 0000-0200, 1600-0000 April 1 to August 31.	Minute pulses prolonged.
			10,000	Between minutes 15-20, 25-30, 35-40, 45 50. From: (1) 0530-0930, 1000-1330 January 1 to March 31 and September 1 to December 31. (2) 0230-1530 from April 1 to August 31.	
RKM	Irkutsk, USSR		10,004	Between minutes 15-20, 25-30, 51-60. From: (1) 0000 1001, 1800-0000 January 1 to March 31 and September 1 to December 31. (2) 0000-0110-0110, 1800-0000 April 1 to August 31.	Minute pulses prolonged. Rhythmic signals between mintues 1 and 6 at 0000 and all even hours.
			15,004	Between minutes 15-20, 25-30, 51-60. From: (1) 0140-1110 from January 1 to March 31 and September 1 to December 31. (2) 0140-1700 from April 1 to August 31.	Second pulses also transmitted between minutes 5-10 at 0100 and all odd hours.
RTA	Novossibirsk, USSR		4996	Between minutes 5-10, 15-20, 25-29, 35-39. From 0000-0130, 1800-0000 January 1 to March 31 and September 1 to December 31.	Minute pulses prolonged.
			9996	Between minutes 5-10, 15-20, 35-39. From: (1) 0300-0500, 1400-1730 January 1 to March 31 and September 1 to December 31. (2) 0000-0200, 1600-0000 April 1 to August 31.	
			14,996	Between minutes 5-10, 15-20, 25-29, 35-39. From: (1) 0530-1330 from	

				January 1 to March 31 and September 1 to December 31. (2) 0300-1530 from April 1 to August 31.	
RWM	Moscow, USSR		10,000 15,000	Between minutes 30-35, 41-45, 50-60. From: (1) 0000-0420, 1350-0000 January 1 to March 31 and September 1 to December 31. (2) 0000-0220, 1350-0000 April 1 to August 31. Between minutes 30-35, 41-45, 50-60. From: (1) 0450-1320 January 1 to March 31 and September 1 to December 31. (2) 0250-1520 April 1 to August 31.	Minute pulses prolonged. Rhythmic signals between mintues 1 and 6 at 0100 and all odd hours.
RTZ	Irkutsk, USSR		50	Between minutes 00-05 of every hour except 2000.	Minute pulses prolonged.
VNC	Lyndhurst, Australia	10 (Carrier power)	4500 7500 12,000	0845-2130 Continuous except 2230-2245 2145-0930	Seconds marked by 50 cycles of 1 kHz modulation. 5 cycles for markers 55-58 and for markers 50-58 for minutes 5, 10, 15; Marker 59 is omitted. 500 cycles for minute marker. Voice identification during minutes 15, 30, 45, 60.
ZUO	Olifantsfontein, South Africa	4	5000	Continuous	Pulses of 5 cycles of 1 kHz modulation. Second 0 is prolonged.

Chapter 16

Card Swapping

One of the most exciting phases of the SWL hobby has to be the arrival of letters and cards from the various stations which, for the most part, state that the listener has submitted correct and accurate proof of reception to the station. This is the phase that involves the collecting of verifications, or QSLs, and it is, indeed, a very popular part of the hobby. As was pointed out earlier, amateur radio operators also exchange QSL cards as proof of contact with each other. Just as the hams have proud collections of QSLs from their contacts, both near and far, so do many SWLs have equally fine collections of QSLs. It is quite a usual scene when SWLs get together for visits or at club picnics to behold several of those present displaying beautifully bound books containing evidence of their efforts through the years.

STATION CARDS

An offshoot of the practice of sending reception reports and the collecting of stations QSLs came about many years ago when numerous SWLs decided to have their own "station card." Although the listener may have been just that—a listener—and not a licensed operator, there was no reason, it seemed, why he could not also have his own distinctive card made up for swapping with others.

The cards were largely made on the same general order as amateur QSL cards but with an SWL callsign of sorts appearing in place of the amateur's callsign. Thirty or forty years ago, it was a simple matter to have cards made up with an SWL callsign of, for example, W3-SWL (indicating that this SWL lived in the third radio district). Many SWLs had cards such as this made up but with the hyphen omitted, thus making the "callsign" have the appearance of an amateur radio callsign. In more recent years, however, with many thousands of enthusiasts receiving their amateur licenses, the SWL callsign of W3-SWL or W9-SWL was actually issued by the Federal Communications Commission as a bona-fide amateur radio callsign. This meant, in effect, that any SWL who continued to use a call like W3-SWL, or something similar, within an amateur call area where that actual callsign had been issued was doing so in a manner that was virtually illegal. Therefore, a new type of callsign for the SWL had to be devised and we discuss that in Chapter 18.

With the advent of the new type callsigns for SWLs, more and more of the hobby enthusiasts have had their own cards printed up. Some are regally made works of art; others are simple, homemade specimens that serve the purpose; still others use picture postcards with the additional hobby information imprinted on them.

USE OF SWL CARDS

These SWL cards are often used when submitting reception reports to shortwave stations. This is frowned upon in many areas of the hobby, since the inclination is for the listener to simply make out a brief report to a radio station, stick enough postage on the card to get it there, and mail it. The station gets a brief and usually worthless report and no return postage for their QSL if the report is sufficient. As stressed earlier, SWL cards may be included with a more detailed written report, but the card

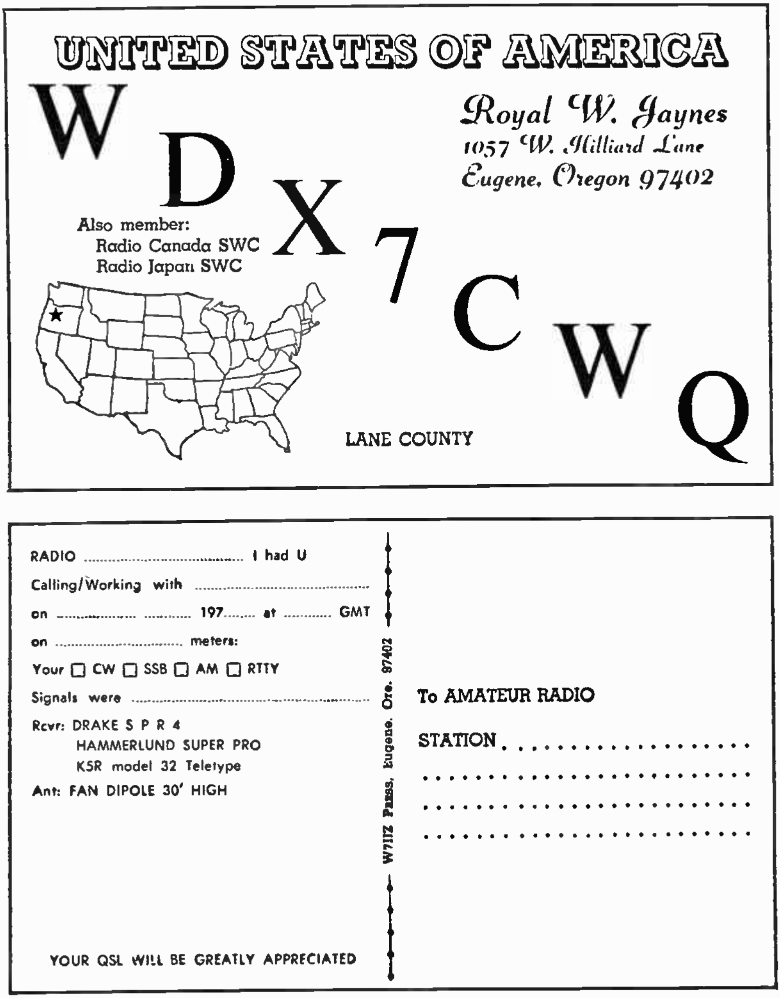
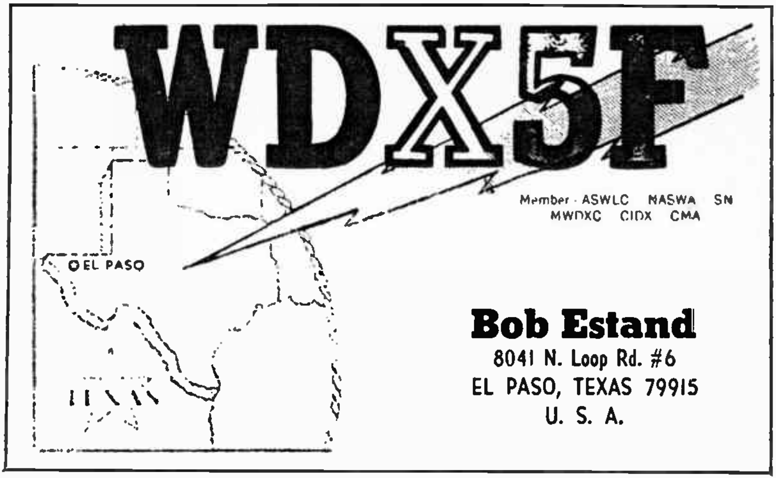


Fig. 16-1. A selection of SWL cards in various styles.



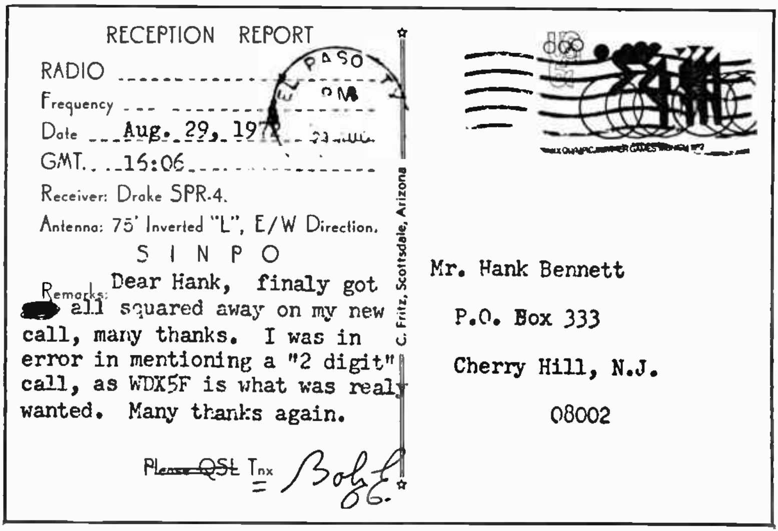
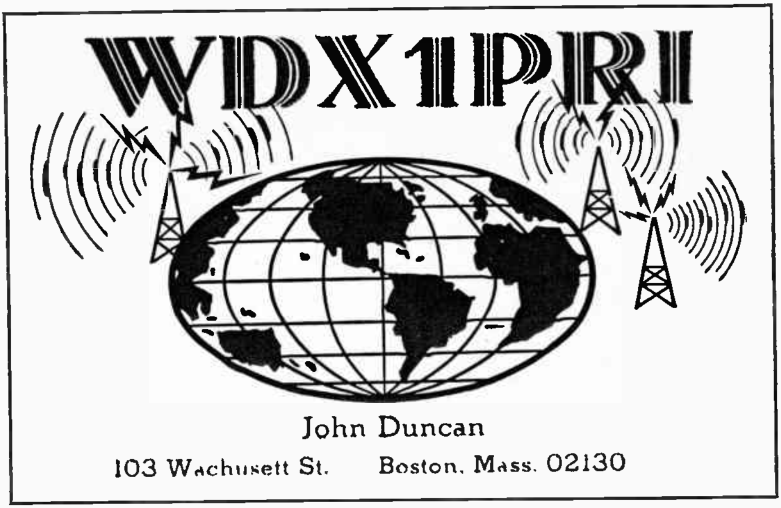


Fig. 16-1. Con't.

itself should never be used for a reception report to any broadcasting station, since there just is not enough room on it for a satisfactory resume. Cards are okay to a point, where reports to amateur radio stations are concerned, because many of the ham operators realize that the listener is trying to build up a collection of QSL cards and the information does not have to be nearly as conclusive as is required for reports to broadcasting stations.

Many SWLs, in addition to trying to hear all of the countries of the world, or all of the states in the United States, or all of the provinces and territories in Canada, also try to get SWL cards from other hobbyists in every state and, in some isolated cases, from every county in the United



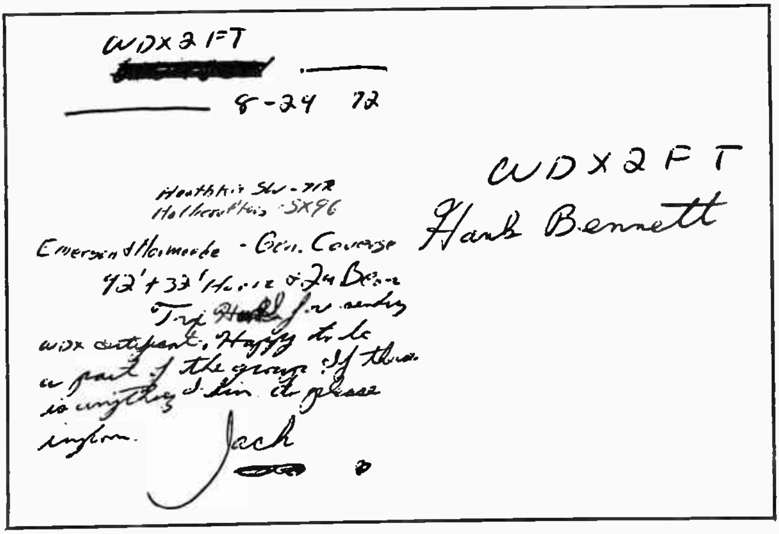
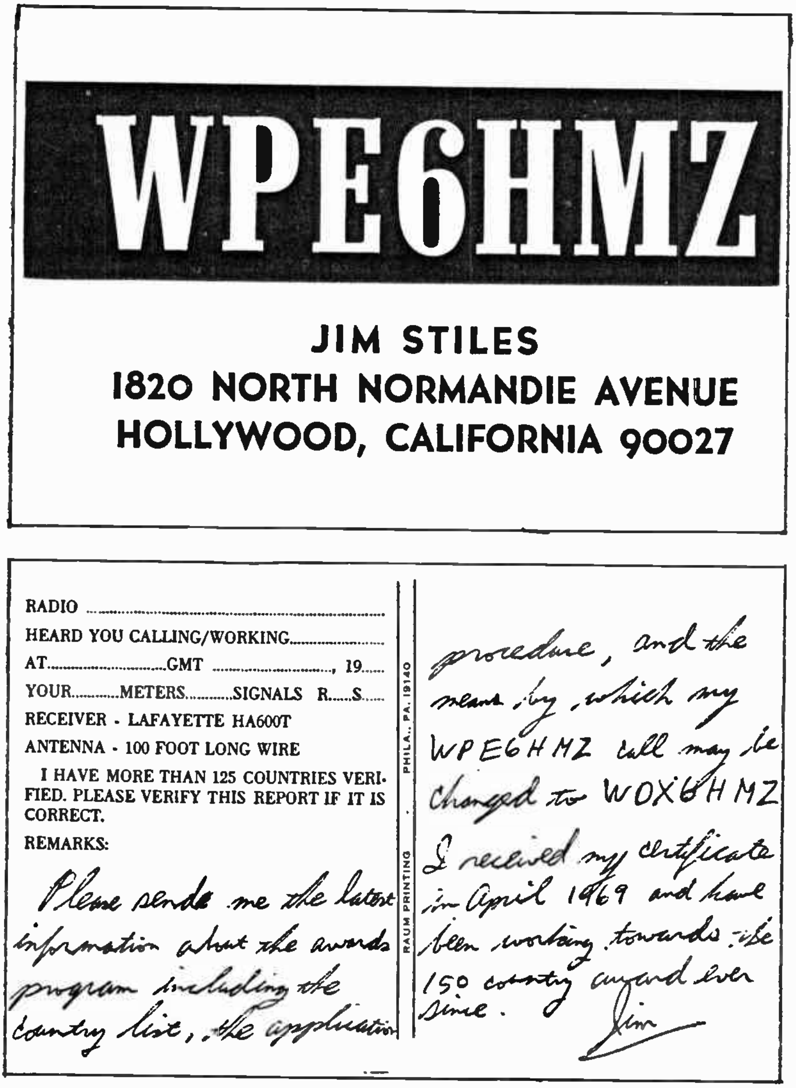


Fig. 16-1. Con't.

States. Some SWLs prefer not to send reception reports, but they will avidly swap SWL cards with anyone who has a card to swap with them. And don't kid yourself into thinking that this is easy, either. Some of the lesser populated states have a resounding scarcity of SWLs to begin with, and those who are in the hobby may not choose to engage in the swapping of SWL cards purely for the sake of it. Further, a card swapper in Nevada, for example, can find his hobby funds quickly exhausted when SWLs in the other 49 states find that a card swapper exists in a "rare" territory. On many occasions, I have seen Nevada card swappers throw in the towel or, at best, **demand** (not request!) that return postage



WPE6HMZ

JIM STILES
1820 NORTH NORMANDIE AVENUE
HOLLYWOOD, CALIFORNIA 90027

RADIO ....
HEARD YOU CALLING/WORKING..........
AT..........GMT ...., 19......
YOUR..........METERS..........SIGNALS R......S......
RECEIVER - LAFAYETTE HA600T
ANTENNA - 100 FOOT LONG WIRE
I HAVE MORE THAN 125 COUNTRIES VERIFIED. PLEASE VERIFY THIS REPORT IF IT IS CORRECT.
REMARKS:

Please send me the latest information about the awards program including the country list, the application procedure, and the means by which my WPE6HMZ call may be changed to WOX6HMZ. I received my certificate in April 1969 and have been working towards the 150 country award ever since. Jim

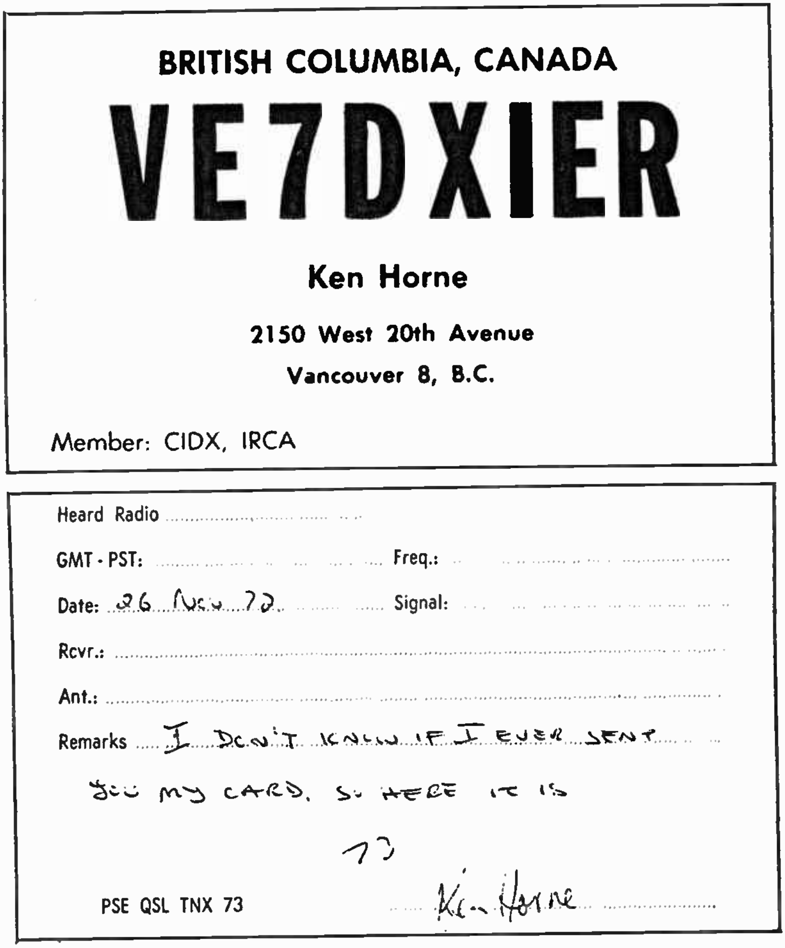
RAUM PRINTING · PHILA., PA. 19140

Fig. 16-1. Con't.

be sent by everyone who wants his card. We're not necessarily criticizing that practice; just merely pointing out that in card swapping, as in ham radio, rare areas actually do exist. Some of the active radio clubs maintain regular listings of card swappers. The Newark News Radio Club often has such a listing.

CARD DESIGN

A good SWL card should be attractive but not gaudy. It should contain your SWL callsign, if you have one, your name, address, and a short



BRITISH COLUMBIA, CANADA

VE7DXIER

Ken Horne

2150 West 20th Avenue

Vancouver 8, B.C.

Member: CIDX, IRCA

Heard Radio ....

GMT - PST: .... Freq.: ....

Date: 26 Nov 72 .... Signal: ....

Rcvr.: ....

Ant.: ....

Remarks I DON'T KNOW IF I EVER SENT

YOU MY CARD. SO HERE IT IS

73

PSE QSL TNX 73 Ken Horne

Fig. 16-1. Con't.

resume of your listening post equipment. It can, but does not necessarily have to, have additional spaces for reception report purposes, if the cards are going to be sent to ham operators. This should include the name of the station being heard as well as the one being worked, the time, date, frequency band, and a signal report.

A large number of SWL and QSL card printers are available to print your cards for you, based either on samples of their own, or to your specific order. Cards come in many colors and styles. However, most of them conform to the more-or-less standard size of the post office postcard. (If they are larger than the government postcards, you will pay extra postage to mail them!) You can find a list of card printers in the classified advertisements of the radio amateur magazines. Many of the card printers will send you a selection of samples in return for a small fee, usually a half-dollar or less (and sometimes this will be refunded if

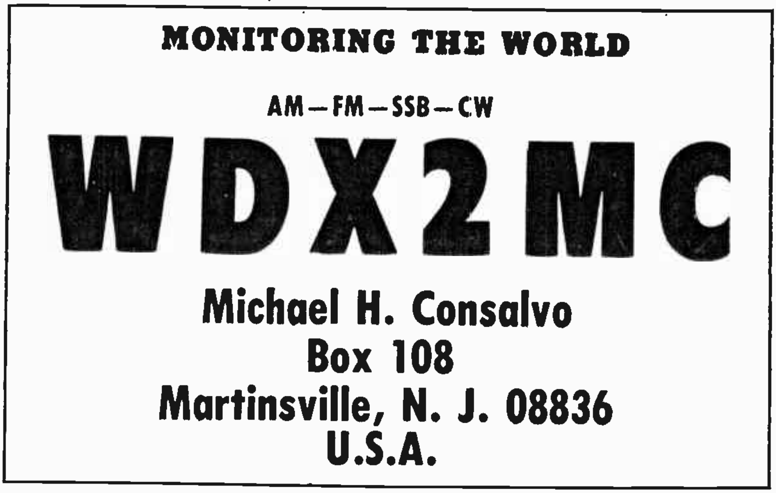


Fig. 16-1. Con't.

you order your cards from them). We suggest that you send for a few samples, if you're seriously interested in having your own station card. Check them over and try to find one that suits your needs. Or you can use the sample as a basis for something of your own design.

When mailing your SWL cards to other swappers, we suggest you use commemorative postage stamps whenever you can obtain them. Many card swappers are also stamp collectors and they'll appreciate the fact that you are helping them in two hobbies at one time!

In closing this chapter, we'd like to point out the importance of having your own SWL callsign; one that is recognized in the hobby. Do not have any cards printed with an SWL callsign chosen strictly at random, because it might be an actual amateur radio licensed call and it might also be an SWL callsign that someone else is properly using. Read further on in this handbook and find out how you can obtain your own distinctive and personalized callsign and then go and get your cards made up. And be sure to send one along to us!

Chapter 17

Radio Clubs

A radio club is often thought of as being a group of persons, having a common interest, meeting on a specified date, at a specified time, in a specified meeting place. The meeting consists, after an opening, of the minutes of the previous meeting, a financial report, reports from various committee heads, correspondence, old and new business, and the closing. There may or may not be a guest speaker and refreshments followed by a general gab session among those present.

Many of the amateur radio clubs and other social, church, and service organizations follow this general agenda. And this is fine for those who are within easy traveling distance of any particular meeting.

But what about the SWL? What kind of a club can he join? About the only type of club that is organized on many local-area levels, and in which there might be a similar interest, is the amateur radio groups. Many of these are organized on a county or regional basis with regular monthly meetings, but unless you know when and where the meetings are, you aren't going to be able to attend.

Most amateur radio clubs that we know of welcome shortwave listeners to their meetings. And a good many of them go all out to help the SWL, especially if they realize that the SWL is interested in becoming a ham radio operator. Code practice sessions and good instructive theory classes are held regularly. Some clubs even have members assigned to this single function in order to help the SWL prepare for the day when he will be taking his amateur radio license examination.

On the other hand, I was once invited to an amateur radio club in Michigan by a then-member of the club. At the time, as now, I was a fully licensed amateur radio operator. However, when I was present at the meeting, it was announced that because a stranger was there, the club would be unable to conduct its regular business meeting. At the close of this "meeting," all regular members present were invited to partake in refreshments. The stranger was invited to purchase whatever refreshments he wanted. I left and have never returned to that unfriendly organization despite many subsequent trips to the same city.

I'm sure that such an attitude on behalf of a few club officials is not indicative of amateur radio clubs as a whole. As stated before, most clubs welcome outsiders to their meetings and will literally roll out the red carpet for them.

But have you ever heard of a club for the SWL that is conducted on a local level? A place where the interested SWL can go once a month, for a meeting, perhaps an interesting speaker, and a gab session and refreshments afterward? No? Neither have I.

SWL CLUBS

So what is the SWL to do? Way back in 1927, a group of fellows in and around Newark, New Jersey, asked themselves the same question. They went out, got themselves loosely organized into club form, and became chartered as the Newark News Radio Club. From the beginning and until recently, the club was more-or-less sponsored by the **Newark News** newspaper. Unfortunately, that fine newspaper passed into oblivion within the past few months, but the club carries on.

The original members held monthly meetings, received some very fine publicity, both from the newspaper and as a result of being "on the air" over a radio station in upstate New Jersey, and soon began receiving inquiries from other interested SWLs in New York, Pennsylvania, Ohio, and a dozen or more states. The NNRC began to come to life as the first of the so-called mail order radio clubs. Periodic bulletins were issued that covered the radio news of the day; meetings were held in which anyone in the area was invited to attend, and no one was denied membership because of race, national origin, or religion. This pioneer of the radio clubs is still going strong today, and we still have some of the original charter members present.

Regular monthly board of directors meetings are held, following parliamentary procedure, but on a very friendly and informal basis; club members who are not official members of the board are welcome to attend or to present their views in writing, and nonmembers are also welcome to attend the meetings in company with a member. The NNRC publishes a monthly bulletin that covers virtually every phase of shortwave listening. Additionally, the club sponsors a picnic-convention yearly that is held somewhere within the Middle Atlantic States. Again, nonmembers are warmly welcomed.

The Newark News Radio Club is certainly not the only SWL club that is available. There are others that cater to your interest in the hobby. Some of the clubs, like the NNRC, cover many phases of the hobby, while others are more specialized. All of them issue periodic bulletins to their members. In most cases, the bulletins are reproduced by mimeograph, while some are offset. The bulletins may run upward of 50 to 60 pages per month. All of them do a great job for their members and in virtually every instance, all of the club work, including publishing of the bulletin, is done on a volunteer basis with no thoughts of remuneration.

The clubs that are listed below will welcome your inquiries and membership. Many of them have been in business for years, while others are fairly new to the scene. However—and this is important—the author and the publisher of this handbook cannot be held responsible in the event that any of the clubs fail to produce. At the time that this list was compiled, all of the listed clubs were in good sound condition. We urge you to contact the clubs for membership and dues requirements. In view of the ever-changing financial picture, we will not list the dues requirement, but all of them are currently between $5 and $13 per year, and for the information and fellowship that can be obtained, this is money well spent.

Newark News Radio Club, P. O. Box 539, Newark, New Jersey 07101. They issue a monthly mimeographed bulletin covering the BCB, amateur, shortwave broadcast, utility, FM, and TV bands, plus columns for the card swapper and tapesponders.

American Short Wave Listeners Club, 16182 Ballad Lane, Huntington Beach, California 92647. This club covers BCB and shortwave broadcast only, but they may have other topics from time to time.

North American Shortwave Listeners Association, P. O. Box 8452, South Charleston, West Virginia 25303. This publication, **Frendx**, is basically shortwave broadcast only and they cover it in perhaps more detail than any other club.

International Radio Club of America, 6059 Essex Street, Riverside, California 92504. They publish **DX Monitor** weekly during the DX season, less often at other times, for a total of 34 issues yearly. They feature eastern, central, and western DX reports and DX forum columns, "DX Worldwide," and many special features. Members participate actively in a strictly democratic club government. This is a BCB club only.

National Radio Club, Box 99, Cambridge, Massachusetts 02138. This, too, is a medium-wave club only. They publish **DX News**, an offset magazine, 32 times a year (weekly during the winter DX season). Their main columns are "Musings of the Members," "International DX Digest," and "Domestic DX Digest," plus special features and technical articles.

Worldwide TV-FM DX Association, Box 163, Deerfield, Illinois 60015. Their monthly **VHF-UHF Digest** is for TV and FM hobbyists. Regular features include FCC FM and TV news, "North of the Border" (for Canadian FM and TV news), Techni-Corner, Tech-Notes, Statistics, eastern, central, and western TV DX report columns, northern, western, and southern FM DX report columns, VHF radio DX, FM, and TV QSL corners, TV and FM unidentified columns, DX photographs, and TV station logos to help identify DX. A full line of club supplies is available.

SPEEDX, Box 321, Santa Ana, California 92702. A monthly offset magazine covers shortwave broadcast and utilities only. The shortwave portion is divided into Western Hemisphere, Europe-Africa, Asia-Oceania sections. They have QSL columns for shortwave broadcast and utility station, articles, pictures, station schedules, "SPEEDXTRAS," "DX Montage" and, last but not least, a midmonthly "SPEEDXGRAM" on request.

Swaps Newsletter, 801 South Fairview, Apartment U-1, Santa Ana, California 92704. This is basically a club for those interested in card swapping.

Canadian International DX Club, 169 Grandview Avenue, Winnipeg, Manitoba R2G OL4, Canada. Their **Messenger** features shortwave, amateur, and BCB news, plus other features and articles.

International Shortwave League, 60 White Street, Derby, England. This club covers broadcast and amateur bands and includes features for the transmitting amateur and VHF enthusiast.

International Shortwave Club, 100, Adams Gardens Estates, London, S. E. 16, England. They have a bulletin printed on legal-sized paper covering mainly shortwave broadcast but with a bit of ham radio news.

The author has not seen recent publications of the above two English clubs, but it is our belief that they are still very much alive and in business.

One of the newest clubs on the scene is the **Lunar (AM-SSB) Club**, P.O. Box 283, Bell, California 90201. As this was written, I have little information about this club, other than the fact that it is working with a handicapped aid program. Full details may be obtained from Wes Ogden, president of the club.

If, in our intent to list all of the clubs, we have omitted any, the fault is that of the author. I have no desire to slight any club, but if I succeeded in doing just that, I offer a sincere apology.

CLUB ASSOCIATIONS

A number of years ago, it came to our attention that several of the European and Scandinavian clubs had banded together to form an association among the clubs. The main purpose, as it was understood, was to create an overall body composed of elected members of each of the participating clubs whose primary function would be to eliminate petty bickering between the various clubs and to form a policy on various subjects that would meet with the approval of all member clubs. I made an attempt to create a similar organization in North America and, after considerable discussion with many prominent DXers, Mr. Don Jensen accepted the first chairmanship.

The primary purpose of the new organization, the **Association of North American Radio Clubs (ANARC)**, as it was established early in 1964, was to develop a means of working together, furthering interclub cooperation, and lessening the communication gaps between various clubs.

Under Mr. Jensen's able leadership, a constitution was formed. Any decisions that had to be made were voted upon by the membership of ANARC; the membership was composed of representatives from each of the participating clubs with voting proportional to club membership. The structure also allowed member clubs to remain fully independent as well as to reap the benefits of working together on many fronts, working on a basis of voluntary cooperation rather than of compulsion.

The role of ANARC continued to develop over the succeeding two-year terms of Gerry Dexter, Gray Scrimgeour, and Wendel Craighead as executive secretary. Mr. Scrimgeour's successful election is symbolic of the involvement of many DXers in Canada with the work and ideals of ANARC (Mr. Scrimgeour is a resident of Toronto, Ontario).

The most visible function of ANARC is its annual convention which draws together hobbyists from all areas of DXing and all phases of the hobby. Speakers of great interest to the hobby, displays of equipment, news publications, general gabfests, DXing parties lasting into the wee hours, and a general good time are always on the schedule. The personal contact across club lines is particularly beneficial for the goodwill generated at such times.

Other ANARC functions are carried out in committees, such as the QSL committee (seeking to improve verification policies of the more reluctant broadcasters), the public relations committee (getting the hobby before the listening public), the manufacturers liaison committee (letting radio equipment producers know what the hobbyists would like) and other committees. Communication is via the monthly ANARC Newsletter which carries information from one segment of the hobby to another, as well as keeping the ANARC committees in touch. Individual subscriptions are available. Please write Mr. Al Reynolds, P. O. Box 3012, Jackson, Tennessee 38301.

Smaller clubs (less than 50 members) and new clubs may become associate member clubs, which puts them into communication and into idea-sharing via the newsletter. Further growth in the club membership roles will make them eligible for full voting membership.

The future course of the association depends on the individual hobbyist and his club, large or small, for ANARC exists to make the hobby more rewarding for all of us and to provide a friendly handclasp between DX clubs of all types.

The various clubs, as has been pointed out, are very much alive and any of them would appreciate your membership. All of the clubs will be glad to send you a sample bulletin upon request, but please send 50 cents to cover the cost of mailing and handling for each sample. (Exceptions: Canadian International DX Club, 20 cents; American Shortwave Listeners Club, 75 cents; SPEEDX, $1.00.)

Bear in mind that in holding a club membership, you have the right to take part in all club functions, the main one of which is the club bulletin. Your loggings of what you have heard over the past month may not seem like very much to you, but they are bound to help someone else who may have been in the hobby an even shorter time than you. By the same token, the reports from older, more experienced members will assist you in finding new stations on your dials and help you to make many new loggings in your logbook. The dues-paying member is a valuable asset to any club. The active club member is a valuable asset to everyone. Join a club, any of them or all of them, but don't be content to sit back and simply read the bulletins. Do your part to make the bulletins bigger and better. Remember that just as you depend on help from the older members, so do the newer and younger members depend on you to help them.

Chapter 18

WDX Callsigns and Awards

As the SWL hobby ranks swelled, it became necessary to devise a system whereby the SWL could have a call of his own, similar to those issued by the government to hams but different enough so that there would be no conflict with the real thing.

A gentleman in Ohio undertook this task several years ago by issuing callsigns (or identifiers, as they are more properly called) bearing a WRO prefix, followed by a number and two or three additional letters; the number, of course, was to indicate the radio call area in which the applicant lived. However, the demand for these personalized callsigns was so great that the gentleman reportedly was unable to keep up with it and the system was taken over by one of the trade magazines and virtually started over again from scratch and with a new prefix. At the same time, a new 8½-by-11-inch certificate was issued and this bore the identifier and the name and city location of the applicant.

CURRENT SWL IDENTIFIERS

Several years and several thousand certificates later, the decision was made to phase the program out of the magazine. Upon an urgent request of the author, the program was turned over, almost totally intact except for a few of the earliest records, and the program was reactivated under the name of **Monitor and DX Headquarters** and all new certificates were made with the prefix of WDX. Since that time, in 1970, the WDX program has been rolling along and thousands of the old WRO and WPE certificates have been reissued with the new WDX prefix; additional thousands of new WDX certificates have been issued to interested applicants.

The only requirement that is necessary in order for you to obtain your own WDX shortwave listening monitor certificate is a sincere interest in radio listening—any phase of it. The cost is $1 for a general issuance certificate with your identifier issued in regular alphabetical order; $2 if you would like to have your initials or any other specific set of two or three letters as part of your callsign-identifier; $5 if you would like one of the rare one-letter callsign-identifiers (such as WDX2H, WDX9K, or WDX5Y).

AWARDS

Monitor and DX Headquarters also has a DX awards program available wherein listeners can apply for certificates attesting to their achievement in the field of collecting verifications (after you have first obtained your WDX monitor certificate). These awards are broken down into four categories: The country award is available in steps of 10, 25, 50, 75, 100, 125, and 150 countries verified, with gold-printed certificates of excellence for those who have more than 150 countries verified; the state award in steps of 10, 20, 30, 40, and 50 states verified; the Canadian area award in steps of 4, 6, 8, 10, and 12 provinces and territories verified; and the zone award in steps of 5, 10, 20, 30, and 40 zones verified. These certificates are printed in much the same style as the WDX monitor certificates, but they are approximately one-half the size. All of the award certificates are $1 each.

Complete information on the WDX monitor certificates and DX awards may be obtained for return postage from the author, at P. O. Box 333, Cherry Hill, New Jersey 08002.

Many amateur organizations also issue awards to hams and SWLs for operating or listening proficiency. These awards are given for logging and verifying a given number of hams belonging to a certain club, or in a given number of areas of the world, a certain number of hams in a given country, or city, or county, and any number of other categories. The Certificate Hunters Club is run by Cliff Evans, K6BX, Bonita, California 92002. The CHC publishes a book called the **Directory of Awards and Certificates**, which lists most of the awards available to both hams and SWLs from over 50 countries around the world.

The American Radio Relay League, Newington, Connecticut 06111, also sponsors several award programs, but these are for amateur operators only.

Many of the SWL clubs have their own awards program of one kind or another and most of them are, of course, for members only. When you decide to join a club, be sure to inquire about their DX award programs.

At periodic times throughout the year, the ARRL sponsors various contests and competitions for amateur radio operators; these are based primarily on how many stations in how many countries can be worked by any given individual, or, in the case of the ARRL Field Day, how many stations in how many amateur sections can be worked by any given radio club or group; this latter is generally done through the use of emergency power systems rather than the more readily available commercial power lines. Coinciding with these competitions, some of the SWL clubs, notably NNRC and ISWL, also hold competitions of their own for their members. The basic object is to log as many different countries and as many different prefixes as possible during the contest period, usually 48 hours. These contests give the listener a chance to show other SWLs how good his DXing skill really is. It also gives the serious DXer a good chance to build up his number of states, countries, zones, and Canadian areas heard. And if you can get QSLs from a number of them, you'll be well on your way toward a WDX award!

HANDICAPPED AID PROGRAM

Early in 1972, a handicapped aid program (HAP) was instituted by the SPEEDX Club and is, to the best of our knowledge, the first and only such program in existence today, at least among the SWLs. The purpose and operation of the HAP is to seek out and introduce shortwave listening to the physically disabled. Handicaps include both those with birth defects and those with afflictions acquired later in life. Further, HAP will make every effort to aid those already in the hobby by supplying replacement equipment or technical and lay information, or by providing the help of one or more of its service committees for their full enjoyment of the hobby. All of these benefits are available to any novice or advanced handicapped shortwave listener.

At the time of the formation of the HAP, Editor Jack White of the SPEEDX Club asked Mr. Gene Moser of Coloma, Michigan, to not only spearhead the program but to consent to being its first chairman. Two months of planning saw the development of Progress Reports which later became known as **HAPpenings**, a monthly feature of SPEEDX. News of the project is carried in several publications; additionally, support is given by the European DX Council and by Harry van Gelder of Radio Nederlands' "DX Juke Box."

By the end of 1972, HAP was working with six disabled persons, three of whom are enjoying the hobby today. Six clubs have appointed representatives to HAP to help support the growth of the project.

HAP makes every effort to seek out the physically disabled through referrals from sister clubs, newspaper articles, shortwave broadcasts, direct contact, and through any other means so that those afflicted can learn of the hobby and receive voluntarily given step-by-step guidance.

HAP services are free and include placing of receivers, antennas, headphones, and other items of equipment. A free membership in SPEEDX, as well as in one of the newer clubs, Lunar (AM-SSB) Club (P.O. Box 283, Bell California 90201), are given. The HAP Welcome Wagon contacts all new members and offers to help with any questions they may have. A HAP Pal is assigned to offer information and friendship. Also provided are various club bulletins, antenna and equipment leaflets, and a list of clubs.

For those in shortwave listening, HAP will endeavor to replace lost equipment and do whatever else is possible to make the journey of the handicapped into the SWL hobby more enjoyable.

HAP continues to grow and, as a result, Bill Paschke of Swaps Newsletter has been appointed vice chairman. Additionally, Ted Polling of the American Short Wave Listeners Club is the HAP Pal vice chairman. In 1973, HAP formed its Welcome Wagon and the office of HAP chaplain. Both are filled by Don Johnson whose job it is to send get-well and sympathy cards to any shortwave listener in any club when the information is brought to his attention. A translation committee has been formed so that communications can be carried on, when necessary, in French. German, and Spanish. Future plans call for a general translation service that will be available to all SWLs at a small fee which will help support HAP's work.

The goal of HAP is twofold. First, to educate and aid the individually disabled man or woman in matters concerning the hobby, and to reach into rehabilitation centers and veterans hospitals, and, secondly, to seek the services of all of the major SWL clubs so that the benefits of HAP can be made known and available for a far greater majority rather than just a few.

HAP does not look at a handicapped person from the standpoint of race, color, national origin, or the club in which he may have membership, if any. Likewise, HAP has no intention of interfering in any way with the internal affairs of any club.

Memberships in and services of HAP are free to qualified persons; funds for the program are received from the sale of the SPEEDX Utility DXers Handbook and the U.S. Coast Guard DX Handbook. HAP also sells rubber stamps and supplies. Their budget also provides for a bimonthly HAP-I-GRAM, which is sent to all clubs and United States and foreign associates.

There are thousands of physically handicapped persons in the world. Some have been handicapped from birth, while others have been afflicted in later life. Blindness in both instances can be a factor in bringing loneliness to their lives. To teach the hobby of SWL to those who have no sight, HAP went to noted DXer Arthur Cushen of New Zealand who is, himself, sightless. Mr. Cushen recorded a Blind DXers Course, which HAP has put on tape in both cassette and open-reel form. The course is nontechnical and available to any blind or legally blind person.

Further information on this extremely important and voluntary phase of shortwave listening can be obtained from Chairman Gene Moser, 6805 Woodland Court, Coloma, Michigan 49038. If you know of anyone who may be interested in shortwave listening and who is suffering from a handicap, please get in touch with Mr. Moser.

Late information as this was written indicates a possibility that the Newark News Radio Club is considering the possibility of making its monthly bulletin available to the blind. Further details will be made available through the club when details have been finalized.

WORLDWIDE SUNRISE-SUNSET MAPS

In order to aid DXers in their never-ending search for more and better DX, a set of maps was prepared, showing the times of sunrise and sunset for each month for the entire world (Fig. 18-1). These maps appear in **DX Monitor**, the publication of the International Radio Club of America, each month, approximately a month before needed. These maps are accurate to about 15 minutes, which should be sufficient for most purposes. For more accurate values of the times of sunrise and sunset, it is recommended that tables of such times be consulted. **Useful Tables from the American Practical Navigator**, published by the United States Hydrographic Office, and printed by the U.S. Government Printing Office, Washington, D.C. 20402, was the source of the data presented in this series of maps.

In using these maps near the beginning or end of a month, approximate times of sunrise and sunset can be determined by comparing the times given on the two nearest maps.

All questions pertaining to their use should be directed to the author and draftsman of the maps, Father Jack Pejza, 3266 Nutmeg Street, San Diego, California 92104. A complete set of maps with an instruction sheet may be obtained for 50 cents in coins or stamps, from Don Erickson, International Radio Club of America, 6059 Essex Street, Riverside, California 92504.

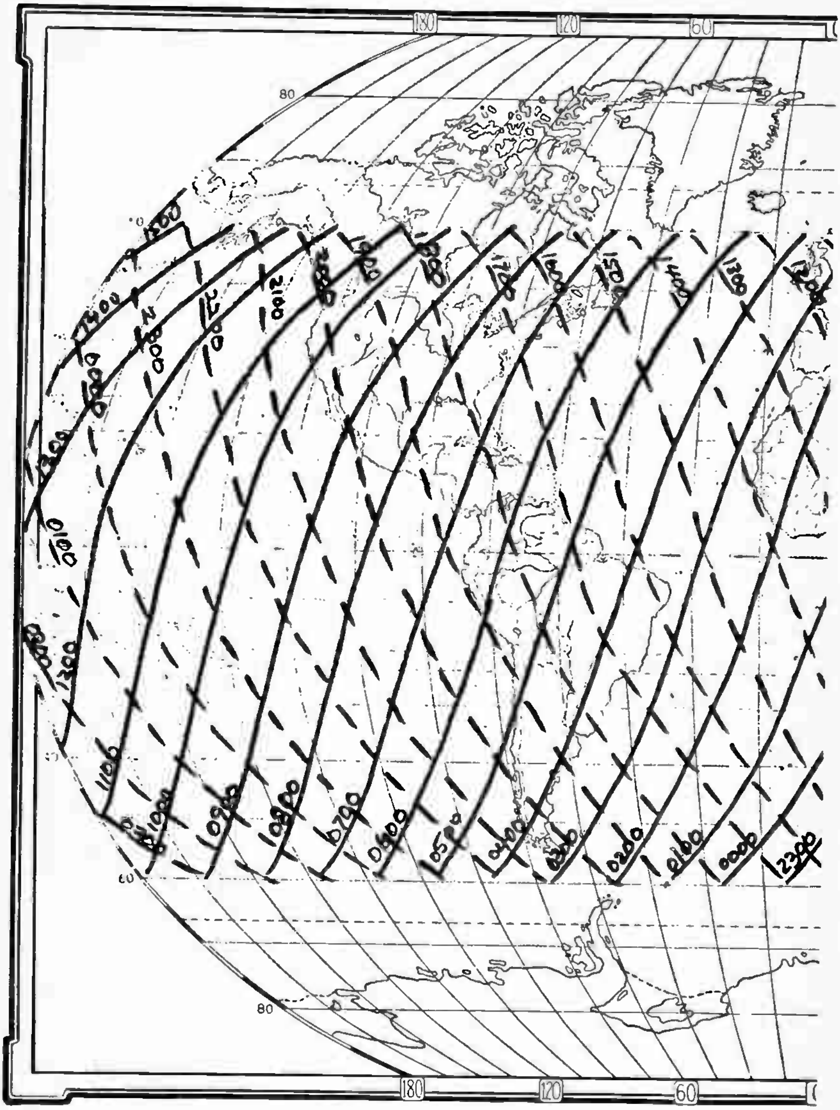
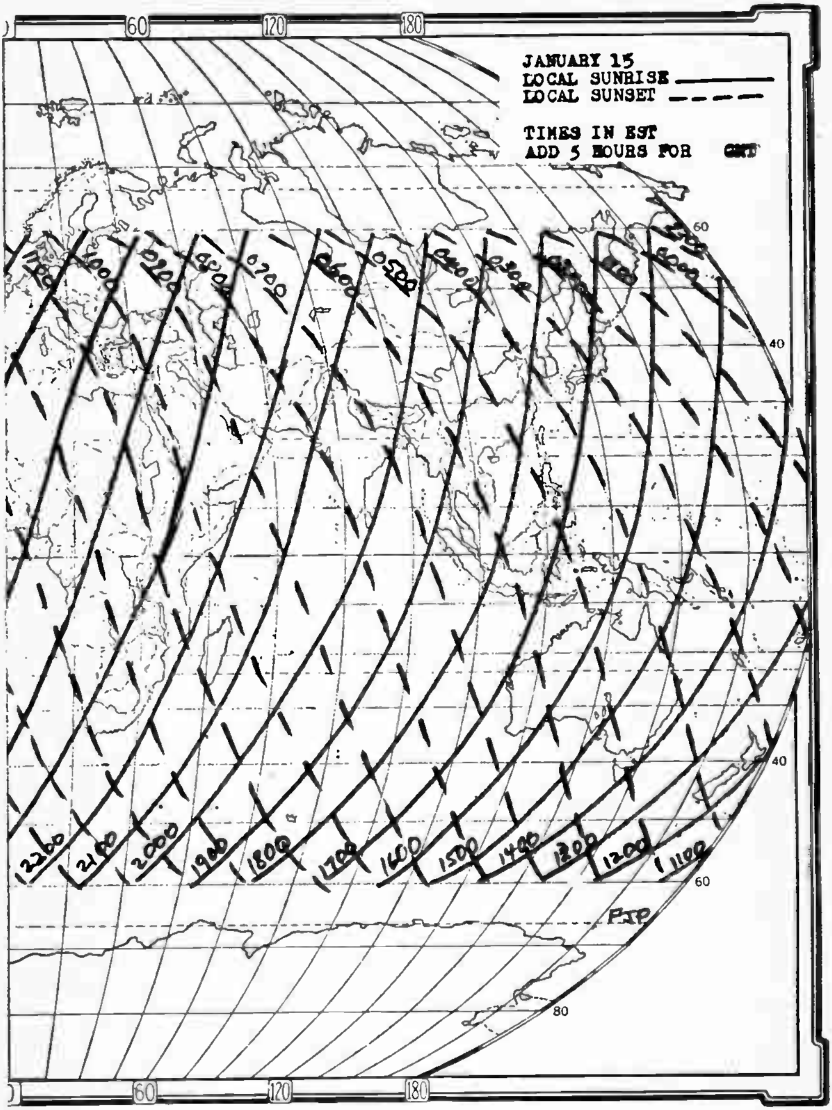


Fig. 18-1. Sunrise-sunset map for January. Maps are available



for each month of the year. Time shown is EST.

Appendix

Appendix

State	Location	Call	Freq. (kHz)
Alabama	Birmingham	BHM	224
Arizona	Tucson	TUS	338
	Winslow	INW	226
Arkansas	Texarkana	TXK	329
California	Blythe	BLH	251
	Fresno	FAT	344
	Los Angeles	LAX	332
	Oakland	OAK	362
	Red Bluff	RL	338
Colorado	Denver	DEN	379
	Trinidad	TAD	329
District of Columbia	Washington	DC	332
Florida	Jacksonville	JAX	344
	Miami	MIA	365
	Pensacola	PNS	326
	Tampa	TPA	388
Georgia	Atlanta	ATL	266
Idaho	Boise	BOI	359
	Idaho Falls	IDA	350
Illinois	Chicago	MDW	350
Indiana	Indianapolis	IND	266
Kansas	Garden City	GCK	257
	Wichita	ICT	332
Louisiana	New Orleans	MSY	338
Maine	Millinocket	MLT	344
Massachusetts	Boston	BOS	382
Michigan	Detroit	DTW	388
	Houghton	CMX	227
	Sault Ste. Marie	SSM	400
	Traverse City	TVC	365
Minnesota	Duluth	DLH	379
	Minneapolis	MSP	266
Mississippi	Jackson	JAN	260
Missouri	Kansas City	MKC	359
	St. Louis	STL	338
Montana	Billings	BIL	400
	Bozeman	BZN	329
	Great Falls	GTF	371
	Miles City	MLS	320
	Missoula	MSO	308
Nebraska	North Platte	LBF	224
	Omaha	OMA	320
Nevada	Elko	EKO	391
	Las Vegas	LAS	206
	Tonopah	TPH	221
New Jersey	Newark	EWR	379
New Mexico	Albuquerque	ABQ	230
New York	Elmira	ELM	375
North Carolina	Raleigh	RDU	350
Ohio	Cincinnati	LUK	335
	Cleveland	CLE	344
Oklahoma	Oklahoma City	OKC	350
	Tulsa	TUL	245
Oregon	Pendleton	PN	341
	Portland	PO	332
	Redmond	RM	368
Pennsylvania	Pittsburgh	PIT	254
South Carolina	Charleston	CHS	329
	Spartanburg	SPA	248
South Dakota	Rapid City	RAP	254
Tennessee	Knoxville	TYS	257
	Nashville	BNA	304
Texas	Amarillo	AMA	251
	Big Spring	BGS	326
	El Paso	ELP	242
	Fort Worth	FTW	365
	Houston	HOU	206
	San Antonio	SAT	254
Utah	Delta	DTA	212
	Ogden	OGD	263
Vermont	Burlington	BR	323
Virginia	Roanoke	ROA	371
Washington	Seattle	SJ	260
	Spokane	GEG	365
Wisconsin	Milwaukee	MKE	242
Wyoming	Casper	CPR	269
	Rock Springs	RKS	290

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

WORLD WIDE TIME CHART

Newcomers to the shortwave listening hobby will find what appears to be several different forms of time used, depending on the station to which they are listening. Stateside broadcast band stations stick almost entirely to the well known a.m.-p.m. system. Shortwave stations is virtually every country of the world base their time upon Greenwich mean time, which is five hours ahead of the American eastern standard time. To add to the apparent confusion, most of the shortwave stations also use the 24-hour system instead of straight a.m. and p.m. The 24-hour system is universal and is also used by most DXers in keeping their logs and in sending reception reports. Further, the 24-hour system is generally recorded in GMT, but it can be used in any time zone of the world. In the 24-hour system, 12 o'clock is known as 1200. One hour later, the time is 1300. The midevening hour of 9:00 p.m. is 2100. Any minutes past the hour, of course, are expressed as just that: 23 minutes past 9:00 p.m. is simply 9:23 p.m. or 2123. Midnight is known as 0000, although some sources prefer 2400; the former is far more widely used.

Following is a time conversion chart for many of the larger cities around the globe. Please note that for those persons who have not yet mastered the 24-hour system, eastern standard time is given in the 24-hour system in the second column and in the a.m.-p.m. method in the last column. A more comprehensive table may be found in the **Radio Amateur Callbook Magazine** or the **World Radio-Television Handbook.**

Manila Peking	Tokyo	Melbourne	Hawaii	Rio de Janeiro	Azores	Canary Islands	EST a.m.-p.m.
0800	0900	1000	1400	2100	2200	2300	7:00 p.m.
0900	1000	1100	1500	2200	2300	0000	8:00 p.m.
1000	1100	1200	1600	2300	0000	0100	9:00 p.m.
1100	1200	1300	1700	0000	0100	0200	10:00 p.m.
1200	1300	1400	1800	0100	0200	0300	11:00 p.m.
1300	1400	1500	1900	0200	0300	0400	Midnight
1400	1500	1600	2000	0300	0400	0500	1:00 a.m.
1500	1600	1700	2100	0400	0500	0600	2:00 a.m.
1600	1700	1800	2200	0500	0600	0700	3:00 a.m.
1700	1800	1900	2300	0600	0700	0800	4:00 a.m.
1800	1900	2000	0000	0700	0800	0900	5:00 a.m.
1900	2000	2100	0100	0800	0900	1000	6:00 a.m.
2000	2100	2200	0200	0900	1000	1100	7:00 a.m.
2100	2200	2300	0300	1000	1100	1200	8:00 a.m.
2200	2300	0000	0400	1100	1200	1300	9:00 a.m.
2300	0000	0100	0500	1200	1300	1400	10:00 a.m.
0000	0100	0200	0600	1300	1400	1500	11:00 a.m.
0100	0200	0300	0700	1400	1500	1600	Noon
0200	0300	0400	0800	1500	1600	1700	1:00 p.m.
0300	0400	0500	0900	1600	1700	1800	2:00 p.m.
0400	0500	0600	1000	1700	1800	1900	3:00 p.m.
0500	0600	0700	1100	1800	1900	2000	4:00 p.m.
0600	0700	0800	1200	1900	2000	2100	5:00 p.m.
0700	0800	0900	1300	2000	2100	2200	6:00 p.m.

There are a few countries scattered around the world that do not conform exactly to the procedure of even hours and, therefore, have times that are so many hours and so many minutes ahead of, or behind, GMT. They are as follows:

Country	Deviation from GMT
Newfoundland	—3 hours, 30 minutes
Surinam	—3 hours, 30 minutes
Guyana	—3 hours, 45 minutes
Iran	+3 hours, 30 minutes
Afghanistan	+4 hours, 30 minutes
India	+5 hours, 30 minutes
Sri Lanka (Ceylon)	+5 hours, 30 minutes
Nepal	+5 hours, 40 minutes
Burma	+6 hours, 30 minutes
Cocos, Keeling Is.	+6 hours, 30 minutes
Malaysia	+7 hours, 30 minutes
Singapore	+7 hours, 30 minutes
Northern Australia	+9 hours, 30 minutes
Southern Australia	+9 hours, 30 minutes
Cook Islands	+10 hours, 30 minutes
Nauru	+11 hours, 30 minutes
Norfolk Island	+11 hours, 30 minutes

Abt	About	Mni	Many
AM	Amplitude modulation	Msg	Message
BCNU	Be seeing you	Nw	Now
Bk	Book, break	OM	Old man, male
Bn	Between, been	Op	Operator
C	Yes, correct	Pse	Please
Clg	Calling	R	Received, I copied
CUL	See you later	Rcv	Receive
Cum	Come	Rcvr	Receiver
CW	Code	Rpt	Repeat, report
DX	Distance	Sa	Say
Es	And	Sed	Said
FB	Fine business (good)	Sum	Some
FM	Frequency modulation	Tt	That
Fm	From	U	You
Fone	Phone (radiotelephone)	Ur	Your
Gg	Going	VFB	Very fine business
Gud	Good	Wl	Well, will
Hi	High, laughter	Wx	Weather
Ham	Radio amateur operator	Xmtr	Transmitter
K	Go ahead	XYL	Married woman
Lid	Incompetent operator	Xtal	Crystal
Mi	My	Yf	Wife
Mike	Microphone	YL	Young lady

COMMONLY USED SWL ABBREVIATIONS

You may wonder why we have included two separate lists of abbreviations when they both have to do with radio. In amateur radio work, especially on code transmission, many words are shortened simply to put the point across without having to go through the necessity of spelling out every last letter. Many of the amateur abbreviations are just not used in SWL. By the same token, many ham radio operators will find the SWL list of abbreviations unsuitable to their needs. The following list is by no means official nor totally complete, but is given more as a matter of general information. This list does not include abbreviations of languages; they immediately follow this general listing. The prime users of this list are those SWLs who belong to a radio club and to whom regular monthly reports are submitted.

ABC	Australian Broadcasting Corporation	ASWLC	American Short Wave Listeners Club
AC	Alternating current	BBC	British Broadcasting Corporation
Af	Africa	B/C	Broadcast
AFN	Armed Forces Network	BCB	Broadcast band
AFRTS	Armed Forces Radio and Television Service	CA	Central America
AIR	All India Radio	CBC	Canadian Broadcasting Corporation
AM	Amplitude modulation	CIDX	Canadian International DX Club
Ancd	Announced	Coml	Commercials
Anmt	Announcement		
As	Asia		

Corp	Corporation
CPS	Cycles per second
CW	Morse code
D	Daily
DC	Direct current
DX	Distance
ECNA	East Coast North America
Eng	English (old form still in use)
EST	Eastern standard time
Eur	Europe
FBIS	Foreign Broadcast Information Service
FBS	Forces Broadcast Service
FCC	Federal Communications Commission
FE	Far East
FEBC	Far East Broadcasting Corporation
FEN	Far East Network
FM	Frequency modulation
Fq	Frequency (also known as Freq or QRG)
GMT	Greenwich mean time
GOS	General Overseas Service
Hrd	Heard
ID	Identify, identification
Info	Information
Intl	International
IRC	International reply coupons
IRCA	International Radio Club of America
IS	Interval signal
ISWC	International Shortwave Club
ISWL	International Shortwave League
Kc	Kilocycles (old form)
kHz	Kilohertz (new form)
kW	Kilowatts
LA	Latin America
Lang	Language
M	Measured frequency
m	meters
Mc	Megacycles (old form)
ME	Middle East
MHz	Megahertz (new form)
MW	Medium waves
Mx	Music
N, nx	News
NA	North America
N. Af.	North Africa
NASWA	North American Short Wave Association
NHK	Nippon Hoso Kyokai
NNRC	Newark News Radio Club
NRC	National Radio Club
Pac	Pacific
Pgm	Program
Pop	Popular
Q	(Please refer to Q signals)
R	Radio
RAI	Radiotelevisione Italiana
Rcvd	Received
RCVR	Receiver (also known as Rx)
Rdif	Radiodifusora
Reg	Regional
RFE	Radio Free Europe
RIAS	Radio in American Sector (of Berlin)
RNE	Radio Nacional Espana
Rpt	Report
RST	A reporting code
RTF	Radiodiffusion-Television Francaise
SA	South America
SABC	South African Broadcasting Corporation
S. Af.	South Africa
SBC	Swiss Broadcasting Corporation
Sig	Signal
SINPO	A reporting code
Sked	Schedule
*S/off	Sign off
*S/on	Sign on
SSB	Single sideband
Svc	Service
SW	Shortwave
SWBC	Shortwave broadcast
SWL	Shortwave listener
Tnx	Thanks
UK	United Kingdom
Unid	Unidentified
V	Varies (refers to frequency)
Veri	Verification, confirmation, QSL
VOA	Voice of America
W	West
w	watts
WCNA	West Coast North America
WI	West Indies
WRTVH	World Radio Television Handbook
Wx	Weather
X	Approximate
Xmsn	Transmission
Xmtr	Transmitter
—	Dual, parallel
30	End of transmission
73	Best regards
88	Love and kisses

*Gradually being adopted by DXers and SWLs is the new system of an asterisk (*) placed before a listed time in a report to indicate sign-on time, or after a listed time to indicate sign-off time. Thus, *1130 would indicate a station having an 1130 sign-on time and 1130* would be the sign-off time.

LANGUAGE ABBREVIATIONS

For years on end, SWLs have used rather self-explanatory abbreviations to indicate languages when reporting to various club bulletins. These included such abbreviations as Eng for English, Jap for Japanese, and Sp for Spanish. Within the past couple of years or so, certain clubs and members thereof have 'adopted' a new form whereby EE meant English, RR for Russian, and JJ for Japanese, among others. While both systems are good, they both, nevertheless, have glaring faults. The following list of language abbreviations has been submitted by a member of the **Newark News Radio Club** and, in the opinion of the author, it is a good, foolproof system. We are urging our club members to adopt this system and we further urge all other clubs to consider making it a part of their format. The list is alphabetical by language, not by abbreviation.

AP	Afghan-Persian	GR	Greek	QC	Quechua
AK	Afrikaans	GN	Guarani	RM	Romanian
AB	Albanian	GJ	Gujarati	RS	Russian
AH	Amharic	HA	Hausa	SC	Serbo-Croatian
AR	Arabic	HB	Hebrew	SN	Sinhalese
AM	Armenian	HD	Hindi	SL	Slovene
AY	Amoy	HG	Hungarian	SM	Somali
AS	Assamese	*IN	Indonesian	SP	Spanish
AZ	Azerbaijani	IT	Italian	SH	Swahili
BL	Belorussian	JP	Japanese	SW	Swedish
BN	Bengali	KR	Korean	TZ	Tadzhik
BG	Bulgarian	KD	Kurdish	TG	Tagalog
BR	Burmese	LH	Lithuanian	TM	Tamil
CB	Cambodian	LV	Latvian	TL	Telugu
CN	Cantonese	MC	Macedonian	TH	Thai
CR	Creole	ML	Malay	TB	Tibetan
CZ	Czech	MN	Mandarin	TK	Turkish
DN	Danish	MG	Mongolian	UG	Uighur
DT	Dutch	NP	Nepali	UK	Ukrainian
EG	English	NW	Norwegian	UR	Urdu
EP	Esperanto	PS	Persian	UZ	Uzbek
ES	Estonian	PL	Polish	VT	Vietnamese
FN	Finnish	PT	Portuguese	YD	Yiddish
FR	French	PJ	Punjabi	YR	Yoruba
GM	German	PS	Pushtu	ZL	Zulu

*The original designation for Indonesia, as submitted by the member, was ID. The author feels that there is too great a chance for this to be confused with the widely used abbreviation ID, which means identification or identity.

RST METHOD OF SIGNAL REPORTS

Readability (R)

1—Unreadable
2—Barely readable; occasional words distinguishable
3—Readable with considerable difficulty
4—Readable with practically no difficulty
5—Perfectly readable

Signal Strength (S)

1—Faint; signals barely perceptible
2—Very weak signals
3—Weak signals
4—Fair signals
5—Fairly good signals
6—Good signals
7—Moderately strong signals
8—Strong signals
9—Extremely strong signals

Tone (T)

1—Sixty-cycle ac or less, very rough and broad
2—Very rough ac, very harsh and broad
3—Rough ac tone, rectified but not filtered
4—Rough note, some trace of filtering
5—Filtered rectified ac, but strongly ripple-modulated
6—Filtered tone, definite trace of ripple modulation
7—Near pure tone, trace of ripple modulation
8—Near perfect tone, slight trace of modulation
9—Perfect tone, no trace of ripple modulation of any kind

Q SIGNALS

The following list of Q signals is not the entire list, but they are the signals that are most frequently used. The entire list may be found in the **Radio Amateur Callbook Magazine** or from the American Radio Relay League. These are primarily used in the amateur radio service, but many of them are easily adapted to SWL as well. Most of the Q signals can be used in either question or statement form; for question form, simply add a question mark after the Q signal.

QRG Will you tell me my exact frequency in kilohertz? Your exact frequency is ___ .

QRH Does my frequency vary? Your frequency varies.

QRI How is the tone of my transmissions? The tone of your transmissions is (1—good, 2—variable, 3—bad).

QRK What is the intelligibility of my signals? The intelligibility of your signals is (1—unintelligible to 5—perfectly intelligible).

QRL Are you busy? I am busy. Please do not interfere.

QRM Is my transmission being interfered with? Your transmission is being interfered with.

QRN Are you troubled by static? I am troubled by static.

QRO Shall I increase power? Increase power.

QRP Shall I decrease power? Decrease power.

QRQ Shall I send faster? Send faster, ___ words per minute.

QRS Shall I send slower? Send slower, ___ words per minute.

QRT Must I stop sending? Stop sending.

QRU Have you anything for me? I have nothing for you.

QRV Are you ready? I am ready.

QRX When will you call again (on ___ kHz)? I will call you again at hours on ___ kHz.

QRZ Who is calling me? You are being called by ___ on ___ kHz.

QSA What is the strength of my signals? The strength of your signals is (from 1—barely audible to 5—extremely strong).

QSB Are my signals fading? Your signals are fading.

QSL Can you acknowledge receipt? I acknowledge receipt.

QSO Can you communicate with ___ direct or by relay? I can communicate with ___ direct or by relay through ___.

QSP Will you relay to ___? I will relay to ___.

QSY Shall I change to another frequency? Change to another frequency or to ___ kHz.

QTC How many messages have you to send? I have ___ messages to send.

QTH What is your location? My location is ___.

QTR What is the correct time? The correct time is ___.

QRRR (Unofficial) This is the amateur distress signal and is to be used in cases of emergency only.

INTERNATIONAL MORSE CODE

Letter, Number, Punctuation	Code Symbols	Phonetic Sound
A	• —	ditdah
B	— • • •	dahditditdit
C	— • — •	dahditdahdit
D	— • •	dahditdit
E	•	dit
F	• • — •	ditditdahdit
G	— — •	dahdahdit
H	• • • •	ditditditdit
I	• •	ditdit
J	• — — —	ditdahdahdah
K	— • —	dahditdah
L	• — • •	ditdahditdit
M	— —	dahdah
N	— •	dahdit
O	— — —	dahdahdah
P	• — — •	ditdahdahdit
Q	— — • —	dahdahditdah
R	• — •	ditdahdit
S	• • •	ditditdit
T	—	dah
U	• • —	ditditdah
V	• • • —	ditditditdah
W	• — —	ditdahdah
X	— • • —	dahditditdah
Y	— • — —	dahditdahdah
Z	— — • •	dahdahditdit
1	• — — — —	ditdahdahdahdah

2	..---	ditditdahdahdah
3	...--	ditditditdahdah
4	....-	ditditditditdah
5	.....	ditditditditdit
6	-....	dahditditditdit
7	--...	dahdahditditdit
8	---..	dahdahdahditdit
9	----.	dahdahdahdahdit
Ø (zero)	-----	dahdahdahdahdah
/ (fraction bar)	-..-.	dahditditdahdit
. (period)	.-.-.-	ditdahditdahditdah
? (question mark)	..--..	ditditdahdahditdit
, (comma)	--..--	dahdahditditdahdah
Error	....	ditditditditditditditdit

The following are not in the FCC code tests for amateur licenses, but they are useful to know.

: (colon)	---...	dahdahdahditditdit
; (semicolon)	-.-.-.	dahditdahditdahdit
() (parenthesis)	-.--.-	dahditdahdahditdah
Double dash	-...-	dahditditditdah
Wait	.-...	ditdahditditdit
End of message	.-.-.	ditdahditdahdit
Go ahead	-.-	dahditdah
End of work	...-.-	ditditditdahditdah

Each code group shown is sent as a single symbol without pauses. The unit of code time is the "dit," equivalent to a short tap on the telegraph key or a quick flip of the tongue. The "dah" is three times as long as a dit; spacing between dits and dahs in the same character is equal to one dit. The spacing between letters in a word is equal to one dah. The spacing between words is equal to five to seven dits.

OFFICIAL NNRC-WDX COUNTRY LIST

The following list of countries is the official country list of the Newark News Radio Club for use by the members of that organization who wish to apply for NNRC DX awards. It is also used in its entirety by Monitor and DX Headquarters for all WDX awards. It does not conform in every detail to the official country list of the American Radio Relay League (Amateur radio headquarters) or to various other country lists in use by various shortwave clubs.

This countries list serves as the basis for country, continent, and zone credits when applying for NNRC certificates of achievement and for WDX DX country award certificates. Only countries included in this list may be used.

The first column following the country name indicates the continent in which it lies. (Af—Africa, As—Asia, Eu—Europe, Oc—Oceania, NA—North America, SA—South America.) The second column after the country name indicates the radio zone. There are forty zones.

Indented area names (see Aden, Socotra, Newfoundland, and Labrador) mean that parts of a single country lie in more than one continent or zone. They do not indicate separate countries. Provinces or states have sometimes been indented for the same purpose (see Australia and the United States), as have parallels of longitude and latitude (see RSFSR, Asiatic).

Countries whose names are followed by "before" or "after" dates are valid for credit only before, after, or within the time limits indicated. (See Tanganyika, Tanzania, Ruanda-Urundi, and Singapore.)

For radio purposes, the dividing line between Asia and Europe is the line between Asiatic and European Russia. This runs east along the Mezen River from the White Sea to 48 degrees East, south to 59 degrees North, east to 55 degrees East, south to 56 degrees North, east to the Urals, and south to the Caspian Sea. Novaya Zemlya is in Europe; Kolguyev and Vaygach Islands are in Asia.

Abu Ail and Jabal at Tair	As 21
Aden and Socotra	
Aden (South Yemen)	As 21
Socotra	Af 37
Afghanistan	As 21
Agalega Is.	Af 39
Aland Is.	Eu 15
Alaska	NA 1
Albania	Eu 15
Aldabra, Cosmoledos Is.	Af 39
Algeria	Af 33
Amirante Is. (Desroches)	Af 39
Amsterdam, St. Paul Is.	Af 39
Andaman, Nicobar Is.	As 26
Andorra	Eu 14
Angola	Af 36
Anguilla	NA 8
Annobon Is.	Af 36
Antarctica	SA 13
Antigua, Barbuda	NA 8
Argentina	SA 13
Armenia	Eu 21
Aruba, Bonaire, Curacao	SA 9
Ascension Is.	Af 36
Auckland, Campbell Is.	Oc 32
Australia	
Northern Territory	Oc 29
Queensland, South Australia	Oc 30
Victoria, Tasmania, N. S. W.	Oc 30
Western Australia	Oc 29
Austria	Eu 15
Aves Is.	NA 8
Azerbaijan	Eu 21
Azores	Eu 14
Bahama Is.	NA 8
Bahrein	As 21
Bajo Nuevo	NA 8
Balearic Is.	Eu 14
Bangladesh (East Pakistan)	As 22
Barbadoes	NA 8
Belgium	Eu 14
Bermuda	NA 5
Bhutan	As 22
Blenheim Reef	Af 39
Bolivia	SA 10
Bonin, Volcano Is.	Oc 27
Borneo, British North (before September 16, 1963)	Oc 28
Borneo, Netherlands (before May 1), 1963)	Oc 28
Botswana (Bechuanaland)	Af 38
Bouvet Is.	Af 38
Brazil	SA 11
Brunei	Oc 28
Bulgaria	Eu 20
Burma	As 26
Burundi (after June 30, 1962)	Af 36
Cambodia	As 26
Cameroun	Af 36
Canada	
Alberta, Saskatchewan	NA 4
British Columbia	NA 3
Islands in Hudson and James Bays	NA 2
Labrador, Quebec north of 52 deg.	NA 2
Manitoba, Ontario	NA 4
New Brunswick, Nova Scotia	NA 5
Newfoundland, Prince Edward Is.	NA 5
North of 60 deg., East of 102 deg.	NA 2
North of 60 deg., West of 102 deg.	NA 1
Quebec south of 52 deg.	NA 5
Canal Zone	NA 7
Canary Is.	Af 33
Cape Verde Is.	Af 35
Cargados Carajos (St. Brandon)	Af 39
Caroline Is., Eastern	Oc 27
Caroline Is., Western	Oc 27
Cayman Is.	NA 8
Celebes, Molucca Is. (before May 1, 1963)	Oc 28
Central African Republic (after August 12, 1960)	Af 36
Ceuta and Melilla (Spanish Morocco)	Af 33
Ceylon	As 22
Chad (after August 10, 1960)	Af 36
Chagos	Af 39
Chatham Is.	Oc 32
Chile	SA 12
China (not including Tibet)	
Inner Mongolia west of 108 deg.	As 23
Sinkiang, Kansu, Tsinghai	As 23
Remainder (east China)	As 24
Christmas Is. (Indian Ocean)	Oc 29
Clipperton Is.	NA 7
Cocos Is. (Costa Rican)	NA 7
Cocos-Keeling Is. (Indian Ocean)	Oc 29
Colombia	SA 9
Comoro Is.	Af 39
Congo Republic (Brazzaville) (after August 14, 1960)	Af 36
Congo, Republic of (Kinshasa)	Af 36
Cook Is.	Oc 32
Corsica	Eu 15

Costa Rica	NA 7
Crete	Eu 20
Crozet Is.	Af 39
Cuba	NA 8
Cyprus	As 20
Czechoslovakia	Eu 15
Dahomey	Af 35
(after July 31, 1960)	
Damao, Diu	As 22
(before January 1, 1962)	
Denmark	Eu 14
Dodecanese Is. (Rhodes)	Eu 20
Dominica	NA 8
Dominican Republic	NA 8
Easter Is.	SA 12
Ecuador	SA 10
Egypt (United Arab Republic)	Af 34
El Salvador	NA 7
England	Eu 14
Equatorial Africa, French	Af 36
(before August 17, 1960)	
Eritrea	Af 37
(before November 15, 1962)	
Estonia	Eu 15
Ethiopia	Af 37
Falkland Is.	SA 13
Faroe Is.	Eu 14
Farquhar Is.	Af 39
Fernando de Noronha	SA 11
Fiji Is.	Oc 32
Finland	Eu 15
Formosa (Taiwan)	As 24
France	Eu 14
Franz Josef Land	Eu 40
Gabon	Af 36
(after August 16, 1960)	
Galapagos Is.	SA 10
Gambia	Af 35
Georgia	Eu 21
Germany	Eu 14
(before October 7, 1949)	
Germany, East	Eu 14
(after October 6, 1949)	
Germany, West, and West Berlin	Eu 14
(after October 6, 1949)	
Geyser Reef	Af 39
Ghana	Af 35
(after March 4, 1957)	
Gibraltar	Eu 14
Gilbert, Ellice, Ocean Is.	Oc 31
Glorioso Is. (Glorieuses)	Af 39
Goa	As 22
(before January 1, 1962)	
Gold Coast, British Togoland	Af 35
(before March 5, 1957)	
Greece	Eu 20
Greenland	NA 40
Grenada and Dependencies	NA 8
Guadeloupe	NA 8
Guam and Cocos Is.	Oc 27
Guantanamo Bay	NA 8
Guatemala	NA 7
Guernsey and Dependencies	Eu 14
Guiana, French	SA 9
Guinea	Af 35
Guinea, Equatorial (Rio Muni)	Af 36
Guinea, Portuguese	Af 35
Guyana (British Guiana)	SA 9
Haiti	NA 8
Hawaiian Is. (except Kure)	Oc 31
Heard Is.	Af 39
Honduras	NA 7
Honduras, British	NA 7
Hong Kong	As 24
Hungary	Eu 15

Iceland	Eu 40
Ifni	Af 33
(before May 13, 1969)	
India	As 22
India, French	As 22
(before November 1, 1954)	
Indo-China, French	As 26
(before December 21, 1950)	
Indonesia	Oc 28
(after April 30, 1963)	
Int'l Telecommunications Union	Eu 14
(Geneva, Switzerland)	
Iran	As 21
Iraq	As 21
Ireland	Eu 14
Isle of Man	Eu 14
Israel	As 20
Italy	
Italian Mainland, Sicily	Eu 15
Pantelleria, Pelagian Is.	Af 33
Ivory Coast	Af 35
(after August 6, 1960)	
Jamaica	NA 8
Jan Mayen Is.	Eu 40
Japan	As 25
Java	Oc 28
(before May 1, 1963)	
Jersey	Eu 14
Johnston Is.	Oc 31
Jordan	As 20
Juan de Nova, Europa, Bassas	
da India	Af 39
Juan Fernandez	SA 13
Kaliningradsk	Eu 15
Kamaran Is.	As 21
Karelo-Finnish Republic	Eu 16
(before July 1, 1960)	
Kazakh	As 17
Kenya	Af 37
Kerguelen Is.	Af 39
Kermadec Is.	Oc 32
Kirghiz	As 17
Korea	As 25
(before June 25, 1950)	
Korea, North	As 25
(after June 24, 1950)	
Korea, South	As 25
(after June 24, 1950)	
Kure Is.	Oc 31
Kuria Maria Is.	As 21
(before December 1, 1967)	
Kuwait	As 21
Kuwait—Saudi Arabia Neutral Zone	As 21
(before December 18, 1969)	
Kwantung Peninsula	As 24
(before September 3, 1945)	
Laccadive Is.	As 22
Laos	As 26
Latvia	Eu 15
Lebanon	As 20
Lesotho (Basotuland)	Af 38
Liberia	Af 35
Libya	Af 34
Liechtenstein	Eu 14
Line Is.	Oc 31
(Christmas, Fanning, etc.)	
Lithuania	Eu 15
Lord Howe Is.	Oc 30
Luxembourg	Eu 14
Macao	As 24
Macquarie Is.	Oc 30
Madeira Is.	Af 33
Malagasy (Madagascar)	Af 39
Malawi (Nyasaland)	Af 37
Malaya	As 28
(before September 16, 1963)	

Malaysia, Eastern (Sabah, Sarawak)	Oc 28
(after September 15, 1963)	
Malaysia, Western	As 28
(after September 15, 1963)	
Maldive Is.	As 22
Mali	Af 35
(after June 19, 1960)	
Malpelo Is.	SA 9
Malta	Eu 15
Manchuria	As 24
(before September 16, 1963)	
Manihiki	Oc 32
Marcus Is.	Oc 27
Mariana Is. (except Guam and Cocos)	Oc 27
Marion, Prince Edward Is.	Af 38
Market Reef	Eu 15
Marshall Is.	Oc 31
Martinique	NA 8
Mauritania	Af 35
(after June 19, 1960)	
Mauritius	Af 39
Mexico	NA 6
Midway Is.	Oc 31
Minerva Reefs	Oc 32
(before July 15, 1972)	
Moldavia	Eu 16
Monaco	Eu 14
Mongolia	As 23
Montserrat	NA 8
Morocco	Af 33
Mozambique	Af 37
Nauru Is.	Oc 31
Navassa Is.	NA 8
Nepal	As 22
Netherlands	Eu 14
New Caledonia	Oc 32
Newfoundland, Labrador	
(before April 1, 1949)	
Newfoundland	NA 5
Labrador	NA 2
New Guinea, Netherlands	Oc 28
(before May 1, 1963)	
New Guinea, Territory of	Oc 28
New Hebrides	Oc 32
New Zealand	Oc 32
Nicaragua	NA 7
Niger	Af 35
(after August 2, 1960)	
Nigeria	Af 35
Niue	Oc 32
Norfolk Is.	Oc 32
Northern Ireland	Eu 14
Norway	Eu 14
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Demilitarized Zone	As 20
(before July 2, 1968)	
Palmyra, Jarvis Is.	Oc 31
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Papua Territory	Oc 28
Paraguay	SA 11
Peru	SA 10
Philippine Is.	Oc 27
Phoenix Is., American (including	
Baker and Howland Is.)	Oc 31
Phoenix Is., British	Oc 31
Pitcairn Is.	Oc 32
Poland	Eu 15
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Marquesas Is.	Oc 31
Society, Tubai, Tuamotu Is.	Oc 32
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Puerto Rico	NA 8

Qatar	As 21
Reunion Is.	Af 39
Revilla Gigedo Is.	NA 6
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Roncador Cay, Serrana Bank	NA 7
Rodriguez Is.	Af 39
Romania	Eu 20
RSFSR, Asiatic (Asiatic Russia)	
East of 110 deg., north of 60 deg.	As 19
East of 120 deg., south of 60 deg.	As 19
Exception to above: Kurile Is.	As 25
West of 82 deg., north of 57 deg.	As 17
West of 75 deg., south of 57 deg.	As 17
Balance of Asiatic Russia	As 18
Exception to above: Tuvan S.S.R.	As 23
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(July 1, 1960 through June 30, 1962)	
Rwanda	Af 36
(after June 30, 1962)	
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(before May 15, 1972)	
Saarland	Eu 14
(before April 1, 1957)	
St. Helena	Af 36
St. Kitts, Nevis	NA 8
St. Lucia	NA 8
St. Martin, French	NA 8
St. Peter and St. Paul Rocks	SA 11
St. Pierre, Miquelon Is.	NA 5
St. Vincent and Dependencies	NA 8
Samoa, American	Oc 32
Samoa, Western	Oc 32
San Andres, Providencia	NA 7
San Felix, San Ambrosio	SA 12
San Marino	Eu 15
Sao Tome, Principe	Af 36
Sarawak	Oc 28
(before September 16, 1963)	
Sardinia	Eu 15
Saudi Arabia	As 21
Saudi Arabia/Iraq Neutral Zone	As 21
Scotland	Eu 14
Senegal	Af 35
(after June 19, 1960)	
Seychelles Is.	Af 39
Sierra Leone	Af 35
Sikkim	As 22
Singapore	As 28
(before September 16, 1963 or	
after August 8, 1965)	
Sint Maarten, St. Eustatius, Saba	NA 8
Solomon Is., British	Oc 28
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Somaliland, British	Af 37
(before July 1, 1960)	
Somaliland, French	Af 37
Somaliland, Italian	Af 37
(before July 1, 1960)	
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South Georgia Is.	SA 13
South Orkney Is.	SA 13
South Sandwich Is.	SA 13
South Shetland Is.	SA 13
South West Africa	Af 38
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Tangier (before July 1, 1960)	Af 33
Tanzania (after June 30, 1964)	Af 37
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Tibet	As 23
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Togo	Af 35
Tokelau (Union) Is.	Oc 31
Tonga (Friendly) Is.	Oc 32
Trieste (before April 1, 1957)	Eu 15
Trindade, Martin Vaz Is.	SA 11
Trinidad, Tobago Is.	SA 9
Tristan da Cunha, Gough Is.	Af 38
Tromelin	Af 39
Tunisia	Af 33
Turkey	As 20
Turkoman	As 17
Turks, Caicos Is.	NA 8
Uganda	Af 37
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Atlantic coastal states	NA 5
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Idaho, Utah, Nevada, Arizona	NA 3
Pacific coastal states	NA 3
Balance, except Hawaii, Alaska	NA 4
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Vietnam, South (after July 20, 1954)	As 26
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Virgin Is., British	NA 8
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Wallis, Futuna Is.	Oc 32
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CALLSIGN ALLOCATIONS OF THE WORLD

AAA-ALZ	United States of America
AMA-AOZ	Spain
APA-ASZ	Pakistan
ATA-AWZ	India
AXA-AXZ	Australia
AYA-AZZ	Argentina
A2A-A2Z	Botswana
A3A-A3Z	Tonga
A5A-A5Z	Bhutan
BAA-BZZ	China
CAA-CEZ	Chile
CFA-CKZ	Canada
CLA-CMZ	Cuba
CNA-CNZ	Morocco
COA-COZ	Cuba
CPA-CPZ	Bolivia
CQA-CRZ	Portuguese Overseas Provinces
CSA-CUZ	Portugal
CVA-CXZ	Uruguay
CYA-CZZ	Canada
C2A-C2Z	Nauru (Republic of)
C3A-C3Z	Andorra
DAA-DTZ	Germany
DUA-DZZ	Philippines
EAA-EHZ	Spain
EIA-EJZ	Ireland
EKA-EKZ	USSR
ELA-ELZ	Liberia
EMA-EOZ	USSR
EPA-EQZ	Iran
ERA-ERZ	USSR
ESA-ESZ	USSR (Estonia)
ETA-ETZ	Ethiopia
EUA-EWZ	USSR (Belorussia)
EXA-EZZ	USSR
FAA-FZZ	France, Overseas States, and Territories of the French Community
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, Overseas States, and Territories of the French Community
HZA-HZZ	Saudi Arabia
IAA-IZZ	Italy and United Nation Mandates
JAA-JSZ	Japan
JTA-JVZ	Mongolia
JWA-JXZ	Norway
JYA-JYZ	Jordan
JZA-JZZ	Indonesia (West Iran)
KAA-KZZ	United States of America
LAA-LNZ	Norway
LOA-LWZ	Argentina
LXA-LXZ	Luxembourg

LYA-LYZ	USSR (Lithuania)
LZA-LZZ	Bulgaria
L2A-L9Z	Argentina
MAA-MZZ	United Kingdom
NAA-NZZ	United States of America
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 West Indies
PKA-POZ	Indonesia
PPA-PYZ	Brazil
PZA-PZZ	Surinam
QAA-QZZ	International Service Abbreviations
RAA-RZZ	USSR
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, Overseas States, and Territories of the French Community
TIA-TIZ	Costa Rica
TJA-TJZ	Cameroun
TKA-TKZ	France, Overseas States, and Territories of the French Community
TLA-TLZ	Central African Republic
TMA-TMZ	France, Overseas States, and Territories of the French Community
TNA-TNZ	Congo (Republic of)
TOA-TQZ	France, Overseas States, and Territories of the French Community
TRA-TRZ	Gabon
TSA-TSZ	Tunisia
TTA-TTZ	Chad
TUA-TUZ	Ivory Coast
TVA-TXZ	France, Overseas States, and Territories of the French Community
TYA-TYZ	Dahomey
TZA-TZZ	Mali
UAA-UQZ	USSR
URA-UTZ	USSR (Ukraine)
UUA-UZZ	USSR
VAA-VGZ	Canada
VHA-VNZ	Australia
VOA-VOZ	Canada
VPA-VSZ	Overseas Territories for which the United Kingdom is responsible for international relations
VTA-VWZ	India
VXA-VYZ	Canada
VZA-VZZ	Australia
WAA-WZZ	United States of America
XAA-XIZ	Mexico
XJA-XOZ	Canada
XPA-XPZ	Denmark
XQA-XRZ	Chile
XSA-XSZ	China
XTA-XTZ	Upper Volta
XUA-XUZ	Khmer Republic
XVA-XVZ	Vietnam
XWA-XWZ	Laos
XXA-XXZ	Portuguese Overseas Provinces
XYA-XZZ	Burma
YAA-YAZ	Afghanistan
YBA-YHZ	Indonesia
YIA-YIZ	Iraq
YJA-YJZ	New Hebrides
YKA-YKZ	Syria
YLA-YLZ	USSR (Latvia)
YMA-YMZ	Turkey
YNA-YNZ	Nicaragua
YOA-YRZ	Romania
YSA-YSZ	El Salvador
YTA-YUZ	Yugoslavia
YVA-YYZ	Venezuela
YZA-YZZ	Yugoslavia
ZAA-ZAZ	Albania
ZBA-ZJZ	Overseas Territories for which the United Kingdom is responsible for international relations
ZKA-ZMZ	New Zealand
ZNA-ZOZ	Overseas Territories for which the United Kingdom is responsible for international relations
ZPA-ZPZ	Paraguay
ZQA-ZQZ	Overseas Territories for which the United Kingdom is responsible for international relations
ZRA-ZUZ	South Africa (Republic of)
ZVA-ZZZ	Brazil
2AA-2ZZ	United Kingdom
3AA-3AZ	Monaco
3BA-3BZ	Mauritius
3CA-3CZ	Equatorial Guinea
3DA-3DM	Swaziland
3DN-3DZ	Fiji
3EA-3FZ	Panama
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	USSR
4MA-4MZ	Venezuela
4NA-4OZ	Yugoslavia
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4YA-4YZ	International Civil Aviation Organization
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5HA-5IZ	Tanzania
5JA-5KZ	Colombia
5LA-5MZ	Liberia
5NA-5OZ	Nigeria
5PA-5QZ	Denmark
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6KA-6NZ	Korea
6OA-6OZ	Somali Republic
6PA-6SZ	Pakistan
6TA-6UZ	Sudan.
6VA-6WZ	Senegal
6XA-6XZ	Malagasy Republic
6YA-6YZ	Jamaica
6ZA-6ZZ	Liberia
7AA-7IZ	Indonesia
7JA-7NZ	Japan
7OA-7OZ	Yemen
7PA-7PZ	Lesotho
7QA-7QZ	Malawi
7RA-7RZ	Algeria
7SA-7SZ	Sweden
7TA-7YZ	Algeria
7ZA-7ZZ	Saudi Arabia
8AA-8IZ	Indonesia
8JA-8NZ	Japan
8OA-8OZ	Botswana
8PA-8PZ	Barbadoes
8QA-8QZ	Maldive Islands
8RA-8RZ	Guyana
8SA-8SZ	Sweden
8TA-8YZ	India
8ZA-8ZZ	Saudi Arabia
9AA-9AZ	San Marino
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9HA-9HZ	Malta
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9KA-9KZ	Kuwait
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9NA-9NZ	Nepal
9OA-9TZ	Zaire
9UA-9UZ	Burundi
9VA-9VZ	Singapore
9WA-9WZ	Malaysia
9XA-9XZ	Rwanda
9YA-9ZZ	Trinidad and Tobago

A2	Botswana
AC	Bhutan
AC3	Sikkim
AC4	Tibet
AP	East Pakistan (Bangladesh)
AP	West Pakistan
BV	Formosa
BY	China
C2	Nauru
C3	Andorra
CE	Chile
CE9AA-AM, FB8Y, KC4, LA/G, LU-Z, OR4, UA1, VK0, VP8, ZL5, 8J	Antarctica
CE0A	Easter Island
CE0X	San Felix
CE0Z	Juan Fernandez Archipelago
CM, CO	Cuba
CN2, 8, 9	Morocco
CP	Bolivia
CR3	Portuguese Guinea
CR4	Cape Verde Islands
CR5	Principe, Sao Tome
CR6	Angola
CR7	Mozambique
CR8	Portuguese Timor
CR9	Macao
CT1	Portugal
CT2	Azores
CT3	Madeira Islands
CX	Uruguay
DJ, DK, DL, DM	Germany
DU	Philippine Islands
EA	Spain
EA6	Balearic Islands
EA8	Canary Islands
EA9	Rio de Oro
EA9	Spanish Morocco
EI	Republic of Ireland
EL	Liberia
EP, EQ	Iran
ET3	Ethiopia
F	France
FB8W	Crozet Islands
FB8X	Kerguelen Islands
FB8Z	Amsterdam and St. Paul Islands
FC (unofficial)	Corsica
FG7	Guadeloupe
FH8	Comoro Islands
FK8	New Caledonia
FL8	Somaliland (French)
FM7	Martinique
FO8	Clipperton Island
FO8	French Oceania
FP8	St. Pierre and Miquelon Islands
FR7	Glorioso Islands
FR7	Juan de Nova
FR7	Reunion Island
FR7	Tromelin
FS7	Saint Martin
FW8	Wallis and Futuna Islands
FY7	French Guiana and Ininl
G	England
GC	Guernsey and Dependencies
GC	Jersey
GD	Isle of Man
GI	Northern Ireland
GM	Scotland
GW	Wales
HA, HG	Hungary
HB	Switzerland
HB0	Liechtenstein
HC	Ecuador
HC8	Galapagos Islands
HH	Haiti
HI	Dominican Republic
HK	Colombia
HK0	Bajo Nuevo
HK0	Malpelo Island
HK0	San Andres and Providencia
HL, HM	Korea
HP	Panama
HR	Honduras
HS	Thailand
HV	Vatican
HZ	Saudi Arabia
I1, IT1	Italy
IS1	Sardinia
JA, JH, JR, KA	Japan
JD	Ogasawara Islands

JD	Minami Torishima
JT	Mongolia
JW	Svalbard
JX	Jan Mayen
JY	Jordan
K, W	United States of America
KA	(see JA)
KB6	Baker, Howland, and American Phoenix Islands
KC4	(see CE9)
KC4	Navassa Island
KC6	Eastern Caroline Islands
KC6	Western Caroline Islands
KG4	Guantanamo Bay
KG6	Guam
KG6R, S, T	Mariana Islands
KH6	Hawaiian Islands
KH6	Kure Island
KJ6	Johnston Island
KL7	Alaska
KM6	Midway Islands
KP4	Puerto Rico
KP6	Palmyra Group, Jarvis Island
KR6, 8	Ryukyu Islands
KS4	Swan Islands
KS4B	Serrana Bank, Roncador Cay
KS6	American Samoa
KV4	American Virgin Islands
KW6	Wake Island
KX6	Marshall Islands
KZ5	Canal Zone
LA	Norway
LA/G	(See CE9AA-AM)
LU	Argentina
LU-Z	(See CE9, VP8)
LX	Luxembourg
LZ	Bulgaria
M1, 9A1	San Marino
MP4B	Bahrein
MP4D, T	Trucial Oman
MP4M, VS9O	Sultanate of Muscat and Oman
MP4Q	Qatar
OA	Peru
OD5	Lebanon
OE	Austria
OF, OH	Finland
OH0	Aland Islands
OJ0	Market Reef
OK	Czechoslovakia
ON4, 5, 8	Belgium
OR4	(See CE9AA-AM)
OX	Greenland
OY	Faeroes
OZ	Denmark
PA, PD, PE, PI	Netherlands
PJ	Netherlands Antilles
PJ	Sint Maarten
PY	Brazil
PY0	Fernando de Noronha
PY0	St. Peter and St. Paul's Rocks
PY0	Trindade and Martin Vaz Islands
PZ1	Surinam
SK, SL, SM	Sweden
SP	Poland
ST2	Sudan
SU	Egypt
SV	Crete
SV	Dodecanese Islands
SV	Greece
TA	Turkey
TF	Iceland
TG	Guatemala
TI	Costa Rica
TI9	Cocos Island
TJ	Cameroun
TL	Central African Republic
TN	Congo Republic
TR	Gabon
TT	Chad
TU	Ivory Coast
TY	Dahomey
TZ	Mali
UA, UK1, UK3, UK4, UK6, UV, UW 1-6, UN	European Russia
UA, UK9, UV, UW9, 0	Asiatic Russia
UA1	Franz Josef Land
UA2, UK2F	Kaliningradsk
UB5, UK5, UT5, UY5	Ukraine
UC2, UK2A/C/I/L/O/S/W	White Russia
UD6, UK6C/D/K	Azerbaijan
UF6, UK6F/O/Q/V	Georgia
UG6, IK6G	Armenia
UH8, UK8H	Turkoman
UI8, UK8I	Uzbek
UJ8, UK8J/R	Tadzhik
UL7, UK7L	Kazakh
UM8, UK8M	Kirghiz
UO5, UK5O	Moldavia
UP2, UK2B/P	Lithuania
UQ2, UK2G/Q	Latvia
UR2, UK2R/T	Estonia
VE	Canada
VK	Australia (including Tasmania)
VK	Lord Howe Island
VK	Willis Islands
VK9, N	Norfolk Island
VK9, X	Christmas Island
VK9, Y	Cocos Islands
VK9, AA-MZ	Papua Territory
VK9, AA-MZ	Territory of New Guinea
VK0	(See CE9)
VK0	Heard Island
VK0	Macquarie Island
VO	Newfoundland, Labrador
VP1	British Honduras
VP2A	Antigua, Barbuda
VP2D	Dominica
VP2E	Anguilla
VP2G	Grenada and Dependencies
VP2K	St. Kitts, Nevis
VP2L	St. Lucia
VP2M	Montserrat
VP2S	St. Vincent and Dependencies
VP2V	British Virgin Islands
VP5	Turks and Caicos Island
VP7	Bahama Islands
VP8	(See CE9AA-AM, LU-Z)
VP8	Falkland Islands
VP8, LU-Z	South Georgia Islands
VP8, LU-Z	South Orkney Islands
VP8, LU-Z	South Sandwich Islands
VP8, LU-Z, CE9AN-AZ	South Shetland Islands
VP9	Bermuda
VQ1	Zanzibar
VQ9	Aldabra Islands
VQ9	Chagos
VQ9	Desroches
VQ9	Farquhar
VQ9	Seychelles
VR1	British Phoenix Islands
VR1	Gilbert and Ellice Islands and Ocean Island
VR2	Fiji Islands
VR3	Fanning and Christmas Islands
VR4	Solomon Islands
VR5	Tonga (Friendly) Islands
VR6	Pitcairn Island
VS5	Brunei
VS6	Hong Kong
VS9K	Kamaran Islands
VS9M	Maldive Islands
VS9O	(See MP4M)
VU	Andaman and Nicobar Islands
VU	India
VU	Laccadive Islands
W	(See K)
XE, XF, 4A	Mexico
XF4	Revilla Gigedo
XP	(See OX)
XT	Voltaic Republic

XU	Cambodia
XV5	(See 3W8)
XW8	Laos
XZ	Burma
YA	Afghanistan
YB	Indonesia
YI	Iraq
YJ	New Hebrides
YK	Syria
YN, YN0	Nicaragua
YO	Rumania
YS	El Salvador
YU	Yugoslavia
YV	Venezuela
YV0	Aves Island
ZA	Albania
ZB2	Gibraltar
ZC4	(See 5B4)
ZD3	Gambia
ZD5	Swasiland
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Tristan da Cunha and Gough Island
ZE	Rhodesia
ZF1	Cayman Islands
ZK1	Cook Islands
ZK1	Manihiki Islands
ZK2	Niue
ZL	Auckland and Campbell Islands
ZL	Chatham Islands
ZL	Kermadec Islands
ZL	New Zealand
ZL5	(See CE9AA-AM)
ZM7	Tokelau Islands
ZP	Paraguay
ZS1, 2, 4, 5, 6	South Africa
ZS2	Prince Edward and Marion Islands
ZS3	Southwest Africa
1M	Minerva Reefs
1S	Spratly Island
3A	Monaco
3B6, 7	Agalega and St. Brandon
3B8	Mauritius
3B9	Rodriguez Island
3C	Equatorial Guinea
3V8	Tunisia
3W8, XV5	Vietnam
3X (7G)	Republic of Guinea
3Y	Bouvet
4A	(See XE)
4S7	Ceylon
4U1	International Telecommunications Union, Geneva
4W	Yemen
4X, 4Z	Israel
5A	Libya
5B4, ZC4	Cyprus
5H3	Tanganyika
5N2	Nigeria
5R8	Malagasy Republic
5T	Mauritania
5U7	Niger
5V	Togo
5W1	Samoa
5X5	Uganda
5Z4	Kenya
6O1, 2, 6	Somali
6W8	Senegal
6Y	Jamaica
7G1	(See 3X)
7O	South Yemen
7P	Lesotho
7Q7	Malawi
7X	Algeria
7Z	Saudi Arabia
8P	Barbadoes
8Q	Maldive Islands
8R	Guyana
8Z4	Saudi Arabia/Iraq Neutral Zone
8Z5	(See 9K3)
9A1	(See M1)
9G1	Ghana
9H1	Malta
9J2	Zambia
9K2	Kuwait
9K3, 8Z5	Kuwait/Saudi Arabia Neutral Zone
9L1	Sierra Leone
9M2	Malaya
9M6	Sabah
9M8	Sarawak
9N1	Nepal
9Q5	Congo Republic
9U5	Burundi
9V1	Singapore
9X5	Rwanda
9Y4	Trinidad and Tobago

FEDERAL COMMUNICATIONS COMMISSION FIELD OFFICES

All inquiries concerning communications are to be addressed to the Engineer in Charge, FCC, at the office listed below that is nearest your home.

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California, San Diego 92101
California, San Francisco 94111
California, San Pedro 90731
Colorado, Denver 80202
District of Columbia, Washington 20554
Florida, Miami 33130
Florida, Tampa 33602
Georgia, Atlanta 30303
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Hawaii, Honolulu 96808
Illinois, Chicago 60604
Louisiana, New Orleans 70130
Maryland, Baltimore 21202
Massachusetts, Boston 02109
Michigan, Detroit 48226
Minnesota, St. Paul 55101
Missouri, Kansas City 64106
New York, Buffalo 14203
New York, New York 10014
Oregon, Portland 97204
Pennsylvania, Philadelphia 19106
Puerto Rico, San Juan, P. O. Box 2987, 00903
Texas, Beaumont 77701
Texas, Dallas 75202
Texas, Houston 77002
Virginia, Norfolk 23510
Washington, Seattle 98104


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