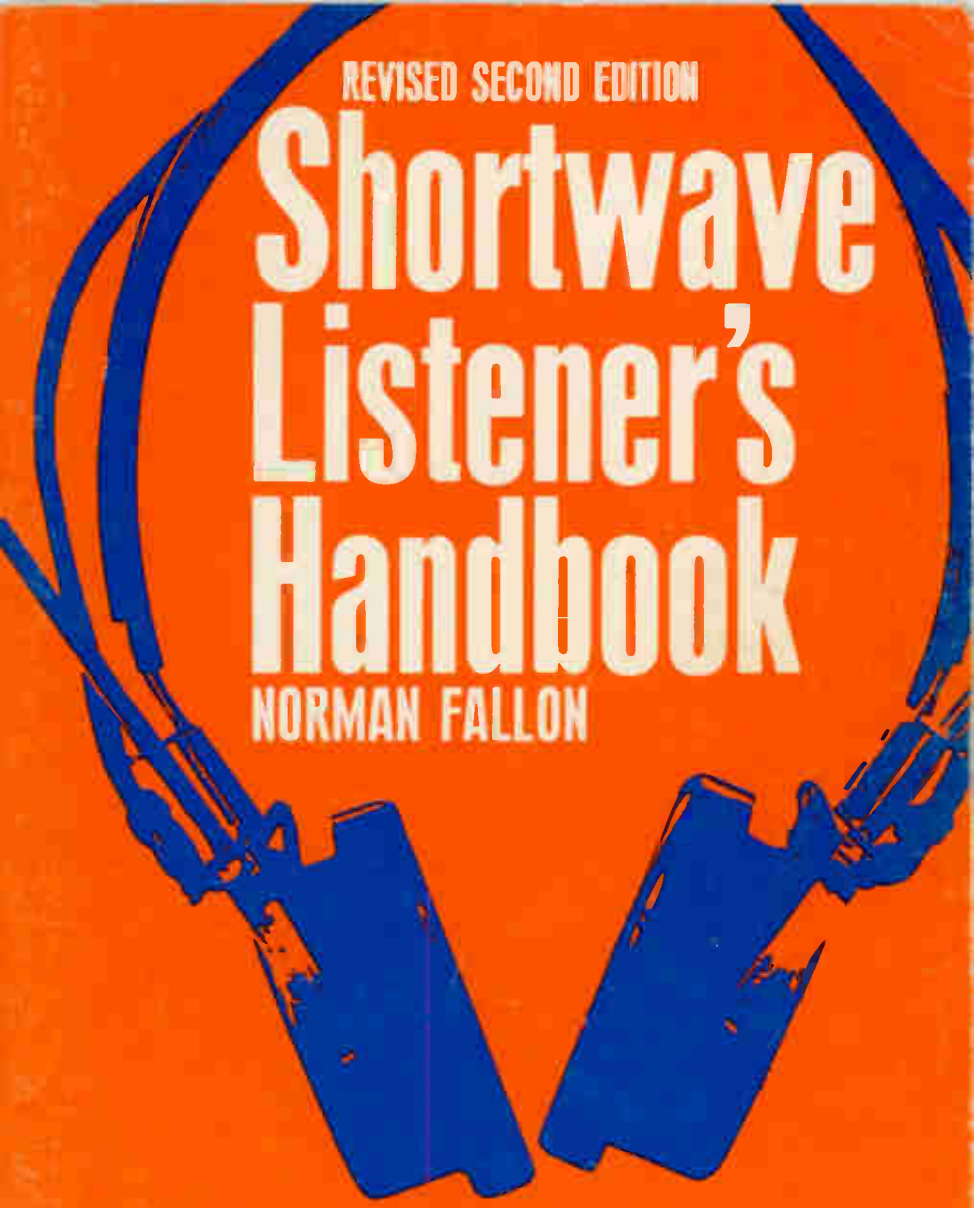
REVISED SECOND EDITION

Shortwave Listener's Handbook

NORMAN FALLON



This Complete Guide Will Show You How To

- ☐ tune in and log the world's major stations
- ☐ choose the right equipment
- ☐ use proven techniques to increase your range

PLUS... how to build simple projects to add to your listening pleasure

HAYDEN

SHORTWAVE LISTENER'S HANDBOOK

Revised Second Edition

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preface

The international shortwave broadcast listener remains, as always, in a unique position: he is able to "tune in" the events in our fast changing "world of events" from the comfort of an arm chair.

The daily scheduling of such events via "satellite TV" may be lurking on the horizon, but as yet it remains too expensive to "move in and take over" on an hour-by-hour daily basis. The shortwave listener still holds the key to the world arena and that key is his dial.

People outside the circle of shortwave listening as such are beginning to realize that the shortwave multiband portable provides a cheap way, indeed, to move into this fast-moving worldwide arena of events; all we can say is welcome aboard and happy dialing.

Yet there are many who are not aware of the fact that programs are in the language of the "target area": for example, any programs beamed at the U.S.A. are in English. Again some are not aware of the fact that such programs are as loud and clear as a local AM broadcast program (in most cases). This is due to the fact that most overseas broadcasters use 250-500 kW transmitters feeding beamed antenna arrays and our local AM broadcasters are limited to 50 kW and a band that is not as noted for "long hops" as the shortwave broadcast bands.

At any rate this book is addressed to all who are interested in listening to overseas broadcasts. Some will be interested in the international shortwave bands alone, with their multiband coverage of news events, music (exotic and otherwise), language lessons, history, culture, and the like.

Others will be interested in the so called "Tropicals" (60-120 meters). Such people are called DX'ers and the reception of such programs calls for a knowledge of languages and electronics plus expensive communications receivers and great antennas. Tropical programs are not beamed. They are

low-powered programs aimed at a local audience (and they are in the language of that audience). All of this attracts rather than repels the DX'er: he likes his DX exotic and difficult. In other words receiving the BBC or Radio Australia as if it were an AM local from a New York apartment is not his dish. He would rather go after that "south of the border" one kilowatt.

This book covers both areas so that the listener can dial the programs that suit his tastes, even if he will most likely dial a beamed program in his own language and settle for a daily listen from Radio Australia or the BBC.

The reader is reminded that political disturbances in certain areas may occasionally cause an interruption in transmission.

Parts That May Be Hard to Find

Some parts are no longer available from mail order retail electronics supply outlets such as: Lafayette, Radio Shack (Allied), etc. This can include everything from ganged tuning variables to 100 kHz crystal calibrator units to "slug tuned" coils, etc. Because of this, those who intend to build projects are directed to the classified pages or the display ads in the back of the "ham" publication *QST* which is issued on a monthly basis. Generally speaking, 100 kHz calibrator units will come from people who deal in crystals. Slug tuned coils, ganged tuning variables, and about everything else that is hard to find (maybe even the crystal calibrator unit) will come from the big surplus outlets listed on the pages of such magazines as *QST*.

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1
Overseas Listening

Some readers will remember Armed Forces Radio Service (AFRS, now AFRTS) during World War II. Others will remember the shortwave newscasters and commentators, such as Edward R. Murrow and his *This Is London* series. Few, however, will remember the shortwave flash of Byrd's flight over the South Pole. Nor will many remember the 1930 shortwave "round robin" between President Hoover in Washington, D.C., Prime Minister MacDonald in London, and

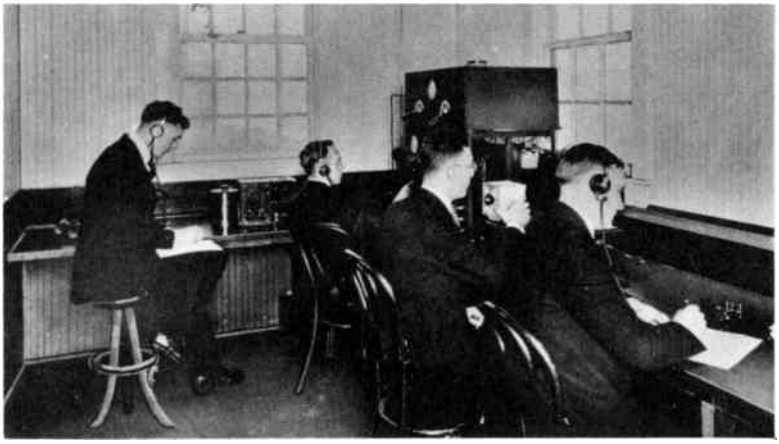


Fig. 1-1 A famous first claimed in AM broadcast radio: On November 2, 1920, the Harding-Cox election returns were heard over KDKA radio, Pittsburgh. (KDKA photo)

Premier Hamaguchi in Tokyo. And it will take a real old-timer to remember when KDKA, WJZ, WABC, and WENR had 47-meter shortwave transmitters, which were used to relay programs and help the DX'er, the searcher for the rare and distant station, receive his relay broadcast programs by switching to the 47-meter band.

Fig. 1-2 One of the claims for first place in the AM broadcast race is held by WWJ, Detroit. This photograph, taken in 1931 after WWJ had been on the air for many years, shows Ty Tyson—famous for his on-the-spot Tiger baseball broadcasts—taking an "announce cue" from engineer Edwin Boyes. (WWJ photo)

Most of the development work connected with radio transmission and reception of voice was done by the telephone interests. Longwaves were used for all but the really long hauls, which required the use of shortwaves.

It has been said that Alexander Graham Bell paved the way for radio when he invented the telephone. Yet, it took the young Marconi to make practical the waves of Hertz and develop the wireless telegraph. And finally, it took DeForest and his amplifying vacuum tube to make come true the

"music box in every home"—dream of the late RCA President David Sarnoff.

Nowadays, most of the commercial radio traffic has gone over to direct wire or line-of-sight relay networks. This includes cables, on the one hand, and highly directional microwave antennas and satellites on the other. However, shortwave radio can still deliver a world-wide scoop. For example, a European-based wire-service reporter was listening to shortwave when he suddenly heard the Russians announce that they were taking off for Prague. He called his office, and in so doing, scooped his own wire service. The Moscow teletype broke with the story a little later.

MODERN LISTENING AND THE SHORTWAVE BROADCASTERS

Today, for the first time in history, all mankind can be reached instantly anywhere in the world by way of cheap, multiband, portable transistor radios. Because of this, shortwave broadcasters are in the middle of a struggle to capture all types of listeners enveloped in this new market. In most cases, the broadcasters are mature outlets offering a variety of news, cultural, and talk shows; some of this is given with a definite political point of view and some is given with an attempt at objectivity. Depending on the listener's own political point of view, many of the stations will seem to be simply propagandizing.

The hovering giant of the East is Radio Peking, which pours a reported 450kW (450,000 watts) into every corner of the globe. Radio Peking broadcasts primarily to Asia, Africa, and South America (her *target* areas), and programs are always in the language of the target area.

Another powerful broadcaster heard daily is Radio Havana, Cuba. Its broadcasts are primarily to Central and South America and are sent in the language of the target area. North America seems to be a lesser target.

Radio Moscow and all of the Iron Curtain countries all send their programs in the language of the target area. Radio Australia, BBC (British Broadcasting Corporation), and VOA

(Voice of America) are probably the prime users of shortwaves for broadcasting, besides the Iron and Bamboo Curtain

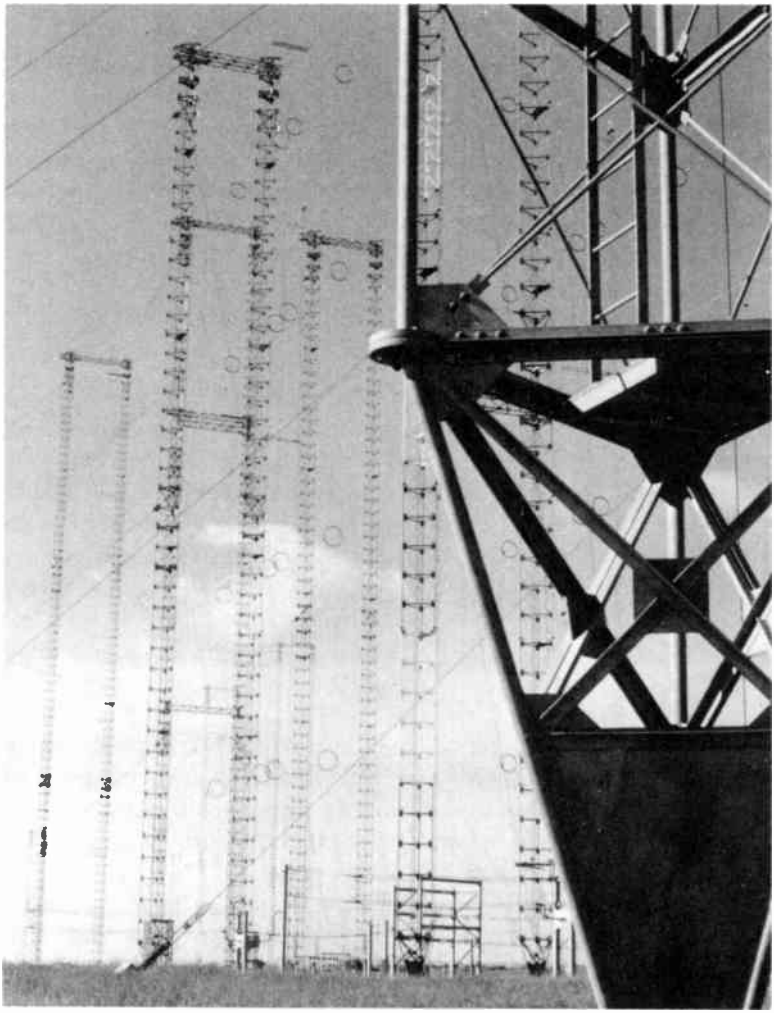


Fig. 1-3 Voice of America has relay stations all over the world, feeding giant antenna arrays—like this one in Tianang, Philippines. (VOA photo)

countries. These three not only cover the world by direct broadcast but also by powerful global relay stations.

Radio Australia is considered the objective voice for Asia, and a reliable source of Asian and "Down Under" news for the rest of the world. She has, at times, topped the BBC in popularity polls. Her audience numbers more than 56 million. Radio Australia news reports are monitored by all of Asia, and programs are beamed in several languages, including English.

Fig. 1-4 Radio Australia is the "loud and clear" Asian station heard daily in the United States and Canada. The station broadcasts in several languages besides English. Shown here is Nitya Phangsapa, conducting her "Replying to You" program for the Thai service. (ABC photo)

The BBC has been around since the early days of radio, and the BBC World Service is well known for its mature programming, news coverage, and comedy. Both BBC and

VOA beam programs in many languages, including English. Where most overseas outlets have a daily 55-minute segment in English, BBC and VOA go on in English for hours on end. It's like listening to a local AM/FM station, and just as loud and clear.

Fig. 1-5 This is Transmitter Hall at Trans-World Radio in the sunny Netherlands Antilles. TWR's huge 500kW (800kHz) AM broadcast transmitter is shown being monitored from the foreground console. A 260kW shortwave broadcast transmitter is being adjusted in the background. (TWR photo)

VOA covers the world from Washington, D.C. Programs are beamed from the world's largest beam antennas, located on both coasts of the United States. Any corner not reached by these antennas is reached by one of VOA's many relay stations located all over the world.

Radio Moscow, Radio Peking, and Radio Havana and Radio Australia, BBC, and VOA were the big cold war power

blocks. Of these, Radio Havana, Cuba, is the only one using less than 250kW transmitters. Some are reported to be using 450kW transmitters feeding beam antennas. Considering that the most powerful AM (local) broadcast transmitters in the United States are 50kW, it is easy to see why the shortwave

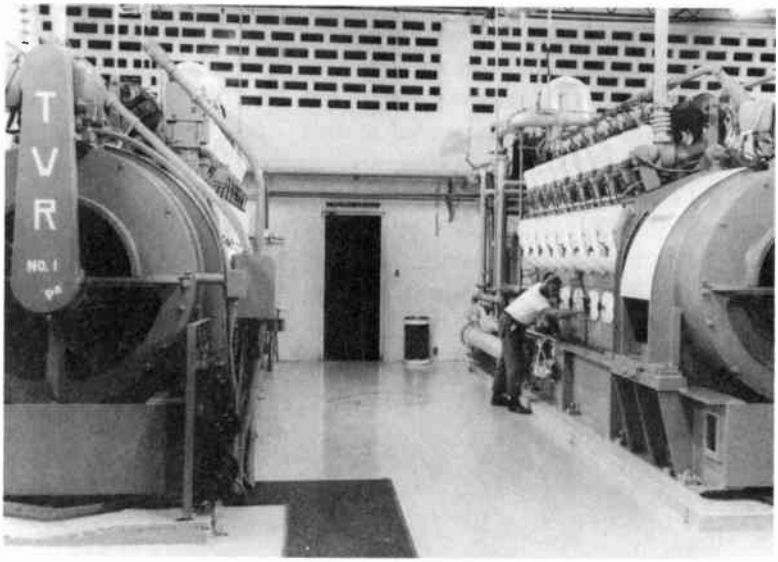


Fig. 1-6 Trans-World Radio generates 3.2 Million watts of power for the operation of it's transmitters. (TWR photo)

broadcaster's signal delivered to a target area is so good. The shortwave broadcaster wants to be able to compete with the local station; this is his reason for pouring on the power. He wants the average listener, not just the DX'er.

The DX'er and the New Order

When the cold war came into the living room like a local broadcaster, East jammed West and VOA used a floating broadcast station to beam broadcasts behind the Iron Curtain. Radio Moscow and VOA led the way to power and the bands soon became a tangled mess. New nations, bred in

the United Nations, could hardly wait to get on the air and create a world-wide image.

DX'ers, now fed up with the "new order," headed for other channels. Those who didn't wind up listening to "hams" or "utilities" are still around—hunting an odd 1 or 2kW broadcaster. These listeners use fine communications receivers to help them hunt their rare DX and are bored with a high-powered station once it is logged. They don't look forward to bagging Radio Australia every morning from their New York apartment; they want that 1kW in New Zealand.

Since the old experimental station days, the broadcaster has always needed the DX'er—and he still needs him. Most stations are government controlled and a large or small mailbag directly affects the budget. The DX'er will take the time to send mail and reception reports to the stations he hears or to beef about the ones he can no longer hear.

The sales product is not involved in shortwave broadcasting: here everything done is keyed to the listener.

Fig. 1-7 A Philippine farmer plows his rice paddy while listening to world news on a transistor radio. (Intermedia photo)

Stations will answer a listener's questions, send him cards and folders, involve him in "aired" language lessons, and sometimes even offer him prizes and entertain him.

Schedules are seasonal and are submitted ahead of time to the International Frequency Registration Board (IFRB), an agency of the Telecommunications Union, Geneva, Switzerland. In this way, the bands are kept as open as possible.

The international shortwave broadcaster has many problems. Besides supplying a signal that can be heard on a portable, he must deliver it in the evening, when listeners are home. He also must remind himself that people are listening from nut farms and rice paddies—and that the transistor radio is a status symbol in India.

The Growth of Listeners

Because there are a number of AM and FM broadcast band stations in or near every locality, the average American has overlooked shortwave broadcast listening. In many other parts of the world, however, stations are few and far apart,

Fig. 1-8 Group listening to shortwave broadcasts is common practice in many parts of the world. (Intermedia photo)

and shortwave listening is a part of everyday life. In poor areas of a few continents, people often huddle together and "group listen." The following figures will give some idea of the way the transistor radio—and shortwave listening--has moved into Africa. Africa had about 1.4 million radios in 1950. It now has more than 15 million, many of them multiband shortwave portables. In the Middle East, the findings are such that one investigator feels that the transistor radio is changing the history of that area.

They hear the world, whereas Americans are content to listen only to domestic commentators whose news comes off the wire service. Americans, therefore, receive "canned" coverage of world and domestic news, as they are limited to the one or two views of the wire services. Americans should no longer be satisfied with the wire-service news coverage when the whole world stands ready to be dialed as easily as a local station.

2
The Shortwave Radio Signal

The listener may or may not know a long-range shortwave communications signal from a short, line-of-sight FM utility signal. Few people know, or care, that all radio waves are electromagnetic waves—or want to study theory. However, there is a certain amount of basic theory that should be understood to become an expert SWL'er (shortwave listener).

RADIO WAVES

Without going into too much detail, it is sufficient to say that all radio signals have a number of things in common. AM or FM, they all travel at about the speed of light (186,000 miles per second), whereas sound travels at only about 1100 feet per second. People who know this sometimes joke about a preacher reaching his "radio audience" before he reaches the man in the back of the church.

Radio waves are alternating waves; that is, the strength of the wave goes from zero to maximum and back to zero, first in one direction, and then from zero to maximum and back to zero, in the opposite direction. This does not mean that the wave itself changes direction as it moves through space, but only that the strength of the wave changes, as shown in Fig. 2-1.

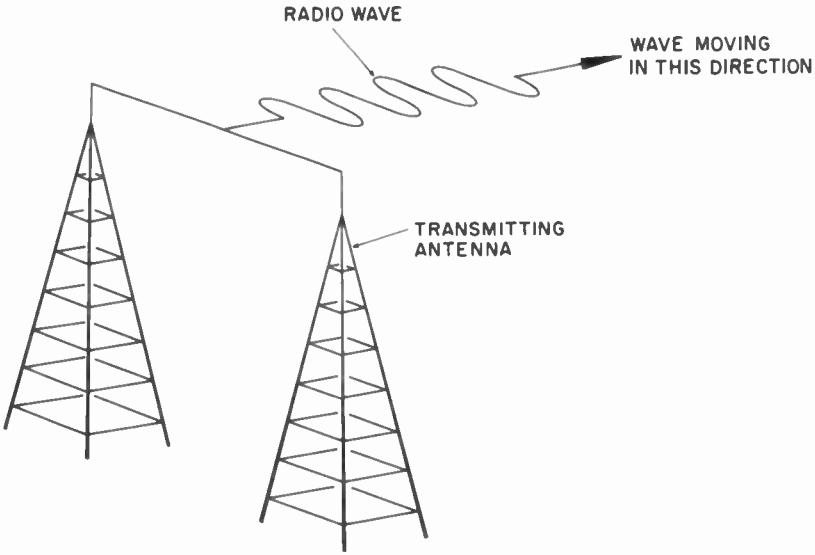


Fig. 2-1 Radio wave radiated into space.

Frequency

Two terms that the SWL'er will encounter again and again are *frequency* and *wavelength.*

When the strength of a radio wave goes from zero to maximum and back to zero in one direction and then in the other direction, the wave is said to have gone through one *cycle.* The number of cycles that a wave completes in one second is called the frequency of the wave. For example, the radio wave shown in Fig. 2-2 goes through three cycles in one second; therefore, its frequency is three cycles per second. Until a few years ago, the frequency of radio waves was always expressed in cycles per second (cps). Nowadays, the frequency is more commonly expressed in *Hertz.* For example, we refer to 3 Hertz (3 cycles per second), 400 Hertz (400 cycles per second), and so on.

However, the term "cycles per second," or cps, is still around. In fact, the tuning dial on many radios is still

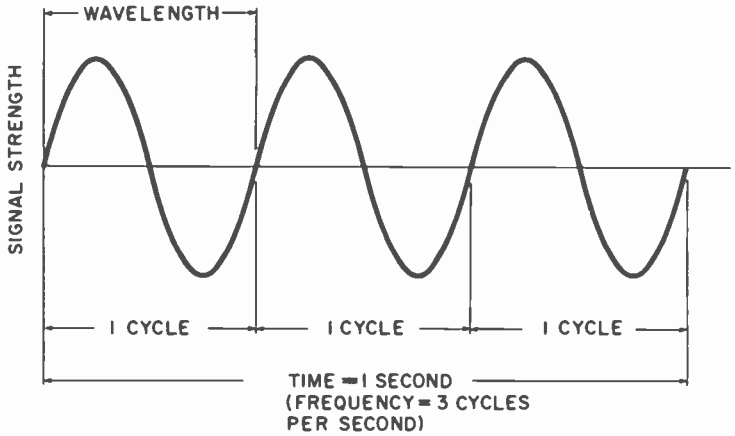


Fig. 2-2 Frequency and wavelength of a radio wave.

specified in cycles per second rather than in Hertz. Throughout the rest of this book, though, frequency will be expressed in the more up-to-date term Hertz (abbreviated Hz).

Radio waves are very-high-frequency waves. In fact, they are measured in thousands and millions of Hertz. Rather than express radio frequencies as 500,000Hz, 10,000,000Hz, and so on, the prefixes kilo, meaning one thousand, and mega, meaning one million, are used. Using k as the abbreviation for kilo, 500,000Hz is expressed as 500kHz. Similarly, 10,000,000Hz is expressed as 10MHz.

Wavelength

Wavelength and frequency are directly related. Wavelength is the distance traveled by the wave in the time required for the wave to complete one cycle (Fig. 2-1). In other words, it is the physical length of one cycle. Wavelength is expressed in meters, and if the frequency of a wave is known, its wavelength can be determined by dividing the velocity of the wave by the frequency. Since the velocity of all radio waves is 300,000,000 meters per second (the same as 186,000 miles per second), the wavelength of the wave shown in Fig. 2-2 is

$$\text{Wavelength (meters)} = \frac{300{,}000{,}000 \text{ meters per second}}{3\text{Hz}} = 100{,}000{,}000 \text{ meters.}$$

Similarly, if the frequency of a wave is 10MHz, its wavelength would be:

$$\text{Wavelength (meters)} = \frac{300{,}000{,}000 \text{ meters per second}}{10{,}000{,}000\text{Hz}} = 30 \text{ meters}$$

Suppose the wavelength of the wave is known but its frequency is not. Then the velocity of the wave is divided by the frequency. For example, if the wavelength is known to be 30 meters, then the frequency is

$$\text{Frequency (Hz)} = \frac{300{,}000{,}000 \text{ meters per second}}{30 \text{ meters}} = 10\text{MHz (10,000,000Hz)}$$

It's important to understand wavelength, because shortwave broadcast bands are almost always referred to by wavelength (in meters); that is, the 13-meter band, the 25-meter band, and so on. Stations *within* the band are usually referred to by frequency, however.

INTERNATIONAL SHORTWAVE BROADCAST BANDS

The international shortwave broadcast bands are listed in the table below. The frequency range for each band is also shown.

Band Wavelengths (meters)	
13 meters	21,450 = 21,750 kHz
16 meters	17,700 = 17,900 kHz
19 meters	15,100 = 15,450 kHz
25 meters	11,700 = 11,975 kHz
31 meters	9200 = 9700 kHz
41 meters	7100 = 7300 kHz
49 meters	5950 = 6200 kHz

Stations operating in these bands are usually the most powerful stations that can be received, and almost all of them

broadcast in English. However, as will be explained later, all of these stations cannot be received at all times.

In addition to the international broadcast bands listed above, there are other shortwave listeners' bands called "tropicals." These bands, which fall between 60 and 120 meters, are occupied by relatively low-power stations located in Central and South America and parts of Africa and Asia for local use. Broadcasts from these stations are usually in the language of the country in which the station is located.

THE RECEIVED RADIO SIGNAL

Radio signals are very-high-frequency waves. The human voice and music, by comparison, are low-frequency signals, called *audio signals*. Audio signals range from about 20Hz to 15,000Hz. Because they are of such low frequencies and because of other technical considerations, they cannot be transmitted over long distances like radio-frequency signals. Therefore, at the transmitting station, the audio signal is superimposed on the radio signal during a process called *modulation*. The combined signal is then radiated into space by the transmitting station's antenna, picked up by an antenna a few thousandths of a second later, and fed to a receiver. Within the receiver, the audio signal is separated from the radio signal by the process of *demodulation* and then amplified and fed to the speaker or headphones. The transmitting and receiving process may sound quite simple, but it really isn't considering that the signals have traveled thousands of miles through space. In fact, the strength of the signal received by the antenna is measured in microvolts (millionths of a volt). To make sure that an area receives the strongest signal possible, the transmitting stations use directional antennas to beam, or aim, the signal in that direction. Unlike the simple antenna used for the typical home radio, a good receiving antenna is required to distinguish the weak signal from the electrical noise that is always present in the atmosphere (from power lines, neon signs, etc.). Because of the importance of receiving antennas in SWL'ing, Chapter 5 is devoted solely to this subject.

Another major factor affecting the reception of a signal is *wave propagation*; that is, the path the wave follows from the transmitting antenna to the receiving antenna and how various atmospheric conditions affect it along the way. Since this varies from shortwave band to shortwave band, an understanding of wave propagation is needed to know which bands to use during different times of the day and year.

Propagation

When a radio wave is transmitted, various parts of it travel from the transmitting antenna to different paths as shown in Fig. 2-3. One part, called the *ground wave*, travels along the surface of the earth. Another part, called the *skywave*, travels upward and outward into space. The skywave makes long distance SWL'ing possible.

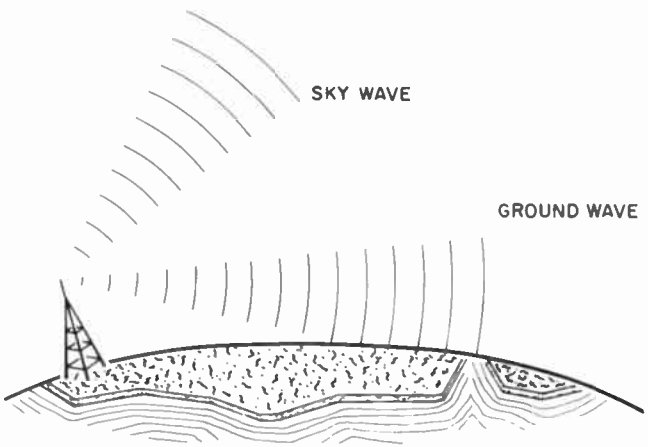


Fig. 2-3 A transmitted signal consists of a ground wave and a sky wave.

As a skywave travels upward into space, it encounters the ionosphere, a region consisting of layers of ionized gases about 60 to 200 miles above the earth.

As shown in Fig. 2-4, the skywave is reflected back to

earth by the ionosphere. This is known as *skip*, and the distance between the transmitting antenna and the point where the skywave returns to earth is known as the *skip distance*.

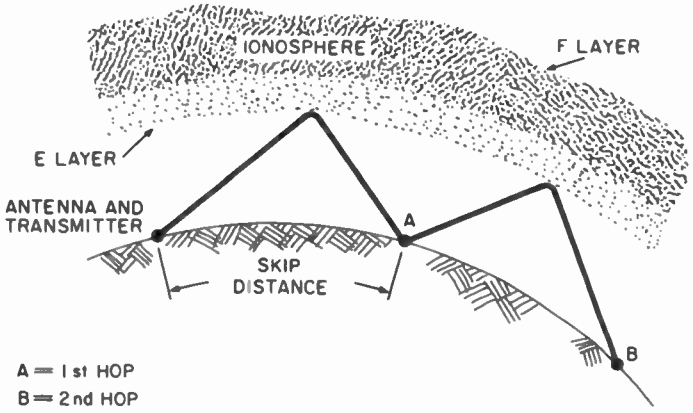


Fig. 2-4 Radio wave reflected from the ionosphere.

As the transmitted signal depends on frequency and angle, not signal strength, the signal often bounces back and forth between the ionosphere and earth several times. This is known as *multiple-skip* or *multiple-hop* transmission. Skip makes transmission over thousands of miles possible.

Broadcast station engineers make use of skip to beam their broadcasts at certain target areas. They do this by controlling the angle, called the *critical angle*, at which a radio signal, of a certain frequency, strikes the ionosphere.

The ionosphere is not stable. Its thickness and altitude vary, particularly with the time of year. Also, sunspots, whose intensity varies over an eleven-year cycle, greatly affect the characteristics of the ionosphere.

It's up to the broadcast station engineers to worry about critical angles, skip distances, frequencies, and the like. Generally, losses are kept down by using as few hops as possible, which means using the lowest angle of radiation

(highest practical frequency). As a rule of thumb, the F layer of the ionosphere and the highest frequency for a given time that will ensure reception in the target area are used. Generally, the E layer of the ionosphere is not dependable for overseas broadcasting. However, during the low period of the sunspot cycle, it is sometimes dependable for overseas broadcasting. This condition is often referred to as the *sporadic E* condition.

Actually, the E layer is the dependable mirror for the 60- to 120-meter tropical and regional outlets. The E layer is also responsible for making AM broadcast band DX'ing possible. Sporadic E conditions sometimes do affect the international shortwave broadcast bands. At such times an alert DX'er can receive rare stations he would not normally hear.

The Sunspot Cycle

Generally speaking, the international shortwave broadcast bands are dependent upon what is known as the eleven-year sunspot cycle. Although the sunspot cycle is not precisely predictable, a rough curve of the cycle appears in Fig. 2-5. Early in the cycle the number of sunspots is low, reaching peak approximately midway through the cycle, and then dropping off again in the last part of the cycle. The sunspot cycle has little effect on the 25- through 49-meter bands, but greatly affects the higher frequency 13-, 16-, and 19-meter bands. During the peak years of the cycle, reliable long-range skip transmission is possible on the higher frequency bands. Transmission on the higher bands is unreliable at other times during the cycle and, in fact, may be impossible at the beginning and end of a cycle.

Although the 25-, 31-, and 49-meter bands are not directly affected by the sunspot cycle, they are affected in another way. They become very crowded because they are called upon to carry the bulk of the scheduling during all but the peak years. During peak sunspot years, broadcast engineers use 13, 16, and 19 meters regularly, but there are also plenty of evening programs on 25 and 31 meters, because these bands are on almost every shortwave set. Only the better sets will include 13, 16, and 19 meters.

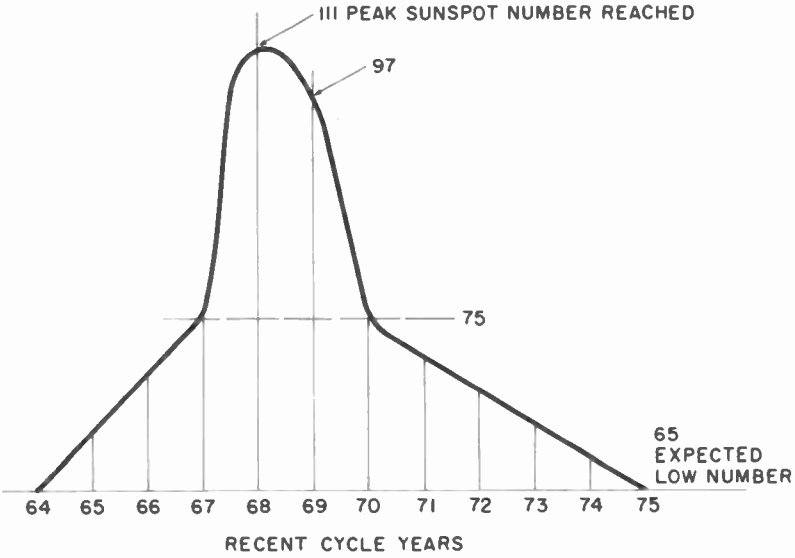


Fig. 2-5 The sunspot cycle.

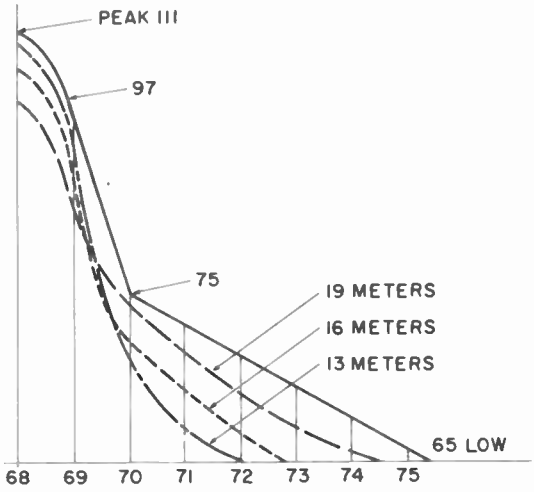


Fig. 2-6 How the recent cycle really looked to the listener. The upswing starts again in 1976.

Predicting sunspot conditions is strictly for the frequency division experts. Conditions change hourly, daily, weekly, and monthly—as well as yearly. During peak years, the best listening months usually occur in spring, summer, and early fall rather than in winter.

A rough rundown of the recent sunspot cycle and its effects on the 13-, 16-, and 19-meter bands is shown in Fig. 2-6. As the sunspot numbers decrease, transmission on these bands falls off; during the low-cycle years, the higher the frequency, the poorer the transmission. As pointed out before, the 25-, 31-, and 49-meter bands are not too much changed by sunspot conditions and should remain relatively stable throughout a given cycle period.

Ionospheric Storms

Ionospheric storms are sunspot disturbances that greatly upset the characteristics of the ionosphere. Storms may last from one to several days. During this time, refracting layers of the ionosphere may disappear and communications may come to a grinding halt. At best, the going will be rough.

MAXIMUM USABLE FREQUENCY

Maximum usable frequency (MUF) is the highest radio frequency that will be reliably reflected back to earth from the ionosphere. Since the ionosphere is directly affected by the sunspot cycle, so too is the MUF. It is highest during peak sunspot years. Determining the MUF is the broadcast engineer's problem; it is taken into consideration in the broadcast schedules published and distributed by the broadcast stations.

Fading

There is a daily variation in the MUF. If the variation is such that the MUF drops significantly below the station frequency, the signal will fade out. Also, fading conditions should be expected during the day on any given frequency because signal absorption by the ionosphere changes with the height of the sun.

Fading can sometimes be overcome by *diversity reception*. Diversity reception involves using two antennas, one vertical and one horizontal, and two receivers, or two antennas with a special diversity receiver set-up. However, this is expensive and will interest only the serious DX'er.

WHAT TO EXPECT ON THE BANDS

International shortwave broadcast schedules will reflect the best MUF conditions. The bands and times listed will be the best broadcast time available for an area. Some broadcasters try to tie listeners in by issuing predictions. DX clubs and some electronics magazines also try to keep listeners up to date. However, the best way to find out what is coming through is to scan the bands and consult the latest schedules —and let the station engineer worry about reaching listeners on a given evening.

Generally, the highly changeable 13-, 16-, and 19-meter bands will be best during the spring, summer, and early fall periods of the peak sunspot years. The 25- and 31-meter bands are always crowded, but will be more so during the beginning and end of the sunspot cycle, or low sunspot years. The same is true for 49 meters, except that it is usually best during the winter months. During the peak sunspot years, the 19- and 25-meter bands tend to be in an MUF position around the clock. At such times the DX'er can count on bagging a few new countries on these long-distance bands.

The 13-, 16-, and 19-meter Bands (peak sunspot years)

Bandswitching is always important because of changing band conditions, and during the peak sunspot years the 13- and 16-meter bands should be open from mid-morning through late afternoon. The 19-meter band should be open from noon through late evening.

The 25-, 31-, and 49-meter Bands

These bands broadcast in the evening and at night year-in and year-out. They are little changed by sunspot conditions

and, except for peak years, carry the bulk of the scheduling. Again, bandswitching is the key to SWL'ing.

The habit of sending for schedules—and using them—will make listening a pleasure. Listeners will find that the station's engineer has picked the best time and band (MUF) possible to deliver a good signal. Only a sunspot storm or interference on the selected station will make him depart from his scheduled choice. Such a storm could make him change bands, but channel interference will send him only a few kilohertz up or down the scheduled band.

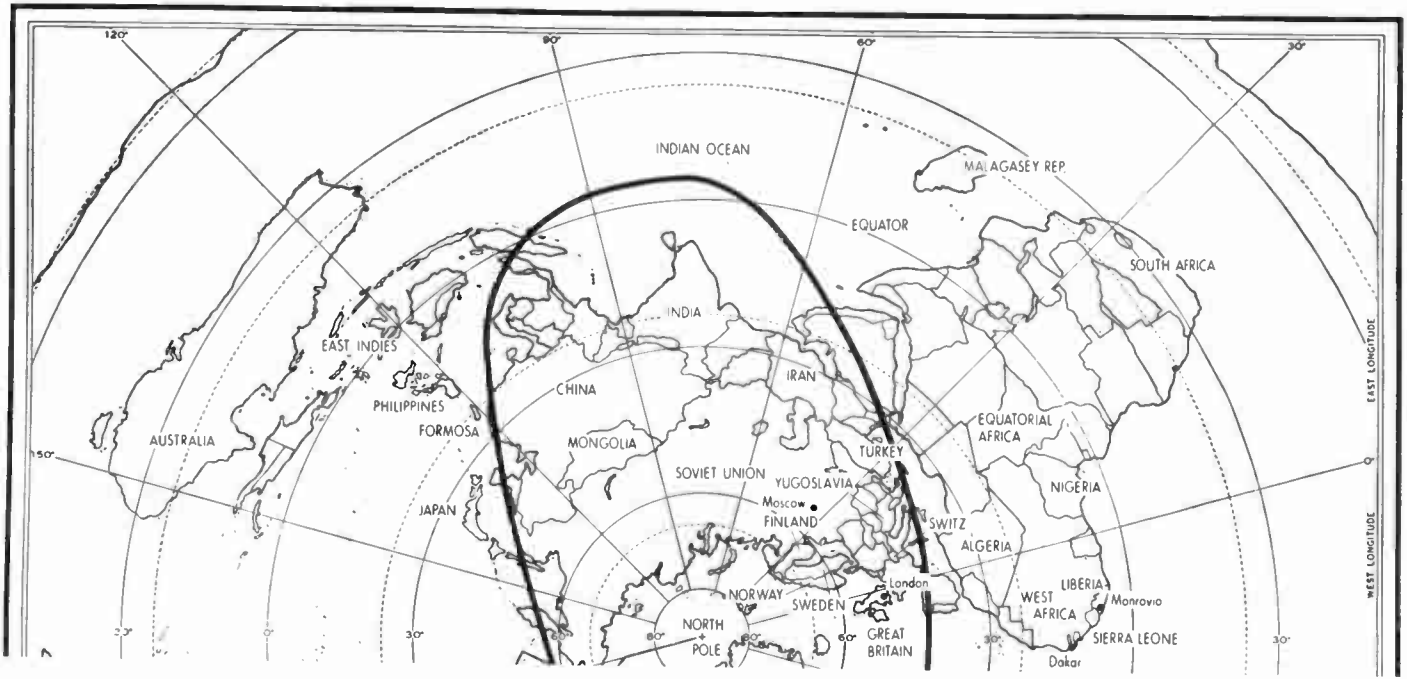
With a little practice, a listener can soon learn his way around. For a beginning listener, it's a good idea to scan the bands as he starts listening, for bands are always changing, which is all part of the game. If there is activity on a given band, the fish are biting; if a listener sticks with it, he may haul in a rare one.

3
Listening to Shortwave

There are numerous musical programs broadcast on the international shortwave bands, but music is not the main feature. Talk is, and anyone who loves news, commentary, drama, language lessons, or information on the history and culture of a country is in luck. The general level of the talk programs is high. Listeners may tune in a few "basic English" programs aimed specifically at underdeveloped areas, but most of these programs will be confined to Voice of America. These programs, however, serve to remind us that shortwave radio is big in countries where newspapers and magazines are scarce and readers are scarcer still.

Those who live by one or two TV commentators won't like shortwave broadcast listening. It is not for the person who likes to doze off in front of the tube—satisfied that all is well. On the other hand, it is made to order for the individual who flips off the TV and says, "There must be something else," and who wants to be a living part of the next Prague or Paris event. Scheduled world-wide TV on a daily basis, sooner or later will probably shoot down shortwave broadcasting. But until this happens, overseas shortwave listening offers the only ticket to the global arena.

"Canned" wire-service news is world-wide, but a shortwave listener gets an *on-the-spot* in-depth view, and this makes a difference. Here, there is an instant scanning ability. In short, a listener can scan the world as fast as he can spin his dial.


120°
90°
60°
30°
INDIAN OCEAN
MALAGASEY REP.
EQUATOR
SOUTH AFRICA
INDIA
EAST INDIES
CHINA
IRAN
PHILIPPINES
FORMOSA
AUSTRALIA
MONGOLIA
EQUATORIAL AFRICA
TURKEY
SOVIET UNION
YUGOSLAVIA
NIGERIA
Moscow
JAPAN
FINLAND
SWITZ
ALGERIA
LIBERIA
London
NORWAY
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Monrovia
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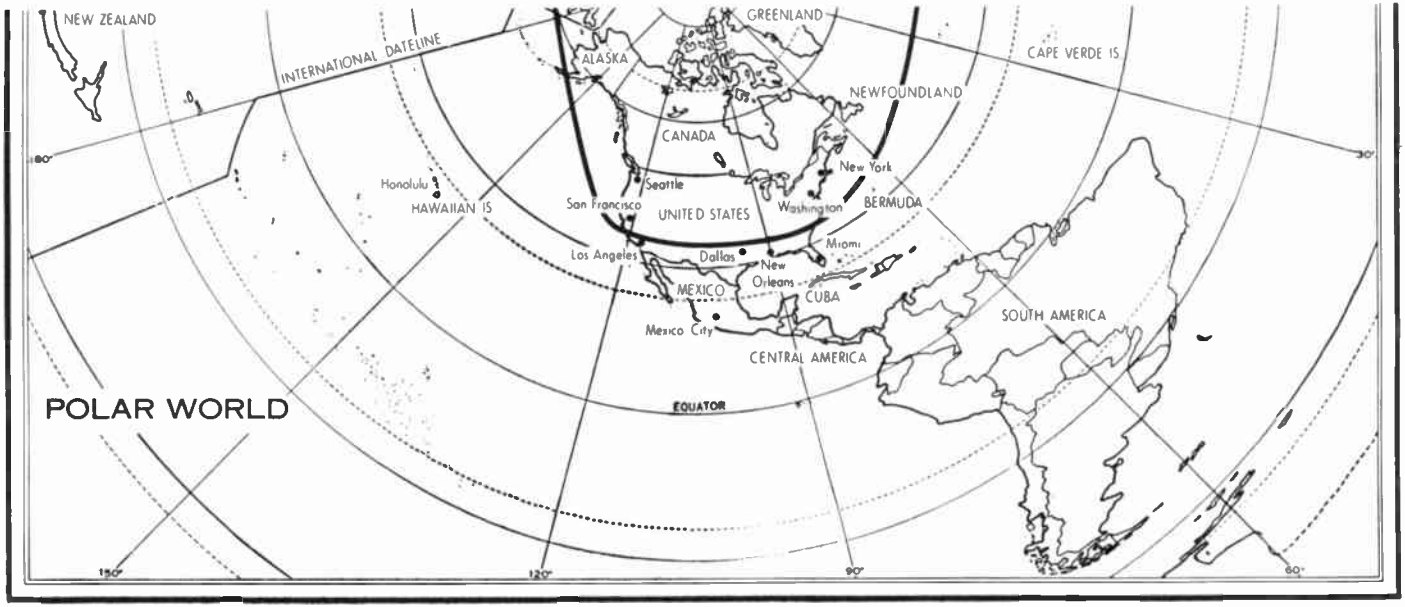


Fig. 3-1 Areas affected by aurora zone.

HOW TO MEET LISTENING CONDITIONS

The successful scanning and use of the international shortwave broadcast bands for daily communications purposes depends on four things: (1) where the listener is located in relation to the *aurora zone* (the ionized polar sky cap that makes reception over the poles difficult most of the time); (2) the listener's ability as an operator; (3) his respect for good receivers; and (4) his knowledge of antennas.

When conditions are right, any wire hooked to a cheap all-band portable will bring in the world if the portable is placed in a good location. This isn't so, however, if conditions are bad and the signals must pass through the aurora zone.

Figure 3-1 gives a general idea of the area in which reception is affected by the aurora zone. In the United States, listeners on the West Coast experience difficulty listening to European short-path signals, because European signals to the West Coast pass through a major part of the aurora zone. East Coast listeners, although not free of aurora problems, have much better reception from Europe because the signal does not pass through as much of the aurora zone.

For the most part, West Coast listeners must depend on long-path (Great Circle), early morning signals from the continent unless the station uses relays. For example, Radio Nederland has a relay station in Bonaire, Netherlands Antilles, which can be heard on the West Coast. BBC has relay stations, but they are not beamed at the United States mainland (except from London and Ascension Island). The short-path angle will allow the BBC to be a prime source for the East Coast listener, but the West Coast short-path to Europe is just not reliable for communications purposes.

If a listener lives in a problem area, he will have to give up the idea of being an average listener and become a DX'er. This means that he will be a hunter of weak as well as of powerful long-path signals. In this way, he will be able to cope with aurora conditions.

Being a DX'er will mean owning a good receiver and knowing how to operate it. Cheap receivers are sometimes

prone to *cross-modulation*, or local-station interference on shortwave bands, and a listener who already has reception problems can live without this additional annoyance. A DX'er needs good antennas; random-wire antennas, although better than nothing, do not have the gain (added signal level) required for DX'ing.

Daily reception of a fixed number of global stations depends on time and bandswitching techniques tailored to meet daily conditions. Such an operation must be a do-it-yourself scheme, based on listening needs and location.

SETTING UP A NETWORK

If a listener has a good location, he will have few tuning problems. If he does have a problem, it will be because the signals are down in the mud, and in such cases, the following hints may be helpful.

Solar storms or the aurora zone can always cause problems, and a listener may have to work around the zone. In such a case, he may be DX'ing or hunting long-path signals to replace the regular short-path signals. He may pick up signals aimed at other countries, which will sound weaker than the regulars. The best place to look for such signals is on the band edges; in this case, the edges of 19-, 25-, 31-, and 49-meter bands. An example of how helpful this can be is to consider the following:

The BBC in London beams seven hours of world service features to the United States daily. If the aurora zone starts acting up and these seven hours become hard to receive, there is a way out. In the mid-afternoon or early evening, the listener should try the 25- or 31-meter band edges for the BBC European, African, or any other BBC service he can find. The BBC has outlets in Ascension Island and Malaysia, as well as in London.

London and Ascension Island have the only beamed service covering North America. Trying to receive BBC on any other service may be difficult, but it also may save the day. Of course, not every DX station will be found on a band edge; some may be in the depths between the giants.

When a listener hunts DX, it is a good idea to tune slowly and then *zero in* by giving the dial a short rock back and forth to really hit the target. (More details on tuning and logging will be found in Chapter 7.)

If the listener makes a practice of hunting and logging extra outlets, he will wind up with a stockpile of useful substitutes for future use. A time and frequency card file (such as described in a later chapter) will be most helpful in finding a station in a hurry.

Another useful tool is an Azimuthal Equidistant Projection Map published by the United States Department of Commerce and centered on a nearby city. For example, map No. 3042 is centered on New York City and will work for the East Coast area. Such a map allows its user to see and measure the great circle paths that radio signals will follow.

Once a listener has decided on a fixed number of stations and has tested their usefulness, he should get on their mailing list. In so doing, he automatically will be fed schedules and, in some cases, reception report forms, if he wants them.

Networks for East Coast Listeners

The following is an example of a useful news and feature network (in English) for listeners on the North American East Coast:

Europe (via aurora zone)	BBC Radio Nederland (relay) Radio Switzerland Italian Radio (on aurora zone edge) Radio Prague Radio Sofia Radio Moscow
Europe (via aurora zone; too far north for daily use)	Radio Finland Radio Sweden Radio Norway Deutsche Welle, Germany (uses relay)

Europe	Radio Portugal Radio Nederland (Bonaire) Deutsche Welle (Portugal)
Africa	Radio RSA (South Africa) Radio Cairo (now Cairo State Radio) Radio Nigeria — News in English Radio Accra (Ghana) — News in English
Asia	Radio Japan Radio Lebanon Radio Jerusalem Radio Kuwait
Asia (aurora zone)	All India Radio Peking
North America	Voice of America Radio Canada
South and Central America	HCJB (Quito Ecuador) Radio Nederland (Bonaire) Trans-World Radio (Bonaire) Windward Islands Radio Radio Havana, Cuba
Oceania	Radio Australia (best for Asian news)

(Note: Radio Peking and Radio Moscow never call out transmitter locations, but they are reported to use relays. At any rate, they do a good job bucking the aurora zone and getting through.)

4
Shortwave Broadcast Receivers

Professional communications receivers have always been the standard of excellence for long-distance reception. In the old days, in fact, this type of receiver was required if a DX'er wanted to hear a distant station on a regular basis. Professional communications receivers, however, are quite expensive, as will soon become apparent.

Fig. 4-1 The Zenith D7000Y still remains a top choice in the $250 class. It replaces the older 3000 series.

Today, there are portable communications receivers, better known as multiband, solid-state, global portables, which are in the price range of most listeners. These receivers are about as easy to operate as a common clock-radio and are often more sensitive than the old tube-type communications receivers. In fact, everything the listener needs is built into these receivers, unless he is going in for hard-core DX'ing.

Some people are fooled by the word portable. They think this means something less than the best. They have seen and heard too many cheap receivers. The modern solid-state global portable in the $200 class is really as good as many communications receivers. In fact, it will take a professional communications receiver to beat a global portable.

THE MULTIBAND PORTABLE AND THE AVERAGE LISTENER

A true global portable has bands that will include all international shortwave broadcast bands, the bulk of the regionals and tropicals (low-powered Latins), and the FM-AM standard domestic broadcast bands. The best of such portables will spread each of the international shortwave broadcast bands over the major portion of the dial for easy tuning.

The quality of the sound is up to the listener. The best of hifi speakers can be plugged into the external speaker jack and adjusted (there are bass, treble, and volume controls) to suit individual taste. 'Phones, the set's speaker, or a communications speaker can be used for DX'ing. The only real skill needed will be the ability to listen carefully and tune slowly.

Multiband portables of this kind can be highly recommended to any average listener who lives in a fair reception location and has the desire to hear the major global shortwave broadcasters. Those who want to hear a given station night-in and night-out at a given time year-in and year-out are no longer average listeners. They should buy a communications receiver, put up good antennas, and study band conditions. In short, they must become DX'ers.

The appeal here is to those who are willing to make use

of what is coming through at the time—for what is coming through will usually be plenty. On the other hand, there is no need to mislead an East Coast listener who wants to listen to Radio Finland night-in and night-out. Finland is in a far northern position in relation to the aurora zone and United States reception conditions are bound to be bad at times.

If Finland is out, why does Radio Moscow come through

Fig. 4-2 The Sony TFM-8000 is a good all-band portable selling for under $200.

for the same listener, night after night? It isn't certain where Radio Moscow is transmitting from, but it can't be from Moscow, because the transmissions come through too well. Radio Moscow uses relays or widely spaced transmitters to beat propagation and aurora conditions; Finland doesn't. Another thing, a down-in-the-mud, too-far-north station can be plowed under by a southern European powerhouse, even when conditions are fair. Here is where a listener needs the selectivity of a real communications receiver to make sense (or copy) out of the station. If he is using a portable, he will have to be satisfied to listen to the powerhouse that is causing the trouble or tune in another station.

The *portable* is made for stations with power and the bands are loaded with powerful 250kW stations, but it also has other advantages not found in most communications receivers. For example, powerline noise can be a real problem in a city; but, since portables are battery operated, they lick this problem. Also, whip antennas are generally noisemakers and do not work well on communications receivers. But they do work pretty well on portable receivers, because portables are designed to operate on short antennas. Therefore, if space or other problems prohibit the use of a rather large and complex communications receiver antenna, the listener might be better off with a portable. A simple, properly cut, single-wire antenna for each band will often do wonders for the portable.

THE DX'ER AND THE COMMUNICATIONS RECEIVER

If a listener likes to DX, or lives on the West Coast of the United States and often must DX, he will need a "hunter's" receiver. Such a receiver is called a *communications receiver*, not a communications *type* receiver. A communications type receiver can be had for as little as $175.00 new. A true communications receiver can cost as little as $200 used or $400 new, or, for a real DX nut, $3000 new. A budget communications type receiver is in another league by any count and it will not do the job of a regular communications

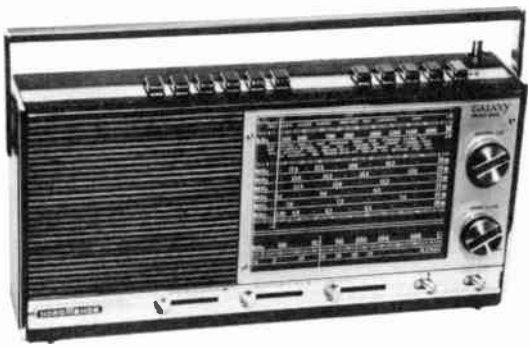


Fig. 4-3 The NordMende Galaxy 6606 is a fine 9-band receiver selling for a little under $200.

receiver. A typical "budget" receiver will allow a listener to hear code and single sideband signals and will perform as a communications receiver when reception conditions are at least fair. However, when a lot of selectivity is needed, the "budget" receiver fails completely. It is fine if the listener can work within their limits, but if he can't, or he wants to DX, he will want and need a real communications receiver.

Fig. 4-4 The new Drake SSR-1 is a synthesized, solid-state desk-top 500kHz to 30MHz AM portable. A great new receiver in the $350 class.

This is, however, a receiver for the "buff" and not for the average listener who simply doesn't need it.

A real communications receiver will not only tune every type of signal, but it will allow the listener to tune one close signal in and another close signal out. This is called *variable selectivity*, or the ability to select one signal over another when both are on about the same frequency. Excellent variable selectivity is one feature that makes the communications receiver so expensive. Other features are greater dial accuracy (the ability to reset within ±1kHz) and better high-frequency reception.

Operating a communications receiver with any degree of success takes a little patience and a small amount of skill. This type of receiver will make sense out of a down-in-the-mud signal, but at the expense of audio quality. This loss of audio quality might be enough to discourage the average listener, but sacrificing audio quality is often the only way out if the listener wants to grab the really weak signal. Poor signals need peaking so that sideband interference from other stations is kept down. What is called for is the use of the selectivity controls in order to narrow the passband so that only the desired signal is received. But a narrow passband distorts the signal if a crystal filter selectivity control is used. If the set has a mechanical filter control network, the signal will have an annoying "ringing" sound. So it all boils down to which is the lesser of two evils.

It is hard to find communications receivers with selectivity controls really suited for shortwave AM broadcast signals, which are the signals being handled on shortwave broadcasting. The crystal networks are best when used on code signals. The mechanical filter networks supplied are geared for "ham" CW or single sideband (SSB) use, and they may have to be used this way on AM. The problem is that there are not enough broadcast DX'ers to warrant the design of special receivers. For the DX'er, the lesser of the two evils is the mechanical filter network. The distortion of the crystal filter may destroy the signal, whereas the mechanical ringing may just be annoying.

The communications receiver always has a BFO, or *beat frequency oscillator*, for code reception, which the average shortwave listener is not interested in, but the BFO helps the DX'er find distant carriers on the broadcast bands. Once the carrier is located, the BFO is turned off so that the voice signal can be copied. The BFO is also needed if a crystal oscillator is used to calibrate dials. This is mentioned because some budding DX'ers may think they are paying for communications receiver gadgets that they won't need.

THE SOLID-STATE DUAL-CONVERSION COMMUNICATIONS RECEIVER

A good modern solid-state communications receiver will outperform its vacuum tube counterpart. It will be more stable, have a better signal-to-noise ratio (it will be dead quiet), and if it is a dual-conversion receiver, the dial will have real reset accuracy. The instant-on feature of solid-state receivers is common knowledge.

In this type of receiver, each band will be calibrated to take up part or all of a 500kHz-wide crystal-controlled segment. The dial width will be 500kHz wide and will spread the band out according to its width (a 450kHz-wide band would read 0-450 ±1kHz). Stable (heat-free) operation simply means that the receiver-tuned circuits drift very little. The dial can be reset and the station found on the same spot. Modern transistor receivers are, in most cases, noise-free from antenna input to speaker. If noise problems exist, the powerline or the antenna system is at fault. Tubes, by nature, are noisy and cause drift (because of the heat generated).

The dual-conversion receiver greatly improves reception on all of the international shortwave bands. This will be explained in detail in Chapter 6.

THE COST OF RECEIVERS

The portable receiver buyer has a wide choice in every price range. At the lowest level, he can choose from sets having one or two shortwave bands and selling from $25 to

$100. He won't have any bandspread, which means the bands are hard to tune, and as mentioned before, there may be cross-modulation problems. If he lives in the open or can tune around the problem, the sets will receive overseas broadcasts by the dozen. In the better sets, the buyer will have bandspread and most or all of the international bands, plus the possible cross-modulation worries.

The global portable is the one most recommended, for it delivers professional signals without cross-modulation worries or other problems. Such receivers cost between $200 and $400. Some people try to shoot down all transistor portables because of problems existing in cheaper sets. But a cheap set is always a problem in one way or another, whether tube or transistor.

The DX'er has little choice. He can try a "budget" communications receiver, but he will soon find himself eyeing a $600 dual-conversion set. The sky is the limit for those who want luxury listening. Such a listener can go in for diversity reception and wind up with two receivers and a

Fig. 4-5 Drake also offers this conventional double-conversion solid-state receiver in the $600 bracket.

double-antenna system covering all directions. If he desires such listening, he should remember that the automatic gain controls (AGCs) must be hooked together. A system such as this reduces fading and greatly improves reception.

The balance of the shortwave listener's outfit will consist of an antenna and perhaps a few other items. He may want to add a better speaker or a pair of 'phones, or maybe a tape recorder—but that is it.

The average listener might get started for as little as $60 and reach a top figure of $400. The DX'er might start at $200, but would be far wiser to figure on $600. The luxury listener won't hear more stations—he will just live better. It's a pleasure to operate fine receivers and have one's own antenna farm, but it's not necessary. It is useless to spend such money unless one really knows how to operate, and even then it may not pay.

Fig. 4-6 Drake offers this continuous coverage 10kHz to 30MHz digital synthesized solid state DSR-2 as their "top of the line" communications receiver in the $3000 price range.

5
How to Become an Antenna Buff

There is nothing like a good receiver, except, perhaps, a good antenna hooked to the front of the receiver. A good antenna is not just any wire, but a wire cut specifically for the band in use. Such a wire is called a *halfwave* or *resonant wire.* Unfortunately, some people buy very costly receivers and then scream about poor reception, due, in most cases, to a poor antenna.

A lot of money can be spent on converters, preamps, and assorted antenna couplers, and the result can produce more noise than gain. Such accessories may add a noisy one or two *S-units* (a scale on the *S-meter* which is a tuning indicator found on most good receivers to indicate the strength of the received signal; two S-units is enough gain to pull a signal out of the mud), but a simple halfwave antenna will add a clean one, two, or maybe three S-units. Halfwaves are simple to make; what's more, they cost very little.

A halfwave antenna for the band in use is a resonant wire cut five percent shorter than one-half the wavelength of the center frequency of the band. The international shortwave broadcast bands are not very wide, and a resonant wire cut for the center of a given band will be down very little on the ends of the dial.

Antenna lengths for the international shortwave bands are as follows:

Band	*Antenna Length*
13 meters	21 ft. 9 in.
16 meters	26 ft. 3 in.
19 meters	30 ft. 5 in.
25 meters	40 ft.
31 meters	48 ft. 6 in.
41 meters	65 ft.
49 meters	77 ft.

The wire may be used as is for portables. For a communications receiver, the wire should be cut in the center and an insulator inserted to make *dipoles*.

TYPICAL HALFWAVE RECEIVING ANTENNAS

Probably the two most common antennas for shortwave radios are the end-terminated Hertz and the dipole. An end-terminated Hertz antenna matches the input circuit of portable receivers very well, and it is the most simple and most useful halfwave antenna for the SWL'er. (End-terminated means simply that one end of the antenna is connected to the receiver.) The antenna can be mounted horizontally, as shown in Fig. 5-1, or simply draped from a window if the window is high enough above ground. It can also be mounted

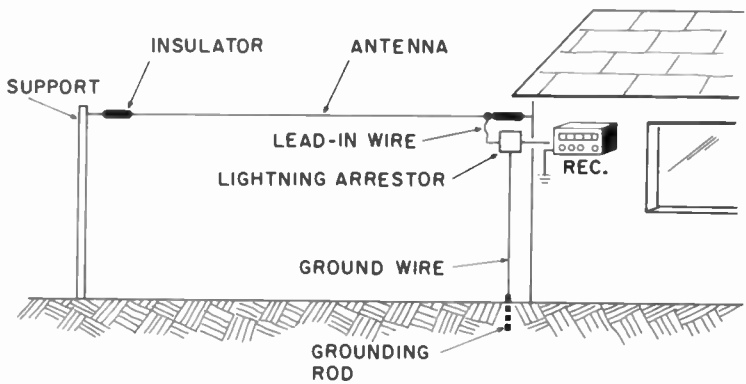


Fig. 5-1 A typical end-terminated Hertz antenna.

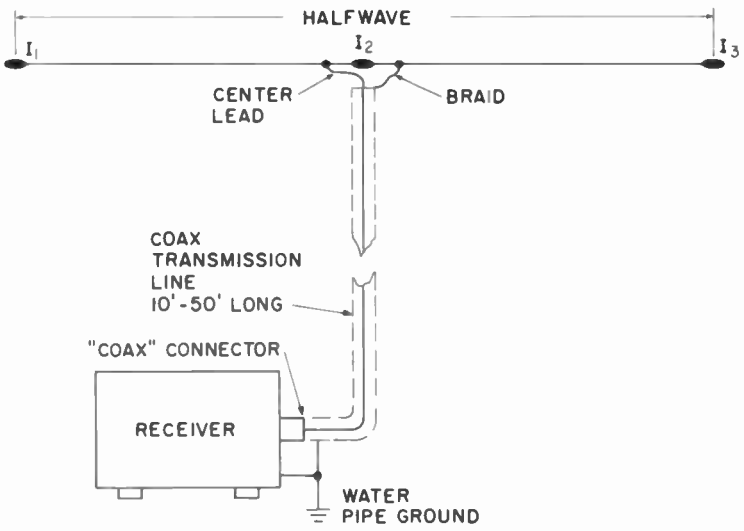


Fig. 5-2 Halfwave dipole.

horizontally in the home; for example, in the attic, if space permits. But it is best mounted outside.

The dipole antenna illustrated in Fig. 5-2 is a center-fed halfwave antenna. Center-fed means that the center point is connected to the receiver (as opposed to an end-terminated antenna). The center-fed dipole has a low impedance and therefore is used very often with communications receivers, which have a low-input impedance. As explained later, it is advisable to use a coaxial transmission with this type of antenna.

The Hertz antenna will often prove satisfactory for the average SWL'er; the DX'er might prefer the dipole or one of the other antennas described later in this chapter. (Chapter 12 describes the construction of a number of other antennas of interest to the SWL'er and the DX'er.)

The Hertz Antenna

It is always necessary to match the antenna to the receiver's input or antenna circuit. The average listener will,

in most cases, use a portable, and this receiver usually has a high-input impedance to match the built-in whip antenna. End-terminated halfwaves naturally have this matching ability. In other words, a Hertz will match the portable's higher input, whereas a dipole (or center-terminated) antenna would reflect a better match when used with a 50-ohm communications receiver.

A good global portable used with a full set of end-terminated halfwaves will have gain to burn. Good global portables come with a tuned R-F or antenna stage that makes the use of R-F boosters unnecessary. A modern R-F stage is the equal of two stages a few years back. If a receiver lacks such a stage, the weak signal response will be poor.

Although it is true that pre-selectors were used in the old days, overseas signals were then very weak. DX'ers then were not dealing with 100kW and 250kW stations; they were lucky to find a 5kW station. Converters were also used to make shortwave sets out of broadcast receivers. Today, using the broadcast band as an I-F stage for a converter would be unbearable: The local broadcasters would all but blot out overseas reception (by coming in on the 1500 kHz I-F of the converter setup). It is sufficient today to buy a set with an R-F stage that will tune the overseas broadcasters and to hook it to a good antenna.

To make Hertz antennas for a portable, ordinary "zip cord" (household lamp cord) can be used. A set of wires can be measured off with a yardstick, and these are then split down the middle. If the resulting antennas are draped out of a window, they can be switched in as needed by plugging them one by one into the external antenna jack, or lacking a jack, by clipping them to a depressed whip.

If there is not enough room for a 31-meter band antenna, the 13-meter halfwave will work fairly well.

GROUNDS AND LIGHTNING

Outside antennas are the best high-frequency antennas and this means a good ground for the antenna and receiver. The best ground is a heavy noninsulated wire connected to a

grounding rod driven into the earth, as shown in Fig. 5-1. If this is not possible, a cold water pipe may be used as a ground (beware of plastic joints).

The DX'er and the Dipole

A DX'er's receiver, a modern communications receiver, usually has a 50-ohm input impedance. This calls for a center-terminated halfwave, or dipole, to reflect the proper match. End-terminated antennas require antenna couplers to correct the end-terminating mismatch. The dipole is the natural because it will match the communications receiver input. Most communications receiver manuals recommend it as *the* antenna. The reasons it remains at the top of all DX antenna polls are reviewed below.

(1) The dipole is a noise canceling antenna.

(2) The dipole is center-fed and so provides a perfect low-impedance input circuit match.

(3) A true dipole is a one-band antenna and helps cancel interference from outside the band in use.

(4) A dipole will supply a gain of two to three S-units over a random wire.

(5) A dipole allows the use of low-loss, low-noise coax as a transmission line.

The Loop Antenna

Dipoles are fine in lengths from 13 to 49 meters (or from 21 feet 9 inches through 77 feet). If they are longer than this, they start getting center heavy and are hard to maintain. Here, a tunable *loop antenna* may provide the best reception. The loop antenna is the best noise-cancelling antenna for the lower frequencies; it is also fully directional, which is required for the lower frequencies, and completely tunable.

For DX'ing the tropicals (60 to 120 meters) or the domestic AM broadcast band, the best antenna is a large tunable indoor loop; since it is directional and relatively noise-free. This tunable loop permits the listener to cover the world on the AM broadcast band during the DX season. A smaller tunable loop can be used to cover the 60- to 120-meter bands (Fig. 5-3).

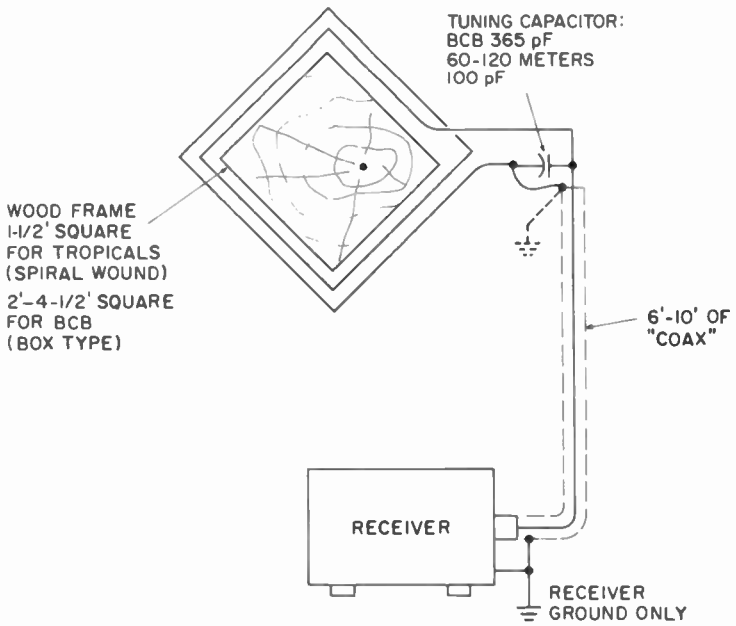


Fig. 5-3 Tunable loop for the tropical and broadcast bands. Use two or three turns for the tropicals and five or six turns for the BCB.

The Longwire Antenna

Roughly, a *longwire* is an antenna 100 feet or longer. To beat a halfwave, a longwire must be about five wavelengths long. Two longwires are necessary for low-frequency directional coverage. The amount of wire necessary makes this kind of antenna impractical, and particularly so, since the listener may wind up with the world's loudest (as well as longest) noise generator—that is, unless he lives on a far-off island remote from industry.

The modern longwire is actually nothing more than a long random. It is usually an all-band wire 100 to 160 feet long. If the listener has the room for one or two, a longwire will work well in a quiet location. An antenna coupler may be required to obtain uniform gain on each of the bands.

Another version of the longwire antenna is the rhombic, a high-gain, diamond-shaped wire, but, here again, an island is necessary for good listening.

The DX'er and the Vertical

Any longwire other than a noise-canceling dipole is apt to be noisy, and especially the verticals because man-made noise is vertically polarized. This is also the reason a vertical lead-in wire must be "coax" with the braid grounded. If the listener must use a vertical (because of limited space), he should use a short one with an antenna coupler working against ground (Fig. 5-4).

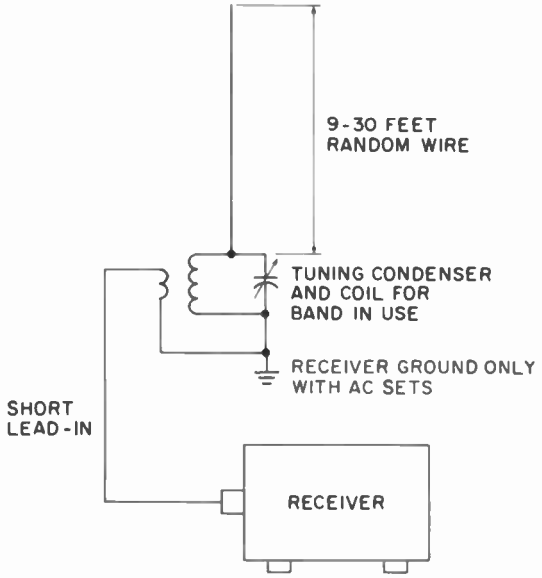


Fig. 5-4 Antenna coupler tuning with a short vertical antenna.

The DX'er and Other Multiband Antennas

There are fan verticals and multiband dipoles that use the coax lead-in or a *balun* to cancel out bands not in use. (Fig. 5-5). Because multiband fan dipoles are heavy and hard to support, however, they are not recommended.

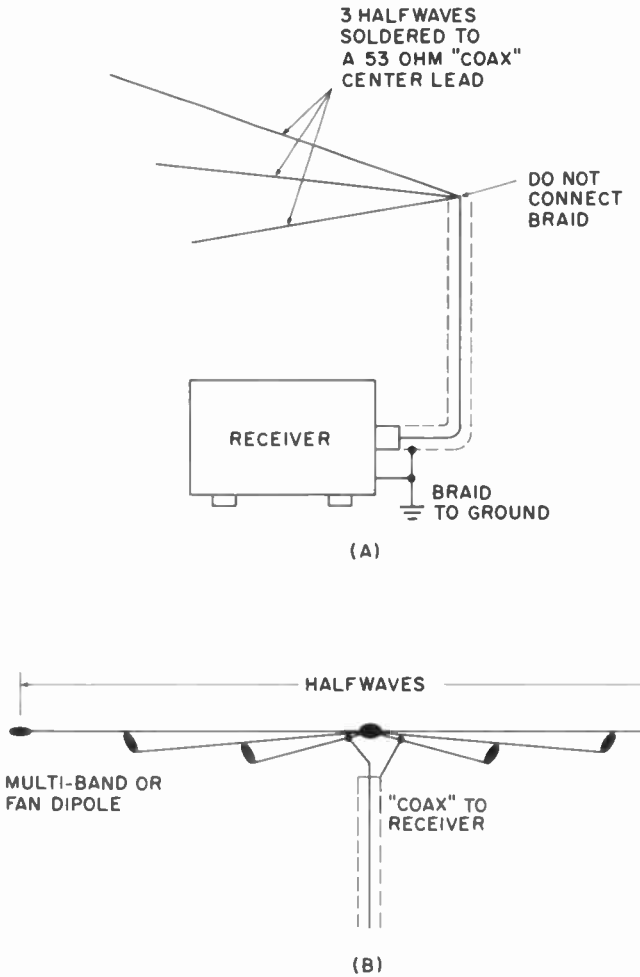


Fig. 5-5 Fan vertical (A) and multiband fan dipole (B).

The Coax Lead-in

An end-terminated Hertz can be directly connected to the external antenna post of a portable, or a short coax lead-in can be used. For dipoles, long coax lead-in connections to the receiver are necessary.

Coax, or low-loss coaxial (RG-58/U 53.5 ohm) cable, should be used on any of the antennas just described. Failure to do so will result in noise pickup that may cancel out all of the extra needed gain or volume. Using coax is meaningless unless the braid is properly soldered to a coax connector (UG-358/U) and grounded (Fig. 5-6). The cable, with a connector on each end, can be had in 20-foot lengths, or the cable and connectors can be purchased separately and assembled.

However, watch out for plastic water pipes, as they are useless as grounds. Grounding kits and lightning arresters are available from most electronic supply stores, and they

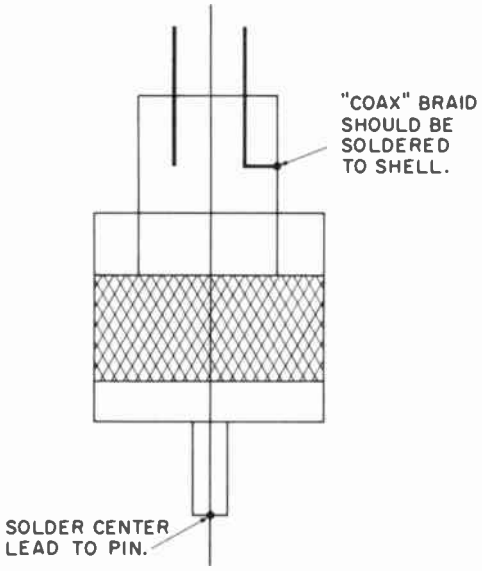


Fig. 5-6 Coax connector assembly.

contain installation instructions. Be sure to order a coax lightning arrester (Fig. 5-7) if a coax transmission line is being used.

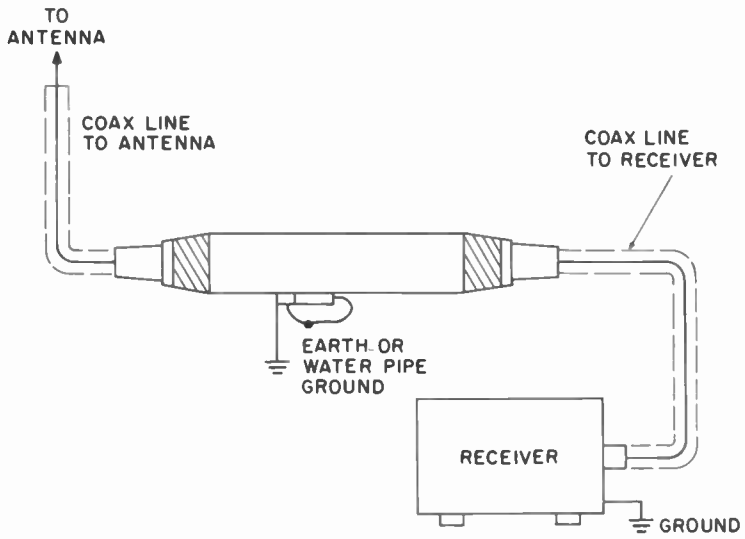


Fig. 5-7 Lightning arrester.

Antenna Wire and Insulators

Stranded enameled copper wire (steel-clad if the antennas are long) in a good heavy gauge is the best antenna wire. It can be bought in 50- to 100-foot coils from any radio supply store. The insulation should be scraped off before the coax lead-in is soldered. Once the coax is soldered, the connection should be painted with aluminum paint. Only the center lead of the coax to a Hertz antenna should connect at the antenna end. The braid should not touch the antenna; it is grounded at the receiver end only. For a dipole antenna, the braid is soldered to one leg and the coax center wire to the other leg. This keeps the connections short and tight to the center insulator, and eliminates shorting.

The best receiving insulators are "egg" or strain insulators, since they prevent the wire from falling if the insulator breaks. This feature can prevent property damage or injury.

6
Basic Receiver Principles

A shortwave listener should have a basic understanding of what his receiver consists of and how it works. Actually, all modern radio receivers, whether they cost $25 or $2000, operate on what is called the *superheterodyne* principle. In fact, all modern radio receivers are called "superhets."

THE SUPERHET

A superhet receiver is one in which the received radio-frequency (R-F) signal is converted to a lower R-F signal, called an intermediate-frequency (I-F) signal. No matter what the frequency of the received signal, the I-F signal will always be the same, usually 455kHz. A constant frequency I-F results in two very important advantages for the superhet: (1) the selectivity of the receiver, that is, its ability to distinguish between two stations on almost the same frequency, is greatly improved; and (2) greater and more constant amplification is possible because only one frequency, the I-F, is amplified, rather than a range of frequencies spread across all of the bands.

A block diagram of a typical superhet receiver, typical of the average SWL'er basic portable receiver is shown in Fig. 6-1. The incoming antenna signal is first amplified by the receiver antenna, or R-F stage. Then it is fed into a mixer stage where superheterodyning (mixing) takes place. In the mixer, the incoming signal is mixed with a signal from the

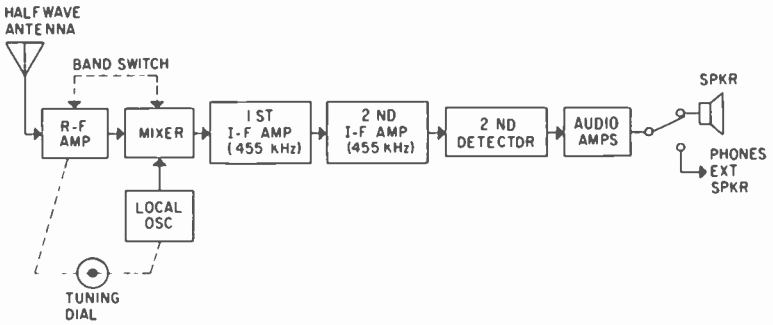


Fig. 6-1 Average listeners's superhet receiver.

local oscillator. The oscillator frequency is always 455kHz above the frequency of the received signal because as one tunes across the bands, one automatically tunes the oscillator also. In other words, no matter what frequency is tuned, the oscillator will always be 455kHz above that frequency. In the mixer, the incoming signal and the oscillator signal are mixed, and the difference signal (455kHz) results. The difference signal is the I-F signal, and it is fed into the I-F amplifiers (455kHz channels). This is a signal-filtering channel and if the channel is supplied with selectivity controls, adjacent channel interference can be reduced to a low level, sometimes almost to zero. The signal next enters the second detector (the mixer is sometimes called the first detector), where the audio component is recovered, and the audio is then amplified and fed to the speaker or 'phones as listening material.

A communications receiver is basically the same as the portable described above, except that it will have some added features to improve reception. For example, a communications receiver (Fig. 6-2) always has a beat-frequency oscillator (BFO) for code or CW reception. The BFO is just an oscillator beating close to the I-F frequency (a kilohertz off, or so) to give the necessary "beat note" to receive CW signals. The DX'er can turn this on and hunt for weak AM carriers. It will also have selectivity controls to reduce to a very low level interference from adjacent stations; that is, to improve selectivity.

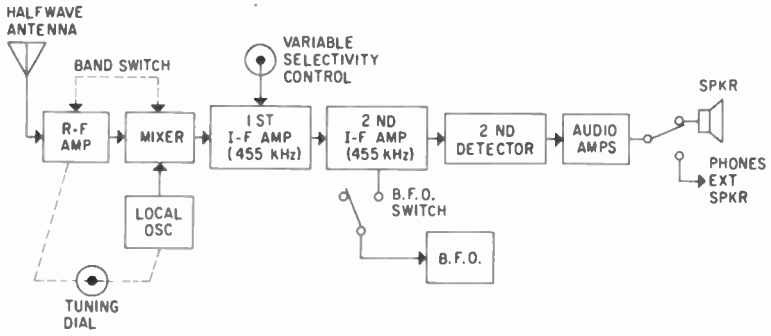


Fig. 6-2 Communications superhet.

DUAL-CONVERSION COMMUNICATIONS SUPERHETS

The *dual-conversion receiver* (Fig. 6-3) is basically the same as the receivers above; it is just more complicated. This is the serious DX'er's choice because the incoming signal is treated to a programmed, segmented, and very stable crystal or variable frequency oscillator (VFO) controlled front end. This segmented tuning system permits dialing only 500kHz (enough for most shortwave broadcast bands), before switching to the next segment or band. Dial readout will be ±1kHz on a dial reading 0 to 500.

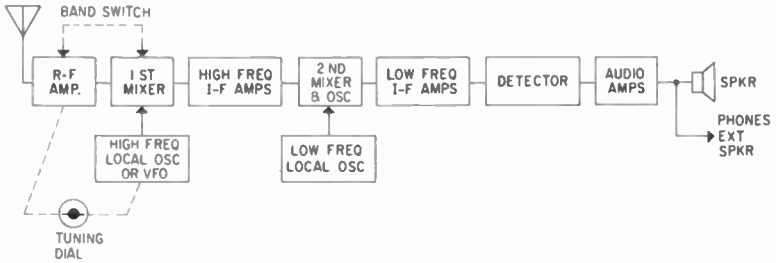


Fig. 6-3 Basic dual conversion receiver.

Another feature of the dual-conversion receiver is an extra I-F channel (one high-frequency and one low-frequency) for added selectivity, plus the usual I-F controls. High-frequency reception is at its best when a dual-conversion receiver is used (Fig. 6-4).

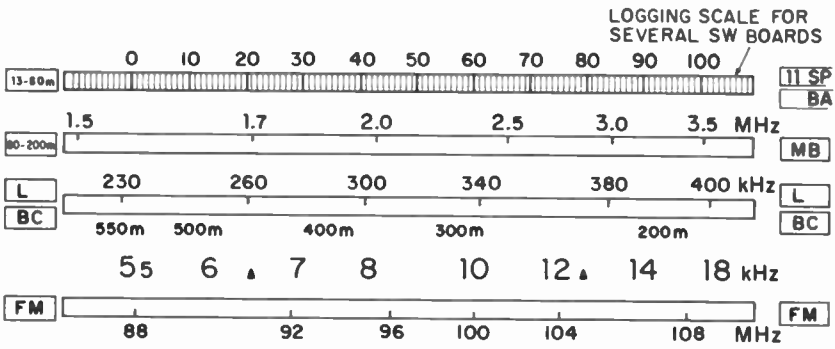


Fig. 6-4 Frequencies spread across the dial.

Sensitivity

Sensitivity is the measure of a receiver's ability to pull in weak, usable signals. It is expressed as the strength of a signal, in microvolts, required at the input terminals of a receiver to deliver a specific amount of audio to a speaker or headset. Another expression of sensitivity is the signal, in microvolts, required at the receiver's input terminals to give a specific signal output level above the inherent noise output of the receiver. This is best because it gives some idea of how well a weak signal will be heard. Such expressions are offered as guides only; they are not to be thought of in any other way.

Most global receivers with an R-F stage will have sensitivity to burn, and the DX'er will find his needs more than satisfied with a modern communications receiver. (See Chapter 4.)

Sensitivity is built into a set and cannot be added outboard, unless the set lacks an R-F stage. In this case, a preselector can help. However, if a set has an R-F stage, an outboard unit may add more noise. Today, it is cheaper and better to buy a set with a tuned R-F stage built in and forget about outboard units. With a good receiver, all that is necessary to improve sensitivity is the addition of a good antenna.

Selectivity

Selectivity is the ability of a receiver to cancel out signals close to the signal being received, as well as to reject "images." Selectivity is an I-F channel function and depends on the number of tuned circuits involved. Curves supplied with communications receivers show graphically how unwanted I-F signals are rejected by selectivity controls. (Mechanical filters are best for DX'ing broadcast channels.) In lower-priced receivers, the I-F channel rejects unwanted signals, but the amount of rejection can't be varied. This makes the domestic receiver a problem if used on crowded bands, and the listener wants to pull up a weaker signal.

Images

All high-frequency local oscillators will cause an I-F channel response to the signal, one higher and one lower than the oscillator frequency, which can show up as ghosts on the dial. A good receiver front end will reduce the image response. This depends on the R-F selectivity (not I-F) and the conversion frequency involved with the I-F system. The best image rejection is obtained with good dual-conversion communications receivers.

Noise

Noise also depends on conversion frequencies and some dual-conversion receivers are noisy because of a poor choice of conversion frequency. Tubes will cause more noise than properly used transistors.

If a noise limiter is used, the limiter must be for AM use. Many limiters are for single sideband and code only. Generally speaking, however, noise can be controlled by using a noise-canceling dipole antenna for the band in use. Another help is the use of a solid-state receiver that is battery operated and free from powerline noise. Last of all, using headphones, if necessary, can also limit room noise.

Bandspread

Bandspread refers to the ability of a receiver to separate stations on a dial without a "pile-up." The best receivers

(global or professional) switch each band and spread it across the major portion of the dial. A fine segment-tuned (500kHz), dual-conversion receiver is unbeatable.

Calibration

Here again, the ±1kHz segment-tuned dual-conversion receiver provides the best calibration. For those who can't afford segment-tuned receivers, crystal calibrators (usually 100kHz) give dial markers every 100kHz across the dial. These are available in kit form and can be placed in the antenna circuit of any receiver that has a beat frequency oscillator (BFO). With the unit and the BFO turned on, the desired station frequency is hunted, and the calibrator and BFO then turned off. It should then be easy to hear the station and "zero in." This works only if WWV, the National Bureau of Standards transmitting station, is used as frequency check points, and if the receiver has a fixed bandspread (not just a bandspread dial off a general coverage dial).

S-meters

Such meters give an indication of signal level, calibrated in S-units from 0 to 9. However, S-meters are not standardized, but provide only a relative indication for the particular receiver used. The meters will help find weak carriers and give a rough idea concerning the signal, and that's all.

Speakers

Some sets have poor speakers, but all have a headphone or external speaker jack. A good 4- or 8-ohm hifi speaker can be plugged in, improving the sound 100 percent.

Headphones

Headphones are often necessary to fight room noise. Voice-range phones are best for DX use. These are usually 500 to 2000 ohms impedance or higher, and, if magnetic, need a matching transformer to work out of an 8-ohm (voice coil) portable jack. They will, however, work directly out of some communications receivers, and others will need a transformer. This can be an ordinary plate-to-line-transformer, used in reverse, as described in Chapter 12.

7
GMT and Logging and Tuning Tricks

Overseas broadcast time is Greenwich Mean Time (GMT), or universal time. In other words, GMT is a sort of global radio standard time that makes world tuning a real pleasure. It makes no difference if one tunes Australia, Africa, England, or the United States; the time remains the same year-in and year-out.

GMT is based on a twenty-four-hour clock system (Fig. 7-1). Every overseas broadcast schedule, station break, or

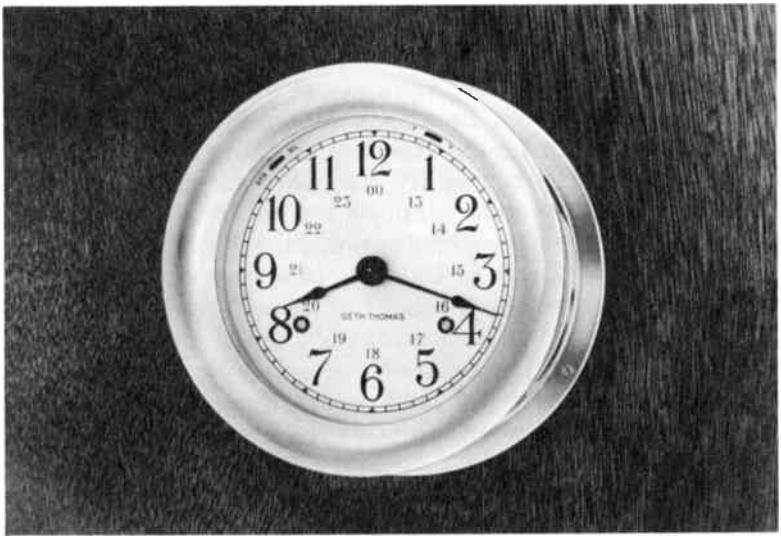


Fig. 7-1 GMT clock.

time signal is based on this universal time for the listener's convenience. Once a listener starts dialing his shortwave international BCB radio, he can forget all about local time—his and the station's. To help him with GMT, he can purchase a clock with a twenty-four-hour face, or with a little ingenuity, he can set any clock to read GMT.

Operating a clock on GMT is simple. Any overseas station can be tuned in and, when a GMT signal is given, the clock can be set—and forgotten. The broadcasters plan their schedules to conform with the GMT clock and mail out printed programs. Local time and international dateline worries are theirs, not the listener's. If he follows the GMT schedule—tunes his radio accordingly, the program listed will be there, at the time listed. Twenty-three hundred hours is still 2300 hours on his GMT clock or on a GMT clock in Bombay.

GMT is actually world time. All time zones are based on GMT. All time zones in the United States lag behind GMT. For example, Eastern Standard Time lags behind GMT by five hours (four hours for EDT). If GMT is 0600 (6:00 A.M.), Eastern Standard Time is 0100; if GMT is 1800 (6:00 P.M.), Eastern Standard Time is 1300. Six hours must be subtracted from GMT to arrive at the local time for Central Standard Time; seven hours for Mountain Standard Time; and eight hours for Pacific Standard Time.

In addition to tuning by the GMT clock, the listener should date his reception reports according to GMT. In the past, many DX'ers wasted time making local time conversions. An East Coast (EST) local clock may read 8:00 P.M. during listening, while the GMT clock will read 0100 hours the following day. In this case, GMT is five hours ahead of EST, and the report will have to be dated the following day, if it is to be considered a valid report. Engineers can be very fussy about this. More on reception reports later.

LOGGING

Serious listeners keep a daily log listing every station heard. Direct copy machines can be used to print a batch of

homemade standard forms. Most DX'ers use standard 8½ by 11-inch sheets that can be filed in three-ring binders. A typical daily log is shown in Fig. 7-2.

SW DX LOG_____19___.

ANTENNA:_____ RECEIVER:_____

STATION	GMT.	KC. mHz.	SINPO	CONDITION ON CHANNELS	CALL	LOCATION	DIAL	REMARKS

Fig. 7-2 Typical log.

Accurate logging depends on a fixed bandspread dial, not just on a general coverage dial or on bandspreading a general coverage dial. In order to know where he is, the listener needs a receiver that switches each band, spreading it across the entire dial. Such bandspreading arrangements are found on the better global portables for general use and on communications receivers for DX use.

If the receiver lacks a 100kHz "pip" marker or if one cannot be used because the necessary BFO is lacking, known-frequency charts can be made. When the sign "on" or "off" frequency announcement is made, chronological listings of the programs can be logged, band by band, indicating the announced frequency and the exact dial setting on which it was received. If the listener is fortunate enough to be using ±1kHz (readout) dual-conversion receiver, he can forget all about known-frequency charts and read the dial.

Keeping Records

Record keeping is not required, but the serious listener will need a time and frequency card file. This is an easy way

to know where and when his favorite programs will be aired. A simple time and frequency card is shown in Fig. 7-3. The

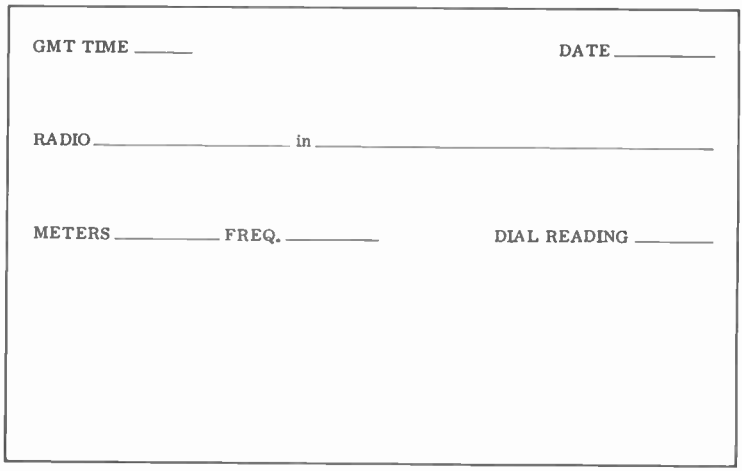


Fig. 7-3 Time and frequency card.

stations can be listed from broadcast schedules obtained from the stations, or the stations that one has already listened to and wants to dial again can simply be listed. Because of seasonal schedule changes, the card file must be updated frequently and the date of the most recent entries listed. Time and frequency cards will make station hunting a pleasure instead of a headache.

TUNING

Successful tuning will depend on the listener's ability to put into practice what has been discussed before, such as his willingness to go along with GMT, his use of a bandspreading receiver if possible, and his ability as a logkeeper. In other words, order will pay—unless his first love happens to be chaos.

The listener's knowledge of antennas, receivers, and band

conditions (propagation) will also help in tuning. Any special interest in languages, other than his own, will be most rewarding.

Most station breaks (ID's) are given in more than one language. If, for example, one listens for the break "This is Radio Canada," he will hear it in both English and French. Voice of America (VOA) beams programs in many languages. Listening as stations change their programs from English to another language permits the study of each ID. The listener will be surprised how quickly he can absorb enough language know-how to identify stations. This knowledge is needed only in tuning or in skipping from band to band and in picking up programs not beamed the listener's way. Programs beamed at the listener will be in his language.

Each station signs on and off with a musical ID. This is another way to identify stations, as it is a station's "trade mark" regardless of language. No matter how the listener goes about learning ID's he will find a tape recorder a big help.

If a listener likes tuning DX stations, he will be hunting for stations that "flutter" as the signal passes over the North Pole region. This can be a fooler—it could be the backwave of a fairly close giant, like VOA, or it could be real DX. A real DX'er never tries to guess; he won't know until he listens. At these times, his knowledge of both band conditions and languages is tested.

The listener should always listen on the same speaker or pair of 'phones. Distant stations can sometimes be hard to understand because of fading and flutter, and believe it or not, a different speaker than the one he is used to can throw a listener off. Trying to make copy out of one's own language can be a problem when things get rough. The listener may find that 'phones are best.

Ear training and keeping alert as one listens may not seem important at first, but it takes some DX'ers years to make copy out of hard-to-copy English. He will soon find that he can't be thinking of something else at the time. He will also have to train his ear to catch fading bits of information. A

good DX'er can catch an ID plus the correct frequency as it fades in and out the first time around. (Try it. Many DX'ers have to resort to taping and playback in order to write a report.) An experienced DX'er can even come up with program information: names, song titles, talk titles, the name of the show—everything as it is aired without resorting to recording. Many would consider recording and playback simply to write a valid report a waste of time.

HUNTING WEAK SIGNALS

Mention has already been made of using a BFO to hunt weak signals (recognized by their whistle sound as the carrier is tuned) and all that is needed is a communications receiver. The BFO is turned on and the automatic gain control (AGC) is turned off, so that the whistle can be hunted and "zeroed in." There, the BFO is turned off and the AGC switched on to see if the signal will kick the S-meter—or if enough audio can be heard to copy the signal. This method may have to be used if the listener intends hunting rare 1kW stations.

The average listener will never have to worry about such methods of tuning as he will be dealing with powerful 100 to 250kW signals; not one to 7.5kW signals. Chasing such signals probably would not even interest him. He may, however, have to join the DX'er in the battle against interference. If his global portable has a "narrow I-F position," he will need to use it at times. The DX'er resorts to using his adjustable I-F controls. This may take a little retuning in order not to lose the station in the bargain.

Hunting a low-powered station on a known frequency may require a long monitoring period. It is common practice to monitor such a channel at a given time every day for a week or even a few months. This is the price the DX'er pays for a few rare ones.

Jamming

Jamming, or intentionally generated noise to "kill" a given channel or even part of a whole band, is a curse on the

SWL'ing art and very annoying. There is less jamming today than there was ten years ago, but it still exists. A listener can't beat it; all he can do is flip the switch and wait until it goes away.

8
Tuning the World

Shortwave listeners are divided into many age groups and have varied backgrounds. Roughly speaking, forty percent are under twenty years old; about thirty percent are in their twenties; ten percent in their thirties; another ten percent in their forties; and the final ten percent comprises the forty-plusers.

As for background, again roughly speaking, fifty percent are students; ten percent, businessmen; twenty percent, industrial, fifteen percent, professional, and a final five percent are classified as "others."

In other words, the shortwave broadcast bands are today in about the same spot the AM broadcast band was before the public took to AM radio. The next few years could spell a "shortwave broadcast breakthrough."

Such a breakthrough has already been kicked off by the transistor radio. The broadcasters have the necessary power—all that remains is to alert the public to the enjoyment of SWL'ing.

Today, the world is there for the dialing. All that is required other than a multiband receiver and a little antenna wire is the desire to listen and the ability to tune. A book can make the game and coach a listener into the winner's circle, but the desire to "scoop the world" or "hear how the other half lives" is what really counts.

REVIEW OF SHORTWAVE BANDS

The international shortwave broadcast stations will be found on the 13-, 16-, 19-, 25-, 31-, and 49-meter bands. The tropicals will be found on the 60-, 75-, 90-, and 120-meter bands. And the listener shouldn't be surprised if he hears teletype stations mixed in with the tropicals on 90 and 120 meters. Remember, the 13- to 16- and 19-meter bands will depend on sunspot cycle conditions. The 25-meter band may be spotty, but the 31- to 41- and 49-meter bands should be good year in and year out.

The best tropical band is 60 meters. The others are subject to summer static, which can make DX'ing tiresome. Some DX'ers are still hunting their first DX station on 120 meters, so not too much should be expected from this end of the dial. Listeners will also run into broadcast band hash as well as static and teletype interference. All considered, the fight may be just too great on this end and a listener may find himself joining the troops on 60 meters; that is, if he is not cured of listening to tropicals.

GMT LISTING FOR U.S. EAST COAST LISTENERS

Ten hundred GMT and 31 meters: For those who can get up even at the break of dawn, there is usually a lot of South Pacific activity on 25 and 31 meters on the United States East Coast.

At 1215 GMT, Radio Australia will hit the United States on 9.58MHz or 9580kHz (31-meter band). The program lasts an hour and a quarter every morning, year in and year out. After Radio Australia signs off, a few more DX stations plus Radio Canada can be heard before the band folds up at around 1413 GMT.

Fourteen hundred GMT and 13 meters: During the peak of the sunspot cycle the 13-meter band should open about 1400 GMT and remain open for four or five hours. This

usually holds true from spring through fall with a little letdown during the summer.

The 13-meter band is wide and easy to tune. This is a high-frequency band and the listener will have to learn to live with ignition noise from passing cars if he is near a road.

Halfwave antennas for 13 meters are short enough so that any apartment dweller can rig one, and come up with excellent signals.

Here are some of the stations that can be heard on 13 meters. Many of them are heard daily:

Djakarta, Indonesia
Rio de Janeiro, Brazil
Tokyo, Japan
Manila, Philippines (rare)
Radio RSA Johannesburg, South Africa
Tangier, Morocco (VOA)
Vienna, Austria
Paris, France
BBC, London
Radio Sweden
Radio Norway
Deutsche Welle (West Germany)
Radio Nederland
Lagos, Nigeria
Radio Praha
Radio Portugal
Radio Kuwait
Radio Roma, Italy
Vatican Radio
AIR Delhi, India
Karachi, Pakistan
Radio Canada
Radio Moscow
Kabul, Afghanistan
VOA, Philippines (rare)
Radio Budapest
Windward Islands

1500 GMT and 16 meters: This band will be just about the same as 13 meters, as far as signals and seasons go, except that it opens up a little latter. This band is hard to tune as it is just a little over 200kHz wide. Most international shortwave broadcast bands are 400 to 500kHz or so wide, except 41 meters which is exactly 200kHz wide. The secret is to tune slowly.

Halfwaves are short, and no problem. Here again, a listener can use them to produce excellent signals. By this time, most Americans are at work, so signals on this band may be beamed to other countries—and not in English. This band usually remains open until late afternoon and more English language broadcasts are heard after lunch.

Here, it is important to remember that the 13- and 16-meter bands will be knocked out at the start of a given

sunspot cycle. They may open up now and then during this period, but operation will be spotty and very few broadcasters will bother using these bands. However, as the sunspot numbers start getting larger, scheduling starts and the world can be heard with ease. Here are some of the stations and countries to look for on 16 meters:

Tokyo, Japan
BBC, London
Radio RSA Johannesburg, South Africa
Radio Peking
Deutsche Welle (West Germany)
AIR Delhi, India
VOA
Radio Havana, Cuba
Radio Free Europe (Portugal)
Radio Ghana
Radio Portugal
BBC Tebrau, Malaysia (rare)
Radio Budapest
Radio Kuwait
Radio Moscow
Radio Nederland
VOA Philippines (rare)
Radio Liberty (Germany)
Karachi, Pakistan
Radio Roma, Italy
Radio Norway
Radio Sofia, Bulgaria
Radio Sweden
HCJB Quito, Ecuador

Some of the listings for 13 and 16 meters will be heard only once—and then only when conditions are right for long-path reception. Again, some of these transmissions will not be in English as they will not be beamed at the United States.

1700 GMT and 19 meters: From 1700 on, the listener will begin hearing scores of programs in English beamed at the United States. Such programming begins on 19 meters. The listener will notice almost immediately that the 19-meter band carries more English segments than the 16- or 13-meter bands. The 19-meter band is another world-wide band and it is generally good from 1700 GMT until about 2200 GMT. During sunspot peaks, it may remain open around the clock. When this happens, a listener can pick off a lot of new countries. Here again, halfwaves are short and the signals will be excellent. From 19 meters on, the listener will find the bands are broad (except 41 meters) and easy to tune.

Here is a short list of countries and stations that may be heard on 19 meters:

Radio Portugal
BBC, London
Radio Iran
Lagos, Nigeria
Colombo, Ceylon (rare)
Radio Japan
HCJB Quito, Ecuador
AIR Delhi, India
Karachi, Pakistan
Radio Free Europe (Portugal)
Radio Kiev, USSR
Radio Moscow
Radio Havana, Cuba
Radio Peking
Wellington, New Zealand
(rare indeed)
Windward Islands
Vatican Radio
VOA, Philippines (rare)
Vienna, Austria
Jeddah, Saudi Arabia
Radio Budapest
Ankara, Turkey
Damascus, Syria
Radio Norway
Radio Sweden
Radio Nederland
Radio RSA, South Africa
Deutsche Welle (West Germany)
Radio Canada
VOA
VOA, Tangier
Radio Belgrade
Radio Berlin International
Radio Praha
Radio Bucharest
Radio Roma
Vatican Radio
Trans-World Radio, Bonaire
Warsaw, Poland
Ghana Radio
Radio Liberty (Germany)
Radio Sofia, Bulgaria
Radio Switzerland
Athens, Greece (rare)
Radio Kuwait
Radio National, Argentina
Radio Luxembourg (rare)
Baghdad, Iraq

2000 GMT and 25 meters: On the 25-meter band, the listener is dealing with very powerful signals on overcrowded bands. Although the bands are among the widest (except 41 meters), great care is required in tuning during the evening, which is when the whole world is trying to get through. Generally speaking, 25 meters is a year-in and year-out band. This does not mean that it can't get knocked out occasionally—during the sunspot "low" period, for instance—but it will never be down for long.

(Note: A halfwave antenna for this band will be 40 feet long and some apartment dwellers may not have the room even to drape one out a window. If there is not enough room, the 19-meter halfwave working as a random will suffice as very powerful, 100 to 500kW signals are transmitted on 25 meters. However, to DX this band for the 5kW's, a halfwave antenna is necessary.)

Here is a short list of the powerhouse signals that can be heard on 25 meters:

Radio Berlin International
BBC, London
Radio Nederland
Radio Peking
Radio Moscow
Windward Islands
Trans-World Radio, Bonaire
Radio Sweden
Vatican Radio
Radio Havana, Cuba
HCJB Quito, Ecuador
Radio Japan
Karachi, Pakistan
VOA
Radio Canada
Radio Madrid
VOA, Rhodes, Greece
AIR Delhi, India
VOA, Tangier
Radio Australia
Radio Tirana, Albania
Radio National, Argentina
Radio Switzerland
Radio Belgium
Djakarta, Indonesia
Radio Free Europe (rare)
Radio Liberty, Taiwan
ETLF Addis Ababa (rare)
Radio Finland
Radio Iran
Radio Norway
Radio Belgrade
Radio Kuwait
VOA, Liberia
Radio Roma
Radio Sofia, Bulgaria
Deutsche Welle (West Germany)
Radio Nigeria
Vienna, Austria
Baghdad, Iraq
Kabul, Afghanistan
Radio Praha
VOA, Philippines (rare)
Radio Bucharest, Rumania
Radio Lebanon
Warsaw, Poland
Trans-World Radio, Monaco
Radio Tahiti
Radio Portugal
BBC, Malaysia (rare)
Jeddah, Saudi Arabia
Radio Angola (rare)
Radio RSA, South Africa
Radio Budapest
Radio Nepal (rare)

2200 GMT and 31 meters: About the time most offices are closing the 31-meter band starts to open. This band is a wide, crowded, dependable, world-wide broadcasters' favorite. In fact, this is the band for the English-speaking nighttime shortwave listener. If a set has only two good shortwave bands, they will no doubt be 25 and 31 meters, and with them a listener, by tuning carefully, can hear the world.

(Note: A halfwave antenna for this band will be 50 feet long, but the 13-meter halfwave (believe it or not) can be used if there is not enough room for such a wire. Most

stations up here are running 250 to 500kW to beamed antennas, and they will pound in like a local broadcast station. Here again, the DX'er hunting 5kW's will need the halfwave.)

Here are some of the super-powerhouse signals that can be heard on 31 meters:

BBC, London
Radio Nederland
Radio Moscow
Radio Portugal
Radio RSA, South Africa
Radio Peking
Radio Praha
Radio Tirana, Albania
Radio Belgrade
VOA, Tangier
Radio Bucharest
Radio Japan
Kabul, Afghanistan
Radio Ankara, Turkey
Radio Kuwait
Wellington, New Zealand
Vienna, Austria
VOA, Liberia
AIR Delhi, India
Warsaw, Poland
VOA, Greece
Radio Australia
Deutsche Welle (West Germany)
Radio Berlin International
Radio Ghana
Radio Nigeria
Radio Norway
Radio Finland
Radio Switzerland
Baghdad, Iraq
Jerusalem Radio
Vatican Radio
Radio Roma
Windward Islands
Radio Sofia, Bulgaria
Radio Amman, Jordan
Trans-World Radio, Monaco
Trans-World Radio, Bonaire
Karachi, Pakistan
Radio Madrid
VOA, Philippines (rare)
Djakarta, Indonesia (rare)
Damascus, Syria
HCJB Quito, Ecuador
Athens, Greece (rare)
Radio Canada
Radio Budapest
Radio Sweden
Saigon, Vietnam
Radio Havana, Cuba
Radio Ghana
Radio Belgium
BBC Malaysia (rare)
Radio Cairo (not on the air)

TUNING OTHER NIGHTTIME BANDS

The 41-meter band is omitted here because it is seldom used to beam programs to the United States. However, Radio Peking sometimes uses it to aim a powerful signal at this country.

The 31-meter band is really the last of the international shortwave broadcast bands; the balance are more or less regional. The 49-meter band is a big shortwave band for European stations, but not really a world or global band. If a listener has missed logging some European country, he will, no doubt, find it on 49 meters. A winter band and a haven for all when the other bands are down, the 49-meter band is unquestionably "old reliable." Signals are loud and clear, but the band is usually crowded, and although it is the widest of all the bands, it must be tuned carefully because of the pile-up. If this band is down, the listener may as well flip the switch.

(Note: Halfwave antennas for the 49-meter band are 77 feet long and are out of the question unless the listener has a lot of room. For hard-core DX'ing, a listener will need either a halfwave or a tunable loop; otherwise, a random wire will work.)

When this band starts to close or begins to open, DX'ers hunt low-powered commercial Canadians for kicks.

DX'er Nightime Bands

The Tropicals: The 60-, 75-, 90-, and 120-meter bands are strictly for the DX'er. Most of the stations are low-powered Latins and the DX'er has to know Spanish and Portuguese. He will also need a good communications receiver with a longwire antenna or a tunable loop. On 60 meters he will also hear Africans and Asians. As mentioned earlier, the 75-, 90-, and 120-meter bands can be a headache unless the listener lives out in the open.

DX'ing the AM Broadcast Band: If a DX'er has a lot of patience, likes to listen to weak DX signals, and refuses to buy a shortwave receiver he can hear the world on the broadcast band. Yes, that's right, the standard broadcast band, and the best time to listen is from sundown until dawn. The band can only be used at night for such distance dialing, and it's best during the winter months (November through February).

Signals travel great distances over salt water and a listener can hear foreign stations during the season. Darkness plays a

big part here, and the best time to hear Europeans on the United States East Coast is at sundown. The reason is that it is already dark in Europe and starting to get dark in America. On the other hand, the best time for the United States East Coast to hear the West Coast is at dawn. This is because it is still dark there and just getting light on the East Coast. In other words, the transmitter should always be in total darkness. The reception area is best if it is in total darkness or just turning one way or the other.

The best antenna for the broadcast-band DX'er is a tunable loop (Chapter 5). If he uses a longwire, it must be at least 100 feet long and requires a good ground.

The DX'er will have to hunt the valleys between the locals for the broadcast-band DX. This means, once he has passed a local, he should turn the volume control all the way up and hunt DX before he hits the next local. A good loop will allow him to knock out interference, because it is directional. It will also kill noise because it will respond to the magnetic rather than the electrical part of the signal.

If the listener tunes the broadcast band for DX it will be a big help to belong to a good DX club for BCB DX'ers (see Chapter 9). Besides a good receiver and antenna, he will need a pair of voice-range, DX headphones. DX'ing this band is strictly for the "buff" and not for the average listener. In addition, he must know languages, as everything he hears will be scheduled for local consumption only.

9
Mail from the World

Schedules

The printed schedule, in one form or another, is the key to shortwave listening. Schedule information can be found by thumbing through a recent copy of the *World Radio-TV Handbook*, or listeners can personally write the broadcasters requesting such information. A typical schedule request postcard is shown in Fig. 9-1. It is a good idea to get on program-guide mailing lists, and this can only happen if a listener sends out his own request cards. Some broadcasters will even supply reception-report forms or cards.

Once the schedules arrive, it is a good idea to file them by continent in separate folders, where they can be easily located.

Date: _____

Dear Sirs:

Please send your External Services Shortwave

Broadcast Schedule and transmitter power rating.

Place my name on your mailing list for future schedules,

and SWL DX helps.

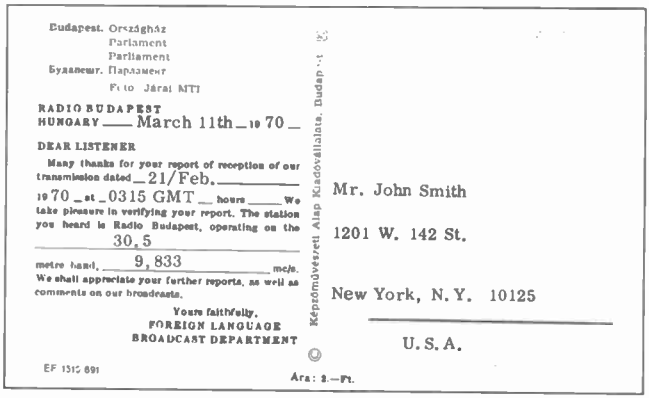
Yours,

Mr. John Smith
1201 W. 142 St.
New York, N.Y. 10125, U.S.A.

Fig. 9-1 Typical schedule request card.

QSL (Reception) Reports

The QSL or reception report is the listener's request for an official notice of reception. Sometimes this is in letter form, but more often it is a colorful card or "QSL." Many DX'ers have hundreds or even thousands of these cards. Those who have thousands will, of course, have many cards from the same station. Serious DX'ers make a habit of sending at least seasonal reports to most of the stations they hear regularly. Each one of these, if correct, will be good for a QSL card (Fig. 9-2). This habit is not limited to those who


Budapest. Országház
Parliament
Parliament
Будапешт. Парламент
Photo Járai MTI

RADIO BUDAPEST
HUNGARY — March 11th — 1970 —

DEAR LISTENER

Many thanks for your report of reception of our transmission dated — 21/Feb. —
1970 — at — 0315 GMT — hours — We take pleasure in verifying your report. The station you heard is Radio Budapest, operating on the 30,5
metre band, 9,833 m/c/s.
We shall appreciate your further reports, as well as comments on our broadcasts.

Yours faithfully,
FOREIGN LANGUAGE
BROADCAST DEPARTMENT

EF 1515 691

Képzőművészeti Alap Kiadóvállalata, Budapest

Mr. John Smith

1201 W. 142 St.

New York, N.Y. 10125

U.S.A.

Ára: 2.—Ft.

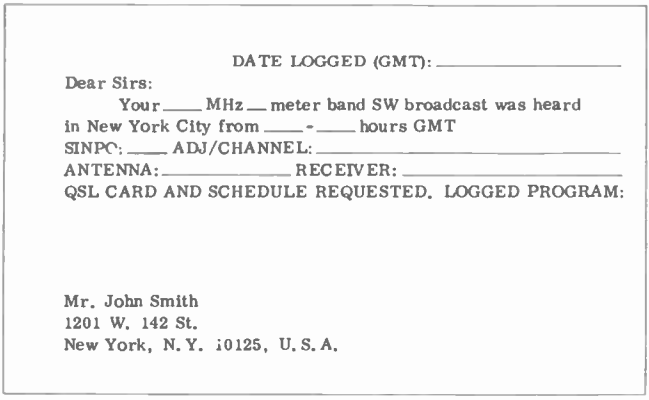
Fig. 9-2 QSL card received from Radio Budapest.

class themselves as DX'ers: Any ordinary listener can play the game and collect beautiful cards from all over the world. He will wind up with many singles or rare ones that he will prize because he heard them only once.

It is surprising to learn from broadcasters that many listeners try to "fake" reports using the printed schedules as a guide. Some stations claim they have received reports on programs a week or two before they have been "aired." This practice is silly; it's a fool's game—the listener can't kid himself or the broadcaster, so why try?

Some DX'ers send in so many valid reports that they are, sooner or later, invited to join a listening panel or elected to become a monitor. The broadcaster usually hands out special awards for such service.

A log is needed for valid reception reports, and such a report must contain the following information:
(1) Log date in GMT; (2) hour of reception in GMT; (3) frequency in megahertz or kilohertz and the waveband in meters; (4) SINPO code (see Glossary); (5) adjacent channel information; and (6) at least five minutes of detailed program information. Figure 9-3 shows the reception report postcard used by the author.


DATE LOGGED (GMT): _____

Dear Sirs:

Your ____ MHz ___ meter band SW broadcast was heard in New York City from ____-____ hours GMT

SINPO: ____ ADJ/CHANNEL: _____

ANTENNA: _____ RECEIVER: _____

QSL CARD AND SCHEDULE REQUESTED. LOGGED PROGRAM:

Mr. John Smith
1201 W. 142 St.
New York, N.Y. 10125, U.S.A.

Fig. 9-3 Typical reception report postcard.

A report is useful to the station only if it is airmailed as soon as it is logged; otherwise, the station is just doing the listener a favor by honoring the report. Interference from other broadcasters is the engineer's big problem. If a listener happens to spot such a problem, his fast report may allow a broadcaster to move a few days later. Going over logs that are two months old (after receiving a non-airmailed report) is strictly a public relations move on the part of the broadcaster. A response may take forever, whereas an airmailed

report will bring a fast QSL. It's the old story of one hand washing the other. Take another look at the card in Fig. 9-3. It contains the necessary information and will travel a lot cheaper than an airmail letter. Such cards can be printed cheaply by offset, and the United States postal service will supply free airmail stickers for the address side of the cards.

Awards

For future budget reasons, the stations need regular proof of a growing listening audience. In order to move the listener to respond, they sometimes offer awards. These usually take the form of official recognition (suitable for framing) for a given number of valid reception reports. In this way, a listener can be made a member of their listening club. In some cases, broadcasters will ask a listener to become a monitor.

Contests

The award is aimed at the listening "buff" or DX'er. Contests are aimed at trying to excite the same type of response from the average listener. He is usually asked to write an essay. The "top" prize may be a trip to the country involved; this can amount to free jet tickets for two—with lesser prizes for smaller talents.

There are also contests involving simple prizes, but the big ones pull the mail.

DX Clubs

Any overseas listener will profit by joining a good DX club. As a member, he will be supplied with the latest band status material and a list of all stations currently being logged by the experts. Free technical help—in a limited way—plus fellowship with other listeners makes listening more fun.

DX CLUBS TO KNOW

The Newark News Radio Club (NNRC) is both the biggest and most famous DX club in the United States. It covers the complete range of shortwave listeners' interests, including the broadcast band, and during the early days of

radio, had many stars as members. NNRC issues a monthly bulletin. For information, write:

Newark News Radio Club
Box 539
Newark, N.J. 07101

For DX'ers of the broadcast band, there are two famous clubs totally devoted to this band alone. The West Coast listener will get lots of tips from the Western club, and the East Coast DX'er will find the Eastern club unbeatable:

International Radio Club of America
12536 Arabian Way
Poway, California 92064

National Radio Club
P.O. Box 127
Boonton, N.J. 07005

NNRC and the two clubs listed for broadcast band DX'ers are the largest DX clubs in America. NNRC covers shortwave and broadcast band DX'ing. Here are a few clubs just for the shortwave buff:

North American Shortwave Association
P.O. Box 8452
South Charleston, W. Va. 25203

American SWL's Club
16182 Ballad Lane
Huntington Beach, California 92647

Association of North American Radio Clubs
557 N. Madison Ave.
Pasadena, California 91101

To join a club outside the United States (or for those who live outside the United States), one or more of the following may be of interest:

Australia Radio Club
Box 227, Box Hill
Victoria, Australia 3128

Benelux DX Club
P.O. Box 1306
Nijmegen, Nederland

Radio Canada Shortwave Club
P.O. Box 6000, Montreal

Italia Radio Club
P.O. Box 1355
34100 Trieste, Italy

Japan SW Club
CPO Box 79
Sendoi, Japan

Israel DX Club
P.O. Box 7125
Haifi, Israel

New Zealand DX League
P.O. Box 1313
Invercargill, New Zealand

New Zealand DX Radio Association
78 District Road, Green Island
Dunedin, New Zealand

DX Listeners Club
P.O. Box 1284 Vika
Oslo 1, Norway

International Shortwave League
1 Grove Road, Lydney
Glos. GL15 5EP, England

All of these have English-language bulletins and station-sponsored clubs that usually require reception reports (not dues) for membership.

QSL's

Once a listener has more than a dozen QSL's, he will start wondering where, and how, he should file them. He can try photo albums or decorate his walls with them only to figure—"There must be a better way." There is—a four-by-six-inch card file. (A card may require trimming here and there but nothing will be lost.)

A card file will keep the system flexible; and cards can then be filed by continent, with easy access to 100 or 1000. This is not the only way, or necessarily the best way; it is, however, a workable way. A listener can see at once what he does or doesn't have on file.

Awards for QSL's

Some DX clubs offer "Six Continent Awards," and the like, for collected QSL's. In such cases, the QSL's (front and back) will have to be photographed or sent in, if requested. The above card-file operation will permit doing this with ease.

STARTING A SHORTWAVE DX'ER FILE

News items or articles clipped from papers and magazines concerning the art of DX'ing should be kept in some sort of

letter file. If many items are collected, they should be divided up into properly labeled folders or envelopes reading: Antennas, Receivers, Propagation, DX Clubs, and so on. The same might be said for correspondence to and from fellow DX'ers and broadcasters.

STARTING A DX ATLAS

If a listener does much QSL'ing he will soon want to know, at a glance, what he has heard. The best way to view the QSL world is to turn an ordinary world atlas into a DX atlas. All that is needed to do this is a red-colored felt marker to circle the countries or cities that have supplied QSL's. If the listener tunes overseas stations only, a one-dollar atlas will do. If he also tunes the broadcast band or does a lot of world-wide DX'ing, a standard atlas will be better. Here, he will have maps, state by state and country by country, as well as by continent. This method of "red dot" marking stations logged will show the listener at once where he is and where he hopes to go. It will be a lot easier on him than handling assorted loose maps.

10
Aids to Shortwave Broadcast Listening

There are plenty of SWL helps available. A great many of them are free for the asking, whereas others will cost, altogether, a few dollars.

The broadcasters will supply most of the free material. A listener can request everything from material on antenna construction projects to booklets on the philosophy of listening. Some outlets even conduct courses on propagation, antenna theory, and the like. If the listener wants to try a free course or two, he should write to Radio Nederland (Box 222, Hilversum, Holland). Some of the other stations offering free SWL helps are BBC London, Radio Canada, Radio RSA (South Africa), Radio Switzerland, Radio Australia, and Radio Nederland (besides their courses). Some broadcasters may offer one SWL booklet, whereas several offer as many as five. The listener need only write for their lists to see what is available, and then send for those that interest him.

The receiver manufacturers will be able to help SWL'ers who are interested in getting the most out of a DX receiver. Some have SWL handout literature, and for a small fee, they will usually send a copy of an owner's manual for any receiver they manufacture. If the listener plans to buy a good DX communications receiver and if he understands receivers, such manuals will be a big help in making a choice he will be

able to live with. If he doesn't know receivers, there is no better way to learn than by spending a little time with a few good owner's manuals, which can teach him a lot about receiver operation.

The *World Radio-TV Handbook* has been mentioned and a listener will find that the latest edition can simplify all his tuning, world listening, schedules, and station address problems. The *Handbook* is available at most large newsstands or mail-order electronics dealers.

For listeners who DX the AM broadcast band, the best station listing is published by the National Radio Club, P.O. Box 99, Cambridge, Massachusetts 02138.

Great circle maps are available from the United States Department of Commerce. If the listener wants such a map and is starting a DX Atlas, pick an atlas containing a polar projection map of the world. (Most of the large editions carry such a map.)

Bibliography

ANTENNAS

The A.R.R.L. Antenna Book—American Radio Relay League

RADIO HANDBOOKS

World Radio-TV Handbook, 165 West 46th Street, New York, N.Y. 10036

The Radio Amateur's Handbook, American Radio Relay League

RADIO HISTORY

Settel, I., *A Pictorial History of Radio*, Grosset & Dunlap, New York: 1967

Briggs, A., *The Birth of Broadcasting*, Oxford University Press, New York: 1961

This is the first volume of a set and is the standard history concerning the start of broadcasting on the continent of Europe. This book may be consulted in the library or the one volume alone can be purchased.

Barnouw, E., *The Tower of Babel: A History of Broadcasting in the United States, vol. 1, to 1933;* Oxford University Press, 1966.

The Golden Web: A History of Broadcasting in the United States, vol. 2, 1933-1953; Oxford University Press, 1968.

This is the standard history of broadcasting in the United States. Again, both volumes may be consulted in a library or each volume can be purchased separately.

The history of shortwave radio is the history of broadcast radio, as this is where it all started. If this interests the reader, any or all of the histories listed will give all the details.

11
Shortwave Broadcast Stations Guide

This section provides a key to the major overseas broadcasters on a continent-by-continent basis. It also lists much of the shortwave broadcast world by country and by frequency.

It must be remembered, however, that international shortwave broadcasters are free to move from band to band or within a given band as they see fit; therefore, current broadcast schedules must be checked. Many stations try to keep a known frequency so they can be found easily. Some change frequency with the seasons to improve transmission.

The listing given at the end of this chapter will *help* the listener spot and hunt stations. He will need his own latest schedules or a current copy of *World Radio-TV Handbook* to close the gap. Along with the general coverage, QSL or reception report addresses are supplied under the Continent listing. These usually remain stable. A brief guide is also provided for DX'ers interested in domestic or Canadian AM broadcast stations.

A Final Note on Reception Reports and QSL's

Overseas broadcasters will not send QSL's unless they receive a valid reception report (see Chapter 9).

To receive a fast reply, it is a good idea to send reception reports *airmail*. Another good idea, although not vital, is to address these reports to the "external" or "overseas" services department. The reason the latter idea is not vital is that the

overseas airmail stamp will allow the station to spot the report and sort it from the general mail. If a post office box number is given, there is no problem. Some sample reception report addresses are listed below:

Radio Ghana
External Services Department
Accra, Ghana

Radio Nederland
P.O. Box 222
Hilversum, Holland

MAJOR OUTLETS CONTINENT BY CONTINENT

Only stations with news or scheduled programs in English are listed continent by continent. These are for listeners in the United States and Canada. This limits the listing to the international services and for a very good reason: the listener is not required to learn another language.

Europe has a big international operation and this is where the listener will receive most of his QSL cards. The other continents do not have nearly as many international operations as most listeners have been led to believe by glancing at station listings.

There are hundreds of low-powered stations in Africa, Asia, South America, and Oceania which have programs for local consumption, but they will be in everything but English. Moreover, they are, for the most part, in the 60- to 120-meter region, which means using long antennas and a communications receiver to snag them.

The purpose here is to make the powerful international beamed English programs known to the listener. A continent-by-continent listing, such as this, is for the average international listener or DX'er. However, it is not going to help the "tropical" bands DX'er to take him on this tour.

(The DX'er will understand why. For one thing, GMT goes down the drain when a listener gets away from international operations. The local broadcasters may not

know, or care, where they are in relation to GMT. So at least, part of the time, the DX'er is confronted with local time problems, especially in the Pacific area. Another problem is keeping up with schedules, and he will rely on his own from the broadcasters or on a copy of the latest *World Radio-TV Handbook.*)

Africa

There are all sorts of 60-meter Africans as well as other mediumwave stations, including a number of powerful AM broadcast-band outlets. Many of these are old and famous. This is the group known and hunted by DX'ers the world over but are of little interest to the average listener. The stations listed can be heard on multiband transistor portables.

Radio RSA (QSL: P.O. Box 4559, Johannesburg, South Africa). This is, by far, the loudest signal coming out of Africa (250kW). A new 55-minute daily program is repeated on many bands, on a staggered time schedule.

Morning or afternoon segments may start on 13 meters beamed at the United Kingdom and Ireland. Late afternoon and evening programs beamed at the United States are usually carried on three bands: 19, 25, and 31 meters. Wintertime schedules may call for 25, 31, and 49 meters.

Radio Nigeria (QSL: Lagos, Nigeria). This is a powerful (100kW) outlet. There are no English language programs, but the news is given in English. Try tuning this station afternoons on 19 or 25 meters.

Radio Ghana (QSL: Accra, Ghana). Everything is identical to Radio Nigeria except Radio Ghana will also be found on 31 meters.

Cairo State Radio (QSL: Cairo, Egypt, UAR). Off the air at the time of this listing.

ETLF (QSL: Addis Ababa, Ethiopia). Lutheran World Federation (100kW) outlet. This Radio Voice of the Gospel may be heard, although but rarely, when programs are beamed to North Africa. However, most of the programming

is beamed toward Asia and Africa proper. The trick is to keep trying. ETLF has been heard in America by DX'ers.

There are also a few powerful relay stations operating from African bases: VOA (Voice of America), Deutsche Welle, Radio Nacional (Spain), plus BBC on Ascension Island.

Where addresses are listed, reception reports should be sent to home-based stations.

Asia

Asian signals have to come over the polar regions via the short path to be received in the United States. This results in "flutter," which always makes them hard to copy. Some of them can be heard, but others will never be received.

Asia is a fooler. As big as she is, she has very few international outlets. Most of her shortwave broadcasts are for local consumption. This being the case, the 60- to 120-meter bands (tropicals) are used and not the 13- to 49-meter international bands.

There are 13- to 49-meter international outlets in Asia, but there are not as many as is generally assumed. Some have network tie-ins and use a prefix: AIR India, NHK Japan, ABC Australia, and the like. This prefix is something that may be heard if a station is "relaying" a domestic service. Australia is listed as it is the best source for Asian news.

In the radio world, the Middle East is a part of Asia, and many of these international outlets are easily received in the United States. Here again, there are a lot more on the 60- to 120-meter bands, but little of this will be in English.

Asia also has a few powerful relay outlets, such as Voice of America (VOA) and British Broadcasting (BBC), but their programs are never beamed toward the United States. They are there to supply better reception for the continent of Asia, not to pump signals across the Pacific. West Coast listeners may hear one, now and then, via the "long path." It should also be remembered that not all international outlets carry English programs, but those listed here will, at least, have news in English.

Radio Peking (QSL: Peking, China). This is the loudest voice in the Orient, a reported 450kW. All international bands are used to pour propaganda into every corner of the globe, and much of it is in English. Radio Peking can be heard evenings on the 19- to 41-meter bands, with the loudest signals on the 31- and 41-meter bands.

NHK Japan-Radio Japan (QSL: Tokyo, Japan). This is one of the first international broadcasters. Radio Japan is well known for its English language broadcasts, as well as its language lessons. Try tuning it around sundown on the 16- or 19-meter bands.

Radio Kuwait (QSL: P.O. Box 193, Kuwait). The listener may want to tune Radio Kuwait (250kW) and hear news in English from 1830-1845 GMT on 19 meters. It comes in like a local.

Radio Lebanon (QSL: Beirut, Lebanon). Lebanon can be heard with very good volume on 19 meters from 0230-0300 GMT.

Radio Ankara (QSL: Ankara, Turkey). News in English can be heard from 2200-2210 GMT on 19 meters. This broadcaster does not seem to QSL, but will send a schedule.

Radio Saudi Arabia (QSL: Riyadh, Saudi Arabia). Here is a good 25-meter catch (mid-afternoon when conditions are good), but it seems a QSL for an English report is not obtainable.

Jerusalem Radio (QSL: Jerusalem, Israel). News in English can be heard in late afternoon, 1830-1845 GMT, on 31 meters.

Radio Baghdad (QSL: Baghdad, Iraq). English service is usually from 1930-2020 GMT. This station is a little "rough" to tune. The listener may have to try 19, 25, 31, 41, and 49 meters.

Radio Iran (QSL: Tehran, Iran). Try 16, 19, and 25 meters for the usual 2030-2130 GMT English program for Iranians abroad.

Damascus Radio (QSL: Damascus, Syria). The best bet is to try 19 meters from 2230-0100 GMT.

Voice of Indonesia (QSL: P.O. Box 157, Djakarta, Indonesia). West Coast listeners can try 31 meters from 1430-1530 GMT.

Far East Broadcasting Company (QSL: Box 2041, Manila, Philippines). West Coast listeners may hear this one when the skip is right. This is a missionary outlet.

AIR India-All India Radio (QSL: New Delhi, India). This outlet can be heard now and then with news in English on 31 meters.

Radio Afghanistan (QSL: P.O. Box 544, Kabul, Afghanistan). The listener can try for news in English at 1800 GMT on 19 or 25 meters.

Radio Ceylon (QSL: P.O. Box 574, Colombo, Ceylon). This is a rare one, or a once-in-a-lifetime shot.

Radio Nepal (QSL: Department of Broadcasting, Nepal). This is another rare one that may be heard when the skip is right.

North America

International Broadcast Station KGEI (QSL: P.O. Box 887, Belmont, California). Operated by The Far East Broadcasting Company.

AFRTS—American Forces Radio TV Service (QSL: Washington, D.C.) This can be heard daily.

VOA—Voice of America (QSL: Washington, D.C.) This station can also be heard around the clock.

Radio Canada (QSL: P.O. Box 6000, Montreal, Canada). Radio Canada can be heard every day.

All bands are used by the above stations for their international services.

South America

South America has hundreds of stations on the international and tropical bands. The Caribbean area has all sorts of shortwave broadcasters, but the combined effort in English is very small indeed.

HCJB—The Voice of the Andes (QSL: Quito, Ecuador). This is a powerful missionary outlet, and if the listener wants a QSL from South America, this is his best bet. The others will require reception reports in Spanish or Portuguese and will not have English programs.

Radio Nederland (QSL: P.O. Box 222, Hilversum, Holland). This is Radio Nederland's relay station in the Netherlands Antilles. (Reports should read: via Bonaire.)

Trans-World-Radio (QSL: Bonaire, Netherlands Antilles). This is another missionary outlet that will send a QSL for a valid report.

Windward Islands Broadcasting Service (QSL: Grenada, Windward Islands) Fails to respond to reports.

Oceania

Radio Australia is the best bet for QSL's from "Down Under." She has the power and the international services. She beams programs daily to both the East and West coasts of the USA. There are no short path "flutter problems" to contend with; in fact, Radio Australia comes in like a local.

Radio Australia (QSL: Box 428 G, G.P.O., Melbourne, Australia). The best East Coast transmission is the 9.58mHz 7:13-8:13 AM EDST 100kW airing. The 25-meter transmission is only 10kW.

Europe

If any of the European stations can't be found on any of the 13- through 31-meter bands, the listener should try 49 meters. This is the old continental band found on most European receivers, and for this reason, it is widely used.

BBC London (QSL: Bush House WC3, London, England). BBC is, of course, the biggest English language outlet in Europe (250kW), and there is no difficulty in hearing it.

Radio Nederland (QSL: P.O. Box 222, Hilversum, Holland). Radio Nederland has a relay station in Bonaire, Netherlands Antilles, so the Americas are covered with local-station volume.

Radio Moscow (QSL: Moscow, USSR). Radio Moscow comes pounding into the United States and Canada every evening.

Radio Portugal (QSL: Lisbon, Portugal): No information at time of publication.

Radio Switzerland (QSL: Berne, Switzerland): Radio Switzerland can also be heard daily.

Radio Rome (QSL: Rome, Italy): Radio Rome can be heard daily in the United States and Canada.

Radio Paris (QSL: Paris, France) This station broadcasts only in French.

Vatican Radio (QSL: Vatican City, Italy). Vatican Radio has daily programs beamed to the United States and Canada.

Radio Madrid (QSL: Madrid, Spain). The listener should try 49 meters for this broadcaster.

Radio Prague (QSL: Prague, Czechoslovakia). Radio Prague provides daily English language programs.

Radio Budapest (QSL: Budapest, Hungary). This broadcaster can be heard daily in the United States and Canada.

Radio Austria (QSL: Vienna, Austria). Daily programs are heard in most parts of the United States and Canada.

Radio Sofia (QSL: Sofia, Bulgaria). Sofia pours a powerful signal into North America.

Radio Bucharest (QSL: Bucharest, Romania). Here is another outlet the listener will have little trouble hearing.

The following Europeans will be heard often, but are too far north (via the polar short path) to be heard on a regular daily basis. Like the others listed here, they will be heard in English and have a North American service.

Deutsche Welle (QSL: Köln, Germany). A very powerful signal with an excellent North American service.

Radio Berlin International (QSL: Berlin, Germany). Another powerful signal from Germany.

Radio Belgium (QSL: Brussels, Belgium). This is not heard too often, but it can be heard.

Radio Finland (QSL: Helsinki, Finland). Finland is another one that you will hear once in a while.

Radio Sweden (QSL: Stockholm, Sweden). Sweden has a very powerful signal and it can be heard often.

Radio Norway (QSL: Oslo, Norway). Radio Norway is powerful and it can be heard quite often.

Greece, Poland, and Luxembourg are left out only because they are very seldom heard.

520-1600 kHz STARTER LIST OF DOMESTIC U.S. AND CANADIAN AM BROADCAST BAND STATIONS

Local broadcasters don't depend on listener reception reports and return postage should be enclosed when requesting a broadcast-band QSL. All reports should be addressed to the station's chief engineer and should contain the following information: Date heard; time (EST in this case); frequency in kilohertz; signal level; call letters; the listener's antenna and receiver, and five or ten minutes of program details. A prompt, valid report will usually bring a fast reply.

USA (State by State)

Alabama, Birmingham—WBRC 960kHz.
Alaska, Anchorage—KYAK 650kHz.
Arizona, Phoenix—KTUF 1580kHz.
Arkansas, Little Rock—KAAY 1090kHz.
California, Los Angeles—KNX 1070kHz.; San Francisco—KNBR 680kHz.
Colorado, Denver—KOA 850kHz., KHOW 630kHz.
Connecticut, Bridgeport—WICC 600kHz.; Hartford—WTIC 1080kHz.
Delaware, Dover—WDOV 1410kHz.; Wilmington—WDEL 1150kHz.
Florida, Jacksonville—WAPE 690kHz.
Georgia, Atlanta—WSB 750kHz.
Hawaii, Honolulu—KORL 650kHz.
Idaho, Boise KBOI 670kHz.
Illinois, Chicago—WBBM 780kHz., WGN 720kHz., WMAQ 670kHz.,WJJD 1160kHz.
Indiana, Fort Wayne—WOWO 1190kHz.; Indianapolis—WIRE 1430kHz.
Iowa, Des Moines—WHO 1040kHz.
Kansas, Topeka—WIBW 580 kHz.
Kentucky, Louisville—WHAS 840kHz.
Louisiana, New Orleans—WWL 870kHz.
Maine, Portland—WCSH 970kHz.
Maryland, Baltimore—WBAL 1090kHz.
Massachusetts, Boston—WBZ 1030kHz.
Michigan, Detroit—WJR 760kHz.
Minnesota, Minneapolis—WCCO 830kHz.
Mississippi, Jackson—WOKJ 1550kHz.
Missouri, St. Louis—KMOX 1120kHz.
Montana, Butte—KXLF 1370kHz.
Nebraska, Omaha—WOW 590kHz.
Nevada, Reno—KOH 630kHz., KCRL 780kHz.
New Hampshire, Dover—WTSN 1270kHz.
New Jersey, Paterson—WPAT 930kHz.
New Mexico, Albuquerque—KOB 770kHz.
New York, New York—WOR 710kHz., WCBS 880kHz., WINS 1010kHz.
North Carolina, Charlotte—WBT 1110kHz.
North Dakota, Bismark—KFYR 550kHz.
Ohio, Cincinnati—WCKY 1530kHz.; WLW 700kHz.
Oklahoma, Tulsa—KVOO 1170kHz.
Oregon, Portland—KEX 1190kHz.
Pennsylvania, Pittsburgh—KDKA 1020kHz.; Philadelphia—KYW 1060kHz.
Rhode Island, Providence—WPRO 630kHz.
South Carolina, Charleston—WCSC 1390kHz.
South Dakota, Sioux Falls—KSOO 1140kHz.
Tennessee, Nashville—WSM 650kHz.
Texas, Dallas—WFAA 820kHz.; San Antonio—WOAI 1200kHz.

Utah, Salt Lake City—KSL 1160kHz.
Vermont, Burlington—WVMT 620kHz.
Virginia, Richmond—WRVA 1140kHz.
Washington, Spokane—KGA 1510kHz.
West Virginia, Wheeling—WWVA 1170kHz.
Wisconsin, Milwaukee—WTMJ 620kHz.
Wyoming, Casper—KTWO 1030kHz.

Canada

Alberta, Edmonton—CBX 740kHz.
British Columbia, New Westminster—CKNW 980kHz.
Manitoba, Winnipeg—CBW 990kHz.
New Brunswick, Sackville—CBA 1070kHz.
Newfoundland, St. John's—CBN 640kHz.; Grand Falls—CBT 540kHz.
Northwest Territories, Inuvik—CHAK 860kHz.; Yellowknife—CFYK 1340kHz.
Nova Scotia, Halifax—CBH 860kHz., CHNS 960kHz.
Ontario, Toronto—CBL 740kHz.
Prince Edward Island, Charlottetown—CFCY 630kHz.
Quebec, Montreal—CBM 940kHz.
Saskatchewan, Regina—CBK 540kHz.
Yukon, Whitehorse—CFWH 570kHz.

WORLD SHORTWAVE BROADCAST STATIONS

*Standard Frequency Station. †Time Signal Station. Br.=Brazil, Cl.=Cultura, Col.=Colombia, Czecho.=Czechoslovakia, Ger.=Germany, Guat.=Guatemala, Hon.=Honduras, Isl.=Island, Venez.=Venezuela.

kHz	m	kw	Stations & Countries
2312	129.8	2	Djakarta, Indonesia
2340	128.4		Foochow, China
	128.4	0.1	S. Cruz Barillas, Guatemala
	128.4	0.5	R. Dif. Brasileira, Brazil
	128.4	1	R. Nueva Esparta, Venezuela
2350	127.6		Tsinan, China
	127.6	1	Jogjakarta, Indonesia
	127.6	1	La Voz de Candelaria, Guat
	127.6	1	R. Dif. Itacoatiara, Brazil
	127.6	1	R. Gaurico, Venezuela
2360	127.1	0.75	R. Maya, Guatemala
	127.1	0.25	R. Dif. Parintins, Brazil
	127.1	1	R. Cult. do Nordeste, Brazil
	127.1	0.5	R. Carúpano, Venezuela
2370	126.6	1	Surabaja, Indonesia
2380	126.0	0.35	Mexico City, Mexico
	126.0	0.25	R. Educ. Limeira, Brazil
2390	125.5		Banda Afjeh, Indonesia
	125.5	1/0.3	Tjirebon, Indonesia
2400	125.0	0.1	R. Mossoró, Brazil
	125.0	0.5	R. Dif. Amparo, Brazil
2410	124.5	0.25	R. Goroka, New Guinea
	124.5	0.25	R. Lumière, Haiti
	124.5	1	R. Em. Educ. Rural, Brazil
	124.5	1	R. Sirena, Brazil
2420	124.0	0.25	Bandung, Indonesia
	124.0	0.25	Singaradja, Indonesia
	124.0	0.5	R. Carajá, Brazil
	124.0	0.25	R. Carolina, Brazil
	124.0	0.5	R. Sao Carlos, Brazil
2430	123.5	0.2	R. El Progreso, Ecuador
	123.5	1	Esc. Radiofonicas, Venezuela
2440	122.9	1	R. Girardot, Venezuela
2442	122.8	1	Tel Aviv, Israel
2450	122.5	0.25	R. Mt. Hagen, New Guinea
	122.5	0.25	R. 4VEH, Haiti
	122.5	0.5	Cultura de Aracatuba, Brazil
	122.5	1	R. Los Llanos, Venezuela
2460	121.9	2	Djakarte, Indonesia
2470	121.5	0.5	R. Cacique, Brazil
2480	121.0	10	Padang, Indonesia
	121.0	1	R. Bragança, Brazil
	121.0	1	R. Tiempo, Venezeula
2490	120.5	0.3	Djambi, Indonesia
	120.5	0.3	Makassar, Indonesia
	120.5	0.3	Semarang, Indonesia
*2500	120.0	1	Praha, Czechoslovakia
*	120.0	5	Bagneux, France
*	120.0	0.5	Teddington, Gt. Britain
*	120.0	2	Tokyo, Japan
*	120.0	0.3	Lower Hutt, New Zealand
*	120.0	2.5	WWH, Ft. Collins, USA
*	120.0	1	WWVH, Puunene, Hawaii
2510	119.5	10	Seoul, Korea
†2614	114.5	10	Elmshorn, Germany
†	114.8	2	Norddeich, Germany
2635	113.9	0.3	Seoul (VUNC), Korea
†2775	108.1	10	Elmshorn, Germany
†	108.1	2	Kiel, Germany
2800	107.1	20/240	R. Peking, China
3200	93.75	20/240	R. Peking, China
3202	93.69	2	Bangkok, Thailand
3204	93.64	10	Ibadan (NBC), Nigeria
3205	93.60	10	AIR Lucknow, India
	93.60	10	Bandung, Indonesia
	93.60	1	R. Litoral, Venezuela
3210	93.44	10/0.25	Quelimane, Moçambique
	93.44	1.5	St. Denis, Réunion
3218	93.22	5/100	R. Clube de Moçambique
3220	93.17	20/240	R. Peking, China
3223	93.09	2.5	AIR Simla, India
	93.09	1	Mataram, Indonesia
3230	93.00	10	Suva, Fiji Islands
3232	92.82	1.5	R. Brazzaville, Congo
	92.82	0.3	Bukittinggi, Indonesia
3235	92.74	10	AIR Gauhati, India
3240	92.59	0.3	Beira, Mozambique
	92.59	50	Baghdad, Iraq
	92.59	0.3	R. Turismo, Ecuador
	92.59	1	R. América, Peru
	92.59	0.05	R. Nickerie, Surinam
3241	92.56	10	Ambon, Indonesia
	92.56	1	Sibolga, Indonesia
3242	92.54	25	Abidjan, Ivory Coast
3245	92.45	1	R. Educ. Palmares, Brazil
	92.45	1	R. Libertador, Venezuela
	92.31	0.4	R. La Droya, Peru
3255	92.16	10	Liberian Bc. Corp, Liberia
	92.16	0.5	R. Clube de Marilia, Brazil
	92.16	1	Le Voz del Tigre, Venezuela
3260	92.02	4	R. Niger, Niger
3265	91.87	5/100	R. Clube de Moçambique
	91.87	1	R. Sol, Dom. Rep.
	91.87	4	R. Ribeirão Preto, Brazil
	91.87	1	R. Tamandaré, Brazil
	91.87	2	R. Damerara, Br. Guiana
	91.87	0.2	La Voz del Dorado, Ecuador
	91.87	1	R. Nirgua, Venezuela
3268	91.78	1	R. Timor, Timor
3270	91.75	4	R. Dahomey, Dahomey
	91.75	120	Lusaka, Zambia
	91.75	20/240	R. Peking, China
3275	91.60	1	R. Clube Bauru, Brazil
	91.60	1	R. Mara, Venezuela
3277	91.55		R. Kashmir, India
	91.55	7.5	Djakarta, Indonesia
3280	91.40	5	Grenada, Windward Islands
3284	91.35	10	Suva, Fiji Islands
3285	91.32	1	Emiss. Educ. Rural, Brazil
	91.32	1	R. Puerto Cabello, Venezuela
3286	91.26	1	Madiun, Indonesia
	91.26	2.5	Philipp. Bc. Sce, Philippines
3288	91.24	30	Tananarive, Malagasy Rep.
3290	91.19	20/240	R. Peking, China
3295	91.05	10/100	AIR Bombay, India
	91.05	7.5	Samarinda, Indonesia
	91.05	1	R. Cult. Serguipe, Brazil
	91.05	1	R. Educ. Rural, Brazil
	91.05	0.5	R. Educ. de Uberlandia, Br.
	91.05	1	R. Trujillo, Venezuela
3300	90.91	4	R. Gabon, Gabon
	90.91	5	Belize, Honduras (BR)
	90.91	0.45	R. Junin, Peru
3305	90.77	1	NCDAF, Philippines
	90.77	1	La Voz de la Patria, Venez.
3306	90.73	10	Gwelo, Rhodesia

kHz	m	kw	Stations & Countries
3308	90.70	1.5	Ondas Quevedañas, Ecuador
3310	90.63	10/0.25	Quelimane, Moçambique
3315	90.50	10	AIR Bhopal, India
	90.50	4	R. Martinique, Martinique
	90.50	1	R. Gazeta de Alagoas, Brazil
	90.50	0.5	R. Itatiaia, Brazil
	90.50	1	R. Maracay, Venezuela
3316	90.46	5/10	Freetown, Sierra Leone
3320	90.34	1	R. Erpa, Peru
3325	90.23	1	Palankaraya, Indonesia
	90.23	2	R. Borborema, Brazil
	90.23	0.1	R. Dif. Guarulhas, Brazil
	90.23	5	R. Monagas, Venezuela
3326	90.20	7.5	Kaduna (NBC), Nigeria
†3330	90.09	3	CHU, Dominion Observatory, Can.
	90.09	1	R. Progreso, Peru
3331	90.06	4	Ozaoudzi, Comores Islands
3335	89.95	1	R. Marajoará, Brazil
	89.95	0.5	Vóz do Sertão, Brazil
3336	89.95	4	Ziguinchor, Senegal
3338	89.87	5/100	R. Clube de Moçambique
3339	89.85	10	R. Tanzania, Zanzibar
3340	89.81	2	La Estación de la Alegria, Ec.
3345	89.68	2	R. Kashmir, India
	89.68	10	Pontianak, Indonesia
	89.68	1	R. Alvorada, Brazil
	89.68	1	R. Central, Venezuela
3346	89.68	20	Lusaka, Zambia
3350	89.55	4	Franceville, Gabon
	89.55	10/20	Accra, Ghana
	89.55	1	R. 27 de Diciembre, Bolivia
	89.55	1	R. Independencia, Peru
3355	89.42	10/0.25	Nampula, Moçambique
	89.42	7.5	AIR Kurseong, India
	89.42	4	R. Nouméa, New Caledonia
	89.42	0.25	La Voz Romana, Dom. Rep.
	89.42	1	R. Ondas de Huallaga, Peru
	89.42	0.3	R. Luz, Peru
	89.42	1	R. Valencia, Venezuela
3356	89.40	10	Gaberones, Botswana
3360	89.29	0.2	La Voz Nahualá, Guatemala
	89.29	0.5	R. Huánuco, Peru
3365	89.15		Lanchow, China
	89.15	10/100	AIR Delhi, India
	89.15	0.5	Manokwari, Indonesia
	89.15	1	R. Exitos, Dom. Rep.
	89.15	1	R. Tovar, Venezuela
3366	89.12	10/20	Accra, Ghana
	89.12	10/0.25	Nampula, Moçambique
3370	89.02	4	R. Université, Malagasy Rep.
	89.02	0.5	R. Universidád, Bolivia
3372	88.96	0.25	R. Iris, Ecuador
3373	88.94	5/100	R. Clube de Moçambique
3375	88.89	10	R. Angola, Angola
	88.89	10	AIR Gauhati, India
	88.89	1	Djambi, Indonesia
	88.89	1	R. San Juan, Dom. Rep.
	88.89	1	R. Olinda Pernambuco, Br.
	88.89	1	La Voz de la Fé, Venezuela
3378a	88.81	0.25	R. Iris, Ecuador
3380	88.76	10	Blantyre, Malawi
	88.76	1	R. Shortis, Guatemala
	88.76	1	R. Chiclayo, Peru
3385	88.63	10	Colombo, Ceylon
	88.63	0.5	Kupang, Indonesia
	88.63	10	R. Rabaul, New Guinea
	88.63	0.5	R. Clube Teresina, Brazil
	88.63	0.5	R. Dif. do Paraná, Brazil
	88.63	4	Cayenne, Fr. Guiana
	88.63	1	La Voz del Valle Montaro, P.
	88.63	1	R. Barcelona, Venezuela
3390	88.50	1	R. Zaracay, Ecuador
	88.50	0.3	R. Industrial, Peru
3395	88.37	1	Medan, Indonesia
	88.37	0.5	Biak, Indonesia
	88.37		R. Dif. Goiania, Brazil
	88.37	1	R. Tapuyo de Mossoró, Br.
	88.37	0.35	R. Suriname, Surinam
	88.37	1	R. Universidád, Venezuela
3396	88.34	10	Kaduna (NBC), Nigeria
	88.34	20	Gwelo, Rhodesia
3448	87.11	0.75	Purwokerto, Indonesia
3450	86.96	120/240	R. Peking, China
3465	86.58	1	Pakanbaru, Indonesia
3520	85.23	0.2	R. Escuelas Radiales, Ecuad.
3615	82.99	0.4	R. Pillaro, Ecuador
3704	80.99	1	Nova Lisboa, Angola
3755	79.90	0.4	R. Latacunga, Ecuador
3830	78.33	20/240	R. Peking, China
3835	78.23	0.35	La Voz del Triunfo, Ecuador
3900	76.92	20/240	R. Peking, China
	76.92		Fukien, China
3905	76.83	10/100	AIR Delhi, India
	76.83	0.5	Port Vila, New Hebrides
3910a	76.73	1	R. Barlavento, Cape V. Isl.
	76.73	10/1	Tokyo (FEN), Japan
	76.73	5	Seoul, Korea
3915	76.64	15/100	BBC London, Gt. Britain
	76.64	20/240	R. Peking, China
	76.64	0.3	Ternate, Indonesia
	76.64	7.5/100	BBC, Malaysia
3925	76.43	50	Tokyo, Japan
	76.43	10	Port Moresby, Australia
3930	76.34		Huhehot, Inner Mongolia
3935	76.24	5	Semarang, Indonesia
	76.24	35/100	Okinawa (VOA), Ryukyu Isl.
3945	76.05	1	Denpassar, Indonesia
	76.05	0.3	Ternate, Indonesia
	76.05	10	Sapporo/Tokyo, Japan
	76.05	0.5	Cotabato, Philippines
3950	75.95		Sining, China
3952	75.90	15/100	BBC London, Gt. Britain
3958	75.78	0.5	Stanley, Falkland Islands
3960	75.76	10/100/250	R. Free Europe
	75.76	1	R. Barlavento, Cape V. Isl.
	75.76	20/240	R. Peking, China
	75.76		Urumchi, China
	75.76	0.1	Kendari, Indonesia
	75.76	10	Padang, Indonesia
	75.76	100	Baghdad, Iraq
3970	75.57	10/100/250	R. Free Europe
	75.57	1	R. Clube Huila, Angola
	75.57	8	R. Buea, Cameroon
	75.57		Huhehot, Inner Mongolia
3972	75.52	25	Ulan Bator, Mongolia
3975	75.47	0.6	R. Sira, Ecuador
3980	75.38	8	Munich (VOA), Germany
	75.38	15	Baku, USSR
3985	75.28	100	Schwarzenburg, Switzerland
	75.28	0.5	R. Cordac, Burundi
	75.28	0.25	Merauke, Indonesia
	75.28	0.2	Seoul (VUNC), Korea
	75.28	1	Esc. Radiofónicas Pop, Ec.
3990	75.19	20	R. Liberty
	75.19	50	Monrovia (VOA), Liberia
	75.19	1	AFNT, Taiwan
3995	75.09	10/100/250	R. Free Europe
	75.09	5	R. Roma, Italy
	75.09	5	Solomon Islands
	75.09	0.5	La Voz del Rio Tarqui, Ec.
3999	75.02	1.5	Godthab, Greenland
4000	75.00		Tengkou, China
4008	74.81	15	Frunze, USSR
†4010	74.80		San Francisco, USA

kHz	m	kw	Stations & Countries
4020	74.63	120/240	R. Peking, China
4035	74.35	20/240	R. Peking, China
	74.35		Llasa, Tibet
4040	74.26	50	Erevan, USSR
4055	73.98	50	Petropavlovsk, USSR
4060	73.89	20/240	R. Peking, China
4069	73.74		Huhehot, Inner Mongolia
4080	73.53	50	Semipalatinsk, USSR
4085	73.44	50	Ulan Bator, Mongolia
4100	73.17	50	Kzyl Orda, USSR
4110	72.99		Urumchi, China
4200	71.43	120/240	R. Peking, China
4220	71.09	20/240	R. Peking, China
	71.09		Urumchi, China
4250	70.59	120/240	R. Peking, China
†4265	70.34	5	Elmshorn, Germany
†4286	70.00	10	Belconnen, Australia
4310	69.61		Chimkent, USSR
4380	68.49		Fukien, China
4460	67.26	120/240	R. Peking, China
†4478	67.00		Sydney, Australia
4485	66.89	50	Petropavlovsk, USSR
4500	66.67		Urumchi, China
4510	66.52	50	Andizhan, USSR
4520	66.37	50	Khanty Manziysk, USSR
†4525	66.30	5	Nauen, G.D.R.
	66.30		Silinhot, China
†	66.30		Honolulu, Hawaii
4544	66.00	50	Alma Ata, USSR
4610	65.08	50	Vladivostok, USSR
4620	64.94	120/240	R. Peking, China
4635	64.72	50	Dushanbé, USSR
4684	64.05		Hanoi, Vietnam (Dem. Rep.)
4715	63.56	0.25/ 0.45	R. Cl. Mindelo, C. Verde Isl.
4750	63.16	10	Lubumbashi, Congo D. Rep.
	63.16	20	Makassar, Indonesia
	63.16	0.25	R. El Mundo, Ecuador
4755	63.09		Sibolga, Indonesia
	63.09	0.25	R. Yoro, Honduras Rep.
	63.09	1	R. Brasil, Brazil
	63.09	0.1	R. Dif. Maranhão, Brazil
4756	63.08	10	Suva, Fiji Islands
	63.03	5	R. Bolivia, Bolivia
	63.03	1	R. Frontera, Venezuela
4765	62.95	50	R. TV Congolaise, Congo
	62.95	1	R. Feira de Santana, Brazil
	62.95	1	R. Dif. del Ecuador, Ecuador
4770	62.89	0.5	R. Diamang, Angola
	62.89	10	R. St. ELWA, Liberia
	62.89	1	R. Continental, Hond. Rep.
	62.89	0.4	R. Cenit, Ecuador
	62.89	1	R. Guayaquil, Ecuador
	62.89	0.5	R. Cajamarca, Peru
	62.89	1	R. Bolivar, Venezuela
4775	62.84	100	R. Afghanistan, Afghanistan
	62.84	10	AIR Gauhati, India
	62.84	7.5	Djambi, Indonesia
	62.84	0.1	R. Onkoi, Bolivia
	62.84	5	R. Dragão do Mar, Brazil
	62.84	5	R. Progresso, Brazil
	62.84	1	Los Voz de Maria, Colombia
4777	62.80	30	R. Gabon, Gabon
	62.76	1	R. Atahualpa, Ecuador
	62.76	1	La Voz de Carabobo, Ven.
4783	62.72	18	R. Mali, Mali
4785	62.70	10	R. Tanzania, Tanzania
	62.70	1	R. Indoamérica, Bolivia
	62.70	1	R. Cult. Caiari, Brazil
	62.70	0.5	R. Ribamar, Brazil
	62.70	1	Ecos Combéima, Colombia
	62.70	0.2	La Voz de Bolivar, Ecuador
	62.70	1	R. Horizonte, Peru
4790	62.63	10	R. Malaysia, Malaysia
	62.63	1	R. Primero de Mayo, Hon.
	62.63	1	R. Sistema Atalaya, Ecuador
	62.63	0.4	R. Nazca, Peru
	62.63	5	Ondas Porteñas, Venezuela
4795	62.57	10	R. Com. de Angola, Angola
	62.57	4	R. Brazzaville, Congo
	62.57	1	R. Nueva América, Bolivia
	62.57	1	R. Congonhas, Brazil
	62.57	0.5	R. Copacabana, Brazil
	62.57	2	R. Tabajará, Brazil
	62.57	1	La Voz del Comercio, Col.
4800	62.50	10	AIR Hyderabad, India
	62.50	0.25	R. Amazonas, Ecuador
	62.50	0.5	R. Onda Azul, Peru
	62.50	10	R. Lara, Venezuela
4804	62.45	5	Kisumu, Kenya
4805	62.43	50	Djakarta, Indonesia
	62.43	0.5	Fak Fak, Indonesia
	62.43	5	R. Dif. do Amazonas, Brazil
4807	62.41	4	St. Denis, Réunion
	62.41	10	R. Clube de São Tomé
	62.37	0.3	La Voz del Manabi, Ecuador
	62.37	0.2	R. Coro de Sta. Cecilia, Ec.
	62.37	1	R. Popular, Venezuela
4815	62.31	25	Ouagadougou, Upper Volta
	62.31	1	R. Los Andes, Bolivia
	62.31	1	R. Icarema Fortaleza, Brazil
	62.31	1	Petropolis R. Dif, Brazil
	62.31	1	R. Amazonas, Peru
	62.31	1	La Voz de Huamanga, Peru
4820	62.24	10	R. Angola, Angola
	62.24	3.1	R. Gambia, Gambia
	62.24	0.25/10	AIR Calcutta, India
	62.24	5	R. Evangélica, Hond. Rep.
	62.24	0.2	Guadalajara, Mexico
	62.24	2	La Estación de la Alegria, Ec.
	62.24	0.45	R. Puno, Peru
	62.24	1	La Voz de Apure, Venezuela
4825	62.18	15	Ashkabad, USSR
	62.18	1	R. Grigota, Bolivia
	62.18	0.5	Educ. de Parnaiba, Brazil
	62.18	0.5	R. Cl. de Varginha, Brazil
	62.18	1	R. Nariño, Colombia
	62.18	1	R. San José, Peru
4830	62.11	5	R. Thailand, Thailand
	62.11	0.5	Ondas del Angel, Ecuador
	62.11	1	La Voz del Táchira, Ven.
4835	62.05	60	Erevan, USSR
	62.05	18	R. Mali, Mali
	62.05	20/10	R. Malaysia, Sarawak
	62.05	1	R. Dif. Roraima, Brazil
	62.05	0.5	R. Triangulo Mineiro, Brazil
	62.05	1	R. Buenaventura, Colombia
	62.05	1	La Voz del Valle, Ecuador
	62.05	0.35	R. Sicuani, Peru
	62.05	0.5	R. Sudamericana, Peru
4840	61.98	2	Novo Redondo, Angola
	61.98	10/100	AIR Bombay, India
	61.98	1	R. Andahuaylas, Peru
	61.98	1	R. Atántida, Peru
	61.98	1	R. Valéra, Venezuela
4845	61.92	10	Francistown, Botswana
	61.92	10	R. Malaysia, Malaysia
	61.92	0.5	R. Católica S. Isidro, Hon.
	61.92	1	D. Dif. Teresina, Brazil
	61.92	1	R. Bucaramanga, Colombia
	61.92	1	La Voz del Chira, Peru
4850	61.86	50	Tashkent, USSR
	61.86	1	Carmona, Angola
	61.86	30	R. Mauritania, Mauritania

kHz	m	kw	Stations & Countries
	61.86	10	Forest Side, Mauritius
	61.86	2	AIR Kohima, India
	61.86	0.25	Ondas del Zamora, Ecuador
	61.86	10	Ondas Popular, Venezuela
4855	61.79	5/100	R. Clube de Moçambique
	61.79	10	Enugu, Nigeria
	61.79	10	Palembang, Indonesia
	61.79	1	R. Corona, Honduras Rep.
	61.79	1	R. Centenario, Bolivia
	61.79	1	R. Cobija, Bolivia
	61.79	1	R. Dif. de Taubaté, Brazil
	61.79	1	R. Neiva, Colombia
	61.79	0.35	R. Marañon, Ecuador
	61.79	0.5	R. La Hora, Peru
4860	61.73	0.5	R. Callao, Peru
	61.73	1	R. Mundo, Venezuela
4865	61.66	5/100	R. Clube de Moçambique
	61.66	10	Brunei Bc. Sce, Brunei
	61.66	2.5	R. Club de Pará, Brazil
	61.66	1	R. Punto 83, Ecuador
4870	61.60	30	R. Dahomey, Dahomey
	61.60	10	Colombo, Ceylon
	61.60	5	R. Tropical, Venezuela
4872	61.58	10	Sorong, Indonesia
4875	61.54	10/0.25	Porto Améliа, Moçambique
	61.54	20	Paradys, So. Africa
	61.54	5/1	R. Jornal do Brasil, Brazil
	64.54		La Voz del Rio Cauca, Col.
	61.54	1	R. Villavicencio, Colombia
	61.54	3	La Voz Esmeraldas, Ecuador
4877	61.52	80/20	Saigon, Vietnam
4880	61.48	1	R. Comercial, Dom. Rep.
	61.48	0.5	La Voz de Atlantico, Hon.
	61.48	1	R. Nac. Espejo, Ecuador
	61.48	1	R. Once Sesenta, Peru
	61.48	10	R. Universo, Venezuela
4885	61.45	50	Vladivostok, USSR
	61.45	10	Nairobi, Kenya
	61.45	1	Lahore, Pakistan
	61.45	0.5	R. Ibare, Bolivia
	61.45	1	R. Sararenda, Bolivia
	61.45	1	R. Acreana, Brazil
	61.45	1	R. Cultura de Pocos, Brazil
	61.45	1	R. Pioneira de Teresina, Br.
	61.45	1	Ondas del Meta, Colombia
	61.45	1	R. Villarica, Peru
4890	61.35	25	Dakar, Sénégal
	61.35	10	Port Moresby, Australia
	61.35	1	R. Lux, Honduras Rep.
	61.35	5	R. Dif. Venezuela, Venezuela
	61.29	7.5	AIR Kurseong, India
	61.29	4	R. Martinique, Martinique
	61.29	5	R. Baré, Brazil
	61.29	1	R. Cultura da Bahia, Brazil
	61.29	0.4	R. Chanchamaya, Peru
4896	61.27	1	Silva Porto, Angola
4900	61.22	1	Gorontalo, Indonesia
	61.22	0.5	La Voz del Ulúa, Hon. Rep.
	61.22	10	R. Juventud, Venezuela
4904	61.18	30	Fort Lamy, Chad
4905	61.16	20/240	R. Peking, China
	61.16	5	R. Relogio Federal, Brazil
	61.16	1	Emis. Atlántico, Colombia
4907	61.14	15	R. Cambodia, Cambodia
4908	61.12	1	R. Trasandina, Chile
4910	61.10	1	R. HIN, Dominican Republic
	61.10	5	Emis. Gran Colombia, Ec.
	61.10	0.5	R. Libertad, Peru
	61.10	1	R. Tahuantisuyo, Peru
	61.10	10	Esc. Radiofónicas, Venez.
4911	61.08	20	Lusaka, Zambia
4912	61.07	2	Tarawa, Gilbert Islands
4914	61.05	0.25	La Voz del Pacifico, Hon.
4915	61.03	10/20	Accra, Ghana
	61.03	1	R. Amboro, Bolivia
	61.03	1	R. Cult. de Araraquara, Br.
	61.03	2	R. Dif. de Macapá, Brazil
	61.03	0.5	R. La Hora, Peru
4916	61.03	0.3	R. El Trebol, Ecuador
4920	60.98	10	AIR Madras, India
	60.98	10	Brisbane, Australia
	60.98	0.15	V. San Raymundo, Guat.
	60.98	1	R. Progreso, Honduras Rep.
	60.98	0.2	La Voz de la Peninsular, Ec.
	60.98	1	R. Ondas del Titicaca, Peru
	60.98	7.5	R. Caracas, Venezuela
4923	60.94	5	R. Quito, Ecuador
4925	60.90	5/100	R. Clube de Moçambique
	60.90	1	R. Icarema, Brazil
	60.90	1	R. Industrial, Brazil
4926	60.90	5	R. Ecuatorial, Sp. Guinea
4930	60.85	50	Erevan, USSR
	60.85	1	R. Católica, Honduras Rep.
	60.85	10	Casa de la Cultura, Ecuador
	60.85	1	R. Junin, Venezuela
4932	60.83	10	Benin City, Nigeria
4934	60.80	10	Nairobi, Kenya
	60.80	0.25	R. Concejo Provincial, Peru
4935	60.80	1	R. Clube de Malanje, Angola
	60.80	1	R. Nortes, Bolivia
	60.80	1	R. Poti, Brazil
	60.80	1	R. Tropical, Peru
4940	60.73	50	Kiev, USSR
	60.73	10	R. Abidjan, Ivory Coast
	60.73	10	AIR Gauhati, India
	60.73	0.5	R. Diff. Haitienne, Haiti
	60.73	10	R. Dif. Nacional, Ecuador
	60.73	0.5	R. Misti, Peru
	60.73	0.5	R. San Juan, Peru
	60.73	10	R. Yaracuy, Venezuela
4945	60.67	20	Paradys, So. Africa
	60.67	0.5	Nat. Teachers Coll, Philipp.
	60.67	1	R. Capixaba, Brazil
	60.67	0.25	R. Dif. Mearim, Brazil
	60.67	1	R. Educ. Bragança, Brazil
	60.67	1	R. Colosál, Colombia
4946	60.65	10/0.25	Nampula, Moçambique
4950	60.60	5	Nairobi, Kenya
	60.60	0.5	R. Madre de Dios, Peru
	60.60	1	R. Coro, Venezuela
†4955	60.54		Guam
	60.54	2	R. Cult. de Campos, Brazil
	60.54	1	R. Amauta, Peru
4957	60.52	50	Anadyr, USSR
4958	60.51	50	Baku, USSR
	60.51	10/0.25	Nampula, Moçambique
4960	60.48	120/240	R. Peking, China
	60.48	1	La Voz del Chofer, Ecuador
	60.48	0.5	R. Lambayeque, Peru
	60.48	1	R. Sucre, Venezuela
4965	60.42	20	Paradys, So. Africa
	60.42	20	Lusaka, Zambia
	60.42	1	R. Juan XXIII, Bolivia
	60.42	2.5	R. Santa Fé, Colombia
4967	60.40	1/10/50	R. Kuwait, Kuwait
4968	60.38	10	Colombo, Ceylon
4970	60.36	5	Jesselton, Sabah
	60.36	3	R. Tarqui, Ecuador
	60.36	1	R. San Juan, Peru
	60.36	10	R. Rumbos, Venezuela
4972	60.33	30/4	R. Yaoundé, Cameroon
4975	60.30	50	Blagovechensk, USSR
	60.30	50	Oushanbé, USSR
	60.30		Foochow, China

kHz	m	kw	Stations & Countries
	60.30	1	R. Copacabana, Brazil
	60.30	5/2.5	R. Timbira, Brazil
	60.30	1	R. Internacional, Colombia
4976	60.29	3/9	Kampala, Uganda
4980	60.25	10/20	Accra, Ghana
	60.25	10/50	Karachi, Pakistan
	60.25	0.3	Ondas Azuayas, Ecuador
	60.25	0.3	R. Maldonado, Peru
	60.25	1	Ecos del Torbes, Venezuela
4985	60.18	1	R. Ecclesia, Angola
	60.18	10	Kotaradja, Indonesia
	60.18	10	R. Malaysia, Malaysia
	60.18	10	La Cruz del Sur, Bolivia
	60.18	1.5	Voz de Deste, Brazil
4990	60.12	10	Lagos, Nigeria
	60.12		Changsha, China
	60.12	10	AIR Bhopal, India
	60.12	1	R. Xavier, Ecuador
	60.12	1	R. Chulucanas, Peru
	60.12	1	R. Triunfo, Peru
	60.12	10	R. Barquisimeto, Venezuela
4995	60.06	5	R. Brasil Central, Brazil
	60.06	1	R. Andina, Peru
4996	60.05	50	Magadan, USSR
*5000	60.00	0.5	Teddington, Gt. Britain
*	60.00	1	Rome, Italy
*	60.00	5	Turin, Italy
*	60.00	20	Moscow, USSR
†	60.00	4	Olifantsfontein, So. Africa
*	60.00		Peking, China
*	60.00	2	Tokyo Japan
*	60.00	2	WWVH, Puunene, Hawaii
*	60.00	10	WWH, Ft. Collins
†	60.00	2	Buenos Aires, Argentina
5005	59.94	1	R. Jaén, Peru
5010	59.88	4/30	R. Garoua, Cameroon
	59.88		Nanning, China
	59.88	10	FBS, Singapore
	59.88	0.4	R. Eco, Peru
	59.88	1	R. Boconó, Venezuela
5015	59.82	15	Arkhangelsk, USSR
	59.82	50	Vladivostok, USSR
	59.82	1	Moçamedes, Angola
	59.82	5	Grenada, Windward Islands
	59.82	1	R. Universo, Bolivia
5020	59.76	30	R. Niger, Niger
	59.76	10	Colombo, Ceylon
	59.76	0.5	R. Indépendence, Haiti
	59.76	1	Trans. Caldas, Colombia
	59.76	10	R. Nacional, Venezuela
5025	59.70	1	R. Dif. Aquidauana, Brazil
	59.70	1	Voz Amazonia, Brazil
	59.70	0.2	R. Splendit, Ecuador
	59.70	0.3	R. Quillabamba, Peru
5026	59.70	3/8	Kampala, Uganda
5030	59.64	120/240	R. Peking, China
	59.64	20	Medan, Indonesia
	59.64	50	R. Malaysia, Malaysia
	59.64	1	La Voz del Papagayo, Dominican Republic
	59.64	10	R. Continente, Venezuela
5035	59.58	30	Bangui, Central African Rep.
	59.58	1	La Voz de Las Fronteras, Honduras
	59.58	1	R. Anhanguera, Brazil
	59.58	0.5	R. Espirito Santo, Brazil
	59.58	0.75	R. Centinela del Sur, Ec.
	59.58	0.5	R. Ayaviri, Peru
	59.58	1	R. Ilo, Peru
5040	59.52	50	Tbilisi, USSR
	59.52	50	Rangoon, Burma
	59.52	0.15	R. Capois da Mort, Haiti
	59.52	10	R. Los Andes, Peru
	59.52	1	R. Maturin, Venezuela
5041	59.51	10	Emiss. da Guiné, Port. Guinea
5042	59.50	1	R. Clube de Benguela, Angola
5045	59.46	0.25	Rarotonga, Cook Islands
	59.46	1	R. Imperial, Brazil
	59.46	5	La Voz del Altiplano, Bolivia
5047	59.43	4/100	Lomé, Togo
	59.43	20	Djakarta, Indonesia
5050	59.41	50	Petropavlovsk, USSR
	59.41	20	R. Tanzania, Tanzania
	59.41	1	La Voz de Medellin, Col.
	59.41	1	R. Tumbes, Peru
	59.41	2	R. Cultura, Venezuela
5052	59.38	50	Ulan Bator, Mongolia
	59.38	10	R. Singapura, Singapore
5055	59.35	50	Chita, USSR
	59.35	5	R. San Rafael, Bolivia
	59.35	1	R. Vitória, Brazil
	59.35	0.5	R. Católica, Ecuador
	59.35	1	R. Onda Imperial Peru
5058	59.31	1	R. Tarma, Peru
5060	59.29	1	Nova Lisboa, Angola
5065	59.23	10	Petrozavodsk, USSR
5070	59.17	0.3	R. Nac. Mazatenango, Guat.
5075	59.12	120/240	R. Peking, China
	59.12	25	Acción Cult. Popular, Col.
5076	59.10	10	Colombo, Ceylon
5090	59.00	0.25	R. Grand Anse, Haiti
5095	58.88	50	Acción Cult. Popular, Col.
5125	58.54	120/240	R. Peking, China
5145	58.31	20/240	R. Peking, China
5160	58.14	20/240	R. Peking, China
5170	58.03		Fukien, China
5220	57.47	20/240	R. Peking, China
	57.25		Fukien, China
5260	57.03	15	Alma Ata, USSR
5295	56.66	20/240	R. Peking, China
5320	56.39	20/240	R. Peking, China
5448	55.05		Canal Zone, Panama
5455	55.00	50	Moscow, USSR
5535	54.20	20/240	R. Peking, China
5545	54.10	20/240	R. Peking, China
5850	51.28	20/240	R. Peking, China
5860	51.19	20/240	R. Peking, China
†5870	51.11		Annapolis, USA
5875	51.06	1	La Voz de Honduras, Hon.
5900	50.84	50	Moscow, USSR
	50.84		La Voz del Norte, Ecuador
5908	50.78	7.5	Voix de la Rev. Duv, Haiti
5915	50.72	100	Sverdlovsk, USSR
5920	50.68	50	Moscow, USSR
5925	50.63	50	Tashkent, USSR
5930	50.59	100	Praha, Czechoslovakia
	50.59	15	Arkhangelsk, USSR
5933	50.57		Chengtu, China
	50.55		Lhasa, Tibet
5940	50.51	50	Magadan, USSR
5950	50.42	120	R. Tirana, Albania
	50.42	20/240	R. Peking, China
	50.42	7.5	Voix de la Rev. Duv, Haiti
5954	50.39	1	R. Casino, Costa Rica
5955	50.39	100	Allouis, France
	50.39	50	R. Liberty
	50.39	100	Sverdlovsk, USSR
	50.39	10	Pakanbaru, Indonesia
	50.39	0.4	Suva, Fiji Islands
	50.39	5	R. Cultural, Guatemala
	50.39	1	R. Exitos, Honduras Rep.
	50.39	0.5	R. Zelaya, Nicaragua
	50.39	1	R. Pio XII, Bolivia
	50.39	50	R. Gazeta, Brazil

kHz	m	kw	Stations & Countries
	50.39	1	R. Nuevo Mundo, Chile
	a50.39	0.75	R. Equinoccial, Ecuador
	50.39	0.5	R. Huancayo, Peru
5960	50.34	100	Trans World Radio, Monaco
	50.34	20/240	R. Peking, China
	50.34		R. Kashmir, India
	50.34	50	Ulan Bator, Mongolia
	50.34	1	Taipei, Taiwan
	50.34	1.5	Godthab, Greenland
	50.34	1	La Voz de Occidente, Hon.
	50.34	1	La Voz de Bogotá, Colombia
	50.34	0.25	La Voz del Altiplano, Peru
5965	50.29	35	Tanger (VOA), Morocco
	50.29	7.5	R. Guiaba, Brazil
	50.29	0.2	R. Mundial, Ecuador
5970	50.25	10/100/250	R. Free Europe
	50.25	100	Moscow, USSR
	50.25	50	Alger, Algeria
	50.25	4	R. Brazzaville, Congo
	50.25	10	AIR Gauhati, India
	50.25	10	Bandjarmasin, Indonesia
	50.25	1	NCOA, Philippines
	50.25	50	R. Canada, Canada
	50.25	5	R. Horizonte, Colombia
	50.25	10	R. El Sol, Peru
5975	50.21	15/100	BBC London, Gt. Britain
	50.21	20/240	R. Peking, China
	50.21	10	Seoul, Korea
	50.21	1	R. Nacional, Bolivia
	50.21	10	R. Guarujá, Brazil
	50.21	10	Emis. Pres. Balmaceda, Chile
	50.21	3	R. Guarani, Peraguay
5980	50.17	100	Tbilisi, USSR
	50.17	0.5	Freetown, Sierra Leone
	50.17	100	Beirut, Lebanon
	50.17	3.5	Taipei (BBC), Taiwan
	50.17	1.5	Godthab, Greenland
	50.17	10	La Voz del Rio Grande, Col.
	50.17	5	R. Panaméricana, Peru
5985	50.13	10/100/250	R. Free Europe
	50.13	50/100	R. Nacional, Portugal
	50.13	7.5/100	Dacca, Pakisten
	50.13	1	Taipei, Taiwan
	50.13		Hanoi, Vietnam (Dem. Rep.)
	50.13	1	R. Splendid, Argentina
	50.13	10	Trans. Independencia, Col.
5990	50.08	15/100	BBC London, Gt. Britain
	50.08	50/60/100	R. Roma, Italy
	50.08	120	R. Bucharest, Rumania
	50.08	100	Hörby, Sweden
	50.08	10	AIR Bhopal, India
	50.08	10	Menado, Indonesia
	50.08	0.5	Pakanbaru, Indonesia
	50.08	50	R. Canada, Canada
	50.08	7.5	R. Educação, Brazil
	50.08	1	R. Nac. Tumbes, Peru
5993	50.05	10	R. Mdandaka, Congo
5995	50.04	35	Thessaloniki (VOA), Greece
	50.04	10	Blantyre, Malawi
	50.04	3	Taipei, Taiwan
	50.04	50	R. Canada, Canada
	50.04	250	Greenville, USA
	50.04	1	Ecos de Honduras, Honduras
	50.04	4	R. Martinique, Martinique
	50.04	1	Circuito RPC, Penama
	50.04	1	R. Loyola, Bolivia
	50.04	1	La Voz del Pueblo, Colombia
6000	50.00	1	Aldrans, Austria
	50.00	50/100	Moscow, USSR
	50.00	50/100	R. Afghanistan, Afghanistan
	50.00	20/240	R. Peking, China
	50.00	50	Riyadh, Saudi Arabia
	50.00	7.5	R. Singapura, Singapore
	50.00	25	R. Inconfidencia, Brazil
	50.00	5	R. Sur, Uruguay
	50.00	1	R. Miranda, Venezuela
6005	49.96	20/100	Berlin (RIAS), Germany
	49.96	1	R. Buea, Cameroon
	49.96	20	Paradys, South Africa
	49.96	10	R. Tanzania, Zanzibar
	49.96	10	Colombo, Ceylon
	49.96	9.4	Suva, Fiji Islands
	49.96	0.075	Montreal, Canada
	49.96	10	R. Progreso, Bolivia
6010	49.92	100	Wavre, Belgium
	49.92	15/100	BBC London, Gt. Britain
	49.92	100	Moscow, USSR
	49.92	7.5/100	BBC, Malaysia
	49.92	35/100	Okinawa (VOA), Ryukyu Isl.
	49.92	10	Thai TV Co, Thailand
	49.92	1	Sydney, Canada
	49.92	0.5	R. Mil, Mexico
	49.92	5	R. Nacional, El Salvador
	49.92	0.25	R. Norte, Chile
	49.92	10	La Voz Amiga, Colombia
	49.92	0.5	R. América, Peru
6015	49.88	50	Rhodes (VOA), Greece
	49.88	100	R. Abidjan, Ivory Coast
	49.88	25	R. Cl. de Pernambuco, Brazil
	49.88	1	R. Paraguay, Paraguay
6020	49.83	10	R. Nederland, Holland
	49.83	50	Khabarovsk, USSR
	49.83	50	Kiev, USSR
	49.83	100	Moscow, USSR
	49.83	20	Gwelo, Rhodesia
	49.83	10/100	AIR Delhi, India
	49.83	2.5	AIR Simla, India
	49.83	250	Greenville, USA
	49.83	7	R. Caraibes, Haiti
	49.83	1	R. Moderna, Honduras Rep.
	49.83	0.25	El Eco de Sotavento, Mexico
	49.83	1	R. Victoria, Peru
6025	49.79	100	Deutsche Welle, Germany
	49.79	50/100	R. Nacional, Portugal
	49.79	20/240	R. Peking, China
	49.79	10	R. Malaysia, Malaysia
	49.79	10	R. Em. de Piratininga, Brazil
	49.79	3	R. Nacional, Paraguay
6030	49.75	20	Mühlacker (SOR), Germany
	49.75	100	Simferopol, USSR
	49.75	4	Franceville, Gabon
	49.75	100	Baghdad, Iraq
	49.75	2	Call of the Orient, Philippines
	49.75	0.1	Calgary, Canada
	49.75	110	Bethany, USA
	49.75	1	R. Minera, Chile
6035	49.71	50	Khabarovsk, USSR
	49.71	4	R. Mauritania, Mauritania
	49.71	50	Rangoon, Burma
	49.71	10/100	AIR Delhi, India
	49.71	1	R. Tic Tac, Honduras Rep.
	49.71	10	R. Globo, Brazil
	49.71	0.5	R. Cariamanca, Ecuador
	49.71	0.2	R. Landa, Peru
	49.71	1	R. Nacional, Uruguay
6037	49.69	2	Faro del Caribe, Costa Rica
6040	49.67	100	Munich (VOA), Germany
	49.67	4/30	R. Yaoundé, Cameroon
	49.67	7.5	Taipei (BBC), Taiwan
	49.67	0.5	R. Caribe, Honduras Rep.
	49.67	10	La Voz del Tolima, Colombia
6042	49.65	0.25	R. Arequipa, Peru

kHz	m	kw	Stations & Countries
6045	49.63	5	Athens (FBS), Greece
	49.63	50	Moscow, USSR
	49.63	100	Djakarta, Indonesia
	49.63	0.25	R. Universidad, Mexico
	49.63	1	La Voz del Baru, Panama
	49.63	25	R. Clube Paranaense, Brazil
6050	49.59	50/100	R. Berlin Int, Germany
	49.59	50/250	BBC London, Gt. Britain
	49.59	20	Irkutsk, USSR
	49.59	5/100	R. Clube de Moçambique
	49.59	10	Ibadan (WNRS), Nigeria
	49.59	10/100	AIR Delhi, India
	49.59	1	R. América, Honduras Rep.
	49.59	0.5	R. Libertad, Chile
	49.59		R. Tucapel, Chile
	49.59	30/50	La Voz de los Andes, Ecuad.
6055	49.55	100	Praha, Czechoslovakia
	49.55	50	Tallinn, USSR
	49.55	50	Kigali, Rwanda
	49.55	10/50	Tokyo, Japan
	49.55	0.25	Dumaguete City, Philippines
	49.55	250	Greenville, USA
	49.55	10	R. Panamericana, Brazil
	49.55	5	R. Pacifico, Colombia
	49.55	1	R. Continental, Peru
	49.55	5	La Voz de Melo, Uruguay
6060	49.50	250	Woofferton (VOA), Gt. Brit.
	49.50	5/25	Caltanisetta, Italy
	49.50	50	Chita, USSR
	49.50	20	Lusaka, Zambia
	49.50	120/240	R. Habana, Cuba
	49.50	1	R. Centro, Honduras Rep.
	49.50	50	Buenos Aires, Argentina
	49.50	0.75	La Voz Democracia, Ecuador
6062	49.48	2	Bangkok, Thailand
	49.48	0.25	R. Telesar, Peru
6065	49.46	100	Hörby, Sweden
	49.46	50	Kazan, USSR
	49.46	100	Addis Ababa, Ethiopia
	49.46	2	AIR Kohima, India
	49.46	50/500	Greenville, USA
	49.46	1	R. Dif. México, Mexico
	49.46	10	R. Nac. Brasilia, Brazil
6070	49.42	100	R. Sofia, Bulgaria
	49.42	100/250	Accra, Ghana
	49.42	4	R. Université, Malagasy Rep.
	49.42	4	Ziguinchor, Sénégal
	49.42	0.5	Sukarnopura, Indonesia
	49.42	10/50	Karachi, Pakistan
	49.42	1	R. Thailand, Thailand
	49.42	1	Toronto, Canada
	49.42	0.5	R. El Mercurio, Ecuador
	49.42	1	R. Onda Popular, Peru
6075	49.38	100	Deutsche Welle, Germany
	49.38	50/60/100	R. Roma, Italy
	49.38	50	Volgograd, USSR
	49.38	10	Colombo, Ceylon
	49.38	35/100	Okinawa (VOA). Ryukyu Isl.
	49.38	5	La Voz del Junco, Honduras
	49.38	1	R. Tissey, Nicaragua
	49.38	5	Soc. Nac. de Mineria, Chile
	49.38	10	Acción Cult. Popular, Col.
	49.38	2.5	R. Ariel, Uruguay
6080	49.34	50/100	R. Berlin Int, Germany
	49.34	15/100	BBC London, Gt. Britain
	49.34	10	R. Cl. Portuguese, Portugal
	49.34	20	Komsomolsk, USSR
	49.34	100	Alger, Algeria
	49.34	100	R. Japan, Japan
	49.34	7.5/100	BBC, Malaysia
	49.34	0.25	Voice of Manila, Philippines
	49.34	7.5	Wellington, New Zealand
	49.34	0.01	Vancouver, Canada
	49.34	0.5	R. Nac. San Marcos, Guat.
	49.34		R. Bolivar, Ecuador
6082	49.32	15	R. Nacional, Lima, Peru
6085	49.30	10	Munich (BR), Germany
	49.30	50/100	R. Nederland, Holland
	49.30	100	Tallinn, USSR
	49.30	10	R. Kisangeni, Congo Democratic Rep.
	49.30	10/100	AIR Delhi, India
	49.30	1	Ecos de Pasto, Colombia
6090	49.26	15/100	BBC London, Gt. Britain
	49.26	100	R. Luxembourg, Luxembourg
	49.26	15	Chita, USSR
	49.26	50	Simferopol, USSR
	49.26	10	Liberia Bc. Corp, Liberia
	49.26	10	R. TV Kaduna, Nigeria
	49.26	50	R. Cambodia, Cambodia
	49.26	3	Taipei, Taiwan
	49.26	2	Sydney, Australia
	49.26	7.5	R. TV Dominicana, Dominican Republic
	49.26	1	R. Morazán, Honduras Rep.
	49.26	1	R. Mante, Mexico
	49.26	100	R. Belgrano, Argentina
6095	49.22	20	Paradys, So. Africa
	49.22	100	Baghdad, Iraq
	49.22	25	R. Dif. de São Paulo, Brazil
	49.22	1	Voz del Centro, Colombia
	49.22	0.25	R. Oficial del Congreso, Peru
6100	49.18	100	Deutsche Welle, Germany
	49.18	100	R. Belgrade, Yugoslavia
	49.18	50	Vladivostok, USSR
	49.18	100	R. Malaysia, Malaysia
	49.18	0.25	R. Lumière, Haiti
	49.18	1	R. Calama, Chile
	49.18	1	La Voz del Volante, Ecuador
6105	49.14	10/100/250	R. Free Europe
	49.14	5	Ulan Bator, Mongolia
	49.14	7.5	Air Force St, Taiwan
	49.14	0.25	Mérida, Mexico
	49.14	5	Ceará R. Clube, Brazil
	49.14	5	R. Visión, Colombia
	49.14	1	E. Nacional Tacna, Peru
6107	49.12	20/240	R. Peking, China
6110	49.10	75	BBC London, Gt. Britain
	49.10	50	Baku, USSR
	49.10	7.5/100	BBC, Malaysia
	49.10	0.5	R. Nac. Quezaltenango, Guat.
	49.10	1	R. Comayagüela, Honduras
	49.10	1	R. Charitas, Paraguay
	49.10	1	R. Cabimas, Venezuela
6115	49.06	20	R. Berlin Int, Germany
	49.06	10/100/250	R. Free Europe
	49.06	50	Khabarovsk, USSR
	49.06	1	R. Douala, Cameroon
	49.06	50	R. TV Congolaise, Congo
	49.06	5/100	R. Clube de Moçambique
	49.06	1	R. Univ. de Sonora, Mexico
	49.06	100	R. Tamoio, Brazil
	49.06	5	Soc. Nac. de Agric, Chile
	49.06	1	La Voz del Llano, Colombia
	49.06	10	R. Union, Peru
	49.06	1	R. Clarin, Uruguay
6120	49.02	120	R. Tirana, Albania
	49.02	15	Pori, Finland
	49.02	100	Deutsche Welle, Germany
	49.02	15/100	BBC London, Gt. Britain
	49.02	100	Schwarzenburg, Switzerland
	49.02	10	AIR Hyderabad, India
	49.02	18	Rawalpindi, Pakistan
	49.02	50	Call of the Orient, Philipp.

kHz	m	kw	Stations & Countries
	49.02	2.5	R. St. 4VEH, Haiti
	49.02	0.5	R. XETS, Mexico
	49.02	1	R. Atlanta, Nicaragua
	49.02	10	R. El Mundo, Argentina
6123	49.01	1	R. La Cronica, Peru
6125	48.98	15/100	BBC London, Gt. Britain
	48.98	10	R. Kasai, Congo Dem. Rep.
	48.98	250	Greenville, USA
	48.98	1	La Boz de Suyapa, Honduras
	48.98	1	R. El Condor, Bolivia
	48.98	7.5	R. Nac. de São Paulo, Brazil
	48.98	1	R. Continental, Colombia
	48.98	10	S.O.D.R.E., Uruguay
6128	48.96	0.1	R. Cuzco, Peru
6130	48.94	100	R. Nacional, Spain
	48.94	50	Khabarovsk, USSR
	48.94	100/250	Accra, Ghana
	48.94	10	Colombo, Ceylon
	48.94	10	Vientiane, Laos
	48.94	0.5	Halifax, Canada
	48.94		R. Condor, Ecuador
	48.94	30/50	La Voz de los Andes, Ecuad.
6135	48.90	10/100/250	R. Free Europe
	48.90	5/100	Warsaw, Poland
	48.90	4	Papéete, Tahiti
	48.90	1	R. El Patio, Honduras Rep.
	48.90	1	R. Sta. Cruz, Bolivia
	48.90	7.5	R. TV Gaucha, Brazil
	48.90	10	Concepción, Chile
	48.90	0.5	R. Pasco, Peru
6140	48.86	100	R. Nacional, Spain
	48.86	10	R. Burundi, Burundi
	48.86	50/250	Monrovia, (VOA), Liberia
	48.86	10/100	AIR Delhi, India
	48.86	100	R. Japan, Japan
	48.86	10	Peshawar, Pakistan
	48.86	10	Perth, Australia
	48.90	0.5	R. Pasco, Peru
6140	48.86	100	R. Nacional, Spain
	48.86	10	R. Burundi, Burundi
	48.86	50/250	Monrovia (VOA), Liberia
	48.86	10/100	AIR Delhi, India
	48.86	100	R. Japan, Japan
	48.86	10	Peshawar, Pakistan
	48.86	10	Perth, Australia
	48.86	0.5	Luis de Fuentes, Bolivia
	48.86	1	R. El Sol, Colombia
	48.86	0.02	R. Amazonas, Peru
	48.86	0.2	R. Oelcar, Peru
6145	48.82	100	Deutsche Welle, Germany
	48.82	100	Moscow, USSR
	48.82	100	Addis Ababa, Ethiopia
	48.82	50/250	Monrovia (VOA), Liberia
	48.82	50/200	Dixon, USA
	48.82	1	R. Mil Treinta, Hon. Rep.
	48.82	50	R. Nacional Rio, Brazil
	48.82	1	La Vox del Cauca, Colombia
	48.82	0.5	R. Mineria, Peru
6150	48.78	15/100	BBC London, Gt. Britain
	48.78	120	R. Bucharest, Rumania
	48.78	10	R. Belgrade, Yugoslavia
	48.78	20	JABC, So. Africa
	48.78	10	Melbourne, Australia
	48.78	1	R. Guapiles, Costa Rica
	48.78	5	La Voz de Chile, Chile
	48.78	2	R. Excelsior, Peru
6155	48.74	100	Vienna, Austria
	48.74	3	R. Renascença, Portugal
	48.74	20/240	R. Peking, China
	48.74		Lanchow, China
	48.74	5	R. Tabriz, Iran
	48.74	50	Baghdad, Iraq
	48.74	10	Tokyo (FEN), Japan
	48.74	50	R. Singapura, Singapore
	48.84	0.25	R. Citadelle, Haiti
	48.74	1	R. Fides, Bolivia
	48.74	1	R. Pucallpa, Peru
6160	48.70	120	R. Tirana, Albania
	48.70	50	Sabaa-Aioun, Morocco
	48.70	1	Lahore, Pakistan
	48.70	1	R. Thailand, Thailand
	48.70	0.5	Vancouver, Canada
	48.70	0.3	St. John's, Canada
	48.70	10	Emis. Nueva Granada, Col.
	48.70	1	R. Mundo, Peru
6165	48.66	250	Schwarzenburg, Switzerland
	48.66	100	Kiev, USSR
	48.66	15	Vladivostok, USSR
	48.66	120	Lusaka, Zambia
	48.66	20/200	Saigon, Vietnam
	48.66	1	R. Televisión, Hon. Rep.
	48.66	10	Voz América Latina, Mexico
	48.66	7.5	R. Dif. São Paulo, Brazil
	48.66	0.4	R. Trujillo, Peru
6170	48.62	50	R. Liberty
	48.62	50/100	BBC London, Gt. Britain
	48.62	100	ETLF, Addis Ababa, Ethiopia
	48.62	5	Ulan Bator, Mongolia
	48.62	10	Padang, Indonesia
	48.62	50	Malolos (VOA), Philippines
	48.62	7.5/50	Philipp. Bc. Sce, Philippines
	48.62	1	R. Valledupár, Colombia
	48.62	0.25	R. Fluminense, Ecuador
	48.62	0.35	R. Corporación, Peru
	48.62	1	R. Fenix, Uruguay
	48.62	10	R. Nacional, Venezuela
6175	48.58	100	Allouis, France
	48.58	120	Kazan, USSR
	48.58	50	Alger, Algeria
	48.58	20	Kaduna (NBC), Nigeria
	48.58	100	R. Malaysia, Malaysia
	48.58	10	R. Guarani, Brazil
	48.58	0.3	R. Tahuantisuyo, Peru
6176	48.56		Sian, China
6180	48.54	15/100	BBC London, Gt. Britain
	48.54	100	Alma Ata, USSR
	48.54	40	Tashkent, USSR
	48.54	50/250	Monrovia (VOA), Liberia
	48.54	5/100	R. Clube de Moçambique
	48.54	20/240	R. Peking, China
	48.54	10	R. Nac. Mendoza, Argentina
	48.54	50	R. Nacional, Colombia
	48.54	0.5	R. Miraflores, Peru
6185	48.50	100	Deutsche Welle, Germany
	48.50	10	R. Norway, Norway
	48.50	10/100	R. Nacional Portugal
	48.50	50	Dushanbé, USSR
	48.50	100	Addis Ababa, Ethiopia
	48.50	10	Colombo, Ceylon
	48.50	20/200	Delano (VOA), USA
	48.50	1	R. Molina Rojo, Hon. Rep.
	48.50	1	La Voz del Maestro, Mexico
	48.50	1	R. Amauta, Bolivia
	48.50	10	R. Bandeirantes, Brazil
6190	48.47	10	R. Bremen, Germany
	48.47	120	R. Bucharest, Rumania
	48.47	50	Khabarovsk, USSR
	48.47	15	Petropavlovsk, USSR
	48.47	25/100	Vatican Radio
	48.47	10/100	AIR Delhi, India
	48.47	250	Greenville, USA
	48.47	10	R. Corporación, Chile
	48.47	0.4	R. Lima, Peru

kHz	m	kw	Stations & Countries
6195	48.43	50/100	BBC London, Gt. Britain
	48.43	50	Baku, USSR
	48.43	1	R. Haiti, Haiti
	48.43	10	Emiss. Continental, Brazil
	48.43	1	La Voz de Cali, Colombia
	48.43	1.5	R. Cosmopolita, Ecuador
6198	48.40	0.3	R. Sudamericana, Peru
6560	45.73	20/240	R. Peking China
7100	42.25	5/135	R. Budapest, Hungary
	42.25	0.25	Izmir, Turkey
7105	42.22	100	R. Nacional, Spain
	42.22	250	BBC, Ascencion Island
	42.22	4	R. Brazzaville, Congo
	42.22	4/30	R. Tananarive, Malagasy Rp.
	42.22	35	Colombo (VOA), Ceylon
	42.22	7.5	Djakarta, Indonesia
	42.22	5	R. Nepal, Nepal
	42.22	2.5	Bangkok, Thailand
	42.22	1	Thai TV Co, Thailand
7110	42.19	75	BBC London, Gt. Britain
	42.19	50	Omsk, USSR
	42.19	50	Tula, USSR
	42.19	3/8	Kampala, Uganda
	42.19	50	R. Malaysia, Malaysia
7115	42.16	10/100/250	R. Free Europe
	42.16	10	Kinshasa, Congo Dem. Rep.
	42.16	10	Sebaa Aioun, Morocco
7120	42.13	120	R. Tirana, Albania
	42.13	75	BBC London, Gt. Britain
	42.13	50	Tula, USSR
	42.13	10	R. Somali, Somalia
	42.13	20/240	R. Peking, China
	42.13	10/100	AIR Delhi, India
	42.13	10	Denpasar, Indonesia
	42.13	50	Rangoon, Burma
	42.13	7.5/100	BBC, Malaysia
7125	42.11	5/100	Warsaw, Poland
	42.11	18	Conakry, Guinea
	42.11	5	Nairobi, Kenya
7130	42.08	100	Deutsche Welle, Germany
	42.08	15/100	BBC London, Gt. Britain
	42.08	50	Krasnoyersk, USSR
	42.08	0.25/10	Nampula, Moçambique
7135	42.05	30	R. Monte Carlo, Monaco
	42.05	250	Monrovia (VOA), Liberia
7140	42.02	15/50/75	BBC London, Gt. Britain
	42.02	50	Riga, USSR
	42.02	0.5	R. Clube de Angola, Angola
	42.02	10	AIR Hyderabad, India
7143	42.01	1.6	Istanbul, Turkey
7145	41.99	10/100/250	R. Free Europe
	41.99	5/100	Warsaw, Poland
	41.99	20	Novosibirsk, USSR
	41.99	10/0.25	Quelimane, Moçambique
	41.99	20/7.5	R. Malaysia, Sarawak
7150	41.96	15/100	BBC London, Gt. Britain
	41.96	100	Lvov, USSR
	41.96	100	Serpukhov, USSR
	41.96	10/0.25	Porto Amélia, Moçambique
	41.96	20/240	R. Peking, China
	41.96	10	AIR Gauhati, India
	41.96	3	Taipei (BCC), Taiwan
7155	41.92	20%50	R. Liberty
	41.92	4/30	Tananarive, Malagasy Rep.
	41.92	4	R. Niger, Niger
	41.92	20/240	R. Peking, China
	41.92	100	Amman, Jordan
7160	41.90	100	Allouis, France
	41.90	50	Lvov, USSR
	41.90	10	AIR Madras, India
	41.90	1	R. University, Philippines
	41.90	20/10	R. Malaysia, Sarawak
7161	41.90	1	Serrae, Greece
7165	41.87	10/100/250	R. Free Europe
	41.87	100	Tripoli, Libya
	41.87	20	R. Tanzania, Tanzania
	41.87		Foochow, China
	41.87	35	Okinawa (VOA), Ryukyu Isl.
7170	41.84	250	Woofferton (VOA), Gt. Brit.
	41.84	50	Novosibirsk, USSR
	41.84	50	Alger, Algeria
	41.84	2	AIR Kohima, India
	41.84	10	R. Singapura, Singapore
	41.84	4	R. Nouméa, New Caledonia
7175	41.81	5/25	Caltanisetta, Italy
	41.81	120	Starobelsk, USSR
	41.81	25	R. TV Congolaise, Congo
	41.81	50/250	Monrovia (VOA), Liberia
	41.81	10	Saigon, Vietnam
7180	41.78	250	R. Liberty
	41.78	250	R. Australia
	41.78	10	AIR Bhopal, India
	41.78	0.5	Taipei, Taiwan
7185	41.75	5/100	R. Berlin Int, Germany
	41.75	75	BBC London, Gt. Britain
	41.75	50	Sverdlovsk, USSR
	41.75	20	JABC, So. Africa
	41.75	35	Taipei (BCC), Taiwan
7189	41.73	20	Tel Aviv, Israel
7190	41.72	10/100/250	R. Free Europe
	41.72	20/240	R. Peking, China
	41.72	10	Sukarnopura, Indonesia
7195	41.70	120	R. Bucharest, Rumania
	41.70	50	Tula, USSR
	41.70	250	Monrovia (VOA), Liberia
	41.70	3/8	Kampala, Uganda
	4.170	10/100	AIR Delhi, India
	41.70	100	R. Japan, Japan
7200	41.67	120	R. Tirana, Albania
	41.67	250	Woofferton (VOA), Gt. Brit.
	41.67	10	R. Belgrade, Yugoslavia
	41.67	50/100	Kabul, Afghanistan
	41.67	10	R. Malaysia, Malaysia
	41.67	10	Taipei, Taiwan
7203	41.65	1	R. Clube do Bie, Angola
	41.64	35	Thessaloniki (VOA), Greece
	41.64	100	Moscow, USSR
	41.64	7.5	Lubumbashi, Congo O.R.
	41.64	10	R. Pax, Moçambique
7210	41.61	50/100	BBC London, Gt. Britain
	41.61	50/100	R. Nederland, Norway
	41.61	0.4	Ukesenderen, Norway
	41.61	25/100	Schwarzenburg, Switzerland
	41.61	100	Moscow, USSR
	41.61	50	Vladivostok, USSR
	41.61	10	Nairobi, Kenya
	41.61	4/100	Dakar, Sénégal
	41.61	0.25/10	AIR Calcutta, India
7215	41.58	1	R. Abidjan, Ivory Coast
	41.58	10/100	AIR Delhi, India
	41.58	1	AFNT, Taiwan
7220	41.55	50	R. Liberty
	41.55	5/135	R. Budapest, Hungary
	41.55	50	Riyadh, Saudi Arabia
	41.55	100	R. Australia, Australia
7225	41.52	100	Deutsche Welle, Germany
	41.52	10	Sebaa-Aioun, Morocco
	41.52	10/100	AIR Delhi, India
	41.52	3	Call of the Orient, Phillipines
7230	41.49	75	BBC London, Gt. Britain
	41.49	100	Kiev, USSR
	41.49	4	Ouagadougou, Upper Volta

kHz	m	kw	Stations & Countries
	41.49	20/240	R. Peking, China
	41.49	7.5	AIR Kurseong, India
	41.49	1	Biak, Indonesia
	41.49	5	Tokyo (NHK), Japan
	41.49	10	Tokyo, Japan
7235	41.47	50/60/100	R. Roma, Italy
	41.47	10/100	AIR Delhi, India
	41.47	7.5/100	BBC, Malaysia
	41.47	10/50	Karachi, Pakistan
	41.47	35/100	Okinawa (VOA), Ryukyu Isl.
	41.47	50/20	Damascus, Syria
7240	41.44	50	Tula, USSR
	41.44	4/30	R. Garoua, Cameroon
	41.44	10	Nairobi, Kenya
	41.44	0.3	Beira, Moçambique
	41.44	10	AIR Bombay, India
	41.44	7.5	Medan, Indonesia
	41.44	10/50	Karachi, Pakistan
	41.44	1.5	Taipei, Taiwan
7245	41.41	100	Vienna, Austria
	41.41	10/100/250	R. Free Europe
	41.41	4	R. Mauritania, Mauritenia
	41.41	4	St. Denis, Réunion
	41.41	20	Saigon, Vietnam
7250	41.38	50	Krasnoyarsk, USSR
	41.38	25/100	Vatican Radio
	41.38	10	AIR Lucknow, India
	41.38	7.5	R. Singapura, Singapore
	41.38	10	Taipei (BCC), Taiwan
7255	42.35	50	R. Sofia, Bulgaria
	41.35	10	Lagos, Nigeria
	41.35	10/0.25	Nampula, Mocambique
	41.35	35/100	Okinawa (VOA), Ryukyu Isl.
7260	41.32	75	BBC London, Gt. Britain
	41.37	100	Trans World Radio, Monaco
	41.32	50	Minsk, USSR
	41.32	4	Dzaoudzi, Comores Isl.
	41.32	10/100	AIR Delhi, India
	41.32	3.5	Air Force St, Taiwan
	41.32	50	Ulan Bator, Mongolia
	41.32	0.5	R. Port Vila, New Hebrides
7265	41.29	120	R. Tirana, Albania
	41.29	1.5	Rohrdorf (SWF), Germany
	41.29	50	Riazan, USSR
	41.29	4/100	Lomé, Togo
7270	41.27	250	Woofferton (VOA), Gt. Brit.
	41.27	50	Erevan, USSR
	41.27	35/100	Tanger (VOA), Morocco
	41.27	20/240	R. Peking, China
	41.27	1	Djakarta, Indonesia
	41.27	20/10	R. Malaysia, Serawak
	41.27	1.5	Taipei, Taiwan
7275	41.24	100	Deutsche Welle, Germany
	41.24	10	Lagos (NBC), Nigeria
	41.24	10/35	Colombo (VOA), Ceylon
	41.24	10/50	Karachi, Pakistan
	41.24	100	Poro (VOA), Philippines
7280	41.21	100	Allouis, France
	41.21	100	Komsomolsk, USSR
	41.21	250	Monrovia (VOA), Liberia
	41.21	10	R. Tanzania, Tanzania
	41.21	10	AIR Gauhati, India
	41.21	0.5	Mindanao Bc, Philippines
	41.21	1.5	Taipei, Taiwan
7285	41.18	5/100	Warsaw, Poland
	41.18	18	R. Mali, Mali
	41.18	10	Ibadan (NBC), Nigeria
	41.18	5	Tokyo (NHK), Japan
7290	41.15	35	Thessaloniki, Greece
	41.15	50/60/100	R. Roma, Italy
	41.15	10	Addis Ababa, Ethiopia
	41.15	10/100	AIR Delhi, India
7295	41.12	250	R. Liberty
	41.12	7.5/5	Athens, Greece
	41.12	50	Rhodes (VOA), Greece
	41.12	50	Moscow, USSR
	41.12	1	Menado, Indonesia
7300	41.09	5	R. Berlin Int, Germany
7305	41.07	20/240	R. Peking, China
	41.07	2.5	Bangkok, Thailand
7306	41.06	0.35	Pathfinders St, Poland
9495	31.60	50/100	Cairo, Un. Arab Rep.
9498	31.59		Sining, China
9500	31.58	50/100	R. Berlin Int, Germany
	31.58	100	Magadan, USSR
	31.58	20/240	R. Peking, China
9504	31.56	1	R. Loreto, Peru
9505	31.56	100	Praha, Czechoslovakia
	31.56	10/100/250	R. Free Europe
	31.56	50	R. Belgrade, Yugoslavia
	31.56	100	R. Japan, Japan
	31.56	50	Call of the Orient, Philippines
	31.56	50	R. TV Dominica, Dom. Rep.
	31.56	1	R. Universo, Bolivia
	31.56	7.5/50	R. Record, Brazil
9508	31.55	20	Omdurman, Sudan
9510	31.55	120	R. Tirana, Albania
	31.55	75	BBC London, Gt. Britain
	31.55	120	R. Bucharest, Rumania
	31.55	50	Alger, Algeria
	31.55	5	R. América, Peru
	31.55	10	R. Barquisimeto, Venezuela
9515	31.53	100	Leningrad, USSR
	31.53	1	Moçamedes, Angola
	31.53	30	Tananarive, Malagasy Rep.
	31.53	10	R. Malaysia, Malaysia
	31.53	10	Voz de la Am. Lat, Mexico
	31.53	10	R. Sarandi, Uruguay
	31.51	250	R. Liberty
	31.51	100	Leningrad, USSR
9520	31.51	1/10/50	R. Kuwait, Kuwait
	31.51	10	Port Moresby, N. Guinea
	31.51	7.5	Wellington, New Zealand
	31.51	5	R. La Crónica, Peru
9525	31.50	20/100	Vienna, Austria
	31.50	100	Allouis, France
	31.50	15/100	BBC London, Gt. Britain
	31.50	15/100	ETLF, Addis Ababa, Ethiopia
	31.50	5/100	Warsaw, Poland
	31.50	250	R. South Africa, So. Africa
	31.50	100	R. Japan, Japan
	31.50	50/500	Greenville, USA
	31.50	120/240	R. Habana, Cuba
9530	31.48	50/100	R. Berlin Int, Germany
	31.48	120	Moscow, USSR
	31.48	35/100	Tanger (VOA), Morocco
	31.48	20	R. Tanzania, Tanzania
	31.48	10/100	AIR Delhi, India
	31.48	100	R. Japan, Japan
	31.48	100	Amman, Jordan
	31.48	35	Poro (VOA), Philippines
	31.48	50/500	Greenville, USA
	31.48	0.3	R. Nacional Tacna, Peru
	31.48	1	Maracaibo, Venezuela
9535	31.46	250	Schwarzenburg, Switzerland
9540	31.45	35	Thessaloniki (VOA), Greece
	31.45	5/100	Warsaw, Poland
	31.45	20	Lubumbashi, Congo Democratic Republic
	31.45	100	R. Australia, Australia
	31.45	7.5	Wellington, New Zealand

kHz	m	kw	Stations & Countries
9545	31.43	100	Deutsche Welle, Germany
	31.43	100/250	Accra, Ghana
	31.43	100	Beyrouth, Lebanon
	31.43	0.25	La Voz de V. Cruz, Mexico
	31.43	200	Delano, USA
	31.43	7.5	R. Emis. Paranaense, Brazil
	31.43	0.5	R. Central, Peru
9550	31.41	100/120	R. Norway, Norway
	31.41	100	R. Tanzania, Tanzania
	31.41	20/240	R. Peking, China
	31.41	7.5	Makasser, Indonesia
	31.41	120/240	R. Havana, Cuba
	31.41	5	Grenada, Windward Isl.
	31.41	1	R. Valentin Letelier, Chile
	31.41	1	R. Nacional Tumbes, Peru
9555	31.40	100	R. Liberty
	31.40	50/75	BBC London, Gt. Britain
	31.40	5	R. Nacional, El Salvador
	31.40	1	La Hora Exacta, Mexico
	31.40	10	R. Emis. del Estado, Bolivia
9560	31.38	50	R. Sofia, Bulgaria
	31.38	100	Praha, Czechoslovakia
	31.38	100	Allouis, France
	31.38	50/100	R. Berlin Int, Germany
	31.38	100	ETLF, Addis Ababa, Ethiopia
	31.38	100	Amman, Jordan
	31.38	100	R. Japan, Japan
	31.38	35/100	Poro (VOA), Philippines
	31.38	50	R. Australia, Australia
	31.38	500	Greenville, USA
	31.38	10	R. Portales, Chile
9562	31.37	50	R. Nacional Lima, Peru
9565	31.36	10/100/250	R. Free Europe
	31.36	100	Deutsche Welle, Germany
	31.36	250	Kigali (DW), Rwanda
	31.36	20/10	R. Malaysia, Sarawak
	31.36	200	Delano, USA
	31.36	110	Bethany, USA
	31.36	15	R. Jornal do Comercio, Br.
9570	31.35	15/100	BBC London, Gt. Britain
	31.35	120	R. Bucharest, Rumania
	31.35	100	R. Nacional, Spain
	31.35	100	Riazan, USSR
	31.35	100	ETLF, Addis Ababa, Ethiopia
	31.35	100	R. RSA, So. Af.
	31.35	20	Lusaka, Zambia
	31.35	20/240	R. Peking, China
	31.35	7.5/100	BBC, Malaysia
	31.35	50	R. Australia, Australia
	31.35	1	R. San Cristóbal, Venezuela
9575	31.33	100	Praha, Czechoslovakia
	31.33	50/60/100	R. Roma, Italy
	31.33	100	Trans World Radio, Monaco
	31.33	10/100	AIR Delhi, India
	31.33	50	Ulan Bator, Mongolia
9580	31.32	75	BBC London, Gt. Britain
	31.32	50	Kazan, USSR
	31.32	250	BBC, Ascencion Isl.
	31.32	7.5/100	BBC, Malaysia
	31.32	100	R. Australia, Australia
	31.32	0.5	R. Mar, Nicaragua
9585	31.30	50/100	R. Nacional, Portugal
	31.30	50/200	Dixon, USA
	31.30	50	R. Exelsior, Brazil
	31.30	0.5	R. Selecta, Peru
9590	31.28	50/100	R. Naderland, Holland
	31.28	120	R. Bucharest, Rumania
	31.28	100	Schwarzenburg, Switzerland
	31.28	50	Starobelsk, USSR
	31.28	50	Omsk, USSR
	31.28	0.4	R. Botswana, Botswana
	31.28	500	Greenville, USA
	31.28	0.2	R. Ica, Peru
9595	31.27	10/100/250	R. Free Europe
	31.27	100	Schwarzenburg, Switzerland
	31.27	50	Tokyo, Japan
	31.27	20	R. Cult. da Bahia, Brazil
9600	31.25	50/100	R. Berlin Int, Germany
	31.25	75	BBC London, Gt. Britain
	31.25	50	Tashkent, USSR
	31.25	100	Moscow, USSR
	31.25	250	BBC, Ascencion Isl.
	31.25	10/100	AIR Delhi, India
	31.25	100	R. Australia, Australia
	31.25	1	Universidad Nac, Mexico
	31.25	0.5	R. Huaráz, Peru
	31.25	0.45	R. Talara, Peru
9605	31.23	100	Deutsche Welle, Germany
	31.23	100	R. Prague
	31.23	50	Serpukhov, USSR
	31.23	25/100	Vatican Radio
	31.23	20	Damascus, Syria
	31.23	200	R. Japan, Japan
	31.23	50	TWR Bonaire, N. Antilles
9610	31.22	100	Vienna, Austria
	31.22	100	Deutsche Welle, Germany
	31.22	120	R. Norway, Norway
	31.22	50	Khabarovsk, USSR
	31.22	50	R. TV Congolaise, Congo
	31.22	10	Addis Ababa, Ethiopia
	31.22	30	R. Mauritania, Mauritanie
	31.22	10/50	Perth, Australia
	31.22	10	R. Tamoio, Brazil
	31.22	1	R. Nacional Iquitos, Peru
9615	31.20	1	R. Diamang, Angola
	31.20	30	Fort Lamy, Chad
	31.20	100	Sebaa-Aioun, Morocco
	31.20	100	Tanger (VOA), Morocco
	31.20	10/100	AIR Delhi, India
	31.20	50	Malolos (VOA), Philippines
	31.20	10/100	AIR Delhi, India
	31.20	50	Malolos (VOA), Philippines
	31.20	50/100	R. New York, USA
	31.20	3	Voz de la Victor, Costa Rica
9618	31.19	0.4	R. El Sol, Peru
9620	31.19	100	R. Tirana, Alb.
	31.19	50	Moscow, USSR
	31.19	50	R. Belgrade, Yugoslavia
	31.19	100	ETLF, Addis Ababa, Ethiopia
	31.19	200/50	Saigon, Vietnam
	31.19	10	R. 9 de Julho, Brazil
	31.19	20	S.O.D.R.E., Uruguay
9625	31.17	75	BBC London, Gt. Britain
	31.17	100	Horby, Sweden
	31.17	120	Moscow, USSR
	31.17	100	Tel Aviv, Israel
	31.17	50	R. Canada, Canada
	31.17	1	R. Atlántida, Peru
9630	31.15	100	Praha, Czechoslovakia
	31.15	50/100	R. Nacional, Portugal
	31.15	50	Serpukhov, USSR
	31.15	25/100	Vatican Radio
	31.15	1	R. Cl. de Angola, Angola
	31.15	10/100	AIR Delhi, India
	31.15	50	Damaguete City, Philippines
9635	31.14	75	BBC London, Gt. Britain
	31.14	50	Vladivostok, USSR
	31.14	50	R. Singapura, Singapore
	31.14	50/500	Greenville (VOA), USA
	31.14	0.25	R. Lumière, Haiti
	31.14	7.5	R. Aparecida, Brazil
	31.14	25	R. Nacional, Colombia

kHz	m	kw	Stations & Countries
	31.14	1	R. Expreso, Peru
9640	31.12	100	Deutsche Welle, Germany
	31.12	75	BBC London, Gt. Britain
	31.12	20/120	Moscow, USSR
	31.12	50	Seoul, Korea
	31.12	250	Greenville, USA
	31.12	10	R. Nacional, Venezuela
9645	31.10	10	R. Norway, Norway
	31.10	50	Khabarovsk, USSR
	31.10	25/100	Vatican Radio
	31.10	10/50	Karachi, Pakistan
	31.10	2	Faro del Caribe, C. Rica
	31.10	7.5	R. Cultura de Pocos, Brazil
	31.10	30	HCJB, La Voz de los Andes, Ecuador
	31.10	0.5	R. Grau, Peru
9650	31.09	15/100	BBC London, Gt. Britain
	31.09	100	Moscow, USSR
	31.09	50	Conakry, Guinea Rep.
	31.09	20/250	R. South Africa, So. Africa
	31.09	50/500	Greenville, USA
	31.09	1	R. Yungay, Chile
9655	31.07	100	Deutsche Welle, Germany
	31.07	100	Minsk, USSR
	31.07	10	Kaduna (NBC), Nigeria
	31.07	5	Tokyo, Japan
	31.07	10	Taipei (BCC), Taiwan
	31.07	120/240	R. Habana, Cuba
	31.07	1	R. Nor Peruana, Peru
9660	31.06	50	R. Sofia, Bulgaria
	31.06	500	R. Liberty
	31.06	15/100	BBC London, Gt. Britain
	31.06	35	Thessaloniki (VOA), Greece
	31.06		Petropavlovsk, USSR
	31.06	1	Nova Lisboa, Angola
	31.06	100	ETLF, Addis Ababa, Ethiopia
	31.06	35	Taipei (BCC), Taiwan
	31.06	10	Brisbane, Australia
9665	31.04	100	Radio Switzerland
	31.04	50	Omsk, USSR
	31.04	20/240	R. Peking, China
	31.04	10	R. Nac. Brasilia, Brazil
	31.04	1	R. Eco. Peru
9670	31.02	15/100	BBC London, Gt. Britain
	31.02	20	Irkutsk, USSR
	31.02	100	R. Japan, Japan
	31.02	50	Jeddah, Saudi Arabia
	31.02	5	Hue, Vietnam
	31.02	500	Greenville, USA
9675	31.09	5/100	Warsaw, Poland
	31.01	120	Voronej, USSR
	31.01	100	R. Japan, Japan
	31.01	10	R. Diário da Manha, Brazil
	31.01	7.5	R. del Pacifico, Peru
9680	30.99	50	R. Liberty
	30.99	50/100	R. Nacional, Portugal
	30.99	20	Paradys, So. Africa
	30.99	10/100	AIR Delhi, India
	30.99	10	Melbourne, Australia
9685	30.98	120	Moscow, USSR
	30.98	50	Alger, Algeria
	30.98	25	Taipei (BCC), Taiwan
	30.98	1	Onda Popular, Panama
	30.98	7.5	R. Gazata, Brazil
9690	30.96	75	BBC London, Gt. Britain
	30.96	25/100	Vatican Radio
	30.96	30	Tananarive, Malagasy Rep.
	30.96	10	Lagos (NBC), Nigeria
	30.96	10/100	AIR Delhi, India
	30.96	0.25	R. Veritas, Philippines
	30.96	50/260	TWR Bonaire, Neth. Antilles
	30.96	100	R. Nacional, Argentina
9695	30.94	10/100/250	R. Free Europe
	30.94	50	R. Cambodge, Cambodia
	30.94	0.25	Rarotonga, Cook Islands
	30.94	50/500	Greenville, USA
	30.94	7.5	R. Rio Mar, Brazil
	30.94	1	R. Continente, Peru
9700	30.93	120	R. Sofia, Bulgaria
	30.93	100	Delano, USA
9705	30.91	10/100	R. Free Europe
	30.91	100	ETLF, Addis Ababa, Ethiopia
	30.91	30	R. Niger, Niger
	30.91	250	R. South Africa, So. Africa
	30.91	10/100	AIR Delhi, India
	30.91	100	R. Japan, Japan
	30.91	10	R. Maua, Brazil
9710	30.90	35	Thessaloniki, Greece
	30.90	50/60/100	R. Roma, Italy
	30.90	50	Kiev, USSR
	30.90	10	Forest Side, Mauritius
	30.90	50	R. Malaysia, Malaysia
	30.90	50	TWR Bonaire, N. Antilles
	30.90	6	R. El Mundo, Argentina
	30.90	1	R. Tropical, Peru
9715	30.88	50/100	R. Nederland, Holland
	30.88	50	R. TV Congolaise, Congo
	30.88	10/2	Call of the Orient, Philippines
	30.88	1	R. La Plata, Bolivia
9720	30.86	120	Riazan, USSR
	30.86	20/250	R. South Africa, So. Africa
	30.86	10	Colombo, Ceylon
	30.86	50	Riyadh, Saudi Arabia
	30.86	50	R. Nacional, Brazil
	30.86	1	R. Victoria, Peru
9725	30.85	10/100/250	R. Free Europe
	30.85	15/100	BBC London, Gt. Britain
	30.85	100	ETLF, Addis Ababa, Ethiopia
	30.85	100	Tel Aviv, Israel
	30.85	7.5/100	BBC, Malaysia
	30.85	50	Greenville, USA
9730	30.83	50	R. Berlin Int., Germany
	30.83	50	Tula, USSR
	30.83	15	R. Brazzaville, Congo
	30.83	7.5	R. Farroupilha, Brazil
9735	30.82	100	Deutsche Welle, Germany
	30.82	75	BBC London, Gt. Britain
	30.82	50	Nikolaievsk, USSR
	30.82	250	Kigali (DW), Rwanda
9740	30.80	20/100	Wavre, Belgium
	30.80	250	Woofferton (VOA), Gt. Brit.
	30.80	10/100	AIR Delhi, India
	30.80	100	Amman, Jordan
	30.80	50/200	Dixon, USA
	30.80	10	R. Splendid, Argentina
	30.80	10	R. Los Andes, Peru
9745	30.78	100	Moscow, USSR
	30.78	50	R. Mali, Mali
	30.78	10	Sukarnopura, Indonesia
	30.78	3.5	Air Force St, Taiwan
	30.78	20	R. Ankara, Turkey
	30.70	7.5	R. Cultura, Brazil
	30.78	1/30	La Voz de los Andes, Ecuad.
9750	30.77	50	R. Liberty
	30.77	50/250	Monrovia (VOA), Liberia
	30.77	10/50	Karachi, Pakistan
	30.77	5	Soc. Nac. Mineria, Chile
	30.77	1	R. Tovar, Venezuela
9755	30.75	100	Allouis, France
	30.75	50/100	R. Nederland, Holland
	30.75	5/135	R. Budapest, Hungary

kHz	m	kw	Stations & Countries
	30.75	10/50	Karachi, Pakistan
	30.75	10	Saigon, Vietnam
	30.75	1	R. Anhanguera, Brazil
	30.75	7.5	R. Brasil, Central Brazil
	30.75	2.1	R. Sideral, Peru
9760	30.74	100	Munich (VOA), Germany
	30.74	15/100	BBC London, Gt. Britain
	30.74	20	R. Nacional, Spain
	30.74	100	Ivanofrankovsk, USSR
	30.74	100/250	Accra, Ghana
	30.74		Hanoi, Vietnam
	30.74	10	La Voz de Guatemala
	30.74	1	R. Continental, Peru
9765	30.72	100	Deutsche Welle, Germany
	30.72	75	BBC London, Gt. Britain
	30.72	100	Leningrad, USSR
	30.72	20/240	R. Peking, China
	30.72	10/100	AIR Delhi, India
	30.72	100	R. Japan, Japan
	30.72	50	Taipei (BCC), Taiwan
9770	30.71	100	Vienna, Austria
	30.71	75	BBC London, Gt. Britain
	30.71	100	Vladivostok USSR
	30.71	20	Djakarta, Indonesia
	30.71	50	Greenville (VOA), USA
	30.71	0.35	R. St. 4VEH, Haiti
	30.71	7.5	R. Min. Educação, Brazil
	30.71	1	R. Amazonas, Peru
11700	25.64	50/100	Leningrad, USSR
	25.64	120	Serpukhov, USSR
	25.64	0.5	R. Nac de Quezaltenango, Guatemala
11705	25.63	10/100/250	R. Free Europe
	25.63	250	Woofferton (VOA), Gt. Brit.
	25.63	100	Radio Sweden
	25.63	120	Serpukhov, USSR
	25.63	25/100	Vatican Radio
	25.63	100	R. Iran, Iran
	25.63	100	R. Japan, Japan
11710	25.62	250	Woofferton (VOA), Gt. Brit.
	25.62	100	R. Nacional, Spain
	25.62	100	Moscow, USSR
	25.62	50	R. Brazzaville, Congo
	25.62	100	ETLF, Addis Ababa, Ethiopia
	25.62	35/100	Tanger (VOA), Morocco
	25.62	10/100	AIR Delhi, India
	25.62	100/10	R. Australia, Australia
11715	25.61	20/100	Wavre, Belgium
	25.61	100	Schwarzenburg, Switzerland
	25.61	50	Dushanbé, USSR
	25.61	20/240	R. Tirana, Albania
	25.61	10/100	AIR Delhi, India
	25.61	50	Malolos (VOA), Philippines
	25.61	50	R. Canada, Canada
11720	25.60	15/100	BBC London, Gt. Britain
	25.60	7.5/5	Athens, Greece
	25.60	100	Trans World Radio, Monaco
	25.60	20/240	R. Peking, China
	25.60	50	R. Canada, Canada
	25.60	10	R. Nacional Brasilia, Brazil
11725	25.59	10/100/250	R. Free Europe
	25.59	20/50	R. Liberty
	25.59	5/100	Warsaw, Poland
	25.59	50	R. Brazzaville, Congo
	25.59	100	ETLF, Addis Ababa, Ethiopia
	25.59	20/240	R. Peking, China
	25.59	7.5/100	BBC, Malaysia
11730	25.58	50/100	R. Nederland, Holland
	25.58	50	Vinnitsa, USSR
	25.58	100	ETLF, Addis Ababa, Ethiopia
	25.58	35	Poro (VOA), Philippines
	25.58	50/100	WNYW, R. New York, USA

kHz	m	kw	Stations & Countries
11735	25.56	100/120	R. Norway, Norway
	25.56	100	R. Belgrade, Yugoslavia
	25.56	50	Tanger, Morocco
	25.56	100	R.RSA, So. Africa
	25.56	120/240	R. Habana, Cuba
	25.56	7.5	R. Clube de Goiania, Brazil
	25.56	5	R. Oriental, Uruguay
11740	25.55	15	Novosibirsk, USSR
	25.55	25/100	Vatican Radio
	25.55	50/250	Monrovia (VOA), Liberia
	25.55	100	R. Australia, Australia
	25.55	1	R. Dif. XEMP, Mexico
	25.55	5	R. Nuevo Mundo, Chile
11745	25.54	50	Minsk, USSR
	25.54	10	R. Piratininga, Brazil
11750	25.53	75	BBC London, Gt. Britain
	25.53	50	R. Mali, Mali
	25.53	10/1	Tokyo (FEN), Japan
	25.53	7.5/100	BBC, Malaysia
11755	25.52	100	Leningrad, USSR
	25.52	50	Vladivostok, USSR
11760	25.51	100	Kharkov, USSR
	25.51		Radio Switzerland
	25.51	25/100	Vatican Radio
	25.51	0.25	R. Rarotonga, Cook Islands
	25.51	120/240	R. Habana, Cuba
11765	25.50	50	R. Sofia, Bulgaria
	25.50	50/100	R. Berlin Int., Germany
	25.50	120/240	Pyongyang, Korea (PDR)
	25.50	25	R. Dif. São Paulo, Brazil
11770	25.49	20/250	R. Liberty
	25.49	100	ETLF, Addis Ababa, Ethiopia
	25.49	20	Djakarta, Indonesia
	25.49	50/200	Delano, USA
	25.49	30	HCJB, La Voz de los Andes, Ecuador
11775	25.48	100	Schwarzenburg, Switzerland
	25.48	50	Kursk, USSR
	25.48	100	ETLF, Addis Ababa, Ethiopia
	25.48	100	R. Afghanistan, Afghanistan
	25.48	50	Poro (VOA), Philippines
11780	25.47	75	BBC London, Gt. Britain
	25.47	50/100	R. Nederland, Holland
	25.47	5/100	R. Clube de Moçambique
	25.47	100	R. Japan, Japan
	25.47	7.5	Wellington, New Zealand
	25.47	8/10	R. Belgrano, Argentina
11785	25.46	100	Vienna, Austria
	25.46	100	Deutsche Welle, Germany
	25.46	50	Vinnitsa, USSR
	25.46	250	R. South Africa, So. Africa
	25.46	1.5	Makassar, Indonesia
	25.46	100	Beirut, Lebanon
	25.46	7.5	R. Guaiba, Brazil
11790	25.45	35/100	Tanger (VOA), Morocco
	25.45	10/100	AIR Delhi, India
	25.45	100	R. Australia, Australia
11795	25.43	100	Deutsche Welle, Germany
	25.43	50	Kinshasa, Congo (Dem. Rep)
	25.43	50	Red Lion, USA
	25.43	10	R. Nacional Rio, Brazil
11800	25.42	100	Praha, Czechoslovakia
	25.42	50/60/100	R. Roma, Italy
	25.42	50	R. Nac. España, Canary Isl.
	25.42	4	Fort Lamy, Chad
	25.42	100/250	Accra, Ghana
	25.42	35	Colombo, Ceylon
11805	25.41	50	Kazan, USSR
	25.41	50	Delano, USA
	25.41	50/100	WNYW, R. New York, USA
	25.41	10	R. Globo, Brazil
11810	25.40	50/60/100	R. Roma, Italy

kHz	m	kw	Stations & Countries
	25.40	120	Bucharest, Rumania
	25.40	100	Simferopol, USSR
	25.40	50	Alger, Algeria
	25.40	10/100	AIR Delhi, India
	25.40	5	Amman, Jordan
	25.40	100	R. Australia, Australia
11815	25.39	5/100	Warsaw, Poland
	25.39	100	R. Japan, Japan
	25.39	50/260	TWR Bonaire, N. Antilles
	25.39	7.5	R. Brazil Central, Brazil
11820	25.38	75	BBC London, Gt. Britain
	25.38	50	Murmansk, USSR
	25.38	250	BBC, Ascencion Isl.
	25.38	5/100	R. Clube de Moçambique
	25.38	50/260	TWR Bonaire, N. Antilles
11825	25.37	10/100/250	R. Free Europe
	25.37	100	ETLF, Addis Ababa, Ethiopia
	25.37	25	Taipei (BCC), Taiwan
	25.37	4	Papéete, Tahiti
	25.37	15	R. Jornal do Comercio, Br.
11830	25.36	100	Moscow, USSR
	25.36	250	Greenville, USA
11835	25.35	50	Alger, Algeria
	25.35	35	Colombo (VOA), Ceylon
	25.35	50/500	Greenville, USA
	25.35	1/2.5	R. St. 4VEH, Haiti
	25.35	5	El Espectador, Uruguay
11840	25.34	5/100	Warsaw, Poland
	25.34	50/100	R. Nacional, Portugal
	25.34	20	R. RSA, So. Africa
	25.34		Hanoi, Vietnam (Dem. Rep.)
11845	25.33	100	Allouis, France
	25.33	50	Kazan, USSR
	25.33	500	Greenville, USA
11850	25.32	100/120	R. Norway, Norway
	25.32	50	Kazan, USSR
	25.32	100/250	Accra, Ghana
	25.32	50	Ulan Bator, Mongolia
	25.32	1	R. Cruz del Sur, Chile
	25.32	3	R. Teleco, Paraguay
11855	25.31	50	Call of the Orient, Philippines
	25.31	50	Jeddah, Saudi Arabia
	25.31	50/100	WNYW, R. New York, USA
11860	25.30	100	Gorki, USSR
	25.30	250	BBC, Ascencion Isl.
	25.30	20/240	R. Peking, China
	25.30	50	Taipei (BCC), Taiwan
11865	25.28	100	Schwarzenburg, Switzerland
	25.28	100	Lubumbashi, Congo D.R.
	25.28	120/240	R. Habana, Cuba
	25.28	1	R. Cl. Pernambuco, Brazil
11870	25.27	100/240	R. Liberty
	25.27	50	Kaunas, USSR
	25.27	100	Amman, Jordan
	25.27	50	Jeddah, Saudi Arabia
11875	25.26	250	R. South Africa, So. Africa
	25.26	10/100	AIR Delhi, India
	25.26	20/200	R. Japan, Japan
	25.26	50	Dumaguete City, Philippines
	25.26	100	Poro (VOA), Philippines
	25.26	10	R. Soc. Bahia, Brazil
11880	25.25	50	R. Australia, Australia
	25.25.	10	Melbourne, Australia
	25.25	5	R. Dif. Comerciales, Mexico
	25.25	20	R. Splendid, Argentina
11885	25.24	10/100/250	R. Free Europe
	25.24	10/100	AIR Delhi, India
	25.24	10/50	Karachi, Pakistan
	25.24	10	R. Moud, Brazil
	25.24	10	R. Sarandi, Uruguay
11890	25.23	15/100	BBC London, Gt. Britain
	25.23	50	Erevan, USSR
	25.23	100	ETLF, Addis Ababa, Ethiopia
	25.23	2/50	Call of the Orient, Philippines
	25.23	110	Bethany, USA
	25.23	50/500	Greenville, USA
11895	25.22	10/100	AIR Delhi, India
11900	25.21	50	Sverdlovsk, USSR
	25.21	100	Lagos (NBC), Nigeria
	25.21	250	R. South Africa, So. Africa
	25.21	100	R. Malaysia, Malaysia
	25.21	5	La Voz de Chile, Chile
	25.21	20	S.O.D.R.E., Uruguay
11905	25.20	120	R. Tirana, Albania
	25.20	100	Deutsche Welle, Germany
	25.20	75/100	BBC London, Gt. Britain
	25.20	50/60/100	R. Roma, Italy
	25.20	250	Kigali (DW), Rwanda
	25.20	3	Taipei (BCC), Taiwan
11910	25.19	5/135	R. Budapest, Hungary
	25.19	100	R. Thailand, Thailand
	25.19	30	HCJB, La Voz de los Andes, Ecuador
11915	25.18	50	Orenburg, USSR
	25.18	50/250	Monrovia (VOA), Liberia
	25.18	50/500	Greenville, USA
	25.18	7.5	R. TV Gaucha, Brazil
	25.18	30	HCJB, La Voz de los Andes, Ecuador
11920	25.17	120	R. Bucharest, Rumania
	25.17	15	Moscow, USSR
	25.17	50	Call of the Orient, Philippines
	25.17	35/100	Okinawa (VOA), Ryukyu Isl.
11925	25.16	100	Deutsche Welle, Germany
	25.16	75	BBC London, Gt. Britain
	25.16	10	Emis. Nacional, Portugal
	25.16	50	Tashkent, USSR
	25.16	20/240	R. Peking, China
	25.16	10/100	AIR Delhi, India
	25.16	10	R. Bandeirantes, Brazil
11930	25.15	150	Moscow, USSR
	25.15	50	R. Brazzaville, Congo
	25.15	50	Poro (VOA), Philippines
	25.15	120/240	R. Habana, Cuba
11935	25.14	20/250	R. Liberty
	25.14	50/100	R. Nacional, Portugal
	25.14	25	R. Cl. Paranaense, Brazil
11940	25.13	120	R. Bucharest, Rumania
	25.13	50	Krasnoyarsk, USSR
	25.13	100	ETLF, Addis Ababa, Ethiopia
	25.13	100	R. Japan, Japan
	25.13	1/10/50	R. Kuwait, Kuwait
	25.13	50	R. Singapura, Singapore
	25.13	35	Taipei (BCC), Taiwan
11945	25.12	100	Deutsche Welle, Germany
	25.12	75	BBC London, Gt. Britain
	25.12	50/100	R. Nederland, Holland
	25.12	50	Alma Ata, USSR
	25.12	240	R. Peking, China
	25.12	50/500	Greenville, USA
11950	25.10	50	R. Sofia, Bulgaria
	25.10	50/100	R. Nederland, Holland
	25.10	50	Vladivostok, USSR
	25.10	10/50	R. ELWA, Liberia
	25.10	50	Riyadh, Saudi Arabia
	25.10	25	Saigon, Vietnam
	25.10	7.5	R. Min. Educacão, Brazil
11955	25.09	75	BBC London, Gt. Britain
	25.09	50/100	R. Nederland, Holland
	25.09	5/100	Warsaw, Poland
	25.09	50	Serpukhov, USSR
	25.09	7.5/100	BBC, Malaysia

kHz	m	kw	Stations & Countries
	25.09	500	Greenville, USA
11960	25.08	100	Praha, Czechoslovakia
	25.08	35/100	Tanger (VOA), Morocco
11965	25.07	100	Deutsche Welle, Germany
	25.07	20/240	R. Peking, China
	25.07	100	R. Japan, Japan
	25.07	50	Poro (VOA), Philippines
	25.07	50	R. Record, Brazil
11970	25.06	50	R. Sofia, Bulgaria
	25.06	20/250	R. Liberty
	25.06	4	R. Brazzaville, Congo
	25.06	100	Amman, Jordan
	25.06	3	Chiayi (BCC), Taiwan
	25.06	50/100	R. New York, USA
	25.06	5	Grenada, Windward Islands
11975	25.05	10/50	R. ELWA, Liberia
	25.05	20/240	R. Peking, China
11980	25.04	120/240	R. Peking, China
11990	25.02	100	Praha, Czechoslovakia
	25.02	50	Dushanbé, USSR
12060	24.88	20/240	R. Peking, China
12065	24.87	10/50	R. Peking, China
12070	24.86	100	Kiev, USSR
15100	19.87	10/50	Karachi, Pakistan
15105	19.86	50/75	BBC London, Gt. Britain
	19.86	10/100	AIR Delhi, India
	19.86	100	R. Japan, Japan
	19.86	250	BBC, Ascencion Isl.
15110	19.85	100	Kiev, USSR
	19.85	7.5	Wellington, New Zealand
	19.85	5	R. Oif. Comerciales, Mexico
	19.85	50	HCJB, La Voz de los Andes, Ecuador
15115	19.85	10/100/250	R. Free Europe
	19.85	50	Jeddah, Saudi Arabia
	19.85	1/30	HCJB, La Voz de los Andes, Ecuador
15120	19.84	100	Allouis, France
	19.84	25/100	Vatican Radio
15125	19.83	50	R. Liberty
	19.83	50/100	R. Nacional, Portugal
	19.83	100	Taipei (BCC), Taiwan
	19.83	10	R. Soc. da Bahia, Brazil
15130	19.83	50	Simferopol, USSR
15135	19.82	25/100	Vatican Radio
	19.82	100	R. Japan, Japan
	19.82	10	R. Panamericana, Brazil
15140	19.82	75/100	BBC London, Gt. Britain
	19.82	50	Petropavlovsk, USSR
	19.82	50	Riazan, USSR
	19.82	250	BBC, Ascencion Isl.
15145	19.81	10/100/250	R. Free Europe
	19.81	15	R. Jornal do Comercio, Br.
15150	19.80	100	Minsk, USSR
	19.80	100	ETLF, Addis Ababa, Ethiopia
	19.80	7.5	Djakarta, Indonesia
	19.80	1/10/50	R. Kuwait, Kuwait
	19.80	100	Jeddah, Saudi Arabia
15155	19.80	50	R. ELWA, Liberia
	19.80	100	Poro (VOA), Philippines
	19.80	25	R. Oif. de São Paulo, Brazil
15160	19.79	50	Rhodes (VOA), Greece
	19.79	5/135	R. Budapest, Hungary
	19.79	50	Moscow, USSR
	19.79	10/100	AIR Delhi, India
	19.79	100	R. Ankara, Turkey
	19.79	110	Bethany, USA
15165	19.78	10/100	AIR Delhi, India
	19.78	35/100	Poro (VOA), Philippines
	19.78	50	Damascus, Syria
	19.78	5	Ceara R. Clube, Brazil
15170	19.78	10/100/250	R. Free Europe
	19.78	100	Amman, Jordan
	19.78	10	La Voz de Guatemala, Guat.
15175	19.77	100/120	R. Norway, Norway
	19.77	100	Lvov, USSR
	19.77	35/100	Poro (VOA), Philippines
15180	19.76	75	BBC London, Gt. Britain
	19.76	50/100	R. Nederland, Holland
	19.76	50	Petropavlovsk, USSR
	19.76	50	Sverdlovsk, USSR
	19.76	250	BBC, Ascencion Isl.
	19.76	100	R. Australia, Australia
	19.76	10	R. Cult. da Bahia, Brazil
15185	19.76	100	Pori, Finland
	19.76	50	Askhabad, USSR
	19.76	10/100	AIR Delhi, India
15190	19.75	50	R. Brazzaville, Congo
	19.75	10/100	AIR Delhi, India
	19.75	50	R. Canada, Canada
	19.75	5	R. Inconfidencia, Brazil
15195	19.74	250	Woofferton (VOA), Gt. Brit.
	19.74	35/100	Tanger (VOA), Morocco
	19.74	100	R. Japan, Japan
15200	19.74	50	K Jatch, USSR
15205	19.73	100	Deutsche Welle, Germany
	19.73	100	ETLF, Addis Ababa, Ethiopia
	19.73	500	Greenville, USA
15210	19.72	100	Vienna, Austria
	19.72	100	Moscow, USSR
	19.72	35/100	Poro (VOA), Philippines
	19.72	3	R. Guarani, Paraguay
15215	19.71	10/100/250	R. Free Europe
	19.71	50/100	WNYW, R. New York, USA
15220	19.71	50/100	R. Nederland, Holland
	19.71	50	Riga, USSR
	19.71	250	R. South Africa, So. Africa
	19.71	100	R. Australia, Australia
	19.71	10	Melbourne, Australia
15225	19.71	250/500	R. Liberty
15230	19.70	50	Voronej, USSR
	19.70	100	Colombo, Ceylon
	19.70	10	Melbourne, Australia
	19.70	250	Greenville, USA
	19.70	120/240	R. Habana, Cuba
15235	19.69	15/100	BBC London, Gt. Britain
	19.69	250	BBC, Ascencion Isl.
	19.69	100	R. Japan, Japan
	19.69	250	Greenville, USA
15240	19.69	50	Irkutsk, USSR
	19.69	100	R. Belgrade, Yugoslavia
	19.69	50	R. Australia, Australia
15245	19.68	100	Allouis, France
	19.68	100	Deutsche Welle, Germany
	19.68	250	Greenville, USA
	19.68	10	R. Marajoára, Brazil
15250	19.67	120	R. Bucharest, Rumania
	19.67	100	ETLF, Addis Ababa, Ethiopia
	19.67	50/100	Poro (VOA), Philippines
	19.67	250	Greenville, USA
15255	19.66	10/100/250	R. Free Europe
	19.66	20/240	R. Peking, China
	19.66	50/260	TWR Bonaire, Neth. Antilles
15260	19.66	75/250	BBC London, Gt. Britain
	19.66	1	Tokyo (FEN), Japan
15265	19.66	100	Gorki, USSR
	19.66	50	R. Afghanistan, Afghanistan
	19.66	50	R. Excelsior, Brazil
15270	19.65	35/100	Tanger (VOA), Morocco
	19.65	20/240	R. Peking, China
	19.65	120/240	R. Habana, Cuba
	19.65	1	S.O.O.R.E., Uruguay

kHz	m	kw	Stations & Countries
15275	19.64	100	Deutsche Welle, Germany
	19.64	5/100	Warsaw, Poland
15280	19.63	50	Serpukhov, USSR
	19.63	3	Taipei (BCC), Taiwan
	19.63	500	Greenville, USA
	19.63	50/260	TWR Bonaire, Neth. Antilles
15285	19.63	100	Praha, Czechoslovakia
	19.63	25/100	Vatican Radio
	19.63	100/250	Accra, Ghana
	19.63	35	Colombo (VOA), Ceylon
15290	19.62	35/100	Tanger (VOA), Morocco
	19.62	20/240	R. Peking, China
	19.62	10/100	AIR Delhi, India
	19.62	35/100	Poro (VOA), Philippines
	19.62	20	Damascus, Syria
	19.62	10	R. El Mundo, Argentina
15295	19.62	100	Allouis, France
	19.62	50	Voronej, USSR
	19.62	5/100	R. Clube de Moçambique
15300	19.61	50/75	BBC London, Gt. Britain
	19.61	200	R. Japan, Japan
	19.61	2/10/50	Call of the Orient, Philippines
15305	19.60	100	Schwarzenburg, Switzerland
	19.60	50	Kazan, USSR
15310	19.60	100	R. Sofia, Bulgaria
	19.60	100	Praha, Czechoslovakia
	19.60	75	BBC London, Gt. Britain
	19.60	50/60/100	R. Roma, Italy
	19.60	50	Tula, USSR
	19.60	50	Conakry, Guinea Rep.
	19.60	7.5/100	BBC, Cyprus
15315	19.59	100	Duetsche Welle, Germany
	19.59	100	ETLF, Addis Ababa, Ethiopia
	19.59	100	Tanger (VOA), Morocco
	19.59	20/240	R. Peking, China
	19.59	10/50	Karachi, Pakistan
15320	19.58	100	Kazan, USSR
	19.58	50/250	Monrovia (VOA), Liberia
	19.58	100	R. Australia, Australia
	19.58	50	R. Canada, Canada
15325	19.58	50	R. Canada, Canada
	19.58	1	R. Gazeta São Paulo, Brazil
	19.58	50	HCJB, La Voz de Los Andes, Ecuador
15330	19.57	100	Sverdlovsk, USSR
	19.57	100	R. Australia, Australia
	19.57	110	Bethany, USA
15335	19.56	20	Wavre, Belgium
	19.56	10/100	AIR Delhi, India
	19.56	100	AIR Madras, India
	19.56	10/50	Karachi, Pakistan
	19.56	10	R. Farroupilha, Brazil
15340	19.56	50/250	R. Liberty
	19.56	50/60/100	R. Roma, Italy
	19.56	120/240	R. Habana, Cuba
15345	19.55	7.5/5	Athens, Greece
	19.55	50	Sebaa Aioun, Morocco
	19.55	100	Amman, Jordan
	19.55	50	Poro (VOA), Philippines
	19.55	25	Taipei (BCC), Taiwan
	19.55	50	R. Nacional, Argentina
15350	19.54	15/100	BBC London, Gt. Britain
	19.54	100	Vologda, USSR
15355	19.53	10/100/250	R. Free Europe
	19.53	50/100	WNYW, R. New York, USA
	19.53	100	BBC London, Gt. Britain
	19.53	100	Moscow, USSR
15365	19.52	10/100/250	R. Free Europe
	19.52	100	Praha, Czechoslovakia
	19.52	10/50	Karachi, Pakistan

kHz	m	kw	Stations & Countries
15370	19.52	250	R. Liberty
	19.52	100	ETLF, Addis Ababa, Ethiopia
	19.52	10.50	Karachi, Pakistan
	19.52	50/100	R. New York, USA
	19.52	10	R. Tamoio, Brazil
15375	19.51	100	Leningrad, USSR
	19.51	50	Malolos (VOA), Philippines
15380	19.50	100	Deutsche Welle, Germany
	19.50	50	R. Liberty
	19.50	50/100	R. Nacional, Portugal
	19.50	120	R. Bucharest, Rumania
	19.50	50	Tanger, Morocco
	19.50	250	Kigali (DW), Rwanda
15385	19.50	50/60/100	R. Roma, Italy
	19.50	100	Gorki, USSR
	19.50	100	Moscow, USSR
	19.50	2/50	Call of the Orient, Philippines
	19.50	10	R. Sarandi, Uruguay
15390	19.49	50/100	R. Berlin Int, Germany
	19.49	75	BBC London, Gt. Britain
	19.49	10	R. Australia, Australia
15395	19.49	120	Tashkent, USSR
	19.49	500	Greenville, USA
15400	19.48	100	Vienna, Austria
	19.48	50/60/100	R. Roma, Italy
	19.48	250	BBC, Ascencion Isl.
	19.48	100	ETLF, Addis Ababa, Ethiopia
	19.48	50	Baghdad, Iraq
	19.48	250	Greenville, USA
15405	19.47	100	Deutsche Welle, Germany
	19.47	100	Kingisepp, USSR
	19.47	10/50	Karachi, Pakistan
15410	19.47	20	Vienna, Austria
	19.47	100	Deutsche Welle, Germany
	19.47	100	ETLF, Addis Ababa, Ethiopia
	19.47	10	Tanger, Morocco
	19.47	7.5/100	APD2 Dacca, Pakistan
	19.47	50	Malolos (VOA), Philippines
	19.47	35/100	Poro (VOA), Philippines
	19.47	50/200	Delano, USA
	19.47	500	Greenville, USA
15415	19.46	100	Kiev, USSR
	19.46	50/100	Cairo, Un. Arab Rep.
	19.46	500	Greenville, USA
	19.46	1	R. Cl. Ribeirão Preto, Brazil
15417	19.46	20/200	R. Peking, China
15420	19.46	75	BBC London, Gt. Britain
	19.46	100	R. Nacional, Spain
	19.46	250	BBC, Ascencion Isl.
	19.46	50	Dumaguete City, Philippines
15425	19.45	50/100	R. Nederland, Holland
	19.45	120	Moscow, USSR
	19.45	50	Perth, Australia
17700	16.95	50	Tallinn, USSR
17705	16.94	100	Praha, Czechoslovakia
	16.94	75/100	BBC London, Gt. Britain
	16.94	35/100	Tanger (VOA), Morocco
	16.94	10/100	AIR Delhi, India
	16.94	10	R. 9 de Julho, Brazil
	16.94	100	Praha, Czechoslovakia
	16.94	75/100	BBC London, Gt. Britain
	16.94	35/100	Tanger (VOA), Morocco
	16.94	10/100	AIR Delhi, India
	16.94	10	R. 9 de Julho, Brazil
17710	16.94	100	Moscow, USSR
	16.94	50/200	Delano, USA
	16.94	250	Greenville, USA
17715	16.93	75/100	BBC London, Gt. Britain
	16.93	10/100	AIR Delhi, India
	16.93	50	Dumaguete City, Philippines

kHz	m	kw	Stations & Countries
	16.93	50	R. Australia, Australia
	16.93	120/240	R. Habana, Cuba
17720	16.93	15	Pori, Finland
	16.93	50	R. Liberty
	16.93	50	Novosibirsk, USSR
	16.93	50	R. Brazzaville, Congo
	16.93	20/240	R. Peking, China
	16.93	50	Taipei (BCC), Taiwan
	16.93	50	Red Lion, USA
17725	16.93	10/100/250	R. Free Europe
	16.93	100	R. Japan, Japan
	16.93	1	R. Universitaria, Brazil
17730	16.92	100	Vienna, Austria
	16.92	100	Allouis, France
	16.92	50	Serpukhov, USSR
	16.92	50/100	WNYW, R. New York, USA
17735	16.92	10/100/250	R. Free Europe
	16.92	35/100	Poro (VOA), Philippines
17740	16.91	15/100	BBC London, Gt. Britain
	16.91	50/100	R. Nacional, Portugal
	16.91	50/250	Monrovia (VOA), Liberia
	16.91	10/50	Karachi, Pakistan
17745	16.91	15/100	BBC London, Gt. Britain
	16.91	7.5/5	Athens, Greece
	16.91	50	Kursk, USSR
	16.91	10/50	Karachi, Pakistan
17750	16.90	100	Vienna, Austria
	16.90	50	R. Liberty
	16.90	1/50/100	R. Kuwait, Kuwait
	16.90	20/240	R. Peking, China
	16.90	50	Poro (VOA), Philippines
	16.90	50/500	Greenville, USA
17755	16.90	100	Vienna, Austria
	16.90	50/100	R. Berlin Int, Germany
	16.90	100	Gorki, USSR
	16.90	50/100	WNYW, R. New York, USA
17760	16.89	500	R. Liberty
	16.89	50/100	WNYW, R. New York, USA
17765	16.89	100	Allouis, France
	16.89	100	Deutsche Welle, Germany
	16.89	100	Tula, USSR
	16.89	250	Kigali (DW), Rwanda
	16.89	50	Delano, USA
17770	16.88	10/100/250	R. Free Europe
	16.88	50/60/100	R. Roma, Italy
	16.88	7.5	Wellington, New Zealand
17775	16.88	120	R. Bucharest, Rumania
	16.88	10/50	Karachi, Pakistan
17780	16.87	50/100	R. Berlin Int, Germany
	16.87	50	R. Liberty
	16.87	50/250	Monrovia (VOA), Liberia
	16.87	10/100	AIR Delhi, India
	16.87	20/240	R. Peking, China
	16.87	500	Greenville, USA
17785	16.87	100	R. Japan, Japan
17790	16.86	100	Deutsche Welle, Germany
	16.86	75/100	BBC London, Gt. Britain
	16.86	250	R. South Africa, So. Africa
17795	16.86	5/135	R. Budapest, Hungary
	16.86	20/240	R. Peking, China
17800	16.85	10/100	AIR Delhi, India
	16.85	10/50	Karachi, Pakistan
	16.85	50/200	Dixon, USA
	16.85	250	Greenville, USA
17805	16.85	50	Khabarovsk, USSR
	16.85	250	R. South Africa, So. Africa
	16.85	50/500	Greenville, USA
17810	16.84	75	BBC London, Gt. Britain
	16.84	50/100	R. Nederland, Holland
	16.84	20/240	R. Peking, China
17815	16.84	50/100	R. Nederland, Holland
	16.84	50/60/100	R. Roma, Italy
	16.84	100	Simferopol, USSR
	16.84	100	Tanger (VOA), Morocco
	16.84	35	Colombo, Ceylon
	16.84	10	R. Dif. de São Paulo, Brazil
17820	16.84	15/100	BBC London, Gt. Britain
	16.84	25/100	Vatican Radio
	16.84	100	R. Ankara, Turkey
	16.84	100	R. Australia, Australia
	16.84	50	R. Canada, Canada
	16.84	50/200	Delano, USA
17825	16.83	100/120	R. Norway, Norway
	16.83	50	R. Afghanistan, Afghanistan
	16.83	10/100	AIR Delhi, India
	16.83	100	R. Japan, Japan
	16.83	35/100	Poro (VOA), Philippines
17830	16.83	100	Deutsche Welle, Germany
	16.83	50/100	R. Nederland, Holland
	16.83	50/250	Monrovia (VOA), Liberia
	16.83	35	Colombo, Ceylon
	16.83	10/100	AIR Delhi, India
	16.83	50/100	Poro (VOA), Philippines
	16.83	250	Greenville, USA
17835	16.82	10/100/250	R. Free Europe
	16.82	20/240	R. Peking, China
	16.82	50/100	WNYW, R. New York, USA
17840	16.82	100	Praha, Czechoslovakia
	16.82	50/100	R. Nederland, Holland
	16.82	25/100	Vatican Radio
	16.82	100	R. Australia, Australia
17845		100	Deutsche Welle, Germany
	16.81	100	Schwarzenburg, Switzerland
	16.81	50/100	WNYW, R. New York, USA
17850	16.81	100	Allouis, France
	16.81	120	R. Bucharest, Rumania
	16.81	50	Moscow, USSR
	16.81	50	Malolos (VOA), Philippines
	16.81	50/200	Delano, USA
	16.81	50/200	Dixon, USA
	16.81	10	R. Nacional, Brazil
17855	16.80	100	Vienna, Austria
	16.80	20/100	R. Liberty
	16.80	35	Tanger (VOA), Morocco
17860	16.80	20/100	Wavre, Belgium
	16.80	15/100	BBC London, Gt. Britain
	16.80	120	Tashkent, USSR
	16.80	20/240	R. Peking, China
17865	16.80	10/100/250	R. Free Europe
17870	16.79	15/100	BBC London, Gt. Britain
	16.79	100	R. Australia, Australia
17875	16.79	100	Deutsche Welle, Germany
	16.79	100	R. Liberty
	16.79	20/240	R. Peking China
	16.79	50/250	Greenville, USA
	16.79	250	Monrovia (VOA), Liberia
	16.79	7.5	R. Min. Educação, Brazil
17880	16.78	50/100	R. Berlin Int, Germany
	16.78	15/100	BBC London, Gt. Britain
	16.78	50/100	R. Nederland, Holland
	16.78	50/100	R. Nacional, Portugal
	16.78	50	Petropavlovsk, USSR
	16.78	50	Tula, USSR
	16.78	7.5/100	BBC, Malaysia
	16.78	30/50	HCJB, La Voz de Los Andes, Ecuador
17885	16.78	15/100	BBC London, Gt. Britain
	16.78	25/100	Vatican Radio
	16.78	50/200	Delano, USA
17890	16.77	5/135	R. Budapest, Hungary
	16.77	50/60/100	R. Roma, Italy
	16.77	50/100	R. Nacional, Portugal

kHz	m	kw	Stations & Countries
	16.77	10/100	AIR Delhi, India
	16.77	50	Greenville, USA
	16.77	30	HCJB, La Voz de los Andes, Ecuador
17895	16.76	500	R. Liberty
	16.76	50/100	R. Nacional, Portugal
17897	16.76	20/240	R. Peking, China
17900	16.76	50/100	R. Berlin Int, Germany
21450	13.99	100	Praha, Czechoslovakia
21455	13.98	35	Tanger (VOA), Morocco
21460	13.98	50/200	Dixon, USA
21465	13.98	50/100	WNYW, R. New York, USA
21470	13.97	75/100	BBC London, Gt. Britain
21485	13.96	25/100	R. Nederland, Holland
	13.96	110	Vatican Radio
21495	13.96	50/100	Bethany, USA
21500	13.95	2/50	R. Nacional, Portugal
	13.95	250	R. Brazzaville, Congo
	13.95	50/200	R. South Africa, So. Africa
21505	1394	50/100	Delano, USA
	13.94	50	R. Nederland, Holland
21510	13.94	100	Monrovia (VOA), Liberia
	13.94	50/500	Wavre, Belgium
21515	13.94	25/100	Greenville, USA
	13.94	110	Vatican Radio
21520	13.94	100	Bethany, USA
	13.94	50/250	SBC, Switzerland
21525	13.94	1/10/50	Monrovia (VOA), Liberia
21530	13.93	75	R. Kuweit, Kuweit
	13.93	25/100	BBC London, Gt. Britain
	13.93	25/100	Vatican Radio
	13.93	50/100	WNYW, R. New York, USA
21535	13.93	0.5	R. ELWA, Liberia
	13.93	250	R. South Africa, So. Africa
21540	13.93	100	SBC, Switzerland
	13.93	100	Kursk, USSR
	13.93	50	R. Australia, Australia
	13.93	50/500	Greenville, USA
21545	13.92	100/250	Accra, Ghana
21550	13.92	75/100	BBC London, Gt. Britain
	13.91	100	Deutsche Welle, Germany
21560	13.91	50/60/100	R. Roma, Italy
21565	13.91	50/100	R. Nederland, Holland
	13.91	100	Lvov, USSR
21570	13.91	50/100	R. Nederland, Holland
21580	13.90	100	Hörby, Sweden
	13.90	120	Minsk, USSR
	13.90	100	R. Afghanistan
21590	13.90	15/100	BBC London, Gt. Britain
	13.90	110	Bethany, USA
21595	13.89	50	R. Canada, Canada
21600	13.89	10/100/250	R. Free Europe
	13.89	100	Leningrad, USSR
	13.89	50/500	Greenville, USA
21610	13.88	15/100	BBC London, Gt. Britain
	13.88	50/200	Dixon, USA
	13.88	50/100	Cairo, Un. Arab Rep.
21620	13.87	100	Allouis, France
	13.87	10/100/250	R. Free Europe
21625	13.87	50/100	R. Nederland, Holland
	13.87	100	Kursk, USSR
21630	13.87	75/100	BBC London, Gt. Britain
	13.87	50/200	Delano, USA
	13.86	50/500	Greenville, USA
21645	13.86	100	Deutsche Welle, Germany
21650	13.86	100	Deutsche Welle, Germany
	13.86	15/100	BBC London, Gt. Britain
	13.86	110	Bethany, USA
21660	13.85	50/100	R. Nacional, Portugal
21665	13.85	10/100/250	R. Free Europe
	13.85	50/100	R. Nederland, Holland
	13.85	5/135	R. Budapest, Hungary
21670	13.84	10	LLP, R. Norway, Norway
	13.84	50/250	Monrovia (VOA), Liberia
21680	13.84	10/100/250	R. Free Europe
	13.84	75/100	BBC London, Gt. Britain
	13.84	100	R. Australia, Australia
21690	13.83	100	R. Sweden
	13.83	50	Tanger (VOA), Morocco
	13.83	5	Grenada, Windward Isl.
21695	13.83	50	Tashkent, USSR
	13.83	50/100	R. Nacional, Portugal
21700	13.83	100	Praha, Czechoslovakia
21705	13.83		Deutsche Welle, Germany
21710	13.83	75/100	BBC London, Gt. Britain
21715	13.82	50/100	R. Nederland, Holland
	13.81	100/250	Accra, Ghana
21730	13.81	10/120	LLQ, R. Norway, Norway
21735	13.81	100	Praha, Czechoslovakia
21740	13.80	50/500	Greenville, USA
21745	13.80	10/100/250	R. Free Europe
†21760	13.79		Guam
†22515	13.74		Canal Zone
†22593	13.28		Honolulu, Hawaii
†22635	13.25		San Francisco, USA
†22845	13.13	10	Belconnen, Australia
†23650	12.68		Annapolis, USA
*25000	12.00	2.5	WWH, Ft. Collins, USA

12
Build-it-Yourself Listening Helps

Once the listener has decided on a good shortwave receiver which includes an R-F stage, bandspread, and a sharp I-F channel (see Chapters 4 and 6), he will need to start thinking about good antennas (see Chapter 5).

As was pointed out in Chapter 5, the best answer for the shortwave broadcast listener is a set of halfwaves. This can be a system of "Hertz" halfwaves or halfwave dipoles, depending on the receiver used.

The greater part of this chapter is devoted to both permanent and portable antenna systems that will bring a receiver to life. The listener will need something more than a whip on a portable if he wants dependable shortwave reception.

Construction Hints

The listener will notice that when components are called for they are housed in small metal boxes. What is more, the antenna systems are fed with "coax" transmission lines terminated with coax connectors. The reason for this is man-made noise—it must be suppressed—and this is the best way to do it. Such noise is caused by power lines, motors, neon signs, and the like, and is always an SWL problem. In this case, noise control depends on the proper wiring and grounding of the connectors' unit housing, and the return of the "coax braid" to ground, and so on. Metal boxes are preferred to plastic boxes, because they can be grounded and also to protect the components from dust. Nothing is used for show—or called for unless it is needed.

It is a good idea to use low-loss parts on the antenna or input end of the receiver. This means using silver-plated switch contacts set in mica-filled cases as well as low-loss binding posts, insulators, and tie points. It even means using plastic-covered instead of rubber-covered wire where the wire touches windowsills, metal boxes, and the like.

The connections to the audio or output (speaker) end of the receiver should be just as carefully considered, but the type of insulation used is not a problem.

Giving careful consideration to connections simply means making a good tight mechanical connection before soldering. Also, the mechanical joint should be preheated by first applying the hot iron for a few seconds and then the solder.

The iron can be kept well-tinned by occasionally touching the hot tip with solder and quickly wiping it on a clean rag. The preheated connections must be clean and the solder used should be rosin-core solder. A word of warning: acid-core solder should never be used on any electronics project. The best solders are 60 percent tin and 40 percent lead. The iron should be wiped clean as one works.

In soldering, the thing to avoid is a "cold joint," usually caused by not applying enough heat. A good solder joint should look bright and clean. For the projects in this chapter, a good 100-watt iron should be used in order to get the solder to flow on smoothly. A low wattage iron should be used only when working on small transistor projects—not when working on projects of the kind described in this chapter. The low-wattage iron keeps the average listener from becoming a soldering expert.

WINDOWSILL ANTENNA FARM

No matter how much room the listener has or doesn't have, his best bet is a halfwave cut for each band. If he uses a portable, he won't need anything but the unit shown in Fig. 12-1 to bring in the world. The author has a "Six-Continent Award" from the Newark News Radio Club and this was the antenna system used from a New York apartment.

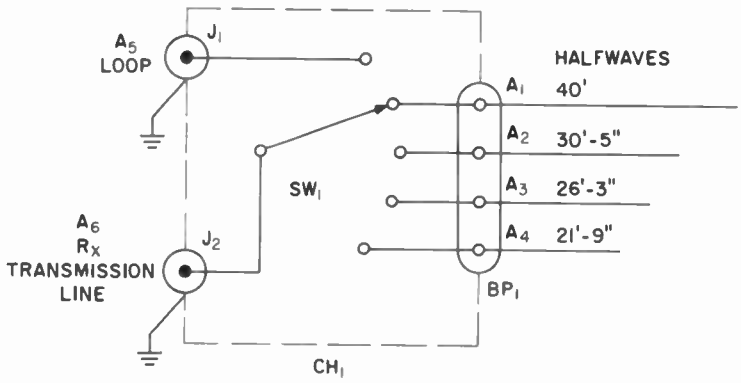


Fig. 12-1 Windowsill antenna farm.

Antenna wires can be made from split "zip cord" (household lampcord or antenna wire). Two connector receptacles are used. One connects the transmission line to the receiver and the other allows the use of either one dipole, loop, or longwire along with the other switched antennas.

A metal box is used to house the unit, and there should be a good low-loss single-pole, five-position switch. Keep the switch box on the windowsill with the antenna wires draped out the window and tied. If there is enough room, fan the halfwaves; if not, they will work well just draped.

Parts List

A1-4—Halfwaves; A5—Loop, Dipole, or Longwire; A6—Transmission Line
BP1—Low-loss terminal board
SW1—Low-loss, single pole, five-position switch
J1, J2—Amphenol SO-239 Sockets
CH1—Small metal box

THE FOLDED DIPOLE

The DX'er will really enjoy using the folded dipole antenna (shown in Fig. 12-2). Folded dipoles make excellent directional, one-band receiving antennas, but two antenna

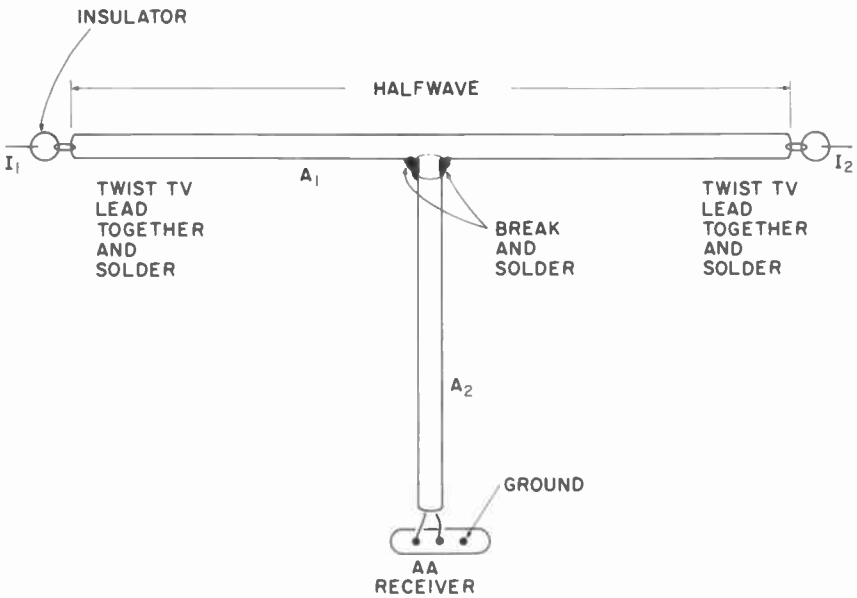


Fig. 12-2 DXer's folded dipole.

posts are required on the receiver in order to use them. This sort of antenna is only for receivers with balanced-input antenna circuits, or the best of communications receivers.

A balun could be used to match an unbalanced input circuit but it is better to use regular dipoles and a coax transmission line (or a standard dipole).

The folded dipole's "twin" lead-in wires can always be twisted together to make a single-post antenna connection, but the result is an inverted-L, not a dipole.

Dipoles, simple or folded, are noise-balancing antennas, which means they will do a better job of killing noise than any other type. They should be used as dipoles, not as L's, and strung outside, high and in the clear. Dipoles are used by commercial stations and a better antenna cannot be erected. However, one dipole is needed for each band in use.

Parts List

A1—300-ohm TV Twin-lead. Halfwaves: 13 meters 21 ft. 9 in., 16 meters 26 ft. 3 in., 19 meters 30 ft. 5 in., 25 meters 40 ft., 31 meters 48 ft. 6 in. (use steel-clad on the long ones.)

A2—300-ohm TV Twin-lead

I1-2—2 Strain or "Egg" insulators

AN ALL-BAND RANDOM AND COUPLER FOR A PORTABLE

This antenna system (Fig. 12-3) is designed for the traveler or for people who can't drape halfwaves out their windows. Although this unit was not designed to replace halfwaves, it can save the day for those who have little space. It can, for instance, be hung indoors behind a window drape or snaked out a window and hauled in after each listening session.

The antenna wire is only nine feet long and this much wire is hardly a problem. Such a short antenna would not work well except for the built-in coupler. This is a broad-band pretuned affair that will match all portables. Once the slug is tuned for the best results with the set, it can be forgotten. It will then work as is from 16 through 49 meters.

The antenna coupler must be worked against ground (a cold-water metal pipe), but the portable should not be grounded; that is, the portable *must be battery operated* (as one side of the AC plug acts as ground); otherwise, the coupler may not work to increase the signal.

If the set has a ground, as well as an antenna outlet, the ground connection should not be used. If the receiver lacks even an external antenna post or jack, the output of the coupler can be connected to a depressed whip antenna.

The ground connection from the coupler to a water pipe (make sure all lead pipes are metal, not plastic) should be kept under twelve feet. The output lead or transmission coax should be kept short (and ungrounded at the receiver end).

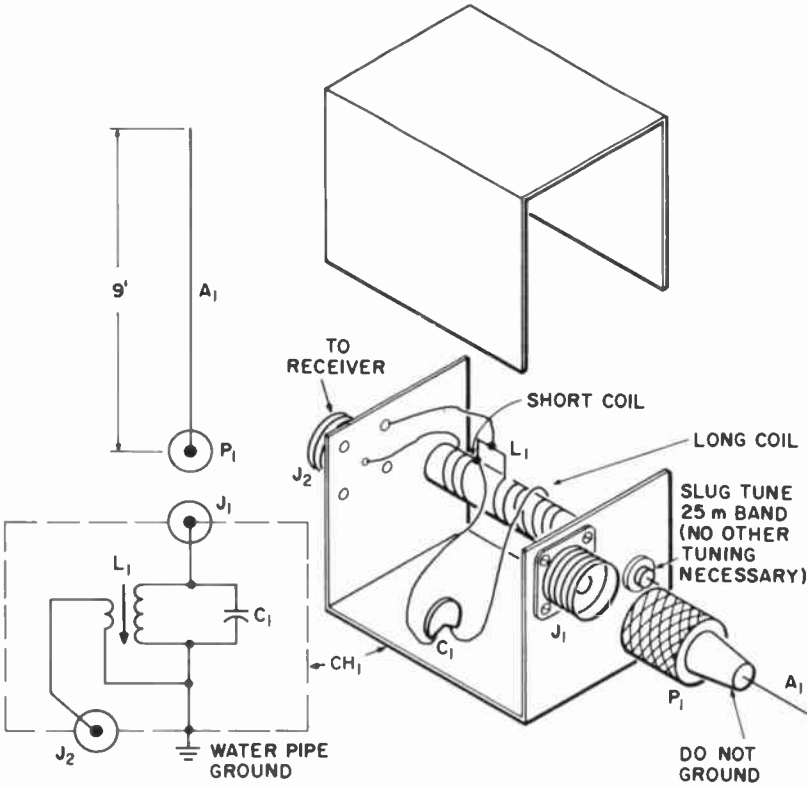


Fig. 12-3 All-band random and coupler.

Parts List

A1—Antenna wire: 9 feet of plastic insulated wire (split lampcord etc.)
CH1—Small metal box
C1—180 pF disc ceramic 1kW
L1—1.7-5.5 MHz. Slug tuned coil (Miller B5495-A, or equiv.)
J1-2—Amphenol SO-239 Receptacles
P1—PL 239 Amphenol

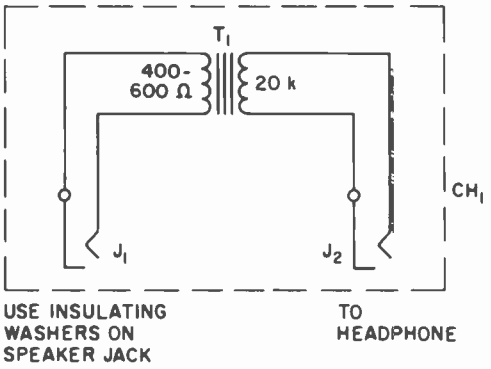


Fig. 12-4 DX headphone adapter.

HEADPHONE ADAPTOR

This simple project is for the DX'er who is tired of trying to use the single earphone that comes with multiband portables.

The best DX 'phones are 500-ohm aircraft 'phones, but the unit described here will work with any commercial head-set, 500- to 2000-ohm or more (magnetic or dynamic).

The unit is based on the use of any small 500/600-ohm to 20,000-ohm (push-pull, plate-to-line) transformer in reverse (Fig. 12-4). Two open-circuit jacks, plus a set of insulating washers, and a small metal box are needed. The whole unit takes less than an hour to construct.

To operate the unit, the 500-ohm side of the transformer is plugged into the receiver's external speaker or headphone jack, and the 'phones are plugged into the other jack. No volume will be lost; in fact, it may gain a little. Everything will come through loud and clear; however, the volume should not be turned up so loud that the 'phones blow.

THE CLIFFDWELLER'S SIMPLE ANTENNA SYSTEM

Not all listeners have the room for four or five halfwaves, but many have room for something more than nine feet of

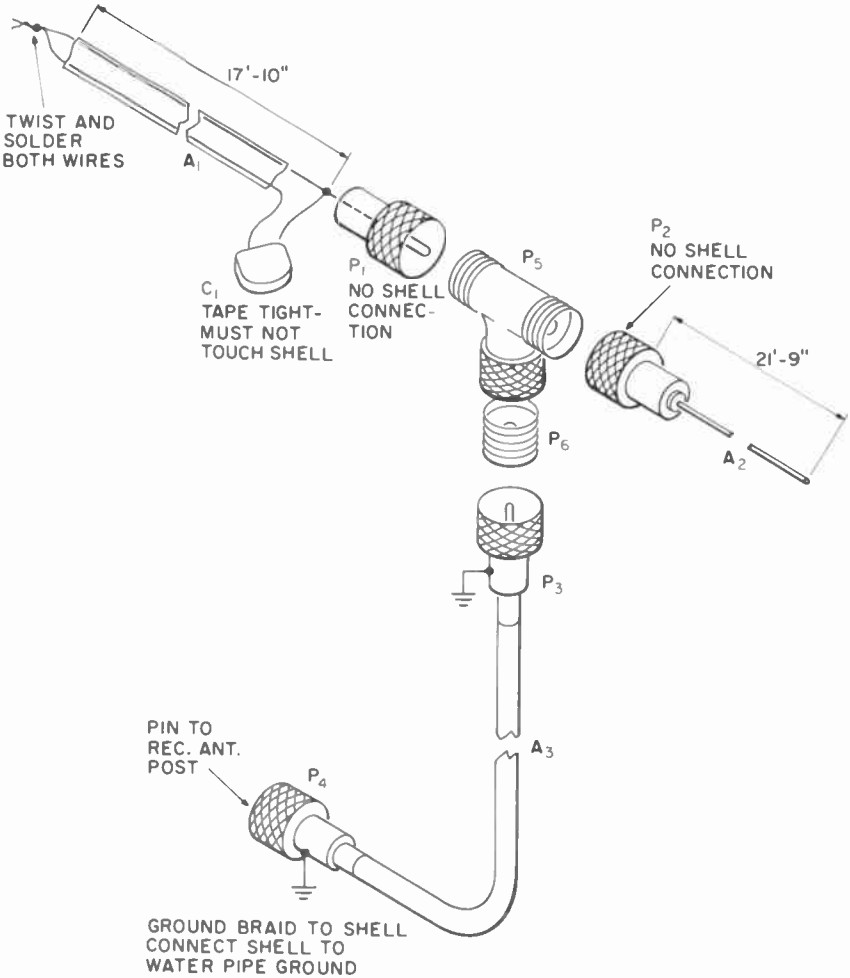


Fig. 12-5 Cliff-dweller's simple antenna system.

wire and an antenna coupler. The system shown in Fig. 12-5 will run the four or five halfwaves a close race. It is not meant to replace dipoles, but it is good.

It was mentioned earlier that a 13-meter halfwave could

be used on 31 meters. A 13-meter halfwave is only 21 feet 9 inches long and will be used for one leg of the system.

The other leg will take the form of a simple closed loop 17 feet 10 inches long. This is made up from No. 20 gauge 300-ohm TV twin-lead. One end is soldered together and the other end is capacity coupled by means of a 22pF fixed capacitor. PL-259 UHF plugs are used to terminate each leg. The two legs are then fitted to M-358 UHF T adapters and fed to the receiver through ten or twelve feet of RG58-U coax fitted with PL-259's. The coax braid and shells should be grounded.

The antenna system is a simple untuned broadband type that will give excellent results from 13 through 49 meters with any good transistor multiband portable. It will, in fact, bring in every continent.

Once the unit is finished, it will never need care or adjustment and can simply be draped out any window for convenient use. This simple system will work about as well as halfwaves on most portables.

Parts List

A1—300-ohm TV twin-lead (20 gauge) 17 feet 10 inches long
A2—"Split" household ribbon lampcord (plastic covered) 21 feet 9 inches long
A3—"Coax" transmission line (RG-58/U) 10 to 12 feet long
C1—22pF Disc ceramic 1kV (or smaller)
P1-4—PL-259 Amphenol
P5—M-258 Amphenol
P6—PL-258 Amphenol

WINDOW-FRAME ANTENNA

Here is an antenna that any listener can construct in minutes for less than a dollar (Fig. 12-6). This is a "better than nothing" antenna for the man who won't bother with stringing a good antenna. It is a random, but it will work better than the "whip" on a portable receiver.

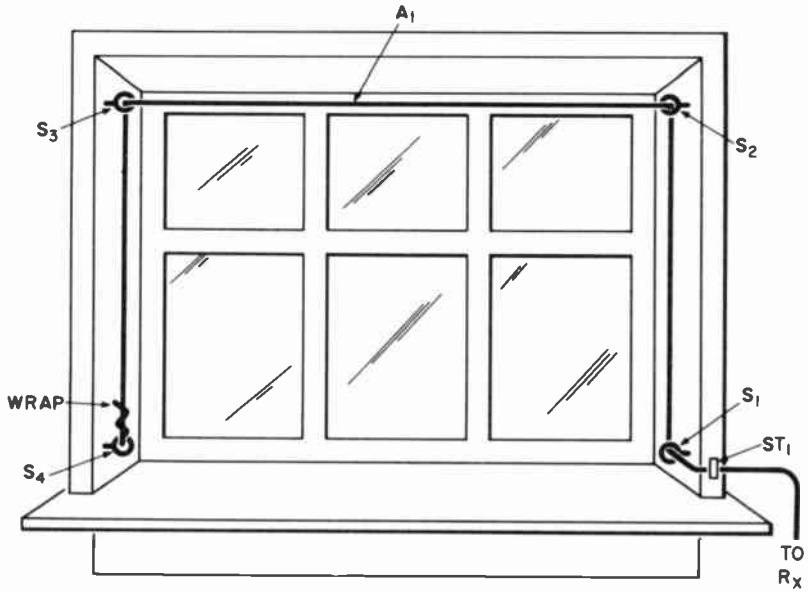


Fig. 12-6 Window-frame antenna.

A fairly large window frame is necessary to get really good results; otherwise, the antenna will be too short to work well. A 6- by 8-foot frame will be best.

Parts List

A1—Any insulated wire: split lampcord, bell wire, etc.
S1-4—4 small screw-eyes from the local hardware store
ST1—Small insulated staple or cable clamp to secure wire

THE WINDOM ANTENNA

Most longwires are really random wires, but the Windom (Fig. 12-7) can be tuned to a given frequency. This can be done by using an antenna coupler or by cutting halfwaves and using them as Hertz (end fed) or dipole (center fed) antennas would be used, that is, one for each band.

The lead-in should always be connected one third in on any Windom that is erected, and it can be ordinary insulated wire (not coax).

An all-band Windom can be made by stringing 126 feet of antenna wire with a lead-in coming off 42 feet from the end. This can be used, as is, without bothering with an antenna coupler. Nor is a coupler needed if halfwaves are cut.

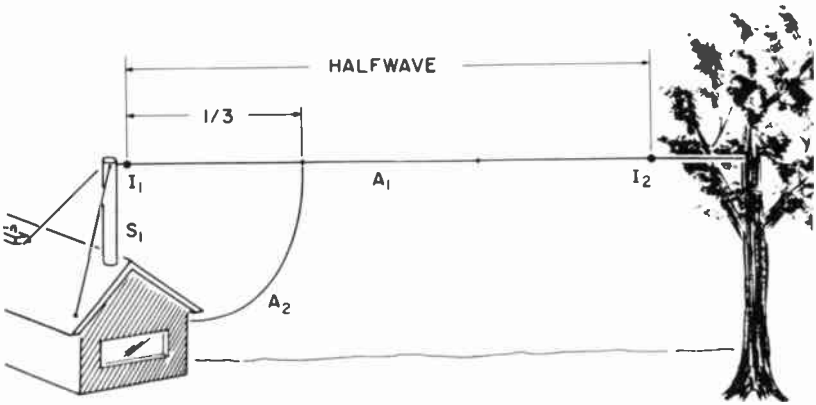


Fig. 12-7 Windom antenna.

Parts List

A1—Ordinary antenna wire. Halfwaves: 13 meters 21ft. 9in.; 16 meters 26ft. 3in.; 19 meters 30ft. 5in.; 25 meters 40ft.; 31 meters 48ft. 6in.; 41 meters 65ft.; 49 meters 77ft.
A2—Ordinary insulated lead-in wire (keep this lead short)
I1-2—Strain or "Egg" insulators
S1—Standard roof (or chimney mount if desired)

100kHz (OSC.) CALIBRATOR FOR A COMMUNICATIONS RECEIVER

The calibrator is an item for the DX'er who has a communications receiver and wants to hunt weak stations by zeroing in on known frequencies. The set has a beat frequency oscillator, and although the DX'er may never use the BFO to listen to CW or code signals, he can use it in two other ways: First, to hunt weak AM signals, and second, to

produce a sharp marker signal for a calibrator, such as the one described below (see Chapter 6, under Calibration).

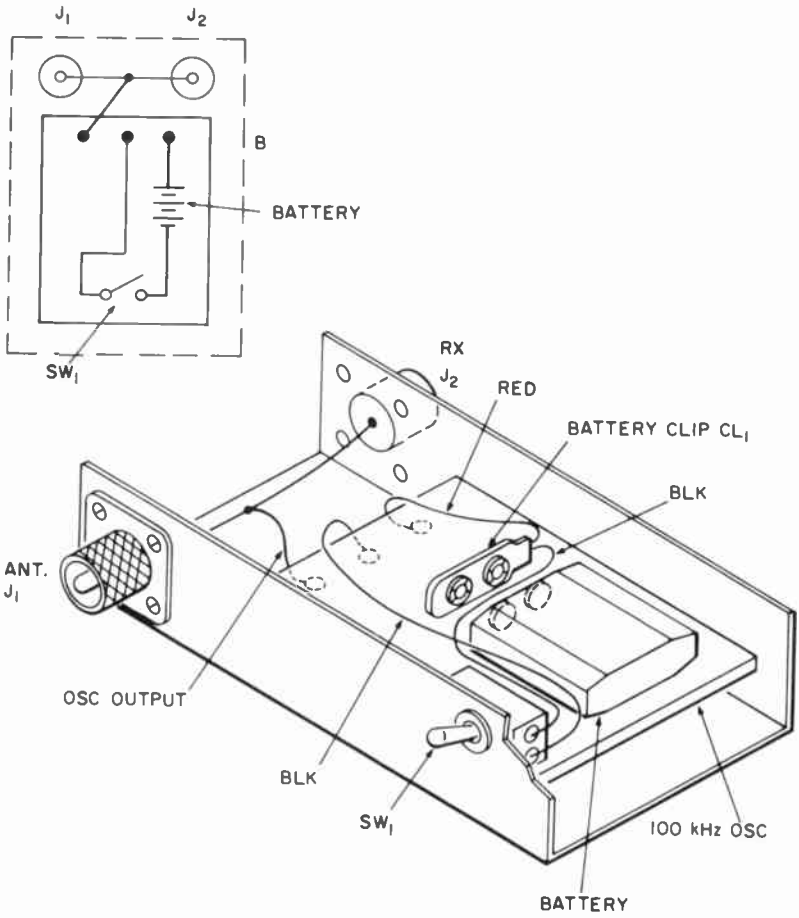


Fig. 12-8 100kHz crystal calibrator.

The calibrator (Fig. 12-8) comes prewired except for battery and output connections; what's more, it will work by simply inserting it into the coax transmission line. All that need be done is to flip the switch and, by using the BFO, the dial will be marked off every 100kHz on all the shortwave

broadcast bands. The signal can also be checked (and adjusted) against WWV (padder set-screw on unit).

Parts List

CL1—Battery clip
SW1—Single-pole single throw switch (toggle)
J1-2—Amphenol SO-239
OSC—100 kHz Unit (surplus, etc.; see Preface note)
B—Metal Box

A DESK-TUNING UNIT FOR AM BROADCAST BAND LOOPS

The reader may have heard that it is possible to hear long-distance stations on the AM broadcast band and perhaps would like to give them a try. How can he reach in between the 50kW locals and nab a rare one? It's simple: he can build a tunable loop, a good box-type loop (Fig. 12-9) to do the job. Loops of this type will do as good a job or better than most longwire antennas on the AM broadcast band. The listener is able to control the signal in two ways: (1) by tuning the loop as a coil, and (2) by tuning out interference by turning the loop. Both operations will increase the signal level and greatly improve the reception of the wanted signal. The listener also has the added advantage of less noise, as the loop is, by nature, noise canceling.

Indoor antennas (such as loops) work well on the AM broadcast, or mediumwave (MW) band, whereas outdoor antennas are required for good shortwave reception.

Indoor loops can be hung from a ceiling fixture or from a simple wall bracket. The loop described here is easy to handle because of the desk-control unit. (Most loops are hard to control because the tuning unit is on the loop proper.)

This loop is, in fact, two loops (Fig. 12-10) dividing the AM broadcast band in half and providing an excellent turns ratio. Eight turns of No. 22 magnet wire are used to tune the high-frequency (900-1600kHz) half and 13 turns of No. 22 are used to cover the low-frequency (900-540kHz) half.

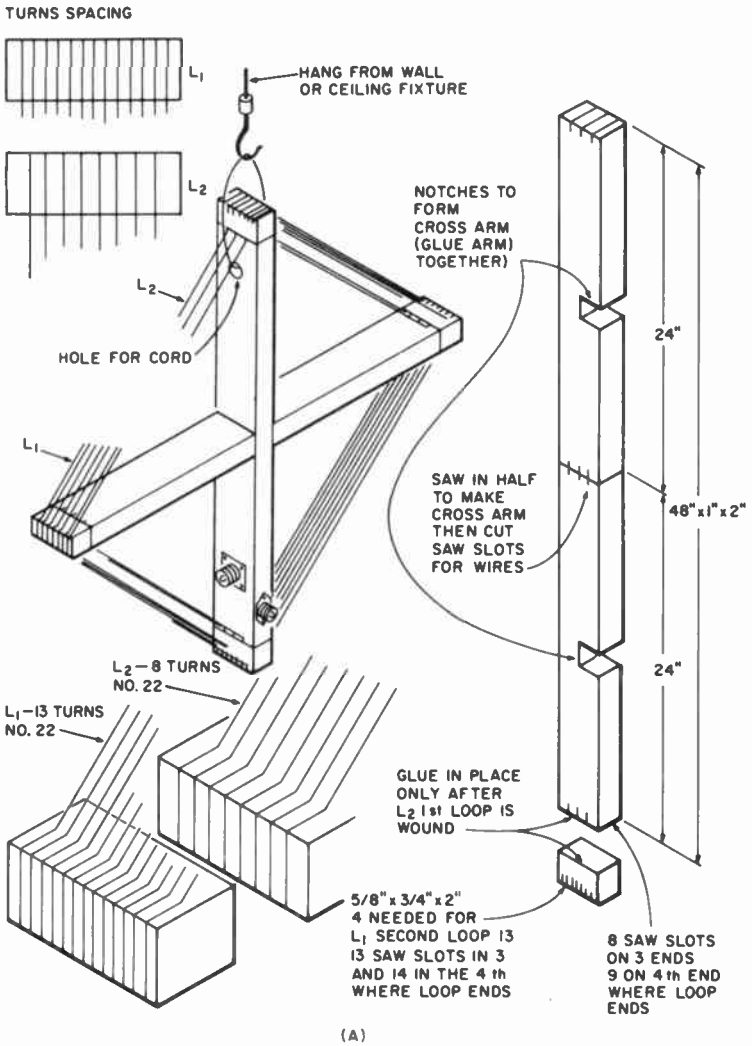


Fig. 12-9 (A) BCB Loop antenna.

A coax transmission line (RG-58U) exactly 42 inches long must be used to connect the BCB loop to the desk-control unit. The desk unit, in turn, is coupled to the receiver by

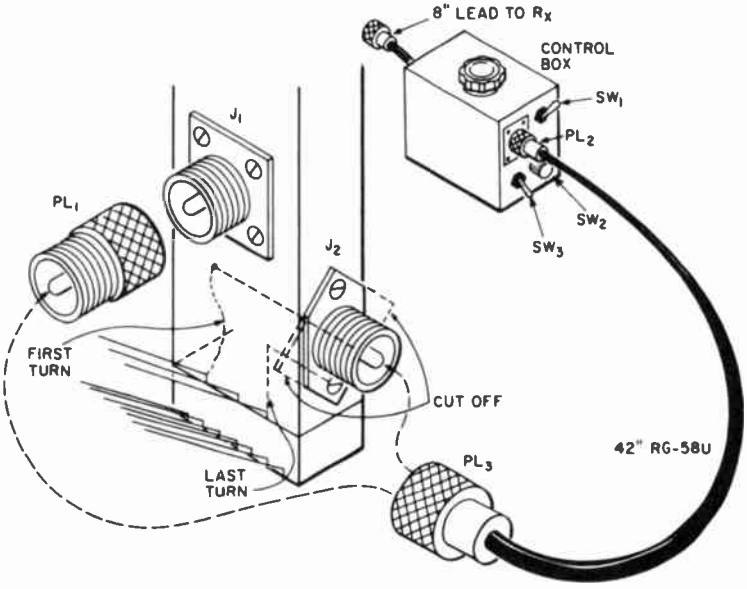


Fig. 12-9 (B) BCB Loop Antenna.

two short eight-inch leads: one connected to the antenna post or jack and the other to the receiver's ground post or jack. (No "external" ground should be used.)

The short receiver connection will allow the loop to work properly and also give you the option of enclosing a useful 100kHz calibrator in the same metal housing. (See previous project.) The calibrator, or marker may be a little broad, as it will no doubt be used on a receiver without a BFO, but it will work on the AM broadcast band. Just remember to turn it off once the 100kHz marking point has been located.

Loop Tuning the AM Broadcast Band. Pick a spot on the AM receiver dial between two locals. Next, turn the volume up all the way and hunt DX by tuning very slowly. Distant AM stations are usually weak and must be carefully and sharply tuned. Once a station is tuned in the loop is ready for tuning. If the 8-turn section is being used (J1) to cover a station in the 900-1600kHz range of the broadcast band, all

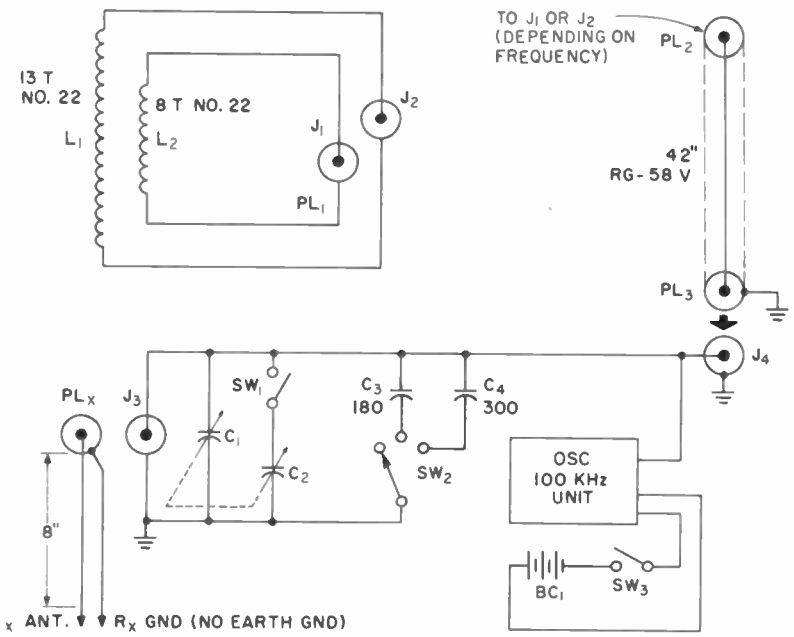


Fig. 12-10 BCB Loop antenna construction.

loop switches should be open on the high (or 1600kHz) end of the band. (This, in turn, will depend on where the DX station is on the AM dial.) As the dial is moved up toward the 900kHz middle of the AM band, SW1 (connecting C2) will need to be closed. As the center of the band is approached (or the 900kHz range), switch in C3 and then, at the dead center of the band, switch in C4. This switching is accomplished with one rotary control SW2. If, on the other hand, the DX station is on the lower (900-540kHz) end of the AM dial (J2), the 13-turn loop section will be used with all switches open at the center (or 900kHz) portion of the dial. (SW1 may or may not need to be closed here, depending on how the loop covers.) As the 540kHz or low end of the AM band is approached, SW2 will need to be closed, engaging C3; possibly C4 may be needed at the extreme 540 kHz end (again depending on how the loop is wound).

The clue to proper loop tuning depends on hearing a sharp increase in signal level as the desk-control tuning condenser is tuned. If nothing happens as the loop tuning knob is rotated, either the wrong loop section or the wrong switching arrangement for the station that was tuned on the receiver's AM dial is being used. Practice will correct this.

Once the signal level has been increased by "sharply" tuning the desk-control tuning knob, the loop is ready to be "nulled" or turned and the station direction can be zeroed in. The listener will find that he always has two "null" points 180 degrees apart. This "nulling" or turning of the loop will bring up the signal still more and cut sideband interference: this is the last step in loop tuning.

As the listener DX'es, he may want to tune for the loudest background-noise level between two locals. This will be necessary if he fails to hear a distant station between the two locals he has selected. In this case, the loop control is tuned (making sure the correct loop section and switches are engaged), and the DX'er listens for an increase in background noise as he hits the "thud" point. Next, the loop is slowly swung and, in this way, a distant station may be found. If it is, the receiver and loop tuning should be sharpened for the loudest signal level.

Parts List

C1-C2—Midget cut plate BCB Superhet Var./Cond. (surplus outlets; see Preface note)
C3—180 pF disc ceramic 1kV
C4—300 pF disc ceramic 1kV
L1—13 turns No. 22 magnet wire on a 24-inch cross arm
L2—8 turns No. 22 magnet wire on a 24-inch cross-arm
J1-4—SO-239 UHF receptacle Amphenol
PL1—UG-646 Right-angle Adapter Amphenol
PL2-4—PL-259 Plug UHF Amphenol
SW1-SW3—SPST toggle
SW2—Single-pole 3-position rotary
BC1—OSC. Battery
OSC. 100kHz Unit (surplus, etc.; see Preface note)
No. 22 magnet wire
RG-58U coax 42 inches long
Metal Box to house desk-tuning unit

glossary

adjacent channel interference: Interference from a station whose frequency is slightly below or above that of the desired station.

AFRTS: Armed (or American) Forces Radio and TV Service.

AGC (automatic gain control): Circuit that keeps the receiver volume level fairly constant even though the strength of the received signal may vary. Usually found on the better receivers. (Also, AVC, or automatic volume control.)

antenna array: A group of halfwave antennas erected for transmitting or receiving signals.

antenna farm: A term referring to the collection of antennas used by shortwave broadcasters for beaming their signals throughout the world.

antenna frequency: The highest frequency that is returned to earth, during a given transmission, is known as the "critical" antenna frequency.

aurora zone: An ionized "polar sky cap" (over both North and South poles). Auroras make reception over the poles very difficult most of the time. Sometimes, however, they can act as "mirrors" and bring in odd DX.

awards: DX clubs and some stations give awards for collections of QSL's, usually for all six continents and 25-50-75-100 countries, and so on.

balun: An antenna matching unit used to match 300-ohm antennas to 50- or 75-ohm transmission lines or receivers (or vice versa).

band edges: The extreme ends of the shortwave broadcast bands where much DX will be found.

bandspread: The ability to tune a receiver without station pile-ups. The ability to spread a single shortwave broadcast band across a wide portion of the dial. Mechanical bandspread is useful, but a combination of electrical and mechanical is best.

BCB: The standard AM broadcast band.

beat frequency oscillator (BFO): A special oscillator in a communications receiver used for the reception of SSB or code CW signals. A BFO is needed if a crystal calibrator (Xtal cal) is used for tuning.

blackout: A sudden fade or loss of signal because of propagation conditions.

carrier: The high-frequency radio signal upon which the audio signal is superimposed.

center fed: Feeding or terminating an antenna at the center (such as a dipole). This is the lowest impedance point and the best termination for a low-impedance (50-100-ohm) receiver input, such as a communications receiver. (See end termination.)

coax lead: A low-impedance (50-75 ohms), low-loss transmission line.

contests: Many stations in the international SW broadcast community sponsor contests to promote the station and country involved. For example, the contest may require that the listener write an essay on a specific topic. Prizes sometimes include trips to the country and station involved.

cross-modulation: Modulation of the desired signal by an undesired signal of nearly the same frequency or harmonic. Cross-modulation occurs within the receiver itself, and is usually caused by a local broadcast station. Often, the signal will appear at several points within the shortwave bands.

crystal calibrator (Xtal cal): A 100kHz oscillator used to divide the receiver dial markings into 100kHz-wide segments in order to help the DX'er locate his stations (by frequency).

crystal (Xtal) filter: A highly selective tuned circuit used in a receiver's I-F strip to improve the selectivity of the receiver when receiving code. Does not work well on voice reception.

curtain antenna: A favored high-gain transmitting antenna used by shortwave broadcasters. It consists of two widely separated support towers connected by a wire. Many vertical wires hang from the connecting wire, giving the antenna the appearance of a curtain.

curtain array: A collection of curtain antennas used only for beaming signals in many directions.

dipole: A halfwave, single-conductor antenna. One of the best receiving antennas for single-band use. Cut one for each band in use.

direct wire: Cable or telephone transmission and reception.

diversity receiver: As used here, *two* receivers are set up for diversity reception to reduce signal fading. The automatic volume controls of both receivers are tied together. One receiver is fitted with a flat top antenna and the other with a vertical antenna and both receivers are tuned to the same signal.

down in the mud: This refers to a signal that has become lost or hard to copy becuase it is fading or because the signal strength is not much higher than the normal background noise.

drift: The inability of a receiver to remain exactly on the frequency to which it is tuned. Drift is generally caused by heat.

DX atlas: Any standard world atlas marked for DX purposes (QSL's received, stations heard, etc.). Mediumwave and BCB DX'ers with cards from many cities within a state will profit by using a state-by-state highway atlas.

DX'ing: Searching for distant or rare (in this case, shortwave broadcast) stations.

DX receiver: Any good receiver is really a DX receiver. However, in this book the reference is usually to communications receivers needed to successfully work the tropical bands. Such receivers will make copy out of the weakest of stations if properly operated.

end termination: Connecting the transmission line (or lead-in) to the end (as opposed to the center) of an antenna. An end termination has high impedance and is used in portable receivers to match the high-input impedance of these receivers. (See center fed.)

fading: Dips in signal strength during reception.

first detector: Also known as the mixer or converter stage. This stage converts the R-F signal to an I-F signal. The mixer or first detector is also the first stage in receivers not equipped with an R-F stage. (See R-F stage.)

500kHz segment tuning: Crystal-controlled bands 500kHz wide. Each band is spread across the whole dial.

flat top: A reference, in the broad sense, to any flat, longwire antenna strung horizontally.

floating broadcast station: Commonly, a pirate station operating in international waters under no jurisdiction of any government.

frame antenna or loop: A box loop used for DX tuning of the mediumwave (MW) and longwave (LW) bands.

GMT (Greenwich Mean Time): A standard worldwide time system based on the twenty-four-hour clock. Used by all international shortwave broadcast stations for scheduling and programming.

ground: Generally speaking, a water-pipe connection to the receiver's ground post. Never use a gas-pipe connection.

ID: Station break, or ID, giving call sign and location, and time and frequency (or even power).

IFRB: International Frequency Regulation Board. A division of the Telecommunications Union whose purpose is to regulate international broadcast frequencies on a seasonal basis. However, some stations refuse to enter their proposed schedules.

I-F stage: One or more sharply tuned amplifier stages that amplify the I-F signal received from the first detector in all superhets. The I-F stage provides most of the signal amplification and selectivity for the receiver.

international SW broadcast bands: The overseas broadcast bands that beam powerful signals at a given target area in the language of the target area.

ionosphere: A region of the earth's atmosphere containing a great number of positive and negative ions. The ionosphere extends from about 25 to 400 miles above the earth. A reference to the E and F layers of outer space used as a mirror for long-distance SW transmissions.

ionospheric storms: Sometimes known as solar flares or sunspot storms, such storms may last anywhere from an hour to a few days. Reception may be poor to impossible if the storm is intense.

log: A private or commercial station's listing, or an operator's log of stations heard or worked.

logging: Keeping a record or records of the stations heard.

longwave: The frequency range from 60kHz to 540kHz (start of the low end of the AM broadcast band). Weather, ships, European broadcasts, etc.

longwire: Generally, any antenna 100 feet long or longer.

maximum usable frequency (MUF): The highest frequency reflected back to earth for a particular transmission path. MUF fluctuates according to propagation conditions and the sunspot cycle.

mechanical filter: A filter used in a receiver's I-F strip to manually vary the selectivity of the receiver from broad to narrow. Improves voice readability, but will give the signal a ringing sound.

mediumwave: 540-1600kHz. The standard AM broadcast band.

mirror: Refers to the layers (E or F) of the atmosphere that act as a mirror to reflect SW signals back to earth.

modulation: The audio signal that rides the AM carrier. Or, the process of superimposing the audio signal on the carrier.

multiband transistor portable: A transistor receiver containing the AM-FM broadcast bands plus one or more shortwave bands (having SW broadcast channels such as 25, 31, and 49 meters). Most of them also include 13, 16, and 19 meters, which means the set would have at least two SW bands. Some models will also have short- and longwave marine coverage and a few will have police and fire channels.

musical ID: Most international shortwave broadcasters use a musical theme when signing on and off. They can be spotted by this theme (no translation necessary) and it is known as their musical ID.

narrow passband: An I-F strip whose bandwidth has been made very narrow to reduce interference from stations near the frequency being received.

noise: Random, unintelligible electrical disturbances interfering with or blocking reception of the desired signal.

noise canceling: In this book, the term refers to the phasing action of a dipole antenna and its ability to "cancel out" incoming noise to the receiver.

noise limiter: A circuit used in many communications receivers to reduce man-made or other noises hindering reception.

overseas bands: Commonly used when referring to the international shortwave broadcast bands.

polar projection map: A map of the world centered on the North Pole.

QSL: The acknowledgement requested by a listener from a station in answer to his reception report. Usually a full-color picture postcard with report data on the back.

random wire: Any antenna wire of an odd length not cut for a band in use. Random wire antennas are not nearly as effective as halfwave antennas cut for a specific band.

reception report: A valid report sent by a listener to a station to prove reception of a given program. It must contain: The GMT log date and time of reception, the station's frequency in megahertz, the waveband in meters, and the SINPO code for reception quality. Also includes the condition of adjacent channels at the time of reception and the type of antenna and receiver being used. To this must be added detailed program information (what the program was about, musical selections, or any other information that will prove that the listener was actually listening to the program) if the report is to merit a QSL card.

relay station: An auxiliary station expressly for the broadcasting or rebroadcasting of a given outlet's program to

improve reception in a specific area. For example, the VOA relay stations are scattered throughout the world.

report forms: This refers to standard reception report forms issued by the many SW DX clubs and shortwave broadcast stations.

R-F stage: A tuned voltage amplifier that selects and amplifies a narrow band of high-frequency radio signal received from the antenna. After amplifying the R-F signal, the R-F stage feeds the signal to the first detector or converter, where the signal is changed to an I-F stage.

S-meter: A tuning indicator found on most good SW receivers to provide an indication of the strength of the received signal. The scale of the S-meter is calibrated in "S" units from 0 to 9. The receiver is tuned for the highest "S" reading. The scale of some S-meters is also calibrated in dB's above S9. Thus, a reading above S9 would be expressed as "3dB above S9," "10dB above S9," etc. Some S-meters provide only a relative indication of signal levels for the particular receiver; they are meaningless when compared with the "S" reading on another receiver. Other S-meters are calibrated in absolute values; for example, a signal of 50 microvolts at the antenna will produce an S9 reading. Thus, a reading of S6 or 10dB over S9 will be an absolute, rather than a relative, value.

second detector: This stage removes the audio signal from the carrier signal so that it can be heard in a speaker.

selectivity: The receiver's ability to reject stations on frequencies close to the frequency of the station being received.

sensitivity: A receiver's ability to pull in weak signals that can be copied. Good shortwave receivers have a sensitivity of 1μV (microvolt) or better.

shortwave: 1.6MHz to 30MHz. Covers the range of the average communications receiver (from the high 1600 kHz end of the AM broadcast band through 10 meters). Most communications receivers also include the AM broadcast (or mediumwave) band.

SINPO code: A five-step quality report recognized by all international SW broadcasters: S-signal strength; I-interference; N-noise; P-propagation; O-overall merit. Each letter has five progressive stages: 1, poor, through 5, excellent (nil for INP). Therefore, the best station rating is 55555.

skywave: The wave from the transmitter that reaches the receiver via reflection from the ionosphere.

SSB (single sideband): A mode of transmission in which only one sideband, rather than both, is transmitted. A BFO and product detector are required for SSB reception on communications receivers.

static: Atmospheric electrical charges that cause a crackling sound in the receiver; usually, a summer problem on the low-frequency shortwave bands (tropicals) and the AM broadcast band, sometimes blocking out all reception.

sunspot cycle: The eleven-year (approximately) period over which sunspot activity rises from minimum to maximum and back to minimum agian.

sunspot numbers: An indication of sunspot activity during the eleven-year sunspot cycle. During the first few years and the last few years of a cycle, sunspot numbers are usually in the 60 to 70 range. They often reach a hundred or more during the peak middle years.

target area: The country or countries to which the shortwave broadcast is beamed.

Telecommunications Union: The recognized world agency concerned with communications and telecommunications, based in Geneva, Switzerland. Publishers of frequency listings, a journal, etc. (Also see IFRB.)

time lag: The difference in time between reception of the great circle short-path signal and the long-path signal. Time lag is the cause of the flutter, which often spoils reception.

trap dipole: A long single dipole used to match several SW bands by the use of wave traps spaced along the dipole. Such dipoles are limited to narrow band use.

tropicals: The bands (60-120kHz) favored in the tropics for home-service broadcasts because of high static problems existing on the regular 540 to 1600kHz AM broadcast band. Broadcasts on the tropical bands are almost always in the language of the country broadcasting. Such broadcasts are always weak and are seldom beamed. This makes them a catch for the DX'er.

tunable loop: A rotatable loop that has a variable condenser to further peak the signal after the loop is aligned for best reception.

valid report: DX clubs and SW broadcasters have generally agreed on the necessary data to make a reception report valid. Basically they are: Call, Frequency and meterband, GMT, SINPO code, channel conditions, program details, and the type of antenna and receiver. (See reception report.)

vertical: Any vertical or pole antenna, including the whip on a portable.

whip antenna: A small vertical antenna used on shortwave portable radios.

WWV: National Bureau of Standards transmitting station that broadcasts signals of extremely high accuracy throughout the radio frequency spectrum (5MHz, 10MHz, etc.). Also broadcasts precise time signals.

zero in: Carefully rocking the dial back and forth to fine-tune a station.

zeroing in the loop: Nulling or sharpening up the loop signal for best reception.

index

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