

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**

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# SHORTWAVE LISTENER'S HANDBOOK

*Revised Second Edition*

NORMAN FALLON



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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

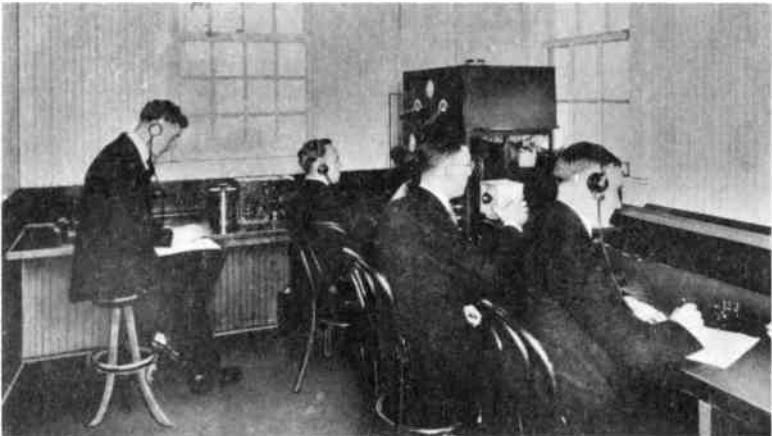


Fig. 1-1 A famous first claimed in AM broadcast radio: On November 2, 1920, the Harding-Cox election returns were heard over KDKA radio, Pittsburgh. (KDKA photo)

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 short-waves for broadcasting, besides the Iron and Bamboo Curtain

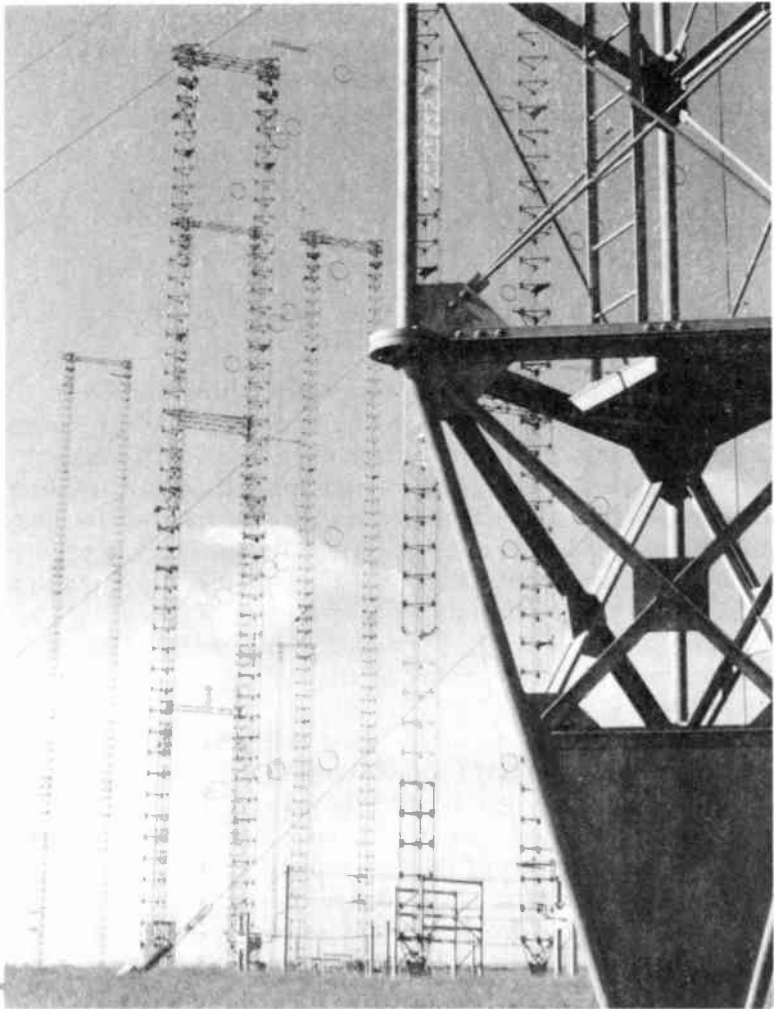


Fig. 1-3 Voice of America has relay stations all over the world, feeding giant antenna arrays—like this one in Tianang, Philippines. (VOA photo)

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

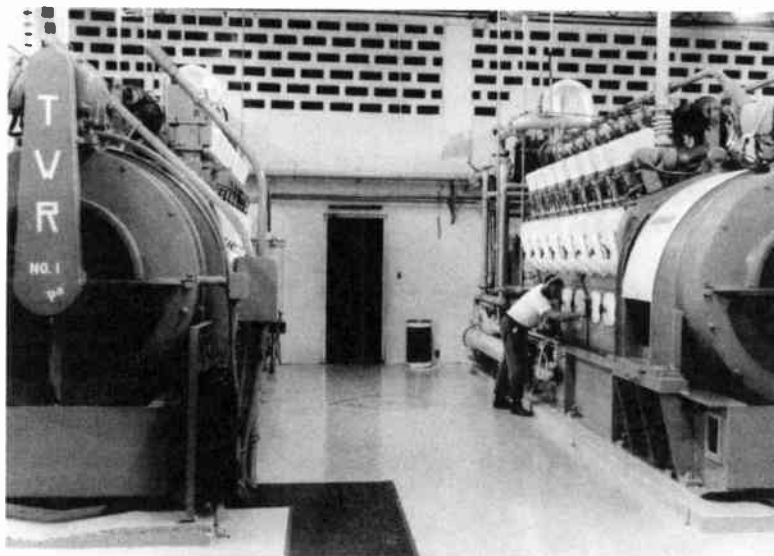


Fig. 1-6 Trans-World Radio generates 3.2 Million watts of power for the operation of it's transmitters. (TWR photo)

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 short-wave 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 short-wave 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.

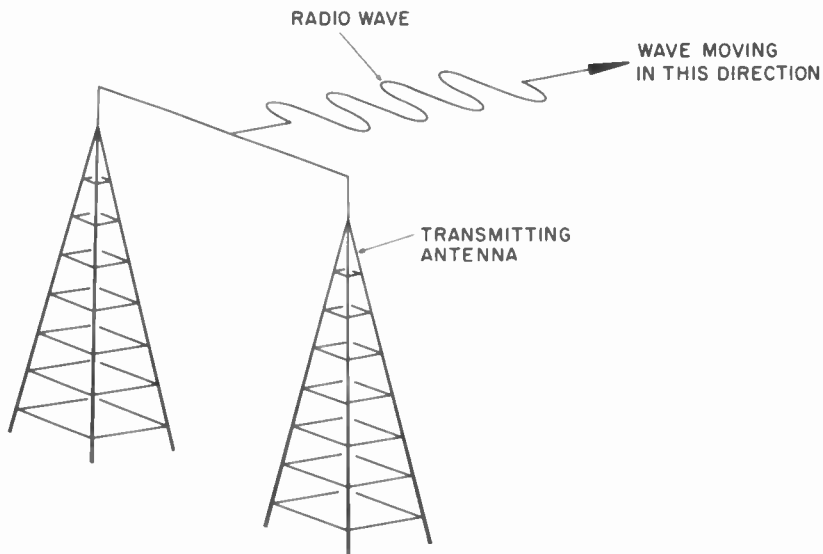


Fig. 2-1 Radio wave radiated into space.

### 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

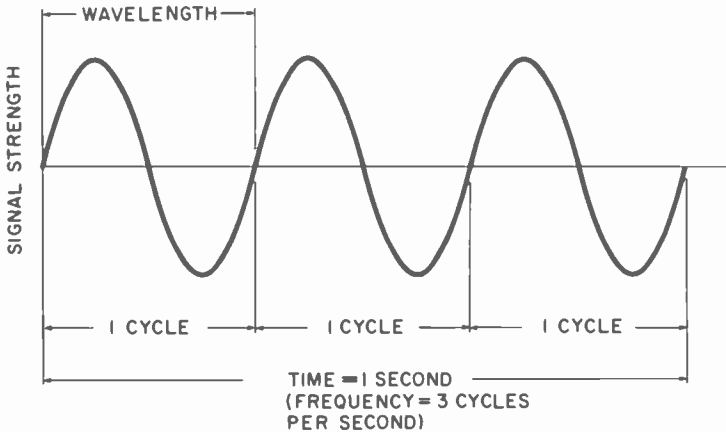


Fig. 2-2 Frequency and wavelength of a radio wave.

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

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

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

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

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

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

It's important to understand wavelength, because short-wave 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.

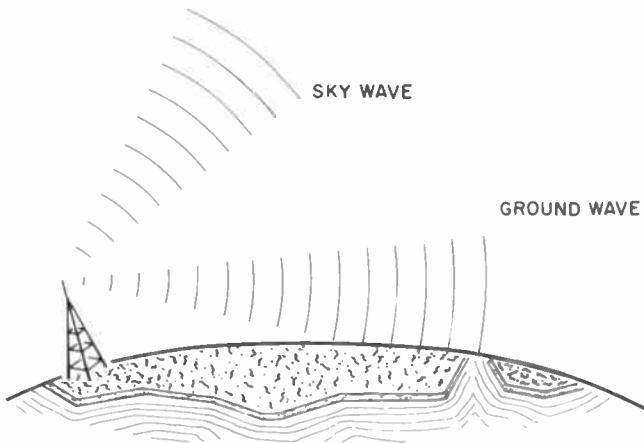


Fig. 2-3 A transmitted signal consists of a ground wave and a sky wave.

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*.

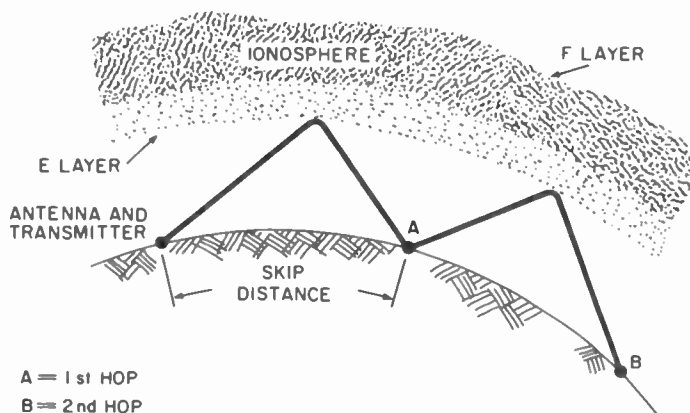


Fig. 2-4 Radio wave reflected from the ionosphere.

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.

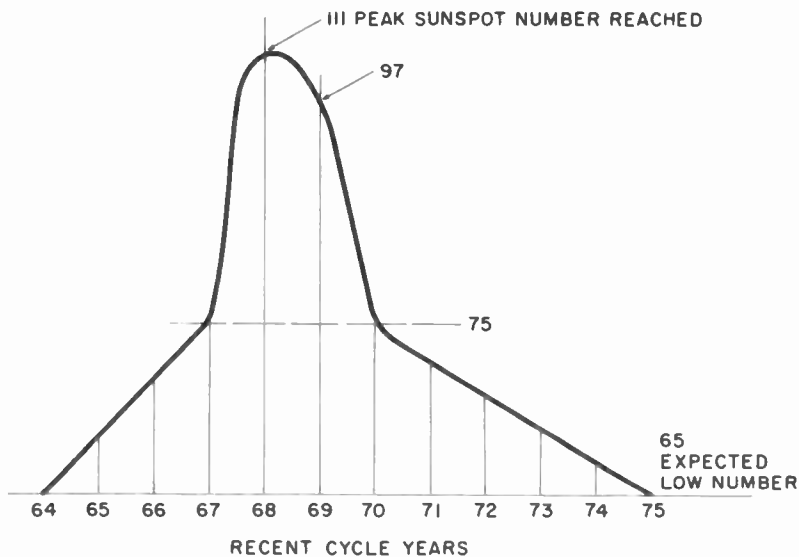


Fig. 2-5 The sunspot cycle.

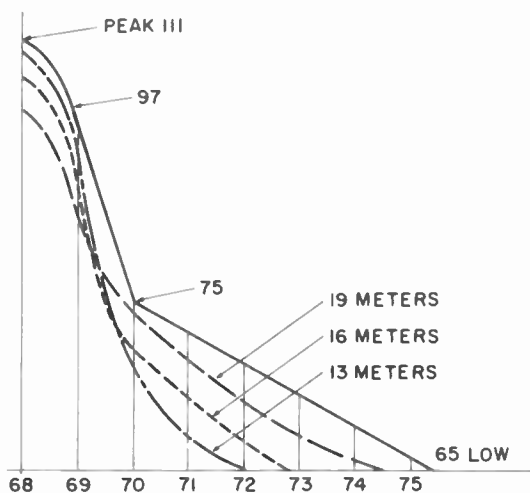


Fig. 2-6 How the recent cycle really looked to the listener. The upswing starts again in 1976.

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.





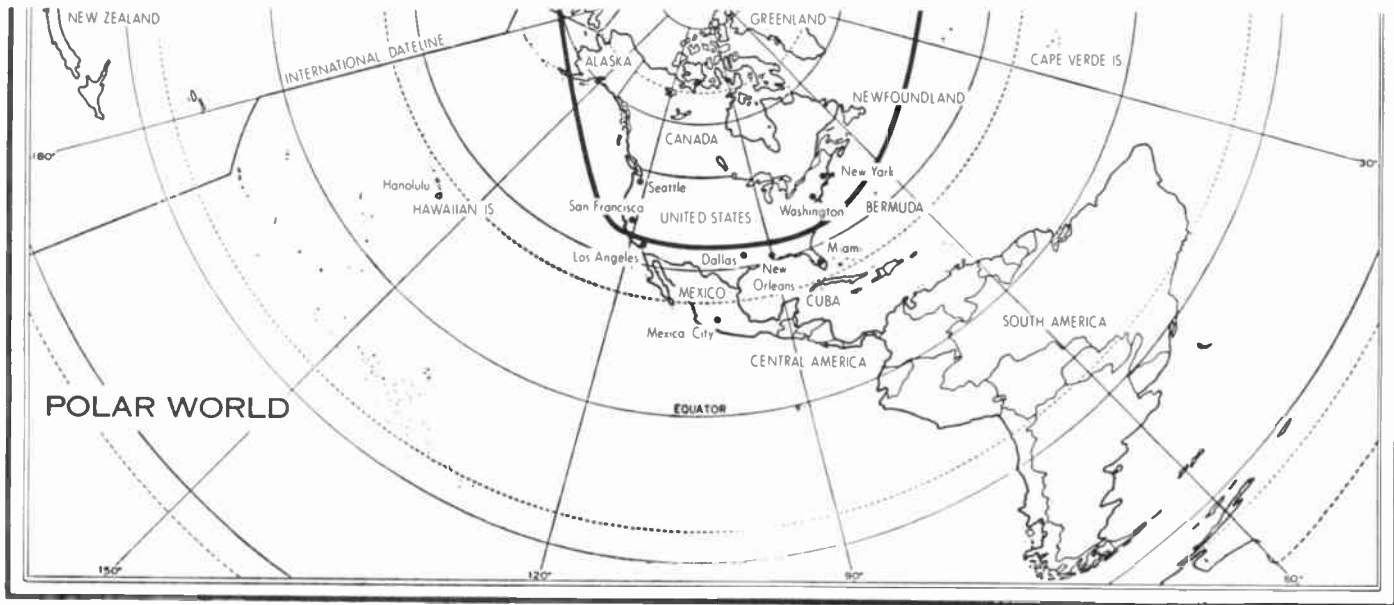


Fig. 3-1 Areas affected by aurora zone.

## 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:

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

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

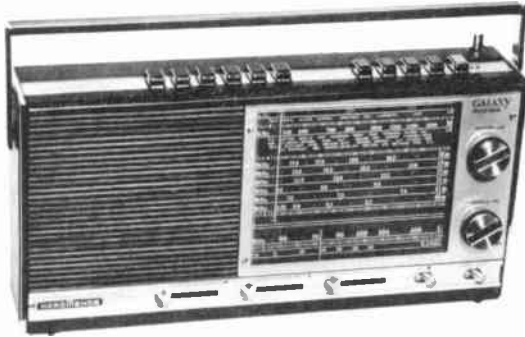


Fig. 4-3 The NordMende Galaxy 6606 is a fine 9-band receiver selling for a little under \$200.

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  $\pm 1\text{kHz}$ ) 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  $0-450 \pm 1\text{kHz}$ ). 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:

<i>Band</i>	<i>Antenna Length</i>
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 HALF-WAVE 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 half-wave 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

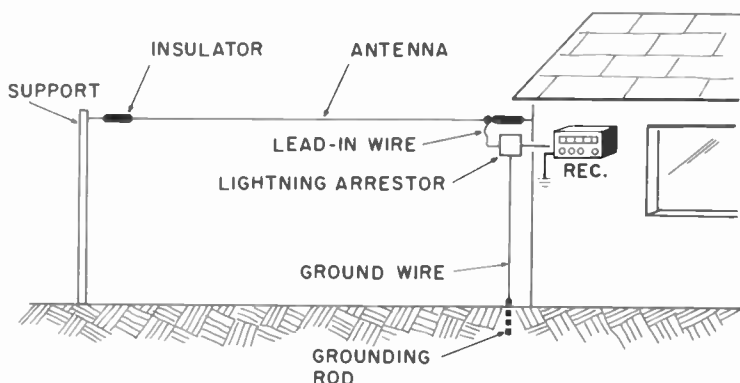


Fig. 5-1 A typical end-terminated Hertz antenna.



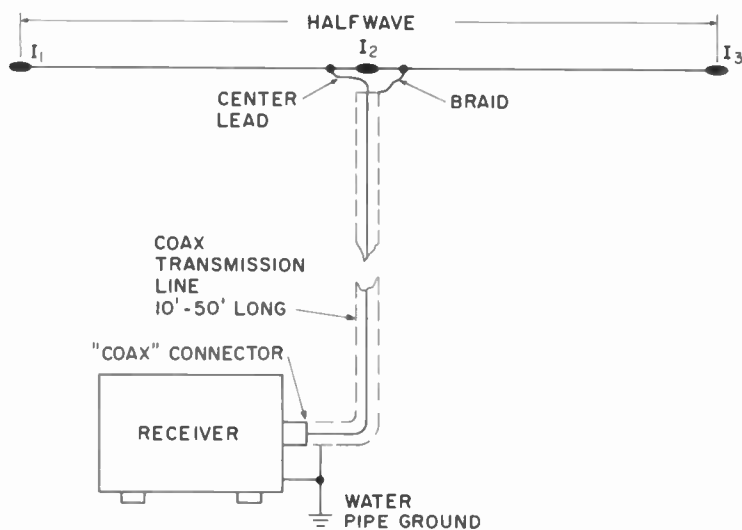


Fig. 5-2 Halfwave dipole.

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 tropics (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).

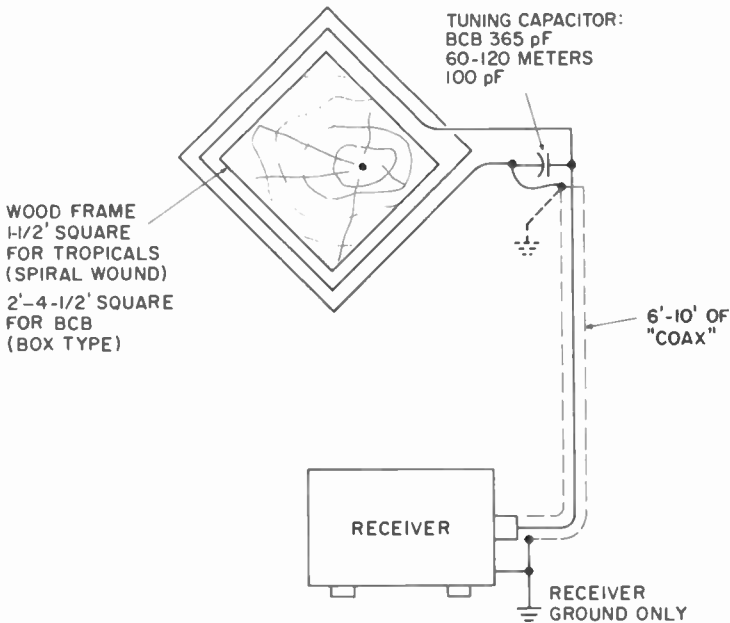


Fig. 5-3 Tunable loop for the tropical and broadcast bands. Use two or three turns for the tropicals and five or six turns for the BCB.

### 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).

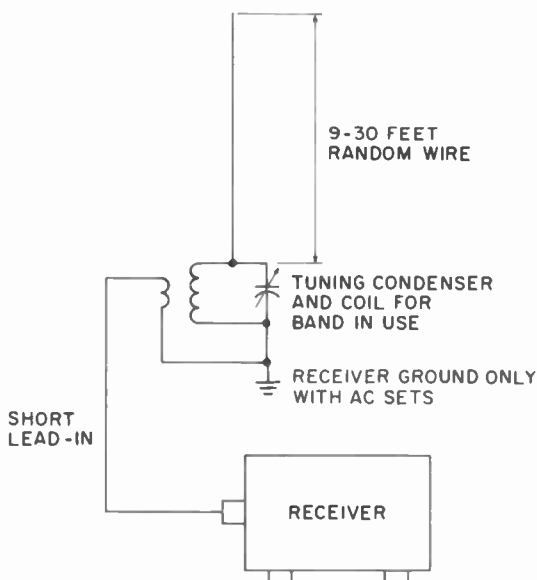


Fig. 5-4 Antenna coupler tuning with a short vertical antenna.

### 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.

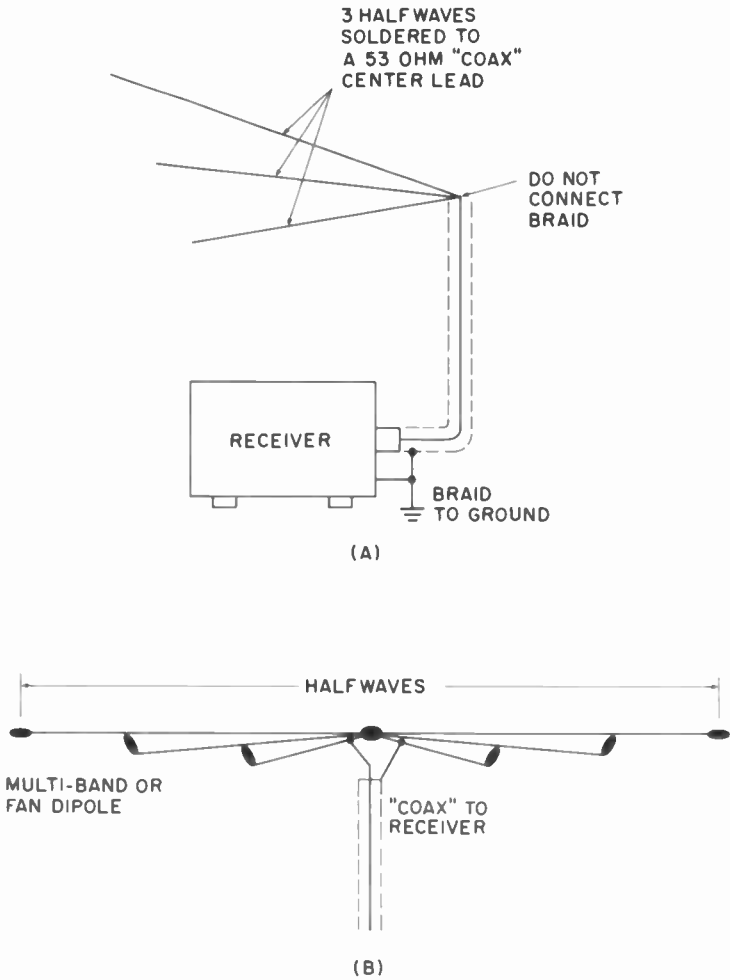


Fig. 5-5 Fan vertical (A) and multiband fan dipole (B).

### 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

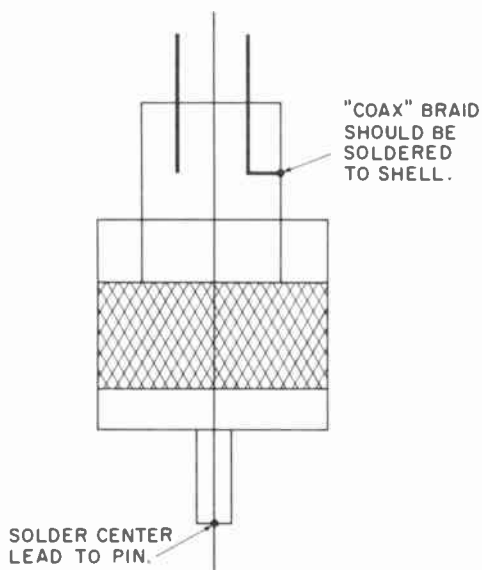


Fig. 5-6 Coax connector assembly.

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

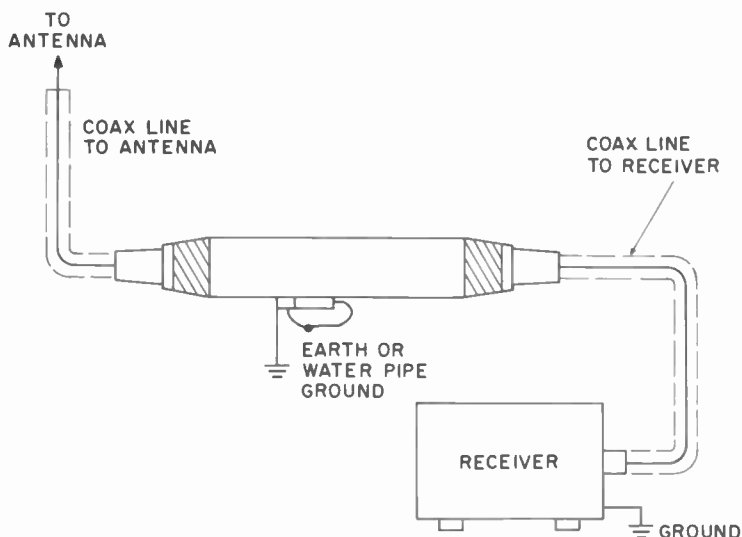


Fig. 5-7 Lightning arrester.

### 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

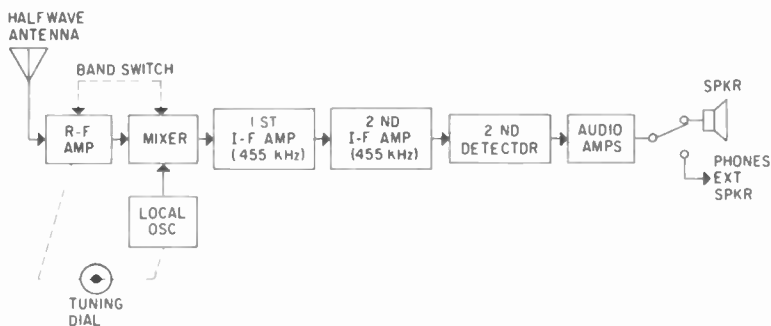


Fig. 6-1 Average listener's superhet receiver.

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.

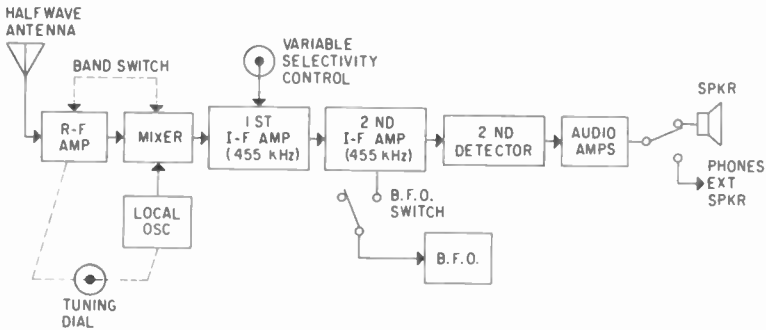


Fig. 6-2 Communications superhet.

## 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  $\pm 1$ kHz on a dial reading 0 to 500.

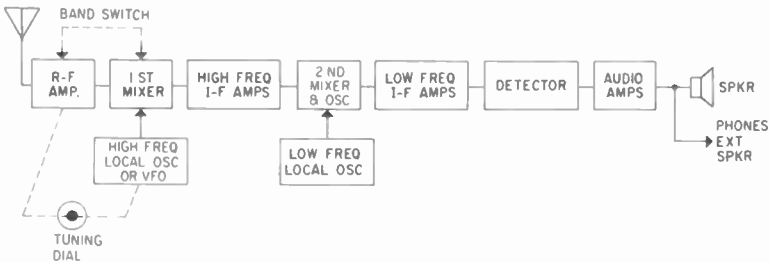


Fig. 6-3 Basic dual conversion receiver.

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).

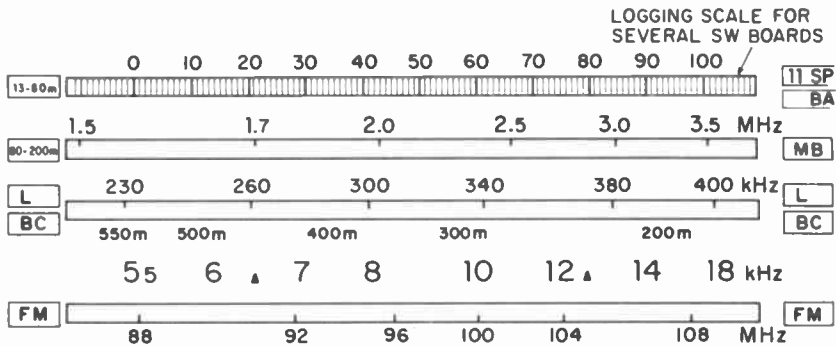


Fig. 6-4 Frequencies spread across the dial.

### 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.

## Bandsread

*Bandsread* 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  $\pm 1$ kHz 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

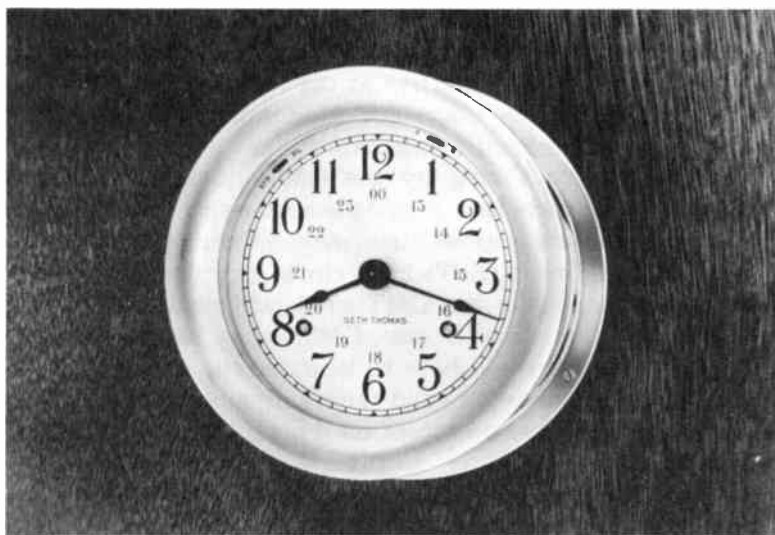


Fig. 7-1 GMT clock.

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

GMT TIME _____	DATE _____
RADIO _____ in _____	
METERS _____	FREQ. _____
DIAL READING _____	

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.

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

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

<p>Dudapest. Országos Parlament Parlament Egyasnov. Helyzet F. to J. J. M. T. T.</p> <p><b>RADIO BUDAPEST</b> HUNGARY _____ March 11th _____ 19 70 _____</p> <p><b>DEAR LISTENER</b></p> <p>Many thanks for your report of reception of our transmission dated _____ 21/Feb. _____ 19 70 _____ 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 _____ mc/s. We shall appreciate your further reports, as well as comments on our broadcasts.</p> <p>Yours faithfully, <b>FOREIGN LANGUAGE BROADCAST DEPARTMENT</b></p> <p>EF 1510 691</p>	<p>Mr. John Smith 1201 W. 142 St. New York, N. Y. 10125 U. S. A.</p>	<p>Képfelirás: Alap Kiadóvállalat, Budapest</p>
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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
SINPC: _____ 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

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### 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.

# 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.

### 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.

*West Virginia*, Wheeling—WWVA  
1170kHz.

*Wisconsin*, Milwaukee—WTMJ  
620kHz.

*Wyoming*, Casper—KTWO  
1030kHz.

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

kHz	m	kw	Stations & Countries	kHz	m	kw	Stations & Countries
3308	90.70	1.5	Ondas Duevedañas, Ecuador				
3310	90.63	10/0.25	Ouelimane, Moçambique	3395	88.50	0.3	R. Industrial, Peru
3315	90.50	10	AIR Bhopal, India	88.37	1		Medan, Indonesia
	90.50	4	R. Martinique, Martinique	88.37	0.5		Biak, Indonesia
	90.50	1	R. Gazeta de Alagoas, Brazil	88.37			R. Dif. Goiania, Brazil
	90.50	0.5	R. Itatiaia, Brazil	88.37	1		R. Tapuyo de Mossoró, Br.
	90.50	1	R. Maracay, Venezuela	88.37	0.35		R. Suriname, Surinam
3316	90.46	5/10	Freetown, Sierra Leone	88.37	1		R. Universidad, Venezuela
3320	90.34	1	R. Erpa, Peru	3396	88.34	10	Kaduna (NBC), Nigeria
3325	90.23	1	Palankaraya, Indonesia	88.34	20		Gwelo, Rhodesia
	90.23	2	R. Borborema, Brazil	3448	87.11	0.75	Purwokerto, Indonesia
	90.23	0.1	R. Dif. Guarulhas, Brazil	3450	86.96	120/240	R. Peking, China
	90.23	5	R. Monagas, Venezuela	3465	86.58	1	Pakanbaru, Indonesia
3326	90.20	7.5	Kaduna (NBC), Nigeria	3520	85.23	0.2	R. Escuelas Radiales, Ecua.
13330	90.09	3	CHU, Dominion Observatory, Can.	3615	82.99	0.4	R. Pillaro, Ecuador
	90.09	1	R. Progreso, Peru	3704	80.99	1	Nova Lisboa, Angola
3331	90.06	4	Ozaoudi, Comores Islands	3755	79.90	0.4	R. Latacunga, Ecuador
3335	89.95	1	R. Marajoara, Brazil	3830	78.33	20/240	R. Peking, China
	89.95	0.5	Vóz do Serião, Brazil	3835	78.23	0.35	La Voz del Triunfo, Ecuador
3336	89.95	4	Zigunchor, Senegal	3900	76.92	20/240	R. Peking, China
3338	89.87	5/100	R. Clube de Moçambique		76.92		Fukien, China
3339	89.85	10	R. Tanzania, Zanzibar	3905	76.83	10/100	AIR Delhi, India
3340	89.81	2	La Estación de la Alegria, Ec.		76.83	0.5	Port Vila, New Hebrides
3345	89.68	2	R. Kashmir, India	3910a	76.73	1	R. Barlavento, Cape V. Isl.
	89.68	10	Pontianak, Indonesia		76.73	10/1	Tokyo (FEN), Japan
	89.68	1	R. Alvorada, Brazil		76.73	5	Seoul, Korea
	89.68	1	R. Central, Venezuela	3915	76.64	15/100	BBC London, Gt. Britain
3346	89.68	20	Lusaka, Zambia		76.64	20/240	R. Peking, China
3350	89.55	4	Franceville, Gabon		76.64	0.3	Ternate, Indonesia
	89.55	10/20	Accra, Ghana		76.64	7.5/100	BBC, Malaysia
	89.55	1	R. 27 de Diciembre, Bolivia	3925	76.43	50	Tokyo, Japan
	89.55	1	R. Independencia, Peru		76.43	10	Port Moresby, Australia
3355	89.42	10/0.25	Nampula, Moçambique	3930	76.34		Huhehot, Inner Mongolia
	89.42	7.5	AIR Kursong, India	3935	76.24	5	Semarang, Indonesia
	89.42	4	R. Nouméa, New Caledonia		76.24	35/100	Okinawa (VDA), Ryukyus Isl.
	89.42	0.25	La Voz Romana, Dom. Rep.	3945	76.05	1	Denpasar, Indonesia
	89.42	1	R. Ondas de Huallaga, Peru		76.05	0.3	Ternate, Indonesia
	89.42	0.3	R. Luz, Peru		76.05	10	Sapporo/Tokyo, Japan
	89.42	1	R. Valencia, Venezuela		76.05	0.5	Cotabato, Philippines
3356	89.40	10	Gabernes, Botswana	3950	75.95		Sining, China
3360	89.29	0.2	La Voz Nahuatlá, Guatemala	3952	75.90	15/100	BBC London, Gt. Britain
	89.29	0.5	R. Huánuco, Peru	3958	75.78	0.5	Stanley, Falkland Islands
3365	89.15		Lanchow, China	3960	75.76	10/100/250	R. Free Europe
	89.15	10/100	AIR Delhi, India		75.76	1	R. Barlavento, Cape V. Isl.
	89.15	0.5	Manokwari, Indonesia		75.76	20/240	R. Peking, China
	89.15	1	R. Exitos, Dom. Rep.		75.76		Urumchi, China
	89.15	1	R. Tovar, Venezuela		75.76	0.1	Kendari, Indonesia
3366	89.12	10/20	Accra, Ghana		75.76	10	Padang, Indonesia
	89.12	10/0.25	Nampula, Moçambique		75.76	100	Baghdad, Iraq
3370	89.02	4	R. Université, Malagasy Rep.	3970	75.57	10/100/250	R. Free Europe
	89.02	0.5	R. Universidad, Bolivia		75.57	1	R. Clube Huila, Angola
3372	88.96	0.25	R. Iris, Ecuador		75.57	8	R. Busa, Cameroon
3373	88.94	5/100	R. Clube de Moçambique		75.57		Huhehot, Inner Mongolia
3375	88.89	10	R. Angola, Angola	3972	75.52	25	Ulan Bator, Mongolia
	88.89	10	AIR Gauhati, India	3975	75.47	0.6	R. Sira, Ecuador
	88.89	1	Djambi, Indonesia	3980	75.38	8	Munich (VDA), Germany
	88.89	1	R. San Juan, Dom. Rep.		75.38	15	Baku, USSR
	88.89	1	R. Olinda Pernambuco, Br.	3985	75.28	100	Schwarzenburg, Switzerland
	88.89	1	La Voz de la Fé, Venezuela		75.28	0.5	R. Cordac, Burundi
3378a	88.81	0.25	R. Iris, Ecuador		75.28	0.25	Merauke, Indonesia
3380	88.76	10	Blantyre, Malawi		75.28	0.2	Seoul (VUNC), Korea
	88.76	1	R. Shortis, Guatemala		75.28	1	Esc. Radiofónicas Pop, Ec.
	88.76	1	R. Chiclayo, Peru	3990	75.19	20	R. Liberty
3385	88.63	10	Colombo, Ceylon		75.19	50	Monrovia (VDA), Liberia
	88.63	0.5	Kupang, Indonesia		75.19	1	AFNT, Taiwan
	88.63	10	R. Rabaul, New Guinea	3995	75.09	10/100/250	R. Free Europe
	88.63	0.5	R. Clube Teresina, Brazil		75.09	5	R. Roma, Italy
	88.63	0.5	R. Dif. do Paraná, Brazil		75.09	5	Solomon Islands
	88.63	4	Cayenne, Fr. Guiana		75.09	0.5	La Voz del Rio Tarqui, Ec.
	88.63	1	La Voz del Valle Montaro, P.	3999	75.02	1.5	Godthab, Greenland
	88.63	1	R. Barcelona, Venezuela	4000	75.00		Tengkou, China
3390	88.50	1	R. Zaracay, Ecuador	4008	74.81	15	Frunze, USSR
				14010	74.80		San Francisco, USA

kHz	m	kw	Stations & Countries	kHz	m	kw	Stations & Countries
4020	74.63	120/240	R. Peking, China				
4035	74.35	20/240	R. Peking, China	4790	62.70	1	R. Horizonte, Peru
	74.35		Lhasa, Tibet		62.63	10	R. Malaysia, Malaysia
4040	74.26	50	Erevan, USSR		62.63	1	R. Primero de Mayo, Hon.
4055	73.98	50	Petropavlovsk, USSR		62.63	1	R. Sistema Atalaya, Ecuador
4060	73.89	20/240	R. Peking, China		62.63	0.4	R. Narca, Peru
4069	73.74		Huhehot, Inner Mongolia	4795	62.63	5	Ondas Porteñas, Venezuela
4080	73.53	50	Sempalatinsk, USSR		62.57	10	R. Com. de Angola, Angola
4085	73.44	50	Ulan Bator, Mongolia		62.57	4	R. Brazzaville, Congo
4100	73.17	50	Kzyl Orda, USSR		62.57	1	R. Nueva América, Bolivia
4110	72.99		Urumchi, China		62.57	1	R. Congonhas, Brazil
4200	71.43	120/240	R. Peking, China		62.57	0.5	R. Copacabana, Brazil
4220	71.09	20/240	R. Peking, China		62.57	2	R. Tabajara, Brazil
	71.09		Urumchi, China		62.57	1	La Voz del Comercio, Col.
4250	70.59	120/240	R. Peking, China	4800	62.50	10	AIR Hyderabad, India
14265	70.34	5	Elmshorn, Germany		62.50	0.25	R. Amazonas, Ecuador
14286	70.00	10	Belconnen, Australia		62.50	0.5	R. Onda Azul, Peru
4310	69.61		Chimkent, USSR		62.50	10	R. Lara, Venezuela
4380	68.49		Fukien, China	4804	62.45	5	Kisumu, Kenya
4460	67.26	120/240	R. Peking, China	4805	62.43	50	Djakarta, Indonesia
14478	67.00		Sydney, Australia		62.43	0.5	Fak Fak, Indonesia
4485	66.89	50	Petropavlovsk, USSR		62.43	5	R. Dif. do Amazonas, Brazil
4500	66.67		Urumchi, China	4807	62.41	4	St. Denis, Réunion
4510	66.52	50	Andizhan, USSR		62.41	10	R. Clube de Sao Tomé
4520	66.37	50	Khanty Manzyvsk, USSR		62.37	0.3	La Voz del Manabí, Ecuador
14525	66.30	5	Nauen, G.D.R.		62.37	0.2	R. Coro de Sta. Cecilia, Ec.
	66.30		Sinhait, China		62.37	1	R. Popular, Venezuela
	66.30		Honolulu, Hawaii	4815	62.31	25	Duagadougou, Upper Volta
4544	66.00	50	Alma Ata, USSR		62.31	1	R. Los Andes, Bolivia
4610	65.08	50	Vladivostok, USSR		62.31	1	R. Icarera Fortaleza, Brazil
4620	64.94	120/240	R. Peking, China		62.31	1	Petropolis R. Dif, Brazil
4635	64.72	50	Dushanbé, USSR		62.31	1	R. Amazonas, Peru
4684	64.05		Hanoi, Vietnam (Dem. Rep.)	4820	62.24	10	La Voz de Huamanga, Peru
4715	63.56	0.25/0.45	R. Cl. Mindelo, C. Verde Isl.		62.24	3.1	R. Gambia, Gambia
4750	63.16	10	Lubumbashi, Congo D. Rep.		62.24	0.25/10	AIR Calcutta, India
	63.16	20	Makassar, Indonesia		62.24	5	R. Evangelica, Hond. Rep.
	63.16	0.25	R. El Mundo, Ecuador		62.24	0.2	Guadalajara, Mexico
4755	63.09		Sibolga, Indonesia		62.24	2	La Estación de la Alegría, Ec.
	63.09	0.25	R. Yoro, Honduras Rep.		62.24	0.45	R. Puno, Peru
	63.09	1	R. Brasil, Brazil		62.24	1	La Voz de Apure, Venezuela
	63.09	0.1	R. Dif. Maranhão, Brazil	4825	62.18	15	Ashkabad, USSR
4756	63.08	10	Suva, Fiji Islands		62.18	1	R. Grigota, Bolivia
	63.03	5	R. Bolivia, Bolivia		62.18	0.5	Educ. de Parnaba, Brazil
	63.03	1	R. Frontera, Venezuela		62.18	0.5	R. Cl. de Varginha, Brazil
4765	62.95	50	R. TV Congolaise, Congo		62.18	1	R. Narino, Colombia
	62.95	1	R. Feira de Santana, Brazil		62.18	1	R. San José, Peru
	62.95	1	R. Dif. del Ecuador, Ecuador	4830	62.11	5	R. Thailand, Thailand
4770	62.89	0.5	R. Diamang, Angola		62.11	0.5	Ondas del Angel, Ecuador
	62.89	10	R. St. ELWA, Liberia		62.11	1	La Voz del Táchira, Ven.
	62.89	1	R. Continental, Hond. Rep.	4835	62.05	60	Erevan, USSR
	62.89	0.4	R. Cenit, Ecuador		62.05	18	R. Mali, Mali
	62.89	1	R. Guayaquil, Ecuador		62.05	20/10	R. Malaysia, Sarawak
	62.89	0.5	R. Cajamarca, Peru		62.05	1	R. Dif. Roraima, Brazil
	62.89	1	R. Bolivar, Venezuela		62.05	0.5	R. Triangulo Mineiro, Brazil
4775	62.84	100	R. Afghanistan, Afghanistan		62.05	1	R. Buenaventura, Colombia
	62.84	10	AIR Gauhati, India		62.05	1	La Voz del Valle, Ecuador
	62.84	7.5	Djambi, Indonesia		62.05	0.35	R. Sicuan, Peru
	62.84	0.1	R. Onkoi, Bolivia		62.05	0.5	R. Sudamericana, Peru
	62.84	5	R. Dragão do Mar, Brazil	4840	61.98	2	Novo Redondo, Angola
	62.84	5	R. Progresso, Brazil		61.98	10/100	AIR Bombay, India
	62.84	1	Los Voz de Mana, Colombia		61.98	1	R. Andahuaylas, Peru
4777	62.80	30	R. Gabon, Gabon		61.98	1	R. Atántida, Peru
	62.76	1	R. Atahualpa, Ecuador		61.98	1	R. Valéria, Venezuela
	62.76	1	La Voz de Carabobo, Ven.	4845	61.92	10	Francistown, Botswana
	62.72	18	R. Mali, Mali		61.92	10	R. Malaysia, Malaysia
4783	62.72	18	R. Tanzania, Tanzania		61.92	0.5	R. Católica S. Isidro, Hon.
4785	62.70	10	R. Indoamérica, Bolivia		61.92	1	D. Dif. Teresina, Brazil
	62.70	1	R. Cult. Casari, Brazil		61.92	1	R. Bucaramanga, Colombia
	62.70	0.5	R. Ribamar, Brazil		61.92	1	La Voz del Chira, Peru
	62.70	1	Ecos Combeima, Colombia	4850	61.86	50	Tashkent, USSR
	62.70	0.2	La Voz de Bolivar, Ecuador		61.86	1	Carmona, Angola
					61.86	30	R. Mauritania, Mauritania

kHz	m	kw	Stations & Countries	kHz	m	kw	Stations & Countries
	61.86	10	Forest Side, Mauritius	4914	61.05	0.25	La Voz del Pacifico, Hon.
	61.86	2	AIR Kohima, India	4915	61.03	10/20	Accra, Ghana
	61.86	0.25	Ondas del Zamora, Ecuador		61.03	1	R. Amboro, Bolivia
	61.86	10	Ondas Popular, Venezuela		61.03	1	R. Cult. de Araraquara, Br.
4855	61.79	5/100	R. Clube de Moçambique		61.03	2	R. Dif. de Macapá, Brazil
	61.79	10	Enugu, Nigeria		61.03	0.5	R. La Hora, Peru
	61.79	10	Palembang, Indonesia	4916	61.03	0.3	R. El Trebol, Ecuador
	61.79	1	R. Corona, Honduras Rep.	4920	60.98	10	AIR Madras, India
	61.79	1	R. Centenario, Bolivia		60.98	10	Brisbane, Australia
	61.79	1	R. Cobiya, Bolivia		60.98	0.15	V. San Raymundo, Guat.
	61.79	1	R. Dif. de Taubaté, Brazil		60.98	1	R. Progreso, Honduras Rep.
	61.79	1	R. Nueva, Colombia		60.98	0.2	La Voz de la Peninsular, Ec.
	61.79	0.35	R. Marañon, Ecuador		60.98	1	R. Ondas del Titicaca, Peru
	61.79	0.5	R. La Hora, Peru		60.98	7.5	R. Caracas, Venezuela
4860	61.73	0.5	R. Callao, Peru	4923	60.94	5	R. Quito, Ecuador
	61.73	1	R. Mundo, Venezuela	4925	60.90	5/100	R. Clube de Moçambique
4865	61.66	5/100	R. Clube de Moçambique		60.90	1	R. Icaremba, Brazil
	61.66	10	Brunei Bc. Sec, Brunei		60.90	1	R. Industrial, Brazil
	61.66	2.5	R. Club de Pará, Brazil	4926	60.90	5	R. Ecuatorial, Sp. Guinea
	61.66	1	R. Punto 83, Ecuador	4930	60.85	50	Erevan, USSR
4870	61.60	30	R. Dahomey, Dahomey		60.85	1	R. Católica, Honduras Rep.
	61.60	10	Colombo, Ceylon		60.85	10	Casa de la Cultura, Ecuador
	61.60	5	R. Tropical, Venezuela		60.85	1	R. Junin, Venezuela
4872	61.58	10	Sorong, Indonesia	4932	60.83	10	Bennin City, Nigeria
4875	61.54	10/0.25	Porto Amélia, Moçambique	4934	60.80	10	Nairobi, Kenya
	61.54	20	Paradys, So. Africa		60.80	0.25	R. Concejo Provincial, Peru
	61.54	5/1	R. Jornal do Brasil, Brazil	4935	60.80	1	R. Clube de Malanje, Angola
	61.54	1	La Voz del Rio Cauca, Col.		60.80	1	R. Nortes, Bolivia
	61.54	1	R. Villavicencio, Colombia		60.80	1	R. Poti, Brazil
	61.54	3	La Voz Esmeraldas, Ecuador		60.80	1	R. Tropical, Peru
4877	61.52	80/20	Saigon, Vietnam	4940	60.73	50	Kiev, USSR
4880	61.48	1	R. Comercial, Oom. Rep.		60.73	10	R. Abidjan, Ivory Coast
	61.48	0.5	La Voz de Atlantico, Hon.		60.73	10	AIR Gauhati, India
	61.48	1	R. Nec. Espejo, Ecuador		60.73	0.5	R. Dif. Haitienne, Haiti
	61.48	1	R. Once Sesenta, Peru		60.73	10	R. Dif. Nacional, Ecuador
	61.48	10	R. Universo, Venezuela		60.73	0.5	R. Misti, Peru
4885	61.45	50	Vladivostok, USSR		60.73	0.5	R. San Juan, Peru
	61.45	10	Nairobi, Kenya		60.73	10	R. Yaracuy, Venezuela
	61.45	1	Lahore, Pakistan		60.67	20	Paradys, So. Africa
	61.45	0.5	R. Ibare, Bolivia	4945	60.67	0.5	Nat. Teachers Coll, Philipp.
	61.45	1	R. Sararenda, Bolivia		60.67	1	R. Capixaba, Brazil
	61.45	1	R. Acreana, Brazil		60.67	0.25	R. Dif. Mearim, Brazil
	61.45	1	R. Cultura de Pocos, Brazil		60.67	1	R. Educ. Braganca, Brazil
	61.45	1	R. Pioneira de Teresina, Br.		60.67	1	R. Colosal, Colombia
	61.45	1	Ondas del Meta, Colombia	4946	60.65	10/0.25	Nampula, Moçambique
	61.45	1	R. Villarica, Peru	4950	60.60	5	Nairobi, Kenya
4890	61.35	25	Dakar, Senegal		60.60	0.5	R. Madre de Dios, Peru
	61.35	10	Port Moresby, Australia		60.60	1	R. Coro, Venezuela
	61.35	1	R. Lux, Honduras Rep.	14955	60.54		Guam
	61.35	5	R. Dif. Venezuela, Venezuela		60.54	2	R. Cult. de Campos, Brazil
	61.29	7.5	AIR Kurseong, India		60.54	1	R. Amauta, Peru
	61.29	4	R. Martinique, Martinique	4957	60.52	50	Anadyr, USSR
	61.29	5	R. Baré, Brazil	4958	60.51	50	Baku, USSR
	61.29	1	R. Cultura da Bahia, Brazil		60.51	10/0.25	Nampula, Moçambique
	61.29	0.4	R. Chanchamaya, Peru	4960	60.48	120/240	R. Peking, China
4896	61.27	1	Silva Porto, Angola		60.48	1	La Voz del Chofer, Ecuador
4900	61.22	1	Gorontalo, Indonesia		60.48	0.5	R. Lambayeque, Peru
	61.22	0.5	La Voz del Ulúa, Hon. Rep.		60.48	1	R. Sucre, Venezuela
	61.22	10	R. Juventud, Venezuela	4965	60.42	20	Paradys, So. Africa
4904	61.18	30	Fort Lamy, Chad		60.42	20	Lusaka, Zambia
4905	61.16	20/240	R. Peking, China		60.42	1	R. Juan XXIII, Bolivia
	61.16	5	R. Relogo Federal, Brazil		60.42	2.5	R. Santa Fé, Colombia
	61.16	1	Emis. Atlántico, Colombia	4967	60.40	1/10/50	R. Kuwait, Kuwait
4907	61.14	15	R. Cambodia, Cambodia	4968	60.38	10	Colombo, Ceylon
4908	61.12	1	R. Trasandina, Chile	4970	60.36	5	Jessilton, Sabah
4910	61.10	1	R. HIN, Dominican Republic		60.36	3	R. Tarqui, Ecuador
	61.10	5	Emis. Gran Colombia, Ec.		60.36	1	R. San Juan, Peru
	61.10	0.5	R. Libertad, Peru		60.36	10	R. Rumbos, Venezuela
	61.10	1	R. Tahuantinsuyo, Peru	4972	60.33	30/4	R. Yaoundé, Cameroun
	61.10	10	Esc. Radiofónicas, Venez.	4975	60.30	50	Blagovchensk, USSR
4911	61.08	20	Lusaka, Zambia		60.30	50	Dushanbé, USSR
4912	61.07	2	Tarawa, Gilbert Islands		60.30		Foohow, China



k Hz	m	kw	Stations & Countries	k Hz	m	kw	Stations & Countries
	60.30	1	R. Copacabana, Brazil		59.52	10	R. Los Andes, Peru
	60.30	5/2.5	R. Timbira, Brazil		59.52	1	R. Maturin, Venezuela
	60.30	1	R. Internacional, Colombia	5041	59.51	10	Emis. da Guiné, Port. Guinea
4976	60.29	3/9	Kampala, Uganda	5042	59.50	1	R. Clube de Benguela, Angola
4980	60.25	10/20	Accra, Ghana	5045	59.46	0.25	Rarotonga, Cook Islands
	60.25	10/50	Karachi, Pakistan		59.46	1	R. Imperial, Brazil
	60.25	0.3	Ondas Azuayas, Ecuador		59.46	5	La Voz del Altiplano, Bolivia
	60.25	0.3	R. Maldonado, Peru	5047	59.43	4/100	Lomé, Togo
	60.25	1	Ecos del Torbes, Venezuela		59.43	20	Djakarta, Indonesia
4985	60.18	1	R. Ecclesia, Angola	5050	59.41	50	Petropavlovsk, USSR
	60.18	10	Kotaradja, Indonesia		59.41	20	R. Tanzania, Tanzania
	60.18	10	R. Malaysia, Malaysia		59.41	1	La Voz de Medellín, Col.
	60.18	10	La Cruz del Sur, Bolivia		59.41	1	R. Tumbes, Peru
	60.18	1.5	Voz de Deste, Brazil		59.41	2	R. Cultura, Venezuela
4990	60.12	10	Lagos, Nigeria	5052	59.38	50	Ulan Bator, Mongolia
	60.12		Changsha, China		59.38	10	R. Singapura, Singapore
	60.12	10	AIR Bhopal, India	5055	59.35	50	Chita, USSR
	60.12	1	R. Xavier, Ecuador		59.35	5	R. San Rafael, Bolivia
	60.12	1	R. Chulucanas, Peru		59.35	1	R. Vitória, Brazil
	60.12	1	R. Triunfo, Peru		59.35	0.5	R. Católica, Ecuador
	60.12	10	R. Barquisimeto, Venezuela		59.35	1	R. Onda Imperial Peru
4995	60.06	5	R. Brasil Central, Brazil	5058	59.31	1	R. Tarma, Peru
	60.06	1	R. Andina, Peru	5060	59.29	1	Nova Lisboa, Angola
4996	60.05	50	Magadan, USSR	5065	59.23	10	Petrozavodsk, USSR
*5000	60.00	0.5	Teddington, Gt. Britain	5070	59.17	0.3	R. Nac. Mazatenango, Guat.
*	60.00	1	Rome, Italy	5075	59.12	120/240	R. Peking, China
*	60.00	5	Turin, Italy		59.12	25	Acción Cult. Popular, Col.
*	60.00	20	Moscow, USSR	5076	59.10	10	Colombo, Ceylon
†	60.00	4	Diflantsfontein, So. Africa	5090	59.00	0.25	R. Grand Anse, Haiti
*	60.00		Peking, China	5095	58.88	50	Acción Cult. Popular, Col.
*	60.00	2	Tokyo, Japan	5125	58.54	120/240	R. Peking, China
*	60.00	2	WWVH, Puunene, Hawaii	5145	58.31	20/240	R. Peking, China
*	60.00	10	WWH, Ft. Collins	5160	58.14	20/240	R. Peking, China
†	60.00	2	Buenos Aires, Argentina	5170	58.03		Fukien, China
5005	59.94	1	R. Jaén, Peru	5220	57.47	20/240	R. Peking, China
5010	59.88	4/30	R. Garoua, Cameroon		57.25		Fukien, China
	59.88		Nanning, China	5260	57.03	15	Alma Ata, USSR
	59.88	10	F8S, Singapore	5295	56.66	20/240	R. Peking, China
	59.88	0.4	R. Eco, Peru	5320	56.39	20/240	R. Peking, China
	59.88	1	R. Bocónó, Venezuela	5448	55.05		Canal Zone, Panama
5015	59.82	15	Arkhangelsk, USSR	5455	55.00	50	Moscow, USSR
	59.82	50	Vladivostok, USSR	5535	54.20	20/240	R. Peking, China
	59.82	1	Moçamedes, Angola	5545	54.10	20/240	R. Peking, China
	59.82	5	Grenada, Windward Islands	5850	51.28	20/240	R. Peking, China
	59.82	1	R. Universo, Bolivia	5860	51.19	20/240	R. Peking, China
5020	59.76	30	R. Niger, Niger	†5870	51.11		Annapolis, USA
	59.76	10	Colombo, Ceylon	5875	51.06	1	La Voz de Honduras, Hon.
	59.76	0.5	R. Indépendance, Haiti	5900	50.84	50	Moscow, USSR
	59.76	1	Trans. Caldas, Colombia		50.84		La Voz del Norte, Ecuador
	59.76	10	R. Nacional, Venezuela	5908	50.78	7.5	Voix de la Rev. Ouv, Haiti
5025	59.70	1	R. Of. Aquidauana, Brazil	5915	50.72	100	Sverdlovsk, USSR
	59.70	1	Voz Amazonia, Brazil	5920	50.68	50	Moscow, USSR
	59.70	0.2	R. Splendit, Ecuador	5925	50.63	50	Tashkent, USSR
	59.70	0.3	R. Quillabamba, Peru	5930	50.59	100	Praha, Czechoslovakia
5026	59.70	3/8	Kampala, Uganda		50.59	15	Arkhangelsk, USSR
5030	59.64	120/240	R. Peking, China	5933	50.57		Chengtu, China
	59.64	20	Medan, Indonesia		50.55		Lhasa, Tibet
	59.64	50	R. Malaysia, Malaysia	5940	50.51	50	Magadan, USSR
	59.64	1	La Voz del Papagayo, Dominican Republic	5950	50.42	120	R. Tirana, Albania
	59.64	10	R. Continente, Venezuela		50.42	20/240	R. Peking, China
5035	59.58	30	Bangui, Central African Rep.		50.42	7.5	Voix de la Rev. Ouv, Haiti
	59.58	1	La Voz de Las Fronteras, Honduras	5954	50.39	1	R. Casino, Costa Rica
	59.58	1	R. Anhanguera, Brazil	5955	50.39	100	Allouis, France
	59.58	0.5	R. Espirito Santo, Brazil		50.39	50	R. Liberty
	59.58	0.75	R. Centinela del Sur, Ec.		50.39	100	Sverdlovsk, USSR
	59.58	0.5	R. Ayaviri, Peru		50.39	10	Pakanbaru, Indonesia
	59.58	1	R. Ilo, Peru		50.39	0.4	Suva, Fiji Islands
5040	59.52	50	Tbilisi, USSR		50.39	5	R. Cultural, Guatemala
	59.52	50	Rangoon, Burma		50.39	1	R. Exitos, Honduras Rep.
	59.52	0.15	R. Capois da Mort, Haiti		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	kHz	m	kw	Stations & Countries
	50.39	1	R. Nuevo Mundo, Chile		50.00	50	Riyadh, Saudi Arabia
	50.39	0.75	R. Equinoccial, Ecuador		50.00	7.5	R. Singapura, Singapore
	50.39	0.5	R. Huancayo, Peru		50.00	25	R. Inconfidencia, Brazil
5960	50.34	100	Trans World Radio, Monaco		50.00	5	R. Sur, Uruguay
	50.34	20/240	R. Peking, China		50.00	1	R. Miranda, Venezuela
	50.34		R. Kashmir, India	6005	49.96	20/100	Berlin (RIAS), Germany
	50.34	50	Ulan Bator, Mongolia		49.96	1	R. Buea, Cameroon
	50.34	1	Taipei, Taiwan		49.96	20	Paradys, South Africa
	50.34	1.5	Godthab, Greenland		49.96	10	R. Tanzania, Zanzibar
	50.34	1	La Voz de Occidente, Hon.		49.96	10	Colombo, Ceylon
	50.34	1	La Voz de Bogotá, Colombia		49.96	9.4	Suva, Fiji Islands
	50.34	0.25	La Voz del Altiplano, Peru		49.96	0.075	Montreal, Canada
5965	50.29	35	Tanger (VOA), Morocco		49.96	10	R. Progreso, Bolivia
	50.29	7.5	R. Guiba, Brazil	6010	49.92	100	Wavre, Belgium
	50.29	0.2	R. Mundial, Ecuador		49.92	15/100	BBC London, Gt. Britain
5970	50.25	10/100/250	R. Free Europe		49.92	100	Moscow, USSR
	50.25	100	Moscow, USSR		49.92	7.5/100	BBC, Malaysia
	50.25	50	Alger, Algeria		49.92	35/100	Okinawa (VOA), Ryukyu Isl.
	50.25	4	R. Brazzaville, Congo		49.92	10	Thai TV Co, Thailand
	50.25	10	AIR Gauhati, India		49.92	1	Sydney, Canada
	50.25	10	Bandjarmasin, Indonesia		49.92	0.5	R. Mil, Mexico
	50.25	1	NCOA, Philippines		49.92	5	R. Nacional, El Salvador
	50.25	50	R. Canada, Canada		49.92	0.25	R. Norte, Chile
	50.25	5	R. Horizonte, Colombia		49.92	10	La Voz Amiga, Colombia
	50.25	10	R. El Sol, Peru		49.92	0.5	R. América, Peru
5975	50.21	15/100	BBC London, Gt. Britain	6015	49.88	50	Rhodes (VOA), Greece
	50.21	20/240	R. Peking, China		49.88	100	R. Abidjan, Ivory Coast
	50.21	10	Seoul, Korea		49.88	25	R. Ci. de Pernambuco, Brazil
	50.21	1	R. Nacional, Bolivia		49.88	1	R. Paraguay, Paraguay
	50.21	10	R. Guarujá, Brazil	6020	49.83	10	R. Nederland, Holland
	50.21	10	Emis. Pres. Balmaceda, Chile		49.83	50	Khabarovsk, USSR
	50.21	3	R. Guaraní, Paraguay		49.83	50	Kiev, USSR
5980	50.17	100	Tbilisi, USSR		49.83	100	Moscow, USSR
	50.17	0.5	Freetown, Sierra Leone		49.83	20	Gwelo, Rhodesia
	50.17	100	Beirut, Lebanon		49.83	10/100	AIR Delhi, India
	50.17	3.5	Taipei (BBC), Taiwan		49.83	2.5	AIR Simla, India
	50.17	1.5	Godthab, Greenland		49.83	250	Greenville, USA
	50.17	10	La Voz del Rio Grande, Col.		49.83	7	R. Caraibes, Haiti
	50.17	5	R. Panamericana, Peru		49.83	1	R. Moderna, Honduras Rep.
5985	50.13	10/103/250	R. Free Europe		49.83	0.25	El Eco de Sotavento, Mexico
	50.13	50/100	R. Nacional, Portugal		49.83	1	R. Victoria, Peru
	50.13	7.5/100	Dacca, Pakistan	6025	49.79	100	Deutsche Welle, Germany
	50.13	1	Taipei, Taiwan		49.79	50/100	R. Nacional, Portugal
	50.13		Hanoi, Vietnam (Dem. Rep.)		49.79	20/240	R. Peking, China
	50.13	1	R. Splendid, Argentina		49.79	10	R. Malaysia, Malaysia
	50.13	10	Trans. Independencia, Col.		49.79	10	R. Em. de Piratininga, Brazil
5990	50.08	15/100	BBC London, Gt. Britain		49.79	3	R. Nacional, Paraguay
	50.08	50/60/100	R. Roma, Italy	6030	49.75	20	Muhlacker (SDR), Germany
	50.08	120	R. Bucharest, Rumania		49.75	100	Simferopol, USSR
	50.08	100	Horby, Sweden		49.75	4	Franceville, Gabon
	50.08	10	AIR Bhopal, India		49.75	100	Baghdad, Iraq
	50.08	10	Menado, Indonesia		49.75	2	Call of the Orient, Philippines
	50.08	0.5	Pakanbaru, Indonesia		49.75	0.1	Calgary, Canada
	50.08	50	R. Canada, Canada		49.75	110	Bethany, USA
	50.08	7.5	R. Educacao, Brazil		49.75	1	R. Miner, Chile
	50.08	1	R. Nac. Tumbes, Peru	6035	49.71	50	Khabarovsk, USSR
5993	50.05	10	R. Mdandaka, Congo		49.71	4	R. Mauntana, Mauritania
5995	50.04	35	Thessaloniki (VOA), Greece		49.71	50	Rangoon, Burma
	50.04	10	Blantyre, Malawi		49.71	10/100	AIR Delhi, India
	50.04	3	Taipei, Taiwan		49.71	1	R. Tic Tac, Honduras Rep.
	50.04	50	R. Canada, Canada		49.71	10	R. Globo, Brazil
	50.04	250	Greenville, USA		49.71	0.5	R. Carriamanca, Ecuador
	50.04	1	Ecos de Honduras, Honduras		49.71	0.2	R. Landa, Peru
	50.04	4	R. Martinique, Martinique		49.71	1	R. Nacional, Uruguay
	50.04	1	Circuito RPC, Panama	6037	49.69	2	Faro del Caribe, Costa Rica
	50.04	1	R. Loyola, Bolivia	6040	49.67	100	Munch (VDA), Germany
	50.04	1	Le Voz del Pueblo, Colombia		49.67	4/30	R. Yaounde, Cameroon
6000	50.00	1	Aldrans, Austria		49.67	7.5	Taipei (BBC), Taiwan
	50.00	50/100	Moscow, USSR		49.67	0.5	R. Caribe, Honduras Rep.
	50.00	50/100	R. Afghanistan, Afghanistan		49.67	10	La Voz del Tolima, Colombia
	50.00	20/240	R. Peking, China	6042	49.65	0.25	R. Arequipa, Peru

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

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

kHz	m	kw	Stations & Countries	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, Ascension Island				
	42.22	4	R. Brazzaville, Congo				
	42.22	4/30	R. Tananarive, Malagasy Rp.				
	42.22	35	Colombo (VDA), 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	Dmsk, 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	Sabaa Aïoun, 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	Krasnoyarsk, USSR				
	42.08	0.25/10	Nampula, Moçambique				
7135	42.05	30	R. Monte Carlo, Monaco				
	42.05	250	Monrovia (VDA), 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	Duelimane, 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
				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 (VDA), Ryukyu Is.
				7170	41.84	250	Woofferton (VDA), 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	Caltanissetta, Italy
					41.81	120	Starobelsk, USSR
					41.81	25	R. TV Congolaise, Congo
					41.81	50/250	Monrovia (VDA), 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 (VDA), Liberia
					41.70	3/8	Kampala, Uganda
					41.70	10/100	AIR Delhi, India
					41.70	100	R. Japan, Japan
				7200	41.67	120	R. Tirana, Albania
					41.67	250	Woofferton (VDA), 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 (VDA), Greece
					41.64	100	Moscow, USSR
					41.64	7.5	Lubumbashi, Congo D.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	Ukasenderen, 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, Senegal
					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	Sabaa-Aïoun, Morocco
					41.52	10/100	AIR Delhi, India
					41.52	3	Call of the Orient, Philippines
				7230	41.49	75	BBC London, Gt. Britain
					41.49	100	Kiev, USSR
					41.49	4	Duagadougou, Upper Volta

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

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

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



kHz	m	kw	Stations & Countries	kHz	m	kw	Stations & Countries
		30.75 10/50	Karachi, Pakistan	11735	25.56 100/120		R. Norway, Norway
		30.75 10	Saigon, Vietnam		25.56 100		R. Belgrade, Yugoslavia
		30.75 1	R. Anhangera, Brazil		25.56 50		Tanger, Morocco
		30.75 7.5	R. Brasil, Central Brazil		25.56 100		R. RSA, So. Africa
		30.75 2.1	R. Sideral, Peru		25.56 120/240		R. Habana, Cuba
9760		30.74 100	Munich (VOA), Germany		25.56 7.5		R. Clube de Goiania, Brazil
		30.74 15/100	BBC London, Gt. Britain		25.56 5		R. Oriental, Uruguay
		30.74 20	R. Nacional, Spain	11740	25.55 15		Novosibirsk, USSR
		30.74 100	Ivanofrankovsk, USSR		25.55 25/100		Vatican Radio
		30.74 100/250	Accra, Ghana		25.55 50/250		Monrovia (VOA), Liberia
		30.74	Hanoi, Vietnam		25.55 100		R. Australia, Australia
		30.74 10	La Voz de Guatemala		25.55 1		R. Dif. XEMP, Mexico
		30.74 1	R. Continental, Peru		25.55 5		R. Nuevo Mundo, Chile
9765		30.72 100	Deutsche Welle, Germany	11745	25.54 50		Minsk, USSR
		30.72 75	BBC London, Gt. Britain		25.54 10		R. Piratininga, Brazil
		30.72 100	Leningrad, USSR	11750	25.53 75		BBC London, Gt. Britain
		30.72 20/240	R. Peking, China		25.53 50		R. Mali, Mali
		30.72 10/100	AIR Delhi, India		25.53 10/1		Tokyo (FEN), Japan
		30.72 100	R. Japan, Japan		25.53 7.5/100		BBC, Malaysia
		30.72 50	Taipei (RCC), Taiwan	11755	25.52 100		Leningrad, USSR
9770		30.71 100	Vienna, Austria		25.52 50		Vladivostok, USSR
		30.71 75	BBC London, Gt. Britain	11760	25.51 100		Kharkov, USSR
		30.71 100	Vladivostok USSR		25.51		Radio Switzerland
		30.71 20	Djakarta, Indonesia		25.51 25/100		Vatican Radio
		30.71 50	Greenville (VOA), USA		25.51 0.25		R. Rarotonga, Cook Islands
		30.71 0.35	R. St. 4VEH, Haiti		25.51 120/240		R. Habana, Cuba
		30.71 7.5	R. Min. Educacão, Brazil	11765	25.50 50		R. Sofia, Bulgaria
		30.71 1	R. Amazonas, Peru		25.50 50/100		R. Berlin Int., Germany
11700		25.64 50/100	Leningrad, USSR		25.50 120/240		Pyeongang, Korea (PDR)
		25.64 120	Serpukhov, USSR		25.50 25		R. Dif. São Paulo, Brazil
		25.64 0.5	R. Rac de Quezaltenango, Guatemala	11770	25.49 20/250		R. Liberty
					25.49 100		ETLF, Addis Ababa, Ethiopia
11705	25.63	10/100/250	R. Free Europe		25.49 20		Djakarta, Indonesia
	25.63	250	Woofferton (VOA), Gt. Brit.		25.49 50/200		Osleno, USA
	25.63	100	Radio Sweden		25.49 30		HCJB, La Voz de los Andes, Ecuador
	25.63	120	Serpukhov, USSR	11775	25.48 100		Schwarzenburg, Switzerland
	25.63	25/100	Vatican Radio		25.48 50		Kursk, USSR
	25.63	100	R. Iran, Iran		25.48 100		ETLF, Addis Ababa, Ethiopia
	25.63	100	R. Japan, Japan		25.48 100		R. Afghanistan, Afghanistan
11710		25.62 250	Woofferton (VOA), Gt. Brit.		25.48 50		Poro (VOA), Philippines
		25.62 100	R. Nacional, Spain	11780	25.47 75		BBC London, Gt. Britain
		25.62 100	Moscow, USSR		25.47 50/100		R. Nederland, Holland
		25.62 50	R. Brazzaville, Congo		25.47 5/100		R. Clube de Moçambique
		25.62 100	ETLF, Addis Ababa, Ethiopia		25.47 100		R. Japan, Japan
		25.62 35/100	Tanger (VOA), Morocco		25.47 7.5		Wellington, New Zealand
		25.62 10/100	AIR Delhi, India		25.47 8/10		R. Belgrano, Argentina
		25.62 100/10	R. Australia, Australia	11785	25.46 100		Vienna, Austria
11715	25.61	20/100	Wavre, Belgium		25.46 100		Deutsche Welle, Germany
	25.61	100	Schwarzenburg, Switzerland		25.46 50		Vinnitsa, USSR
	25.61	50	Dushanbé, USSR		25.46 250		R. South Africa, So. Africa
	25.61	20/240	R. Tirana, Albania		25.46 1.5		Makassar, Indonesia
	25.61	10/100	AIR Delhi, India		25.46 100		Beirut, Lebanon
	25.61	50	Malolos (VOA), Philippines		25.46 7.5		R. Guaiaba, Brazil
	25.61	50	R. Canada, Canada	11790	25.45 35/100		Tanger (VOA), Morocco
11720	25.60	15/100	BBC London, Gt. Britain		25.45 10/100		AIR Delhi, India
	25.60	7.5/5	Athens, Greece		25.45 100		R. Australia, Australia
	25.60	100	Trans World Radio, Monaco	11795	25.43 100		Deutsche Welle, Germany
	25.60	20/240	R. Peking, China		25.43 50		Kinshasa, Congo (Dem. Rep)
	25.60	50	R. Canada, Canada		25.43 50		Red Lion, USA
	25.60	10	R. Nacional Brasilia, Brazil		25.43 10		R. Nacional Rio, Brazil
11725	25.59	10/100/250	R. Free Europe	11800	25.42 100		Praha, Czechoslovakia
	25.59	20/50	R. Liberty		25.42 50/60/100		R. Roma, Italy
	25.59	5/100	Warsaw, Poland		25.42 50		R. Nec. Espana, Canary Isl.
	25.59	50	R. Brazzaville, Congo		25.42 4		Fort Lamy, Chad
	25.59	100	ETLF, Addis Ababa, Ethiopia		25.42 100/250		Accra, Ghana
	25.59	20/240	R. Peking, China		25.42 35		Colombo, Ceylon
	25.59	7.5/100	BBC, Malaysia	11805	25.41 50		Kazan, USSR
11730	25.58	50/100	R. Nederland, Holland		25.41 50		Osleno, USA
	25.58	50	Vinnitsa, USSR		25.41 50/100		WNYW, R. New York, USA
	25.58	100	ETLF, Addis Ababa, Ethiopia		25.41 10		R. Globo, Brazil
	25.58	35	Poro (VOA), Philippines	11810	25.40 50/60/100		R. Roma, Italy
	25.58	50/100	WNYW, R. New York, USA				

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

kHz	m	kw	Stations & Countries	kHz	m	kw	Stations & Countries
	25.09	500	Greenville, USA	15170	19.78	10/100/250	R. Free Europe
11960	25.08	100	Praha, Czechoslovakia		19.78	100	Amman, Jordan
	25.08	35/100	Tanger (VOA), Morocco		19.78	10	La Voz de Guatemala, Guat.
11965	25.07	100	Deutsche Welle, Germany	15175	19.77	100/120	R. Norway, Norway
	25.07	20/240	R. Peking, China		19.77	100	Lvov, USSR
	25.07	100	R. Japan, Japan		19.77	35/100	Poro (VOA), Philippines
	25.07	50	Poro (VOA), Philippines	15180	19.76	75	BBC London, Gt. Britain
	25.07	50	R. Record, Brazil		19.76	50/100	R. Nederland, Holland
11970	25.06	50	R. Sofia, Bulgaria		19.76	50	Petropavlovsk, USSR
	25.06	20/250	R. Liberty		19.76	50	Sverdlovsk, USSR
	25.06	4	R. Brazzaville, Congo		19.76	250	BBC, Ascension Isl.
	25.06	100	Amman, Jordan		19.76	100	R. Australia, Australia
	25.06	3	Chiayi (BCC), Taiwan		19.76	10	R. Cult. de Bahia, Brazil
	25.06	50/100	R. New York, USA	15185	19.76	100	Pori, Finland
	25.06	5	Grenada, Windward Islands		19.76	50	Ashkhabad, USSR
11975	25.05	10/50	R. ELWA, Liberia		19.76	10/100	AIR Delhi, India
	25.05	20/240	R. Peking, China	15190	19.75	50	R. Brazzaville, Congo
11980	25.04	120/240	R. Peking, China		19.75	10/100	AIR Delhi, India
11990	25.02	100	Praha, Czechoslovakia		19.75	50	R. Canada, Canada
	25.02	50	Oushanbé, USSR		19.75	5	R. Inconfidencia, Brazil
12060	24.88	20/240	R. Peking, China	15195	19.74	250	Woolferton (VOA), Gt. Brit.
12065	24.87	10/50	R. Peking, China		19.74	35/100	Tanger (VOA), Morocco
12070	24.86	100	Kiev, USSR		19.74	100	R. Japan, Japan
15100	19.87	10/50	Kerachi, Pakistan	15200	19.74	50	Kalatch, USSR
15105	19.86	50/75	BBC London, Gt. Britain	15205	19.73	100	Deutsche Welle, Germany
	19.86	10/100	AIR Delhi, India		19.73	100	ETLF, Addis Ababa, Ethiopia
	19.86	100	R. Japan, Japan		19.73	500	Greenville, USA
	19.86	250	BBC, Ascension Isl.	15210	19.72	100	Vienna, Austria
15110	19.85	100	Kiev, USSR		19.72	100	Moscow, USSR
	19.85	7.5	Wellington, New Zealand		19.72	35/100	Poro (VOA), Philippines
	19.85	5	R. Ofic. Comerciales, Mexico		19.72	3	R. Guarani, Paraguay
	19.85	50	HCB, La Voz de los Andes, Ecuador	15215	19.71	10/100/250	R. Free Europe
15115	19.85	10/100/250	R. Free Europe		19.71	50/100	WNYW, R. New York, USA
	19.85	50	Jeddah, Saudi Arabia	15220	19.71	50/100	R. Nederland, Holland
	19.85	1/30	HCB, La Voz de los Andes, Ecuador		19.71	50	Riga, USSR
15120	19.84	100	Allouis, France		19.71	250	R. South Africa, So. Africa
	19.84	25/100	Vatican Radio		19.71	100	R. Australia, Australia
15125	19.83	50	R. Liberty		19.71	10	Melbourne, Australia
	19.83	50/100	R. Nacional, Portugal	15225	19.71	250/500	R. Liberty
	19.83	100	Taipei (BCC), Taiwan	15230	19.70	50	Voronej, USSR
	19.83	10	R. Soc. de Bahia, Brazil		19.70	100	Colombo, Ceylon
15130	19.83	50	Simleropol, USSR		19.70	100	Melbourne, Australia
15135	19.82	25/100	Vatican Radio		19.70	250	Greenville, USA
	19.82	100	R. Japan, Japan		19.70	120/240	R. Habana, Cuba
	19.82	10	R. Panamericanas, Brazil	15235	19.69	15/100	8BC London, Gt. Britain
15140	19.82	75/100	8BC London, Gt. Britain		19.69	250	BBC, Ascension Isl.
	19.82	50	Petropavlovsk, USSR		19.69	100	R. Japan, Japan
	19.82	50	Riazan, USSR		19.69	250	Greenville, USA
	19.82	250	BBC, Ascension Isl.	15240	19.69	50	Irkutsk, USSR
15145	19.81	10/100/250	R. Free Europe		19.69	100	R. Belgrade, Yugoslavia
	19.81	15	R. Jornal do Comercio, Br.		19.69	50	R. Australia, Australia
15150	19.80	100	Minsk, USSR	15245	19.68	100	Allouis, France
	19.80	100	ETLF, Addis Ababa, Ethiopia		19.68	100	Deutsche Welle, Germany
	19.80	7.5	Djakarta, Indonesia		19.68	250	Greenville, USA
	19.80	1/10/50	R. Kuwait, Kuwait		19.68	10	R. Marajoara, Brazil
	19.80	100	Jeddah, Saudi Arabia	15250	19.67	120	R. Bucharest, Rumania
15155	19.80	50	R. ELWA, Liberia		19.67	100	ETLF, Addis Ababa, Ethiopia
	19.80	100	Poro (VOA), Philippines		19.67	50/100	Poro (VOA), Philippines
	19.80	25	R. Dif. de São Paulo, Brazil		19.67	250	Greenville, USA
15160	19.79	50	Rhodes (VOA), Greece	15255	19.66	10/100/250	R. Free Europe
	19.79	5/135	R. Budapest, Hungary		19.66	20/240	R. Peking, China
	19.79	50	Moscow, USSR		19.66	50/260	TWR Bonaire, Neth. Antilles
	19.79	10/100	AIR Delhi, India	15260	19.66	75/250	BBC London, Gt. Britain
	19.79	100	R. Ankara, Turkey		19.66	1	Tokyo (FEN), Japan
	19.79	110	Bethany, USA		19.66	100	Gorki, USSR
15165	19.78	10/100	AIR Delhi, India		19.66	50	R. Afghanistan, Afghanistan
	19.78	35/100	Poro (VOA), Philippines		19.66	50	R. Excelsior, Brazil
	19.78	50	Damascus, Syria	15270	19.65	35/100	Tanger (VOA), Morocco
	19.78	5	Ceara R. Clube, Brazil		19.65	20/240	R. Peking, China
					19.65	120/240	R. Habana, Cuba
					19.65	1	S.O.D.R.E., Uruguay

kHz	m	kw	Stations & Countries	kHz	m	kw	Stations & Countries
15275	19.64	100	Deutsche Welle, Germany	15370	19.52	250	R. Liberty
	19.64	5/100	Warsaw, Poland		19.52	100	ETLF, Addis Ababa, Ethiopia
15280	19.63	50	Serpukhov, USSR		19.52	10.50	Karachi, Pakistan
	19.63	3	Taipei (BBC), Taiwan		19.52	50/100	R. New York, USA
	19.63	500	Greenville, USA		19.52	10	R. Tamoi, Brazil
	19.63	50/260	TWR Bonaire, Neth. Antilles	15375	19.51	100	Leningrad, USSR
15285	19.63	100	Praha, Czechoslovakia		19.51	50	Malolos (VDA), Philippines
	19.63	25/100	Vatican Radio	15380	19.50	100	Deutsche Welle, Germany
	19.63	100/250	Accra, Ghana		19.50	50	R. Liberty
	19.63	35	Colombo (VDA), Ceylon		19.50	50/100	R. Nacional, Portugal
15290	19.62	35/100	Tanger (VDA), Morocco		19.50	120	R. Bucharest, Rumania
	19.62	20/240	R. Peking, China		19.50	50	Tanger, Morocco
	19.62	10/100	AIR Delhi, India		19.50	250	Kigali (DW), Rwanda
	19.62	35/100	Poro (VDA), Philippines	15385	19.50	50/60/100	R. Roma, Italy
	19.62	20	Damascus, Syria		19.50	100	Gorki, USSR
	19.62	10	R. El Mundo, Argentina		19.50	100	Moscow, USSR
15295	19.62	100	Allouis, France		19.50	2/50	Call of the Orient, Philippines
	19.62	50	Voronej, USSR		19.50	10	R. Sarandi, Uruguay
	19.62	5/100	R. Clube de Moçambique	15390	19.49	50/100	R. Berlin Int, Germany
15300	19.61	50/75	BBC London, Gt. Britain		19.49	75	BBC London, Gt. Britain
	19.61	200	R. Japan, Japan		19.49	10	R. Australia, Australia
	19.61	2/10/50	Call of the Orient, Philippines	15395	19.49	120	Tashkent, USSR
15305	19.60	100	Schwarzenburg, Switzerland		19.49	500	Greenville, USA
	19.60	50	Kazan, USSR	15400	19.48	100	Vienna, Austria
15310	19.60	100	R. Sofia, Bulgaria		19.48	50/60/100	R. Roma, Italy
	19.60	100	Praha, Czechoslovakia		19.48	250	BBC, Ascension Isl.
	19.60	75	BBC London, Gt. Britain		19.48	100	ETLF, Addis Ababa, Ethiopia
	19.60	50/60/100	R. Roma, Italy		19.48	50	Baghdad, Iraq
	19.60	50	Tula, USSR		19.48	250	Greenville, USA
	19.60	50	Conakry, Guinea Rep.	15405	19.47	100	Deutsche Welle, Germany
	19.60	7.5/100	BBC, Cyprus		19.47	100	Kingisepp, USSR
15315	19.59	100	Deutsche Welle, Germany		19.47	10/50	Karachi, Pakistan
	19.59	100	ETLF, Addis Ababa, Ethiopia	15410	19.47	20	Vienna, Austria
	19.59	100	Tanger (VDA), Morocco		19.47	100	Deutsche Welle, Germany
	19.59	20/240	R. Peking, China		19.47	100	ETLF, Addis Ababa, Ethiopia
	19.59	10/50	Karachi, Pakistan		19.47	10	Tanger, Morocco
15320	19.58	100	Kazan, USSR		19.47	7.5/100	APD2 Dacca, Pakistan
	19.58	50/250	Monrovia (VDA), Liberia		19.47	50	Malolos (VDA), Philippines
	19.58	100	R. Australia, Australia		19.47	35/100	Poro (VDA), Philippines
	19.58	50	R. Canada, Canada		19.47	50/200	Delano, USA
15325	19.58	50	R. Canada, Canada		19.47	500	Greenville, USA
	19.58	1	R. Gazeta São Paulo, Brazil	15415	19.46	100	Kiev, USSR
	19.58	50	HCJB, La Voz de Los Andes, Ecuador		19.46	50/100	Cairo, Un. Arab Rep.
15330	19.57	100	Sverdlovsk, USSR		19.46	500	Greenville, USA
	19.57	100	R. Australia, Australia		19.46	1	R. Cl. Ribeirão Preto, Brazil
	19.57	110	Bethany, USA	15417	19.46	20/200	R. Peking, China
15335	19.56	20	Wavre, Belgium	15420	19.46	75	BBC London, Gt. Britain
	19.56	10/100	AIR Delhi, India		19.46	100	R. Nacional, Spain
	19.56	100	AIR Madras, India		19.46	250	BBC, Ascension Isl.
	19.56	10/50	Karachi, Pakistan		19.46	50	Dumaguete City, Philippines
	19.56	10	R. Farroupilha, Brazil	15425	19.45	50/100	R. Nederland, Holland
15340	19.56	50/250	R. Liberty		19.45	120	Moscow, USSR
	19.56	50/60/100	R. Roma, Italy		19.45	50	Perth, Australia
	19.56	120/240	R. Habana, Cuba	17700	16.95	50	Tallinn, USSR
15345	19.55	7.5/5	Athens, Greece	17705	16.94	100	Praha, Czechoslovakia
	19.55	50	Sebaa Aiou, Morocco		16.94	75/100	BBC London, Gt. Britain
	19.55	100	Amman, Jordan		16.94	35/100	Tanger (VDA), Morocco
	19.55	50	Poro (VDA), Philippines		16.94	10/100	AIR Delhi, India
	19.55	25	Taipei (BBC), Taiwan		16.94	10	R. 9 de Julho, Brazil
	19.55	50	R. Nacional, Argentina		16.94	100	Praha, Czechoslovakia
15350	19.54	15/100	BBC London, Gt. Britain		16.94	75/100	BBC London, Gt. Britain
	19.54	100	Vologda, USSR		16.94	35/100	Tanger (VDA), Morocco
15355	19.53	10/100/250	R. Free Europe		16.94	10/100	AIR Delhi, India
	19.53	50/100	WNYW, R. New York, USA		16.94	10	R. 9 de Julho, Brazil
	19.53	100	BBC London, Gt. Britain	17710	16.94	100	Moscow, USSR
	19.53	100	Moscow, USSR		16.94	50/200	Delano, USA
15365	19.52	10/100/250	R. Free Europe		16.94	250	Greenville, USA
	19.52	100	Praha, Czechoslovakia		16.93	75/100	BBC London, Gt. Britain
	19.52	10/50	Karachi, Pakistan		16.93	10/100	AIR Delhi, India
					16.93	50	Dumaguete City, Philippines

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

kHz	m	kw	Stations & Countries	kHz	m	kw	Stations & Countries
16.77	10/100		AIR Delhi, India	13.90	110		Bethany, USA
16.77	50		Greenville, USA	21595	13.89	50	R. Canada, Canada
16.77	30		HCJB, La Voz de los Andes, Ecuador	21600	13.89	10/100/250	R. Free Europe
17895	16.76	500	R. Liberty		13.89	100	Leningrad, USSR
	16.76	50/100	R. Nacional, Portugal		13.89	50/500	Greenville, USA
17897	16.76	20/240	R. Peking, China	21610	13.88	15/100	BBC London, Gt. Britain
17900	16.76	50/100	R. Berlin Int, Germany		13.88	50/200	Dixon, USA
21450	13.99	100	Praha, Czechoslovakia		13.88	50/100	Cairo, Un. Arab Rep.
21455	13.98	35	Tanger (VDA), Morocco	21620	13.87	100	Allouis, France
21460	13.98	50/200	Oixon, USA		13.87	10/100/250	R. Free Europe
21465	13.98	50/100	WNYW, R. New York, USA	21625	13.87	50/100	R. Naderland, Holland
21470	13.97	75/100	BBC London, Gt. Britain		13.87	100	Kursk, USSR
21485	13.96	25/100	R. Naderland, Holland	21630	13.87	75/100	BBC London, Gt. Britain
	13.96	110	Vatican Radio		13.87	50/200	Delano, USA
21495	13.96	50/100	Bethany, USA		13.86	50/500	Greenville, USA
21500	13.95	2/50	R. Nacional, Portugal	21645	13.86	100	Deutsche Welle, Germany
	13.95	250	R. Brazzaville, Congo	21650	13.86	100	Deutsche Welle, Germany
	13.95	50/200	R. South Africa, So. Africa		13.86	15/100	BBC London, Gt. Britain
21505	13.94	50/100	Delano, USA		13.86	110	Bethany, USA
	13.94	50	R. Naderland, Holland	21660	13.85	50/100	R. Nacional, Portugal
21510	13.94	100	Monrovia (VDA), Liberia	21665	13.85	10/100/250	R. Free Europe
	13.94	50/500	Wavre, Belgium		13.85	50/100	R. Naderland, Holland
21515	13.94	25/100	Greenville, USA		13.85	5/135	R. Budapest, Hungary
	13.94	110	Vatican Radio	21670	13.84	10	LLP, R. Norway, Norway
21520	13.94	100	Bethany, USA		13.84	50/250	Monrovia (VDA), Liberia
	13.94	50/250	SBC, Switzerland	21680	13.84	10/100/250	R. Free Europe
21525	13.94	1/10/50	Monrovia (VDA), Liberia		13.84	75/100	BBC London, Gt. Britain
21530	13.93	75	R. Kuwait, Kuwait		13.84	100	R. Australia, Australia
	13.93	25/100	BBC London, Gt. Britain	21690	13.83	100	R. Sweden
	13.93	25/100	Vatican Radio		13.83	50	Tanger (VDA), Morocco
	13.93	50/100	WNYW, R. New York, USA		13.83	5	Grenada, Windward Isl.
21535	13.93	0.5	R. ELWA, Liberia	21695	13.83	50	Tashkent, USSR
	13.93	250	R. South Africa, So. Africa		13.83	50/100	R. Nacional, Portugal
21540	13.93	100	SBC, Switzerland	21700	13.83	100	Praha, Czechoslovakia
	13.93	100	Kursk, USSR	21705	13.83		Deutsche Welle, Germany
	13.93	50	R. Australia, Australia	21710	13.83	75/100	BBC London, Gt. Britain
	13.93	50/500	Greenville, USA	21715	13.82	50/100	R. Naderland, Holland
21545	13.92	100/250	Accra, Ghana		13.81	100/250	Accra, Ghana
21550	13.92	75/100	BBC London, Gt. Britain	21730	13.81	10/120	LLO, R. Norway, Norway
	13.91	100	Deutsche Welle, Germany	21735	13.81	100	Praha, Czechoslovakia
21560	13.91	50/60/100	R. Roma, Italy	21740	13.80	50/500	Greenville, USA
21565	13.91	50/100	R. Naderland, Holland	21745	13.80	10/100/250	R. Free Europe
	13.91	100	Lvov, USSR	21760	13.79		Guam
21570	13.91	50/100	R. Naderland, Holland	222515	13.74		Canal Zone
21580	13.90	100	Härby, Sweden	222593	13.28		Honolulu, Hawaii
	13.90	120	Minsk, USSR	222635	13.25		San Francisco, USA
	13.90	100	R. Afghanistan	222845	13.13	10	Belconnen, Australia
21590	13.90	15/100	BBC London, Gt. Britain	223650	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, bandsread, 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.



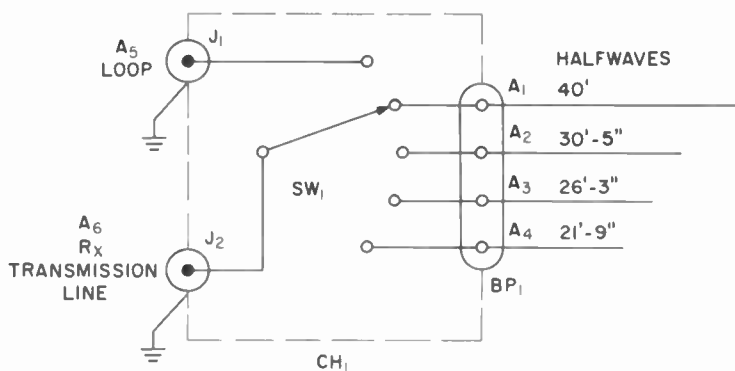


Fig. 12-1 Windowsill antenna farm.

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

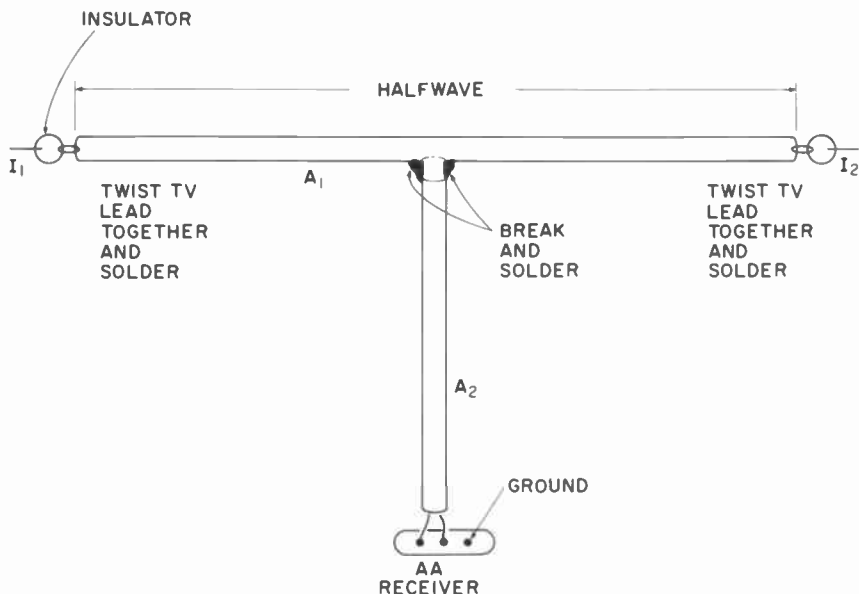


Fig. 12-2 DXer's folded dipole.

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 broadband 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).

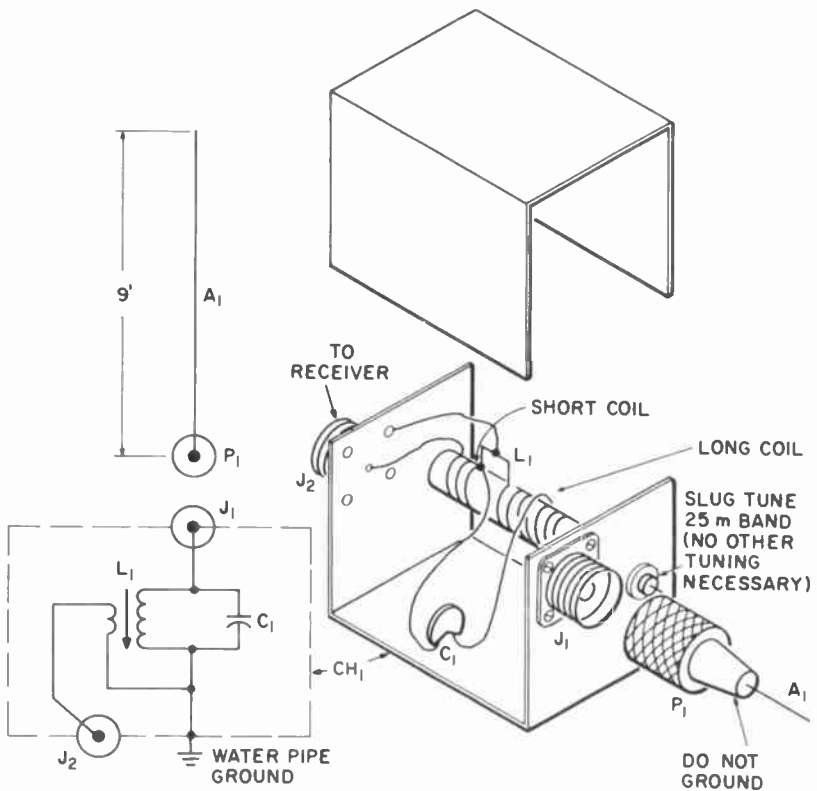


Fig. 12-3 All-band random and coupler.

### Parts List

- A<sub>1</sub>—Antenna wire: 9 feet of plastic insulated wire (split lampcord etc.)
- CH<sub>1</sub>—Small metal box
- C<sub>1</sub>—180 pF disc ceramic 1kW
- L<sub>1</sub>—1.7-5.5 MHz. Slug tuned coil (Miller B5495-A, or equiv.)
- J<sub>1-2</sub>—Amphenol SO-239 Receptacles
- P<sub>1</sub>—PL 239 Amphenol

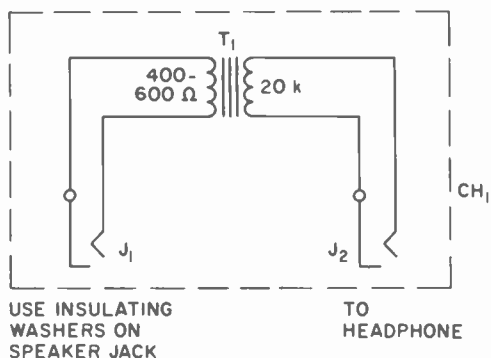


Fig. 12-4 DX headphone adapter.

### 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

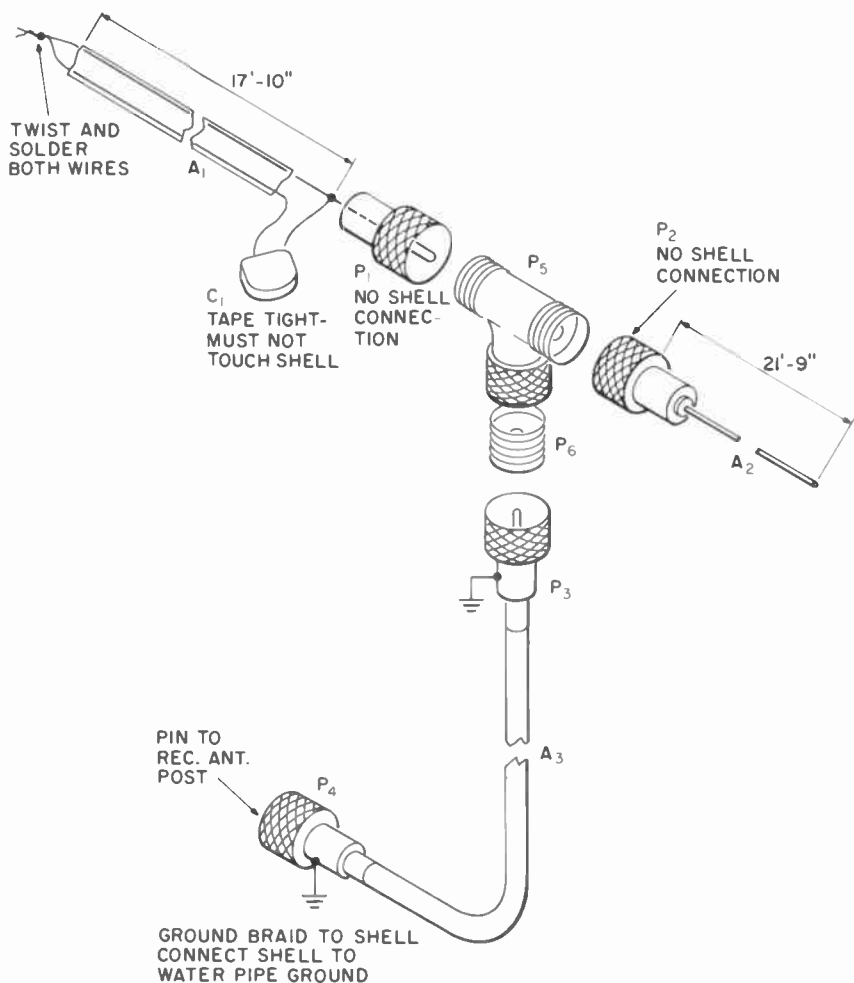


Fig. 12-5 Cliff-dweller's simple antenna system.

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.

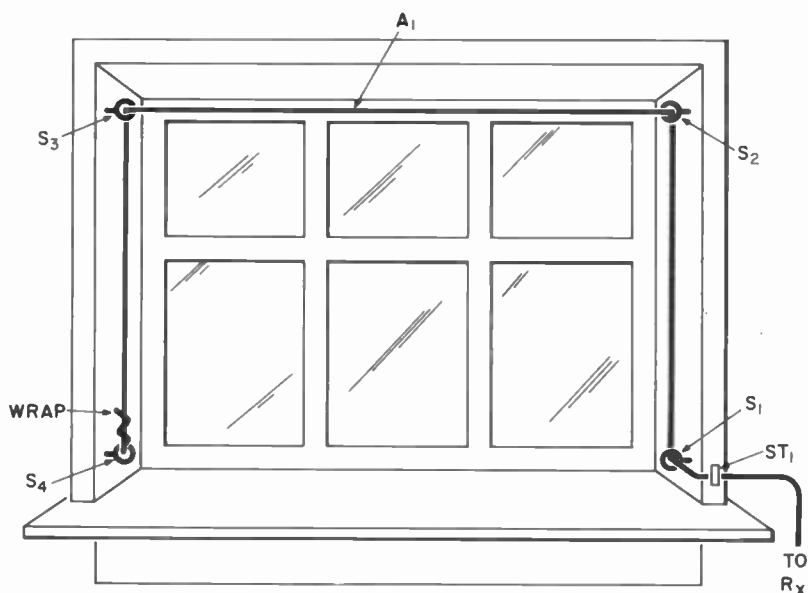


Fig. 12-6 Window-frame antenna.

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.

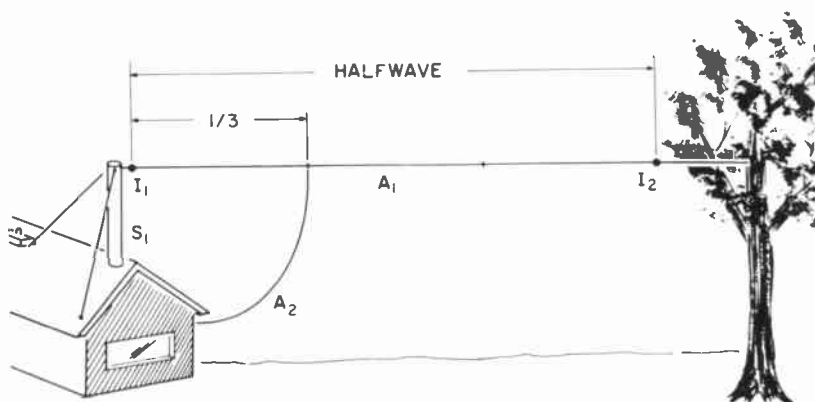


Fig. 12-7 Windom antenna.

### 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).

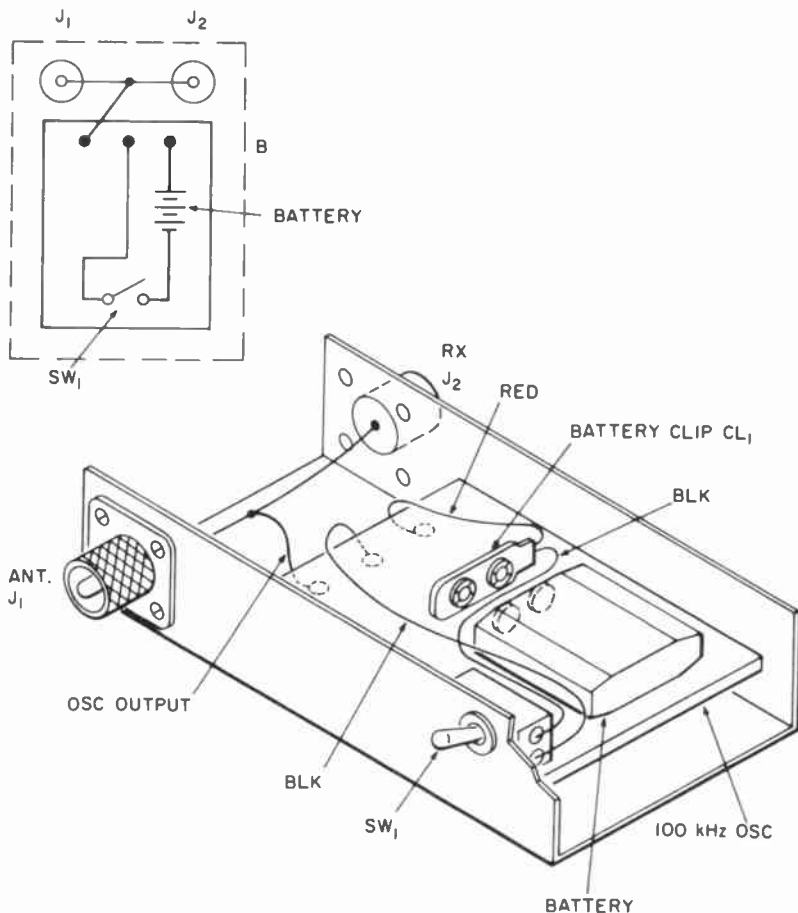


Fig. 12-8 100kHz crystal calibrator.

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.

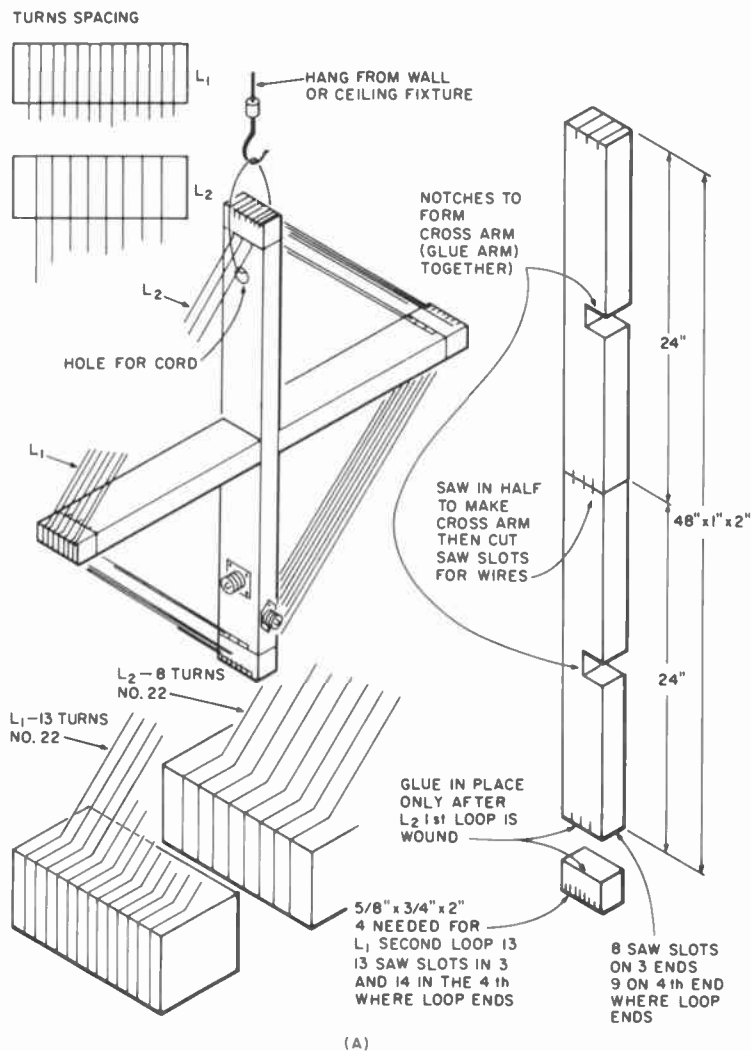
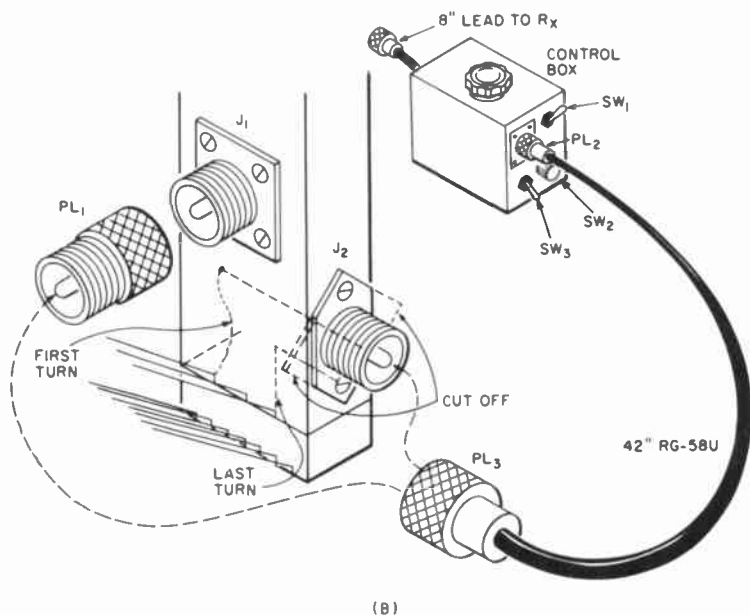


Fig. 12-9 (A) BCB Loop antenna.

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



(B)

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

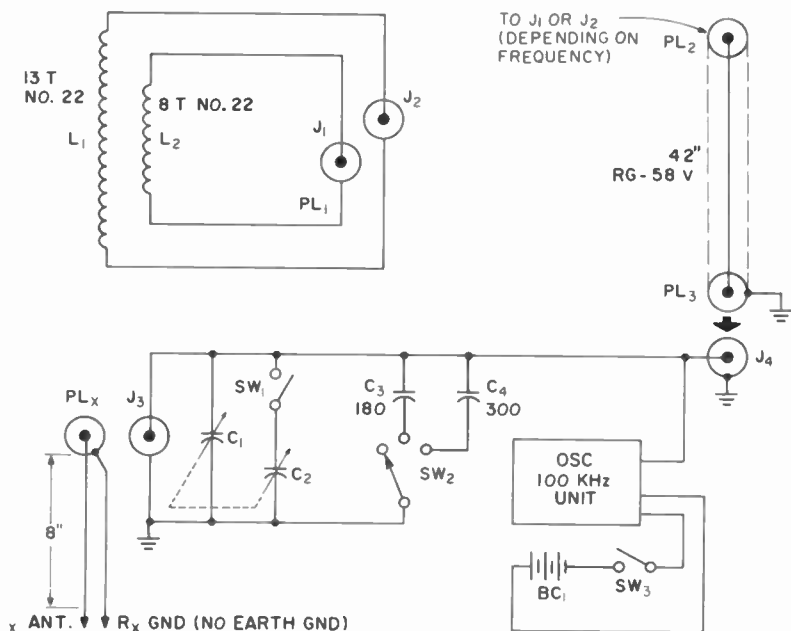


Fig. 12-10 BCB Loop antenna construction.

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,  $SW_1$  (connecting  $C_2$ ) will need to be closed. As the center of the band is approached (or the 900kHz range), switch in  $C_3$  and then, at the dead center of the band, switch in  $C_4$ . This switching is accomplished with one rotary control  $SW_2$ . If, on the other hand, the DX station is on the lower (900-540kHz) end of the AM dial ( $J_2$ ), the 13-turn loop section will be used with all switches open at the center (or 900kHz) portion of the dial. ( $SW_1$  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,  $SW_2$  will need to be closed, engaging  $C_3$ ; possibly  $C_4$  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 short-wave 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 because 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  $\mu\text{V}$  (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.

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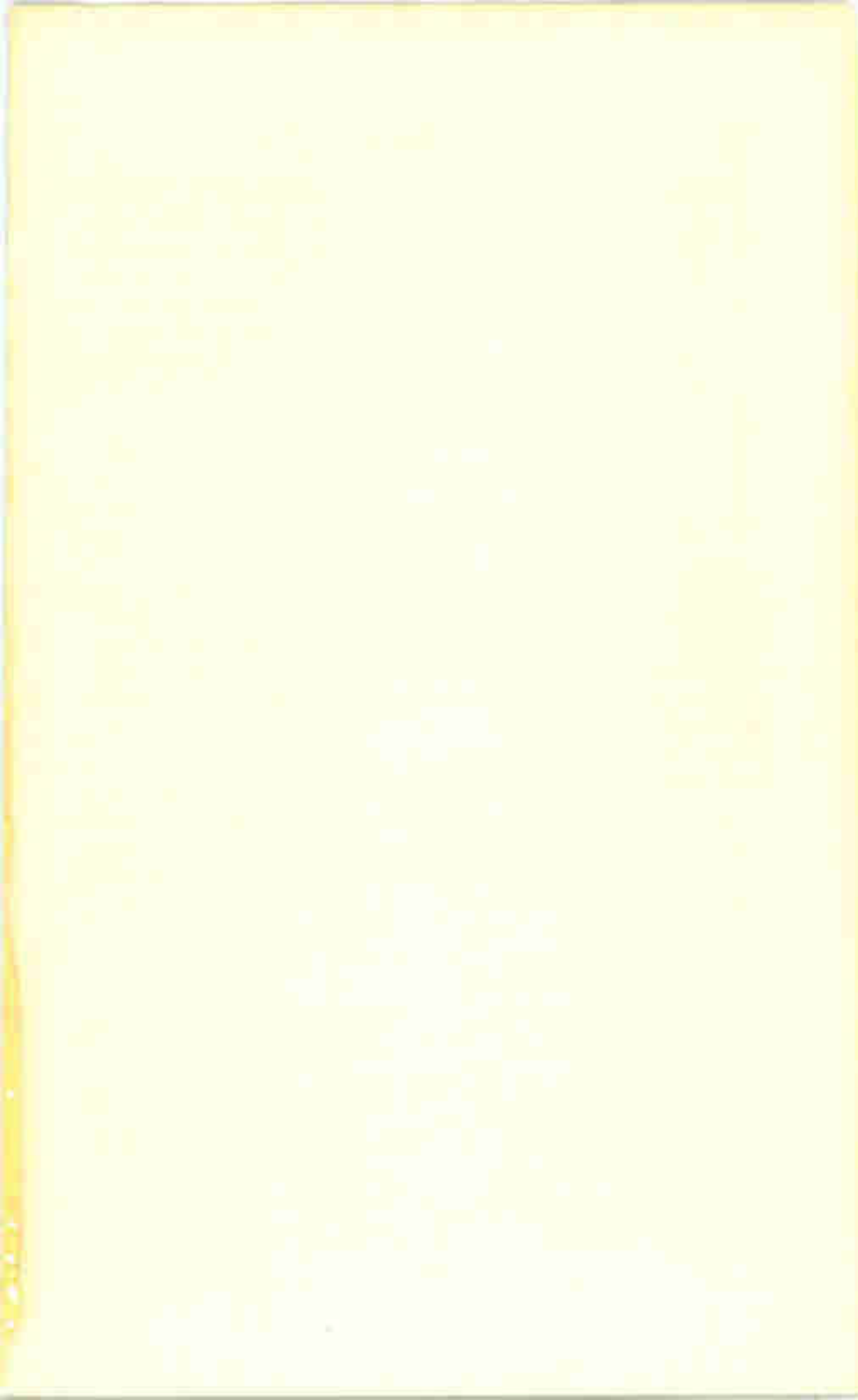
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- tropicals:** The bands (60-120kHz) favored in the tropics for home-service broadcasts because of high static problems existing on the regular 540 to 1600kHz AM broadcast band. Broadcasts on the tropical bands are almost always in the language of 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.

- 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 again.
- 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.



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