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short wave RADIO HANDBOOK

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MANUAL OF

SHORT-WAVE TECHNIQUE

AND

INTERNATIONAL BROADCAST RECEPTION

COMPILED BY

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Bernards (Publishers) Ltd.,
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BOOK II

PREFACE

Ever since the inception of short-wave radio I have devoted much time to this subject and have followed with keen interest any developments and the progress made.

The importance of international short-wave broadcasting became clear to me, years ago, when I started writing articles for various journals, eventually becoming short-wave note writer and short-wave reviewer for a popular journal. Besides this, I had the experience of both the practical and technical side of radio while serving with H.M. Forces during the first World War.

The experience so gained has enabled me to compile this manual of instruction and information on the various aspects of short-wave radio, knowing that it would supply a long-standing need.

While care has been taken to include only up-to-date information, it should be remembered that changes are always taking place on the short-waves. Thus new stations make their appearance periodically, others close down for good, and some make changes in schedule and wavelengths. Listeners are advised to keep a S.W. Log-Book and in this way information in this manual can be checked and brought up-to-date. In compiling the lists of stations (See Book II—Tables, Stations, etc.) space has been left for new stations, new times of operation, and altered wavelengths, etc.

Newcastle-upon-Tyne. CHARLES A. RIGBY.

January 22nd, 1944.

BOOK I.—INSTRUCTION.

CHAPTER I.

Introduction to Short-Wave Broadcasting.

International short-wave broadcasting has now reached such a high stage of development that its importance is becoming more and more recognised. Countries all over the world have taken to short-wave broadcasting so that the peoples of other lands, however far away, could learn more about them through their music and talks in various languages.

Short-wave radio development still goes on apace. With the perfection of apparatus, both broadcasting and reception have been greatly improved. Nowadays, it is possible through this form of radio to obtain more first-hand knowledge of a country, and news if needed, than by referring to books or reading a newspaper.

Glorious adventure, indeed, lies before the owner of a short-wave receiver. Close contact can be effected with strange lands, new people and different manners and customs appreciated. The outposts of the world are brought to the living-room and a "passport" supplied to many countries that all hope to visit but somehow never seem to reach.

Since a broadcast is an expression of the people, it is naturally typical of the country of its origin. Take, for example, the programmes emanating from the United States. These follow a pattern that is peculiar to its people and their times. As such, they are recognised wherever they are heard. The same can be said of broadcasts originating in European, South American, Australian, and Asiatic centres. So typical are many of these programmes, that after a few months, listeners can identify the sources of their entertainment long before the stations announce their call-letters or give their identifying signals.

The beginning of short-wave radio is well known. Several years ago, the short-wave bands, that is those below 100 metres, were regarded by experts as being completely useless for communication except over distances of a few miles. For this reason these S.W. bands were allotted to the amateurs when "crowding" on the medium-wave bands (200-500 metres) become a nuisance. It was considered that the short-waves would be good enough for the close-range working in which amateurs were likely to indulge.

But the amateurs were ambitious. Relegated to the short-wave bands they soon had some surprises and began making their "home" there. To their own astonishment and that of others, the experiments carried out by these pioneers were convincing proof that the S.W. were the best for long distance work with small power.

A feat which astonished the world was the establishment of communication with another enthusiast in New Zealand by a British amateur whose transmitter had a power rating which seemed ridiculous. From that time on, progress was made in leaps and bounds.

Side by side with the researches of the amateurs were those of Marconi. In 1919, he telephoned from Ireland to Canada; and in 1924, the Poldhu, Cornwall station, spoke to Australia. The problems of short-wave radio occupied the closing years of this pioneer's life.

As time went on more and more was found out about transmission and reception on these bands, so great was the interest in short-wave. First there were the "Americans" such as New York, Pittsburgh, and Oakland to listen to for they readily took to the new craze. Later on, Australia and Java took to S.-W. broadcasting. African stations followed and those in different parts of the Empire a little later. South America and Central America showed tremendous interest, so much in fact that stations in these parts made their appearance like "mushrooms"!

Initial steps in international broadcasting were introduced by the Westinghouse Company at Pittsburgh. Transmitting on a wave-length of 62 metres, their station KDKA, famous as "The World's Pioneer Broadcasting Station," became known all over the world.

In 1925, W2XI, then an improvised station of the General Electric Company, on Van Slyck Island, New York State, sent out a signal on 100 metres which was picked up by several listeners in different countries. This was the start of the Schenectady transmitters, W2XAD and W2XAF (or 2XAD and 2XAF), with call-letters now WGEA and WGEO.

PCJ, the experimental S.-W. station of Philip's Radio, Eindhoven, Holland, began transmitting in March, 1927. Operating on 31.4 metres, its programmes were heard all over the world.

In 1927, the first world-wide broadcasts were commenced from VK2ME (Sydney), and VK3ME (Melbourne), Australia.

The first trans-Atlantic relay took place in October, 1927, when the B.B.C. relayed throughout Britain, KDKA, Pittsburgh, then transmitting on 62.5 metres.

On February 1st, 1929, G5SW transmitted the first programme intended for reception in the U.S.A.

The "first-around-the-world" broadcast occurred on June 30th, 1930, the programme being that sent out by W2XAD, Schenectady, N.Y. This was relayed and then re-transmitted to Sydney, Australia, and sent on again to America.

With the great interest in international broadcasting came the struggle for prestige. Hence, many of the leading S.-W. broadcasters began calling their stations "VOICES" when giving the call-letters. Thus, VK2ME, styled itself "The Voice of Australia," and the Schenectady transmitters in time became known as "The Voice of Electricity." Many other stations are known as the Voices of the countries in which situated, the city at which located, or the particular locality where near. There is a "Voice of the Argentine," "Voice of the Tropics," "Voice of the Air," "Voice of British Guiana," "Voice of America," "Voice of Colombia," etc.

Of the many developments of short-wave radio and international broadcasting, a few may be mentioned, by way of interest. In 1937, "A.V.C." or automatic volume control, was fitted to superheterodyne receivers. This device automatically varies the sensitivity so that weak signals are amplified more than powerful ones. This reduces the risk of overloading and distortion when a strong station is being received, and also compensates in great measure for the rhythmic variations in signal strength known as fading.

Only a few years ago, the new type "frequency-modulated" radio broadcasts started in America. Such transmissions afford practically static-free reception. This new feature of American radio necessitated the "Frequency-Modulated" broadcast commercial receiver for "high-fidelity" reception. "F.M." stations are now in operation in many parts of the U.S.A.

Most of the larger international broadcasting stations have adopted "beaming" or directional broadcasts when transmitting to other countries. "Beaming" is made possible with the use of special styles of directional aerials. This greatly increases signal strengths in definite directions and assures listeners in particular parts or areas good reception.

With the raising of the power of some stations up to 100 kilo-watts there came into use a new type of transmitting valve and peak-limiting amplifiers. In this type of valve, the filament can be replaced, the effective directional power output being near 600,000 watts. The valve makes possible greater output with a simpler "set-up" at the transmitter, thus providing efficiency in transmission. Whereas six valves were used to obtain a power output of 40 K.W., two valves of the new pattern have a power of 100 K.W. A new type filament of activated tungsten is used in the valves which allows greater current at lower voltages.

Many other improvements in broadcast transmission and reception have been made. All kinds of directional aerials have been tried with varying success. "Side-band Interference," once a difficulty with reception, has now been partly overcome. New types of microphones and methods of modulating or "smoothing" transmissions are now so perfect that short-wave or international broadcasting has almost reached perfection.

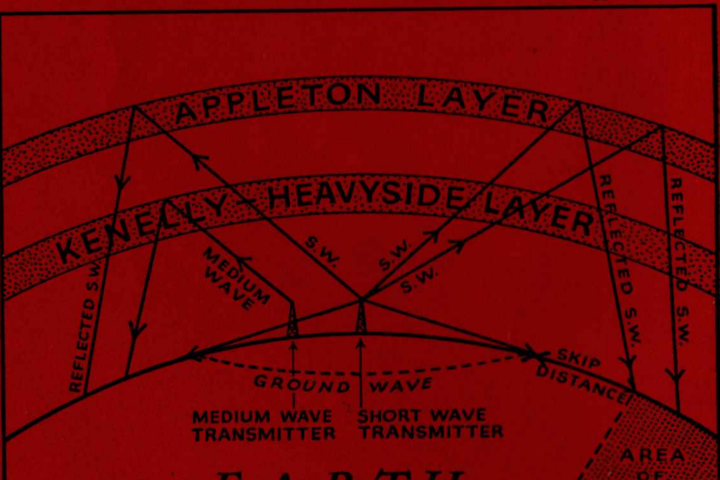
CHAPTER II.

Behaviour of Short-Waves. Reflection, Echoes, Kilocycles, Megacycles and Meters.

The short-wave newcomer may be thrilled at hearing stations at great distance, and perhaps wonder why this is possible. The explanation is simple.

Like the medium-waves, when short-waves leave the transmitting aerial they travel in all directions. That portion which travels close to the ground is called the "ground wave." (See DIAGRAM SHOWING SHORT-WAVE PATHS, below.) This wave is soon absorbed by buildings, metal deposits and natural screens. Other waves start off towards the sky at angles, determined by the design of the aerial and the frequency of the transmitter.

DIAGRAM SHOWING MEDIUM AND SHORT-WAVE PATHS —— *Chapter II*



Unlike the medium waves which are turned earthwards when they reach the Kenelly-Heavyside Layer, the short-waves travel much higher. The "sky-waves" sent out from the S.-W. transmitter go clean through the Kenelly-Heavyside Layer and travel, in most instances, to a height of about 150 miles where they meet another reflecting "envelope" known as the Appleton Layer. As a result, most of the impulses are turned back to earth, though some may escape to outer space to give rise to "echoes." Owing to the height of the Appleton Layer the waves come down to earth again at a great distance from the transmitter.

The distance between the terminus of the "ground wave" and the point of the reflected ray's return to earth is called the "SKIP DISTANCE" and in this area it is not possible to hear the station with any degree of reliability. This explains why a short-wave station of relatively low power is often heard at good volume several thousands of miles away, whereas its signal may be completely missing only 50 miles or so from the transmitter.

Because the short-waves are so "reflected," stations thousands of miles distant may be tuned in. The waves reach the receiver at *the speed of light,* at approximately 186,000 miles per second, or 300,000,000 metres per second (A METRE BEING A LITTLE LONGER THAN A YARD, or 39.37 INCHES). Travelling at this speed, wireless waves could thus go completely round the world nearly eight times in a single second.

It was found that some of them did speed right round the earth more than once, producing at the end of each journey fainter and fainter " echoes " in the receiver.

More amazing discoveries were made. It was found that "echoes" often occurred after an interval of three seconds duration. In that time wireless waves would make a journey of 558,000 miles, or just about the distance from the earth to the moon and back again.

Later, "echoes" with time intervals as long as 40 seconds were recorded, showing a journey of nearly 7,500,000 miles for the waves. During the last few years, much attention has been given to "echoes" and through these, certain new devices of great importance have been invented.

The height of the Appleton Layer varies with the time of day and the season. The earth has probably several reflecting "envelopes," whose conditions change during the day and throughout the season. These act differently upon short-waves of various lengths; hence it is found that at one period of the twenty-four hours a certain wavelength gives best results, while at other times this may prove useless. The use of a longer or a shorter wavelength may result in much better reception, however.

As signals change in strength as the hours pass from daylight, radio engineers have worked out charts which give the best wavelength to use at every hour of the day; and these charts are followed closely in selecting the frequency best suited for any particular broadcasting service. At a certain time during a transmission a certain volume or a "peak" is reached which may remain steady. The time when such a peak is reached is known as the "peaking period."

Tuning is so "fine" on the S.-W. that more care is necessary when tuning in or "revolving the tuning or condenser dials." If the tuning knobs or dials are turned too quickly then a distant station coming in faintly might be missed. After a few attempts at "tuning in" stations it will be found that there is much more room for these on the S.-W. bands than on the medium waves, where "Continentals" are even received over a wide range of tuning. This is because "WAVELENGTH IN METRES" does not mean anything when considering the separation between any two stations with a view to finding out whether they are likely to interfere with one another. The Kilocycle figure alone, gives this information.

For example, a station on 261.1 metres corresponds to a frequency of 1,149 kilocycles, and one on 263.2 metres to 1,140 kc/s.—a difference of 9 kc/s. On the S.-W., 30.51 metres corresponds to 9,832 kc/s., and 28.51 metres to 10,522 kc/s. While the difference between the last two wavelengths is 2 metres, the difference in kilocycles is 10,522—9,832 or 690 kc/s. Thus it will be seen that there is room for many more stations between the last two frequencies. Yet there is no room for even a single station to be sandwiched in between the stations on the medium-waves, mentioned above.

When a broadcasting station receives a licence to "go on the air," it is assigned a definite wavelength or frequency. The number of radio impulses or waves sent out per second is *the station's frequency. A station's wavelength* is the fixed speed at which radio waves travel (in metres per second) divided by the number of waves per second. For example, in the case of Moscow (on former or old wavelength), this would be 300,000,000 divided by 6,000,000 or 50 metres.

While the Kilocycle Listing is a simple and quick guide to station selection, some on the other hand, are accustomed to identifying a station by its wavelength. Frequencies higher than ONE MILLION CYCLES are usually designated as MEGACYCLES—MEGA means a million. Thus a MEGACYCLE is simply a thousand kilocycles or a million cycles. Most S.-W. stations now announce the frequency in use in MEGACYCLES and give the corresponding wavelength.

When referring to the CHIEF BANDS of the S.W. either the wave-length or frequency in megacycles may be stated, thus :

S.-W. BANDS	MEGACYCLES (Roughly)
60 METRES	5
49 ,,	6
40 ,,	7
31 ,,	9
25 ,,	11
19 ,,	21
16 ,,	17
13 ,,	15

In calculating FREQUENCIES and WAVELENGTHS, the following formulæ should be used :

FREQUENCY IN KC/s. = 300,000 ÷ WAVELENGTH IN METRES.
WAVELENGTH IN METRES = 300,000 ÷ FREQUENCY KC/s.
(OR FREQUENCY IN CYCLES × WAVELENGTH IN METRES = SPEED OF WIRELESS WAVES.)

CHAPTER III.

Choosing A Receiver.

At the present time most people prefer buying a receiver rather than making one, as there is so little time to spare, and again, certain components may be difficult to get. It is for those who are thinking of buying a set that this chapter is intended. In a later chapter, home-made receivers and circuits are dealt with.

Receivers which can be used for short-waves may be classified as follows:—

(1) ALL-WAVE: Covering Long Waves, Medium Waves and Short Waves. Often using 3, 4, or five valves.

(2) SUPER HETERODYNE: Multi-valve sets, usually.

(3) SPECIAL COMMUNICATION SHORT-WAVER: Used for specific band or bands, and consisting of 1-5 valves, or multi-valve set.

From the purchaser's point of view, the chief considerations he has in mind when buying a set, are:

(*a*) Expenses or upkeep of such a receiver. This depends on number of valves, etc.

(*b*) Type of receiver and number of valves to suit one or more rooms (size of home).

(*c*) Whether Mains-operated set, A.C. or D.C. This will depend upon facilities in the home, or whether electricity is used for lighting or otherwise.

If electricity is available a mains-operated receiver should be chosen. If not fitted with electricity, a battery-driven receiver should be chosen. Once this is decided all that an intending listener has to do is to decide upon the number of valves.

For good loudspeaker volume a receiver with at least three or four valves will be sufficient. Quite a number of multi-valvers of various designs are to be had, but expenses of operating such receivers are usually too much for the average person.

Whether it be an electric or battery-driven receiver, the intending purchaser should find out the uses of the chief tuning knobs, and with that object in mind should ask for demonstrations. It would also be well to find out the following (and more if necessary):

(1) Best type of aerial to use.

(2) Best earth to use.

(3) General information regarding upkeep or expense of operating the receiver.

(4) With battery-driven receivers, full particulars of all batteries used, including Accumulator, High Tension Supply, and Grid Bias Battery.

If satisfied with particulars and demonstration, then the buyer will ask for one to be installed.

(A) *All-Wave Receivers.* There are so many different kinds of "all-wavers" on the market (2-valve to multi-valve sets) that there is no point in discussing these in detail. An "all-waver," of course, is handy for those who wish to receive programmes on (a) Long Waves; (b) Medium Waves, and (c) Short Waves—generally from 13 to 50 metres.

(B) *Communication and Super-Heterodyne Receivers.* Here again, the short-wave listener has a wide choice of type, number of valves, and specific range or ranges covered. As in the case of all-wavers, all these sets whether special communcation or super- heterodyne, can be bought for using on the mains, or with ordinary high tension battery and accumulator.

Communication and Super-heterodyne receivers may be bought to cover certain specific bands, as below:

(*a*) Two bands—250-550 metres and 5-180 metres.
(*b*) One band—7½-60 metres.
(*c*) One band—1-10 metres, etc.

Any maker of a receiver will give the *Specifications* or special features incorporated in a receiver. Here are the specifications of a certain well-known communication receiver with Pre-Selection and Built-in-Speaker.

Features.

Beat Frequency Oscillator.
A.V.C. Switch.
Excellent Sensitivity and Selectivity.
A. F. Gain Control.
Band Switch.
Sensitivity Control.

Tube Complement (Valves).

6K7—RF. Stage.
6L7—First Detector.
6J5—High Frequency Oscillator.
6K7—I.F. Stage.
6Q7—Second Detector AVC and first audio.
6F6—Power Output Tube.
8.0—Rectifier.
6J5—BFO.

Chief Controls.

RF. Gain, Tone Control, Phone Jack, AVC Switch, Beat Oscillator Switch, Send-Receive Switch, AF. Gain Control, Band Switch and Pitch Control.

For Operation on A.C. Only.

Some of the chief tuning knobs of a typical Communication Receiver may be noted. (*See diagram next page.*)

A.V.C.

or Automatic Volume Control, varies the sensitivity so that weak signals are amplified more than powerful ones. This reduces the risk of overloading and distortion when a strong station is being received, and also compensates in great measure for the rhythmic variations in signal strength, known as "FADING." Of the various forms of "A.V.C.", delayed-A.V.C. is the most useful. This is not needed when the Beat-Frequency Oscillator is at work, and there are times when A.V.C. is a hindrance rather than a help on the S.W.

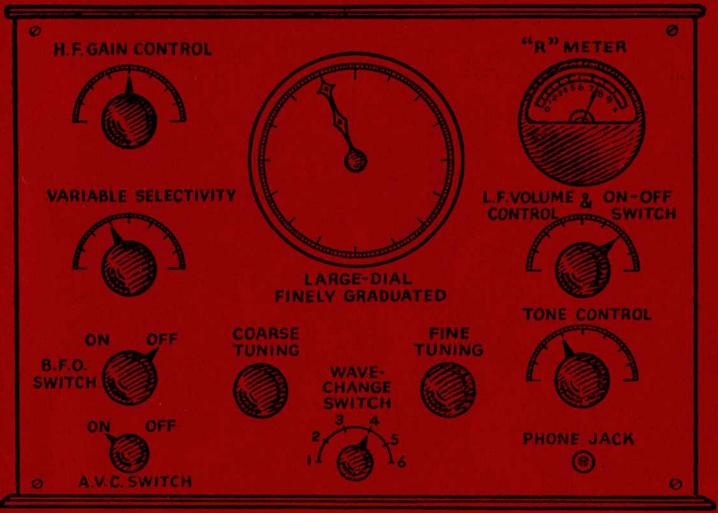
H.F. Gain Control.

The sensitivity of the receiver is not fixed but can be adjusted by this knob to get the best out of the wanted signal and a minimum of unwanted background.

Selectivity Control.

One is not tied down to a fixed 9 Kc/s separation. Sometimes one may wish to pick out a transmission from a neighbour (or neighbours) working much less than 9 Kc/s. away. The listener can adjust the selectivity to meet the needs of the moment. In some Communication receivers a "Crystal Gate" circuit can be switched in giving up to 1 Kc separation if necessary.

CONTROL PANEL OF TYPICAL COMMUNICATION RECEIVER-*Chap.III*



Beat Frequency Oscillator.

This is coupled to the detector. When switched on it heterodynes an incoming signal giving rise to a squeal. Its primary purpose is to enable stations sending continuous-wave morse to be received; but it is of the greatest value to the searcher after distant stations, for even the weakest "announce their presence" by squeals as their settings are reached. One can thus "tune by the squeal" without any possibility of causing annoyance to neighbours by radiation.

Coarse and Fine Tuning.

There are many possible tuning arrangements. Sometimes only one knob is used; sometimes there is a single large dial with fine graduations; sometimes there is a secondary auxiliary pointer for precision readings; sometimes there is a separate "band spread" dial.

Wave-Change Switch.

This may have five or six positions for as many ranges.

Low Frequency and Volume Controls.

Correspond to similar controls on ordinary broadcast receivers.

The "R" Meter.

This is often calibrated in DECIBELS and shows the measure of a signal's strength. Sometimes a milliammeter or some other form of tuning indicator is used.

Phone Jack.

This is used for plugging in headphones when listening to weak signals.

Large Tuning Dial.

This is finely graduated and is revolved for the purpose of tuning in stations.

The different stages in a SUPER-HETERODYNE RECEIVER may be understood better from the diagram below.

A RADIO SET ANALYSED.

Sections of a Super-Heterodyne.

Incoming Signal	High Frequency Amplifier	First Detector	Intermediate Frequency Amplifier	Second Detector	Low Frequency Amplifier	Loud-Speaker
	Oscillator or Frequency Changing Valve					

Mention may be made here of the ADAPTOR, a one-valve arrangement or unit, often used for short-wave work. With this piece of apparatus plugged into the DETECTOR SOCKET of any existing "straight" set (as apart from a super-het.) an efficient short-wave receiver is available. The advantages of such an arrangement are two-fold, for not only does it enable short-wave stations to be received on the ordinary broadcast receiver for a very small outlay, but also, it enables use to be made of the existing set amplifiers when receiving on the ultra-short-waves.

CHAPTER IV.

The Aerial and Earth.

When a receiver has been chosen, the next considerations are the aerial and earth.

For short-wave work the shortest wire to earth is best, this making for greater stability, particularly when the receiver is ultra-sensitive or may be home-made. Again, there should be a good connection to the earth source which should be at good depth.

A flimsy connection to a gas-pipe will not prove satisfactory, and an aerial of thin-stranded steel wire is not much good either. An insulated wire aerial, composed of thick strands of copper or one of superior make, gives the best results.

Most likely the makers of the receiver will specify the type of aerial most suitable for S.W. reception. On the other hand, such particulars may rest entirely with the salesman who supplied the set. The ordinary type of aerial consisting of a single length of wire suspended from a pole is quite good, but only one direction is favoured.

It may be of interest to point out that an inside aerial stretched along the picture rail ledge of four walls and held by insulators, was tried with great success. No more than about 12 feet high from ground level this appeared to favour most directions. In this connection, height above sea-level in the particular locality should be considered.

Outside aerials bring in loudest signals, being more sensitive to the incoming waves. But there is inclined to be too much "mush," local electrical interference, and "spark" and "jamming" stations come in so loud as to be a nuisance. In order to reduce this to a minimum, a type of indoor aerial may be conveniently arranged at fair height and with directional possibilities. Indoor aerials are used more often than not for the sake of convenience; and there are many kinds.

For most short-wave listening, an aerial of from 50 to 75 feet in length is suitable. For reception on the Ultra-S.-W. a much shorter length is usually needed. (See later chapter dealing with the U.S.-W.) The most suitable lengths for either the short-waves or the ultra-S.-W. can be found by experimenting with several. It should be remembered that each aerial has a FUNDAMENTAL WAVELENGTH depending not only on the length of aerial but the type.

Taking the single half-wave type, according to theory, the length in feet should correspond to the wavelength on which reception is desired most, in the proportion of 1.57 :1. In other words, the length should be approximately 1.57 times the wavelength of desired reception.

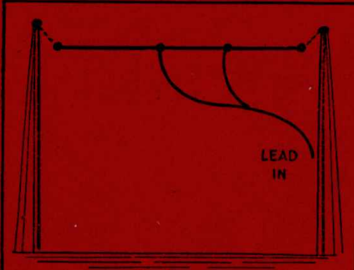
Below is a table showing the wavebands corresponding to certain lengths of HALF-WAVE AERIALS, or those not earthed. Those earthed at one end, through a receiver coupling coil, resonate at a wavelength equal to *four times* the physical length, and are therefore known as QUARTER-WAVE AERIALS.

Wave-Band.	Aerial Length.
49.5 metres	77ft. 9ins.
42 ,,	66ft.
31.5 ,,	49ft. 6ins.
25.5 ,,	40ft.
21.0 ,,	33ft.
19.7 ,,	31ft.
16.9 ,,	26ft. 6ins.
13.9 ,,	22ft.
10.5 ,,	16ft. 6ins.

In concluding this chapter, mention may be made of static eliminators or noise suppressors, and other devices connected in the aerial. These generally make use of fixed condensers or their equivalents. While static and other interference may be lessened to a smaller amount, total elimination is almost impossible except in the case of "frequency-modulated" broadcasts which need special receivers. To lessen static and local interference a frame aerial should be tried.

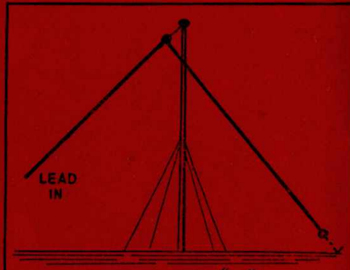
OUTDOOR TYPES OF SHORT-WAVE AERIALS: (CHAPTER IV)

1



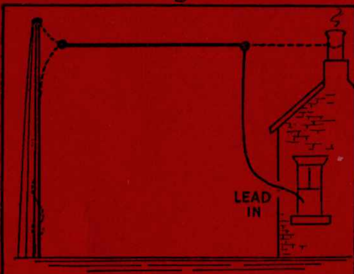
THE "V" DOUBLET

2



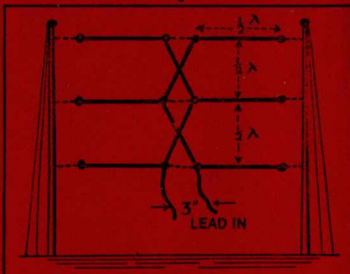
INVERTED "V."

3



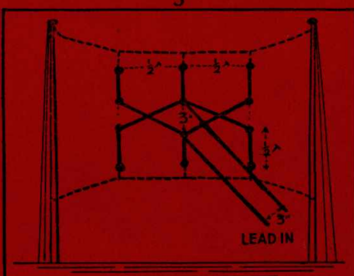
INVERTED "L."

4



HORIZONTAL HALF-WAVE

5



VERTICAL HALF-WAVE

(NOTE; *These arrays receive most strongly from a direction at right angles to them*)

CHAPTER V.

Operating the Receiver and Tuning In.

As mentioned previously, when purchasing a receiver, full details of the chief tuning knobs and method of operation should be obtained from the makers or salesman concerned. This applies to all types whether battery-driven or mains operated. Such details as correct voltages to apply to the valves are important, not only from the expense point of view, but because of the care and proper handling of the valves and the receiver as a whole. An intending purchaser should only be satisfied after a proper demonstration of a receiver's capabilities. In the case of a communication receiver which is fitted with special controls, the beginner should refer to Chapter III.

The tuning-in of short-wave stations is not quite the same as tuning in those on the medium waves, however distant they may be. When the approximate dial location is found the tuning knob must be rotated very slowly and carefully backwards and forwards and the volume control adjusted until the signal is recognised. Then by closer and finer tuning the signal is built up to a volume sufficient to identify the programme.

Let there be no misconceptions regarding the tuning in of S.-W. broadcasts as considerable skill and practice are necessary. At first a little practice at turning the set on and off and manipulating the knobs and switches for the various arrangements will prove helpful.

Then an attempt may be made to pick up a station. The listener may be fortunate enough to tune in, say, Chunking, then, after about half an hour, the transmission may have disappeared or "faded out" altogether without announcements being heard or any warning whatever. Or he may have tuned around 19 metres with the intention of hearing WGEA, Schenectady, New York, without hearing a trace of it.

Here again, patience must be shown for besides skill in tuning, the short-wave enthusiast must learn something about ether conditions. At the time of first trying out a receiver, conditions may not be favourable for picking up short-wave broadcast stations at short-range, let alone distant ones.

S.W. stations at ranges up to 1,500 miles, including all those in Europe, may be regarded as "LOCALS." Provided that they are not too near, these are generally well heard on most occasions not being so dependent upon favourable conditions. When the stations are at great distance, the peculiarities of the higher frequencies are more noticeable.

As for short-wave knowledge, the listener will inculcate this in time. Times of transmission in various countries should be noted or calculated if necessary. As transmitting schedules are difficult to obtain, details as announced from time to time from the various stations should be entered into a log-book. Again listeners should remember after first switching on a set and tuning in a station, a second re-tuning is often necessary for technical reasons, or just after the time when a receiver has got "heated up" as it were.

In normal broadcast reception, the station to be received is usually a comparatively short distance away, and uses very high power. In order to receive it the dial is turned to its wave, and the volume increased until it is loud enough. Following the same procedure with short-waves, it may be noted that fading is bad, or quality worse. There is fading on the medium waves, that gradually dying away and equally gradual return to full strength of the station. On short-waves, not only is there "fading," but also another type called "selective fading." This selective fading is one of the main causes of distortion. It causes certain frequencies to fade more than others, and as these frequencies may be very close it ruins the quality of reception. In non-technical language the high notes of a S.-W. station may fade, while the low notes are unaffected. If this fading is very rapid, that is, occurring several times a second, it can easily be realised how badly, quality may be impaired.

Turning to the TONE CONTROL, if this is turned the top notes are reduced. If selective fading is affecting these top notes, and the top notes in reception reduced, then fading must be reduced at the same time. The ear will scarcely notice this reduction of top note response, but it will notice a tremendous improvement in fading, and the reception will sound far better.

Some receivers, as previously mentioned, are fitted with "variable selectivity." Use of this control also has the same effect, and by a judicious use of this control and the tone control, a station which is apparently coming in poorly can be turned into quite a decent signal.

The ordinary type of "up and down" fading, the sort experienced on the medium waves, is supposed to be taken care of by the automatic volume control (A.V.C. incorporated in the set). This is entirely automatic, and is operated by the signal reaching the receiver. When this signal fades, the receiver is automatically turned up, and when the signal regains its full strength once again the receiver is automatically turned down, thus obviating any effect of fading. There is a limit to the amount the receiver can be turned up, and if the signal fades so much that turning the receiver full on still does not make it readable, fading will be noticed. Fading as bad as this is seldom experienced on medium waves, hence the present-day use of A.V.C. smoothing out all of it. Going down to short-waves, one finds that fading is rarely as bad as this, but occurs far more rapidly.

Thus, although on medium waves it may take up to three minutes for a station to fade from full strength to minimum, on S.-W. it usually takes only a matter of seconds and this gives reception in a series of "bursts." If the volume control is turned up full, the loudest part of the signal will most likely overload the set, whereas when it fades to minimum, as the ears have been deafened by the previous burst of volume, there will be difficulty in hearing, although the signal may still be perfectly readable. When fading of this type occurs a good tip is to reduce volume, and the effects will be nothing like so apparent as when the receiver was turned full on.

Many a listener falls into this trap of too much volume. A weak signal is heard, the volume is increased, only to hear it "swamped" out by noise. Receivers of this type have R.F., I.F., and L.F. Volume Controls, as well as variable selectivity and tone controls. Don't turn all the volume controls up full and expect good results because you won't get them. Try the effect of reducing each of these volume controls in turn, and you will be surprised at the improvement in reception.

CHAPTER VI.

Effects of Sunspots and the Aurora Borealis. Fading.

The study of short-wave conditions and the effects of sunspots upon these is sufficiently important to mention here. At the present time many of the leading international broadcast stations give talks on ether conditions, sunspots, magnetic disturbance and the aurora borealis; and often data is supplied.

From time to time reports of sunspots appear in daily newspapers. Observations of the effects round about then will be interesting. Many may wonder what sunspots are. These are believed to be huge whirlpools in the outer gaseous layers of the sun and are caused by tremendous activity within. Strangely enough, the biggest sunspots observed are usually in pairs.

Small sunspots may go unobserved. When they are large they may be seen by the naked eye with the use of a smoked glass. Ordinary glass may be used, but better still, a magnifying glass. This should be smoked by holding it above the flame of a candle or similar light for about half a minute. Viewed through the glass, the sun's face appears to have a dirty mark on it when a large sunspot is present.

Observations show that when large sunspots are reported to be crossing the sun's disc, a period follows when signal strengths of distant stations and "locals," are exceptionally strong and in fact "freakish." Stations most difficult to tune-in ordinarily may be reasonably heard, and wave-bands which appeared to be "dead" become "lively."

Probably, there are few periods of any great duration in which the sun's surface does not display a few sunspots, but only the larger ones can be seen and so reported in newspapers. The common or average kind are less heard about being chiefly observed by astronomers through a telescope. Astronomers have been studying sunspots with great interest since early times. In this way it was proved that the sun makes one rotation in a little more than 25 days. Usually, there are groups of sunspots which last a few days, but occasionally a group lives long enough to be brought round again by the rotation of the sun. In this manner, the group may continue for about a month, or even a period up to a year.

According to some scientists, there is a sunspot "cycle" or period of 11 years between one maxima of activity and the next. Others, of course, differ on this point. Usually, short-wave signals deteriorate towards a sunspot minimum, and begin to improve as a maximum approaches. In other words, the "OPTIMUM," or best frequency on the band roughly between 10 and 100 metres, increases with approach to a sunspot maximum, and gradually decreases after it.

However, it should be thoroughly understood that S.W. are distinctly different from the U.S.W., since poor conditions may exist on the former, quite the reverse is often the case on the U.S.W. For this reason, the U.S.W. are dealt with in a later chapter.

The effects of the aurora borealis on reception are well known. Sometimes this is referred to as magnetic disturbance. So far as is known the aurora phenomenon is due to a bombardment of the atmosphere by charged particles shot out from the sun. The aurora itself is generally not less than some 60 miles above the earth's surface. The phenomenon is by no means uncommon in high northern latitudes, but there have been times when it has been observed even farther south.

The term "fade-out" is often used when there is magnetic disturbance. In such a case signals disappear altogether, although they may have been strong at first. There is a common belief that an auroral display wipes out all S.W. signals, but this is a fallacy. The magnetic disturbance resulting from a display has various effects. Just before taking place, conditions begin to change, first on the higher frequencies, and gradually spreading to the lower frequencies as the phenomenon becomes visible. In most cases "FLUTTER" is noticeable. This is the term applied to a signal constantly changing in strength, and is usually associated with "fading," this being so rapid that the signal "flutters"—an appropriate term. At the same time there is a shortening of "SKIP DISTANCE," and a slight falling off of signal strengths. Telephony signals have a hollow sound. Besides atmospherics, certain noises peculiar to an auroral display as "squeaks" are heard. Usually, the after-effects of a display last for days, and are serious. Signals on many bands are usually very weak and scarce, "SKIP" being long.

A station perhaps 1,000 miles distant may come in exceptionally loud, and then, after a lapse of a few minutes, just as suddenly disappear, the only other signals audible coming from a distance of perhaps a few thousand miles, still with marked "flutter." Such conditions are termed "ERRATIC." Some "locals" may be heard quite well and with no sign of others, while distant stations difficult to hear ordinarily, might be heard at good strength. On some bands, effects might be hardly noticeable.

The "SHORT SKIP" is undoubtedly due to the comparatively low altitude of the reflecting layers or *IONOSPHERE.* At this point, it may be said that "skip distance" varies widely for a given frequency, being effected by *daylight and darkness,* by the *seasons,* by such remote phenomena as *sunspots,* and by the direction (*geographical bearing*) of the line between transmitter and receiver. All these seemingly unrelated factors have one influence: the IONIZATION of the atmosphere, the degree of which is governed by the amount and quality of SUN RADIATION through the atmosphere. In general, daylight decreases skip distance, and therefore effective range.

Radio engineers keep all these points in mind when choosing the frequencies for transmission, since not only do the hours of sunrise and sunset change with the season, but also THE ANGLE AT WHICH SUNLIGHT PASSES THROUGH THE ATMOSPHERE.

Even these fairly predictable variations occurring with the season have been upset somewhat during the last few years, and the deviation ascribed to the influence of coincident sunspot phenomena.

Another problem in connection with the ionosphere is FADING. This bothered S.W. listeners for many years until A.V.C. was used to deal partly with it. In the case of commercial circuits, a combination of effective Automatic Volume Control and diversity reception or the use of several receivers with aerials variously disposed at some distance apart, is used to good purpose. This, of course, is impracticable in the home.

Fading may be of a general sort, or it may be of the "selective" variety, in which it is accompanied by acute distortion. Much of the fading experienced when listening to distant transmitters, arises from interference between rays reflected at different heights in the atmosphere and reaching the upper layer at various angles to the horizontal, being reflected downward again at various angles.

In the case of distant stations, it is the "sky-wave" alone which is received, hence the fading in a rather different way. The aerial receives not just one set of "sky waves," but two or more sets that have been reflected down from one of the "Appleton Layers." Although there is no "ground wave," the waves arrive at the receiving aerial simultaneously travelling by different routes, which may or may not be "in step" when they reach it.

CHAPTER VII.

Ether Conditions.

After a long-term of listening on the S.W., variations and changes in ether conditions may be easily recognized. As previously mentioned, the two chief sources for such changes as occur are (1) The Sun, and (2) The Aurora Borealis.

The conditions experienced at various times may be grouped as follows :

1—PHENOMENAL. 2—NORMAL. 3—MODERATE : (a) Noisy ; (b) Moderately Noisy. 4—POOR or BAD. 5—GOOD or NORMAL. 6—VARIABLE. 7—ERRATIC. 8—SEASONAL EFFECTS.

Phenomenal and normal conditions are discussed together as they are opposites. When there are no disturbing influences at work, conditions are said to be normal. The far distant station and "locals" come in at average strengths. In other words, there is consistency in signal strengths on most bands. Atmospherics do not indicate any immediate change, and both locals and distant stations can be relied upon.

Phenomenal conditions are associated with the sun and sunspots and can be readily recognized. There is a peculiar "glassy-smoothness" when listening and absence of static. The "locals" pound in at enormous or prodigious strengths, being so strong as if only a few miles away. Some distant stations not previously heard may come in easily, the whole of the magic of S.W. reception seeming to be under some peculiar spell. During such times even some of the smallest of stations in out of the way places may come in quite as good, if not better, than some of the more powerful ones.

There is hardly any difference between normal and moderate conditions, but the term normal is more used, say, when phenomenal or erratic conditions have changed to their normal state. But, while normal conditions may ordinarily be "QUIET" where static or atmospherics are concerned, moderate conditions may imply normal signal strengths with a little more trouble from static. Noisy and moderately noisy conditions, of course, call for some distinction.

Again, the bad or poor conditions are considered together with the good or normal. When conditions are normal, there are often opportunities for surprises in distant reception on certain wavelengths. In this respect, reception of many distant stations is satisfactory, particularly those transmitting with good power.

When conditions are poor or adverse, reception is likewise. There may be "fade-outs," too much static, and an inconsistency associated with disturbance of some kind. Most bands appear to be more or less useless or "dead," and even "locals" may perform badly.

Variable and erratic conditions have already been mentioned in connection with the effects of the aurora borealis. There are times when quick changes in ether conditions are noted after a few hours of listening, and these can only be differentiated by a variable grouping. Variable conditions usually precede those described as erratic, when nothing on the S.W. is occurring true to form. When conditions are erratic, signal strengths drop rapidly.

At this point, however, it should be noted that a quick drop in signal strength may be due to another cause: namely, BEAMING. At certain hours of the day stations of the B.B.C. and other large broadcasting groups change over to another aerial, a directive one, for the purpose of "beaming" the transmission to a certain country or locality. Immediately this change of aerial is made, signal strength of the transmitter may be greater or less, according to the line of direction between station and listener. (Further notes about beaming are dealt with at the end of this manual.)

Seasonal effects on the reception of certain distant stations are much more difficult to recognize. Owing to a seasonal change, there may be a "WIPE OUT" of signals on a particular band. "Wipe out" seems to affect stations within a certain distance. Then some stations are heard much better at one season than at another. And while direction and locality may be important in certain instances, a DIRECTIVE RECEIVING AERIAL will give maximum results.

The best examples of seasonal effects have been with stations situated in the Far East, transmitting on the 31m. band. As example, the Nairobi Station, VQ7LO. While Nairobi may be heard better in the S. of England at most times of the year, it is best heard during the late summer, in the North. Again, the 60-m. Indian stations, transmitting during the afternoon, come in best during the summer months. No doubt many more examples of these seasonal effects will occur to the experienced listener.

To conclude this chapter, something must be said about the powerful locals, which are often heard over many degrees of the tuning condenser. This is hardly avoidable, and although giving trouble, is often a sign of phenomenal conditions when stations in every corner of the globe can be heard.

CHAPTER VIII.

The Chief Bands. Logging the Stations.

Below is the B.B.C. short-wave service for Europe and the Far East:

Call sign	*Wavelength*	*Mc/s.*	*Call sign*	*Wavelength*	*Mc/s.*
GSA	49.54 metres	6.05	GRH	30.53 metres	9.82
GRR	49.34 „	6.08	GRD	25.53 „	11.75
GSL	49.10 „	6.11	GSN	25.38 „	11.82
GRO	48.54 „	6.18	GSE	25.28 „	11.86
GRN	48.43 „	6.19	GRV	24.29 „	12.04
GRT	41.96 „	7.15	GRF	24.80 „	12.09
GSW	41.49 „	7.23	GSF	19.82 „	15.11
GRJ	40.98 „	7.32	GSP	19.60 „	15.31
GRV	31.75 „	9.45	GRE	19.51 „	15.39
GSB	31.55 „	9.51	GSG	16.86 „	17.79
GSC	31.32 „	9.58	GSY	16.84 „	17.81
GRX	30.96 „	9.69	GRZ	13.86 „	21.64

With a list of stations set out as above, it will be seen how most of the broadcasting stations operate on the PRINCIPAL BANDS. These bands are generally referred to as the 13, 16, 19, 25, 31, 40 and 49-metre bands. With the 60-m. stations, this makes a total of eight principal bands on the S.W. Regarding amateur transmissions, the bands allotted are 20, 40, 80, and 160 metres. Due to war conditions, however, amateur transmissions are curtailed.

While the principal bands are named, listeners should note that other bands are used. Stations on these are to be found on (a) 75m., (b) 61-63m., (c) 41-49m., (d) 25-31m., and (e) 19-25m. These are known as the INTERMEDIATE BANDS OF THE S.W. Also many Venezuelan stations are now operating on various wavelengths between 85.70m. and 90.90m. These are known as the ’ Mc. group of stations.

For the periods of listening extending from just before noon till a few hours after, the 13-m. and 16-m. bands should be tried. The 19-m. stations are usually best in the evening; while the 25, 41-43, and 49-m. stations come in well (particularly those of 49m.) late in the day extending to the early hours of the next.

A 49-m. station as Nairobi may be heard after tea-time, conditions permitting. The 60-m. Indian stations generally reach a "PEAK" round 16.00 B.S.T., just about the time when 16-m. transmissions are good. The South American stations on 60m. come in during the early hours of the morning. The 31-m. South Americans, of course, are heard much earlier.

Perhaps the most outstanding reception is obtained on 19m. and 31m. These are the "KEY BANDS," and stations all over the world have succeeded in being heard on these at all times. Even stations with low power have succeeded on these wavelengths. There is an excellence about signals here which cannot be mistaken.

The 13-m. transmissions are by no means so good being often spoilt by static and atmospherics generally. "Fade-outs" are common.

The 16-m. transmissions again differ from those of other bands. Signal strengths and qualities cannot be compared with those on 19m. and 31m. The other bands, namely 25, 41-43, 49, and 60m. are more or less in the same class. Transmissions are fair when conditions are favourable, but though not mentioned by others, there is not the same "tone" about them. This has nothing to do with transmission quality or type of receiver in use, but seems to be a peculiarity of 49 and 60m. transmissions in particular. In this respect none of the other bands can compare with those of 19 and 31m., or even 25m. Again, whenever there are atmospherics on 49 and 60m. they are usually very heavy indeed, in fact almost as heavy as on the medium waves.

Logging The Stations.

When listening, entries should be made in the LOG BOOK. In this way short-wave information is added to and brought up-to-date. Times of transmitting are often given and should be written down for future reference. Again, new stations and changed wavelengths should be specially noted.

When LOGGING stations it is usual practice to put down particulars under the following headings :

(1) TIME WHEN HEARD.
(2) STATION CALL, etc., identifying signal, if any.
(3) CITY or LOCALITY.
(4) WAVELENGTH or FREQUENCY.
(5) SIGNAL STRENGTHS.
(6) FADING (if any).
(7) ATMOSPHERICS (if any).
(8) CONDITIONS.
(9) NEW INFORMATION, etc.

The following symbols or abbreviations may be used when entering up the log :—

SHORT-WAVE REPORTING.

(1) TABLE OF SIGNAL STRENGTHS :

R 1 - - Just audible.
R 2 - - Audible, but unintelligible.
R 3 - - Audible, partly intelligible.
R 4 - - Just intelligible.
R 5 - - Quiet, but intelligible.
R 6 - - Moderately loud.
R 7 - - Normal, good clear reception.
R 8 - - Strong reception.
R 9 - - Wipe-out signals.

(2) FADING AND ATMOSPHERICS :

F - - Slight fading.
FF - - Fairly deep fading, but no programme lost.
FFF - - Complete fade-out, and programme lost.
N - - No fading.
SS - - Very slow fading (MINUTES).
S - - Slow (ONE MINUTE OR SO).
R - - Fairly rapid fading (SEVERAL SECONDS).
RR - - Very rapid fading (ONE SECOND OR LESS).
X - - Slight static.
XX - - Rather bad.
XXX - - Very strong atmospherics.
N - - No atmospherics.

(3) TYPE OF RECEIVER :

One-Valver receiver	0—V—0
Detector and one L.F.	0—V—1
H.F.—Detector—one L.F.	1—V—2
Screened Grid—Det.—Pentode	SG—V—Pen.
Screened Grid—S.G. Det.—2 L.F.	SG—V.SG.—2
Plug-in Adaptor and 2 L.F.	AV. 2
Convertor and 2 H.F.—Det.—2 L.F. ...	C plus 2-V-2
Convertor and Superhet. receiver (6 valves)	C plus SH.6

Below is a typical short-wave LOG REPORT. Symbols or abbreviations as given above are used. Relative and varying signal strengths may be those heard on either LOUDSPEAKER or HEAD-PHONES. (In such a case as heard on 'phones, this can be shown in the log.)

LOG REPORT.

Time B.S.T.		*Call sign.*	*Station.*	*Wavelength (m.)*	*Conditions.*	*R.F.X.*	*Items.*
Aug. 7th.	17.00	WCBX	New York.	16.56	Normal.	R6/FR/XX	Talk.
„	23.00	WGEA	Schenectady, N.Y.	19.56	Good.	R8/S/N	Science talk.
„	23.30	PRBA	Rio de Janeiro.	31.58	Normal.	R5/FR/N	Music.
8th.	17.00	VUB	Bombay.	31.36	Good.	R7/F/X	Native music.
„	19.00	VQ7LO	Nairobi.	49.50	Mod.	R5/R/XX	Talk
„	23.30	WPIT	Pittsburgh.	25.27	Mod.	R6/FF/X	Jazz.
„	00.30	HP5B	Panama City.	49.75	Normal.	R5/S/N	Tango.

NOTE : All other particulars such as frequency in megacycles may be entered up.

CHAPTER IX.

Hints on Reception.

Among other points in connection with reception on the S.W. the following should be kept in mind :

(1) Reception varies from year to year, and consequently the precise behaviour of certain frequencies cannot be accurately predicted. During some years or periods, some wavelengths will prove quite good while others are failures.

(2) Reception in different parts of Britain varies considerably. Observations over a long period showed that results in the North of England were in fact quite different from those obtained in the South. Again, results in Scotland showed a marked difference. Hence, locality must be taken into account.

(3) After listening from day to day, a daily "cycle of listening" is apparent, and correspondingly there is a yearly one.
Regarding the daily "cycle of listening," this can be applied as follows :—

(a) 13-m. Americans—most likely at mid-day.

(b) 16-m. Americans, etc.—after lunch.

(c) 19-metre Americans, etc.—round 18.00-19.00 BST (and later).

(d) 25m. & 31m. Americans—round 23.00 BST (and later).

(e) 49m. Americans—during the early hours of the morning.

It has often been stated that those waves travelling best in daylight are "daylight waves" to distinguish them from those preferring paths of darknss. For example, a wavelength of 16m. was often referred to as a "daylight wave," but this term is not now generally used. Often 16-m. transmissions are good when it is dark over a wide area.

Reception on the principal bands of far distant stations located East, South and West of Britain varies considerably. This may seem easy to understand but it is highly involved.

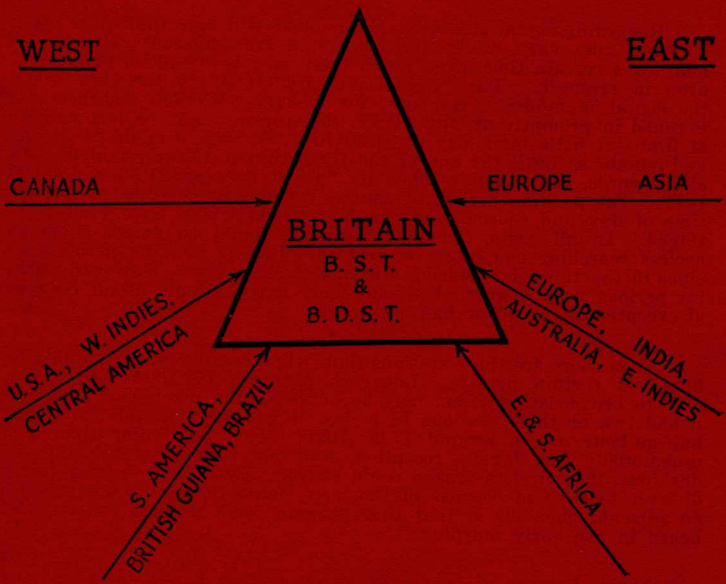
(1) When searching on the S.W. the daily cycle of listening should be applied.

(2) With regard to directions and paths traversed by wireless waves, perhaps the DIAGRAM OF DIRECTIONS (below) will help. Of course, a globe of the world would be better, since the truest paths can only be traced on one.

When determining paths travelled by wireless waves, both the time and the season should be considered. It should be remembered that the inclination of the axis of the earth to the plane of its orbit is 66.5 degrees, and this never varies, the earth's axis always pointing to the same places in the heavens or celestial poles.

Thus, (1) During the Summer, the axis points towards the sun, (2) During the Winter, it points away. (3) At the time of the Equinoxes (Spring and Autumn), the position of the earth in its orbit around the sun is such that day and night are equal, the

DIAGRAM OF DIRECTIONS. (CHAPTER IX)



inclination of the earth's axis then having no relation to the sun's position.

Referring to the DIAGRAM OF DIRECTIONS (keeping in mind that the earth rotates from West to East)—just before dusk, wireless waves from transmitters to the west of Britain will have paths of *daylight* to traverse, and wireless waves from the East will have paths of *darkness*. Disregarding the 13 and 16m. wavelengths which are classed as daylight waves, this explains why signals from North and South America mostly come in late in the day. This partly explains, too, why signals from the east and south-east can be heard at most times of the day. Of course, there are exceptions as in the case of the 19 and 31m. channels which often suit reception of most stations regardless of all laws.

During Summer, the amount and quality of sun radiation through the atmosphere has such an effect upon ionization that reception is generally at its best. Stations in all continents come in fairly easy especially during the early hours of the morning, when it is possible to hear Canadians, Americans, and South Americans as, e.g.: CHNX (Halifax), VONH (St. John's), WBOS (Boston), WRUL (Boston), WRUW (Boston), WLWO (Cincinnati), WDJM (Miami), WNBI (New York), WCBX (New York), WRCA (New York), W5XAU (Philadelphia), WCAB (Philadelphia), WPIT (Pittsburgh), KGEI (San Francisco), WGEO and WGEA (Schenectady N.Y.), LRX (Buenos Aires), PSH (Rio de Janeiro), CD 1190 (Valdivia), TI4NRH (San Jose), COCD (Havana), COCQ (Havana), and TGWB and TGWA (Guatemala City), etc.

Regarding signal strengths, the listener will note that quite often a signal may vary in strength during a transmission. It may be loud for a certain time after which there may be a sudden or gradual drop in strength. The "PEAKING PERIOD" is the time when the signal is loudest. Suppose, for example, WGEA, Schenectady, is tuned in promptly at 21.00 BST. the station might be just audible at first. A little later, say at 21.30 BST, the signal might be strong and remain so until the end of the transmission, about midnight. In other words, the signal reached its "peak" between 21.30 and 00.00 BST. The peaking period, of course, depends upon ether conditions, time of day and season, and the phenomena which have been mentioned. In all cases, "peaking periods" should be noted, as much useless searching can often be avoided. In fact peaking periods are clues to the times for hearing stations at their best. However, peaking periods vary a great deal and there may be none at all because of exceptionally good or bad conditions.

Then there are those stations that, when broadcasting, can only be heard at certain periods. Lourenco Marques (East Africa) which used to broadcast on 25m., may be quoted as an example. Although it had two or three sessions in a day, it was only audible for about half-an-hour or so, around 17.00 BST. That particular time was undoubtedly best for its reception, probably because of the path of darkness the wireless waves could travel. Even then it was fairly difficult to tune in because of the many more transmitters operating on adjacent channels at that time. Again some stations can only be heard in the early morning.

Again, because of overcrowding on certain bands some stations cannot be heard at all or are "SWAMPED." In such cases, suitable times (if any) when fewer transmitters are operating should be chosen. Perth (Australia), which used to broadcast just after breakfast time, could not be heard at all because of a local station operating on the same wavelength.

CHAPTER X.

Symbols of Time and Relation to G.M.T.

VARIOUS PARTS OF THE WORLD:

L.S.T.	Local Standard Time.	
G.M.T.	Greenwich Mean Time.	
B.S.T.	British Summer Time (August 9th—April)	1 hour ahead of G.M.T. DURING WINTER.
D.B.S.T.	Double British Summer Time (April—August 8th).	2 hours ahead of G.M.T. DURING SUMMER.
C.E.T.	Central European Time.	1 hour ahead of G.M.T.
S.A.T.	South African Time.	2 hours „ „ „
I.S.T.	Indian Standard Time.	5½ „ „ „ „
E.A.S.T.	Eastern Australian Standard Time.	10 „ „ „ „
J.S.T.	Japanese Standard Time.	9 „ „ „ „
H.S.T.	Haiwaiian Standard Time.	10½ „ earlier than G.M.T.
B.G.T.	British Guiana Time.	

NORTH AND SOUTH AMERICA (INCLUDING CANADA, U.S.A., LATIN-AMERICA).

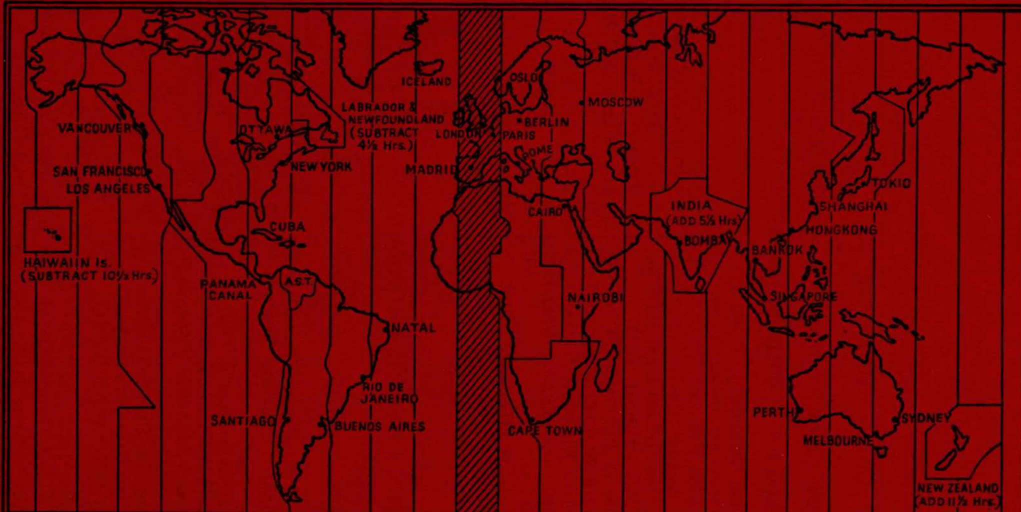
D.S.T.	Daylight Saving Time.	4 hours earlier than G.M.T.
A.S.T. or A.T.	Atlantic Standard Time.	4 „ „ „ „
E.S.T.	Eastern Standard Time.	5 „ „ „ „
E.W.T.	EASTERN WAR TIME.	4 „ „ „ „
C.S.T. or C.T.	Central Standard Time.	6 „ „ „ „
M.S.T.	Mountain Standard Time.	7 „ „ „ „
P.S.T.	Pacific Standard Time.	8 „ „ „ „
P.W.T.	PACIFIC WAR TIME.	7 „ „ „ „

NOTE: With U.S.A. standards of time in particular, WAR TIME IS ONE HOUR EARLIER IN EVERY CASE.

TO CONVERT TO B.S.T. ADD 1 HOUR.

TO CONVERT TO D.B.S.T. ADD 2 HOURS.

TIME ZONE AND CONVERSION CHART -*Chapter X*



H.S.T.		P.S.T.	M.S.T.	C.S.T.	E.S.T.	A.S.T.				G.M.T.		S.A.T.			I.S.T.					E.A.S.T.		
10 hrs.	9 hrs.	8 hrs.	7 hrs.	6 hrs.	5 hrs.	4 hrs.	3 hrs.	2 hrs.	1 hr.		1 hr.	2 hrs.	3 hrs.	4 hrs.	5 hrs.	6 hrs.	7 hrs.	8 hrs.	9 hrs.	10 hrs.	11 hrs.	11½ hrs.
		P.W.T.			E.W.T.					G.M.T.												
		7 hrs.	6 hrs.	5 hrs.	4 hrs.	3 hrs.	2 hrs.	1 hr.	0	↓												

THESE MUST BE SUBTRACTED — THESE MUST BE ADDED

{ TO CONVERT G.M.T. TO B.S.T.—— ADD 1 HOUR
{ TO CONVERT G.M.T. TO D.B.S.T.— ADD 2 HOURS

Time and Relation of G.M.T. with Other Parts of the World.

Most Short-wave schedules make use of the 24-hour system for indicating times. Thus, 00.00 is midnight or zero hour, and 12.00 corresponds to noon. The time 7 a.m. is denoted thus: 07.00, 10 a.m. thus, 10.00; 4 p.m. by 16.00, 7 p.m. by 19.00, 9 p.m. by 21.00, and 11 p.m. by 23.00. Then follows 00.00 or zero hour

The conversion of Greenwich Mean Time to that of other places throughout the world and vice versa usually gives the beginner trouble and for this purpose reference should be made to the page detailing the SYMBOLS OF TIME and their equivalents, and the TIME ZONE AND CONVERSION CHART.

The earth rotates through 360 degrees in 24 hours, that is, through 15 degrees in one hour. Thus, one hour difference of mean time at two places denotes that they differ 15 degrees in LONGITUDE. As the earth rotates from West to East, places—

(1) East of Greenwich are AHEAD OF G.M.T.

(2) and those West of Greenwich, EARLIER THAN G.M.T.

Many stations announce times locally, and these should be noted, and comparison and reckoning made when converting to G.M.T. (or B.S.T. and D.B.S.T.). Thus, if the listener happened to be listening to Sydney, Australia, on 31.28 metres at 19.00 or 7 p.m. D.B.S.T., Sunday, August 17th, the time by Eastern Australian Standard Time would be 03.00 MONDAY, AUGUST 18th. Similarly, E.S.T., or Eastern Standard Time in New York, is 5 hours earlier that G.M.T., and Eastern War Time, 4 hours earlier, and not only the time but the date should be considered when reckoning.

As will be seen from the Time Symbol Table and the Time Zone Chart, Hawaii, British Guiana, Labrador, Newfoundland, India, and New Zealand have their own standard times. Venezuela is included in the A.S.T. Zone, and South Africa is a zone by itself.

In China, Afghanistan, Iran, Arabia, Abyssinia, Borneo, Sumatra, Greenland, parts of New Guinea, and certain other parts, either the legal time is not known or no legal time is kept.

In particular, it should be noted that with her entry into the war, the United States has adopted "WAR TIME." Eastern War Time is 4 hours earlier than G.M.T., and Pacific War Time is 7 hours earlier. Again, Time in Britain is as follows: During the Winter B.S.T. is 1 hour ahead of G.M.T., and during the Summer D.B.S.T. is 2 hours ahead of G.M.T. Thus: 15.00 B.S.T. corresponds to 14.00 G.M.T., and 15.00 D.B.S.T. corresponds to 13.00 G.M.T.

CHAPTER XI.

Station Identification and Cautions When Listening.

When listening for news and other items certain cautions are necessary and care should be taken in the identification of stations. There is a distinct advantage with headphone listening but, of course, most mains operated receivers are intended for loudspeaker only.

After some experience it will be noted that the chief hindrances to perfect reception of news items or music are:—

(1) FADING.

(2) INTERRUPTION FROM TELEGRAPHY AND other stations (including "JAMMING").

(3) BANDSPREAD FROM "LOCALS."

This necessitates the tuning in of stations afresh, and often re-tuning at intervals. In any case, most receivers—as mentioned before—need a second re-tuning after the first "switching-on," for technical reasons.

As slight fading may not be so noticeable when listening with headphones, this is an advantage when listening to news items, when accurate details are required. A slight fade or a "burst" of static can spoil any news item. For note-taking, an abbreviated form of longhand is recommended when writing down anything, being much easier to follow when transcribing. However, a good shorthand writer used to reporting should find no difficulty in making accurate reports.

The listener who wishes to make station identification simpler should:

(1) Practice the tuning in of stations he wishes to listen to.

(2) Practice "searching" proper bands in turn.

(3) Keep a LOG and make a habit of referring to it and adding details.

Even with such precautions, there should be no guessing as some stations are constantly changing wavelengths and times of operation. A set of specially printed IDENTIFICATION PANELS such as shown below are often useful when identifying stations, but these are difficult to obtain now. In this connection, calls may be repeated once or twice only, thus making reference to identification panels difficult. As further advice, when attempting identification: USE YOUR EARS! LISTEN CAREFULLY AND INTELLIGENTLY. As a radio operator at sea must rely upon his sense of hearing, so must the listener who is identifying stations. Again, listening experience counts a great deal more than anything. (BELOW ARE THREE EXAMPLES OF IDENTIFICATION PANELS.)

PANEL 1.

STATION LRX, BUENOS AIRES (ARGENTINE).

WAVELENGTH: 31.06m.

FREQUENCY: 9,660 kc/s.

POWER: 5 K.W.

OPERATING SCHEDULE: Approx. 21.30-02.30 GMT. Sunday, until 05.00 GMT.

STANDARD TIME: G.M.T. less 4 hours.

DISTANCE FROM LONDON: 6,800 miles.

POSTAL ADDRESS: RADIOEMISORA LRX, CALLE MAIPU, 555, BUENOS AIRES, ARGENTINE REPUBLIC, SOUTH AMERICA.

REPORTS: Verifies with card bearing the call of the medium wave LR 1.

IDENTIFICATION SIGNAL:

Four vibraphone notes usually at 15 minute intervals coupled to the call in SPANISH: LR 1 (phonetically) "Ellay-erray-uno y Ellay-Erray-Ay-kis, Radio El Mundo en Buenos Aires."

("El Mundo" is an illustrated daily newspaper, and mentioned frequently.)

PANEL 2.

PRF 5 RIO DE JANEIRO (BRAZIL).

WAVELENGTH: 31.58m.

FREQUENCY: 9501 kc/s.

POWER: 6 to 50 K.W.

OPERATING SCHEDULE: 22.45 - 23.45 B.S.T. daily.

STANDARD TIME: G.M.T. less 3 hours.

DISTANCE FROM LONDON: 5,650 miles.

POSTAL ADDRESS: (Either) P.O. BOX 709 or Departamento de Propaganda do Brasil, Avenida Presidente Wilson, 305, Rio de Janeiro, Brasil, South America.

IDENTIFICATION:

Programmes commenced and concluded with the Brazilian National Anthem. Frequent mention of "departamento de Propaganda do Brasil," "Horo do Brasil," "Radio Nacional," and "A Voz do Brazil." First 45 minutes of programme usually given in Portuguese, and the remaining 15 mins. in either English, French, Italian, German or Esperanto. THE CALL IS GIVEN IN PORTUGUESE AS (PHONETICALLY) "Pay-air-effe-sinko." Occasionally a 3-note gong is used.

PANEL 3.

COCQ, HAVANA, CUBA.

WAVELENGTH: 30.77m.

FREQUENCY: 9,750 kc/s.

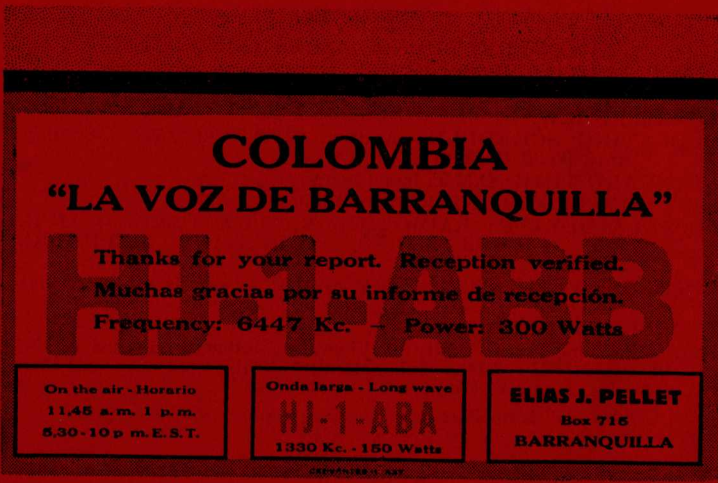
POWER: 4 K.W.

OPERATING SCHEDULE: Mon. to Sat., 11.55-06.00 GMT. Sun., 11.55-05.00 (Monday morning).

STANDARD TIME: G.M.T. less 5 hours.

DISTANCE FROM LONDON: Approx. 4,200 miles.

POSTAL ADDRESS: CALLE 25, No. 445, HAVANA, CUBA, West Indies.



IDENTIFICATION:

Quite a number of different interval signals are employed, including the cry of a baby, a man's laughter, the roar of a rapidly accelerating motor car, and usually two chimes every 15 minutes. Interval signals are used in connection with advertisements. The call in SPANISH is given as "CMQ" (phonetically, 'Say-oh-say-koo') de la crema dental Colgate y el Jabon Embellecedor Palm-Olive, en Habana, Cuba. (Often mention of "La fabrica de la RCA Victor.") (Relays CMQ on 880 kc/s.—Verifies with card.)

Q.S.L. cards are helpful, too, when identifying stations. These can only be obtained by sending in a report of reception to a station. Stamps or their equivalent as an International Reply Coupon should be enclosed for return post. Under present conditions, QSL's seem out of fashion and there are now quite a number of stations that have long ceased to verify reports.

HEREIN ARE REPRODUCTIONS OF QSL'S RECEIVED FROM VPD2, Suva, Fiji; VUB, Bombay; and HJ 1ABB Barranquilla, Colombia, South America.

Sometimes harmonics mislead one, as regards wavelength. This is not often a difficulty on the S.W., but in odd cases, as with "locals," these may be on a fraction or multiple of the station's wavelength.

Call-signs are often given in a number of ways, most being given out both carefully and fully in various languages to make identification easy. Some station announcers are in the habit of dropping the district letters, thus VQ7LO, frequently announced as "7LO," etc. Again the call given may not directly indicate the station which is transmitting. If a station is relaying a M.W. transmitter, the call of the Medium-Wave station will be heard during the broadcast, and the listener, invariably, must wait right till the end before hearing the call-letters of the S.W. transmitter responsible for the relay.

Several years ago there was great difficulty in identifying PRBA, understood to be at Sao Paulo, Brazil. The Call-sign PRBA was an old one, and the different calls heard and the futile attempts definitely to identify the station made it a mystery. Some reported the call to be PRA3 (a correct one as it was the call of a M.W. station often relayed), while someone reported the call to be PRS5 (Pay-air-esso-sinko). Listeners in this country and the U.S.A., were kept guessing until the station authorities sent full details to the radio Press. Actually, the station with the call-sign PRF5, which relayed PRA3, was located at Rio de Janeiro.

Listeners should also be aware that point-to-point relays by commercial transmitters are private and not to be regarded as "broadcast programmes" until re-radiated by the station to which they are addressed.

Many stations make announcements in ENGLISH besides the language of the country in which situated. Other than this, linguists are the only ones qualified to understand the language. In differentiating between Brazilian stations and those in other parts of South America, it should be remembered that Portuguese is the official language of Brazil, while in the other republics SPANISH is used. To help in the identification of Spanish stations (SPAIN & LATIN-AMERICA) a knowledge of the Spanish alphabet and numerals is almost essential : (Phonetic Pronunciation below.)

ALPHABET

A	...	ah	J	...	hota	S	...	essay
B	...	bay	K	...	kah	T	...	tay
C	...	say	L	...	ellay	U	...	oo
D	...	day	M	...	emmay	V	...	vay
E	...	aye	N	...	ennay	W	...	doo-ble-vay
F	...	effey	O	...	o or oh	X	...	ay-kis
G	...	hey	P	...	pay	Y	...	yay
H	...	ah-tchay	Q	...	koo	Z	...	thay-tah
I	...	ee	R	...	erray			

NUMERALS.

1—oo-no	6—says
2—dos	7—see-et-aye.
3—treys	8—oh-cho
4—kwatro	9—no-ay-vay
5—thinko or sinko	10—dee-ays

Quite often, besides announcing the call in English, a Spanish station will be prefixed by either of the following :—

"ESTACION"	"RADIO-EMISORA"
"RADIO-DIFUSORA "	"EMISORA "

FOR EXAMPLE :

"Radio-emisora ah-tchay-hota kwatro ah-bay-bay. La Voz Catia Palacio Municipal, Medellin, Colombia, sud America," or in ENGLISH : Radio Station HJ4ABB, The Voice of Catia, Municipal Palace, Medellin, Colombia, South America.

OR CALL MAY BE GIVEN SIMPLY, as : "Ah-tchay-hota-kwatro ah-bay-bay . . . etc."

Again there are slight differences as in the case of HJ7ABD, Bucaramanga :

(CALL) "Radio Bucaramanga, Estacion Ah-tchay-hota-see-et-aye-ah bay-day- en Bucaramanga, Colombia, America del sud." Or in ENGLISH : Radio Bucaramanga, Station HJ7ABD, in Bucaramanga, Colombia, South America. (N.B.—*Bucaramanga is spelt out distinctly followed by a bugle fanfare at a certain time.*)

Respecting South American and Central American stations (especially) listeners should be ready for announcements in other languages (apart from English and Spanish). For instance, HH3W, Port-au-Prince, HAITI, announces in *FRENCH*, ENGLISH and SPANISH. But most S. American republics keep to Spanish and English—except Brazil.

Here is another example of a call from one of the Latin-American stations:

"RADIO-DIFUSORA TAY-EE-AYE-PAY, LA VOZ DEL TROPICO EN SAN HO-SAY, COSTA RICA" (*OR* Radio Station TIEP, The Voice of the Isthmus, in San José, Costa Rica).

Where native announcers are employed to speak in English this sometimes leads to confusion. This is not generally the case with stations in the British Empire as in India, where English announcers make these announcements. Certain consonants and words in English present great difficulty to the foreigner and coming over the radio sound worse and more confused still. Thus, with Asiatics, the consonant "h" comes over like sibilant "s" or "z', and in this case, a word as "Hybia" (name of a park) would sound like "Sybia." Other instances of this may occur to the listener.

Dates and times should be checked when possible as both listener and announcer are liable to make a mistake. Where stations are in far distant countries it is a wise plan to consult a TIME ZONE CHART (as that included in previous chapter) to compare the time as announced with the time as shown. In the case of Argentina, this is one of the few countries of South America recognising a Summer Time. During our Winter it is Summer in Argentina, so that the difference in time accordingly would be four hours, though actually, there is a difference of five hours between BST. and AST. (ATLANTIC STANDARD TIME). When it is Winter in Argentina and Summer in England, the difference in time would be six hours, since Argentina reverts to AST. and England advances its clocks two hours in order to comply with DOUBLE BRITISH SUMMER TIME.

The recognition of interval signals again presents difficulties, there being an infinite number in use. These include CLOCKS, CHIMES, GONGS, BUGLE CALLS, CUCKOO NOTES, VIBRAPHONE NOTES, BIRD CALLS (as the cuckoo and kookaburra), MUSICAL NOTES, AND RECORDINGS, ETC. Besides these interval signals, stations sometimes have SIGNATURE TUNES, either when commencing or when concluding programmes. Thus in the case of CB 960, Santiago, Chile, the OPENING SELECTION is "Babes in Toyland" and closing selection "Rhapsody in Blue." Georgetown, British Guiana, concludes with the National Anthem, "God Save the King" and the Ted Lewis "Goodnight" song. COCD, Havana, Cuba, also concludes with the Ted Lewis "Goodnight" song, but its call cannot be mistaken for that of Georgetown, ("Say-emmay-say-day y say-oh-say-day, La Vox del Aire, en Habana, Cuba," or CMCD (Medium-wave) relayed by COCD, The Voice of the Air, in Havana, Cuba.)

Care should be exercised over surnames heard, especially when there may be two or three ways of spelling them. Place names and geographical references are best checked by referring to a good gazetteer. A music album is sufficient when referring to specific items of music.

Finally, a warning with regard to RECORDINGS. Listeners should be wary of these. Several stations follow the practice of broadcasting them, and English tunes coming over a distant station may keep one guessing some long time as to identity.

CHAPTER XII.

THE ULTRA-SHORT-WAVES. CHIEF BANDS AND RECEPTION DIFFERENCES.

The ultra-short-waves extending from 11 metres and below are a study in themselves, behaving very differently from the longer waves. The chief groups or bands are as shown below:

BROADCASTING.

41.00 Mc/s or 7.31 metres.
31.00 Mc/s or 9.494 metres.
25.00-26.00 Mc/s. or 11 metres.

AMATEUR TELEPHONY.

28.00-30.00 Megacycles or 10 metres.
56.00-60.00 Megacycles or 5 metres.

The development of these bands dates back only a few years ago when amateurs and one or two broadcasting stations began transmitting on these very high frequencies. At first they were considered useful for short-range communication, but transmissions were heard over long distances. Besides the ordinary S.W. bands, the Americans showed great interest in these and may easily claim to be the pioneers, having monopolized them with astonishing results.

Reception of most U.S.W. stations is fairly difficult and more than average care is needed in tuning. While it is possible to purchase a communication receiver which will receive most "ultra-shorts," it is better to use a receiver which is built for these special bands. Thus, there are receivers to cover 3.75-13 metres, 5-7 metres, and 1-10 metres, etc.

While it is possible to hear U.S.W. transmissions quite well, there is still much to be discovered regarding transmission and the laws governing these wavelengths. As previously mentioned, when conditions are poor on the S.W., the U.S.W. bands may be quite good for reception, a fact which is difficult to explain.

American stations on all these bands can be heard in this country fairly regularly. Besides, it is possible to hear many amateur stations in many other countries. Usually, some time in February, the U.S.W. bands begin to show liveliness, stations being audible at various periods of the year right until December.

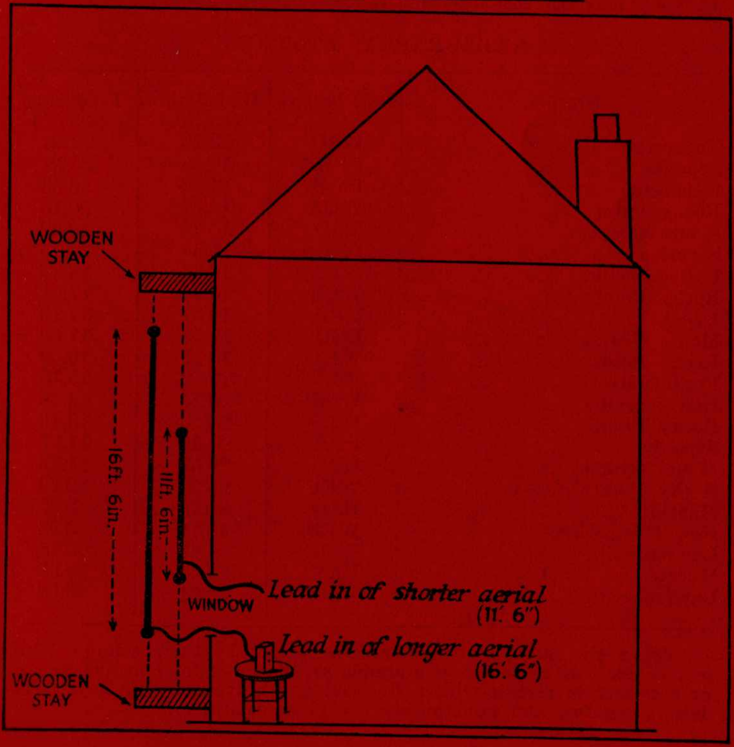
The 5-metre amateurs are perhaps the most difficult to receive. The special type of receiver (and aerial), needed to receive these, is often beyond the reach of the ordinary listener. Once the short-waves have been mastered, the spell of the ultra-short-waves makes itself felt, and again, there are some good signals to be heard. The 5-metre amateurs are usually to be heard before noon, and if conditions are favourable the 10-metre amateurs follow. In the case of the 10-metre Americans, it is an outstanding fact that each "W" district is heard one after the other. The 9.494 Mc. group of broadcast "relays" is also interesting an hour or so after mid-day (GMT).

The best amateur band is the 10-metre one, and at one time it was easy to hear over a score or more amateurs all within an hour or so. Of the broadcast bands, the 11-metre one comes first, stations being heard with fair regularity and at maximum strengths from about 16.00-18.00 (or 19.00) B.S.T. One of the "Star" performers within recent years was W6XKG, Los Angeles, California.

On the whole there is inclined to be too much "surging" of the carrier waves from most of these stations, thus spoiling programme value. Most of these become audible, reach a "peak," and are away in an hour or perhaps little more. Within short-range most of these stations are quite good and reliable. (SEE LIST OF ULTRA S.W. STATIONS, BOOK II.)

For U.S.W. reception, a vertical type of aerial should be tried as shown in SKETCH BELOW. Different lengths of aerial should be tried for each band, e.g., a 16 feet 6 inch aerial will do for 10 metre reception, and one about 11 feet 6 inches for 7-metres, and so on. Either bare copper wire or insulated wire would be suitable, the length and thickness deciding the fundamental wavelength to a great extent. It might be more convenient to have at least two lengths of wire suspended, one for the 10 and 11-metre bands, and the shorter one for 5-7 metres. Results on the above type of aerial are quite good. All bands are receivable including that for television (now discarded as war time measure). American police cars can also be heard transmitting.

OUTDOOR TYPE OF AERIAL FOR THE ULTRA-SHORT-WAVES



CHAPTER XIII.

Use of the Morse Code. Identification of Telegraphy and Telephony Stations.

A knowledge of the MORSE CODE is useful for the identification of telegraphy stations. And, with the aid of a short list of such stations, preferably arranged with the wavelengths in ascending order, as shown below, unknown broadcasting stations operating on nearby channels may be recognised and the wavelengths checked.

TELEGRAPHY STATIONS.

Station.	*Call-Letters.*	*Wavelength.* (*metres*)	*Frequency.* (*Mc/s.*)
Tuckerton	WSC	13.42	22.36
Sepetiba	PPX	14.48	20.72
Bandoeng	PMB	14.56	20.58
Rocky Point	WQX	14.87	20.16
Monte Grande	LQD	15.46	19.39
Sepetiba	PPU	15.58	19.23
Lawrenceville	WLA	16.36	18.32
Rocky Point	WQF	16.74	17.91
Bangkok	HSP	16.91	17.73
Monte Grande	LQC	16.99	17.66
Rocky Point	WKQ	18.75	16.02
Paramaribo	PZC	19.80	15.15
Lawrenceville	WMP	20.73	14.45
Rocky Point	WAJ	22.26	13.46
Sepetiba	PPH	25.15	11.97
Monte Grande	LQE	25.59	11.73
Rocky Point	WEF	28.25	10.62
Madrid	EAQ	30.43	9.85
New Brunswick	WEO	43.11	6.95
Lawrenceville	WOA	44.41	6.75
Madrid	EAV	50.47	5.93
Lawrenceville	WCN	59.01	5.08

Then the morse letters should be learnt by their sound. This can be done with the use of a simple arrangement for learning morse, or a buzzer in circuit with a dry cell and a transmitting key. The letters, figures, and punctuation are given below.

When learning by ear, a dot is "DIT", and a dash is "DAH." Thus:

A or . — is "DIT-DAH"

B or — . . . is "DAH-DIT-DIT-DIT"

C or — . — . is "DAH-DIT-DAH-DIT"

MORSE CODE

LETTERS				FIGURES	
A	·—	N	—·	1	·————
B	—···	O	———	2	··———
C	—·—·	P	·——·	3	·· ——
D	—··	Q	——·—	4	····—
E	·	R	·—·	5	·····
F	··—·	S	· · ·	6	—····
G	——·	T	—	7	——···
H	····	U	··—	8	———··
I	··	V	···—	9	————·
J	·———	W	·——	0	—————
K	—·—	X	—··—		
L	·—··	Y	—·——		
M	——	Z	——··		

PUNCTUATION

FULL STOP: ·· ·· ··

COMMA: ·— ·— —

COLON: ———···

QUESTION: · —— ··

COMMENCING SIGN: —· —· —·

BREAK SIGN: — ··· —

FINISHING SIGN: ·— ·— ·

SPACING AND LENGTH OF SIGNALS:

1—A dash is equal to 3 dots.

2—The space between the signals which form the same letter is equal to one dot.

3—The space between two letters is equal to 3 dots.

4—The space between two words is equal to 5 dots.

When these different morse "tunes" involving the "dit-dah" method have been learnt, an effort at listening for telegraphy stations should be made. When copying down the call-letters of a morse station and the message, they should be written down as in ordinary writing and *not in BLOCK CAPITALS.* This is for speed in writing down the message of morse signals.

On the S.W., where telegraphy stations are also numerous on all bands, the call-letters of the specially prepared list of telegraphy stations should be heard, and often after a series of "V"s or "ABC" repeated thrice. Often it may be noted that the announced wavelengths of different stations are not correct when checked with others who keep a constant check on wavelength.

For further information respecting morse and code signals the beginner is advised to obtain the HANDBOOK FOR WIRELESS TELEGRAPHY OPERATORS from H.M. Stationery Office.

CHAPTER XIV.

Stations In The British Empire.

Those who wish to make a "tour" of the British Empire can do so readily. Far away colonies, dominions, and outposts can be contacted in turn, and in this way one can be better informed upon matters of vital importance.

Other than the BBC Empire Services, perhaps the stations in Australia have claimed more attention from British listeners than those of any other colony or dominion. VLQ, Sydney (31.20m.), as well as VLGR, Melbourne (31.23m.), both owned and operated by A.W.A. Ltd., have been entertaining listeners for years with fascinating talks on Australia and splendid recordings of popular songs and military bands, etc. The call of the kookaburra bird, heard from the Sydney station, is perhaps the most attractive feature for S.W. listeners. There must be few who have not got up about breakfast time on Sunday morning to hear that strange bird-call. Sydney can be justly proud of its slogan, "The Voice of Australia," for it is well heard. At present there are several transmissions from Sydney viz. VLQ (9.615 mc/s.), VLQ2 (11.87 mc/s.), VLQ5 (9.68 mc/s.), and VLQ7 (17.80 mc/s.). The slogan during these broadcasts is V for Victory, L for Loyalty, Q for Quality, and the National Anthem played. Melbourne is not quite such a favourite among listeners. But VLR, Melbourne 9.58 mc/s, and VLR8 17.66 mc/s., announcing as the AUSTRALIAN NATIONAL SHORT-WAVE STATION is well heard in this country. Here again, broadcasts are identified by the playing of the National Anthem, and the interval signal of three notes on a gong. This station usually relays the programmes of the Australian Broadcasting Commission. VLW2 (9.65 mc/s.), VLW3 (11.85 mc/s.), and VLW4 (9.66 mc/s., Perth, West Australia), is fairly difficult to hear. The transmitters of the Perth stations are at Wanneroo, the National Anthem helping in identification.

The Indian stations all owned and operated by ALL-INDIA RADIO, include VUB, Bombay; VUC, Calcutta; VUM, Madras; and VUD2, Delhi. These stations make use of the 60, 31, 25 and 19-metre bands. All are audible at the appropriate times. While the 60-metre transmissions are excellently heard, particularly during the afternoon from about 16.00 to 17.00 BST, these are not known to all listeners because of the channel used. VUD2, Delhi, on 31.28m., is usually a good signal at any time. Of the lot, Bombay and Delhi are the favourites and more so the former since it was the first Indian station "on the air." Besides interesting talks on India to be heard, the music calls attention among listeners. Both European and Indian music may be heard. The Indian music is similar to that played in the streets and bazaars, the instruments used being strange to Western ears. Strange to say, a type of harmonium may often be heard. A stringed instrument called a "tamboora" is another novelty. The "sanai" is a wind instrument like a musette in shape. In a typical Indian orchestra there is the "sitar" (stringed), "sinai" (wind), "sarangi" (stringed), "tamboora" (stringed), "tablas" or drums, which rest on the ground, and "jaltrang" or dulcimer arrangement of hollow vessels. Announcements are made in English and Hindustini; English announcers making the announcements.

The chief S.W. centres of British Africa are at Durban (ZRD on 6.14 mc/s.); Nairobi (VQ7LO), Kenya Colony; Johannesburg (ZRH on 6.0 mc/s. and ZRJ on 6.10 mc/s.); Salisbury, South Rhodesia, on 7.21 mc/s.; and ZRL (Cape Town) on 9.61 mc/s. Nairobi, commonly known as 7LO, was first "on the air" and is owned by

Cable and Wireless Ltd. This station often radiates novel programmes, including native music, which can be easily recognised. When this station first started transmitting one of the novelties heard was the roar of the lion in the native jungle. Often there are recordings of popular tunes. When transmitting regularly, the station is best heard in the late Summer. Often there are times when reception is difficult. Capetown is fairly difficult to hear, but the others are heard occasionally. Undoubtedly, Nairobi is the favourite among listeners. Direction may have something to do with poor reception of other African stations.

Canada has a fair number of S.W. transmitters, but here again reception is by no means good or reliable. Among these are CBRX (Vancouver) on 6.16 mc/s. and CKFX on 6.08 mc/s. VONH, St. Johns (Newfoundland) on 6.01 mc/s., CJCX, Sydney (Nova Scotia) on 6.01 mc/s.; CFRX, Toronto, on 6.07 mc/s., CHNX, Halifax, on 6.13 mc/s., and CBFY, Montreal, on 11.70 mc/s. Perhaps the best received is CHNX, Halifax; and VONH, St. Johns. Winnipeg used to be another favourite Canadian station, but evidently it has now ceased operating. On the whole, Canadian reception is none too good, and stations are apparently not powerful enough.

Among other stations of the British Empire, ZFY, Georgetown, British Guiana, is worthy of mention because of its typically British programmes which much resemble those of Sydney, Australia. When conditions are favourable, the signal is a delightful surprise. Georgetown is heard well during the late summer and can easily be identified by the signature tune when closing down (Ted Lewis "Goodnight" song), its call, "The Voice of British Guiana," and the playing of "God Save the King."

Fiji, Suva (VPD2 on 9.53 mc/s., or 31.46m.) is another difficult station to hear. Times of operation are not regular, and those listeners who succeed in hearing it may consider themselves lucky. While still broadcasting on 6.08 mc/s. in the evenings, a channel of 6.13 mc/s. is also being tried.

Another interesting station is ZQ1, Kingston, Jamaica, operating on 4.70 mc/s. The station may be identified by the call and the playing of the National Anthems of both Britain and the United States.

Among other outposts to be heard are ZNS, Bahamas, operating on 6.01 mc/s.; and ZIK2, Belize, British Honduras, operating on 10.60 mc/s.

CHAPTER XV.

High-Fidelity Programmes.

Only a few years ago the new type "frequency-modulated" radio broadcasts started in America. Such transmissions make possible practically static-free reception with a high-fidelity which was unattainable with the ordinary "A.M" or Amplitude-Modulated system. The "F.M.", or frequency-modulated system employs the use of ultra-short-waves, and the signals broadcast travel only slightly beyond the distance of the horizon.

This new feature of American radio necessitated the frequency-modulated broadcast commercial receiver for high-fidelity reception. Outstanding characteristics of such receivers is their ability to re-create music and voice to an astonishingly life-like degree with an almost complete absence of static and interference. The receivers faithfully reproduce the fundamental notes and harmonic overtones, retaining the personal element even in a human whisper. The individual instruments of a symphony orchestra which ordinarily defy reproduction, such as the tambourine, cymbal and triangle, can be made to emerge with clarity.

As already mentioned, broadcasting stations using the ordinary "Amplitude-Modulated" system send out waves in all directions. Some travel along near the ground and are called "ground waves." Others go shooting up into the sky and are called "sky waves." A receiver located at a distance from a station picks up both the "ground wave" and the reflected "sky wave." At times these waves reach the set together, thus producing normal volume. At other times, the "sky wave" is delayed so that it reaches the radio after the "ground wave," thus causing fading and distortion.

Since "F.M." stations also send out waves in all directions, the "sky waves" are generally not reflected back to earth but go right on through the higher reflecting "envelopes" because they travel at much higher frequencies than conventional waves. As a result, the receiver picks up only the ground waves from an "F.M." station and fading is virtually eliminated, the programme coming in clearly regardless of the season or time of day.

Frequency-modulated broadcast has several advantages. It permits greatly increased coverage for equal power and frequency, as compared with the conventional method. It makes possible the transmission of actual high-fidelity programmes. It greatly reduces, and under certain circumstances, eliminates both kinds of static by reducing the "noise level." This reduction in noise-level is essentially the reason for greater coverage of the transmitter, since it permits the receiver to operate on very weak signals. With the ordinary method of broadcasting, these signals would be covered up by noise and static. But to be of practical use, frequency-modulation must operate in the high-frequency band or ultra-short-waves, approaching that used for television.

In the United States, the trend to F.M. is already established. The majority of present stations are low-power or medium power A.M. stations (250 watts—10 K.W.). For these stations and some high power stations as well, the all-important post-war consideration is the expansion of "F.M." Actually, the trend to "F.M." will not be entirely a post-war development. A careful study of the facts shows that the swing to F.M. was already pronounced before the war.

In 1938, there was one experimental F.M. station. There were seven in 1939, and 11 in 1940. During 1941, when commercial stations were first authorised, 18 commercial, 2 non-commercial, and 14 experimental stations were broadcasting. During 1942, 48 F.M. stations (36 commercial, 3 non-commercial, and 9 experimental) were in regular operation. When the war stopped F.M. expansion, a total of more than 100 individuals—many of them operators of "A.M." stations—had applied for construction permits.

To-day, F.M. stations have established audiences in large cities, for example, New York, Chicago, Philadelphia, and Los Angeles and in smaller cities such as Nashville, Hartford, and Evansville. Public realisation and appreciation of the improved reception which "F.M." brings is demonstrated by listener surveys.

To-day, 50,000,000 people of the U.S.A. live in areas served by "F.M." stations. There are now 600,000 F.M. receivers in use and applications pending for F.M. construction permits total more than 40—almost equal the number of F.M. stations now in service.

CHAPTER XVI.

More About Receivers and How to Set About Their Construction, etc.

Although many prefer to buy a short-wave receiver quite a number of enthusiasts like to build their own. Battery-operated sets, of course, present the least difficulty, but certain principles should be kept in mind.

The chief things to consider before starting are :

(1) Selection of a good S.W. Circuit, and number of valves to have for economy in upkeep.

(2) Selection of good and suitable components.

(3) Selection of suitable valves.

With the construction of such a set, the following points are important :—

(a) The connections and wiring should be as short as possible so that the "range" of the receiver is within the limits of the S.W. Bands. Receivers to go down to 10 metres require very short connections between components, etc. A fairly thick connecting wire should be used, as this will determine lowest limit of S.W. or U.S.W.

(b) When trying out a circuit a rough "hook-up" will be sufficient at first. If results with this are good, then the receiver can be set up properly, and with more care in wiring. (Note : A rough "hook-up" can be arranged on a piece of wood or behind an old panel with base-board as shown in diagram.)

(c) Care in spacing and setting up of components as L.F. Transformers, Coils, etc., so that "mutual inductance" does not cause interference, or "howling," etc.

By far the most important parts of a S.W. receiver, and the parts which are used in the largest number and in a variety of forms are VALVES (or tubes), resistors, tuning or variable condensers, tuning coils, slow-motion dials, transformers, H.F. Coils, valve holders, switches and filament resistances, besides the H.T., L.T., and Grid Batteries.

In connection with valves alone, it should be noted that there are at the present day quite a number of different makes and kinds. Chief kinds are the ordinary four-pin (or triodes) type (detectors L.F. and H.F.), screen-grid, and pentode. The valve is the life and soul of any radio receiver and may perform one of the three important functions, besides a number of minor ones. The three primary functions are :—

(1) High Frequency amplification.

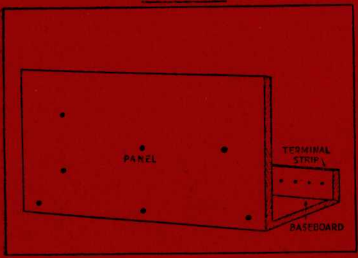
(2) Rectification or detection.

(3) Low Frequency amplification.

Many modern receivers are of the super-heterodyne type. This is a scientific way of saying that the signals are received on the frequency on which they are transmitted. These signals have their frequency changed (by heterodyning—that is, by mixing another

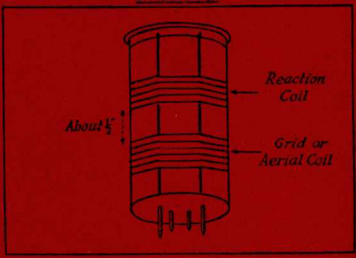
(CHAPTER XVI)

DIAGRAM A.



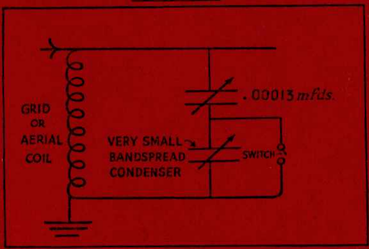
Base-board and Panel with terminal strip

DIAGRAM B.



Four-pin Short-wave Coil

DIAGRAM C.



Switching arrangement for Bandspread

signal with the incoming signal), and are amplified at this new frequency; they are then rectified (that is, changed in their characteristics so that they become audible to the human ear) and then they are amplified at low frequency. Because the amplification takes place at a frequency above the limit of audibility it is called supersonic. Super-heterodyne is an abbreviation for supersonic receivers. "Super-het" circuits can be rapidly resolved into the following classes:—(1) Circuits with separate oscillator; (2) Circuits with combined oscillator and detector; (3) Circuits with H.F. stage preceding the first detector. In a super-het receiver there are two valves which are rectifiers or detectors. If it were not for the inconvenience of having to adjust them from time to time, it would be quite practical to build a set with two valves less, replacing those valves with crystal detectors. These two valves are known as "detector valves," and, to distinguish them, are called the first and second detector. (DIAGRAM IN CHAPTER III SHOULD BE REFERRED TO.) Amplification before the first detector is called high-frequency amplification and is carried out by H.F. amplifying valves. Between the two detectors there are one or more stages of Intermediate-frequency amplification, and after the second detector there is some low frequency amplification. Amplification means the increasing in strength of a weak signal. "Straight" receivers are those simply employing one stage of rectification or detection followed by one or more stages of amplification.

Regarding short-wave coils, the best type to use is the four-pin variety, with reaction and grid coils wound on a former. The four pins fit into a socket. (SEE DIAGRAM.) These may be home-made or they can be bought for a few shillings. Thickness of wire on these coils is important. A good thickness of wire should be used for very short wavelengths (1-10 metres). Above these wavelengths ordinary enamelled wire will prove satisfactory.

There are several types of S.W. tuning condensers, and such components are best purchased, although those of very small value in capacity can be easily made. When purchasing such a component, the value required should be stated, as it is important to have the correct value in a short-wave receiver. In most instances the value needed will vary generally from .00025 mfds. to about .00013 (or .0001 mfds.). For bandspread tuning and ultra-short-wave reception, capacities should even be smaller. If condensers of too great a capacity are used, tuning is not "fine" enough. Quite often it will be an advantage to have two or three S.W. variable condensers, in case a different value is necessary in the circuit which is being tried. A grid-leak is also an important component. Two or three values ranging from .0001 to .0003 mfds. will prove useful for testing purposes. Resistors or resistances used in connection with the grid-leak condenser vary a great deal, too, the best values for testing purposes being from 1 to 3 megohms.

In tuning-dials or disc-drives for S.W. work one has the choice of three kinds: (1) A dial with a relatively low reduction ratio in the slow-motion drive, making rapid "searching" easy but very fine adjustment rather difficult; (2) one with a very high reduction ratio, greatly facilitating very accurate tuning but making rapid adjustment of the condenser almost impossible; (3) a dial with two gear ratios, a low reduction for rapid adjustment and a high reduction for putting the "finishing touch" to the tuning-in of a sharply-tuned signal. This last type, if properly designed, may be said to combine the advantages of the other two. For S.W. work, complete absence of "slip" or "back-lash" in the dial mechanism, is essential. Although an ordinary reaction condenser can be used for S.W. work, a slow motion condenser of a type expressly designed for use below 100 metres is greatly to be preferred. But the slow-motion drive must be smooth and free from slip or backlash, or it will be worse than an ordinary drive.

In the selection of fixed condensers for by-passing H.F. Circuits or decoupling H.F. circuits in a S.W. set, one should bear in mind that, owing to the very high-frequencies involved a capacity much smaller than that normally used in a corresponding position in an ordinary broadcast receiver, is quite adequate. This, of course, cuts both ways, so to speak. A small capacity that would be of little or no practical consequence in an ordinary broadcast receiver may be seriously detrimental in a S.W. set. This point should be remembered when choosing and mounting coils, H.F. chokes, etc.

The effect of an H.F. choke, for instance, might be seriously modified on short-waves by connecting the ends of the winding to large terminals mounted unduly close together on an ebonite strip or base. The capacity existing between the terminals might have a result equivalent to connecting a small condenser across the choke.

Regarding L.F. transformers for amplification there are many makes and types. Uusually, a transformer with a ratio of 5 : 1 should be used in the first stage of amplification. In the second or later stages, a ratio of 3 : 1 will be found quite sufficient. A good make of transformer should be chosen, preferably one in a strong metal case. Care must be taken when setting these up in position on the base-board as they often seriously affect reception if placed too near coils or vital components. In fact, badly placed components, of whatever kind, may be responsible for "howling", excessive reaction or pronounced noise.

Before commencing to build a receiver, of course, one should have a thorough understanding of :—

(1) THE CIRCUIT DIAGRAM. (And components needed.)

(2) THE BLUE PRINT OR WIRING DIAGRAM.

(3) THE PANEL LAY-OUT. (This helps in the drilling of the panel.)

Components needed in above circuit include :

1.—Panel, 9in. by 7in., with base-board mounting.

2.—Cabinet.

3.—.0001 mfd. variable condenser.

4.—.0001 or .00013 Differential Reaction Condenser.

5.—L.T. ON/OFF switch.

6.—One valve holder.

7.—One detector valve.

8.—Set of S.W. coils (4-pin type).

9.—High frequency Choke Coil.

10.—200-400 ohm potentiometer for base-board mounting.

11.—.0003 mfd. fixed condenser.

12.—Grid-leak—2 Megohms.

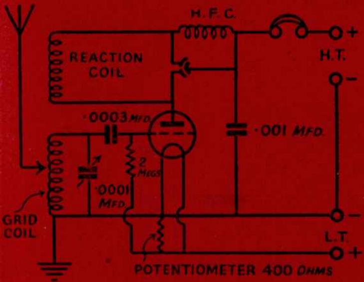
13.—Terminal Strip and set of terminals.

(OTHER COMPONENTS, AND GEAR AS H.T. Battery, L.T. Battery, and Headphones also needed.)

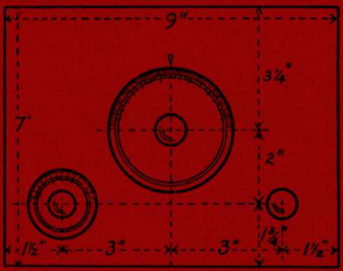
As an example of the above, see diagrams next page.

Short-wave receivers of the "straight" type depend for their sensitivity, and to a certain extent for their selectivity, on reaction control. For ease of operation and maximum sensitivity, the reaction should be perfectly smooth so that the receiver slides easily into and out of a state of oscillation. If there is no oscillation, a change over of the coil-leads (grid or aerial and reaction coils) may produce it. If still no oscillation there is some fault in the wiring which should be checked carefully over and corrected. (This is important.)

As the reaction is advanced a slight hiss should be heard before the set slides into oscillation, while in the case of a grid-leak detector a meter connected in the anode supply circuit should show a gradual decrease in current. No "plop" or sudden howl should occur if the reaction knob is rotated slowly, and oscillation should cease at the same point at which it began, that is to say, without what is known as "overlap." If oscillation begins with a "plop" and the condenser has to be reduced two or three degrees before it stops again, it makes it impossible to work the set at its most sensitive point when distant and weak transmissions are to be received. Since much S.W. "searching" is carried out with the set on the verge of oscillation it will be seen that the simple straight type of receiver is only so good as its reaction condenser.

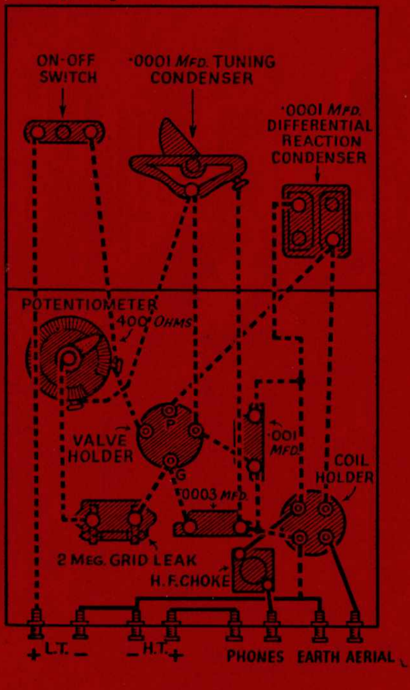


1. Circuit diagram of one-valve S.W. receiver

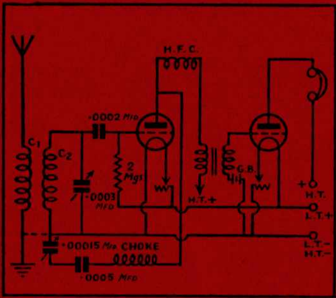


2. Panel lay-out for receiver

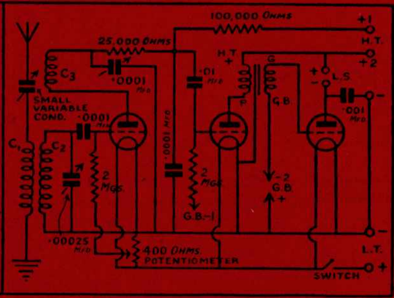
3.
Wiring diagram for above S.W. receiver



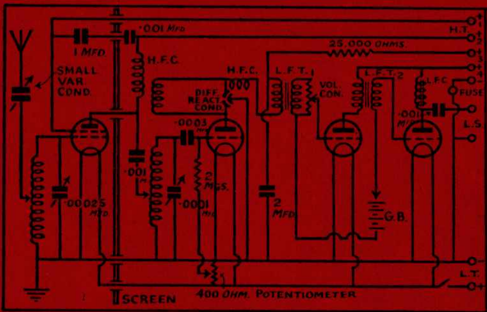
SOME USEFUL CIRCUITS – *Chapter XVI*



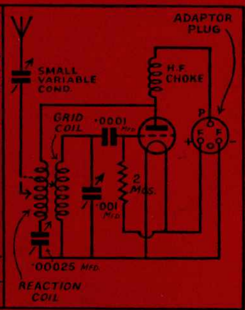
1. Two-valve Short-wave Circuit



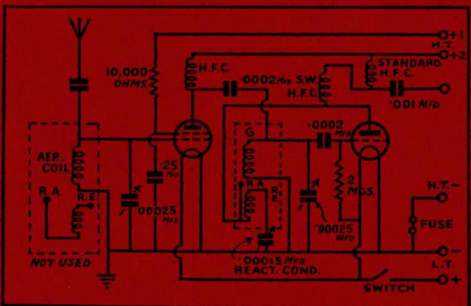
2. Three-valve S.W. Circuit



3. Circuit for Four valves



4. Circuit for an Adaptor



5. A Super-heterodyne adds on to any set with an H.F. Stage:

The S.G. Valve is a straight amplifying stage, but the next valve acts as an oscillator as well as first detector, the remainder of the H.F. amplifier and 2nd detector being in the H.F. unit and detector set to which the UNIT should be attached.

There are many possible cures for these unwanted reaction effects but one should be sure before trying them that the H.F. Choke is a good one and is not responsible for the trouble or part of it. An anode by-pass condenser should be connected between the anode of the detector valve and earth, and it is often an advantage to connect an additional by-pass condenser between the output of the H.F. Choke and earth. A suitable value for these condensers is .0002 mfds.; too large a capacity would interfere with the high note response of the receiver.

If a screen-grid valve is used, there may be "feed-back" between the aerial coil and the detector coil or coil in the grid circuit. In this case, the trouble lies in the "SCREENING" which is faulty. Again, it must not be forgotten that if the loudspeaker wires are taken close to the H.F. end, this may cause sufficient feed-back for instability to occur and upset the handling and reproduction of the set.

Parasitic oscillation in the detector which is a cause of unstable reaction, may be reduced or cured by the addition of a resistance in series with the reaction condenser. Different values should be tried for this resistance until one is found which is effective over the range of wavelengths it is desired to receive. The value will probably lie between 250 and 600 ohms, depending on the type of receiver and the values of by-pass and reaction condenser.

Reduction of the H.T. voltage on the detector valve may help to smooth the reaction, and a higher value of de-coupling resistance may be tried. Different values of grid-leak and grid condenser should also be tried and the substitution of a condenser of .00015 mfds., or .0002 mfds. for a condenser of lower capacity may effect an immediate cure. The connection of the grid-leak return to the negative instead of the positive end of the filament frequently effects a cure, but results in loss of volume. A much better idea is to connect the grid-leak to the slider of a potentiometer connected across the filament supply. By variation of the slider a position may be found which is a compromise between perfectly smooth working and maximum volume. A suitable value for the potentiometer would be 200 ohms.

Where L.F. transformers are used these may be the source of the trouble. A fixed resistance connected across the secondary terminals may eliminate "howling" or noise.

General instability of a S.W. set may be considerably lessened and often cured by using the shortest lead of thick wire to earth.

Where "crowding" on the S.W. bands makes station separation difficult it is advisable to use a smaller value of tuning condenser. Or an arrangement may be used whereby another condenser of smaller capacity than that in circuit can be switched in, in series, thus making the capacity of the original much smaller again. (SEE DIAGRAM C.) Such a system known as "bandspreading" is useful, but must not be regarded as a real solution to the problem of station separation where there is overcrowding, or stations operating too close to each other. However, it does make tuning much easier mechanically because, by this method, any portion of the short-wave "spectrum" is spread over a greater portion of the tuning dial than usual. Again, bandspread not only makes tuning in of stations easier, but often results in louder signals.

FINAL POINTS respecting HOME-MADE SETS:—

(1) As rectifier or detector, a good "soft" valve should be used. This helps to make the set oscillate so much easier.

(2) In the case of home-made coils, these can be calibrated, or their TUNING RANGE measured roughly by tuning in "LOCALS" or powerful stations as "MARKERS."

CHAPTER XVII.

MAINS UNITS AND CHARGERS.

Unlike ordinary electrical appliances, the wireless leaves a good deal to the discretion of the user. The Low Tension problem is probably the more involved of the two, for there are so many ways of keeping the valves supplied directly or indirectly from the mains.

A SIMPLE L.T. SCHEME.

The simplest is probably the use of a small accumulator of a voltage to suit valves and a trickle charger. There are one or two points, which require attention for the best results, both as regards convenience and actual service. First of all, a change-over switch to put the battery over from the set to the charger is essential. The change-over from set to charger must be done regularly every night.

SWITCHING A CHARGER.

The correct type of switch is a Double-pole-change-over, and a strong type is recommended so that there shall be no risk of poor contacts. These are the connections: (1) Battery terminals to the two middle switch contacts; (2) Set L. Tension terminals to one pair of switch side contacts; (3) Charger terminals to other side of switch. To keep the battery well charged a charger should be chosen with an output suited to the particular requirements. For example, if the set only takes .3 amp., and it is used 4 hours a day, it is not desirable to employ a charge giving .75 amp. and charge every night for, say, 8 hours, because that would mean a very wasteful amount of over-charging, with the consequent necessity for constant topping up and possible ill-effects on the battery. If a charger is used in circumstances like this, probably the best thing to do is to charge every other night or thereabouts. Evidently, then, a charger should be chosen with a lower rate for smaller sets. Other mains L.T. supply methods as actual L.T. battery eliminators, A.C. heated valves, and so on, form too large a subject to be dealt with here.

THE H.T. QUESTION.

To get satisfactory results from a mains H.T. supply is very largely a matter of building or purchasing a unit of really adequate size for the particular needs. To over-run a small unit by trying to make it supply a large set is simply asking for trouble, and usually results in an undue amount of hum, a heavy fall in output voltage, and sometimes motor-boating or howling due to working several valves off the same positive tapping on the unit. Evidently then, the first thing is to see that the unit is rated at a maximum output safely above largest possible requirements. Next, the unit should have an adequate number of positive tappings so that a separate feed can be given to the different groups of valves in the set-H.F., detector, and L.F. This last is very important, since motor-boating often follows when several valves are run from one tap, quite apart from the need for separate voltage.

MAINS H.T. UNIT.

An important point in using mains H.T. units is the question of safety precautions. With all types of units it is essential to provide complete insulation for the Loudspeaker, and an easy way of doing this is to use an output filter of the correct type with a 2 mfd. condenser in series with each of the speaker leads. An output transformer of suitable type could also be used, but some such device is imperative to eliminate risk of shocks.

With A.C. units this is all, beyond the obvious points of using well-covered leads, insulated terminals, and so on, but more is necessar with D.C. units. Here, one must provide inside the set a high voltage type 1 or 2 mfd. condenser in series with the lead to the earth terminal and another condenser (.001 mfd. mica type) in the lead to the aerial terminal. Also, it should be remembered that all wiring of the set may be "alive" on some mains, including the L.T. circuit, so everything should be safely enclosed, including the L.T. Battery, G.B. Battery, and so on. Again, metal parts as grub screws in knobs and dials should not be touched while the set is in operation. Above all, while the H.T. is on, nothing should be done except operating the set from outside. When anything is to be done, H.T. supply must be disconnected entirely. Also, the H.T. must always be switched on last, and switched off first.

(1) *NOTE ON BEAMING.*

While the beaming of stations, including "locals," at certain times of the day affects signal strengths, it does not follow that they will be inaudible. It is possible to hear KGEI, San Francisco, when beamed to the Pacific. Similarly, WCBX, New York, using a "Double inverted V" aerial for S. America, may be heard in Great Britain because of "siderial lobes of radiation." In this case the beam sector may embrace the whole of Middle Europe and perhaps as far south as the Golden Horn. It is also possible to hear a station even when miles back behind the beam itself because of "aerial recoil."

EXAMPLES OF BEAMING:

STATION CALL	LOCATION OR SERVICES	WAVELENGTH METRES	FREQUENCY MC/S.	PERIODS B.S.T.	BEAMED TO
WCEA	SCHENECTADY	19.56	15.33	14.00–23.30	EUROPE
WCEA	"	31.41	9.59	00.00–06.00	LATIN-AMERICA
WCEO	"	31.48	9.53	11.00–13.00	AUSTRALIA
WCEO	"	31.48	9.53	22.00–04.45	LATIN-AMERICA
WCEO	"	31.48	9.53	05.00–06.00	EUROPE
VARIOUS	B.B.C. WORLD SERVICES	VARIOUS	VARIOUS	06.00–09.15	PACIFIC
"		"	"	11.45–16.15	EAST
"	"	"	"	16.30–22.00	AFRICA
"	"	"	"	22.15–05.45	N. AMERICA
CRV	"	24.92	12.04	23.30–03.45	LATIN-AMERICA
CRF	"	24.80	12.095		
CSB	"	31.55	9.51	00.00–03.45	S. & CENTRAL AMERICA MEXICO
CRV	"	24.92	12.04		

(2) *NOTE ON SIDE-BAND INTERFERENCE.*

The need for increased power of S.W. broadcasting stations became known when it was found that listeners often experienced what is known as side-band interference, the interference of one signal by that of a station up to 10 kc/s. apart on the frequency band. This effect occurs because the modulating or voice frequency tends to widen out the "carrier" by an amount plus and minus the modulating frequency. Technically, a modulated "carrier wave" can be resolved into three component frequencies, namely: (1) The fundamental carrier frequency; (2) the fundamental minus the modulating frequency; and (3) the fundamental plus the modulating frequency. While it was found impossible many times to tune in either of two stations of low power on adjacent frequencies and even more difficult to tune in one of low power adjacent to one on high power, it was found that in the case of two high power transmitters either could be received with equally good clarity.

BOOK II.—

TRANSMITTING AERIALS.

These may be classified as follows :

A.—Uni-directional.

B.—Omni-directional and non-directional.

CHIEF TYPES INCLUDE :

1.—Telefunken-Tannenbaum, with Horizontal dipoles.

2.—Horizontal Rhombic.

3.—Centre-fed Hertz.

4.—Vertical Radiator.

5.—Zeppelin Half-wave.

6.—Alexanderson "PANEL."

7.—Double Inverted "V".

8.—Marconi Double Franklin, with vertical dipoles.

NEWS IN ENGLISH
B.B.C. WORLD SERVICES

TIMES G.M.T.	WAVELENGTHS METRES	M	M	M	M	M	M	M
06.15 – 06.30	49.10	42.46	31.55	31.25	25.53	19.82	19.60	19.49
08.00–08.15	42.46	31.55	25.53	19.82	19.60	19.49	19.42	16.84
11.00–11.15	25.53	19.82	19.49	19.42	16.84	16.77	13.97	—
13.00–13.15	25.53	19.82	19.49	19.42	16.84	16.77	13.97	—
16.00–16.15	31.25	25.53	19.82	19.66	19.49	16.84	16.77	—
18.00–18.15	31.55	31.25	25.53	19.82	19.66	16.77	—	—
20.45–21.00	31.25	25.68	25.53	19.82	16.77	—	—	—
21.15 – 21.30	31.32	31.25	30.53	25.68	25.53	19.82	—	—
21.45 – 21.55 EXCEPT SUNDAYS			31.32	31.25	30.53	25.68	25.53	19.82
22.45–23.00	31.32	30.53	25.68	25.53	—	—	—	—
01.00–01.15	31.32	30.53	25.68	25.53	—	—	—	—
02.45–02.55	31.32	30.53	25.68	25.53	—	—	—	—
04.30–04.45	40.98	31.32	30.53	25.68	25.53	—	—	—
(ADD 1 HOUR TO CONVERT TO B.S.T. & 2 HOURS FOR D.B.S.T.)								

LANGUAGE OF THE AMATEUR FRATERNITY.

TERMS EXPLAINED. (*SEE NOTE BELOW.*)

The amateur or "Ham" transmissions contain a jumble of the old radio-telegraphic codes—authentic and otherwise—and "slang" which the amateurs have developed as a common language among themselves, e.g. :

Rig.—Transmitter.

Shack.—Transmitter room or cabin.

Rock.—Quartz crystal.

Tank.—Main tuning circuit.

Putting on the cans.—Putting on headphones.

Mil.—Milliampere.

O.W.—Amateur's wife.

XYL.—Ex-young lady.

W.A.C.—Worked all continents.

CQ.DX.—I wish to make long-distance contact.

CQ.—I want to talk to anybody.

CQ. New York.—I wish to contact amateur in New York.

(*Note*: This call is not permitted to British amateurs who call "TEST" or "TEST DX."

DX.—Long distance.

QSO.—Contact.

fb. QSO.—Thanks for the fine business contact or communication.

QRM.—Interference between stations.

QRN.—Static interference or atmospherics.

QSY.—Change of frequency to another part of the band.

QRX.—Stand by for a short time.

QSA 1 to QSA 5.—Completely unintelligible to 100 per cent. understood.

R.—Signal strengths (figures after indicate volumes). (*See Chapter on LOGGING.*)

RST CODE.—Used by amateurs transmitting morse, R for readability, S for signal, and T for tone.

QSL.—A verification card.

DX'er.—Long-distance enthusiast.

QRA.—Address.

'73's O.M.—Kind regards old men.

Pulling the big switch or QRT.—Closing down or leaving the "air."

NOTE.—AMATEUR TRANSMISSIONS NOW CURTAILED.

SOME USEFUL FORMULÆ AND TERMS, ETC.

Speed of Wireles waves.—Speed of LIGHT or 186,000 miles per sec. or 300,000,000 metres per sec.

1 Metre.—39.37 inches.

Frequency of a station.—Number of impulses or waves sent out per second.

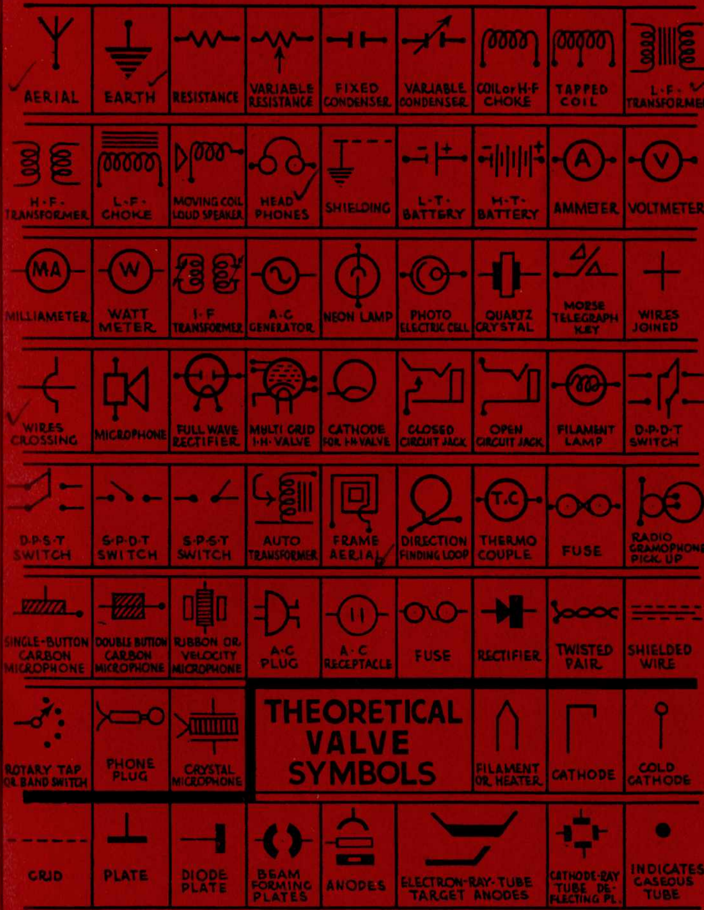
Wavelength.—Fixed speed at which radio waves travel in metres per sec., divided by the number of waves per second.

Frequency in kilocycles.—300,000 ÷ wavelength in metres.
Wavelength in metres.—300,000 ÷ frequency in kilocycles.
Mega.—A million.
Megacycle.—A million cycles or 1,000 kilocycles.
1 Kilocycle.—1,000 cycles.
"Flutter."—Rapid fading of signals.
Fade-out.—Disappearance of stations altogether.
Optimum.—Best frequency on the band between 100 and 10 metres (roughly).
Skip-distance.—Distance between the terminus of the ground-wave and the point of the reflected ray's return to earth.
Atmospherics or static.—Interfering noises caused by natural sources.
"Jamming" station.—"Spark" or telegraphy transmitter which blots out or "swamps" a transmission.
Wipe-out of signals.—Caused by a seasonal change.
F.M.—Frequency Modulation (or modulated).
A.M.—Amplitude Modulation (or modulated).
M.W.—Medium-wave transmission.
S.W.—Short-wave(s).
U.S.W.—Ultra-short-wave(s).
G.M.T.—Greenwich Mean Time.
B.S.T.—British Summer Time (one hour ahead of G.M.T.).
D.B.S.T.—Double British Summer Time (two hours ahead of G.M.T.).
E.W.T.—Eastern War Time (four hours earlier than G.M.T.).
P.W.T.—Pacific War Time (seven hours earlier than G.M.T.).
Heaviside Layer.—Reflecting "envelope" which reflects Medium waves.
Appleton Layer.—Reflecting "envelope" which reflects the S.W. and U.S.W.
D.X. Work.—Long distance reception.

TELEGRAPHY STATIONS

STATION	CALL	Kc/s	METRES	STATION	CALL	Kc/s	METRES
BANGKOK.	HSP	17·741	16·91	NAUEN (Germany)	DHA	10·920	27·47
BERMUDA.	ZFB	10·055	21·93	″	DIH	19·947	15·04
BUDAPEST.	HAS2	13·685	29·93	NEW BRUNSWICK (N.J.)	WDW	4·545	66·01
BUDAPEST.	HAT2	6·840	44·25	″	WEO	5·270	56·93
COLTANO	IAC	6·650	45·11	OCEAN GATE (N.J.)	WOO	8·560	35·05
HURLINGHAM (Argentine)	LSL	21·160	14·18	″	WOO	4·752	63·12
KONIGS WUSTERHAUSEN.	DIQ	10·290	29·16	RIO DE JANEIRO	PSA	21·080	14·23
KONIGS WUSTERHAUSEN.	DIZ	5·800	51·72	″ ″ ″	PSF	14·690	20·40
LAWRENCEVILLE (New Jersey)	WKF	19·220	15·61	″ ″ ″	PSA	14·935	20·70
″ ″	WCN	5·077	59·08	″ ″ ″	PSH	10·220	29·35
″ ″	WLA	18·340	16·36	″ ″ ″	PSK	8·185	36·65
″ ″	WLK	16·270	18·44	ROCKY POINT N.Y.	WAJ	13·480	22·36
″ ″	WMA	13·390	22·4	″ ″	WAD	4·550	65·93
″ ″	WMF	14·470	20·73	″ ″	WEA	10·610	28·28
″ ″	WOA	6·755	44·41	″ ″	WEC	8·930	33·59
″ ″	WOF	9·750	30·77	″ ″	WEJ	6·740	44·51
″ ″	WOK	10·550	28·44	″ ″	WEM	7·400	40·54
″ ″	WKN	19·820	15·14	″ ″	WEF	9·490	31·61
″ ″	WMN	14·590	20·56	″ ″	WQEA	5·190	57·80
″ ″	WON	9·870	30·40	″ ″	WIK	13·930	21·53
MARACAY (Venezuela)	YVQ	6·672	44·96	″ ″	WIY	13·870	21·62
MARION (Mass. U.S.A)	WCC	12·645	23·72	″ ″	WIZ	6·965	43·07
MONTE GRANDE (Argentine)	LQA	9·700	30·93	″ ″	WKJ	9·460	31·71
″	LQC	17·660	16·99	″ ″	WKQ	16·000	18·75
″	LQD	19·400	15·46	″ ″	WKU	14·830	20·23
″	LQE	10·875	27·59	″ ″	WLL	17·900	16·76
″	LSO	8·830	33·99	″ ″	WQB	17·940	16·72
″	LSI	9·800	30·61	″ ″	WQN	5·260	57·03
NAGOYA (Japan)	JNB	13·880	21·61	″ ″	WQO	6·725	44·61
″	JNH	7·820	38·36	″ ″	WQX	20·180	14·87
″	JNL	6·810	44·05	ROME (Italy)	IRW	19·520	15·37
″	JNI	12·200	24·59	SAYVILLE N.Y.	WIH	6·927	43·30
″	JNJ	13·945	21·51	″	WIV	10·490	28·60
″	JNE	10·160	29·53	″	WIW	10·810	27·75
″	JNA	8·890	33·41	″	WJX	14·680	20·44
NASSAU (Bahamas)	ZFS	4·512	66·44	″	WKI	14·710	20·39
NAUEN (Germany)	DFB	17·520	17·12	″	WKS	16·285	18·42
″	DFJ	19·700	15·23	SHANGHAI	XGR	11·540	26·00
″	DFT	7·812	38·40	VIENNA	OEK	17·389	40·60
″	DGB	20·420	14·69	VIENNA	OER	10·003	29·90
″	DGK	6·680	44·91	SEPETIBA ″	PSY	6·882	43·59
″	DGU	9·650	31·09				

THEORETICAL RADIO SYMBOLS



TIME CONVERSION LOG. (TIMES IN G.M.T.)

ALEUTIAN ISLANDS	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p
ALASKA (Haiwaii Is. Less ½ hr.)	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p
YUKON.	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p
PACIFIC TIME. Canada & U.S.A.	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p
MOUNTAIN TIME, " " "	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p
CENTRAL TIME, " " "	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m
EASTERN STAN. TIME, " " " Cuba.	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a
ATLANTIC TIME, Canada, Argentine (Venez. less ½ hr)	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a
BRAZIL	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a
AZORES Is.	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a
ICELAND, W. AFRICA, CANARY Is.	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a
ENGLAND, FRANCE, SPAIN, (HOLLAND add 20 mins)	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a
NORWAY, SWEDEN, GERMANY, ITALY.	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a
RUSSIA (Moscow) EGYPT, S. AFRICA.	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a
MADAGASCAR, ARABIA, ABYSSINIA, PERSIA.	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a	9a
CENTRAL RUSSIA, TURKESTAN.	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a	10a
INDIA, (Add 30 mins.)	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n	11a
BURMA, TIBET, E. INDIA, (Calcutta).	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p	12n
SUMATRA, (Java, add 20 mins.)	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p	1p
CHINA, WEST AUSTRALIA.	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p	2p
JAPAN, (CENTRAL AUSTRALIA, Add 30 mins.)	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p	3p
EAST AUSTRALIA, NEW GUINEA.	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p	4p
SOLOMAN Is., NEW HEBRIDES.	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p	5p
NEW ZEALAND, (Less 30 mins.)	5p	4p	3p	2p	1p	12n	11a	10a	9a	8a	7a	6a	5a	4a	3a	2a	1a	12m	11p	10p	9p	8p	7p	6p

TO FIND TIME AND DAY IN ANY COUNTRY OF THE WORLD. (G.M.T.)

Select horizontal line opposite the country in which you live (using particular time band mentioned for your locality), and move along this line to the nearest hour as shown by your watch, then move up or down the vertical column to the line opposite the country in which you desire the time. The figure at the intersection is the time required ("a" denotes a.m.; "p" denotes p.m.).

To find the day, the rule is—if when moving up or down the vertical column you pass the zig-zag line in an upward movement, the time indicated will be "yesterday," or one day behind. If in moving downward on the vertical column you cross the zig-zag line, the time indicated is "to-morrow," or one day ahead.

Example.

If it is 5 p.m. on Wednesday in London (G.M.T.) ,what time and day is it in New Zealand? Follow horizontally along the line marked "ENGLAND" to 5 p.m. and drop down from this point to the New Zealand horizontal line. The intersection gives the time as 5 a.m. Having crossed the heavy zig-zag line in a downward direction *the time is one day ahead. HENCE IT IS 5 A.M. THURSDAY MORNING IN NEW ZEALAND.*

WORLD-WIDE MILEAGE CHART.

MOSCOW	43	83	76	90	11	78	71	46	50	41	57	59	55	72	16	15	10	70	10	34	21	46	59	39	66	22	13	103	10	51	25	22	15	63	62	52	46	60	38
KHABAROVSK	29	113	58	57	49	99	108	57	42	14	83	69	10	85	51	52	47	40	48	31	53	9	41	67	66	53	50	66	44	25	60	57	52	91	82	58	60	51	
LOS ANGELES.	23	61	93	74	62	48	63	22	11	65	35	23	56	35	55	57	58	25	62	81	63	54	89	97	16	59	56	66	54	73	56	58	59	99	36	16	25		
NEW YORK (U.S.A.)	33	53	118	99	42	40	48	4	25	73	25	13	38	29	34	36	40	50	43	79	42	67	101	74	22	36	36	89	37	85	33	36	39	77	22	9			
ST. LOUIS, (U.S.A.)	29	55	108	90	49	41	52	7	17	72	26	13	45	28	42	44	47	41	51	82	51	63	99	83	14	45	44	80	43	82	42	44	47	86	25				
CARACAS, VENEZUELA.	54	31	108	96	54	19	28	25	42	95	6	14	52	11	46	47	52	60	55	96	52	88	121	71	23	41	49	81	52	106	40	43	49	63					
CAPE TOWN, S. AFRICA.	104	42	54	68	56	53	38	81	101	79	65	77	61	66	59	57	59	115	56	59	52	91	59	25	85	49	60	70	65	74	53	53	51						
GENEVA, SWITZERLAND.	49	68	87	105	5	63	56	39	51	57	55	50	7	60	4	3	5	77	6	47	4	61	72	38	60	11	4	118	9	66	9	6							
MADRID, SPAIN.	51	62	91	110	11	57	50	37	52	62	49	46	13	54	8	6	11	78	12	53	8	67	77	39	56	5	9	124	15	73	3								
LISBON, PORTUGAL.	51	59	94	113	14	54	47	35	51	66	46	43	15	51	9	9	14	78	15	56	12	70	81	40	54	4	12	120	17	75									
MANILA, P.I.	53	110	32	39	61	117	111	81	65	12	107	94	60	107	67	67	62	53	61	22	61	18	17	58	88	76	54	52	60										
OSLO, NORWAY.	40	76	87	99	8	68	64	36	45	50	57	49	3	62	7	8	5	78	9	45	12	53	69	44	57	20	5	110											
WELLINGTON, NEW ZEALAND.	73	61	32	14	113	67	72	87	72	62	75	78	112	69	118	118	113	47	112	71	115	58	45	84	68	118	116												
HUIZEN, HOLLAND.	44	71	88	103	5	65	59	37	48	54	55	49	3	60	3	3	4	72	7	47	8	58	72	41	58	14													
RABAT, MOROCCO.	55	58	92	112	15	52	46	38	54	67	47	45	17	52	12	11	16	81	16	56	12	72	79	38	56														
MEXICO CITY.	38	46	100	80	63	33	58	21	25	70	20	11	59	19	56	57	61	38	64	96	62	70	103	92															
NAIROBI, KENYA COL.	82	64	55	75	37	71	55	75	89	58	76	81	42	79	42	40	39	50	36	38	38	70	49																
BANDOENG, JAVA.	36	93	18	32	67	107	95	98	82	36	121	110	69	118	74	73	68	66	66	25	69	36																	
TOKIO, JAPAN.	53	114	50	48	57	103	117	64	47	12	88	74	55	89	60	60	56	38	56	32	61																		
ROME, ITALY.	52	69	83	101	5	65	57	44	55	56	58	54	9	63	9	7	7	80	5	45																			
CALCUTTA, INDIA.	58	102	42	57	43	108	92	77	70	20	102	92	43	106	49	49	44	70	41																				
BUDAPEST, HUNGARY.	49	73	81	99	2	69	61	44	52	51	61	55	6	66	9	7	4	76																					
HONOLULU, HAWAII.	28	75	68	51	76	66	82	46	27	50	57	48	71	55	72	74	72																						
BERLIN, GERMANY.	45	73	85	101	3	68	61	40	49	51	58	52	2	63	6	5																							
PARIS, FRANCE.	47	68	89	105	6	62	56	37	49	56	54	48	6	58	2																								
LONDON, ENGLAND.	45	69	91	106	9	61	58	35	47	55	53	46	6	57																									
QUITO, ECUADOR.	56	22	99	83	63	14	29	31	43	99	5	16	63																										
COPENHAGEN, DENMARK.	43	74	85	99	5	68	62	39	47	50	58	51																											
HAVANA, CUBA.	40	43	110	90	54	29	42	15	28	83	14																												
BOGOTA, COLOMBIA.	55	29	98	88	59	15	28	28	42	98																													
NANKING, CHINA.	43	122	44	50	51	112	112	76	56																														
VANCOUVER, CANADA.	13	70	92	78	52	70	69	21																															
TORONTO, CANADA.	29	56	113	96	43	52	52																																
RIO DE JANEIRO, BRAZIL.	81	12	83	72	61	16																																	
LA PAZ, BOLIVIA.	69	13	90	80	68																																		
VIENNA, AUSTRIA.	48	73	83	99																																			
SYDNEY, AUSTRALIA.	73	72	20																																				
PERTH, AUSTRALIA.	83	76																																					
BUENOS AIRES, ARGENTINA.	83																																						
ANCHORAGE, ALASKA.																																							

To determine Mileage between any two of the listed Cities in the World, first find these two Cities on the World Chart above. Follow the horizontal column across chart from the upper city, and the vertical column up from the lower city. The box at which these two columns intersect shows the required mileage in HUNDREDS OF MILES.

All Mileages show the shortest (Great Circle) paths between points.

LIST OF ULTRA-SHORT-WAVE BROADCASTING STATIONS

M/cs	CALL LETTERS	LOCATION	PERSONAL LOG alterations etc.	Times of operation G.M.T. (Schedule)
25·95	W6XKG	LOS ANGELES		Broadcasts 24 hours daily
25·95	W9XUP	ST PAUL, MINN.		Relays KSTP 16·00–22·00
25·95	W8XNU	CINCINNATI		Relays WSAI, daytime programmes.
26·05	W9XTC	MINNEAPOLIS		(Irregular)
26·10	W9XJL	SUPERIOR, WISC.		Relays WEBC, 15·00–20·00
26·30	W2XJI	NEWARK, N.J.		Relays WOR, 18·00–23·00
26·40	W9XAZ	MILWAUKEE		Relays WTPM, 18·00–05·00
26·45	W9XA	KANSAS CITY		Relays KITE, around 17·00–22·30
26·55	W2XQO	NEW YORK		Relays WMCA, 17·00–23·00
31·60	W1XKA	BOSTON, MASS.		Relays WBZ, 11·00–18·00
31·60	W4XCA	MEMPHIS, TENN.		Relays WMC, 13·00–01·00
31·60	W8XKA	PITTSBURGH		Relays KDKA, 20·00–23·00 Irreg.
31·60	W3XKA	PHILADELPHIA		Relays KYW, 15·00–03·00
31·60	W5XD	DALLAS, TEXAS.		Relays WFAA, around 17·00
31·60	W3XEY	BALTIMORE		Relays NBC, 23·00–05·00
31·60	W8XAI	ROCHESTER, N.Y.		Relays WHAM.
31·60	W8XWJ	DETROIT		18·15–03·30, 19·00–22·00.
				and 00·00–03·00
31·60	W2XDV	NEW YORK		Relays WABC
31·60	W9XHW	MINNEAPOLIS		14·00–22·00
31·60	W9XPD	ST LOUIS		Relays KSD 14·00–24·00
31·60	W1XAQ	NEW BEDFORD		Relays WNBH 19·00–23·00
31·60	W5XAU	OKLAHOMA C.		17·00–18·00 & 23·00–11·00
31·60	W9XUY	OMAHA		Almost all day.
35·60	W3XES	BALTIMORE		Relays WCAO 14·00–22·00
35·60	W2XDV	NEW YORK C.		Owned by C.B.S. 14·00–17·00
37·50	W3XES	BALTIMORE		Broadcasts 22·00–04·00
38·60	W2XDV	NEW YORK		Relays WABC
38·60	W2XDG	NEW YORK C.		Afternoons
38·60	W8XNT	CLEVELAND		Relays WHK Wed., 17·00–05·00
41·00	W2XDV	NEW YORK		Relays WABC
41·00	W2XGH	SCHENECTADY	(Altered call.)	13·00–04·00 daily
41·00	W8XA	SCHENECTADY	(Altered call.)	Mon., Wed., & Frid. 01·00–02·00
				Sat. 20·00–22·00
41·50	W8OE	CLEVELAND		14·00–16·30 & 18·20–20·40
49·00	W2XBS	NEW YORK C.		On Empire Building
55·50	W8XK	PITTSBURGH		Irreg. 18·00–02·00
55·50	W1XKA	BOSTON MASS.		Daily 11·00–05·00. Sund. starts at 13·00

LOG OF NEW STATIONS ETC.

LIST OF SHORT-WAVE BROADCASTING STATIONS

By making a note of the calls of stations, listeners will gain some idea of the various PREFIX LETTERS ALLOTTED TO COUNTRIES ALL OVER THE WORLD.
(Personal Log for alterations etc.) Times G.M.T.

Mc/s	METRES	CALL	LOCATION	MAIN SCHEDULE. TIMES G.M.T.	Personal Log.
4·01	74·81	Ponta	DELGADA, Azores.	22·00—24·00	
4·27	70·10	RVI5	KHABAROVSK.	06·00—13·00	
4·70	63·84	ZQ1	KINGSTON, Jamaica.	23·15—00·15	
4·75	63·16	YV1RV	MARACAIBO.	21·30—02·30	
4·76	63·00	YV4RO	VALENCIA.	22·30—02·00	
4·77	62·81	HJGB	BUCARAMANGA.	23·00—03·00	
4·78	62·76	HJAB	BARRANQUILLA.	22·30—02·00	
4·79	62·60	YV6RU	BOLIVAR.	22·00—02·00	
4·79	62·63	HJDX	MEDILLIN.	22·00—02·30	
4·80	62·50	YV1RX	MARACAIBO.	22·00—02·30	
4·82	62·19	YV3RN	BARQUISIMETO.	23·30—22·30	
4·82	62·16	HJED	CALI.	23·00—23·00	
4·83	62·00	YV2RN	SAN CRISTOBAL.	23·00—22·30	
4·84	61·98	YV1RZ	VALERA.	22·00—22·00	
4·84	61·98	VUC2	CALCUTTA.	15·30—16·30	
4·84	61·92	HJCD	BOGOTA.	00·00—03·30	
4·86	61·73	YV5RU	CARACAS.	22·30—22·30	
4·88	61·48	VUB2	BOMBAY.	12·30—16·30	
4·88	61·42	HJDP	MEDILLIN.	23·30—03·00	
4·89	61·35	YV5RM	CARACAS.	20·00—02·00	
4·89	61·35	HJCH	BOGOTA.	20·00—02·00	
4·90	61·20	HJAG	BARRANQUILLA.	23·00—03·00	
4·92	60·98	YV5RN	CARACAS.	21·00—02·30	
4·92	60·98	HJAP	CARTAGENA.	22·30—22·30	
4·92	60·98	VUM	MADRAS.	14·30—16·30	
4·94	60·67	HJCW	BOGOTA.	23·00—23·00	
4·96	60·48	VUD2	DELHI.	12·00—16·30	
5·91	50·72	TIGPH	SAN JOSE.	23·00—23·45	
5·95	50·42	HH2S	PORT-AU-PRINCE.	00·00—23·00	
5·95	50·42	XGOY	CHUNGKING.	20·00—21·00	
5·97	50·25	VONH	St. JOHN'S, (Newf.)	21·30—02·30	
6·00	50·00	CXA30	MONTEVIDEO.	04·30—06·00	
6·00	50·00	HP5K	COLON.	18·00—04·00	
6·00	50·00	XEBT	MEXICO C.	18·00—04·00	
6·00	50·00	ZRH	JOHANNESBURG.	16·45—17·45, 14·00—21·00	
6·01	49·85	CJCX	SYDNEY, N.S.	00·00—23·00	
6·02	49·83	HJCX	BOGOTA.	22·00—23·30	
6·02	49·83	HI3U	SANTIAGO D.R.	22·00—22·30	
6·03	49·75	DXP	BERLIN.	22·30—23·00	
6·03	49·75	HP5B	PANAMA.C.	23·30—23·00	
6·03	49·75	CFVP	CALGARY.	00·00—23·00 (IRREGULAR)	
6·04	49·67	WRUL	BOSTON.	19·00—02·30	
6·05	49·59	GSA	B.B.C. Services	06·00—16·00, 18·00—04·00	
6·06	49·50	WCAB	PHILADELPHIA.	00·15—04·00	
6·06	49·50	VQ7LO	NAIROBI.	16·00—20·15, (IRREGULAR)	
6·06	49·50	SBO	STOCKHOLM.	21·20—21·35	
6·07	49·42	CFRX	TORONTO.	18·00—03·30	
6·08	49·34	HP5F	COLON.	01·45—02·00	
6·08	49·30	OAX4Z	LIMA. (Peru)	00·30—04·00	
6·08	49·34	CKFX	VANCOUVER.	05·00—08·00	
6·09	49·26	ZNS	BAHAMAS.	23·00—00·00	
6·08	49·34	GRR	B.B.C. Services.	05·30—06·00, 10·30—10·45 & 22·00—22·45	
6·08	49·34	ZFY	GEORGETOWN.	11·00—12·30, 01·00—02·00	
6·09	49·26	CBFW	MONTREAL	18·00—03·00	
6·10	49·20	ZRJ	JOHANNESBURG.	14·00—21·00 AND OTHER TIMES.	
6·11	49·10	GSL	B.B.C. Services.	06·00—06·45, 16·30—17·00, 22·15—03·45	
6·11	49·02	CP2	LA PAZ.	23·30—05·00	
6·12	49·02	MTCY	HSINKING.	10·00—11·00 (IRREGULAR)	

Mc/s	Metres	CALL	LOCATION	MAIN SCHEDULE (GMT)	Personal Log.
6·12	49·00	HP5H	*PANAMA CITY*	*22·00–03·00*	
6·13	48·94	VUD2	*DELHI*	*opens daily 13·15*	
6·13	48·92	CHNX	*HALIFAX N.S.*	*12·00–04·15*	
6·14	48·86	DXX	*BERLIN*	*18·00–22·00*	
6·14	48·80	GRW	*B.B.C. (S)*	*06·00–07·00, 18·30–05·30*	
6·14	48·80	ZRD	*DURBAN*	*14·00–21·00 etc.*	
6·15	48·75	CS2WD	*LISBON*	*20·00–22·00*	
6·17	48·62	WCRC	*NEW YORK C.*	*18·00–08·00*	
6·17	48·54	TIRCC	*SAN JOSÉ*	*00·00–01·00*	
6·18	48·54	GRO	*B.B.C. (S)*	*23·00–01·45*	
6·19	48·50	TG2	*GUATEMALA*	*23·00–03·30*	
6·19	48·47	HVJ	*VATICAN*	*20·00–21·00, 01·00–02·30*	
6·20	48·39	HI4V	*SAN F. de*	*00·00–03·00*	
6·23	48·11	HRD	*LA CEIBA*	*22·00–03·00*	
6·24	48·08	HI1N	*TRUJILLO*	*22·30–01·30*	
6·24	48·08	HJCF	*BOGOTA*	*00·00–03·14 (IRREG)*	
6·27	47·85	YSR	*SAN SALVADOR*	*00·00–03·00*	
6·29	47·65	OAX1A	*CHICLAYO*	*01·30–03·30*	
6·32	47·47	COCW	*HAVANA*	*18·00–04·00*	
6·34	47·32	HI1G	*TRUJILLO (D.R.)*	*18·00–04·00*	
6·39	46·95	HI9B	*SANTIAGO*	*22·45–02·00*	
6·42	46·73	HI1S	*SANTIAGO*	*22·45–02·00*	
6·43	46·22	Radio	*DAKAR*	*12·15–19·15*	
6·48	46·30	TGWB	*GUATEMALA*	*00·30–04·30*	
6·51	46·08	YN1GG	*MANAGUA*	*01·00–02·00*	
6·58	45·49	YSPB	*SALVADOR*	*00·30–04·00*	
6·63	45·25	HIT	*TRUJILLO*	*23·30–02·00*	
6·69	44·84	TIEP	*SAN JOSE*	*22·00–04·00*	
7·15	41·96	GRT	*B.B.C. (S)*	*20·15–21·00*	
7·21	41·60		*SALISBURY, RHODESIA.*	*16·00–16·15 and other times*	
7·23	41·49	GSW	*B.B.C. (S)*	*18·00–21·45*	
7·24	41·44	DXJ	*BERLIN*	*18·00–04·00*	
7·25	41·38	VLQ9	*SYDNEY (N.S.W.)*	*06·00–06·30*	
7·26	41·32	CSW8	*LISBON*	*21·00–22·00*	
7·85	38·08	HC2JSB	*GUAYAQUIL*	*21·00–03·00*	
7·89	38·00	YSD	*SAN SALVADOR*	*00·00–03·00*	
8·59	34·92	YNRS	*MANAGUA*	*01·00–02·30*	
8·70	34·48	COCO	*HAVANA*	*18·00–04·00*	
8·83	34·02	COCQ	*HAVANA*	*18·00–04·00*	
8·96	33·45	COKG	*SANTIAGO*	*18·00–03·00*	
9·03	33·33	COBZ	*HAVANA*	*18·00–03·00*	
9·12	32·88	HAT4	*BUDAPEST*	*18·00–03·00*	
9·13	32·80	KNBC	*HOLLYWOOD (Cal.)*	*03·00–04·00*	
9·20	32·59	COCX	*HAVANA*	*18·00–04·00*	
9·29	32·29	HI2G	*TRUJILLO*	*20·00–02·00*	
9·34	32·15	OAX4J	*LIMA*	*18·00–04·00 (IRREGULAR)*	
9·34	32·10	HBL	*GENEVA*	*01·45–02·30*	
9·35	32·09	COBC	*HAVANA*	*18·00–04·00*	
9·41	31·88	Radio	*DAKAR*	*Daily at 19·15*	
9·42	31·85	GRI	*B.B.C. (S)*	*11·00–12·30, 15·30–16·45*	
9·43	31·82	COCH	*HAVANA*	*18·00–04·00*	
9·45	31·75	GRU	*B.B.C. (S)*	*13·30–16·30, 18·00–19·30*	
9·46	31·71	TAP	*ANKARA*	*15·15–16·15, 18·00–00·00*	
9·47	31·68	VONG	*St JOHN'S (Newf.)*	*13·30–17·30*	
9·50	31·58	OFD	*LAHTI, Finland.*	*06·00–16·00, 18·00–21·00*	
9·50	31·58	XGOY	*CHUNGKING*	*10·00–11·15*	
9·50	31·56	XEWW	*MEXICO CITY*	*18·00–04·00*	
9·50	31·56	CB950	*SANTIAGO*	*23·20–(Onward)*	
9·51	31·55	GSB	*B.B.C. (S)*	*06·00–09·00*	
9·52	31·51	Moscow	—	*18·00–02·00*	
9·52	31·50	ZRG	*JOHANNESBURG*	*10·00–11·15*	
9·53	31·48	JZI	*TOKIO*	*05·30–06·30, 15·00–16·00*	
9·53	31·48	VUC2	*CALCUTTA*	*07·30–09·00*	
9·53	31·48	SBU	*STOCKHOLM*	*21·20–21·45*	

c/s	Metres	CALL	LOCATION	MAIN SCHEDULE (GMT)	Personal Log
53	31·48	WGEO	SCHENECTADY NY.	20·00 – 04·00	
53	31·46	VPD2	FIJI	05·00 – 09·00 (IRREGULAR)	
54	31·45	DJN	BERLIN	06·00 – 16·15	
54	31·45	VLG2	MELBOURNE	12·30 – 16·15	
·54	31·45	OAX5C	(PERU)	00·00 – 04·00	
·54	31·43	MTCY	HSINGKING	13·00 – 13·30	
·55	31·41	WGEA	SCHENECTADY NY.	23·00 – 02·15	
·55	31·41	VUB2	BOMBAY	06·30 – 08·30	
·55	31·41	Moscow	–	07·30 – 09·30	
·56	31·38	DJA	BERLIN	10·00 – 15·00, 22·30 – 23·00	
·57	31·35	VUM2	MADRAS	08·00 – 09·30	
·58	31·32	GSC	B.B.C. (S)	21·45 – 03·45	
·58	31·23	VLGR	MELBOURNE	08·30 – 12·30	
·59	31·28	VUD2	DELHI	11·30 – 16·00	
·59	31·28	WLWO	CINCINNATI	00·00 – 03·30	
·60	31·25	GRY	B.B.C. (S)	06·15 – 08·00	
·60	31·25	CB96	SANTIAGO	23·00 – 04·00	
·61	31·23	ZRL	CAPETOWN	10·00 – 12·30, 14·00 – 16·00	
·61	31·22	HP5J	PANAMA CITY	20·00 – 03·00	
·61	31·20	VLQ	SYDNEY N.S.W.	06·00 – 14·00 (intervals)	
·62	31·20	TIPG	SAN JOSE	22·00 – 04·00	
·63	31·15	XGOX	CHUNGKING	14·00 – 15·30	
·64	31·13	CXA8	COLONIA	18·00 – 04·00	
·65	31·09	VLW2	PERTH (Austral.)	11·00 – 15·30	
·66	31·06	LRX	BUENOS AIRES	18·00 – 02·00	
·66	31·03	HVJ	VATICAN	11·30 – 01·00	
·67	31·02	WRCA	NEW YORK	00·00 – 04·00	
·67	31·07	KGEI	SAN FRANCISCO	00·00 – 04·00	
·68	30·99	TGWA	GUATEMALA C.	18·00 – 04·00	
·68	30·99	VLQ5	SYDNEY N.S.W	begins 19·00	
·69	30·96	GRX	B.B.C. (S)	08·30 – 09·00, 18·00 – 21·00	
·70	30·93	WRUL	BOSTON	18·00 – 02·00 (IRREGULAR)	
·74	30·75	ZRO	DURBAN	08·30 – 12·00	
·83	30·53	GRH	B.B.C. (S)	21·15 – 04·15	
·84	30·49	CR7BE	LOURENCO MARQUES	09·30 – 11·00, 19·00 – 20·00	
·84	30·49	COCM	HAVANA	18·00 – 04·00	
·80	30·43	EAQ	MADRID	19·00 – 03·30	
·25	29·35	PSH	RIO DE JANEIRO	01·00 – 01·30	
·60	28·30	ZIK2	BELIZE (Bri. Hon.)	18·00 – 23·30	
·40	26·31	HBO	GENEVA	23·30 – 03·15	
·70	25·64	JLG3	TOKIO	06·30 – 08·30	
·70	25·64	CBFY	MONTREAL	18·00 – 03·00	
·70	25·64	CB1170	SANTIAGO	21·00 – 23·00 (IRREGULAR)	
·70	25·64	HP5A	PANAMA CITY	22·00 – 03·00	
·71	25·62	VLG3	MELBOURNE	06·00; 11·45; & 12·15.	
·71	25·62	WLWO	CINCINNATI	23·30 – 04·00	
·71	25·62	SBP	STOCKHOLM	(Off and on) 08·00; & 21·30	
·71	25·62	VLG3	MELBOURNE	Starts 06·00	
·72	25·60	ZP14	VILLARICA	19·00 – 02·30	
·73	25·58	WRUW	BOSTON	19·00 – 02·30 (IRREGULAR)	
·75	25·52	GSD	B.C.C. (S)	06·00 – 16·00, 18·00 – 20·00	
·76	25·51	VLR8	MELBOURNE	08·30 – 12·15, 20·30 – 00·30	
·77	25·49	DJD	BERLIN	18·00 – 04·00	
·78	25·47	HP5G	PANAMA C.	22·00 – 04·00	
·79	25·45	WRUL	BOSTON	23·00 – 04·00	
·80	25·42	COGF	MATANZAS	18·00 – 04·00	
·81	25·39	JVZ	TOKIO	22·00 – 04·00	
·82	25·38	GSN	B.B.C. (S)	18·00 – 22·00	
·83	25·36	WCBX	NEW YORK	20·00 – 04·00	
·83	25·36	VUD4	DELHI	12·00 – 16·00	
·87	25·27	VLQ2	SYDNEY	begins 09·45	
·87	25·27	VLG2	MELBOURNE	12·30 – 14·00	
·87	25·27	WBOS	BOSTON	18·00 – 04·00	
·88	25·25	VLG5	MELBOURNE	06·00 – 11·00	

Mc/s	Metres	CALL	LOCATION	MAIN SCHEDULE (GMT)	Personal Log
11·88	25·25	VLR3	MELBOURNE	06·00–08·15	
11·88	25·24	VLQ7	SYDNEY N.S.W.	13·15–16·15	
11·89	25·23	WNBI	NEW YORK	18·00–20·45	
11·89	25·22	VPD	FIJI	08·00	
11·90	25·21	XGOY	CHUNGKING	09·00–12·30	
11·97	25·06	BRAZZAVILLE		13·00 ; & 17·45–21·30	
11·98	25·04	CB1180	SANTIAGO	18·00–04·00	
12·04	24·92	GRV	B.B.C. (S)	21·00 etc.	
13·35	22·48	RADIO	DAKAR	12·15 daily	
15·10	19·84	JLG4	TOKIO	19·00–02·00	
15·11	19·84	DJL	BERLIN	11·00–13·00, 18·00–21·30	
15·12	19·83	EIRE	DUBLIN	18·30–20·00	
15·14	19·82	GSF	B.B.C. (S)	06·00–16·00, 18·00–20·00	
15·16	19·79	VUD3	DELHI	02·30–04·30	
15·17	19·78	TGWA	GUATEMALA C.	begins 18·00	
15·19	19·75	TAQ	ANKARA	10·30–12·30	
15·20	19·73	DJB	BERLIN	06·00–03·00	
15·21	19·72	WBOS	BOSTON	13·00–17·45	
15·23	19·70	VLG6	MELBOURNE	06·00–08·15, 20·30–04·00	
15·25	19·67	WLWO	CINCINNATTI	18·00–23·15	
15·26	19·66	GSI	B.B.C. (S)	06·00–16·00	
15·27	19·65	WCAB	PHILADELPHIA	18·00–22·00	
15·29	19·62	VUD3	DELHI	02·30–04·00	
15·31	19·60	GSP	B.B.C. (S)	06·00–09·00	
15·33	19·56	WGEA	SCHENECTADY NY.	18·00–23·00	
15·33	19·56	KGEI	SAN FRANCISCO	18·00–21·00	
15·35	19·53	WRUL	BOSTON	18·00–21·00	
17·76	16·89	DJE	BERLIN	06·00–23·00	
17·78	16·87	WNBI	NEW YORK	13·00–16·00	
17·79	16·86	GSG	B.B.C. (S)	06·00–16·00	
17·84	16·81	EIRE	DUBLIN	12·30–13·30, 17·00–18·15	
17·89	16·77	GRP	B.B.C. (S)	11·00–13·30	
21·45	13·99	DJS	BERLIN	06·00–12·00	
21·47	13·97	GSH	B.B.C. (S)	11·00–14·00	
21·50	13·95	WGEA	SCHENECTADY NY.	13·00–15·00	
21·55	13·92	GST	B.B.C. (S)	13·45–04·00	
21·57	13·91	WCBX	NEW YORK	12·00–16·00	

NEW STATIONS

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