WORLD WIDE SHORT WAVE RECEPTION

With the
ACSW-58
and
DCSW-34

By
James Millen, M.E.

THE pleasurable possibilities of broadcast reception can be increased many times by extending the wavelength range of the listener below 200 meters. It is the purpose of this booklet — one of a series — to explain just what the short waves are and do — what stations broadcast and when and where to find them — to describe a highly efficient short wave receiver and to demonstrate its simplicity of operation.

THE NATIONAL COMPANY

Malden, Mass. U. S. A.

Short Waves—
A New World of Broadcasting

INTERNATIONAL broadcasting has taken the short-wave receiver from the experimental laboratory and placed it in the parlor of the broadcast enthusiast. The repeated appearances of Ramsay Macdonald in England, Cosgrave in Ireland, Mussolini and the Pope in Rome before the international short-wave microphone, and the almost universal rebroadcast on long waves, have stimulated the interest of the average broadcast listener in the high-frequency impulses that carry their voices across the oceans. However, regardless of the possibilities of rebroadcast reception, there exists an admittedly greater fascination in receiving the voice of Senatore Marconi direct from HVJ, the Vatican City, Rome, Italy, than via the intermediary of a local station. And aside from the intriguing element of direct contact, it is occasionally possible to secure better reception from a foreign short-wave station than from a semi-local rebroadcasting the program. Also many interesting programs are being broadcast by domestic short-wave stations which may be received with consistent excellence, and the short-wave receiver thus contributes to the possible sources of radio entertainment. In rural communities, isolated from long-wave coverage, the s.w. receiver often provides the only reliable reception.

The short-wave receiver has definitely emerged from the laboratory. In simplicity, reliability, battery or light socket convenience, and appearance, it compares favorably with the conventional broadcast apparatus. It may take its place in the parlor with the long-wave receiver or in a "short-wave nook" where its offerings are reserved for the privileged ears of the real radio fans of the family.

What Are Short Waves?

The expression "short-waves," offhand, is self-explanatory, but on further thought requires qualification. After all, the term is relative. Two hundred meters was a short wavelength ten years ago. Today one hundred meters is hardly among the conventional short-wave bands which, in general parlance, include the wavelengths between ten and sixty meters. The larger part of short-wave communication is carried on at present between fourteen and fifty-four meters, but successful experimental work has established two-way communication over short distances on wavelengths fifty centimeters long!

Wavelength and Frequency

Wavelength is a physical conception by means of which we represent how a radio signal travels from the transmitting station to your receiver. A "wave form" is assumed, because a highly refined recording instrument placed anywhere within the influence of the signal would show a wavy line on the recording paper or tape. Such an instrument would show that the signal, starting at zero, would attain a certain maximum positive strength, then slowly decrease to zero again, to build up on the negative side to a similar maximum, again dropping to zero to recommence the "cycle." This cycle occupies a certain definite time, which can be measured directly and indirectly. Also, radio waves travel from the transmitting antenna to the receiving antenna with a speed that has been definitely established at about 300,000,000 meters a second. Now if a railroad train, or any other object, travels at a known speed past a given point in a known time, the length of that object can be determined by multiplying the speed of the train (let us say) by the time interval. This relationship, in reference to a wave "train," is shown in Figure 1. The time element in this case happens to be one-millionth of a second, and the wavelength is therefore 300,000,000 x 1/1,000,000 = 300 meters. If the time consumed by one cycle is one millionth of a second the frequency with which that cycle will repeat itself is one million times in one second, and we can speak of the frequency of 300 meters as one million cycles.

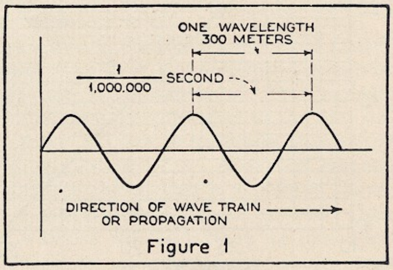


FIGURE 1 — A graphical conception of wavelength and frequency. This is the sort of a picture that an ultra sensitive recording instrument might make of a passing wave, showing that wavelength equals velocity divided by frequency — and vice versa

The relationship is more simply expressed in the equations:

$$F = \frac{V}{\lambda} \text{ and } \lambda = \frac{V}{F}$$

Where F is the frequency in cycles per second, V the velocity of propagation or 300,000,000 meters per second and λ the wavelength in meters.

Thus, if we know either the wavelength or frequency we can always compute the other quantity by means of one of the two equations.

Cycles, Kilocycles and Megacycles

For scientific purposes, it is often more desirable to work with frequencies rather than with their corresponding wavelengths, principally because, regardless of wavelength, a certain definite frequency band is considered necessary for the transmission of radio telephone signals utilizing the systems employed today. This band is 10,000 cycles wide. That is, if a broadcasting station is transmitting on 300 meters, or one million cycles, it will occupy a band extending 5000 cycles on each side of the carrier frequency of one million cycles — i.e., between 995,000 and 1,005,000 cycles. In order that no other station can overlap or interfere, the carrier of a second station must not be within 10,000 cycles of the carrier of the first station.

Due to the existence of this desirable frequency band, a broadcasting station operating on a fundamental of 300 meters will spread over a wave range of about three meters, and at 600 meters about twelve meters.

In other words, the amount of space required by a broadcasting station, in wavelength spread, varies with the wavelength, becoming greater as the wavelength increases. But the frequency band of ten thousand cycles remains constant. Hence, it is more convenient to compute many radio calculations in terms of frequency rather than those of wavelength.

Long wavelengths are low frequencies; short wavelengths are high frequencies. When frequencies become very high, it is less clumsy to group them into thousands of cycles — the kilocycle or kc. — and into millions of cycles — the megacycle or mc.

A wavelength of ten meters is equivalent to a frequency of 30,000,000 cycles, or 30,000 kilocycles or 30 megacycles.

Let us try to think in terms of frequency rather than wavelength. If at first you are somewhat confused, you may readily translate frequency into wavelength by means of computation, or the conversion chart shown in Figure 2.

Characteristics of Short Waves

One of the principal advantages of short-wave communication lies in the multiplicity of available radio channels as contrasted to the congested conditions existing above 200 meters.

The frequency corresponding to ten meters is, as we have shown, 30,000 kc. Between this frequency and that of 1500 kc., corresponding to 200 meters, there exists a 28,500 kc. band of usable frequencies. Dividing this by 10 (10,000 cycles, the recommended band for a broadcasting station) we find that 2850 broadcasting stations, within interfering power-distances, could be accommodated without interfering with each other on a well-designed receiver. Between 200 meters and 600 meters, there is room for only 1000 similar stations.

High frequencies are characterized by an un-

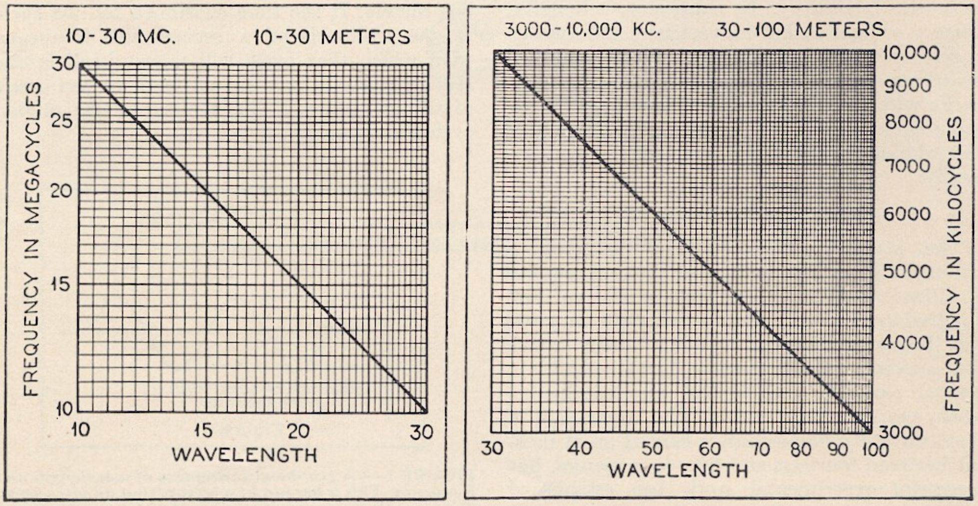


FIGURE 2 — Wavelength-frequency conversion charts. These may be used for higher wavelengths, or lower frequencies, merely by shifting the decimal point

canny carrying power, low powers on low wavelengths transmitting over distances that could be spanned on long wavelengths only by the expenditure of hundreds of times the same power.

Short-wave signals suffer from peculiar fading and absorption effects from which long-wave signals are relatively free. The most unusual of these is, perhaps, the so-called "skip-distance" effect. For instance, the direct wave from a fifty-watt transmitter operating on 7500 kc may be so attenuated at a receiving station five hundred miles away, by absorption or deflection due to terrestrial conditions, that the signal is entirely lost. However, another portion of the signal, traveling more directly upwards, collides with the somewhat problematical Kennelly-Heaviside layer — a stratum of ionized gases high above the earth's atmosphere — and is reflected to the earth thousands of miles away from the transmitter. Thus a receiver in Australia might hear a transmitter in New York City, the signal from which is inaudible in New Orleans or Panama.

The tricks played by high frequencies vary with atmospheric conditions, the time of day and the frequency employed. But it is almost always possible, by making a shift in frequency, to pick out a short wavelength satisfactory for the communication desired. For instance, for consistent trans-oceanic telephone communication, three frequencies, approximating 20, 15 and 10 megacycles, are always available. During the day, the 20-megacycle frequency is generally used, shifting to 15 mc in the evening and to 10 at night.

The greatest distances will be received on the three principal bands in accordance with the table given below:

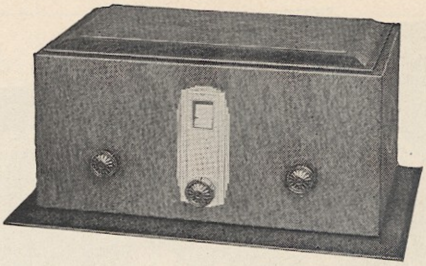
22 to 14 m.c.	daytime.
14 to 10 m.c.	morning and evening twilight.
10 to 2 m.c.	night.

Short-Wave Telephone Stations

Only a small percentage of the available short-wave frequencies are given over to telephone transmission, but the actual number of such stations in regular operation exceeds the number of broadcasting stations in the United States. The average short-wave receiver will pick up several times as many telephone stations as the average broadcast receiver.

Short-wave telephone services may be divided into six classes — broadcast, television sound accompaniment, amateur, trans-oceanic, commercial, police radio and airplane. The broadcast stations are generally given over to the simultaneous transmission of long-wave programs and are operated in conjunction with a long-wave station. For instance, W2XAD is a short-wave channel of WGY, Schenectady, N. Y., U. S. A. The following are the international frequency allocations for short-wave broadcasting:

6000–6150 kc.	(50–48.9 meters).
9500–9600 kc.	(31.6–31.2 meters).
11,700–11,900 kc.	(25.6–25.2 meters).
15,100–15,350 kc.	(19.85–19.55 meters).
17,750–17,800 kc.	(16.9–16.85 meters).



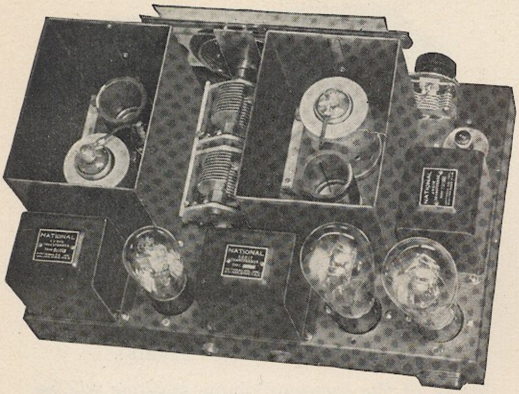
Many of the amateur phone stations will be found on the 3,500–4,000 kc and 14,000–14,400 kc bands with the preponderance of traffic being handled on the first mentioned channel. While it is stretching the point somewhat to say that amateur radio telephone conversations are entertaining, they are occasionally interesting.

Commercial transoceanic telephony is generally conducted on the three fixed service bands from 17,800–21,450 kc, 15,350–16,400 kc and 9,600–11,000 kc. These conversations are generally "inverted" — that is, intentionally garbled so that they sound to the casual listener like Chinese. However, by beating the signal (permitting the receiver to squeal) at the correct frequency, it is sometimes possible to render inverted speech intelligible. The conversation between the technical operators is often carried on without garbling. On the occasions when commercial traffic is transmitted clearly, listening-in is quite as edifying as eavesdropping on a party wire.

Practically all airplane telephone traffic is handled on the 4,000-5,500 kc band, including point-to-point flying field and mobile services. This is often fascinating, always interesting, and some very reliable weather reports may be picked up from local airmail terminals. Police alarm stations, broadcasting to cruising squad cars, are shown in the call lists on page 18.

Four sets of coils are generally required to cover the short wave spectrum in which we are interested — 22 to 13 m.c., 14 to 7 m.c., 8 to 4 m.c., and 5 to 2 m.c.

An easily acquired knack of tuning contributes an artistry to short wave reception which is lacking on the broadcast band. The variation in technique may be attributed to the fact that the short wave receiver is generally tuned with the circuit oscillating — i.e., with the regenerative control so adjusted that a whistle is heard each time a carrier frequency is crossed. (Most of these whistles will be broken up into the characteristic dots and dashes of the code transmitter.) The highest type of short wave receiver has four controls — the main tuning control, the regeneration or oscillation control, a volume control,



and the trimmer. These controls are much more closely interlocked than the comparable knobs on the broadcast receiver, and a variation of one of them may alter the wavelength to which the receiver is tuned. In tuning, the regenerative control should be maintained just beyond the oscillation point. When the circuit is oscillating a distinct hiss is audible in the 'phones or speaker, the background noise is considerably intensified and a whistle will be heard whenever a carrier frequency is encountered. At the correct tuning point — with the circuit just oscillating — the background noise and signal response will be at a maximum. In other words the receiver is at its most sensitive adjustment. To maintain this condition while tuning, it will usually be necessary to vary the regeneration control for every ten degrees or so on the tuning dial. When a telephone carrier is crossed, readily identified by the steady whistle and generally modulated by voice or music, reduce the regeneration (retuning slightly with each variation in the regenerative control) until the circuit is no longer oscillating and the carrier is clear. A faint "swish" will now locate the carrier (if unmodulated) as the tuning dial receives its final adjustment. In some instances of very weak signals, it is desirable to "zero beat" the carrier, rather than stop oscillations. As the carrier is approached with an oscillating receiver, the pitch of the whistle becomes lower, vanishing at zero beat — the exact resonance or tuning point — trailing off again into a squeal on the other side. Occasional stations are best received at zero beat with the circuit just oscillating. In achieving this adjustment a slight body capacity effect may make it necessary to tune slightly to one side of zero beat, the beat becoming zero when the hand is removed from the tuning control.

It will often be interesting to log the stations, and the author suggests ruling off a sheet of paper to accommodate the following observations:

Date, Time, Coil, Dial, Frequency, Call Letters, Language, Remarks.

The station may be logged in local time, but in corresponding with the station for verification of transmission, the hour should be given in G. M. T. — which is Eastern Standard Time plus five hours. Conversion can be readily made by means of the time chart on page 13.

Harmonics of long wave broadcasting stations may fool you at first. However, such spurious short wave signals can generally be identified by their position in reference to international allocations and the very mushy quality of speech. Local short wave stations can be recognized without waiting for the quarter hourly signature, by checking for simultaneous broadcasts on the long waves — though this is not altogether reliable in these days of chain broadcasts.

A foreign language does not necessarily place a station beyond the confines of the U. S. A. The babel from W9XAA has been responsible for many fantastic tales of dx fish. But a station failing to sign at quarter hour periods may be tentatively logged as a foreigner.

Peak Efficiency Short Wave Receivers

THE ACSW-58 and THE DCSW-34

IN THE ultimate interpretation of efficiency — results per dollar expended — the modern tuned radio-frequency circuit undoubtedly provides the highest order of short wave reception. The development of new vacuum tubes, notably the radio-frequency pentode, has contributed greatly to this efficiency, and an exceptionally high gain has been achieved, even below 20 meters, in the National receivers described in this booklet. These receivers, both a-c and d-c models — respectively the ACSW-58 and the DCSW-34 — represent an engineering achievement comparable, without apology, with a high grade short wave superheterodyne. Until something finer can be developed, these receivers are the ultimate stage in the evolution of a long line of short-wave sets, the more familiar of which — the "Thrill Boxes," the SW-3, SW-5 and the SW-45 — have been widely employed for amateur, experimental and commercial purposes.

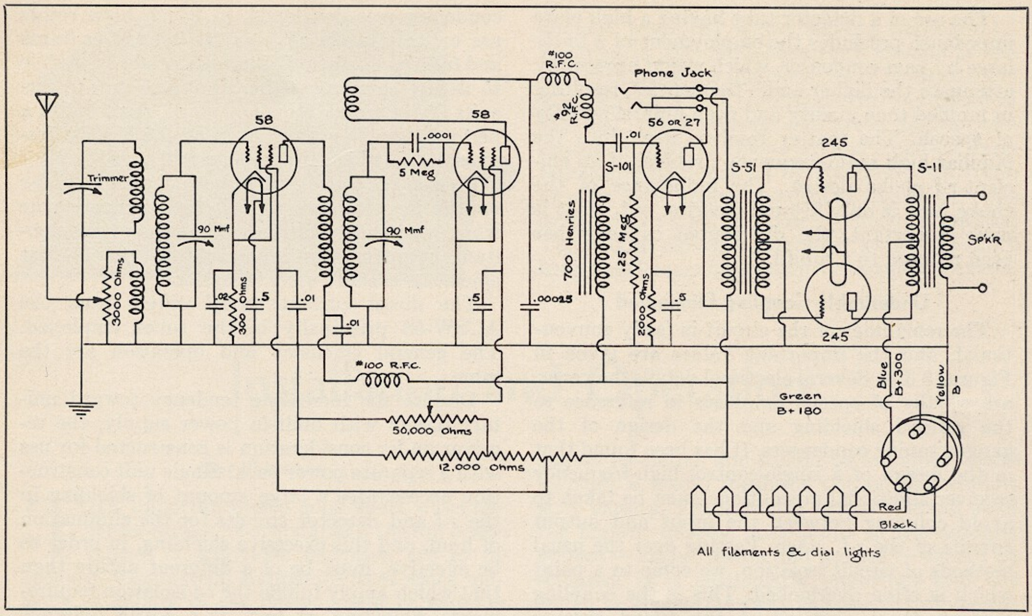


FIGURE 3 — Wiring diagram of the ACSW-58 and showing connections to power supply. It is important that the voltages are correct at the indicated current drains

The principal differences between the present receiver and its immediate predecessor, the SW-45, are best explained by reference to the wiring diagrams, Figures 3 & 4, respectively the ACSW-58 and the DCSW-34. These are the substitution of the type — 58 pentodes in the r.f. and detector circuits ('34s in the d-c model), the provision for radio-frequency gain control and the radio-frequency filter in the plate circuit of the detector.

The new tubes, as intimated, have contributed in no small way to the high efficiency of this circuit. The high amplification factor, transconductance and, above all, high plate impedance, enable the designer to achieve a degree of selectivity and sensitivity that have heretofore been little more than experimental ideals. The use of these tubes naturally necessitated the redesign of the plug-in radio-frequency inductors. The coils, T1 and T2, are wound on the low-loss R-39 material and are available in various sets, covering from 12 to 2000 meters, and band-spread coils can be obtained for special portions of the frequency spectrum.

Control of Volume

It has heretofore been considered that the simple regeneration control in the detector circuit provided adequate overall volume control. Such an arrangement, however, results in several forms of distortion. The radio-frequency tube is necessarily operating at maximum amplifications at all times, resulting in considerable overload of both that tube and the detector on strong signals. Backing up the regeneration control to reduce the signal strength results in additional distortion, due to the fact that the detector tube is then being operated with decreased plate or screen voltage. The obvious solution is to employ a second control operating at the input to the r.f. stage.

Under actual reception conditions, this additional control contributes several other advantages. The detector may always be operated on that portion of its characteristic at which best rectification is obtained, with a resulting improvement in tone quality and detecting efficiency. The receiver may also be operated in the condition of maximum selectivity by setting the regeneration control close to the point of oscillation and controlling volume altogether at the r.f. input. This latter feature is of particular utility in bringing in a foreign station having a frequency allocation close to that of a powerful local.

The radio-frequency filter in the detector plate circuit is the result of careful study of the problem. Few experimenters seem to realize the difficulties encountered when excessive r.f. is permitted to invade the audio-frequency circuits. The most noticeable characteristic of such a condition is the presence of hand-capacity effects on all parts of the a-f. system, including the headphones and loudspeaker leads as well as the metal cabinet. Another symptom is the exasperating fringe howl as the detector approaches oscillation. A sticky regeneration control — an apparently excessive amount of lost motion — is directly traceable in many cases to inadequate filtering in the detector output circuit.

The use of a detector tube having a high plate impedance precludes the employment of a fairly large by-pass condenser, which would necessarily attenuate the higher audio frequencies, resulting in muffled tone quality and even unintelligibility of speech. The matter resolves itself into the familiar high radio-frequency problem of an efficient r-f choke design. The inductance of the choke used is only 2½ millihenries, but, what is more important, the distributed capacity has been reduced to 1 mmfd.

Undesirable Coupling Eliminated

The remainder of the circuit is fairly conventional, and the important values are given in Figures 3 & 4. Several electrical details, however, are worthy of special emphasis in reference to the general shielding and the design of the ganged tuning condensers. It has been found that in the design of a single-control high-frequency receiver additional precautions must be taken to avoid coupling between the input and output circuits of the r-f. stage. Passing over the usual methods of circuit isolation, we come to a point which is often overlooked. This is the coupling through those portions of the tuned circuits which happen to be common in parts of the gang condenser frame. While the paths involved are very short, an inch or so represents an appreciable part of the total conductor length at frequencies above 15 megacycles, and is sufficient to cause instability and circuit interlocking.

To overcome this trouble, a special tuning condenser was developed, in which both rotors are entirely insulated from the condenser frame and from each other. This design makes it possible to isolate completely the input and output circuits of the radio-frequency stage, resulting in a perfectly stable system even at the highest frequencies to which the receiver will tune.

Plug-in coils are used in both the a-c and d-c models in preference to switching arrangements which necessarily introduce losses and concomitant complications inimicable to the highest efficiency in short wave reception.

The direct current model differs from the ACSW-58 principally in the tubes employed. The general efficiency and operation are the same.

Despite the increasing tendency toward unitary design with built-in power supply, the receiver under consideration is constructed for use with a separate power pack. Single unit construction necessitates a large amount of shielding in the r-f and detector circuits for the elimination of hum, and this excessive shielding, in order to be effective, must be of a different nature than that which amply fulfills the r-f isolation requirements. Shielding, at best, is a costly nuisance which tends to offset the increased efficiency attained through the use of low-loss insulation and careful design. These considerations strongly recommend the use of the separate unit with a high-frequency receiver, limiting the shielding to radio-frequency fields.

The mechanical details of the receiver are fairly

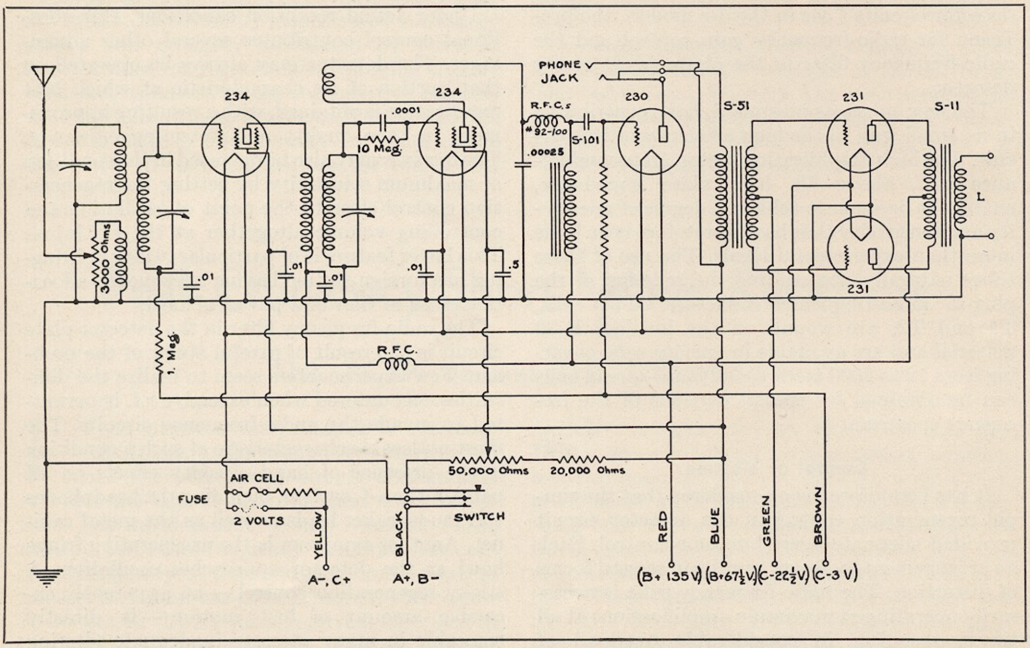
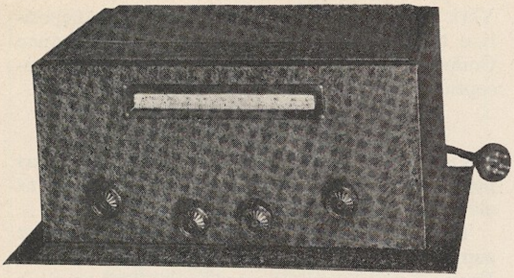


FIGURE 4 — The DCSW-34. Either batteries or an eliminator can be used for the "B" supply



obvious from the accompanying photographs. Rigidity in the radio-frequency circuits is obtained through the judicious use of Isolantite and R-39 supports and mountings. In the design of the dial, consideration was given to the concensus of opinion among several hundred amateurs and experimenters who favored a full vision or open scale arrangement. The dial has a scale seven inches long, insuring accuracy in reading. The pointer moves horizontally across the entire length in a linear relationship to the tuning control.

Installation and Operation

The Antenna

THE importance of a good short wave antenna cannot be overstated if the full possibilities of enjoyable reception are to be realized. Commercial companies have spent millions of dollars in the development of suitable short wave aerial systems, while the average short wave experimenter is content with a shoddy installation which experience has taught him works fairly well on his broadcast receiver.

Because an antenna is effective on the lower broadcast frequencies, it does not follow that it is a satisfactory short wave aerial. Induced currents, man-made static and leakage effects which would not be annoying on 300 meters, will seriously impair reception at 30 meters. The peculiar carrying power of the very high frequencies, which makes short wave reception possible on almost any kind of an antenna, is responsible for the slip-shod aerial systems, which, in turn, are largely responsible for noisy reception and a retarded acceptance of short wave reception on the part of the average radio fan.

Wherever choice is possible the short wave receiving station should be located away from power lines, electrically operated machinery of any kind and isolated, as far as practical, from roads carrying automobile traffic and monitored by traffic lights.

While the antenna should be carefully installed, it need not be in any way elaborate. A single horizontal wire, T or L type, twenty-five to fifty feet in length will provide ample pick-up. If possible, the antenna should be erected in the open, and as high as practical. It should be well insulated, at each end, and of fairly heavy wire — say number 14, insulated or bare. It should be erected as far away as circumstances will permit from possible sources of noise interference, and should not parallel power lines. It should preferably run at right angles to the nearest road. It should be clear of tree branches in the strongest wind.

The leadin should be well supported, thoroughly insulated, and should be brought indoors through a leadin insulator not of the window strip variety. The lightning arrestor should be of the highest quality. Any joints in the antenna system — aerial, leadin and ground — should be soldered. It is particularly important that the leadin be kept as far away as possible from power lines, elevator shafts and electrical machines of all descriptions.

Equal care and attention should be directed to the ground connection. Where several possible grounds are available, they should be tried individually and in groups for the least noisy connection. The ground leads should be soldered to the clamps and the clamps themselves soldered to the pipes.

Indoor antennas are very effective, but obviously it is seldom possible to erect them as far away from interference inducing sources as an outdoor antenna. The indoor antenna is really nothing more than "leadin" — and it is appreciated that the ordinary leadin will pick up noise. The main idea of the outdoor antenna is to obtain a noise free pick-up so that the signal to noise ratio will be improved. If an indoor antenna is erected, the same precautions as to rigidity, insulation and preferred location should be observed.

Under no circumstances use any form of "patented" aerial tacked to the walls, under rugs, or socket type antennas and expect satisfactory short wave results.

Transposed Leadins

As mentioned above, with a properly located outdoor antenna, most of the noise is picked up by the leadin. With a special leadin, it is possible to reduce the noise pick-up considerably, thereby taking full advantage of the antenna pick-up. Such an arrangement is shown in Figure 5. It will be observed that the aerial itself has been broken in the middle, and two leadins brought down, which are "transposed," or crossed, every fifteen inches by special blocks. These blocks which are from 2 to 2½ inches square, can be made from bakelite, or better yet, Victron, by notching, as shown in Figure 6.

The two leadins are connected to the antenna and ground posts of your receiver. No ground is used. If the receiver is unstable or hums without the ground, the ground may be connected providing the lead from the antenna primary, which connects to ground, is broken and connected directly to one of the leadins. An alternative circuit is shown in Figure 7, whereby a special coupler is employed between the transposed leadins and the receiver. This coupler can be wound with ten turns of number 18 enameled wire on National R-39 standard coil forms. The two windings are close wound, and spaced ½ inch from each other. Condensers C1 and C2 are 30 to 60 mmf. midgets. Further details on transposed leadins can be obtained from the Lynch Manufacturing Company, 1775 Broadway, New York City, who are manufacturers of transposition blocks, Antennae Insulators and Antennae Couplers especially designed for short wave reception.

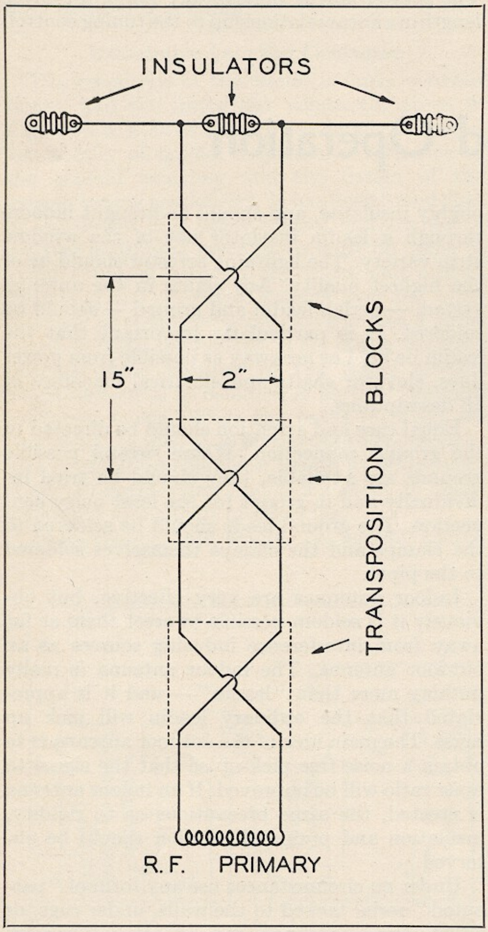


FIGURE 5 — The transposed leadin system used for noise reduction

Installation

The receiver itself should be located as far as possible from any interference source — such as elevators, electric fans, etc.

The ACSW-58 must be operated with a power supply furnishing the exact potentials shown in Figure 3 under the indicated loads. This receiver is designed to operate in conjunction with the National 5880 ABS power unit, to which all connections are made by means of the single plug on the end of the receiver power cable. If an adequate power supply other than the National 5880 ABS is available, the plug should be removed from the cable, and the connections made in accordance with the following color code:

WIRE COLOR	CONNECT TO —
Red or Black	2½ volts A.C.*
Yellow	B—
Green	B+180
Blue	B+300

It is strongly recommended that the National power unit be employed, due to ease of connection, reliability of operation and the elimination of any adjustment or experimentation.

The d-c Model

The DCSW-34 should be connected to the various voltage sources indicated in the diagram, Figure 4, and on the leads of the connection cable. The most convenient "A" battery is the Everready Air Cell, which will provide one year of average operation. If another source of filament potential is used such as a storage battery or dry cells, a rheostat should be provided to maintain two volts at the set terminals.

The "C" potentials are preferably obtained from the usual batteries. Either "B" batteries or an eliminator may be employed as the high potential source. The National Velvet-B Type 3580 is recommended as a reliable and economical power unit for use in conjunction with the DCSW-34.

All connections should be thoroughly tightened. Pliers are preferable to fingers in making a permanent installation.

Antenna, ground and loudspeaker or output binding-posts are plainly marked. Telephone receivers are plugged into the jack, behind the set, by means of the conventional plug. When telephone receivers are used, the power amplifying stage and loudspeaker are automatically disconnected.

*The 2½-volt circuit center tap must not be grounded directly, but is connected to B— (ground) through a 750-ohm, 10-watt resistor, for biasing the 245 tubes.

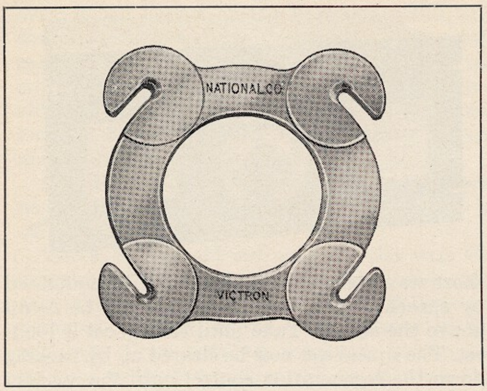


FIGURE 6 — The new National Victron featherweight transposition block

Tubes

Satisfactory short wave reception is impossible without perfect tubes. Tubes that will "play" on a broadcast receiver may be altogether unsatisfactory on the higher frequencies. Poor tubes may result in noisy reception, erratic volume and regeneration control, fringe howl and exceedingly bad microphonic conditions. By microphonics, we refer to the ringing sound occasioned by tapping the table or cabinet. A distant footstep may give rise to this trouble if other than perfect tubes are used.

Spare tubes — a duplicate of each tube in the receiver — should be maintained at hand. Do not experiment with "bootleg" tubes. Only the products of the most reputable manufacturers are recommended for use in all National "Thrill Boxes."

The a-c model, type ACSW-58, requires two type 58 variable mu pentodes in the radio frequency and detector stages, a type 56 or 27 in the first audio socket and two type 45 tubes in the push-pull power stage. The d-c model, DCSW-34, employs two type 34 variable mu screen grid tubes in the r-f and detector sockets, a type 30 first audio and two type 31 output tubes. The tubes required are plainly engraved on the sockets.

Coils

Five sets of coils are furnished with each SW-58 and SW-34, two coils to a set, and covering wavelengths from 13.5 to 200 meters. One coil of each set is plugged into the r-f circuit (left hand coil socket) and one coil into the detector coil socket. The two coils of each set are identical, and the wave bands they cover are indicated on the chart on the cover of the receiver and in the catalog coil list on page 19 of this booklet. The coils for the a-c receiver are designated by numbers only, beginning with the number 60 and increasing with wavelength. The d-c coils may be identified by number — from 10 to 21 increasing with wavelength — and by the color strip molded into the top ring. The wavelength of the coils increases with the number of turns of wire.

Coils can be had extending the wavelengths of the receivers as high as 2000 meters (see catalog page 19), and the coils forms are available for the home winding of special inductors.

Amateur bandspread coils may be obtained which spread the amateur bands over 50 dial divisions. No changes in the receiver are necessary, and these coils are recommended to the experimenter interested in amateur reception. The windings of the bandspread coils can, of course, be changed to provide similar spreading over any narrow portion of the short wave spectrum.

Choose a set of coils covering the wavelength to which you wish to listen — *making sure that the two coils used are from the same set.* The process of choosing the correct coils for any station is very simple and becomes automatic after a few hours of experimental short wave reception. First translate your local time into Eastern Standard Time, by means of the time chart on page 13. Then refer to the call list on page 15 and select a station broadcasting at that time. For a start a station fairly close by is preferable. Note the wavelength and choose the coils covering that band as indicated on the same line with the station call letters. The correct coils are also indicated on the tuning curve on the inside cover of your receiver and in the coil list on catalog page 19. Where due to overlapping, the wave desired can be tuned on two sets of coils, choose the higher wave-length coil.

If desired the 40 to 70 meter band coils may be chosen — No. 63 for the ACSW-58 and No. 13 (white band) for the DCSW-34 — and the receiver tuned at random (but very carefully and slowly) with the certainty of running across several good stations.

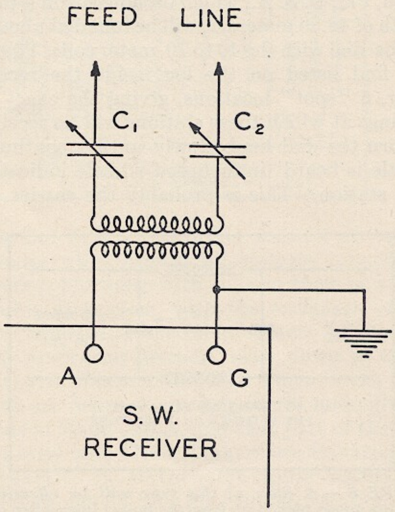


FIGURE 7 — Where a ground connection to the receiver proper is essential, transposed leadins can be employed with this simple coupler

Tuning

The functions of the various controls have been indicated in the general discussion of the SW-58 and 34. From left to right they are the antenna trimmer, r-f volume control, tuning control and regeneration. The trimmer provides the most efficient lining-up between the antenna circuit and radio-frequency stage. It is not critical, requires little adjustment, and once set for the coils used, need be touched only for very weak stations. The r-f volume control increases clockwise and functions exactly as does the volume control on the conventional broadcast receiver. The tuning control is the familiar station selector. The regeneration control increases clockwise and also operates as a volume control, while performing additional function of throwing the circuit into oscillation which simplifies the location of stations and makes possible the reception of continuous wave code transmitters. (The circuit should go in and out of oscillation smoothly — without howling. If not, check as indicated under "Trouble.")

For a start, it will be best to turn the r-f volume control up full, and adjust the trimmer, by visual inspection, until the condenser is half in. Turn up the regeneration control until a distinct background hiss is heard. The set will now be oscillating. In this condition it is extremely sensitive, and as the dial is turned rapidly, a series of whistles and squeals should be heard as many stations, code, telephone television, etc. are passed. Adjust the trimmer for the loudest hiss.

By reference to the curve chart on the cover of the receiver, locate the approximate position on the dial where the station in which you are interested (unless tuning at random) is located. For instance, if you wish to listen to W8XK, Pittsburgh, Pa., U. S. A., which broadcasts on a wavelength of 48.86 meters, it will be found at about 60 on the dial with the 40 to 70 meter coils. You will also find listed on the log inside the receiver cover, 5 "spot" locations, giving the exact dial readings at which these stations will be received.

Turn the dial knob slowly until a continuous whistle is heard (interrupted whistle indicates a code station). This is probably the carrier of a

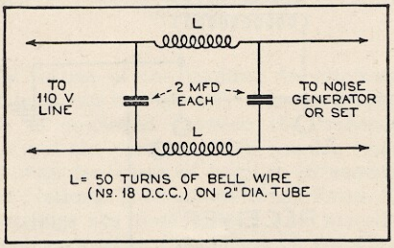
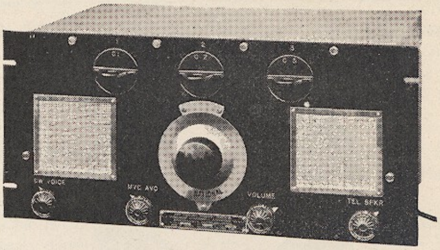


FIGURE 8 — A filter of this type will be effective in reducing noises picked up from the power lines when other than a genuine National Power Unit is employed. All the National Short Wave Receiver Power Units are efficiently filtered



short wave telephone station, and if modulated by speech or voice, these sounds will be heard above the squeal. Tune until the squeal is loudest. The squeal can now be cleared up by backing down the regeneration control until the receiver stops oscillating. A slight readjustment of the tuning dial may be necessary as the regeneration control is moved. Adjust volume to suit, either by means of the r-f volume control or the regeneration control (below the point of oscillation). As a general rule it is desirable to operate with the regeneration control about ¼ turn below oscillation (after the station is located) and the r-f control set for the desired volume. (For extreme selectivity, the regeneration control should be set just below the oscillating point.)

The receiver is most sensitive in an oscillating state when the regeneration control is just above the oscillating point. When tuning with this adjustment, the circuit may stop oscillating, necessitating the turning up, slightly, of the regeneration control.

As already indicated, the trimmer adjustment need only be set for each set of coils, except for the reception of very weak stations, which may necessitate careful adjustment, all around, for best reception. On such stations, slight readjustment of the tuning dial may be necessary, following the movement of any of the other controls.

Code and television stations are good for practice tuning, and are located with the receiver oscillating as described. Code stations transmit either an irregular stream of dots and dashes, or a constant sequence of dots (for test purposes). Many code stations are modulated by a high pitched tone, and can be received when the regeneration control is turned below the oscillating point.

The carrier of a television station is constant, but is modulated by a variety of rising and falling tones. These tones alone are also received with the regeneration control turned down below the oscillation point. With the usual loudspeaker, the television signals are, of course, audible only. For picture reception, further amplification and a light reproducing system are required.

Trouble Shooting

Carefully assembled and wired the ACSW-58 and the DCSW-34 should be as free from trouble as a reliable long wave broadcast receiver. However, it can happen in the best of families, and the major causes of faulty operation, with their symptoms, are described below. In general, the troubles will be the same as those which occasionally afflict the longer wave receivers, and their location follows the same procedure — voltage and continuity tests, etc.

No Signal: Burned out detector or a-f tubes, no plate or heater voltages. Same possibilities as exist on longer waves.

Weak Signal: Mixed coils. In this case the adjustment of the r-f volume control and trimmer will have practically no effect. If coils are matched properly, check for continuity in the windings. Open coupling condenser in the impedance coupled amplifier will cause weak signals, accompanied with pronounced loss of low frequencies in 'phone reception. Check antenna, grid cap connections, etc.

Faulty Regeneration: Sticky controls, howling, etc. May be caused by a poor detector tube, incorrect value of grid leak and short circuited radio frequency choke coil.

Poor Quality: Check on several stations before being satisfied that the trouble is in the set. Garbled or inverted speech is deliberate with most commercial point-to-point short wave stations. Also, poor reception conditions, accompanied with fading, is a frequent cause of poor quality on certain stations. Make the usual check on voltages and tubes. Muffled tone may be due to over regeneration, while scratchy, hashed speech on strong signals points the finger of suspicion to the grid leak in the impedance coupled amplifier.

Noise: Discrimination between receiver noise and pick-up noise is more important on short waves, and is effected by the usual tests. If noise is consistent, and checks show that the receiver is not at fault, a filter system in the line, such as shown in Figure 8 should be employed, and, as a last resort, an anti noise antenna as described on page 10. In the d-c model, the "B" batteries (when used instead of an eliminator) can be suspected if they have been in operation for several months. The usual sources of noise give rise to similar disturbances in short wave receivers with an amplified degree of annoyance.

Radio Time the World Over

TIME AND DAY CONVERSION TABLE

Longitude		Place						TODAY													TOMORROW					
EAST	180	Fiji Islands	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11
	165	New Zealand (*)	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10
	150	Australia, east	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9
	135	Japan	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8
	120	China, Philippines	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7
	105	Indo China, Straits Settlements	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6
	90	Calcutta (**)	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5
	75		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4
	60	Mauritus, Seychelles	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3
	45	Aden, Somaliland, Madagascar	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2
	30	South Africa	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1
	15	Germany, Italy, Norway, Sweden	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0
	0	England, France, G.M.T.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	15		23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	30		22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	45	Brazil, east	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	60	Agentina, Porto Rico	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	75	Washington, D. C., E.S.T.	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	90	Chicago, C.S.T	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	105	Denver, M.S.T.	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	120	San Francisco, P.S.T.	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	135		15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	150	Alaska	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	165	Samoa, Hawaii (***)	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12
WEST	180		12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11
								YESTERDAY													TODAY					

NOTES:—(*) Add one-half hour for New Zealand Time.
(**) Calcutta local time. Subtract one-half hour for India Standard Time.
(***) Subtract one-half hour for Hawaiian Standard Time.

NOTES:—0 is midnight, 1 is 1.00 A.M., etc. 12 is noon, 13 is 1.00 P.M., 15 is 3.00 P.M., etc.
Read the figure columns vertically, thus:—when it is 12, noon on Monday in New York E.S.T., it is 3.00 A.M. on Tuesday in Melbourne, Australia.
Or again; 11.00 P.M. on Sunday in San Francisco is 6.30 P.M. on Monday in New Zealand and 5.00 P.M. in Australia.
The hours of darkness—6 P.M. to 6 A.M. are shaded

By the intelligent use of the above time chart much futile listening on the short wavelengths can be avoided. In the latest revised call list shown on page 15 transmission times are Eastern Standard. Eastern Standard Time (or any other time for that matter) can be translated into your local time by reference to the time chart, and stations listened to at the hours they are scheduled to be on the air.

Difference in time is a thing which is difficult for short wave fans to understand. Listening to "Big Ben" strike midnight at 7:00 P.M. in New York should clarify the point, but still listeners who fail to hear European stations at 8:00 P.M. wonder why. Almost all stations broadcast at hours conforming with time in their part of the world. Europeans, with the exception of PCJ, who broadcasts special programs for American and Australian listeners, close down as early as 6:00 P.M. Eastern Standard Time. South Americans are heard from then on till midnight. Stations in Siam, Japan, and that part of the world, get busy while New Yorkers are thinking about breakfast. It is therefore quite natural that listeners should tune for European stations in the afternoons providing they live in the United States and tune for stations in the Antipodes, in the early mornings. Always keep a good station list on hand.

As already explained, tuning a short wave set is somewhat different from tuning a regular broadcast receiver. All in all, it is simply a matter of the operator learning how to tune his set. A good receiver does not solve the question of results on short waves, for the operator must become familiar with the short waves and their peculiarities. To bring about this familiarity is the purpose of this booklet. Once this is mastered, it is just as simple to get distant stations under ordinary circumstances as to get local stations.

The first thing a new listener should do is to log as many local stations as possible as already suggested. There is room for fourteen stations on the log provided on the inside cover of each SW-58-34. Since stations do not appear on every part of the dials, these stations will act as guides to locating distant stations. The operator should also find just what each dial on his set does when tuned, and what effect they have on the stations once they are tuned in. Locating the spot where stations are heard the best is a good idea.

It is desirable to reiterate that the listener should time his reception, or tune on certain wavelengths at certain times of the day. From 14 to 20 meters all tuning should be done from daybreak till 3 P.M. local time. From 20 to 33 meters, stations to the east of the listener will be heard best from about 11 A.M. till 10 P.M. Stations to the west of the listener in this band should be heard best from midnight till about two hours after daybreak, when they will fade out. From 33 to 70 meters, distant stations can be heard only after darkness falls. Very little in the way of distance can be heard above 70 meters, although the ships, police, fire, coast guard and aircraft stations are all heard above that wavelength.

Short wave stations have a habit of changing in volume from time to time, these changes being affected mostly by the amount of daylight between the stations and the listener. For example, European stations are always best for American listeners during the summer months. In reverse, South Americans are best during the winter months. Each year we hear from hundreds of listeners arguing that winter months are best for distant reception and others that summer is best. It depends mostly on the habits of the listener and his location. By habits we mean, the stations he generally tunes for. There is not the least doubt that European stations such as G5SW, I2RO, PCJ, Zeesen and OXY are best during the summer months.

A few pointers for new listeners are:

Don't expect to find stations on all parts of the dials. Short wave stations are widely separated except in a very few places.

Don't expect stations to tune broadly. Most distant stations tune very sharply.

Don't expect to hear the world the first day you tune. It requires some knowledge of tuning to get excellent results.

Don't expect to hear a station simply because it is on the air. Many things govern short wave reception.

Don't get discouraged. If reception is poor one day, it may be fine the next.

Don't skim over the dials. Tune slowly.

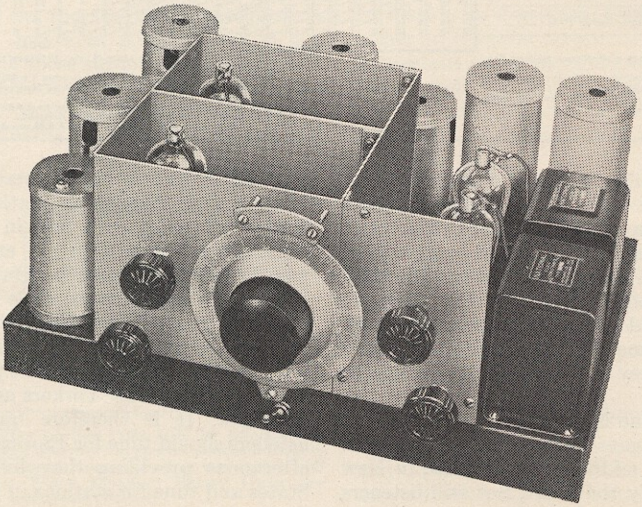
Don't pass up any weak signals. Ofttimes a weak program can be brought out plainly by careful tuning.

Don't tune for stations when they are not on the air. Use the station list.

Don't get into the habit of tuning haphazardly. Learn where stations should be found on the dials of your particular receiver.

Don't tune above 33 meters for distant stations in daylight.

Don't tune below 25 meters for distant stations after dark.



Revised Call List

Of International Short Wave Broadcasting Stations

(We are indebted to the International Short Wave Club, with headquarters at Klondyke, Ohio, U.S.A., for permission to publish this list which includes stations authentically reported active.)

It is recommended that the magazine published by this Club be secured monthly as it contains an up-to-date call list, and so many changes are being made in short wave broadcasting stations from day to day that any list becomes obsolete after a few weeks.

SHORT WAVE BROADCAST STATIONS

All times are given in Eastern Standard Time, add five hours for G.M.T.

(Note — The following group of stations broadcast musical programs. Commercial stations are listed separately).

Wave Length	Call Letter	Location
14.47 —	LSY	Buenos Aires, Argentina. Near 4 P.M. Sundays.
15.93 —	PLE	Bandoeng, Java. Tuesdays 8:40–10:40 A.M.
16.87 —	W3XAL	Boundbrook, N. J. Week days. 7 A.M. to 3 P.M.
19.57 —	W2XAD	Schenectady, N. Y. 3 to 6 P.M. daily. Sat. & Sun. 1 to 6 P.M.
19.68 —		Pontoise, France. 7 A.M. to 10 A.M. daily.
19.73 —	DJB	Zeesen, Germany. 8 A.M. to 12 noon daily.
19.84 —	HVJ	Vatican City. Broadcasts daily 5 A.M. to 5:15 A.M.
19.90 —	TI4-NRH	Heredia, Costa Rica. Saturday 11 A.M. to noon, 4–5 P.M. and 10–11 P.M. Sun. and Mon., 11 A.M. to noon and 4–5 P.M.
20.60 —	HBJ	Geneva, Switzerland. Testing.
20.95 —	G2NM	Sonning-on-Thames, England. Sundays.
23.38 —		Rabat, Morocco. Broadcasts Sunday, 7:30 to 9 A.M.
25.20 —		Pontoise, France. 10:30 A.M. to 1:30 P.M. daily.
25.25 —	W8XK	Pittsburgh, Pa. 3 P.M. to 9 P.M. Daily.
25.34 —	W9XAA	Chicago, Ill. Relays WCFL, irregularly.
25.40 —	I2RO	Rome, Italy. Broadcasts 11 A.M. to 12:30 and 3 to 5:30 P.M.
25.42 —	W1XAL	Boston, Mass. Testing, irregularly.
25.53 —	G5SW	Chelmsford, England. Monday to Friday, 6:45 A.M. to 7:30 A.M. and 12:30 to 6:10 P.M. Sat. 7–8 A.M. and 12:30 to 6:10 P.M.
25.60 —		Pontoise, France. 3 P.M. till 6 P.M. Daily.
25.60 —	VE9JR	Winnipeg, Canada. Daily exc. Sat. and Sun., 11:45 A.M. to 1:30 P.M.
26.83 —	CT3AQ	Funchal, Madeira. Tues.–Thurs., 5 to 6:30 P.M.; Sun. 10:30 A.M. to noon.
28.98 —	LSX	Buenos Aires, Argentina. Daily, 8 to 9 P.M.
29.26 —	DIQ	Zeesen Germany. Used irregular.
30.40 —	EAQ	Madrid, Spain. 6:30 to 8 P.M. daily. Sat. 1 to 3 P.M.
31.00 —	TI4NRH	Heredia, Costa Rica. Daily exc. Sunday 9 to 10 P.M.
31.25 —	CT1AA	Lisbon, Portugal. Heard Tues., Thurs., Fri., 4 to 7 P.M.
31.28 —	VK2ME	Sydney, Australia. Saturday midnight to Sunday 2 A.M., 4:30 to 8:30 A.M. and 1:30 to 3:30 P.M.
31.30 —	HBL	Praquins, Switzerland. Testing near 4 P.M.
31.36 —	W1XAZ	Springfield, Mass. 3:30 P.M. to 11:30 P.M. Daily.
31.38 —	DJA	Zeesen, Germany. 2 P.M. to 6:30 P.M. daily.
31.40 —	VK3ME	Melbourne, Australia. Wed. 5 till 6:30 A.M., Sat. 5–7 A.M.
31.48 —	W2XAF	Schenectady, N. Y. Relays WGY daily 5 P.M. to 11 P.M.
31.51 —	OXY	Skamleback, Denmark. Broadcasts 2 to 6:30 P.M.
31.58 —	PRBA	Rio de Janeiro, Brazil. Heard between 6 P.M. and 8:30 P.M.
32.26 —		Rabat, Morocco, broadcasts, Sundays, 3 to 5 P.M.
33.50 —	TGX	Guatemala City, Guatemala. Saturdays 10 P.M. till midnight.
34.68 —	VE9BY	London, Canada. Mondays 3 to 4 P.M. and irregular times.
38.60 —	HBP	Geneva, Switzerland. Testing.
39.40 —	HJ3ABF	Bogota, Colombia. 7 P.M. to 11 P.M.
40.50 —	HJ3ABD	Bogota, Colombia. Tues., Thur., Sat., 8 to 11 P.M.
41.00 —	CM5RY	Matanzas, Cuba. Saturdays 10:45 to 11:30 P.M.
41.60 —	EAR58	Teneriffe, Sat. and Sun., 4:30 P.M. to 6:00 P.M.
42.00 —	HJ4AAB	Manizales, Colombia. Thur. and Sat. 7–9 P.M. and 11–12 P.M.
42.20 —	HKN	Medellin, Colombia. 8 P.M. till 10 P.M. 8:30–10:30 P.M. Earlier Sun.
45.31 —	PRADO	Riobamba, Ecuador. Thursdays, 9 P.M. till 11 P.M.
46.60 —	REN	Moscow, U. S. S. R. Relays Moscow, 1 P.M. to 6 P.M.
46.67 —	VE9BY	London, Canada. Wednesday 8:30–9:30 P.M., Friday 7:00–7:55 A.M. and Saturday 8–11 P.M.
46.96 —	W3XL	Boundbrook, N. J. No regular schedule.
47.00 —	HKS	Cali, Colombia. Irregular, near 10 P.M.
47.00 —	HCIDR	Quito, Ecuador. 8 P.M. till 10 P.M.
47.50 —	TITR	San Jose, Costa Rica. 10 to 12 A.M., 4 to 9:30 P.M.
48.00 —	HKA	Barranquilla, Col. 8 P.M. to 10 P.M. Daily.
48.85 —	VE9CL	Winnipeg, Canada. Daily except Sun., 6 P.M. till 8:30 P.M.
48.86 —	W8XK	Pittsburgh, Pa. 4 P.M. to 11 P.M., daily. Late Saturdays.
48.95 —	YV11BMO	Maracaibo Venezuela Broadcasts, 8 to 11 P.M.
49.18 —	W9XF	Chicago, Ill. 3:30 P.M. to 1 A.M. daily.
49.18 —	W3XAL	Boundbrook, N. J. Saturday 4 P.M. to midnight.
49.20 —	JB	Johannesburg, South Africa.
49.22 —	VE9GW	Bowmanville, Can. Week days, 3–9 P.M., Sun. 11 A.M.–7 P.M.
49.29 —	VE9BJ	St. John, N. B. Near 5 P.M. and 11 P.M.
49.34 —	W9XAA	Chicago, Ill. Relays WCFL, Sun. 11 A.M.–9 P.M.; Wed., Sat., 8:30.

	A.M. to 9 P.M.; Tues. and Thurs., 8:30 A.M. to 8 P.M.
49.42 — VE9CS	Vancouver, B. C. Sun. 3:30 P.M. to Midnight. Fri. at 0 to 1:30 A.M.
49.50 — W8XAL	Cincinnati, Ohio. 5 A.M.–9:30 A.M., 12:30–2:30 P.M. and 6 P.M. to 12:30 midnight.
49.50 — VQ7LO	Nairobi, Kenya, Africa. Daily 11 A.M.–3:30 P.M. Tues. 3 A.M.–4 A.M. Thursday 8 A.M. to 9 A.M.
49.50 — CMCI	Havana Cuba. 9 P.M.–11 P.M.
49.51 — ZL2ZX	Wellington, N. Z. Mon., Wed., Thur., Sat., 2:15 to 6:15 A.M.
49.59 — VE9HX	Halifax, N. S. Mon., Tues., 6–10 P.M. Other days 6–7 P.M.
49.96 — VE9DR	Drummondville, Can. Relays CFCF, 7 P.M. to 12 Midnight.
50.00 — RW59	Moscow, U.S.S.R. 9 A.M.–11 A.M., 2 P.M.–5 P.M. Daily.
50.00 — HKD	Barranquilla, Col. Daily 8–10 P.M.
50.26 — HVJ	Vatican City. Broadcasts daily, 2–2:15 P.M., Sun. 5–5:30 A.M.
50.60 — HKO	Medellin, Colombia. Mon., Wed., Fri. 8 to 10 P.M., Tues., Thurs. Sat. and Sun., 6 to 8 P.M.
51.00 — HKB	Tunja, Colombia. Irregular near 10 P.M.
51.72 — VK3LR	Victoria, Australia. Heard 2 A.M. to 6:30 A.M.
52.70 — FIUI	Tananarive, Madagascar. Sat., Sun. 1–3 P.M. Other days 9:15–11:15 A.M.
58.00 — PMY	Bandoeng, Java. 12:40 to 2:40 A.M. and 6:40 to 9:40 A.M.
62.50 — W2XV	Long Island City, N. Y. Wed. and Fri. 8 till 10 P.M.
62.56 — VE9BY	London, Canada. Saturday midnight on.
70.1 — RV15	Khabarovsk, U.S.S.R., 3 A.M.–9 A.M.
109.60 — VE9CI	London, Ontario. Daily 9 to 11 P.M. Sun. 11 A.M.–7 P.M.

COMMERCIAL STATIONS

(Note — These stations are used for relaying telephone messages between countries, ships at sea and shore stations, and aircraft and airport stations. These stations ofttimes may be on the air for hours without anything taking place on them, with the exception of the aircraft stations which come on the air and back off again in an instant, or as soon as a message is delivered. They are also sometimes rented to relay radio programs.)

14.01 — WKK	Lawrenceville, N. J. Phones 8 A.M. till 4 P.M. LSN.
14.19 — LSM	Buenos Aires, Arg. Phones Europe, mornings.
14.24 — WKA	Lawrenceville, N. J. Phones England 8 A.M. till 4 P.M.
14.27 — LSN	Buenos Aires, Arg. Phones WLO, 8 A.M.–4 P.M.
14.47 — LSY	Buenos Aires, Arg. Phones 10 A.M. to 2 P.M., irregular.
14.55 — PMB	Bandoeng, Java. 3:10 A.M.–4:40 A.M. and 8–9:20 A.M., PCK.
14.70 — GBA	Rugby, England. Phones to ships and LSN, irregular.
14.97 — DHO	Nauen, Germany. Phone to LSG., 7 A.M.–11 A.M., Irreg.
14.97 — OPL	Leopoldsville, Belgian Congo. Phones ORG mornings.
15.07 — LSG	Buenos Aires, Arg., phone to FTM 10:30 A.M.–3:30 P.M.
15.13 — WKN	Lawrenceville, N. J. Phones England 8 A.M. till 4 P.M.
15.23 — EAQ	Madrid, Spain. Phones to LSY 7–11 A.M., Irreg.
15.24 — CEC	Santiago, Chile. Phones LSR HJY near 11 A.M. and 4 P.M.
15.50 — FTM	St. Assise, France, 10 A.M.–2 P.M. LSG.
15.57 — PPU	Rio de Janeiro, Brazil. Phone to FTM, 10:30 A.M.–3 P.M.
15.58 — DFA	Nauen, Germany. Phone to XDA, Irreg., 10 A.M.–2 P.M.
15.61 — WKF	Lawrenceville, N. J. Phones England 8 A.M. till 4 P.M.
15.62 — ORG	Brussels, Belgium. Testing phone, 11 A.M.–11:30 A.M.
15.77 — WKW-W2XBJ	Rocky Point, N. Y. Testing, mornings.
15.82 — LSR	Buenos Aires, Arg. Phones HJY, CEC, 11 A.M. and 4 P.M.
15.90 — ZSB	Cape Town, South Africa. 3 A.M. to 8 A.M. GAA.
15.93 — PLE	Bandoeng, Java, Tues., Fri., 5:40–10:40 A.M. PCK.
16.06 — OCI	Lima, Peru. Testing with HJY near 2 P.M.
16.11 — GBU	Rugby, England, 6 A.M.–2 P.M. WMI.
16.25 — HJY	Bogota, Col. Phones CEC, LSR, 11 A.M. and 4 P.M.
16.35 — WLA	Lawrenceville, N. J. Phones England 8 A.M. till 4 P.M.
16.35 — ZLW	Wellington, New Zealand. Phones VK2ME irregularly.
16.38 — GBS	Rugby, England, 6 A.M.–2 P.M. WND.
16.39 — YVQ	Maracay, Venezuela. Testing, near 10 A.M., irregular.
16.44 — FTE	St. Assise, France. Phones to FZR, 5 to 9 A.M.
16.50 — PMC	Bandoeng, Java. Phones PCV, 3:10–9:20 A.M.
16.54 — GBW	Rugby, England, 6 A.M.–2 P.M. WNC.
16.57 — GBK	Bodmin, England, 6 A.M.–2 P.M. CGA.
16.67 — KQJ	Bolinas, California. Testing.
16.82 — PCV	Kootwijk, Holland, 6 A.M.–9 A.M. Java.
17.05 — Ships	Majestic (GFWV), Olympic (GLSQ), Belgenland (GMJQ), Homeric (GDLJ), Leviathan (WSBN), Monarch of Bermuda (GTSD), Minnetonka (GKFY), Empress of Britain (GMBJ).
17.52 — WOO	Ocean Gate, N. J. Phones ships, irregularly.
18.06 — DAN	Norden, Germany. Testing with ships, 9 A.M.–12 noon.
18.44 — WLK	Lawrenceville, N. J. Phones England.
18:56 — GBX	Rugby, England, 4 P.M.–11 P.M. VK2ME.
18.71 — KKP	Kaunuku, Hawaii. Phones KWO, 2 P.M.–7 P.M.
18.90 — FTK	St. Assise, France. Phones to FZS, 9 to 10 A.M.
19.03 — J1AA	Kemikawa-Cho, Japan. Experimental. Heard early morn'gs.
19.46 — KWO	Dixon, California. Phones Hawaii 2:00 till 7:00 P.M.
19.54 — KWU	Dixon, California. Phones Hawaii 2:00 till 7:00 P.M.
20.27 — WKU-W2XBJ	Rocky Point, N. Y. Testing in daytime.
20.42 — PSS	Rio de Janeiro, Brazil. Testing with LSN, near 6 P.M.
20.56 — WMN	Lawrenceville, N. J. Phones England, daylight.
20.70 — LSN	Buenos Aires, Argentina. Phones WLO, afternoons.
20.73 — WMF	Lawrenceville, N. J. Phones England. daylight.
20.75 — GBW	Rugby, England. Phones WNC 6 A.M.–6 P.M.
20.97–21.26 —	Amateur phones heard in daylight.

21.63 — WIY-W2XBJ	Rocky Point, N. Y. Testing irregular.
21.70 — SUZ	Cairo, Egypt. Phones GAA 7 A.M. to 3:30 P.M.
21.77 — KKW	Bolinas, Calif. Used for experimenting.
21.90 — KKZ	Bolinas, Cal., testing irregularly.
22.06 — GBB-GBC	Rugby, England. Phones CGA and ships, afternoons.
22.26 — WAJ	Rocky Point, N. Y. R. C. A. test station.
22.40 — WMA	Lawrenceville, N. J. Phones England, daylight.
22.55 — CGA	Drummondville, Canada. Phones GBC 8 A.M. to 2 P.M.
22.68 — Ships	Majestic (GFWV), Olympic (GLSQ), Belgenland (GMJQ), Homeric (GDLJ), Leviathan (WSBN), Monarch of Bermuda (GTSD), Minnetonka (GKFY), Empress of Britain (GMBJ).
22.93 — J1AA	Kemikawa-Cho, Japan. Experimental tests, irregularly.
23.00 — German ships	11:15 A.M. and 1:30 P.M.
23.36 — WOO	Ocean Gate, N. J. Phones ships, irregularly.
23.38 — CNR	Rabat, Morocco. Phones St. Assise, 5 A.M. 8 A.M.
23.45 — IAC	Coltana, Italy. Tests irregularly.
24.00 — DAN	Norden, Germany. Phones ships, noon to 3 P.M.
24.40 — PLM	Bandoeng, Java. Phones VK2ME near 6:30 A.M.
24.40 — ZLW	Wellington, New Zealand. Phone VK2ME, 3 to 8 A.M.
24.41 — GBU	Rugby, England, 2 P.M.–7 P.M. WMI
24.46 — FTN	St. Assise, France. Testing with USA, daytime, irregularly.
24.60 — GBX	Rugby, England, 4 A.M.–9 A.M. VK2ME-VLK.
24.6 — GBS	Rugby, England, 2 P.M.–7 P.M. WND.
25.05 — KKQ	Bolinas, California. Testing irregularly.
25.50 — XDA	Mexico City. Testing with XAM near 1 and 6 P.M.
25.65 — KIO	Kauhuku, Hawaii, Phones to KES, 2 to 8 P.M. Irregular.
25.67 — YVQ	Maracay, Venezuela. Testing with Germany, 5–7 P.M.
25.75 — PPQ	Rio de Janeiro, Brazil. Testing near 6 P.M. irregularly.
26.80 — XAM	Merida, Yucatan. Test with XDA, near noon and 6 P.M.
27.35 — OCI	Lima, Peru. Phones HJY evenings.
27.68 — KWV	Dixon, California. Phones Hawaii, irregularly.
27.80 — GBP	Rugby, England. Phones VLK and J1AA, 9 P.M. and 6 A.M.
28.09 — WNB	Lawrenceville, N. J. Phones Bermuda, daytime.
28.09 — GBP	Rugby, England. Testing with JIAA and others.
28.12 — CEC	Santiago, Chile. Testing with HJY, evenings, irreg.
28.44 — WOK	Lawrenceville, N. J. Phones LSN, evenings.
28.5 — VK2ME	Sydney, Australia, 1 A.M.–7 A.M. GBX.
28.80 — KEZ	Bolinas, California. Testing.
28.80 — PKP	Medan, Sumatra. Phones Java and VLK, 3 A.M. to 8 A.M.
29.04 — ORK	Brussels, Belgium. Phones OPM 2–4, 9–11 A.M. and 3–6 P.M.
29.35 — PSH	Rio de Janeiro, Brazil. Testing withW2XBJ, evenings.
29.58 — OPM	Leopoldville, Belgian Congo. Phones ORK 9–11 A.M., 3–6 P.M.
29.80 — VRT-ZFB	Hamilton, Bermuda. Phones WNB in daytime.
29.83 — SUV	Cairo, Egypt. Phones GAA after 3:30 P.M.
30.10 — LSL	Buenos Aires, Arg. Works irregularly.
30.15 — GBU	Rugby, England, 5 P.M.–11 P.M. WMI.
30.20 — HJY	Bogota, Colombia. Phones OCI irregularly, evenings.
30.3 — LSN	Buenos Aires, Argentina. 6 P.M.–6 A.M. WLO.
30.40 — WON	Lawrenceville, N. J. Phones England, evenings.
30.60 — GCW	Rugby, England. Phones America, evenings.
30.75 — VK2ME-VLK	Sydney, Australia. Phones Java, 4 A.M.–8 A.M.
30.77 — WOF	Lawrenceville, N. J. Phones England, evenings.
31.60 — WEF-W2BJ	Rocky Point, N. Y. Testing irregularly, evenings.
31.63 — PLW	Bandoeng, Java. Phones Australia, 3 A.M.–8 A.M., irregular.
31.74 — WES-W2XBJ	Rocky Point, N. Y. Testing irregularly, evenings.
31.86 — PLV	Bandoeng, Java. Phones Australia and Sumatra, 4 A.M.–8 A.M.
32.1 — CGA	Drummondville, Can., 6 P.M.–6 A.M. GBK.
32.21 — GBC	Rugby, England. Phones to ships, irregularly.
32.4 — GBK	Bodmin, England, 6 P.M.–6 A.M. CGA.
32.72 — WNA	Lawrenceville, N. J. Phones England, evenings.
33.25 — GBS	Rugby, England, 6 P.M.–6 A.M. WND.
33.27 — KEJ	Bolinas, California. Testing irregularly.
33.52 — WEL-W2XBJ	Rocky Point, N. Y. Testing irregularly, evenings.
33.70 — ZLT	Wellington, New Zealand. Phones VLK 1 A.M.–9 A.M.
33.95 — Ships	Majestic (GFWV), Olympic (GLSQ), Belgenland (GMJQ), Homeric (GDLJ), Leviathan (WSBN), Monarch of Bermuda (GTSD), Minnetonka (GKFY), Empress of Britain (GMBJ).
35.02 — WOO	Ocean Gate, N. J. Phones ships, irregularly.
36.00 — DAN	Norden, Germany. Phones ships 2–4 A.M. and 3–9 A.M.
36.00 — German ships.	2:30 A.M., 4:45 P.M. and 9:30 P.M.
36.65 — PSK	Rio de Janeiro, Brazil. Heard phoning WOK.
37.76 — VK2ME	Sydney, Australia, tests, 3:00–7:00 A.M. GBX.
38.07 — J1AA	Kemikawa-Cho, Japan testing with KEL irregularly.
38.86 — KEE	Bolinas, California. Testing, irregularly.
39.42 — KWX	Dixon, California. Phones Hawaii, nights.
39.65 — KWY	Dixon, California. Phones Hawaii, nights.
39.89 — KDK-KKH	Kauhuku, Hawaii. Phones KWO 9 P.M.–2 A.M.
40.54 — WEM-W2XBJ	Rocky Point, N. Y. Testing irregularly, evenings.
42.9 — GBS	Rugby, England, 6 P.M.–6 A.M. WND.
43.54 — KEQ	Kauhuku, Hawaii. Phones California, nights.
44.41 — WOA	Lawrenceville, N. J. Phones VRT, nights.
44.41 — WOB	Lawrenceville, N. J. Phones England, nights.

44.54 — WEJ-W2XBJ Rocky Point, N. Y. Testing irregularly, evenings.
44.91 — DGK Nauen, Germany. Heard testing with WEJ near 9 P.M.
45.10 — IAC Coltano, Italy. Testing irregularly.
51.00 — XDA Mexico City, Mexico. Testing with XAM, 10 A.M.–8 P.M., irr.
51.09 — WNB Lawrenceville, N. J. Phones Bermuda nights.
52.00 — XAM Merida, Yucatan. Testing with XDA, 10 A.M.–8 P.M., irreg.
58.30 — PMY Bandoeng, Java. Phones Australia, near 11 A.M.
59.42 — VRT-ZFA Hamilton, Bermuda. Phones WNB and GMBJ, nights.
60.26 — GBC Rugby, England. Phones to ships, irregularly.
62.70 — CGA Drummondville, Canada. Phones ships irregularly.
63.13 — WOO Ocean Gate, N. J. Phones ships, irregularly.
71.82 — Ships Majestic (GFWV), Olympic (GLSQ), Belgenland (GMJQ), Homeric (GDLJ), Leviathan (WNBN), Monarch of Bermuda (GTSD), Minnetonka (GKFY), Empress of Britain (GMBJ).
75 — 75.8 — Amateurs on voice.
118.06 — WOX Bell Telephone test station. Irregularly.

AIRCRAFT STATIONS

(Note — This group of stations is used to relay messages to and from airplanes, such as location of a plane, storms coming and other things. They come on the air suddenly, deliver a message and go right off again. Airplanes in flight may be found on the same wavelength). They will be found between 53.00 and 54.00.

POLICE STATIONS

(Note — These stations are used by Police departments to relay messages to police cars that patrol the cities. They come on the air, deliver their message and go right off again. When one is tuned in, just keep the dials at the same place and ofttimes many others may be heard.) They will be found between 119.71 and 124.27 also between 175.23 and 192.55.

IDENTIFYING STATIONS

Here are a few tips on identifying stations that may be heard on a short wave receiver. The call letters of each station are given and then the identification signal.

PLE — Announces in English, Dutch, and French as "Bandoeng Radio."
Pontoise — Plays "Marseillaise" at start and close of program.
DJA and DJB — Announces all stations in chain broadcast like "Berlin, Dresden, Hamburg, Struttgart."
HVJ — Announces "Hillo, Hillo, Radio Vaticano."
RABAT — Announces "Radio Rabat." Uses beat of Mentronome.
2RO — Lady announces "Radio Roma" or "Radio Roma Napoli."
G5SW — Announces "London Calling" or "G5SW, Chelmsford."
EAQ — Announces "Hillo, Ay ah, coo., Transradio, Madrid."
T14-NRH — Bugle Call or Tic-Tac between selections.
VK2ME — Laughing notes of Kookaburra Bird open and close programs.
CT1AA — Six Cuckoo calls between selections.
VK3ME — Broadcasts 9:00 o'clock chimes at 6 A.M., E.S.T.
OXY — Broadcasts midnight chimes at 6 P.M., E.S.T.
TGX — Announces "Tay, hay, aykis, Guatemala."
HKF — Announces "Achay, kah, effay, Bogota."
PRADO — Announces "Estacion El Prado, Rio Bamba, Ecuador."
HSP2 — Strikes six notes on piano between selections.
HKM — Announces "Achay, kah, emmie, Bogota, Colombia."
HKA — Announces "Achay, kah, ah, Barranquilla." Uses whistle.
F3ICD — Striking of gongs and symbols between selections.
CMCI — Announces in Spanish and English.
HCJB — Announces in Spanish and English.
HKD — Announces "Achay, kah, day, Barranquilla, Colombia."
HKO — Announces "Achay, kah, oh, Medellin, Colombia."
LSG — Calls "Allo, Allo, Paree, ici Buenos Aires."
FTM — Calls "Allo, Allo, Buenos Aires, ici Paree."
IAC — Calls "Pronto, Pronto, heir is Roma."
LSX — Announces "Ellie, essie aykiss, Transradio Buenos Aires."
YV11BMO — Announces "La Vox de Lago."
GENEVA — Announces in English and French.
PRBA — Announces "Radio Club de Brazil."
American Stations — Identified by the stations they relay.

Most telephone stations can be identified by the station or city they are heard calling and judging the wavelength it is heard on. For example, if you hear a station near 17 meters calling "Hillo Bandoeng" you are almost certain it is PCV, Kootwijk, Holland, who works with the Bandoeng telephone stations on 16.82 meters.

News from Short Wave Headquarters

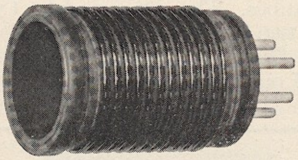
The National Company has pioneered in the development and manufacture of short wave apparatus for the amateur, experimenter, broadcast fans and commercial users. The following items, from our general catalog (sent on request) are of particular interest to the users of the SW–58 and 34—

NATIONAL PLUG-IN TYPE INDUCTORS

These coils are of the plug-in type, providing the highest possible efficiency in short wave reception. They are wound on the famous low loss R-39 insulating material.

Coils for The ACSW-58 and ACSW-3

Catalog Symbol	*Range*	*List Price Per Pair*
No. 60	9. to 15. meters	$5.00
No. 61	13.5 to 25. meters	5.00
No. 62	23. to 41. meters	5.00
No. 63	40. to 70. meters	5.00
No. 64	65 to 115. meters	5.00
No. 65	115. to 200. meters	5.00
No. 66	200. to 360. meters	5.50
No. 67	350. to 550. meters	5.50
No. 68	500. to 850. meters	6.50



Coils for The DCSW-34 and DCSW-3

Catalog Symbol	*Color*	*Range*	*List Price Per Pair*
No. 10	Brown	9. to 15. meters	$5.00
No. 11	Black	13.5 to 25. meters	5.00
No. 12	Red	23. to 41. meters	5.00
No. 13	White	40. to 70. meters	5.00
No. 14	Green	65. to 115. meters	5.00
No. 15	Blue	115. to 200. meters	5.00
No. 16	Orange	200. to 360. meters	5.50
No. 17	Yellow	350. to 550. meters	5.50
No. 18	Purple	500. to 850. meters	6.50
No. 19		850. to 1200. meters	8.00
No. 20		1200. to 1500. meters	8.00
No. 21		1500. to 2000. meters	8.00

Forms only — 4-prong UX base	ea. $.75
5-prong UY base	ea. .75
6-prong Special	ea. .75
Socket only — 4, 5, or 6-prong Special made of Isolantite	ea .60

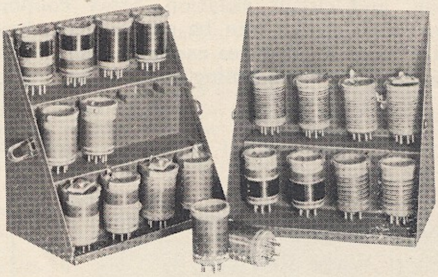
Special AMATEUR Coils

These coils are designed so as to permit 50 dial division spreading on the amateur 20, 40, 80 and 160 meter bands, using the standard NATIONAL SW Thrill Boxes.

The Band Spread coils are available in both the "10" and the "60" series. Be sure and order the "60" series if the receiver with which the coils are to be used employs the 58 type tubes. If the receiver does not use the 58 tubes, then order the "10" series.

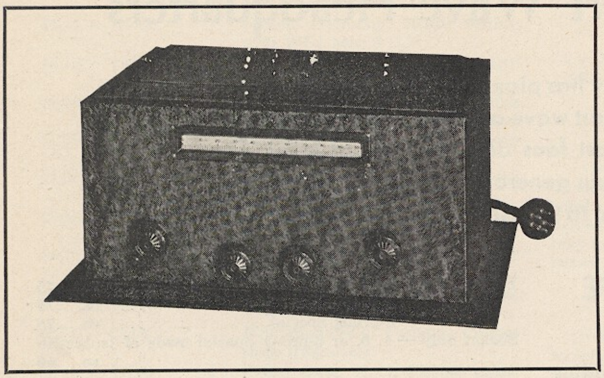
No. 11A — 20 meter band (per set of 2)	$5.00
No. 13A — 40 meter band (per set of 2)	5.00
No. 14A — 80 meter band (per set of 2)	5.00
No. 15A — 160 meter band (per set of 2)	5.00
No. 61A — 20 meter band (per set of 2)	$5.00
No. 63A — 40 meter band (per set of 2)	5.00
No. 64A — 80 meter band (per set of 2)	5.00
No. 65A — 160 meter band (per set of 2)	5.00

NATIONAL Coil Cabinet



A convenient way of keeping the extra coils when not in use in the short wave receiver is in a National Coil Cabinet. When open, the coils are all in full view so as to facilitate the ready selection of the desired pair. The two halves of the cabinet fit together so as to form a compact unit measuring approximately 9 inches by 8 inches by five inches when closed. Made of heavy gauge steel and finished in durable attractive brown moiré. On the front of the cabinet is a receptacle for the calibration curves.

National Coil Cabinet. . . . List price, **$3.75.**



NATIONAL

Tuned Radio Frequency

SW-58 and SW-34 Amateur Receivers

AC and Battery Models

Where utmost sensitivity, with extremely low background noise level, together with unequaled flexibility and ease of control is required, these receivers are outstandingly in a class by themselves.

The most essential requirement of a short-wave receiver is sensitivity with ease of control, and in designing the Types SW-58 and SW-34 no detail which would help in attaining this end has been overlooked. The circuit consists essentially of a tuned R.F. stage, a regenerative detector, and two audio stages. All dielectric material in the radio frequency and detector signal circuits is the latest improved Isolantite and R-39. This, together with correct coil design, is absolutely necessary in order to obtain the desired sensitivity and to provide a sufficiently high degree of selectivity.

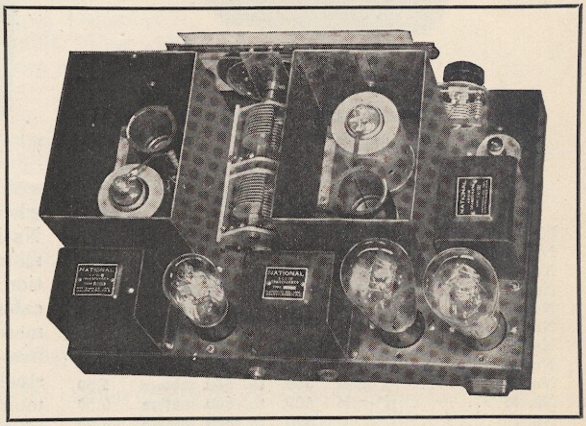
No less important, from the standpoint of stability and ease of control, is proper shielding, filtering, and circuit isolation. Stray coupling between coils, which can be particularly objectionable since it produces excessive interlocking between trimmer and tuning controls, is avoided through the use of heavy copper shields and the over all shielding of the metal cabinet.

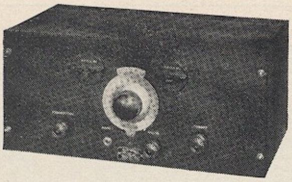
The detector is impedance coupled to the first audio amplifier by means of a special coupling unit. The push-pull stage employs 245 tubes for best tone quality and is transformer coupled. The output transformer is correct for direct connection to any standard magnetic or dynamic speaker having an impedance in the neighborhood of 5000 ohms. A jack is provided for head phones and is connected in the output of the first audio stage.

An R.F. volume control, connected in the antenna input circuit, is very helpful in securing the optimum regeneration control setting consistent with selectivity and signal strength, and also prevents tube overload.

The AC model, Type SW-58, employs two Type 58 variable MU Pentodes in R.F. and Detector, Type 56 (or 227) first audio, and two Type 245 output tubes. The DC model, Type SW-34, employs two Type 234 variable MU screen grid R.F. and Detector, Type 230 first audio, and two Type 231 output tubes.

Catalog Symbol	*Description*	*List Price*
AC-SW 58	National 5-tube AC Short Wave Receiver, with five sets of coils covering the wave-lengths from 13.5 to 200 meters, less tubes..........	**$89.50**
DC-SW 34	National 5-tube DC Short Wave Receiver, with five sets of coils covering the wave-lengths from 13.5 to 200 meters, less tubes..........	**$85.00**





NATIONAL 58C

Communication Type

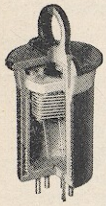
Short Wave Receiver

The National 58C Receiver is the well known SW-58, described elsewhere in this bulletin, arranged for Relay Rack Mounting, and provided with front-of-panel coil changing. The panel conforms to Government specifications, and will fit any standard rack, as well as those of National manufacture.

Because of the definitely superior signal-to-noise ratio, many hundred receivers of this type are in use by the principal American Continent Air Lines.

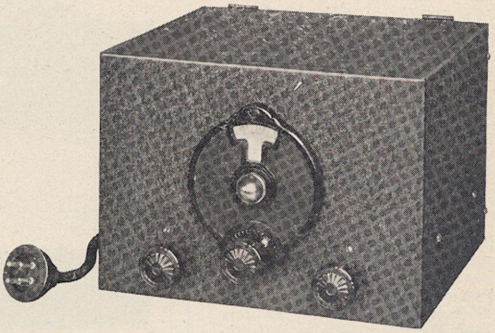
Type 58C Receiver, with four sets of coils (13½ to 115 meters). List Price **$120.00**

Additional coils available to 2000 meters.



The type of Plug-in-From-Front-of-panel coil used in the 58C and AGS communication type receivers.

The SW-3, Three Tube Thrill Box



A highly efficient and popular receiver for amateur use, with telephone receiver output It is identical with the SW-45 with the exception that the power amplifier stage has been eliminated. Available in a-c or d-c models. New AC model now uses the "58" type tubes.

Catalog Symbol	*Name of Parts*	*List Price*
ACSW3	NATIONAL complete set of parts for 3-tube Short Wave Thrill Box — less coils and tubes — wired by the Jackson Research Laboratories	**$29.50**

Note: The above price is for either AC or DC models. (Either 2 or 6 v.)

AC uses 2–58s and 1–27. 6v DC uses 2–36s and 1–37. 2v DC uses 2–32s and 1–30.

When DC Battery model is desired, specify Catalog Symbol as DCSW3 and whether for 2 or 6 volt tubes.

Band spread coils for either the 20, 40, 80, or 160 meter bands, list at $5.00 per pair. See complete listings of coils on page 9. *Federal tax paid*

NATIONAL Power Units for AC Short Wave Reception

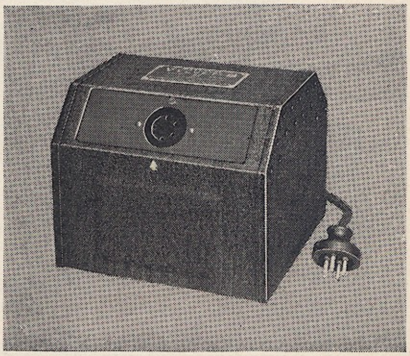
One of the essentials for humless AC Short Wave reception is the use of a power unit designed especially for that purpose.

NATIONAL power packs have an exceedingly low inherent hum, employing a double section filter using good quality chokes and plenty of condenser capacity. The power transformer has an electrostatic shield between the primary and other windings in order to prevent line disturbances from getting into the power unit and thus into the receiver.

A special R.F. filter, located between the 280 rectifier tube and the hum filter is a feature of all NATIONAL power packs designed for short wave use and is one of several important factors contributing to the complete elimination of so-called "tunable hums," frequently encountered in short wave reception.

Catalog Symbol	*Description*	*List Price*
5880-AB	Completely wired power supply for use with the ACSW3 Thrill Box using the '27 tubes in the output stage on 105–120 volts, 50–60 cycle current supply. Less tube	**$26.50**
5880-AB-25	Completely wired power supply for use with the ACSW3 Thrill Box using the '27 tubes in the output stage on 105–120 volts, 25–40 cycle current supply. Less tube	**39.50**
5880-AB-220	Completely wired power supply for use with the ACSW3 Thrill Box using the '27 tubes in the output stage on 220–230 volts, 50–60 cycle current supply. Less tube	**37.00**
5880-AB-S	Completely wired power supply for use with the ACSW58 Thrill Box using the '45 tubes in the output stage on 105–120 volts, 50–60 cycle current supply. Less tube	**39.50**
5880-AB-S25	Completely wired power supply for use with the ACSW58 Thrill Box using the '45 tubes in the output stage on 105–120 volts, 25–40 cycle current supply. Less tube	**42.50**

All prices on this page include Federal Excise Tax

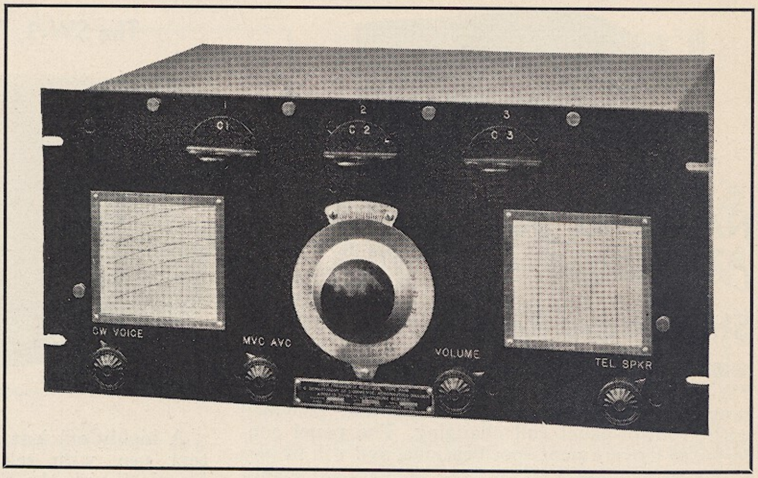


NATIONAL

"AGS" and "AGS-X"

Communication Type

Short Wave Receivers



The use of short waves for military and commercial purposes has produced a demand for a professional receiver in which considerations of price are entirely subordinate to those of performance and reliability. The AGS, designed in co-operation with the Airways Division of the U. S. Department of Commerce, is such a receiver. Its universal acceptance by commercial operators and government departments indicates how fully it meets the severe requirements of high *usable* sensitivity and selectivity with thorough image suppression, easy operation, permanent frequency calibration and dependability of performance.

Particularly important is its unusual preselector circuit, which is largely responsible for the exceptionally high signal-to-noise ratio, which is so vital to the reception of weak signals. To this preselector may also be credited an efficient gain in sensitivity and almost complete image suppression.

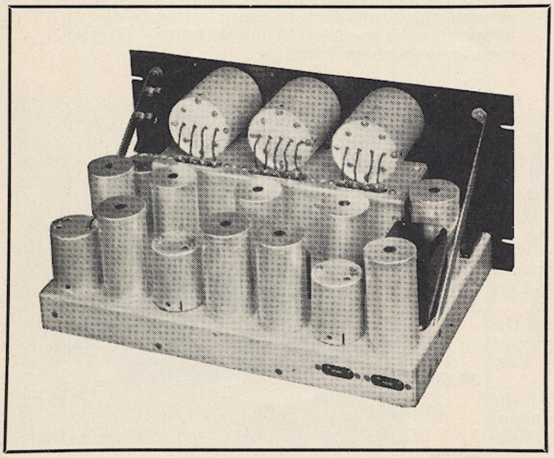
The AGS-X offers a still further refinement in the use of a single signal (mechanical quartz filter) circuit preceding the I. F. amplifier. With this device selectivity is measured in cycles rather than kilocycles, resulting in an almost complete elimination of interference from unwanted signals, and a marked reduction in static. Front-of-panel controls provide for smooth variation of single-signal selectivity, as well as rejection of the filter for phone reception.

Both AGS and AGS-X employ nine tubes in a superheterodyne circuit, comprising a preselector stage of tuned R. F. amplification and first detector employing screen grid tubes; a high frequency oscillator; two stages of air-tuned high-gain screen-grid I. F. amplification; I. F. power detector; automatic volume control, working in conjunction with both R. F. and I. F. amplifiers; beat frequency oscillator, and Pentode output with provision for either phones or loudspeaker.

Tubes.. { 3—236's, 1—237, 1—89, 1—77, 3—78's

Outstanding Features:

1. Tuned R. F. stage preceding first detector. (Image suppression — improved signal-to-noise ratio — improved "weak signal" response.)
2. Electron coupled oscillators.
3. No frequency drift—air padded oscillators.
4. Air dielectric tuning condensers in I. F. amplifier.
5. Single dial straight frequency line tuning (270°).
6. Calibration curves and station chart on panel.
7. Coil change from front of panel.
8. Automatic volume control or manual volume control, by throw of switch.
9. Extremely rigid mechanical construction from very heavy aluminum plate.
10. Relay rack or table mounting (panel size 8¾" x 19").
11. Frequency range 1500 to 20,000 k.c. band spread coils available.
12. Heterodyne oscillator for c.w. reception.
13. A.C. or battery operation.
14. Panel switch for phones or speaker.
15. Mechanical filter for single signal reception (in AGS-X).



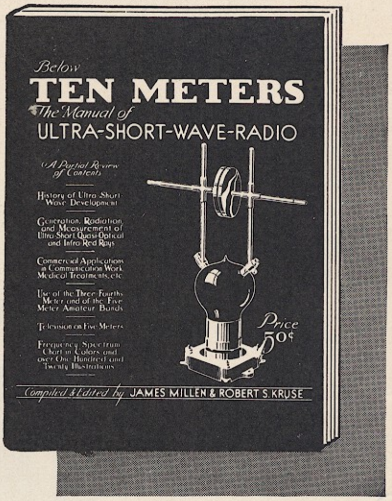
Band Spread Coils

The special band spread coils are interchangeable with the standard types, thus making the AGS and AGS-X receivers entirely adaptable for full band spread operation on any of the amateur bands. Each band is spread over 100 divisions (180°) of the 150 division (270°) tuning dial.

Catalog Symbol	*Description*	*List Price*
AGS	National Type AGS Short Wave Receiver completely wired and Laboratory tested, with coils to cover Frequency Range 1500 to 20,000 k.c. (less tubes)	**$265.00**
AGS-X	Same as above but with Single Signal feature. Complete with crystal	**$295.00**

Band Spread Coils for the 20, 40, 80 and 160 meter bands may be substituted for standard coils at same price.

THE SHORT WAVE LIBRARY



The engineer, the experimenter, and the advanced amateur, as well as the beginner, will find much data of real interest in Manuals and Engineering Bulletins issued by the Engineering Department of the NATIONAL COMPANY.

The MANUALS 50¢ each

*VOL. I — The Manual of Short Wave Radio
by Zeh Bouck

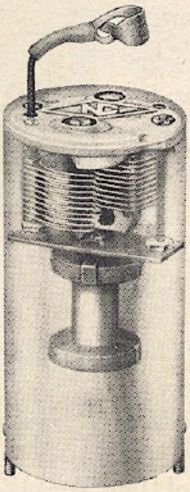
VOL. II — The Manual of Short Wave Radio
by Zeh Bouck

VOL. III — The Manual of Ultra Short Wave Radio
by James Millen and R. S. Kruse

The ENGINEERING BULLETINS 10¢ each

1. The Stenode
2. A Low Cost Push Pull C.W. Transmitter
*3. A Combination A.C. and D.C. Amateur-Band Receiver
4. World Wide Short Wave Reception
5. An Inexpensive Radiophone Transmitter
6. Engineering a Universal A.C. & D.C. Receiver, Especially Designed for Amateur Band Reception
7. The "AGS," a De Luxe High Frequency Communication Receiver
8. An investigation into Single Signal Reception

*Temporarily out of print



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