Important Considerations for All-Wave Reception

Energy is radiated from an antenna in various directions, depending on the shape and size of the antenna and its length as compared to the wave length of the frequency being broadcast. The energy radiated horizontally gives rise to what is called the "ground wave." The energy which is radiated upward gives rise to what is called the "sky wave." At long wave lengths the ground wave follows the curvature of the surface of the earth and radiates along the earth's surface until its energy is completely absorbed by the earth, building, trees, mineral deposits, atmosphere, etc., in which it induces voltages. At very short wave lengths below 10 meters the ground wave does not follow the curvature of the earth but radiates at a tangent to the earth's surface like a beam of light and very little energy can be found beyond the horizon as seen from the antenna. Intermediate frequencies follow an intermediate course. Therefore, the ground wave will extend outward from a long-wave broadcasting station much farther than from a short-wave station. The distance from the antenna that a ground wave can reasonably be expected to be detected is given below:

FREQUENCY (K. C.)	WAVE LENGTHS IN METERS	GROUND-WAVE RANGE IN MILES
100	3000	1000–500
1000	300	175
3000	100	90
6100	49	75
9400	31	60
12000	25	50
15600	19	35
18000	16	15

This data together with that which follows has been collated from the best available sources and represents conditions as generally and dependably found. Many variations occur, some of which differ so much from our accepted ideas as to warrant their being called freakish. These variations make it extremely difficult to establish definite laws. However, if you will treat the data given as a general guide rather than a hard-and-fast rule you will find it very valuable.

The sky wave is considered to continue upward until it strikes an ionized layer (called the Kennelly-Heaviside layer), where it is partially reflected.

Up to a frequency of about 3500 KC (86 M) the reflected sky wave overlaps the ground wave near the station and extends outward a distance which depends on the frequency and the condition of the atmosphere. For these frequencies (below 3500 KC) distances up to 2000 miles can be reliably covered during winter nights. In this range of frequencies 1500 KC has the least effective range. Refer to the following illustration:

Above 3500 KC the sky wave returns to the earth so as to cover a band which surrounds the transmitter but does not extend close enough to it to overlap the ground wave. Because of this, a dead spot (Sky's Distance) lies between the point at which the ground wave ends and the sky wave starts. The distance from the station to the point at which the sky wave starts increases very rapidly as the frequency increases so that beyond 14 meters (21,400 KC) almost no sky wave reception is possible either winter or summer (or day or night).

Below 3500 KC (where there is little or no sky's distance), the daylight range of a station is very much less (from 15 to 40 per cent) than its range when the path is wholly in darkness. For frequencies slightly above 3500 KC (86 M) the sky wave during daylight hours covers a fairly narrow band of the earth's surface. As darkness covers more and more of the path the whole band moves outward and at the same time broadens, thus increasing the "Sky's Distance," and very greatly increasing the maximum range. For relatively high frequencies (above 16,000 KC) the sky wave, when in darkness, returns to the earth such a great distance from the transmitter as to be of little value for reception. For daylight along the entire path, this condition occurs above 20,000 KC (15 M).

Conditions differ radically between winter and summer. For low frequencies (below 3500 KC) the range is greatly decreased in summer. For the higher frequencies the band in which the sky wave returns to the earth's surface is much nearer the transmitter in summer than in winter and the width of the band is much narrower. This gives rise to shorter "sky's distances" and lowers the maximum range during summer. This makes for better reception at certain wave lengths and poorer reception at other wave lengths. This effect will be discussed in reference to each of the broadcast bands in a few minutes.

Broadcast channels are usually established by an International Radio Congress. Channels of limited carrying power are usually established and allotted by a Federal Radio Commission. The following Broadcast channels have been established:

NAME	KC RANGE	METERS
	EUROPEAN LONG WAVE	
Assigned	150– 265	2000–1138
Used	150– 440	2000– 682
	MEDIUM WAVE	
Assigned	550– 1500	545– 200
Used	500– 1500	600– 200
49 Meters	6000– 6140	50–48.86
31 "	9500– 9600	31.58–31.25
25 "	11700–11900	25.64–23.21
19 "	15100–15350	19.87–19.54
16 "	17750–17800	16.90–16.85
13 "	21450–21550	13.98–13.92
11 "	26500–26600	11.68–11.28

1. European Long-Wave Band. This was assigned to cover 150–265 KC, but was expanded to include 150 to 440 KC largely by the action of Russian stations, and this has since been officially approved.

2. Medium-Wave Band. This band has an assigned frequency of 550–1500 KC and is used chiefly in the United States. European and a few other stations are using frequencies from 520–550 KC as well.

3. Forty-nine Meter Band which extends from 6000 KC (50.0 M) to 6140 KC (48.86 M).

4. Thirty-one Meter Band extending from 9500 to 9600 KC (31.58–31.25 M).

5. Twenty-five Meter Band including 11,700 KC (25.64 M) to 11,900 KC (23.21 M).

6. Nineteen Meter Band including 15,100–15,350 KC (19.87–19.54 M).

7. Sixteen Meter Band including 17,750–17,800 KC (16.90–16.85 M).

8. Thirteen Meter Band including 21,450–21,550 KC (13.98–13.92 M).

9. Eleven Meter Band including 26,500–26,600 KC (11.68–11.28 M).

The Long and Medium Broadcasting Wave Bands serve well a limited area surrounding the transmitter. This area is greatly limited in the daytime, however, so that many sections of the United States have very little in the way of broadcast entertainment until late in the evening.

Even then these sections may have to rely on one or two transmitters carrying entertainment of doubtful value. The shorter wave lengths make more nearly possible a greater selection of programs, entertainment at any time of the day, direct (not relayed) reports on events of importance, entertainment in one's native language and offer the thrill of DX reception.

Referring to the chart, we see that the 49 meter band offers good distant reception at night and in the evening when part of the path is in darkness. It contains more transmitters which broadcast regularly and reliably than any of the other short-wave bands and should be the most satisfactory for evening or night distant reception. This band will also be useful in daylight reception from stations about 300 miles distant.

The 31 meter band has fewer broadcast stations which are reliable and regular in operation. It will be useful in daylight reception of transmitters about 800 miles distant and on more distant stations, after dark especially during the summer months.

The 25 meter band has about the same number of broadcasters as the 31 meter band. It is especially useful for reception from stations 1000 miles distant during daylight hours, and in Camden has been found to be next to the 49 meter band in usefulness. Night reception from stations 3000 miles distant is possible during summer months.

The 19 meter band is fourth in the number of stations transmitting regularly and fourth in usefulness (in Camden). Stations 1500 miles, or more, away can be received under favorable conditions during daylight hours. Rarely can stations be heard on this band when any appreciable part of the path is in darkness.

The 16 meter band is used by but few transmitters and is useful for daylight reception from stations 2500 miles and more distant and rarely at night.

The 13 meter band is also used by but few transmitters. On the chart we have indicated the reception possible at 14 meters and at 13.7 meters (on each side of the 13 meter band) to illustrate the fact that this band is on the very edge of the range useful for daylight reception and affords no night reception except within the range of the ground wave (15 M). Its only present usefulness is experimental.

The newly assigned 11 meter band is occupied by but one or two experimental stations and has, like the 13 meter band, no present usefulness.

In computing the distance from the various transmitters to your home town, it is necessary to follow a great circle course. The following approximate figures were measured on a globe map of the world. Measurements cannot be taken from a flat map with any degree of accuracy.

FROM	TO	DISTANCE
New York	California	2,500 miles
" "	Central America	2,000 "
" "	Buenos Aires	5,500 "
" "	Mexico City	2,000 "
" "	Winnipeg	1,500 "
" "	Dallas, Texas	1,500 "
" "	Denver, Colo.	1,500 "
" "	Berlin	4,000 "
" "	Melbourne	10,000 "
" "	St. Louis	1,000 "
" "	Jacksonville, Fla.	1,000 "
" "	South Africa	8,000 "
" "	Moscow	5,000 "
California	Berlin	6,000 "

Nature in its thunder and lightning storms produces very little disturbance in these shorter wave bands. However, man-made interference, for example, power line noises, automobile ignition noises, commutators' sparkings, etc., appear to contain a larger component of short-wave disturbances than exists in medium-wave broadcasting.

Another disturbing factor in short-wave reception is fading, which becomes worse as the frequency goes up. Fading is of two types—intensity fading with no change in quality and selective fading in which the energy level is but little changed but the signal is badly distorted through cancellation (or re-enforcement) of certain frequencies. Excellent automatic volume control action is necessary, but even then selective fading occurs which makes the sound go "mushy." The actual extent of the fading does not differ greatly from that of medium waves but occurs much more often and with greater rapidity of change. Selective fading is caused by energy coming to the receiving antenna over paths of different lengths. This makes some of the energy lag the balance by an exceedingly short time. Obviously the same time lag will cause a greater phase difference on a high frequency band than on a low.

Another problem arises in the high frequency band. Some short-wave stations operate at a comparatively low percentage of modulation because this results in a reduction of distortion while fading is taking place. This means that a carrier of given strength may contain a smaller audio signal than on the long waves. This must be considered in the design of a short-wave receiver to avoid overloading the radio stages in order to get sufficient audio output.

As a rule the field strength upon which we depend for our short-wave reception is smaller than that upon which we depend for our good long-wave reception. This means a large amount of gain must be used with the consequent increase in noise to signal ratio. This presents a very important problem which has to be met in the receiver design.

In order to cover long and short waves in the same instrument, it is possible to build the instrument to fit one point of the range to be covered and accommodate it to the various other bands by modifications of various kinds. In doing this, compromises must be made in one range or another. This presents a very important problem to manufacturers building quality merchandise since others following the cheaper, and less satisfactory method, may be able to produce a set at a lower cost.

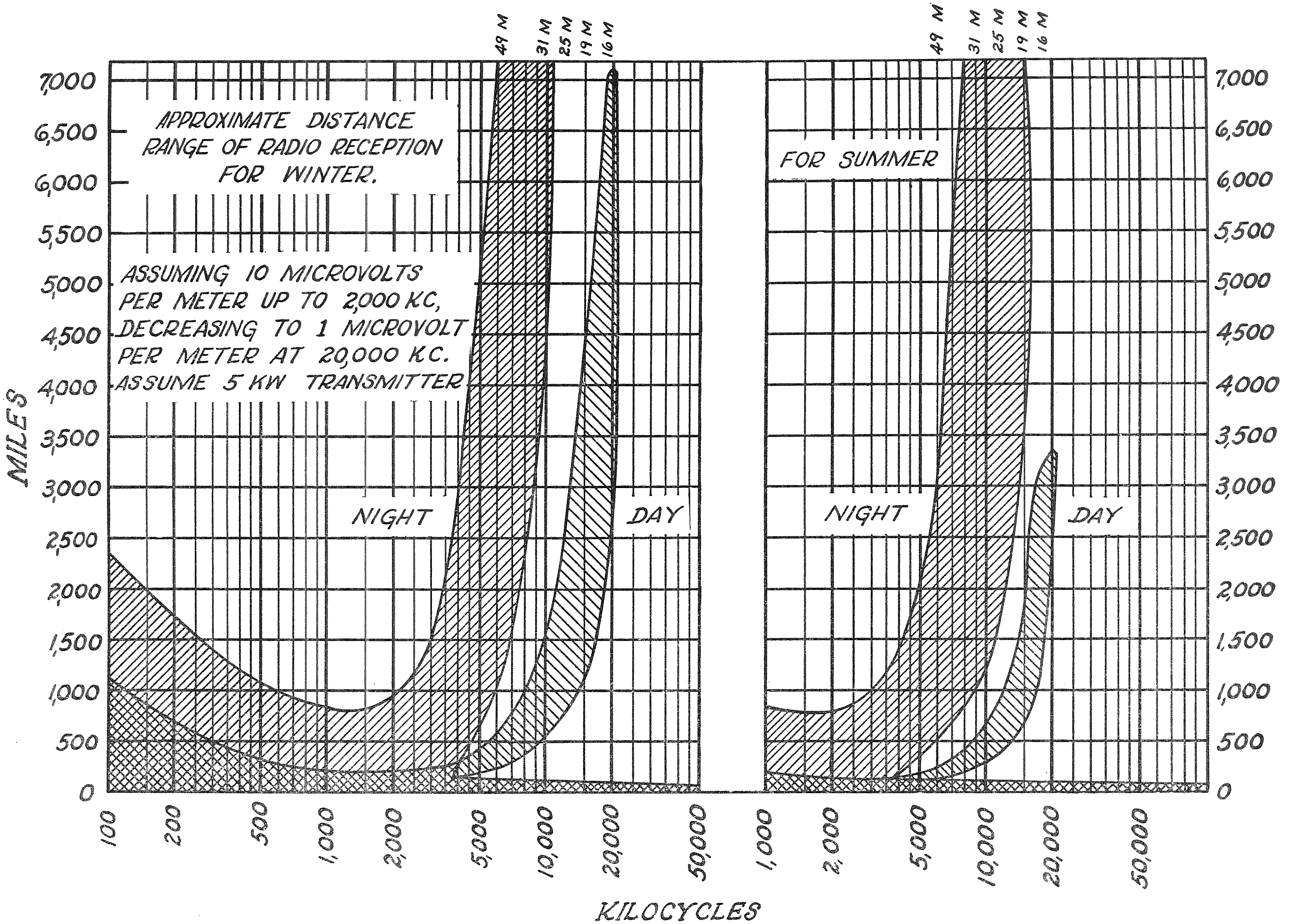
Another factor in the design of an all-wave receiver is of great importance. Harmonics of long-wave stations, of phone and code transmission may produce annoying disturbances unless great care is taken to reduce them to a minimum. Check this factor when comparing two different all-wave receivers.

Before explaining how these difficulties have been met by our engineers, it might be well to say a word or two about antennas for all-wave sets. The length of the antenna is of secondary importance. The first consideration is that the antenna be so located as to pick up a minimum of noise from automobiles, oil burners, power lines, etc. Keep the antenna and lead-in as far as possible from such sources of interference. It may be feasible to put a condenser across motors producing noise. Other methods of noise prevention will present themselves to you. Shielded lead-in or transformers in the antenna circuit may cause serious attenuation of signal on the shorter wave bands, and they should not be used unless definite improvement is demonstrated.

Within the past year a great improvement has occurred in short-wave broadcasting. The present political situation throughout the world has been partially responsible for this increased activity and propaganda is being broadcast frequently from U. S. S. R. and Germany. The power of a number of important stations has been increased and a number of new stations have been put into operation. Notable among these are the British Empire stations established, one in each band, to keep the entire Empire in touch with London. The number of hours of operation have been increased and more definite schedules are maintained.

All this has greatly increased the value of short-wave reception and explains why we feel that a receiver of excellent quality to cover the short-wave bands is now warranted.

RECEPTION CHART



The chart shown gives a graphic indication of the distances, frequencies, time of day and season of the year for best or possible reception at transmitting frequencies from 100 KC to 50,000 KC for winter and 1,000 KC to 50,000 KC in summer. It should be noted that the bands shown are centered for the middle of each period. For example, the center of the day band represents noon, for reception between north and south locations and 9 or 10 AM Eastern Standard Time for reception of European stations in the eastern United States. Noon and mid-night are figured on the basis of the position of the sun in respect to both transmitter and receiver.

These bands move and contract or expand as time progresses. From mid-night to noon the wide night band moves in the direction of and contracts to, the size of the mid-day band. From mid-day to mid-night, the day band expands and moves in the direction and to the width of the night band.

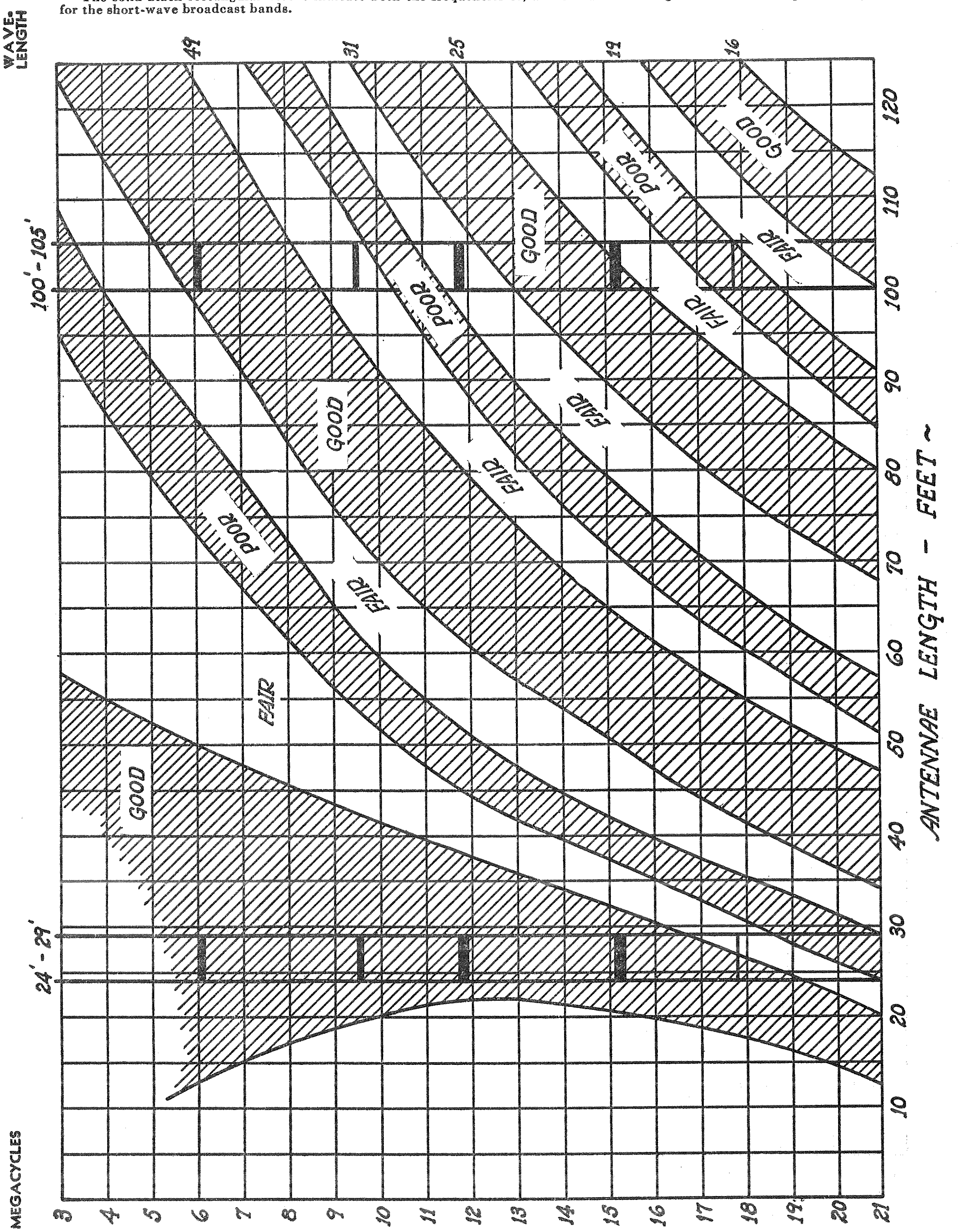
ANTENNA LENGTH CHART

(Lengths shown are overall, including Lead-in Wire to Receiver—Ground Wire not to exceed 15 feet.)

From the chart shown, it can be seen that a wide variation in signal strength can be obtained with various length antennas. This data applies particularly to the six-tube receiver and in general to the eight-tube receivers but does not necessarily apply to competitive instruments. The various degrees of reception are approximately equal for various antenna lengths. For example, the "good" sections give about four times as much sensitivity as the "poor" sections. As this is also an equal gain over noise, proper choice of antenna length can often make the difference between satisfactory and unsatisfactory reception.

In conjunction with the question of the relative merits of a short or long antenna for the frequencies that fall in the "good" sections of each, either length will be equally good, assuming that neither is shielded by buildings of metallic construction or other such objects. If, for example, part of the antenna or lead-in is shielded by the building, then the longer antenna will give better results. Also the longer antenna will give better results in the broadcast band.

The solid black rectangular blocks indicate both the frequencies of, and the antenna lengths recommended particularly for the short-wave broadcast bands.



SERVICE DIVISION

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RCA Victor Company, Inc.

CAMDEN, N. J., U. S. A.

Printed in U. S. A.

PREDICTING SHORT-WAVE RECEPTION

Through the co-operation of H. H. Beveridge, of R.C.A. Communications, Inc., and the United States Government, we are able to outline a method of forecasting probable reception conditions for a considerable period in advance. Although these predictions are not entirely accurate, they compare in accuracy with the ordinary weather forecast, which, as we know, is generally reliable.

These predictions are based on the magnetic activity reports furnished by the United States Observatory at Tucson, Arizona. It has been found that the spots on the sun have a more or less direct relation to the magnetic conditions on earth, which in turn have a definite relation to the reception conditions for short waves.

The illustration shows a typical magnetic activity chart prepared for such predictions. On this chart, ordinates (vertical divisions) are magnetic range, one scale division being 30 gammas. If the magnetic range extends beyond 60 gammas it has been found by experience that this range is sufficient to disturb the reception of short-wave signals. Accordingly, all range above 60 gammas have been filled in with black to make it apparent, in looking at the chart, where the disturbing magnetic conditions lie.

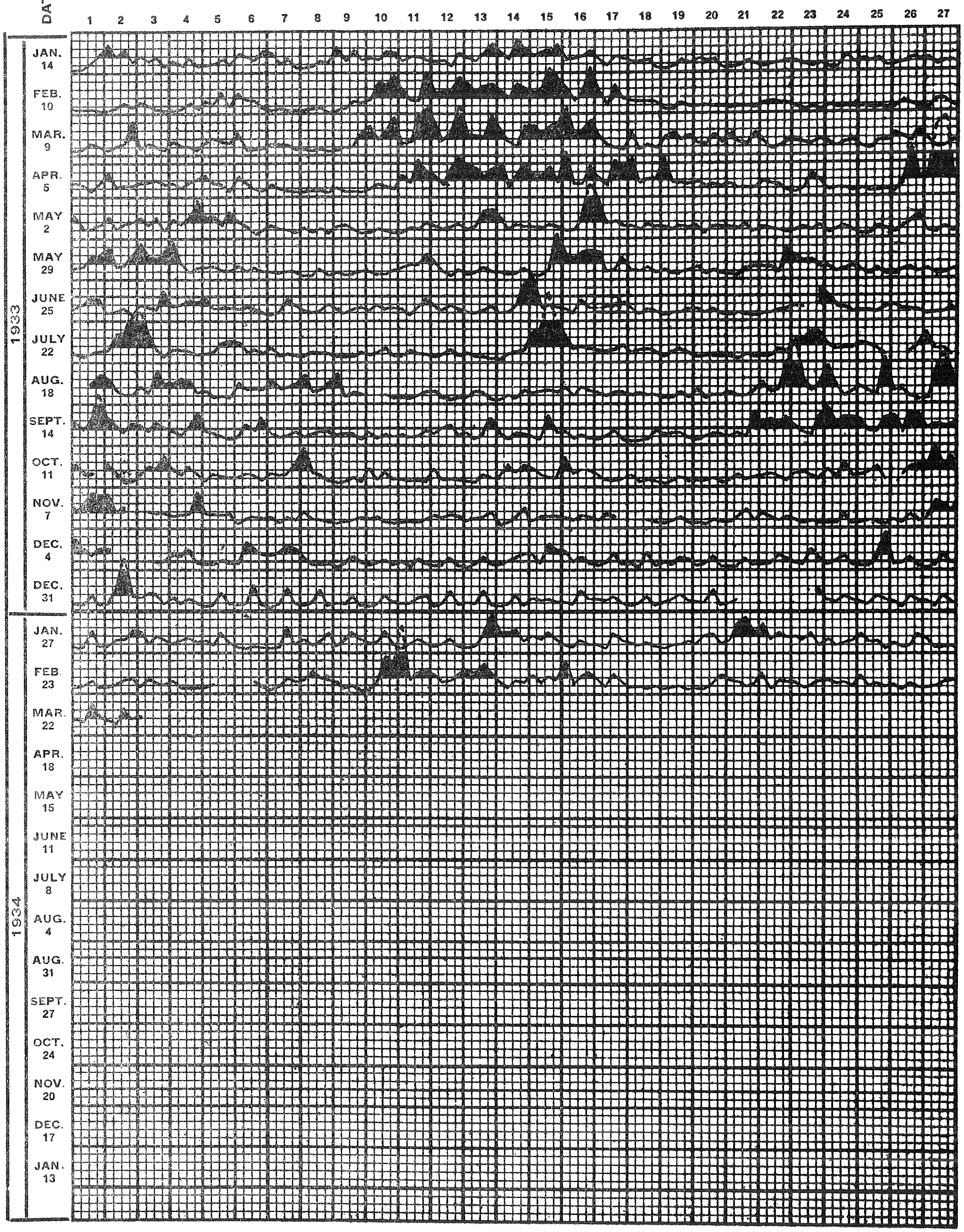
It has been found that the co-ordination between disturbed signals and magnetic range is very close, so that wherever a black peak appears on the chart, it has almost invariably been confronted with bad signal transmission.

It will be noted that the abcissa (horizontal divisions) extend from 1 to 27, indicating that the magnetic ranges are plotted on the basis of a 27-day period. The date of the first division of each 27-day period is shown on the left of each period. To find a particular date it is but necessary to count the dates from left to right, from those given.

Astronomers tell us that the Polar regions of the sun rotate once in approximately 34 days, while the Equator rotates once in approximately 24 days. Since the magnetic disturbances appear to repeat themselves on the average every 27 days, it seems probable that the sun spots which have the greatest effect on the magnetic conditions on the earth are located at such a latitude on the sun that the period of rotation is 27 days. This is the basis of the prediction service, that is, a magnetic disturbance on a certain day, say November 7th, would indicate a similar disturbance to appear again 27 days later, or on December 4th. In general, it will be noted that this repetition does occur, although it is not an invariable rule. For example, it will be noted that a severe storm occurred on August 5, 1933, but this storm did not repeat itself 27 days later, although it did appear again 54 days later with much less amplitude than on August 5th.

In this case, we would have predicted disturbed conditions on September 1st, but actually we would have found that there was no disturbance; therefore, it is not possible to guarantee the predictions, but, in general, it is possible to predict the times which are subject to disturbances and the times which are almost certain to be free from disturbances.

MAGNETIC ACTIVITY
SIX HOUR TOTALS OF HOURLY RANGES OF HORIZONTAL INTENSITY
ONE SCALE DIVISION—30 GAMMAS
TUCSON, ARIZONA OBSERVATORY



Announcing . . .

The RCA World-Wide Antenna System

A Di-Pole Antenna System for All-Wave Receivers

Stock No. 9500

The RCA World-Wide Antenna System is an expertly designed di-pole antenna system for all-wave receivers. Greatly improved signals and elimination of noise pickup between the antenna and receiver are among its numerous features.

ADVANTAGES

1. The RCA World-Wide Antenna System uses a "Double Doublet" antenna (a doublet is a special short-wave antenna), which gives as much as five times the signal pickup as that of an ordinary antenna.

2. The RCA World-Wide Antenna System uses a special transmission line between the antenna and the receiver which permits the antenna to be placed as far as 500 feet from the receiver without loss in efficiency. This transmission line also eliminates noise pickup between the antenna and the receiver.

3. The RCA World-Wide Antenna System uses a coupling transformer, located at the receiver, to properly match the transmission line to the input circuit of the receiver. A low-capacity switch is mounted on the transformer for switching from broadcast to short-wave reception so that maximum efficiency is obtained on both bands.

4. The RCA World-Wide Antenna System gives greatly improved results on the broadcast band.

5. The RCA World-Wide Antenna System greatly improves the reception of all short-wave receivers. On the older type short-wave receivers using adaptors, the results are especially desirable.

6. The RCA World-Wide Antenna System is easy to install. Stranded antenna wire is furnished in exact lengths, tinned at proper points for soldering. The transmission line is light and flexible and does not require heavy transposition blocks or cut-and-try methods for installing. A special cross-over insulator and all necessary insulators and fittings are included in the kit.

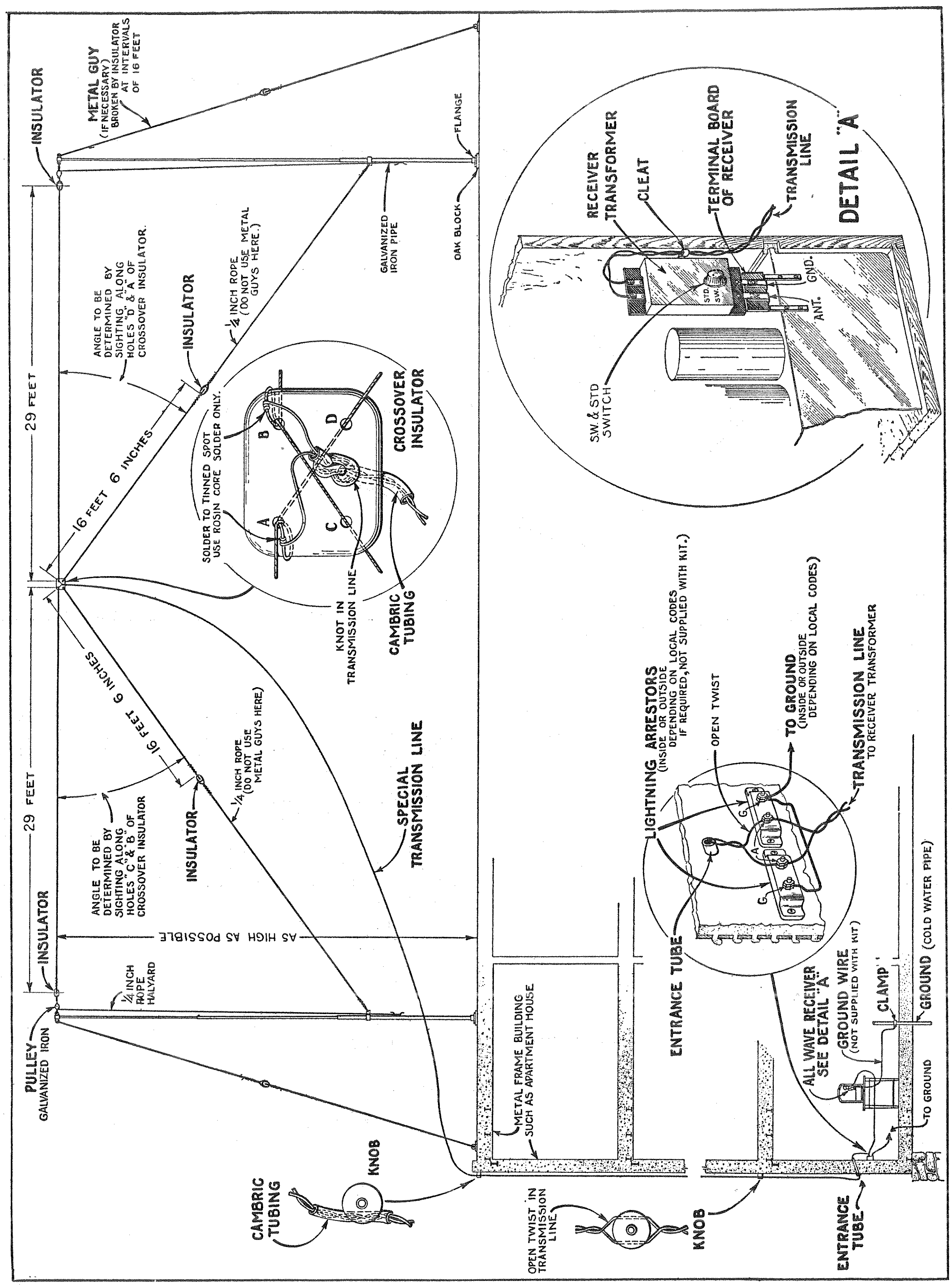
7. The RCA World-Wide Antenna System may be used in locations where physical limitations prohibit the erection of full-length antenna spans. Loading coils (obtainable as an accessory) may be used to increase the antenna lengths, electrically.

8. The RCA World-Wide Antenna System consists of a kit of parts, packed in an attractive carton and made up of the following items:

- 1 Antenna Transformer and Switch
- 1 Antenna Crossover Insulator
- 2 Rolls Antenna Wire—each roll 46½ ft. long
- 1 Roll Transmission Line—110 ft. long
- 4 Strain Insulators
- 1 Lead-in Insulator
- 2 Transmission Line Insulators
- 1 Ground Clamp
- 1 Transmission Line Clamp
- 3 Wood Screws
- 2 Insulating Sleeves
- 2 Spacers

List Price $6.00

Order from



Typical Installation of Stock No. 9500 Kit

MANUFACTURED BY

RCA Victor Company, Inc.

CAMDEN, N. J., U. S. A.

Printed in U. S. A.

RCA VICTOR SHIELD KITS

Stock Nos. 7717 and 7718

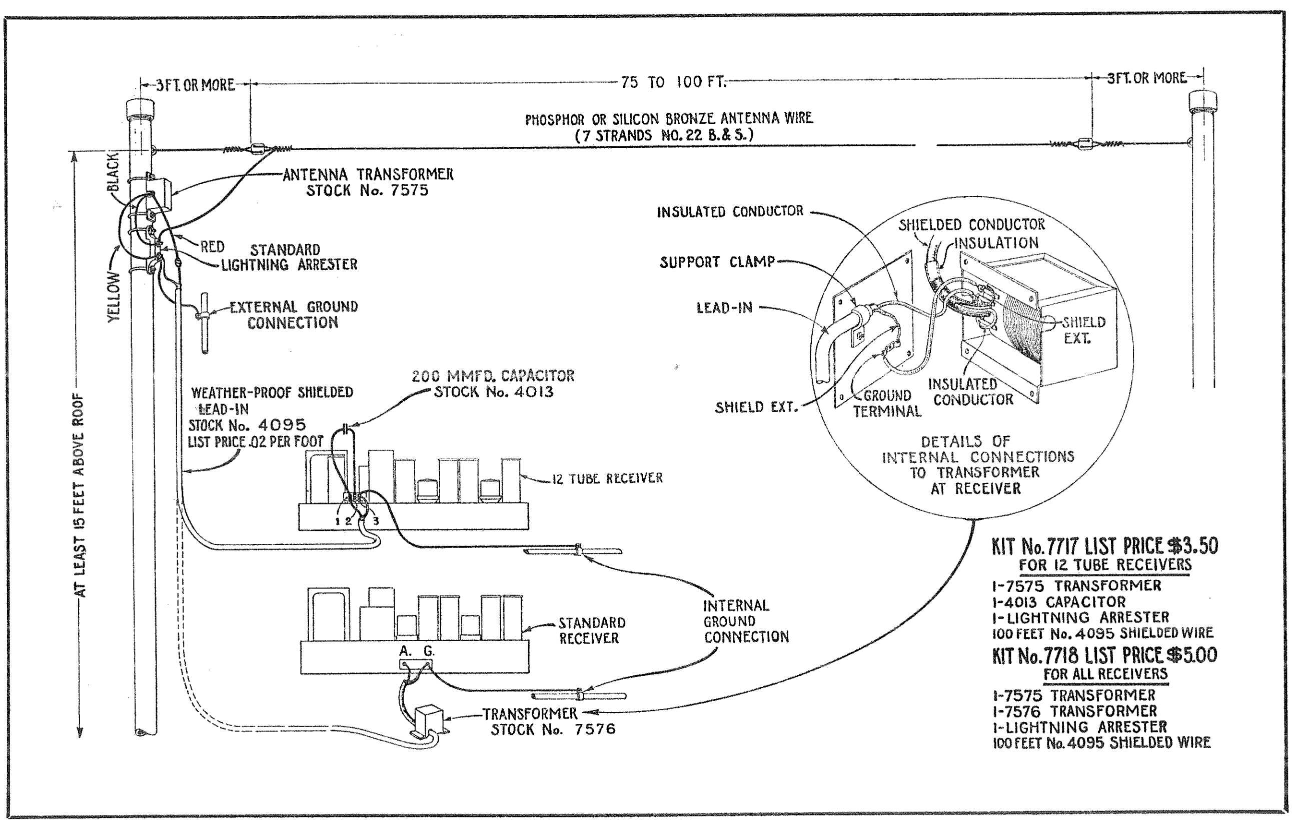
The RCA Victor Shield Kits, Stock Nos. 7717 and 7718, consist of an assembly of parts designed to be used in conjunction with radio receivers for the prevention of interference pickup by the lead-in portion of an antenna system. Inasmuch as the majority of man-made interference is picked up on the lead-in section of an antenna, installation of these kits greatly improves the ratio of signal to noise.

The Stock No. 7717 kit consists of an antenna transformer, 100 feet of low-impedance shielded lead-in wire, a 200 mmfd. capacitor and a lightning arrester. This kit is designed to be used with the RCA Victor Model 280 *only* and does not include a receiver coupling transformer. Such omission is made possible by the inclusion of a tap on the antenna coil of the Model 280, which matches the impedance of the shielded lead-in.

The Stock No. 7718 kit consists of an antenna transformer, 100 feet of shielded lead-in wire, a receiver transformer and a lightning arrestor. This kit is designed to be used with all types of broadcast receivers. The illustration below shows the proper manner of connecting these kits.

In conjunction with the Stock Nos. 7717 and 7718 kits, it must be remembered that these lead-in systems will not affect such conditions as natural atmospheric conditions which induce static into the antenna or any other noise that is picked up by the flat top portion of the antenna. To visualize the gain in these systems, the results will be approximately equal to the reception that would be obtained if the receiver were located at the top of the antenna pole.

These kits will give excellent results over the entire broadcast and police frequency bands. However, they are not recommended for the short-wave broadcasting bands.



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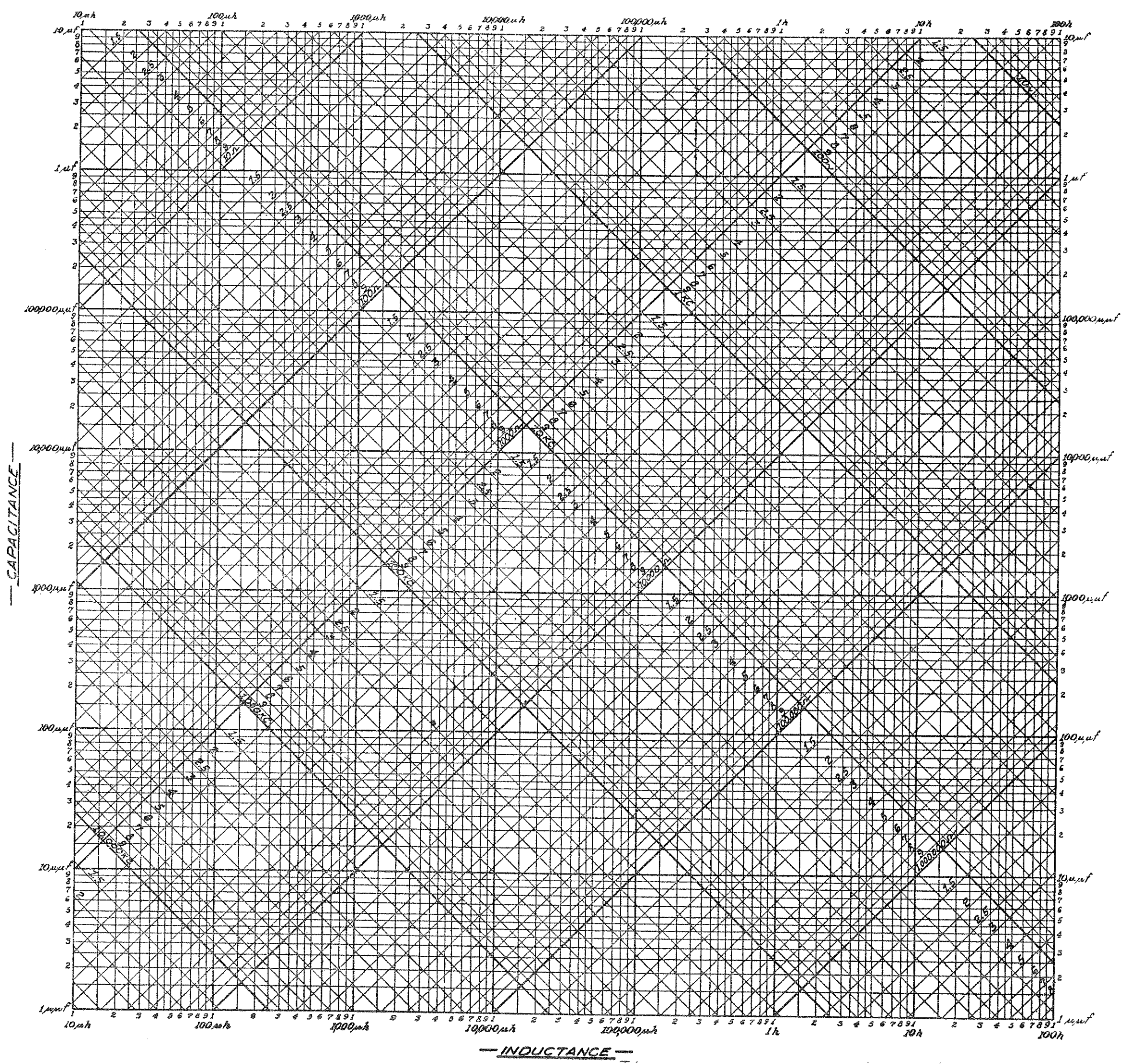
Proper Method of Connecting Kits to Antenna and Receivers

CHART OF FREQUENCY OR IMPEDANCE VS. INDUCTANCE AND CAPACITY

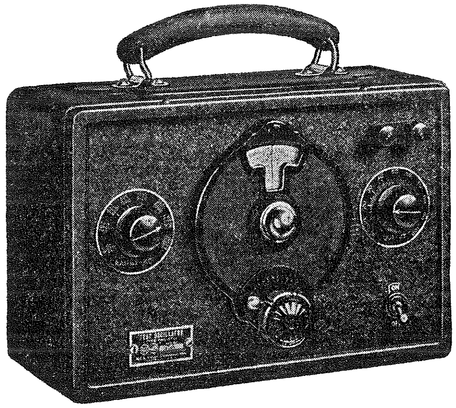
The Chart shown below provides a quick method of determining several unknown factors when one or more are known. The Chart covers a very wide range, namely, from 10 micro-henries to 100 henries inductance, 10 cycles to 50,000 kilocycles, 1 ohm to 10 megohms and 1 micro-microfarad to 10 microfarads. If, for example, one wishes to know the capacitance to use with a 10 henry inductor to have it resonate at 50 cycles, it can be readily seen that it would be a 1 mfd. capacitor. This is determined by finding the intersection of the vertical line representing 10 henries and the oblique line representing 50 cycles. The intersection occurs at the horizontal line representing 1 mfd. The other oblique line at this intersection represents the impedance at this frequency. This is approximately 3000 ohms.



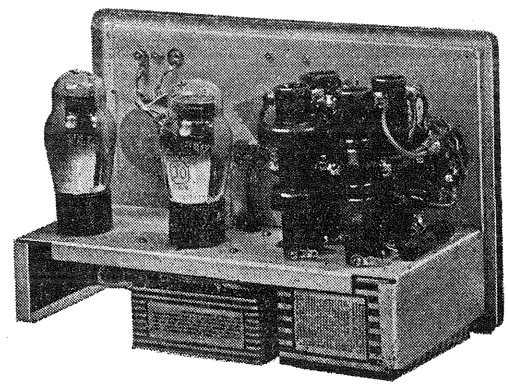
RCA

Full Range Test Oscillator

Type TMV-97-B



Front View



Rear View of Chassis

The RCA Full Range Type TMV-97-B Test Oscillator is a modulated R. F. oscillator which supersedes the Type TMV-97-A. New features are a wider frequency range, an improved calibrated tuning dial (reading in frequency) and a direct-reading range switch. All older features such as small compact size, light weight, self-contained batteries, etc., of the Type TMV-97-A are retained.

The frequency range extends continuously from 90 K. C. to 25,000 K. C. (3300–12 meters) and is divided into eight bands. This covers all intermediate, broadcast, police and short-wave frequency line-up points of all makes of receivers. An eight-position range switch provides for the selection of any desired band. An attenuator (output control) gives a means of adjusting the output to any level. This is very important in modern receivers, due to the increasing practice of combining the automatic volume control with other tubes.

Of special interest to amateurs and experimenters is the simplicity with which the modulation may be eliminated. This may be done by the use of a special adapter in the modulator socket. The oscillator then may be used as a heterodyne oscillator for short-wave superheterodyne receivers or for heterodyning the I. F. frequency of all-wave receivers to permit reception of pure CW signals.

Proper servicing of the simplest receivers is impossible without an oscillator. New designs covering an increasingly higher frequency range make the use of such an oscillator imperative. The TMV-97-B Oscillator fills the need for such apparatus at a price heretofore considered impossible

SPECIFICATIONS

CIRCUIT—A tuned-grid, plate-modulated circuit is used, which gives good stability over a wide range of voltage and climatic conditions. The output is modulated 50% at 400 cycles.

RADIOTRONS—Two Radiotrons RCA-30 are used, one as an R. F. oscillator and one as an A. F. modulator.

BATTERIES REQUIRED—One 22½ volt "B" battery and one 4½ volt "C" battery are used. The "C" battery provides filament power for the Radiotrons, the filaments of which are connected in series.

SIZE—Height 8½ inches (including raised handle), case alone 6½ inches, width 9¾ inches, depth 4½ inches.

WEIGHT—5 lbs., including batteries.

SWITCH—A toggle-type operating switch for turning the oscillator "on" and "off" is mounted on the front panel.

FREQUENCY RANGE—90 K. C.–25,000 K. C. by eight bands. The Range Switch is located on the front panel and marked directly in frequency.

OUTPUT—Two binding posts on the front panel, together with an attenuator, give an easy means of connecting and adjusting the output.

DIAL—Variable vernier dial adjustable from 6:1 to 20:1 speed reduction. The dial glass has been made thicker so that the indicator line is very close to the dial, thus avoiding a possible parallax.

CALIBRATION—The dial is calibrated directly in frequency to an accuracy of ±3%. Complete individual calibration may be obtained at an additional cost of $5.00.

CASE—The entire oscillator is enclosed in a black wrinkle-finished aluminum case provided with a leather handle.

RCA Tools and Accessories

The following tools and accessories are useful for servicing Radio Receivers, Combinations and Short-Wave Instruments of all types and manufacture.

Alignment Tool

Stock No. 4160 **Net Price $0.60**

The Stock No. 4160 Alignment Tool is a bakelite shaft combination screwdriver and socket wrench. The metal screwdriver bit is so shaped that the increase in capacity caused by its touching a trimmer screw is offset by the reduction in inductance caused by its shape. This is very important when making adjustments on all-wave receivers where the screwdriver must be inserted through the end of the coil. The socket end fits the main tuning capacitor trimmer adjustment screws used on numerous RCA Victor Receivers. The bakelite shaft is 7/32″ diameter, which gives entrance to ¼″ holes, used on older model Radiola receivers.

Alignment Wrench

Stock No. 7065 **Net Price $0.50**

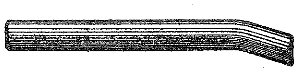
The Stock No. 7065 Alignment Wrench is a combination screwdriver and alligator jaw end wrench. The metal screwdriver bit is shaped so that it will have a minimum effect on the alignment of the set when it touches a trimmer screw. The end wrench is suitable for adjusting trimmer screws that are accessible only from the side. The shaft is of bakelite, 7/32″ diameter and the overall length is 5½″.

Riveting Punch

Stock No. 10987 **Net Price $0.50**

The Stock No. 10987 Riveting Punch is a special metal punch for use with a riveting anvil. The punch may be used with the rivets usually used on radio receivers and permits the service man to make a factory type repair, instead of using machine screws to replace rivets. The punch is 5/16″ in diameter and 5½″ long.

Riveting Anvil



Stock No. 10988 **Net Price $0.70**

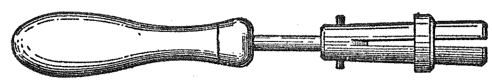
The Stock No. 10988 Off-Set Riveting Anvil is a special anvil that permits riveting in places ordinarily inaccessible. It is to be used in conjunction with a riveting punch such as Stock No. 10987. The Anvil is 5/16″ in diameter and 3½″ long.

Tuning Wand

Stock No. 6679 **Net Price $1.10**

The Stock No. 6679 Tuning Wand is a special alignment tool which makes possible the checking of alignment in all-wave receivers without disturbing the adjustment of the trimmer capacitors. The tool consists of a bakelite rod having a brass cylinder at one end and a special finely divided iron core at the other end. Inserting the brass cylinder into a coil lowers its inductance, while inserting the iron increases the inductance. From this it is evident that before adjusting trimmers, the adjustment may be checked by inserting each end of the wand into the coil. Proper adjustment is evidenced by a reduction in output with either end of the wand inserted into the coil.

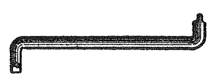
Knurled Nut Wrench

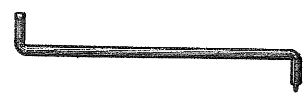


Stock No. 10982 **Net Price $1.20**

The Stock No. 10982 Knurled Nut Wrench is a special wrench designed for tightening or removing the knurled nuts such as are used with toggle type switches. These nuts are ordinarily impossible to remove or tighten without marring. The wrench will hold a nut from 5/8″ to ½″ diameter. The overall length is 8½″.

Off-Set Screwdrivers



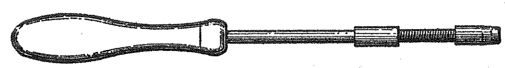


Stock No. 3064
Net Price $0.50

Stock No. 2930
Net Price $0.50

The Stock Nos. 3064 and 2930 Off-Set Screwdrivers are useful for making adjustments to remote control units and other small screws that are inaccessible with an ordinary screwdriver. The No. 3064 screwdriver is 2½″ long while No. 2930 has an overall length of 4⅜″.

Socket Wrench



Stock No. 10983 **Net Price $1.80**

The Stock No. 10983 Socket Wrench is a special flexible end socket wrench designed for adjusting the alignment screws of the 1929 and 1930 Victor Receivers, Models R-32, R-35, etc. The overall length is 8¾″.

MANUFACTURED BY

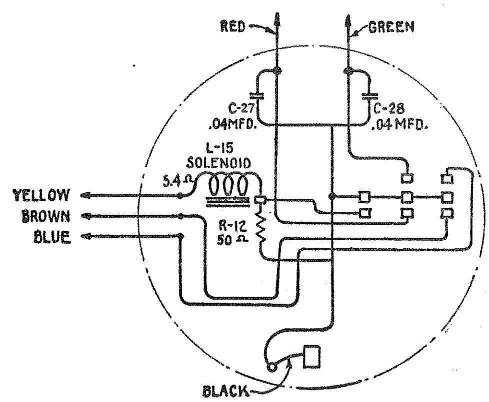
RCA Victor Company, Inc.

CAMDEN, N. J., U. S. A.

Printed in U. S. A.

RCA Victor
Sealed Replacement Vibrator
Stock No. 7604 for Model M-34 *only*

Stock No. 7604 Vibrator



Schematic Diagram

The RCA Victor Sealed Replacement Vibrator is an improved inverter-rectifier unit recommended for replacement use in the RCA Victor M-34 Automobile Receiver. High efficiency, long life and wide input voltage range are inherent features of this unit.

Proper adjustment of vibrators of this type is dependent upon laboratory equipment of advanced design. To insure proper adjustment and freedom from tampering, the Stock No. 7604 is sealed in such a manner that adjustment cannot be made without breaking the seal. This unit carries the Standard RCA Victor Guarantee for ninety days, provided the seal is unbroken.

SPECIFICATIONS

Size—Height, 4½ inches; Diameter, 2½ inches.

Input Voltage—Four to eight volts. The life of the vibrator varies inversely with the input voltage.

Circuit—Mechanical inverter with full-wave mechanical rectifier.

Output Voltage—Approximately 265 volts at 50 M.A. with 6 volts input.

Shielding—Double aluminum case with felt insulator. The entire vibrating unit is rubber-mounted.

Efficiency—Approximately 60%.

Seal—A lead seal is provided to prevent removal of the shielding cans without breaking the seal.

[List Price $5.00]

RCA Victor Company, Inc.

CAMDEN, N. J., U. S. A.

Printed in U. S. A.

Dealer's and Servicemen's Kits

of RCA Victor Factory Tested Parts

The first of a series of Dealer's and Servicemen's Kits to be offered is now ready for shipment. It is prepared for the 6-tube table, console and combination models of the "Selective Short Wave" Superheterodyne Receivers.

CONTENTS

Handy Parts Kit for 6-Tube RCA Victor Models 121, 122, 221, 321 and G. E. Models K-64, M-65, M-68

Qty.	*Stock No.*	*Description*	*Also Used in*	*Unit List*	*Extension*
1	9428	Cone (Table Model)	R-37, R-38, 112, 141B, 241B, 310	$1.00	$1.00
1	8935	Cone (Console Model)	RE-81, R-70, R-73, R-75, 210	1.05	1.05
1	9446	Power Transformer		5.40	5.40
2	6707	Glass (Table)		.20	.40
2	6614	Glass (Console)	220, 222, 140, 141, 240, AVR-1	.30	.60
1	6703	Capacitor Pack		2.46	2.46
1	6476	Output Transformer	RE-40, R-37, R-38	1.44	1.44
1	6697	1st IF Transformer		1.80	1.80
1	6698	2nd IF Transformer		1.78	1.78
1	6695	Volume Control		1.20	1.20
			Total Cost at List Prices		$17.13

A part instantly available when need arises means a better satisfied customer. Your patrons do not forget when delays cause them to miss their most favored programs. The Handy Kit is your evidence to prospective customers that should need arise, you are prepared to handle their service requirements immediately.

IMPORTANT

DEALER COST

$9.26

DEALER PROFIT

$7.87

Through the prompt action which you can take when called upon, you will secure new service business or new prospects for receiver sales. The Handy Kits of RCA Victor Factory Tested Parts are an investment in GOOD WILL which pays dividends in increased business. Factory TESTED PARTS ARE:

DESIGNED FOR THE JOB

BY

RCA Victor Company, Inc., Camden, N. J.

Printed in U. S. A.

MODERN TUBES FOR MODERN RECEIVERS

In the initial period of radio tube development and application, the same tube type—usually a triode—was used in every socket of a receiver. Obviously enough, one tube type could not possibly meet all receiver requirements to the best advantage. Thus, out of this pioneering grew the development of tubes to give optimum performance in particular applications—and even to combine within one bulb functions which formerly required the use of two or more tubes. This transition from "general-purpose" tubes to the highly efficient and sensitive "specialty" types has made possible the refinements of modern radio receivers, as, for example, high sensitivity, knife-edge selectivity, great power output, natural tone quality, automatic volume control, interchannel noise suppression and efficient operation—available for all classes of service—city, farm, and mobile alike.

RCA Victor sets are synonymous with modern receiver design. A number of representative examples are discussed below.

The automobile superheterodyne M-34 employs four tubes: one RCA-78, one RCA-6A7, one RCA-6B7, and one RCA-89. The RCA-78, a Triple-Grid Super-Control type, is used in the radio frequency (r-f) stage as a pentode r-f amplifier. It was selected because of its long "cut-off" feature which enables it to handle large input signal voltages with minimum cross-modulation and distortion. The RCA-6A7 operates simultaneously as a combined mixer (first detector) and oscillator to produce the intermediate frequency. The pentode section of the RCA-6B7 acts as the intermediate-frequency (i-f) amplifier which feeds into the diode units of the same tube. The diodes are connected for use as a half-wave second detector and arranged to provide automatic-volume-control (a.v.c.) voltage for the r-f and i-f stages. The audio output from the second detector is reflexed through the pentode section and then fed to the RCA-89. This tube is a Triple-Grid Power Amplifier type, with external connections for each grid. It may be used as (1) a Class A Power Amplifier Triode, (2) a Class A Power Output Pentode, and (3) a Class B Power Output Triode. In the M-34, the RCA-89 is connected as a Power Output Pentode in order to give good output with the relatively small input signal voltages. The tubes in this receiver are of the 6.3-volt heater type and are operated directly from the 6-volt car battery. The performance of this set is superior to that of many earlier a-c models employing a larger number of tubes.

The Model R-38 is a typical example of a modern a-c receiver designed to operate from the power line. It is a superheterodyne employing two RCA-58's, one RCA-2A7, one RCA-2B7, one RCA-2A5, and one RCA-80. The RCA-58, a Triple-Grid Super-Control Type designed especially for a-c operation, is used in the r-f and i-f amplifier stages as a pentode amplifier. Like the RCA-78, its remote "cut-off" feature enables it to handle large input signal voltages with minimum cross-modulation and distortion. The RCA-2A7 is used as a combined oscillator and mixer tube to generate the intermediate frequency. This tube is similar to the RCA-6A7 except that it contains a heater cathode designed for 2.5-volt a-c operation. The versatile RCA-2B7 is employed as a second-detector (diode), a.v.c. tube and first audio-frequency (a-f) amplifier. It is similar to the RCA-6B7 but designed for use in 2.5-volt a-c receivers. The RCA-2A5 is used in the last audio stage as a power output pentode. It is capable of giving high audio output with a small input signal. The feature of using a heater-cathode in the design of this tube assures a very low hum-level in the output. The RCA-80 is used as a full-wave rectifier. This popular high-vacuum rectifier tube is capable of handling the load of the average receiver and gives quiet output without the use of r-f filters and electrostatic shielding.

In the battery-operated receiver field, the superheterodyne model R-51-B illustrates RCA Victor design and merits discussion. This set employs three RCA-34's and seven RCA-30's. These tubes have 2.0-volt filaments and draw only 60 milliamperes of filament current per tube. The RCA-34 is an r-f pentode with super-control characteristics. This type is used in the r-f, first-detector, and i-f positions of the receiver. Like other Super-Control tubes it is capable of handling large-input signals with minimum cross-modulation and modulation-distortion. The RCA-30 is a triode. This type is used as an oscillator, second detector-a.v.c. tube, and Class A and B a-f amplifier. The audio section of the R-51-B receiver consists of a single 30 driving two 30's in a balanced Class B circuit. This stage drives the output Class B stage employing another pair of 30's. The R-51-B—due to the design of tubes for this particular service—compares favorably in performance with many a-c receivers, yet draws so little power as to permit economical battery operation.

The Model 140 embodies the all-wave feature, made possible by skillful coordination of efficient tubes and circuit design. A tuned radio-frequency stage employing the RCA-58 precedes a modern heterodyne circuit. For the higher frequencies (8,000–18,000 kc.) two r-f stages are used in order to minimize extraneous signal interference (image-frequency response, etc.), to improve the signal-to-noise ratio as well as to make automatic volume control more effective. These stages, as well as the i-f stage, use an RCA-58. An RCA-2A7 is used as a mixer tube. This tube is especially desirable inasmuch as it helps to simplify circuit construction, which is bound to be somewhat complicated in any multi-tube, all-wave receiver. The diode unit of the RCA-2B7 acts as the second detector-a.v.c. tube, while the pentode unit acts as an a-f amplifier to supply audio-frequency voltage to the RCA-56 driver. This tube in turn feeds an RCA-53 Class B Twin Amplifier, a tube which combines in one bulb two high-mu triodes designed for Class B operation. An RCA-80 supplies the rectified voltage for this receiver.

Model 280 is a twelve-tube superheterodyne a-c receiver incorporating many refinements, such as two-band operation (540–1500 kc. and 1400–2800 kc.), automatic volume control and silent-tuning control (noise suppression or "silencer"). The tube complement consists of four RCA-58's, four RCA-56's, one RCA-55, two RCA-59's, and one RCA-5Z3. The RCA-58 is used in the r-f amplifier, first detector, and in the signal and a.v.c. intermediate stages. RCA-56's are employed in the high-frequency oscillator and the a.v.c. stage. In the latter case it is used as a diode, a.v.c. voltage being obtained from the voltage drop across its grid-circuit resistor. RCA-56's are also used as a push-pull audio frequency amplifier to drive two RCA-59's in a balanced Class B power amplifier circuit. The RCA-55 diode section is used as a half-wave second detector. Audio-frequency voltage is obtained from this unit to supply the triode audio-amplifier of the same tube. An RCA-5Z3 is employed as a full-wave rectifier to supply the d-c plate load for the receiver.

Representative among the RCA Victor universal a-c–d-c receivers is the model R-18-W. It uses one RCA-78, one RCA-77, one RCA-38 in a tuned radio-frequency circuit, and one RCA-25Z5. These tubes were chosen because of their favorable performance at low plate voltages. The r-f stage employs the RCA-78 because of its super-control feature. The detector uses the RCA-77. The latter tube is a Triple-Grid type especially useful as a biased detector because of its ability to deliver a large a-f output voltage with relatively small input voltage. The RCA-38 pentode is used for several reasons. First, because it has a 0.3 ampere heater which permits series operation with the heaters of the other tubes in the receiver. Second, because it requires only a small input signal for full output. It is necessary to have such a tube in this position since the gain offered by only two preceding tubes is not very high. The Voltage-Doubler Rectifier RCA-25Z5 is unique in design. It consists of two heater-cathode, half-wave rectifiers enclosed in one bulb. The heater is common to both rectifier diodes. The tube may be connected as either a half-wave rectifier, full-wave rectifier, or voltage-doubler rectifier. In the case of the R-18-W, a switching arrangement permits voltage-doubler operation when the receiver is connected to the a-c line while the tube is disconnected from use (except the heater) when the set is operated from a d-c line. The heaters of all tubes in the R-18-W may be operated from a-c or d-c. They are connected in series with a voltage-dropping resistor across the supply line.

This brief discussion has been set forth to illustrate the close coordination of radio tube and circuit design principles that are observed in the construction of RCA Victor receivers. The models described are representative and incorporate the modern refinements that go to make radio reception so much more worthwhile.