

INSTRUCTION BOOK

FOR

MODEL S-36

RADIO RECEIVING EQUIPMENT

FOR

AMPLITUDE AND FREQUENCY MODULATED SIGNALS

FREQUENCY RANGE — 27.8 to 143 MEGACYCLES

the hallicrafters *co.*

CHICAGO, ILL., U. S. A.

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Figure 1. Model S-36 Receiver, front view



INSTRUCTION BOOK FOR MODEL S-36

RADIO RECEIVING EQUIPMENT

A. DESCRIPTION OF EQUIPMENT

A-1. GENERAL - The Model S-36 radio receiving equipment consists of an ultra-high frequency receiver mounted in a table mounting cabinet. The receiver may be removed from its cabinet and mounted directly onto a standard rack without any mechanical alterations.

A-2. RECEIVER UNIT - The Model S-36 receiver is an ultra-high frequency radio receiver capable of receiving amplitude and frequency modulated radio signals within a frequency range of 27.8 to 143 megacycles. Refer to Fig. 2 for circuit details, and to Fig. 7 for location of important parts.

The tube complement is as follows:

- V₁ - Type 956 (Acorn) radio frequency amplifier
- V₂ - Type 954 (Acorn) first detector-mixer
- V₃ - Type 6AC7 or 1852 first I.F. amplifier
- V₄ - Type 6AB7 or 1853 second I.F. amplifier
- V₅ - Type 6SK7 third I.F. amplifier
- V₆ - Type 6H6 A.M. detector and automatic noise limiter
- V₇ - Type 6AC7 or 1852 F.M. limiter
- V₈ - Type 6H6 F.M. detector
- V₉ - Type 6CS6 audio amplifier

- V₁₀ - Type VR150 voltage regulator
- V₁₁ - Type 6V6GT power audio amplifier
- V₁₂ - Type 6V6GT power audio amplifier
- V₁₃ - Type 5Z3 rectifier
- V₁₄ - Type 6J5 beat frequency oscillator
- V₁₅ - Type 955 (Acorn) high frequency oscillator

The circuit is that of a conventional superheterodyne receiver preceded by one stage of tuned radio frequency amplification. The intermediate frequency amplifier of the superheterodyne circuit terminates in both amplitude modulation and frequency modulation detector circuits which can be switched to the same audio amplifying system by means of the front panel AM/FM switch, thus providing either type of reception at will. Refer to Fig. 2 for block diagram.

This receiver tunes through a frequency range of 27.8 to 143 megacycles in 3 bands.

- Band 1 - 27.8 to 47 MC.
- Band 2 - 46 to 82 MC.
- Band 3 - 82 to 143 MC.

Band switching is accomplished with a specially designed ceramic switch which operates in the antenna, first detector and oscillator circuits.

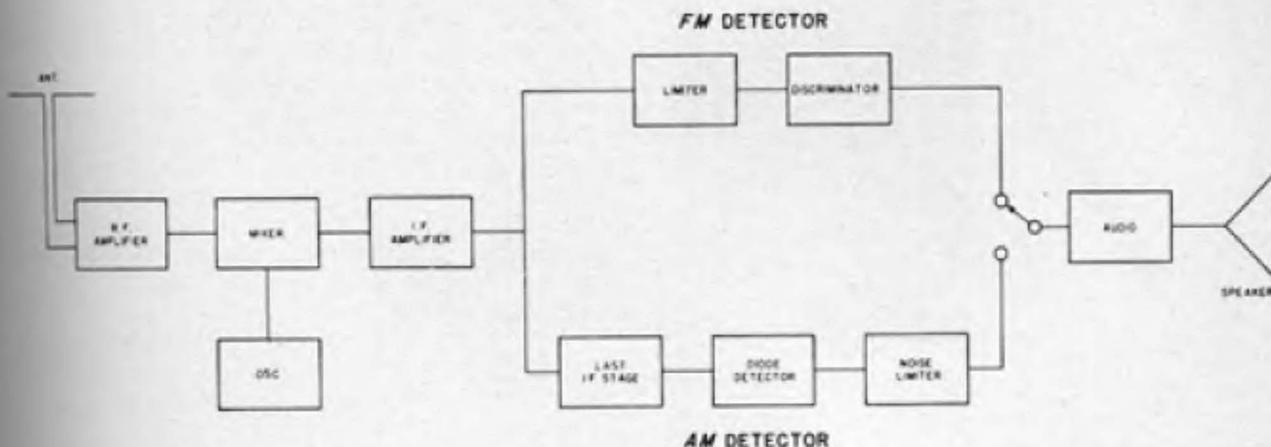
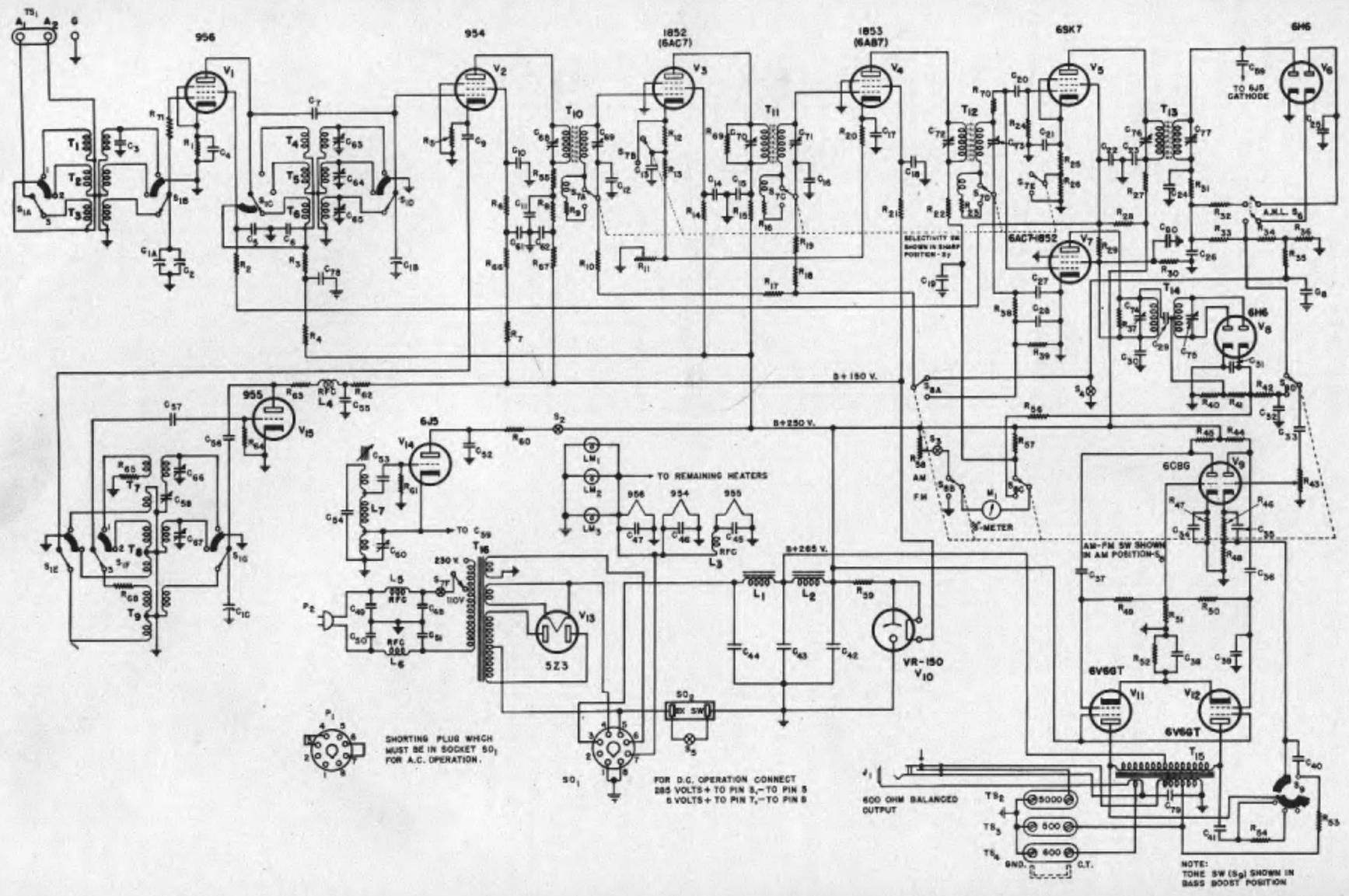


Figure 2. Model S-36 Receiver, block diagram

Figure 3. Model S-36 Receiver, schematic wiring diagram



A-3. CIRCUIT DESCRIPTION - The signal enters the receiver through the antenna terminals and flows through the primary of the first R.F. transformer, T-1. A voltage is induced in the secondary which is then applied to the grid of the first R.F. tube V-1. Refer to Fig. 3.

The amplified signal flows through the plate circuit of V-1 and R.F. transformer T-4. A voltage is induced in the secondary and applied to the grid of the mixer tube V-2.

Another voltage is applied to the cathode of tube V-2. This voltage is generated by the high frequency circuit of V-15 and differs from the frequency of the received signal by 5.25 MC. These two signals heterodyne each other in the plate circuit of the tube and produce a beat note whose frequency is equal to the difference of the two signals applied to the mixer tube or 5.25 MC.

The primary of transformer T-10 is tuned to this frequency and a voltage at this frequency is thereby developed across it. This induces a voltage across the secondary of T-10 which is applied to the grid of tube V-3. The received signal is then amplified at intermediate frequency through transformer T-11, Tube V-4, transformer T-12, and tube V-5. Transformer T-13 couples to one of the diodes in tube V-6. The signal is here rectified and the amplitude modulation of the carrier causes a similar audio frequency signal to appear across resistors R-33, R-34, and R-36 in series. That part of the audio frequency voltage across R-34 and R-36 in series is connected to the audio frequency gain control through condenser C-33. The voltage applied to the grid of one of the triodes in the double triode tube V-9 is varied by operation of volume control R-43. The audio frequency voltage appearing in the plate of tube V-9 is applied to the grid of tube V-12 and also to the grid of the other triode in tube V-9. Thus tube V-9 operates as a push-pull A.F. amplifier feeding the grids of the push-pull output tubes V-11 and V-12. The output of these tubes flows through transformer T-15. The secondary of this transformer has a 5000 ohm winding with a tap at 500 ohms. In addition, there is also a center tapped 600 ohm winding which is connected to the phone jack J-1. This winding is balanced to ground and both sides of the phone jack to which it connects are insulated from the chassis. The audio amplifier circuit util-

izes degeneration to improve its fidelity. By means of the tone switch the degeneration is removed at the low frequencies which gives an appreciable base boost in the output. The tone switch also serves to connect the resistor condenser network R-54, C-41 across the primary of T-15 which reduces high frequency response. In the low frequency position this switch short circuits R-54 thus giving maximum reduction of high frequencies.

The voltage applied to the grid of tube V-5 is also applied to tube V-7. This tube acts as a limiter, which means the signal voltage appearing across its plate circuit is limited to a certain pre-determined value. Amplitude modulation of the carrier, whether intentional or caused by static or other forms of interference is thus effectively reduced. Frequency modulation of the carrier, however, is unaffected. The amplitude limited signal voltage appears across the primary of transformer T-14 and voltage is induced in the secondary of this transformer which reacts with the voltage coupled from the primary through condenser C-29 to produce frequency discriminating action. When the frequency of the signal flowing through T-14 is exactly 5.25 MC the voltages across resistors R-40 and R-41 are equal and opposite. A change in the frequency in one direction produces a positive difference between the voltage across resistors R-40 and R-41. A frequency change in the opposite direction produces a negative voltage difference. In this way frequency modulation of the received carrier produces a similar audio frequency voltage across resistors R-40 and R-41. This is applied through the high frequency deemphasis network R-42, C-32 to audio frequency volume control R-43. From here it feeds into the audio frequency amplifier as previously outlined.

The beat frequency oscillator consisting of tube V-14 and reactor L-7 produces a 5.25 MC output which is coupled to the rectifier tube V-6 to permit the reception of c-w signals.

The other diode in tube V-6 is used as an automatic noise limiter to reduce the amplitude of sharply peaked interference when receiving amplitude modulated signals. This greatly increases the intelligibility of such reception in the presence of undesirable noise, such as that caused by ignition equipment.

The power supply line cord feeds through the filter network C-49, L-5, C-48 and C-50, L-6, C-51 before connecting to the primary of the power transformer. This filter ef-

fectively eliminates interference feeding into the receiver from the power supply mains. The output of the 5Z3 rectifier is filtered by means of iron core reactors L-1 and L-2 and filter condensers C-42, C-43 and C-44. The voltage regulator tube VR150 is connected to the output of the power supply through resistor R-59 and furnishes constant voltage to the plate supply of high frequency oscillator tube V-15, the screen and plate supply of mixer tube V-2 and the screen of tube V-4.

The "S" meter M-1 used for indicating the

strength of the carrier input is connected in the plate circuit of tube V-4. An increase in carrier strength increases the automatic volume control voltage supplied to this tube which in turn reduces the plate current, thus causing a change in the reading of meter M-1. This same meter is connected through a high resistance R-56 across resistors R-40 and R-41 in the FM position. When the receiver is tuned to the FM carrier this meter will indicate zero. Any slight deviation in the tuning from this point will cause the "S" meter to deflect in either direction.

B. INSTALLATION

B-1. CAUTION - The voltages exposed at the bottom of the receiver chassis are high, and care must be taken so that the operators hands do not contact any of the circuit connections during adjustment. Before making repairs requiring work underneath the receiver chassis the power cord should be removed from the supply receptacle.

B-2. UNPACKING - Carefully unpack and inspect the receiver for any possible damage during shipment. In case of damage a claim should be filed immediately with the transportation company.

B-3. INSTALLATION - After the set has been unpacked and before it is connected to its source of power be sure that all tubes, especially acorn tubes, are firmly located in their sockets. The acorn tubes can be reached by removing the cover of the R.F. assembly which is held in place by eight knurled nuts.

The antenna connects to the terminals at the rear of the chassis. Reference is made to Fig. 5. If a single wire antenna is used it should be connected to terminal A-1 and a jumper connected between terminals A-2 and G. If a concentric cable is used the inner conductor connects to A-1 and the same jumper remains between A-2 and G. If a two wire balanced or twisted pair transmission line is used, the two wires connect to A-1 and A-2 and the jumper is removed. In all cases terminal G should be connected to a good earth ground. The loudspeaker connects to the pair of terminals in the rear marked 5000 ohms.

The phone jack on the front panel connects to a 600 ohm output circuit both sides of which are insulated from ground. The center tap of this output winding connects to

a terminal on the rear apron marked 600 and may be grounded by connecting a jumper across both of the terminals on this terminal strip.

B-4. ANTENNA - Refer to Fig. 4. This figure shows several typical antenna installations. Where interference from man made static does not exist, the recommended installation is that of a long single wire shown in Fig. 4A.

Where there is considerable local interference and reception over a narrow frequency band is most desired the dipole installation shown in Figs. 4B and 4C is most effective. Where it is desired to cover a fairly wide frequency band, it is recommended that a dipole antenna designed for the highest desired frequency is used. A simple way of determining the length of each half of the dipole in inches is to divide 2770 by the frequency in megacycles. For reception at 42 megacycles for instance the use of the formula will show that the length of each half of the dipole will be 65.9" or approximately 5 ft. 6".

The antennae shown in Figs. 4B and 4C will give the best reception in the direction broadside to the length. The dipole antenna, operating at its fundamental frequency, will be found to be much more directional than the single long wire.

The receiving antenna should be directed in either a horizontal or vertical plane, depending upon polarization of the transmitted signal. When receiving over short distances the receiver antenna should be erected in the same plane as the transmitter antenna. For long distance reception the received signals are more often horizontally polarized which dictates the use of a horizontal antenna.

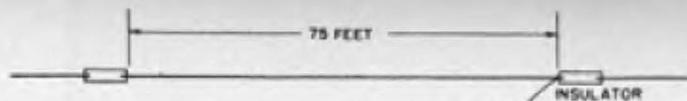


FIG 4A. SINGLE WIRE ANTENNA

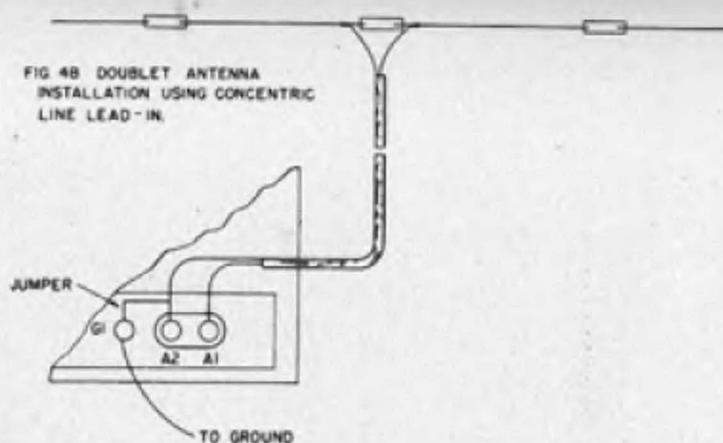
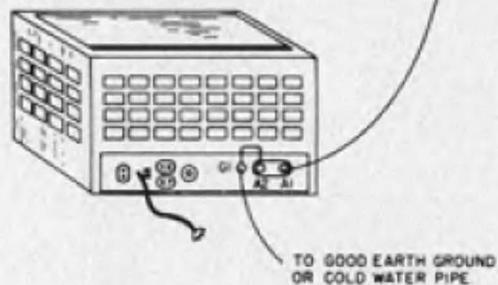


FIG 4B DOUBLET ANTENNA INSTALLATION USING CONCENTRIC LINE LEAD-IN.

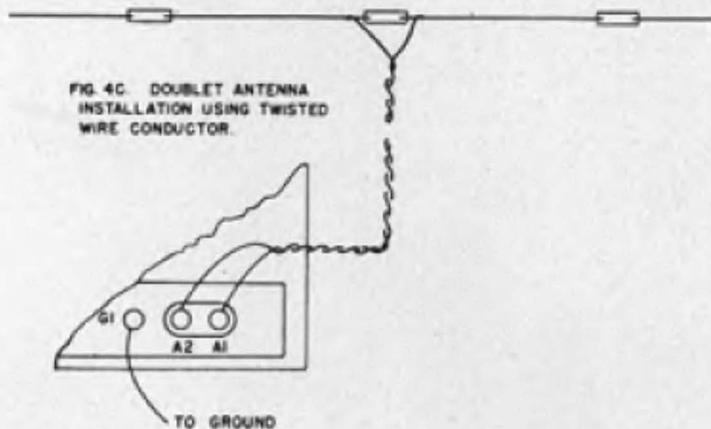


FIG 4C DOUBLET ANTENNA INSTALLATION USING TWISTED WIRE CONDUCTOR.

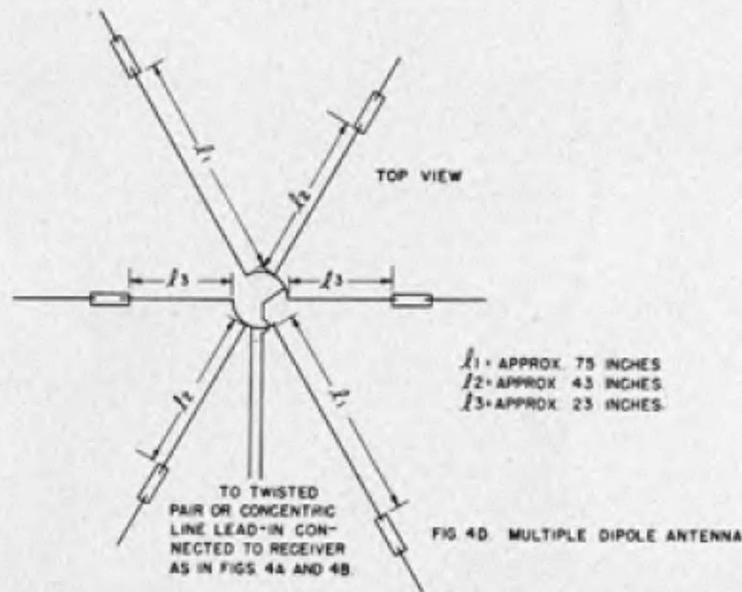


FIG 4D. MULTIPLE DIPOLE ANTENNA

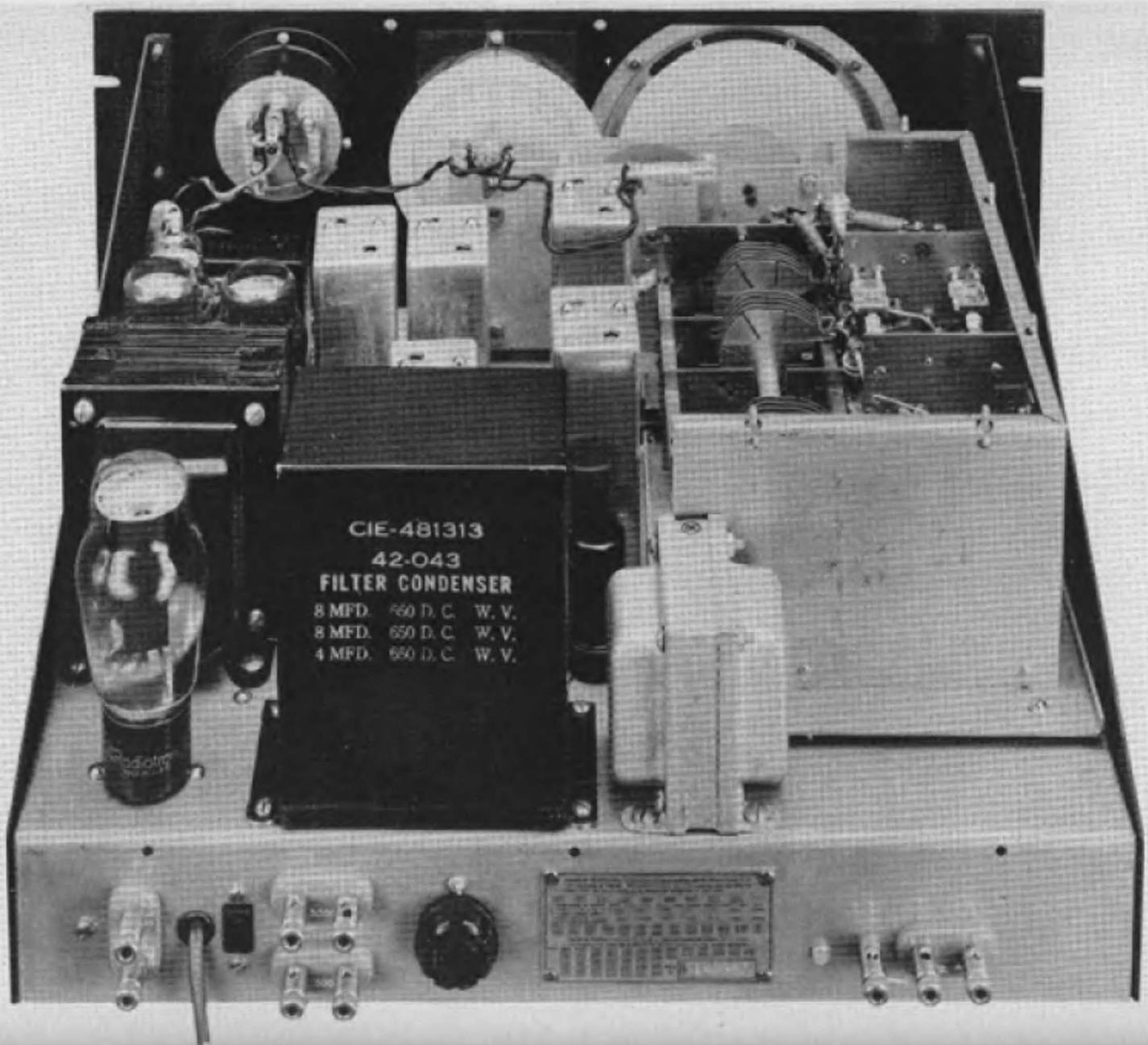


Figure 5. Model S-36 Receiver, rear view

C. ADJUSTMENT AND OPERATION

C-1. RECEIVER OPERATION - With all the connections made as described above, the receiver may be operated as follows:

- (a) Plug in phones, or connect speaker to 5000 ohm terminals at rear.
- (b) Set the SEND-REC. switch at RECEIVE. This switch prevents the receiver from operating when in the SEND position but allows the tube heaters to remain on.
- (c) Place the AM/FM switch in position to receive the type of modulation desired.
- (d) Turn the R.F. gain control clockwise as far as it will go.
- (e) Set the band switch to the desired band and then operate the hand-wheel tuning knob until a signal is heard and indicated on the tuning meter. For A.M. reception adjust for maximum "S" meter reading. For F.M. reception adjust the tuning to resonance as indicated by the zero center reading of the pointer on the red line. See Note (1) Tuning Meter.
- (f) Adjust the ANTENNA control for maximum signal for A.M. reception or minimum background noise if no modulation is present when an F.M. carrier is being received. See Note (2) Antenna Trimmer.
- (g) Adjust R.F. gain control for the desired speaker volume.
- (h) The AVC switch should be set at ON for normal reception.
- (i) In the presence of ignition interference the ANL switch may be set at ON, to increase the intelligibility of the received signal. Nor-

mally it should remain in the OFF position.

- (j) Where c-w reception is desired or where it is necessary to locate a weak carrier, the BFO switch may be set at ON. The pitch of the resulting beat note may be varied by adjusting the PITCH CONTROL directly above and to the right of the BFO switch.
- (k) The TONE control may be set to produce the type of tone modification desired from base boost through high fidelity to high frequency out-off.

Note (1) TUNING METER - When used in the AM position the tuning meter indicates the strength of the carrier received. The AVC switch must be set at ON and the R.F. gain control turned to the extreme clockwise position or this meter will not operate.

When tuning the receiver in the FM position the meter will deflect to one side when approaching a carrier, then swing back through zero and to an equal deflection on the other side of zero as the carrier is passed, then return to zero when tuned beyond the carrier. The zero center position of the pointer in the middle of the swing represents the correct setting for resonance.

Note (2) ANTENNA TRIMMER - The antenna trimmer is necessary to compensate for misalignment produced in the first tuned circuit by antenna variations. For the same antenna its setting will be approximately constant for a considerable range of frequencies. Adjust the antenna trimmer knob as indicated in paragraph C-1 (f). When operating this control at the high frequency end of Band 3 it may be necessary to re-adjust the tuning control after each adjustment of the ANTENNA control knob, manipulating both controls until maximum signal is heard.

D. ALIGNMENT AND SERVICE

D-1. RECEIVER ALIGNMENT - This receiver has been carefully aligned at the factory by qualified engineers and alignment should not be attempted unless it is known that the adjustments have been tampered with or that tubes of a different manufacture have been substituted. The equipment needed will be a signal generator capable of tuning from 28 to 130 MC., another or the same

signal generator tuneable to 5.25 MC (intermediate frequency), a non-metallic screw driver, a 50 ohm non-inductive resistor for a dummy antenna and an output meter.

The controls should be set as follows:

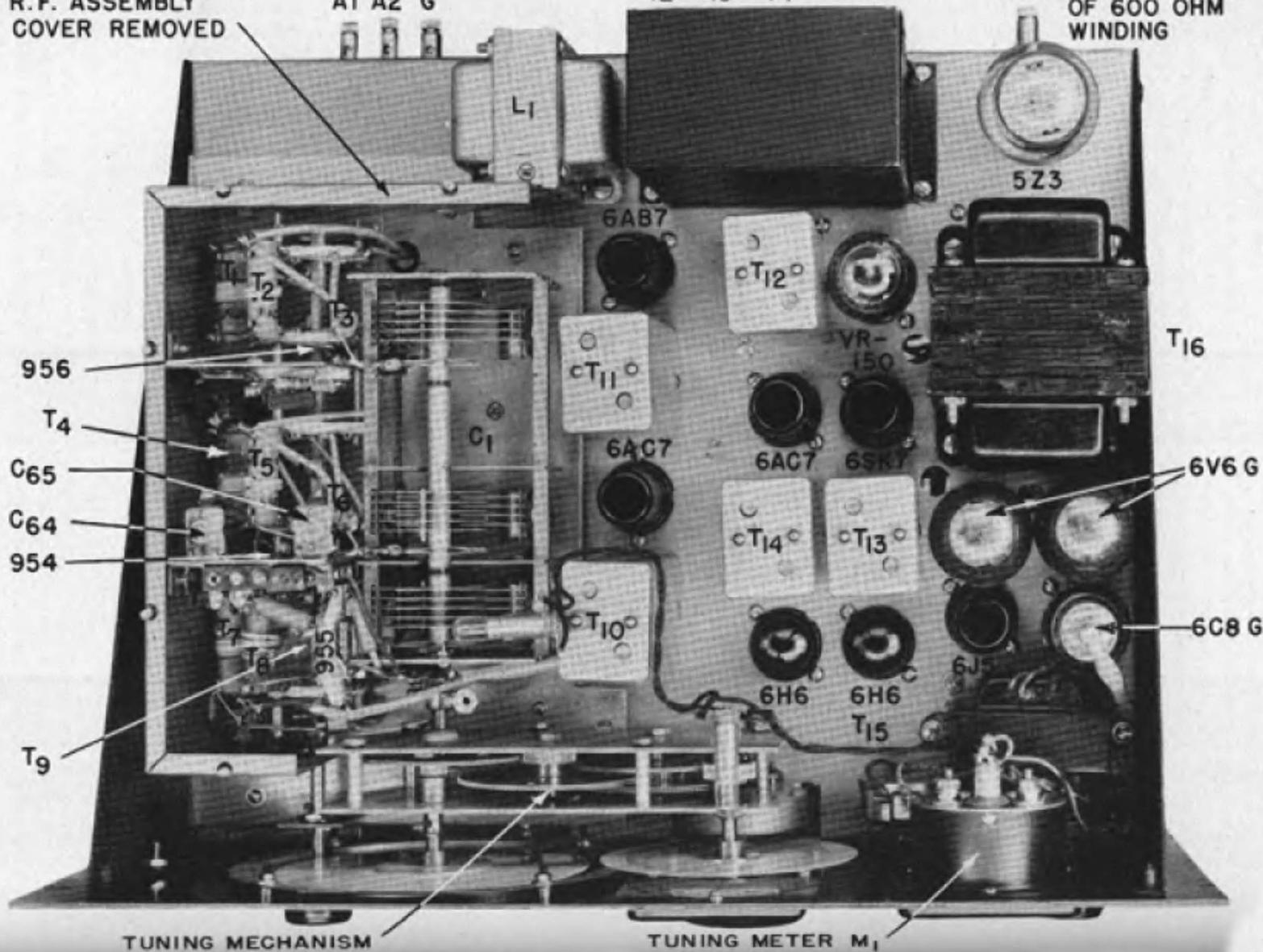
RF GAIN Control At Maximum
AF GAIN Control At Maximum

R.F. ASSEMBLY
COVER REMOVED

A1 A2 G

C42 C43 C44 COND.

TERMINALS FOR
GROUNDING CENTER-TAP
OF 600 OHM
WINDING



TUNING MECHANISM

TUNING METER M₁

Figure 6. Model S-36 Receiver, top view

BOTTOM

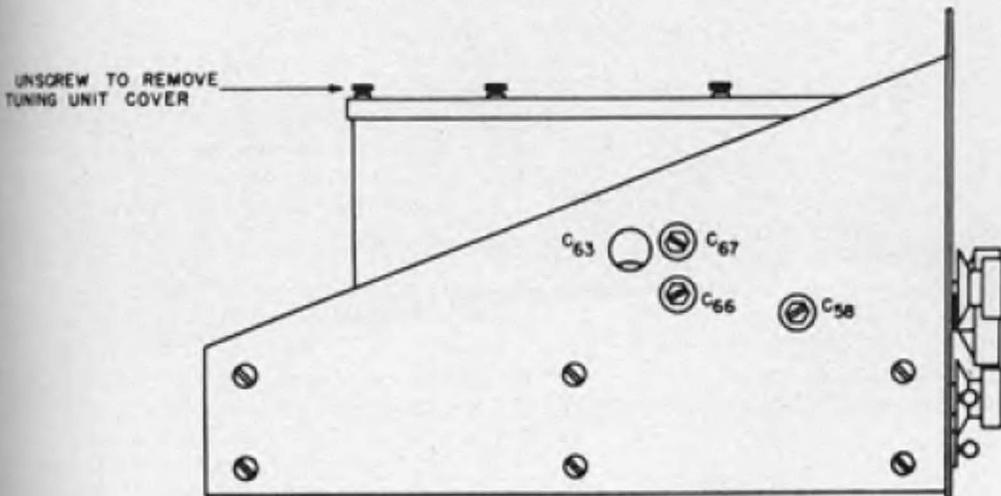
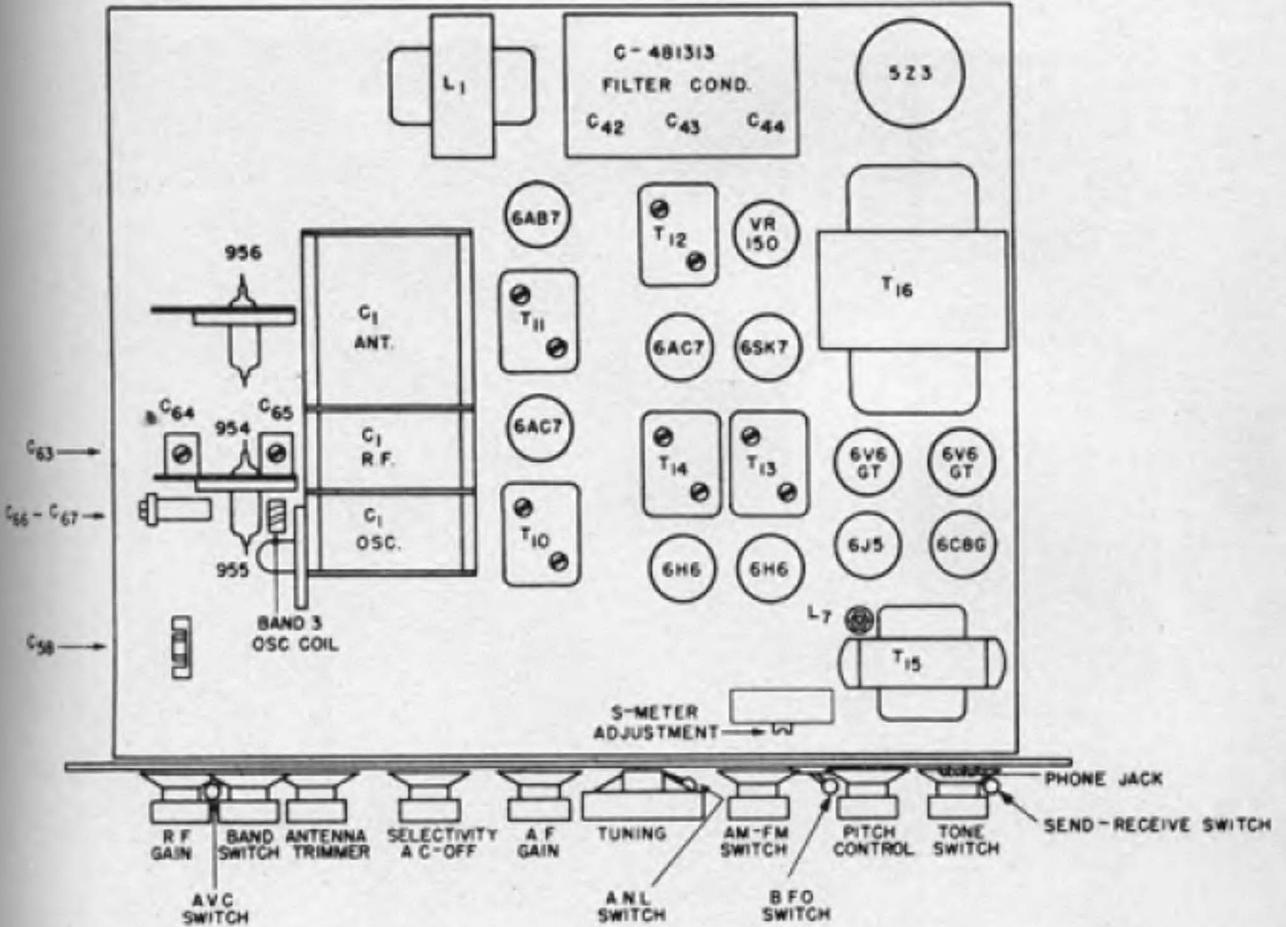
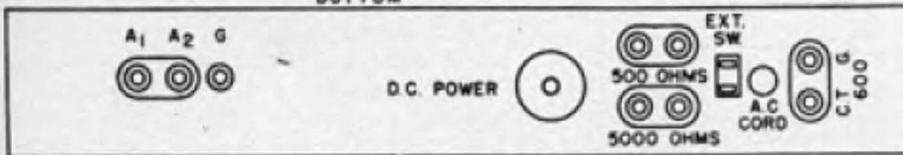


Figure 7. Model S-36 Receiver, top and side views showing location of important parts

SELECTIVITY Switch At SHARP
BAND SWITCH At Band 2
AM/FM Switch At AM
AVC Switch At OFF
ANL Switch At OFF
BFO Switch At OFF

(a) I.F. ALIGNMENT

Remove the grid connection to tube V-2 and connect a signal generator to the grid of the 954 converter (tube V-2), using either a small clip or a piece of flexible wire around the grid terminal. Do not attempt to solder to the tube as the heat is certain to crack the glass. Connect the output meter across the speaker terminals.

Tune the signal generator to 5.25 megacycles and align transformers T-10, T-11, T-12, and T-13 for maximum response.

A bakelite screw-driver with a metal or insulated tip is necessary for accurate alignment.

This alignment process should be repeated at least once to assure greatest possible selectivity.

To align the "discriminator" transformer T-13 set the selectivity switch at BROAD and the AM/FM switch at FM.

With the signal generator set at the frequency originally used for IF alignment and with the modulation left on. Rotate the trimmer across the discriminator (T-14) secondary (nearest the front of the chassis) until the signal drops to zero. As this point is approached very suddenly, turn the control very slowly. Now slightly detune the generator until the output meter gives a readable indication. Adjust the primary trimmer control of the discriminator transformer for maximum output. Reset the generator to the original frequency and check for zero output.

Next detune the signal generator to either side of resonance and note the maximum output in each case as indicated on the output meter. These values should be the same for good balance. If they are not, then tune the signal generator to the lower of the two peaks and adjust the primary until the output rises an amount equal to about half the difference of the two outputs previously noted.

Retest for balance as above and readjust the primary till both maximum readings are alike when the signal generator is detuned to either side of resonance.

If a balance cannot be obtained, it is an indication that the discriminator secondary trimmer control has been adjusted off its proper center and will require a very slight readjustment in either direction. The direction of adjustment that will cause the off-tune peaks to assume the same values is the correct one. Care must be taken in adjusting the discriminator secondary control as even a slight misadjustment will result in the distorted reception of frequency-modulated signals.

(b) R.F. ALIGNMENT

The Ferris Signal Generator Model 18B is recommended for alignment purposes. If this is not available, harmonics of a standard signal generator may be used. The controls should be set in the same position as for I.F. alignment.

Set the AM/FM switch at AM
Set the bandswitch on Band 1
Tune the generator and receiver to 42 MC

Adjust oscillator trimmer C-66 until the signal is heard. The frequency of the oscillator is higher than that of the signal. Next adjust trimmer C-63 and the antenna trimmer for maximum response. Refer to Fig. 7.

Tune both receiver and signal generator to 28 megacycles and adjust padder C-58 for maximum response while rocking the tuning control. Then repeat the alignment at the high frequency end as described.

BAND 2

Tune the receiver and signal generator to 75 megacycles. Adjust trimmer C-67 until the signal is heard. In this band, the frequency of the oscillator is lower than that of the signal. Adjust the antenna trimmer and trimmer C-64 for maximum response while rocking the gang condenser. No padder condenser adjustment is provided for the low-frequency end of this band.

BAND 3

Tune the receiver and signal generator to 120 megacycles. Adjust trimmer C-65 and the antenna trimmer for maximum response while rocking the gang. It is not recommended that the frequency of the oscillator in this band be adjusted except at the factory. Should it be impractical to return the receiver to the factory for adjustment, then the following instructions are included.

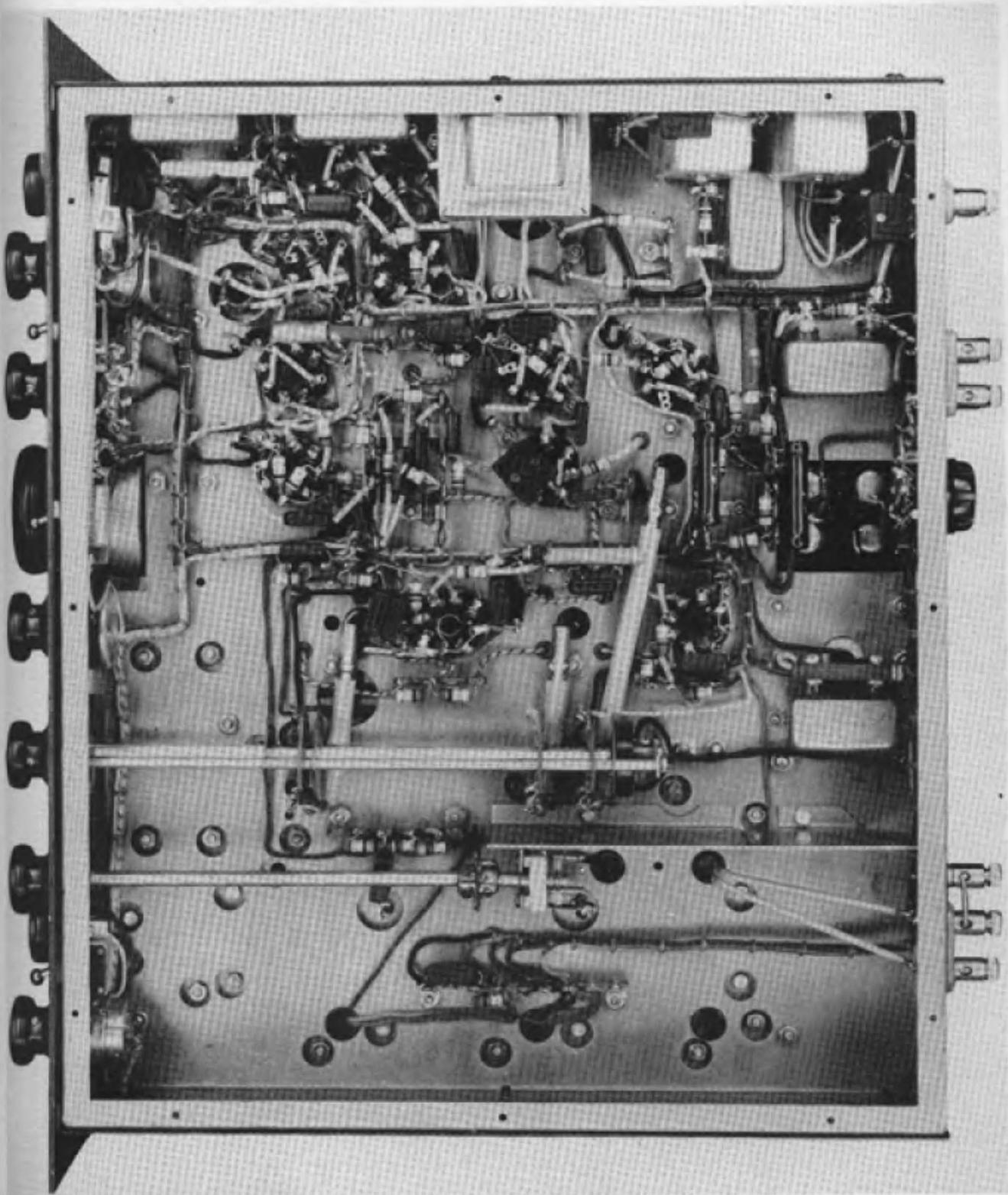


Figure 8. Model S-36 Receiver, bottom view

Remove the top cover and locate the high frequency oscillator coil. The white wire winding, one end of which is connected to a terminal on the form is the primary. By carefully shifting the free end of this winding the frequency can be changed over a sufficient range. This lead should be cemented in place with Q-Max or any other low loss cement when adjustment is completed.

Repeat the adjustment of C-65 as described above after shifting the frequency of the oscillator.

As in band 2, the frequency of the oscillator is lower than that of the signal. No padder condenser adjustment is provided for the low frequency end of this band.

D-2. MAINTENANCE - Routine maintenance should include keeping the units inside of the cabinet free from dust. If dust collects on the plates of the tuning condenser or the gear drive, it should be blown out with dry air.

The gear-drive will require a minute amount of light-machine oil at each of its bearings at least twice per year.

If the sensitivity of the receiver begins to fall off, - the tubes should be individually tested. In replacing original tubes which have tested O.K., care should be exercised to plug them back into the same socket. Acorn tubes should be inserted into the socket with the short end of the body in the socket.

D-3. TABLE OF TUBE SOCKET VOLTAGES

(Measured from socket pin to ground with 1000 ohm per volt meter)

TUBE	DESCRIPTION	ACORN TUBE ELEMENTS				
		HEATER	HEATER	PLATE	SCREEN	CATHODE
V-1 (956)	RF Amplifier	0	6.2 AC	155 DC	100 DC	2.5 DC
V-2 (954)	1st Detector-Mixer	0	6.2 AC	150 DC	65 DC	4.0 DC
V-15 (955)	High Freq. Osc.	0	6.2 AC	95 DC		0

SOCKET PIN NUMBERS

	1	2	3	4	5	6	7	8
V-3 (6AC7)	0	0	0	0	1.8 DC	140 DC	6.2 AC	225 DC
V-4 (6AB7)	0	0	0	0	1.8 DC	150 DC	6.2 AC	225 DC
V-5 (6SK7)	0	6.2 AC	5.5 DC	0	5.5 DC	95 DC	0	225 DC
V-6 (6H6)	0	6.2 AC	0	0	0	0	0	0
V-7 (6AC7)	0	6.2 AC	0	0	0	70 DC	0	70 DC
V-8 (6H6)	0	6.2 AC	0	0	0	0	0	0
V-9 (6C8G)	0	6.2 AC	95 DC	2.2 DC	0	105 DC	0	2.5 DC
V-10 (6V6GT)	0	6.2 AC	235 DC	230 DC	0	0	0	15 DC
V-11 (6V6GT)	0	6.2 AC	235 DC	230 DC	0	0	0	15 DC
V-12 (VR150)	0	0	155 DC	0	155 DC	0	155 DC	0
V-13 (5Z3)	260	250 AC	250 AC	260 DC				
V-14 (6J5)	0	6.2 AC	0	0	0	0	0	0

E. ELECTRICAL AND MECHANICAL DATA

E-1. POWER EQUIPMENT - The Model S-36 receiver draws 80 watts from the A.C. power mains.

E-2. POWER OUTPUT - Three watts of audio power can be obtained with less than 5% distortion. Audio fidelity is within plus or minus 3 db. from 40 to 10,000 cycles. Deemphasis compensation is included for F.M. reception.

E-3. WEIGHTS - The weight of the chassis

and cabinet together is 68 lbs. The weight of the chassis alone is 53 lbs.

E-4. DIMENSIONS - The overall dimensions of the receiver chassis installed in its table mounting cabinet are 19-1/8 inches wide, 9-3/8 inches high and 14-3/16 inches deep. Dimensions of the chassis alone are 19 inches wide, 8-23/32 inches high (these are the front panel dimensions) and 13-29/32 inches deep. This does not include the binding posts protruding from the rear side.

F. LIST OF REPLACEABLE PARTS

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFR. CODE	CONTR.'S PART NO.
R ₁	Resistor, 250 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Cathode bias for tube V ₁	ER	23BX251E
R ₂	Resistor, 1,000 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Screen decoupling for tube V ₁	ER	23BX102E
R ₃	Same as R ₂	Plate decoupling for tube V ₁		
R ₄	Resistor, 10,000 ohm, 20%, 2 watt, carbon, type BT-2	Plate decoupling for tube V ₁	IRC	23BV103F
R ₅	Resistor, 2,000 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Cathode bias for tube V ₂	ER	23BX202E
R ₆	Same as R ₂	Screen decoupling for tube V ₂		
R ₇	Resistor, 0.1 megohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Screen decoupling for tube V ₂	ER	23BX104E
R ₈	Resistor, 8 ohm, 20%, $\frac{1}{2}$ watt, carbon, type 504	Plate decoupling for tube V ₂	ER	23A008
R ₉	Same as R ₈	1st I.F. band expansion		
R ₁₀	Resistor, 0.1 megohm, $\frac{1}{2}$ watt, carbon, type 504 (Part of T ₁₀ . Shown for reference only)	AVC isolating	ER	23BX104E
R ₁₁	Resistor, 10,000 ohm, 20%, wire wound, variable, type RAC35	R-F gain control	CT	25C058
R ₁₂	Resistor, 35 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Cathode bias for tube V ₃	ER	23BX350E
R ₁₃	Resistor, 120 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Cathode bias for tube V ₃	ER	23BX121E
R ₁₄	Resistor, 40,000 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Screen decoupling for tube V ₃	ER	23BX403E
R ₁₅	Resistor, 300 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Plate decoupling for tube V ₃	ER	23BX301E
R ₁₆	Same as R ₈	2nd I.F. band expansion		
R ₁₇	Same as R ₇	AVC isolating		
R ₁₈	Same as R ₇	AVC isolating		

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFR. CODE	CONTR'S PART NO.
R ₁₉	Same as R ₇ . (Part of T ₁₁ . Shown for reference only.)	AVC isolating		
R ₂₀	Resistor, 200 ohm, 10%, ½ watt, carbon, type 504	Cathode bias for tube V ₄	ER	23BX201E
R ₂₁	Same as R ₂	Screen decoupling for tube V ₄		
R ₂₂	Same as R ₁₅	Plate decoupling for tube V ₄		
R ₂₃	Same as R ₈	3rd I.F. band expansion		
R ₂₄	Resistor, 0.5 megohm, 20%, ½ watt, carbon, type 504	Grid return for tube V ₅	ER	23BX504F
R ₂₅	Same as R ₁₅	Cathode bias for tube V ₅		
R ₂₆	Resistor, 800 ohm, 10%, ½ watt, carbon, type 504	Cathode bias for tube V ₅	ER	23BX801E
R ₂₇	Same as R ₂	Plate decoupling for tube V ₅		
R ₂₈	Resistor, 7,500 ohm, 5%, 10 watt, wire wound, type AB	Voltage divider	IRC	24BG752D
R ₂₉	Same as R ₅	Voltage divider		
R ₃₀	Resistor, 20,000 ohm, 20%, 2 watt, carbon, type BT-2	Voltage divider	CRL	23BV203F
R ₃₁	Resistor, 50,000 ohm, 10%, ½ watt, carbon, type 504	Diode filter for tube V ₆	ER	23BX503E
R ₃₂	Resistor, 1 megohm, 10%, ½ watt, carbon, type 504	A.N.L. resistor for tube V ₆	ER	23BX105E
R ₃₃	Same as R ₇	Diode load for tube V ₆		
R ₃₄	Resistor, 0.25 megohm, 10%, ½ watt, carbon, type 504	Diode load for tube V ₆	ER	23BX254E
R ₃₅	Same as R ₂₄	AVC isolating		
R ₃₆	Same as R ₃₄	Diode load for tube V ₆		
R ₃₇	Resistor, 15,000 ohm, 10%, ½ watt, carbon, type 504	Primary loading on discriminator transformer T ₁₄	ER	23BX153E

R ₃₈	Same as R ₃₁	Grid return for tube V ₇		
R ₃₉	Same as R ₃₄	Grid return for tube V ₇		
R ₄₀	Same as R ₇	Diode load for tube V ₈		
R ₄₁	Same as R ₇	Diode load for tube V ₈		
R ₄₂	Resistor, 0.2 megohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Deamphasis network for tube V ₈	ER	23BX204E
R ₄₃	Resistor, 1 megohm, 20%, wire wound, variable, type 35	A.F. Gain control	CT	25C059
R ₄₄	Same as R ₃₄	Plate load for tube V ₉		
R ₄₅	Same as R ₃₄	Plate load for tube V ₉		
R ₄₆	Resistor, 5,000 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Cathode bias for tube V ₉	ER	23BX502E
R ₄₇	Same as R ₄₆	Cathode bias for tube V ₉		
R ₄₈	Same as R ₃₂	Cathode bias for tube V ₉		
R ₄₉	Same as R ₃₄	Grid return for tube V ₁₁		
R ₅₀	Same as R ₃₄	Grid return for tube V ₁₂		
R ₅₁	Same as R ₇	A.F. balancing for tube V ₉		
R ₅₂	Resistor, 250 ohm, 20%, 2 watt, carbon, type 710	Cathode bias for tubes V ₁₁ and V ₁₂	CRL	23BV251F
R ₅₃	Resistor, 10,000 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Degeneration control for tube V ₉	ER	23BX103E
R ₅₄	Resistor, 4,000 ohm, 20%, 2 watt, carbon, type 710	Tone control for tubes V ₁₁ and V ₁₂	CRL	23BV402F
R ₅₅	Same as R ₈	Plate decoupling for tube V ₂		
R ₅₆	Resistor, 0.6 megohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Meter current limiting	ER	23BX604E
R ₅₇	Same as R ₁₂	"S" meter shunt		

REP. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFR. CODE	CONTR'S PART NO.
R ₅₈	Resistor, variable, 1,500 ohm, 20%, wire wound, type 25	"S" meter control	CT	25C060
R ₅₉	Resistor, 3,200 ohm, 5%, 10 watt, wire wound, type AB	Voltage dropping for tube V ₁₀	IRC	24BG322D
R ₆₀	Resistor, 25,000 ohm, 20%, 2 watt, carbon, type 710	Plate decoupling for tube V ₁₄	CRL	23BV253F
R ₆₁	Same as R ₃₁	Grid return for tube V ₁₄		
R ₆₂	Same as R ₁₅	Plate decoupling for tube V ₁₅		
R ₆₃	Same as R ₄₆	Plate decoupling for tube V ₁₅		
R ₆₄	Resistor, 20,000 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Grid return for tube V ₁₅	ER	23BX203E
R ₆₅	Same as R ₁₂	Grid current control on tube V ₁₅		
R ₆₆	Same as R ₂	Screen decoupling for tube V ₂		
R ₆₇	Same as R ₂	Plate decoupling for tube V ₂		
R ₆₈	Resistor, 6 ohm, 10%, $\frac{1}{2}$ watt, carbon, type 504	Grid current control on tube V ₁₅	ER	23A011
R ₆₉	Same as R ₇	Primary loading for transformer T ₁₁		
R ₇₀	Same as R ₁₂	Parasitic suppressor for tube V ₅		
R ₇₁	Same as R ₈	Parasitic suppressor for tube V ₁		

C _{1A}	Capacitor, variable, 47.5 mmfd per section maximum capacity, 3 section, air, special type	Receiver tuning	CM	Unit 48B048 (C _{1A} , C _{1B} and C _{1C} on same frame and ganged together)
C _{1B}				
C _{1C}				
C ₂	Capacitor, 25 mmfd., variable, 3/4 inch shaft, air, special type	Antenna trimmer for transformers T ₁ , T ₂ , T ₃	RC	48A039
C ₃	Capacitor, 5-6.5 mmfd., 5%, 500 V. D-C, ceramic, type 807-004	Shunt capacitor for transformers T ₁ , T ₂	CRL	47A005
C ₄	Capacitor, 0.002 mfd., 20%, 500 V. D-C, mica, wax sealed, type 1462	Cathode by-pass for tube V ₁	A	47BR202F-S
C ₅	Capacitor, 300 mmfd., 10%, 500V. D-C, moulded mica, wax sealed, type 5W	Screen by-pass for tube V ₁	CD	47BU301E-S
C ₆	Same as C ₄	Plate return for tube V ₁		
C ₇	Capacitor, 10 mmfd., 10%, 500V. D-C, ceramic, type 811-077	Coupling between tubes V ₁ and V ₂	CRL	47A006
C ₈	Capacitor, 0.01 mfd., -10+20%, 600V. D-C, moulded paper, type 342	AVC by-pass	MIC	46AG103F
C ₉	Same as C ₅	Oscillator coupling between tubes V ₂ and V ₁₅		
C ₁₀	Same as C ₅	Screen by-pass for tube V ₂		
C ₁₁	Capacitor, 50 mmfd., 20%, 500V. D-C moulded mica, wax sealed, type 5W	Plate return for tube V ₂	CD	47BU500F-S
C ₁₂	Capacitor, 0.001 mfd., 20%, 500V. D-C mica, wax sealed, type 1468 (Part of T ₁₀ . Shown for reference only)	AVC by-pass for tube V ₃	A	47BR102F-S
C ₁₃	Same as C ₈	Cathode by-pass for tube V ₃		
C ₁₄	Same as C ₈	Screen by-pass for tube V ₃		

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFR. CODE	CONTR'S PART NO.
C ₁₅	Same as C ₈	Plate return for tube V ₃		
C ₁₆	Same as C ₁₂ (Part of T ₁₁ . Shown for reference only)	AVC by-pass for tube V ₄		
C ₁₇	Same as C ₈	Cathode by-pass for tube V ₄		
C ₁₈	Same as C ₈	Screen by-pass for tube V ₄		
C ₁₉	Same as C ₈	Plate return for tube V ₄		
C ₂₀	Same as C ₁₁	Grid coupling for tube V ₅		
C ₂₁	Same as C ₈	Cathode by-pass for tube V ₅		
C ₂₂	Same as C ₈	Screen by-pass for tube V ₅		
C ₂₃	Same as C ₈	Plate return for tube V ₅		
C ₂₄	Same as C ₁₁	Diode return for tube V ₆		
C ₂₅	Capacitor, 0.05 mfd., -6+14%, 500V. D-C type 7678	A.N.L. by-pass	IC	46A005
C ₂₆	Same as C ₁₁	Diode filter for tube V ₆		
C ₂₇	Capacitor, 100 mmfd., 10%, 500V. D-C moulded mica, wax sealed, type 1468	AVC filter	A	47BU101E-S
C ₂₈	Capacitor, 500 mmfd., 20%, 500V. D-C moulded mica, wax sealed, type 5W	AVC filter	CD	47BU501F-S
C ₂₉	Capacitor, 25 mmfd., 20%, 600V. D-C, mica, type 5W (Part of T ₁₄ . Shown for reference only)	Coupling for discriminator transformer T ₁₄	CD	Part of 50C079
C ₃₀	Same as C ₄	Plate return for tube V ₇		
C ₃₁	Same as C ₁₁	Cathode by-pass for tube V ₈		
C ₃₂	Same as C ₂₈	Deemphasis circuit for tube V ₈		

C ₃₃	Same as C ₈	Coupling for tube V ₉		
C ₃₄	Capacitor, 20 mfd., -20+50%, 25V. D-C type 1B113	Cathode by-pass for tube V ₉	IC	46A011
C ₃₅	Same as C ₃₄	Cathode by-pass for tube V ₉		
C ₃₆	Same as C ₈	Coupling between tubes V ₉ and V ₁₂		
C ₃₇	Same as C ₈	Coupling between tubes V ₉ and V ₁₁		
C ₃₈	Same as C ₃₄	Cathode by-pass for tubes V ₁₁ and V ₁₂		
C ₃₉	Same as C ₄	Grid by-pass		
C ₄₀	Same as C ₈	Degeneration for tube V ₉		
C ₄₁	Same as C ₂₅	Tone control for tubes V ₁₁ and V ₁₂		
C ₄₂	Capacitor, 8 mfd., -3+10%, 650 V. D-C, working (C ₄₂ , C ₄₃ and C ₄₄ in same container) type 7392	Power supply filter	IC	42B043
C ₄₃				
C ₄₄				
C ₄₅	Same as C ₅	Heater by-pass for tube V ₁₅		
C ₄₆	Same as C ₅	Heater by-pass for tube V ₂		
C ₄₇	Same as C ₅	Heater by-pass for tube V ₁		
C ₄₈	Same as C ₈	Power line filter in primary of transformer T ₁₆		
C ₄₉	Same as C ₈	Power line filter in primary of transformer T ₁₆		
C ₅₀	Same as C ₈	Power line filter in primary of transformer T ₁₆		

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFR. CODE	CONTR'S PART NO.
C ₅₁	Same as C ₈	Power line filter in primary of transformer T ₁₆		
C ₅₂	Same as C ₄	Plate decoupling for tube V ₁₄		
C ₅₃	Same as C ₂₇	Grid coupling for tube V ₁₄		
C ₅₄	Capacitor, 200 mmfd., 10%, 500V. D-C, zero temperature coefficient, ceramicon, type 814XL-118	B.F.O. tuning	CRL	47A026
C ₅₅	Same as C ₅	Plate decoupling for tube V ₁₅		
C ₅₆	Capacitor, 50 mmfd., 10%, 500V. D-C, ceramicon, type 812-109	Plate blocking for tube V ₁₅	CRL	47A025
C ₅₇	Capacitor, 0.001 mfd., 20%, 500V. D-C, mica, wax sealed, type 1462	Grid coupling for tube V ₁₅	A	47BU102F-S
C ₅₈	Capacitor, 450 mmfd (nominal), 10%, mica, adjustable, special mounting bracket, special	Padding for transformer T ₇	UE	44A050
C ₅₉	Capacitor, 2 mmfd, twisted wire	Coupling between tubes V ₆ and V ₁₄		
C ₆₀	Capacitor, 3.5-23.0 mmfd., variable, air, special type	Pitch control for tube V ₁₄	RC	48A064
C ₆₁	Same as C ₄	Screen filter for tube V ₂		
C ₆₂	Same as C ₈	Plate decoupling for tube V ₂		
C ₆₃	Capacitor, 3-50 mmfd., 5%, 500V. D-C working, adjustable, ceramic, type A	Trimmer for transformer T ₄	UE	44A049
C ₆₄	Same as C ₆₃	Trimmer for transformer T ₅		
C ₆₅	Same as C ₆₃	Trimmer for transformer T ₆		
C ₆₆	Capacitor, 1-18 mmfd., adjustable, type 22-5230	Trimmer for transformer T ₇	MN	48A031

C ₆₇	Same as C ₆₆	Trimmer for transformer T ₈		
C ₆₈		Primary trimmer for transformer T ₁₀	SI	Part of 50C075
C ₆₉				
C ₇₀	Capacitor, 75-110 mmfd., adjustable, type SD2180, (C ₆₈ and C ₆₉ part of T ₁₀) (C ₇₀ and C ₇₁ part of T ₁₁) (C ₇₂ and C ₇₃ part of T ₁₂) Shown for reference only	Primary trimmer for transformer T ₁₁	SI	Part of 50C076
C ₇₁		Secondary trimmer for transformer T ₁₁		
C ₇₂		Primary trimmer for transformer T ₁₂	SI	Part of 50C077
C ₇₃		Secondary trimmer for transformer T ₁₂		
C ₇₄	Capacitor, 34-67 mmfd., adjustable, type SD2144 (C ₇₄ and C ₇₅ , part of T ₁₄) Shown for reference only	Primary trimmer for transformer T ₁₄	SI	Part of 50C079
C ₇₅		Secondary trimmer for transformer T ₁₄		
C ₇₆	Same as C ₆₈ and C ₆₉ (part of T ₁₃) Shown for reference only	Primary trimmer for transformer T ₁₃	SI	Part of 50C078
C ₇₇		Secondary trimmer for transformer T ₁₃		
C ₇₈	Same as C ₄	Plate decoupling for tube V ₁		
C ₇₉	Same as C ₅	A.F. balance for transformer T ₁₅		
C ₈₀	Capacitor, 0.002 mfd, 30%, 500V. D-C, mica, type 1467	Screen by-pass for tube V ₇	A	47BV202G
T ₁	Transformer, 27.8-47 MC, adjustable, air core, type 651	Antenna transformer - Band 1	SWI	51A265

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFR. CODE	CONTR'S PART NO.
T ₂	Transformer, 46-82 MC, adjustable, air core, type 654	Antenna transformer - Band 2	SWI	51-268
T ₃	Transformer, 82-143 MC, adjustable, air core, type 657	Antenna transformer - Band 3	SWI	51A271
T ₄	Transformer, 27.8-47 MC, adjustable, air core, type 652	R-F transformer - Band 1	SWI	51-266
T ₅	Transformer, 46-82 MC, adjustable, air core, type 655	R-F transformer - Band 2	SWI	51-269
T ₆	Transformer, 82-143 MC, adjustable, air core, type 658	R-F transformer - Band 3	SWI	51-272
T ₇	Transformer, 27.8-47 MC, adjustable, air core, type 653	Oscillator transformer - Band 1	SWI	51-267
T ₈	Transformer, 46-82 MC, adjustable, air core, type 656	Oscillator transformer - Band 2	SWI	51-270
T ₉	Transformer, 82-143 MC, adjustable, air core, type 659	Oscillator transformer - Band 3	SWI	51-273
T ₁₀	Transformer, 5.25 MC, coupling adjustable, iron core, type 663	I-F transformer between tubes V ₂ and V ₃	SWI	50C075
T ₁₁	Transformer, 5.25 MC, coupling adjustable, iron core, type 664	I-F transformer between tubes V ₃ and V ₄	SWI	50C076
T ₁₂	Transformer, 5.25 MC, coupling adjustable, iron core, type 665	I-F transformer between tubes V ₄ and V ₅	SWI	50C077
T ₁₃	Transformer, 5.25 MC, coupling adjustable, iron core, type 666	I-F transformer between tubes V ₅ and V ₆	SWI	50C078
T ₁₄	Transformer, 5.25 MC, coupling adjustable, iron core, type 667	Discriminator transformer	SWI	50C079

T ₁₅	Transformer, primary; push-pull, 10,000 ohms plate to plate; secondary; 5000 ohms, tapped at 500 ohms, 600 ohms center tapped, type 3A452	Audio output transformer	GT	55B019
T ₁₆	Transformer, primary; 117V. A-C, 50-60 cycle, secondary, 550V. A-C, @ 110 milliampres, 6.3V. A-C, @ 4 amp; 5V. A-C, @ 3 amp. type 10P17	A-C power transformer	ST	52C032
L ₁	Inductor, 2 henries, 150 ma., d-c resistance 85 ohms, 10%, iron core, type 10C3	Power supply filter choke	ST	56B006
L ₂	Inductor, 10 henries, 80 ma., iron core, type 10C2	Power supply filter choke	ST	56B007
L ₃	Inductor, fixed, dowl wound, type 662	Choke for heater of tube V ₁₅	SWI	53-009
L ₄	Inductor, 14.5-15.0 microhenries, similar to L ₃ , type 661	Plate choke for tube V ₁₅	SWI	53-008
L ₅	Inductor, fixed, shielded, type 660	Primary filter choke for transformer T ₁₆	SWI	53A007
L ₆	Same as L ₅	Primary filter choke for transformer T ₁₆		
L ₇	Inductor, 5.25 MC, adjustable, iron core, type 668	Best frequency oscillator coil	SWI	54-013
S ₁	Switch, 7 section, 3 position, ceramic wafers, rotary, type 7AHC3991E	Wave band selector	HH	60B044
S ₂	Switch, 250V., 1 ampere, SPST toggle, 15/32 inch bushing, type 20994	B.F.O. "ON-OFF"	HH	60A116
S ₃	Switch, SPST, on the back of R ₁₁	"S-Meter" switch	HH	25C059
S ₄	Same as S ₂	A.V.C. "ON-OFF"		

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFR. CODE	CONTR'S PART NO.
S ₅	Same as S ₂	"Send-Receive" (high voltage center tap of transformer T ₁₆ to ground)		
S ₆	Switch, 250V., 1 ampere, DPST toggle, 15/32 inch bushing, type 8360K2	Noise limiter switch	CH	60A123
S ₇	Switch, 3 section, 3 position, rotary, type QH3AC	Selectivity switching	OM	60B043
S ₈	Switch, single section rotary, type 18383QH	AM-FM selecting switch	OM	60B045
S ₉	Switch, single section rotary, type 18869-53	Tone switching	OM	60B050
M ₁	Meter, micro ammeter, 160-0-40 microamperes, type #701	AM-FM tuning meter	BE	82A006
P ₁	Plug, bakelite, octal, shorting plug	Power supply shorting plug for A-C operation	AP	35A003
J ₁	Jack, std. tip and sleeve, type ST-1003, $\frac{1}{2}$ inch shank	Headphone connection	U	36B008
I ₁	Lamp, 6.3V. 250 ma., type #44 bayonet base	Main tuning dial light	GE	39A003
I ₂	Same as I ₁	Vernier scale dial		
I ₃	Lamp, 6.3V. 150 ma., type #47 bayonet base	Tuning meter dial illumination	GE	39A004

X ₁	Socket, bakelite, octal, type MIP-8, marked PWR	D-C power supply	AP	60A050
X ₂	Socket, two circuit, type 4002T	Standby connection	AL	10A015
V ₁	Tube, acorn, pentode, type 956	R-F amplifier	RCA	90X956
V ₂	Tube, acorn, pentode, type 954	1st detector	RCA	90X954
V ₃	Tube, pentode, type 6AC7	1st I-F amplifier	RCA	90X6AC7
V ₄	Tube, pentode, type 6AB7	2nd I-F amplifier	RCA	90X6AB7
V ₅	Tube, pentode, type 6SK7	3rd I-F amplifier	RCA	90X6SK7
V ₆	Tube, duo-diode, type 6H6	2nd detector and A-N-L	RCA	90X6H6
V ₇	Same as V ₃	F-M limiter		
V ₈	Same as V ₆	F-M discriminator		
V ₉	Tube, duo-triode, type 6C8	Audio amplifier	RCA	90X6C8
V ₁₀	Tube, gas filled diode, type VR-150	Voltage regulator	RCA	90XVR-150
V ₁₁	Tube, beam power amplifier, type 6V6GT	Audio output	RCA	90X6V6GT
V ₁₂	Same as V ₁₁	Audio output		
V ₁₃	Tube, duo-diode, type 5Z3	Plate supply rectifier	RCA	90X5Z3
V ₁₄	Tube, triode amplifier, type 6J5	Beat frequency oscillator	RCA	90X6J5
V ₁₅	Tube, acorn, triode, type 955	High frequency oscillator	RCA	90X955

G. INDEX TO PARTS MANUFACTURERS

SYMBOL	MANUFACTURER	SYMBOL	MANUFACTURER
A	Aerovox Corp. New Bedford, Mass.	IC	Industrial Condenser Chicago, Illinois
AL	Alden Manufacturing Co. Brockton, Mass.	IRC	International Resistance Co. Philadelphia, Pa.
AP	American Phenolic Corp. Chicago, Illinois	MIC	Micamold Radio Corp. Brooklyn, N. Y.
BE	Beede Electrical Instrument Co. Chicago, Illinois	MN	Meissner Manufacturing Co. Mt. Carmel, Illinois
CD	Cornell-Dubilier Electric Corp. South Plainfield, N. J.	OM	Oak Manufacturing Chicago, Illinois
CH	Cutler-Hammer Milwaukee, Wis.	RC	Radio Condenser Corp. Chicago, Illinois
CRL	Centralab Milwaukee, Wis.	RCA	RCA Manufacturing Co., Inc., Camden, N. J.
CT	Chicago Telephone Supply Co. Chicago, Illinois	SI	F. W. Sickles Co. Springfield, Mass.
ER	Erie Resistor Erie, Pa.	ST	Standard Transformer Corp. Chicago, Illinois
GE	General Electric Co. Chicago, Illinois	SWI	S. W. Inductor Co. Chicago, Illinois
GT	General Transformer Corp. Chicago, Illinois	U	Utah Produce Co. Chicago, Illinois
HH	Hart & Hegeman Electric Co. Hartford, Conn.	UE	Underwood Electric Co. Chicago, Illinois