

SERIAL NO. _____

INSTRUCTION BOOK

FOR

MODEL RBK-15

RADIO RECEIVING EQUIPMENT

FOR

AMPLITUDE AND FREQUENCY MODULATED SIGNALS

FREQUENCY RANGE — 27.8 to 143 MEGACYCLES

CONTRACT No. NObsr-39304

the hallicrafters *co.*

CHICAGO, ILL., U. S. A.

INSTRUCTION BOOK
 FOR
 MODEL BRK-()
 RADIO RECEIVING EQUIPMENT
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Figure 1. Radio Receiver CHU-46228, Front View



INSTRUCTION BOOK FOR MODEL RBK-() RADIO RECEIVING EQUIPMENT

A. DESCRIPTION OF EQUIPMENT

A-1. GENERAL.— The Model RBK-() radio receiving equipment consists of a type CHL-46298 ultra-high frequency radio receiver mounted in a sheet steel table mounted cabinet. The receiver is entirely self contained except for headset or speaker, panoramic adapter, and 115/230-volt source.

A-2. RECEIVER UNIT.— Radio Receiver CHL-46298 is a ultra-high frequency super-hetrodyne radio receiver capable of receiving both amplitude modulated (A-M) and frequency modulated (F-M) phone signals and continuous wave (C-W) telegraph signals. Automatic volume control (A-V-C) and automatic noise limiter (A-N-L) circuits are incorporated. See figure 3 for the schematic circuit diagram.

a. The frequency range of the receiver is from 27.8 megacycles to 143 megacycles and is divided into three bands. Each band is provided with sufficient overlap to insure continuity of coverage over the entire tuning range.

b. The complete tube complement is as follows:

Symbol	Tube Type	Function
V ₁	JAN- 956	R-F amplifier
V ₂	JAN- 954	Converter
V ₃	JAN- 6AC7	1st I-F amplifier
V ₄	JAN- 6AB7	2nd I-F amplifier
V ₅	JAN- 6SK7	3rd I-F amplifier
V ₆	JAN- 6H6	A-M second detector and automatic noise limiter

V ₇	JAN- 6AC7	F-M limiter
V ₈	JAN- 6H6	F-M discriminator
V ₉	JAN- 6SL7GT	Audio voltage amplifier
V ₁₀	JAN- OD3/ VR-150/30	Voltage regulator
V ₁₁	JAN- 6V6GT/G	Audio power amplifier
V ₁₂	JAN- 6V6GT/G	Audio power amplifier
V ₁₃	JAN- 5U4G	Full wave rectifier
V ₁₄	JAN- 6J5	Beat frequency oscillator
V ₁₅	JAN- 955	High frequency oscillator
V ₁₆	JAN- 956	Radiation suppressor.

c. All tubes with the exception of the four acorn type tubes can be reached from the top of the chassis. Acorn tubes V₁, V₂, V₁₅ and V₁₆ are reached by removing the top cover plate of the r-f sections. See figure 4 for location of all tubes.

d. When receiving a-m signals the circuit consists basically of a radiation suppressor stage, a stage of radio frequency amplification, a converter stage, a high frequency oscillator, three stages of intermediate frequency amplification, a second detector, an audio frequency voltage amplifier, a push-pull audio frequency power amplifier, a signal level indicator, an automatic volume control circuit and an automatic noise limiter circuit.

e. When receiving f-m signals the circuit consists basically of a radiation suppressor stage, a stage of tuned radio frequency amplification, a converter stage, a

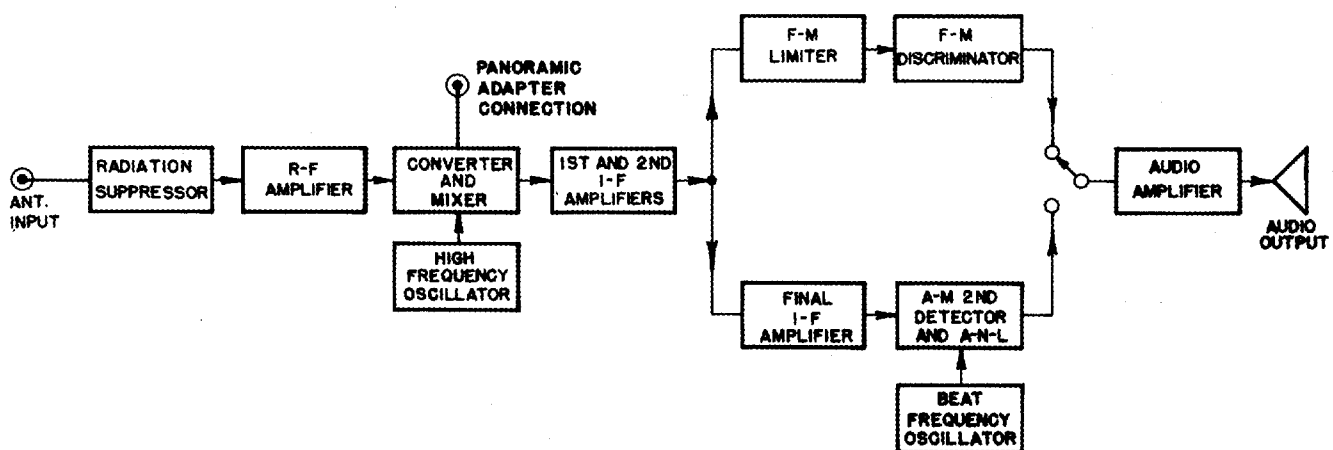


Figure 2. Radio Receiver CHL-46298, Block Diagram

high frequency oscillator, two stages of intermediate frequency amplification, an amplitude limiter stage, a discriminator, a tuning indicator, an audio frequency voltage amplifier, and a push-pull audio frequency power amplifier.

Reference to the block diagram, figure 2, will illustrate the above circuit arrangements.

A-3, CIRCUIT DESCRIPTION.--Refer to the schematic diagram, figure 3. Since the circuit functions of bands 1, 2 and 3 are essentially identical this discussion will describe the circuit with the BAND SWITCH (SW_{1A} to SW_{1G}) set at band 3, as shown in the schematic diagram. The BAND SWITCH (SW₁) selects the proper radio frequency, converter, and high frequency oscillator transformers to tune a given frequency range.

a. Signals picked up by the antenna enter the receiver through the antenna connector (SO₃) at the rear of the cabinet. (Refer to figure 6). The signal is fed through the radiation suppressor tube V₁₆ to the radio frequency amplifier tube (V₁) through transformer T₃. The secondary of this transformer (T₃) is tuned by capacitor C_{1A} and trimmed by capacitor C₂.

b. The amplified radio frequency signal at the plate circuit of tube V₁ is coupled to the control grid of the converter tube (V₂) through the radio frequency transformer T₆.

c. Another signal generated in the high frequency oscillator tube (V₁₅) is fed to the cathode of the tube V₂ through capacitor C₉. These two signals mix and heterodyne within the converter tube (V₂) and produce a third signal the frequency of which is the same as the intermediate frequency amplifier channel band-pass frequency or 5.25 MC. The frequency of the signal generated in the high frequency oscillator tube (V₁₅) is controlled by the high frequency oscillator transformer (T₉) which is tuned by capacitor C_{1C}. On band #1 the oscillator tunes 5.25 MC. higher in frequency than the received signal frequency and on bands #2 and #3 it is 5.25 MC lower in frequency than the incoming signal.

d. A shielded lead from the plate circuit of the converter tube (V₂) feeds the intermediate frequency signal voltage, through an isolating resistor (R₈), to a panoramic adapter connection. This output connection is an Amphenol type 83-1R coaxial socket. It is located on the rear apron of the chassis. Refer to figure 6.

e. The intermediate frequency amplifier consists of tubes V₃, V₄ and V₅ and associ-

ated transformers T₁₀, T₁₁, T₁₂, and T₁₃. The i-f channel band width provided by transformer T₁₀, T₁₁, and T₁₂ is expanded by a third winding, controlled by SELECTIVITY switch SW_{7A} to 7C. Expanding the i-f amplifier band-pass frequency allows high fidelity f-m reception.

f. The R.F. GAIN control (R₁₁), connected in series with the cathodes of tubes V₃ and V₄ and ground, varies the sensitivity of the receiver by controlling the gain in the first two i-f stages. This is accomplished by varying the self biasing voltage developed by these tubes.

g. The i-f amplifier terminates in two separate detectors, namely the amplitude modulation detector and the frequency modulation discriminator.

(1) The amplitude modulation (A-M) detector tube (V₆) is fed by the fourth i-f transformer (T₁₃). The diode load resistor network for the first diode section of the tube V₆ consists of resistors R₃₁, R₃₃, R₃₄, and R₃₆. From this voltage divider network the audio voltage developed is fed to the A.F. GAIN control (R₄₃) through capacitor C₃₃ and section SW_{8D} of the AM/FM switch. An automatic volume control (A-V-C) voltage developed in this load network is applied to the grids of the 1st and 2nd intermediate amplifier tubes (V₃ and V₄) through the isolating networks consisting of resistor R₁₀ and capacitor C₁₂ for the tube V₃, resistor R₁₉ and capacitor C₁₆ for tube V₄ and resistor R₃₅ and capacitor C₈ for both tubes when the receiver is set for A-M reception. The A.V.C. switch (SW₄) shorts out the a-v-c voltage when automatic volume control is not required. The second diode section of the A-M detector tube (V₆) is used as an automatic noise limiter (A-N-L), and is activated by switch SW₆. This circuit functions as follows: Capacitor C₂₅ becomes charged by the rectified carrier voltage when the A.N.L. switch (SW₆) is set at ON. The time constant of this capacitor and associated network is such that the audio frequency variations do not alter this charge. However, during a severe noise pulse the cathode of the second diode section of tube V₆ becomes more negative than the charge held by capacitor C₂₅, hence, current flows shorting the audio voltage to ground through capacitor C₂₅ until the cathode voltage of the a-n-l diode of tube V₆ reaches a higher negative potential than its plate. By this action noise peaks are clipped off and do not appear in the output as sudden blasts of noise.

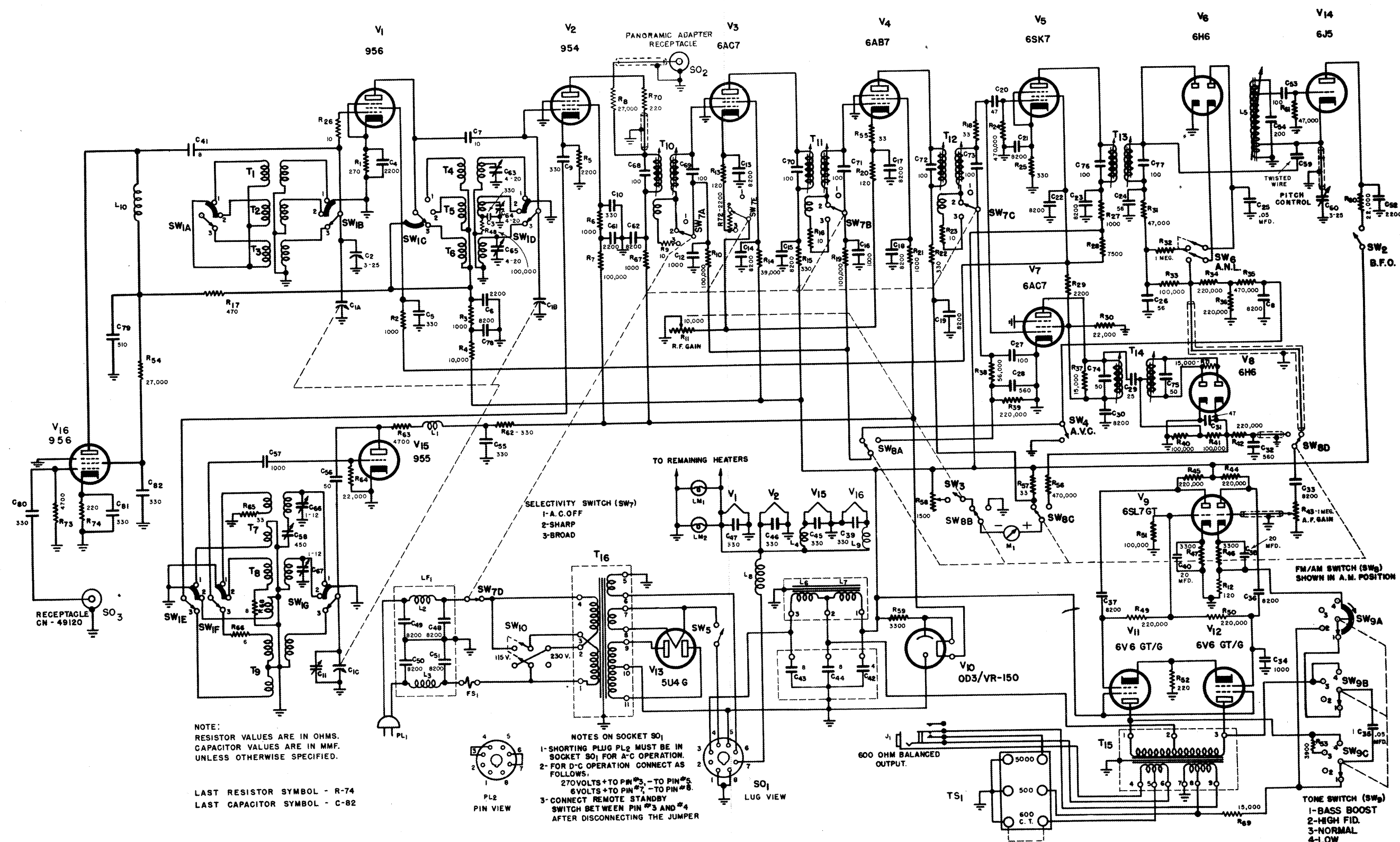


Figure 3. Radio Receiver CHL-46298, Schematic Diagram

(2) The frequency modulation detector circuit consists of a limiter stage and a discriminator stage. The limiter tube (V₇) is fed by the third i-f transformer (T₁₂). This stage operates as a saturated amplifier in which the output remains constant over a large range of input levels thus eliminating variations in the amplitude of the received carrier signal. When operating as an f-m receiver, automatic volume control action is obtained by applying a part of the voltage developed across resistor R₃₉ to the control grids of the first and second i-f amplifier tubes (V₃ and V₄) through section SW_{8A} of the F.M./A.M. switch in the same manner as in a-m reception. The constant level output signal from the limiter tube (V₇) is fed to the discriminator tube (V₈) through the discriminator transformer (T₁₄) and coupling capacitor C₂₉. The discriminator circuit, consisting of transformer (T₁₄), tube V₈ and load resistor R₄₀ and R₄₁, converts the frequency variations in the f-m signal into amplitude variations or an audio signal. The de-emphasis network consisting of a resistor R₄₂ and capacitor C₃₂ attenuates the high frequency end of audio range since these frequencies are emphasized at the transmitter. From the de-emphasis network the audio signal is fed to the A.F. GAIN control (R₄₃) in the same way as the signal from the amplitude modulation detector tube (V₆).

h. The audio amplifier consists of a voltage amplifier and phase inverter stage (tube V₉) and a push-pull power amplifier stage (tubes V₁₁ and V₁₂). The audio signal from either the a-m detector or the f-m discriminator is fed to the control grid of the first triode section of tube (V₉) through the A.F. GAIN control (R₄₃) which controls the amount of excitation to the audio amplifier circuit. The amplified audio signal from the first triode section of tube V₉ is fed to the audio power amplifier tube (V₁₂) and to the second triode section of tube V₉. The audio signal on the plate of the second triode section of tube V₉, which is now 180° out of phase, is fed to the remaining power amplifier tube V₁₁. The output of the audio power amplifier tubes (V₁₁ and V₁₂) is fed to the output terminals through transformer T₁₅, the secondary of which provides output impedances of 500 ohms, 5000 ohms to ground and 600 ohms balanced to ground. The network consisting of resistors R₅₃ and R₆₉ and capacitor C₃₅ provide inverse feedback in varying degrees in the audio amplifier tubes to

allow tone control ranging from bass boost to high frequency out off. TONE SWITCH (SW₉) selects the desired fidelity.

1. The tuning meter (M₁) is used to indicate correct tuning for both amplitude modulation and frequency modulation reception. It is switched from one circuit to the other by sections SW_{8B} and SW_{8C} of the A.M./ F.M. switch.

(1) When receiving amplitude modulated signals the tuning meter indicates a change in the plate current drawn by the second intermediate amplifier tube (V₄). This tube (V₄) draws maximum current with zero signal level. Current drain decreases with an increase in signal level causing the meter to fluctuate in accordance with the strength of the received signal. The meter circuit is completed by turning the R.F. GAIN control (R₁₁) full on (to the extreme right hand position). This activates switch SW₃ which is ganged to the control. When switch SW₃ is "on" the meter and the METER ADJ. resistor (R₅₈) are shunted across resistor (R₅₇).

(2) When receiving frequency modulated signals the meter indicates resonance by indicating the voltage developed across load resistors R₄₀ and R₄₁. When the receiver is in exact tune with the received signal the voltages developed across the two load resistors cancel out while detuning the receiver on either side of the incoming signal frequency causes a difference in the voltage developed across each resistor which is shown on the meter by a deflection on either side of zero.

j. The beat frequency oscillator stage consists of a triode oscillator tube (V₁₄) and a resonant circuit (L₅). The frequency of the oscillator is adjusted to approximately the i-f frequency plus 1000 cycles by varying the inductance of L₅ with an adjustable iron slug. B.F.O. switch (SW₂) activates this circuit by applying plate voltage to tube V₁₄. Capacitor C₆₀ varies the pitch of the note to suit the operator.

k. The voltage regulator tube (V₁₀) supplies a constant voltage to the plate and screen of the mixer tube (V₂), the screen grid of the second i-f amplifier tube (V₄) and the plate of the high frequency oscillator tube (V₁₅).

l. Socket SO₁ provides for operation from an external d-c voltage source. When so operated the heater voltage is supplied

Figure 4. Radio Receiver CHL-40229, Top View Of Chassis

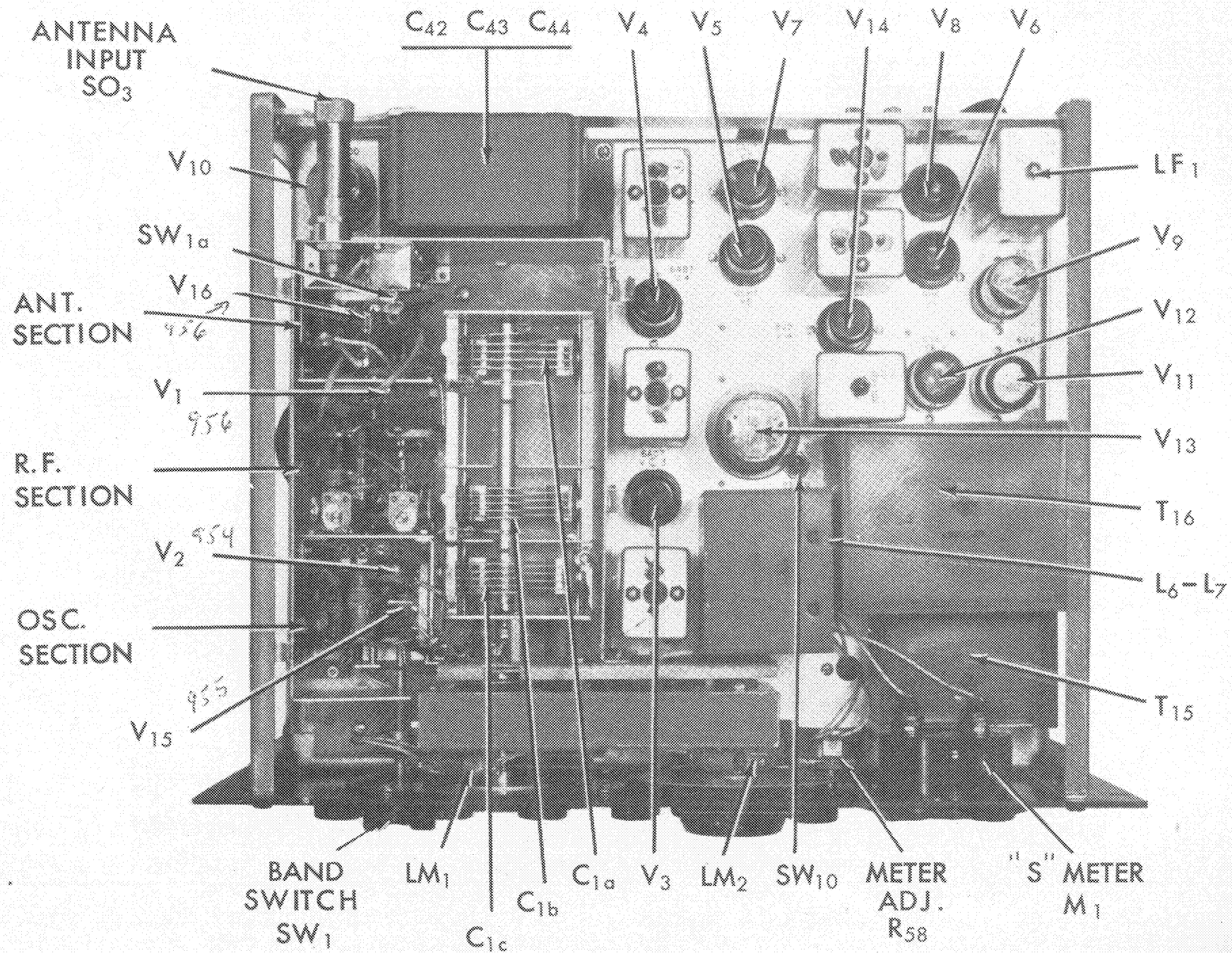
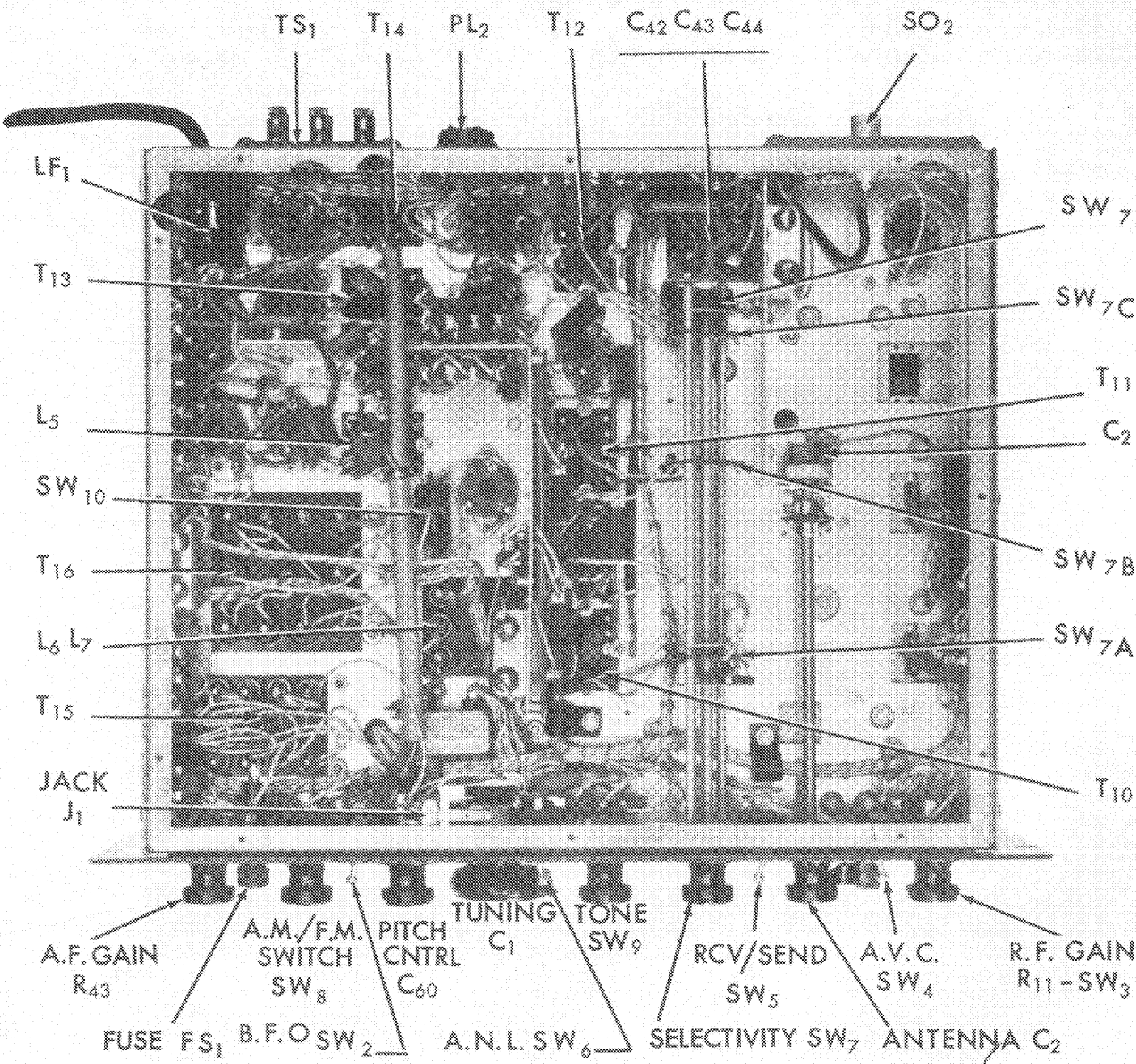


Figure 5. Radio Receiver CHL-46226, Bottom View Of Chassis



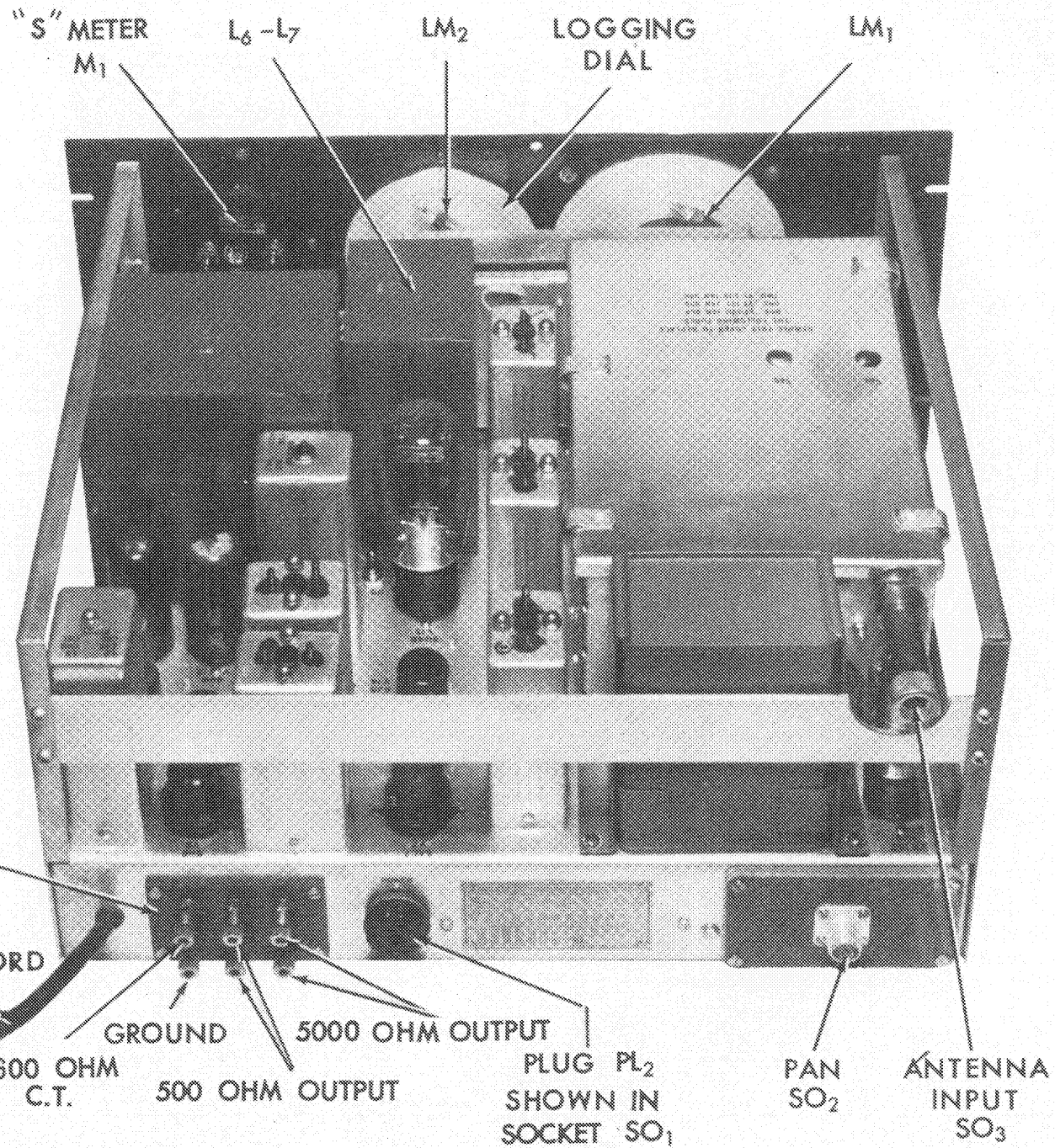


Figure 6. Radio Receiver CHU-4622A, Top Rear View

directly to the tubes while the plate and screen voltage is applied through the fil-

ter network and voltage regulator tube (V₁₀) just as when operating from an a-c source.

B. INSTALLATION

B-1. CAUTION. - Voltages appearing within the receiver chassis are high and dangerous. Exercise care in making adjustments. Before making any repairs on the receiver, remove the power cord plug from supply receptacle or disconnect the d-c source from socket SO₁.

B-2. UNPACKING. - Carefully unpack and inspect the receiver for possible damage during transit. Claim for any damage should be made immediately to the transportation carrier.

B-3. INSPECTION. - After the receiver has been unpacked and BEFORE power is applied, check the following items:

a. See that the tubes are secure and in their proper sockets. Reference to figure 4 will show their proper location. The four acorn type tubes are made accessible by removing the shield cover over the r-f section.

b. Check pilot lamps behind the translucent tuning dials. These can be checked by simply raising the cabinet cover.

c. Check the line fuse located in the fuse container on the front panel to see that it is in operating order.

B-4. ANTENNA CONNECTIONS. - A type CN-49120 receptacle is provided for antenna connections and is located just inside the large rectangular cut-out located above the panoramic receptacle. A type CN-49121 plug is also furnished with each receiver which engages the above receptacle. Connect the concentric line lead-in from the antenna to this plug. Refer to figure 9 for suggested antenna installation.

a. **Single Wire Antenna.** - When only a single wire is available for use as an antenna, connect it to the center terminal on plug CN-49121. If a ground is available connect it to the outer shell of this plug. This type of antenna works well where the signal to noise ratio is relatively high and a more elaborate installation is not available. Erect the antenna as high and free from surrounding objects as possible.

b. **Doublet Antenna.** - The doublet antenna is recommended where receiving conditions are difficult or where maximum sensitivity is required over a relatively narrow range of frequencies. The transmission line from

the antenna is connected to plug CN-49121. If a concentric line with a grounded outer conductor is used, connect the inner conductor to the center terminal of plug CN-49121 and the outer conductor to the shell. To determine the proper length in inches for the doublet antenna, divide 5540 by the frequency of reception in megacycles. After cutting the wire to the length determined above, cut it in half and insert an insulator at that point. Solder the two wires of the transmission line to each of the quarter wave sections at the insulator. Keep in mind that this type of antenna is directional broadside to its length and should be so oriented if maximum pickup from a certain direction is desired.

B-5. POWER INPUT CIRCUITS. - The receiver is designed to operate from either a 115/230 volt, 50-60 cycles a-c power source, or from a 6-volt storage battery and 270 volts of "B" battery or vibrator supply.

a. **A-C Operation.** - If the receiver is to be operated from an a-c line, check the setting of the 115/230-volt change-over switch (SW₁₀), located on the chassis deck to the left of the power transformer, and see that it is set for the proper line voltage. Also see that the plug (PL₂) on the rear apron of the receiver is in place. This is necessary to provide continuity in the power circuits. Refer to figure 3.

b. **D-C Operation.** - To operate the receiver from external batteries delivering 6-volts at 4.5 amperes and 270-volts at 145 milliamperes (or from a vibrator supply of like capacity), connect plug PL₂ as shown in figure 7 and insert it in socket SO₁ in place of the jumper plug used for a-c operation.

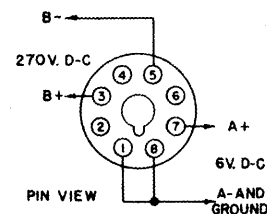


Figure 7. D-C Power Plug Connections

B-6. AUDIO OUTPUT CIRCUITS. - A headset or loudspeaker may be used with the receiver.

a. The headset jack (J₁) marked PHONES and located on the front panel provides a

600 ohm outlet for headset operation. Both terminals of this outlet are insulated from ground. By connecting a jumper between the terminals marked 600 OHM C.T. and GND. on terminal strip TS₁, located on the rear apron of the chassis, this 600 ohm line may be balanced to ground for other uses.

b. The speaker terminal board (TS₁) located on the rear apron of the receiver's chassis provides output impedances of 500 and 5000 ohms for loudspeaker operation.

B-7. PANORAMIC ADAPTER. - A type 49194 coaxial cable connector (SO₂) is provided for connection of a panoramic adapter designed to be used with Model RBK-() receiving

equipment. The panoramic adapter is coupled to the plate circuit of the receiver's converter tube V₂ through isolating resistor R₈.

B-8. REMOTE STAND-BY OPERATION. - Remote control of the stand-by switch in the receiver can be obtained by removing the jumper wire between pins #3 and #4 and connecting leads to pins #3 and #4 of either the jumper plug (PL₂) used for a-c operation or its substitute plug used for battery operation, and connecting the leads to an external relay or switch. Note: The remote relay or switch must be insulated for high voltage, since this switch is wired into the plate voltage circuit of the receiver.

C. ADJUSTMENT AND OPERATION

C-1. PANEL CONTROLS. - Reading across the front panel from left to right the control markings and functions are as follows: (Refer to figure 1.

a. R.F. GAIN (radio frequency gain) Control. - It controls the sensitivity of the receiver. Ganged to this control is the "S" meter switch which connects the tuning meter into the circuit when the control is rotated completely to the right.

b. BAND SWITCH. - This switch is used to select the desired frequency range covering the frequencies shown on the main tuning dial.

c. A.V.C. (Automatic volume control) Switch. - It switches in a circuit which controls the sensitivity of the receiver. This action provides a more nearly constant audio output level over reasonable variations in signal strength at the antenna.

d. ANTENNA Control. - This control is used to compensate for misalignment of antenna transformers T₁, T₂, and T₃ due to antenna impedance variations. Once set for a given antenna its calibration will hold for a wide range of frequencies. Since this capacitor acts as a trimmer for the main tuning capacitor (C_{1A}), its use will have a slight detuning effect on the high frequency end of Band 3 and will have to be "touched-up" to retune the desired signal.

e. REC./SEND Switch. - This switch is used to silence the receiver for short periods of time. It connects the high voltage to the receiver circuits when set at REC.

f. SELECTIVITY Switch. - This switch controls the a-c line voltage to the receiver when operating from an a-c power source and in addition sets the band width of the intermediate frequency amplifier stages in

its SHARP and BROAD positions.

g. TONE Switch. - It controls a feedback circuit in the audio amplifier stages which allows the audio frequency response to be modified from bass boost through high fidelity to high frequency cut-off.

h. A.N.L. Switch. - This switch cuts in a circuit which will increase the intelligibility of the received signal when a high noise level distorts the signal. The circuit clips the noise peaks in excess of the normal signal level. The switch should be left at OFF when the receiving conditions are normal.

i. TUNING Wheel. - This control varies the capacity of capacitor C₁ which tunes the receiver to the desired frequency. The frequency of reception is read directly from the main tuning dial. The scale on the logging dial is used in conjunction with the outer-most scale on the main tuning dial for logging purposes.

j. PHONES Jack. - It is connected to the 600 ohm secondary winding of the output transformer and is insulated from the chassis. It can be used to feed a headset or a 600 ohm line.

k. METER ADJ. - This adjustment is used to set the "S" meter to its "0" signal position when the receiver is set for amplitude modulation reception.

l. PITCH CONTROL. - This control varies the pitch of the c-w signal for code reception.

m. B.F.O. Switch. - It turns on the beat frequency oscillator, used to produce the beat note for the reception of c-w (telegraph) signals.

n. A.M./F.M. Switch. - It connects the output of either the a-m detector or the f-m discriminator to the audio amplifier and switches the tuning meter from one circuit to the other.

o. "S" Meter or Tuning Meter. - When the receiver is set to receive amplitude modulated signals the tuning meter indicates the carrier strength of the received signal. To put the meter in operation, turn the R.F. GAIN control to the extreme right until the switch (SW3) snaps "on". The meter is not used when receiving c-w signals.

When the receiver is set to receive frequency modulated signals the tuning meter is used to indicate resonance with the carrier. As the receiver is tuned through an f-m carrier the meter pointer will first deflect to one side of "0", return to "0" and deflect an equal distance on the opposite side of "0", and return to "0". The zero center position in the middle of the swing represents the correct setting of the receiver tuning dial and indicates resonance.

p. The FUSE holder contains a 3 amp., 250-volt fuse which protects the receiver against accidental overloads.

q. A.F. GAIN Control. - The audio output level of the receiver is controlled by varying the signal level to the grid of the first audio amplifier tube. (V_9).

C-2. OPERATION. -

a. A.M. SIGNAL RECEPTION. - To receive amplitude modulated signals set the front panel controls as follows:

- SELECTIVITY SWITCH - Set at A.C. OFF when the set is not in use. Set at SHARP for reception of phone signals.
- A.M./F.M. switch - Set at A.M.
- BAND SWITCH - Set to band covering desired frequency.
- A.V.C. - Set at ON
- REC./ SEND switch - Set at REC. Set in SEND position to disable the receiver for short periods.
- B.F.O. switch - Set at OFF
- PITCH CONTROL - Not used
- TUNING wheel - Set dial to frequency of desired signal adjust for maximum tuning meter reading.
- R.F. GAIN control - Turn to right until tuning meter switch snaps on.
- ANTENNA trimmer - Adjust for maximum tuning reading

- A.F. GAIN control - Adjust for desired signal level at headset or speaker
- TONE switch - Set at HIGH FID. or BASS BOOST when signal to noise ratio is high or at NORMAL or LOW when signal to noise ratio is low.
- A.N.L. switch - Set at OFF unless background noise is excessive.

b. F-M SIGNAL RECEPTION. - To receive frequency modulated signals set the front panel controls as follows:

- SELECTIVITY switch - Set at A.C. OFF when set is not in use. Set at BROAD for reception of phone signals.
- A.M./F.M. switch - Set at F.M.
- BAND SWITCH - Set at band covering desired frequency.
- A.V.C. switch - Not used.
- REC./SEND switch - Set at REC. Set in SEND position to disable the receiver for short periods.
- B.F.O. switch - Set at OFF
- PITCH CONTROL - Not used
- TUNING wheel - Set dial to frequency of desired signal adjust for center "0" position of tuning meter.
- R.F. GAIN control - Turn all the way to the right
- ANTENNA TRIMMER - Adjust for maximum audio level
- A.F. GAIN control - Adjust for desired signal level at headset or speaker.
- TONE switch - Set at BASS BOOST or HIGH FID.
- A.N.L. switch - Set at OFF

c. C-W (TELEGRAPH) RECEPTION. - To receive continuous-wave (telegraph) signals set the front panel controls as follows:

- SELECTIVITY switch - Set at A.C. OFF when the set is not in use. Set at SHARP for c-w telegraph reception.
- A.M./F.M. switch - Set at A.M.
- BAND SWITCH - Set to band covering desired frequency
- A.V.C. switch - Set at OFF
- REC./SEND switch - Set at REC. Set in SEND position when disabling receiver for short periods of time.
- B.F.O. switch - Set at ON

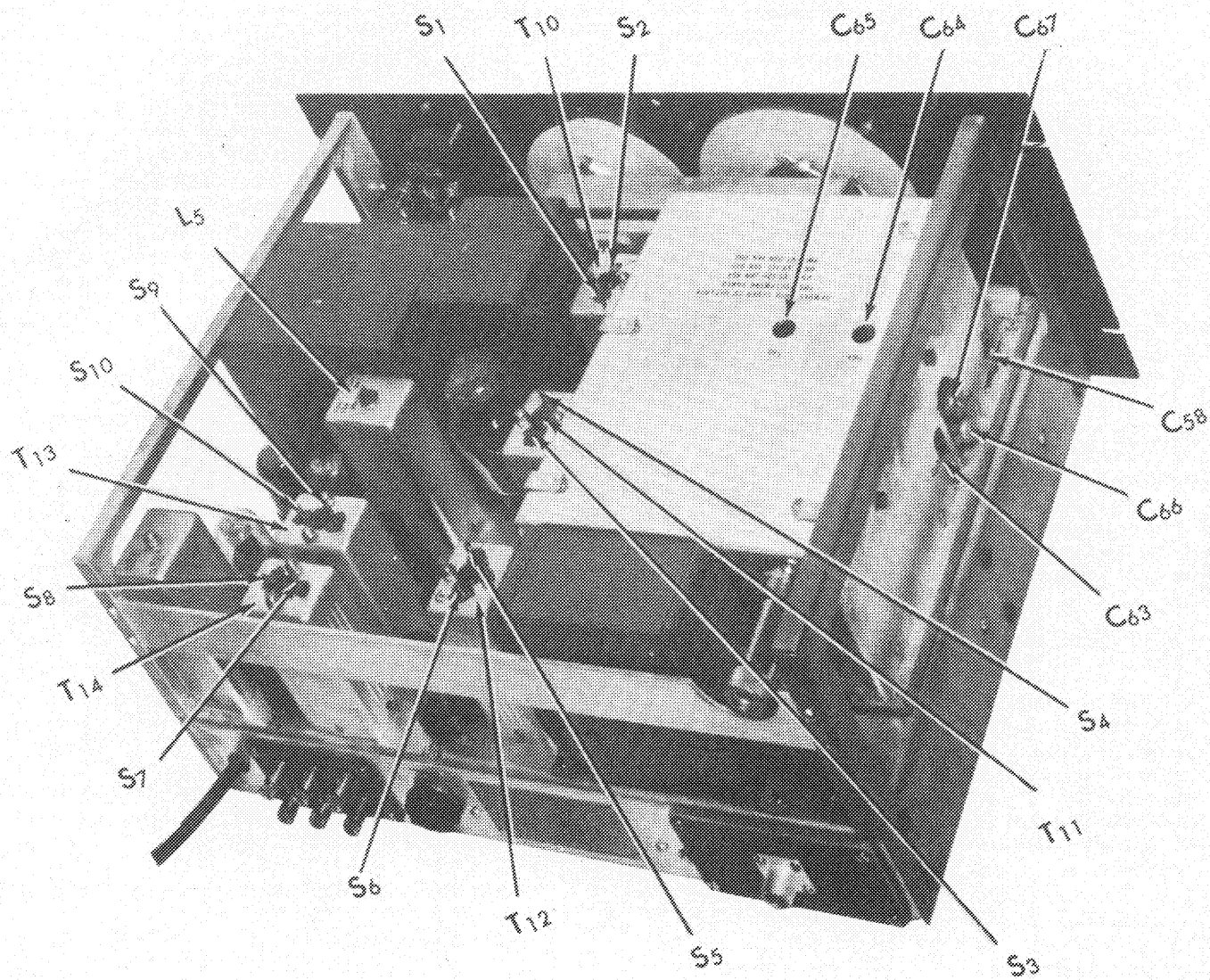


Figure 8. Radio Receiver CHL-46298, Top View Showing Alignment Points

- PITCH CONTROL - Adjust to produce approximately a 1000 cycle code signal.
- TUNING wheel - Set dial to frequency of signal. Tune for maximum signal level at headset or speaker
- R.F. GAIN control - Turn up as high as the signal strength of the received signal will allow
- ANTENNA trimmer - Adjust for maximum signal level at headset or speaker
- A.F. GAIN control - Adjust for desired signal level at headset or speaker
- TONE switch - Set at LOW

C-3. CALIBRATION AND LOGGING. - The three frequency ranges shown on the main tuning dial are calibrated directly in megacycles.

The fourth or outside scale on the calibrated dial is used for logging purposes. The logging scale runs from 1 to 23. Each of the 23 divisions are further divided into 100 parts by the vernier dial scale, located just above the TUNING wheel. The vernier dial makes one revolution as the calibrated dial moves one division along the logging scale, hence, the log reading will be the calibrated dial log reading followed by a decimal point and the vernier dial reading.

C-4. "S" METER ADJUSTMENT. - With the set turned off check the resting position of the meter. Adjust the screw on the meter face for zero. (Right side of meter face.) Set up the receiver for amplitude modulation reception and set the receiver at a frequency not being used for communications. With zero signal level and no noise being received set the METER ADJ. screw located on the front panel for an "S" meter reading of zero db. (left side of meter scale).

D. ALIGNMENT AND SERVICE.

CAUTION - Voltages at various points in the r-f stages and under the chassis are sufficiently high to produce a severe shock. When working on the set avoid contact with the high voltage points and remember, improper or rough handling may disable certain component parts. BE CAREFUL.

D-1. INSPECTION. - All components of the radio set should be given a thorough inspection upon issue and at regular intervals thereafter. Keep the equipment dry. Moisture, even in a completely tropicalized set may cause deterioration of material and produce general unsatisfactory operation. Dust and dirt materially effect both electrical and mechanical operation. Keep the various parts clean especially the tuning capacitors and gear drive. A minute amount of oil in the gear drive occasionally will provide smoother operation. Do not oil the condenser wipers. Noisy reception may be caused by dirty condenser wipers, gain controls, switches, loose connections in the cables, tubes, wiring contacts etc. in the installation. Do not oil any of the switch contacts. Check accessible connections and tubes regularly making sure that all contacts are clean and tight and that tubes are held securely in their sockets.

D-2. REPLACING TUBES, LAMPS AND FUSES. - All tubes with the exception of the four acorn types are accessible at the top of the chassis. The four acorn tubes are reached by removing the top cover of the r-f assembly. These tubes should be inserted with the short end of the body in the socket. The two pilot lamps, LM₁ and LM₂, are identical and are lo-

cated behind the translucent dials. They are of the bayonet type and are removed by pressing down slightly in the socket and turning counter-clockwise. The fuse is replaceable from the front panel. It is contained in the bayonet type holder that is removed by pressing in slightly and turning counter-clockwise to release.

D-3. ALIGNMENT. -

a. **GENERAL** - The receiver has been carefully aligned at the factory and alignment should not be attempted unless it is known that the adjustments have been tampered with or that tubes of a different manufacturer have been substituted. The equipment required to align this receiver will be:

- (1) Signal Generator capable of tuning from 5 to 140 MC.
- (2) Non-metallic screw driver
- (3) 50 ohm non-inductive resistor for a dummy antenna
- (4) Output meter.

b. I-F ALIGNMENT. -

(1) Disconnect the grid lead of the 954 converter tube (V₂) and connect the signal generator output between the grid and ground. Make the connection with a small clip or wind a piece of flexible wire around the grid terminal, but do not attempt to solder a lead to the terminal as the heat is sure to crack the glass envelope. Connect the output meter to either the headset jack or the speaker terminal board.

(2) Set the controls on the receiver as follows:

- (a) R.F. GAIN control at maximum gain.
- (b) A.F. GAIN control at maximum gain.
- (c) SELECTIVITY switch at SHARP.
- (d) AM/FM switch AM.
- (e) BAND SWITCH at band #2
- (f) A.V.C. switch at OFF
- (g) SEND/REC. switch at REC.
- (h) A.N.L. switch at OFF.
- (i) B.F.O. switch at OFF
- (j) TONE control at NORMAL.

(3) Set the signal generator frequency at 5.25 MC. and with the 400 cycle modulation turned on, align transformer T₁₀, T₁₁, T₁₂ and T₁₃ by adjusting the slug adjustment screws S₁, S₂, S₃, S₄, S₅, S₆, S₉ and S₁₀. Refer to figure 8 for location of these adjustment screws. A bakelite screw driver with a metal or insulated tip is necessary for accurate alignment.

(4) Repeat the alignment procedure at least once to insure an accurate alignment.

(5) The discriminator transformer T₁₄, is aligned as follows:

(a) Set the SELECTIVITY switch at BROAD and FM/AM switch at FM.

(b) With the signal generator set at the 5.25 MC. i-f frequency and with the 400 cycle modulation on, rotate the slug adjustment screw S₈ until the signal level read on the output meter drops to zero. This null point is approached very suddenly, therefore, the slug adjustment screw must be turned very slowly. NOTE: The output of the signal generator should be approximately 1000 microvolts for good results. Back off the audio gain slightly if necessary.

(c) Now detune this adjustment slightly so that the output meter gives a readable indication.

(d) Adjust the primary slug adjustment, S₇, of the discriminator transformer for maximum response.

(e) Retune the secondary slug adjustment until the output again drops to zero.

(f) Detune the signal generator to a frequency lower than the i-f frequency until the maximum output

point is reached. Note the output meter reading and the frequency deviation from the i-f frequency. (5.25 MC.)

(g) Repeat the procedure above the i-f frequency. The frequency deviation and maximum output 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 slug adjustment, S₇, until the output rises an amount equal to about half the difference of the two outputs previously noted.

(h) Retest for balance as above and readjust the primary slug adjustment until both maximum readings are alike when the signal generator is detuned approximately the same amount on either side of resonance (5.25 MC.) If a balance cannot be obtained, it is an indication that the discriminator transformer secondary slug adjustment 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 very slight misadjustment will result in distortion in frequency modulated signals.

c. B.F.O. ADJUSTMENT. - With the signal generator connected as for i-f alignment above, set the generator's frequency to 5.25 MC. and turn off the 400 cycle modulation. Turn on the receiver's B.F.O. switch and back off the A.F. GAIN control slightly. Adjust the iron core screw on top of coil L₅ until a 1000 cycle note is obtained in the headset. The headset should replace the output meter for this operation. Note that the 1000 cycle note appears at two settings of this screw. Either setting is useable. It merely means that the oscillator is set 1000 cycles above or below the i-f frequency.

d. R-F ALIGNMENT. - Refer to figure 8 for location of alignment controls.

(1) Connect the signal generator to plug CN-49121 and wire the dummy antenna resistor (50 ohm noninductive resistor) in series with the generator terminals. Connect the output meter to the speaker terminals.

(2) Set the controls on the receiver as for i-f amplifier alignment. Refer to paragraph D-3. b. (2).

(3) Turn on 400 cycle tone modulation on the signal generator.

(4) Align the three bands as follows:

(a) BAND 1.

1. Set signal generator and receiver at 45 MC.

2. Adjust trimmer capacitor, C₆₆ for maximum output. Note that the frequency at which the receiver's oscillator operates on this band, is higher than the signal frequency.

3. Adjust trimmer capacitor C₆₃ for maximum output.

4. Set signal generator and receiver at 30 MC.

5. Set padder capacitor C₅₈ for maximum output while rocking the tuning control to obtain the optimum setting of the padder.

6. Repeat the above operations for alignment of the high frequency end of the band as described.

7. Check the 40 MC. check point for alignment.

(b) BAND 2.

1. Set signal generator and receiver at 80 MC.

2. Adjust trimmer capacitor C₆₇ for maximum output. Note that the frequency at which the receiver's oscillator operates on this band is lower than the signal frequency.

3. Adjust trimmer capacitor, C₆₄ for maximum output.

4. No padder capacitor adjustment is provided for the low frequency end of this band.

5. Check the 60 MC. check point for alignment.

(c) BAND 3.

1. Set signal generator and receiver at 135 MC.

2. Adjust trimmer capacitor C₆₅ for maximum output. Rock the tuning control while making the adjustment to obtain the optimum settings.

3. It is not recommended that the frequency of the oscillator in this band be adjusted except at the factory or at a service depot. Should it be impractical to return the receiver to a depot or the factory for adjustment, then make the following adjustments:

a. Remove the top cover of the r-f unit and locate the high frequency oscillator coil T₉.

b. Set the signal generator and receiver at 135 MC.

c. Locate the white cellanese wire on the coil form of transformer T₉, and carefully shift its position for maximum output. Note that the frequency at which the receiver's oscillator operates on this band is lower than the signal frequency.

d. Set the signal generator and receiver at 90 MC.

e. Locate the heavy tinned wire on the coil form of transformer T₉ and carefully shift the turns until maximum signal output is obtained. Note that this transformer does not have a padding capacitor.

f. Recheck the high frequency end of the band and then cement the windings in place with "Q-Max" or equivalent low loss cement.

g. Set the signal generator and receiver at 135 MC.

h. Reset trimmer capacitor C₆₅ for maximum output.

E. ELECTRICAL AND MECHANICAL DATA

E-1. RESISTANCE CHART. - All measurements were made from the tube socket terminals to ground. The tubes were in their sockets. The power was disconnected from the receiver, all front panel switches were set at ON and both

GAIN controls were turned to their maximum output position. The AM/FM switch was set at A.M. All measurements were made with a Weston Model 772 analyzer.

ACORN TYPE TUBES

TUBE	JAN	PIN						
		H	G1	G2	G3	P	H	K
V ₁	956	0	8.5	23,000	250	42,000	0	270
V ₂	954	0	0	160,000	0	34,000	0	2,000
V ₁₅	955	0	22,000	X	X	38,000	0	0
V ₁₆	956	0	4,700	70,000	0	45,000	0	220

STANDARD TYPE TUBES

TUBE	JAN	PIN							
		1	2	3	4	5	6	7	8
V ₃	6AC7	0	0	0	over 500,000	170	75,000	0	30,000
V ₄	6AB7	0	0	0	over 500,000	180	34,000	0	30,000
V ₅	6SK7	0	0	290	over 500,000	290	22,500	0	31,000
V ₆	6H6	0	0	over 500,000	0	over 500,000	NC	0	over 500,000
V ₇	6AC7	0	0	0	33,500	0	20,000	0	20,000
V ₈	6H6	0	0	120,000	240,000	120,000	NC	0	0
V ₉	6SL7GT	over 500,000	295,000	5750	100,000	310,000	5750	0	0
V ₁₀	VR-150/30	0	0	33,000	0	33,000	NC	33,000	NC
V ₁₁	6V6GT/G	0	0	30,000	30,000	340,000	NC	0	250
V ₁₂	6V6GT/G	0	0	30,000	30,000	340,000	NC	0	250
V ₁₃	5U4G	NC	30,000	NC	45	NC	45	NC	30,000
V ₁₄	6J5	0	0	54,000	NC	50,000	NC	0	0

NC - No Connection

X - No Pin

E-2. VOLTAGE CHART. - All measurements were made from the tube socket terminals to ground. The tubes were in their sockets. All panel switches were set at ON (REC.-SEND switch at REC.) and both GAIN controls were turned to

their maximum output position. The AM/FM switch was set at AM, the SELECTIVITY switch at SHARP, and the BAND SWITCH at #1 position. All measurements were made with an RCA Volt Ohmyst Junior and with a line voltage of 117-volts.

ACORN TYPE TUBES

TUBE	JAN	PIN						
		H	G1	G2	G3	P	H	K
V ₁	956	6.3 (a-c)	0	100	2.8	160	0	2.8
V ₂	954	00	0	80	4.2	120	6.3 (a-c)	4.2
V ₁₅	955	0	-2.6	X	X	100	6.3 (a-c)	0
V ₁₆	956	6.3 (a-c)	0	100	2.3	160	0	2.3

STANDARD TYPE TUBES

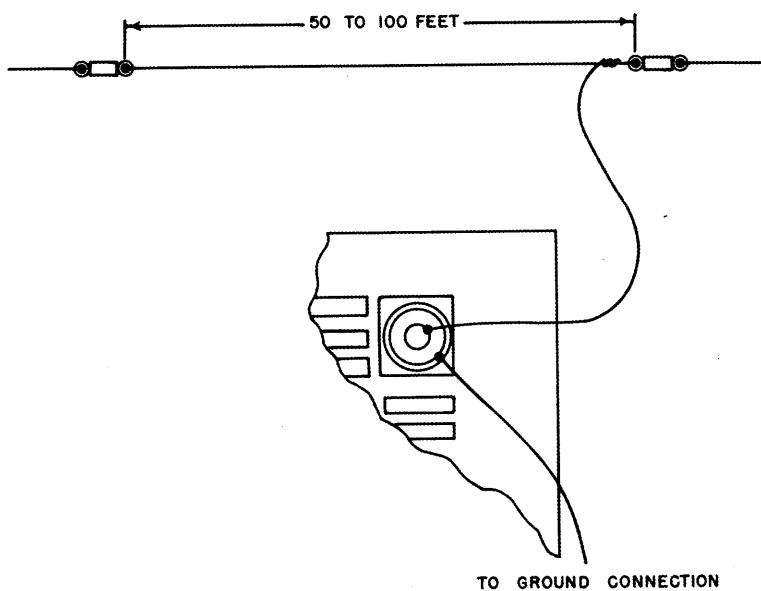
TYPE	JAN	PIN							
		1	2	3	4	5	6	7	8
V ₃	6AC7	0	0	0	-3	1.5	180	6.3 (a-c)	260
V ₄	6AB7	0	0	0	-2.8	0.8	125	6.3 (a-c)	260
V ₅	6SK7	0	6.3 (a-c)	4	0	4	100	0	240
V ₆	6H6	0	0	-5.6	0	-6.8	X	6.3 (a-c)	-5.8
V ₇	6AC7	0	0	0	-0.9	0	78	6.3 (a-c)	78
V ₈	6H6	0	0	-1.0	0	-1.0	X	6.3 (a-c)	0
V ₉	6SL7GT	0	150	2.2	0	150	2.2	0	6.3 (a-c)
V ₁₀	VR-150/30	NC	0	120	X	120	X	120	NC
V ₁₁	6V6GT/G	0	6.3 (a-c)	280	260	0.2	X	0	14
V ₁₂	6V6GT/G	0	6.3 (a-c)	260	250	0.2	X	0	14
V ₁₃	5U4G	0	300	X	280	X	280	X	300
V ₁₄	6J5	0	0	110	X	-7.8	X	6.3 (a-c)	0

NC - No Connection

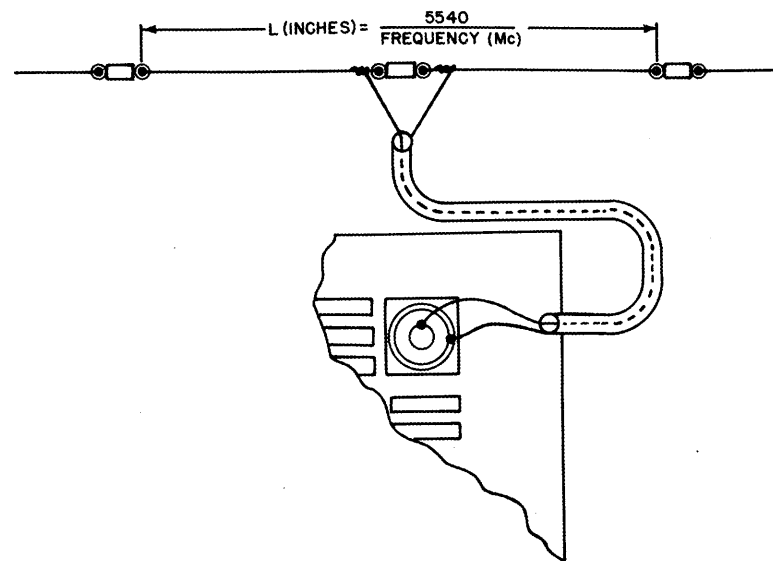
X - No Pin

* - Tie Lug

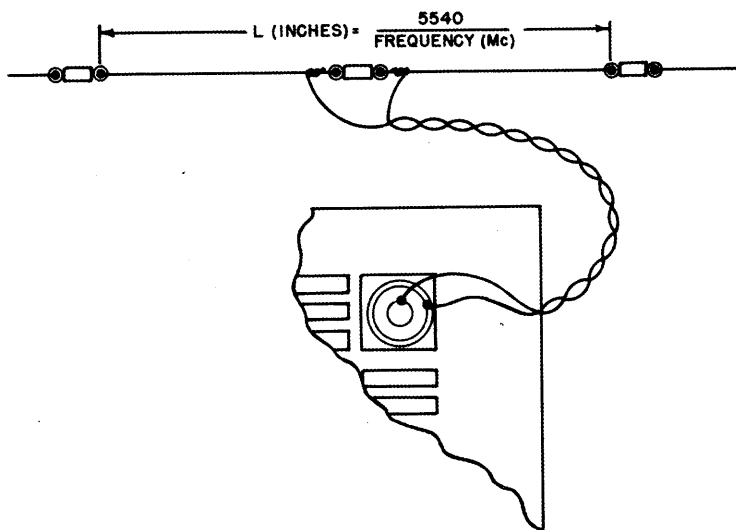
SINGLE WIRE ANTENNA INSTALLATION



DOUBLET ANTENNA INSTALLATION
USING COAXIAL LINE LEAD-IN



DOUBLET ANTENNA INSTALLATION
USING TWISTED PAIR LEAD-IN



MULTIPLE DIPOLE ANTENNA

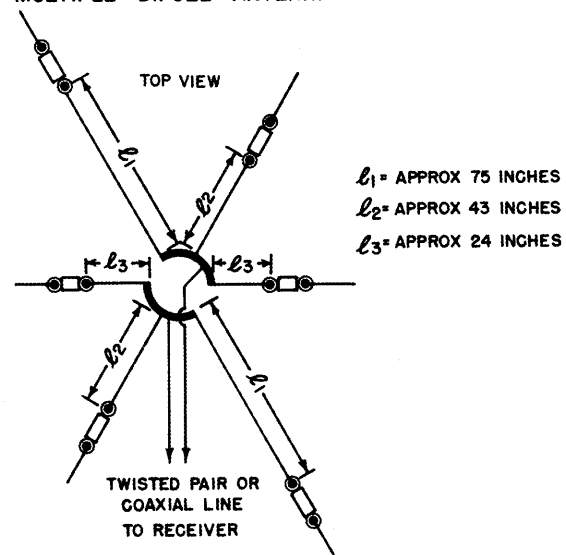
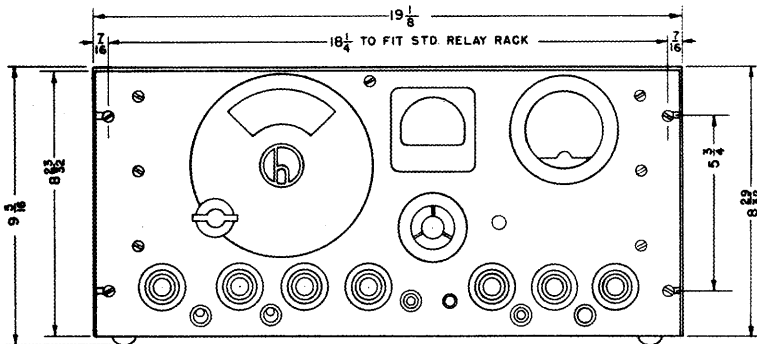
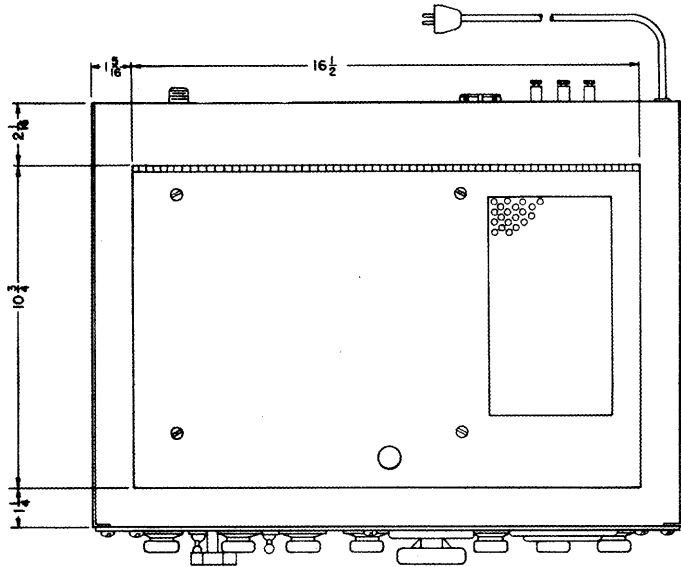


Figure 9. Recommended Antenna Installations



WEIGHT - 78 LBS.

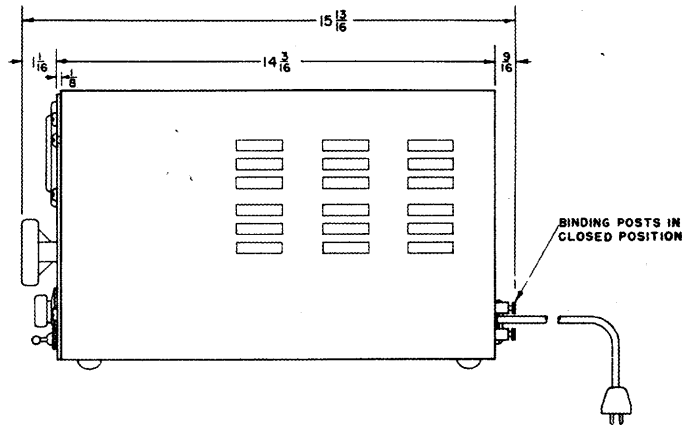


Figure 10. Radio Receiver CHL-46298, Outline Dimensional Sketch

PARTS LIST

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
CAPACITORS			
C1	Capacitor, variable: air dielectric; 3 section; 9 plates with double spacing between plates; min. cap. 6 mmfd., max. cap. 54.7 mmfd.: plates are aluminum; shaft silver plated brass $\frac{1}{2}$ " long x 0.375" dia., with x 2B insulation on stators; front rotor section grounded to frame, other two sections insulated from frame; spade lug mtg.; solder lug terminals.	Secondary tuning of transformers T ₁ to T ₉ inclusive	48C147
C2	Capacitor, variable: air dielectric; single section; 7 plates; min. cap. 3 mmfd., max. cap. 25 mmfd.: aluminum plates; ceramic insulation:	ANTENNA tuning	48A039
C3	Capacitor, fixed: mica dielectric; 330 mmfd. \pm 10%; 500 V. D-C working:	Secondary padder on transformer T ₅	CM20A331K
C4	Capacitor, fixed: mica dielectric; 2200 mmfd. \pm 10%; 500 V. D-C working:	Cathode by-pass for tube V ₁	CM30A222K
C5	Same as C ₃	Screen by-pass for tube V ₁	-
C6	Same as C ₄	Plate return for tube V ₁	-
C7	Capacitor, fixed: ceramic dielectric; 10 mmfd. \pm 10%; 500 V. D-C working; temp. coeff. -0.00055 mmfd./mmfd./deg. Cent.	Coupling between tubes V ₁ and V ₂	47A006
C8	Capacitor, fixed: mica dielectric; 8200 mmfd. \pm 10%; 500 V. D-C working.	A-V-C filter	CM40A822K

C ₉	Same as C ₃	Coupling between oscillator tube V ₁₅ and mixer tube V ₂	-
C ₁₀	Same as C ₃	Screen by-pass for tube V ₂	-
C ₁₁	Capacitor, variable: air dielectric; small variable capacity formed between a 6-32 metal screw and a CRS plate 5/8" wd x 13/16" lg, rolled to 3/16" ID.	Trimmer adjustment for osc. tuning capacitor C ₁₀	48A140
C ₁₂	Capacitor, fixed: paper dielectric; 1000 mmfd. + 100-20%; 600 V. D-C working; part of transformer T ₁₀	A-V-C filter for tube V ₃	47A121
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	-
C ₁₅	Same as C ₈	Plate return for tube V ₃	-
C ₁₆	Same as C ₁₂	A-V-C filter for tube V ₄	-
C ₁₇	Same as C ₈	Cathode by-pass for tube V ₄	-
C ₁₈	Same as C ₈	Screen grid by-pass for tube V ₄	-
C ₁₉	Same as C ₈	Plate return for tube V ₄	-
C ₂₀	Capacitor, fixed: mica dielectric; 47 mmfd. ± 10%; 500 V. D-C working.	Coupling between transformer T ₁₂ and Tube V ₅	CM20A470K
C ₂₁	Same as C ₈	Cathode by-pass for tube V ₅	-

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
C ₂₂	Same as C ₈	Screen grid by-pass for tube V ₅	-
C ₂₃	Same as C ₈	Plate return for tube V ₅	-
C ₂₄	Capacitor, fixed: mica dielectric; 56 mmfd. \pm 10%; 500 V. D-C working.	Diode return for tube V ₆	CM20A560K
C ₂₅	Capacitor, fixed: paper dielectric; 0.05 mfd. \pm 6 \pm 14%; 600 V. D-C working.	A-N-L by-pass	46A005
C ₂₆	Same as C ₂₄	Diode filter for tube V ₆	-
C ₂₇	Capacitor, fixed: mica dielectric; 100 mmfd. \pm 10%; 500 V. D-C working.	A-V-C filter	CM20A101K
C ₂₈	Capacitor, fixed: mica dielectric; 560 mmfd. \pm 10%; 500 V. D-C working.	A-V-C filter	CM30A561K
C ₂₉	Capacitor, fixed: ceramic dielectric; 25 mmfd. \pm 10%; 500 V. D-C working; zero temp coeff; part of transformer T ₁₄	Coupling between tube V ₇ and transformer T ₁₄ .	47A142
C ₃₀	Same as C ₈	Plate return for tube V ₇	-
C ₃₁	Same as C ₂₀	Cathode by-pass for tube V ₈	-
C ₃₂	Capacitor, fixed: mica dielectric; 560 mmfd. \pm 10%; 500 V. D-C working.	De-emphasis for tube V ₈	CM25A561K

C ₃₃	Same as C ₈	Coupling between tubes V ₆ , V ₈ and V ₉	-
C ₃₄	Capacitor, fixed: mica dielectric; 1000 mmfd \pm 10%; 500 V. D-C working.	Grid by-pass for tube V ₁₂	CM30A102K
C ₃₅	Same as C ₂₅	Tone control for tubes V ₁₁ and V ₁₂	-
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	Capacitor, fixed: paper dielectric; 20 mfd. - 10 + 75%; 25 V. D-C working.	Cathode by-pass for tube V ₉	46A011
C ₃₉	Same as C ₃	Heater by-pass for tube V ₁₆	-
C ₄₀	Same as C ₃₈	Cathode by-pass for tube V ₉	-
C ₄₁	Capacitor, fixed: ceramic dielectric; 8 mmfd \pm 10%; 500 V. D-C working.	Coupling between tubes V ₁₆ and V ₁	CC20UK080K
C ₄₂	Capacitor, fixed: paper dielectric; triple unit; unit #1 is 4 mfd. 650 V. D-C working (C ₄₂); unit #2 is 8 mfd. 650 V. D-C working (C ₄₃); unit #3 is 8 mfd. 650 V. D-C working (C ₄₄).	Power supply filter	42B043
C ₄₃			
C ₄₄			
C ₄₅	Same as C ₃	Heater by-pass for tube V ₁₅	-
C ₄₆	Same as C ₃	Heater by-pass for tube V ₂	-
C ₄₇	Same as C ₃	Heater by-pass for tube V ₁	-

Ref. Symbol	Name of Part and Description	Function	Hallcrafters Part No.
C ₄₈	Capacitor, fixed; mica dielectric; 8200 mmfd \pm 20%; 500 V. D-C working; part of filter LF ₁ .	Power line filter.	CM35A822M
C ₄₉	Same as C ₄₈ ; part of filter LF ₁	Power line filter.	-
C ₅₀	Same as C ₄₈ ; part of filter LF ₁	Power line filter.	-
C ₅₁	Same as C ₄₈ ; part of filter LF ₁	Power line filter.	-
C ₅₂	Same as C ₄	Plate decoupling for tube V ₁₄	-
C ₅₃	Capacitor, fixed: mica dielectric; 100 mmfd \pm 20%; 500 V. D-C working; part of B-F-0 assembly L ₅	B-F-0 grid coupling	CM20A101K
C ₅₄	Capacitor, fixed: ceramic dielectric; 200 mmfd \pm 10%; 500 V. D-C working; zero temp. coeff; part of B-F-0 assembly L ₅ .	B-F-0 tuning on L ₅	47A026
C ₅₅	Same as C ₃	Plate decoupling for tube V ₁₅	-
C ₅₆	Capacitor, fixed: ceramic dielectric; 50 mmfd \pm 2.5 mmfd; 500 V. D-C working; neg. 0.00085 mmfd/mmfd/deg. Cent.	Plate coupling for tube V ₁₅	47A109
C ₅₇	Capacitor, fixed: ceramic dielectric; 1000 mmfd \pm 20%; 500 V. D-C working.	Grid coupling for tube V ₁₅	47A132
C ₅₈	Capacitor, adjustable: mica dielectric; 450 mmfd \pm 10%; bakelite mtg. insulation.	Padder for transformer T ₇	44A050
C ₅₉	Capacitor, fixed: twisted pair of leads to form 1 mmfd capacity.	Coupling between tubes V ₁₄ and V ₆	-

C60	Capacitor, variable: air dielectric; min. cap. 3.5 mmfd, max. cap. 23 mmfd; ceramic insulation.	Pitch control for tube T ₁₄ .	48A064
C61	Same as C ₄	Screen grid by-pass for tube V ₂	-
C62	Same as C ₈	Plate decoupling for tube V ₂	-
C63	Capacitor, adjustable: ceramic dielectric; min. cap. 4 mmfd, max. cap. 20 mmfd; ceramic insulation.	Secondary trimmer for transformer T ₄	44A076
C64	Capacitor, adjustable: ceramic dielectric; 4 to 20 mmfd; 300 V D-C working; screw driver adjustment.	Secondary trimmer for transformer T ₅	44A101
C65	Same as C ₆₄	Secondary trimmer for transformer T ₆	-
C66	Capacitor, adjustable: air dielectric; 1 to 12 mmfd; bakelite insulation; screw driver adjustment.	Secondary trimmer for transformer T ₇	44A140
C67	Same as C ₆₆	Secondary trimmer for transformer T ₈	-
C68	Capacitor, fixed: ceramic dielectric; 100 mmfd \pm 3%; 500 V D-C working; neg. 0.00005 mmfd temp. coeff.; part of transformer T ₁₀ .	Primary trimmer for transformer T ₁₀	47A117
C69	Same as C ₆₈ , part of transformer T ₁₀ .	Secondary trimmer for transformer T ₁₀	-
C70	Same as C ₆₈ , part of transformer T ₁₁ .	Primary trimmer for transformer T ₁₁	-

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
C ₇₁	Same as C ₆₈ , part of transformer T ₁₁	Secondary trimmer for transformer T ₁₁	-
C ₇₂	Same as C ₆₈ , part of transformer T ₁₂	Primary trimmer for transformer T ₁₂	-
C ₇₃	Same as C ₆₈ , part of transformer T ₁₂	Secondary trimmer for transformer T ₁₂	-
C ₇₄	Capacitor, fixed: ceramic dielectric; 50 mmfd \pm 10%; 500 V. D-C working; zero temp. coeff; part of transformer T ₁₄	Primary trimmer for transformer T ₁₄	47A091
C ₇₅	Same as C ₇₄ , part of transformer T ₁₄	Secondary trimmer for transformer T ₁₄	-
C ₇₆	Same as C ₇₄ , part of transformer T ₁₃ .	Primary trimmer for transformer T ₁₃	-
C ₇₇	Same as C ₇₄ , part of transformer T ₁₃	Secondary trimmer for transformer T ₁₃	-
C ₇₈	Same as C ₈ .	Plate decoupling for tube V ₁	-
C ₇₉	Capacitor, fixed: mica dielectric; 510 mmfd \pm 10%; 500 V. D-C. working.	Plate decoupling for V ₁₆	CM20A511K

C80	Same as C ₃ .	Coupling between antenna and grid of tube V ₁₆	-
C81	Same as C ₃ .	Cathode by-pass for tube V ₁₆ .	-
C82	Same as C ₃ .	Screen grid by-pass for tube V ₁₆	
FUSES			
FS ₁	Fuse: 3 amperes @250 V.; 4AG; glass enclosed.	Power transformer primary protection	39A318
JACKS			
J ₁	Jack, phone: switching-one make, one break.	600 ohm headset connector	36B008
INDUCTORS			
L ₁	Inductor, R-F: 75 turns of #38 SCE single layer winding; inductance 15.5 microhenries \pm 10%; d-c resistance 4.10 ohms; color coded red.	Plate choke for tube V ₁₅	53A008

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
L ₂	Inductor, line filter: 57 turns of #22 SCE universal winding; 46 microhenries inductance; part of filter LF ₁ .	Power line filter choke	53A082
L ₃	Same as L ₂ , part of filter LF ₁	Power line filter choke	-
L ₄	Inductor, R-F: 42 turns of #28 SCE single layer winding; inductance 4.20 microhenries $\pm 10\%$; color coded blue.	Choke for heater of tube V ₁₅	53A009
L ₅	Inductor, beat frequency oscillator; assembly includes resistor R ₆₁ and capacitors C ₅₃ , C ₅₄ , and C ₅₉ ; tuned by adjustable iron core; unit shielded.	Beat frequency oscillator (B-F-O) coil	54C024
L ₆	Inductor assembly, filter: 2 section unit; section #1 inductance 3 henries - 10 + 30% @ 150 milliamperes; d-c resistance 85 ohms $\pm 10\%$; connected to solder lug terminals #2 and #3 (L ₆); section #2 inductance 12 henries - 10 + 20%, @ 90 milliamperes; d-c resistance 215 ohms $\pm 10\%$; connected to solder lug terminals #1 and #2 (L ₇); each section has a separate iron core.	Power supply filter choke	56C048
L ₇			
L ₈	Same as L ₄	Choke for heaters of tubes V ₁ , V ₂ , V ₁₅ , V ₁₆	-
L ₉	Same as L ₄	Choke for heater of tube V ₁₆	-
L ₁₀	Same as L ₁	Plate choke for tube V ₁₆	-

LINE FILTERS

LF ₁	Line filter assembly; consists of inductors L ₂ and L ₃ and capacitors C ₄₈ , C ₄₉ , C ₅₀ and C ₅₁ , mounted in drawn aluminum can.	A-C line filter	53C056
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LAMPS

LM ₁	Lamp: bayonet base; 6 to 8 volts @ 250 milliamperes; glass bulb.	Main tuning dial lamp	39A003
LM ₂	Same as LM ₁	Vernier tuning dial lamp	-

METERS

M ₁	Meter: "S" meter; calibrated in "S" units; 160-0-40 microamperes movement.	AM/FM tuning meter	82A065
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PLUGS

PL ₁	Plug and line cord assembly: 2 conductor #18 type S-J all rubber covered cord 6 feet long with a spring type (allied type 371) molded on plug at one end.	A-C power line connection	87A125
PL ₂	Plug, octal male; supplied with insulated jumpers between contacts 3 and 4, and contacts 6 and 7	Shorting plug for A-C operation and remote stand-by connection	35A003

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
	Plug, co-axial, Navy type 49121	Antenna connector	10A134
RESISTORS			
R ₁	Resistor, fixed: 270 ohms \pm 10%; $\frac{1}{2}$ watt; carbon; insulated.	Cathode bias for tube V ₁ .	RC21AE271K
R ₂	Resistor, fixed; 1000 ohms \pm 10%; 1/2 watt; carbon; insulated.	Screen voltage dropping for tube V ₁	RC21AE102K
R ₃	Same as R ₂	Plate decoupling for tube V ₁	-
R ₄	Resistor, fixed: 10,000 ohms \pm 20%; 2 watt; carbon; insulated.	Plate decoupling for tube V ₁	RC41AE103M
R ₅	Resistor, fixed: 2200 ohms \pm 10%; 1/2 watt; carbon; insulated.	Cathode bias for tube V ₂	RC21AE222K
R ₆	Same as R ₂	Screen voltage dropping for tube V ₂	RC21AE104K
R ₇	Resistor, fixed: 100,000 ohms \pm 10%; 1/2 watt; carbon; insulated.	Screen voltage dropping for tube V ₂	RC21AE104K
R ₈	Resistor, fixed: 27,000 ohms \pm 10%; 1/2 watt; carbon; insulated.	Panoramic adapter decoupling	RC21AE273K.

R ₉	Resistor, fixed: 10 ohms \pm 10%; 1/2 watt; carbon; insulated	1st I-F band expansion on transformer T ₁₀	RC21AE100K
R ₁₀	Resistor, fixed: 100,000 ohms \pm 10%; 1/2 watt; carbon; insulated; part of transformer T ₁₀ .	A-V-C decoupling for tube V ₃	RC10AE104K
R ₁₁	Resistor, variable: 10,000 ohm \pm 20%; #8 reversed taper; includes switch (SW ₃) on rear.	R.F. GAIN control	25C059G
R ₁₂	Resistor, fixed: 120 ohms \pm 10%; 1/2 watt; carbon; insulated.	Cathode bias for tube V ₉	RC20AE121K
R ₁₃	Resistor, fixed: 120 ohms \pm 10%; 1/2 watt; carbon; insulated.	Cathode bias for tube V ₃	RC21AE121K
R ₁₄	Resistor, fixed: 39,000 ohms \pm 10%; 1/2 watt; carbon; insulated.	Screen voltage dropping for tube V ₃	RC21AE393K
R ₁₅	Resistor, fixed: 330 ohms \pm 10%; 1/2 watt; carbon; insulated.	Plate decoupling for tube V ₃	RC21AE331K
R ₁₆	Same as R ₉	2nd I-F band expansion on transformer T ₁₁	-
R ₁₇	Resistor, fixed: 470 ohms \pm 10%; 1/2 watt; carbon; insulated.	Plate decoupling for tube V ₅	RC21AE471K
R ₁₈	Resistor, fixed: 33 ohms \pm 10%; 1/2 watt; carbon; insulated.	Parasitic suppressor for tube V ₅	RC21AE330K

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
R ₁₉	Same as R ₁₀ , part of transformer T ₁₁	A-V-C decoupling for tube V ₄	-
R ₂₀	Same as R ₁₃	Cathode bias for tube V ₄	-
R ₂₁	Same as R ₂	Screen voltage dropping for tube V ₄	-
R ₂₂	Same as R ₁₅	Plate decoupling for tube V ₄	-
R ₂₃	Same as R ₉	3rd I-F band expansion on transformer T ₁₂	-
R ₂₄	Resistor, fixed: 470,000 ohms \pm 10%; 1/2 watt; carbon; insulated	Grid return for tube V ₅	RC21AE474K
R ₂₅	Same as R ₁₅	Cathode bias for tube V ₅	-
R ₂₆	Same as R ₉	Parasitic suppressor for tube V ₁	-
R ₂₇	Same as R ₂	Plate decoupling for tube V ₅	-
R ₂₈	Resistor, fixed; 7500 ohms \pm 5%; 10 watt; wire wound; coated with baked vitreous enamel;	Screen voltage dropping for tubes V ₁ , V ₅ , and V ₇ .	24BG752D

R ₂₉	Same as R ₅	Screen and plate voltage dropping for tube V ₇	-
R ₃₀	Resistor, fixed; 22,000 ohms \pm 10%; 2 watt; carbon; insulated.	Screen voltage divider for tube V ₇	RC41AE223K
R ₃₁	Resistor, fixed: 47,000 ohms \pm 10%; 1/2 watt; carbon; insulated.	Diode load for tube V ₆	RC21AE473K
R ₃₂	Resistor, fixed: 1 megohm \pm 10%; 1/2 watt; carbon; insulated.	A-N-L load	RC21AE105K
R ₃₃	Same as R ₇	Diode load for tube V ₆	-
R ₃₄	Resistor, fixed: 220,000 ohms \pm 10%; 1/2 watt; carbon; insulated:	Diode load for tube V ₆	RC21AE224K
R ₃₅	Same as R ₂₄	A-V-C decoupling	-
R ₃₆	Same as R ₃₄	Diode load for tube V ₆	-
R ₃₇	Resistor, fixed: 15,000 ohms \pm 10%; 1/2 watt; carbon; insulated	Primary load for discriminator transformer T ₁₄	RC21AE153K

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
R ₃₈	Resistor, fixed: 56,000 ohms \pm 10%; 1/2 watt; carbon; insulated.	Grid return for tube V ₇	RC21AE563K
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	same as R ₃₄	De-emphasis network for tube V ₈	-
R ₄₃	Resistor, variable: 1 megohm \pm 20%; carbon: #6 taper.	A.F. GAIN control	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, fixed: 3300 ohms \pm 10%; 1/2 watt; carbon; insulated;	Cathode bias for tube V ₉	RC21AE332K
R ₄₇	Same as R ₄₆	Cathode bias for tube V ₉	-
R ₄₈	Resistor, fixed: 100,000 ohms \pm 20%; 1/2 watt; carbon; insulated.	Grid bias for tube V ₂ on band 2	RC21AE104M
R ₄₉	Same as R ₃₄	Grid return for tube V ₁₁	-

R50	Same as R ₃₄	Grid return for tube V ₁₂	-
R51	Same as R ₇	Grid return for tube V ₉	-
R52	Resistor, fixed: 220 ohms \pm 10%; 2 watt; carbon; insulated.	Cathode bias for tubes V ₁₁ and V ₁₂	RC41AE221K
R53	Resistor, fixed: 3900 ohms \pm 10%; 2 watt; carbon; insulated.	Tone control feed back impedance	RC40AE392K
R54	Same as R ₈ .	Screen voltage dropping for tube V ₁₆	
R55	Same as R ₁₈	Degeneration for tube V ₄	-
R56	Same as R ₂₄	"S" meter current limiting	-
R57	Same as R ₁₈	"S" meter shunt	-
R58	Resistor, variable: 1500 ohms \pm 20%; wire wound; st. line taper;	"S" meter "0" setting control	25C060
R59	Resistor, fixed: 3300 ohms \pm 5%; 10 watt; wire wound; coated with baked vitreous enamel.	Voltage dropping for tube V ₁₀	24BG332D

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
R60	Same as R ₃₀	Plate decoupling for tube V ₁₄	-
R61	Resistor, fixed: 47,000 ohms \pm 10%; 1/2 watt; carbon; insulated; part of B-F-0 assembly L ₅	Grid return for tube V ₁₄	RC20AE473K
R62	Same as R ₁₅	Plate decoupling for tube V ₁₅	-
R63	Resistor, fixed; 4700 ohms \pm 10%; 1/2 watt; carbon; insulated.	Plate decoupling for tube V ₁₅	RC21AE472K
R64	Resistor, fixed: 22,000 ohms \pm 10%; 1/2 watt; carbon; insulated.	Grid return for tube V ₁₅	RC21AE223K
R65	Same as R ₁₈	Grid current limiter for tube V ₁₅	-
R66	Resistor, fixed: 6 ohms \pm 10%; 1/2 watt; carbon; insulated.	Grid current limiter for tube V ₁₅	23A011
R67	Same as R ₂	Plate decoupling for tube V ₂	-
R68	Resistor, fixed: 8 ohms \pm 10%; 1/2 watt; carbon; insulated.	Grid current limiter for tube V ₁₅	23A019
R69	Resistor, fixed: 15,000 ohms \pm 20%; 1/2 watt; carbon; insulated.	Tone control feed back impedance	RC20AE153M

R70	Same as R ₅₂	Parasitic suppressor for tube V ₂	-
R71	Same as R ₃₇	Secondary load for discriminator transformer T ₁₄	-
R72	Same as R ₅	Cathode bias for tube V ₃	-
R73	Resistor, fixed: 4700 ohms \pm 10%; 1/2 watt; carbon; insulated	Grid return for tube V ₁₆	RC21AE472K
R74	Resistor, fixed: 220 ohms \pm 10%; 1/2 watt; carbon; insulated	Cathode bias for tube V ₁₆	RC21AE221K
SOCKETS			
SO ₁	Socket, octal: female; high dielectric mica filled bakelite.	D-C power input and remote stand-by connection	6A200
SO ₂	Connector, co-axial: type CN-49194	Panoramic adapter input.	10A056
SO ₃	Connector, co-axial: type CN-49120	Antenna input	36A018

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
SWITCHES			
SW ₁	Switch, rotary selector: 3 position, single pole, 7 section; non-shorting type contacts; ceramic wafers.	BAND SWITCH	60B181
SW ₂	Switch, toggle: SPST; rated 3 amperes @ 250 V.	B.F.O. switch	60A175
SW ₃	Switch, toggle action: SPST; part of resistor R ₅₈	"S" meter switch	-
SW ₄	Same as SW ₂	A.V.C. switch	-
SW ₅	Same as SW ₂	REC./SEND switch	-
SW ₆	Switch, toggle: DPST; rated 3 amperes @ 250 V.	A.N.L. switch	60A123
SW ₇	Switch, rotary selector: 3 section 3 position; 2 shields separate section #1 from rest of the assembly; a single pole A-C power switch is included at rear and is open at position #1, and closed in positions #2 and #3;	SELECTIVITY control and and A.C. switch	60B178
SW ₈	Switch, rotary selector: single section 2 position	A.M./F.M. switch	60A177
SW ₉	Switch, rotary selector: 3 circuit; single section 4 position.	TONE switch	60B212
SW ₁₀	Switch, toggle: DPDT, rated 3 amperes @ 250 V.	115/230 volt A-C change over	60A090

TRANSFORMERS

T ₁	Transformer, R-F: 27.8 to 47 megacycles.	Coupling between radiation suppressor and grid of tube V ₁ for band 1	51A265
T ₂	Transformer, R-F: 46 to 82 megacycles.	Coupling between radiation suppressor and grid of tube V ₁ for band 2	51A268
T ₃	Transformer, R-F: 82 to 143 megacycles.	Coupling between radiation suppressor and grid of tube V ₁ for band 3	51A792
T ₄	Transformer, R-F: 27.8 to 47 megacycles.	Coupling between tubes V ₁ and V ₂ for band 1	51B793
T ₅	Transformer, R-F: 46 to 82 megacycles.	Coupling between tubes V ₁ and V ₂ for band 2	51B794
T ₆	Transformer, R-F: 82 to 143 megacycles.	Coupling between tubes V ₁ and V ₂ for band 3	51A776
T ₇	Transformer, R-F: 27.8 to 47 megacycles.	Tuned circuit of oscillator stage for band 2	51A267
T ₈	Transformer, R-F: 46 to 82 megacycles.	Tuned circuit of oscillator stage for band 2	51A270

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
T ₉	Transformer, R-F: 82 to 143 megacycles.	Tuned circuit of oscillator stage for band 3	51B778
T ₁₀	Transformer, intermediate-frequency: 5.25 megacycles; fixed trimmer capacitors (C ₆₈) and (C ₆₉), a fixed resistor (R ₁₀) and a fixed capacitor (C ₁₂) complete the assembly;	Coupling between tubes V ₂ and V ₃	50C140
T ₁₁	Transformer, intermediate-frequency: 5.25 megacycles; fixed trimmer capacitors (C ₇₀) and (C ₇₁), a fixed resistor (R ₁₉) and a fixed capacitor (C ₁₆) complete the assembly.	Coupling between tubes V ₃ and V ₄	50C141
T ₁₂	Transformer, intermediate-frequency: 5.25 megacycles; fixed trimmer capacitors (C ₇₂) and (C ₇₃), complete the assembly.	Coupling between tubes V ₄ and V ₅	50C142
T ₁₃	Transformer, intermediate-frequency: 5.25 megacycles; fixed trimmer capacitors (C ₇₆) and (C ₇₇) complete the assembly.	Coupling between tubes V ₅ and V ₆	50C143
T ₁₄	Transformer, discriminator: 5.25 megacycles; fixed trimmer capacitors (C ₇₄) and (C ₇₅), and a fixed coupling capacitor (C ₂₉) complete the assembly.	Coupling between tubes V ₇ and V ₈	50C144
T ₁₅	Transformer, A-F: one primary and 2 secondary windings; primary to match a 12,000-ohm push-pull load @ 35 ma. for each tube; first secondary to match a load of 600 ohms, center tapped; second secondary to match a load of 5000 ohms and 500 ohms.	Coupling between audio out-put tubes V ₁₁ and V ₁₂ and load	55C062

T ₁₆	Transformer, power: primary, 2 section winding connected in parallel for 115 V. A-C, and connected in series for 230 V. A-C operation, 50/60 cycles, single phase; first secondary center tapped to provide 270 V. D-C @ 150 milliamperes across 10 mfd. capacitor and a 2 henry 85 ohm choke with a 5U4G rectifier tube; second secondary 6.4 V A-C @ 4 amperes; third secondary 5 V. A-C @ 3 amperes.	A-C power transformer.	52C084
TERMINAL BOARDS			
TS ₁	Board, terminal: output; consists of vacuum impregnated natural linen bakelite, marked "600 OHM CENTER TAP - GND. and 500 OHM, 5000 OHM-GND",	500 ohm, 5000-ohm and center tap of 600-ohm output connections	41X6506
TUBES			
V ₁	Tube, acorn pentode, type 956	R-F amplifier	90X956
V ₂	Tube, acorn pentode, type 954	Converter	90X954
V ₃	Tube, R-F pentode, type 6AC7	1st I-F amplifier	90X6AC7
V ₄	Tube, R-F pentode, type 6AB7	2nd I-F amplifier	90X6AB7
V ₅	Tube, R-F pentode, type 6SK7	3rd I-F amplifier	90X6SK7
V ₆	Tube, double diode, type 6H6	A-M second detector	90X6H6

Ref. Symbol	Name of Part and Description	Function	Hallicrafter's Part No.
V ₇	Same as V ₃	F-M limiter	
V ₈	Same as V ₆	F-M discriminator	
V ₉	Tube, twin triode, type 6SL7GT	Audio voltage amplifier	90X6SL7GT
V ₁₀	Tube, gas filled diode, type OD3/VR-150	Voltage regulator	90XVR-150/30
V ₁₁	Tube, beam power amplifier, type 6V6GT/G	Audio power amplifier	90X6V6GT/G
V ₁₂	Same as V ₁₁	Audio power amplifier	
V ₁₃	Tube, full wave diode, type 5U4G	Plate supply rectifier	90X5U4G
V ₁₄	Tube, triode amplifier, type 6J5	Beat frequency oscillator	90X6J5
V ₁₅	Tube, acorn triode, type 955	High frequency oscillator	90X955
V ₁₆	Same as V ₁	Radiation suppressor	