SERVICE MANUAL

for

THE NATIONAL MODELS NC-TV 7W

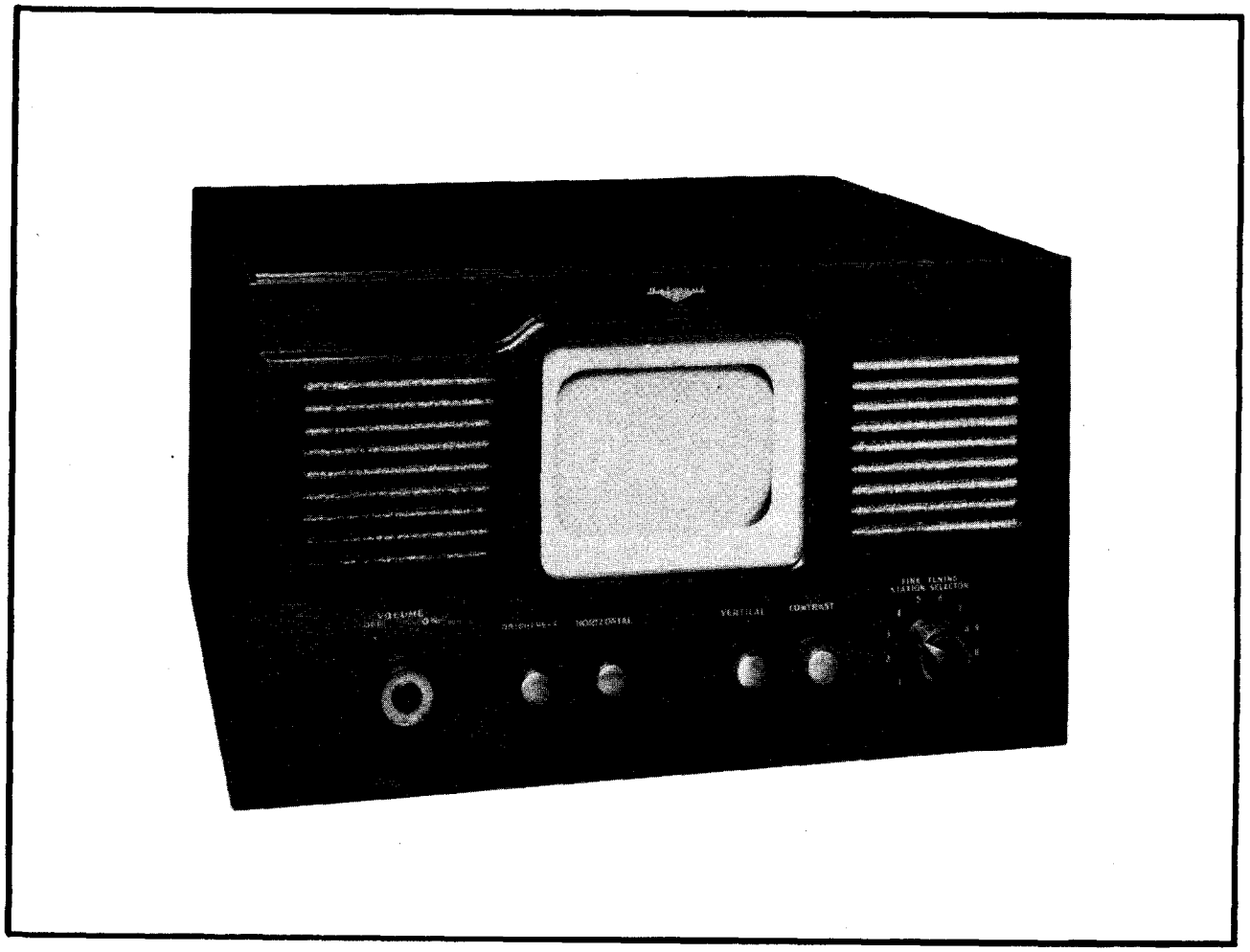
and

NC-TV 7M

TELEVISION RECEIVERS

National NC

Price $1.00



THE NC-TV 7 Television Receiver

a product of
NATIONAL COMPANY, INC.
MALDEN, MASS.

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SERVICE MANUAL
for the
NC-TV 7 and NC-TV 7M
TELEVISION RECEIVER

SECTION 1. DESCRIPTION

1-1. General

The National model NC-TV 7 is a direct-viewing, table model Television Receiver with a complement of 21 tubes, including a 7 inch picture tube and three rectifiers. The Receiver tunes all twelve television channels by means of eight, front-panel mounted controls. An efficient circuit provides a well-defined screen image bright enough for excellent visibility under all normal room lighting conditions. The two 6" loudspeakers reproduce the F.M. sound in a realistic manner with more than ample volume.

1-2. Summary

The following tabulations list in brief the pertinent data on the NC-TV 7.

Tube Complement

Tube	Function
6AU6	R.F. Amplifier
6AG5	Mixer
6C4	Local Oscillator
6AU6	First Video I.F. Amplifier
6AU6	Second Video I.F. Amplifier
6AU6	Third Video I.F. Amplifier
6AL5	Video Detector—Automatic Gain Control
6AU6	Video Amplifier
6AU6	Sync Clipper—D.C. Restorer
6AU6	4.5 Mc. Ratio Detector Driver
6T8	Ratio Detector—Audio Amplifier
6V6GT	Audio Output
6SN7GT	Vertical Sweep Generator
6SN7GT	Vertical Sweep Output
6SN7GT	Horizontal Sweep Generator
6SN7GT	Horizontal Sweep Output
12AU7	R.F. High Voltage Oscillator
1B3GT/8016	High Voltage Rectifier
5V4G	Rectifier
6X5GT	B Minus Rectifier
7JP4	Picture Tube

Input Power Supply Rating
115 volts A.C., 60 cycles, 160 watts

Antenna Input Circuit Impedance
300 ohms balanced or 72 ohms unbalanced

Audio Output Power
2 watts

I.F. Frequency
38.85 Mc. (center frequency)

Picture Size
4-3/16" X 5-3/4"

Loud-Speaker (2)
Type — 6 inch P.M.
Voice Coil Impedance — 3.2 ohms at 400 cps.

Fine Tuning Range
2 to 3 Mc. (varies on each channel)

Front-Panel Operating Controls
Off-On Switch
Volume — Dual Control
Station Selector
Fine Tuning — Dual Control
Contrast
Brightness
Horizontal
Vertical

Non-operating controls

Focus	At rear of chassis.
Horizontal Centering	At rear of chassis.
Vertical Centering	At rear of chassis.
Horizontal Size	At rear of chassis.
Vertical Size	At rear of chassis.
R.F. High Voltage Osc. Output Adjustment	At rear of chassis.
Horizontal Linearity	At bottom of chassis.

Overall Dimensions
NC-TV 7W (wooden cabinet)
Width 20-13/16"
Height 12-1/2"
Depth 17-13/32"
NC-TV 7M (metal cabinet)
Width 19-3/4"
Height 11-7/64"
Depth 17-1/2"

Television Channel Frequencies

Channel	Freq. Mc.	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver Local Osc. Freq. Mc.
2	54 - 60	55.25	59.75	92.55
3	60 - 66	61.25	65.75	98.55
4	66 - 72	67.25	71.75	104.55
5	76 - 82	77.25	81.75	114.55
6	82 - 88	83.25	87.75	120.55
7	174 - 180	175.25	179.75	141.25
8	180 - 186	181.25	185.75	147.25
9	186 - 192	187.25	191.75	153.25
10	192 - 198	193.25	197.75	159.25
11	198 - 204	199.25	203.75	165.25
12	204 - 210	205.25	209.75	171.25
13	210 - 216	211.25	215.75	177.25

SECTION 2. INSTALLATION

2-1. *General*

Installation of a television receiver differs greatly from the procedure followed with a conventional A.M. or F.M. receiver. The first and main requirement to be considered is the "know-how" of the installing technician. He should be thoroughly familiar with the installation requirements of your Receiver in all its aspects or, failing this, possess enough radio knowledge to carry out the instructions in this section in a capable manner.

Installation consists mainly of three parts: the selection of an antenna, erection of the antenna and initial adjustments in the NC-TV 7. Each of the three foregoing parts is of paramount importance and each has a direct bearing on the performance of your television receiver. Instructions for installation in its entirety are given in Section 2-6. The sections prior to this discuss, in detail, individual parts of the installation procedure.

2-2. *Precautions*

Due to the voltage requirements of the picture tube, extremely high voltages exist in the receiver. Operation of the NC-TV 7 outside its cabinet constitutes a dangerous shock hazard. High voltages are present inside the R.F. high voltage compartment and at points on the bottom of the chassis. Due caution must be employed to insure that bodily contact is not made to any high voltage point when working on the receiver. Make sure that the cover of the high voltage compartment is replaced in the event it is removed.

Precautions are required also in regards to the picture tube. Since the picture tube bulb has a large area and contains a high vacuum, considerable air pressure is exerted on the surface of the bulb. For this reason, never handle the picture tube unless it is absolutely necessary and then only when wearing shatter-proof glasses and heavy gloves. The bulb of the tube (particularly the large end) must never be struck, scratched or subjected to any pressure. In the receiver, the picture tube is amply protected by a shock-resistant mounting and a pane of shatter-proof safety glass in front of the viewing surface. If the picture tube is ever removed from the receiver, make sure it is replaced properly i.e., secure in its socket and mounting ring.

2-3. *Selection of the Antenna*

There are many good types of antennas commercially available. A specific type of antenna cannot be recommended since the antenna type should be determined by the location of the receiving antenna with respect to the transmitting antenna of the station or stations to be received. There are three main factors to be considered when selecting an antenna:

a. The directional characteristic of the antenna.
b. The gain or sensitivity of the antenna.
c. The frequency for which the antenna is designed.

Antennas are available which are uni-direct-

ional, bi-directional or omni-directional and with various degrees of gain. Select an antenna with as restricted a directional characteristic as possible. For example, if all transmitting antennas in the area are located in one direction, the uni-directional type should be preferred. However, bearing in mind the line-of-sight propagation of the television signals, the antenna must be receptive towards all directions in which television transmitting antennas are located and the bi-directional or omni-directional type may be called for in some areas.

The gain of the selected antenna should not be in excess of what is required. For example, in metropolitan areas where the antenna is in close proximity to transmitting antennas, a high-gain antenna would not improve reception, but rather be detrimental because too strong a signal at the input of the receiver will cause overload. Conversely, in areas where the transmitting antennas are far removed, a high-gain antenna must be used for good reception.

Closely allied with the gain of the antenna is the frequency for which the antenna has been designed. An antenna designed for the lower frequency television band will have better gain at the designed frequency than on the higher frequency television band and vice versa. An antenna designed for both bands will give fair gain on both bands. After learning the frequency of the television stations in the area, an antenna may be selected which covers all the desired stations, or possibly is designed to favor a remote station against a station fairly close to the receiving antenna.

It should be noted, from the preceding discussion, that all three factors which enter into the selection of an antenna are closely interrelated and have a direct bearing on the efficiency of reception. Therefore, each factor must be considered equally and none can be neglected. In summation, determine the antenna requirements of the installation and select an antenna which most nearly meets all these requirements.

An all-band antenna worthy of consideration is the "High-Low" type. This type has two sets of antenna elements, one stacked above the other, with one set designed for the low-frequency television band, the other for the high-frequency. A unique feature of this antenna is that each set of elements may be oriented, as desired, independent of each other. Antennas of this type are currently being manufactured by the Technical Appliance Co., (Taco), their type "E284", and the Ward Products Corp., their type "High-Low". Antenna manufacturers issue data sheets, on the various types of antennas, which should be of great assistance in selecting the antenna.

2-4. Erection of the Antenna

Theoretically, the ideal installation would have the antenna mounted high enough so that there would be a clear, unobstructed path for the television signal to travel from the transmitting antenna to the receiving antenna. However, in this case the ideal is not usually possible nor practical. In general, the antenna should be mounted high enough to clear obstructions such as buildings, hills etc., in the immediate vicinity. Mount the antenna at least 6 feet (1/4 wavelength) above ground or any adjacent conducting structure. Make sure the antenna is firmly mounted to support its own weight and to withstand strong winds. The position of the antenna elements with respect to the transmitting antenna depends on the directional characteristic of the antenna and the receiving area. Only by trial can the antenna be positioned properly. The elements should be positioned so that all stations in the area are well received and that "ghosts" (multiple images) are absent from the viewing screen. Ghosts are generally encountered when secondary emission of the transmitted signal from nearby buildings etc. cause a signal to arrive at the receiving antenna a fraction of time later than the fundamental signal.

Ghosts are sometimes produced by mismatch between antenna and receiver whereby a secondary signal is reflected back from the receiver to the antenna and back again to the receiver. This effect can be minimized by proper matching of antenna to receiver and by keeping the antenna feeders as short as possible with no excess length. The antenna input circuit of the NC-TV 7 is designed for a 300 ohm balanced line or a 72 ohm unbalanced line. The impedance of television antennas will be found to be one or the other. Select a transmission line to match the antenna and connect it to the matching terminals on the receiver. See Section 2-6 for instructions. Bring the transmission line out perpendicular from the antenna elements and keep it as far away as possible from metal objects in its travel to the receiver. In installations where the transmission line is, of necessity, very long, put a gradual twist in the line about once every foot to minimize the possibility of "ghost" production.

Installations may be encountered where, due to the restricted location for the antenna and/or the length of the transmission line, it is impossible to eliminate "ghosts". A possible solu-

tion in this case is to place the antenna in the same room with the receiver, thereby, changing the antenna location and shortening the transmission line to a minimum. An inside-the-room antenna is feasible only in receiving areas fairly close to the transmitting antennas. This type of antenna is usually a folded dipole, constructed of 300 ohm twin-lead, fastened to the wall or laid on the floor out of the way.

2-5. *Initial Adjustments*

The NC-TV 7 is carefully aligned at National Company laboratories and ordinarily requires no readjustment before being placed in operation.

The R.F. unit is calibrated so that nine of the twelve television channels are tuneable by the Station Selector switch. Each receiver is tagged to indicate whether the R.F. unit has been calibrated to tune either the odd or even higher-frequency channels i.e., 8, 10 and 12 or 9, 11 and 13. Receivers are shipped to areas with stations corresponding to the channels pre-set in the NC-TV 7. The occasion may arise when it is desired to change from the odd to even, or even to odd, channels. Instructions follow to take care of this eventuality.

Equipment required:

R.F. Sweep Generator with a 10-12 Mc. sweep width.

Marker generator with the required frequencies (see below).

Oscilloscope (RCA type WO-60 or equivalent).

1. Remove the receiver from its cabinet and place it on its side.
2. Remove local oscillator tube.
3. Unsolder the mixer, 6AG5, blue plate lead from the terminal board located just outside the R.F. compartment. See Figure No. 12. Connect the plate lead to B plus (junction of R-12 and C-15) through a 4700 ohm resistor.
4. Connect oscilloscope to the junction of the mixer plate lead and the 4700 ohm resistor (see step 3) and chassis.
5. Connect the sweep generator to the antenna input terminals. If the sweep generator is terminated in a 50 ohm single-ended output, connect the output lead to one of the A terminals and the ground lead to terminal G.
6. Connect the A.C. line cord of the receiver to a 115 volt, 60 cycle A.C. supply source.
7. Turn the receiver On.
8. To adjust the receiver for the odd channels, set the Station Selector switch on channel 9; for the even channels set the Station Selector switch on channel 8.
9. Adjust the sweep generator to cover

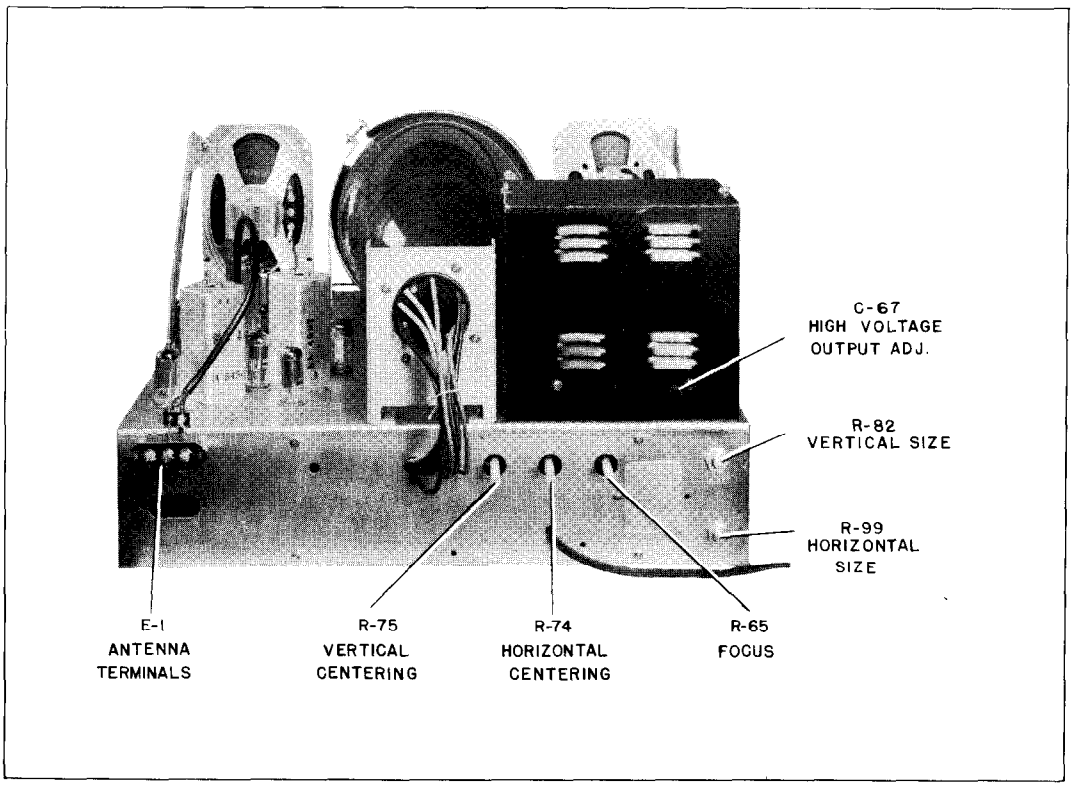


Figure No. 1. Rear View of Receiver (cabinet removed)

channel 8 or 9 corresponding to the setting of the Station Selector switch.

10. Adjust the marker generator to insert markers at the picture carrier and sound carrier frequencies of the channel being aligned. The picture carrier frequency of channel 8 is 181.25 mc., of channel 9, 187.25; the sound carrier frequency of channel 8 is 185.75, of channel 9, 191.75.

11. Adjust L-4 and L-6 for an approximately flat topped response curve located equal distance between the markers. See Figure No. 7 for location of L-4 and L-6. Check the response curve against that shown on the R.F. alignment table for channel 8 or 9. (Page 12).

12. Check the response curves on the two higher frequency channels. There is no individual adjustment for the higher channels and if the response curve is not correct, a compromise might be made in the adjustment made on channel 8 or 9.

13. Restore the receiver to its original condition by replacing the oscillator tube, removing the 4700 ohm resistor and soldering the mixer plate lead back to its original location. Remove all test equipment and replace the receiver in its cabinet.

2-6. Installation Procedure

The NC-TV 7 is installed as follows:

1. Install the antenna as recommended in Section 2-4.

2. Place the receiver in its operating position, preferably with the viewing screen facing away from a strong light source, such as a window, etc.

3. Connect the transmission line from the antenna to the posts on the antenna terminal board, E-1. Connect 300 ohm balanced line to terminals A and A; connect the inner conductor of 72 ohm unbalanced line to one of the A terminals and the shield braid to terminal G.

4. Connect the A.C. line cord of the receiver to a 115 volt, 60 cycle, A.C. source of supply.

5. Set controls as recommended in Section 3 for the reception of signals.

SECTION 3. OPERATION

3-1. Operating Instructions

The NC-TV 7 is placed in operation by adjustment of the controls as follows:

1. Turn the Off-On Volume control On to about mid-position. Allow about 30 seconds for the receiver to reach normal operating condition.

2. Set the Station Selector switch at a channel on which there is no television broadcast.

3. Turn the Contrast control fully counterclockwise.

4. Turn the Brightness control clockwise until a glow appears on the viewing screen, then slowly counterclockwise to the setting where the glow first disappears.

5. Reset the Station Selector switch to a channel having a television broadcast. Initial tuning is best accomplished when the test pattern is being broadcast. Proper tuning is indicated when all lines on the test pattern are straight, when the circles are perfectly round, and when there is visible distinction between black, white and intermediate shades of gray.

6. Turn the Contrast control clockwise until the picture is seen on the screen.

7. Adjust the Vertical control to a setting where all vertical movement of the picture stops.

8. Adjust the Horizontal control to a setting providing the clearest picture.

9. Adjust the Fine Tuning control for the sharpest and clearest picture.

10. Adjust the Contrast control for suitable contrast. The correct setting is indicated by the range of tones visible on the test pattern. The tones should range from white, through various shades of gray, to black.

Readjust the Brightness control, if necessary, to produce a better picture.

11. Readjust, if necessary, the Volume control for the desired volume.

12. Turn off the receiver by setting the Off-On switch at Off without disturbing any other control settings. Thus, when the set is turned on again, the controls will not require readjustment. If the settings of the controls are changed, it is recommended that the entire tuning procedure be repeated.

When switching from station-to-station it may be necessary to reset 9 and 10. If any difficulty is encountered in making the adjustments in 7 and 8, change the setting of the Contrast control by turning the control slightly counterclockwise.

3-2. Non-Operating Controls

The five controls at the rear of the cabinet

are not normally used when operating the receiver and need not be adjusted unless there is evident indication that adjustment is required. The controls and their functions are as follows:

Focus — Brings the picture into proper focus.

Horizontal Size — Adjusts the horizontal size of the picture.

Vertical Size — Adjusts the vertical size of the picture.

Horizontal Centering — Centers the picture horizontally.

Vertical Centering — Centers the picture vertically.

SECTION 4. CIRCUIT DESCRIPTION

4-1. General

This section discusses in detail the circuit employed in the NC-TV 7. Figure No. 2. is a block diagram of the receiver and the following discussion is divided up into sections as shown thereon. It is recommended that the Schematic Diagram at the back of this manual be unfolded so that it is completely visible, for ready reference, while reading this section.

4-2. R. F. Unit

The R.F. unit functions to select the desired signal, to amplify and convert the signal to provide an output at the plate of the mixer, consisting of heterodyned frequencies as follows:

Channels	Picture Carrier	Sound Carrier
2 thru 6	37.3 mc.	32.8 mc.
7 thru 13	34.0 mc.	38.5 mc.

The input circuit of the R.F. amplifier tube is designed for a 72 ohm unbalanced line or a 300 ohm balanced line. The input signal is fed to the grid of the tube through a coupling network and multi-tapped coil L-3. Switching of coils is accomplished by S-2. The grid circuit is tuned by L-2 and L-15 in series with L-3 on channels 7 through 13 and by L-3 on channels 2 through 6. The plate circuit of the R.F. tube is resonated by an adjustable, brass core coil, L-4, in series with a multi-tapped coil, L-5, on channels 2 through 11 and by L-4 on channels 12-13. Switching of coils is accomplished by S-3. A.G.C. voltage is applied to the grid of the R.F. tube. Coupling to the mixer grid is accomplished through capacitor, C-5, on channels 7 through 13, the coupling is inductive on the lower channels.

The mixer circuit employs a 6AG5 pentode, V-2, with grid leak bias. The grid of the mixer

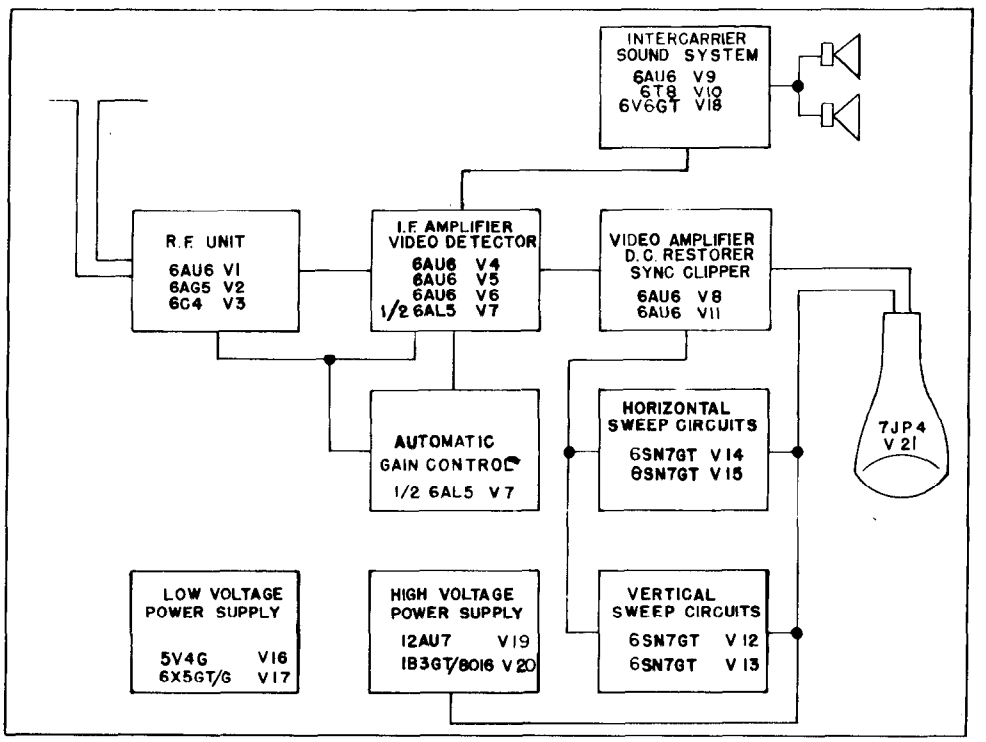


Figure No. 2. Block Diagram of Receiver

is resonated in the same manner as the plate circuit of the R.F. amplifier tube. L-6 tunes channel 12-13 and L-6 in series with L-7 tunes the lower channels. The switch associated with the mixer stage is S-4.

The local oscillator, V-3, employs a 6C4 triode in a modified ultra-audion circuit. B plus is fed to the plate of the tube through a 2200 ohm resistor, R-7. Each channel has a separate inductor made adjustable by a movable iron core. Switches S-5 and S-6 select the proper inductor for each channel. A variable capacitor, C-14, connected in the grid of the oscillator, is the fine tuning adjustment. The oscillator operates on the high side of the picture carrier on channels 2 through 6 and on the low side of the picture carrier on the higher frequency channels.

4-3. I. F. Amplifier — Video Detector

The NC-TV 7 employs the intercarrier sound system. It differs mainly from the conventional system in that the hetrodyning frequency which determines the sound I.F. frequency is the picture carrier and the F.M. sound carrier is separated from the picture carrier at the plate of the video detector. The intercarrier sound is relatively independent of local oscillator tuning because the sound I.F. frequency is determined at the transmitter and not in the receiver. The system consists of three stages of symmetrical I.F. amplifiers and four stagger-tuned circuits with two alignment frequencies. Traps are not required in this system, thereby greatly simplifying the alignment procedure.

The three I.F. stages are similar for the most part. Tuning is accomplished by means of adjustable iron-core coils. The alignment frequency of L-19 and L-22 is 34.8 mc., of L-20 and L-24, 36.9 mc. The I.F. bandpass characteristic is shown in Figure No. 3. By use of the symmetrical curve, the local oscillator is operated on the low side on the high frequency channels to maintain oscillator stability. The plate supply to I.F. tubes V-5 and V-6 is shunt fed through R.F. chokes. This is done in the case of V-6 to keep the resistance in series with the I.F. plate and diode detector small. It is done in the case of V-5 to keep the impedance in the grid of V-6 small to prevent bias from developing on this grid by noise pulses which are of sufficient amplitude to draw grid current. If bias were produced, the gain would be reduced for a time following each noise pulse. Each noise pulse, which modulates the carrier towards the black level, is followed by a white tail which would prove objectionable on the picture. A.G.C. voltage is applied to the grids of the first and second I.F. tubes.

The video detector, V-7, is a conventional diode. The input to the detector is tapped down on L-24 to obtain the proper operating Q. The output of the detector is fed through a series peaking choke, L-25, and a shunt peaking choke, L-26, to the input of the video amplifier. In this manner a video response is obtained relatively flat to 3-1/2 mc. See Figure No. 4 for the video frequency response characteristic at the output of the detector.

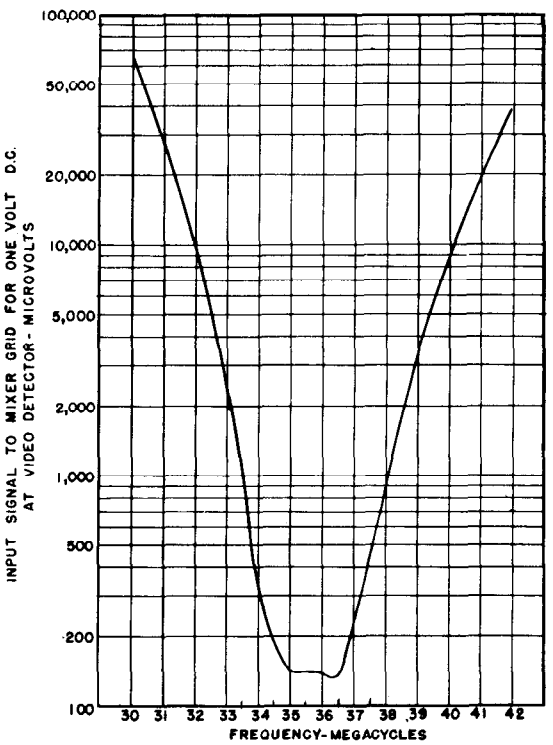


Figure No. 3. I.F. Amplifier Characteristic Curve

4-4. Automatic Gain Control

The automatic gain control circuit utilizes one-half of a type 6AL5 tube, V-7. The A.G.C. action in television receivers is comparable to that of A.V.C. in conventional receivers. A.G.C. voltage is applied to the first two I.F. tubes and the first R.F. tube to keep the contrast of the picture fairly constant with different signal input levels. This permits the operator to switch from station-to-station without having to reset the Contrast control each time.

Cathode bias is used to delay the application of A.G.C. voltage until the video output is sufficient for full contrast.

Two time constants are used: C-26, R-21 is the first with a time constant approximately one

picture line long; C-24, R-20 is the other and is considerably longer. Because of the short time constant C-26 stores only a small amount of energy and at the end of each line the voltage across it has dropped to about the black level at which time C-26 is again charged. Due to the small amount of energy stored in C-26 it discharges quickly, even though it may charge to the peak of an interfering noise pulse, thereby minimizing the effect of relatively long noise pulses on receiver performance. The longer time constant, C-24 and R-20, filters out the A.C. component and the 60 cycle component caused by the vertical sync pulses.

4-5. *Video Amplifier, D. C. Restorer, Sync Clipper*

This system employs two type 6AU6 tubes. A sync-negative signal from the video detector is applied to grid of the video amplifier, V-8, so that noise pulses, with an amplitude greater than that of the signal, will have negative polarity. The video amplifier stage is so designed that, with a full contrast picture on the picture tube, the top of the sync signal will be at about cutoff and noise signals above this level will drive the stage beyond cutoff and be clipped. The Contrast control is placed in the cathode of the video amplifier tube and controls the contrast by controlling the gain of the video stage. The range of the gain adjustment is about 8 to 1. The circuit arrangement of the Contrast control is such that with the control at a normal operating setting the higher video frequencies are boosted. By boosting the higher frequencies in this manner a marked improvement is obtained in all video detail. This improvement is readily apparent when the picture is observed from a normal viewing distance. The bias for the video amplifier remains constant at approximately 1.5 volts and is independent of the setting of the Contrast control. Peaking coils, L-27 and L-28, are placed in the plate of the tube to extend the output to 3-1/2 mc. See Figure No. 4. The output is coupled through capacitor C-34 and resistor R-41 to the cathode of the picture tube.

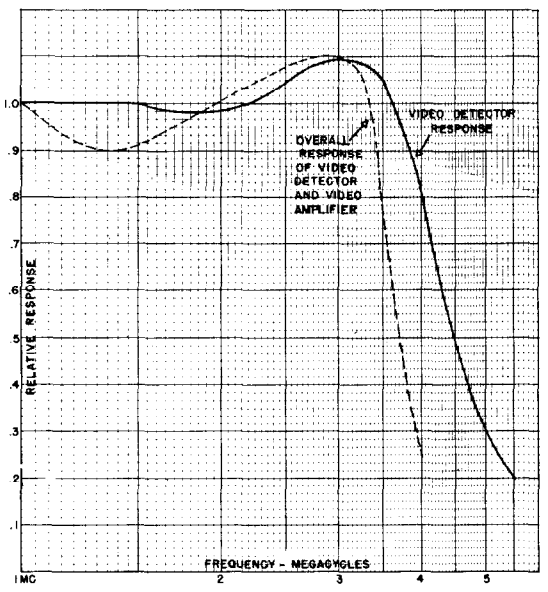


Figure No. 4. Response of Video Output Circuits

The other 6AU6 tube, V-11, functions to restore the D.C. component, clip the sync from the composite signal and then clip the sync on the other side. A D.C. voltage is developed across cathode resistor, R-33, which is proportional to the average value of the input signal. This voltage is applied to the grid of the picture tube to re-insert the D.C. component. The value of cathode bias is such that all picture information is beyond the tube cutoff and only sync pulses appear in the plate. These pulses are clipped on both sides since their peak amplitude rises beyond the tube's cutoff. The pulses are then fed through a voltage divider network to obtain the desired voltage for application to the horizontal and vertical sweep oscillators.

4-6. *Horizontal Sweep Circuits*

The horizontal sweep oscillator employs a 6SN7GT type tube, V-15, in a Potter-type cathode coupled multivibrator circuit. The input sync signal is of negative polarity with a potential of about 1/4 to 1/2 volt. The method used in the initial adjustment of the controls associated with this circuit is of interest. The Horizontal Size control, R-99, is set for the largest possible size picture consistent with good linearity. The anode voltage on the picture tube is then adjusted by means of capacitor, C-67, to obtain the proper size picture. In this manner correct size is obtained along with the brightest possible picture. Thereafter, the Horizontal Size control is used for slight adjustment of the size of the picture. The saw-tooth output of the sweep oscillator is applied to one grid of the push-pull horizontal sweep output dual tube, V-14. Phase reversal is obtained by capacity coupling between the plate of the first triode to the grid of the other. A horizontal linearity adjustment is provided by capacitor, C-87.

4-7. *Vertical Sweep Circuits*

The vertical sweep oscillator circuit is the same as that employed for the horizontal circuit.

The output of the sweep oscillator is applied to one grid of the push-pull vertical sweep output dual tube, V-12. Phase reversal is obtained by driving the same grid from a resistive voltage divider circuit from the plate of the first triode to ground. Good vertical linearity is obtained as follows: the voltage developed across the resistor in the R-86, C-78 time constant circuit is fed back to the input of the tube through capacitor, C-76; careful determination of this feedback compensates for any distortion caused by the time constant of C-81, R-92.

4-8. Intercarrier Sound System

Coupling from the video detector to the sound system is accomplished through capacitor, C-32, whose small value of 1 mmf. minimizes any possible effect on the gain of the video amplifier below 4.5 mc. A trap inductance, L-29, with an adjustable iron-core, is made resonant at 4.5 mc. for maximum transfer of the audio signal. The impedance in the grid circuit of the type 6AU6 ratio detector driver, V-9, is kept low by tapping down on inductor, L-29, to prevent self-oscillation of the tube. The detector circuit used is a conventional ratio type. The audio output at the detector is then applied to the audio amplifier and then the audio output tube.

4-9. Low Voltage Power Supply

The low voltage power supply furnishes at its output voltages of plus 375 and minus 260. The negative supply is applied to the cathodes of the deflection circuit tubes while the positive supply is applied to the plates, thus adding to a total 635 volts. The plus 375 volts is dropped through resistor, R-58, to obtain 250 volts for the R.F. high voltage oscillator tube, V-19. The plus 375 is also applied to the plates and screens of the sound system tubes. A 150 volt supply is obtained from the cathode returns of the sound system tubes for the R.F. and I.F. circuits.

4-10. High Voltage Power Supply

The high voltage power supply is completely enclosed in a shield compartment to prevent emission of R.F. energy into the receiver circuits and as a safety measure. A type 12AU7 tube, V-19, is used as the R.F. oscillator and it is operated well within its maximum rating. The oscillator voltage is applied to the primary of the transformer, T-3. The high voltage is developed across the secondary of T-3, rectified by the type 1B3GT-8016 tube, V-20, and is then well filtered before being applied to the bleeder resistor network. The Horizontal Centering control, R-74, the Vertical Centering control, R-75 and the Focus control, R-65, function by controlling the voltage applied to one set of deflection plates and the second anode, respectively. The fixed voltage for the other set of deflection plates is also supplied by the high voltage system.

SECTION 5. ALIGNMENT

5-1. General

Instructions for complete alignment of the NC-TV 7 Receiver are given in this section. Alignment is divided into five sub-sections, each independent of the other. Alignment of any one sub-section does not necessitate alignment of any other sub-section.

(a) Video I.F. Amplifier Alignment.
(b) Sound System Alignment.
(c) R.F. Amplifier and Mixer Alignment.
(d) Local Oscillator Alignment.
(e) Adjustment of the non-operating controls

The efficiency of alignment will depend in great measure upon the accuracy of the test equipment employed. The test equipment required to effect alignment is as follows:

1. Cathode-ray oscilloscope - Preferably a 5 inch tube such as the RCA type WO-60 or equivalent.

2. Marker Generator — Accurate calibration is a must. The frequency range should be from 40 mc. to 215 mc.

3. Sweep Generator — A 10-12 mc sweep width is required with a frequency range of from 40 to 220 mc.

4. Signal Generator — Here the accuracy of a crystal-controlled device and adjustable attenuation are recommended. The frequencies required are 4.5 mc., 34.8 mc. and 36.9 mc.

5. Vacuum tube voltmeter — A good high-impedance voltmeter such as the RCA type "Voltohymst" or equivalent.

6. Heterodyne Frequency Meter — Frequencies required range from 82 mc. to 180 mc. Crystal controlled accuracy is preferable. (Used only in local oscillator alignment.)

5-2. Video I. F. Amplifier Alignment

The preliminary procedure for alignment of

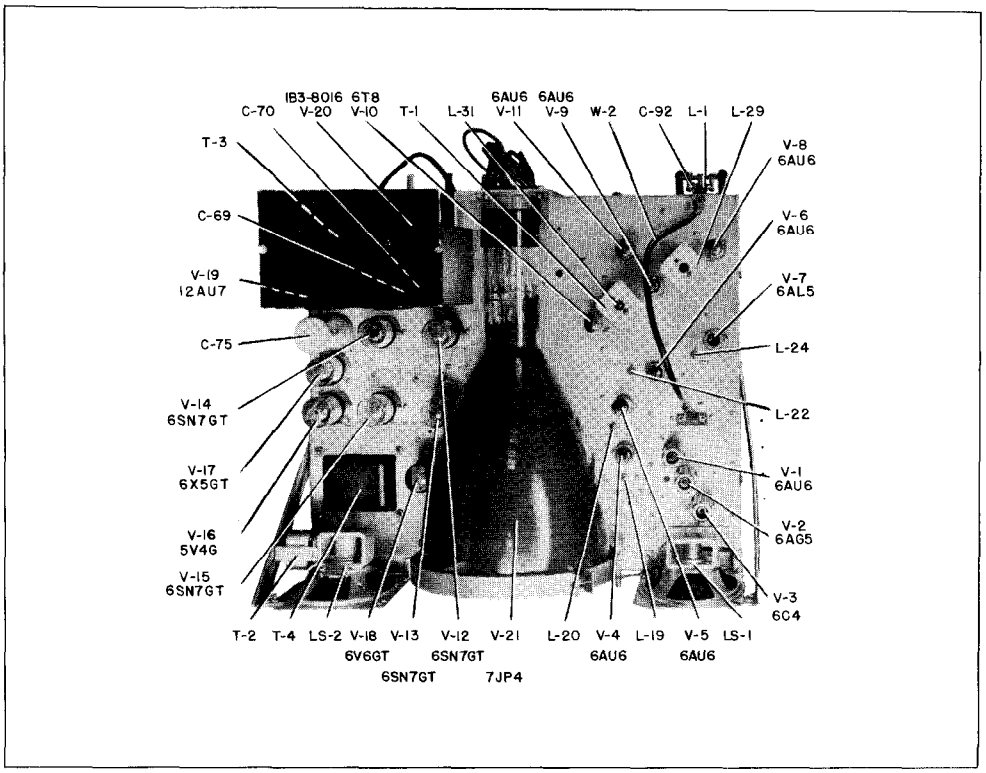


Figure No. 5. Top View of Receiver (cabinet removed)

the video I.F. stages in the NC-TV 7 is as follows:

1. Remove the local oscillator tube, V-3.

2. Connect the signal generator through a 0.01 capacitor to channel 5 contact of S-4A and chassis. (Junction of L-7D and L-7E, see Fig. 7.)

3. Connect the vacuum tube voltmeter to the junction of L-26 and R-26 and chassis.

After the preceding connections have been made procede as follows:

Step 1. Turn the Receiver On.

Step 2. Set the vacuum tube voltmeter on the lowest voltage scale (5 volts).

Step 3. Set the signal generator at 34.8 mc. with an output of approximately 0.3 volt.

Step 4. Adjust L-19 and L-22 for maximum reading on the voltmeter. Retard the output of the generator, as necessary, to keep an on-scale reading on the voltmeter. See Figure No. 5 for location of L-19 and L-22.

Step 5. Set the signal generator at 36.9 mc.

Step 6. Adjust L-20 and L-24 for maximum reading on the voltmeter.

Step 7. Repeat steps 3, 4, 5 and 6 to check the accuracy of alignment.

After steps 1 through 7 are completed, the voltmeter should read approximately 15 volts with the generator set at 36.9 mc. and 0.3 volt output.

Step 8. Disconnect the signal generator and connect the sweep generator in its place. Adjust the sweep generator to sweep the I.F. frequencies.

Step 9. Disconnect the vacuum tube voltmeter and connect the oscilloscope in its place.

Step 10. Adjust the marker generator for an output of 34.8 and 36.9 mcs.

Check the response curve on the oscilloscope against the curve shown on Figure No. 6.

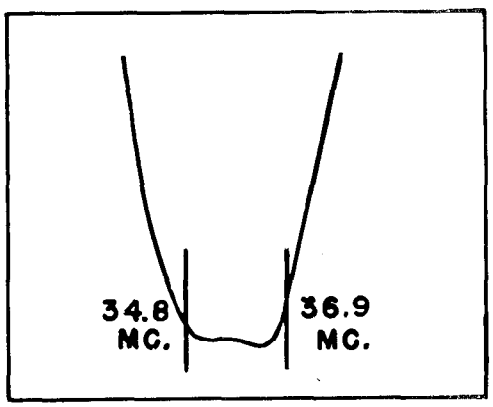


Figure No. 6. I.F. Response Curve

5-3. *Sound System Alignment*

The preliminary procedure for alignment of the sound system is as follows:

1. Remove all test equipment pertaining to

I.F. amplifier alignment and replace the local oscillator tube.

2. Connect the output lead of the signal generator to the junction of L-26 and C-30 through a 0.01 capacitor and connect the ground lead of the generator to the chassis of the receiver.

3. Connect the vacuum tube voltmeter to pins 2 and 7 of the ratio detector tube, V-10.

4. Set the Contrast control on the receiver full on—extreme clockwise position.

After the preceding connections have been made procede as follows:

Step 1. Turn the Receiver On.

Step 2. Set the voltmeter on its lowest voltage scale (5 volts).

Step 3. Set the signal generator at 4.5 mc. with an output of 0.1 volt.

Step 4. Adjust L-29 (bottom of chassis) for maximum reading on the voltmeter.

Step 5. Adjust L-30 (bottom of chassis) for maximum reading on the voltmeter.

Step 6. Repeat steps 4 and 5 to assure accuracy of alignment.

Step 7. Adjust the output of the signal generator for a reading of 5 volts on the voltmeter.

Step 8. Move the voltmeter connection to the junction of R-47 - C-45 and pin 7 of the ratio detector.

Step 9. Adjust L-31 (top of chassis) for a reading of 2.5 volts on the voltmeter.

5-4. R. F. Amplifier and Mixer Alignment

The order in which R.F. alignment is accomplished is important and the order outlined in the Alignment Table must be followed since adjustment of the higher frequency channels affects those lower.

The preliminary procedure for R.F. alignment is as follows:

1. Remove the local oscillator tube, 6C4.

2. Connect a jumper across the iron-core coil, L-3-F.

3. Unsolder the mixer, 6AG5, blue plate lead from the terminal board located just outside the R.F. compartment. See Figure No. 12. Connect the plate lead to B plus (junction of R-12 and C-15) through a 4700 ohm resistor.

4. Connect the oscilloscope to the junction of the mixer plate lead and the 4700 ohm resistor (see Step 3) and chassis.

5. Connect the sweep generator to the antenna input terminals. If the sweep generator is terminated in a 50 ohm single-ended output, connect the output lead to one of the A terminals and the ground lead to terminal G.

After the preceding steps have been taken alignment is effected as shown on the R.F. Alignment Table. Adjustment of the two coil sections involved for any one channel are made simultaneously. The adjustments consist of varying the spacing between the turns of each coil and the coupling between the two coils. See Figure Nos. 7 and 8 for location of inductors. Note that two sets of frequencies are listed for the high frequency channel inductors. They should all be adjusted for either the odd or even channels; odd and even high-frequency channels cannot be intermixed.

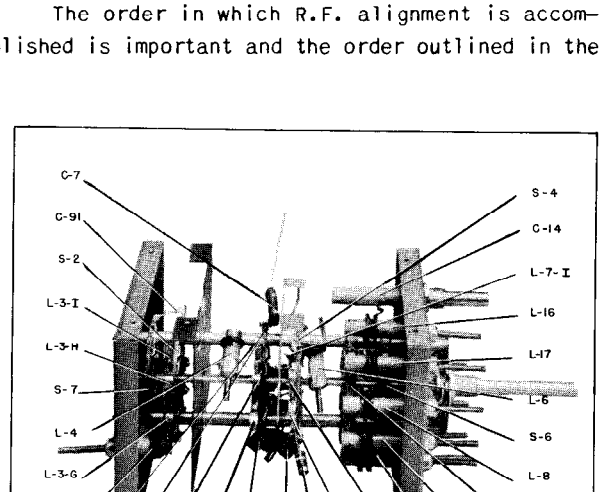


Figure No. 7. Detail of R.F. Unit Switch Assembly

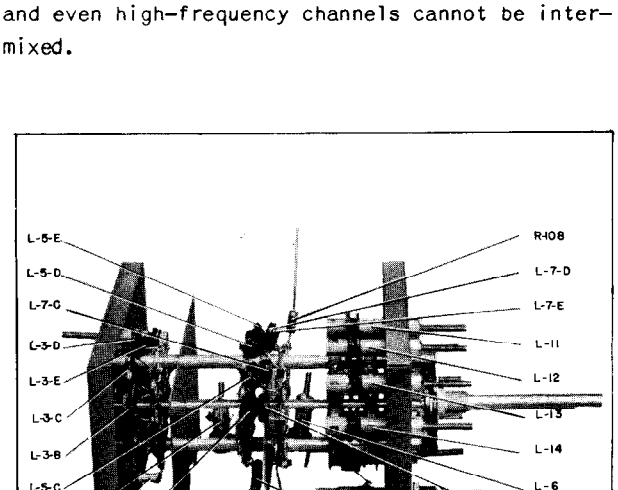


Figure No. 8. Detail of R.F. Unit Switch Assembly

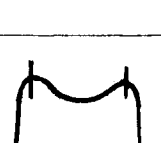
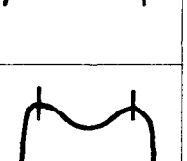
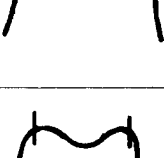
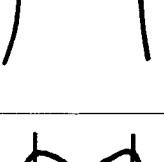
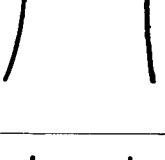
R.F. Alignment Table

Channel	Set Marker Generator At: Picture Carrier Mc.	Set Marker Generator At: Sound Carrier Mc.	Set Sweep Generator For:	Adjust	Response Curve
13 See Note A	211.25	215.75	12 Mc. width	L-4, L-6	
12 See Note B	205.25	209.75	12 Mc. width	L-4, L-6	
11 See Note A	199.25	203.75	12 Mc. width	L-5-I, L-7-I	
10 See Note B	193.25	197.75	12 Mc. width	L-5-I, L-7-I	
9 See Note A	187.25	191.75	12 Mc. width	L-5-H, L-7-H	
8 See Note B	181.25	185.75	12 Mc. width	L-5-H, L-7-H	

Note A: When aligning the Receiver to the odd high-frequency channels, namely channels 13, 11 and 9, do not perform the adjustments listed for channels 12, 10 and 8.

Note B: When aligning the Receiver to the even high-frequency channels, namely channels 12, 10 and 8, do not perform the adjustments listed for channels 13, 11 and 9.

R.F. Alignment Table (continued)

Channel	Set Marker Generator At: Picture Carrier Mc.	Sound Carrier Mc.	Set Sweep Generator For:	Adjust	Response Curve
7	175.25	179.75	10 Mc. width	L-5-G, L-7-G	
6	83.25	87.75	10 Mc. width	L-5-F, L-7-F	
5	77.25	81.75	10 Mc. width	L-5-E, L-7-E	
4	67.25	71.75	10 Mc. width	L-5-D, L-7-D	
3	61.25	65.75	10 Mc. width	L-5-C, L-7-C	
2	55.25	59.75	10 Mc. width	L-5-B, L-7-B	

After completion of the foregoing alignment, procede with alignment of the R.F. amplifier grid coil as follows:

1. Remove the jumper connected across L-3-F.

2. The adjustments for grid coil, L-3, are similar to that for L-5 and L-7 shown on the preceding Alignment Table except that the order of adjustment is different and that L-3-F is adjustable by means of an iron core. The order of adjustment and the coil sections adjusted are shown below. Set the frequencies of the generators and adjust the coil sections for the response curves as shown on the preceding table for the applicable channel.

Channel	Adjust
6	L-3-F
5	L-3-E
4	L-3-D
3	L-3-C
2	L-3-B
7	L-3-G
8	L-3-H
9	L-3-H
10	L-3-I
11	L-3-I

5-5. *Local Oscillator Alignment*

Alignment is effected as follows:

1. Replace the 6C4 oscillator tube.

2. Loosely couple the probe of the heterodyne frequency meter to the local oscillator in the Receiver.

3. Turn the Receiver On and adjust the inductors listed on the Alignment Table to obtain a local oscillator frequency the same as that listed for the setting of the frequency meter.

The oscillator tuning inductors are accessible after removal of the cabinet. See Figure No. 9 for identification of the inductors. Note that two possible frequencies are listed for L-8, L-16 and L-17, the high-frequency channel inductors. As is the case in R.F. alignment they should all be adjusted for either the odd or even channels; odd and even high-frequency channels cannot be intermixed.

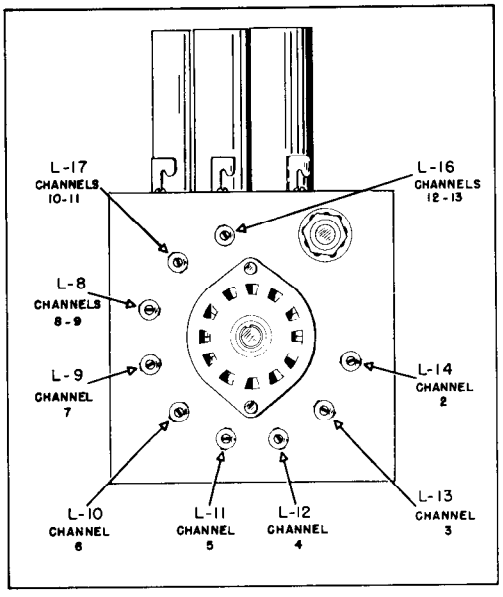


Figure No. 9. Local Oscillator Adjustments

Local Oscillator Alignment Table

Channel	Set Station Selector Switch At Channel:	Set Heterodyne Frequency Meter At:	Adjust
2	2	92.55 Mc.	L-14
3	3	98.55 Mc.	L-13
4	4	104.55 Mc.	L-12
5	5	114.55 Mc.	L-11
6	6	120.55 Mc.	L-10
7	7	141.25 Mc.	L-9
8 See Note B	8-9	147.25 Mc.	L-8
9 See Note A	8-9	153.25 Mc.	L-8
10 See Note B	10-11	159.25 Mc.	L-17
11 See Note A	10-11	165.25 Mc.	L-17
12 See Note B	12-13	171.25 Mc.	L-16
13 See Note A	12-13	177.25 Mc.	L-16

Note A: When aligning the Receiver to the odd high-frequency channels, namely channels 13, 11 and 9 do not perform the adjustments listed for channels 12, 10 and 8.

Note B: When aligning the Receiver to the even high-frequency channels, namely channels 12, 10 and 8, do not perform the adjustments listed for channels 13, 11 and 9.

5-6. *Adjustment of Non-Operating Controls*

The adjustment of the non-operating controls is effected in the following manner and sequence. All controls are accessible from the rear of the cabinet except the Horizontal Linearity Control, C-87, and High Voltage Output adjustment, C-67. The latter, C-67, is accessible after removal of the back of the cabinet, see Figure No. 1, the former, C-87, is accessible after removal of the button plug at the bottom of the cabinet.

Step 1. Set the Horizontal Size control, R-99, and the Horizontal Linearity control, C-87 for the largest size picture consistent with good linearity.

Step 2. Adjust the High Voltage Output adjustment, C-67, for the correct horizontal size. Two settings of C-67 will give the correct picture size, but by using the setting on the low capacity side of resonance, the plate current of the 12AU7 will be lower resulting in longer tube life. To do so, adjust C-67 for resonance (indicated by smallest size picture) and then rotate C-67 in a counterclockwise direction for the correct size picture.

Step 3. Adjust the Vertical Size control, R-82, for the correct vertical size.

Step 4. Adjust the Horizontal Centering, R-74, and Vertical Centering, R-75, controls to center the picture horizontally and vertically.

Step 5. Adjust the Focus control, R-65, to bring the picture into proper focus.

SECTION 6. SERVICE DATA

6-1. *Service Data*

The data in this section is presented to aid the technician in the event servicing of the NC-TV 7 is required. Contained herein is a Trouble Shooting Chart and tube socket to chassis voltage readings. A normal test pattern is shown in Figure No. 10.

Note: Care should be exercised to make sure that the peaking coils and coupling capacitors in the video circuits are kept up and away from the chassis in the event their position is changed.

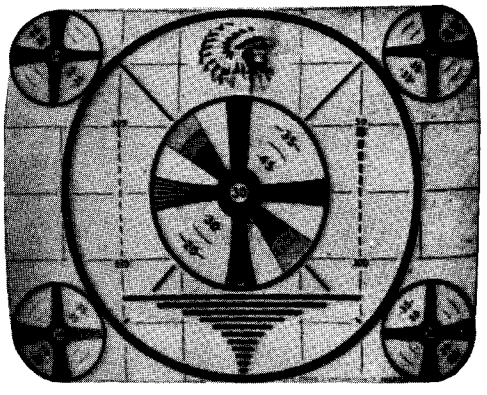
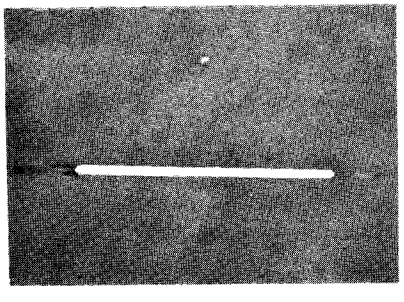
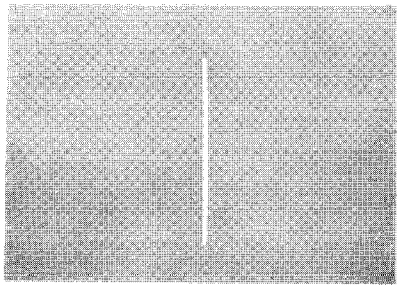
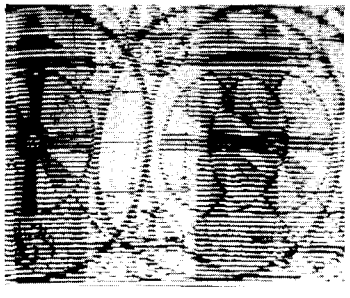
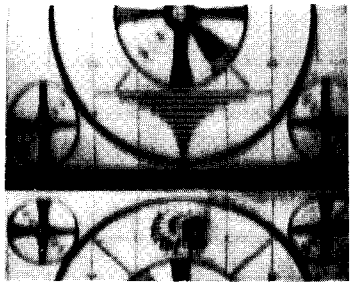
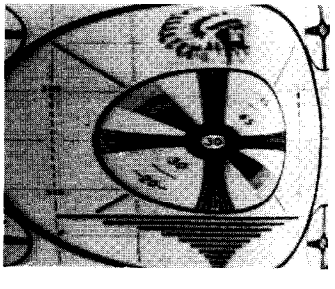


Figure No. 11. Normal Test Pattern

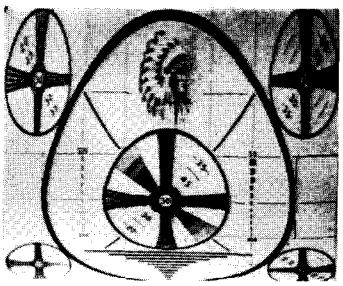
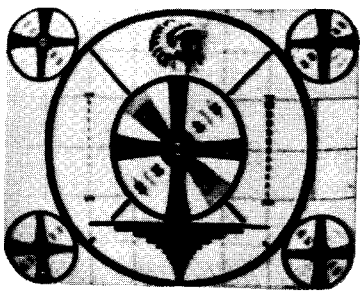
Trouble Shooting Chart

Trouble	Probable Cause
No raster, sound normal	1. Check H.V. power supply output by measuring voltage from junction of high voltage output lead and R-71 to chassis. Normal reading is approximately 5000 volts. 2. Check voltage between grid and cathode of picture tube. May be measured between pin 2 of V-11 and junction of C-34 and R-41. Normal reading is approximately 50 volts with the Contrast control fully clockwise. 3. Check picture tube, V-21. 4. Check socket voltages of picture tube V-21.
No vertical sweep 	1. Check tubes V-12 and V-13. 2. Check socket voltages of tubes V-12, V-13 and V-21. 3. Check capacitors C-81, C-77 and C-74.

Trouble Shooting Chart (continued)

Trouble	Probable Cause
No horizontal sweep 	1. Check tubes V-14 and V-15. 2. Check socket voltages of tubes V-14, V-15 and V-21. 3. Check capacitors C-88, C-89, C-86 and C-84.
Raster and sound normal—no picture.	1. Check tubes V-8 and V-11. 2. Check socket voltages of tubes V-8 and V-11. 2. Check capacitors C-34, C-33, C-35, C-36. 4. Check I.F. Alignment.
No sound—raster and picture normal.	1. Check tubes V-9, V-10 and V-18. 2. Check socket voltages of above tubes. 3. Check audio output circuits by connecting an audio signal to junction of C-45 and R-47. Set the Volume control full On. 4. Check sound system alignment.
No horizontal sync 	1. Check tube V-11 and socket voltages. 2. Check horizontal sweep oscillator circuit by checking tube V-15 and all associated components. 3. Check capacitors C-36, C-83 and resistor R-93.
No vertical sync 	1. Check tube V-11 and socket voltages. 2. Check vertical sweep oscillator circuit by checking tube V-13 and all associated components. 3. Check capacitors C-36, C-72, C-73 and resistors R-76, R-78.
Improper horizontal linearity 	1. Check setting of Horizontal Linearity control, C-87. 2. Check tubes V-14, V-15 and associated components. 3. Check capacitors C-88 and C-89. 4. Check for correct setting of controls affecting horizontal size—R-99 and C-67. See steps 1 and 2 of Section 5-6. 5. Check H.V. power supply output by measuring voltage from junction of high voltage output lead and R-71 to chassis. Normal reading is approximately 5000 volts.

Trouble Shooting Chart (continued)

Trouble	Probable Cause
Improper vertical linearity 	1. Check tubes V-12, V-13 and associated components. 2. Check capacitors C-76 and C-78 for leakage. 3. Check capacitors C-81 and C-82. 4. Check setting of Vertical Size control, R-82. 5. Check H.V. power supply output by measuring voltage from junction of high voltage output lead and R-71 to chassis. Normal reading is approximately 5000 volts.
Small raster	1. Check tubes V-16 and V-17. 2. Check capacitors C-64, C-65, C-75A and C-75B.
Picture stable but detail poor 	1. Check tubes V-7, V-8 and V-11. 2. Check d.c. resistance of peaking coils L-25, L-26, L-27 and L-28. Normal resistance of L-25 is 4 ohms, L-26--11 ohms, L-27--4.5 ohms and L-28--6.5 ohms. 3. Check the range of the Focus control, R-65, by ascertaining that the control operates on either side of the correct setting. 4. Check the ohmic value of resistors in the high voltage divider network, which includes R-60, R-63 through R-69 and R-71 through R-75. 5. Check R.F. and I.F. alignment. 6. Check setting of Fine Tuning control.
Picture unstable	1. Check setting of Contrast control, R-30, to make sure it is not advanced too far. 2. Check grid bias of video amplifier V-8, by measuring voltage across pins 1 and 7. Normal bias voltage is approximately 1.5 volts regardless of the Contrast control setting. 3. Check delay voltage on A.G.C. diode, V-7, by measuring voltage between pin 5 and chassis. Normal delay voltage is approximately 3 volts. 4. Loose connections in the receiver or in the external antenna system may cause instability. Also, strong noise pulses may produce this condition. 5. The transmitter may be at fault, check by tuning to another station.

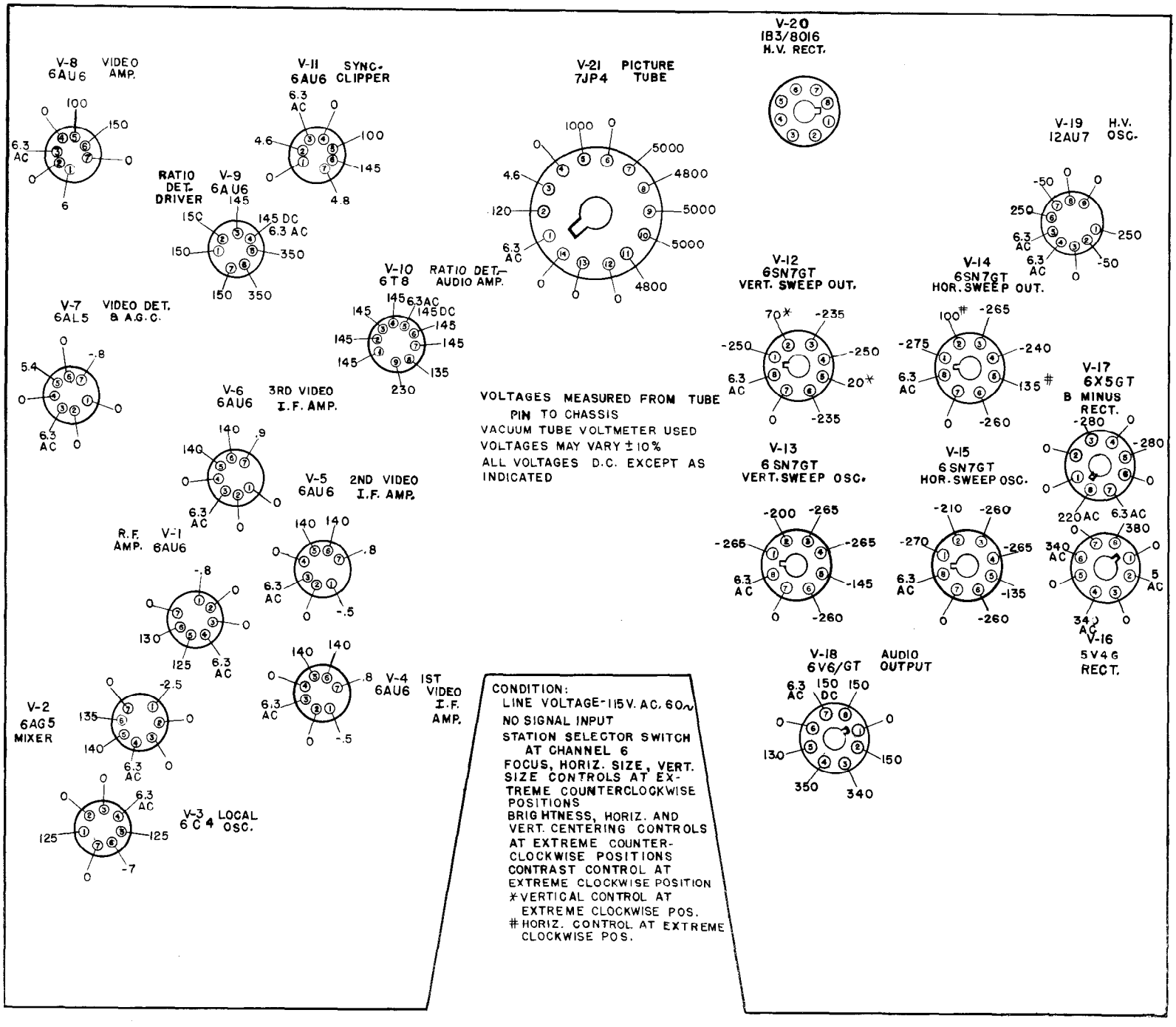


Figure No. 11. Tube Socket Voltages

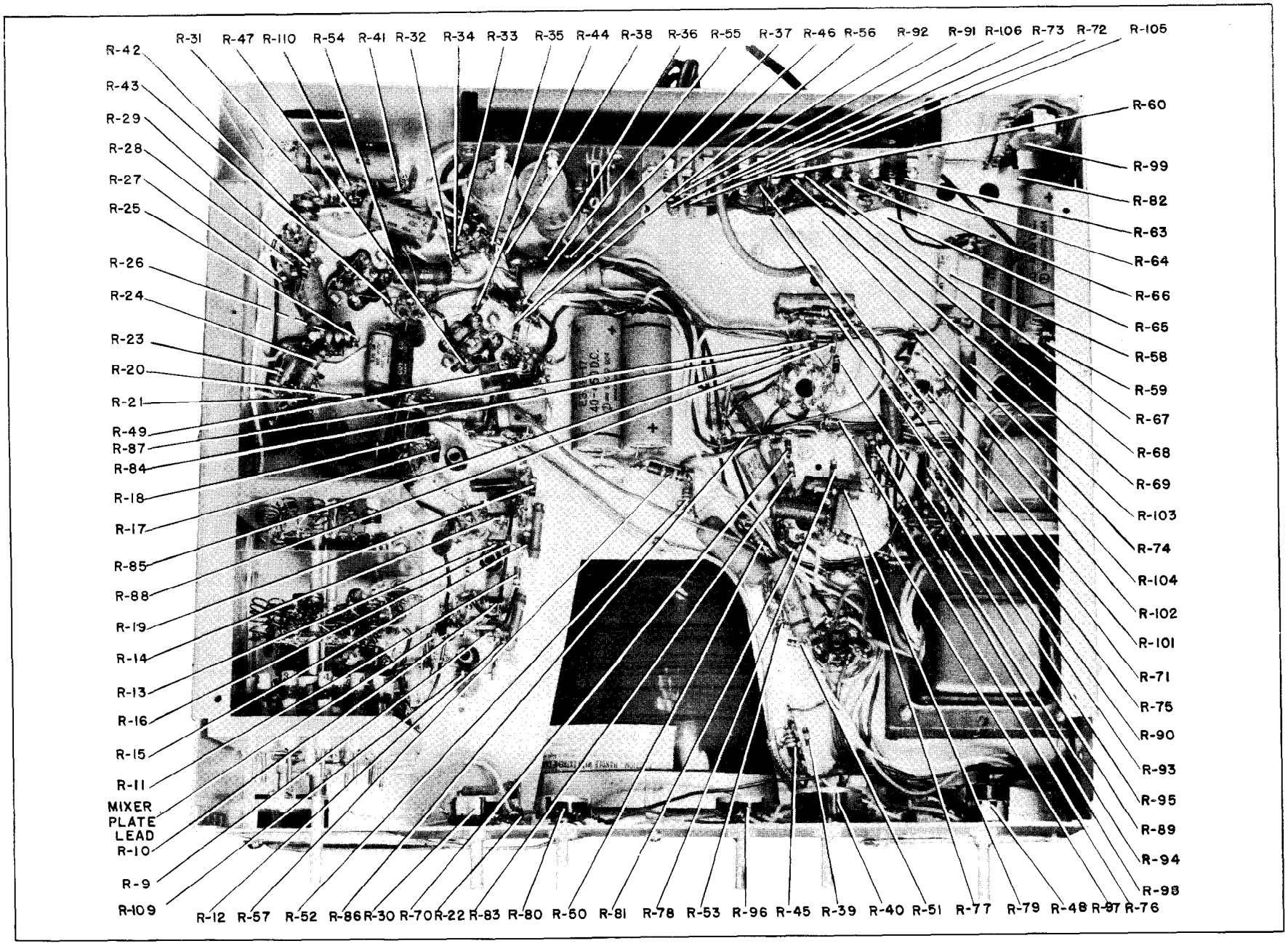


Figure No. 12. Resistor Locations — Bottom of Receiver (cabinet removed)

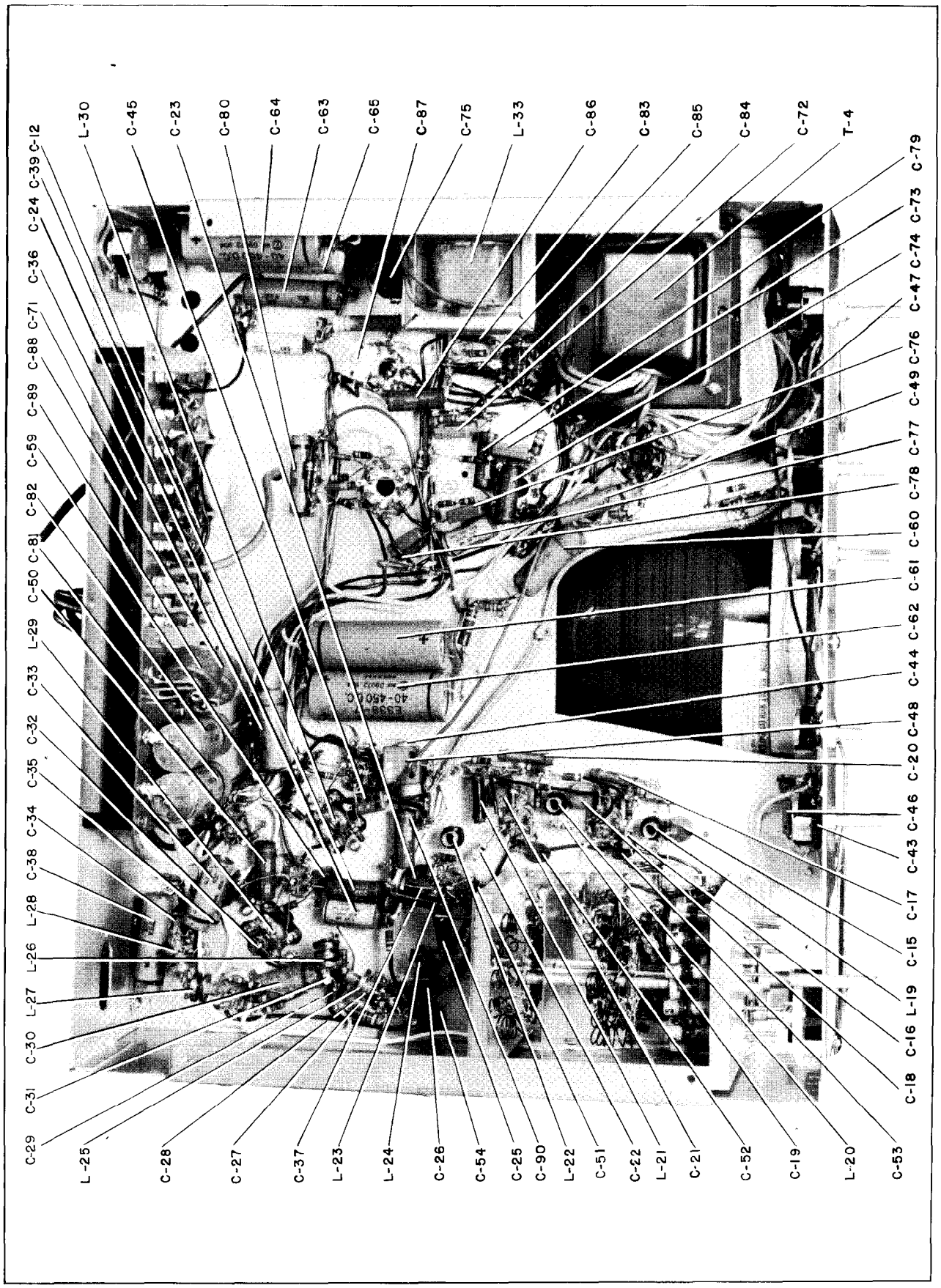


Figure No. 13. Capacitor and other Component Locations — Bottom of Receiver (cabinet removed)

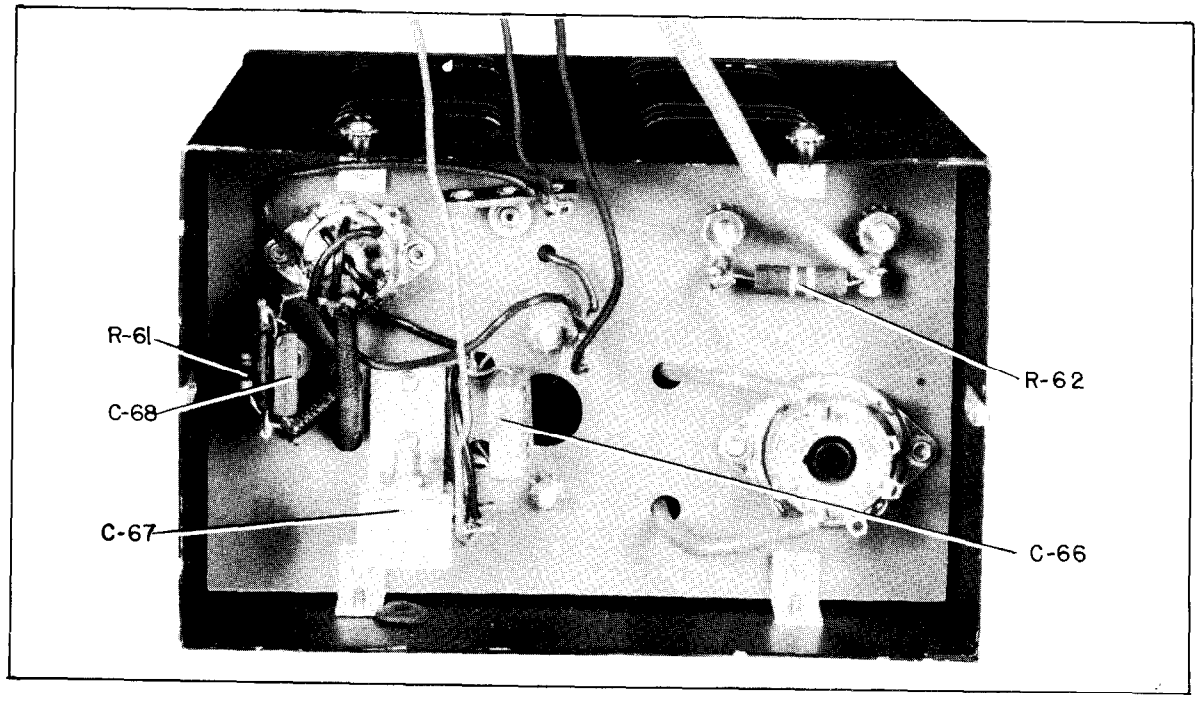


Figure No. 14. Bottom View of H.V. Power Supply Compartment (removed from chassis)

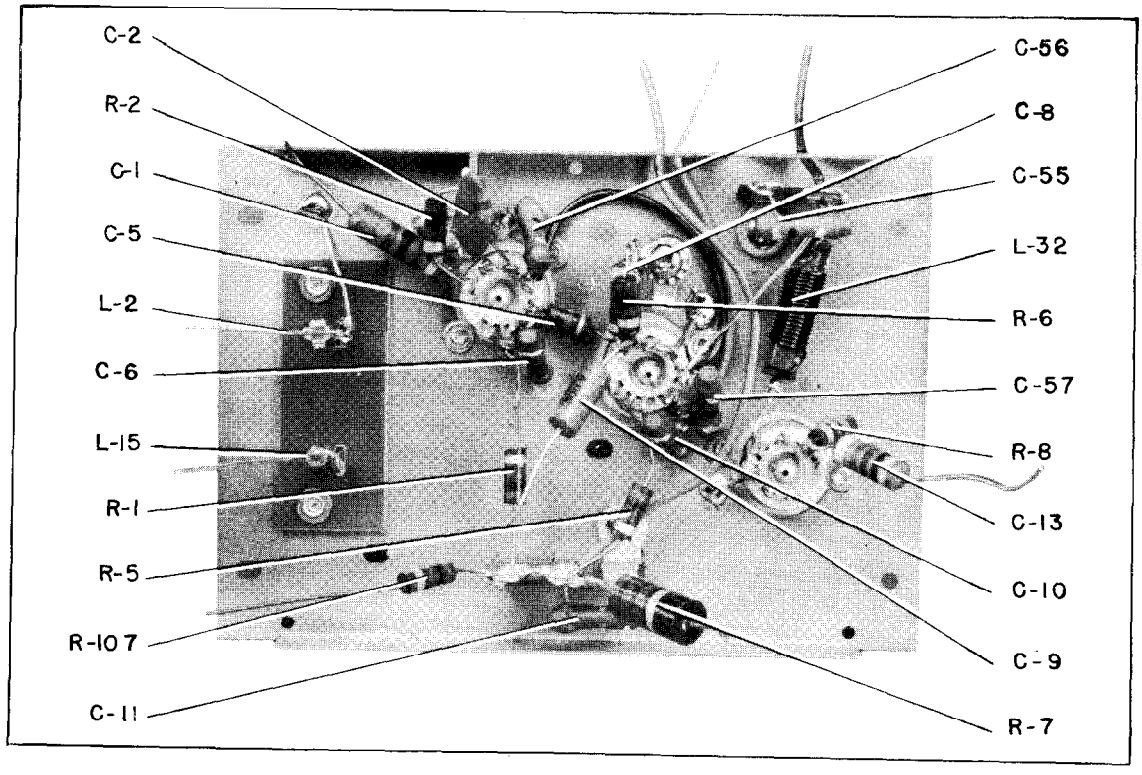


Figure No. 15. Bottom View of R.F. Unit (switch assembly removed)

PARTS LIST

Symbol	Function	Description	National Co. Type
		CAPACITORS	
C-1	R.F. Amp Grid Coupling	Ceramic, 100 mmf., ±10%, 500 vdcw	F913-2
C-2	R.F. Amp Grid Bypass	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-3	Not Used		
C-4	Not Used		
C-5	Mixer Grid Coupling	Ceramic, 1 mmf., ± 10%, 500 vdcw	L081-4
C-6	R.F. Amp Screen Bypass	Ceramic, 360 mmf., 500 vdcw	K941-1
C-7	R.F. Amp Plate Bypass	Ceramic, 360 mmf., 500 vdcw	K941-1
C-8	Mixer Grid Coupling	Ceramic, 22 mmf., ± 10%, 500 vdcw	F912-10
C-9	Osc. Injection	Ceramic, 2 mmf., ± .5 mmf., 500 vdcw	F912-3
C-10	Mixer Screen Bypass	Ceramic, 360 mmf., 500 vdcw	K941-1
C-11	V-1, V-2, V-3 B+ Bypass	Ceramic, 360 mmf., 500 vdcw	K941-1
C-12	High Voltage Filter	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-13	Osc. Grid Coupling	Ceramic, 25 mmf., ± 10%, 500 vdcw	F912-11
C-14	Fine Tuning Control	Variable (Special)	SA4980
C-15	B+ Filter	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-16	V-4 Grid Coupling	Ceramic, 100 mmf., ± 10%, 500 vdcw	K375-3
C-17	A.G.C. Filter	Ceramic, 1500 mmf., 500 vdcw	K942-1
C-18	B+ Filter	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-19	V-5 Grid Coupling	Ceramic, 100 mmf., ± 10%, 500 vdcw	K375-3
C-20	A.G.C. Filter	Ceramic, 1500 mmf., 500 vdcw	K942-1
C-21	B+ Filter	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-22	V-6 Grid Coupling	Ceramic, 100 mmf., ± 10%, 500 vdcw	K375-3
C-23	V-6 Cathode Bypass	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-24	A.G.C. Filter	Paper, 0.25 mfd., 400 vdcw	D827-17
C-25	Video Det. Coupling	Mica, 100 mmf., ± 10%, 500 vdcw	J665-32
C-26	A.G.C. Coupling	Mica, 2200 mmf., ± 10%, 500 vdcw	J666-26
C-27	A.G.C. Cathode Bypass	Mica, 330 mmf., ± 10%, 500 vdcw	J665-50
C-28	Video Det. Plate Filter	Ceramic, 5 mmf., ± 1 mmf., 500 vdcw	D825D-401
C-29	Video Det. Plate Filter	Ceramic, 10 mmf., ± 10%, 500 vdcw	D825D-402
C-30	V-8 Grid Coupling	Paper, 0.1 mfd., 400 vdcw	D827-11
C-31	Video Det. Plate Filter	Ceramic, 5 mmf., ± 1 mmf.,	D825D-401
C-32	V-9 Grid Coupling	Ceramic, 1 mmf., ± 10%, 500 vdcw	L081-4
C-33	V-11 Grid Coupling	Paper, .1 mfd., 400 vdcw	D827-11
C-34	V-21 Cathode Coupling	Paper, 0.25 mfd., 400 vdcw	D827-17
C-35	V-11 Cathode Bypass	Elect., 10 mfd., 25 vdcw	E338-12
C-36	D.C. Blocking	Paper, .05 mfd., 600 vdcw	D827-3
C-37	B+ Filter	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-38	Video Bypass	Paper, 0.1 mfd., 600 vdcw	D827-13
C-39	V-9 Cathode Bypass	Paper, .02 mfd., 400 vdcw	D827-43
C-40	L-30 Tuning	Ceramic, 10 mmf., ± 10%, 500 vdcw, zero T.C.	D825D-402
C-41	Tone	Mica, 0.001 mfd., ± 10%, 500 vdcw	J666-14
C-42	L-31 Tuning	Ceramic, 75 mmf., ± 10%, 500 vdcw	D825C-301
C-43	V-8 Cathode Bypass	Mica, 680 mmf., ± 10%, 500 vdcw	J665-63
C-44	Ratio Det. Load	Paper, 1 mfd., 200 vdcw	D827-47
C-45	Audio Coupling	Mica, 0.001 mfd., ± 10%, 500 vdcw	J665-71
C-46	V-8 Cathode Bypass	Mica, 470 mmf., ± 10%, 500 vdcw	J665-56
C-47	De-Emphasis	Mica, 3900 mmf., ± 10%, 500 vdcw	J666-36
C-48	Audio Amp. Grid Coupling	Mica, 5100 mmf., ± 10%, 500 vdcw	J666-42
C-49	V-18 Grid	Paper, 0.02 mfd., 600 vdcw	D827-44
C-50	B+ Bypass	Paper, 0.02 mfd., 400 vdcw	D827-43
C-51	V-6 Filament Bypass	Ceramic, 0.005 mfd., 450 vdcw	K946-1

PARTS LIST (Continued)

Symbol	Function	Description	National Co. Type
		CAPACITORS (continued)	
C-52	V-5 Filament Bypass	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-53	V-4 Filament Bypass	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-54	V-7 Filament Bypass	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-55	Osc. Filament Bypass	Ceramic, 400 mmf., 500 vdcw	K941-2
C-56	R.F. Amp. Filament Bypass	Ceramic, 400 mmf., 500 vdcw	K941-2
C-57	Mixer Filament Bypass	Ceramic, 400 mmf., 500 vdcw	K941-2
C-58	Not Used		
C-59	V-9 Screen Bypass	Ceramic, 0.005 mfd., 450 vdcw	K946-1
C-60	V-18 Grid Bypass	Paper, 0.05 mfd., 600 vdcw	D827-3
C-61	B+ Bypass	Elect. 40 mfd., 450 vdcw	E338-17
C-62	B+ Bypass	Elect., 40 mfd., 450 vdcw	E338-17
C-63	B+ Filter	Paper, 0.1 mfd., 600 vdcw	D827-13
C-64	B Minus Filter	Elect., 40 mfd., 450 vdcw	E338-17
C-65	B Minus Filter	Elect., 40 mfd., 450 vdcw	E338-17
C-66	T-3 Tuning	Mica, 510 mmf., ± 5%, 500 vdcw	J666-3
C-67	H.V. Output Adjustment	Variable Mica, 400-1100 mmf.	K923-1
C-68	V-19 Grid Bypass	Mica, 220 mmf., ± 10%, 500 vdcw	J665-44
C-69	High Voltage Filter	Ceramic, 500 mmf., 10,000 vdcw	K891-2
C-70	High Voltage Filter	Ceramic, 500 mmf., 10,000 vdcw	K891-2
C-71	High Voltage Filter	Paper, .1 mfd., 600 vdcw	D827-13
C-72	Vertical Pulse Filter	Mica, 4700 mmf., ± 10%, 500 vdcw	J666-40
C-73	Vertical Pulse Filter	Mica, 4700 mmf., ± 10%, 500 vdcw	J666-40
C-74	V-13 Grid Coupling	Paper, .01 mfd., 600 vdcw	D827-7
C-75		Elect., 40+40 mfd., 450 vdcw	K945-1
C-75A	B+ Filter	Part of C-75	
C-75B	B+ Filter	Part of C-75	
C-76	Vertical Linearity Correction	Mica, 1500 mmf., ±10%, 800 vdcw	J666-64
C-77	V-12 Grid Coupling	Paper, .25 mfd., 400 vdcw	D827-17
C-78	Vertical Linearity Correction	Mica, 1500 mmf., ± 10%, 800 vdcw	J666-64
C-79	V-13 Plate Filter	Paer, .01 mfd., 600 vdcw	D827-7
C-80	V-12 Grid Coupling	Paper, .02 mfd., 600 vdcw	D827-44
C-81	V-21 Vertical Deflection Plate Coupling	Paper, .005 mfd., 5000 vdcw	D827-45
C-82	V-21 Vertical Deflection Plate Coupling	Paper, .005 mfd., 5000 vdcw	D827-45
C-83	V-15 Grid Coupling	Mica, 220 mmf., ± 10%, 500 vdcw	J665-44
C-84	V-15 Grid Coupling	Mica, 100 mmf., ± 10%, 500 vdcw	J665-32
C-85	V-15 Plate Filter	Mica, 100 mmf., ± 10%, 500 vdcw	J665-32
C-86	V-14 Grid Coupling	Paper, .01 mfd., 600 vdcw	D827-7
C-87	Horizontal Linearity Control	Variable Mica, 3.5-35 mmf., 500 vdcw	D832-4
C-88	V-21 Horizontal Deflect. Plate Coupling	Ceramic, 500 mmf., 10,000 vdcw	K891-1
C-89	V-21 Horizontal Deflect. Plate Coupling	Ceramic, 500 mmf., 10,000 vdcw	K891-1
C-90	Audio Coupling	Paper, 0.01 mfd., 600 vdcw	D827-7
C-91	Antenna Coupling	Ceramic, 21 mmf., ± .5 mmf., 500 vdcw	D825D-410
C-92	Antenna Coupling	Ceramic, 47 mmf., ± 10%	J695-1
		RESISTORS	
R-1	R.F. Amp. Screen Filter	1,000 ohms, ± 10%, 1/2 watt	J569-25
R-2	R.F. Amp. Grid	1,000,000 ohms, ± 10%, 1/2 watt	J569-57
R-3	Not Used		

PARTS LIST (Continued)

Symbol	Function	Description	National Co. Type
		RESISTORS (continued)	
R-4	Not Used		
R-5	Mixer Screen Filter	1,000 ohms, ±10%, 1/2 watt	J569-25
R-6	Mixer Grid	1,000,000 ohms, ±10%, 1/2 watt	K379-61
R-7	Local Osc. Plate Dropping	2,200 ohms, ±10%, 1 watt	J571-29
R-8	Osc. Grid	18,000 ohms, ±10%, 1/2 watt	J569-40
R-9	V-4 Grid Loading	10,000 ohms, ±5%, 1/2 watt	K379-77
R-10	V-4 Cathode	82 ohms, ±10%, 1/2 watt	J569-12
R-11	A.G.C. Filter	120 ohms, ±10%, 1/2 watt	J569-14
R-12	B+ Filter	100 ohms, ±10%, 1/2 watt	J569-13
R-13	V-5 Grid Loading	10,000 ohms, ±5%, 1/2 watt	K379-77
R-14	V-5 Cathode	82 ohms, ±10%, 1/2 watt	J569-12
R-15	A.G.C. Filter	120 ohms, ±10%, 1/2 watt	J569-14
R-16	B+ Filter	100 ohms, ±10%, 1/2 watt	J569-13
R-17	V-6 Grid Loading	10,000 ohms, ±5%, 1/2 watt	K379-77
R-18	V-6 Cathode	82 ohms, ±10%, 1/2 watt	J569-12
R-19	B+ Filter	100 ohms, ±10%, 1/2 watt	J569-13
R-20	A.G.C. Filter	560,000 ohms, ±10%, 1/2 watt	J569-58
R-21	A.G.C. Plate Load	22,000 ohms, ±10%, 1/2 watt	J569-41
R-22	A.G.C. Delay	680 ohms, ±10%, 1/2 watt	J569-23
R-23	A.G.C. Delay	47,000 ohms, ±10%, 1 watt	J571-45
R-24	Video Det. Series Damping	33,000 ohms, ±5%, 1 watt	K853-1
R-25	Video Det. Shunt Damping	8,200 ohms, ±5%, 1 watt	K853-2
R-26	Video Det. Plate Load	8,200 ohms, ±10%, 1/2 watt	J569-36
R-27	V-8 Grid Bias	1,000,000 ohms, ±10%, 1/2 watt	J569-61
R-28	V-8 Grid	1,000,000 ohms, ±10%, 1/2 watt	J569-61
R-29	V-8 Grid Bias	3,900 ohms, ±10%, 1/2 watt	J569-32
R-30	Contrast Control	Variable, 1,000 ohms, ±10%	K915-11
R-31	V-8 Plate Load	6,800 ohms, ±10%, 1/2 watt	J569-35
R-32	V-8 Grid	1,000,000 ohms, ±10%, 1/2 watt	J569-61
R-33	V-11 Cathode	22,000 ohms, ±10%, 1/2 watt	J569-41
R-34	V-11 Cathode	270 ohms, ±10%, 1/2 watt	J569-18
R-35	V-11 Plate Load	220,000 ohms, ±10%, 1/2 watt	J569-53
R-36	Voltage Divider	560 ohms, ±10%, 1/2 watt	J569-22
R-37	Voltage Divider	560 ohms, ±10%, 1/2 watt	J569-22
R-38	Voltage Divider	180,000 ohms, ±10%, 1/2 watt	J569-52
R-39	Voltage Divider	10,000 ohms, ±10%, 1/2 watt	J569-37
R-40	Brightness Control	Variable, 25,000 ohms	K915-6
R-41	V-21 Cathode	150,000 ohms, ±10%, 1/2 watt	J569-51
R-42	V-8 Series Damping	33,000 ohms, ±5%, 1 watt	K853-1
R-43	V-9 Cathode	82 ohms, ±10%, 1/2 watt	J569-12
R-44	B+ Filter	1,000 ohms, ±10%, 1/2 watt	J569-25
R-45	Voltage Divider	68,000 ohms, ±10%, 1 watt	J571-47
R-46	Ratio Det. Plate Load	47,000 ohms, ±10%, 1/2 watt	J569-45
R-47	De-Emphasis	15,000 ohms, ±10%, 1/2 watt	J569-39
R-48	Volume Control	Variable with switch, 250,000 ohms	K347-4
R-49	Audio Amp Grid	470,000 ohms, ±10%, 1/2 watt	J569-57
R-50	Audio Amp Plate Load	330,000 ohms, ±10%,, 1/2 watt	J569-55
R-51	V-18 Grid	270,000 ohms, ±10%, 1/2 watt	J569-54
R-52	V-18 Grid Bias	330,000 ohms, ±5%, 1/2 watt	J569-88
R-53	V-18 Grid Bias	180,000 ohms, ±5%, 1/2 watt	J569-89
R-54	B+ Filter	1,000 ohms, ±10%, 1/2 watt	J569-25

PARTS LIST (Continued)

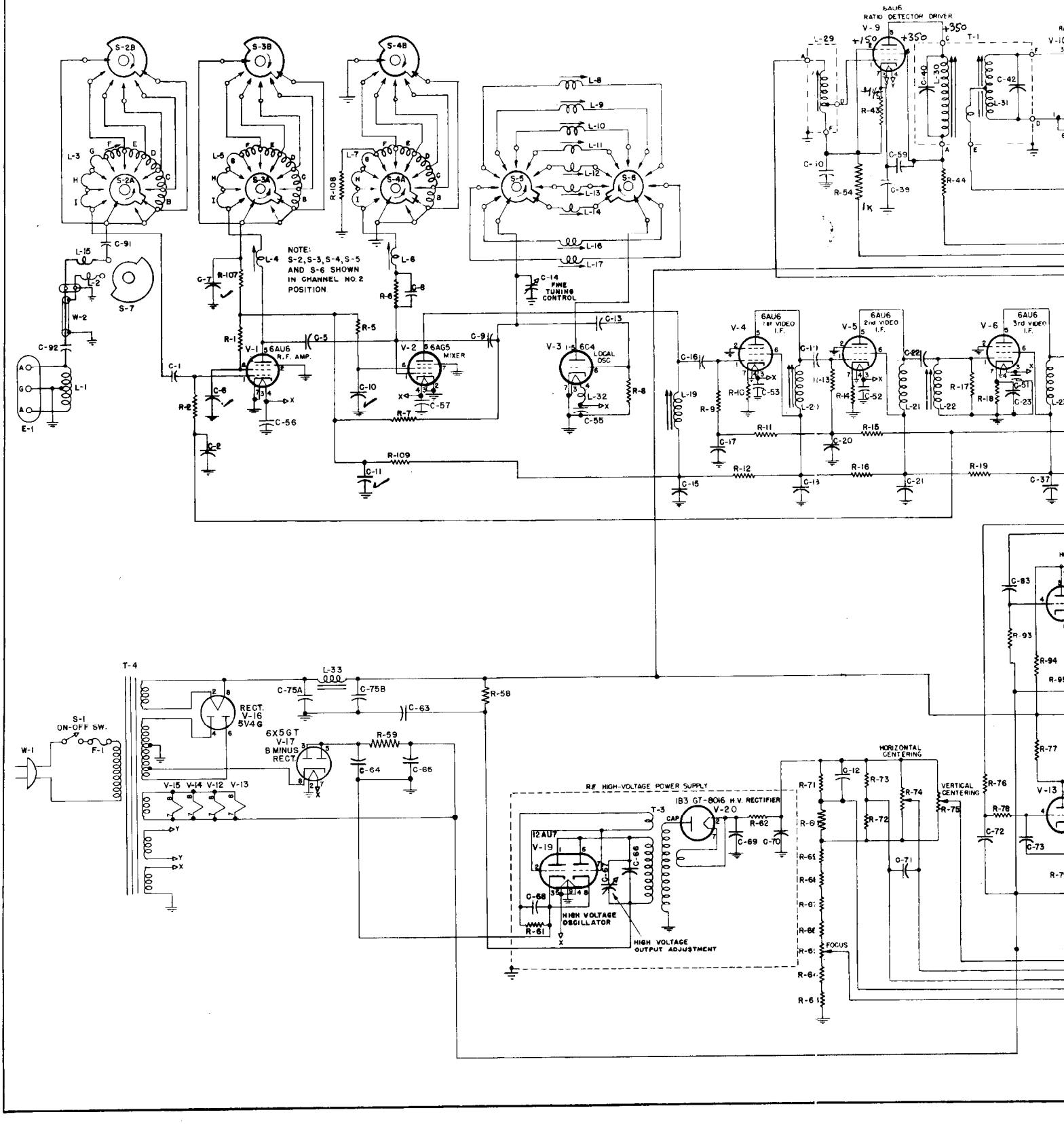
Symbol	Function	Description	National Co. Type
		RESISTORS (continued)	
R-55	Audio Amp. Grid Bias	470,000 ohms, ±10%, 1/2 watt	J569-57
R-56	Audio Amp. Grid Bias	4,700 ohms, ±10%, 1/2 watt	J569-33
R-57	B+ Dropping	390 ohms, ±10%, 1 watt	J571-20
R-58	B+ Dropping	2500 ohms, ±5%, 5 watt	E959-11
R-59	B Minus Filter	1,000 ohms, ±10%, 1 watt	J571-25
R-60	Voltage Divider	2,700,000 ohms, ±10%, 1 watt	J571-66
R-61	V-19 Grid	10,000 ohms, ±10%, 1/2 watt	J569-3
R-62	High Voltage Filter	120,000 ohms, ±10%, 1 watt	J571-50
R-63	Voltage Divider	3,900,000 ohms, ±10%, 1 watt	J571-68
R-64	Voltage Divider	3,900,000 ohms, ±10%, 1 watt	J571-68
R-65	Focus Control	Variable, 5,000,000 ohms	L100-1
R-66	Voltage Divider	4,700,000 ohms, ±10%, 1 watt	J571-69
R-67	Voltage Divider	4,700,000 ohms, ±10%, 1 watt	J571-69
R-68	Voltage Divider	3,300,000 ohms, ±10%, 1 watt	J571-67
R-69	Voltage Divider	3,300,000 ohms, ±10%, 1 watt	J571-67
R-70	V-13 Plate Load	4,700,000 ohms, ±10%, 1/2 watt	J569-69
R-71	Voltage Divider	1,000,000 ohms, ±10%, 1 watt	J571-61
R-72	Voltage Divider	2,700,000 ohms, ±10%, 1 watt	J571-66
R-73	Voltage Divider	2,700,000 ohms, ±10%, 1 watt	J571-66
R-74	Horizontal Cent. Control	Variable, 5,000,000 ohms	L100-1
R-75	Vertical Cent. Control	Variable, 5,000,000 ohms	L100-1
R-76	Vertical Pulse Filter	4,700 ohms, ±10%, 1/2 watt	J569-33
R-77	V-13 Plate Load	100,000 ohms, ±10%, 1 watt	J571-49
R-78	Vertical Pulse Filter	4,700 ohms, ± 10%, 1/2 watt	J569-33
R-79	V-13 Cathode	1,000 ohms, ±10%, 1/2 watt	J569-25
R-80	Vertical Control	Variable, 1,000,000 ohms	K915-3
R-81	V-13 Grid	470,000 ohms, ± 10%, 1/2 watt	J569-57
R-82	Vertical Size Control	Variable, 10,000,000 ohms	K915-5
R-83	V-13 Plate Load	6,800,000 ohms, ±10%, 1/2 watt	J569-71
R-84	V-12 Grid	4,700,000 ohms, ±10%, 1/2 watt	J569-69
R-85	V-12 Cathode	15,000 ohms, ± 10%, 1/2 watt	J569-39
R-86	Vert. Linearity Correction	2,200,000 ohms, ±10%, 1/2 watt	J569-65
R-87	V-12 Grid	150,000 ohms, ±10%, 1/2 watt	J569-51
R-88	Phase Shifting	2,200,000 ohms, ±10%, 1/2 watt	J569-65
R-89	V-12 Plate Load	820,000 ohms, ±10%, 1/2 watt	J569-60
R-90	V-12 Plate Load	820,000 ohms, ±10%, 1/2 watt	J569-60
R-91	V-21 Vertical Deflect. Plate	2,700,000 ohms, ±10%, 1 watt	J571-66
R-92	V-21 Vert. Deflect. Plate	2,700,000 ohms, ±10%, 1 watt	J571-66
R-93	V-15 Grid	4,700 ohms, ± 10%, 1/2 watt	J569-33
R-94	V-15 Plate Load	100,000 ohms, ±10%, 1 watt	J571-49
R-95	V-15 Cathode	1,000 ohms, ± 10%, 1/2 watt	J569-25
R-96	Horizontal Control	Variable, 250,000 ohms	K915-2
R-97	V-15 Grid	220,000 ohms, ± 10%, 1/2 watt	J569-53
R-98	V-15 Plate Load	4,700,000 ohms, ±10%, 1/2 watt	J569-69
R-99	Horizontal Size Control	Variable, 5,000,000 ohms	K915-4
R-100	Degeneration	1,000,000 ohms, 10%, 1/2 watt	J569-61
R-101	V-14 Grid	4,700,000 ohms, 10%, 1/2 watt	J569-69
R-102	V-14 Grid	4,700,000 ohms, ±10%, 1/2 watt	J569-69
R-103	V-14 Plate Load	47,000 ohms, ±10%, 2 watts	J572-45
R-104	V-14 Plate Load	47,000 ohms, ±10%, 1 watt	J571-45
R-105	V-21 Horizontal Deflect. Plate	2,700,000 ohms, ±10%, 1 watt	J571-66

PARTS LIST (Continued)

Symbol	Function	Description	National Co. Type
		RESISTORS (continued)	
R-106	V-21 Horizontal Deflect. Plate	2,700,000 ohms, ± 10%, 1 watt	J571-66
R-107	R.F. Amp. Plate Filter	1,000 ohms, ± 10%, 1/2 watt	J569-25
R-108	Mixer Grid Damping	3,900 ohms, ± 10%, 1/2 watt	J569-32
R-109	V-1, V-2, V-3 B+ Filter	100 ohms, ± 10%, 1/2 watt	J569-13
R-110	V-8 Shunt Damping	1,000,000 ohms, ± 5%, 1 watt	K853-3
		MISCELLANEOUS	
E-1	Antenna Input	Terminal Panel, 3 terminals	E259-3
F-1	Fuse	Fuse, 3 Amps., 250 volts	F135-9
L-1	Antenna Coupling	Coil, center tapped	SA:5448
L-2	Antenna Coupling	Coil, tapped	SA:5457
L-3	R.F. Amp. Grid	Multi-tapped coil	SA:5060-4
			SA:5456 &
			K908-1
L-4	R.F. Amp. Plate	Adjustable Brass-Core Coil	SA5059-2
L-5	R.F. Amp. Plate	Multi-tapped coil	SA5055 &
			K908-1
L-6	Mixer Grid	Adjustable Brass-Core Coil	SA5059-1
L-7	Mixer Grid	Multi-tapped coil	SA5060 &
			K908-1
L-8	Osc. Tuning, channel 8-9	Adjustable iron-core coil	SA5054-6
L-9	Osc. Tuning, channel 7	Adjustable iron-core coil	SA5054-5
L-10	Osc. Tuning, channel 6	Adjustable iron-core coil	SA5054-4
L-11	Osc. Tuning, channel 5	Adjustable iron-core coil	SA5054-4
L-12	Osc. Tuning, channel 4	Adjustable iron-core coil	SA5054-3
L-13	Osc. Tuning, channel 3	Adjustable iron-core coil	SA5054-2
L-14	Osc. Tuning, Channel 2	Adjustable iron-core coil	SA5054-2
L-15	Antenna Coupling	Coil	
L-16	Osc. Tuning, channel 12-13	Adjustable iron-core coil	SA5054-7
L-17	Osc. Tuning, channel 10-11	Adjustable iron-core coil	SA5054-7
L-18	Not Used		
L-19	1st. Video I.F.	Adjustable iron-core coil	SA5002
L-20	2nd. Video I.F.	Adjustable iron-core coil	SA5002
L-21	V-5 Plate Filter	Choke coil	SA5069
L-22	3rd. Video I.F.	Adjustable iron-core coil	SA5002
L-23	V-6 Plate Filter	Choke coil	SA5069
L-24	Video Detector Input	Adjustable iron-core tapped coil	SA5003
L-25	Video Detector Series Peaking	Peaking coil	SA5065
L-26	Video Detector Shunt Peaking	Peaking coil	SA5066
L-27	Video Amp. Series Peaking	Peaking coil	SA5067
L-28	Video Amp. Shunt Peaking	Peaking coil	SA5068
L-29	4.5 Mc. Sound Trap	Adjustable iron-core coil	SA:5450
L-30	T-1 Primary Tuning	Adjustable iron-core coil	Part of T-1
L-31	T-1 Secondary Tuning	Adjustable iron-core coil	Part of T-1
L-32	V-3 Filament	Choke	SA5057
L-33	B+ Filter	Filter Choke	K927-1
S-1	ON-OFF Switch	S.P.S.T. Switch	Part of R-48
S-2	Antenna Coil Switch	Rotary Switch, 2 pole	K900-1
S-2A		S.P. 10 Position	Part of S-2
S-2B		S.P. 5 Position	Part of S-2
S-3	V-1 Plate Coil Switch	Rotary Switch, 2 pole	K900-1
S-3A		S.P. 10 Position	Part of S-3
S-3B		S.P. 5 Position	Part of S-3

PARTS LIST (Continued)

Symbol	Function	Description	National Co. Type
		MISCELLANEOUS (continued)	
S-4	V-2 Grid Coil Switch	Rotary Switch, 2 pole	K900-1
S-4A		S.P. 10 Position	Part of S-4
S-4B		S.P. 5 Position	Part of S-4
S-5	Osc. Coil Switch	Rotary Switch, S.P. 9 Position	K889-1
S-6	Osc. Coil Switch	Rotary Switch, S.P. 9 Position	K889-1
S-7	Antenna Coupling Switch	Rotary Switch D.P.S.T.	K888-1
T-1	Discriminator	Discriminator Transformer	SA4997
T-2	Loud-speaker matching	Audio Output Transformer	Part of LS-2
T-3	High Voltage Transformer	High Voltage Inductor, 5 KV.	K890-1
T-4	Power Transformer	Power Transformer	L454-1
V-1	R.F. Amp.	6AU6	
V-2	Mixer	6AG5	
V-3	Local Osc.	6C4	
V-4	1st. Video I.F. Amp.	6AU6	
V-5	2nd. Video I.F. Amp.	6AU6	
V-6	3rd. Video I.F. Amp.	6AU6	
V-7	Video Det—AGC Diode	6AL5	
V-8	Video Amp.	6AU6	
V-9	Ratio Detector Driver	6AU6	
V-10	Ratio Detector-Audio Amplifier	6T8	
V-11	Sync Clipper - D.C. Restorer	6AU6	
V-12	Vertical Sweep Output	6SN7GT	
V-13	Vertical Sweep Oscillator	6SN7GT	
V-14	Horizontal Sweep Output	6SN7GT	
V-15	Horizontal Sweep Oscillator	6SN7GT	
V-16	Rectifier	5V4G	
V-17	B Minus Rectifier	6X5GT	
V-18	Audio Output	6V6GT	
V-19	High Voltage Oscillator	12AU7	
V-20	High Voltage Rectifier	1B3GT-8016	
V-21	Picture Tube	7JP4	
W-1	A.C. Connector	Two-wire cable with plug	E544-1
W-2	Antenna Coupling	Coaxial cable, 14 1/2" long, type RG-59U	SA:5458
LS-1	Loud-speaker	6" P.M.	K892-2
LS-2	Loud-speaker	6" P.M. with matching transformer	K892-1


S-2B
S-3B
S-4B
S-2A
S-3A
S-4A
S-5
S-6
S-7
NOTE:
S-2, S-3, S-4, S-5
AND S-6 SHOWN
IN CHANNEL NO. 2
POSITION.
C-14
FINE
TUNING
CONTROL
V-1 6AU6
R.F. AMP.
V-2 6AG5
MIXER
V-3 6C4
LOCAL
OSC
6AU6
RATIO DETECTOR DRIVER
V-9
+150
+350
V-4 6AU6
1st VIDEO
I.F.
V-5 6AU6
2nd VIDEO
I.F.
V-6 6AU6
3rd VIDEO
I.F.
T-4
RECT.
V-16
5V4G
6X5GT
V-17
B MINUS
RECT.
S-1
ON-OFF SW.
W-1
F-1
V-15 V-14 V-12 V-13
R.F. HIGH-VOLTAGE POWER SUPPLY
1B3 GT-8016 H.V. RECTIFIER
V-20
T-3
GAP
12AU7
V-19
HIGH VOLTAGE
OSCILLATOR
HIGH VOLTAGE
OUTPUT ADJUSTMENT
HORIZONTAL
CENTERING
VERTICAL
CENTERING
FOCUS
V-13

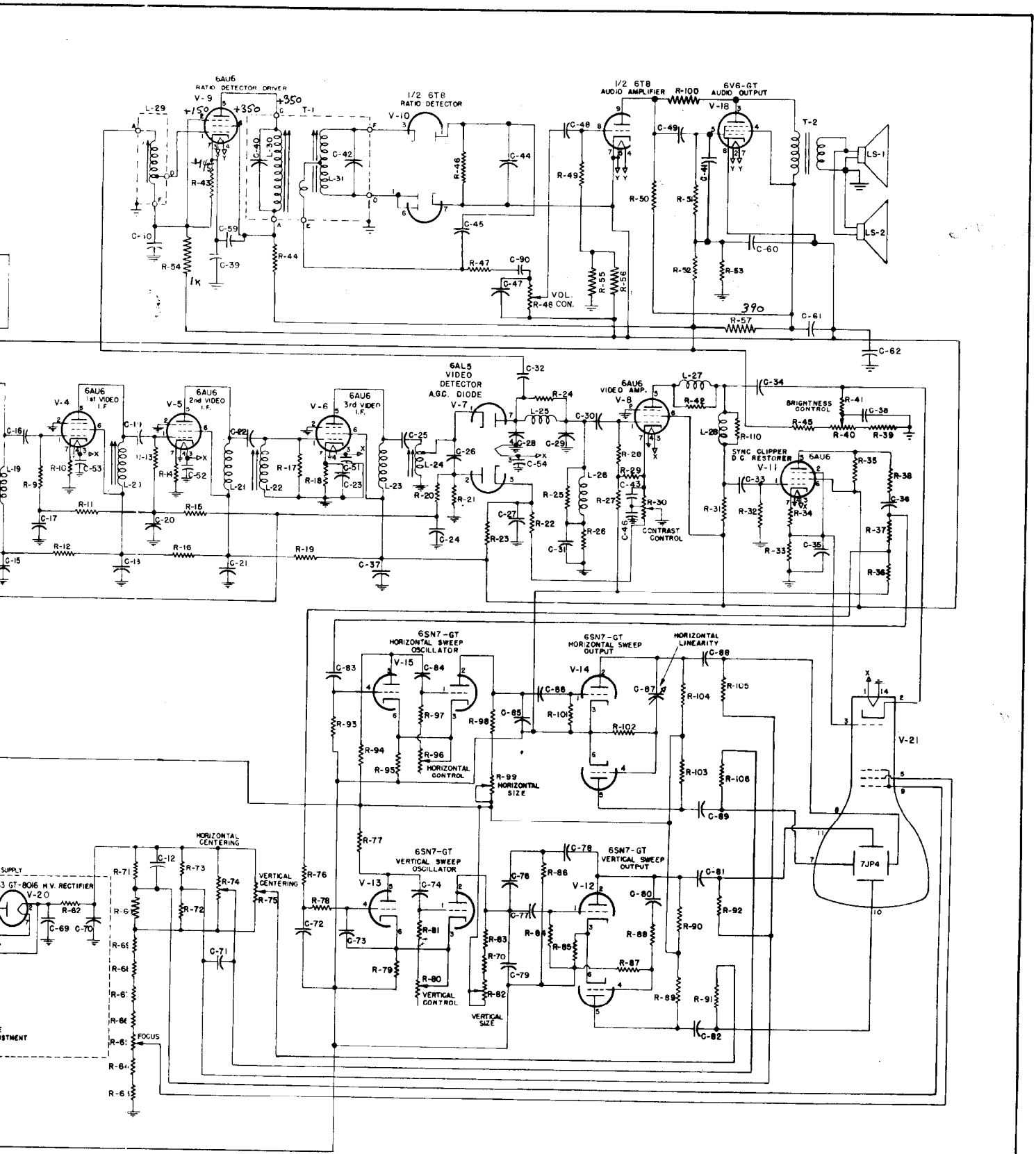


Figure No. 16. Schematic Diagram of NC-TV 7 and NC-TV 7M Receivers

Standard Form Warranty

Adopted by the Radio Manufacturers Association, Inc.

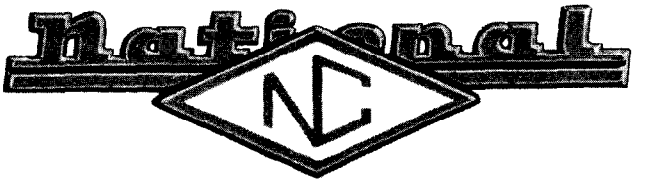
This equipment is warranted to be free from defective material and workmanship and repair or replacement will be made of any part which under normal installation, use and service discloses defect, provided the unit is delivered by the owner to the manufacturer or through the authorized radio dealer or wholesaler from whom purchased, intact, for examination, with all transportation charges prepaid to the factory, within ninety days from the date of original shipment from the factory, and provided that such examination discloses in the manufacturer's judgment that it is thus defective.

This warranty does not extend to any radio products which have been subjected to misuse, neglect, accident, incorrect wiring, improper installation, or to use in violation of instructions furnished by the manufacturer, nor extend to units which have been repaired or altered outside of the factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith of other manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for the manufacturer any other liability in connection with the sale of their radio products.

National Company, Inc. reserves the right to make any change in design or to make addition to, or improvements in, its products without imposing any obligations upon itself to install them in its products previously manufactured.



NATIONAL COMPANY, INC.
MALDEN, MASS.
U. S. A.

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National Company NC-TV 7W and NC-TV 7M TV Receivers Circa 1949

Comments by Leonard H. Anderson on 29 March 2005

The service manual was packed with the set as purchased in 1949 for my parents from an adolescent's meager ability to earn much from part-time jobs while in high school. While the screen was slightly less than today's DVD player portable (and cost about as much in 1949 dollar amounts), it had great sound from *two* speakers (but no stereophonic audio then). The wood cabinet (W suffix on model number, M meant metal cabinet) looked nice. Reception in Rockford, IL, depended on ducting and other niceties of VHF along the 90 mile path from Chicago, the nearest source of TV broadcasting then. Four-element Yagis were tried, one for each channel available and results were less than hoped for.

The Service Manual is typical of the 1940s and early 1950s, covering great details for the possible repairs that might be needed by relatively inexperienced *radio repairmen*. Except for large urban areas, audio-only *radio* was the only technology of broadcasting in those days just four years after the end of World War 2. Only 12 TV channels existed in 1949; the UHF channels were added later. In one way these comprehensive manuals packed with equipment was a source of knowledge at the time, mini-textbooks if you will.

State of the Art Then versus Just A Few Years Later

Electrostatic deflection on picture tubes was the norm in sizes 7 inches or smaller; a couple of kits and one short-lived assembled TV set had 2 inch CRTs! Manufacturers were still struggling with production of an affordable magnetic deflection yoke to enable large-size 10 and 12 inch screens. In the TV7 the deflection plates were also the final accelerating electrode and ran about 5 KV. That was enough for a reasonable nighttime screen brightness. The deflection amplifiers, push-pull for best linearity and differential voltage swing, were run to the limits of their plate voltage ratings.

There was **no** phase lock on the sync signals. That meant viewers had to touch-up the *hold* settings, knobs available on the front panel. Horizontal hold seemed to be affected by almost all sources of interference and rapid changes in signal strength such as aircraft reflection flutter (changing multipath effects). Vertical hold held rather well, even including nasties such as arcing neon signs, the arc at the (then) 60 cycle vertical rate.

The picture tube HV supply used an *RF transformer* with separate oscillator to get the 5 KV. I don't recall the general frequency but it was probably in the LF spectrum. No flyback arrangement here, although that was about to debut and become standard when magnetic deflection was the only way to go. National put it in its own little shield box but I would venture it would **not** meet today's FCC standards on EMI emissions.

The IF strip was only three stages with a -3 db bandwidth limited to about 2 MHz (or *Mc* as it was termed then). That traded slightly less detail of the 7 inch picture for a bit more sensitivity. What was surprising was that National was ahead of most other TV set makers then, the IF passband centered at around 36 MHz. The RCA 630TS chassis set an early standard of 21 to 25 MHz. Color TV receiver IF would double that nearly two decades later. *Intercarrier sound* was a new thing, picking off the audio as if it were a subcarrier on the detected video at 4.5 MHz center. That would become a de facto standard for all NTSC TV receivers in the future. It also forced the TV stations to hold the *white level* of video above 12% to keep the *intercarrier buzz* out of the audio. That buzz resulted from the 60 Hz white level (minimum carrier) going so low that it put a signal hole in the 4.5 MHz output of the video detector; the limiter stage gain wasn't enough to compensate so there was an effective chopping effect on that 4.5 MHz input to the sound detector.

The rotary switch channel selector was rather common then. *Standard Coil Company* would soon be organized to supply most TV set makers with *turret* type channel elements to reduce contact wear. Hallicrafters, in a brief fling at making TV receivers about this time, used a ganged push-button channel switching scheme. In National's *tuner* all channels above 7 had to be selected for odd or even channels by the concentric *fine-tuning* knob. That enabled a 10-position rotary switch (cheapest) to select the fixed front-end high bandwidths while the variable capacitor of the fine-tuning control did the odd-even thing. No sensitivity ratings are given for the TV7 and judging from the performance in the 90 mile *fringe area* (for reception), wasn't all that great.

Alignment of the tuner and IF strip **had** to be done by a good sweep generator with good *marker* frequencies (the best being crystal-controlled). Trying to use narrow-band techniques learned with HF and lower frequency band radio was doomed to yield poor results. That resulted in a new niche in service shop test equipment with *sweepers* being in demand more than the (then) new VTVM or Vacuum Tube Volt Meter.

All in all, looking back more than a half century at the design, National did a nice job of design for the time. Everything then was ruled by available vacuum tubes and one tube meant only one or two functional stages. Competitive sell prices meant cutting corners wherever possible. Assembly was terribly labor-intensive. The first PCBs would not appear in TV and radio sets until the early 50s. 1948 is generally regarded as a kick-off year for lots and lots of TV set makers to jump in on the TV bandwagon. Nearly all radio makers in the USA tried their hand with the TV market but most failed to achieve profitable results by the mid-1950s. National stayed in only about two years and would eventually dissolve four decades later. Hallicrafters kept on with their little TV receivers a bit longer but would not last as long as National as a corporation. One of the early makers, RCA, survived to this day with their Indianapolis, IN, works...although GE bought RCA over a decade ago and GE sold off divisions such as Indianapolis to France's Thompson. The RCA logo lives on in today's TV market.

Leonard H. Anderson 29 March 2005
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