TELEVISION CHASSIS NOTES

All 19 series chassis employ the same basic television circuitry. The 19B1X, 19B1Y, 19C1X and the 19A2X, 19F1X, 19K1X chassis are television only models. The 19E1X, 19G1X and 19D2X-19D2Y, 19N1X chassis are used in combination models.

The 19B1X and 19B1Y use a 17” rectangular picture tube (17BP4A). The 19C1X and 19E1X chassis use a 20” rectangular picture tube (20DP4A). The 19F1X and 19G1X chassis use a 21” (spherical faced) rectangular picture tube (21WP4 or 21WP4X), 19A2X-D2Y, 19K1X and 19N1X chassis use a 21ZP4A picture tube. 19D2Y chassis uses a 21ZP4B (Aluminized) picture tube.

A tone control is used in the 19C1X, 19E1X, 19F1X and 19G1X, 19K1X, 19N1X, 19A2X, 19D2X, 19D2Y.

The 19B1X and 19B1Y use the 94DS2 TV tuner having a pentode tube (6BC5) used as an RF amplifier. All other chassis in the 19 series use the 94D46 (cascode) TV tuner using a twin triode tube (10B7) as an RF amplifier.

This may vary with season and time of day. If the signal in the area concerned is subject to excessive fading and the Range Finder is adjusted during the time the signal is weakest, overloading (picture bending) will take place when the signal is stronger. For this reason be sure that the customer is instructed on the adjustment of this control for periodic variations in signal strength.

INDIVIDUAL CHANNEL SLUG ADJUSTMENT USING A TELEVISION SIGNAL

Individual channel oscillator adjustment of every receiver should be checked upon installation or servicing. If this adjustment is properly made, it is possible to tune from one station to another by merely turning the CHANNEL control. With correct oscillator channel adjustment, best picture will be located at the approximate center of the range of the TUNING control. However, this may not necessarily be maximum sound output.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set the CHANNEL knob for a station in operation.
c. Set all other controls for a normal picture.
d. Set TUNING control at center of its range by rotating it approximately half-way.
e. Insert a 1/4” blade, NON-METALLIC screwdriver (kit consisting of one metallic and one non-metallic screwdriver is available under part number 98A30-31) in the 1/4” hole adjacent to the channel tuning shaft.

For each channel in operation, carefully adjust the channel slug for best picture with clear detail. Be sure that the Tuning control is set at the center of its range before adjusting each channel slug. Only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the coil, move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and reset retaining spring.)

TOUCH-UP OF RATIO DETECTOR SECONDARY USING TELEVISION SIGNAL (AB, BOTTOM SLUG OF T201)

*This adjustment is accessible through the 1/4” hole (just below T201) in bottom of cabinet or the chassis mounting shell, located toward the left side facing the rear of the set. Removal of the chassis is therefore not required. Adjustment need be made on one channel only. Proceed as follows:
a. Turn set on and allow about 15 minutes for warm up.
b. Tune set for normal picture and sound.
c. Carefully insert a non-metallic alignment tool through...
the opening in cabinet bottom below T201. An alignment tool with a screwdriver blade or hexagonal end is required depending on the transformer used; see * note below. When the alignment tool engages the bottom tuning slug A6, adjust the slug for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about ¼ to ½ turn.

d. If necessary, repeat individual channel slug adjustment and conclude with retouching the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will not be necessary to repeat the ratio detector secondary adjustment after once correctly adjusting it.

ALIGNMENT OF 4.5 MC TRAP A12, USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauge-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting the slug for minimum 4.5 MC interference. If greater accuracy is required, the trap should be adjusted as shown on page 8 under "4.5 MC Sound IF and Trap Alignment."

HORIZONTAL OSCILLATOR ALIGNMENT

If the picture will not stay in "horizontal sync" through most of the range of the HORIZONTAL control (on front panel), it will be necessary to make the horizontal oscillator adjustment by following exactly the step-by-step procedure given below. Note that oscillator waveform adjustment in step "b" requires the use of an oscilloscope. Waveform adjustment is made at the factory and generally should not require readjustment in the field. However, waveform adjustment should be checked whenever the receiver is brought into the shop. Step "b" below may be omitted when adjustment is to be made in the customers home. Adjust as follows:

a. Allow the receiver to warm up for a few minutes. Tune in the station, set the front panel controls for normal picture in sync. Important: Before proceeding, be sure that the DX Range Finder control (AGC) is adjusted according to the instructions given in this manual. Adjust the Picture (contrast) control for a normal picture, otherwise it may be difficult to make these adjustments.

If picture cannot be brought into sync with the HORIZONTAL control, alternately adjust the HORIZON- TAL control, HORIZ. FREQ., and/or the HORIZ. LOCK adjustments until the picture is brought in sync.

b. If test pattern is available, examine the picture width and linearity. If necessary, make width, linearity and drive adjustments before proceeding.

c. Connect oscilloscope high side through a 10 mmfd. condenser to terminal "C" or "2" on the horizontal blocking transformer; low side to chassis ground. Set oscilloscope to horizontal frequency (15.75 KC) or a sub-multiple of it. While keeping the picture in sync, adjust the HORIZ. LOCK adjustment L401 (under side of chassis) for oscilloscope waveform pattern as illustrated in figure 1. Adjust for equal height of the rounded and pointed peaks. This adjustment must be accurately made for correct operation of the horizontal oscillator. Disconnect the oscilloscope after adjusting waveform.

d. Turn the HORIZONTAL control fully counterclockwise. Momentarily interrupt the signal by switching the channel selector off channel and then back on. The picture may remain in sync. If so, adjust the HORIZ. FREQ. adjustment until the picture goes out of sync and several diagonal bars sloping down to the left are visible, see figure 2. VERY SLOWLY turn the HORIZONTAL control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 diagonal bars are present just before the picture pulls into sync, adjust the HORIZ. LOCK RANGE. trimmer slightly clockwise. If less than 3 bars are present, adjust the HORIZ. LOCK RANGE. trimmer slightly counterclockwise. Turn the HORIZONTAL control counterclockwise, momentarily interrupt the signal and recheck the number of diagonal bars present just before the picture pulls into sync. Repeat this procedure until only 3 bars are present.

d. With the picture centering lever, shift the picture to the right so that the blanking bar at the left side of the picture is visible.

While observing the left side of the picture, slowly rotate the HORIZ. FREQ. adjustment (in either direction) so as to move the picture to the right until

Figure 1. Horizontal Oscillator Waveform.

Figure 2. Picture Out of Horizontal Sync.
or blanking bar too far to the right may cause the oscillator to go into a spurious mode of oscillation.
Slowly turn the HORIZ. FREQ. adjustment in the opposite direction until the blanking bar moves to the left and the picture just becomes stable.
e. Properly center the picture by readjusting the picture positioning lever.

**B+ DISTRIBUTION IN 19 SERIES CHASSIS**
The figure below illustrates the basic B+ distribution used in 19 series chassis. Note: There are variations in the B+ circuits of TV and combination models and TV models using a different RF amplifier tube (V101) in the TV tuner. Alternate connections for the RF amplifier tube (V101) is shown in the figure below. See "Television Chassis Notes" on page 2 and "Trouble Shooting" information

**SERVICING RADIO TUBES AND DIAL LIGHT IN COMBINATION MODELS**
The radio tubes can be serviced without removing the TV chassis from the cabinet. The radio tubes can be reached through the opening in the underside of the chassis shelf.
The dial light can be serviced by removing the tuning knobs and plastic control panel.

**SERVICE HINTS**
*Also see Production Changes in this Manual*

**TROUBLE SHOOTING**
The 19 series chassis covered in this Service Manual are newly designed sets incorporating the latest in television circuitry. These chassis are similar to other late Admiral chassis with respect to the sync, sweep and power supply circuits. New features incorporated in the 19 series chassis are outlined in paragraph on "New Features in 19 Series Chassis" on page 2. Important: Since there are many differences in the 19 series chassis over earlier model Admiral receivers, it is important to remember the following when servicing or installing receivers having the 19 series chassis.

All 19 series chassis have a "DX Range Finder control" (AGC delay circuit). This control is a potentiometer located at the rear of the chassis to enable precision adjustment of receiver sensitivity to suit the signal conditions in any local of fringe area. Incorrect adjustment of this control in a strong signal area, may result in picture bending, extreme contrast and poor sync. Incorrect adjustment in a weak signal area may result in complete loss of picture and sound. Information on the adjustment of the DX Range Finder control is given on page 2.

The sound output tube V204 (6V6G or 6AS5) functions as a voltage dropping tube in addition to being a sound output tube. The cathode of the sound output tube operates at approximately 140 volts above chassis ground for TV operation. If the sound output stage becomes defective, B+ voltage to the TV tuner, sync separator and clipper, video amplifier and AGC delay circuit will be affected.

B+ voltage to the first and second IF amplifiers V301 and V302 are effectively in series. The cathode of V302 is operated at approximately 120 volts above chassis ground. If either V301 or V302 become defective, B+ voltage to the other stage will be affected.

In sets using the 94D46-2 cascode tuner, B+ voltage to the triode sections of the RF stages (V101) are in series. The cathode of the second triode section is operated at approximately 130 volts above chassis ground. If the tube should become defective or be removed from the socket, there will be no B+ voltage on the plate of the first triode section. See B+ distribution diagram in figure 3.

The horizontal oscillator circuit utilizes pulse width modulation for control of the horizontal oscillator frequency. Information on servicing the horizontal oscillator and horizontal oscillator control circuit are given in paragraph "Service Hints for Horizontal Sync". Note: An oscilloscope is required for adjustment of the horizontal oscillator waveform. Information on adjustment of the horizontal oscillator is given on Page 5.
EXCESSIVE SNOW IN PICTURE

Excessive snow in the picture can be caused by faulty tubes in the receiver. Check receiver as follows:

Short circuit the antenna terminals and turn the picture control (contrast) fully clockwise.

Connect a vacuum tube voltmeter from test point “V” to chassis. Set the channel selector on an unassigned channel. If the voltmeter reading exceeds 5 volts negative, excessive receiver (tube) noise is indicated. This condition can usually be corrected by tube substitution. Substitute tubes in the following order: Video detector tube V304, RF oscillator tube V102, RF amplifier tube V101 and IF amplifier tubes V301, V302 and V303.

Corona or arcing in the second anode supply can also cause a high noise reading at the video detector resulting in excessive snow in weak signal areas.

MISCELLANEOUS TROUBLE DUE TO FAULTY TUBES

Faulty tubes cause the majority of receiver troubles. The list below contains most common troubles which are generally due to faulty tubes.

a. Poor fringe area reception due to low B plus voltage.
   Check the 5U4G tube.

b. Poor fringe area reception due to low sensitivity.
   Check the 6B5s and 6BZ7 tubes, if used in the receiver.

c. Picture and sound separated due to IF oscillation.
   Check the 6CB6 and 6U8 tubes.

d. Picture bending caused by leakage between tube elements.
   Check the 6B5C and 6CB6 tubes.

e. Poor sync stability, usually more noticeable in vertical circuit. Check 12AU7 tube.

f. Washed out picture due to negative grid current.
   Check 6CB6 tube.

SERVICE HINTS FOR HORIZONTAL SYNC

The horizontal oscillator control circuit controls the horizontal oscillator by a method called “Pulse Width Modulation”. This method is so called, because the width of the pulse applied to the grid of the horizontal oscillator control section determines the length of time that current flows through this section. The duration of current flow through the control section determines the DC control voltage applied to the grid of horizontal oscillator, thereby controlling the frequency.

The waveshape applied to the grid of the horizontal oscillator control section is formed by combining a partially integrated pulse from the horizontal oscillator output and the horizontal sync pulse. If these two pulses combine properly, the waveshape shown in Figure 4 will be developed and the horizontal oscillator will be in sync.

With no sync input, the waveform at the horizontal oscillator control grid should appear as shown in Figure 5. Since the horizontal oscillator control voltage is dependent upon a waveshape formed at the horizontal output stages (V404, V405 and V406), a defective component in one of these stages may cause sync trouble. If the waveform shown in Figure 5 can be obtained, this will indicate proper operation of the horizontal sweep circuit.

When the horizontal oscillator is out of sync, it may be difficult to observe this waveshape (Figure 5) on an oscilloscope due to the presence of out-of-phase sync pulses. In this case, remove the sync separator and sync clipper tube V401. If the waveshape shown in Figure 5 is obtained, place the sync and separator tube back into its socket. Then, remove the horizontal oscillator and control tube V403 (6SN7GT). Conventional, well-shaped sync pulses should appear at control grid (pin 1) of V403.

If there are no sync pulses, or the pulses are of low or varying amplitude, accompanied with noise, the sync circuits should be checked. However, if the sync pulses are well-shaped and of constant amplitude, the horizontal oscillator may be misaligned. Place V403 back into its socket and make the “Horizontal Oscillator Alignment” given on page 3.

If it is impossible to sync the picture, or obtain the correct waveform at terminal “C”, check for a defective component in the following sequence:

a. Check tube V403 (6SN7GT) by substitution.

b. Check C417 by substituting identical condenser (270 mmfd) part number 65R21.271.

c. Check C413 for either open or short.

d. Check condenser C416 for short.

e. Check resistance of B428. It should be 150,000 ohms.

f. Lead dress is critical in the horizontal oscillator circuit. Check to see that lead dress has not been disturbed while servicing.

REMOVABLE PICTURE WINDOW

All models using the 19 series television chassis have
picture windows which can be easily removed from the
front of the cabinet for cleaning the inside of the win-
dow, picture tube and picture tube mask. Two types of
picture window mountings are used. A removable mold-
ing in used in wood cabinet models. Removable corner
brackets are used in plastic cabinet models. Instructions
for removing and cleaning the picture window, picture
tube and picture tube mask is given below.

REMOVING PICTURE WINDOW FOR CLEANING

If the picture window has a removable molding
(at the top), remove the window by first removing the
Phillips head screws and molding at the top of the pic-
ture window. Pull the top of the window away from the
cabinet slightly and lift it up out of the channel at the
bottom.

After cleaning the window, picture tube and picture
tube mask as instructed below, install the window by plac-
ing the bottom edge in the channel and replace the
molding. Use care when tightening screws on molding
to prevent stripping.

TELEVISION ALIGNMENT PROCEDURE

GENERAL

Complete alignment consists of the following individual
procedures and should be performed in this sequence.
a. IF Amplifier and Trap Alignment.
b. IF Response Curve Check.
c. 4.5 MC Sound IF and Trap Alignment.
d. RF and Mixer Alignment.
e. Overall RF and IF Response Curve Check.
f. HF Oscillator Adjustment.

TEST EQUIPMENT

To properly service this receiver, it is recommended
that the following test equipment be available.

IMPORTANT: Many service instruments do not
meet the requirements given below. A list of recom-
manded equipment is available from Admiral Distributor.

Oscilloscope

Standard oscilloscope, preferably one with a wide band
vertical deflection, vertical sensitivity at least .5 volt
(RMS) per inch.

Signal (Marker) Generator

4.5 MC frequency.
18 to 30 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.

Must have a built-in calibration crystal for checking
dial accuracy.

If the picture window has removable corner
brackets, first remove the two brackets at the top of
the window. Then, while holding the window, loosen the
screws on the bottom brackets. Allow the window to tilt
out slightly at the top until it can be grasped and lifted
free of the cabinet.

After cleaning, install the window by setting it in posi-
tion and mounting the corner brackets. Use care when
tightening bracket mounting screws to prevent stripping
or cracking glass.

CLEANING GLASS PICTURE WINDOW

Clean the picture mask using a soft cloth, dampened
in mild soapy water. Clean the picture window and the
face of the picture tube using a soft cloth, dampened
with your favorite window cleaner. Wipe dry using a
chamois or soft, lint free cloth. Only use cloths which
are just dampened as presence of moisture or water in-
side the set may cause damage. Install the window as
instructed above.

Sweep Generator

Sweep generator must provide sweep frequencies from
18 to 30 MC range:
50 to 90 MC range:
170 to 225 MC range:

with at least
10 MC sweep width.
Output: adjustable; at least one-tenth volt maximum.
Output impedance: 300 ohms balanced to ground.

A sweep generator not having constant output voltage
over the sweep range and linear sweep, will produce
curves which are widely different from the ideal curves
shown in the following pages. If repeated difficulty is
encountered in obtaining these curves, the sweep gen-
erator should be checked. A simple check is to observe
the response curve for a set that is in alignment.

Before suspecting the generator, be sure the alignment
instructions in this manual have been followed carefully.

Vacuum Tube Voltmeter

Preferably with low range (3 volt) DC zero center
scale and a high voltage probe (30,000 volt range).

ALIGNMENT TOOLS

An alignment tool kit consisting of one metallic and
one non-metallic screwdriver is available under part num-
ber 96A-30-3. A non-metallic alignment tool with a screw-
driver point at one end and hexagonal wrench (for hol-
low hexagon core slugs) at the other is available under
part number 96A-30-7.
IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias battery; negative to test point "T", see figure 9, positive to chassis. A 3 volt battery is required for steps 1, 2, 3, 4 and 5.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.

Use lowest DC scale on VTVM.

<table>
<thead>
<tr>
<th>Step</th>
<th>Signal Gen. Freq.</th>
<th>VTVM and Signal Generator Connections</th>
<th>Instructions</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27.25 MC</td>
<td>VTVM high side to test point &quot;V&quot;, common to chassis.</td>
<td>Use 3 volt bias battery.</td>
<td>A1 for minimum.</td>
</tr>
<tr>
<td>2</td>
<td>25.3 MC</td>
<td>Generator high side to Point W on Tuner; Insulate shield from chassis. Connect low side to chassis near 646 tube base.</td>
<td>Use lowest DC scale on VTVM.</td>
<td>A2 and A3 for maximum.</td>
</tr>
<tr>
<td>3</td>
<td>23.1 MC</td>
<td></td>
<td>When peaking, keep reducing generator-output for VTVM reading of approx. 1 volt or less.</td>
<td>A4 and A5 for maximum.</td>
</tr>
<tr>
<td>4</td>
<td>27.25 MC</td>
<td></td>
<td>Set channel switch to channel 12 or other unassigned high channel.</td>
<td>Repeat step 1 above.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>To insure correct IF alignment, make the &quot;IF Response Curve Check.&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IF RESPONSE CURVE CHECK
(Using sweep generator and oscilloscope)

Receiver Controls and Bias Battery

Set Channel selector on channel 12 or an unassigned high channel. Picture control fully to the left. Connect negative of 3 volt bias battery to test point "T"; positive to chassis.

Sweep Generator

Connect high side to Point W on Tuner, low side to chassis ground. Set sweep frequency to 23MC, and sweep width approximately 7MC.

Marker Generator

If an external marker generator is used, loosely couple high side to sweep generator lead on Point W on Tuner, low side to chassis. Marker frequencies indicated on IF Response Curve.

Oscilloscope

Connect to test point "V". See figure 9. Marker pins on scope will be more distinct if a resistance from 100 ohms to 200 ohms is connected across the oscilloscope input.

Instructions

Check curve obtained against ideal response curve in fig. 6. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touch-up with IF slugs as instructed below.

Figure 6. Ideal IF Response Curve.

Figure 7. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks, carefully adjust slug A2 (25.3 MC). It should not be necessary to turn slug A2 more than one turn in either direction. The curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.

* Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.
ALIGNMENT HINT

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures below.

Figure 8. Top View of TV Tuner Showing Adjustment Locations.

Figure 9. Bottom View of Chassis Showing Test Point Connections and IF Alignment Data.

4.5 MC SOUND IF AND TRAP ALIGNMENT

See page 2 for touch-up of ratio detector using television signal without test equipment.

a. Connect signal generator high side to Pin 2 of V304 (6AL5) through a .01 mfd. condenser, connect low side to chassis.
b. Allow about 15 minutes for receiver and test equipment to warm up.
c. Set Picture control fully to the left (counterclockwise).
d. Use a NON-METALLIC alignment tool. If Ratio Det. Transformer (T20) has hollow core slug, bottom slug adjustment A8 can be made from top of chassis, if you use alignment tool #98A30-7 obtainable from Admiral Distributor.

tabular format:

<table>
<thead>
<tr>
<th>Step</th>
<th>Signal Gen. Freq. (Mc)</th>
<th>VTVM Connections</th>
<th>Instructions</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High side to test point &quot;Y&quot;; common to chassis.</td>
<td>Use lowest DC scale on VTVM.</td>
<td>A6 and A7 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Set to exactly 4.5 Mc</td>
<td>High side to test point &quot;Z&quot;; common to chassis.</td>
<td>Use zero center scale on VTVM, if available.</td>
<td>A8 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A6 was far off, repeat step 1.</td>
</tr>
<tr>
<td>3</td>
<td>High side to test point &quot;Y&quot;; common to chassis.</td>
<td>Connect a 10 mmfd. condenser from pin 5 of V305 (6CB6) to pin 7 of V201 (6AL6). Use lowest DC scale on VTVM.</td>
<td>A9 for minimum.</td>
<td></td>
</tr>
</tbody>
</table>
RF AND MIXER ALIGNMENT
FOR SETS USING TV TUNER 94D52
(This tuner uses a 6BC5 tube for RF amplifier V101.)

a. Connect negative of 3 vol bias battery to test point “T”, positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point “T” to chassis.
b. Connect sweep generator to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.
c. Connect oscilloscope through a 10,000 ohm resistor to test point “W” on tuner (Fig. 11). Keep scope leads away from chassis.
d. Set channel selector to Channel 10.
e. Allow about 15 minutes for receiver to warm up and test equipment.

<table>
<thead>
<tr>
<th>Step</th>
<th>Marker Gen. Freq. (MC)</th>
<th>Sweep Gen. Frequency</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>193.25 MC (Video Carrier)</td>
<td>Sweeping Channel 10. See frequency table below.</td>
<td>Check for curve shown below. If necessary, adjust A10, A11 and A12 (Figure 11) as required. Adjusting A11 will generally shift the center of the response curve in relation to the video and sound carrier markers. A10 and A12 should be alternately adjusted for best gain with flat top appearance. Consistent with proper band width and correct marker location, response curve should have maximum amplitude and flat top appearance.</td>
</tr>
<tr>
<td>2</td>
<td>197.75 MC (Sound Carrier)</td>
<td></td>
<td>Check each channel operating in the service area for curve shown below. In general, the adjustment performed in step 1 is sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor that particular channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.</td>
</tr>
</tbody>
</table>

RF AND MIXER ALIGNMENT
FOR SETS USING TV TUNER 94D46
(This tuner uses a 6SB7 tube for RF amplifier V101.)

a. Connect negative of 3 vol bias battery to AGC bias (test point “T”), positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point “T” to chassis.
b. Connect sweep generator to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.
c. Connect oscilloscope through a 10,000 ohm resistor to test point “W” on tuner (Fig. 11). Keep scope leads away from chassis.
d. Allow about 15 minutes for receiver to warm up.

<table>
<thead>
<tr>
<th>Step</th>
<th>Marker Gen. Freq. (MC)</th>
<th>Sweep Gen. Frequency</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>193.25 MC (Video Carrier)</td>
<td>Sweeping Channel 10. See frequency table below.</td>
<td>Check for curve below. If necessary, alternately adjust A11 and A12 (Figure 11) as required to obtain equal peak amplitudes and symmetry, consistent with flat top appearance, proper band width and correct marker location.</td>
</tr>
<tr>
<td>2</td>
<td>197.75 MC (Sound Carrier)</td>
<td></td>
<td>Check for curve below. If necessary, adjust A10 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper band width and correct marker location. After completing adjustment, re-check adjustment of step 1.</td>
</tr>
<tr>
<td>3</td>
<td>83.25 MC (Video Carrier)</td>
<td>Sweeping Channel 6. See frequency table below.</td>
<td>Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor that particular channel. Repeat step 2 for the weak low channel to favor the particular low channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.</td>
</tr>
<tr>
<td>4</td>
<td>87.75 MC (Sound Carrier)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HF OSCILLATOR ADJUSTMENT
(Using a signal generator)

It is always advisable to make HF oscillator adjustments using a Television Signal. If a Television Signal is not available, HF oscillator adjustment can be made using a crystal calibrated signal generator. Make adjustments as follows:

<table>
<thead>
<tr>
<th>Receiver Control Settings</th>
<th>Signal Generator</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set channel selector for each channel to be adjusted. Set “Tuning” control at half rotation. Turn volume control fully to the right (clockwise).</td>
<td>Connect to antenna terminals. Set generator to exact frequency of HF above. See frequency table.</td>
<td>Connect a wire jumper from test point “W” on the tuner to test point “Z”. See figure 9. Remove the ratio detector tube V202 (6AL5). Carefully adjust the oscillatorugas A13 on each channel until a whistle (beat) is heard in the speaker of the receiver.</td>
</tr>
</tbody>
</table>
# OVER-ALL RF AND IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope)

<table>
<thead>
<tr>
<th>Receiver Controls and Bias Battery</th>
<th>Sweep Generator</th>
<th>Marker Generator</th>
<th>Oscilloscope</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture control fully to the left, Channel selector on channel 10 or other unassigned high channel. Connect negative of 3 volt bias battery to test point &quot;I&quot;, positive to chassis.</td>
<td>Connect to antenna terminals. Set generator to sweep channel selected. Keep generator output as low as possible, to prevent overloading. See frequency table on page 10.</td>
<td>If an external marker generator is used, loosely couple high side to sweep generator lead. Marker frequencies are shown in frequency table on page 10.</td>
<td>Connect to point &quot;V&quot;. See figure 9. Connect output of sweep generator to input of oscilloscope. Note that carrier (marker) on the &quot;Over-all RF-IF Response Curve&quot; will appear on the opposite side of the curve as compared to the &quot;IF Response Curve&quot; figure 6. This is due to action of the mixer tube.</td>
<td>Compare the response curve obtained against the ideal curve shown in figure 13. If the curve is not within tolerance, touch up the IF slug as instructed below. It should never be necessary to turn slugs more than one turn in either direction. If the curve is satisfactory on the channel checked, all other channels should also be satisfactory. IMPORTANT: When sweep output is reduced, response curve amplitude on scope should also decrease, but curve shape should remain the same. If curve shape changes, reduce sweep output and/or the scope gain until the shape does not change.</td>
</tr>
</tbody>
</table>

![Diagram](image_url)

Figure 13. Ideal Overall RF and IF Response Curve.

Note that video carrier (marker) on the "Over-all RF-IF Response Curve" will appear on the opposite side of the curve as compared to the "IF Response Curve" figure 6. This is due to action of the mixer tube.

![Diagram](image_url)

Figure 14. Over-all RF and IF Response Curves, Incorrect Shape.

<table>
<thead>
<tr>
<th>Model Numbers</th>
<th>TV Chassis</th>
<th>Picture Tube</th>
<th>TV Tuner</th>
<th>Record Changer</th>
<th>Radio</th>
<th>Tone Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>17C31X</td>
<td>1981X</td>
<td>17BP4A</td>
<td>94D55-1</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>17DX12X</td>
<td>1981X</td>
<td>17BP4A</td>
<td>94D55-1</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>121DX13X, 15X-16X-17X</td>
<td>19F1X</td>
<td>21WP4 or 21WP4X</td>
<td>94D46-2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>121DX15X-16X-17X</td>
<td>19K1X</td>
<td>20BP4A</td>
<td>94D46-2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>121DX15X-16X-17X</td>
<td>19K1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>221DX13X-16X-17X</td>
<td>19C1X</td>
<td>20BP4A</td>
<td>94D46-2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>221DX15X-16X-17X</td>
<td>19C1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>221DX15X-16X-17X</td>
<td>19D1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>221DX15X-16X-17X</td>
<td>19D1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX15X-16X-17X</td>
<td>19G1X</td>
<td>21WP4 or 21WP4X</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX15X-16X-17X</td>
<td>19G1X</td>
<td>20BP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX15X-16X-17X</td>
<td>19G1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX15X-16X-17X</td>
<td>19G1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX25X-26X-27X</td>
<td>19K1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX25X-26X-27X</td>
<td>19K1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX25X-26X-27X</td>
<td>19K1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX25X-26X-27X</td>
<td>19K1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX25X-26X-27X</td>
<td>19K1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX25X-26X-27X</td>
<td>19K1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX25X-26X-27X</td>
<td>19K1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>321DX25X-26X-27X</td>
<td>19K1X</td>
<td>21ZP4A</td>
<td>94D46-2</td>
<td>RC600 Built-in AM</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

NOTE: Some of the above models may have either of two chassis.
SERVICING RADIO TUNER IN 19E1X, 19G1X AND 19N1X MODELS

SERVICING RADIO TUBES AND DIAL LIGHT
The radio tubes and radio dial light can be serviced without removing the TV chassis from the cabinet. The radio tubes can be reached through the opening cut in the underside of the chassis shelf.

The dial light can be serviced by removing the tuning knobs and plastic control panel.

REMOVING RADIO TUNER
The radio tuner is mounted at the front apron of the chassis. Alignment, taking voltage readings or an inspection of the underside of the radio tuner can be performed without complete removal of the radio tuner from the TV chassis. To gain access to the underside of the radio tuner, disconnect the tuning drive cord, remove the self-tapping screws at the rear of the radio tuner and at the front (4 screws).

ALIGNMENT OF RADIO TUNER
The radio tuner in television and radio chassis should be aligned as instructed under "Radio Alignment Procedure" below.

The radio alignment trimmers are accessible without disassembly of the radio tuner from the TV chassis. Figure at right shows the locations of radio alignment trimmers.

RADIO ALIGNMENT PROCEDURE
- Connect output meter across speaker voice coil.
- Turn receiver Volume control fully on.
- Function switch in "Radio" position.
- Use lowest output setting of signal generator that gives a satisfactory reading on meter.
- Use a NON-METALLIC alignment tool for IF adjustments.
- Repeat adjustments to insure good results.

<table>
<thead>
<tr>
<th>Step</th>
<th>Connect Signal Generator</th>
<th>Dummy Antenna Between Radio and Signal Generator</th>
<th>Signal Generator Frequency</th>
<th>Receiver Dial Setting</th>
<th>Adj. Trimmers in Following Order to Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gang condenser antenna stator</td>
<td>.1 MFD</td>
<td>455 KC</td>
<td>Tuning gang wide open</td>
<td>*A-B (2nd IF) *C-D (1st IF)</td>
</tr>
<tr>
<td>2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>1620 KC</td>
<td>&quot;</td>
<td>E (oscillator)</td>
</tr>
<tr>
<td>3</td>
<td>Place generator lead close to loop of set to obtain adequate signal, No actual connection (signal by radiation).</td>
<td></td>
<td>1400 KC</td>
<td>Tune in signal</td>
<td>$F$ (antenna)</td>
</tr>
</tbody>
</table>

* Adjustments A and C made from underside of chassis. See figure 16 for trimmer locations.

$F$ AM antenna trimmer may not peak if antenna leads are not properly routed or separated.
INDEX

TELEVISION

RCC

Service Manual
1953 Supplement No. 7

PUBLISHED BY RADIO COLLEGE OF CANADA, TORONTO

GORDON OLIVER TELEVISION
T. V. RADIO SERVICE
NO 4615
23 CALVERHALL ST.
VANCOUVER, B. C.

MOTOROLA

Note: For a complete cross-index of all models and chassis numbers, see pages 5 and 12.

1910X Circuit...14, 48
1910X Service/Data...14
1910X TV Alignment...5, 8
1910X Chassis Lay-outs...7
1910X Radio Alignment...8
1910X Same as 1911X.
1911X Circuit...45, 46
1911X Circuit lay-out...45, 46
1911X Other data same as 1910X.
1911X Same as 1913X.
1912X Circuit lay-out...47, 49
1912X Circuit...47, 49
1912X Circuit lay-out...49, 50
1912X Other data same as 1911X.
1912X Same as 1913X.
1913X Circuit...53, 54
1913X Circuit lay-out...53, 54
1913X Other data same as 1911X.
1913X Same as 1912X.
2010M Circuit...55, 56
2010M Circuit lay-out...55, 56
2010M Alignment...9, 10, 11 to 55
2010M Circuit lay-out...9, 10, 11
2010M Circuit...9, 10, 11
2010M Other data same as 1911X.
2010M Same as 1913X.
2210M Circuit...11, 12, 13
2210M Circuit lay-out...11, 12, 13
2210M Service History...15
2210M Alignment...16 to 18
2210M Radio Alignment...18

NORTHERN ELECTRIC

Model
Page
ME11 Circuit...79, 80
ME11 Power Supply Circuits...40
ME11 Production Changes...40 to 41
ME11 Circuit Resistances...88
ME11 Circuit Resistance...88
ME11 Dimer Service...87, 88
ME11 Dimer Circuit...87
ME11 Video I.F. System...86, 87
ME11 Audio Circuit...86
ME11-D Same as ME11.
ME11-DY Same as ME11.
ME11-Y Same as ME11.

Note: The foregoing is preliminary data. Alignment information not yet available from manufacturer.

GORDON OLIVER

PHILCO

Note: For a complete cross-index of all models and chassis numbers, see pages 5 and 12.

5746 Service Data...67, 68
5746 TV Alignment...32
5746 Votages...32
5746 Waveforms...34
5746 Output Changes...36
5746 Service Data...36
5746 TV Output...36
5746 Waveforms...36
5746 Output Changes...36
5746 Service Data...36
5746 TV Output...36
5746 Waveforms...36

Note: BE INDICATING

Since most TV circuits require fold pages for clear reproduction, it is necessary to bind them as a group in the middle of the book. As a result, related data such as alignment, voltages, etc., may be widely separated in some cases. This is particularly true in this supplement because some models have as many as three different circuit diagrams which makes the fold section larger than normal. To avoid confusion, use the index to locate ALL data.

Viking

Model
Page
TV50-256 Same as Electromate 75.
TV50-357 Same as Electromate 75.

Electrohome

Model
Page
Chippendale T-11 Circuit...63, 64
Chippendale T-11 Circuit Revision...63, 64
Chippendale T-11 Service Data...63, 64
Chippendale T-11 Alignment...63
Chippendale T-11 Chassis Layout...53
Chippendale T-11 Votages...53
Chippendale T-11 Same as Chippendale T-11.
Chippendale T-11 Same as Chippendale T-11.
Chippendale T-11 Same as Chippendale T-11.

Philco

Model
Page
5746 Service Data...67, 68
5746 TV Alignment...32
5746 Votages...32
5746 Waveforms...34
5746 Output Changes...36
5746 Service Data...36
5746 TV Output...36
5746 Waveforms...36
5746 Output Changes...36
5746 Service Data...36
5746 TV Output...36
5746 Waveforms...36

Note: BE INDICATING

Since most TV circuits require fold pages for clear reproduction, it is necessary to bind them as a group in the middle of the book. As a result, related data such as alignment, voltages, etc., may be widely separated in some cases. This is particularly true in this supplement because some models have as many as three different circuit diagrams which makes the fold section larger than normal. To avoid confusion, use the index to locate ALL data.

MARCONI

Model
Page
TV-102 (Chassis TV-102) Circuit...67, 68
TV-102 Service Data...68, 69
TV-102 TV Alignment...32
TV-102 Votages...32
TV-102 Waveforms...34
TV-102 Same as TV-102.

MARCONI

Model
Page
TV-102 (Chassis TV-102) Circuit...67, 68
TV-102 Service Data...68, 69
TV-102 TV Alignment...32
TV-102 Votages...32
TV-102 Waveforms...34
TV-102 Same as TV-102.

Note: BE INDICATING

Since most TV circuits require fold pages for clear reproduction, it is necessary to bind them as a group in the middle of the book. As a result, related data such as alignment, voltages, etc., may be widely separated in some cases. This is particularly true in this supplement because some models have as many as three different circuit diagrams which makes the fold section larger than normal. To avoid confusion, use the index to locate ALL data.

RCC

TELEVISION

Supplement No. 7

GORDON OLIVER TELEVISION
T. V. RADIO SERVICE
NO 4615
23 CALVERHALL ST.
VANCOUVER, B. C.
DX RANGE FINDER ADJUSTMENT

Incorrect adjustment of this control in a strong signal area may result in bending of the picture, excessive contrast and poor sync.

In normal signal strength areas, the DX Range Finder Control will generally be set at the "O" position. In intermediate areas, where the TV signal strength is lower and the noise level is higher, the DX Range Finder control will generally be set within the 10 to 150 position. In fringe areas or areas where long distance "DX" reception is possible, the DX Range Finder control will generally be set between the 150 to 10 position. In weak signal and high noise level areas, adjust the DX Range Finder for minimum noise (move closer to the picture).

Adjust the DX Range Finder as follows:

a. Rotate the DX Range Finder control fully to the left (or to the "O" setting).
b. Tune in a picture, preferably on the strongest TV channel.
c. Set the Picture (contrast) control fully to the right (otherwise).
d. While observing a test pattern or picture, slowly rotate the DX Range Finder control to the right for best contrast with minimum noise in the picture. Check for bending of vertical objects (overloading) in the picture. Also check to see that the picture looks in sync properly when switching off and on channel. If necessary, rotate the DX Range Finder control to the left or to the right until the operation is satisfactory.

In some fringe areas where long range reception is possible, TV signals may be subject to excessive fading. This may vary with season and time of day. If the signal in the area concerned is subject to excessive fading and the Range Finder is adjusted during the time the signal is weaker, overloading (picture bending) will take place when the signal is stronger. For this reason be sure that the customer is instructed on the adjustment of this control for periodic variations in signal strength.

INDIVIDUAL CHANNEL SLUG ADJUSTMENT USING A TELEVISION SIGNAL

Individual channel oscillator adjustment of every receiver should be checked upon installation or servicing. If this adjustment is properly made, it should be used for the duration of the warranty by merely turning the CHANNEL control.

With correct oscillator channel adjustment, best picture will be located at the approximate center of the range of the TUNING control. However, this may not necessarily be maximum level output.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set the CHANNEL knob for a station in operation.
c. Set all other controls for a normal picture.
d. Set TUNING control at center of its range by rotating it approximately half-way.
e. Remove the CHANNEL and TUNING knobs.
f. Insert a 1/4" hole, NON-CONDUCTIVE wall plug (kit consisting of one metallic and one non-metallic wall plug is available under part number 90A353-1 in the 1/4" hole adjacent to the channel tuning slab. For each channel in operation, carefully adjust the channel slug for best picture with care detail. Be sure that the TUNING control is set at the center of its range before adjusting each channel slug. Only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the coil, move the remaining spring inside, lightly tap the open end of the coil until the slug slips out. Replace slug and most retaining spring.)

TOUCH-UP OF RATIO DETECTOR SECONDARY USING TELEVISION SIGNAL (AR. BOTTOM SLUG OF Z3D1)

This adjustment is accessible through the 1/4" hole (just below Z3D1) in bottom of the cabinet or the chassis printing shell, located toward the left side facing the rear of the set. Removal of the chassis is therefore not required. Adjustment need be made on one channel only. Proceed as follows:

a. Turn set on and allow about 15 minutes for warm up.
b. Tune set for normal picture and sound.
c. Carefully insert a non-conductive tool through the opening in cabinet bottom just below Z3D1. An align ment point is provided on the oscillator board, or hole marked and "C" mark below. When the alignment tool contacts the bottom tuning slug, A, adjust the slug for best sound with minimum noise level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum bass peaks that will be noticed when turning the slug back and forth about 1/4 to 1/2 turn.
d. If necessary, repeat individual channel slug adjustment and check out with attaching the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will most likely be necessary to repeat the ratio detector secondary adjustment after one cleanly adjusting it.

ALIGNMENT OF 4.5 MC TRAP A12, USING A TELEVISION SIGNAL

Best interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "zoom-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting the slug for minimum 4.5 MC interference. For greater accuracy is required, the trap should be adjusted as shown on page 10 under "4.5 MC Sound IF and Trap Alignment".

HORIZONTAL OSCILLATOR ALIGNMENT

If the picture will not stay in "horizontal" when most of the range of the HORIZONTAL control (on front panel) it will be necessary to make the horizontal oscillator adjustment by following the step-by-step procedure given below. Note that oscillator waveform adjustment of any type "H" requires the use of an oscilloscope. Waveform adjustment must be made at the factory and generally should not require readjustment in the field. However, waveform adjustment should be checked whenever the receiver is brought onto the shop. Field "H" adjustment may be carried out when adjustment to be made in the customer's house. Adjust as follows:

a. Allow the receiver to warm up for a few minutes. Tune in the station, set the front panel controls for normal picture in area. Important: Before proceeding, be sure that the DX Range Finder control (AGC) is adjusted according to the instructions given in his manual. Adjust the Picture (contrast) control for a normal picture, otherwise it may be difficult to make these adjustments.

b. If picture cannot be brought into sync with the HORIZONTAL control, alternately adjust the HORIZONTAL control, VIDEO (FREQ), and/or the HORIZ LOCK adjustments until the picture is brought into sync.

If test pattern is available, examine the picture width and linearity. If necessary, make wider, fines.
unity and drive adjustments before proceeding:

b. Connect oscilloscope high side through a 10 aad.

3. Connect oscilloscope to terminal "C" or "T" on the horizontal blocking transformer; low side to chassis ground. Set oscilloscope to horizontal frequency (13.57 Kc) or a sub-multiple of it. While keeping the picture in sync, adjust the HORIZ LOCK adjustment (underneath of chassis) for oscilloscope waveform pattern as illustrated in Figure 1. Adjust for equal height of the rounded and pointed peaks. This adjustment must be accurately made for correct operation of the horizontal oscillator. Reconnect the oscilloscope after adjusting waveform.

c. Turn the HORIZONTAL control fully counterclockwise. Momentarily interrupt the signal by switching the desired section of channel and then back on. The picture may remain in sync. If so, adjust the HORIZ FREQ. adjustment until the picture goes out of sync.

Figure 1. Horizontal Oscilloscope Waveform.

and several diagonal bars sloping down to the left are visible, see figure 2. VERY SLOWLY turn the HORIZONTAL control clockwise and note the least number of diagonal bars obtained just before the picture goes out of sync.

If more than 3 diagonal bars are present just before the picture goes out of sync, adjust the HORIZ LOCK RANGE trimmer slightly clockwise. If less than 3 bars are present, adjust the HORIZ LOCK RANGE trimmer slightly counterclockwise. Turn the HORIZONTAL control counterclockwise momentarily to interrupt the signal and recheck the number of diagonal bars present just before the picture goes out of sync. Repeat this procedure until only 3 bars are present.

d. With the picture connecting bar, shift the picture to the right so that the blanking bar at the left side of the picture is visible.

While observing the left side of the picture, slowly rotate the HORIZ FREQ. adjustment (in either direction) so as to move the picture to the right until the blanking bar at the left of the picture just begins to move off the screen. Important: Moving the picture or blanking bar too far to the right may cause the oscillator to go into a spurious mode of oscillation.

Slowly turn the HORIZ FREQ. adjustment in the opposite direction until the blanking bar moves to the left and the picture just becomes visible.

a. Properly center the picture by readjusting the picture positioning level.

b. DISTRIBUTION IN 19 SERIES CHASSIS

The figures below illustrate the basic B-X distributions used in 19 series chassis. Note: There are variations in the B-X circuits of TV and combination models and TV models using a different RF amplifier tube (V3111) in the TV tuner. Alternate connections for the RF amplifier tube (V3111) is shown in the figure below. See "Television Chassis Notes" on page 4 and "Trouble Shooting" information on page 5.

SERVICING RADIO TUBES AND DIAL LIGHT IN COMBINATION MODELS

The radio tubes can be serviced without removing the TV chassis from the cabinet. The radio tubes can be reached through the opening in the underside of the chassis shell.

The dial light can be serviced by removing the tuning knobs and plastic control panel.

SERVICE HINTS

Trouble Shooting

The 19 series chassis covered in this Service Manual are newly designed sets incorporating the latest in television circuits. These chassis are similar to other late Admiral chassis with respect to the sync, sweep and power supply circuits.

Since there are many differences in the 19 series chassis even earlier model Admiral receivers, it is important to remember the following when servicing or installing receivers having the 19 series chassis:

All 19 series chassis have a "DX Range Finder control" (AGC delay circuit). This control is a potentiometer located at the rear of the chassis to enable precision adjustment of receiver sensitivity to suit the signal conditions in any level of fringe area. Incorrect adjustment of this control in a strong signal area may result in picture hunting, excessive contrast and poor sync. Incorrect adjustment in a weak signal area may result in complete loss of picture and sound. Information on the adjustment of the DX Range Finder control is given on page 12.

The sound output tube V3104 (V306c or V306c) functions as a valve dropping tube in addition to being a sound output tube. The cathode of the sound output tube operates at approximately 350 volts above chassis ground for TV operation. If the sound output stage becomes defective, B1 voltage to the TV tuner, sync separator and clipper, video amplifier and AGC delay circuit will be affected.

B1 voltage to the first and second IF amplifiers V361 and V362 are effective in series. The cathode of the sound output tube is operated at approximately 1200 volts above chassis ground. If either V361 or V362 becomes defective, B1 voltage to the other stage will be affected.

In case using the 9956B sound tube, B1 voltage to the grid sections of the IF stages (V101) are in series. The cathode of the sound output tube is operated at approximately 1200 volts above chassis ground. If the tube should become defective it be removed from the socket, there will be no B1 voltage on the grid of the first triode section. See B1 distribution diagram in figure 5.
The horizontal oscillator circuit utilizes pulse width modulation for control of the horizontal oscillator frequency. Information on servicing the horizontal oscillator and horizontal oscillator control circuits are given in paragraph "Service Hints for Horizontal Type". Note: An oscilloscope is required for adjustment of the horizontal oscillator waveform. Information on adjustment of the horizontal oscillator is given on page 2.

EXCESSIVE SNOW ON PICTURE

Excessive snow in the picture can be caused by faulty tubes in the receiver. Check receiver as follows:

1. Short circuit the antenna terminals and turn the picture control (contrast) fully clockwise.
2. Connect a vacuum tube voltmeter from test point "Y" to chassis. Set the channel selector on an unassigned channel. If the voltmeter reading exceeds 5 volts negative, excessive receiver tubes: noise is indicated. This condition can usually be corrected by tube substitution.
3. Substitute tubes in the following order: Video detector tube V306, RF oscillator tube V102, RF amplifier tube V103 and IF amplifier tubes V310, V312 and V303.
4. Circuits in the second module supply can also cause a high noise reading at the video detector resulting in excessive snow in weak signal areas.

MISCELLANEOUS TROUBLE DUE TO FAULTY TUBES

Faulty tubes cause the majority of receiver troubles. The list below contains most common troubles which are generally due to faulty tubes.

- Poor fringe area reception due to low plug voltage. Check the 12AU7 tube.
- Poor fringe area reception due to low sensitivity. Check the 6645 and 6SL7 tubes, if used in the receiver.
- Tradients and scan projected due to IF oscillation. Check the 6C66 and 6G7 tubes.
- Picture beating caused by leakage between tube elements. Check the 605A and 6CC tubes.
- Poor sync stability, usually noticeable in vertical circuit. Check 12AU7 tube.
- Washed out picture due to negative grid current. Check 6C56 tube.

SERVICE HINTS FOR HORIZONTAL SYNC

The horizontal oscillator control circuit controls the horizontal oscillator by a method called "Pulse Width Modulation". This method is so called, because the width of the pulse applied to the grid of the horizontal oscillator control section determines the length of time that current flows through this section. The duration of current flow through the control section determines the DC control voltage applied to the grid of horizontal oscillator, thereby controlling the frequency.

The waveform applied to the grid of the horizontal oscillator control section is formed by combining a partially integrated pulse from the horizontal oscillator output and the horizontal sync pulse. If these two pulses combine properly, the waveform shown in Figure 4 will be developed and the horizontal oscillator will be in sync.

With no sync input, the waveform on the horizontal oscillator control grid should appear as shown in Figure 5. Since the horizontal oscillator control voltage is dependent upon a waveform formed at the horizontal output stages (V405, V403 and V406), a defective component in one of these stages may cause sync trouble. If the waveform shown in Figure 5 can be obtained, this will indicate proper operation of the horizontal sweep circuit.

If there are no sync pulses, or the pulses are of low or varying amplitude, accompanied with noise, the sync circuits should be checked. However, if the sync pulses are well-shaped and of constant amplitude, the horizontal oscillator may be misaligned. Place V406 back into its socket and make the "Horizontal Oscillator Alignment" given on page 2.

If it is impossible to sync the picture, or obtain the correct waveform at terminal "C", check for a defective component in the following sequence:

- Check tube V403 (6SN7GT) by substitution.
- Check CE17 by substituting identical condenser (270 microfarad) part number 40822-274.
- Check CE13 for either open or short.
- Check condenser CE16 for short.
- Check resistance of R226. It should be 150,000 ohms.
- Load resistor in the horizontal oscillator circuit. Check to see that load has not been disturbed while servicing.

TELEVISION CHASSIS NOTES

All 10 series chassis employ the same basic television circuits. The 1981X, 1981Y, SCIX and the 1971X chassis are television only models. The 1982X and DG2X chassis are used in combination models.

The 1981X and 1981Y use a 12" rectangular picture tube (13TP18A). The 90C1X and 90X1X chassis use a 20" rectangular picture tube (201P41A). The 1981X and 90G1X chassis use a 21" (cathedral type) rectangular picture tube (21V9P1 or 21V9P3). The 1981X and 1981Y use the 9405-1 TV tuner having a picture tube (6G83) used as an RF amplifier. All other chassis in the 19 series use the 9406-2 (masked) TV tuner using a twin triode tube (6H7) as an RF amplifier.
IF AMPLIFIER AND TRAP ALIGNMENT

- Connect the battery power to the point "A" as given in the circuit to be checked to "B" as well to ensure correct operation of the equipment.
- Ensure the equipment is switched off before connecting any test equipment.
- With the meter and all test equipment, measure the voltage across the output amplifier and the trap as specified in the equipment manual.
- Adjust the gain of the amplifier and trap to the specified values.
- Ensure that the equipment is operating within the manufacturer's specifications.

IF RESPONSE CURVE CHECK

- Check the response curve for any deviation from the expected curve.
- Ensure that the response curve is flat within the specified frequency range.
- Adjust the response curve as necessary.

RF AND MIXER ALIGNMENT

FOR SETS USING TV TUNER 95035-1

- Connect the signal generator as per the equipment manual.
- Ensure that the signal generator is set to the specified frequency range.
- Adjust the signal generator to the expected output power.
- Ensure that the output power is within the manufacturer's specifications.

RF AND MIXER ALIGNMENT

FOR SETS USING TV TUNER 90446-2

- Connect the signal generator as per the equipment manual.
- Ensure that the signal generator is set to the specified frequency range.
- Adjust the signal generator to the expected output power.
- Ensure that the output power is within the manufacturer's specifications.

MODEL IDENTIFICATION CHART

- The model numbers are given in the equipment manual.
- Ensure that the model numbers are correct before proceeding with any adjustments.
- Ensure that the equipment is operating within the manufacturer's specifications.
HF OSCILLATOR ADJUSTMENT
(Using a signal generator)

It is always advisable to make HF oscillator adjustments using a Television Signal as instructed on page 5. If a Television Signal is not available, HF oscillator adjustment can be made using a crystal calibrated signal generator. Make all adjustments as follows:

<table>
<thead>
<tr>
<th>Receiver Controls and Bias Battery</th>
<th>Sweep Generator</th>
<th>Marker Generator</th>
<th>Oscilloscope</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture control fully to the left</td>
<td>Connect to antenna terminals so generator may be tuned to required frequency.</td>
<td>Connect to point 47 in FIG. 9, compare output of generator with that of frequency counter.</td>
<td>位 to the right (clockwise).</td>
<td>Connect to point 46 in FIG. 9, compare output of generator with that of frequency counter.</td>
</tr>
<tr>
<td>Receiver Controls Settings</td>
<td>Connect to sweep generator output terminals ( V = 500 ) volts for upper and ( V = 250 ) volts for lower frequency.</td>
<td>Connect to sweep generator output terminals ( V = 500 ) volts for upper and ( V = 250 ) volts for lower frequency.</td>
<td>Connect to sweep generator output terminals ( V = 500 ) volts for upper and ( V = 250 ) volts for lower frequency.</td>
<td></td>
</tr>
</tbody>
</table>

OVER-ALL RF AND IF RESPONSE CURVE CHECK
(Using sweep generator and oscilloscope)

<table>
<thead>
<tr>
<th>Receiver Controls and Bias Battery</th>
<th>Sweep Generator</th>
<th>Marker Generator</th>
<th>Oscilloscope</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect to antenna terminals, set generator to required frequency.</td>
<td>Connect to sweep generator output terminals ( V = 500 ) volts for upper and ( V = 250 ) volts for lower frequency.</td>
<td>Connect to sweep generator output terminals ( V = 500 ) volts for upper and ( V = 250 ) volts for lower frequency.</td>
<td>Connect to sweep generator output terminals ( V = 500 ) volts for upper and ( V = 250 ) volts for lower frequency.</td>
<td></td>
</tr>
</tbody>
</table>

COILS, TRANSFORMERS

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1022</td>
<td>Main Tuner Coil (6000 ohms)</td>
<td></td>
</tr>
<tr>
<td>L1023</td>
<td>Main Tuner Coil (6000 ohms)</td>
<td></td>
</tr>
<tr>
<td>L1024</td>
<td>Main Tuner Coil (6000 ohms)</td>
<td></td>
</tr>
<tr>
<td>L1025</td>
<td>Main Tuner Coil (6000 ohms)</td>
<td></td>
</tr>
<tr>
<td>L1026</td>
<td>Main Tuner Coil (6000 ohms)</td>
<td></td>
</tr>
<tr>
<td>L1027</td>
<td>Main Tuner Coil (6000 ohms)</td>
<td></td>
</tr>
<tr>
<td>L1028</td>
<td>Main Tuner Coil (6000 ohms)</td>
<td></td>
</tr>
<tr>
<td>L1029</td>
<td>Main Tuner Coil (6000 ohms)</td>
<td></td>
</tr>
<tr>
<td>L1030</td>
<td>Main Tuner Coil (6000 ohms)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 13. Ideal Over-all RF and IF Response Curve.

Figure 6. Ideal IF Response Curve.

Figure 7. IF Response Curve, Intersect Shape.
WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with PICTURE control set fully to the right, all other controls set for normal picture (in sync).

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parasitic tolerances.

TV VOLTAGE DATA
( Voltages given on schematic)

- PICTURE control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "O" position).
- Antenna disconnected from set with Terminals shorted.
- Voltages marked with an asterisk * will vary widely with control setting.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V306 measured from top of socket with tube removed.

CAUTION

Pulsed high voltages are present on the cap of V406, and on the filament terminals and cap of the 1B67T tube. NO ATTEMPT SHOULD BE MADE TO TAKEN MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a millivoltmeter. 2nd anode voltage is approximately 50 kV. Proper filament voltage check of the 1B67T tube may be made by observing filament brilliance as compared with that obtained with a 1.5 volt dry cell battery.

ALIGNMENT HINT

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures below.
SERVICING RADIO TUNER IN 19E1X AND 19G1X MODELS

SERVICING RADIO TUBES AND DIAL LIGHT

The radio tubes and radio dial light can be serviced without removing the TV chassis from the cabinet. The radio tubes can be reached through the opening cut in the underside of the chassis shell.

The dial light can be serviced by removing the tuning knobs and plastic control panel.

REMOVING RADIO TUNER

The radio tuner is mounted at the front apron of the chassis. Alignment, taking voltage readings or an inspection of the underside of the radio tuner can be performed without complete removal of the radio tuner from the TV chassis. To gain access to the underside of the radio tuner, disconnect the tuning drive cord, remove the self-tapping screws at the rear of the radio tuner and at the front (4 screws).

ALIGNMENT OF RADIO TUNER

The radio tuner in television and radio chassis should be aligned as instructed under "Radio Alignment Procedure" below.

The radio alignment trimmers are accessible without disassembly of the radio tuner from the TV chassis. Figure at right shows the locations of radio alignment trimmers.

DIAL STRINGING

Dial stringing for the gang tuning control is shown below.

![Dial Stringing for 19E1X and 19G1X Chassis](image)

Figure 15. Dial Stringing for 19E1X and 19G1X Chassis.

![Radio Trimmer Locations](image)

Figure 16. Radio Trimmer Locations.

RADIO ALIGNMENT PROCEDURE

- Connect output meter across speaker voice coil.
- Turn receiver Volume control fully on.
- Function switch in "Radio" position.
- Use lowest output setting of signal generator that gives a satisfactory reading on meter.
- Use a NON-METALLIC alignment tool for IF adjustments.
- Repeat adjustments to insure good results.

<table>
<thead>
<tr>
<th>Step</th>
<th>Connect Signal Generator</th>
<th>Dummy Antenna Between Radio and Signal Generator</th>
<th>Signal Generator Frequency</th>
<th>Receiver Dial Setting</th>
<th>Adj. Trimmers in Following Order to Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gang condenser antenna stator</td>
<td>.1 MFD</td>
<td>455 KC</td>
<td>Tuning gang wide open</td>
<td>*A-B (2nd IF) *C-D (1st IF)</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>1620 KC</td>
<td></td>
<td>E (oscillator)</td>
</tr>
<tr>
<td>3</td>
<td>Place generator lead close to loop of set to obtain adequate signal, No actual connection (signal by radiation).</td>
<td></td>
<td>1400 KC</td>
<td>Tune in signal</td>
<td>9F (antenna)</td>
</tr>
</tbody>
</table>

* Adjustments A and C made from underside of chassis. See figure 16 for trimmer locations.

1 AM antenna trimmer may not peak if antenna leads are not properly routed or separated.