ELECTRONIC TECHNICIAN

TV-RADIO SCHEMATICS * OVER 30 MANUFACTURERS
COVERS HUNDREDS OF CHASSIS & MODEL NUMBERS

PUBLISHED BY ELECTRONIC TECHNICIAN MAGAZINE, OJIBWAY BUILDING, DULUTH 2, MINNESOTA
# Television Schematics

<table>
<thead>
<tr>
<th>Model/Brand</th>
<th>Chassis/Models</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admiral</td>
<td>TV Chassis - Models 19K3U, -M3U, -R3U, -T3U</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Color TV Chassis 24A2, UA2, B2, UB2, C2, UC2, D2, UD2, UE2</td>
<td>5</td>
</tr>
<tr>
<td>Airline</td>
<td>Models WG 1683A and WG 2683A</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>TV Chassis Models KCS 143 A &amp; B</td>
<td>8</td>
</tr>
<tr>
<td>Coronado</td>
<td>TV Chassis Model TV 2-9442A</td>
<td>9</td>
</tr>
<tr>
<td>Dumont</td>
<td>Chassis 120633 Series 900 Models</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 120662-A, 23-B, 44-A, &amp; 88-A</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 120677-A, 78-B, 79-A, 84-A, 89-A</td>
<td>15</td>
</tr>
<tr>
<td>Electrohome</td>
<td>TV Chassis - Models Kimberly &amp; Kalmar</td>
<td>15</td>
</tr>
<tr>
<td>Emerson</td>
<td>TV Chassis Models 1800 &amp; 2000 Series</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 120572-C, 120573-D</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 120692-A</td>
<td>19</td>
</tr>
<tr>
<td>Gamble Skogmo</td>
<td>TV Chassis Model TV17-9444A</td>
<td>21</td>
</tr>
<tr>
<td>Heath</td>
<td>TV Chassis Model GR-22</td>
<td>30</td>
</tr>
<tr>
<td>Magnavox</td>
<td>TV Chassis 44-01</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 34-01, -03, -04, -05, -07</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 36-08, 09</td>
<td>36</td>
</tr>
<tr>
<td>Montgomery Ward</td>
<td>TV Chassis WG-1833-A</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 1078-233, 243 1078U233, and 243</td>
<td>39</td>
</tr>
<tr>
<td>Motorola</td>
<td>TV Chassis MW</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>TV Chassis M 596 Series</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>TV Chassis, QX Models M502XBN, EB, VY, 3XBN, EB and VY</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>TV Chassis MXT</td>
<td>28</td>
</tr>
<tr>
<td>Packard Bell</td>
<td>TV Chassis Model 23DC16</td>
<td>46</td>
</tr>
<tr>
<td>Philco</td>
<td>TV Chassis 13N51, 52, 53</td>
<td>47</td>
</tr>
<tr>
<td>RCA</td>
<td>Color TV Chassis CTC 12A, B, P &amp; R</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>TV Chassis KCS147A &amp; B</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>TV Chassis KCS 140A, B Models 1930A-542-MV, MU, -546-VM, MU-549-MV, -MU</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>TV Chassis KCS 136Y Series</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>TV Chassis KCS 137 &amp; 138</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>TV Chassis Models GTM 1538A, 2583A</td>
<td>58</td>
</tr>
<tr>
<td>Sony</td>
<td>TV Chassis TV 5-303W</td>
<td>60</td>
</tr>
<tr>
<td>Sparton</td>
<td>TV Chassis Type 19L1</td>
<td>61</td>
</tr>
<tr>
<td>Symphonic</td>
<td>TV Chassis TSL-001</td>
<td>63</td>
</tr>
<tr>
<td>Truetime</td>
<td>TV Chassis 1095-232</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 2DC1300C, -02C, 2DC1301C, -03C</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 1096-243</td>
<td>67</td>
</tr>
<tr>
<td>Western Auto</td>
<td>TV Chassis Models 2DC1300B, 02B, 01B &amp; 03B</td>
<td>69</td>
</tr>
<tr>
<td>Westinghouse</td>
<td>TV Chassis V-2444-1, -2, -3, -5, -6, -9, -10</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>TV Chassis U-2436</td>
<td>72</td>
</tr>
<tr>
<td>Zenith</td>
<td>Color TV Chassis 27 KC20 &amp; 27KC20Q</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>TV Chassis 16K20 &amp; 16K20QS</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>Color TV Chassis 26KL20 &amp; 20QS</td>
<td>77</td>
</tr>
</tbody>
</table>
AIRLINE
Radio Chassis Model
Gen 1731A ................. 79
AM/FM Console Models
WG-2313A, 43A, 73A, BB, 43B & 73B ............. 80
Clock Radio
Model GTM 18 27A ........... 81
Transistor Radio Model
Gen 1225A .................. 81

DELCO
Chev. Radio Model 985431 .. 82
Buick Model 980464 .......... 83
Oldsmobile Model 9821137 84
Auto Radio Cadillac
Model 7286315 ............... 85
Chev. Auto Radio
Model 985332 ................ 86

EMERSON
Transistor Radio Chassis
120664, 664 .................. 86
Transistor Radio Chassis
120655 ....................... 87

GENERAL ELECTRIC
AM/FM Tuners Chassis
TU 220 .......................... 88
Radio-Intercom Model
W360A .......................... 89
Radio Model P970A ......... 90

MAGNAVOX
AM/FM Tuner Model 77-01 92

MATSUSHITA
Transistor Radio Model T-35 93

MONTGOMERY WARD
FM Multiplexer Model
WG-339A ....................... 91

MOTOROLA
Radio Reverberator Model
RV2F .......................... 94
Auto Radio Models 202, 203, & 204 ............. 95
Ford Auto Radio Model ......... 96

TELECTRO (Emerson)
Tape Recorder — Radio
Model 215 ..................... 97

WESTERN AUTO
Transistor Radio Model
DC3438 ....................... 99

WESTINGHOUSE
AM/FM Tuner/Amplifier
V-2515-6 ..................... 99
CB Transceiver and Radio
Chassis V-2451-2 .......... 101
Radio Chassis V-2407-4 .... 102

ZENITH
Transistor Portable Radio
Model Royal 50L Chassis
6KT40Z1 ...................... 102
Transistor Radio Models
6JT40Z1, 6JT41Z1 .......... 103
Transistor Radio Model
Royal 490, Chassis
7KT45Z1 ..................... 104

AIRLINE
Reverberation Unit Model
GVC-9019A ................... 105

DELCO
Reverberation Unit Olds, & Pontiac Models 7284742 & 7284893 ........... 105
Garage Door Opener Models
R59 & T59-12V .................. 106

DUMONT
Stereo Amplifier Chassis
120509-B ..................... 107

EMERSON
Stereo Amplifier Chassis
120637 ....................... 110
Stereo Hi-Fi Models
45C31-1, 55C31-1, and G9400 .... 119

PHILCO
Remote Control Receiver
Model RC-65 .................. 113
Stereo Phonograph Model
L-1532 ......................... 114
Hi-Fi Stereo Phonograph
Model L-1650 .................. 115

RCA
Radio Chassis RC-1214A ...... 96
Stereo Amplifier Model
SA410 ......................... 110

MATSUSHITA
Motional Feedback Amplifier MF800 ........... 110

PERMA-POWER
Remote Control System
Model G-500 & RC-200 ........ 111
Remote Control System
Models G230, 1, 2 Receiver, Models G340, 50 Transmitter ........ 112

SONAR
CB Model "G" Transceiver .... 117

SPARTON
Stereo Phonograph
Model 12M5-P ................. 118

SYLVANIA
Stereo Hi-Fi Models
45C31-1, 55C31-1, and G9400 .... 119

TELECTRO
Tape Recorder Model
MM-214 ....................... 120

UTICA
CB Transceiver Model
T&C 11 ....................... 121
TUBE LOCATIONS

VOLTAGE WARNING
Exercise normal high voltage precautions when servicing receiver power supply and deflection circuits.
Pulsed high voltage is present at various points of the power supply and deflection system. Use suitable test equipment at these points.

REMOTE CONTROL RECEIVER

VHF TUNER 94E228-1, 2 or 3

25A1230-13 VHF TUNER SCHEMATIC

2A53 UHF IF INPUT SWITCH (IF UHF EQUIPPED)

ADIMRAL
Color TV Chassis
24A2, U2, B2, U83, C2,
UC2, D2, U82, UE2
- Run 10

25A1193-5 UHF TUNER SCHEMATIC (IF UHF EQUIPPED)
OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms shown on the schematic diagram are as observed on a Tektronix type 524D wide band television oscilloscope with the receiver tuned to a reasonably strong signal and a normal picture. The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequency accompanying each waveform indicates the repetition rate of the waveform not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown on the schematic diagram and the amplitude of any high frequency pulse will tend to be less.

DC SOCKET VOLTAGES

All DC socket voltages shown on the schematic are measured with a high impedance VTVM and under zero signal conditions.

NOTE: In UHF receivers the filament voltages in the tuner and above the tuner in the heater string will be slightly greater because of the filament voltages of the tuner tubes.

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OILWAY BUILDING, DULUTH 2, MINNESOTA
OSCILLOSCOPE WAVEFORM PATTERNS

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DC SOCKET VOLTAGES

All DC socket voltages shown on the schematic are measured with a high impedance VTVM and under zero signal conditions.

Schematic is divided into four sections with each section having its own series of reference numbers.

All capacitance values less than 1.0 in microfarads and above 10 in microfarads unless otherwise noted.

R=100

All resistances values in ohms and 1/2 watt unless otherwise noted.

NOTE—In VHF receivers the filament voltages in the tuner and above the tuner in the heater string will be slightly greater because of the filament voltages of the heater tubes.
SERVICE HINTS

To provide a simple "Service Saver" procedure, the controls associated with a service condition that can be adjusted without removing the cabinet back are listed adjacent to each picture. To accomplish other control adjustments or to substitute tubes, the cabinet back must be removed. The service condition should be noted adjacent to the control (printed in red). The safety interlock is provided to prevent shock hazard when working inside the cabinet with the cabinet back removed. It operates at 120 volt AC. The cord intended to serve as "cheater" cord and power source. This removes the shock hazard and is the only safe guard. Service tips may result from contact with the chassis if an isolation transformer is not used.

1. Disconnect "cheater" cord each time a tube is substituted.
2. Follow the simple cautions below.

- Disconnect "cheater" cord each time a tube is substituted.
- Touch only those service controls indicated.
- When a tube substitution is made, the tube location diagram on the chart or the diagram on the control box is inside wall of the cabinet, should be returned.
- Do not substitute tubes or remove a tube while the receiver is in operation. If a tube substitution does not correct the symptom, the location of the tube to be replaced must be determined. The location of the tube may be noted by using the original tube. If the receiver has been in operation too long, the tube becomes hot and glows as other permanent means should be used when replacing tubes to prevent finger burns.

Also follow the simple cautions below.

SERVICE SAVER PROCEDURE

1. Carefully study face of picture tube.
2. Select one of the pictures on the chart that is closest to the picture portrayed by the TV set.
3. Adjust controls indicated adjacent to picture until proper control adjustment procedure is followed. Refer to owner's guide which accompanies receiver.
4. If necessary, remove back of set, adjust controls or substitute tubes indicated.
Maximum and minimum values are given. All resistance readings obtained may vary ±10% due to normal component variations.

All measurements taken between points indicated and checked (unless otherwise noted), with VHF PHONO switch (SK-2) in TV position and Automatic Brightness Control switch (SK-3) or OFF position. VTVM used for all voltage and resistance measurements, and low-capacity probe switch (SW-3) in OFF position, VTVM used for all voltage readings taken with common lead of meter connected to Pin 8 of VHF tuner.

All components are in the chassis unless otherwise specified.
![Diagram of a VHF Tuner](image-url)
CONDITIONS FOR VOLTAGE AND RESISTANCE MEASUREMENTS:
VHF TUNERS 471338 AND 471341

VOLTAGE MEASUREMENTS were taken under actual operating conditions (normal picture and sound), with line voltage maintained at 120 volts AC.

RESISTANCE MEASUREMENTS were taken with no power applied. Readings obtained may vary ±10% due to normal component tolerances.

ALL MEASUREMENTS taken using VTVM, between points indicated and chassis, unless otherwise noted. Measurements marked with asterisk (*) taken with common lead of meter connected to B+ 135 volt point on tuner.

RESISTANCE MEASUREMENTS
VHF TUNERS 471338

<table>
<thead>
<tr>
<th>PIN</th>
<th>6K5</th>
<th>6CBG AI</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>12K</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>+1.8K</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>+1K</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>+37K</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>50K</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>100K</td>
</tr>
</tbody>
</table>

RESISTANCE MEASUREMENTS
VHF TUNERS 471341

<table>
<thead>
<tr>
<th>PIN</th>
<th>6K5</th>
<th>6CBG AI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>+1.8K</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>+1K</td>
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<tr>
<td>7</td>
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<td>+37K</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>50K</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>100K</td>
</tr>
</tbody>
</table>
(Separate conditions apply to readings taken on AM, FM, or STEREO chassis. For details, refer to page 15 in section III of this service note.)

VOLTAGES AND WAVESHAPES were taken under actual operating conditions (normal picture and sound). AGC voltage developed at test point C (junction of R-15, R-16) was minus four volts. Voltage and waveshape readings obtained may vary ±20% in value due to component tolerances and strength of input signal to chassis under test.

RESISTANCE READINGS were taken with no power applied. Where readings are affected by control settings, both maximum and minimum values are given. All resistance readings may vary ±10% due to normal component tolerances.

ALL MEASUREMENTS were taken between points indicated on the chassis. Unless otherwise noted, with line voltage maintained at 115 volts AC. A VTVM was used for all voltage and resistance measurements and a low capacity probe was used for all waveshapes shown.

RESISTANCE READINGS CHART

All resistance readings given are in ohms. "K" in Kiloohms, "M" is Megohms. * Indicates varying resistance; allow 30 seconds for meter to settle. N.C. Denotes no connection at terminal indicated.

NOTES:

For CONNEcTiONS (Contact), see page 15.
More Data on Reverse Side

**Fig. 1 - Tube Location, Alignment Points**

**General Alignment Notes**
1. Set tuner to highest unused channel and remove the Horizontal Deflection and Dumper tubes.
2. Allow chassis and equipment to warm up for 10 minutes or more.
3. Maintain signal generator output no higher than necessary to produce a usable reading.
4. Use insulated alignment tools only.
5. Video IF alignment requires the use of a shim for signal injection. This can be easily constructed by pasting a thin piece of metal foil (¾" x ½") on a slightly larger piece of heavy paper. Insert this shim between tuner mixer tube and its shield in such a manner that the foil side faces the tube.

**Video Alignment Procedure**

<table>
<thead>
<tr>
<th>Step</th>
<th>Signal Generator</th>
<th>Frequency</th>
<th>Bias</th>
<th>Output Indicator</th>
<th>Adjust</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High side of signal generator to foil on shim (see general alignment notes), low side to chassis.</td>
<td>47.25 MC (Marker)</td>
<td>-6 Volts to pin 6 of V-9A</td>
<td>VTM to Pin 2 of V-7</td>
<td>L-4, L-6</td>
<td>Tune for minimum negative reading.</td>
</tr>
<tr>
<td>2</td>
<td>As above.</td>
<td>41.25 MC (Marker)</td>
<td>-</td>
<td>As above.</td>
<td>L-2</td>
<td>As above.</td>
</tr>
<tr>
<td>3</td>
<td>As above.</td>
<td>44.6 MC (Marker)</td>
<td>-</td>
<td>As above.</td>
<td>T-5 tap, T-5 bottom</td>
<td>Turn top slug fully counterclockwise and turn bottom slug for maximum negative reading.</td>
</tr>
<tr>
<td>4</td>
<td>As above.</td>
<td>43.3 MC (Marker)</td>
<td>-</td>
<td>As above.</td>
<td>T-4</td>
<td>Turn top slug fully counterclockwise and turn bottom slug for maximum negative reading.</td>
</tr>
<tr>
<td>5</td>
<td>As above.</td>
<td>42.8 MC (Marker)</td>
<td>-</td>
<td>As above.</td>
<td>T-3</td>
<td>As above.</td>
</tr>
<tr>
<td>6</td>
<td>As above.</td>
<td>43.5 MC Center Freq., 10 MC Sweep</td>
<td>-3 Volts to pin 6 of V-9A</td>
<td>Scope through crystal diode to pin 5 of V-4</td>
<td>L-1, L-9</td>
<td>Tune L-1 for 40.2 MC sound kickback peak. Tune L-5 and T-9 simultaneously to position markers as shown in Fig. 3. Move L-1 for 40.2 MC peak.</td>
</tr>
<tr>
<td>7</td>
<td>High side to pin 2 of V-7, low side to chassis.</td>
<td>4.5 MC (Audio Mod.)</td>
<td>-</td>
<td>Scope through crystal diode to pin 11 of V-8 (CRT)</td>
<td>L-13</td>
<td>Tune for minimum amplitude.</td>
</tr>
</tbody>
</table>
Conditions for Chassis Readings

Voltages and Waveforms were taken under actual operating conditions (normal picture and sound), with line voltage maintained at 120 volts AC. Bias voltages developed at the I.C. cut-off (suction of B-15 and B-18H) was minus ten volts.

Resistance Measurements were taken with no power applied. These readings vary with control settings, both maximum and minimum values are given. All resistance readings obtained vary ±10% due to normal component variances.

All Measurements taken between points indicated and chassis tellers where necessary. VTVM used for all voltage and resistance measurements, and low-capacity probe used for all waveforms shown.
GAMBLE-SKOGMO
TV Chassis
Model TV17-9444A

More Data on Reverse Side

ON-OFF
VOLUME
VC-120

CONTRAST
VENT LIN.
VC-195A

VERTICAL
HOLD
VERT SIZE
VC-194A

CHANNEL
SELECTOR
FINE TUNING

V. HOLD
CONTRAST
ON-OFF
VOLUME
U.H.F.

LD-280

300
OHMS

R -24

L-16

C-20

30
IN82A

2AF4A

150

C-24

L-20

TOP SHELF

BOTTOM SLPG
U.F.

L-21

10K

R-11

C-25

4.5

L-12

C-27

1000

L-30

1000

L-28

1000

C-30

U.H.F.

HEATER

U.H.F.

B +

L-11

TOP SLUG
4.5 M.C.

SOUND

TOP SHELF -

TRAMS

L-11

TOP SHELF -

I.F.

L-13

L-14

C-27

C-30

1000

U.H.F

HEATER

B +

L-14

TOP SLUG
4.5 M.C.

SOUND

TOP SHELF -

TRAMS

L-11

TOP SHELF -

I.F.

L-13

L-14

C-27

C-30

1000

U.H.F

HEATER

B +

L-14

TOP SLUG
4.5 M.C.

SOUND

TOP SHELF -

TRAMS

L-11

TOP SHELF -

I.F.

L-13

L-14

C-27

C-30

1000

U.H.F

HEATER

B +

L-14

TOP SLUG
4.5 M.C.

SOUND

TOP SHELF -

TRAMS

L-11

TOP SHELF -

I.F.

L-13

L-14

C-27

C-30

1000

U.H.F

HEATER

B +

L-14

TOP SLUG
4.5 M.C.

SOUND

TOP SHELF -

TRAMS

L-11

TOP SHELF -

I.F.

L-13

L-14

C-27

C-30

1000

U.H.F

HEATER

B +

L-14

TOP SLUG
4.5 M.C.

SOUND

TOP SHELF -

TRAMS

L-11

TOP SHELF -

I.F.

L-13

L-14

C-27

C-30

1000

U.H.F

HEATER

B +

L-14

TOP SLUG
4.5 M.C.

SOUND

TOP SHELF -

TRAMS

L-11

TOP SHELF -

I.F.
**ELECTRONIC TECHNICIAN**

**TEKFX**

**TV Chassis, QX Models M502XBN, EB, VY, 3XBN, EB and VY**

**Sweep Board Component Locations as Viewed from Conductor Side**

**Capacitors**
- C201-A11
- C202-A11
- C204-F1
- C205-E2
- C206-B6
- C207-G4
- C209-B3
- C211-C12
- C212-B11
- C213-E8
- C215-C7
- C216-A9
- C217-G8
- C218-E9
- C219-E12
- C220-E12
- C221-J7
- C222-J5
- C225-J3
- C226-K8

**Resistors (Cont'd)**
- R201-D12
- R202-D11
- R203-F11
- R204-F12
- R205-H5
- R206-G6
- R207-E2
- R208-B7
- R209-A6
- R210-H5
- R211-G6
- R212-G5
- R213-A4
- R214-C4
- R215-C6
- R216-C6
- R217-E1
- R218-A6
- R219-E1
- R220-C4
- R221-E1
- R222-C6
- R223-A4
- R224-J3
- R225-J3
- R226-K8

**WIRE CONNECTIONS**
- V7-D2
- V8-D8
- V9-D9
- V10-D10
- V11-D12

**TUBES**
- SO201-J6

**STEP SIGNAL FREQUENCY ADJUST REMARKS**

1. **47.25 MC AM**
   - Adjust L110 for minimum scope deflection.
   - Use maximum scope deflection not exceedable sensitivities for 47.25 MC AM adjustments.

2. **44.15 MC AM**
   - Adjust first L134, then L153 for maximum scope deflection.
   - Positive L114 core at and of coil scope damped board.
   - Do not relax these adjustments.

3. **36-46 MC sweep generator, with scope calibrated**
   - 3 volts peak to peak for 2 inch deflection.
   - Markers at 41.25, 42.5, 44.15, 45.0 MC 45.75 MC.

4. **L115 (Neutral plate) for maximum deflection of the 45.75 MC marker**
   - Symmetry of the nose is important. No portion of the nose should be out of symmetry by more than 3%.

5. **L115 (Neutral plate) for maximum deflection of the 42.5 MC marker**
   - T110 (2nd I-F) to place 48.75 MC marker properly on the curve.
   - Repeat 5, 6, and 7 if necessary.

6. **L115 (Neutral plate) for maximum deflection of the 42.5 MC marker**
   - T110 (2nd I-F) to place 48.75 MC marker properly on the curve.
   - Repeat 5, 6, and 7 if necessary.
TV Chassis, GQ
Models M602XBN
EB, V9, 3XBN, EB and VY

OJIBWAY BUILDING, DULUTH, 2, MINNESOTA
### ALIGNMENT CHART

<table>
<thead>
<tr>
<th>STAGE</th>
<th>SWEEP GENERATOR CENTER FREQUENCY</th>
<th>MARKER GENERATOR FREQUENCY</th>
<th>ADJUST FOR MINIMUM GAIN AND BANDWIDTH</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 3rd IF</td>
<td>43.5 mc</td>
<td>41.25 mc, 45.75 mc (both CW)</td>
<td>Top and bottom slugs of T204</td>
<td>Adjust output of sweep generator for approximately 3&quot; of deflection. Keep marker output low enough so that it does not distort the waveform.</td>
</tr>
<tr>
<td>2 Adjacent channel sound trap</td>
<td>47.25 mc with 400 - modulation</td>
<td>T203 (top slug)</td>
<td>Reduce output of sweep and marker generator.</td>
<td></td>
</tr>
<tr>
<td>3 1st IF</td>
<td>45 mc (CW)</td>
<td>T203 (bottom slug)</td>
<td>Reduce output of sweep and marker generator.</td>
<td></td>
</tr>
<tr>
<td>4 Adjacent channel picture trap</td>
<td>39.75 mc with 400 - modulation</td>
<td>T202 (top slug)</td>
<td>Reduce output of sweep and marker generator.</td>
<td></td>
</tr>
<tr>
<td>5 Adjacent channel sound trap</td>
<td>42.5 mc, 45.75 mc (both CW)</td>
<td>T202 (bottom slug)</td>
<td>Reduce output of sweep and marker generator.</td>
<td></td>
</tr>
<tr>
<td>6 Adjacent channel sound trap</td>
<td>47.25 mc with 400 - modulation</td>
<td>L205</td>
<td>Reduce output of sweep and marker generator.</td>
<td></td>
</tr>
<tr>
<td>7 Adjacent channel sound trap</td>
<td>39.75 mc with 400 - modulation</td>
<td>L204</td>
<td>Reduce output of sweep and marker generator.</td>
<td></td>
</tr>
<tr>
<td>8 Sound trap</td>
<td>43.25 mc with 400 - modulation</td>
<td>L201</td>
<td>Reduce output of sweep and marker generator.</td>
<td></td>
</tr>
<tr>
<td>9 Overall IF response mixer plate coil</td>
<td>42.5 mc, 45.75 mc (both CW)</td>
<td>L108</td>
<td>Reduce output of sweep and marker generator. If necessary, retouch preceding IF adjustments to obtain the correct overall response.</td>
<td></td>
</tr>
</tbody>
</table>

---

**Sweep Generator Center Frequency**
- 3rd IF: 43.5 mc
- 1st IF: 20.375 mc
- 2nd IF: 11.25 mc
- 3rd IF: 7.5 mc

**Marker Generator Frequency**
- 3rd IF: 41.25 mc, 45.75 mc (both CW)
- 1st IF: 45 mc (CW)

**Adjust for Minimum Gain and Bandwidth**
- Top and bottom slugs of T204
- T203 (top slug)
- T202 (top slug)
- T202 (bottom slug)
- L205
- L204
- L201
- L108

---

**Sweep Generator**
- Connect the sweep and marker generator through a .001 uf capacitor to test point TP4.
- Center frequency 43.5 mc.
- Width approximately 8 mc.

**Adjust for Minimum Gain and Bandwidth**
- Top and bottom slugs of T204

---

**Remark**
- Reduce output of sweep and marker generator if necessary.
Printed Circuit Boards
(Viewed from Copper Pattern)

Video IF Board

Magnavox
Tv Chassis 44-01

Electronic Technician

Tekfax

340027 & 28 Schematic Diagram

Deflection Board

Audio Board

UHF Tuner Schematic

340017 & 18 Schematic Diagram

Electronic Technician
Ojibway Building, Duluth, Minnesota
To increase C47 and R56 to increase horizontal scan.

To increase vertical sync pull-in range, use R70 and C78.

R87 is added to improve vertical interlace.

R64 and R86 are changed to 270 ohms, 1W.

R64 is changed to 2.2 meg.

R86 is changed to .082 mfd - 10% - 400V.

470K is added across Pins 6 and 7 of X1.

Added in cathode circuit from plate of 9Q9.

Added from junction of R9 & R66 to ground.

The tuner changed to 68mmF - 307 - 4KV (N750).

2200 ohms, 1W is used instead.

270 ohms, 1W is used instead.

2.2 MEG is used instead.

.082 mfd - 10% - 400V is used instead.

To improve vertical interlace, use C5, 6800pf.

To improve vertical interlace, use C5 of 6GH8 to terminal 3 of X4.

To improve vertical interlace, connect a 100 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 0.1 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 0.01 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 1.0 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 10.0 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 100.0 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 1000.0 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 1000 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 470K resistor to terminal 3 of X4.

To improve vertical interlace, use a 47K resistor to terminal 3 of X4.

To improve vertical interlace, use a 4.7K resistor to terminal 3 of X4.

To improve vertical interlace, use a 470 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 4.7 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 47 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 4700 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 47000 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 470K resistor to terminal 3 of X4.

To improve vertical interlace, use a 47K resistor to terminal 3 of X4.

To improve vertical interlace, use a 4.7K resistor to terminal 3 of X4.

To improve vertical interlace, use a 470 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 4.7 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 47 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 4700 pf capacitor to terminal 3 of X4.

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To improve vertical interlace, use a 470K resistor to terminal 3 of X4.

To improve vertical interlace, use a 47K resistor to terminal 3 of X4.

To improve vertical interlace, use a 4.7K resistor to terminal 3 of X4.

To improve vertical interlace, use a 470 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 4.7 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 47 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 4700 pf capacitor to terminal 3 of X4.

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To improve vertical interlace, use a 470K resistor to terminal 3 of X4.

To improve vertical interlace, use a 47K resistor to terminal 3 of X4.

To improve vertical interlace, use a 4.7K resistor to terminal 3 of X4.

To improve vertical interlace, use a 470 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 4.7 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 47 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 4700 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 47000 pf capacitor to terminal 3 of X4.

To improve vertical interlace, use a 470K resistor to terminal 3 of X4.

To improve vertical interlace, use a 47K resistor to terminal 3 of X4.

To improve vertical interlace, use a 4.7K resistor to terminal 3 of X4.

To improve vertical interlace, use a 470 pf capacitor to terminal 3 of X4.
The 36-07 chassis uses an additional electrolytic capacitor to provide a decoupled 280 v source for the vertical output transformer and yoke circuit. The chassis layout for both sets is the same.
OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms shown on the schematic diagram are as observed on a Tektronix type 524D wide band television oscilloscope with the receiver tuned to a reasonably strong signal and a normal picture. The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequency accompanying each waveform indicates the repetition rate of the waveform not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown on the schematic diagram and the amplitude of any high frequency pulse will tend to be less.

DC SOCKET VOLTAGES

All DC socket voltages shown on the schematic are measured with a high impedance VTVM and under zero signal conditions.
NOTES:

CAPACITORS - UNLESS OTHERWISE SPECIFIED, DECIMAL VALUES IN MF; ALL OTHERS IN MMF.

VOLTAGES - MEASURED FROM POINT INDICATED TO GROUND WITH A VTVM, ±1LYA. NO SIGNAL IN.

INPUT 120V AC
MODEL TV Chassis
T8-578
Model 23117 Series

NOTES:
1. VOLTAGE MEASUREMENTS
- Taken from point indicated to chassis with a VTVM & 20K ohm resistor.
2. LINE VOLTAGE MAINTAINED AT 120V AC.
3. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
4. Taken with strong signal contrast control at maximum; all other controls in normal operating position.
5. VOLTAGES INDICATED BY AN ASTERISK WILL VARY WITH ASSOCIATED CONTROL SETTINGS.

CAPACITORS UNLESS OTHERWISE SPECIFIED. VALUES IN MILLI-FACTORS.

NOTES:
1. Taken from point indicated to chassis with a VTVM & 20K ohm resistor.
2. TAKEN WITH STRONG SIGNAL CONTRAST CONTROL AT MAXIMUM; ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
3. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
4. TAKEN WITH SIGNAL INPUT.
5. OSCILLOSCOPE SINE WAVE INDICATED.
6. OSCILLOSCOPE SINE WAVE RATE INDICATED.
7. TAKEN WITH CONTRAST CONTROL, AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION WITH NO SIGNAL INPUT.
8. TAKEN WITH STRONG SIGNAL, CONTRAST CONTROL AT MAXIMUM; ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
9. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.

ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

OSCILLOSCOPE
CONTROLS IN NORMAL OPERATING POSITION WITH NO SIGNAL INPUT.

WAVEFORM MEASUREMENTS
- LESS THAN ONE IN MF; ALL OTHERS IN MMF.

1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM.
2. TAKEN FROM POINT INDICATED TO CHASSIS WITH A MF-2400V OR 4800V VOLT-MULTIPLIER.
3. VOLTAGES INDICATED BY AN ASTERISK WILL VARY WITH ASSOCIATED CONTROL SETTINGS.

ELECTRONIC TECHNICIAN
TEKFAX

OJIBWAY BUILDING, DULUTH, MINNESOTA
CHASSIS DESCRIPTION

This manual contains the chassis schematic, alignment information, and a complete parts list for the models shown in the chart.

The TS-578 chassis is electrically similar to the TS-449 used in models 19P15 and 19P16. Basic differences are in the deflection and high voltage circuits and the use of the 23DAP4 picture tube.

SERVICE NOTES

CHASSIS REMOVAL HINTS

Removing the cabinet bottom allows complete access to the under side of the chassis.

To completely remove chassis, remove the four chassis mounting screws. Remove tuner bracket, volume control bracket and brightness-contrast-vertical hold bracket from the bezel. The high voltage connection socket and yoke should then be removed from the picture tube. A substitute speaker and picture tube can be used for bench testing.

SERVICE ADJUSTMENTS

Horizontal size is adjusted by varying the position of the core in the size coil, L-504. It is located between the horizontal module, K-504, and the horizontal oscillator tube, V-10. For information on all other adjustments, refer to the TS-449 manual, Part No. 58P63110A55.

GENERAL INFORMATION
OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 8 volts at the video detector. Though readings taken with center tap filling are not ideal, they give an indication of the normal picture variations. The voltages given are approximate peak-to-peak values. The frequencies shown are those of the waveforms—i.e., the sweep rate of the oscilloscope. All readings were taken with a Model ES-1000 Precision Vu-meter.

1. 62 volts P/P, 60 C.P.S. — maximum output.
2. 60 volts P/P, 60 C.P.S. — normal output.
3. 15 volts P/P, 15,750 C.P.S. — normal output.
4. 23 volts P/P, 15,750 C.P.S. — normal output.
5. 47 volts P/P, 15,750 C.P.S. — normal output.
6. 58 volts P/P, 60 C.P.S. — normal output.
7. 160 volts P/P, 15,750 C.P.S. — normal output.
8. 23 volts P/P, 60 C.P.S. — normal output.
9. 52 volts P/P, 15,750 C.P.S. — normal output.
10. 30 volts P/P, 15,750 C.P.S. — normal output.
11. 30 volts P/P, 60 C.P.S. — normal output.
12. 100 volts P/P, 60 C.P.S. — normal output.
13. 100 volts P/P, 15,750 C.P.S. — normal output.
14. 60 volts P/P, 15,750 C.P.S. — normal output.
15. 100 volts P/P, 15,750 C.P.S. — normal output.
16. 60 volts P/P, 60 C.P.S. — normal output.
17. 52 volts P/P, 60 C.P.S. — normal output.
18. 100 volts P/P, 60 C.P.S. — normal output.
19. 100 volts P/P, 15,750 C.P.S. — normal output.
20. 60 volts P/P, 15,750 C.P.S. — normal output.
21. 100 volts P/P, 15,750 C.P.S. — normal output.
22. 60 volts P/P, 60 C.P.S. — normal output.
23. 52 volts P/P, 60 C.P.S. — normal output.
24. 100 volts P/P, 60 C.P.S. — normal output.
25. 100 volts P/P, 15,750 C.P.S. — normal output.
26. 60 volts P/P, 15,750 C.P.S. — normal output.
27. 100 volts P/P, 15,750 C.P.S. — normal output.
28. 60 volts P/P, 60 C.P.S. — normal output.
29. 52 volts P/P, 60 C.P.S. — normal output.
30. 100 volts P/P, 60 C.P.S. — normal output.
31. 100 volts P/P, 15,750 C.P.S. — normal output.
32. 60 volts P/P, 15,750 C.P.S. — normal output.
33. 100 volts P/P, 15,750 C.P.S. — normal output.
34. 60 volts P/P, 60 C.P.S. — normal output.
35. 52 volts P/P, 60 C.P.S. — normal output.
36. 100 volts P/P, 60 C.P.S. — normal output.
37. 100 volts P/P, 15,750 C.P.S. — normal output.
38. 60 volts P/P, 15,750 C.P.S. — normal output.
39. 100 volts P/P, 15,750 C.P.S. — normal output.
40. 60 volts P/P, 60 C.P.S. — normal output.
41. 52 volts P/P, 60 C.P.S. — normal output.
42. 100 volts P/P, 60 C.P.S. — normal output.
43. 100 volts P/P, 15,750 C.P.S. — normal output.
44. 60 volts P/P, 15,750 C.P.S. — normal output.
45. 100 volts P/P, 15,750 C.P.S. — normal output.
46. 60 volts P/P, 60 C.P.S. — normal output.
47. 52 volts P/P, 60 C.P.S. — normal output.
48. 100 volts P/P, 60 C.P.S. — normal output.
49. 100 volts P/P, 15,750 C.P.S. — normal output.
50. 60 volts P/P, 15,750 C.P.S. — normal output.
51. 100 volts P/P, 15,750 C.P.S. — normal output.
52. 60 volts P/P, 60 C.P.S. — normal output.
53. 52 volts P/P, 60 C.P.S. — normal output.
54. 100 volts P/P, 60 C.P.S. — normal output.
55. 100 volts P/P, 15,750 C.P.S. — normal output.
56. 60 volts P/P, 15,750 C.P.S. — normal output.
57. 100 volts P/P, 15,750 C.P.S. — normal output.
58. 60 volts P/P, 60 C.P.S. — normal output.
59. 52 volts P/P, 60 C.P.S. — normal output.
60. 100 volts P/P, 60 C.P.S. — normal output.
61. 100 volts P/P, 15,750 C.P.S. — normal output.
62. 60 volts P/P, 15,750 C.P.S. — normal output.
63. 100 volts P/P, 15,750 C.P.S. — normal output.
64. 60 volts P/P, 60 C.P.S. — normal output.
65. 52 volts P/P, 60 C.P.S. — normal output.
66. 100 volts P/P, 60 C.P.S. — normal output.
67. 100 volts P/P, 15,750 C.P.S. — normal output.
68. 60 volts P/P, 15,750 C.P.S. — normal output.
69. 100 volts P/P, 15,750 C.P.S. — normal output.
70. 60 volts P/P, 60 C.P.S. — normal output.
71. 52 volts P/P, 60 C.P.S. — normal output.
72. 100 volts P/P, 60 C.P.S. — normal output.
73. 100 volts P/P, 15,750 C.P.S. — normal output.
74. 60 volts P/P, 15,750 C.P.S. — normal output.
75. 100 volts P/P, 15,750 C.P.S. — normal output.
76. 60 volts P/P, 60 C.P.S. — normal output.
77. 52 volts P/P, 60 C.P.S. — normal output.
78. 100 volts P/P, 60 C.P.S. — normal output.
All capacitance values less than 1.F and above 1 in MF unless otherwise noted.

Electronic Technician Duluth, Minnesota

Refer to page two for chassis/tuner/model cross-reference information.

All resistance values in ohms, K = 1000.

Directions of arrows at controls indicate clockwise rotation.

Figure 17—Circuit Schematic

Diagram for chassis 140A B

(Shown with RRK104F/66A4 Tuner)
ELECTRONIC TECHNICIAN

RCA
TV Chassis
KCS 136Y series

CHASSIS ASSEMBLY TMA 2TE/29B

VHF TUNER
KRK 104C/E
UHF TUNER
KRK 66AK

CHANNEL SELECTOR SWITCH NOTES:

1. FRONT AND REAR DISPLAYS SAME SCREEN OR TV.
2. FRONT AND REAR DISPLAYS SAME CENTER TV.
3. FRONT AND REAR DISPLAYS SAME CENTER TV.
4. FRONT AND REAR DISPLAYS SAME CENTER TV.
5. FRONT AND REAR DISPLAYS SAME CENTER TV.

Balloons ①, ②, etc., shown on schematic indicate points of observation of the waveforms shown below the schematic. Use low-capacity probe when observing waveforms ①, ②, ③, and ④.
KRS26A REMOTE CONTROL AMPLIFIER ALIGNMENT

SIGNAL SOURCE
A crystal transmitter, checked for accuracy and proper operation, is recommended as a signal standard to be used in aligning the amplifier. (Transmitters used as standards should be checked frequently against a crystal standard or several amplifiers known to be operating properly.)

TRANSMITTER
The transmitter standard should be operated at a distance of approximately four feet from the amplifier to prevent excessive pick-up when the amplifier is finally peaked.

VACUUM TUBE VOLTMETER
Connect meter to junction of SR1002 and R1023.

MISCELLANEOUS
When depressing the function button on the transmitter, depress the button fully and hold depressed as amplifier adjustment is made. Refer to Fig. 15 below for adjustment locations.

<table>
<thead>
<tr>
<th>STEP</th>
<th>TRANSMITTER FREQUENCY</th>
<th>TRANSMITTER FUNCTION</th>
<th>ADJUST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45.25 kc.</td>
<td></td>
<td>T1001 for maximum dip on meter.</td>
</tr>
<tr>
<td>2</td>
<td>50.50 kc.</td>
<td></td>
<td>T1002 for maximum dip on meter.</td>
</tr>
<tr>
<td>3</td>
<td>50.50 kc.</td>
<td></td>
<td>T1003 for maximum dip on meter.</td>
</tr>
</tbody>
</table>

Note: Sensitivity control R1018 is preset at the factory and should not be adjusted unless one of the transmitters (Q1001 through Q1003) is replaced. To perform this adjustment, when necessary, inject a weak signal from the transmitter (approximately 10 uc.) and adjust R1018 for 20 ma. plate current in the weakest section of the 12BETA tube, V1001.
UHF TUNER SCHEMATIC

ON FRONT OF SET

ON BACK OF SET

TRUETONE
TV Chassis 1095-232

ELECTRONIC TECHNICIAN  DIBWAY BUILDING, DULUTH 2, MINNESOTA
COIL RESISTANCE VALUES LESS THAN 1.0 OHM
ALL CAPACITANCE VALUES LESS THAN 50 IN UV

I2UHF POSIT/ON
SWITCH SHOWN IN
2A553 UHF I-F INPUT
(1F UHF EQUIPPED)

Fig. 5 - 2nd Pic I-F Response

R -F BWDTH
2-6 MC MAX.
7-13 MC MAX.
R -F RESPONSE
Fix & Audio Works

OSCILLOSCOPE WAVEFORM PATTERNS
The waveforms shown on the schematic diagram are as observed on a Tektronix type 2440 wide band television oscilloscope with the mask tuned to a reasonably strong signal and a normal picture. The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequency accompanying each waveform indicates the repetition rate of the waveform not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high

DC SOCKET VOLTAGES
All DC socket voltages shown on the schematic are measured with a high impedance VTVM and under zero signal conditions.

SCHMATIC IS DRAWN IN ITS ACTUAL SETTING.
AVOID CIRCUIT SHOWN IS DRAWN IN ITS ACTUAL SETTING.
ALL RESISTANCE VALUES IN OHMS
ALL CAPACITANCE VALUES LESS THAN 50 UV
ALL INDUCTANCE VALUES LESS THAN 10 MC
ALL RESISTANCE VALUES LESS THAN 0.1 OHM ARE NOT SHOWN.
If the late-production high-voltage transformer (493V012H01) is used to replace the early-production high-voltage transformer (493V012H02), the following parts also must be changed:

<table>
<thead>
<tr>
<th>PART</th>
<th>EARLY PRODUCTION</th>
<th>LATE PRODUCTION</th>
<th>PART NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R422</td>
<td>3.3 ohm, to:</td>
<td>2.7 ohm, to:</td>
<td>251V002479</td>
</tr>
<tr>
<td>R424</td>
<td>2.2K, 2W, to:</td>
<td>3.3K, 2W, to:</td>
<td>251V0141147</td>
</tr>
</tbody>
</table>

WESTERN AUTO

TV Chassis
Models 20C13008, 028, 018 and 038
NOTES:
1. ALL CAPACITOR VALUES LESS THAN 1 ARE IN MF, AND VALUES GREATER THAN 1 ARE IN UF. ALL RESISTANCE VALUES ARE IN OHMS UNLESS OTHERWISE INDICATED.
2. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CIRCUIT GROUND WITH A VOM. LINE VOLTAGE AT 120V A.C., NO SIGNAL APPLIED.
3. WAVETRACES TAKEN WITH CONTROLS SET FOR A NORMAL PICTURE WITH LINE CONTROL SET FOR VIDEO SYNC TIPS 80V BELOW B./ AT TP (E). CAPACITOR MADE FROM 750V 071F 109 CABLE.
4. RESISTANCE MEASURES 8 OHMS COLD, 1 OHM HOT.
5. SWITCH MAKES CONTACT ON UHF POSITION ONLY.
6. SWITCH EXPOSES DIP FOR A NORMAL PICTURE.
8. SERVICE AND FACTORY ADJUSTMENTS JUMPER IN GIVEN WAVEFORM.
10. SEE PARTS LIST.
More Data on Reverse Side
TUBE SOCKET VOLTAGES

Signal Input

Line voltage .......... 117 Volts AC

Input level ........... None

A variation of ±10% is usually permissible.

Conditions of measurement are:
- Voltages were taken with a 300 volt scale used for plate and screen voltages.
- Audio grid voltages were read with a vacuum tube voltmeter.
- Conditions of measurement are:
  - Line voltage ........... 117 Volts AC
  - Input level ........... None
  - A variation of ±10% is usually permissible.
Voltages measured terminal to chassis with a volt-ohm meter - no signal and 12 volts applied to radio. Total battery drain 1.2 amps at 12 volts. Tolerance on voltage ± 10%. Before measuring transistor voltages, a 10 ohm speaker must be connected to radio. Voltage should be measured from power transistor case to ground. If power transistor is replaced, adjust bias potentiometer (Illus. #66) to obtain proper collector voltage with 12 volts applied to radio. Illus. #64 is a fuse resistor for the power transistor. Service with exact replacement. Printed on circuit board. Will not appear in all radios. CAUTION: Only a 10 ohm speaker should be used on this radio.

I. TROUBLESHOOTING PROCEDURE

1. Turn radio on (ear near speaker). If no "thump" is heard, suspect: open fuse, open "Fuse resistor," loose speaker plug, open speaker, or shorted DS503 transistor.

2. Isolate trouble to a stage (AF, IF, Cony., RF-see letters on circuit board below). Use a noise generator or other device at each point starting with 1.

3. Measure voltages in defective stage. Note: Voltage between 11.0 V. line (printed conductor #2) and emitter (E) of each stage checks conduction of that stage.

II. TYPICAL TROUBLES

Possible Trouble

Indication

Weak, fading whistles, or station mixing
No "thump." No "thump" with DS-503 case
No "thump" with DS-503 case
Intermittent or noisy when tapped
Very high bias (B to E) and no conduction in a stage
Probable Trouble

Antenna trimmer not peaked in car
Shorted DS-503, open fuse res. (Also check value of 10 ohm res., Illus. #62)
Defective AGC diode (Normal voltage across each AGC diode is .1 volt)
Loose connection or defective I.F. coil
Open small transistor

About Some or Slightly Water (SERIES #3 TRIMMER)

Inject Signal or Noise in Grouped

TONE MFD.

CHEVROLET Car Model 985431-PRINTED CIRCUIT SHOWN IN HEAVY LINES.

Note: Mfg. Insulators #12218.13 not packaged with DS-503.

Component View

Circuit View

Parts Layout

Tube View
CAUTION: Collector Voltage of DS-503 Transistor should be measured at Transistor Case (not the Heat Radiator).

**ELECTRONIC TECHNICIAN**

**TEKFAX**

**DELCO**

Buick
Model 980464

---

**Model: 980466**—Printed Circuit Shown in Heavy Lines.

- **DS-24 Transistor**
- **DS-25 Transistor**
- **DS-26 Transistor**

**CIRCUIT BOARD (PRINTED VIEW)**

Numbers in squares are major test points for stage isolation—inject signal or noise generator.

**Using New Connector Plug Simplifies Servicing**

(Available with leads under part #122183)

- Connect to Chassis or Speaker Ground
- Power Supply
- Connector Plug with Leads

**CAUTION:**

- Voltage measured terminal to chassis with a voltmeter meter set at 12 volts.
- Voltage measured terminal to chassis with a voltmeter meter set at 11 volts.

**Iron Core Alignment**

- Louder Signal (Checks AF Stage)
- Weak Signal (Checks Output)
- Loud Signal (Checks I.F. Stage)
- Louder Signal (Checks Conv. Stage)
- About Same or Slightly Weaker (Checks R.F. Stage)

**Inject at Ant. Socket**

(Checks Ant. Circuit)
I. TROUBLESHOOTING PROCEDURE

1. Turn radio on (ear near speaker). If no "thump" is heard, suspect:
   - open fuse,
   - open 'Fuse resistor,' loose speaker plug,
   - open speaker, or shorted DS-501 transistor.

2. Isolate trouble to a stage (AF, IF, Conv., RF—see letters on circuit board below). Note that the triggering signal passes through the RF, Conv. and IF before reaching the trigger tube.

3. Measure voltages in defective stage. Note: Voltage between 10.8 V. line (printed conductor #2) & emitter (E) of each stage checks conduction of that stage.

II. TYPICAL TROUBLES

<table>
<thead>
<tr>
<th>Indication</th>
<th>Probable Trouble</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak, fading, whistles, or station mixing</td>
<td>Antenna trimmer not peaked in car</td>
</tr>
<tr>
<td>No &quot;thump,&quot; 0 volts on DS-501 case</td>
<td>Shorted DS-501, open fuse res. (Also check value of 10 ohm res., Illus. 73)</td>
</tr>
<tr>
<td>Very high DS34 collector voltage</td>
<td>Defective ACC diode (Normal voltage across each ACC diode is, .1 volt)</td>
</tr>
<tr>
<td>Intermittent or noisy when tapped</td>
<td>Loose connection or defective I.P, coil (Open or leaky small transistor. (Also check emitter capacitor).</td>
</tr>
</tbody>
</table>

*Check for open by bridging good one across, similar to way resistors are checked in circuit.

III. TYPICAL TROUBLES

- Antenna trimmer not peaked in car
- Shorted DS-501, open fuse res. (Also check value of 10 ohm res., Illus. 73)
- Defective ACC diode (Normal voltage across each ACC diode is, .1 volt)
- Loose connection or defective I.P, coil (Open or leaky small transistor. (Also check emitter capacitor).)

NOTE: ILLUS. 74 IS FUSE RESISTOR. OPEN FUSE RESISTOR MAKES TRANSISTOR COLLECTOR VOLTAGE 0 VOLTS.

NUMBERS ON PRINTED CIRCUIT BOARD CORRESPOND WITH NUMBERS IN CIRCLES ON SCHEMATIC DIAGRAM.

SCHEMATIC DATA

- Voltages measured terminal to chassis with a volt-ohm meter - no signal
- Voltages measured terminal to chassis with a volt-ohm meter - no signal
- Total battery drain 1.9 amps at 12 volts
- Tolerance on voltages ± 10%

- Indicates lead from Tuner Assembly.
- ** Indicates lead from Tuner Assembly.

- Before measuring transistor voltage a 10 ohm speaker must be connected to the radio. If power transistor is replaced, adjust bias potentiometer (Ill. to #85 to obtain proper collector voltage with 12 volts applied to radio. Voltage should be measured from power transistor case to ground.

- On printed circuit board:

- Trigger tube voltages are read with a VTM and with the tuner seeking. Use a Delco P-612 power supply or battery for proper tuner action.

- CAUTION: Only a 10 ohm speaker should be used on this radio.

ADDITIONAL INFORMATION

- Tuner—Bulletin 6D-624 and 6D-630.
- Printed Circuit—Bulletin 6D-555.
** Before measuring transistor voltage a 10 ohm speaker must be connected to the radio. If power transistor is replaced, adjust bias potentiometer to obtain proper collector voltage with 12 volts applied to radio. Voltage should be measured from power transistor case to ground.

III. #64 is a fuse resistor for the power transistor. Service with exact Delco service replacement.

Trigger voltages are read with a VTVM and with the tuner seeking. Use a Delco P-612 power supply or battery for proper tuner action.
MAJOR CHASSIS ITEMS (Cont'd)

<table>
<thead>
<tr>
<th>Component</th>
<th>Model 120664</th>
<th>Model 120664L</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-1</td>
<td>720444</td>
<td></td>
</tr>
<tr>
<td>T-2</td>
<td>720445</td>
<td></td>
</tr>
<tr>
<td>T-3</td>
<td>720446</td>
<td></td>
</tr>
<tr>
<td>T-4</td>
<td>734218</td>
<td></td>
</tr>
<tr>
<td>J-1</td>
<td>506038</td>
<td></td>
</tr>
<tr>
<td>SP-1</td>
<td>180280</td>
<td></td>
</tr>
<tr>
<td>X-1</td>
<td>817091</td>
<td></td>
</tr>
<tr>
<td>Q-1</td>
<td>815065 or</td>
<td>815115</td>
</tr>
<tr>
<td>Q-2</td>
<td>815105</td>
<td>815116</td>
</tr>
<tr>
<td>Q-3</td>
<td>815103</td>
<td>815117</td>
</tr>
<tr>
<td>Q-4</td>
<td>815114</td>
<td>815120A</td>
</tr>
<tr>
<td>Q-5</td>
<td>815114</td>
<td>815120-B z.</td>
</tr>
<tr>
<td>Q-6</td>
<td>815120-B z.</td>
<td>-C, -D, -E</td>
</tr>
<tr>
<td>Q-7</td>
<td>815120-B z.</td>
<td>-C, -D, -E</td>
</tr>
</tbody>
</table>

*NOTE: Proper combinations must be observed when replacing some of the transistors indicated by an asterisk. Refer to the schematic diagram for details.

MAJOR CABINET ITEMS

- Cabinet Front Complete - Ebony: 141338
- Cabinet Front Complete - Green: 141338A
- Cabinet Front Complete - White: 141338B
- Cabinet Front Complete - Red: 141338C
- Cabinet Front Complete - Turquoise: 141338D
- Cabinet Front Complete - Charcoal: 141338E
- Cabinet Back - Ebony: 141428
- Cabinet Back - Green: 141428A
- Cabinet Back - White: 141428B
- Cabinet Back - White: 141428B
- Cabinet Back - Red: 141428C
- Cabinet Back - Turquoise: 141428D
- Cabinet Back - Charcoal: 141428E
- Volume Control Knob: 461564
- Tuning Control Knob: 461567
- Retaining Screw for above: 265162
- Screw - Cabinet Back Ret'g: 265096A
- Battery Container Assembly: 963730

MAJOR CHASSIS ITEMS

- C-A-B: Variable Capacitor: 900217
- C-4: 16 Mf Electrolytic, 3V: 925486
- C-13, 16, 17: 50 Mf Electrolytic, 10V: 925561
- R-14: Volume Control w/switch: 190730
- L-1: Barloop Antenna: 700183
- L-2: Oscillator Coil: 716147
GENERAL ELECTRIC AM FM Tuners Chassis TU 220

ELECTRONIC TECHNICIAN

TEKFAX

EMITTERS: 680K, 100K, 10K, 1K, 100Ω, 10KΩ
COLLECTORS: 220K, 100K, 10K, 1K, 100Ω, 10KΩ

OUTPUT JAKES: 100K, 10K, 1K, 100Ω, 10KΩ

FM LIMITER: 1K, 100Ω

AM DETECTOR: 1K, 100Ω

FM IF AMP: 6EZB, 3000V, 3000Ω

AM IF AMP: 6EZB, 3000V, 3000Ω

FM LIMITER/AM DET: 6J6, 3000V, 3000Ω

FM STEREO MUTING CIRCUIT: 6J6, 3000V, 3000Ω

FM -IF sensitivities are -1 V OC on limiter grid.

AM -IF sensitivities are I TO% mod., 400cps Ifor 100mv output.

Capacitor values more than 1 In mfd.

Capacitor values less than 1 in mfd, unless otherwise noted.

Resistors are 1/2 watt, unless otherwise noted.

All DC voltages measured with respect to ground using a VIVM.

Line voltage maintained at 120 VAC.

Taken In FM position, no signal applied.

Taken in AM position, no signal applied.

Measured with 4 70K n resistor in series with DC probe of VIVM.

FM - AGC

AM AFC

FM MIXER

FM OSC

TOP B01 COMPACT

OUTPUT
BUILT-IN RADIO / INTERCOM

MASTER STATION W360A

GENERAL INFORMATION

The General Electric model W360 Built-in AM-Band Intercom System is a six-transistor home entertainment and intercommunications device designed to operate from any class 2 door-chime transformer, rated at 10, 16, or 24 Volts AC.

Materials for installation of model W360 are supplied in a single package. They include the following items:

1. master wall box
2. Hold-it clamps
3. mounting screws
4. wire nuts
5. master radio
6. indoor remote wall box
7. indoor remote
8. outdoor remote
9. 5-conductor wire (125 ft.)

SPECIFICATIONS

POWER: 10, 16, 24 Volts AC, Transformer Operated
OPERATING FREQUENCIES: 540 - 1600 KC (455 KC IF)
UNDISTORTED POWER: 100 milliwatts
NOISE: 70 decibels
CONDUCTORS: 2 Diodes

DISASSEMBLY

MASTER RADIO REMOVAL

1. Remove four screws which are used at the top and bottom of the cabinet to secure the radio to the wall box.
2. Remove all wire nuts from transformer, antenna, and remote station leads, carefully labeling each wire. Then remove the master radio from the wall box.

REMOTE STATION REMOVAL

1. Remove the two knurled-head bolts appearing in the lower left and lower right corners on the remote station chassis.
2. Remove wire nuts from wires going to the speaker.
3. Remove remote unit from the wall.

COLOR CODE FOR DIFFERENT TRANSFORMER OUTPUTS

Wire from:

Power: Master Radio
Outdoor Remote
Indoor Remote

Radio colored:

10 Volts A.C.: Red and White
16 Volts A.C.: Yellow and White
24 Volts A.C.: Green and White

The other end of each remote station cable should be connected color for color to the wires on each remote assembly. Use the wire nuts provided to make all connections.

TRANSISTOR REPLACEMENT

A transistor suspected to be defective can either be checked by the substitution method or by the use of a suitable transistor checker. Care must be taken to avoid overheating the transistor while soldering it—this may be easily damaged. Always check the circuit for defects which could damage the transistor being placed into the circuit.

If the leads from a transistor are disconnected, make sure that each wire is reconnected to the proper place. Otherwise, voltages of reversed polarity may be applied across a transistor— an action which may cause serious damage to it.

A heavy duty soldering iron should not be used. Make certain that the iron is used at a rating lower than the specified current leakage. An isolation transformer can be used to prevent current leakage. If a transformer is used, it should never be removed or replaced while power is on, as a surge of current may damage it.
CHART 2. FM ALIGNMENT

<table>
<thead>
<tr>
<th>Step</th>
<th>Signal Generator</th>
<th>Generator Setting</th>
<th>Tuning Gang</th>
<th>VTVM Connection</th>
<th>Adjustment</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Couple output to C1A</td>
<td>10.7 MC AM Modulated 80% or less</td>
<td>Open</td>
<td>TP1 of TM tuning point</td>
<td>T4, T5, T2, T1 for max. gain</td>
<td>Keep gen. output level as low as possible, S1 and S2 in FM position</td>
</tr>
<tr>
<td>2</td>
<td>Same</td>
<td>Same</td>
<td>Open</td>
<td>Same</td>
<td>T5 (bottom slug) for slight null</td>
<td>Same</td>
</tr>
<tr>
<td>3</td>
<td>Same</td>
<td>Same</td>
<td>Open</td>
<td>S2B-2</td>
<td>T5 (top slug) for sharp null</td>
<td>Same</td>
</tr>
<tr>
<td>4</td>
<td>Repeat all steps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Couple output and ground to FM antenna terminals</td>
<td>108.25 MC Unmodulated</td>
<td>Open</td>
<td>S2B-2</td>
<td>Adjust coils of L1 and L2 for best null in noise level.</td>
<td>If FM modulation is available, make all adjustments for max. gain in steps 5-7 Use weakest possible signal</td>
</tr>
<tr>
<td>6</td>
<td>Same</td>
<td>87.5 MC Unmodulated</td>
<td>Closed</td>
<td>S2B-2</td>
<td>Adjust coils of C1B and C1A for best null in noise level.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Same</td>
<td>98 MC Unmodulated</td>
<td>98 MC</td>
<td>S2B-2</td>
<td>Adjust coils of L1 for best null in noise level.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Recheck steps 5-7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* DC Isolate both input antenna terminals with .05 mfd, 200 volta capacitor.

CHART 3. AM ALIGNMENT

<table>
<thead>
<tr>
<th>Step</th>
<th>Signal Generator</th>
<th>Generator Setting</th>
<th>Tuning Gang</th>
<th>Connect Scope or Output Meter</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Radiate Output to L5</td>
<td>455 KC Modulated 400 cycles at 30%</td>
<td>Open</td>
<td>Voice Coil</td>
<td>T2 of CM4 and T1, T2, of IFM-2 for max.</td>
</tr>
<tr>
<td>2</td>
<td>Repeat step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Radiate Output to L5</td>
<td>1630 KC</td>
<td>Open</td>
<td>Voice Coil</td>
<td>Oscillator trimmer C2C for max.</td>
</tr>
<tr>
<td>4</td>
<td>Same</td>
<td>580 KC</td>
<td>580 KC</td>
<td>Voice Coil</td>
<td>AM Oscillator T1 of CM4 while rocking gang.</td>
</tr>
<tr>
<td>5</td>
<td>Same</td>
<td>1490 KC</td>
<td>1400 KC</td>
<td>Voice Coil</td>
<td>Peak Antenna trimmer C2B while rocking gang.</td>
</tr>
<tr>
<td>6</td>
<td>Repeat steps 1-5 as necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* DC Isolate both input antenna terminals with .05 mfd, 200 volta capacitor.
Notes:
1. Arrow marks indicate the order of hanging the dial rope.
2. Tuning capacitor is positioned at maximum capacity (closed position).
ELECTRONIC TECHNICIAN
MOTOROLA
Radio
Reverberator
Model RV2F

NOTES:
CAPACITORS - Unless otherwise specified, values less than one in (1), all others in (1000).
VOLTAGES - Measured from point indicated to ground with a VTVM, ±10% accuracy.
INPUT VOLTAGE = 14.4V DC
*The exact value to be determined by production process. Replace with the same value of the original part.
**Production units may have 100UF electrolytic either as an individual unit IC3 or as a separate section in the multiple electrolytic IC2.

CAUTION
"A" LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. UNIT WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

NOTES:
CAPACITORS - Unless otherwise specified, values less than one in (1), all others in (1000).
VOLTAGES - Measured from point indicated to ground with a VTVM, ±10% accuracy.
INPUT VOLTAGE = 14.4V DC
*The exact value to be determined by production process. Replace with the same value of the original part.
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INPUT VOLTAGE = 14.4V DC
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CAUTION
"A" LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. UNIT WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.
**ALIGNMENT PROCEDURE**

For all alignment operations, keep generator output as low as possible to avoid AVC action and clipping. (approx. 20 milliwatts output)

Connect output meter across speaker voice coil. Clip onto extreme ends of speaker terminals only, to avoid damage to voice coil leads.

**BATTERY REPLACEMENT**

1. Press down on center of top side of back section, under handle.
2. Pull front and back sections apart from the top as though bottom were hinged.
3. Lift back section off.
4. Replace batteries observing correct polarity—negative (—) terminal forward outside of case.

**CHASSIS REMOVAL**

1. Open case as described under "Battery Replacement."
2. Remove nut holding auxiliary power jack.
3. Remove three (3) screws holding battery board and two (2) screws holding battery board.
4. Raise loose end of boards slightly and pull them out of slots holding opposite end.

**BATTERY CURRENT VS. POWER OUTPUT**

<table>
<thead>
<tr>
<th>Current</th>
<th>Output</th>
<th>Diode Setting</th>
<th>Adjust for maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.5 ma</td>
<td>0 mw</td>
<td>T4 (3rd IF)</td>
<td></td>
</tr>
<tr>
<td>22.5 ma</td>
<td>20 mw</td>
<td>T3 (2nd IF)</td>
<td></td>
</tr>
<tr>
<td>33.0 ma</td>
<td>50 mw</td>
<td>T2 (1st IF)</td>
<td>650 kHz (Back gang)</td>
</tr>
<tr>
<td>41.5 ma</td>
<td>100 mw</td>
<td>C12B (ant. trimmer)</td>
<td></td>
</tr>
<tr>
<td>50.5 ma</td>
<td>250 mw</td>
<td>C12A (osc. trimmer)</td>
<td></td>
</tr>
<tr>
<td>75.0 ma</td>
<td>400 mw</td>
<td>T1</td>
<td>1620 kHz</td>
</tr>
</tbody>
</table>

**CRITICAL LEAD DRESS**

1. Dress gray lead from oscillator gang terminal against gang bracket, away from gang plane and through hole in bracket.
2. Dress all wires in the area of the volume control away from the oscillator gang terminal.
3. Dress lead from antenna to antenna gang terminal so that when the chassis is in the case the lead lies midway between the circuit components and the front of the case.
NOTE:
1. ALL RESISTORS IN OHMS 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL VOLTAGES INDICATED ARE D.C.
3. ALL D.C. VOLTAGES TO GROUND IN PLAYBACK AND NO SIGNAL APPLIED.
4. D.C. VOLTAGES TAKEN WITH VTVM 11 MEGOMS INPUT
5. POSSIBLE VARIATION IN VOLTAGE AND RESISTANCE MEASUREMENTS ±20%
** ALIGNMENT PROCEDURE **

Output Meter reading to indicate 5 milliwatts ...... 0.47V
Output Meter connection ...... , At home, speaker voice coil
Connection of generator ground lead ...... Common Ground
Generator Modulation ...... , 30% 400 cycles
Position of volume control ...... Fully clockwise

The alignment procedure should be repeated in the original order for greatest accuracy. Always keep the output from the signal generator at its lowest possible value to make the AVC action of the receiver ineffective.
6. ALL CAPACITANCE VALUES IN MFD. AND ALL RESISTANCE VALUES IN OHMS.

5. D.C. VOLTMETERS MEASURED FROM POINTS INDICATED TO GROUND - NO SIGNAL APPLIED, USING A 0-600 V.A.C. LINE Voltmeter SET AT 0D V.A.C. NO SIGNAL INPUT TOVOLTS AT MAX. TO TUNING CAPACITANCE AT MAX.

4. UNDERLINED VOLTAGES ARE TAKEN IN FM POSITION.

3. SW2 AND R16 SHOWN IN THE CCW POSITION, I.E. POSITION.

2. ALL REFERENCES TO LEFT AND RIGHT ARE AS VIEWED FACING FRONT OF SET. external AM or FM Antenna Connector.

1. ARROWS ON CONTROLS INDICATE UP POSITION (CONTROL VIEWED FROM SHAFT END).
TUNE

IMF

VIN

L. NE

DISCONNECT SAP

NOTES:

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V4

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15K

±10%

2.1-23v

KF

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(iip To rat TUNER

BATTERIES TAKEN WITH OTT, FROM POINTS INDICATED

TO II- TUNING CAPACITOR

AT MASIMUM. VOLUME CONTROL AT MINIMUM, LINE VOLTAGE AT

V.C.

2.

ALL CAPACITANCES ANC IN

INFO I ALL RESISTANCES IN ONUS

1/2

WATT UNLESS

STATED OTHERWISE.

VOLTAGES UNDERLINED ARE TAKEN IN PM MONITION.

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2ND

121-237

DRIVER

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100111

8200

r--1 C4

8 MFD

10%

493

121-238.

121-239

OUTT MATCHED

CHASSIS 6KT4021

NOTES:

ALL RESISTORS ARE CARSON. 1/2 WATT. ±20% TOLERANCE UNLESS

OTHERWISE SPECIFIED.

ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.

D.C. VOLTAGES SHOWN ARE MEASURED FROM GROUND WITH NO SIGNAL.

BATTERY CURRENT DRAIN: APPROXIMATELY 12 M.A. WITH VOLUME

CONTROL AT MINIMUM.

SPEAKER IMPEDANCE: 11 OHMS.
CHASSIS INFORMATION CHART

<table>
<thead>
<tr>
<th>Chassis</th>
<th>Transistor Layout Label Color</th>
<th>Part No.</th>
<th>Conv.</th>
<th>1st I.F.</th>
<th>2nd I.F.</th>
<th>Crystal Diode Detector</th>
<th>Driver</th>
<th>Output-Output</th>
<th>Supplier</th>
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<tr>
<td>6JT41Z1 and 6JT41Z1</td>
<td>Black 102-8274</td>
<td>Zenith</td>
<td>121-206</td>
<td>121-207</td>
<td>121-208</td>
<td>103-19</td>
<td>121-210</td>
<td>121-211</td>
<td>121-163 or 121-164</td>
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</table>
ELECTRONIC TECHNICIAN
TEKFAX

ZENITH
Transistor Radio
Model Royal 490,
Chassis 7K45Z1

TRANSMETER & TRIMMER LAYOUT

ALIGNMENT PROCEDURE

Operation | Input Signal | Capacitor (See Data Sheet)  | Set Dial At | Trimmer  | Purpose
--- | --- | --- | --- | --- | ---
1 | 450KC | C15 | 450KC | Adj. T1, T2 for maximum output | For I.F. Alignment
2 | 340KC | C18 | 450KC | Adj. trimmer for dial accuracy | For I.F. Alignment
3 | 650KC | C18 | 450KC | Adj. trimmer for dial accuracy | For I.F. Alignment
4 | 800KC | C18 | 450KC | Adj. trimmer for dial accuracy | For I.F. Alignment
5 | 1200KC | C1A, C1C | 450KC | Adj. trimmer for dial accuracy | For I.F. Alignment

Set Dial At

1. Connect inner conductor to wavemagnet.
2. Connect outer sheath to chassis.
3. Adjust slug in T1, T2 for maximum output.
4. Adjust slug in T3 for maximum output.
5. Adjust slug in T4 for maximum output.
6. Adjust slug in T5 for maximum output.
7. Adjust slug in T6 for maximum output.
8. Adjust slug in T7 for maximum output.
10. Adjust slug in T9 for maximum output.
11. Adjust slug in T10 for maximum output.

Set trimmer at 450KC for I.F. Alignment.

NOTICE: When performing alignment, the trimmers should be adjusted only in the following order: T1, T2, T3, T4, T5, T6, T7, T8, T9, T10. This will ensure maximum accuracy in the alignment process.

ALIGNMENT PROCEDURE

1. Set dial at 450KC.
2. Adjust T1, T2 for maximum output.
3. Adjust T3 for maximum output.
4. Adjust T4 for maximum output.
5. Adjust T5 for maximum output.
6. Adjust T6 for maximum output.
7. Adjust T7 for maximum output.
8. Adjust T8 for maximum output.
10. Adjust T10 for maximum output.

NOTICE: When performing alignment, the trimmers should be adjusted only in the following order: T1, T2, T3, T4, T5, T6, T7, T8, T9, T10. This will ensure maximum accuracy in the alignment process.
IF NO SOUND IS PRESENT - CHECK THE FOLLOWING:
1. Is wall outlet used supplying current?
2. Is instrument volume turned on?
3. Are amplifier and reverberation controls and switches ON?
4. Is your amplifier Stand-By switch open?
5. Are any of the connecting cords defective?
6. Is sound present - Check the following:
   a. Is REVERBERATION INTENSITY control turned on?
   b. Are Reverberation foot and toggle switches turned ON?
   c. Are speakers damaged or worn? Are any of the systems controls or cords worn or defective?
   d. Are speakers damaged or worn? Are any of the systems controls or cords worn or defective?

IF REVERBERATION SIGNAL - CHECK THE FOLLOWING:
1. Is REVERBERATION INTENSITY control turned on?
2. Are tubes seated firmly? Is there a defective tube?
3. Are tubes turned on?
4. Are tubes turned on?
5. Are tubes seated firmly? Is there a defective tube?
6. Are fuses on amplifier or reverberation blown?
7. Are any of the connecting cords defective?
8. Are any of the connecting cords defective?
9. Are any of the connecting cords defective?
10. Are any of the connecting cords defective?

MAINTENANCE
1. Your Reverberation unit is a sensitive electronic device. Treat it with care. Avoid rough handling.
2. Check tubes occasionally if unit is used regularly.
3. Avoid pin damage.
4. Replace tubes when necessary.
5. Maintain proper connections.

TROUBLE SHOOTING
1. Turn on unit and listen for thump in speaker. If no thump is heard, inject an audio signal at the base of the DS-26. Use normal trouble shooting procedures for trouble shooting the audio stages.
2. If no twang is heard, inject an audio signal at the base of the DS-26. Use normal trouble shooting procedures for trouble shooting the audio stages.
3. To test the delay, remove the green or black leads and check for continuity of the coils. The input coil should read 1 ohm. The output coil should read 300 ohms.
**Bench Test Set Up**

The receiver must be connected to 110-120 volt a.c. A six prong amphenol socket should be used (see Fig. 2) and a 8 volt light bulb may be connected to indicate when the receiver relay energizes. A jumper connected between the normally closed relay contact and chassis should be used when the receiver is operated with a bench test adapter. This jumper maintains a constant base voltage to the receiver regardless of whether the relay is closed or open.

**Procedure:**
1. Connect a d.c. voltmeter across sensitive relay.
2. Remove end caps on antenna and push core out of fiber tube.
3. Point end of antenna close to receiver. (Point end which gives most voltage.)
4. Adjust either sliding coil on antenna for maximum relay voltage.

The receiver antenna can be peaked, but this should not be necessary unless the antenna is replaced.

**Additional Alignment and Adjustment Procedures**

No alignment should be necessary, except under one of the following conditions:

(Try first re-positioning receiver antenna for inadequate range or phantom operation.)

- **a.** The receiver antenna is replaced—use steps 2, 3, 4.
- **b.** Range is poor—use steps 1, 2, 3, 4, 6, 7.
- **c.** Phantom operation—use steps 2, 3, 6, 7.

D.C. voltmeter connection . . . . . Across relay coil

---

**Table:**

<table>
<thead>
<tr>
<th>Step</th>
<th>Adjust</th>
<th>Transmitter On</th>
<th>Voltmeter</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>Maximum</td>
<td>Sets transmitter to receiver frequency.</td>
<td></td>
</tr>
<tr>
<td>2**</td>
<td>Yes</td>
<td>Maximum</td>
<td>Polarize with car antenna.</td>
<td></td>
</tr>
<tr>
<td>3**</td>
<td>No</td>
<td>Check for low noise level.</td>
<td>Locate away from a.c. lines and over 6 Ft. from receiver.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>No</td>
<td>Maximum</td>
<td>Sets receiver frequency.</td>
<td></td>
</tr>
<tr>
<td>5*</td>
<td>No-use Generator</td>
<td>Maximum</td>
<td>Sets receiver frequency.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>No</td>
<td>Less than 3 volts</td>
<td>Sets noise level (at garage).</td>
<td></td>
</tr>
<tr>
<td>7****</td>
<td>No</td>
<td>* * *</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Receiver antenna is positioned for minimum noise level if sufficient range is obtained in that position.**

End to end polarization with transmitting antenna gives best range, but broadside polarization is less directional.

- **a.** Receiver antenna is pre-set at factory and adjustment should not be necessary. Requires audio generator at proper channel frequency.
- **b.** Adjustment is made by spacing antennas 14 feet apart, key transmitter and set AGC control at receiver relay. (Receiver must be plugged into operator at garage).
- **c.** Incorrect adjustment may result in phantom operation.

---

**Table:**

<table>
<thead>
<tr>
<th>Channel</th>
<th>Freq. (Cycles/Sec.)</th>
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<tr>
<td>83</td>
<td>7955</td>
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<tr>
<td>85</td>
<td>8175</td>
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<td>95</td>
<td>9386</td>
</tr>
<tr>
<td>97</td>
<td>9632</td>
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</tbody>
</table>

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**Notes:**

- IF OSC. IS OSCILLATING, BASE VOLTAGE IS MORE POSITIVE THAN EMITTER.
- IF NOT OSCILLATING, BASE READS LESS THAN EMITTER.
- Receiver coil is pre-set at factory and adjustment should not be necessary. Requires audio generator at proper channel frequency.
- Adjustment is made by spacing antennas 14 feet apart, key transmitter and set AGC control at receiver relay. (Receiver must be plugged into operator at garage).
- Incorrect adjustment may result in phantom operation.
PORTABLE TRANSMITTER CHECKLIST

- Battery properly installed and plugged in.
- Weak battery. Measure at least 7 volts when operating.
- Location in automobile. Try operation from outside of automobile and without Mounting Bracket to check.
- Code number same as Receiver.

WIRED-IN TRANSMITTER CHECKLIST

- Power Cord improperly connected to automobile supply (see diagram in housing cover for selecting proper battery voltage and polarity).
- Broken Power Cord wire, or defective jumper cable. Test for continuity or shorts.
- Defective push-button - short the 2 wires connected to push-button together, to check.
- Automobile radio antenna connected and radio antenna extended at least 2 feet.
- Mounting bracket connected to metal of automobile to make battery ground connection.
- Code number same as Receiver.
All tubes are accessible through the small panel on the rear of the instrument.

1. Remove power cord.

2. Remove three (3) plated screws holding small access panel on rear of instrument.
3. Swing panel down and to right on its pivot. DO NOT ATTEMPT TO REMOVE PANEL.

CHASSIS REMOVAL

The top of the record changer compartment comprises the complete chassis. It rests on and is secured to a ledge at the front and is held by screws at the rear. The recommended procedure for its removal is as follows:

1. Remove knobs.
2. Open small access panel as described in “Access to Tubes.”
3. Position two (2) holes in access panel over screws holding power cord interlock.
4. Remove two (2) machine screws holding interlock.
5. Pull record changer drawer down.
6. Unscrew two (2) bolts securing record changer in access holes in turntable, one at front and one at rear.

If it is not desired to remove chassis completely, omit Steps 6 & 7.

7. Lift up changer and disconnect cables.
8. Remove four (4) plated screws holding chassis to horizontal ledge located inside of compartment at front of top.
9. Remove wires, running down each back corner of compartments, from holding clips.
10. Remove four (4) painted screws holding record changer to rear of chassis to front of instrument—just below the access panel. (Hold chassis—top of compartment—to prevent its falling.)
11. Chassis may then be lowered and removed.
12. Disconnect speaker cables from transformers and lift chassis out of case.
1. Connect VTVM to point "A" on diagram. Set for DC operation, all grounds to chassis.

2. Connect the generator to the antenna input.
   The frequency must correspond to the frequency the receiver is set for. This frequency is determined by the receiving crystal (Y2).

3. Adjust the output of the generator until -2v. is read on the VTVM.
   During alignment, reduce the generator output so that this voltage is never more than -3 volts. Failure to reduce the generator output may result in an overload condition and subsequent incorrect alignment.

4. Adjust RFT1, L2 and L3 for maximum reading.

5. Adjust IFT1, 2, 3 for maximum reading.
   If two peaks are noticed, use the peak with the adjusting slug most withdrawn. The peak will be evidenced by a pronounced increase in VTVM reading.