# 3. ALIGNMENT PROCEDURE

## 3.1 ALIGNMENT OF MAIN AMPLIFIER

### A. Bias Alignment

This alignment should be performed with the power transistors in cold state, room temperature.

1. Before applying power to the receiver, make sure the trimming resistor "RV603" [2K ohm] [on printed circuit board EPO-143] is in its maximum position.
2. Temporarily connect a DC Voltmeter to the point between R625 and R627 on printed circuit board [EPO-143] and chassis ground.
3. Adjust "RV601" [100K ohm] "BAL ADJ" so that the voltmeter indicates 34 volts.
4. Temporarily remove fuse "F2" [2 amps] from the fuse holder and connect a DC Ammeter in place of the fuse.
5. Adjust "RV603" for an indication of 17mA on DC Ammeter.

   NOTE: Voltage should be kept at 120 volts and no audio signal should be applied during alignment procedure.

### B. Balance Alignment

1. Connect the output of an audio signal generator to the front left "TAPE – PLAY" input jack [located on the rear panel] of the receiver [see Figure 1].

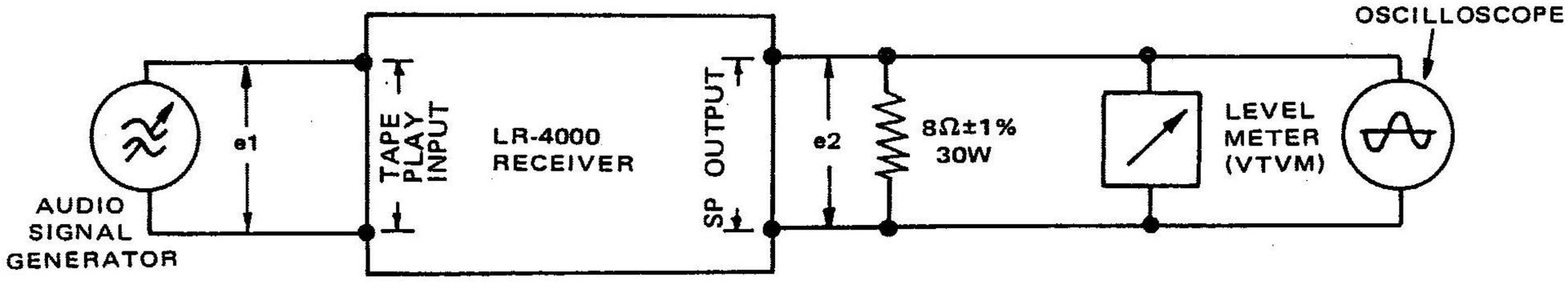



**Figure 1. Audio Amplifier Test Set-Up**

2. Temporarily, set the audio signal generator output to zero.
3. Depress the "MONITOR" push-button [4 CH Tape Monitor] to the "TAPE" position.
4. Connect an 8 ohm resistive dummy load to the appropriate SPKR terminals as shown in Figure 1.
5. Connect a VTVM across 8 ohm resistive dummy load as shown in figure 1.
6. Connect an oscilloscope across the VTVM as shown in Figure 1.
7. Set the Function Selector Switch to the "DISCRETE" position.
8. Set all other controls and switches to their required positions.
9. Increase the audio signal generator output level until clipping of the waveform is just visible on the upper and lower corner of the oscilloscope display.
10. Adjust "RV601" 100K ohm "BAL. ADJ." for equal and symmetrical clipping. The normal values at this clipping point are approximately 0.5 volts for "e1" [input voltage] and 18 to 19 volts for "e2" [output voltage].

Perform the Bias Alignment and Balance Alignment for the remaining three channels [front-right, rear-left and rear-right].

## 3.2 FM IF ALIGNMENT

### A. Discriminator Alignment

1. Connect the output of a 10.7 MHz sweep generator through a ceramic capacitor [with a value from 0.01 to 0.022μF] and the ground lead to the "GND" of the chassis to test point TP-4 on receiver.
2. Connect the input of an oscilloscope directly to test point TP-5 on receiver and the ground lead to chassis ground [no detector probe is necessary].
3. Set the Tuner Mode Selector Switch to the "AM" position.
4. Increase the sweep generator output level until the output display on the scope just saturates. Then adjust both the upper and bottom cores of T202 for straightness and symmetrical "S" curve using a 10.7 MHz marker center. See Figure 2 for correct oscilloscope display.

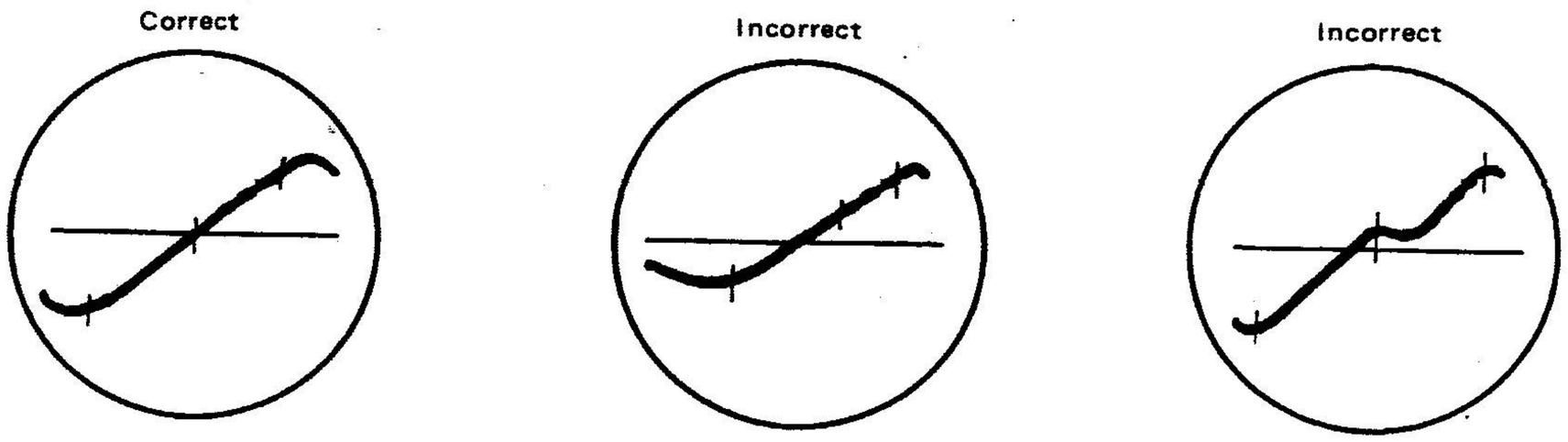



**Figure 2. Discriminator "S" Curve Alignment Display**

NOTE: The upper core of T202 adjusts gain [height] of the curve and the bottom core adjusts the center portion of the "S" curve as shown in Figure 2. When adjusting the bottom core, the correct display [curve] may be obtained at two core positions; one with the core inserted inward and another with the core in the outward position. However, the outward position is not desirable, always start adjusting the bottom core with the core fully inserted inward. Then rotate core slowly outward until the correct symmetrical "S" curve is obtained.

### B. FM IF Alignment

1. Couple the output of the sweep generator to T103 [Mixer Transformer] through a coupling coil [2 or 3 turns of vinyl wire] as shown in Figure 3.

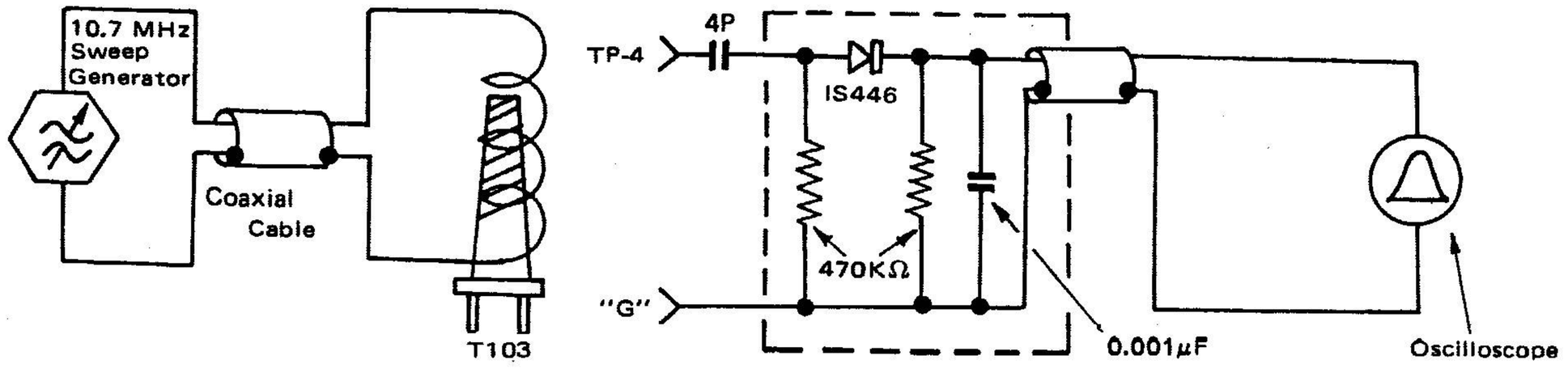



**Figure 3.**

IMPORTANT: Do not ground the coaxial cable ground lead of sweep signal injection coil.

2. Connect the detector probe across "TP-4" and "G" [ground] as shown in Figure 3. The hot lead of the probe should be made as short as possible and the ground lead should be connected to the closest point to TP-4.
3. Set the Tuner Mode Selector Switch to the "FM" position.

4. Short the local oscillator by shorting the oscillator variable capacitor using a 0.001 $\mu$F ceramic capacitor.

5. Increase sweep generator output to the point just before saturation as indicated on the oscilloscope display.

6. Adjust each upper and bottom core of T201 and CF101 for highest, widest and round top response as shown in Figure 4. [Since ceramic filters are used in the IF circuits, ignore 10.7 MHz center marker in the above alignment].

NOTE: When replacing a ceramic filter always use the one having the same color dot [same center frequency].

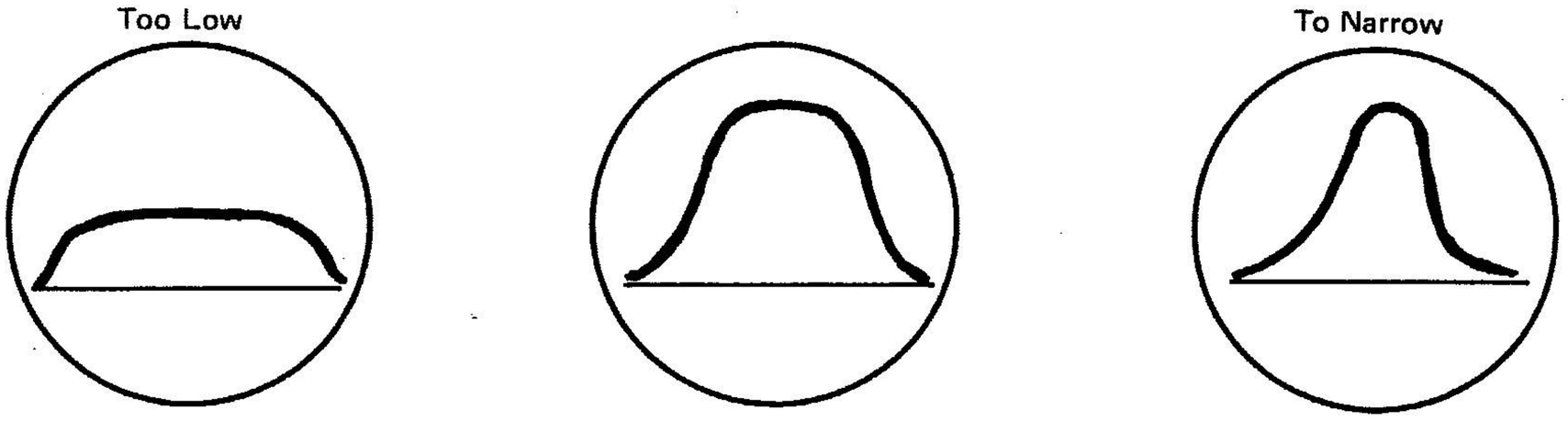



**Figure 4.**

## 3.3 FM FRONT END ALIGNMENT

1. Depress the "TUNER" Program Input Selector push-button. Then, set the Tuner Mode Selector Switch to the "FM" position.

2. Connect test equipment to the LR-4000 as shown in Figure 5; FM Front End Test Set-Up.

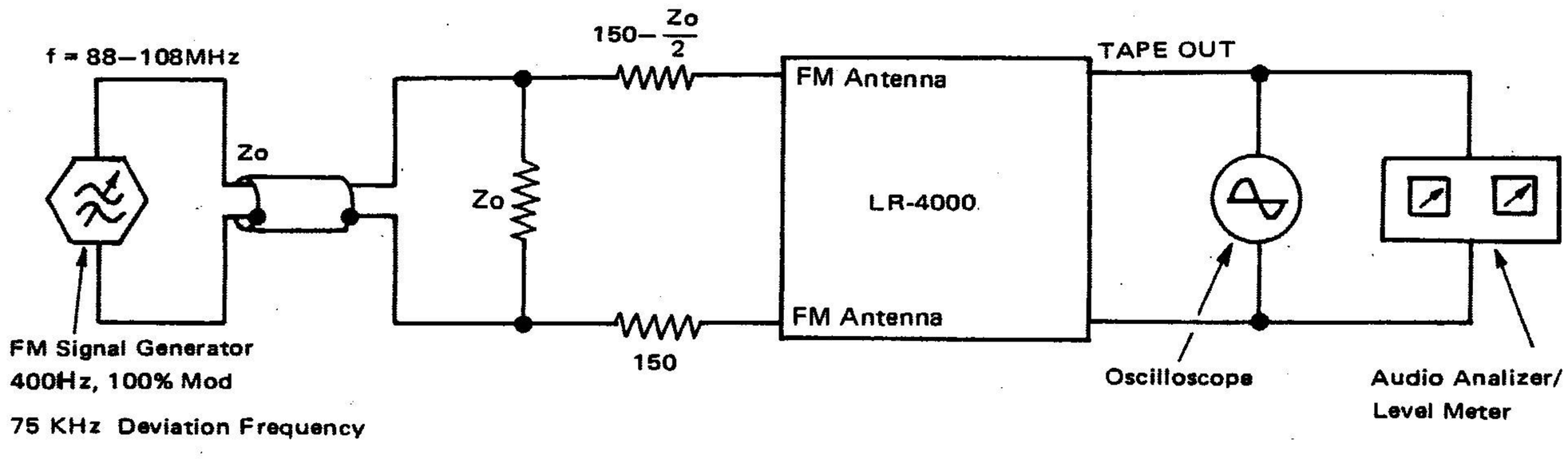



**Figure 5. FM Front End Test Set-Up**

3. Set the FM signal generator frequency to 90 MHz and tuning dial pointer to 90 MHz. Then, adjust T101, T102, T103 and T104 for maximum indication on level meter.

4. Set the FM signal generator frequency to 106 MHz and dial pointer to 106 MHz. Then, adjust CT101, CT102, CT103 and CT104 for maximum indication on level meter.

5. Repeat steps 3 and 4 until no further improvement may be obtained.

NOTE: When audio output is increased during alignment, always decrease the FM signal generator output to such a level at which the sine wave on the scope includes visible noise pulses to avoid inaccurate alignment due to limiting action.

6. Adjust each upper and bottom core of T201 and CF101 for highest, widest and round top response as shown in Figure 4. [Since ceramic filters are used in the IF circuits, ignore 10.7 MHz center marker in the above alignment].

NOTE: When replacing a ceramic filter always use the one having the same color dot [same center frequency].

## 3.4 IF DISTORTION ALIGNMENT

1. Connect test equipment to the LR-4000 as shown in Figure 5, FM Front End Test Set-Up.
2. Decrease the FM signal generator output to a level at which usable or lower sensitivity will be obtained. Then, set the signal generator frequency to 98 MHz.
3. Using the Tuning Control, tune the receiver to 98 MHz on the FM scale so that the receiver and FM signal generator will be tuned to the same frequency so that the symmetrical display of signal amplitude may be obtained on oscilloscope.
4. Increase the signal generator output to 0.1 – 1 mV.
5. Adjust the upper core of T202 so that the center meter pointer indicates exact center on the scale.
6. Set the audio distortion analyzer to the distortion position and adjust the bottom core of T202 for minimum distortion, readjust the upper core of T202 for exact center position. The distortion should be approximately 0.1 – 0.2%.

## 3.5 SIGNAL STRENGTH METER ADJUSTMENT

Set FM signal generator to 98 MHz, 80 dB output and tune the receiver to the same frequency. Then adjust RV201 [20K ohm] to obtain 90–95% deflection of full scale.

## 3.6 MUTE ALIGNMENT

Decrease the FM signal generator output to obtain 35% deflection of full scale on signal strength meter. Then, depress the "MUTE" push-button ON and adjust RV204 [10K ohm] so that the audio output display on the oscilloscope is just disappearing.

## 3.7 FM MPX STEREO CIRCUIT ALIGNMENT

Connect test equipment to the receiver as shown in Figure 5. Then, modulate the FM signal generator with stereo composite signal and perform the following:

**A. 19 KHz Pilot Signal Alignment**

1. Temporarily decrease FM signal generator output to zero. Then, depress the "MUTE" push-button ON. Now, no signal [including noise] will be obtained from the TAPE OUT jacks.
2. Connect a frequency counter to "TP-12" on receiver, and adjust "RV-203" [5K ohm] for 19 KHz ± 2 KHz indication on frequency counter.

**B. Separation Alignment**

1. Release the "MUTE" push-button to OFF position.
2. Modulate the FM signal generator with the normal left channel composite signal [400 or 1000 Hz, 100% modulation] to provide an output signal of 1 mV.
3. Tune the receiver exactly to the FM signal generator frequency [98 MHz] by using the center tuning meter. In this state, at the Left Channel Tape Out jack on the receiver there should be approximately 1 volt output signal. Observe the output signal of the Right Channel Tape Out jack. There should be very little leakage from the left channel. Then, adjust "RV-202" [50K ohm] for minimum leakage voltage.
4. Next, modulate FM signal generator with right channel composite signal and observe the right channel signal leakage appeared on the left channel TAPE OUT jack. The leakage voltage should have the same level as that of the right channel. If not, readjust "RV-202" for equal and minimum leakage at both outputs. The normal leakage voltage [separation] is approximately –45 to –50dB.

## 3.8 AM TUNER ALIGNMENT

1. Connect equipment to LR-4000 as shown in Figure 6, AM TUNER ALIGNMENT SET-UP.

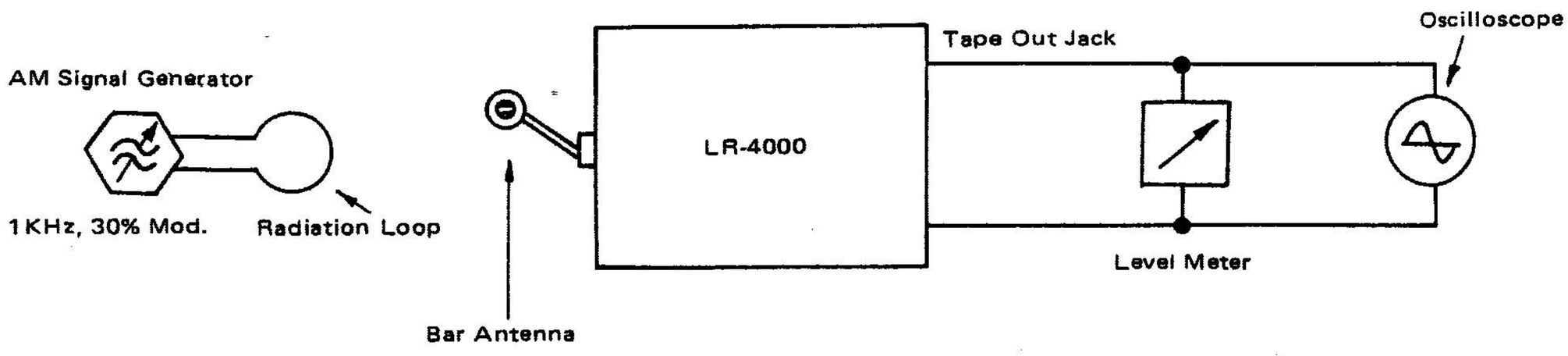



**Figure 6. AM Tuner Alignment Set-UP**

2. Depress "TUNER" push-button on receiver to the ON position.
3. Set "TUNER MODE" Selector Switch to the "AM" position. Place the AM Bar Antenna in the correct position by pulling it outward.
4. Set AM Signal Generator frequency to 600 KHz for 30% modulation at 1 KHz with tuning dial pointer set to the same frequency.
5. Increase the AM signal generator output until a sine wave appears on the oscilloscope display. Then, adjust "T106" for maximum audio output [dial frequency alignment]. Also, adjust "T105" and screw core on AM Bar Antenna for maximum output [tracking alignment].
6. Set the AM signal generator frequency to 1400 KHz and place the dial pointer in the 1400 KHz position. Adjust "CT107" for maximum audio output [dial frequency alignment]. Also, adjust "CT105" and "CT106" for maximum output [tracking alignment].
7. Repeat the above steps [at 600 KHz and 1400 KHz] until no further improvement is obtained.

   NOTE: When adjusting the cores or trimming capacitors the audio output level will rapidly increase and the level meter pointer go off scale. In this case always decrease the signal generator output for proper audio output. Do not change the level meter range to match the increased audio output. Keep the AM signal generator output as low as possible to avoid AGC action during AM tuner alignment.

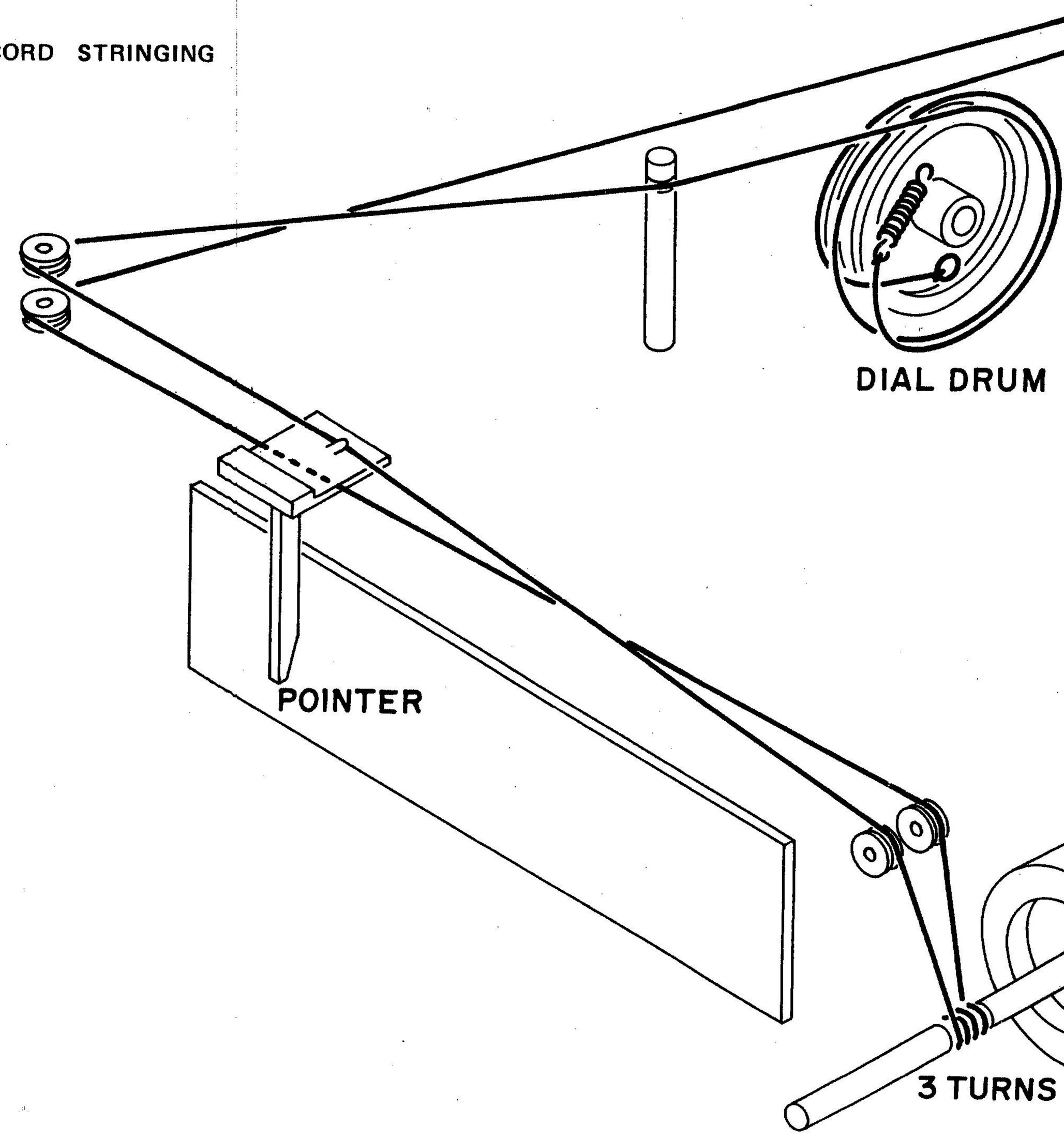
# 4. SERVICING NOTES

a. From a servicing stand point, the voltage drop across the emitter resistor is very important in determining circuit operation. A higher than normal emitter voltage, would generally indicate excessive current flow which can be caused by a shorted transistor or bias defect. A lower than normal emitter voltage would generally indicate an open transistor or bias defect.
   Check the emitter voltage in each stage and compare them with the voltages given in the circuit diagram. If the voltages obtained are 20% higher or lower than the voltages given on the circuit diagram, troubleshoot and find the defective component [s].

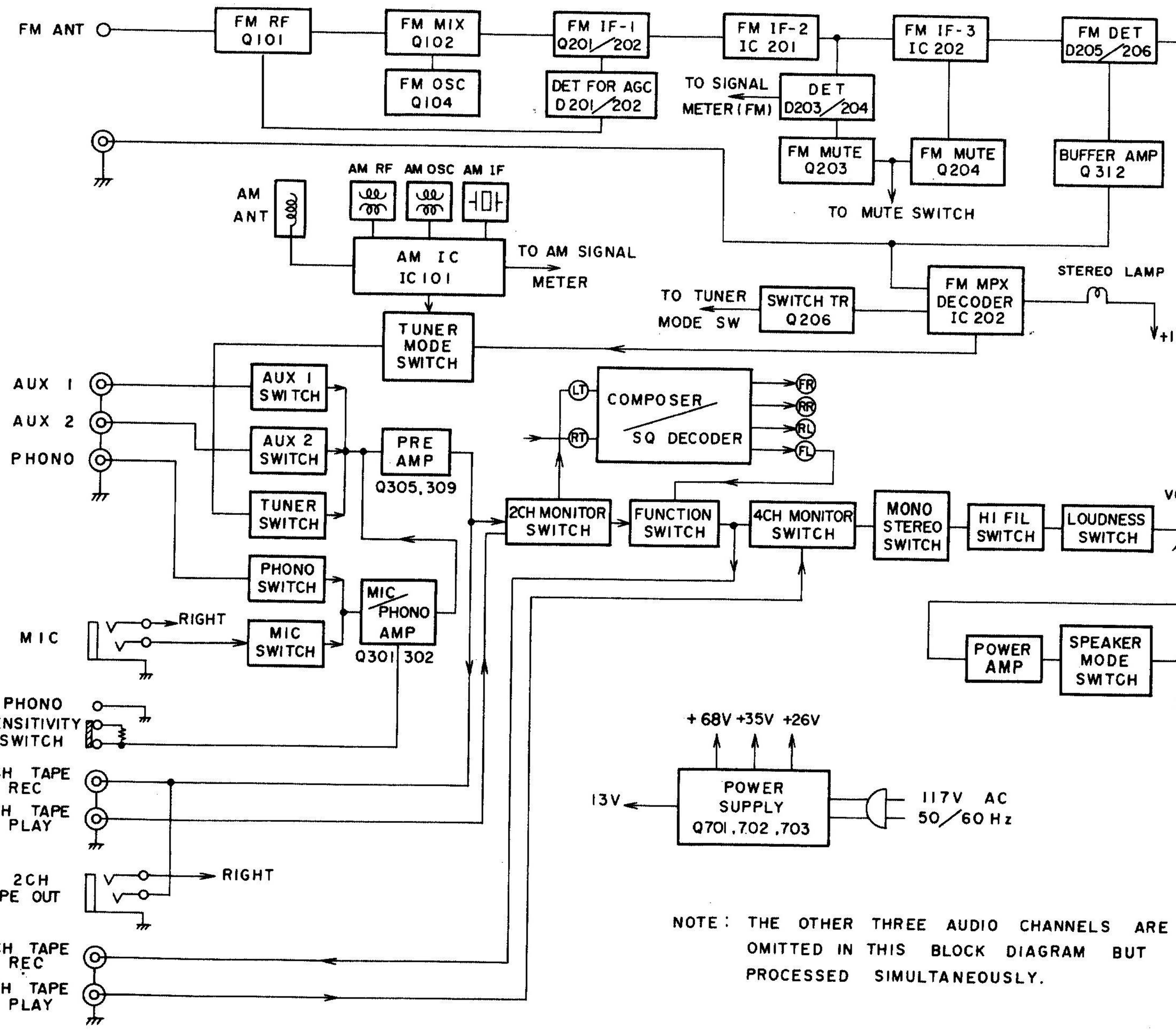
b. When servicing the receiver you may quickly determine the circuit operating conditions by using the method of signal tracing and checking the waveform signal at any given stage on an oscilloscope display.

c. IMPORTANT: Do not attempt to adjust any FM MPX coils, if you have not a proper MPX stereo generator. These coils generally can not be aligned without an MPX stereo generator.

# DIAL CORD STRINGING

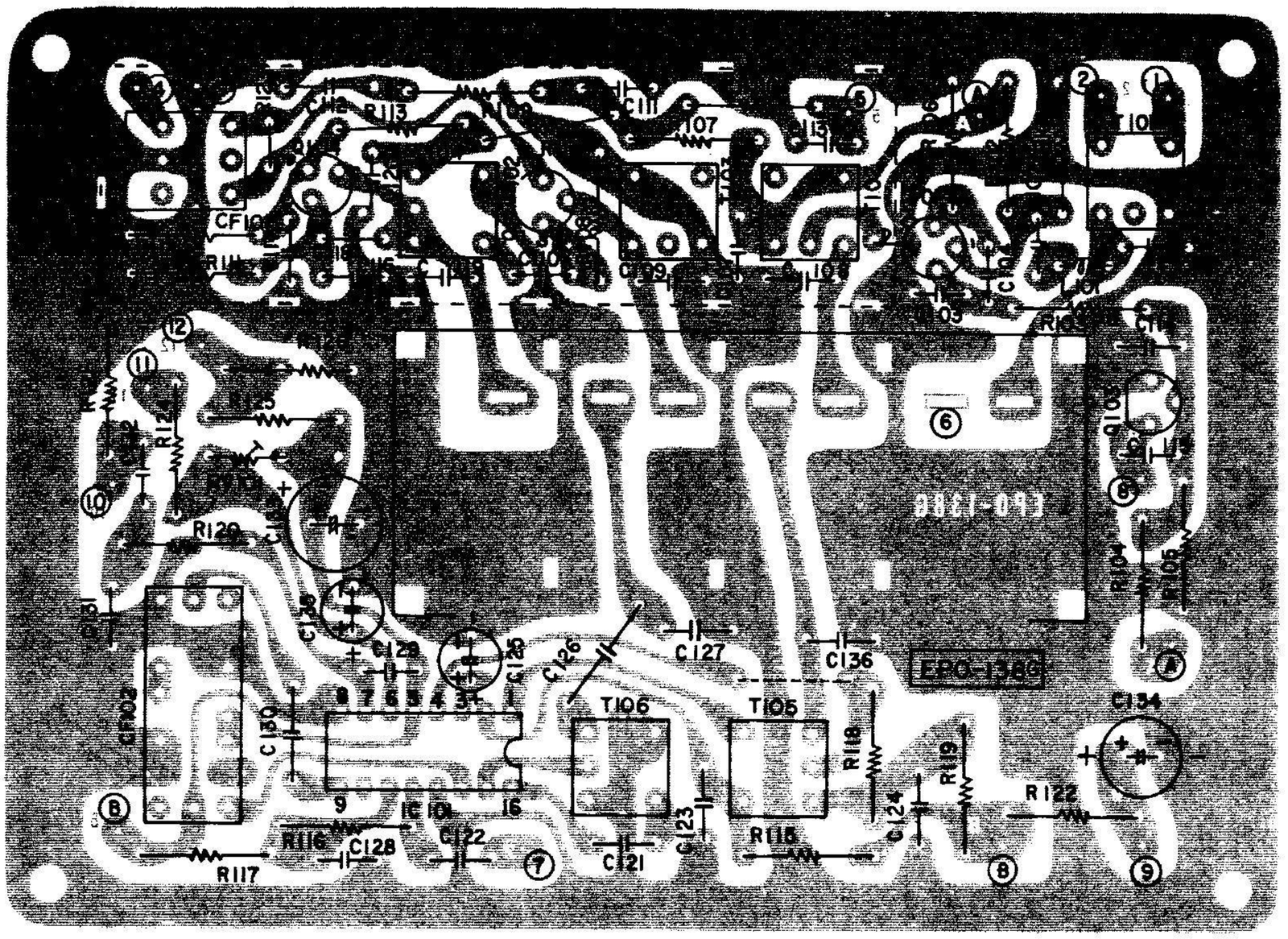


## BLOCK DIAGRAM

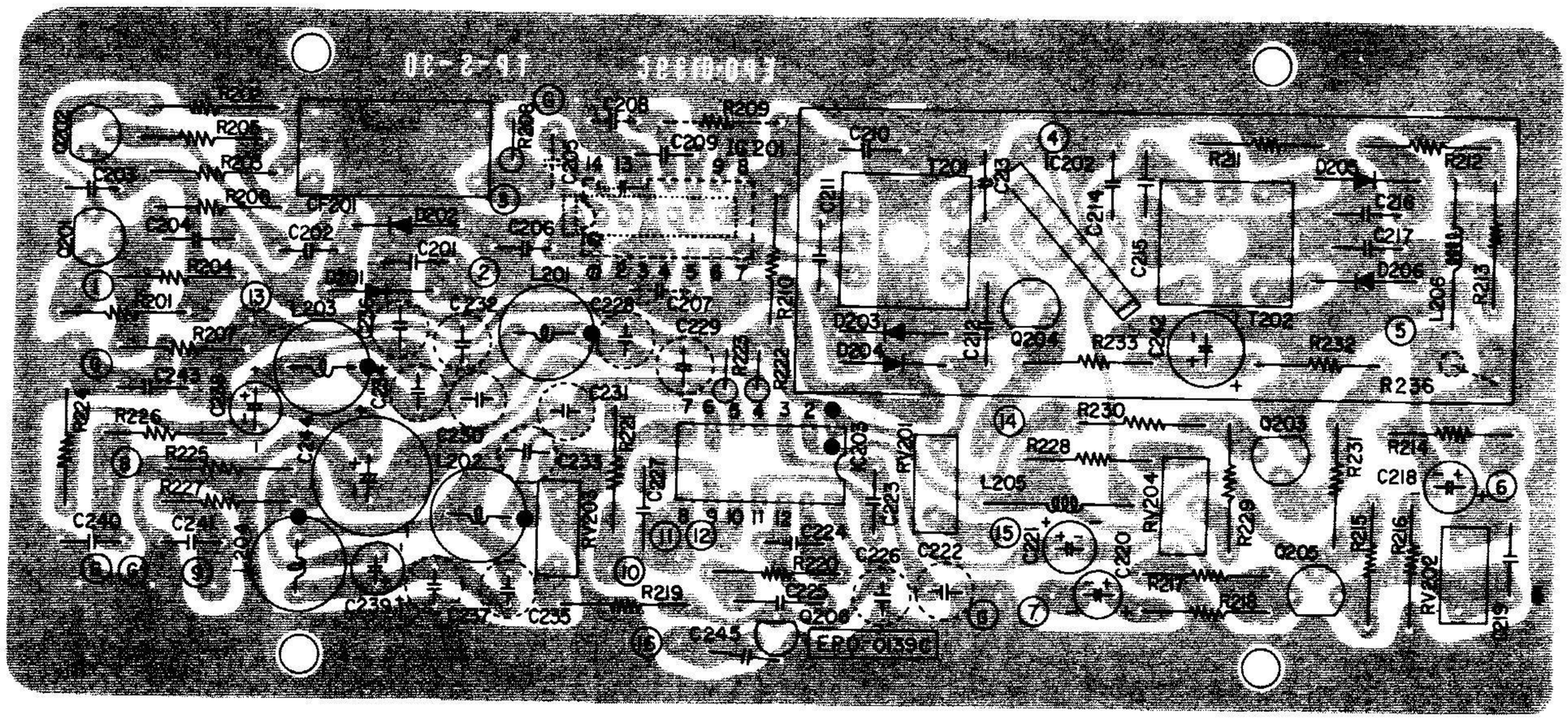



NOTE: THE OTHER THREE AUDIO CHANNELS ARE OMITTED IN THIS BLOCK DIAGRAM BUT PROCESSED SIMULTANEOUSLY.

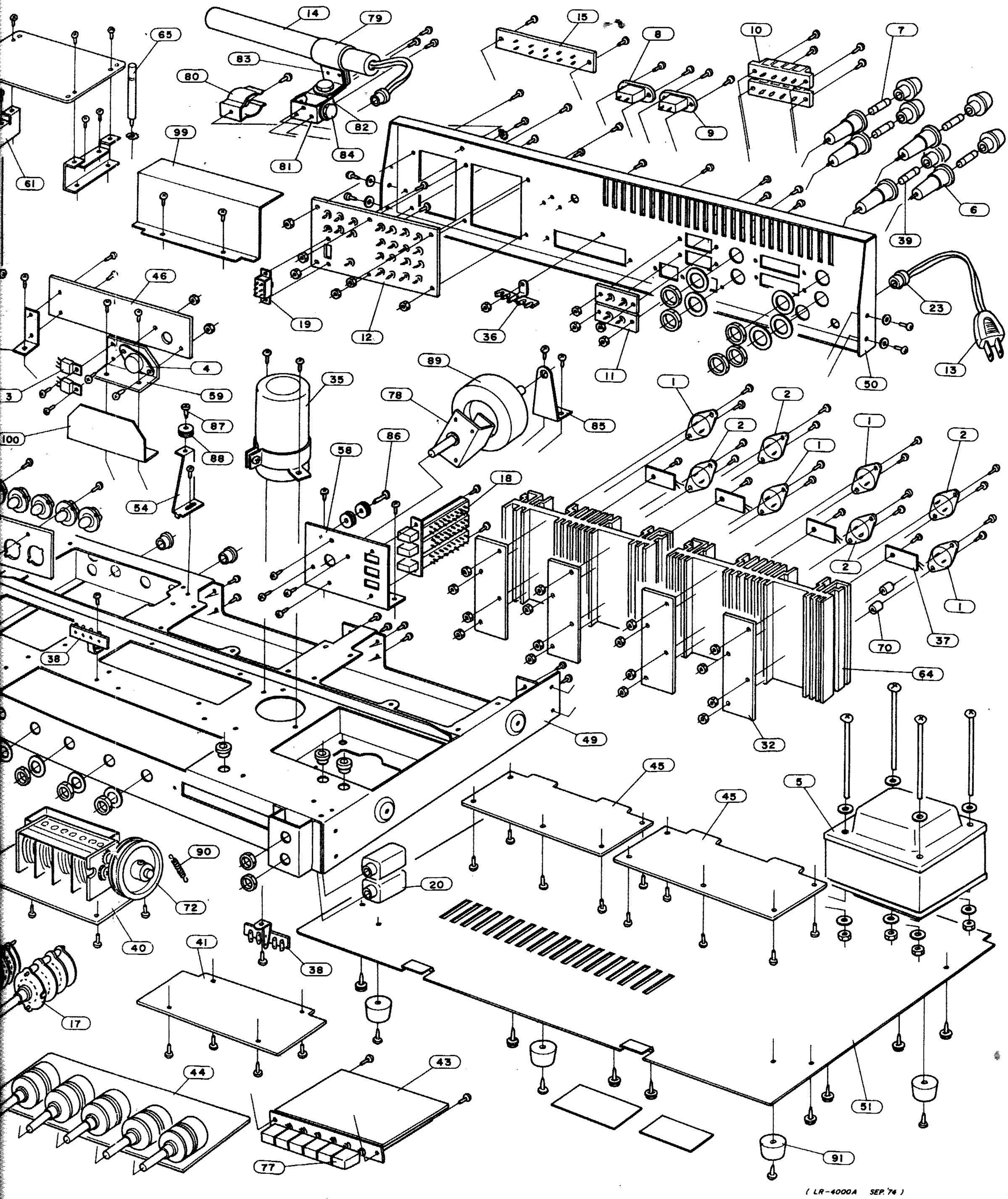
# ELECTRICAL PARTS LOCATION OF MODEL LR-4000A




FM/AM TUNER PC BOARD ASSEMBLY, EPO-138G




IF·MPX PC BOARD ASSEMBLY, EPO-139C




( LR-4000A SEP. '74 )

# EXPLODED VIEW OF MODEL LR-4000A