SERVICE MANUAL 2220B

marantz

model 2220B

Stereophonic Receiver

marantz

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INTRODUCTION

This service manual was prepared for use by Authorized Warranty Stations and contains service information for Marantz Model 2220B Stereophonic Receiver.

Servicing information and voltage data included in this manual are intended for use by the knowledgeable and experienced technician only. All instruction should be read carefully. No attempt should be made to proceed without a good understanding of the operation in the receiver.

The part lists furnish information by which replacement part may be ordered from the Marantz Company. A simple description is included for parts which can be usually be obtained through local suppliers.

1. SERVICE NOTES

As can be seen from the circuit diagram, the chassis of Model 2220B consists of the following units. Each unit mounted on a printed circuit board is described within the square enclosed by a bold dotted line on the circuit diagram.

1.	FM Front End & AM Tuner	mounted on P.W.B. P100
2.	FM IF Amplifier, Detector, Muting Control	mounted on P.W.B. P200
3.	MPX Stereo Decoding Amplifier	mounted on P.W.B. P300
4.	Phono Amplifier	mounted on P.W.B. P400
5.	Tone Amplifier	mounted on P.W.B. PE01
6.	TAPE Montor, Mono, Low and High Filter Switch Unit	mounted on P.W.B. PH01
7.	Loudness, Muting, Main and Remote Switch Unit	mounted on P.W.B. PT01
8.	Power Amplifier	mounted on P.W.B. P700
9.	Power Supply	mounted on P.W.B. P800
10.	Dial Lamp Unit	mounted on P.W.B. PZ01

2. AM TUNER

All components except ferrite bar antenna are mounted on a printed circuit board P100.

The AM signals induced in a ferrite bar antenna are applied to the RF amplifier section of the AM tuner IC H104 through a capacitor of C129 and amplified to the level required for overcoming the conversion noises, thus giving good S/N performance. The tuned circuits inserted in both out and input circuit of the RF amplifier assure very high image and spurious rejection performance. Thus amplified and selected AM signals are then applied to the converter section through a coupling capacitor C132. While the local oscillator voltage is injected through a capacitor C131, both AM signals and oscillating voltage are mixed and converted into 455KHz intermediate frequency. The resulting IF signal is applied to the first IF transformer L110 consisting of one ceramic filter and two tuned circuits.

The output of L110 is led to the IF amplifier/detector section of H104. The detected audio signal is obtained from PIN 11 of H104 and amplified to a required level (about 470 mV for 400Hz 30% mod.) by the amplifier H105 and fed to the function switch.

2.1 Suggestions for AM Tuner Trouble Shooting

Check for broken AM bar antenna, next connect an oscilloscope to the pin 11 of H104 or J112 and check for audio signals with the tuning meter deflected. If detected audio signal is obtained at pin 11 of H104, no failure may exist in the AM tuner IC H104 and its associated circuit. If no audio signal is obtained at pin 11 of H104, check all voltage distribution in the AM circuits by using a DC VTVM.

3. FM TUNER

The FM Tuner section of Model 2220B is divided into three functional blocks: FM front end, IF amplifier & Detector, Muting control and MPX stereo decoding circuit.

FM signals induced on a FM antenna are led to FM antenna coil L101 through a balun coil. These signals are then applied to the FET RF amplifier which in turn applies its output to the next Transistor Mixer H102 through the double tuned high selective circuits. The Mixer convert its input signal into 10.7MHz intermediate frequency and amplifies it at the same time. The H103 is a local oscillator and its output is injected into the base of Mixer transistor, the injection voltage is about 50mV. The 10.7MHz front end IF output is led to the next IF amplifier unit through a coaxial cable.

The IF amplifier unit consists of five stages of IF amplifiers. Two pieces of ceramic filters are used to obtain high selectivity a pair of symmetrical diode limiter is also employed for the best limiting characteristics, improved capture ratio and good AM suppression.

A part of IF amplifier H202 is rectified by the diodes H211 and H212 and its DC output is fed back to the gate of FET RF amplifier to decrease the gain of it with increased input signal strength.

3-1. Muting and Auto-Stereo Switching Circuits

The muting circuit consisting of all solid-state electrical switching has been incorporated in the Model 2220B.

The DC voltage obtained by rectifing the sub IF output signal from the H206 is applied to the base of H207 and turns on it, if the sub IF output is greater than predetermined level (muting threshold level).

When the H207 turns on, the muting switch transistor H208 is turned on, thus decreasing the emitter collector resistance to near zero ohm and allowing emitter current path to the Final IF amplifier H205.

When the input signal is lower than the predetermined level, the DC output obtained is small and can not turn on the H207 thus the H207 keeps its turn off state and this makes the switch transistor keep H208 turn off, then no emitter current is supplied to the H205 and signals below the threshold level are muted out.

The muting threshold level can be varied by adjusting the trimming resistor R253.

The DC voltage obtained is also used to make the Auto-Stereo switching transistor H209 turn on and off.

3-2. MPX Stereo Decoding Circuit

The stereo composite signal from the FM detector undergoes a phase compensation by R303 and C304, is applied to the input terminal pin 2 of the MPX stereo decoding IC H301 on a PLL (Phase Locked Loop) basis, and decoded into the left and right stereo signals, which become available at pins 4 and 5 respectively. These decoded left and right stereo audio signals are introduced through a low pass filter composed of L301 to L304 and C309 to C318 for elimination of undesirable residual switching signal and through a de-emphasis network consisting of R314, R315, C319 and C320, into the npn-pnp direct coupled audio amplifier, where the signals are amplified to a required level for the output from J307 and J308. From these terminal the audio signals are led to the TAPE OUTPUT jacks through the function switch. Figure 1 presents an internal block diagram showing the functions of the PLL basis MPX stereo decoding IC HA1156. The input stereo composite signal, amplified by the audio amplifier, is delivered to the phase detectors PD-1 and PD-2. A part of the stereo composite signal is also applied to the stereo decoder section. The VCO (Voltage Control Oscillator) produces a free run oscillation in the neighborhood of 76KHz with the time constant determined by a capacitor C303 and resistors R304 and R305 set on the outside of pin 14. The VCO output has its freqeuncy divided into 19KHz through the two stages of the frequency divider (DIV-1 & DIV-2), and is reverted to the phase detector PD-1, which contains two input terminals designed to produce an output in proportion to the product of the two input signals. The signal applied to one of the inputs of PD-1 is the 19KHz square wave formed through frequency division of the 76KHz VCO output signal by the two stages of the frequency divider

DIV-1 and DIV-2, and the 19KHz pilot signal included in the stereo composite signal as a reference signal is applied to the other input. Therefore, the output of PD-1 which has passed through the low pass filter LPF-1 provides DC output voltage in proportion to the phase variance between the two inputs. This DC output voltage is amplified by the DC amplifier, and supplied to the 76KHz VCO as a control voltage. This means that the output frequency and phase of the VCO have been phase-locked to the input pilot signal. The 38KHz sub-carrier reproduced by PLL as stated above is delivered through the stereo switch to the stereo decoder section as a switching signal, thus driving the decoder section. One of the inputs of PD-2 is given the 19KHz resulting from the frequency division completed by DIV-1 and DIV-3, whereas the other input gets the 19KHz output contained in the composite signal, and the output is provided with a DC output in proportion to the amplitude of the pilot signal. This DC output is furnished through LPF-2 to the trigger amplifier which drives the stereo indicator lamp and stereo switch. Therefore, insufficient supply of the pilot signal results in failure to light the stereo indicator and to turn on the stereo switch located in the path of the 38KHz switching signal, thereby avoiding a wrong stereo operation. H303 attached on the outside of pin 8 is a switching transistor for automatic monaural-stereo switchover. When the intensity of an incoming signal from an FM station is weaker than a predetermined level, this H303 is turned on and pin 8 is grounded, thereby developing a condition for monaural reception. For a forced monaural operation, switch the MODE switch to "NONO," an H303 comes into an "On" condition with the positive bias voltage applied to the base, and pin 8 is grounded, thereby establishing monaural operation. The transistor H302 connected externally to pin 14 is intended to stop the 76KHz oscillation of the VCO Which interferes an AM signal during the reception of an AM station. When the function switch is set to "AM" position, a positive bias is charged on the base of H302, H302 is turned on, and pin 14 is grounded. Thus, the oscillation of the VCO is stopped, ending the interference with AM reception.

3.3 Suggestion for Trouble Shooting of FM Tuner

3.3.1 Symptom: No FM Reception

First turn ON the power switch and try to tune FM stations. Rotate the fly-wheel tuning knob slowly and observe the FM tuning meter. If the turning meter deflect at several frequencies received, the tuner circuits preceding the discriminator circuit may have no failure. When no reading is obtained in the meter, check FM local oscillator circuit, using a RF VTVM. The normal local oscillator voltage is one or two volts (rms) at the tuning capacitor, depending on the tuning capacitor position. If the local oscillator voltage is normal, next check all voltage distributions in the FM Front End and IF amplifier unit and compare them with those shown in the circuit diagram. When the tuning meter deflects but no sound is obtained, check audio circuits, using a high sensitive oscilloscope.

3.3.2 Symptom: No Stereo Separation

First check the "MONO" switch is in normal out position. Connect a FM RF signal generator output modulated by a stereo modulator to the rear FM antenna terminals, and check the stereo beacon is turned on or not. If not turned on, check for 19KHz VCO output signal (R312 Test Point), using an oscilloscope and a frequency counter.

4. PHONO AND PRE-AMPLIFIER

Signals from the tuner and AUX jacks are applied to the selector switch. Signals from the PHONO jacks are applied to the phono-amplifier consisting of transistor H401, H403 and H405. The gain of the amplifier is 40 dB. The amplified and equalized phono-signals are, then, fed to other section of the selector switch which, in turn, applies output signals from the tuner, phono-amplifier and AUX jacks to the TAPE 1 MONITOR switch and TAPE OUT 1 jacks. The TAPE 1 MONITOR switch applies the signals to the balance and volume controls.

The controlled signals are fed to the pre-amplifier consisting of HE01, HE03 and HE05,

HE07. Frequency response of the amplifier can be varied by BASS, MID and TREBLE controls. The controlled output are then led to the main amplifier through high and low pass filter pushswitches.

5. MAIN AMPLIFIER

Transistor H701 and H703 are a differential amplifier coupled to the transistor H707. Transistor H707 drives the inverter transistors H721 and H723 which, in turn, drive the power stage consisting of H001 and H002. Transistors H709 and H721 are current limitters and operate as power protecting circuits.

Excessive currents flowing into the power stage are detected by the resistors R749 and R747 and the resultant variations are applied to the transistors H709 and H711 and make them turned on. This decreases the current flowing into the H721 and H723. In this way the currents flowing in the power stage (H001 and H002) are restricted within a safe value.

6. AUDIO TROUBLE ANALYSIS

1.	Excessive line consumption	a. Check for shorted rectifiers H801, H802. b. Check for shorted transistors H001, H002, Check L005 for short.
2.	No line consumption or zero bias	a. Check line cord, fuse, shorted H005, H006, H725. b. Check for open rectifiers H801, H802 or open L005.
3.	High hum and noise level	a. Check filter capacitors C002, C004.
4.	Parastic oscillation	a. Check for defective capacitors, C707, C708, C715, C716.
5.	Improper clipping	a. Check for proper adjustment of R711, R712.

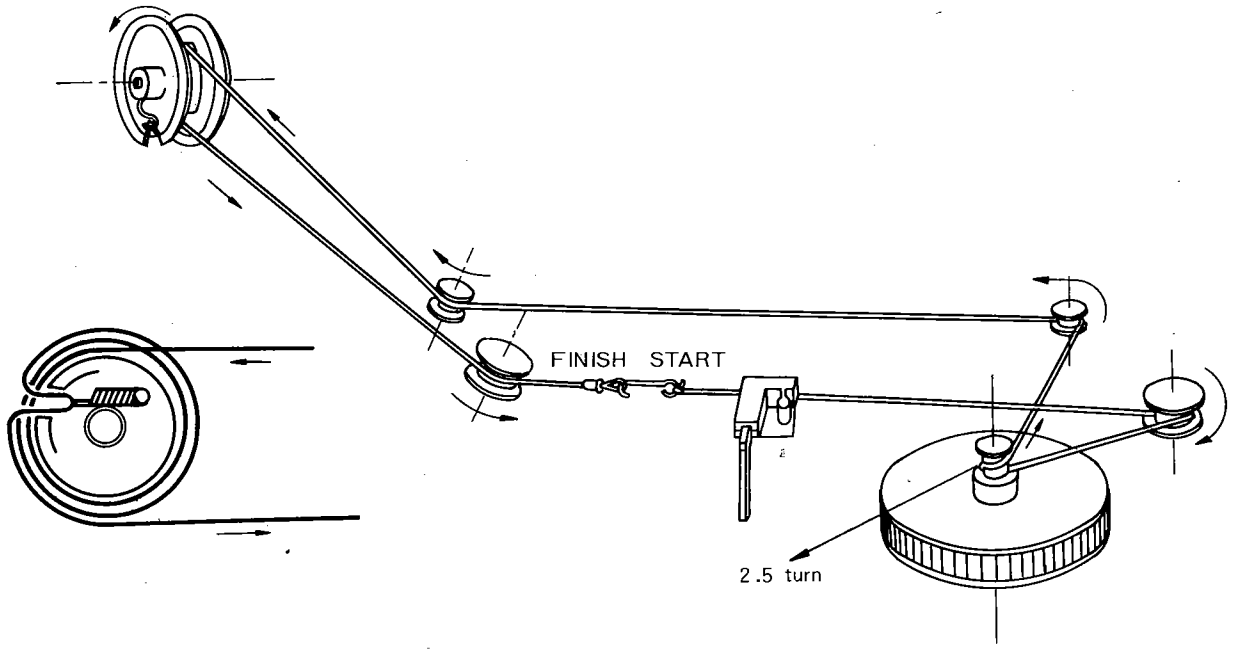

Figure 1. Dial Stringing

7. TEST EQUIPMENT REQUIRED FOR SERVICING

Table 1 lists the test equipment required for servicing the Model 2220B Receiver.

Item	Manufacturer and Model No.	Use
AM Signal Generator		Signal source for AM alignment
Test Loop		Use with AM Signal generator
FM Signal Generator	Less than 0.3% distortion	Signal source for FM alignment
Stereo Modulator	Less than 0.3% distortion	Stereo Separation alignment and trouble shooting
Audio Oscillator	Weston Model CVO-100P, less than 0.02% residual distortion is required.	Sinewave and squarewave signal source.
Frequency Counter		MPX Oscillator adjustment (VCO)
Oscilloscope	High sensitivity with DC horizontal and vertical amplifiers.	Waveform analysis and Trouble Shooting, and ASO alignment.
VTVM	With AC, DC, RF range	Voltage measurements.
Circuit Tester		Trouble Shooting
AC Wattmeter	Simpson, Model 390	Monitors primary power to Amplifier.
AC Ammeter	Commerical Grade (1-10A)	Monitors amplifier output under short circuit condition.
Line Voltmeter	Commercial Grade (0-150VAC)	Monitors potential of primary power to amplifier.
Variable Autotransformer (0-140VAC, 10 amps.)	Powerstat, Model 116B	Adjusts level of primary power to amplifier.
Shorting Plug	Use phono plug with 600 ohm across center pin and shell.	Shorts amplifier input to eliminate noise pickup.
Output Load (8 ohms, 0.5%, 100W)	Commercial Grade	Provides 8-ohm load for amplifier output termination.
Output Load (4 ohms, 0.5%, 100W)	Commercial Grade	Provides 4-ohm load for amplifier output termination.

8. AM ALIGNMENT PROCEDURE

AM IF Alignment

1. Connect a sweep generator to the J106 and an alignment scope to the resistor R120 (out side).
2. Rotate each core of IF transformers L110 and L111 for the maximum height and flat top symmetrical response.

AM Frequency Range and Tracking Alignment

1. Set AM signal generator to 515 KHz. Turn the tuning capacitor fully closed (place the tuning pointer at the low end) and adjust the oscillator coil L109 for maximum audio output.
2. Set the signal generator to 1650 KHz. Place the tuning pointer in the high frequency end and adjust the oscillator trimmer on the oscillator tuning capacitor for maximum audio output.
3. Repeat step 1 and 2 until no further adjustment is necessary.
4. Set the generator to 600 KHz, tune the receiver to the same frequency and adjust a slug core of AM ferrite rod antenna and RF coil L108 for maximum output.
5. Set the generator to 1400 KHz and tune the receiver to the same frequency and adjust both trimming capacitor of antenna and RF tuned circuit for maximum output.

6. Repeat procedures 4 and 5 until no further adjustment is necessary.

Note: During tracking alignment reduce the signal generator output as necessary to avoid AGC action.

9. FM ALIGNMENT PROCEDURE

1. Connect a FM signal generator to the FM antenna terminals and an oscilloscope and an audio distortion analyzer to the tape output jack on the rear panel.
2. Set the FM SG to 87 MHz and provide about 3 to 5μV. Place the tuning pointer at the low frequency end by rotating the tuning knob and adjust the core of oscillator coil L104 to obtain maximum audio output.
3. Set the FM SG to 109 MHz and provide about 3 to 5μV. Rotate the tuning knob and place the tuning pointer at the high frequency end and adjust the trimming capacitor C118 for maximum output.
4. Repeat steps 2 and 3 until no further adjustment is necessary.
5. Set the FM SG to 90 MHz and tune the receiver to the same frequency. Decrease signal generator output until the audio output level decreases with the decreasing generator output. Adjust the ANTENNA coil L101, RF coil L102 and L103 and IF transformer L105 for minimum audio distortion.
6. Set the FM SG to 106 MHz and tune the receiver to the same frequency. Decrease the signal generator output until the audio output level decreases with the decreasing generator ouput. Adjust the trimming capacitors of ANTENNA and RF tuning circuits for minimum distortion.
7. Repeat steps 5 and 6 until no further adjustment is necessary.
8. Connect a DC VTVM with 1 V range selected to the resistor R237 (inside) and adjust the secondary core (black) of discriminator transformer L201 so that no voltage reading is obtained on the VTVM at no signal. Next set the FM SG to 98 MHz and increase the output level 1 Kμ V, then tune the receiver to the same frequency so that no deflection is obtained on the VTVM. Adjust primary core (pink) of L201 for minimum distortion.

10. STEREO SEPARATION ALIGNMENT

1. Set the FM SG to provide 1 Kμ V at 98 MHz. Tune the receiver to the same frequency so that the center tuning meter pointer indicates its center. Then turn off the modulation of the FM SG, connect a frequency counter to test point R312 (point C) and adjust R 304 so that the frequency counter may a precisely read 19 KHz.
2. Modulate the FM SG with stereo composite signal consisting of only L or R channel (of course a pilot signal must be included).
3. Adjust the trimming resistor R 303 for maximum and same separation in both channels.

11. MUTING THRESHOLD ADJUSTMENT

1. Set the FM SG output to provide 12.5μV(IHF) at 98 MHz and tune receiver to the same frequency. Adjust the trimming resistor R 253 for the threshold level of 12.5μV. (During this adjustment turn the MUTING pushswitch "on".)

12. POWER AMPLIFIER ADJUSTMENT

Connect a VTVM between J712(+) and J718(−) and adjust the trimming resistor R733 until the VTVM reads 20 mV DC. And next, connect a VTVM between J723 and J722 (GROUND) and adjust the trimming resistor R711 until the VTVM reads 0 mV DC. Do over again. For the other channel, connect the VTVM between J713(+) and J719(−) and adjust the R734 for the same reading, and connect the VTVM between J724 and J722 and adjust the R712 for the same reading. Do over again.

13. POWER SUPPLY ADJUSTMENT

Connect a VTVM between J812(+) and J811(−) and adjust R808 until the VTVM reads 35.0 V under no signal condition.

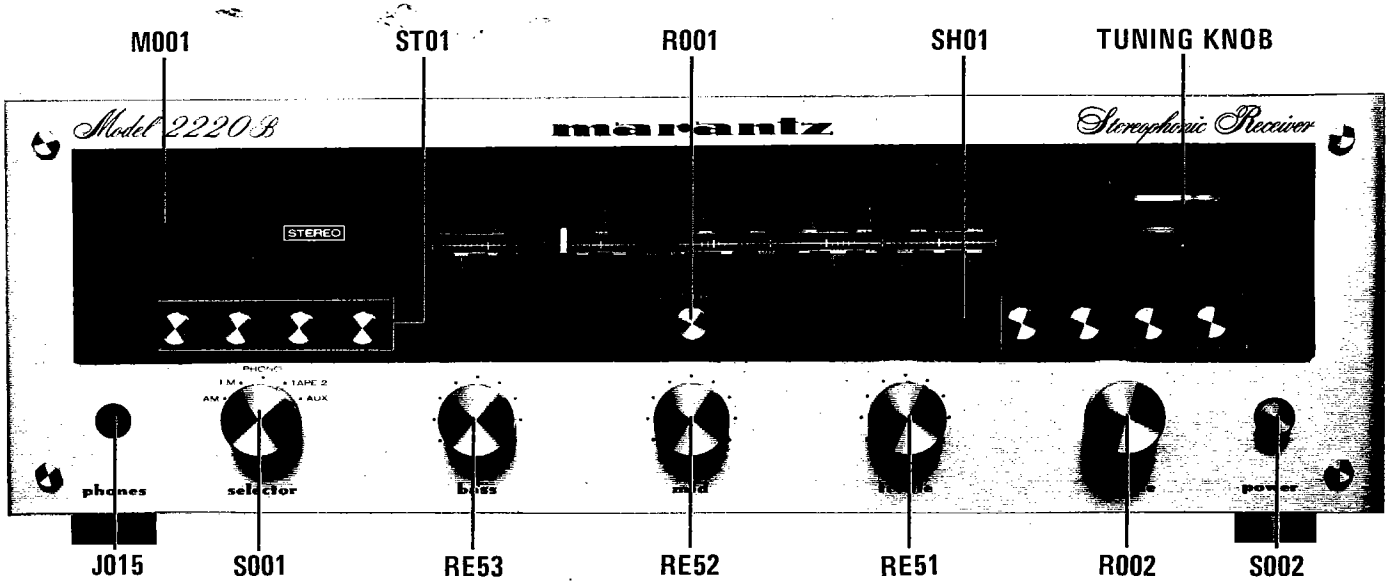

Figure 2. Front Panel Adjustments and Component Locations

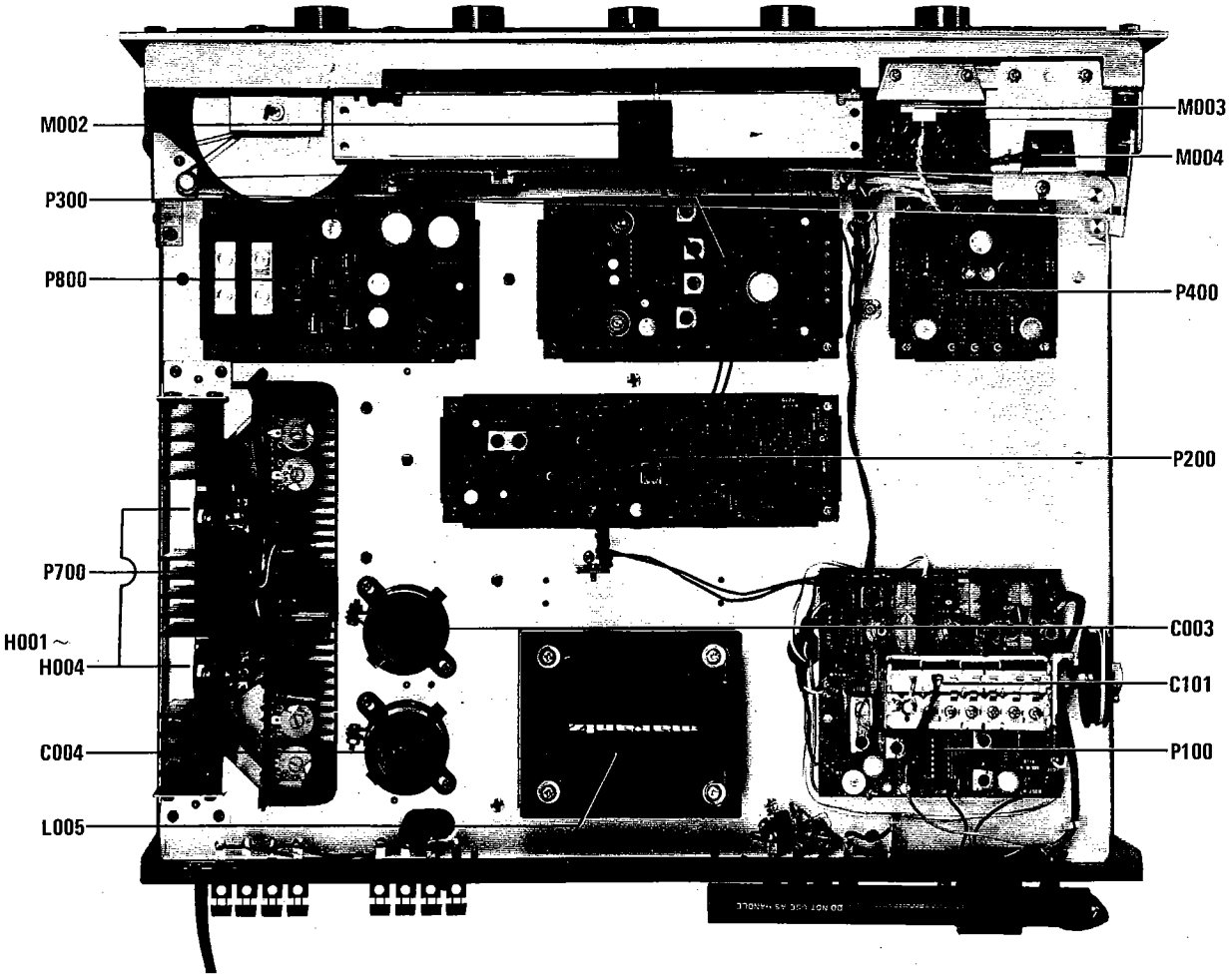

Figure 3. Main Chassis Component Locations (Top View)

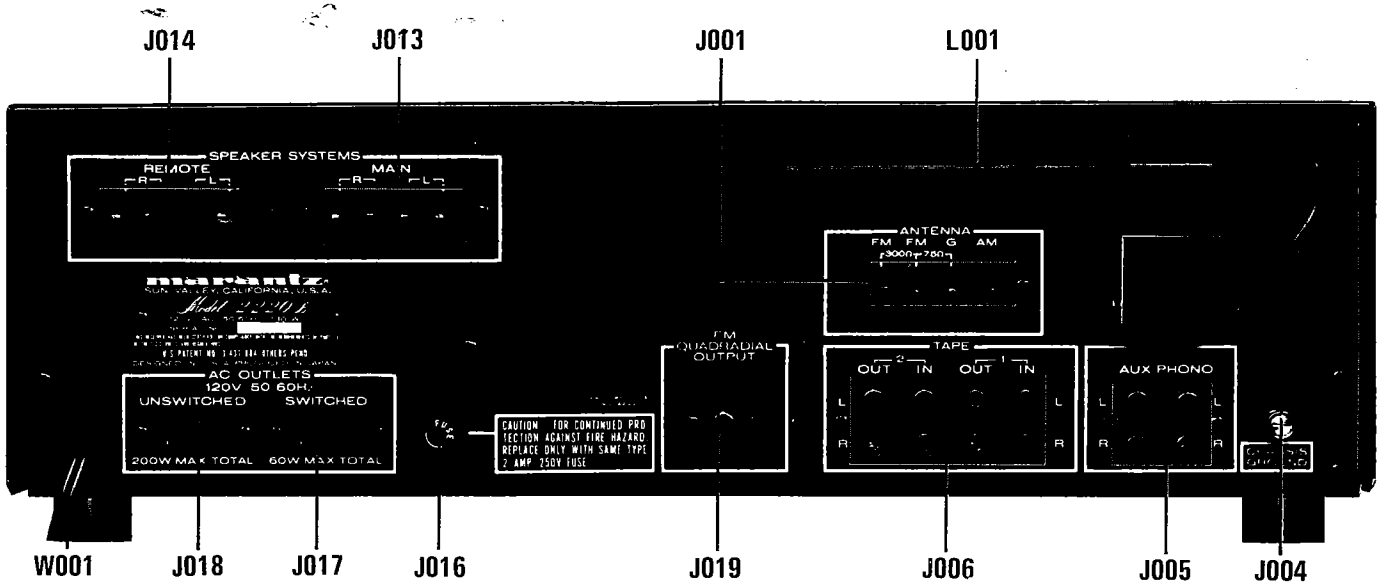

Figure 4. Rear Panel Adjustment and Component Locations

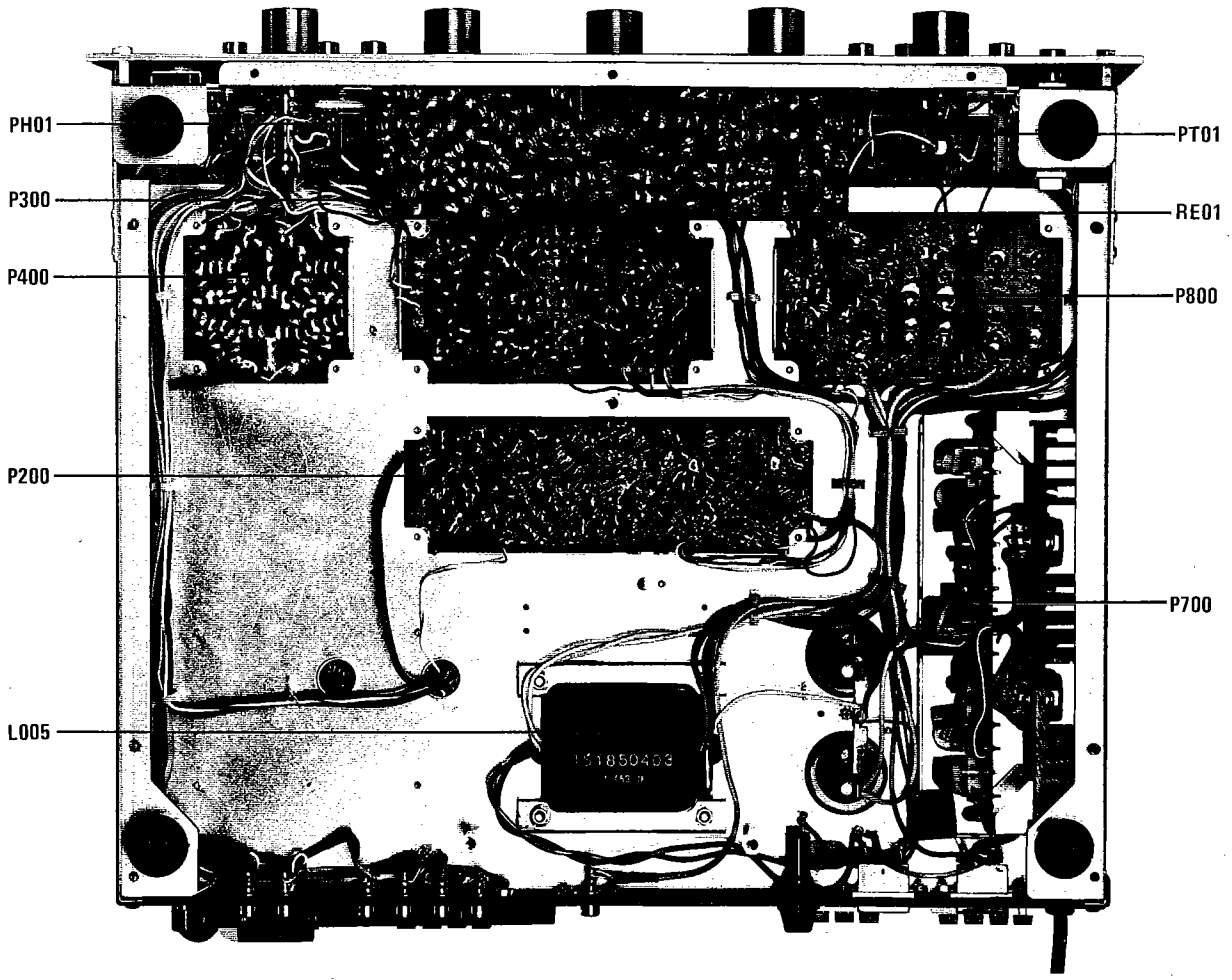

Figure 5. Main Chassis Component Locations (Bottom View)

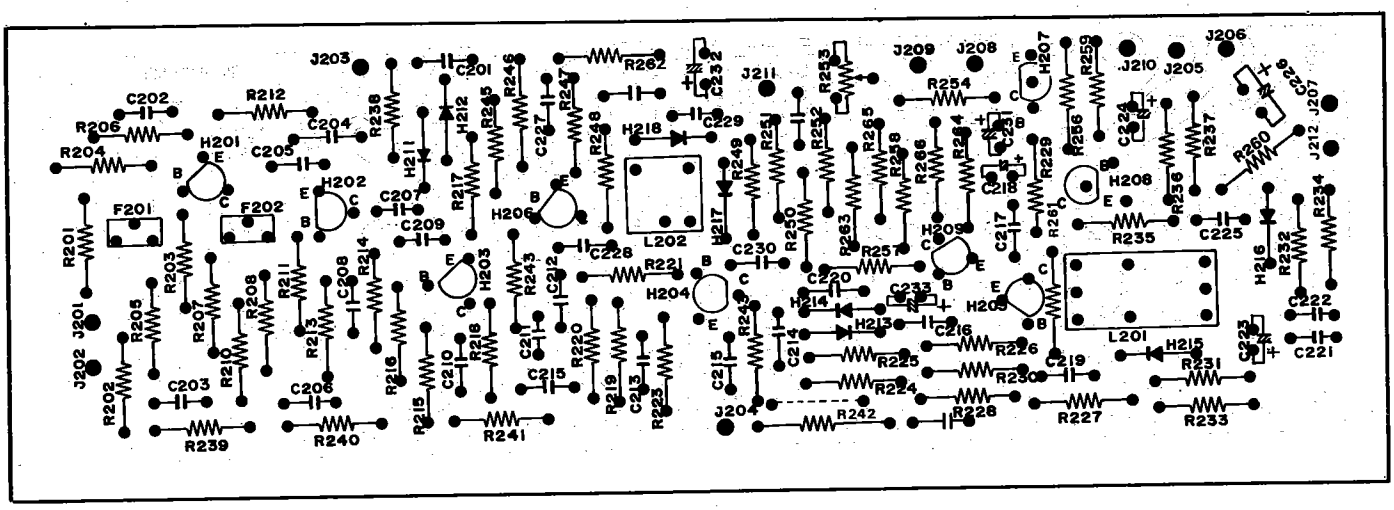

Figure 6. FM Front End and AM Tuner Assembly P100 Component Locations

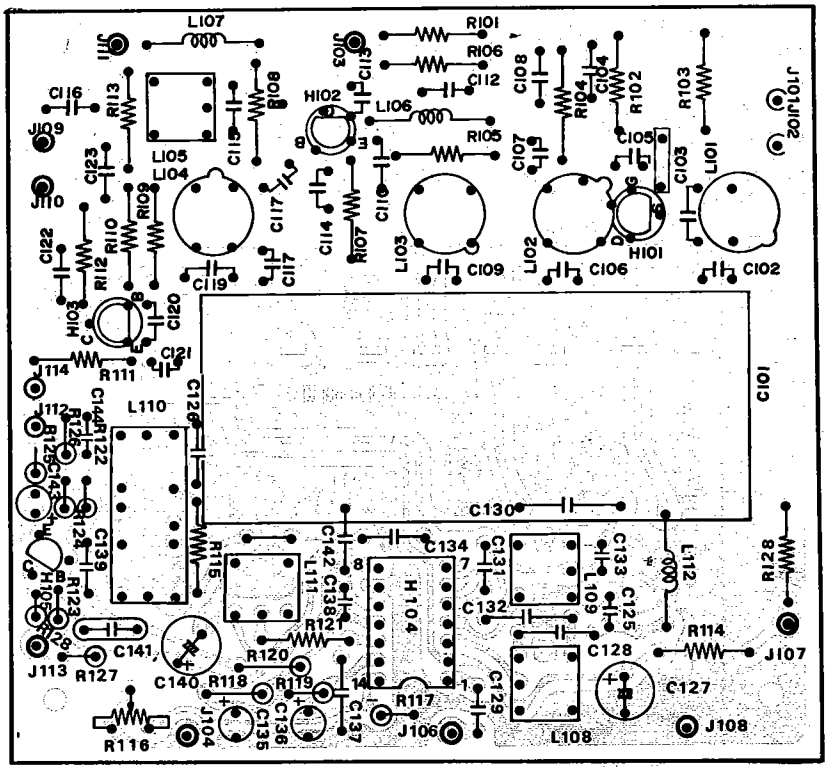

Figure 7. FM IF Amplifier, Detector, Muting Control and Meter Amplifier Unit Assembly P200 Component Locations

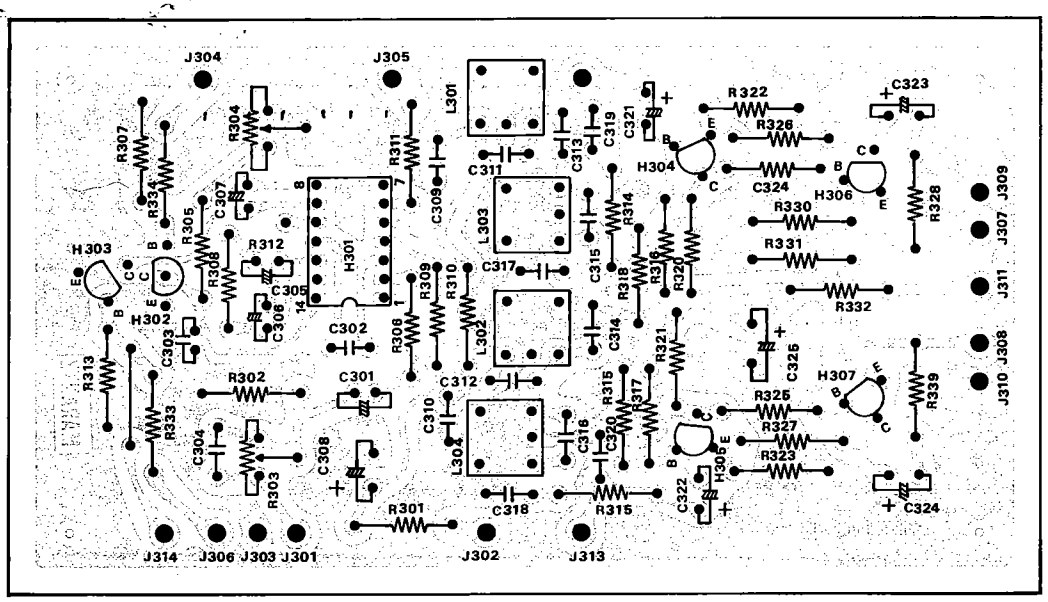

Figure 8. MPX Stereo Decoding Amplifier Assembly P300 Component Locations

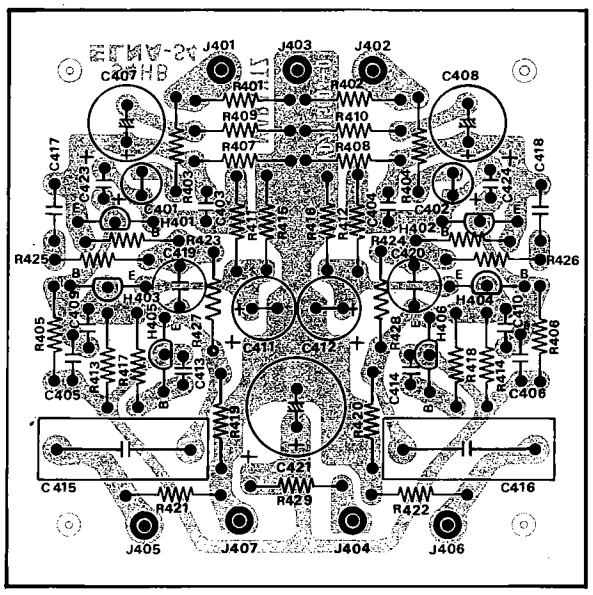

Figure 9. Phono Amplifier Assembly P400 Component Locations