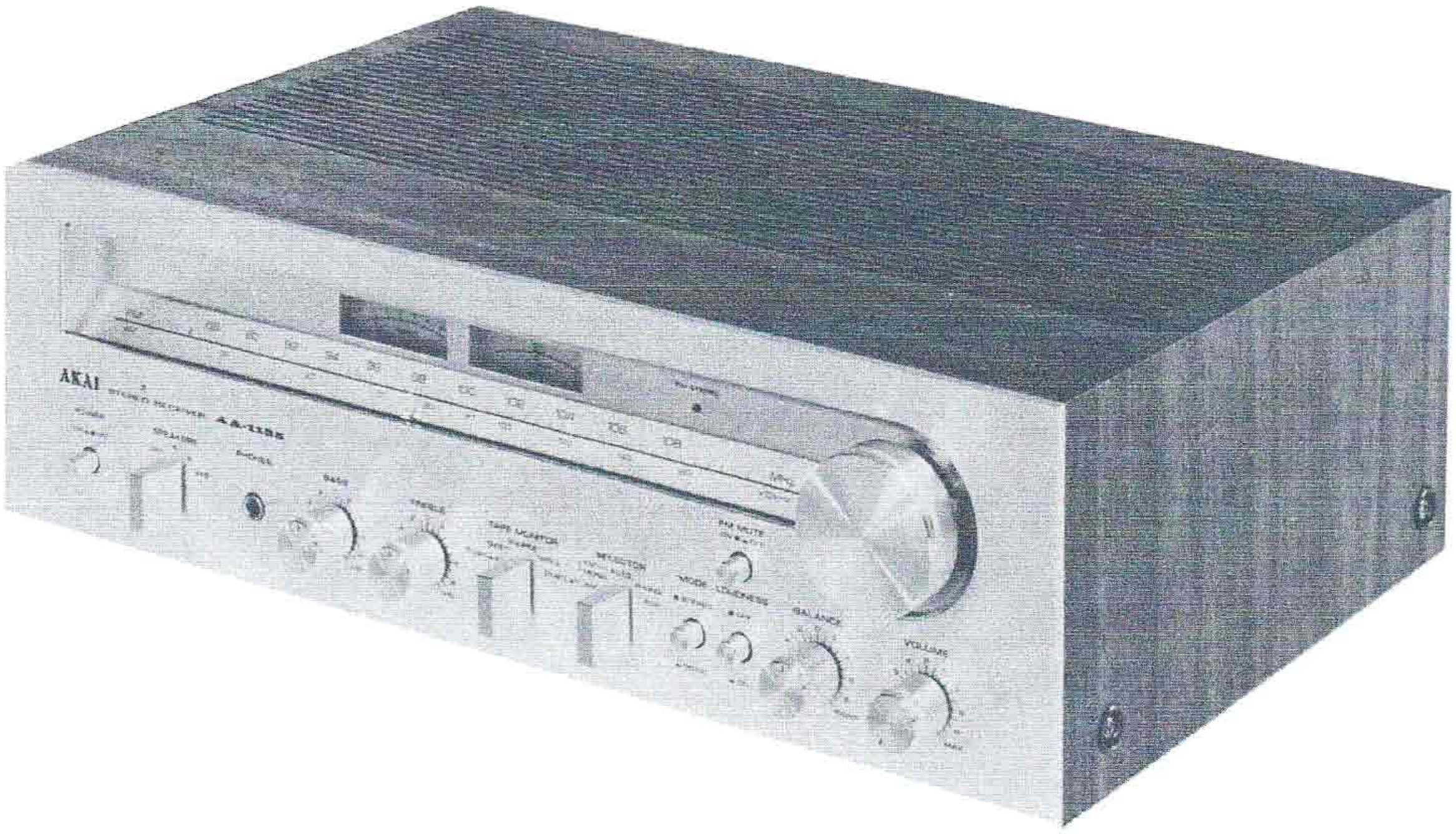
SERVICE MANUAL

PARTS LIST

MODEL AA-1135
AA-1150

AKAI

ALSO APPLICABLE TO BLACK MODEL



AKAI STEREO RECEIVER

MODEL AA-1135 AA-1150

SECTION 1

SERVICE MANUAL

TABLE OF CONTENTS

For basic adjustments, measuring methods, and operating principles, refer to GENERAL OPERATING PRINCIPLES AND ADJUSTMENTS.

I. TECHNICAL DATA

AMPLIFIER SECTION

	AA-1135	AA-1150
POWER OUTPUT	35 watts per channel, min RMS, at 8 ohms from 20 to 20,000 Hz with no more than 0.2% T.H.D.	50 watts per channel, min RMS, at 8 ohms from 20 to 20,000 Hz with no more than 0.1% T.H.D.
POWER BAND WIDTH (IHF)	6 Hz to 50 kHz T.H.D. 0.2% at 8 ohms	6 Hz to 50 kHz T.H.D. 0.1% at 8 ohms
S/N RATIO • PHONO	Better than 80 dB	Better than 80 dB
AUX	Better than 90 dB	Better than 90 dB
RESIDUAL NOISE	Less than 0.8 mV at 8 ohms	Less than 0.5 mV at 8 ohms
CHANNEL SEPARATION (IHF) PHONO	Better than 55 dB at 1 kHz	Better than 55 dB at 1 kHz
DAMPING FACTOR	More than 30 (1 kHz, 8 ohms)	More than 30 (1 kHz, 8 ohms)
OUTPUT SPEAKER	A, B (4 to 16 ohms)/A+B (8 to 16 ohms)	A, B (4 to 16 ohms)/A+B (8 to 16 ohms)
HEADPHONES	4 to 16 ohms	4 to 16 ohms
INPUT SENSITIVITY/IMPEDANCE		
PHONO	3 mV/47 kohms	3 mV/47 kohms
AUX	150 mV/100 kohms	150 mV/100 kohms
TAPE MONITOR 1) INPUT	PIN: 150 mV/100 kohms DIN: 150 mV/100 kohms	PIN: 150 mV/100 kohms DIN: 150 mV/100 kohms
OUTPUT	PIN: 150 mV/4 kohms DIN: 30 mV/30 kohms	PIN: 150 mV/4 kohms DIN: 30 mV/30 kohms
2) INPUT	PIN: 150 mV/100 kohms	PIN: 150 mV/100 kohms
OUTPUT	PIN: 150 mV/100 kohms	PIN: 150 mV/100 kohms
FREQUENCY RESPONSE		
PHONO (RIAA)	30 Hz to 15 kHz ±1 dB	30 Hz to 15 kHz ±1 dB
AUX/TAPE MONITOR	6 Hz to 70 kHz +0 dB, −2 dB	6 Hz to 70 kHz +0 dB, −2 dB
TONE CONTROL BASS	±9 dB at 100 Hz	±9 dB at 100 Hz
TREBLE	±9 dB at 10 kHz	±9 dB at 10 kHz
LOUDNESS CONTROL	±10 dB at 100 Hz, +5 dB at 10 kHz (Volume control set −30 dB position)	+10 dB at 100 Hz, +5 dB at 10 kHz (Volume control set −30 dB position)
FILTER HIGH		−6 dB at 10 kHz
LOW		−6 dB at 50 Hz

TUNER SECTION

FM

	AA-1135	AA-1150
FREQUENCY RANGE	88 MHz to 108 MHz	88 MHz to 108 MHz
SENSITIVITY (IHF)	1.8 μV	1.7 μV
CAPTURE RATIO	1.3 dB	1.3 dB
SELECTIVITY (IHF)	More than 70 dB	More than 70 dB
IMAGE REJECTION	More than 65 dB (at 98 MHz)	More than 90 dB (at 98 MHz)
IF REJECTION	More than 90 dB (at 98 MHz)	More than 100 dB (at 98 MHz)
SPRIOUS REJECTION	More than 90 dB (at 98 MHz)	More than 100 dB (at 98 MHz)
AM SUPRESSION	50 dB	50 dB
S/N RATIO	65 dB	65 dB
HARMONIC DISTORTION MONO	Less than 0.2% (100% Mod.)	Less than 0.15% (100 Mod.)
STEREO	Less than 0.4% (100% Mod.)	Less than 0.3% (100 Mod.)
STREO SEPARATION	More than 40 dB at 1 kHz	More than 42 dB at 1 kHz
SUBCARRIER SUPPRESSION	More than 52 dB	More than 75 dB

AM

FREQUENCY RANGE	520 kHz to 1,605 kHz	520 kHz to 1,605 kHz
SENSITIVITY (IHF)	180 μV/m (Bar antenna), 10 μV (External antenna)	180 μV/m (Bar antenna), 10 μV (External antenna)
SELECTIVITY (IHF)	More than 30 dB	More than 30 dB
IMAGE REJECTION	More than 65 dB at 1 MHz	More than 65 dB at 1 MHz
IF REJECTION	More than 45 dB	More than 45 dB
S/N RATIO	45 dB	45 dB

TUNING INDICATOR METER	FM center tuning/AM, FM signal strength meter	FM center tuning/AM, FM signal strength meter
MUTING LEVEL CONTROL	Switchable to ON/OFF	Switchable to ON/OFF, 3 to 300 μV Variable
ANTENNA INPUT IMPEDANCE	300 ohms balanced, 75 ohms unbalanced	300 ohms balanced, 75 ohms unbalanced

MISCELLANEOUS

	AA-1135	AA-1150
TRANSISTORS	37	39
DIODES	20	24
FET	1	1
ICs	4	4
POWER REQUIREMENTS	U.S.A. & Canada models: 120V, 60 Hz CEE models: 220V, 50 Hz Other models: 110/220/240 V switchable, 50/60 Hz	U.S.A. & Canada models: 120V, 60 Hz CEE models: 220V, 50 Hz Other models: 110/220/240V switchable, 50/60 Hz
DIMENSIONS	480(W) x 155(H) x 345(D) mm (18.9 x 6.1 x 13.6 inches)	480(W) x 155(H) x 345(D) mm (18.9 x 6.1 x 13.6 inches)
WEIGHT	10.8 kg (23.8 lbs)	11.7 kg (25.7 lbs)

* For improvement purposes, specifications and design are subject to change without notice.

II. DISMANTLING OF UNIT

In case of trouble, etc. necessitating disassembly, please desassemble in the order shown in photographs. Reassemble in reverse order.

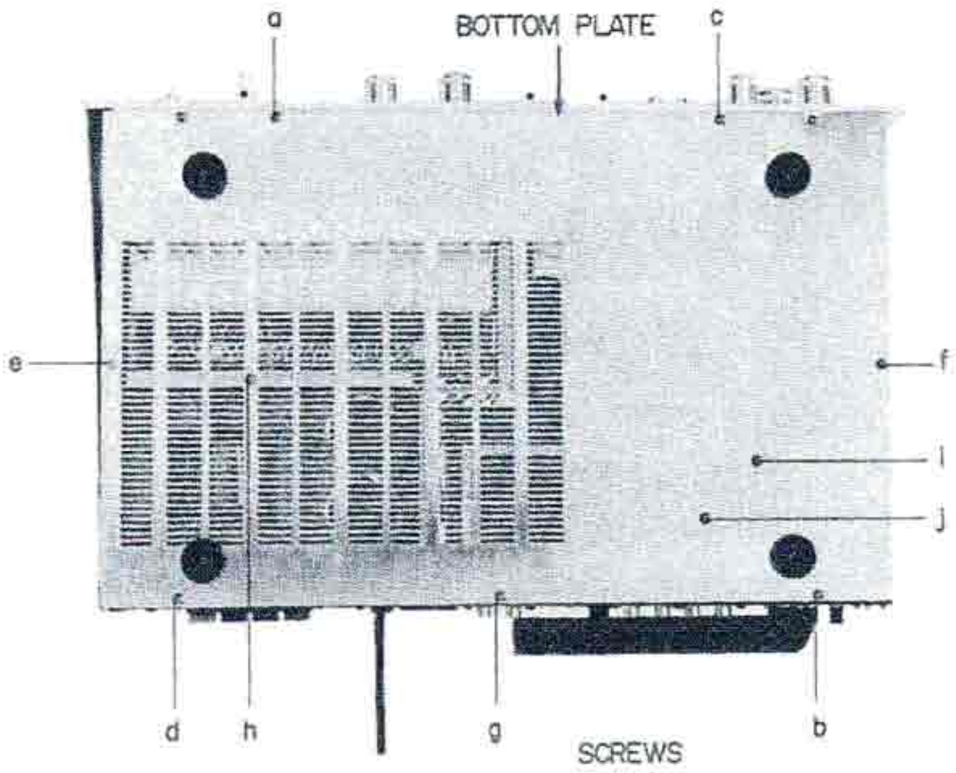
1

SCREWS

2

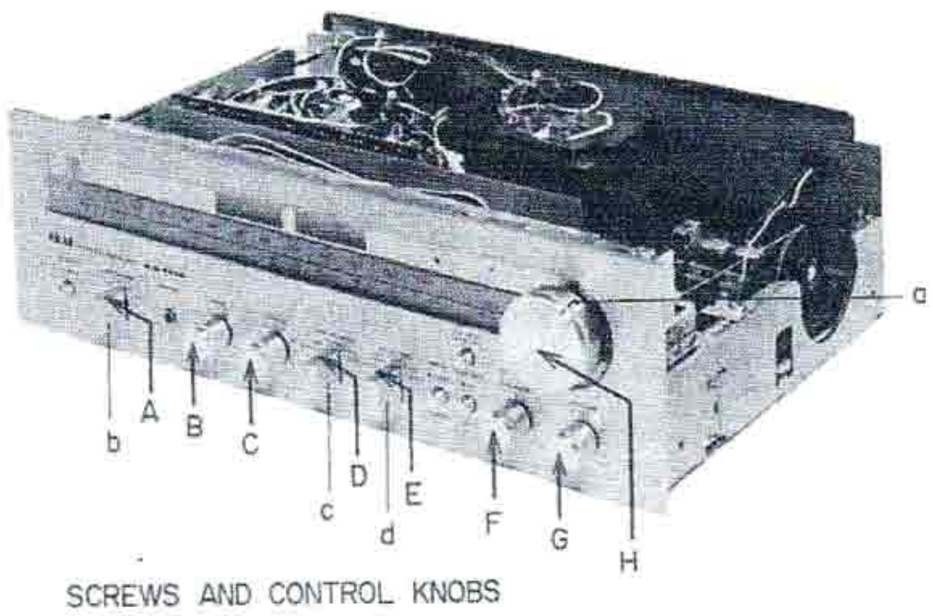
SCREWS

3



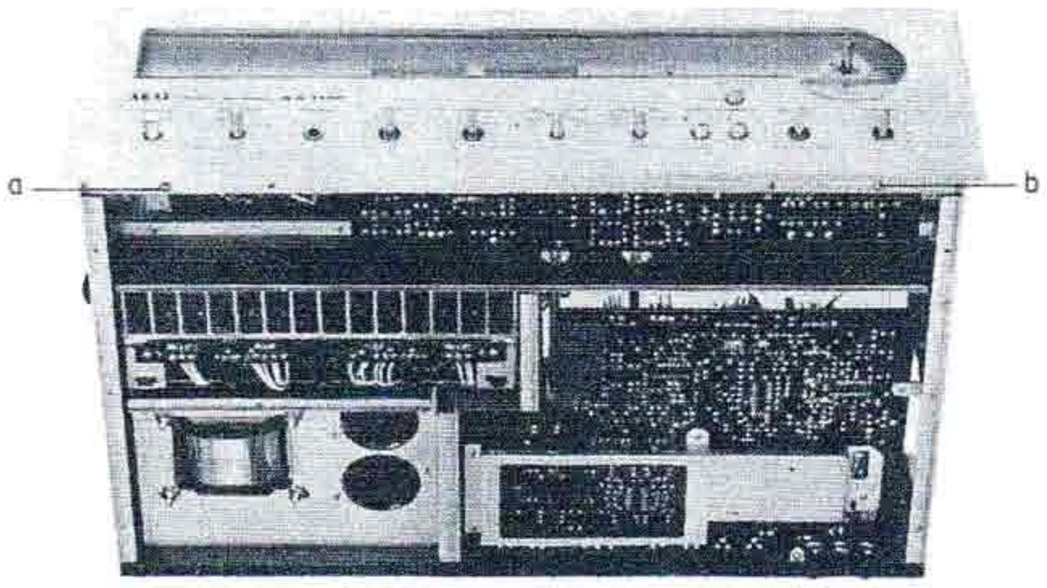
SCREWS

4



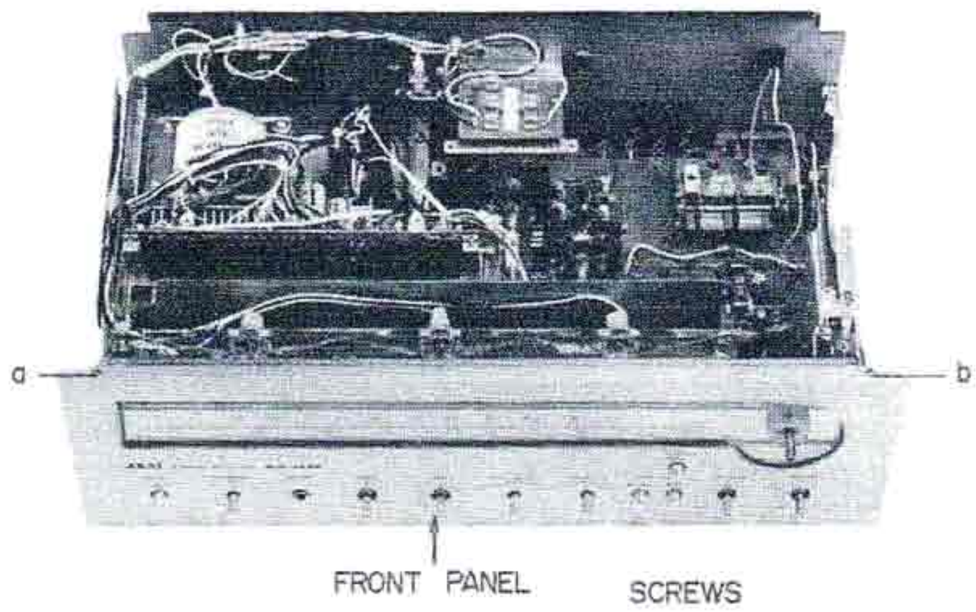
SCREWS AND CONTROL KNOBS

5



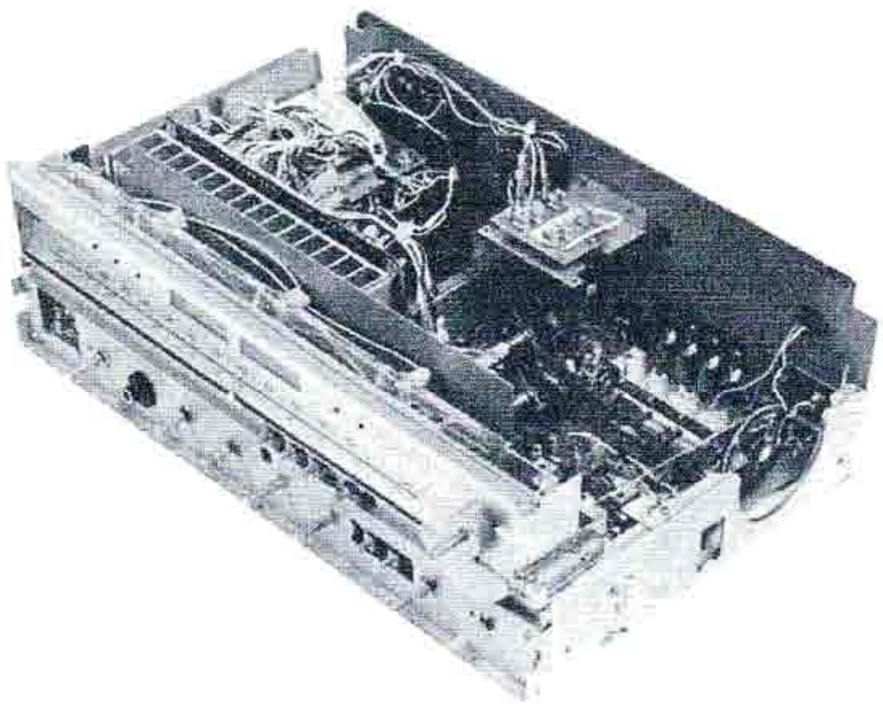
SCREWS

6



SCREWS

7



1. MODEL AA-1135

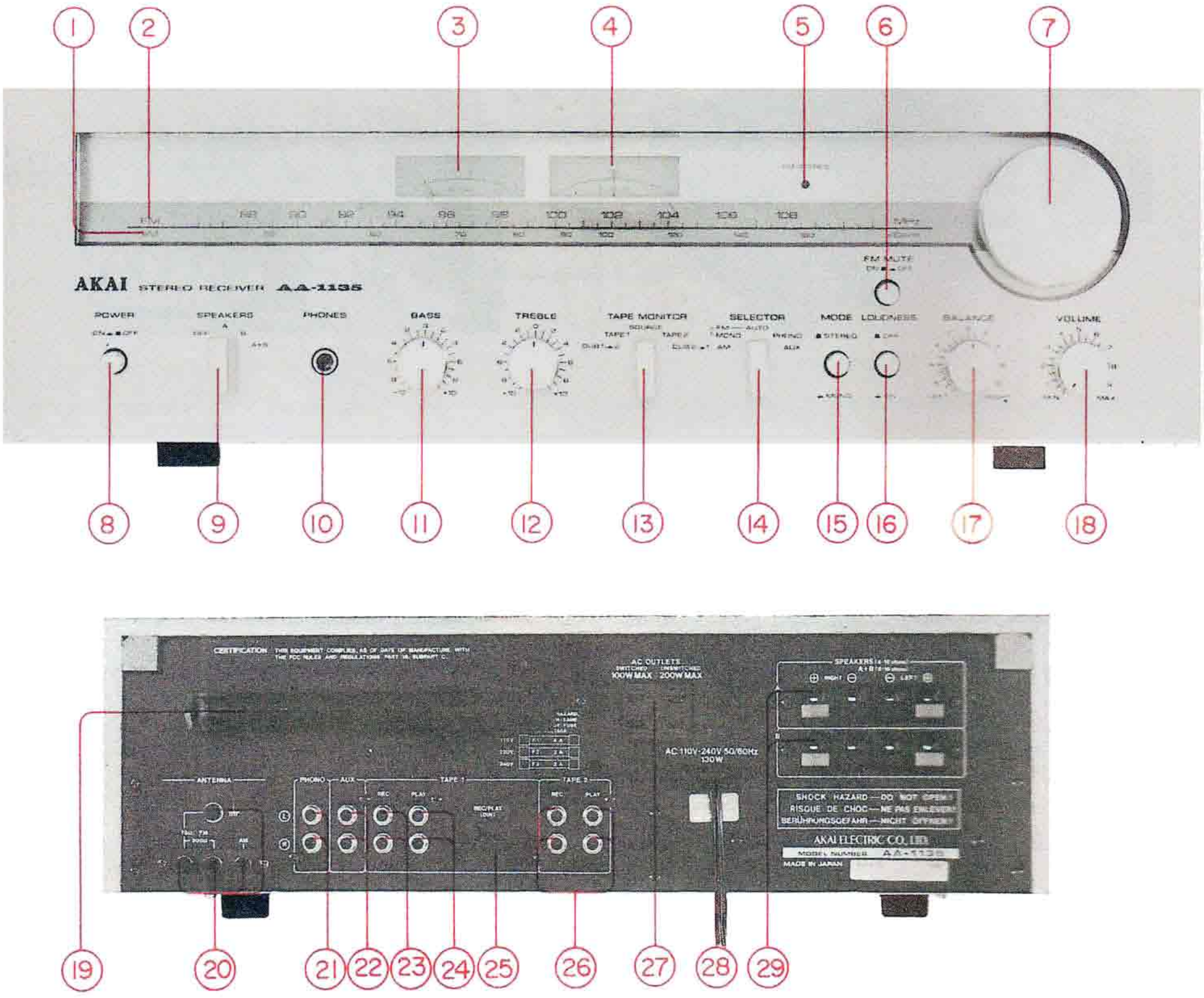


Fig. 1 Controls AA-1135

1. AM DIAL SCALE
2. FM DIAL SCALE
3. SIGNAL STRENGTH METER
4. FM TUNING METER
5. FM STEREO LAMP
6. FM MUTE SWITCH
7. TUNING KNOB
8. POWER SWITCH
9. SPEAKER SYSTEM SELECTOR
10. HEADPHONE JACK
11. BASS CONTROL KNOB
12. TREBLE CONTROL KNOB
13. TAPE MONITOR
14. SOURCE SELECTOR
15. MODE SWITCH
16. LOUDNESS SWITCH
17. STEREO BALANCE CONTROL
18. VOLUME CONTROL
19. AM FERRITE BAR ANTENNA
20. FM AND AM ANTENNA TERMINALS
21. PHONO JACK
22. AUX JACK
23. TAPE 1 SYSTEM REC JACKS
24. TAPE 1 SYSTEM PLAY JACKS
25. TAPE 1 SYSTEM DIN JACK
26. TAPE 2 SYSTEM REC/PLAY JACKS
27. AC OUTLETS (CEE models not equipped with this facility)
28. AC CORD (CEE model is equipped with an AC Inlet instead of an AC cord. Connect with an appropriate power cord)
29. A AND B SYSTEM SPEAKER TERMINALS

2. MODEL AA-1150

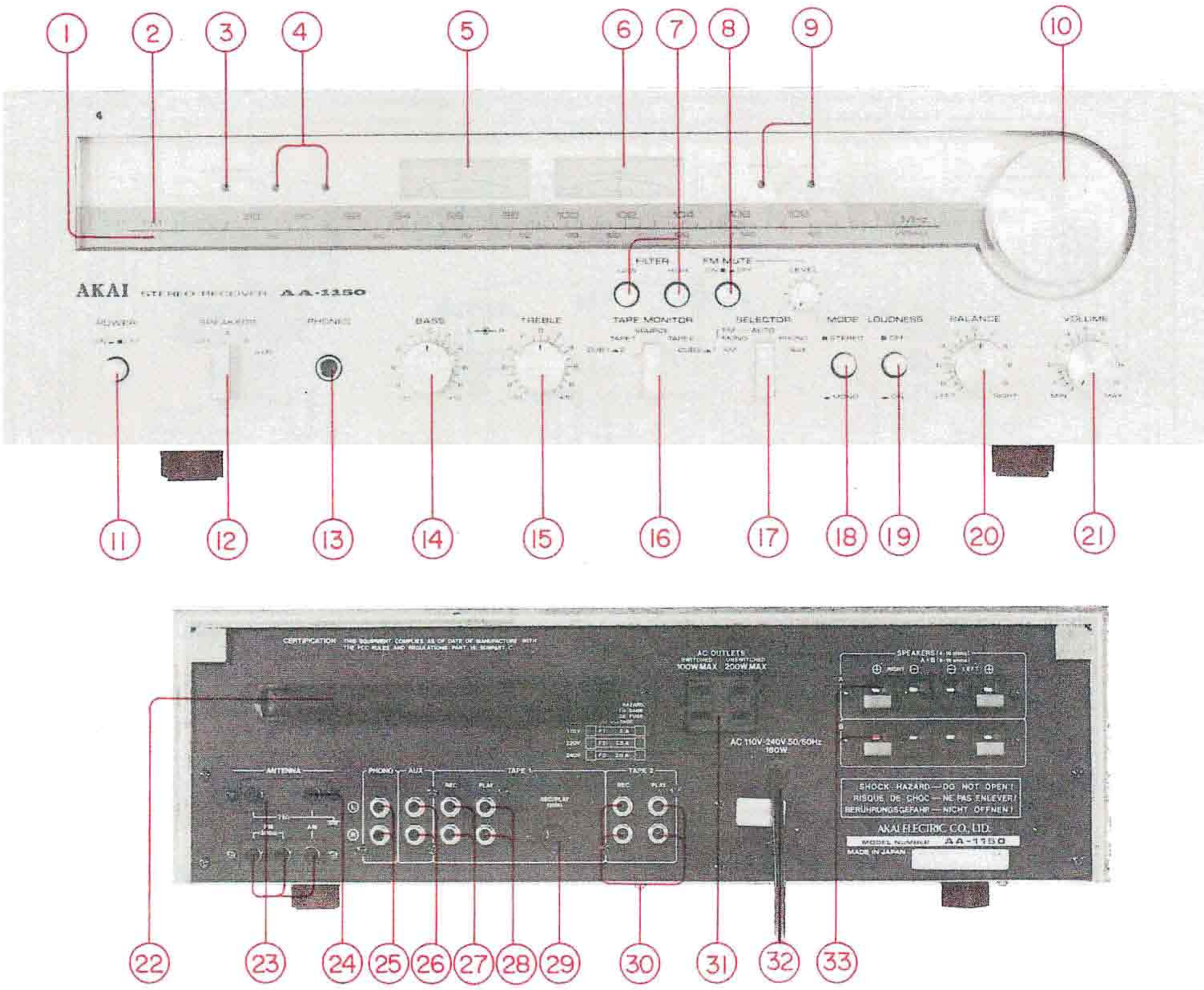


Fig. 2 Controls AA-1150

1. AM DIAL SCALE
2. FM DIAL SCALE
3. FM STEREO INDICATOR LAMP
4. AM AND FM INDICATOR LAMPS
5. SIGNAL STRENGTH METER
6. FM TUNING METER
7. LOW AND HIGH FILTER SWITCH
8. FM MUTE SWITCH AND LEVEL ADJUSTER
9. PHONO AND AUX INDICATOR LAMPS
10. TUNING KNOB
11. POWER SWITCH
12. SPEAKER SYSTEM SELECTOR
13. HEADPHONE JACK
14. BASS CONTROL KNOB (Left and Right)
15. TREBLE CONTROL KNOB (Left and Right)
16. TAPE MONITOR
17. SOURCE SELECTOR
18. MODE SWITCH
19. LOUDNESS SWITCH
20. BALANCE CONTROL
21. VOLUME CONTROL
22. AM FERRITE BAR ANTENNA
23. AM AND FM ANTENNA TERMINALS
24. GROUND TERMINAL
25. PHONO JACK
26. AUX JACK
27. TAPE 1 SYSTEM REC JACKS
28. TAPE 1 SYSTEM PLAY JACKS
29. TAPE 1 SYSTEM DIN JACK
30. TAPE 2 SYSTEM REC/PLAY JACKS
31. AC OUTLETS (CEE models not equipped with this facility)
32. AC CORD (CEE models is equipped with an AC Inlet instead of an AC cord. Connect with an appropriate power cord.)
33. 'A AND B SYSTEM SPEAKER TERMINALS

1. MODEL AA-1135

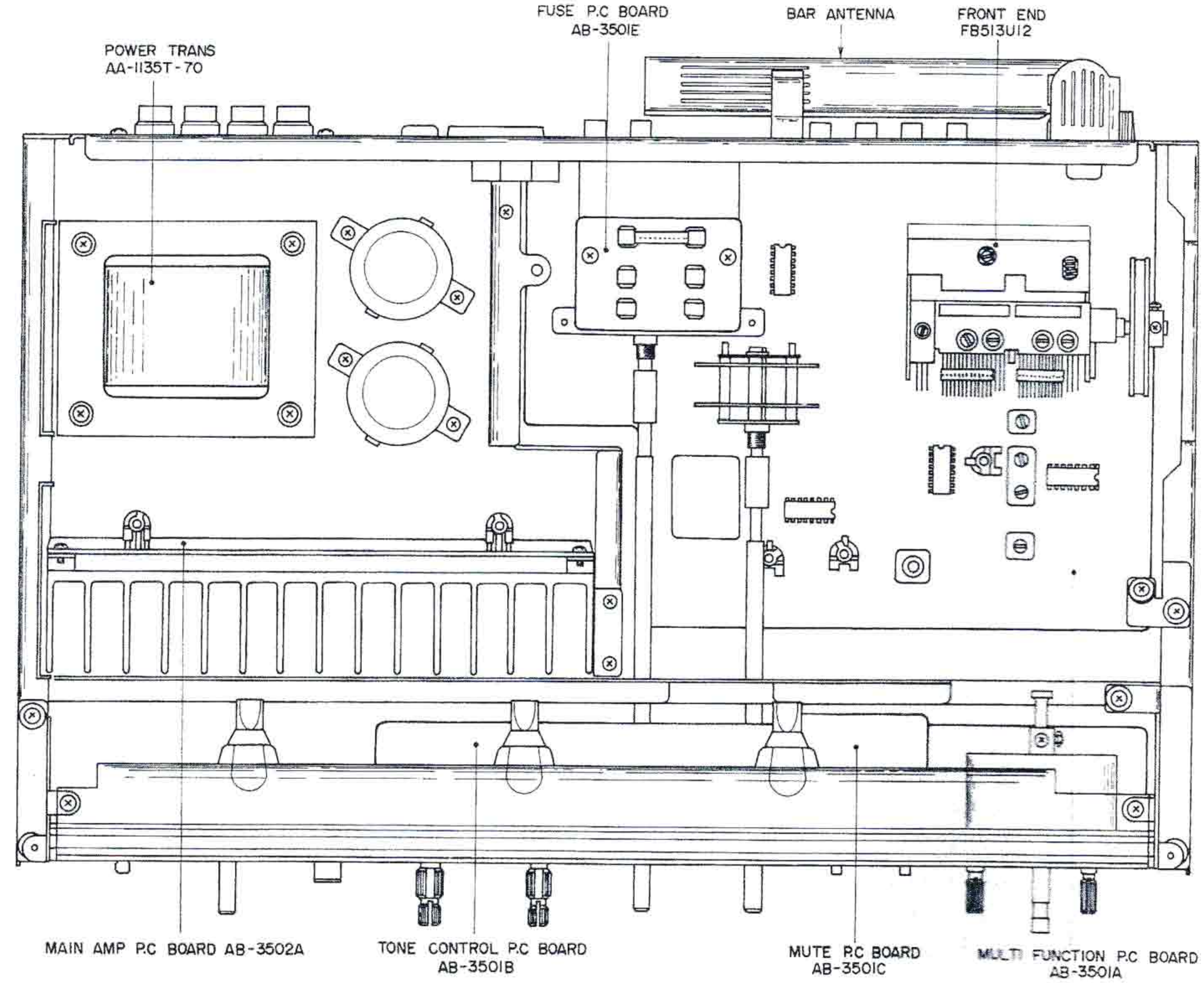


Fig. 3 Top View (AA-1135)

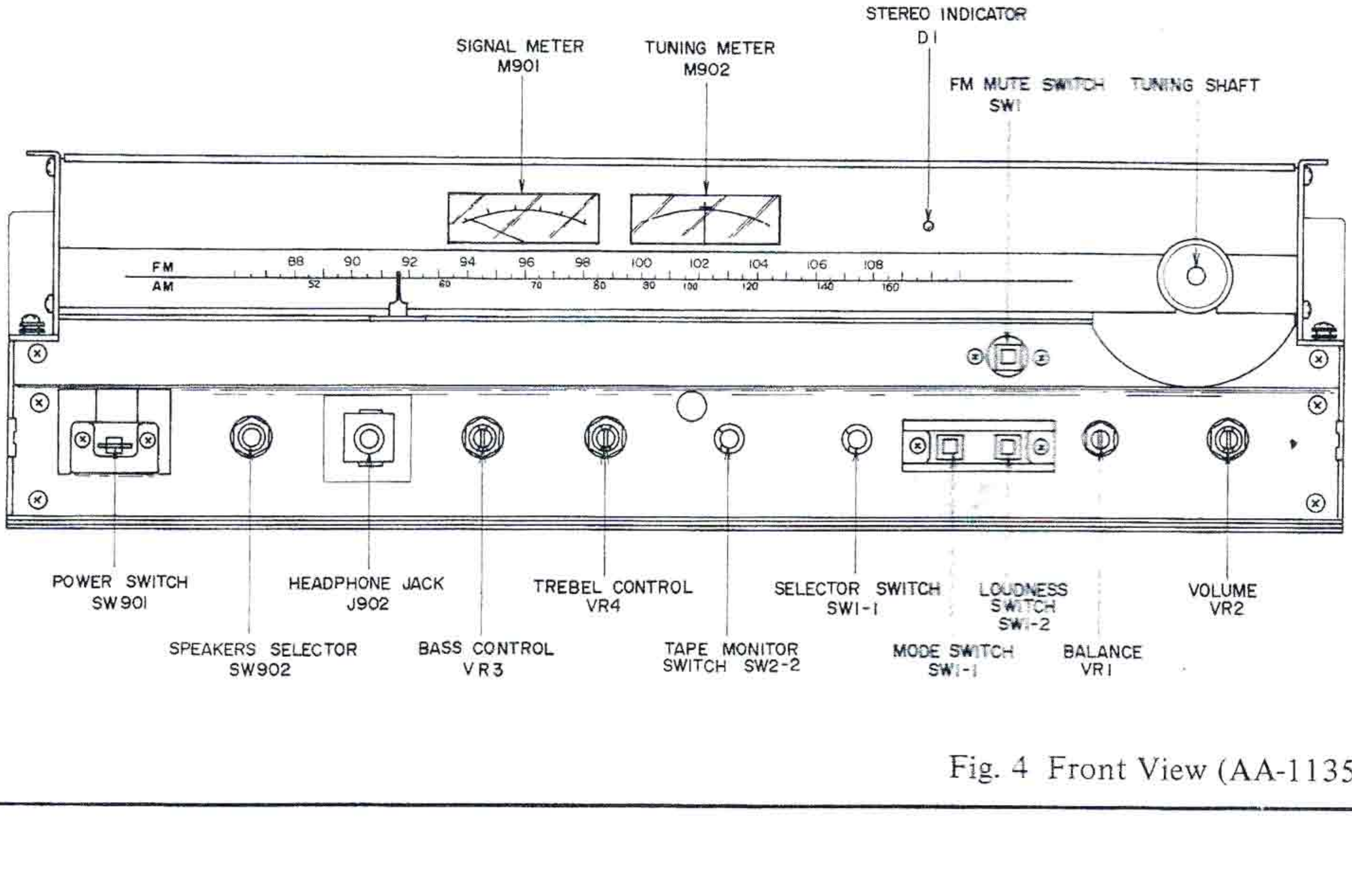


Fig. 4 Front View (AA-1135)

2. MODEL AA-1150

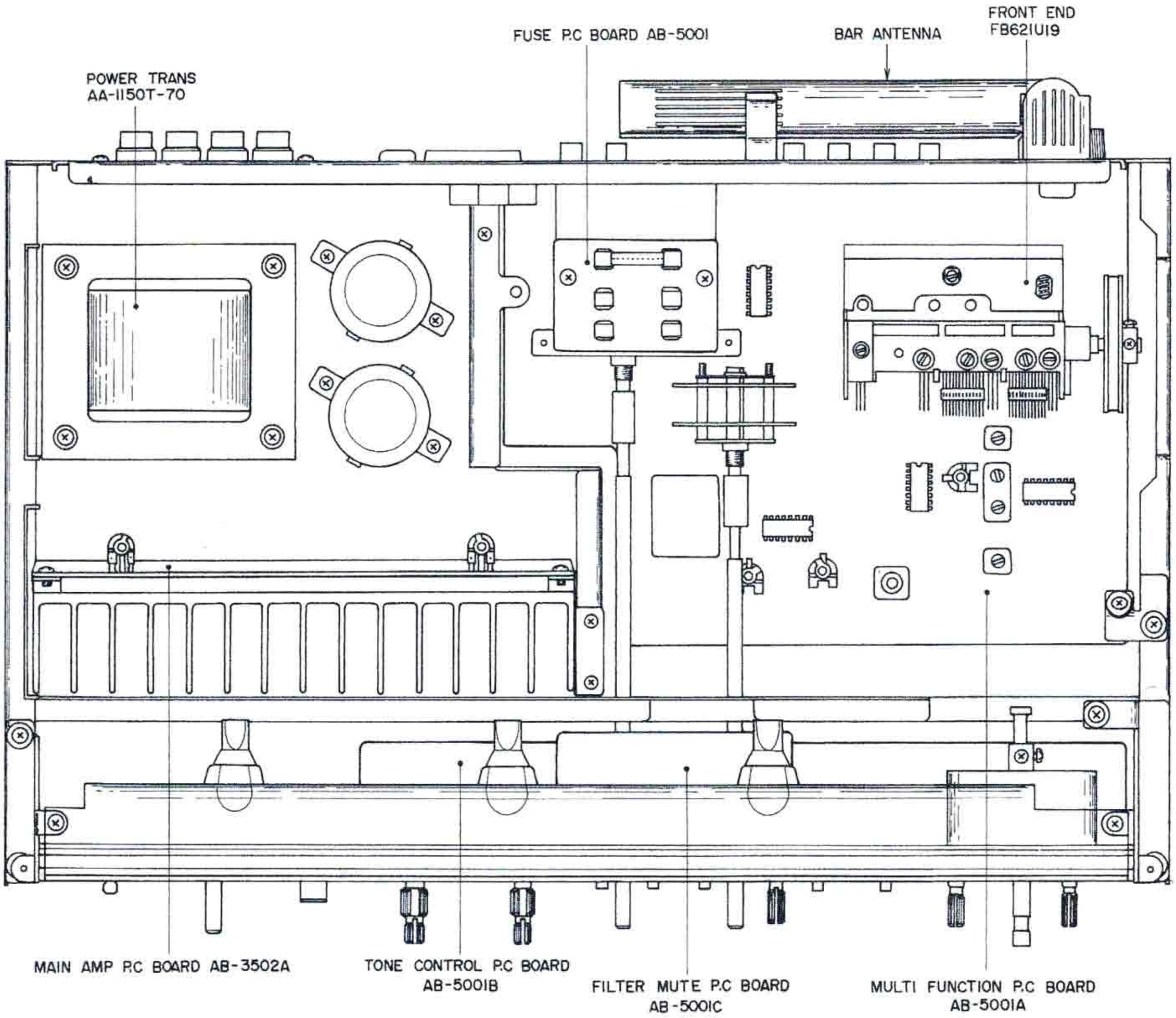
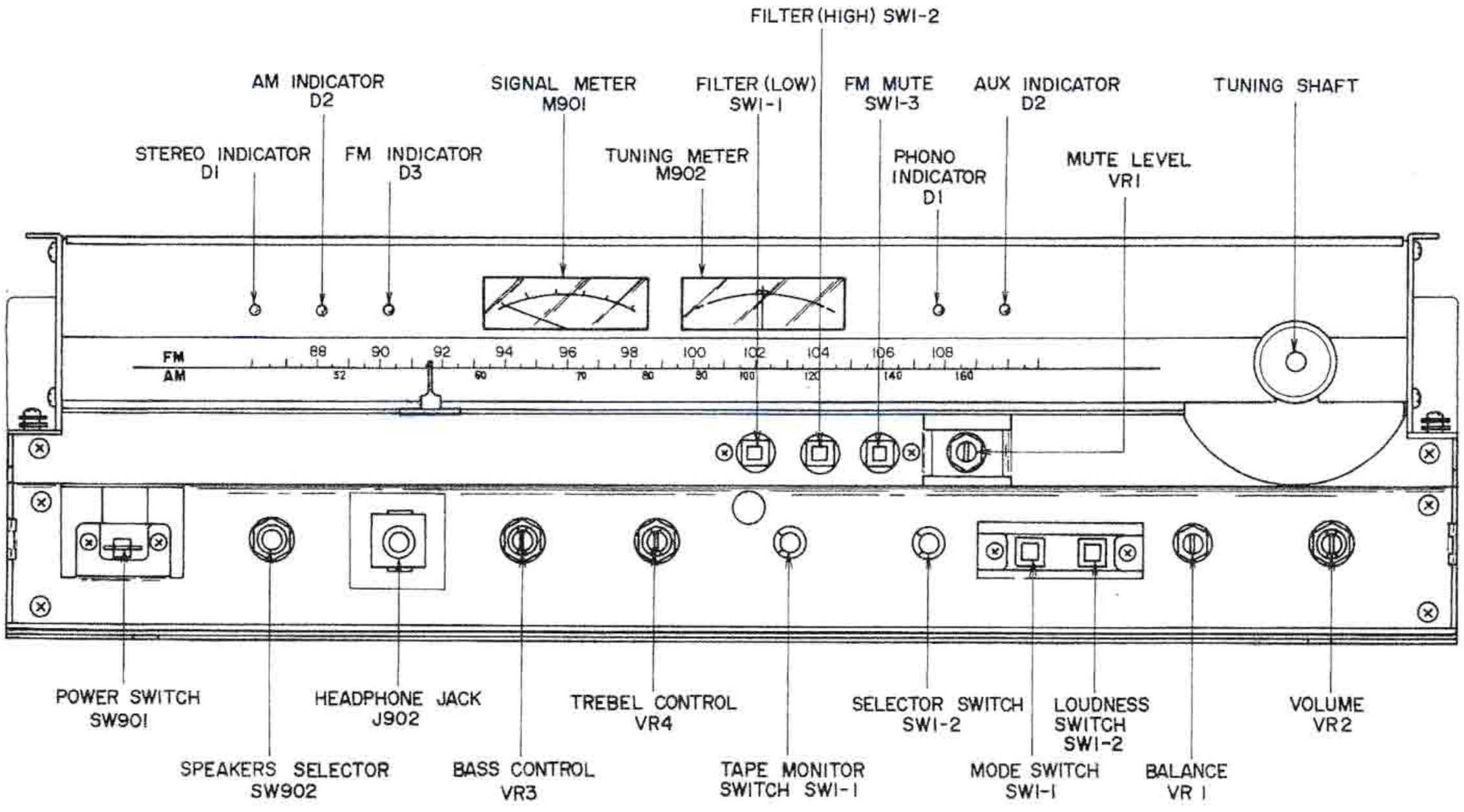


Fig. 5 Top View (AA-1150)



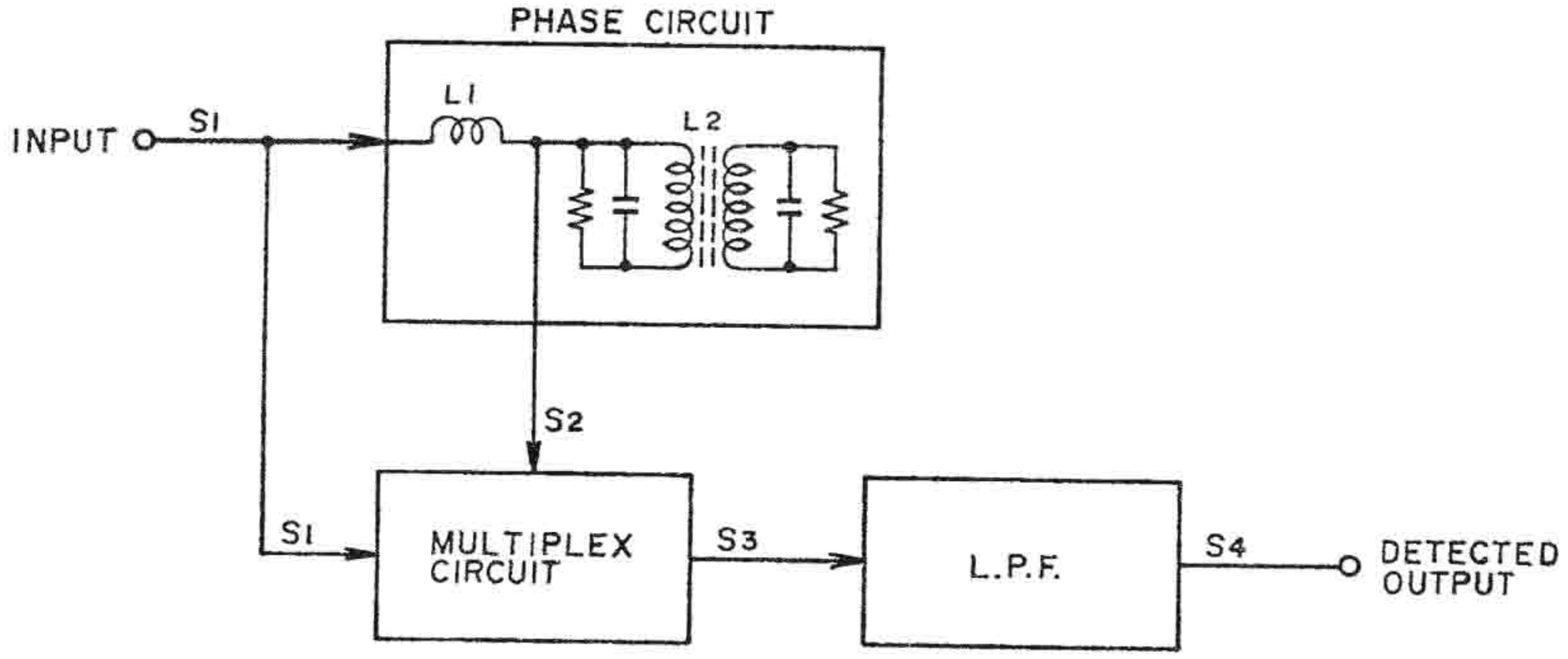


Fig. 7 Quadrature Detection Block Diagram

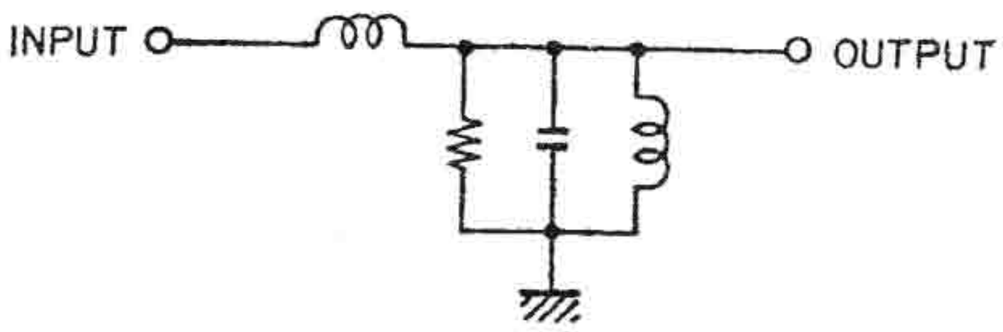


Fig. 8 Single Tuning Type

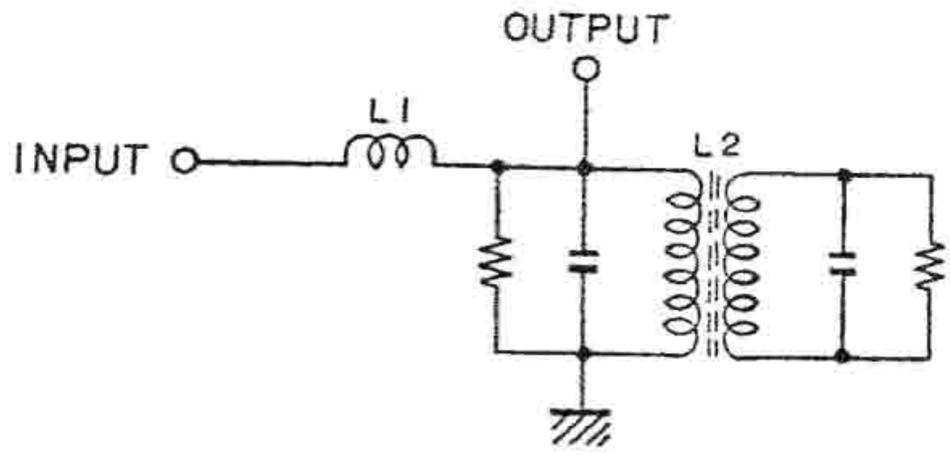


Fig. 9 Double Tuning Type

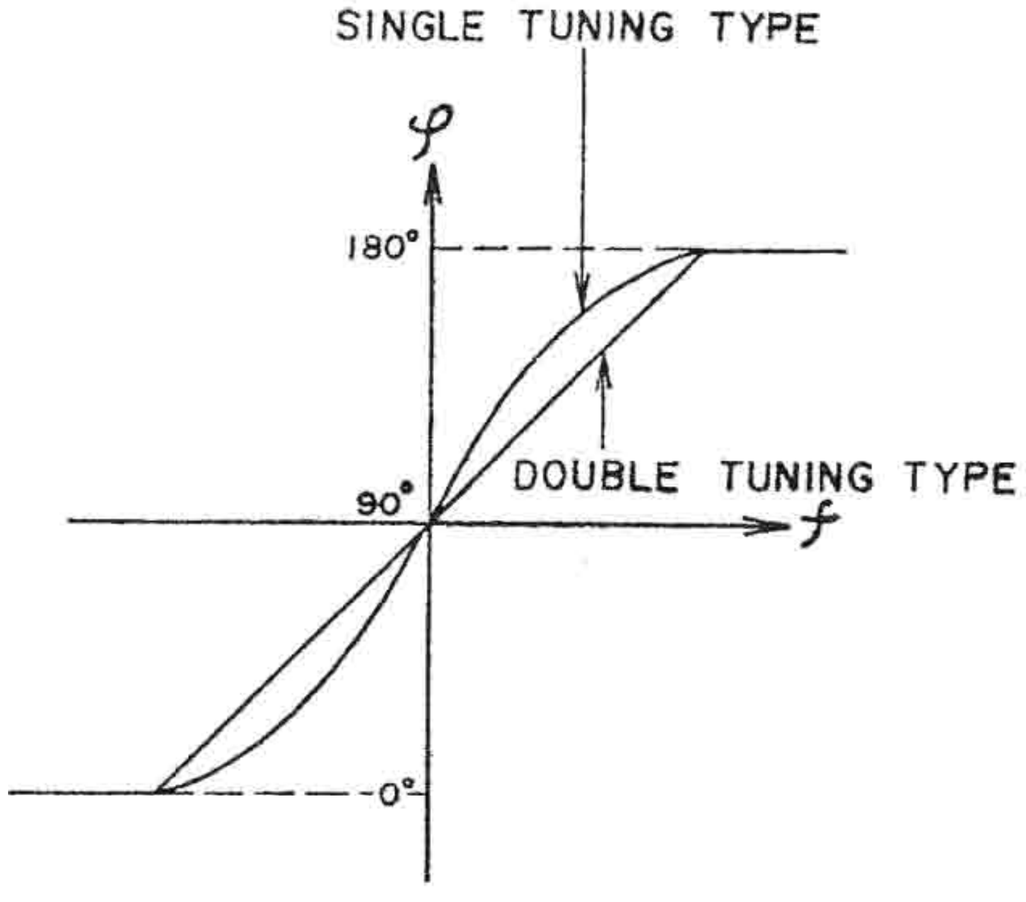


Fig. 10 Tuning Curve

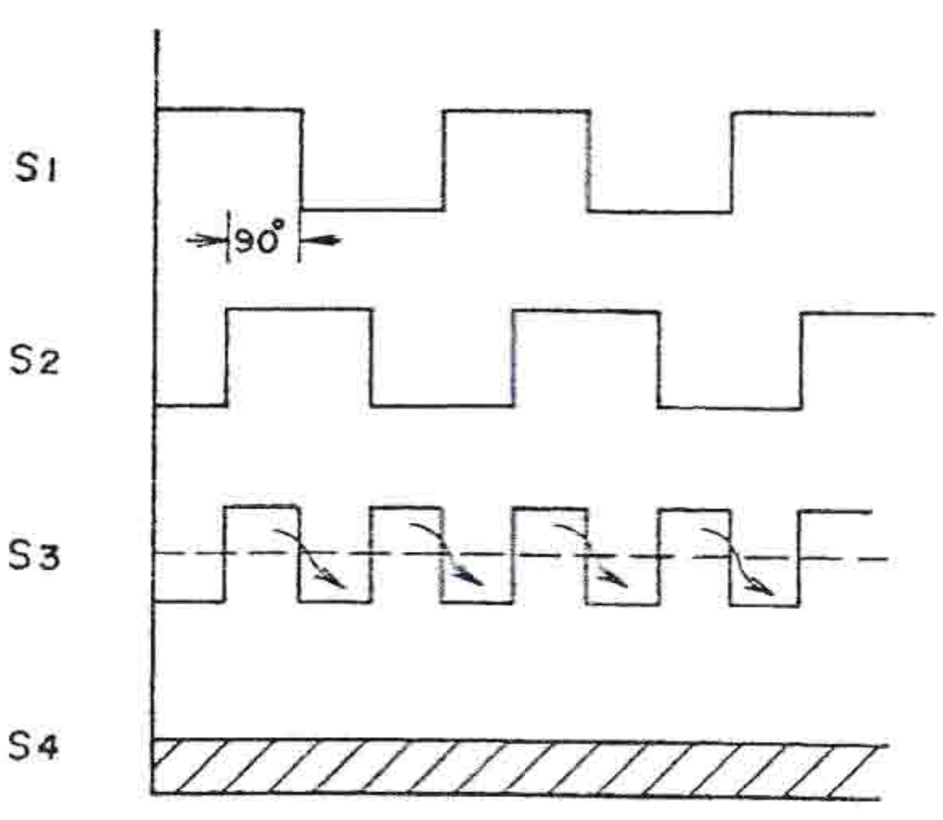


Fig. 11 Output at Non-modulation

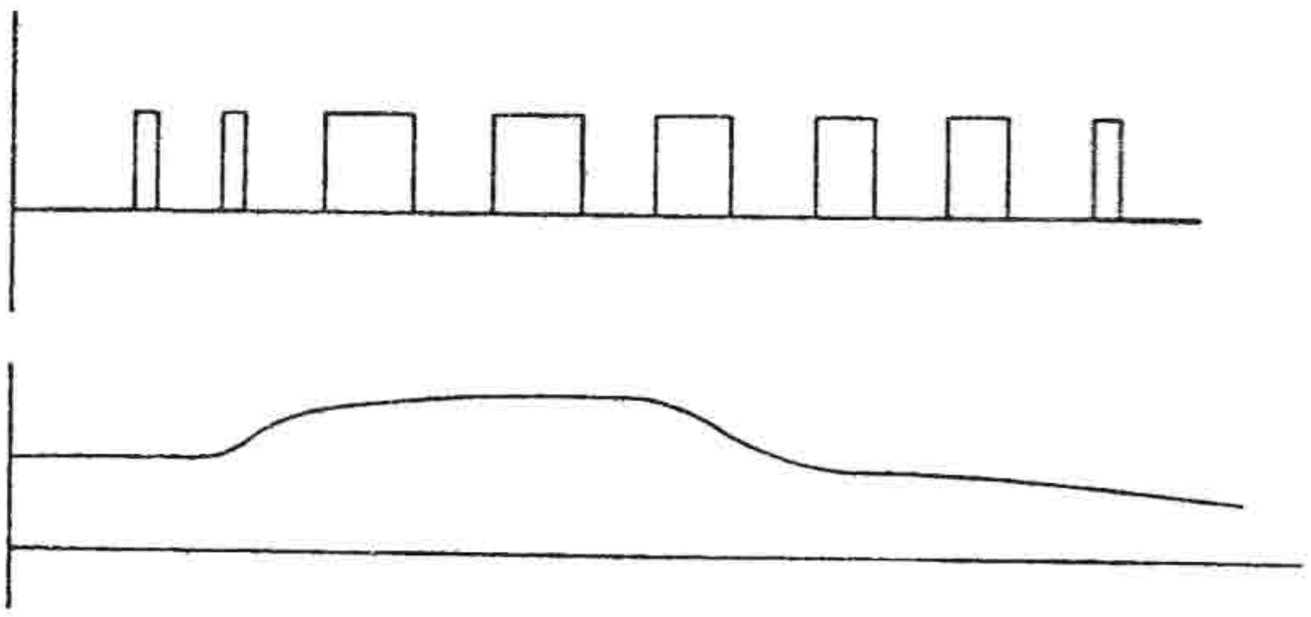


Fig. 12 Output at Modulation Time

The Quadrature Detection Circuit is comprised of a Phase Circuit, a Multiplier Circuit and a Low Pass Filter (L.P.F.) as shown in Fig. 7.

There are two types of Phase Circuits, the Single tuning type shown in Fig. 8 and the Double tuning type shown in Fig. 9. However, because with the double tuning type there is less frequency deviation in relation to carrier frequency, linearity is improved as shown in Fig. 10 and phase distortion is reduced this type phase circuit is employed in the AA-1135 and AA-1150.

Input signal S1 in divided into the part which enters the direct multiplier circuit and the part which passes the phase circuit and enters the multiplier circuit. The signal supplied to the phase circuit is always 90° phase delayed at L1. Also because at Non-modulation time, L2 is tuned to 10.7 MHz, if modulation is applied and S1 is changed from 10.7 MHz, phase deviation at L2 will take place proportionately in relation to this changed part and this becomes S2 signal which is delayed in relation to S1.

At Non-modulation, because as shown in Fig. 11 input signal S1 and 90° phase delayed (by means of L1) signal S2 are switched by means of the multiplier circuit, the output signal becomes S3. Because this S3 passses the low pass filter and becomes S4 fixed direct current, the detector output is zero. Then, when modulation is applied, because the switched output is varied according to the degree of modulation, and the output which passed the low pass filter becomes the pulsating current part as shown in Fig. 12 detector output is obtained.

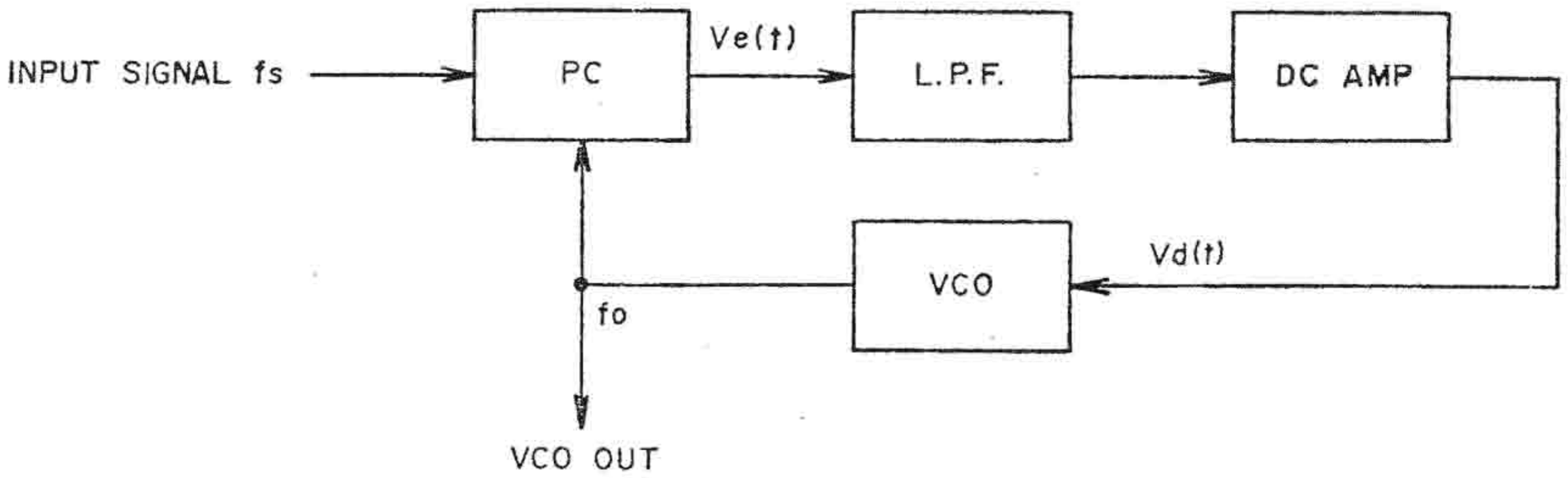


Fig. 13 PLL Circuit

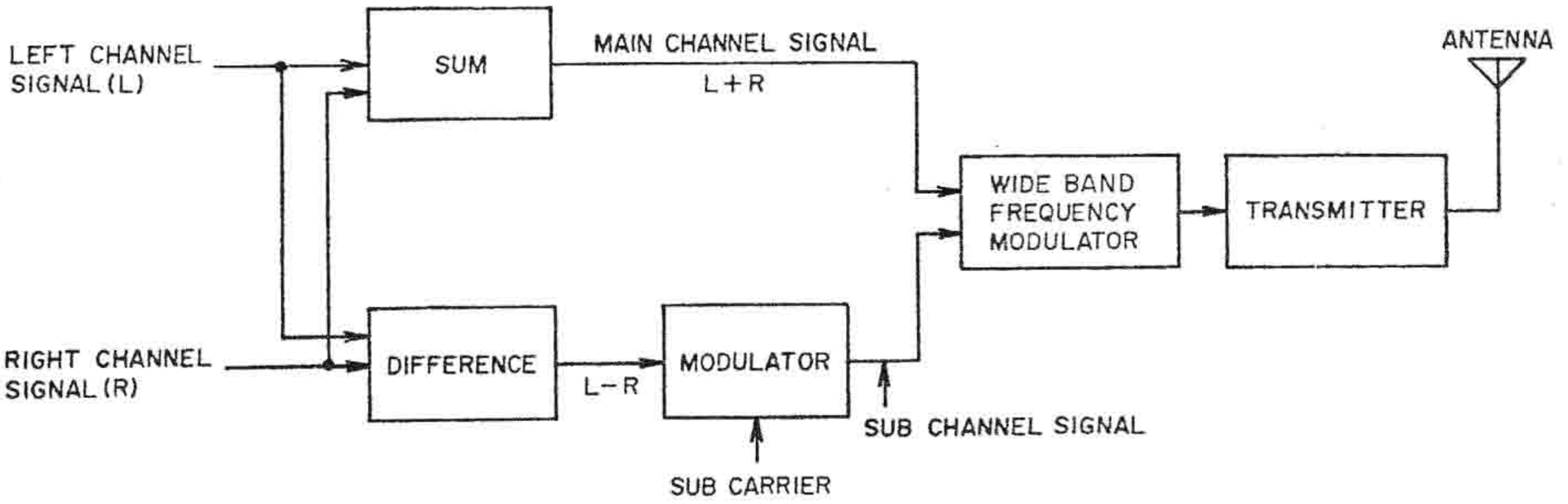


Fig. 14 FM Broadcasting System Diagram

To separate FM stereo broadcast signal received to data into left and right signals, a 19 kHz pilot signal was successively multiplied to form a 38 kHz signal and stereo separation was effected from this. However, with this multiplier system, change in coils due to wear occurred and adjustment points were numerous, etc. Therefore, this model employs a newly developed PLL circuit which produces an exceedingly accurate 38 kHz switching signal.

1. PLL CIRCUIT OPERATION

PLL circuit is a king of feedback circuit and is comprised of a Phase Comparator (PC), a Low Pass Filter (LPF), a Direct Current Amplifier (DC Amp), and a Voltage Control Oscillator (VCO) as shown in Fig. 13.

The PC compares input signal Fs and VCO oscillator output and generates the difference in signal voltage Ve(t) proportionately to this phase deviation. This Ve(t) passes LPF and the DC Amp and becomes control voltage. This control voltage supplied to VCO and VCO oscillation frequency is DC controlled. When there is no input signal Fs, because there is also no Ve(t), control voltage Vd(t) becomes zero, and VCO maintains a *free-running oscillation frequency. When a signal enters, VCO oscillation frequency fo is controlled to narrow the difference between Fs by means of feedback as described above, and the PLL circuit assumes a synchronous condition. This is referred to as input signal lock. (In case the difference between Fo and Fs is too large, the differential signal frequency becomes high and is reduced at the LPF. However, because the VCO control voltage does not change, PLL will not stay within the *lock range).

Because of the ability of the signal interference removing LPF to accumulate the previous voltage in case the PLL deviates from within the lock range due to certain interference, the original condition is quickly reinstated.

* Free running frequency:
  Oscillating frequency when there is no input signal.
* Lock range:
  At the condition in which the VCO oscillation frequency is locked to the input signal, the lock range is the oscillating frequency in which when the input signal changes, the PLL maintains it's input signal lock condition. Accordingly, in case Fs is changed inside the PLL lock range, VCO oscillation frequency always follows this, and a no frequency deviation and no phase difference signal is obtained. In other words, VCO oscillation frequency can be locked to Fs.

2. STEREO DEMODULATION CIRCUIT

As shown in Fig. 14 for FM broadcasts, the sum signal (L+R) consists of left signal (L) and right signal (R) and the audio frequency band of this signal in its original form is frequency modulated. On the other hand, the difference signal of both (L–R) is changed to high frequency through the use of the sub carrier, and is referred to as the sub channel signal. The carrier is further frequency modulated and sent to the FM stereo transmitter.

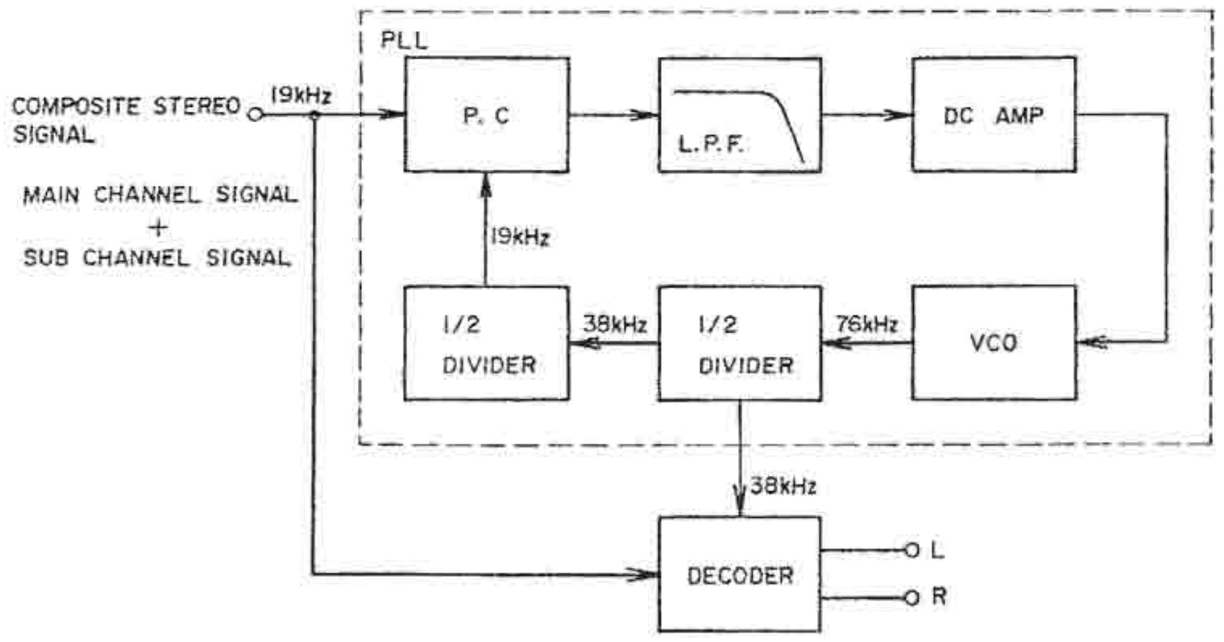


Fig. 15 MPX IC Function

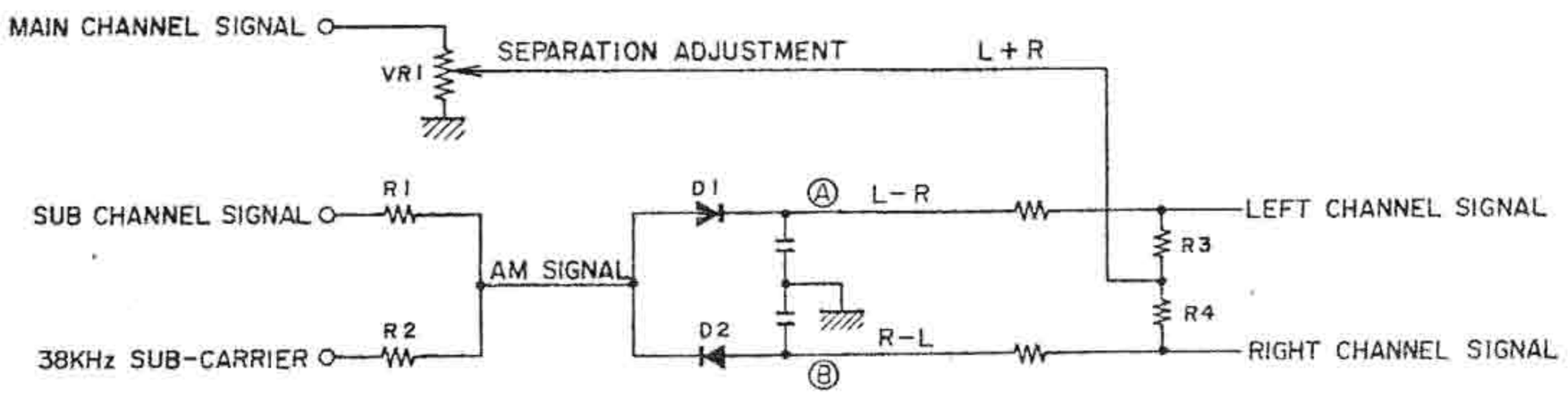


Fig. 16 Multiplex Decoder

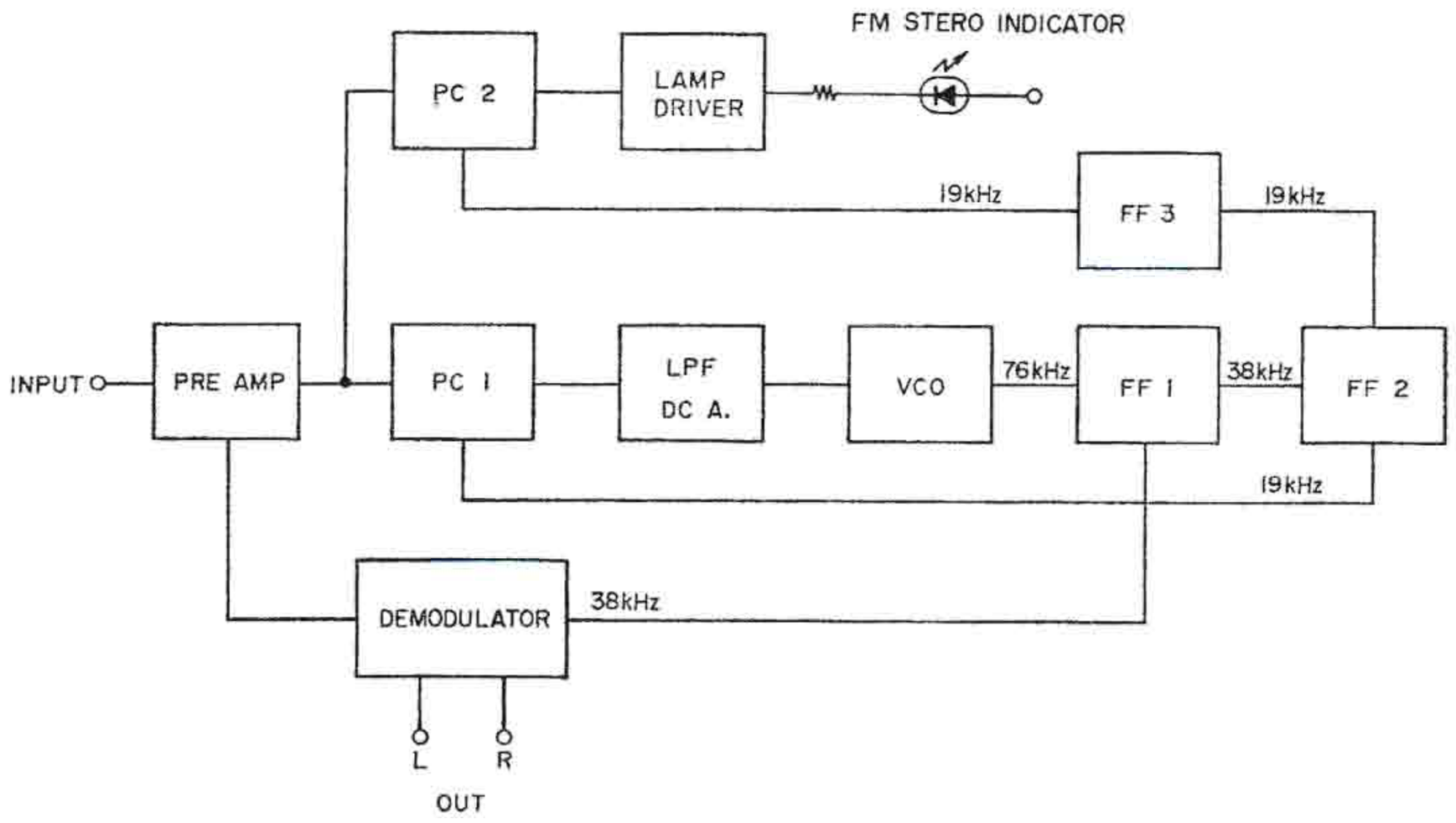


Fig. 17 LA-3350 Function System Diagram

Accordingly, for composite stereo signal demodulation, the sub carrier used for demodulation at the transmitter must be the same uniform 38 kHz signal as the frequency and phase. If the 38 kHz waveform is asymmetrical, channel separation will become poor. At the PLL employed MPX stereo demodulator circuit, as shown in Fig. 13 first a 76 kHz signal is oscillated and when this passes the divider, a symmetrical 38 kHz signal is obtained. This 38 kHz sub carrier is supplied to the multiplex decoder together with the sub channel of the composite stereo signal. At the multiplex decoder, left and right channel audio signals are separated in order as shown in Fig. 16.

The 38 kHz sub carrier composited with the sub removed when sub channel signal and sub carrier passed R1, R2 produces the regular AM wave. Then, because this envelope is detected by mutually reverse polarity connected diodes D1 and D2, L–R signal is emitted at point Ⓐ and R–L signal at point Ⓑ.

Also, because main channel signal (L+R) is supplied to R3, R4 center point, ⒶⒷ point voltage is added and subtracted and becomes

(L+R) + (L–R) = 2L (left channel)

(L+R) + (R–L) = 2R (right channel)

The level of the main channel signal (L+R) can be adjusted by means of variable resistor VR (VR1) for optimum separation. Thus, the function of actually employed PLL IC LA-3350 is a shown in

1. MODEL AA-1135

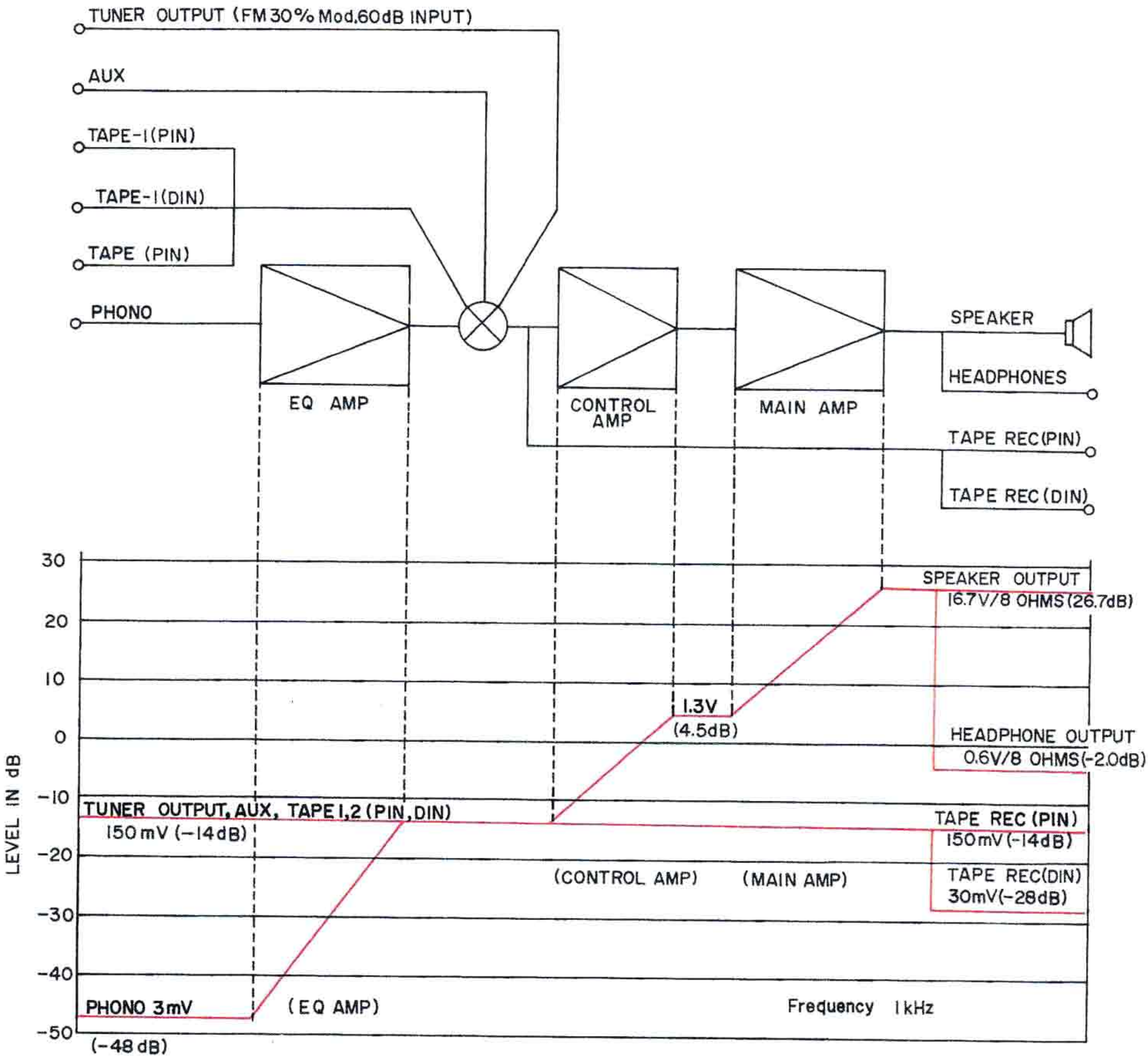


Fig. 18 Level Diagram of Model AA-1135

2. MODEL AA-1150

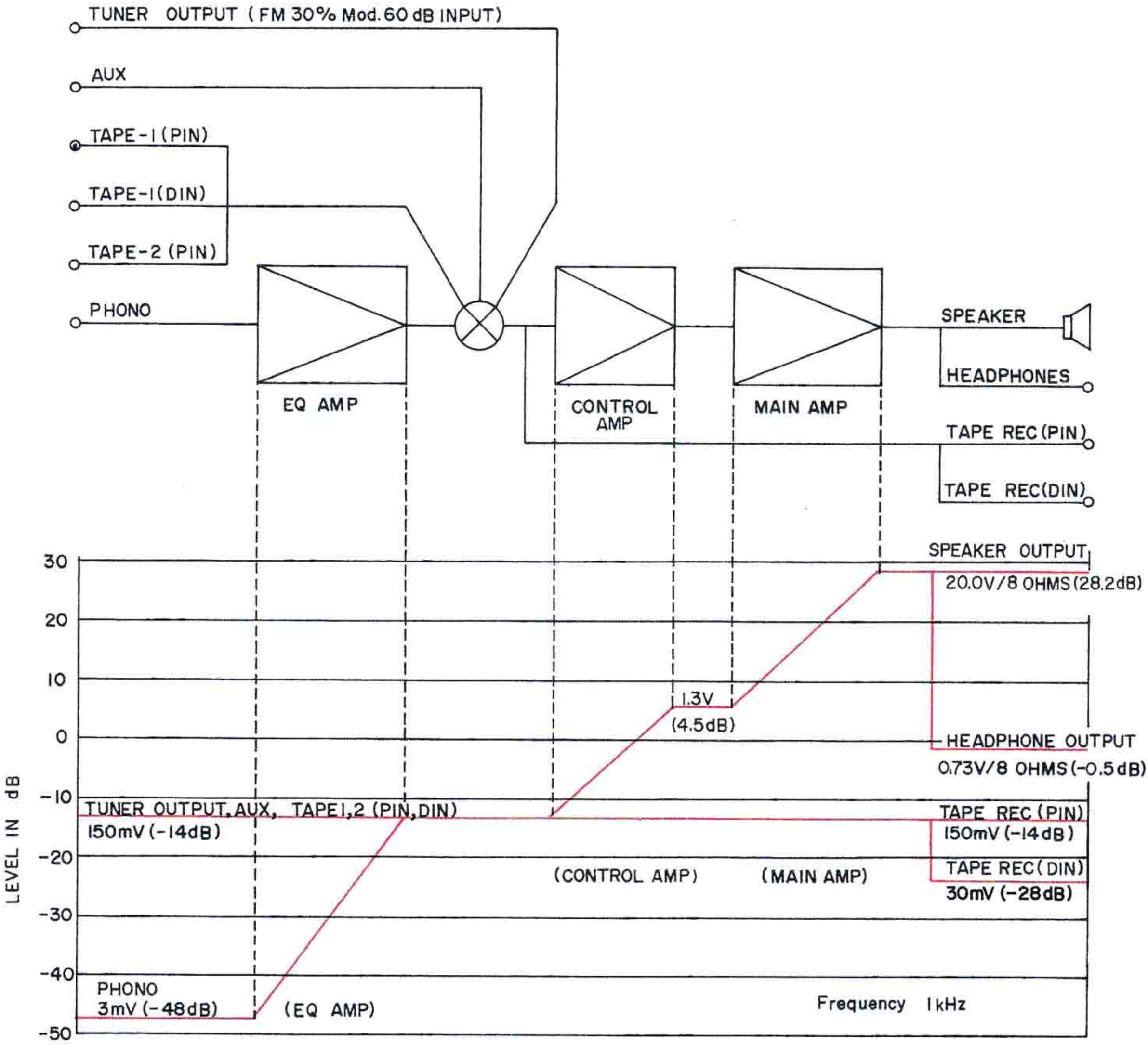


Fig. 19 Level Diagram of Model AA-1150

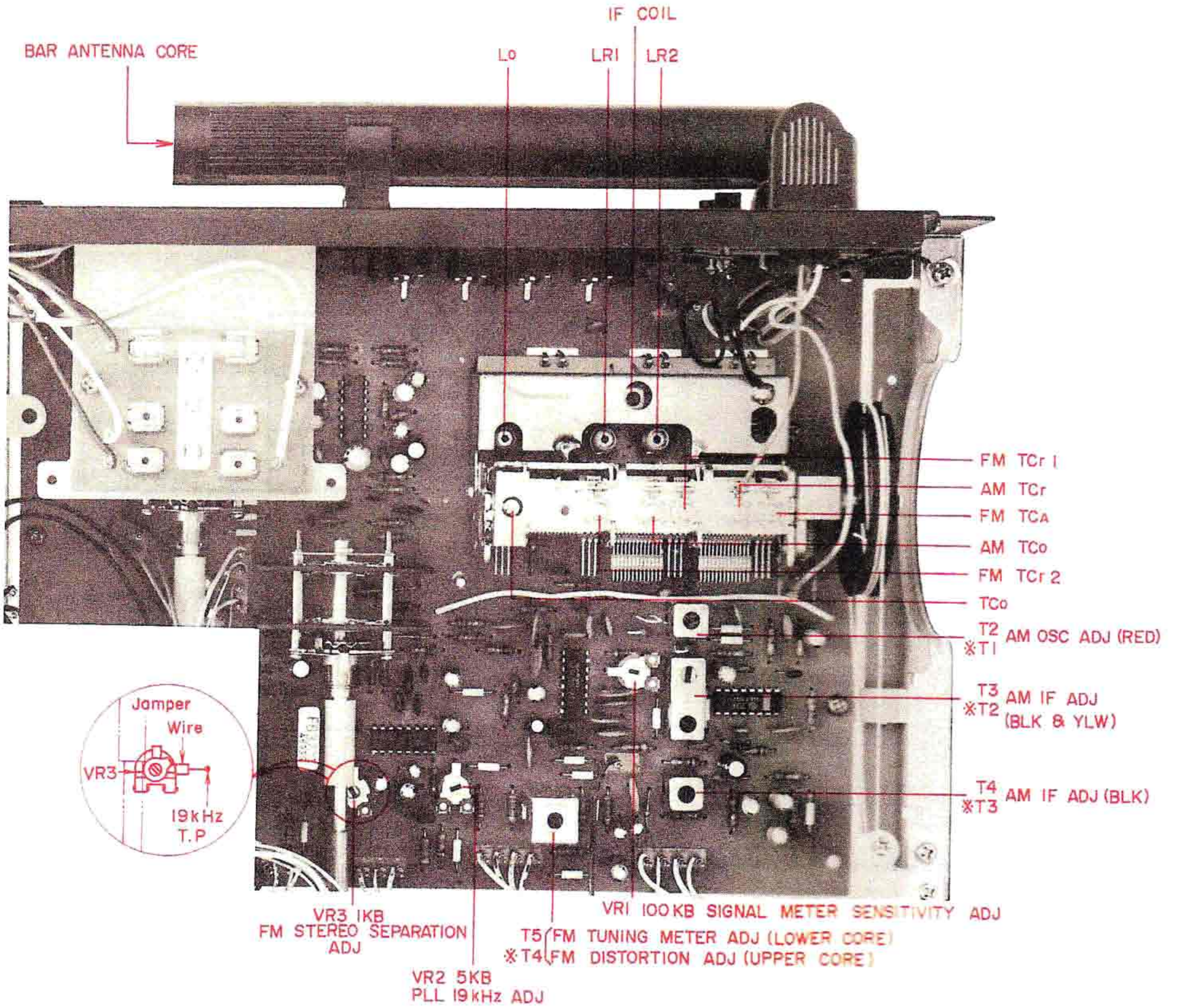


Fig. 20 Multi Function P.C Board AB-3501A (AA-1135)
AB-5001A (AA-1150)

Notes; 1. Schematic Numbers of AA-1135 indicated by * mark.
2. Please refer to Fig. 21 for Front End of AA-1135.

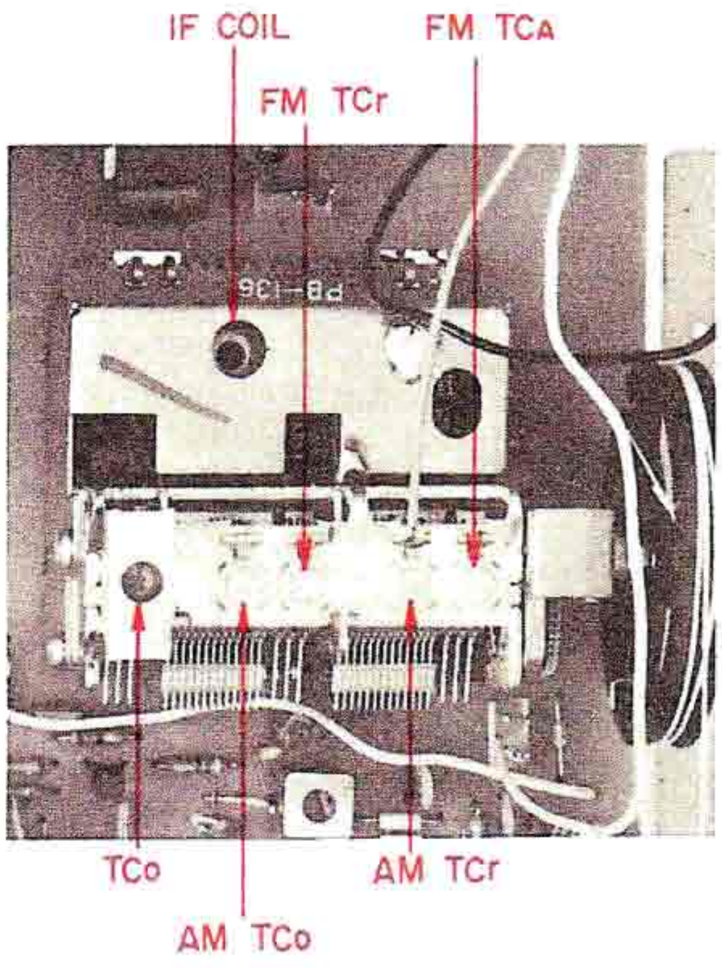


Fig. 21 Front End (AA-1135)

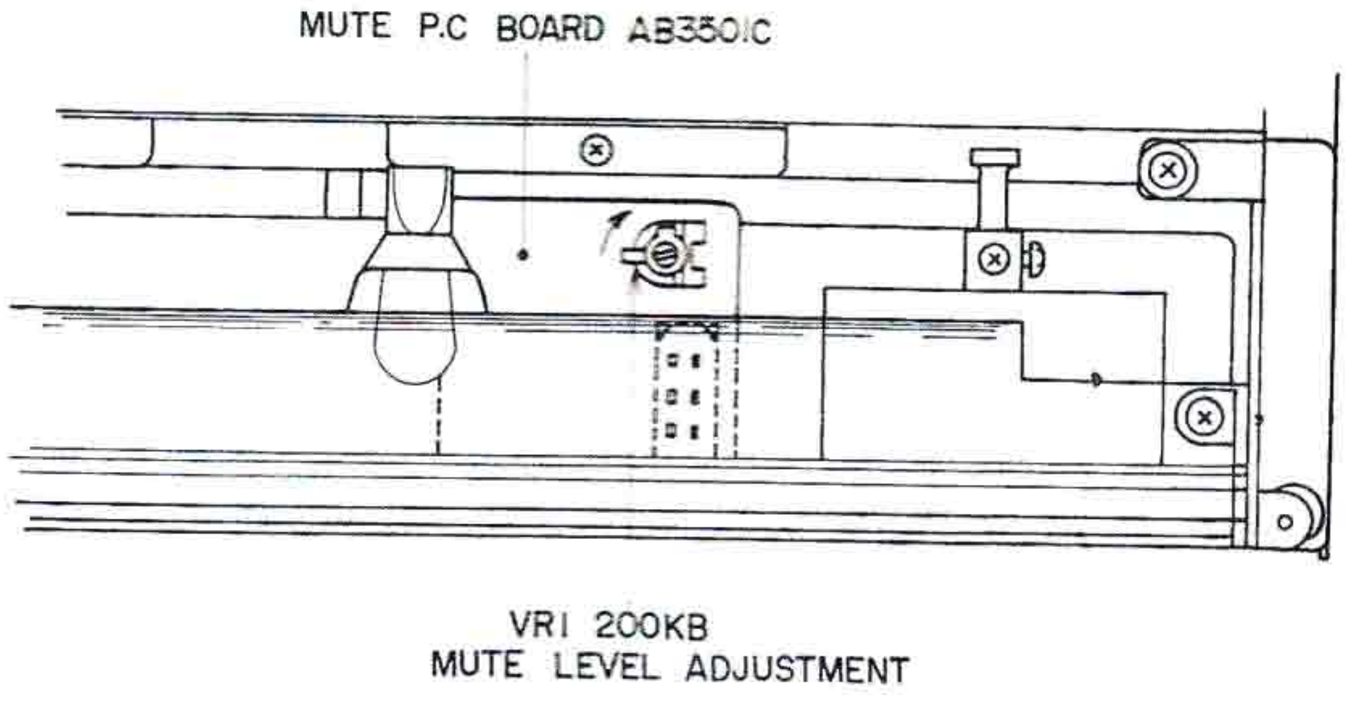


Fig. 22 Mute Level Adjustment (Only AA-1135)

1. FM TUNER SECTION ADJUSTMENT (Refer to Fig. 20, 21 and 22)

Step	Adjustment Item	Adjustment Point	Result	Remarks
1	Front End IF Coil	IF Coil (Front End)	Maximum Noise Level	Selector to FM. FM Mute to OFF. Tune only noise without interference of broadcasting.
2	Tuning Meter Centering	T5 *T4 Lower Side core (Multi Function P.C Board)	Center Tuning Meter Indication	Same as above
3	Distortion Factor	T5 *T4 Upper Side core (Multi Function P.C Board)	Less than 0.15% *0.2% Distortion Factor	98 MHz, 60 dB (mono) input. Less than 0.15% *0.2% on both channels.
4	Confirmation of Tuning Meter Indication			If Tuning Meter Indication is not at center position, re-adjust STEP 2 and 3 above.
5	High Range Frequency Coverage	TCo (Front End)	error: within ±300 kHz	108 MHz, 60 dB (mono) input.
6	Low Range Frequency Coverage	Lo (Front End)	error: within ±300 kHz	88 MHz, 60 dB (mono) input. (only AA-1150)
7	High Range Sensitivity	FM TCr, FM TCA (Front End)	Less than 3% Distortion Factor	FM Mute to OFF. 108 MHz, Less than 10 dB, *12 dB (mono) input.
8	Low Range Sensitivity	LR1, LR2 (Front End)	Less than 3% Distortion Factor	FM Mute to OFF. 88 MHz, Less than 10 dB (mono) input. (For AA-1135: confirmation only)
9	Mid Range Sensitivity Confirmation		Less than 3% Distortion Factor	FM Mute to OFF. 98 MHz, Less than 10 dB, *12 dB (mono) input.
10	Mute Level	VR1 200 kB (Mute P.C Board)	No signal emitted from output	FM Mute to OFF. 88 MHz, 20 dB (mono) input. (Refer to Fig. 22) (only AA-1135)
11	PLL IC Free Running Frequency	VR2 5 kB (Multi Function P.C Board)	19.00 kHz	Frequency Counter to Test Point (Multi Function P.C Board) See NOTE 3.
12	Stereo Indicator Lighting Confirmation			98 MHz, 60 dB (stereo) input. No lighting of stereo indicator indicates no stereo separation.
13	Stereo Separation	VR 3 1 kB (Multi Function P.C Board)	More than 42 dB, *40 dB (1 kHz)	98 MHz, 60 dB (stereo) L ch input. Distortion Factor must be less than 0.3%, *0.4%.

Step	Adjustment Item	Adjustment Point	Result	Remarks
14	Stereo Separation		More than 42 dB, *40 dB (1 kHz)	98 MHz, 60 dB (stereo) R ch input. Distortion Factor must be less than 0.3%, *0.4%. If it exceeds 0.3% *0.4% adjust the coil in STEP 1 within 1/2 turn.
15	Signal Meter Sensitivity	VR1 100 kB (Multi Function P.C Board)	Indicator at "5".	98 MHz, 100 dB (mono) input.

Chart 1

NOTES: 1. AA-1135 specifications are indicated by * marks.
2. When the distortion factor of less than 3% cannot be obtained at Step 9, repeat Front End IF Coil and Step 7 through 9 adjustments several times.
3. Free Running Frequency of the PLL IC must be an exact 19.00 kHz.

2. AM TUNER SECTION ADJUSTMENT (Refer to Fig. 20 and 21)

Step	Adjustment Item	Adjustment Point	Result	Remarks
1	Low Range Scale Indication	T2 *T1 (RED) (Multi Function P.C Board)	Maximum Output	Selector to AM. 520 kHz 50 dB input. Tuning Indicator to 520 kHz. Error within 2%.
2	Low Range Sensitivity	T3 *2 (BLK and YLW) T4 *T3 (BLK) (Multi Function P.C Board) Bar Antenna Core (Rear Panel)	Maximum Output Minimum Distortion Factor	520 kHz, 50 dB input. Less than 10% Distortion Factor.
3	High Range Scale Indication	AM TCo (Front End)	Maximum Output	1,400 kHz, 50 dB input. Tuning Indicator to 1,400 kHz. Error within 2%.
4	High Range Sensitivity	AM TCr (Front End)	Maximum Output Minimum Distortion Factor	1,400 kHz, 50 dB input. Less than 10% Distortion Factor.

Chart 2

NOTES: 1. AA-1135 specifications are indicated by * mark.
2. For best results, repeat Steps 1 through 4 two or three times.

IX. MAIN AMPLIFIER ADJUSTMENT

MODEL AA-1135 and AA-1150

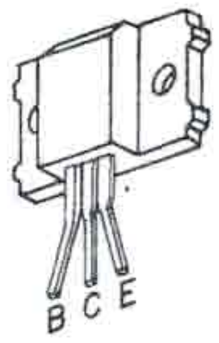


Fig. 23 Instrument Connection

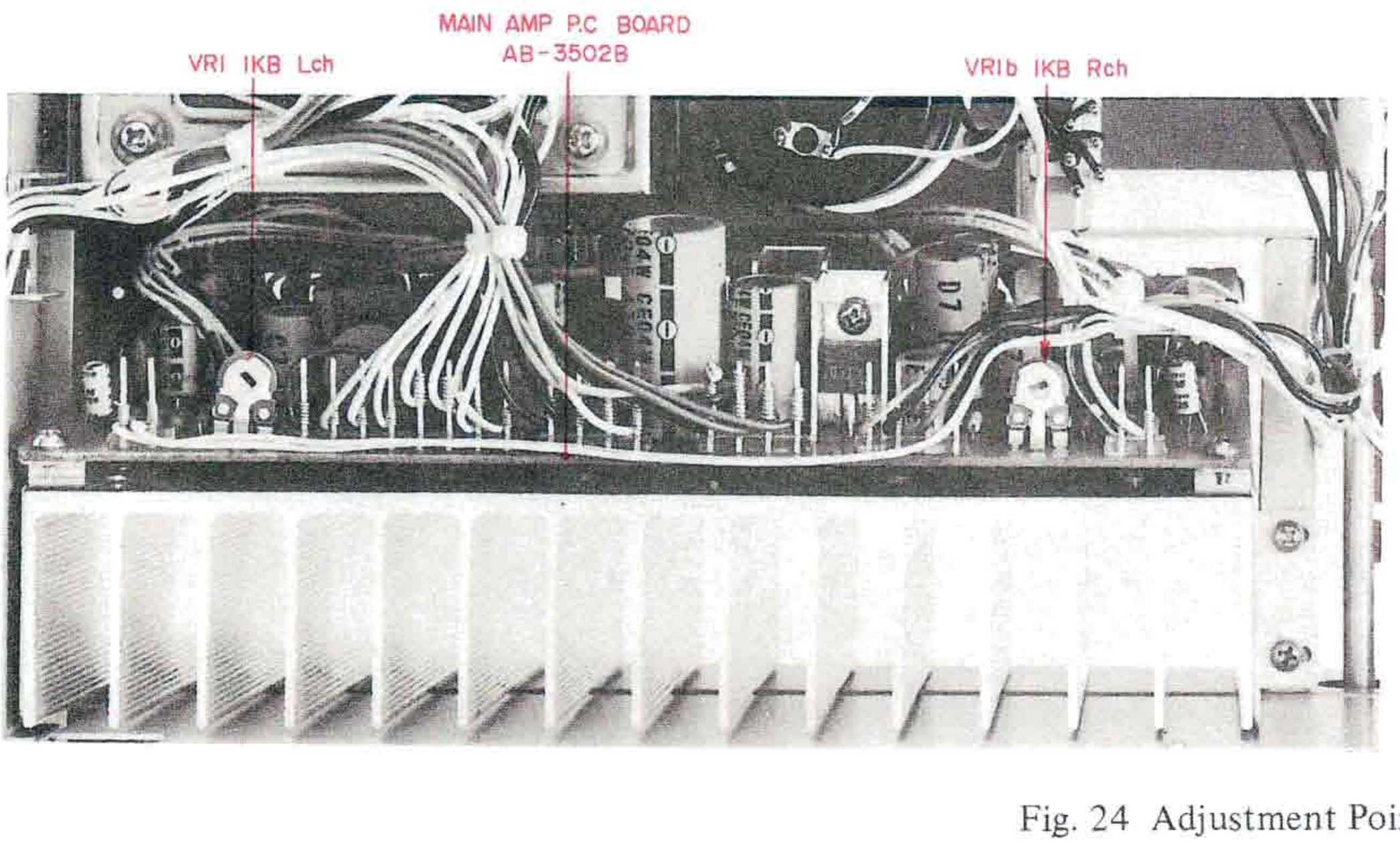


Fig. 24 Adjustment Point

Step	Adjustment Item	Adjustment Point	Result	Remarks
1	Idling Current (Left channel)	VR1 1 kB (Main Amp P.C Board)	25 mV	Use a Voltmeter or Tester with DC 100 mV range.
2	Idling Current (Right channel)	VR1b 1 kB (Main Amp P.C Board)	25 mV	

Chart 3

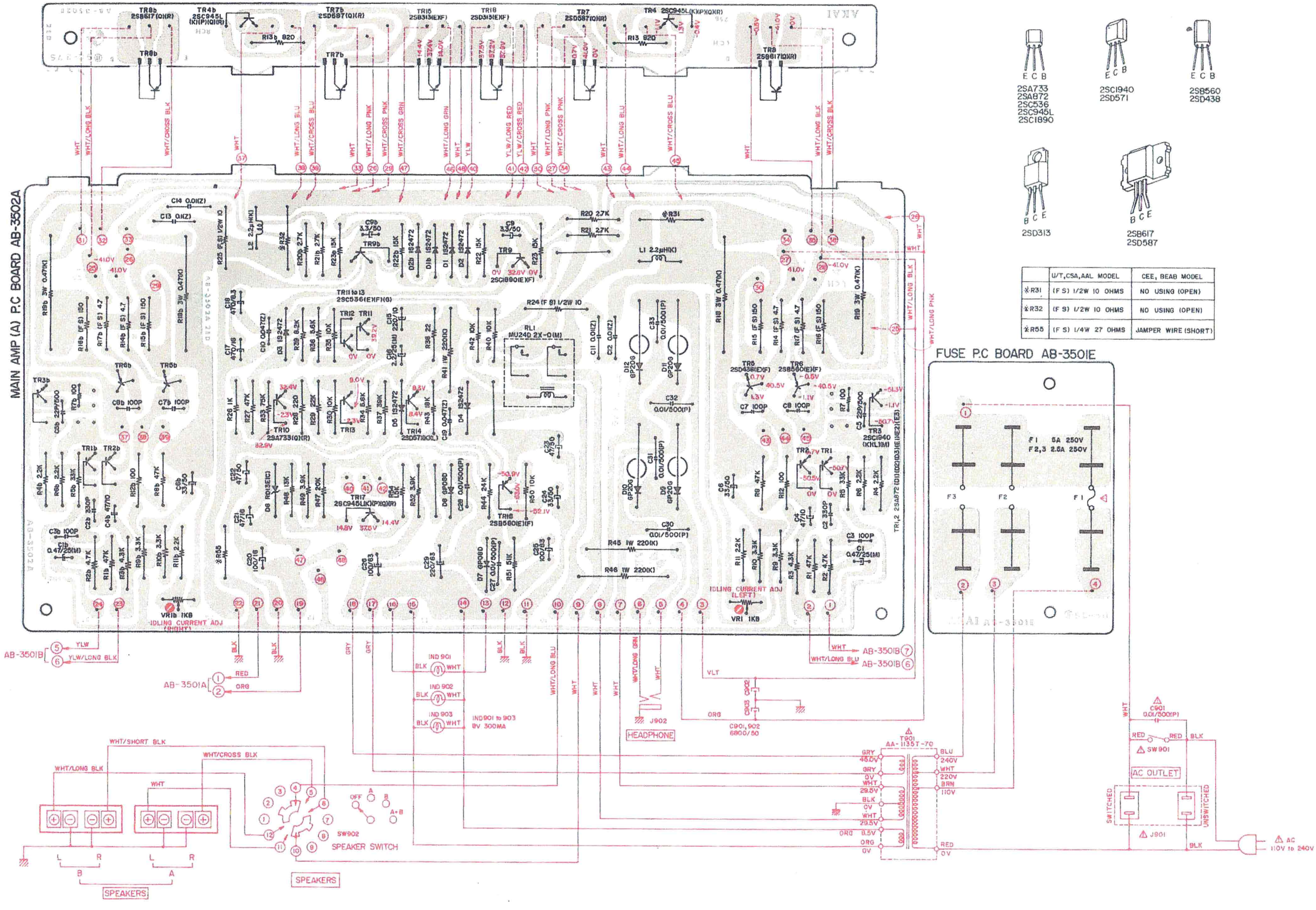
2) MAIN AMP (A/B) P.C BOARD AB-3502A/B (2ED) & FUSE P.C BOARD AB-3501E

WARNING: ⚠INDICATES SAFETY CRITICAL COMPONENTS. FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS

AVERTISSEMENT: ⚠IL INDIQU LES COMPOSANTS CRITIQUES DE SÛRETÉ. POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES CONPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT

MAIN AMP (B) P.C BOARD AB-3502B

MAIN AMP (A) P.C BOARD AB-3502A



	U/T,CSA,AAL MODEL	CEE, BEAB MODEL
※R31	(F S) 1/2W 10 OHMS	NO USING (OPEN)
※R32	(F S) 1/2W 10 OHMS	NO USING (OPEN)
※R55	(F S) 1/4W 27 OHMS	JAMPER WIRE (SHORT)

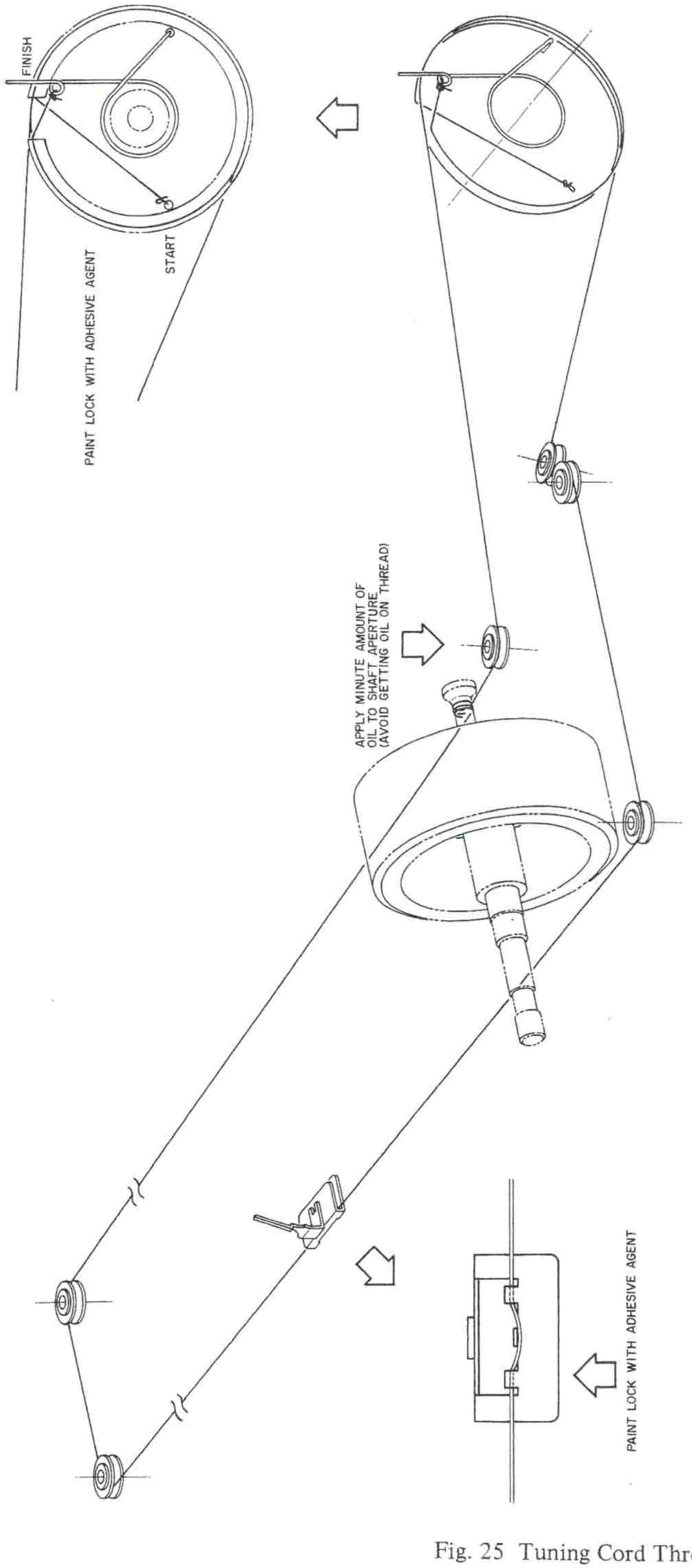


Fig. 25 Tuning Cord Threading

XI. CLASSIFICATION OF VARIOUS P.C BOARDS

1. RELATION OF P.C BOARD TITLE AND IDENTIFICATION NUMBER

1) Model AA-1135

P.C Board Title	P.C Board Number
Multi Function P.C Board	AB-3501A
Tone Control P.C Board	AB-3501B
Mute P.C Board	AB-3501C
LED P.C Board	AB-3501D
Fuse P.C Board	AB-3501E
Main Amp (A) P.C Board	AB-3502A
Main Amp (B) P.C Board	AB-3502B

Chart 4

2) Model AA-1150

P.C Board Title	P.C Board Number
. Multi Function P.C Board	AB-5001A
Tone Control P.C Board	AB-5001B
Filter Mute P.C Board	AB-5001C
LED (A) P.C Board	AB-5001D
LED (B) P.C Board	AB-5001E
Fuse P.C Board	AB-5001F
Main Amp (A) P.C Board	AB-3502A
Main Amp (B) P.C Board	AB-3502B

Chart 5