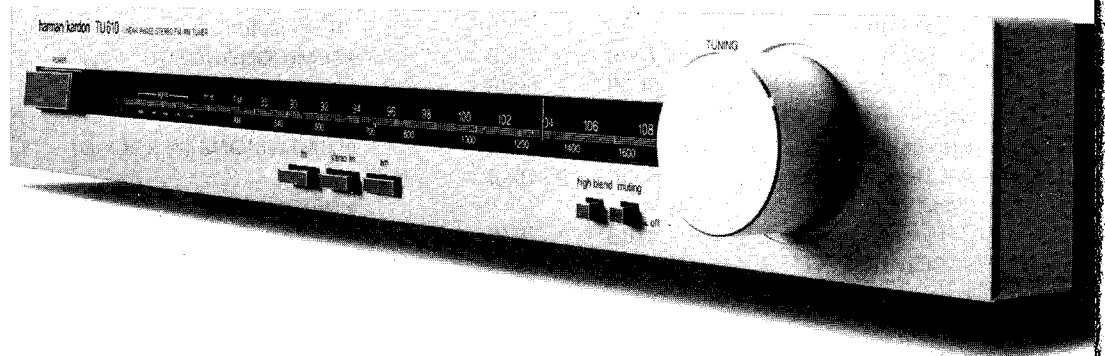


# The Harman Kardon Model TU610

Manual No. 20A

## LINEAR PHASE STEREO FM/AM TUNER

# Technical Manual



**harman/kardon**

240 CROSSWAYS PARK WEST, WOODBURY, N.Y. 11797  
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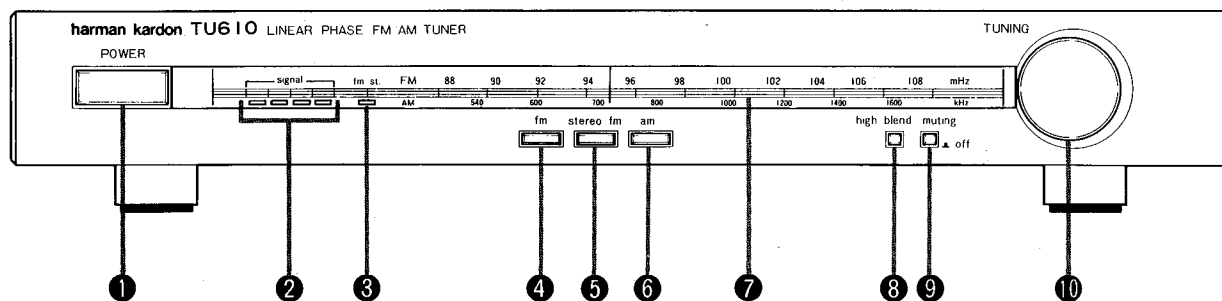
## SPECIFICATIONS

● FM SECTION	Nominal	Limit	● AM SECTION	Nominal	Limit
Tuning Range	87.3 ~ 108.4 MHz		Tuning Range	513 ~ 1,677 kHz	
50dB Quieting Sensitivity			Usable Sensitivity	220 $\mu$ V/m $\leq$ 300 $\mu$ V	
Mono	3.5 $\mu$ V $\leq$ 5 $\mu$ V		Selectivity	69dB $\geq$ 45dB	
Stereo	44 $\mu$ V $\leq$ 79 $\mu$ V		Signal to Noise Ratio	54dB $\geq$ 50dB	
Usable Sensitivity	1.8 $\mu$ V(IHF) $\leq$ 2.8 $\mu$ V		Image Rejection	45dB $\geq$ 35dB	
Image Ratio	57dB $\geq$ 50dB		IF Rejection	87dB $\geq$ 65dB	
IF Rejection	72dB $\geq$ 70dB		● SEMICONDUCTOR	27 Transistors,	
Spurious Response Rejection	95dB $\geq$ 60dB			4 ICs, 1 FET, 6 LEDs,	
Capture Ratio	1.1dB $\leq$ 2.0dB			16 Diodes	
Alternate Channel Selectivity	75dB $\geq$ 55dB		● DIMENSIONS (W x H x D)	17-1/3" x 2-1/6" x 12-4/7"	
AM Rejection	63dB $\geq$ 45dB			(440 x 55 x 320mm)	
Signal to Noise Ratio			● WEIGHT	7.5 lbs (3.4 kg)	
Mono	81dB $\geq$ 75dB		● POWER SUPPLIES	AC 120V, 60Hz	
Stereo	72dB $\geq$ 65dB		● POWER CONSUMPTION	15W	
Total Harmonic Distortion					
Mono	0.09% $\leq$ 0.2%				
Stereo	0.15% $\leq$ 0.3%				
Stereo Separation at 1kHz	54dB $\geq$ 45dB				
Output Level/Impedance	775mV/2k $\Omega$				

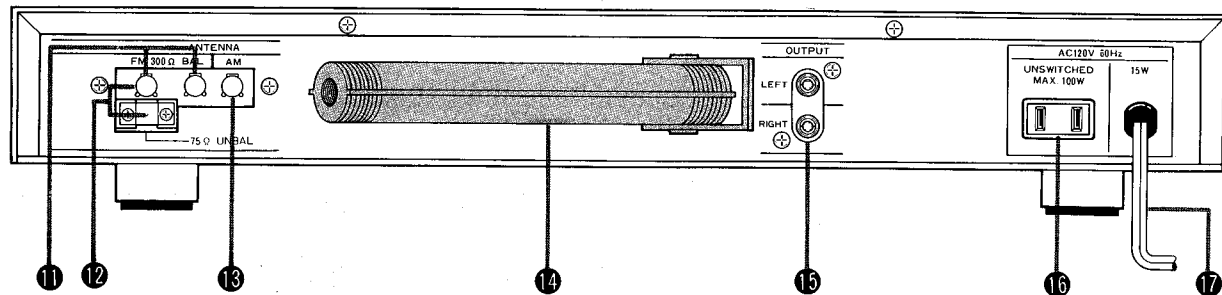
Specifications and components subject to change without notice.  
Overall performance will be maintained or improved.

## COMPONENTS AND THEIR FUNCTIONS

## ■ FRONT PANEL



## ■ REAR PANEL



**❶ POWER SWITCH (POWER)**

For power turning on and off.

When this switch is pressed after AC cord connection to an outlet, the FM/AM tuning dial illuminates. Press this switch again to turn the power off.

**❷ SIGNAL STRENGTH INDICATOR (signal)**

5 LEDs for indication of the receiving signal level.

As the signal gets stronger, more LEDs will illuminate.

**❸ STEREO FM INDICATOR (fm st.)**

For indication of FM stereo broadcast reception.

**❹ FM SWITCH (fm)**

For selection of FM mode.

Depress this switch to tune to an FM monaural broadcast or a weak FM stereo broadcast.

**❺ STEREO FM SWITCH (stereo fm)**

For selection of FM stereo mode.

Depress this switch to tune to an FM stereo broadcast. The tuner will automatically enter monaural mode when it receives a monaural broadcast.

**❻ AM SWITCH (am)**

For selection of AM mode.

Depress this switch to tune to an AM broadcast.

**❼ FM/AM TUNING DIAL**

For indication of tuning and detuning.

This dial illuminates when the power is supplied. As the TUNING knob is turned, it illuminates in green color if when a station is tuned, or in orange color detuned.

**❽ HIGH BLEND SWITCH (high blend)**

For reduction of noise in high frequency range.

Depress this switch to receive a weak FM stereo broadcast with minimal noise.

**❾ MUTING SWITCH (muting)**

For reduction of interstation noise during scanning through the FM or AM band for a station.

To tune to a weak station, depress this switch to invalidate the muting function.

**❿ TUNING KNOB (TUNING)**

For tuning to a station.

Turn this knob while observing the FM/AM tuning dial. When a reasonably strong signal is sensed, the dial color changes from orange to green.

**⓫ FM ANTENNA TERMINALS (FM 300Ω BAL)**

Connect an FM dipole antenna or an FM outdoor antenna cable here.

**⓬ FM ANTENNA TERMINALS (FM 75Ω UNBAL)**

Connect an FM coaxial antenna cable (75Ω) here.

**⓭ AM ANTENNA TERMINAL (AM)**

Connect an AM outdoor antenna cable here if the receiving AM wave is weak.

**⓮ AM FERRITE LOOPSTICK ANTENNA**

For AM broadcast reception.

Draw it out and move it to improve reception.

Because of its high-sensitivity design, this built-in antenna is adequate for reception in most receiving condition except in a fringe reception area where signals are weak.

**⓯ OUTPUT JACKS (OUTPUT)**

Provide fixed stereo outputs. Connect signal cables to tuner (or aux) jacks of your preamplifier or pre-main-amplifier.

**⓰ AC CONVENIENCE OUTLET (UNSWITCHED)**

Connect the AC cord of another component here. This outlet always provides power regardless of whether the tuner is turned on or not.

**⓱ AC CORD**

Connect this cord to the AC convenience outlet of other component or a mains outlet.

## DISASSEMBLY PROCEDURES

### CABINET TOP REMOVAL

Remove screws ① to ⑥ in Fig. 1, and then remove the cover by sliding it to its rear a little.

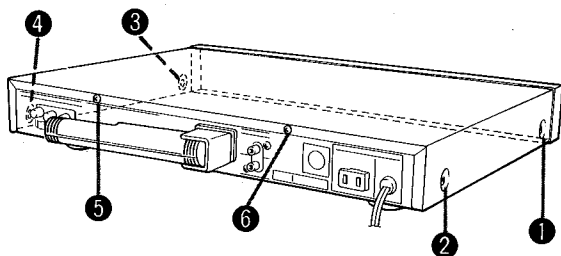


Fig. 1

### CABINET BOTTOM COVER REMOVAL

Remove screws ① to ④ in Fig. 2 and then remove the bottom cover.

### FRONT PANEL ASSEMBLY REMOVAL

1. Pull out the tuning knob.
2. Remove screws ⑤ to ⑦ in Fig. 2 and ① and ② in Fig. 3. Remove the front panel by pulling it toward you gently.

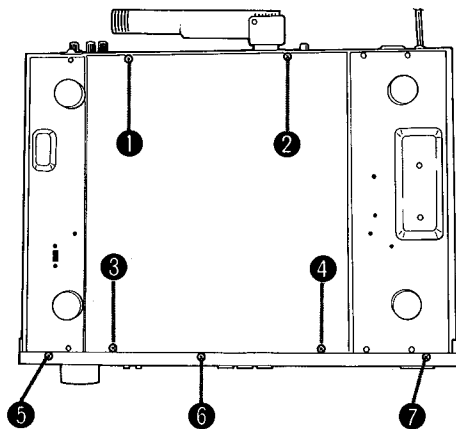


Fig. 2

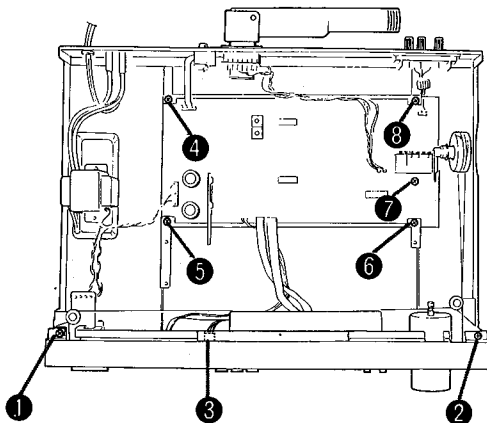


Fig. 3

### DIAL PANEL AND LAMP P.C. BOARD REMOVAL

1. Remove the dial pointer ⑤ in Fig. 4.
2. Pull out connector ③ in Fig. 3 from the lamp P.C. board.
3. Fold the lower part of the metal fixture ⑥ along the horizontal line.
4. Remove screws ① to ④ in Fig. 4.
5. Push down the actuator at the lower side and then remove the lamp P.C. board. Remove the holder.

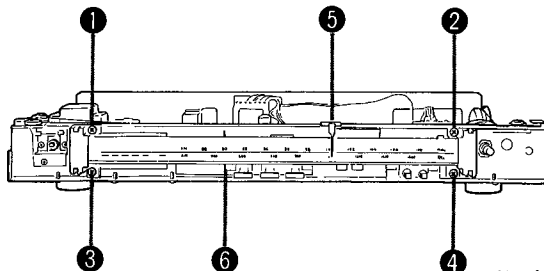


Fig. 4

### FUNCTION SELECTOR P.C. BOARD REMOVAL

Remove screws ① to ④ in Fig. 5 and then remove the function P.C. board.

### POWER SWITCH P.C. BOARD REMOVAL

Remove screws ⑤ and ⑥ in Fig. 5 and then remove the power switch P.C. board.

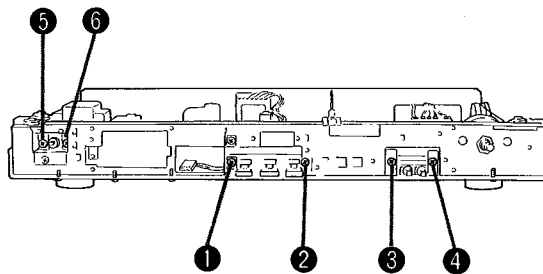


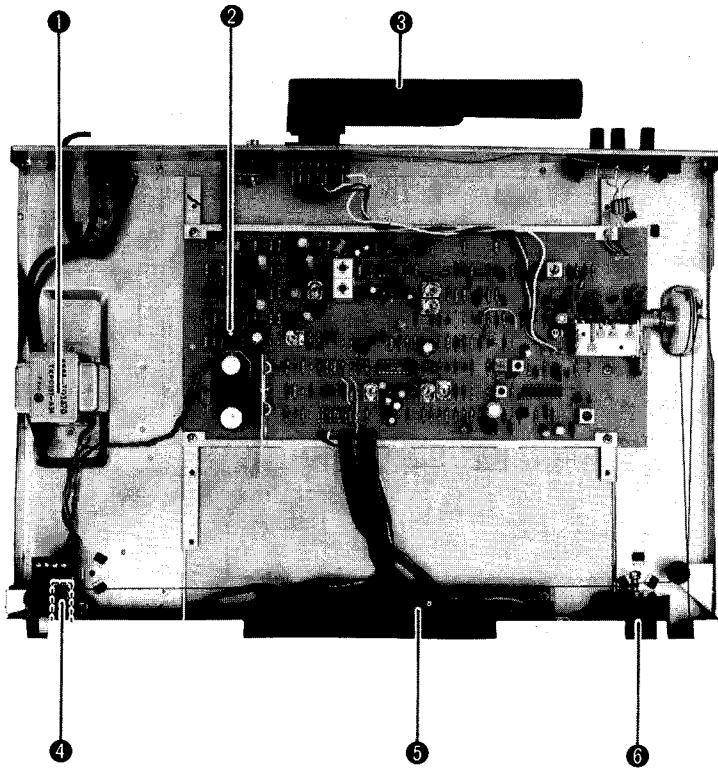
Fig. 5

### MAIN P.C. BOARD REMOVAL

1. Disconnect the lead wires which are connected to the main circuit board.
2. Secure the dial string to the pulley by winding adhesive tape or vinyl tape. Remove screws ④ to ⑧ in Fig. 3 and then remove the main P.C. board.

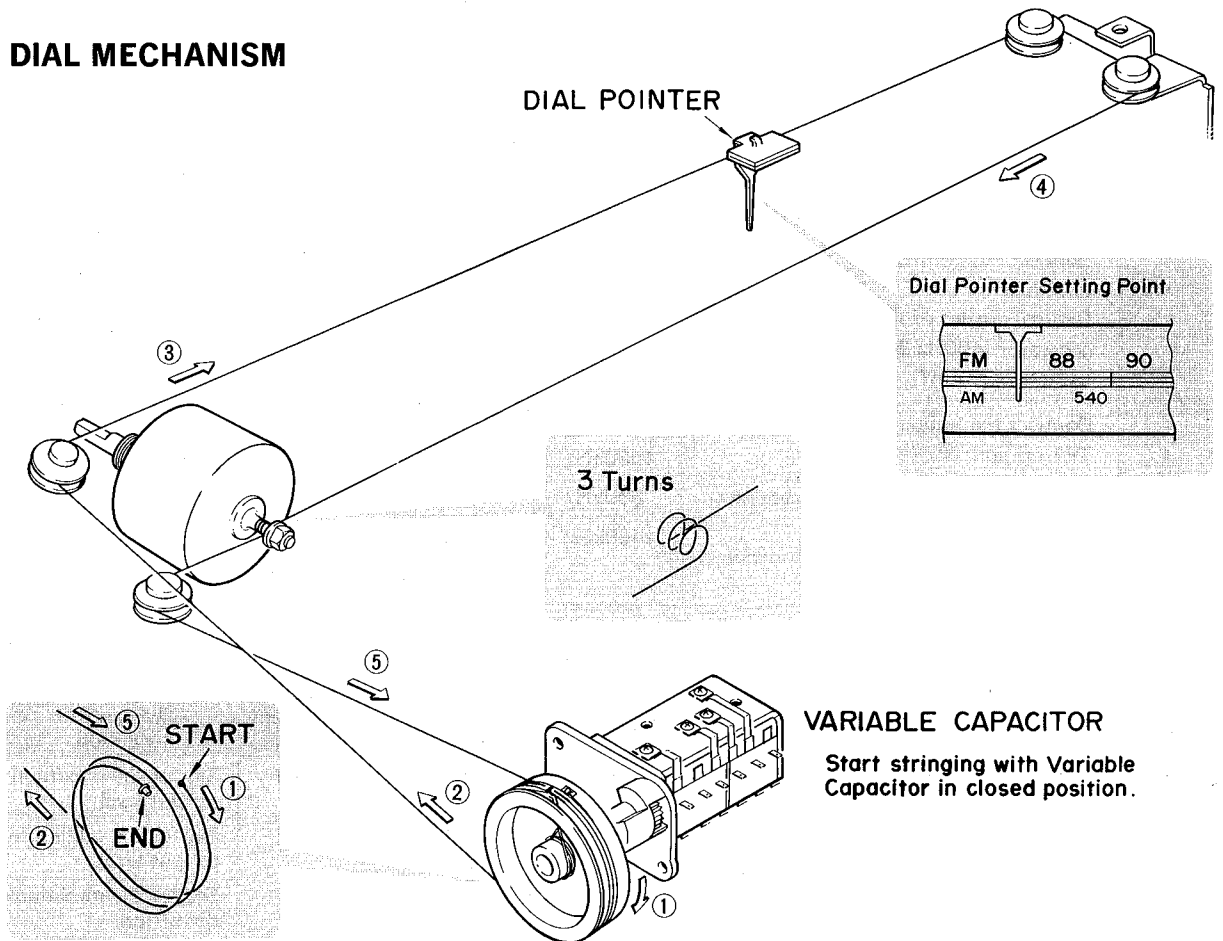
**INTERNAL VIEW**

■ TOP VIEW

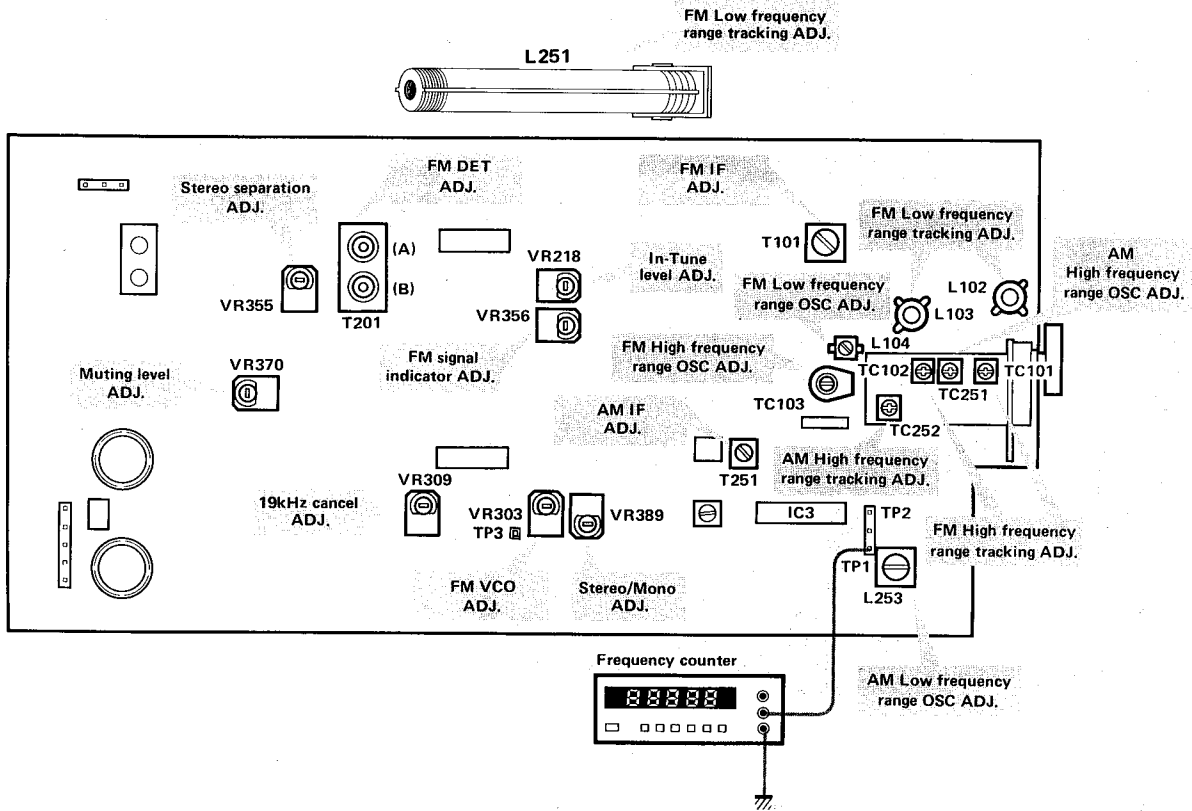


- ① POWER TRANSFORMER
- ② MAIN P.C. BOARD
- ③ AM LOOPSTICK ANTENNA
- ④ POWER SWITCH
- ⑤ FUNCTION SELECTOR P.C. BOARD
- ⑥ TUNING SHAFT

**DIAL MECHANISM**



# ALIGNMENT PROCEDURES



## 1. AM ALIGNMENT

- Set the AM switch to ON.

Step	Terminals to be connected	Frequency	Pointer indication	Adjusting point	Adjustment method
1	Connect AC voltmeter to the Output terminal. Radiate output of AM signal generator (400Hz 30% modulation) to AM BAR ANT.	1000kHz	1000kHz	T251	Set for the maximum output level.
2	Connect the frequency counter to TP1 (+) and TP2 (-).	515kHz	Lowest	L253	Set for 965kHz.
3		1680kHz	Highest	TC251	Set for 2130kHz.
4	Radiate output of AM signal generator to AM BAR ANT. Connect AC voltmeter to the output terminal.	600kHz	600kHz	L251	Set for the maximum output level.
5		1400kHz	1400kHz	TC252	

## 2. FM ALIGNMENT

- Set the FM switch to ON.

Step	Terminals to be connected	Frequency	Pointer location	Adjustment location	Adjustment method
1	<ul style="list-style-type: none"> <li>• Connect FM signal generator (1kHz 100% modulation) to FM 300Ω BAL ANT terminals through the 300Ω balanced dummy.</li> <li>• Connect AC voltmeter and distortion meter to the Output terminal.</li> </ul>	98MHz	98MHz	T201 (A)	Set for the maximum output level.
2		98MHz	98MHz	T201 (B)	Set for the minimum output level.
3		98MHz	98MHz	T201 (B)	Set for the minimum distortion.

Step	Terminals to be connected	Frequency	Pointer location	Adjustment location	Adjustment method
4	<ul style="list-style-type: none"> <li>Connect FM signal generator (1kHz 100% modulation) to FM 300Ω BAL ANT terminals through the 300Ω balanced dummy.</li> <li>Connect AC voltmeter and distortion meter to the Output terminal.</li> </ul>	98MHz	98MHz	T101	Adjust so that the waveform becomes symmetric at the low level input.
5		87.3MHz	Lowest	L104	Set for the maximum output level.
6		108.4MHz	Highest	TC103	
7		90MHz	90MHz	L102 L103	
8		106MHz	106MHz	TC101 TC102	

### 3. MPX ADJUSTMENT

- Set the stereo FM switch to ON.

Step	Terminals to be connected	Frequency	Pointer location	Adjustment location	Adjustment method
1	<ul style="list-style-type: none"> <li>Connect the stereo modulator (L + R = 45%, L - R = 45%, 19kHz = 10%) to FM signal generator. Apply SG output to FM 300Ω BAL ANT terminals through 300Ω balanced dummy.</li> <li>Connect the frequency counter between TP3(+) and TP2(-).</li> <li>Connect AC voltmeter to the Output terminal.</li> </ul>	98MHz	98MHz	VR303	Set for 75.950kHz ± 40Hz
2		98MHz	98MHz	VR309 VR355	Adjust so that the right channel output becomes minimum when only the left channel of the stereo modulator modulated and so with the left channel output when only the left channel modulated.

### 4. SIGNAL INDICATOR ADJUSTMENT

- Set the FM switch to ON and muting switch to OFF.

Step	Terminals to be connected	Frequency	Pointer location	Adjustment location	Adjustment method
1	Connect FM signal generator (1kHz 100% modulation) to FM 300Ω BAL ANT terminals the 300Ω balanced dummy.	98MHz	98MHz	VR218	Turn the VR218 to the center position.
2		98MHz	98MHz	VR356	Adjust so that 3 signal indicators light up at 27dB input level.

*1uv = 0db REFERENCE*

### 5. MUTING SENSITIVITY ADJUSTMENT

- Set the FM switch to ON and muting switch to ON.

Step	Terminals to be connected	Frequency	Pointer location	Adjustment location	Adjustment method
1	Connect FM signal generator (1kHz 100% modulation) to FM 300Ω BAL ANT terminals the 300Ω balanced dummy.	98MHz	98MHz	VR370	Adjust so that the waveform appears at 23dB input level.

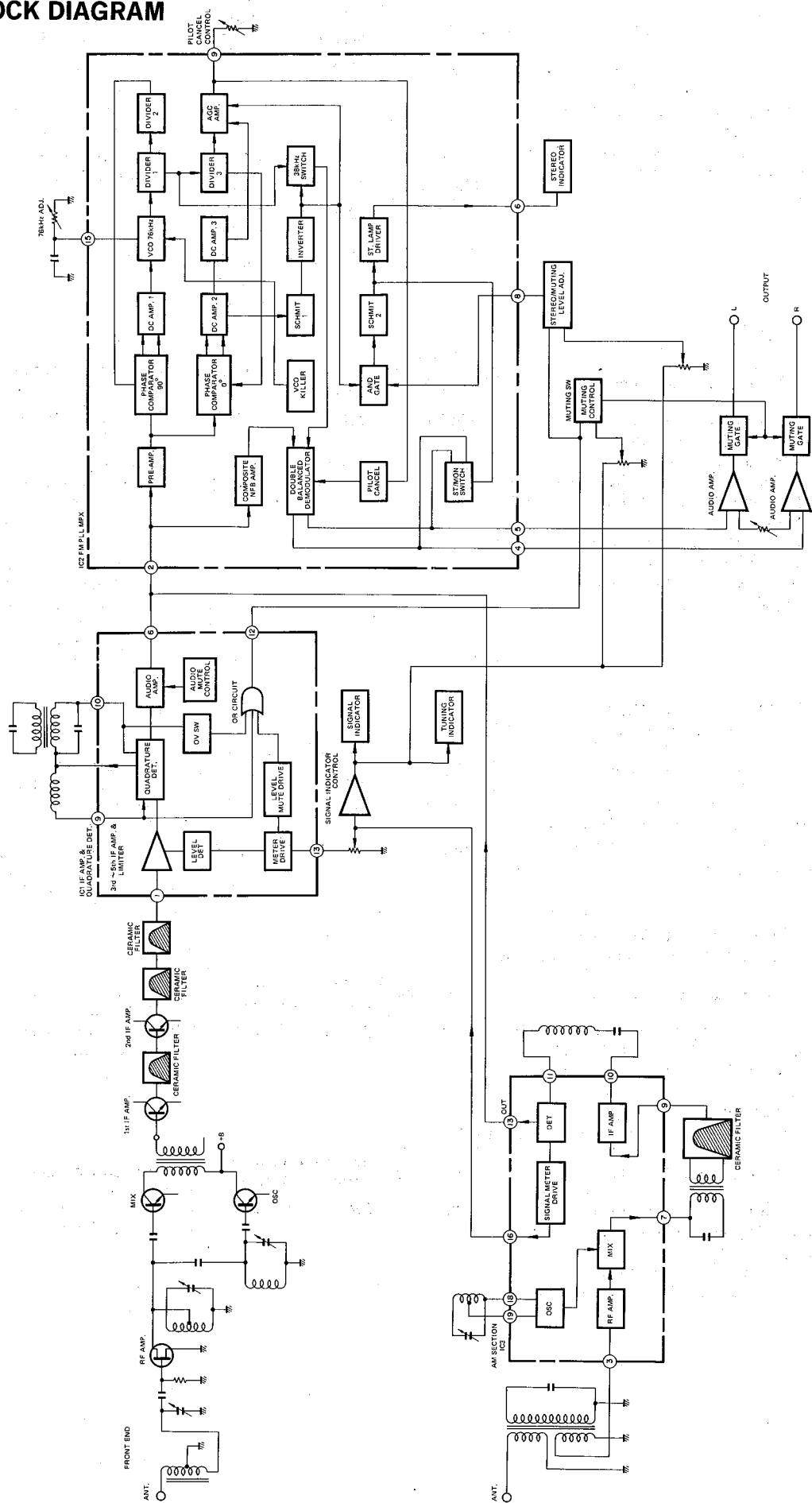
*14uv*

### 6. STEREO INDICATOR ADJUSTMENT

- Set the stereo FM switch to ON and muting switch to OFF.

Step	Terminals to be connected	Frequency	Pointer location	Adjustment location	Adjustment method
1	Connect the stereo modulator (L + R = 45%, L - R = 45%, 19kHz = 10%) to FM signal generator. Apply SG output to FM 300Ω BAL ANT terminals through 300Ω balanced dummy.	98MHz	98MHz	VR389	Adjust so that the set is stereo mode at 25dB input level.

# BLOCK DIAGRAM





## CIRCUIT DESCRIPTION

### [1] SIGNAL PATH

The FM signal is amplified in the RF amp. Q101 of the frontend and then mixed with the output of the local oscillator Q103 in Q102 and converted into a signal of the 10.7MHz intermediate frequency. After the 10.7MHz signal is amplified and then fed to the ceramic filter CF1. After the signal is amplified in Q202 and fed to ceramic filter CF2 and CF3. After the output signal is amplified in the triple IF limiter amplifiers of IC1 and then quadrature detected and PLL MPX demodulated in IC2 and amplified in the audio amp. Q302 and Q304 (Rch) as well Q301 and Q303 (Lch).

### [2] MUTING CIRCUIT

The muting control voltage is taken out from ⑫ pin of IC1 and then fed to the base of Q352. Q352 and Q355 become low level and Q356 becomes high level and muting gate Q306 (Lch) and Q305 (Rch) become low level and then muting operation is completed.

### [3] SIGNAL INDICATOR CIRCUIT

#### 1) FM tuner section

The signal indicator drive signal is taken out from ⑬ pin of IC1 and after passing through the volume control VR356, Q353 and Q354 become ON and the drive signal is fed to LED driver IC4.

#### 2) AM tuner section

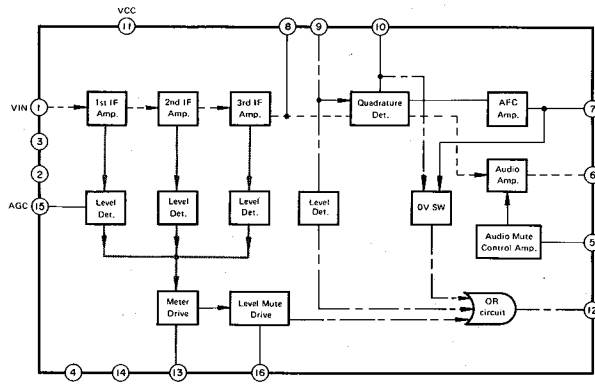
The signal indicator drive signal is taken out from ⑯ pin of IC3 and fed to Q353.

### [4] TUNING INDICATOR CIRCUIT

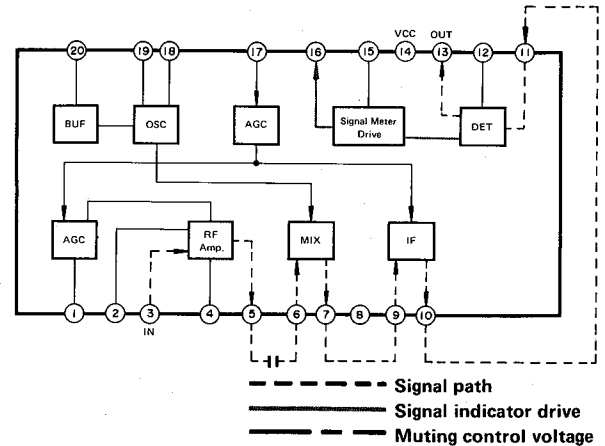
In tune, the output of Q354 in the signal indicator circuit is fed to the base of Q357, and Q357 and Q358 become off and Q359 becomes on and then tuning indicator lamp illuminates in green color.

## IC FUNCTIONAL BLOCK DIAGRAM

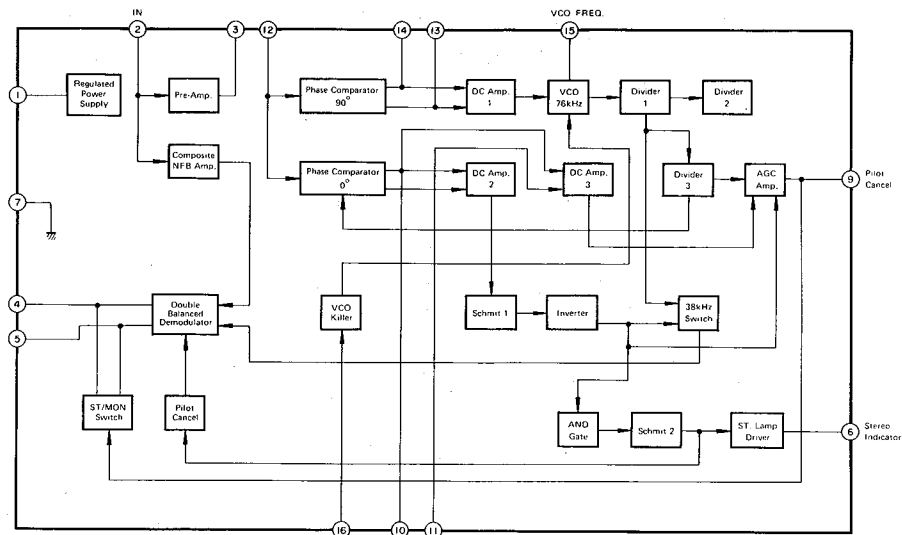
IC1 HA11225 IF DETECTOR



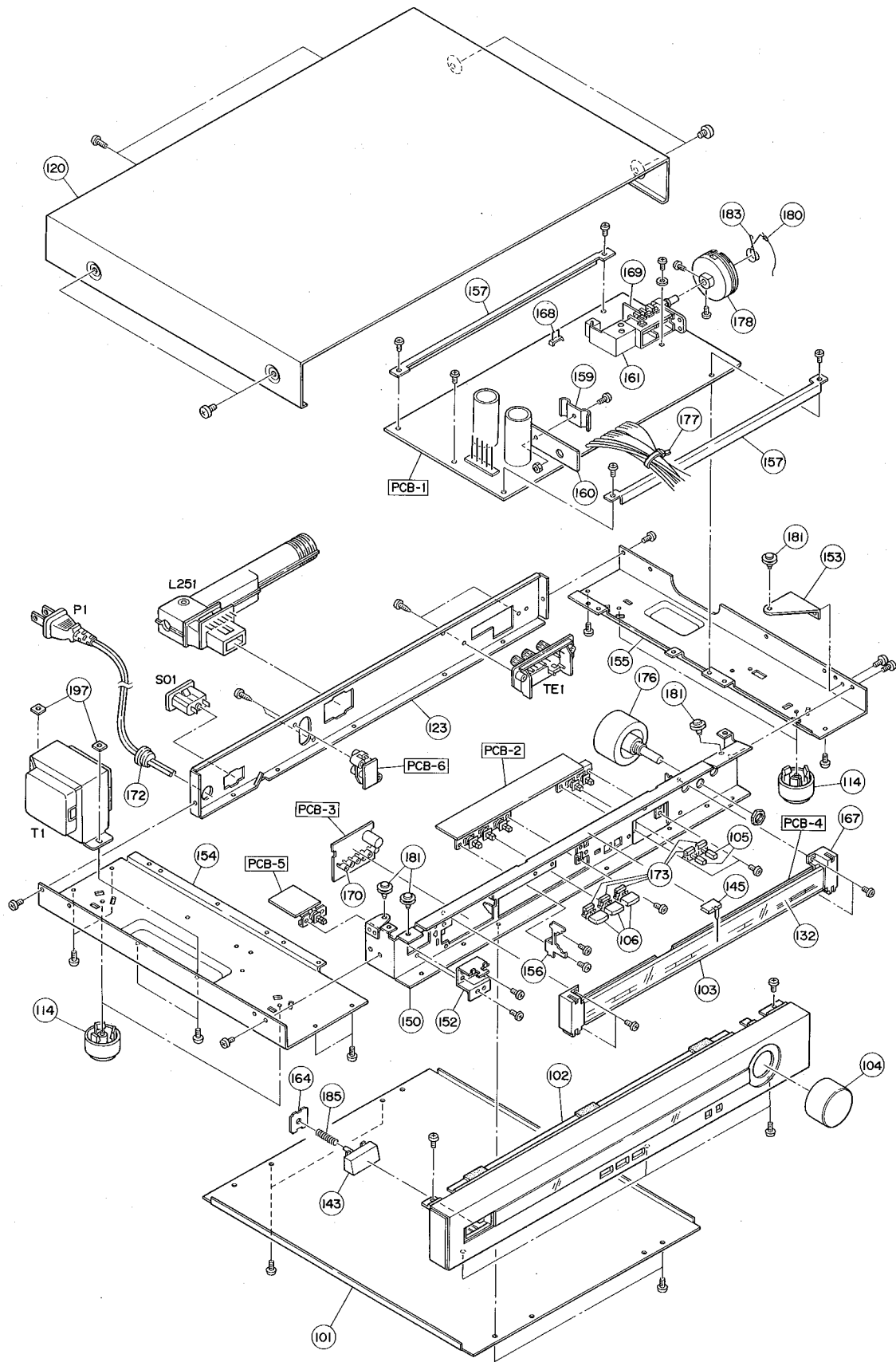
IC3 LA1245 AM CONVERTER & IF



IC2 KB4437 PLL MULTIPLEX DEMODULATOR



GENERAL UNIT EXPLODED VIEW



## GENERAL UNIT PARTS LIST

Ref. No.	Part No.	Description
101	A424-TU610	Cabinet Bottom Cover Assembly
102	A443-TU610	Front Panel Assembly
103	A514-TU610	Plate Assembly
104	A630-TU610	Knob Assembly, Tuning
105	A662-TU610-A	Push Button Assembly, High Blend, Muting
106	A662-TU610-B	Push Button Assembly, FM, Stereo FM, AM
114	1319-0139	Foot
120	1414-02201	Cabinet Top
123	1424-06001	Cabinet Back
132	1541-01501	Dial Panel
143	1662-08001BW	Push Button, Power
145	1674-02701	Dial Pointer
150	2211-7211	Chassis
152	2219-7782	Bracket
153	2219-7806	Bracket
154	2219-7784	Bracket
155	2219-7785	Bracket
156	2219-7781	Bracket
157	2219-7783	Bracket
159	2222-7066	Heat Sink
160	2222-7110	Heat Sink
161	2216-7121	Shield Plate
164	2240-7173	Holder
167	2240-7169	Holder
168	2240-179	Holder
169	2216-7056	Shield Plate
170	2132-7016	Spacer
172	2114-415027	Bushing
173	2601-7098	Shaft
176	2602-007118	Tuning Shaft
177	2240-7120	Holder
178	2611-7154	Dial Drum
180	2424-20351	Eyelet
181	2612-7001	Pulley
183	2651-0000111	Spring
185	2651-210196	Spring
197	2440-49	Special Nut

## ELECTRICAL PARTS LIST

## CHASSIS MISCELLANEOUS

P1	4161-7387	AC Line Cord
SO1	4474-152	External AC Socket, Unswitched
T1	5584-701370	Power Transformer
TE1	4214-104	FM/AM External Terminal
L101	5995-703027	Coil
L251	5911-224	AM Ferrite Loopstick Antenna
J301	4163-041501	Connector with Lead Wire, 4-Pin
J302	4163-051501	Connector with Lead Wire, 5-Pin
J303	4163-70178	Connector with Lead Wire, 3-Pin
JM301	4242-031002	Jumper Lead, 3-Wire
JM302	4242-041402	Jumper Lead, 4-Wire

Ref. No.	Part No.	Description
<b>PCB-1 MAIN P.C. BOARD</b>		
<b>RESISTORS</b>		
R4, 5, 15	5102-4R74713	4.7Ω, ±2%, 1/4W, Fuse
R220	5102-1004713	10Ω, ±2%, 1/4W, Fuse
R262, 305	5102-4704713	47Ω, ±2%, 1/4W, Fuse
R304	5174-153381	15kΩ, ±1%, 1/4W, Metal
R308	5174-751381	750Ω, ±1%, 1/4W, Metal
R380	5102-1504713	15Ω, ±2%, 1/4W, Fuse
<b>CONTROLS</b>		
VR218	5101-1047187	100kΩB
VR303	5101-5027187	5kΩB
VR309	5101-2037187	20kΩB
VR335	5101-1017187	100ΩB
VR356	5101-20371913	20kΩB
VR370, 389	5101-5037187	50kΩB
<b>CAPACITORS</b>		
C5, 6	5345-228D041	2200μF, +50% -10%, 25V, Electrolytic
C207	5345-474-50	0.47μF, +75% -10%, 50V, Electrolytic
C213	5345-106-16	10μF, +50% -10%, 16V, Electrolytic
C214, 216	5345-105-50	1MF, +75% -10%, 50V, Electrolytic
C215, 261, 301, 315, 316	5345-L106M16	10μF, ±20%, 16V, Electrolytic
C257, 317, 318	5345-L475M25	4.7μF, ±20%, 25V, Electrolytic
C258	5345-L335M50	3.3μF, ±20%, 50V, Electrolytic
C264	5345-L474M50	0.47μF, ±20%, 50V, Electrolytic
C269	5345-107-16	100μF, +50% -10%, 16V, Electrolytic
C304	5345-227-16	220μF, +50% -10%, 16V, Electrolytic
C306	5345-L685M25	6.8μF, ±20%, 25V, Electrolytic
C307, 309, 311, 312, 313, 314	5345-L105M50	1μF, ±20%, 50V, Electrolytic
C351	5345-335-50	3.3μF, +75% -10%, 50V, Electrolytic
C352	5345-475-50	4.7μF, +50% -10%, 50V, Electrolytic
C354	5345-477-25	470μF, +50% -10%, 25V, Electrolytic
VC101, 102, 103, 251, 252	5315-7110	5-Gang Variable Capacitor (w/Trimmers TC101, 102, 251, 252)
TC103	5371-55	Trimmer Capacitor
<b>INTEGRATED CIRCUITS</b>		
IC1	5652-HA11225	HA11225
IC2	5652-KB4437	KB4437
IC3	5652-LA1245	LA1245
<b>TRANSISTORS</b>		
Q1	5611-966(O)or(Y)	2SA966(O) or 2SA966(Y)
Q2	5613-2236(O)or(Y)	2SC2236(O) or 2SC2236(Y)
Q3	5613-2603(F)	2SC2603(F)
Q4	5611-1115(F)	2SA1115(F)
Q101	5616-2SK168(D)	F.E.T., 2SK168(D)
Q102	5613-535(B)or(C)	2SC535(B) or 2SC535(C)
Q103	5613-461(B)or(C)	2SC461(B) or 2SC461(C)
Q201, 202	5613-460(B)or(C)	2SC460(B) or 2SC460(C)
Q301, 302, 351, 354, 356, 357	5611-1115(E)or(F)	2SA1115(E) or 2SA1115(F)
Q303, 304, 305, 306, 352, 353, 355, 360, 361, 362	5613-2603(E)or(F)	2SC2603(E) or 2SC2603(F)
Q358, 359	5614-468(C)or(D)	2SD468(C) or 2SD468(D)
<b>DIODES</b>		
D1	5685-S1WB20	Bridge Silicon, S1WB20
D2, 201, 351, 352, 353, 354, 355, 356, 368	5631-1S2473	1S2473
D3, 4	5635-RD9R1EB1	Zener, RD9.1EB1
D357, 358	5635-RD5R1EB2	Zener, RD5.1EB2

Ref. No.	Part No.	Description
<b>COILS</b>		
L102	5943-70125	
L103	5943-70225	
L104	5942-70215	
L105	5991-7065	
L106, 201	5995-3R3254	3.3 $\mu$ H
L107, 108	5597-4	Ferrite Bead
L252	5995-1R0254	
L253	5923-70827	
<b>TRANSFORMERS</b>		
T101	5563-0027	
T201	5574-7023	
T251	5552-7018	
T252	5932-70113	
<b>MISCELLANEOUS</b>		
CF1, 2, 3	5671-7117Z	Ceramic Filter
CF4	5671-7139H	Ceramic Filter
LPF1	5214-30	LC Components
P301	4443-040177	Connector, 4-Pin
P302	4443-050177	Connector, 5-Pin
<b>PCB-2 FUNCTION SELECTOR P.C. BOARD</b>		
<b>CAPACITORS</b>		
C363, 364	5345-L684M50	0.68 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
<b>TRANSISTORS</b>		
Q363	5613-2603(E)or(F)	2SC2603(E) or 2SC2603(F)
<b>DIODES</b>		
D366, 367	5631-1S2473	1S2473
<b>MISCELLANEOUS</b>		
SW2, 3, 4	4431-03067950	Push Switch, FM, Stereo FM, AM
SW5, 6	4431-02047859	Push Switch, High Blend, Muting
<b>PCB-3 LEVEL METER P.C. BOARD</b>		
<b>RESISTORS</b>		
R395	5102-1014713	100 $\Omega$ , $\pm$ 2%, 1/4W, Fuse
<b>CAPACITORS</b>		
C356	5345-476-16	47 $\mu$ F, +50% -10%, 16V, Electrolytic
<b>DIODES</b>		
D359	5637-5NG510(B)or(C)	L.E.D., GL5NG510(B) or GL5NG510(C), FM Stereo
D361, 362, 363, 364, 365	5637-GL5HD10	L.E.D., GL5HD10, Signal
<b>INTEGRATED CIRCUITS</b>		
IC4	5652-AN6875	AN6875
<b>PCB-4 LAMP P.C. BOARD</b>		
LP1, 2	5731-1207244	Lamp, Clarity
LP3, 4	5731-1207144	Lamp, Green
P303	4443-030161	Connector, 3-Pin
<b>PCB-5 POWER SWITCH P.C. BOARD</b>		
SW1	4431-01027274	Push Switch, Power
<b>PCB-6 OUTPUT JACK P.C. BOARD</b>		
J1, 2	4482-7117	2-Pin Jack, Output

PACKAGE

