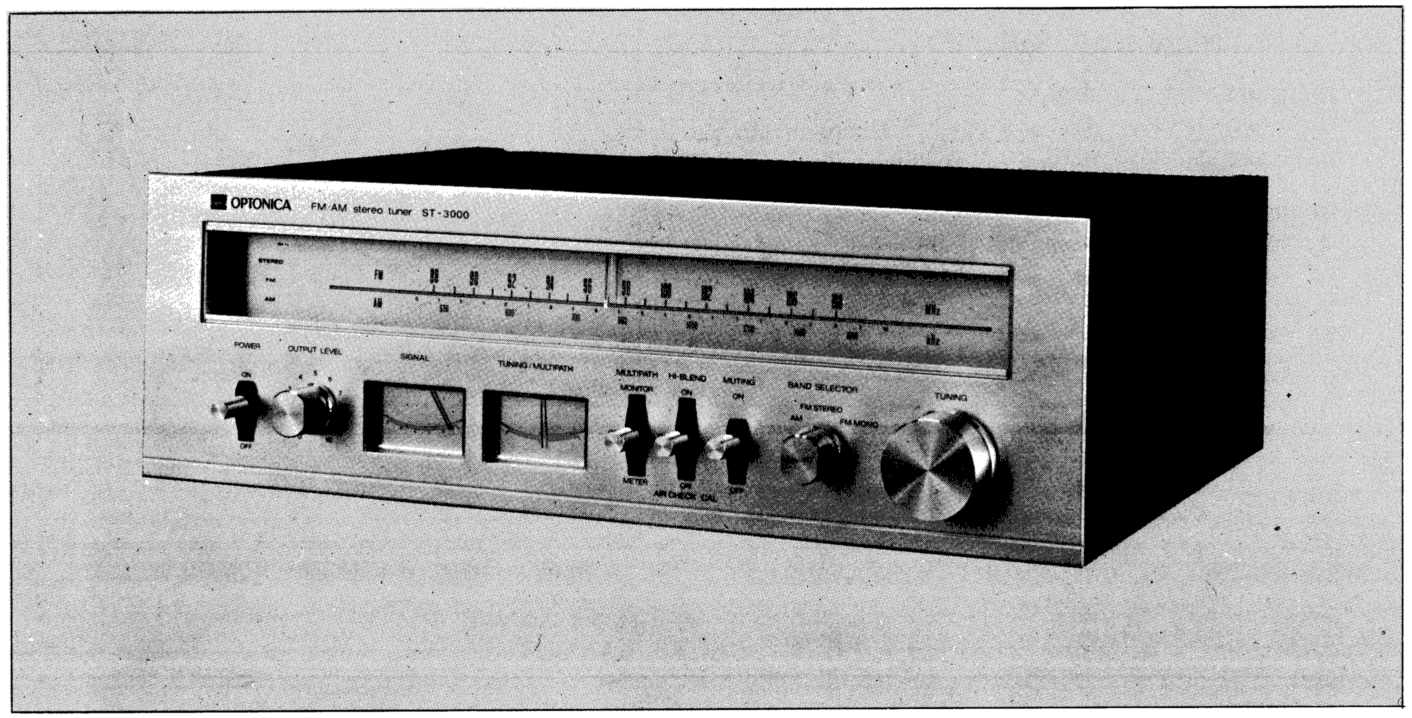
SHARP OPTONICA **SERVICE MANUAL**



MODEL ST-3000H

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SHARP CORPORATION OSAKA, JAPAN

SPECIFICATIONS

■ GENERAL

Power Source .... AC 110/220/240V, 50/60 Hz
Power Consumption .... 24 W
Circuit .... Superheterodyne system, AM/FM 2-bands tuner, with P.L.L. stereo demodulation circuit, FM muting circuit, FM multipath detection circuit, air check calibrator circuit.
Semiconductors .... 5-IC (integrated circuit)+1-Aux. IC, 2-FET(dual gate, MOS type), 10-transistor+16-Aux. transistors and 6-diode+15-Aux. diodes.
Dimensions .... Width: 442 mm (17-13/32")
Height: 144 mm (5-21/32")
Depth: 380 mm (15")
Weight .... 10 kg (22.0 lbs)

■ FM SECTION

Tuning Range .... 87.6 ~ 108 MHz
Intermediate Frequency ... 10.7 MHz
Sensitivity (mono):
(at S/N 30 dB,
40 kHz deviation) .... 1.5 μV
(under IHF standard) ... 1.8 μV
Frequency Response .... 35 ~ 15,000 Hz $^{+0}_{-1.5}$ dB
Signal to noise ratio (mono):
DIN (40 kHz
deviation) .... 65 dB
(at 75 kHz deviation) ... 72 dB
Distortion (75 kHz deviation)
Mono 0.2%
Stereo 0.4%
Image Rejection .... 90 dB
IF Rejection .... 90 dB
Spurious Frequency
Rejection .... 90 dB
AM Suppression
(Mod. 30% AM by 1,000 Hz and 100%
FM by 400Hz) .... 50 dB
Capture Ratio .... 1.0 dB
Selectivity:
DIN (±300 kHz, 40 kHz
deviation) .... 55 dB
Stereo Separation .... 38 dB (1 kHz)
Antenna Input .... 75 ohms unbalanced
300 ohms balanced

■ AM SECTION

Tuning Range .... 520 ~ 1,620 kHz
Intermediate Frequency ... 455 kHz
Quieting Sensitivity .... 230 μV/m
Image Rejection .... 60 dB (at 1,400 kHz)
IF Rejection .... 60 dB (at 600 kHz)
Distortion .... Less than 1.5%
Antenna .... Built-in ferrite loopstick antenna
AM external antenna terminal.

■ AUDIO SECTION

FM Output Voltage
(at 75 kHz deviation) ... VARIABLE: 0 ~ 1.2 V
FIXED: 0.8 V
AM Output Voltage .... VARIABLE (30%, Mod.): 0 ~ 0.3V
FIXED (30%, Mod.) 0.15 V

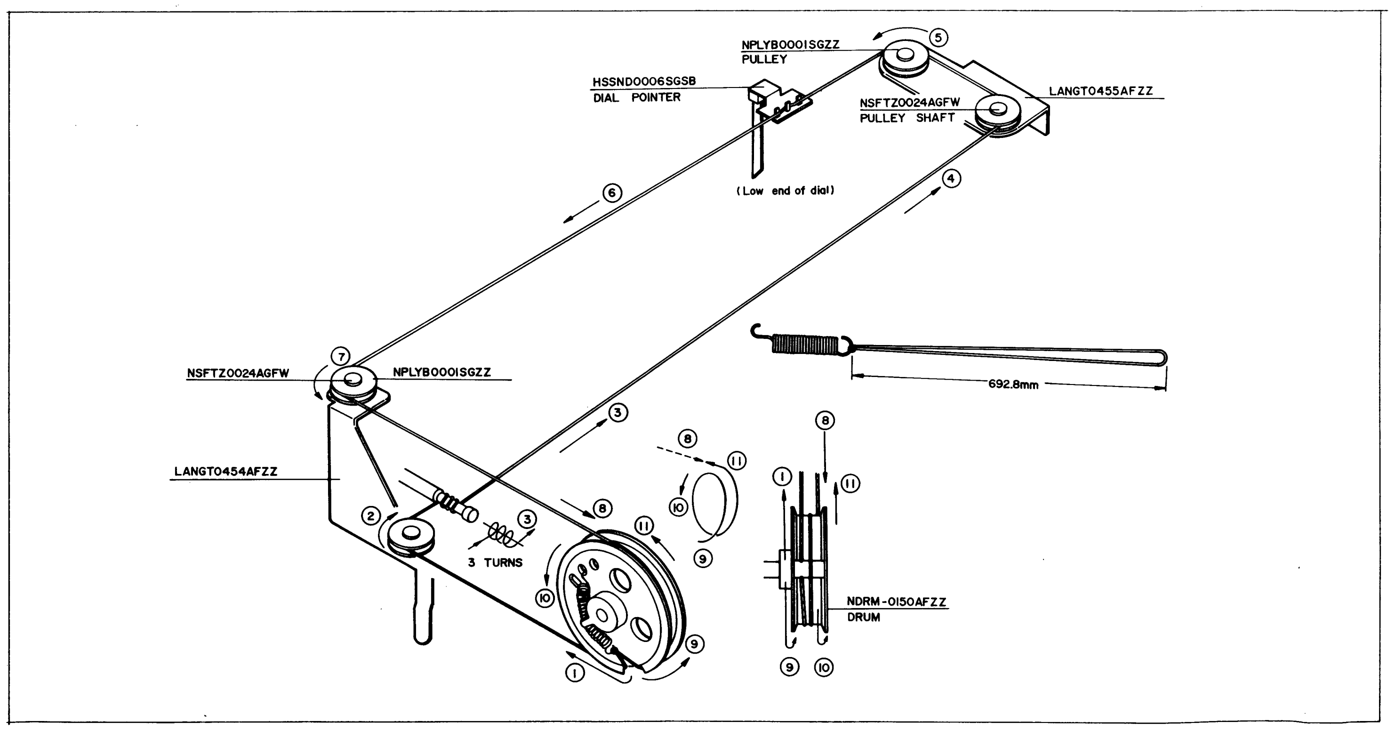


Figure 1 DIAL CORD STRINGING

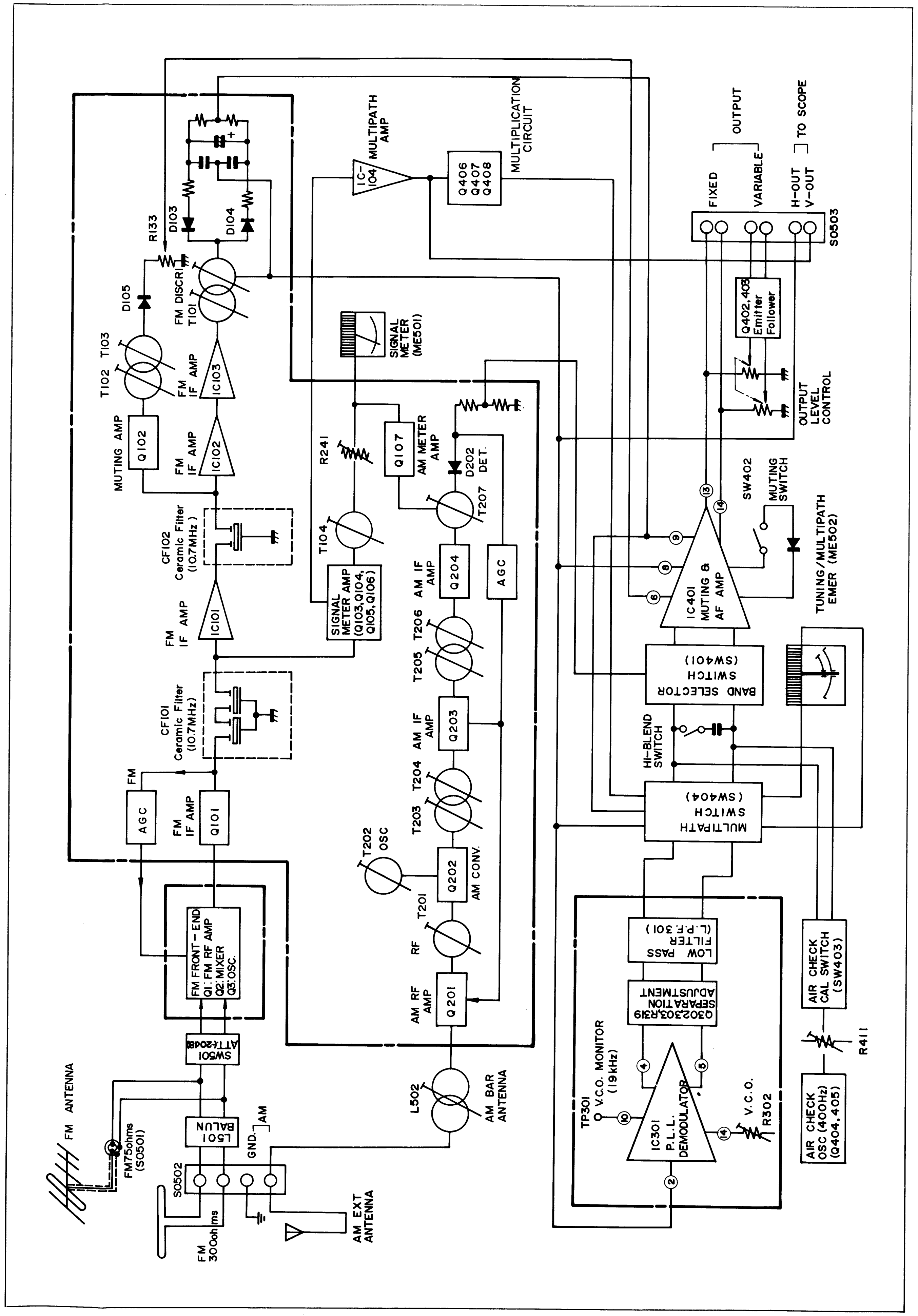


Figure 2 BLOCK DIAGRAM

CHASSIS REMOVAL

① To Remove Cabinet:
(A) Unscrew 8 screws (1) retaining decorative plates on either side of the unit and remove decorative plates.
(B) Unscrew 2 screws retaining cabinets on either side of the unit and remove cabinets.

② To Remove Bottom Board
Turn the unit over, unscrew 8 screws retaining the bottom board and draw the bottom board frontwards.

③ To Remove Front Panel
(A) Remove 7 knobs from the front panel (tuning knob, band selector knob, output level control knob and other 4 lever knob).
(B) Unscrew 5 screws retaining the front panel and remove the front panel.

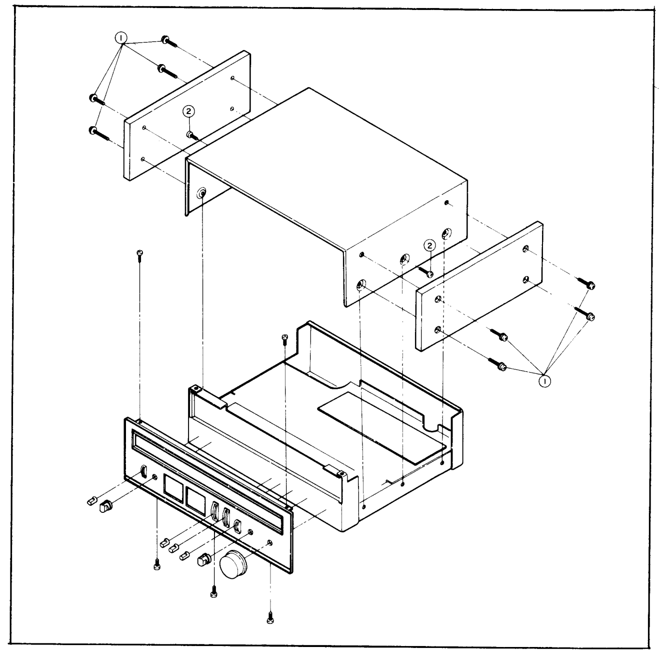
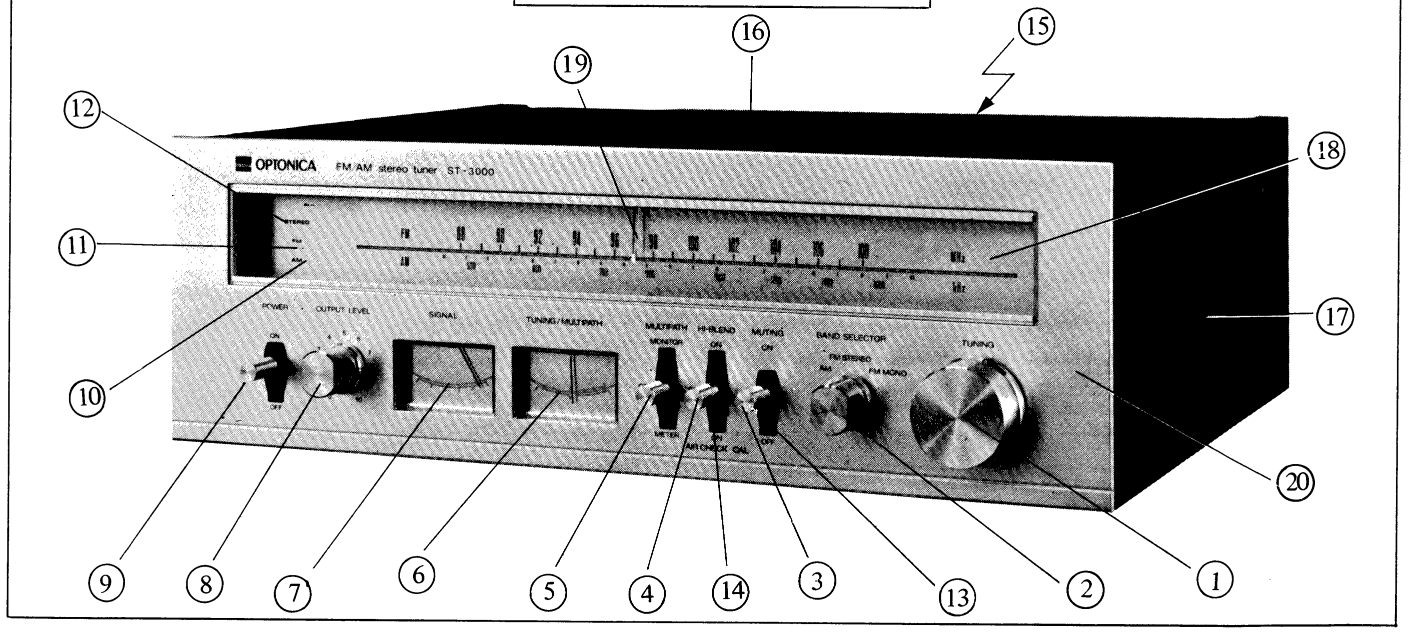


Figure 3 CHASSIS REMOVAL

FRONT PARTS LAYOUT



Fiture 4 FRONT PARTS LAYOUT

① Tuning control knob (JKNBN0275AFSA)
② Band selector knob (JKNBN0274AFSA)
③ FM muting switch knob (JKNBP0058AFSA)
④ High blend/Air check switch knob (JKNBP0058AFSA)
⑤ Multipath switch knob (JKNBP0058AFSA)
⑥ FM tuning/multipath meter (RMTRL0102AFSB)
⑦ Signal meter (RMTRL0103AFSB)
⑧ Output level control knob (JKNBN0274AFSA)
⑨ Power switch knob (JKNBP0058AFSA)
⑩ AM indicator lamp (RLMPM0018AG02)
⑪ FM indicator lamp (RLMPM0018AG09)
⑫ FM STEREO indicator lamp (RLMPM0018AG04)
⑬ Guide of lever switch (GCOVA1053AFSA)
⑭ Guide of lever switch (GCOVA1054AFSA)
⑮ Rear panel (LANGQ0438AFSA)
⑯ Cabinet (GCAB-3002AFSA)
⑰ Decoration plate (HDECW0050AFSB)
⑱ Dial scale (HDALP0330AFSA)
⑲ Dial pointer (HSSND0006SGSB)
⑳ Front panel (HPNLC3218AFSA)

CIRCUIT DESCRIPTION

AM SECTION

Coil L502 is AM antenna coil working as antenna tuning circuit.

Being caught by the antenna coil L502, AM broadcast signal is supplied to the base of transistor Q201 to be amplified, then to the converter (transistor Q202) via RF tuning circuit (transformer T201). Transformer T202 is local oscillation coil.

IF amplification section consists of transformers T203 ~ T207 and transistors Q203 and Q204 in which transformers T203 and T204, T205 and T206 are made respectively to be capacitor coupled double-tuned circuit, and D202 (1N60) is AM detection diode and D201, AGC diode.

FM RF SECTION

FM antenna input circuit has two input terminals (75 ohms and 300 ohms) thanks to impedance converter (balun), coil L501. The 75 ohms input terminal (SO501) is used when FM antenna is connected to the unit by using a coaxial cable. The 300 ohms input terminal (SO502) is used when FM antenna is connected to the unit by using a balanced feeder.

Attenuator is provided to obtain good reception even with stronger signal (FM) input to the antenna and its attenuation is about 20 dB. It is possible to change over the attenuator (0 dB/–20 dB) by the switch SW501. RF amplifying section consists of 2 dual gate MOS-FET's and 1 transistor.

Transistor Q1 is dual gate MOS FET and its function is nearly the same as of vacuum tube. Due to the adoption of MOS FET, crossmodulation characteristic and spurious characteristic are remarkably improved compared with conventional transistor type.

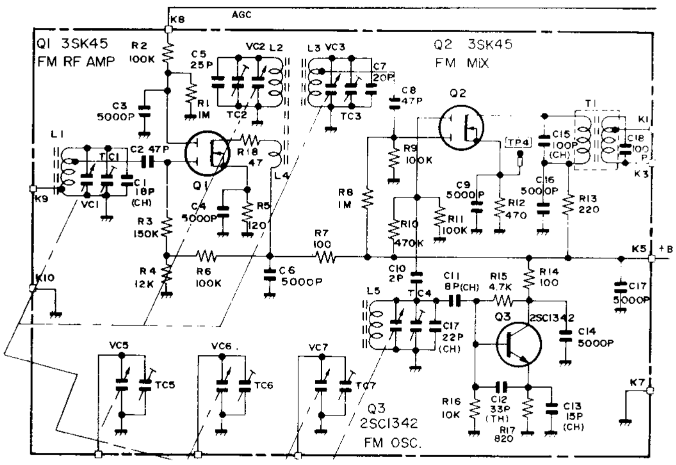


Figure 5 FM FRONT-END CIRCUIT

It is so devised that AGC voltage is applied to the terminal K8 of FM Front-End circuit.....this results in that when input signal to FM antenna is strong, amplification degree of transistor Q1 is lowered so as to stabilize FM reception.

Transistor Q1 is for FM RF amplification and transistor Q2 works as frequency mixer. Transistor Q3 is FM local oscillation transistor and applies oscillation voltage to transistor Q2 through capacitor C10. Therefore, coil L1 is for antenna tuning, coils L2 and L3 are for RF amplification and tuning and coil L5 is for local oscillation. Figure 5 shows the circuits of FM Front-End section.

FM IF SECTION

FM IF section consists of 3 ICs, 1 transistor and 2 ceramic filters. Transistor Q101 is for FM IF amplification and AGC amplification. 10.7 MHz signal is amplified by the transistor Q101 and supplied, through resistor R109, to an integrated selection element, phase linear ceramic filter CF101 featuring high selectivity by which IF signal is amplified without distortion and provided with a proper selectivity. Moreover, IF signal is amplified by IC101, ceramic filter CF102, IC102 and IC103 with its selectivity being kept high. Thereafter, IF signal is detected (demodulated) by ratio detector circuit following transformer T101.

FM MUTING CIRCUIT

The muting circuit of the unit consists of IC401. To the terminal ⑥ of IC401 is applied such signal as:

IF signal comes out of the ceramic filter CF102 and it, passing through R122 and C118, is amplifed by the transistor Q102 and then passes through tuning circuit made of transformers T102 and T103 and finally detected by the diode D105.

Besides, to the terminals ⑧ and ⑨ of IC401 is applied such signal as taken out of the center point Ⓐ between capacitors C119 and C120 and the center point Ⓑ between resistors R126 and R127 respectively of ratio detector circuit (this circuit determines muting width).

Muting signal taken out of the terminal ⑤ of IC401 is so maintained for a given time by the transistor Q401 and capacitor C423 as to prevent unpleasant sound from being caused even when rotating swiftly the dial to tune in a broadcast.

The peripheral circuits are as shown below.

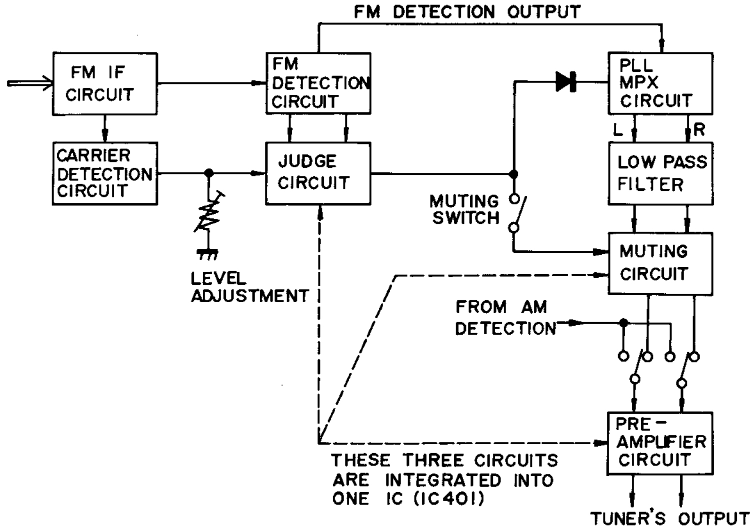


Figure 6

The signal supplied to the judge circuit from the FM detection circuit is as shown below.

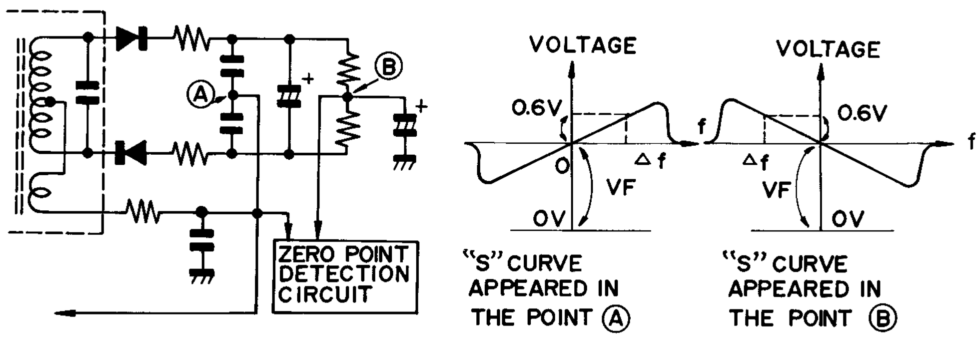
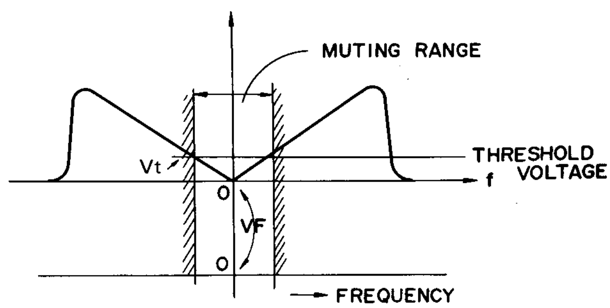


Figure 7

The judge circuit works as follows to determine the muting range. (Refer to "Internal Equivalent Circuit").

As seen from the above figure, it is so designed that the muting becomes uneffective only when the threshold voltage is decreased to less then Vt and IF carrier detection output is being caused. Therefore, not only inter-station noise but also side noise are completely eliminated. Moreover, the muting switch causes less popping sound when switched on or off because it is designed to work only with DC.



MUTING RANGE AND THRESHOLD VOLTAGE

Figure 8

FM STEREO DEMODULATOR SECTION

This set incorporates a stereo demodulator circuit that comprises IC's with the PLL (Phase Locked Loop) system applied. The PLL (Phase Locked Loop) FM demodulator circuit is provided with such characteristics as mentioned below.

In order to demodulate stereo composite signals, it is necessary to take a 19kHz pilot signal out of the stereo composite signals and to make it a 38kHz signal.

Most of the conventional methods to obtain such a 38kHz signal are frequency doubling ones which utilize a nonlinearity of the elements. Compared with the conventional type, the recently developed IC-ed demodulator provides more sufficient separation effects. However, since it also requires 2 or 3 coils like the conventional one, if even one of them is dislocated from the initially adjusted point due to a secular change the separation effects will be deteriorated. Moreover there is such a contradiction that the more the efficiencies of the coils are increased enough to withstand the outer pulse signals like automobil ignition noises, the more the coils suffer secular changes.

To eliminate such disadvantages as above, PLL (Phase Locked Loop) system is employed in the method to make a 38kHz signal using a 19kHz pilot signal.

The PLL system stereo demodulator gives such three merits as:

1. Since the phases of a pilot signal and a 38kHz signal are automatically made the same with each other, the deterioration of separation effect is strongly minimized.
2. Since only one of variable resistor, being newly employed, plays the role of 2 to 3 pieces of conventional coils, troubles of the parts due to secular changes are decreased. In addition, even if this variable resistor is slightly dislocated, the separation effect will never be deteriorated because of the merit as mentioned in 1 by which the automatic phase adjustment is assured.
3. Compared with the conventional one, the PLL system demodulator shows a more noise withstanding characteristic since it has such performances as the selection of frequencies and the continuity of oscillation frequencies (short-time memory), thus assuring a stable stereo demodulation.

Next given are rough explanations on the PLL system stereo demodulator circuit.

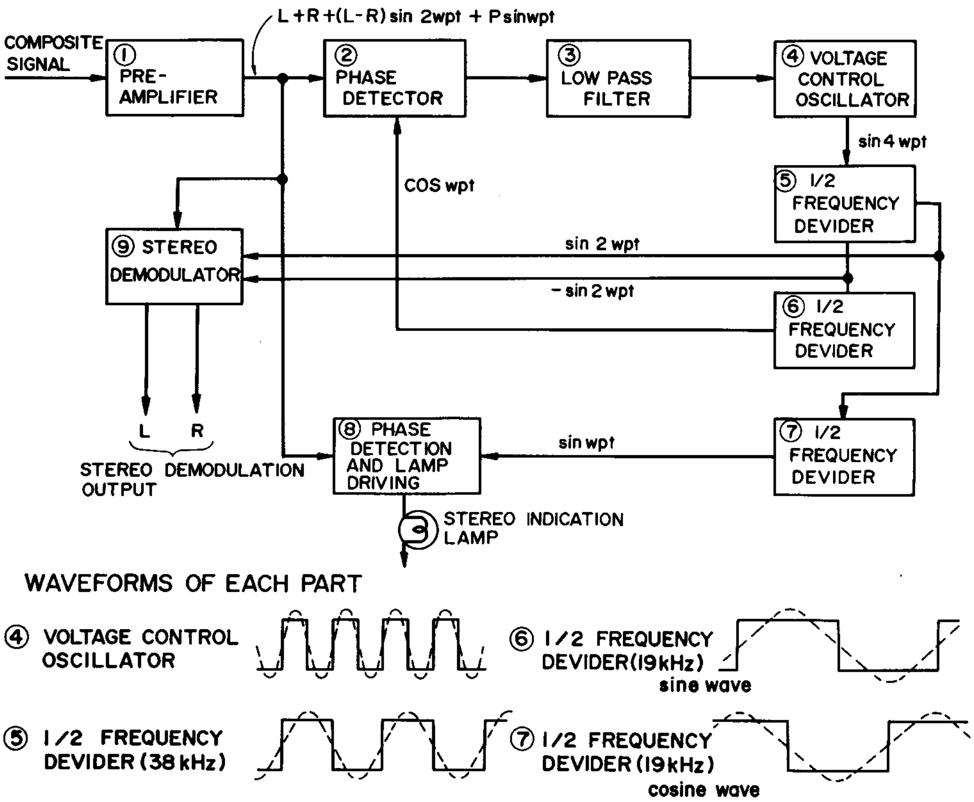


Figure 9

Functions of each part

① Pre-amplifier: Amplifies composite signals.
② Phase detector: Generates the voltage in proportion to the phase difference between the pilot signal and 1/4 frequency devided signal of the voltage control oscillator.
③ Low pass filter: Eliminates the high frequency signal and determines the band of loop.
④ Voltage control oscillator: Varies the frequency in proportion to the voltage. (76kHz oscillation)
⑤ 1/2 frequency devider: Forms 38kHz signal.
⑥ 1/2 frequency devider: Forms 19kHz signal (cosine wave).
⑦ 1/2 frequency devider: Forms 19kHz signal (sine wave). Compared with ⑥, the phase lags by 90°.
⑧ Phase detector: Detects that the loop is locked and let the stereo lamp put on.
⑨ Stereo demodulator: Using a 38kHz signal, it demodulates L and R signals from the composite signal.

With this system, the adjustment of the multiplex section becomes more simple because it can be made by adjusting only two variable resistors; R302 used for adjusting free running frequency and R319 used for adjusting the separation. After being demodulated by this IC, the FM signal passes through the low pass filter LPF301 and the de-emphasis circuit to be supplied to the IC401.

AIR CHECK CALIBRATION CIRCUIT

This circuit is to make appropriate the recording level in advance when recording FM broadcast into the tape recorder.

The air check signal level is based on the output signal at the output terminal (SO503). 400 Hz signal generated by phase type oscillator made of transistor Q404 is taken out of emitter follower circuit, low-frequency amplified to appear at the output terminal (SO503).

In other words, when the AIR CHECK CAL. switch at the front panel is set to "ON" position, ⓐ and ⓑ of the air check cal. circuit are connected to each other, oscillator voltage is taken out of ⓒ and it appears at the output terminal (SO503) at the rear panel being as air check signal level.

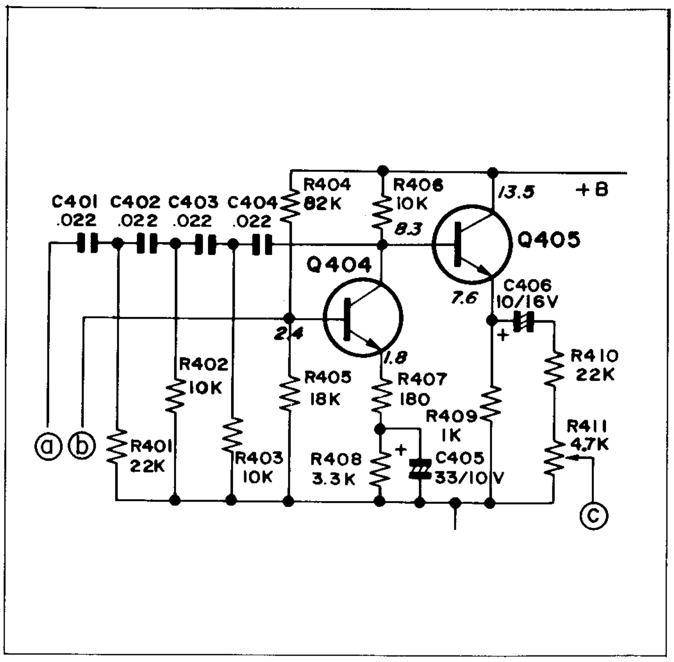


Figure 10 AIR CHECK CALIBRATION CIRCUIT

The air check signal level is set to 38 ± 8% of the output voltage obtained when the tuner receives FM broadcast signal (modulation 100%, 75 kHz deviation) and this level voltage appears at the output terminal of the rear panel through the air check oscillator circuit. R411 is semi-fixed resistor to be used for adjusting the air check signal level.

How to record FM broadcast using the air check calibration system is described below.

Set the air check cal. switch to "ON" position, put the tape recorder in record mode, apply air check signal to the tape recorder and adjust the record level so that the record level meter of tape recorder indicates "0 VU". After that, set the air check cal. switch to "OFF" position and proceed with recording FM broadcast.

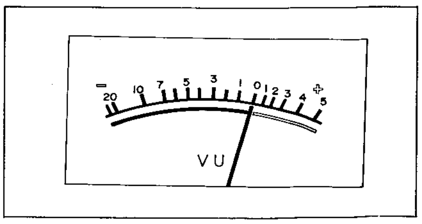


Figure 11 0 VU

MULTIPATH DETECTOR CIRCUIT

(A) What Is Multipath?

Multipath distortion

In general, transmission of sound or visual images by using electric waves from one given point to another may be affected by the nature of the intervening terrain.....the electric wave may reflect on, for example, tall buildings and rough mountainous terrain. The original sound or visual images are distorted by such reflections when they reach the receiving antenna.

An easy example of this distortion is that the picture of television may appear doubly (it is called "Ghost") when the TV set is near tall buildings or mountains and this phenomenon is due to a time lag between direct wave and reflection wave. In case of FM broadcasting, this time lag makes the received signal (sound) be distorted. The distortion is liable to occur particularly in stereo signals because their band width is wider than monaural signals and the separation characteristic is deteriorated. These distortions are called multipath distortion.

(B) Multipath Circuit

After passing through the ceramic filter CF101, multipath component enters the transistor Q103 via resistor R112 and capacitor C110 to be AM detected.

Multipath component thus AM detected is taken out of the capacitor C228 which is being connected to the collector of transistor Q103. Then, the multipath component is made rid of high harmonic by the resistor R252 and capacitor C235 and it enters IC104 to be further amplified.

A part of this output appears at V-OUT terminal (multipath output terminal) and the remaining output enters multiplication circuit made of transistors Q407 and Q408.

The circuit of this type is also used for multiplex stereo demodulator circuit and it includes two input terminals to produce multilication output of two inputs.

When these two input terminals (the bases of transistors Q407 and Q408) are given the same signal (output signal of IC104), the transistors Q407 and Q408 work as square amplifier and thus the ratio between miltipath component and multipath-free FM signal is made larger.

That it, the multipath distorted component is made larger enough to allow the meter (ME502) to swing. Resistor (1K ohm) and capacitor (100MFD) at the collector of transistor Q407 form a low-pass filter. Diode D403 is to determine the maximum range where the meter (ME502) can swing.

When the multipath switch is set to "MONITOR", signal is amplified by IC401 to appear at the output terminal.

How to detect multipath distortion:

① By using meter;

Receive FM broadcast and tune it accurately so that the signal meter (ME501) can swing to the maximum extent. Under this condition, set the multipath switch to "METER". If the signal received is being affected by multipath distortion, the pointer of multipath meter swings to right. At the time, FM broadcast signal comes out of the output terminal at the rear panel.

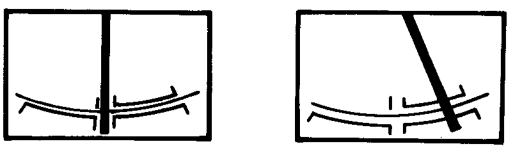
Rotate the antenna so that the pointer of multipath meter swings to the least extent (this means multipath interference is least) while the pointer of signal meter swings to the maximum extent.

The multipath meter functions only at its right half.

② By using monitor;

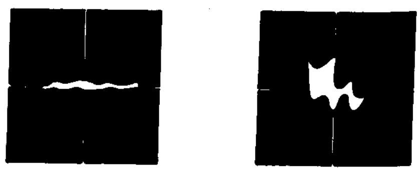
Receive FM broadcast and tune it accurately so that the signal meter (ME501) can swing to the maximum extent. Under this condition, set the multipath switch to "MONITOR" and adjust the volume control of the amplifier connected to the tuner so that multipath distorted sound can be heard. Rotate the antenna so as to lessen distorted sound to the minimum and so that the pointer of signal meter swings to the extent not extremely small and the pointer of tuning meter indicates to its center.

With the multipath switch set to "MONITOR", multipath component appears at the tuner output terminal.



No multipath distortion — Much of multipath distortion

Figure 12



No multipath distortion — Much of multipath distortion

Figure 13

③ By using oscilloscope;
Connect V-OUT terminal and H-OUT terminal of the multipath terminal at the rear panel respectively to the vertical axis terminal and horizontal axis terminal of an oscilloscope. Receive FM broadcast and tune it so that the pointer of signal meter swings to the maximum and that of tuning meter comes to its center.
Adjust the sensitivity of oscilloscope to about 50mV/cm for both the vertical and horizontal axes and generate waveforms on the screen by regulating each axis. Waveform varies according to the degrees of multipath interference as shown in Fig. 13.

METER INDICATOR CIRCUIT (FM)

IF output signal coming from the ceramic filter CF101 is taken out by the resistor R112 and capacitor C110 and amplified by four transistors Q103 thru Q106.
The signal thus amplified is detected by the transformer T104 and diode D206 to allow the signal meter (ME501) to swing. The amplifier made of transistors Q103 thru Q106 is so designed as to make the meter (ME501) to swing in proportion to the input voltage of antenna (up to the variation of about 60 dB).

HIGH-BLEND CIRCUIT

The high-blend circuit consists of high-blend switch and capacitor C436 as shown in the figure hereof. In the reception of stereo broadcast, noises possibly caused in both channels are reverse in phase to each other. The high-blend circuit is to offset these two noises each other thus increasing tone quality. The high-blend circuit functions when the high-blend switch is set to "ON" position. With the high-blend switch set to "ON", however, the separation in high-frequency band becomes a little decreased.

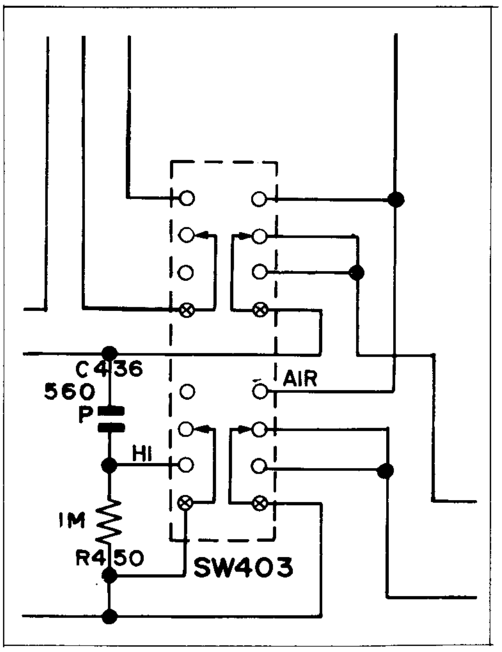


Figure 14 HIGH-BLEND CIRCUIT

POWER SUPPLY SECTION

The power supply section consists of zener diode D504 and transistors Q501 and Q502 and it generates a constant voltage of 13.5V for driving the main parts of the unit and also makes 10.6V supply to light up the stereo lamp and to do the muting operation immediately after the power switch is turned on.

ALIGNMENT INSTRUCTIONS

Alignment is an exacting procedure and should be undertaken only when necessary. If alignment of AM and FM is required, either section may be done first. The FM stereo section, however, should be done only if the FM monaural section is properly adjusted.

REQUIRED EQUIPMENT

1. Signal generator with a frequency range of 450kHz to 1650kHz; AM
2. Signal generator with a frequency range of 86.5MHz to 108.5MHz; FM
3. Signal generator with a frequency output of 10.7MHz ±0.5MHz; FM
4. Vacuum tube voltmeter (AC-VTVM)
5. Sweep signal generator with a sweep range of at least 500kHz and center frequency of 10.7MHz with at least a 10.7MHz marker may be used.
6. Oscilloscope with a wide range amplifier of approximately 100kHz.
7. Test loops, a coil of any size wire, one turn or more; AM
8. Vacuum tube voltmeter (DC-VTVM)
9. FM stereo signal generator.
10. Audio signal generator with a frequency range of 20Hz to 100kHz.
11. Frequency counter with a frequency range of approximately 100kHz.

Notes: Allow the set at least five minutes to warm up before attempting alignment. During alignment keep the signal generator output at the lowest level that will maintain a useble output from the set.
For the adjustment of stereo separation, the FM stereo generator output is usually 1,000μV. Incorrect grounding to the metal chassis may pick up an unwanted 10.7MHz signal from the final IF stage, which will cause a regenerative sweep response on the sweep curve and result in misalignment.
Therefore always connect a ground to point.

Ground connection of signal generator	Chassis ground
Generator modulation (AM)	30%, 400Hz
Generator modulation (FM)	40kHz, 400Hz
Generator modulation (FM stereo)	Ch. L. or Ch. R. 40kHz, 1,000Hz Mod.

THE INSTRUCTION OF FREQUENCY ADJUSTMENT

In order to comply with FTZ rule: Nr. 358 S757, please fix the low end of dial frequency (87.5MHz) and high end of dial frequency (107.9MHz) on FM band, by adjusting oscillation coil (L5) and oscillation trimmer (TC4), repectively, as illustrated in Figure 15.

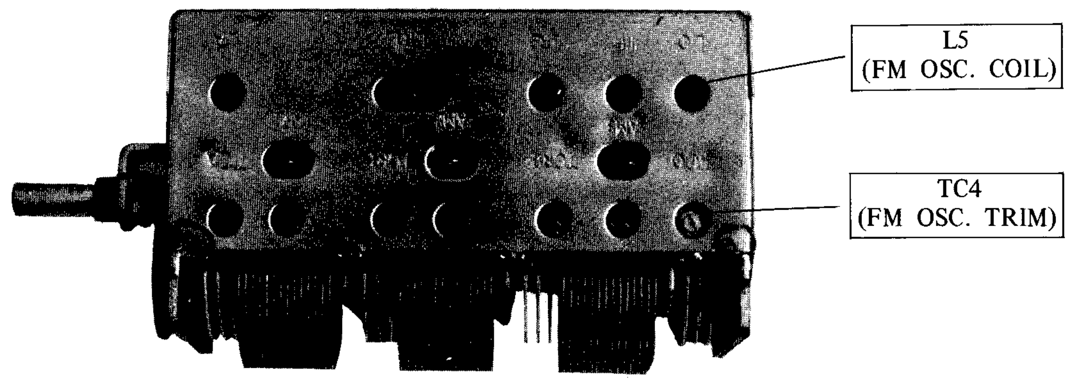


Figure 15 FM FRONT-END

AM ALIGNMENT

(Refer to Figure 16)

PROCEDURE NUMBER	TEST STAGE	SIGNAL GENERATOR CONNECTION	SIGNAL GENERATOR FREQUENCY	DIAL POINTER SETTING	SELECTOR SETTING	METER CONNECTION	ADJUSTMENT	REMARKS
1	IF (NOTE A)	Thru 0.01MFD to Q201 Base as small as possible.	455kHz (SG or sweep) Modulated	High end of dial	Band selector (AM)	Connect oscilloscope between test point TP201 and chassis ground.	T203 T204 T205 T206 T207	Output control maximum. Adjust for maximum response at 455kHz. Repeat 2 or 3 times. (Refer to figure 17)
2	Band Coverage	Radiated signal as small as possible.	515kHz Modulated	Low end of dial	Same as step 1.	Across output load (SO503-B, Lor R)	Oscillator coil T202.	Output control maximum. Adjust for maximum output.
3		Same as above.	1650kHz Modulated	High end of dial	Same as step 1.	Same as sbove.	Oscillator trimmer TC7.	Output control maximum. Adjust for maximum output. Repeat steps 2 and 3, 2 or 3 times.
4	Tracking	Same as step 2.	1400kHz Modulated	1400kHz	Same as step 1.	Same as step 2.	Antenna trimmer TC5 and RF trimmer TC6.	Same as step 2.
5		Same as step 2.	600kHz Modulated	600kHz	Same as step 1.	Same as step 2.	Antenna coil L502 and RF coil T201 (NOTE B)	Same as step 3. Repeat steps 4 and 5, 2 or 3 times.

NOTE A However, as for the set of UK, adjust IF to 465 kHz.

NOTE B When adjusting the antenna coil L502, remove it from the antenna holder and arrange it as shown in Fig. 18, beforehand. (Make the coil be fully apart from and in parallel with the rear panel).

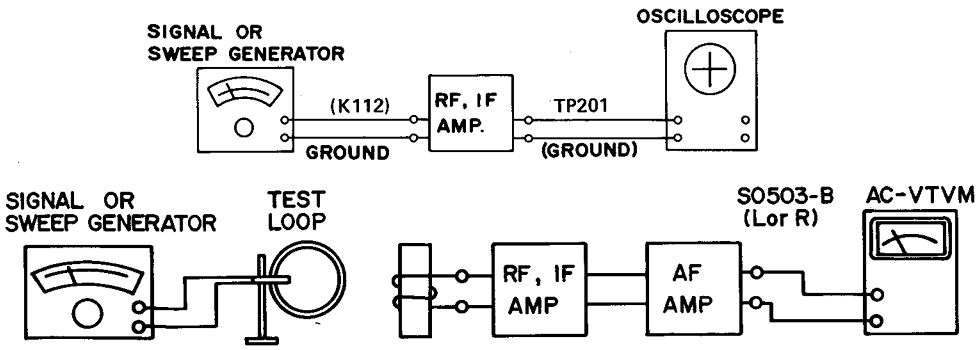
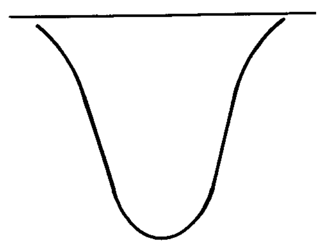


Figure 16 AM ALIGNMENT EQUIPMENT CONNECTIONS



455 kHz

Figure 17

Proceed with the tracking by rotating the core.

Figure 18

FM IF ALIGNMENT (Refer to Figure 21)

PROCEDURE NUMBER	TEST STAGE	SIGNAL OR SWEEP GENERATOR			DIAL POINTER SETTING	SELECTOR SETTING	METER CONNECTION	ADJUSTMENT	REMARKS
		CONNECTION	FREQUENCY	MODULATION					
1	IF (NOTE D)	Detune T101(upper side) completely							
2		Thru 0.01MFD to TP4 .	10.7 MHz ±200kHz	Unmodulated	High end of dial	Band Selector (FM MONO)	TP102 (Oscilloscope)	T1 (Upper and Lower sides) and T101 (Lower side).	Set curve at maximum as shown in the Figure 19.
3	Ratio Detector		10.7 MHz ±200 kHz		Same as above	Same as above		T101 (Upper side)	Top core adjustment: Make the height of two peaks of "S" curve equal. Bottom core adjustment; Make the lineality of "S" curve best
4	If necessary, repeat Step 2–Step 3.								

NOTE C Transformer T1 is provided with core at both the upper and lower parts.

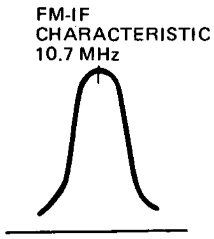


Figure 19

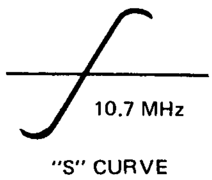


Figure 20

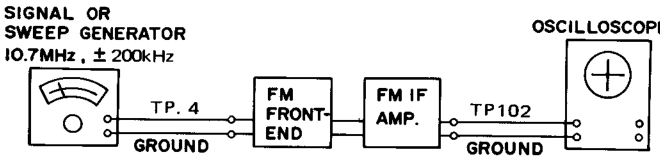


Figure 21 FM IF ALIGNMENT EQUIPMENT CONNECTIONS

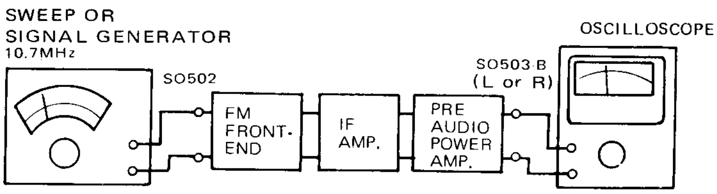


Figure 22 FM RF ALIGNMENT EQUIPMENT CONNECTIONS

FM RF ALIGNMENT (Refer to Figure 22)

PROCEDURE NUMBER	TEST STAGE	SIGNAL GENERATOR		DIAL POINTER SETTING	SELECTOR SETTING	METER CONNECTION	ADJUSTMENT	REMARKS
		CONNECTION	FREQUENCY					
1	Band Coverage	FM Antenna	88MHz as small as possible (Modulated)	Low end of dial	FM MONO	Across output load (SO503-B)	Oscillator coil L5.	Adjust for maximum output.
2		FM Antenna	106MHz (Modulated) as small as possible	High end of dial	FM MONO	Same as above	Oscillator trimmer TC4.	Same as above. Repeat steps 1 and 2, 2 or 3 times.
3	Tracking	FM Antenna	90MHz (Modulated) as small as possible	90MHz	FM MONO	Same as step 1.	Antenna coil L1 and RF coil L2, L3.	Same as step 1.
4		FM Antenna	104MHz (Modulated) as small as possible	104MHz	FM MONO	Same as step 1.	Antenna trimmer TC1 and RF trimmer TC2, TC3.	Same as above. Repeat steps 3 and 4, 2 or 3 times.

NOTE D

Ceramic filter (CF101 and CF102) used in this unit is available in 5 kinds that are identified by colors green, black, red, white and yellow according to the central frequencies. When replacing the ceramic filter with a new one, be sure to use parts of the same color making them a pair.

When using the ceramic filters other than that of central frequency 10.70 MHz (red), the FM sweep marker (10.70 MHz) is shifted. Therefore be sure to turn off the FM sweep marker before the adjustment.

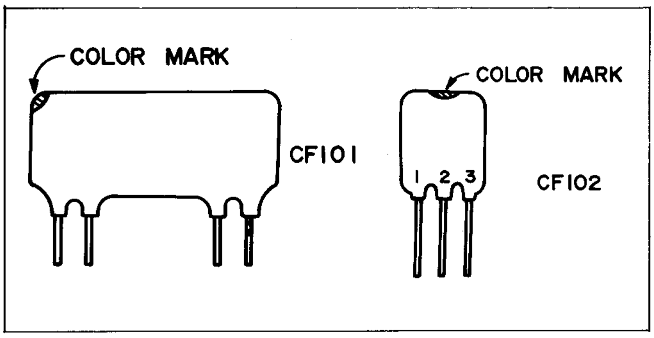


Figure 23

FM STEREO ALIGNMENT (Refer to Figure 24)

PROCEDURE NO.	TEST STAGE	SIGNAL OR SWEEP GENERATOR CONNECTION	FREQUENCY	MODULATION	DIAL POINTER SETTING	SELECTOR SETTING	METER CONNECTION	ADJUSTMENT	REMARKS
1	MPX	FM signal generator connected to the FM ANT terminal through 300 ohm dummy			———	Band selector (FM AUTO)	Connect the frequency counter (or oscilloscope) to TP301. (⑩ pin of IC301)	R302	Adjust so that the frequency becomes 19.0kHz. (In case an oscilloscope is connected to the test point TP301, adjust the signals to be 19kHz by using Lissajou's waveform.
2	MPX		98MHz	Stereo Mod. (1000Hz) L only.	98MHz	Same as above.	Across channel R output load.	R319	Make the L to R crosstalk minimum.

* Output level of FM Signal Generator which is modulated by a FM Stereo Signal Generator shall be 1000μV (60dB).

* If without the frequency counter, proceed with the alignment as follows. While receiving a FM stereo signal, turn the R302 until the PLL will be locked (when it is locked, the stereo indicator will be lit.) Then, reversely turn the R302 halfway and fix it.

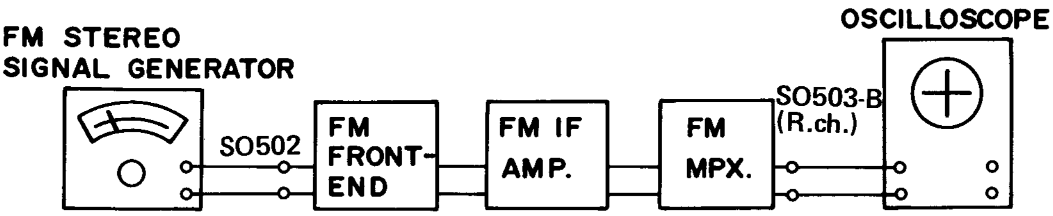


Figure 24 FM STEREO ALIGNMENT EQUIPMENT CONNECTION

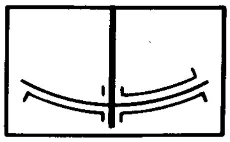


Figure 25

READJUSTMENT OF FM IF

(1) With the set tuned in 98 MHz, adjust the coil at the upper of T101 so that the pointer of FM tuning meter indicates to the center at the time of no-signal as shown in Figure 25.

(2) With signal of 98 MHz (400 Hz, 40 kHz DEV.) 60 dB applied, tune FM SG to the position where the signal meter swings to the maximum extent and the pointer of FM tuning meter indicates to the center as the above (1).

(3) With the above state, adjust the coil of T1 so that the signal meter swings at maximum, then the coil at the lower of T101 so that distortion becomes minimum.

ADJUSTMENT OF SIGNAL METER (ME501)

Use a signal generator to produce FM signal of 98 MHz (400 Hz, 40 kHz deviation) 40 dB to apply it to the unit, rotate the semi-fixed resistor R241 fully to right and adjust the transformer T104 so that the signal meter swings to the maximum. Increase the signal input level to 100 dB and adjust R241 so that the signal meter swings by 4.8. Finally, decrease the input level to 30 dB and make sure the signal meter swings by more than 0.5.

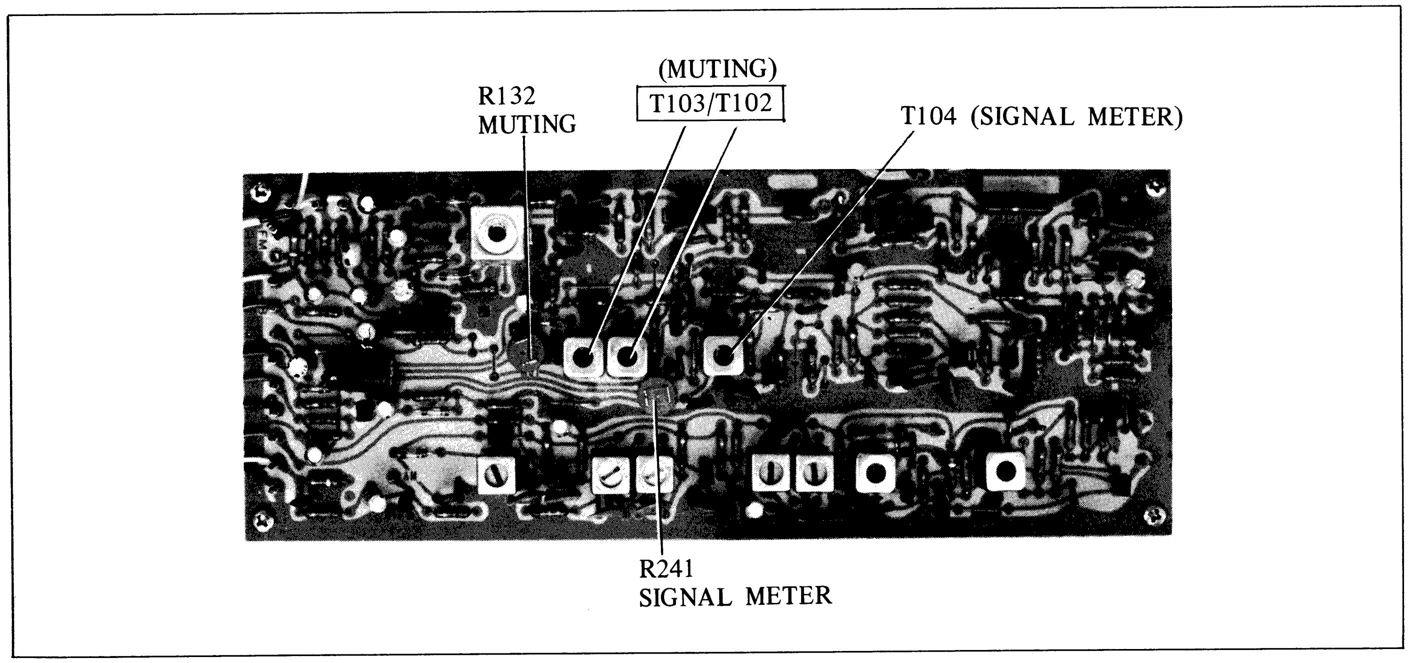


Figure 26 ALIGNMENT POINTS

MUTING ADJUSTMENT

Use a signal generator to produce FM signal of 98 MHz (400 Hz, 40 kHz deviation) 60 dB to apply it to the unit, connect a circuit tester to between the test point TP103 and earth and adjust transformers T102 and T103 so that the tester reads the maximum voltage. Set the muting switch at the front panel to "ON" position, decrease the signal input level to 20dB and adjust semi-fixed resistor R132 so that FM signal comes out of the unit. (20 ± 3 dB)

ADJUSTMENT OF AIR CHECK CAL.

Produce 98 MHz, 60 dB FM mono signal (modulation 100%, 400 Hz) by a signal generator to apply it to the antenna of the unit and read the tuner output voltage. Next, set AIR CHECK CAL. switch to "ON" position, then the output voltage will vary. Adjust semi-fixed resistor R411 so that the output voltage with AIR CHECK CAL. switch set to "ON" becomes about 38% of that with AIR CHECK CAL. switch kept at "OFF".

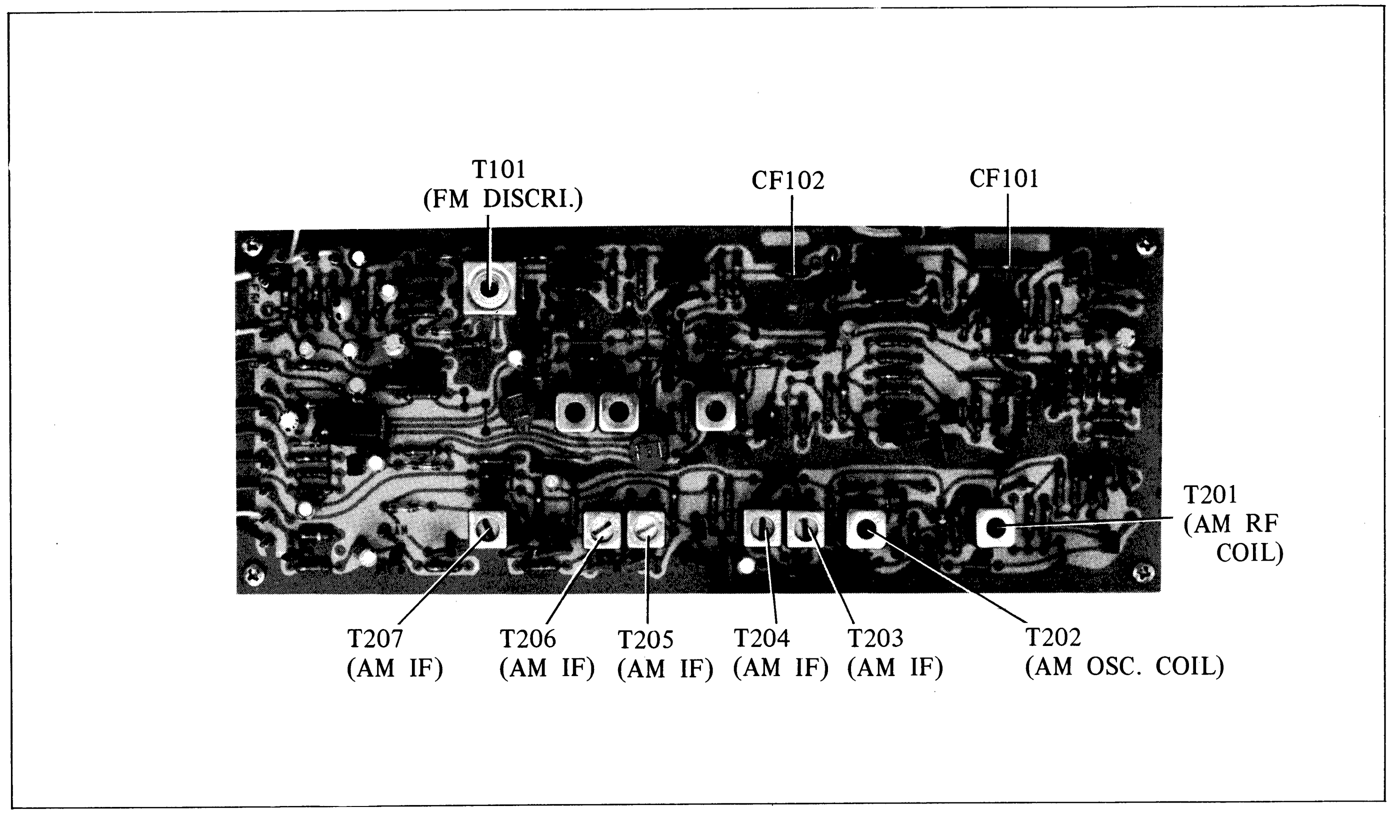


Figure 27 ALIGNMENT POINTS

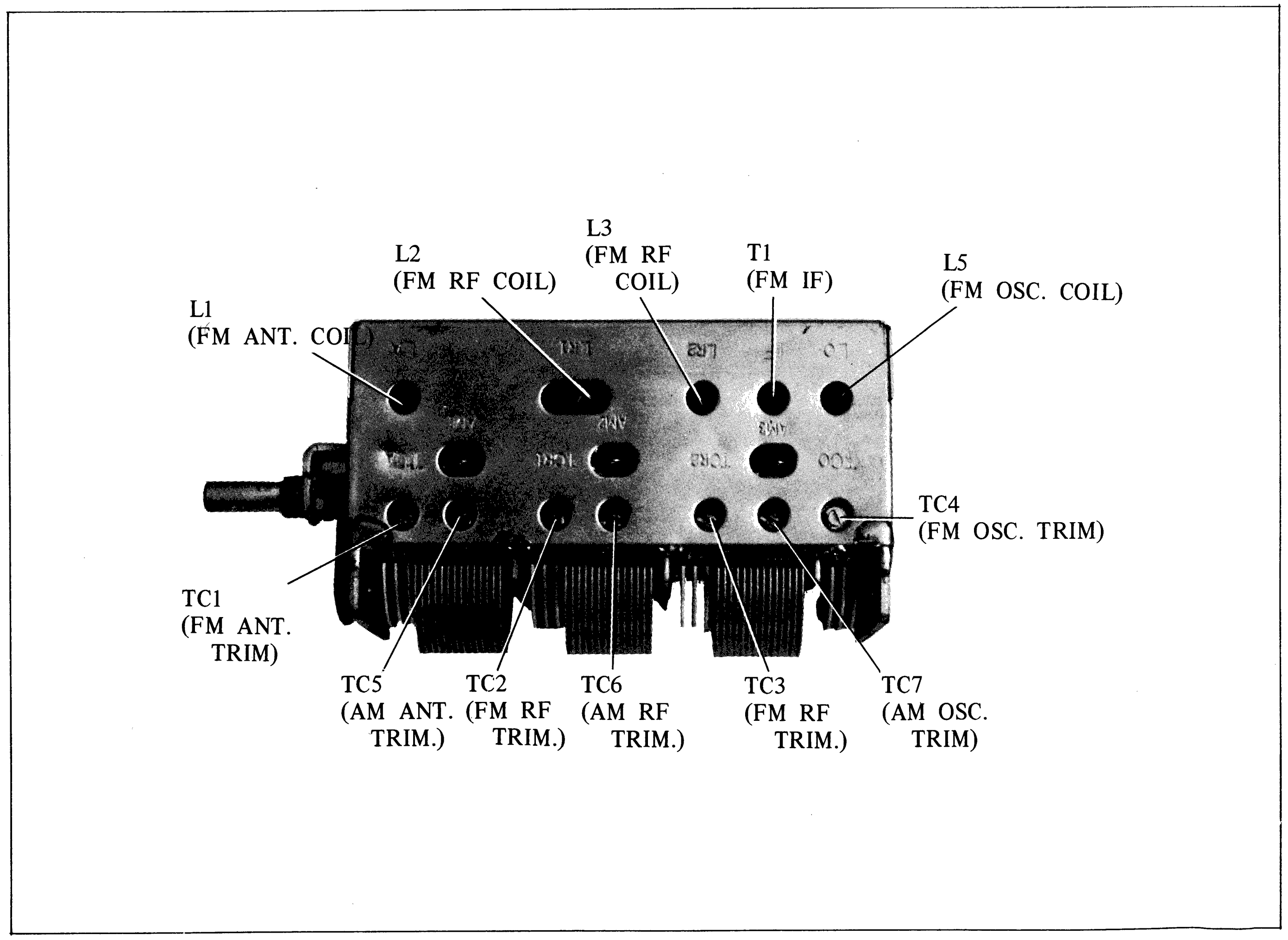


Figure 28 ALIGNMENT POINTS

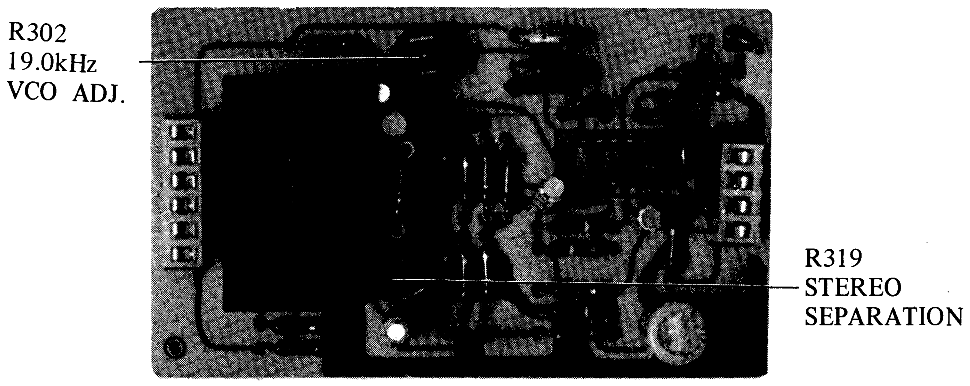


Figure 29 FM STEREO ALIGNMENT POINTS

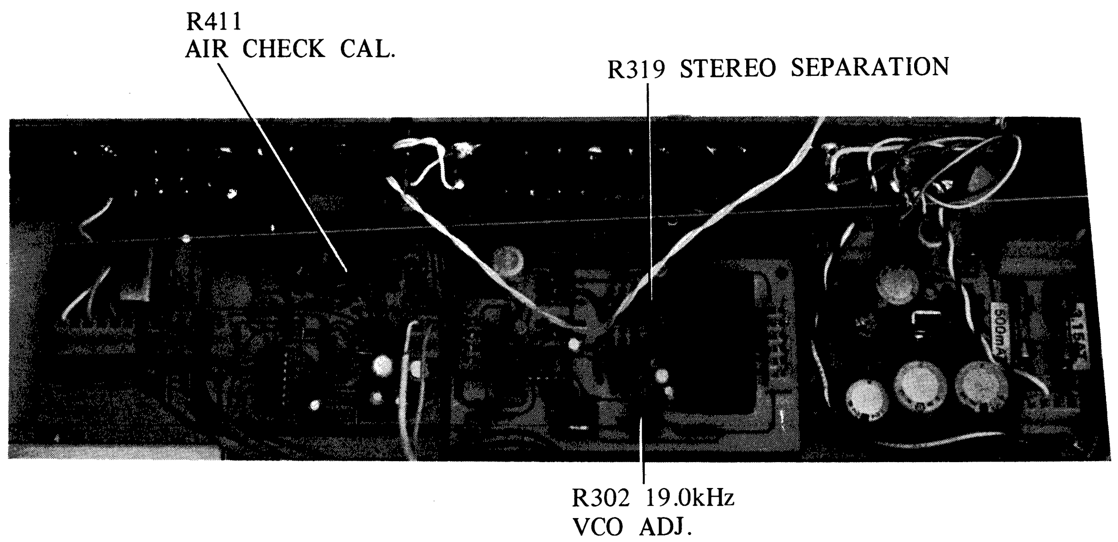


Figure 30 ALIGNMENT POINTS

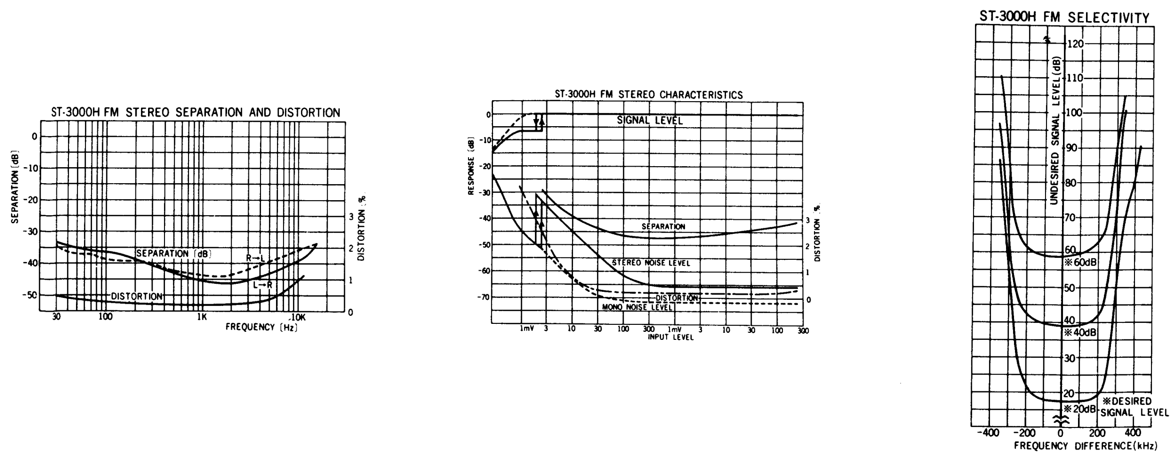


Figure 31

TROUBLE SHOOTING GUIDE (1)

ALL OPERATIONAL MODES

SYMPTOM		PROBABLE CAUSE	TROUBLE SHOOTING HINT
No sound all modes	AC power OK	Broken or shorted connecting cord	Check continuity of connecting cord
	No AC power, pilot lamp is OFF.	No power at wall socket	
		Defective ON-OFF switch (SW502) or line cord	
		Loose AC plug contact	
		Blown fuse (F501)	If the fuse (F501) blows as soon as it is replaced
		Shorted power transformer shorted capacitor	C482, C483, C491
		Shorted power supply circuit of power amplifier	Check continuity of power supply circuit
		Open primary winding of power transformer	Check continuity of transformer
	Pilot lamp is ON, but no sound	Defective power supply circuit	Voltage not as specified on "schematic diagram"
		Blown fuse (F401)	If the fuse (F401) blows as soon as it is replaced
		Defective audio amplifier	Voltages not as specified on "schematic diagram"
		Defective transistor and IC	IC401, Q402, Q403
		Capacitor, shorted or open	C430, C431, C432, C434
Weak sound all modes	Dim or not lit pilot lamp (PL1 ~ PL6)	Low AC supply voltage	
		Defective power circuit	Voltage not as specified on "schematic diagram"
	One channel dead	Defective audio amplifier circuit	Check and compare voltages of each transistor pair
		Aging or weak IC	IC401
Distortion in all modes of operation	One channel is OK, while other is distorted	Low power supply voltage	Voltages not as specified
		Defective audio amplifier circuit	
		Aging or weak IC and transistor	Q302, Q303, Q402, Q403, IC401
Hum in all modes	High level of ripple in DC source	Defective capacitors	C482, C483, C491
	Ripple in power supply circuit of audio amplifier	Defective transistor and diode	Q501, Q502, D501
		Open circuit of ground. Connection between pre-amplifier and chassis.	

TROUBLE SHOOTING GUIDE (2)

AM RECEPTION

SYMPTOM		PROBABLE CAUSE	TROUBLE SHOOTING HINT
No sound	No sound all modes section		See "no sound" all modes
	No sound AM only	No supply voltage to AM circuit	Check power supply
		Defective AM circuit component	Voltages not as specified on "schematic diagram"
		Defective transistor	Q201～Q204
		Defective I. F. transformer	T203～T207
		Detector diode defective	D202
		Improper contacts on selector switch	SW401
		Defective capacitor	
		Defective resistor	
		Oscillator stage inoperative	Check Q202, T202, T203
Weak sound		Weak incoming station signal	Select the direction or location of antenna for best reception
		Defective AM circuit component	Voltages not as specified on "schematic diagram"
		Q-factor of I. F. transformer is too low	T203～T207
		Capacitors off value	C202, C208
		Defective resistor	
		Misalignment of I. F. transformer	T203～T207
	Intermediate frequency is OK	Error in tracking	L502, T201, TC5, TC6
		Voltage drop in local oscillator	Q202, T202
Distortion	Amplifier is OK	Detector diode, defective or weak	D202
		Capacitors off value	C216, C217
	Distortion when receiving strong local stations.	Defective AGC circuit	R213, D201
		Overload at antenna input	Select the direction or location of antenna for best receiving
Noisy	Amplifier is OK	Defective AM section	
		Defective transistor	Q201, Q202
		Broken lead in antenna circuit or shorted tuning gang	L502, T201

TROUBLE SHOOTING GUIDE (3)

FM RECEPTION (1)

SYMPTOM		PROBABLE CAUSE	TROUBLE SHOOTING HINT
No sound in FM position	No sound in AM position, also	Defective power supply of IF stage	Voltage not as specified on "schematic diagram"
	FM detected signal is OK at TP102	Defective FM MPX stage	Refer to the guide for FM MPX reception.
	Weak or no voltage of FM power supply	Open or defective circuit from power supply to FM tuner	Check continuity between tuner and power supply output
		Poor contacts of selector switch	SW401
	FM power supply is OK	Defective FM IF circuit	
		Low voltage in IF circuit	
		Weak transistor or weak IC	Q101, IC101, IC102, IC103
		Defective ceramic filter	CF101, CF102
		Defective IF transformer	T101
		Defective resistor	
	FM IF is OK	Defective FM tuner output circuit	LPF301
		Defective power supply circuit to FM front end	Voltage not as specified on "schematic diagram"
No signal but sufficient background noise	Not tune in FM range	Local oscillator dead	Q3
Weak signal but loud background noise		Weak station signal	Use more sensitive antenna
		Loose antenna connection	
		Open antenna circuit	
Weak signal and weak background noise in FM		Defective transistor, etc.	Voltage not as specified on "schematic diagram"
		Poor Q or misalignment of coil	T1, T101
		Weak transistor or weak IC	Q1, Q2 Q101, IC101～IC103
		Weak diode	D103, D104
		Misadjustment of tracking or IF transformers	Realign following the alignment chart
Distortion in FM		Defective IF stage or low voltage in IF stage	Measure voltages in FM section and repair or replace defective part
		Defective AGC circuit	D101, D102
		Misalignment	T101
		Weak IC	IC301, IC401
Hum	Ripple in FM power supply	Capacitor off value	C491, C485, C484

TROUBLE SHOOTING GUIDE (4)

FM RECEPTION (2)

SYMPTOM		PROBABLE CAUSE	TROUBLE SHOOTING HINT
Noisy	Noisy all modes of operation		See "noisy" in chart for "all modes"
		Defective FM IF stage or FM tuner	Voltage not as specified on "schematic diagram"
		Aging or weak IC	IC301, IC401
Dial calibration off	Pointer does not move smoothly	Pointer off of track or hits obstruction	
	Pointer runs over dial scale	Pointer does not start at zero point of dial	Mechanically reset pointer at zero
		RF tracking off	Realign using alignment chart for tracking

FM MPX RECEPTION

SYMPTOM		PROBABLE CAUSE	TROUBLE SHOOTING HINT
No stereo separation	Stereo light operates normally	Components in one channel physically touching parts for other channel in MPX or audio amplifier	
	Stereo light does not light when receiving stereo signal	Aging or weak IC	IC301
		Aging or weak variable resistor	R302
		Aging or weak capacitor	C302
Distortion		Weak or defective IC	IC301
Stereo light does not operate	MPX amplifier checks OK	Defective indication lamp	PL9
		Defective power circuit to stereo light	R490, Q504

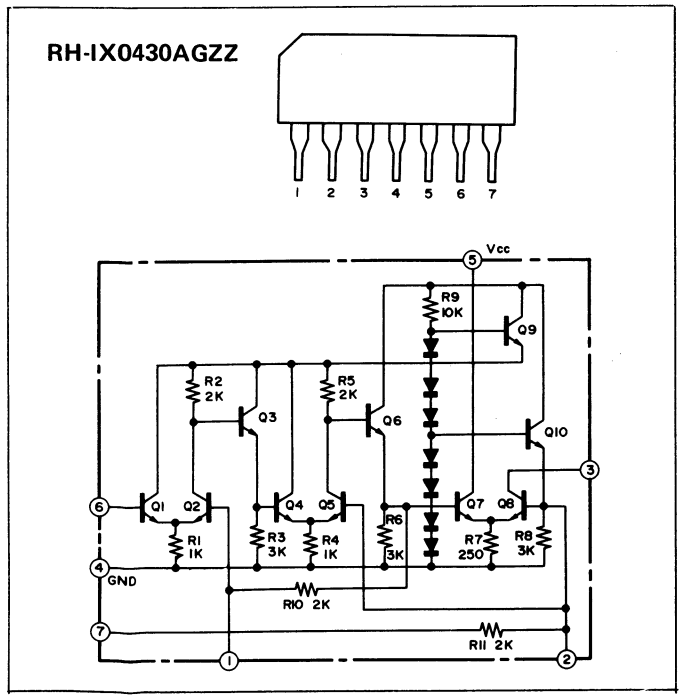


Figure 32 EQUIVALENT CIRCUIT OF INTEGRATED CIRCUIT (IC101)

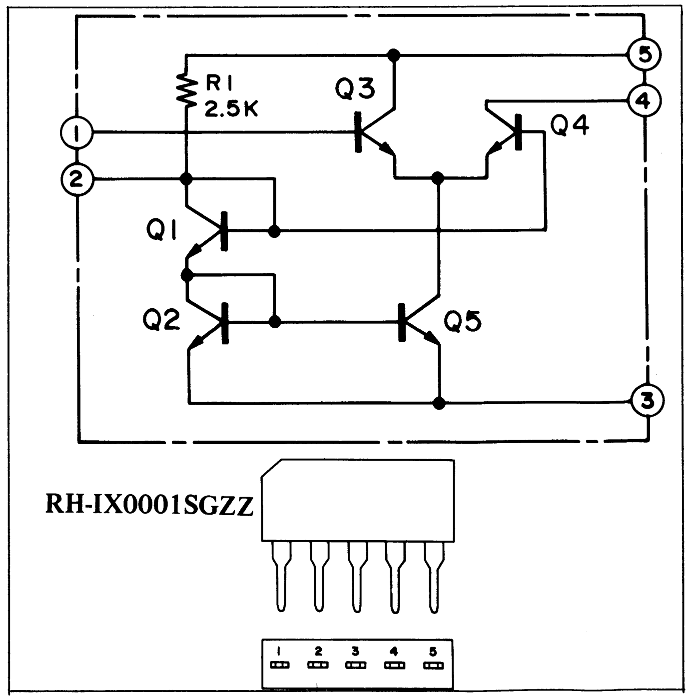


Figure 33 EQUIVALENT CIRCUIT OF INTEGRATED CIRCUIT (IC102 and IC103)

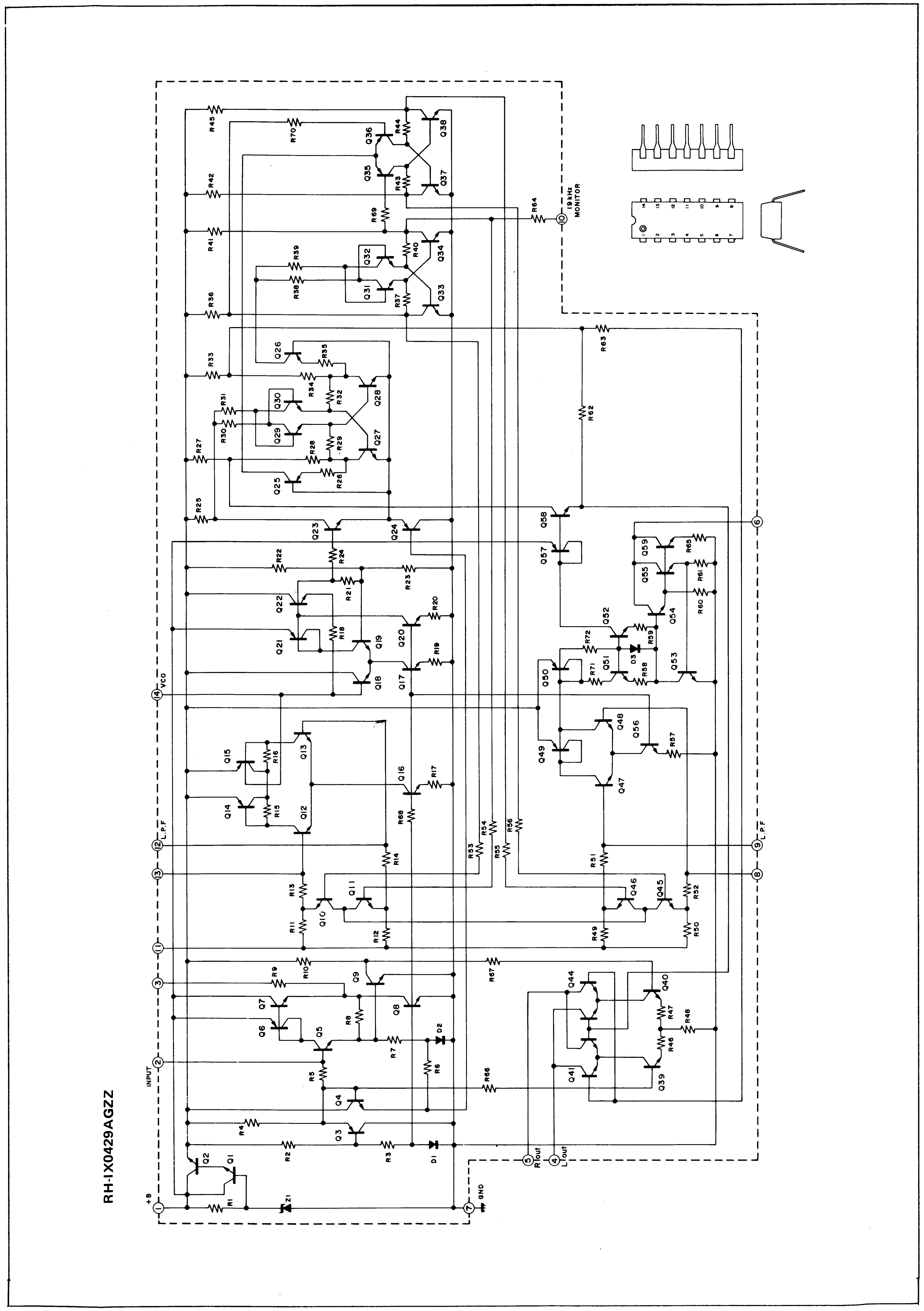


Figure 34 EQUIVALENT CIRCUIT OF INTEGRATED CIRCUIT (IC301)

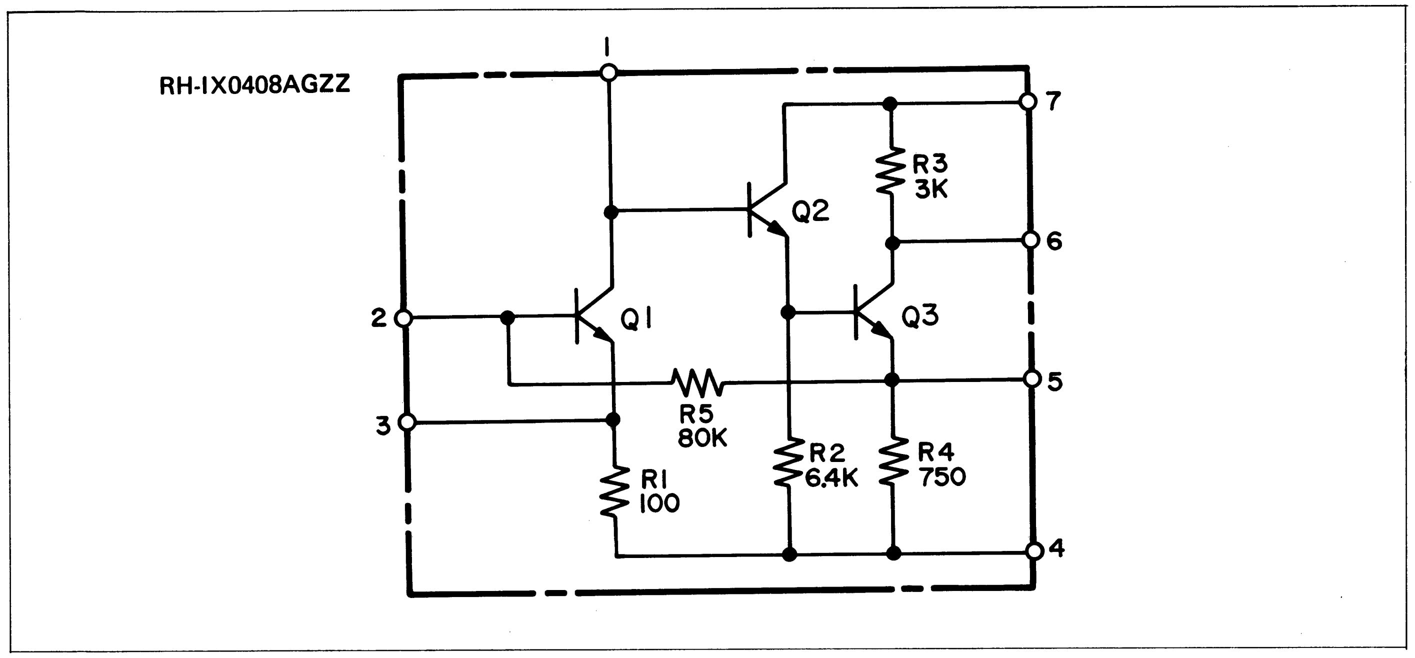


Figure 35 EQUIVALENT CIRCUIT OF INTEGRATED CIRCUIT (IC104)

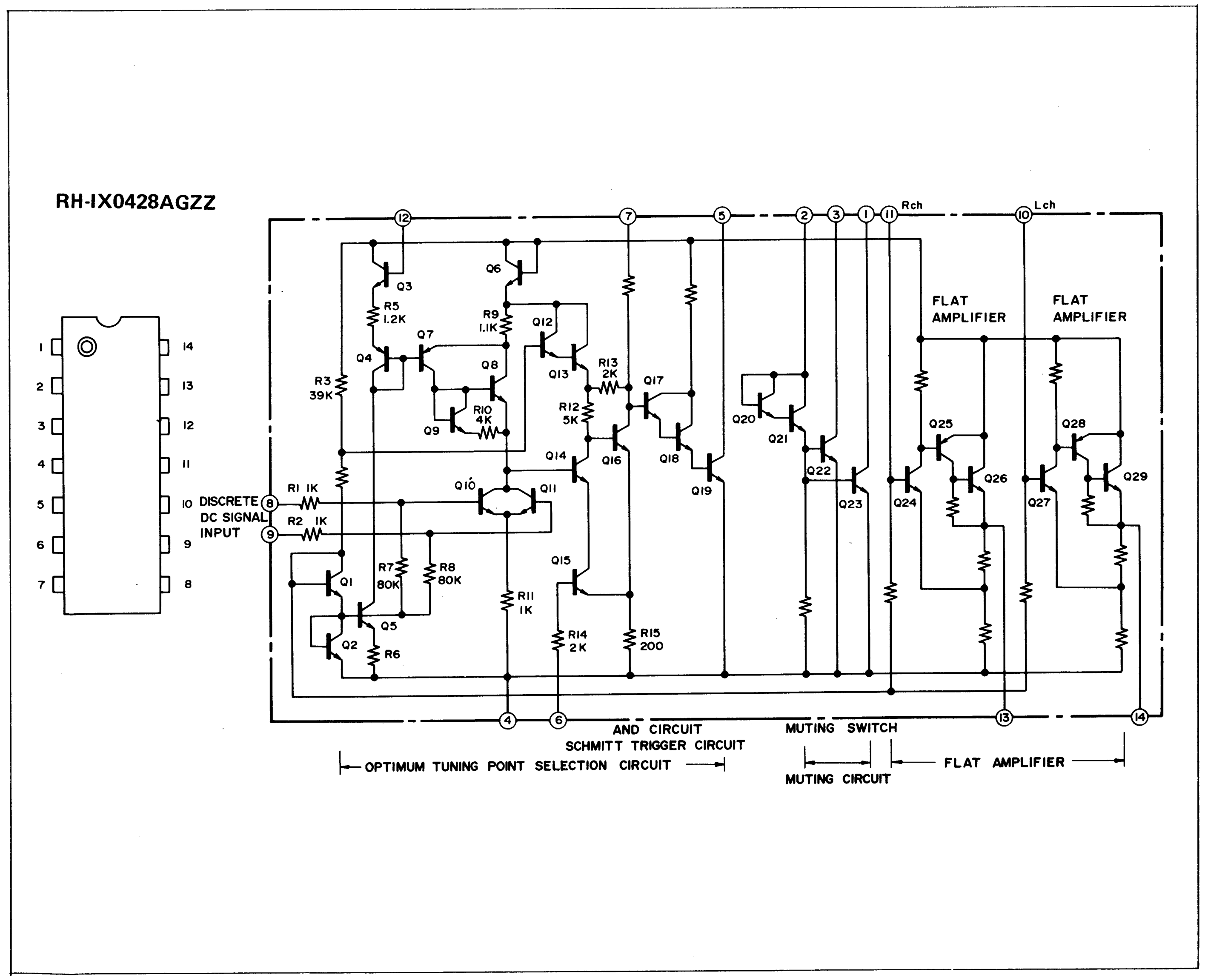


Figure 36 EQUIVALENT CIRCUIT OF INTEGRATED CIRCUIT (IC401)

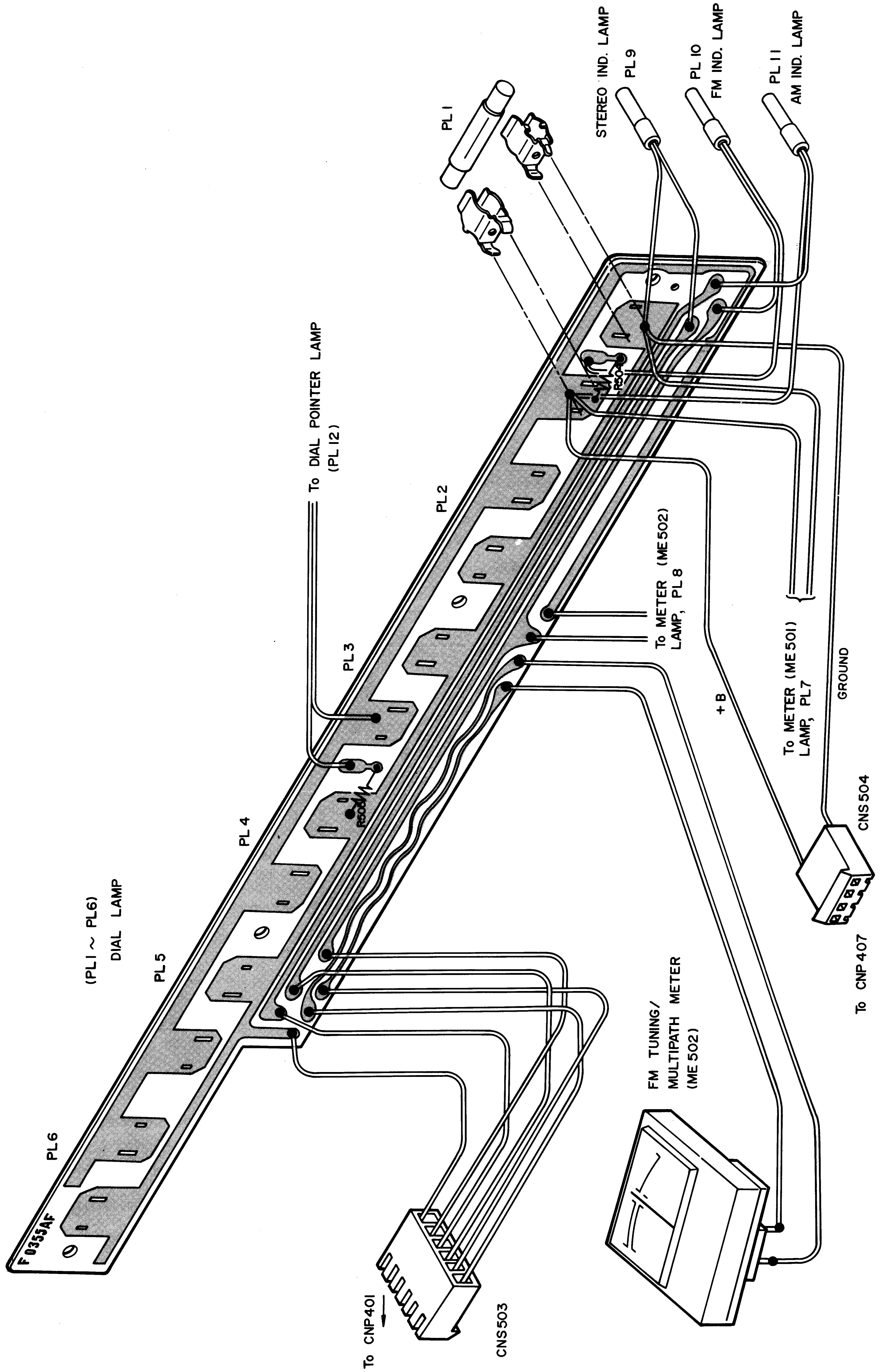
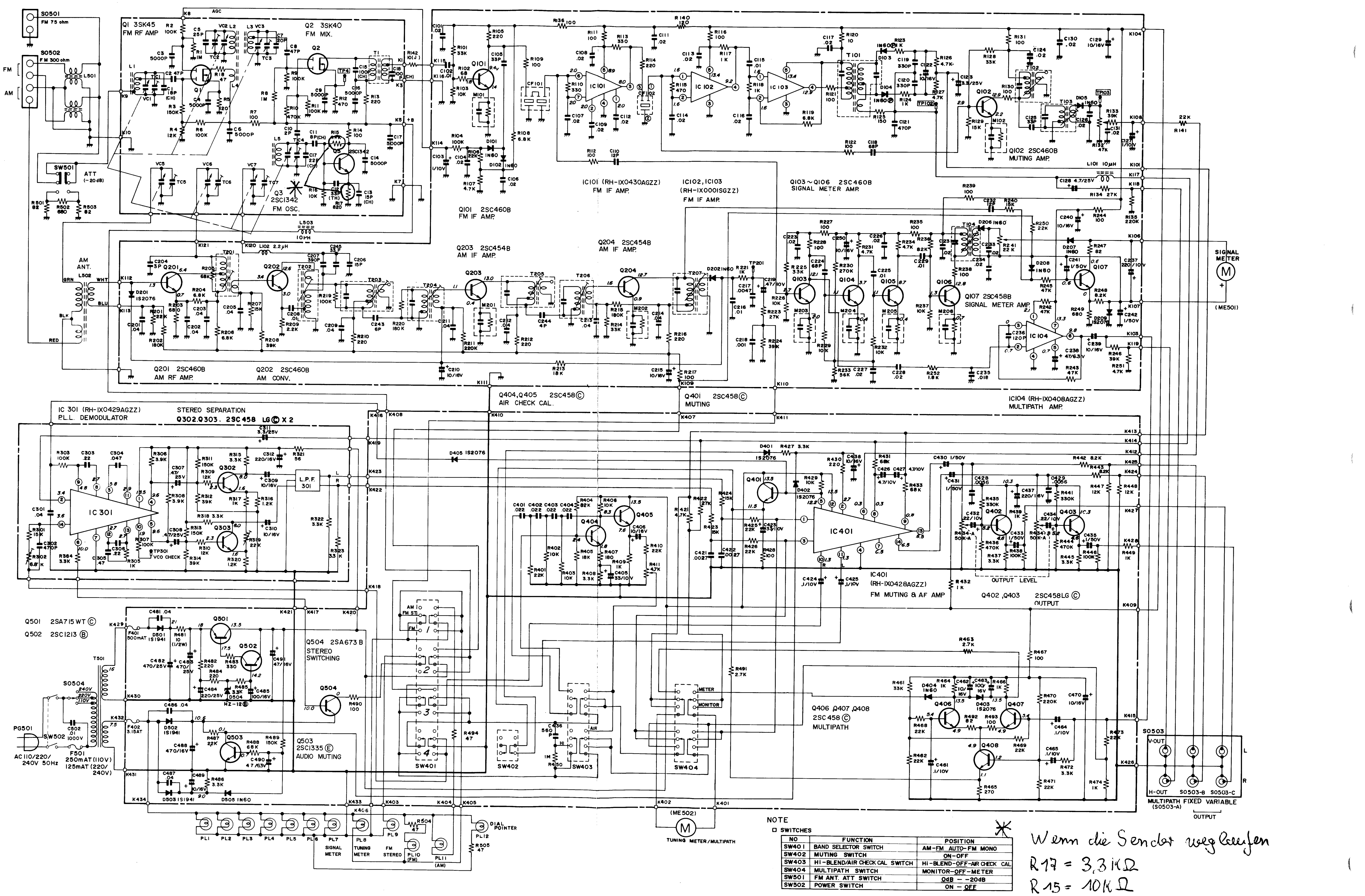


Figure 37 DIAL LAMP CONNECTIONS



(Specifications or wiring diagrams of this model are subject to change for the improvement without prior notice.)

Figure 38 SCHEMATIC DIAGRAM

NOTE

□ SWITCHES

NO	FUNCTION	POSITION
SW401	BAND SELECTOR SWITCH	AM-FM AUTO-FM MONO
SW402	MUTING SWITCH	ON-OFF
SW403	Hi-BLEND/AIR CHECK CAL SWITCH	Hi-BLEND-OFF-AIR CHECK CAL
SW404	MULTIPATH SWITCH	MONITOR-OFF-METER
SW501	FM ANT. ATT SWITCH	0dB – -20dB
SW502	POWER SWITCH	ON – OFF

* Wenn die Sender weglaufen
R17 = 3,3KΩ
R15 = 10KΩ
1 x Abschirmblech

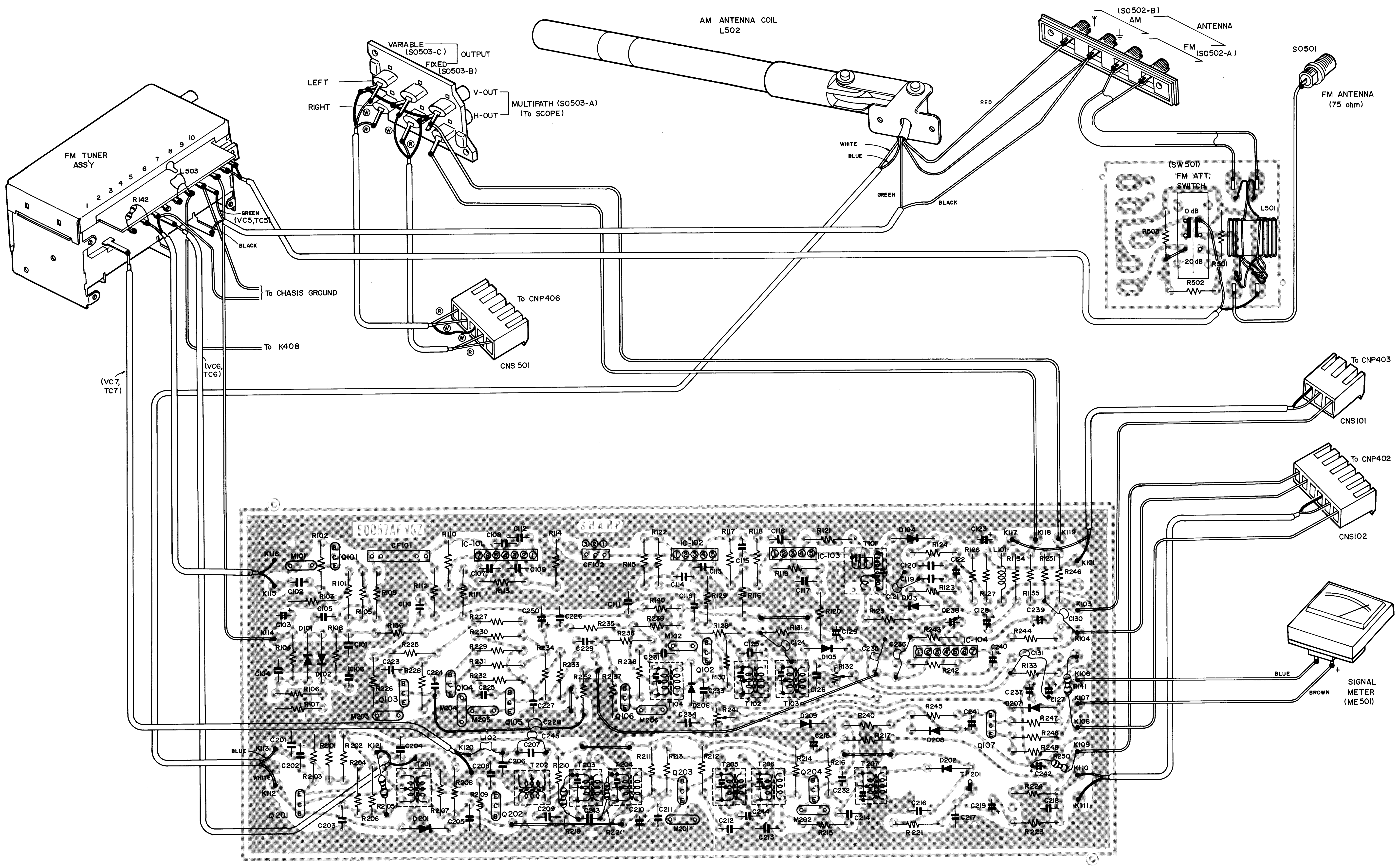


Figure 39 WIRING SIDE OF P.W. BOARD (1)

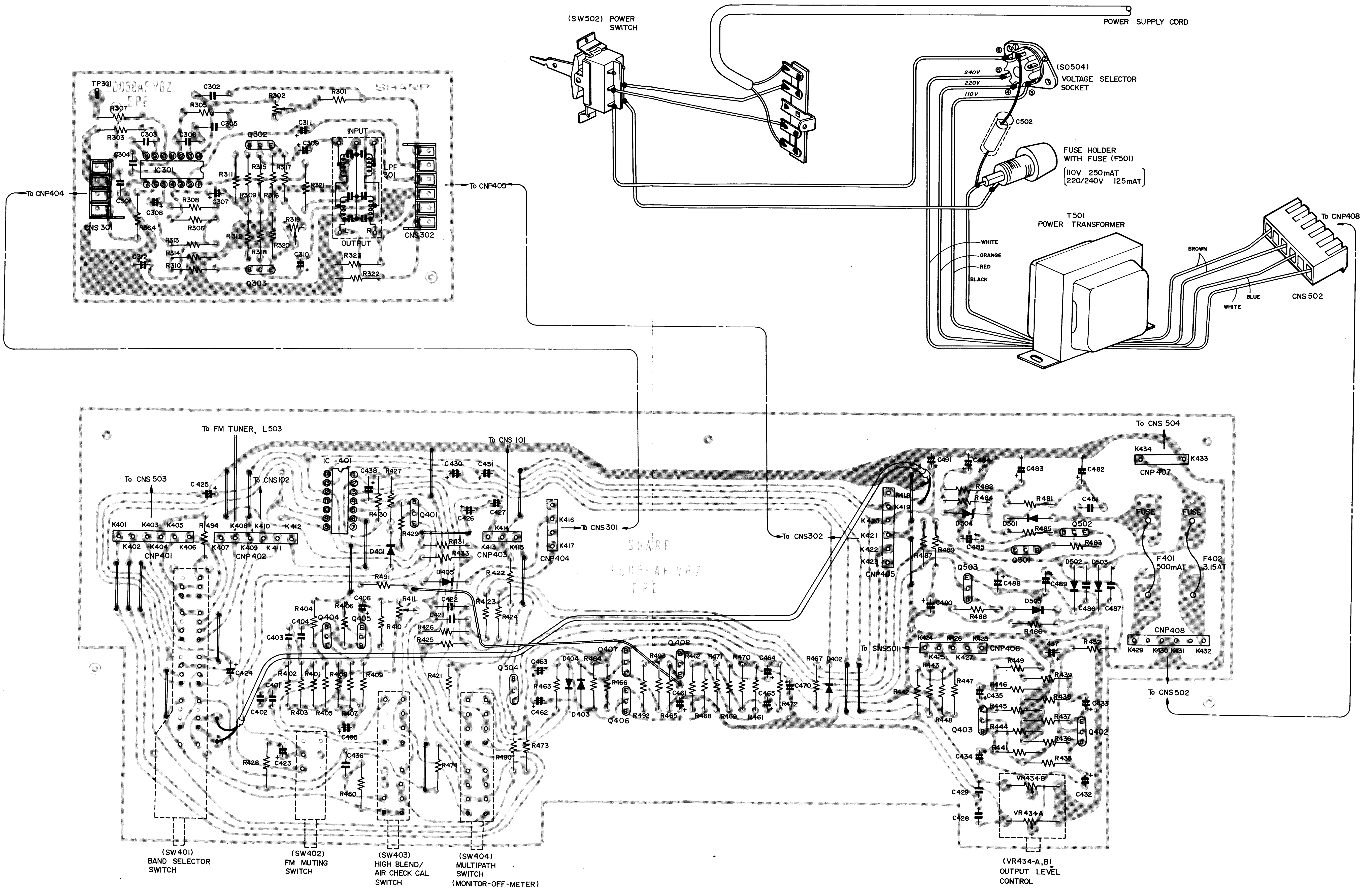


Figure 40 WIRING SIDE OF P.W. BOARD (2)

REPLACEMENT PARTS LIST

"HOW TO ORDER REPLACEMENT PARTS"

To have your order filled promptly and correctly, please furnish the following informations.

1. MODEL NUMBER
2. REF. NO.
3. PART NO.
4. DESCRIPTION

INTEGRATED CIRCUITS

REF. NO.	PART NO.	DESCRIPTION	CODE
IC101	RH-IX0430AGZZ	FM IF Amplifier	AL
IC102	RH-IX0001SGZZ	FM IF Amplifier	AK
IC103	RH-IX0001SGZZ	FM IF Amplifier	AK
IC104	RH-IX0408AGZZ	Multipath Amplifier	AL
IC301	RH-IX0429AGZZ	P.L.L. Demodulation	AW
IC401	RH-IX0428AGZZ	FM Muting and AF Amplifier	AR

TRANSISTORS

REF. NO.	PART NO.	DESCRIPTION	CODE
Q101	VS2SC460-B/-1	FM IF & AGC Amplifier	AF
Q102	VS2SC460-B/-1	Muting Amplifier	AF
Q103	VS2SC460-B/-1	Signal Meter (FM) Amplifier	AF
Q104	VS2SC460-B/-1	Signal Meter (FM) Amplifier	AF
Q105	VS2SC460-B/-1	Signal Meter (FM) Amplifier	AF
Q106	VS2SC460-B/-1	Signal Meter (FM) Amplifier	AF
Q107	VS2SC458-B/-1	Signal Meter (AM) Amplifier	AF
Q201	VS2SC460-B/-1	AM RF Amplifier	AF
Q202	VS2SC460-B/-1	AM Converter	AF
Q203	VS2SC454-B/-1	AM IF Amplifier	AF
Q204	VS2SC454-B/-1	AM IF Amplifier	AF
Q302	VS2SC458LGC-1	Stereo Separation	AF
Q303	VS2SC458LGC-1	Stereo Separation	AF
Q401	VS2SC458-C/-1	Muting	AF
Q402	VS2SC458LGC-1	Output (Emitter Follower)	AF
Q403	VS2SC458LGC-1	Output (Emitter Follower)	AF
Q404	VS2SC458-C/-1	Air Check Oscillator	AF
Q405	VS2SC458-C/-1	Air Check (Emitter Follower)	AF
Q406	VS2SC458-C/-1	Multipath	AF
Q407	VS2SC458-C/-1	Multipath	AF
Q408	VS2SC458-C/-1	Multipath	AF
Q501	VS2SA715WTC-1	Voltage-regulator	AH
Q502	VS2SC1213-B-1	Voltage-regulator	AF
Q503	VS2SC1335-E-1	Audio Muting	AE
Q504	VS2SA673-B/-1	Stereo Switching	AG

DIODES

REF. NO.	PART NO.	DESCRIPTION	CODE
D101	VHD1N60////-1	FM AGC	AC
D102	VHD1N60////-1	FM AGC	AC
D103	VHD1N60////-3	FM Detector (Matched Pair)	AH
D104	VHD1N60////-3	FM Detector (Matched Pair)	AH
D105	VHD1N60////-1	Detector, Muting	AC
D201	VHD1S2076//-1	AM AGC	AG
D202	VHD1N60////-1	AM Detector	AC
D206	VHD1N60////-1	Detector, Signal Meter (FM)	AC
D207	VHD1N60////-1	Meter	AC
D208	VHD1N60////-1	Bias	AC
D209	VHD1S2076//-1	Meter	AG
D401	VHD1S2076//-1	Muting	AG
D402	VHD1S2076//-1	Muting	AG
D403	VHD1S2076//-1	Meter	AG
D404	VHD1N60////-1	Meter	AC
D405	VHD1S2076//-1	Muting	AG
D501	VHD1S1941//-1	Rectifier, Power	AD
D502	VHD1S1941//-1	Rectifier, Power	AD
D503	VHD1S1941//-1	Rectifier, Power	AD
D504	VHEHZ12-BBK-1	Zener, Voltage Regulator	AD
D505	VHD1N60////-1		AC

COILS

REF. NO.	PART NO.	DESCRIPTION	CODE
L101	VP-LH100M0000	10μH	AB
L102	VP-LH2R2M0000	2.2μH	
L501	RCILA0231AFZZ	Balun	AD
L502	RCILA0350AFZZ	AM Bar Antenna	AR
L503	VP-LH100M0000	Choke, +B, 10μH	AB

TRANSFORMERS

REF. NO.	PART NO.	DESCRIPTION	CODE
T101	RCILD0050AFZZ	FM Discriminator	AH
T102	RCILI0060AGZZ	FM Muting	AE
T103	RCILI0060AGZZ	FM Muting	AE
T104	RCILI0060AGZZ	Meter	AE
T201	RCILR0026AGZZ	AM RF	AD
T202	RCILB0082AGZZ	AM Oscillator	AD
T203	RCILI0008SEZZ	AM IF	AD
T204	RCILI0008SEZZ	AM IF	AD
T205	RCILI0012AGZZ	AM IF	AD
T206	RCILI0012AGZZ	AM IF	AD
T207	RCILI0008SEZZ	AM IF	AD
T501	RTRNP0390AFZZ	Power with connecting socket (CNS502)	BE

FILTERS

REF. NO.	PART NO.	DESCRIPTION	CODE
CF101, CF102	RFILF0052AFZZ	FM IF (10.7 MHz), Ceramic, Matched Pair	AP
LPF301	RFILL0001AGZZ	Low Pass Filter	AS

PACKAGED CIRCUIT

REF. NO.	PART NO.	DESCRIPTION	CODE
M101	RMPTA0025AFZZ	1K ohm + 0.01MFD	AB
M102	RMPTA0025AFZZ	1K ohm + 0.01MFD	AB
M201	RMPTA0014AFZZ	1K ohm + 0.04MFD	AC
M202	RMPTA0015AFZZ	470 ohm + 0.04MFD	AC
M203	RMPTA0025AFZZ	1K ohm + 0.01MFD	AB
M204	RMPTA0015AFZZ	470 ohm + 0.04MFD	AC
M205	RMPTA0015AFZZ	470 ohm + 0.04MFD	AC
M206	RMPTA0025AFZZ	1K ohm + 0.01MFD	AB

PARTS LIST

CAPACITORS

(Unless otherwise specified capacitors are 50V, +80 –20%, Ceramic Type)

REF. NO.	PART NO.	DESCRIPTION	CODE
C101	VCKZPU1HF203Z	.02MFD	AA
C102	VCKZPU1HF103P	.01MFD, 50V, +100–0%, Ceramic	AE
C104	VCKZPU1HF203Z	.02MFD	AA
C105	VCCSPU1HL330K	33PF, 50V, ±10%, Ceramic	AA
C106	VCKZPU1HF203Z	.02MFD	AA
C107	VCKZPU1HF203Z	.02MFD	AA
C108	VCKZPU1HF203Z	.02MFD	AA
C109	VCKZPU1HF203Z	.02MFD	AA
C110	VCCSPU1HL120K	12PF, 50V, ±10%, Ceramic	AA
C111	VCKZPU1HF203Z	.02MFD	AA
C112	VCKZPU1HF203Z	.02MFD	AA
C113	VCKZPU1HF203Z	.02MFD	AA
C114	VCKZPU1HF203Z	.02MFD	AA
C115	VCKZPU1HF103P	.01MFD, 50V, +100–0%, Ceramic	AE
C116	VCKZPU1HF203Z	.02MFD	AA
C117	VCKZPU1HF203Z	.02MFD	AA
C118	VCCSPU1HL680K	68PF, 50V, ±10%, Ceramic	AA
C119	VCCSPU1HL331K	330PF, 50V, ±10%, Ceramic	AB
C120	VCCSPU1HL331K	330PF, 50V, ±10%, Ceramic	AB
C121	VCCSPU1HL471K	470PF, 50V, ±10%, Ceramic	AB
C124	VCKZPU1HF203Z	.02MFD	AA
C125	VCCSPU1HL330K	33PF, 50V, ±10%, Ceramic	
C126	VCKZPU1HF203Z	.02MFD	AA
C130	VCKZPU1HF203Z	.02MFD	AA
C131	VCKZPU1HF203Z	.02MFD	AA
C201	VCKZPU1HF403Z	.04MFD	AB
C202	VCKZPU1HF403Z	.04MFD	AB
C203	VCKZPU1HF403Z	.04MFD	AB
C204	VCCSPU1HL3R0C	3PF, 50V, ±0.25PF, Ceramic	AA
C205	VCKZPU1HF403Z	.04MFD	AB
C206	VCCSPU1HL150K	15PF, 50V, ±10%, Ceramic	AA
C207	VCCSPU1HL391J	390PF, 50V, ±5%, Ceramic	AB
C208	VCKZPU1HF103P	.01MFD, 50V, +100–0%, Ceramic	AE
C209	VCKZPU1HF403Z	.04MFD	AB
C211	VCKZPU1HF403Z	.04MFD	AB
C212	VCKZPU1HF403Z	.04MFD	AB
C213	VCKZPU1HF403Z	.04MFD	AB
C214	VCKZPU1HF403Z	.04MFD	AB
C216	VCKZPU1HF103P	.01MFD, 50V, +100–0%, Ceramic	AE
C217	VCQYKU1HM472K	.0047MFD, 50V, ±10%, Mylar	AB
C218	VCQYKU1HM102K	.001MFD, 50V, ±10%, Mylar	AB
C223	VCKZPU1HF203Z	.02MFD	AA
C224	VCCSPU1HL680K	68PF, 50V, ±10%, Ceramic	AA
C225	VCKZPU1HF103P	.01MFD, 50V, +100–0%, Ceramic	AE
C226	VCKZPU1HF203Z	.02MFD	AA
C227	VCKZPU1HF203Z	.02MFD	AA
C228	VCKZPU1HF203Z	.02MFD	AA
C229	VCKZPU1HF103P	.01MFD, 50V, +100–0%, Ceramic	AE
C231	VCKZPU1HF203Z	.02MFD	AA
C232	VCCSPU1HL120K	12PF, 50V, ±10%, Ceramic	AA
C233	VCKZPU1HF203Z	.02MFD	AA
C234	VCKZPU1HF203Z	.02MFD	AA
C235	VCQYKU1HM183J	.018MFD, 50V, ±5%, Mylar	AC
C236	VCCSPU1HL121K	120PF, 50V, ±10%, Ceramic	AA
C243	VCCSPU1HL6R0C	6PF, 50V, ±0.25PF, Ceramic	AA
C244	VCCSPU1HL4R0C	4PF, 50V, ±0.25PF, Ceramic	AA
C245	VCCSPU1HL330J	33PF, 50V, ±5%, Ceramic	AA
C301	VCKZPU1HF403Z	.04MFD	AB
C302	VCQSMT1HS471K	470PF, 50V, ±10%, Styrol	AB
C303	VCKZPU1ND224M	.22MFD, 12V, ±20%, Ceramic	AC
C304	VCQYKU1HM473K	.047MFD, 50V, ±10%, Mylar	AC
C305	VCKZPU1ND474M	.47MFD, 12V, ±20%, Ceramic	AD
C306	VCKZPU1ND224M	.22MFD, 12V, ±20%, Ceramic	AC
C401	VCQYKU1HM223K	.022MFD, 50V, ±10%, Mylar	AB
C402	VCQYKU1HM223K	.022MFD, 50V, ±10%, Mylar	AB
C403	VCQYKU1HM223K	.022MFD, 50V, ±10%, Mylar	AB
C404	VCQYKU1HM223K	.022MFD, 50V, ±10%, Mylar	AB
C421	VCQYKU1HM272J	.0027MFD, 50V, ±5%, Mylar	AC
C422	VCQYKU1HM272J	.0027MFD, 50V, ±5%, Mylar	AC
C428	VCQYKU1HM562K	.0056MFD, 50V, ±10%, Mylar	AB
C429	VCQYKU1HM562K	.0056MFD, 50V, ±10%, Mylar	AB
C436	VCCSPU1HL561K	560PF, 50V, ±10%, Ceramic	AA
C481	VCKZPU1HF403Z	.04MFD	AB
C486	VCKZPU1HF403Z	.04MFD	AB
C487	VCKZPU1HF403Z	.04MFD	AB
C502	VCPOAT3AC103M	.01MFD, 1000WV, ±20%, Oil	AD

ELECTROLYTIC CAPACITORS

REF. NO.	PART NO.	DESCRIPTION	CODE
C103	VCAAAU1AB105M	1MFD, 10V, ±20%, Aluminum	AD
C122	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C123	VCEAAU1EW335A	3.3MFD, 25V, +75–10%	AB
C127	VCAAAU1AB105M	1MFD, 10V, ±20%, Aluminum	AD
C128	VCEAAU1EW475A	4.7MFD, 25V, +75–10%	AB
C129	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C210	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C215	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C219	VCAAAU1AB474M	.47MFD, 10V, ±20%, Aluminum	AC
C237	VCEAAU1AW227Y	220MFD, 10V, +50–10%	AC
C238	VCEAAU0JW476Y	47MFD, 6.3V, +50–10%	AB
C239	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C240	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C241	VCEAAU1HW105A	1MFD, 50V, +75–10%	AB
C242	VCEAAU1HW105A	1MFD, 50V, +75–10%	AB
C250	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C307	VCAAAU1EB474M	.47MFD, 25V, ±20%, Aluminum	AD
C308	VCAAAU1EB474M	.47MFD, 25V, ±20%, Aluminum	AD
C309	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C310	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C311	VCEAAU1EW335A	3.3MFD, 25V, +75–10%	AB
C312	VCEAAU1CW227Y	220MFD, 16V, +50–10%	AC
C405	VCEAAU1AW336Y	33MFD, 10V, +50–10%	AB
C406	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C423	VCEAAU1AW336Y	33MFD, 10V, +50–10%	AB
C424	VCAAAU1AB104M	.1MFD, 10V, ±20%, Aluminum	AC
C425	VCAAAU1AB104M	.1MFD, 10V, ±20%, Aluminum	AC
C426	VCAAAU1AB475M	4.7MFD, 10V, ±20%, Aluminum	AD

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
C427	VCAAAU1AB475M	4.7MFD, 10V, ±20%, Aluminum	AD
C430	VCEAAU1HW105A	1MFD, 50V, +75–10%	AB
C431	VCEAAU1HW105A	1MFD, 50V, +75–10%	AB
C432	VCAAAU1AB224M	.22MFD, 10V, ±20%, Aluminum	AC
C433	VCEAAU1HW105A	1MFD, 50V, +75–10%	AB
C434	VCAAAU1AB224M	.22MFD, 50V, ±20%, Aluminum	AC
C435	VCEAAU1HW105A	1MFD, 50V, +75–10%	AB
C437	VCEAAU1CW227Y	220MFD, 16V, +50–10%	AC
C438	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C461	VCAAAU1AB104M	.1MFD, 10V, ±20%, Aluminum	AC
C462	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C463	VCEAAU1CW107Y	100MFD, 16V, +50–10%	AC
C464	VCAAAU1AB104M	.1MFD, 10V, ±20%, Aluminum	AC
C465	VCAAAU1AB104M	.1MFD, 10V, ±20%, Aluminum	AC
C470	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C482	VCEAAU1EW477Y	470MFD, 25V, +50–10%	AD
C483	VCEAAU1EW477Y	470MFD, 25V, +50–10%	AD
C484	VCEAAU1EW227Y	270MFD, 25V, +50–10%	AC
C485	VCEAAU1CW107Y	100MFD, 16V, +50–10%	AC
C488	VCEAAU1CW477Y	470MFD, 16V, +50–10%	AD
C489	VCEAAU1CW106Y	10MFD, 16V, +50–10%	AB
C490	VCEAAU0JW476Y	47MFD, 6.3V, +50–10%	AB
C491	VCEAAU1CW476Y	47MFD, 16V, +50–10%	AC

RESISTORS

(Unless otherwise specified resistors are 1/4W, ±10%, Carbon Type)

REF. NO.	PART NO.	DESCRIPTION	CODE
R101	VRD-ST2EY333K	33K ohm	AA
R102	VRD-ST2EY680K	68 ohm	AA
R103	VRD-ST2EY103K	10K ohm	AA
R104	VRD-ST2EY104K	100K ohm	AA
R105	VRD-ST2EY221K	220 ohm	AA
R106	VRD-ST2EY223K	22K ohm	AA
R107	VRD-ST2EY472K	4.7K ohm	AA
R108	VRD-ST2EY682K	6.8K ohm	AA
R109	VRD-ST2EY101K	100 ohm	AA
R110	VRD-ST2EY331K	330 ohm	AA
R111	VRD-ST2EY101K	100 ohm	AA
R112	VRD-ST2EY101K	100 ohm	AA
R113	VRD-ST2EY331K	330 ohm	AA
R114	VRD-ST2EY221K	220 ohm	AA
R115	VRD-ST2EY471K	470 ohm	AA
R116	VRD-ST2EY101K	100 ohm	AA
R117	VRD-ST2EY102K	1K ohm	AA
R118	VRD-ST2EY102K	1K ohm	AA
R119	VRD-ST2EY682K	6.8K ohm	AA
R120	VRD-ST2EY100K	10 ohm	AA
R121	VRD-ST2EY101K	100 ohm	AA
R122	VRD-ST2EY101K	100 ohm	AA
R123	VRD-ST2EY102K	1K ohm	AA
R124	VRD-ST2EY102K	1K ohm	AA
R125	VRD-ST2EY151K	150 ohm	AA
R126	VRD-ST2EY472K	4.7K ohm	AA
R127	VRD-ST2EY472K	4.7K ohm	AA
R128	VRD-ST2EY333K	33K ohm	AA
R129	VRD-ST2EY153K	15K ohm	AA
R130	VRD-ST2EY101K	100 ohm	AA
R131	VRD-ST2EY101K	100 ohm	AA
R132	RVR-M0082AGZZ	47K(B) ohm, Pot., Muting	AG
R133	VRD-ST2EY393K	39K ohm	AA
R134	VRD-ST2EY273K	27K ohm	AA
R135	VRD-ST2EY224K	220K ohm	AA
R136	VRD-ST2EY101K	100 ohm	AA
R140	VRD-ST2EY121K	120 ohm	AA
R141	VRD-ST2EY223K	22K ohm	AA
R142	VRD-ST2EY100J	10 ohm, 1/4W, ±5%, Carbon	AA
R201	VRD-ST2EY223K	22K ohm	AA
R202	VRD-ST2EY184K	180K ohm	AA
R203	VRD-ST2EY681K	680 ohm	AA
R204	VRD-ST2EY682K	6.8K ohm	AA
R205	VRD-ST2EY683K	68K ohm	AA
R206	VRD-ST2EY682K	6.8K ohm	AA
R207	VRD-ST2EY153K	15K ohm	AA
R208	VRD-ST2EY393K	39K ohm	AA
R209	VRD-ST2EY222K	2.2K ohm	AA
R210	VRD-ST2EY221K	220 ohm	AA
R211	VRD-ST2EY224K	220K ohm	AA
R212	VRD-ST2EY221K	220 ohm	AA
R213	VRD-ST2EY183K	18K ohm	AA
R214	VRD-ST2EY333K	33K ohm	AA
R215	VRD-ST2EY184K	180K ohm	AA
R216	VRD-ST2EY221K	220 ohm	AA
R217	VRD-ST2EY101K	100 ohm	AA
R219	VRD-ST2EY104K	100K ohm	AA
R220	VRD-ST2EY184K	180K ohm	AA
R221	VRD-ST2EY102K	1K ohm	AA
R223	VRD-ST2EY273K	27K ohm	AA
R224	VRD-ST2EY393K	39K ohm	AA
R225	VRD-ST2EY333K	33K ohm	AA
R226	VRD-ST2EY103K	10K ohm	AA
R227	VRD-ST2EY101K	100 ohm	AA
R228	VRD-ST2EY101K	100 ohm	AA
R229	VRD-ST2EY103K	10K ohm	AA
R230	VRD-ST2EY274K	270K ohm	AA
R231	VRD-ST2EY472K	4.7K ohm	AA
R232	VRD-ST2EY103K	10K ohm	AA
R233	VRD-ST2EY563K	56K ohm	AA
R234	VRD-ST2EY472K	4.7K ohm	AA
R235	VRD-ST2EY101K	100 ohm	AA
R236	VRD-ST2EY823K	82K ohm	AA
R237	VRD-ST2EY103K	10K.ohm	AA
R238	VRD-ST2EY101K	100 ohm	AA
R239	VRD-ST2EY101K	100 ohm	AA
R240	VRD-ST2EY153K	15K ohm	AA
R241	RVR-M0080AGZZ	22K(B) ohm, Pot., Signal Meter	AG
R242	VRD-ST2EY473K	47K ohm	AA
R243	VRD-ST2EY473K	47K ohm	AA
R244	VRD-ST2EY101K	100 ohm	AA
R245	VRD-ST2EY473K	47K ohm	AA
R246	VRD-ST2EY393K	39K ohm	AA
R247	VRD-ST2EY820K	82 ohm	AA
R248	VRD-ST2EY822K	8.2K ohm	AA
R249	VRD-ST2EY681K	680 ohm	AA
R250	VRD-ST2EY223K	22K ohm	AA
R251	VRD-ST2EY472K	4.7K ohm	AA
R252	VRD-ST2EY182K	1.8K ohm	AA
R301	VRD-ST2EY153K	15K ohm	AA
R302	RVR-M0077AGZZ	6.8K(B) ohm, Pot., V.C.O. Frequency	AG
R303	VRD-ST2EY104K	100K ohm	AA
R305	VRD-ST2EY102K	1K ohm	AA
R306	VRD-ST2EY392K	3.9K ohm	AA

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
R307	VRD-ST2EY104K	100K ohm	AA
R308	VRD-ST2EY392K	3.9K ohm	AA
R309	VRD-ST2EY123K	12K ohm	AA
R310	VRD-ST2EY123K	12K ohm	AA
R311	VRD-ST2EY154K	150K ohm	AA
R312	VRD-ST2EY393K	39K ohm	AA
R313	VRD-ST2EY154K	150K ohm	AA
R314	VRD-ST2EY393K	39K ohm	AA
R315	VRD-ST2EY332K	3.3K ohm	AA
R316	VRD-ST2EY122K	1.2K ohm	AA
R317	VRD-ST2EY102K	1K ohm	AA
R318	VRD-ST2EY332K	3.3K ohm	AA
R319	RVR-M0080AGZZ	22K(B) ohm, Pot., Stereo Separation	AG
R320	VRD-ST2EY122K	1.2K ohm	AA
R321	VRD-ST2EY560K	56 ohm	AA
R322	VRD-ST2EY332K	3.3K ohm	AA
R323	VRD-ST2EY332K	3.3K ohm	AA
R364	VRD-ST2EY332K	3.3K ohm	AA
R401	VRD-ST2EY223K	22K ohm	AA
R402	VRD-ST2EY103K	10K ohm	AA
R403	VRD-ST2EY103K	10K ohm	AA
R404	VRD-ST2EY823K	82K ohm	AA
R405	VRD-ST2EY183K	18K ohm	AA
R406	VRD-ST2EY103K	10K ohm	AA
R407	VRD-ST2EY181K	180 ohm	AA
R408	VRD-ST2EY332K	3.3K ohm	AA
R409	VRD-ST2EY102K	1K ohm	AA
R410	VRD-ST2EY223K	22K ohm	AA
R411	RVR-M0065AGZZ	4.7K(B) ohm, Pot., Air Check Level	AF
R421	VRD-ST2EY472K	4.7K ohm	AA
R422	VRD-ST2EY273K	27K ohm	AA
R423	VRD-ST2EY153K	15K ohm	AA
R424	VRD-ST2EY153K	15K ohm	AA
R425	VRD-ST2EY223K	22K ohm	AA
R426	VRD-ST2EY223K	22K ohm	AA
R427	VRD-ST2EY332K	3.3K ohm	AA
R428	VRD-ST2EY101K	100 ohm	AA
R429	VRD-ST2EY103K	10K ohm	AA
R430	VRD-ST2EY221K	220 ohm	AA
R431	VRD-ST2EY683K	68K ohm	AA
R432	VRD-ST2EY102K	1K ohm	AA
R433	VRD-ST2EY683K	68K ohm	AA
R434-A, B	RVR-A0101AFZZ	50K(A) ohm, Output Level Control	AL
R435	VRD-ST2EY334K	330K ohm	AA
R436	VRD-ST2EY474K	470K ohm	AA
R437	VRD-ST2EY332K	3.3K ohm	AA
R438	VRD-ST2EY104K	100K ohm	AA
R439	VRD-ST2EY102K	1K ohm	AA
R441	VRD-ST2EY334K	330K ohm	AA
R442	VRD-ST2EY822K	8.2K ohm	AA
R443	VRD-ST2EY822K	8.2K ohm	AA
R444	VRD-ST2EY474K	470K ohm	AA
R445	VRD-ST2EY332K	3.3K ohm	AA
R446	VRD-ST2EY104K	100K ohm	AA
R447	VRD-ST2EY123K	12K ohm	AA
R448	VRD-ST2EY123K	12K ohm	AA
R449	VRD-ST2EY102K	1K ohm	AA
R450	VRD-ST2EY105K	1Meg ohm	AA
R461	VRD-ST2EY333K	33K ohm	AA
R462	VRD-ST2EY223K	22K ohm	AA
R463	VRD-ST2EY272K	2.7K ohm	AA
R464	VRD-ST2EY102K	1K ohm	AA
R465	VRD-ST2EY271K	270 ohm	AA
R466	VRD-ST2EY102K	1K ohm	AA
R467	VRD-ST2EY101K	100 ohm	AA
R468	VRD-ST2EY223K	22K ohm	AA
R469	VRD-ST2EY223K	22K ohm	AA
R470	VRD-ST2EY224K	220K ohm	AA
R471	VRD-ST2EY223K	22K ohm	AA
R472	VRD-ST2EY332K	3.3K ohm	AA
R473	VRD-ST2EY223K	22K ohm	AA
R474	VRD-ST2EY102K	1K ohm	AA
R481	VRC-MT2HG100K	10 ohm, 1/2W, ±10%, Carbon	AA
R482	VRD-ST2EY221K	220 ohm	AA
R483	VRD-ST2EY331K	330 ohm	AA
R484	VRD-ST2EY221K	220 ohm	AA
R485	VRD-ST2EY332K	3.3K ohm	AA
R486	VRD-ST2EY332K	3.3K ohm	AA
R487	VRD-ST2EY222K	2.2K ohm	AA
R488	VRD-ST2EY683K	68K ohm	AA
R489	VRD-ST2EY154K	150K ohm	AA
R490	VRD-ST2EY101K	100 ohm	AA
R491	VRD-ST2EY272K	2.7K ohm	AA
R492	VRD-ST2EY820K	82 ohm	AA
R493	VRD-ST2EY101K	100 ohm	AA
R494	VRD-ST2EY470K	47 ohm	AA
R501	VRD-ST2EY820K	82 ohm	AA
R502	VRD-ST2EY681K	680 ohm	AA
R503	VRD-ST2EY820K	82 ohm	AA
R504	VRD-ST2EY470K	47 ohm	AA
R505	VRD-ST2EY470K	47 ohm	AA

MISCELLANEOUS

REF. NO.	PART NO.	DESCRIPTION	CODE
	GCAB-3002AFSA	Cabinet, Main	AY
	GFTAU3051AFZZ	Cabinet, Bottom	AN
	GCOVA1053AFSA	Guide, Lever Switch, Small	AB
	GCOVA1054AFSA	Guide, Lever Switch, Large	AC
	GLEGP0002SG00	Leg, Cabinet	AD
	HSSND0006SGSB	Dial Pointer with Lamp (PL12)	AN
	HPNLC3218AFSA	Panel, Front	BF
	HDECW0050AFSB	Decoration Plate, Main Cabinet	AR
	HDALP0330AFSA	Dial	AR
	JKNBN0275AFSA	Knob, Tuning Control	AN
	JKNBN0274AFSA	Knob, Output Level, Band Selector	AL
	JKNBP0058AFSA	Knob, Lever Switch	AH
	LANGQ0438AFSA	Rear Panel	AT
	LCRA-0050AFZZ	Holder, AM Bar Antenna	AB
	LX-WZ5065AGFE	Shakeproof Lockwasher Internal Type, Fuse Holder	AB
	XWWSN10-09180	Shakeproof Lockwasher Internal Type, Antenna Socket	AA
	LCHSM0202AFZZ	Chassis	AL
	LANGT0451AFZZ	Bracket, Chassis	AE
	LBSHC0004AGZZ	Bushing, AC Cord (SEMKO, KEMA)	AC
	LBSHC0007AFZZ	Bushing, AC Cord (SEV)	AB
	LANGT0454AFZZ	Bracket, Pulley, Right Side	AC
	LANGT0455AFZZ	Bracket, Pulley, Left Side	AC
	LANGR0374AFZZ	Bracket, Front Panel	AM
	LHLDW1027AGZZ	Wire Holder, Nylon	AA
	LANGF0302AFSB	Bracket, Dial	AF
	NPLYB0001SGZZ	Pulley, Dial Cord	AB
	NSFTZ0024AGFW	Shaft, Pulley	AA

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
	NSFTD0050AFZZ	Flywheel with Shaft	AR
	NDRM-0150AFZZ	Drum, Dial Cord	AF
	PCUSS0054AF00	Cushion, Dial	AA
	PSHEF0110AFZZ	Felt, Lever Switch	AA
	PSPAI0040AG00	Spacer, Front Panel, Fiber	AA
	PCOVU3100AFZZ	Cover, Dial Illumination Lamp	AK
	PCOVU3101AFZZ	Cover, Meter Illumination Lamp	AH
	PCOVP8150AF00	Holder, Lamp, Rubber	AC
	PCUSG0050AF00	Holder, Meter, Rubber	AG
	PRDAR0038AGZZ	Heat Sink, Transistor Q501	AA
	PSPAZ9004AGZZ	Washer, Transistor Q501	AA
	PSHEP0052AFSB	Sheet, Meter	AA
	CSPRT0304AF01	Dial Cord Assembly	–
	MSPRT0304AFFJ	Spring, Dial Cord	AA
PG501	QACCN0001AGZZ	AC Cord with Plug (SEMKO)	AP
PG501	CACCS9001SE03	AC Cord (SEV) Assembly	–
	QACCS9001SE00	AC Cord (SEV)	AG
	QPLGA0205AGZZ	Plug, AC Cord (SEV)	AK
PG501	QACCV0001AGZZ	AC Cord with Plug (KEMA)	AN
PG501	QACCZ0002TA0F	AC Cord with Plug	
SO501	QCNCW077AAFZZ	Socket, Antenna, 75 ohms	AH
SO502	QTANN0412AGZZ	Socket, Antenna (FM 300 ohms and AM)	AH
SO503	QSOCJ2650AFZZ	Socket, Multipath/Fixed/ Variable	AH
SO504	QSOCE0303AGZZ	Socket, Voltage Selector	AH
	QCNCM069AAFZZ	Plug, Coaxial Cable, 75 ohms	AK
	QCNW-0106AFZZ	Connecting Cord, RCA Type	AP
	QANTW0001SGZZ	FM Antenna	AK
	QFSHP1001AGZZ	Holder, Main Fuse	AH
	QFSHD1001AGZZ	Holder, Fuse, AF Circuit Board	AB
	QFSHA1001SGZZ	Holder, Meter Lamp	AB
	QFSHD1001SEZZ	Holder, Dial Lamp	AA
SW501	QSW-S0152AFSA	Switch, FM ATT. (–20dB)	AF
SW502	QSW-B0037AGZZ	Switch, Power	AN
SW401	QSW-R0103AFZZ	Switch, Band Selector	AP
SW402	QSW-B0051AFZZ	Switch, Muting	AK
SW403	QSW-B0053AFZZ	Switch, HI-BLEND/AIR CHECK CAL.	AL
SW404	QSW-B0054AFZZ	Switch, Multipath	AL
F501	QFS-C251CAGNI	Fuse, 250mAT (110V)	AE
F501	QFS-C121CAGNI	Fuse, 125mAT (220V/240V)	AF
F401	QFS-C501CAGNI	Fuse, 500mAT	AE
F402	QFS-C322CAGNI	Fuse, 3.15AT	AE
	QPWBF0356AFZZ	Printed Wiring Board, ATT. Circuit	AC
	QPWBE0057AFZZ	Printed Wiring Board, RF Circuit	AP
	QPWBE0058AFZZ	Printed Wiring Board, MPX Circuit	AG
	QPWBE0056AFZZ	Printed Wiring Board, AF Circuit	AT
	QPWBF0355AFZZ	Printed Wiring Board, Dial Lamp	AH
	QLUGL0402AGZZ	Terminal Strip, 4Lug	AD
CNS101	QCNCW051CAFZZ	Socket, 3 Pin	AC
CNS102	QCNCW054FAFZZ	Socket, 6 Pin	AC
CNS301	QCNCW070DAFZZ	Socket, 4 Pin	AD
CNS302	QCNCW072FAFZZ	Socket, 6 Pin	AE
CNS501	QCNCW053EAFZZ	Socket, 5 Pin	AC
CNS502	Not Available	Socket, 6 Pin	–
CNS503	QCNCW054FAFZZ	Socket, 6 Pin	AC
CNS504	QCNCW052DAFZZ	Socket, 4 Pin	AC
CNP401	QCNCM054FAFZZ	Plug, 6 Pin	AD
CNP402	QCNCM054FAFZZ	Plug, 6 Pin	AD
CNP403	QCNCM051CAFZZ	Plug, 3 Pin	AC
CNP404	QCNCM072DAFZZ	Plug, 4 Pin	AC
CNP405	QCNCM074FAFZZ	Plug, 6 Pin	AC
CNP406	QCNCM053EAFZZ	Plug, 5 Pin	AD
CNP407	QCNCM052DAFZZ	Plug, 4 Pin	AD
CNP408	QCNCM054FAFZZ	Plug, 6 Pin	AD
PL1, PL2, PL3, PL4, PL5, PL6	RLMPP0001SGZZ	Lamp, Dial Illumination	AE
PL7	RLMPP0001SGZZ	Lamp, Signal Meter (ME501)	AE
PL8	RLMPP0001SGZZ	Lamp, Tuning Meter (ME502)	AE
PL9	RLMPM0018AG04	Lamp, Stereo Indication	AE
PL10	RLMPM0018AG09	Lamp, FM Indication	AE
PL11	RLMPM0018AG02	Lamp, AM Indication	AE
ME501	RMTRL0103AFSB	Meter, Signal Strength	AT
ME502	RMTRL0102AFSB	Meter, FM Tuning/Multipath	AU
	RTUNE0054AFZZ	FM Tuner Assembly	BM