

AM/FM STEREO TUNER

T-310

SERVICE MANUAL

MODEL: T-310

C I R C U I T D E S C R I P T I O N

POWER SUPPLY

The mains input to the tuner goes via a 2 pole power switch to the mains transformer which has two secondary windings:

1. A 12V winding for the panel lamps.
2. A 13V center tapped winding providing after full wave rectification +17V and -17V supplies.

A potential divider using a zener diode which is used to obtain -12V DC supply for the AM and FM muting sections. The 2SD235 transistor is used as a ripple filter on PB328 providing 12V to the AM, FM and Dolby sections. There is a fuse in the secondaries for transistor protection.

AM SECTION

A superhet design using a tuned RF amplifier, a mixer/local oscillator and two stages of IF amplification at 455KHz. A ferrite rod antenna with 3 windings is used, the first winding is connected to the external antenna terminal, the second is connected to the first section of a 3 gang tuning condenser, the last winding feeding the base of the RF transistor amplifier.

A tuned RF transformer is used to couple the collector to the base of the self-mixing oscillator. The oscillator operates at 455KHz above the incoming signal to produce the intermediate frequency, which is passed through a double tuned IF trans and then amplified by two further transistor IF stages. The audio is then recovered by a germanium diode detector and passed on to the active filter, and the signal strength meter and the muting are driven from the audio detector output.

A (-) voltage detector is used to provide an AGC voltage which controls the gain of the first IF amplifier; the collector of this provides an amplified AGC back to the emitter of the RF transistor. This method used provides an audio output relatively constant with varying RF signal strength.

FM SECTION

Front End

An input balun transformer matches either 300-ohm or 75-ohm antenna input to the Front End, which has a 4-gang tuning capacitor and consists of a dual gate FET for the tuned RF amp feeding, via two-section transformer, the bi-polar transistor mixer. A bi-polar transistor "Colpitts" oscillator operates at 10.7MHz above the incoming signal. C115 is a negative temperature coefficient condenser to stabilize the oscillator to less than 25KHz per 10 deg. Celsius. The output is then fed via a lpf condenser to the mixer, the resultant 10.7MHz passes through a double tuned IFT included in the front end module. The front end module is well shielded to prevent any spurious radiation, and to offer good image and selectivity responses.

IF

The IF strip is contained on the same printed circuit board as the stereo multiplex decoder and muting circuits. The 10.7MHz IF intermediate frequency is amplified by a transistor then passed through a block filter with a side chain AGC amplifier to provide a DC control voltage (AGC) for the RF input FET to improve the front end overload capabilities. The main chain is again amplified by a differential IC and block filter providing a wide pass band with steep sides.

A differential IC with a built-in constant current source provides partial limiting, this passing through an double tuned IF transformer into the final multi-stage IC which provides hard limiting characteristics for the ratio discriminator, which provides the composite audio output for the multiplex. A second side chain amplifier and rectifier monitors the input to the first IC to provide a signal strength control command as well as driving the signal strength meter. At the

audio output when the receiver is off-tuned from center either a positive or negative DC will appear which is monitored both by a center tune meter. Amplitude DC signal by bi-phase DC amplifier (IC) passes through bi-phase detector. And a bi-phase detector using one NPN and one PNP transistor forms an "AND" gate for one of two "SHMITT" trigger circuits. The other shmitt trigger receives a command from the signal strength circuit previously mentioned. The collectors of the final transistor in each circuit form a "wired OR" gate which via the muting switch and function switch on the front panel controls the gate on the L- and R-ch FET audio mute circuit if it is enabled. The composite audio passes on to the IC multiplex, which will derive the L and R audio output, the IC also is connected directly to the stereo indicator lamp. The left and right go through LC type rejection filters to remove the 19KHz pilot. These are both in one moulding. Finally, a one-transistor amplifier is used in each channel to raise the level to 100mV at 400Hz stereo \pm 37.5KHz deviation for Dolby level.

AUDIO & DOLBY SECTIONS

4-transistor amplifier with 1-stage differential amp has the Dolby mixer point, and the output of this amplifier drives the Dolby calibration meter (the signal meter) at the time of Dolby calibration after rectified by the voltage doubler diode. The Dolby Off can be done by grounding the decoder signal given to the Dolby mixer point. To remove grounding ensures Dolby ON. When the Dolby calibration button is pressed the gates of FET muting become short-circuitred, and the signals from both channels are muted. And the power source of the 400Hz calibration oscillator is switched on, and the 400Hz signals are fed only to the REC. OUT terminal of the channel where the Dolby calibration is effected. At the same time the input is compulsorily changed into TAPE PLAY and the calibration meter is driven by this input, i.e., the tape monitor output.

T-310 ALIGNMENT PROCEDURE

The alignment procedure described in each chart may be performed independently, without affecting the others. Warm up the signal generators for at least 15 minutes to make certain if they are stabilized at their operating temperature particularly generators containing vacuum tubes. Consult the instruction manual supplied with the particular test instrument for specific information concerning connection and operation.

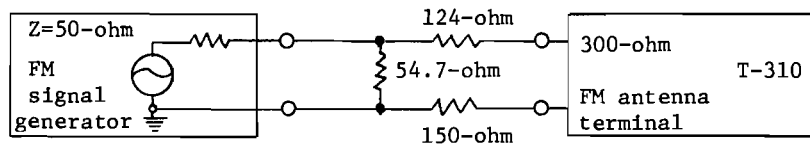
The test equipment listed here is intended only as a guide, but alternate instruments should be of similar quality. The following instruments are required for a complete alignment of the tuner.

1. Measurement instruments and tools

Signal Source	1) FM signal generator (FMSG)	Output Indicator	7) Oscilloscope (CRO)
	2) Sweep generator (SWG)		8) Distortion meter (HDM)
	3) AM signal generator (AMSG)		9) AC volt meter (ACVTVM)
	4) FM stereo modulator (MPXSG)		10) DC volt meter (DCVTVM)
	5) Audio oscillator (AFO)	Tools	11) Hex hed alignment tool
	6) AM standard loop antenna		12) Thin fiber shaft alignment tool

2. General alignment conditions

- 1) The normal test voltage is within $\pm 10\%$ of what is indicated on the tuner, 50Hz with less than 2% harmonic distortion.
- 2) Unless otherwise specified, the normal ambient temperature is $15^{\circ}\text{C} - 25^{\circ}\text{C}$ and humidity 55 - 75%. But as far as correct judgement is ensured $5 - 35^{\circ}\text{C}$, 45 - 85% is allowable.
- 3) FM dummy antenna shall be as follows if not otherwise specified. The output voltage of the signal generator is $1/4$ of the unloaded terminal voltage.



- 4) Connect the low side of signal source and the output indicator to the chassis ground as close as possible to the high side connection unless otherwise specified.
- 5) The 10.7MHz marker used in each section of the alignment should be the same.
- 6) Marker insertion and amplitude should not distort the oscilloscope trace.
- 7) The AM standard loop antenna should be set above the ferrite loopstick antenna.
- 8) The output level of the sweep generator is measured by the output attenuator regardless of its terminated impedance.
- 9) FM modulation 100% with $\pm 75\text{KHz}$.

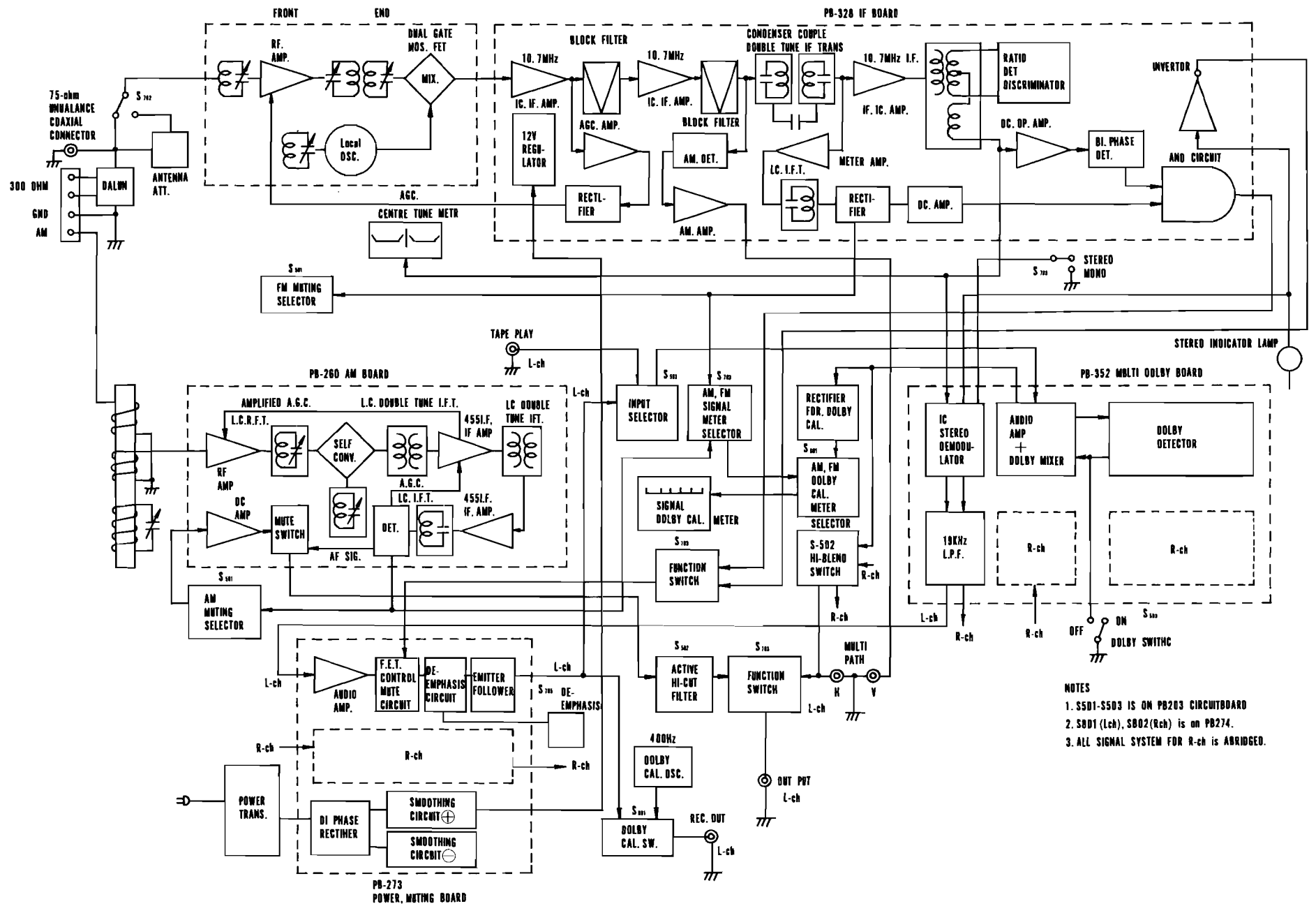
STEP	Signal Source Connected to	Set signal to	Set Radio Dial to	Output Indicator Connected to	Adjust	Adjust for
1	Set MODE switch to FM mono, muting switch to off, hi-blend switch to normal, antenna attenuator switch to out and the mains power switch to off.					
2	Remove wiring of TP2 and TP3					
3	Press power switch for "on"					
4				DCVTVM PB328 5 or 6	VR202 (PB328)	DCVTVM reading 12V \pm 0.2
5	<u>Sweep generator</u> Point 2 of PB328	+400KHz sweep centered at 10.7MHz generator output level 120dB Sweep verocity 3 - 10Hz	Quiet point on band near 98MHz	<u>Oscilloscope</u> PB328 TP1		Find a center frequency where symmetrical response can be obtained in the vicinity of -3dB to -6dB and make note of it.
6				<u>Oscilloscope</u> PB328 TP2		Find a center frequency where symmetrical response can be obtained in the vicinity of -3dB to -6dB and make note of it.
7				<u>Oscilloscope</u> PB328 TP4		T201 core
8		T202 core				
9		T204 core				
10		+400KHz sweep centered at 10.7MHz generator output level 40dB Sweep verocity 3 - 10Hz		PB328 24		T203 top core
11	T203 bottom core					
12	Solder TP2 and TP3 using jumper lead.					
13	<u>FM Signal generator</u> Across FM antenna terminals through 300-ohm matching network	Reduce the output level to zero (interstation receiving condition)	Quiet point on band near 98MHz		T203 top core	Center indication of tuning meter
14		98MHz at 400Hz, 100% modulation Generator output level 1mV		<u>Oscilloscope</u> Distortion meter <u>ACVTVM</u> Output Terminals	T203 bottom core	Maximum distortion - this point should be adjusted in the range of -0.5dB reduce of output level from the core position of peak output level.
15	Repeat steps 13 and 14 as necessary to obtain the maximum output level and minimum distortion at "0" point of tuning meter and to let the meter show "0" at interstation state.					

STEP	Signal Source Connected to	Set signal to	Set Radio Dial to	Output Indicator Connected to	Adjust	Adjust for
16	FM signal generator	98MHz at 400Hz, 30% modulation Output level 1mV	98MHz	Oscilloscope Distortion Meter ACVTVM	T204 core	Identify the peak point of signal meter with the center of tuning meter
17	Across FM antenna terminals through 300-ohm matching network	88MHz at 400Hz, 30% modulation Output level 1mV	88MHz	Output terminals	VR204	Adjust the swing of signal meter so as to indicate 90% swing of full scale
18		88MHz at 400Hz, 100% modulation Output level 1mV			L104	Accurate reception of 88MHz signals at 88MHz dial calibration
19		108MHz at 400Hz, 100% modulation Output level 1mV	108MHz		TC104	Accurate reception of 108MHz signals at 108MHz dial calibration
20		Repeat steps 18 and 19 so that correct dial calibration can be obtained.				
21	FM signal generator	88MHz at 400Hz, 100% modulation Output level 5 - 10uV	88MHz	Oscilloscope Distortion meter ACVTVM Output terminals	T101 top core	Maximum swing of signal meter.
22	Across FM antenna terminals through 300-ohm matching network				T101 bottom core	
23					L101	
24					L102	
25					L103	
26					TC101	
27	108MHz at 400Hz, 100% modulation generator output level 5 - 10 uV				TC102	
28		TC103				
29	Reduce the output level to zero (Interstation receiving condition)	Quiet point on band near 98MHz	T203 top core	Center indication of tuning meter.		
30	98MHz at 400Hz, 100% modulation Output level 1mV	Correct reception of 98MHz signals from FM-SG at the center of tuning meter	T203 bottom core	Minimum distortion below 0.2%. This step No.30 is merely for the confirmation of step No.17 and the core should not exceed 1/10 turn.		
31	Repeat step 29 and 30 as necessary to obtain the maximum output voltage and minimum distortion at the center of tuning meter and to let the meter show the center at the interstation state.					

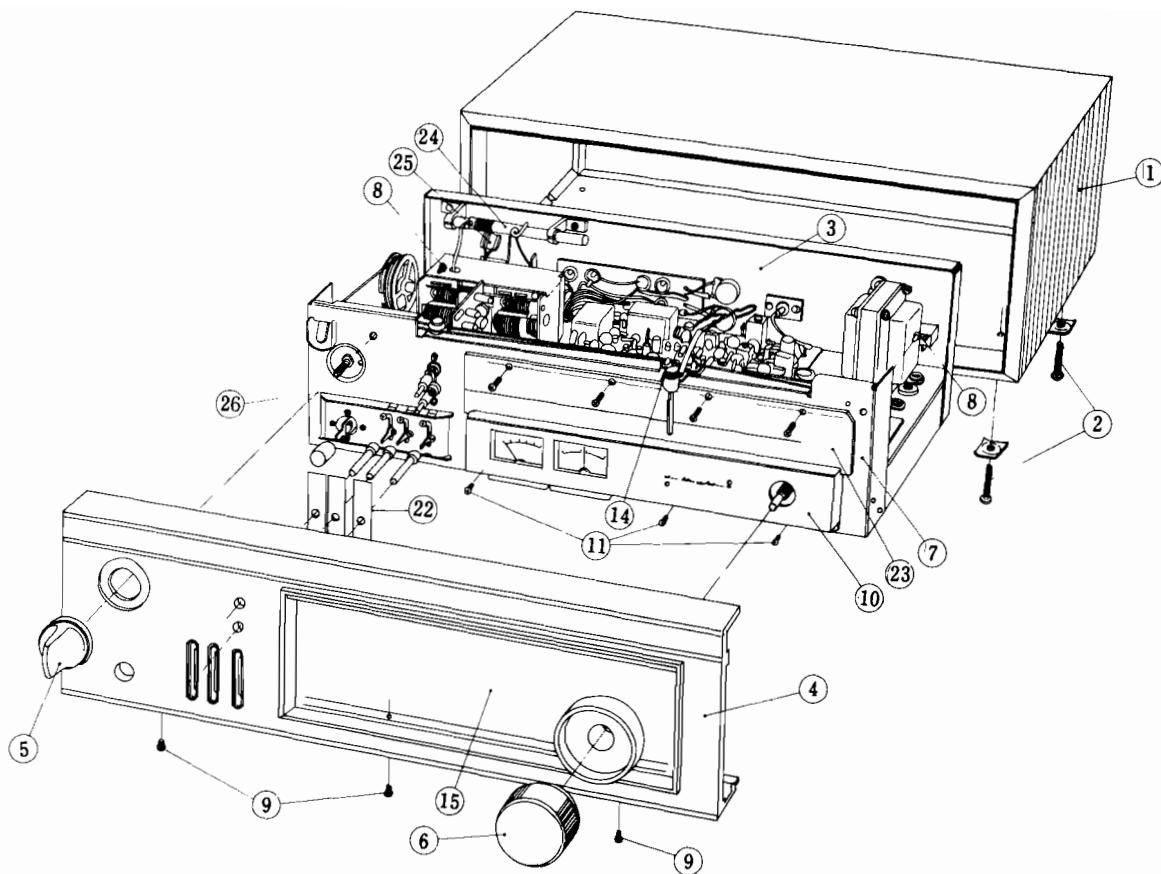
STEP	Signal Source Connected to	Set Signal to	Set Radio Dial to	Output Indicator Connected to	Adjust	Adjust for
32	FM signal generator	88MHz at 400Hz, 100% modulation	88MHz	Oscilloscope Distortion meter ACVTVM		IHF maximum usable sensitivity which is the minimum output level of FMSG required for distortion and noise to be -30dB of total output.
33	Across FM antenna terminals through 300-ohm matching network	108MHz at 400Hz, 100% modulation	108MHz	Output terminal		
34	Repeat steps 20 - 31 so that the maximum IHF sensitivity can be obtained.					
35	Set the muting switch at normal position					
36	FM signal generator	98MHz at 400Hz, 30% modulation Output level 5uV	98MHz	Oscilloscope Distortion meter ACVTVM	VR201	The swing of signal meter should be 30% swing of full scale. Unless this figure is obtained, turn it out within 10% - 40% limit.
37	Across FM antenna terminals through 300-ohm matching network				VR203	
38	Set the MODE switch at FM stereo position					
39	FM signal generator	98MHz at 19KHz, 3 - 5% modulation Output level 1mV	98MHz	Oscilloscope PB352 TR1 (Oscilloscope should be of small input capacitance)	T301 core	Maximum amplitude of oscilloscope
40	Across FM antenna terminals through 300-ohm matching network				T302 core	
41					T303 core	
42	Repeat steps 39 - 41 more than two times so that each coil can be completely turned.					
43	FM signal generator	98MHz at 19KHz, 10% (L-R) 400Hz, 45% or 90% Output level 1mV	98MHz	Oscilloscope Distortion meter ACVTVM	T303 core	To obtain peak of output voltage. (This adjustment relates to stereo distortion.)
44	Across FM antenna terminals through 300-ohm matching network				Output terminal	
45		98MHz at 19KHz, 10% R-ch 90% Output level 1mV			VR901	To minimize the crosstalk to L-ch. The crosstalk should be less -35dB than the output level of R-ch.
46		98MHz at 19KHz, 10% L-ch 90% Output level 1mV			VR901	The crosstalk to R-ch should be less -35dB than L-ch output level, and be the same with the crosstalk of step No.45.

STEP	Signal Source Connected to	Set Signal to	Set Radio Dial to	Output Indicator Connected to	Adjust	Adjust for
47	FM signal generator	98MHz	98MHz	Modulation (1) ACVTVM to CP301	VR601	Adjust to 225mV precisely. Make note the output level at REC. OUT of Lch.
48	Across FM antenna terminals through 300-ohm matching network	Modulation 19KHz 10% L + R 90% Output level 1mV		Modulation (2) ACVTVM to CP302	VR602	Adjust to 225mV precisely. Make note the output level at REC. OUT of Rch.
49	Set the DOLBY NR switch to the "TAPE" position. Ground the No.7 terminal on PB352 together with the CP303.					
50	Audio Frequency Oscillator	Adjust the output VR of the oscillator so as to get the output level of 7.6mV at CP301 when 5KHz signal is fed. (Adjust under No 49)	Any Point	ACVTVM	VR303	Remove No.7 terminal on PB352 from GND. Adjust VR303 to obtain 2.4mV precisely.
51	To Rch TAPE PLAY terminal. Set the VR705 at the extreme clockwise position.			CP301	VR301	
52	Ground No 8 terminal and CP304 on PB352.					
53	Audio Frequency Oscillator	Adjust the output VR of the oscillator so as to get the output level of 7.6mV at CP302 when 5KHz signal is fed. (Adjust under No 52)	Any Point	ACVTVM	VR304	Remove No 8 terminal on PB352 from GND. Adjust VR304 to obtain 2.4mV precisely.
54	To Rch TAPE PLAY terminal. Set the VR705 at the extreme clockwise position			CP302	VR302	
55	Audio Frequency Oscillator	Adjust the output VR of the oscillator so as to get the output level of 100mV at CP302 when 400Hz signal is fed.	Any Point	ACVTVM	VR801	Adjust VR801 with pressing-in the Lch of the DOLBY CAL button so that the needle of the DOLBY METER indicates the CAL point.
56	To Lch TAPE PLAY terminal				VR802	
57	Audio Frequency Oscillator	Adjust the output VR of the oscillator so as to get the output level of 100mV at CP302 when 400Hz signal is fed.	Any Point	REC. OUT terminal of L- or R-ch	VR803	Adjust VR803 with pressing-in the CAL button to obtain 100mV precisely
58	To Rch TAPE PLAY terminal					
58	Set the MODE switch at the "AM" position, hi-cut switch at the "normal" position and muting switch at the "off" position.					
59	Set the VR401 (PB460) at nearly the center, and turn the VR702 (AM-muting) out towards the counter clockwise direction.					
60	Connect TP2 and TP3 (PB460) provisionally.					

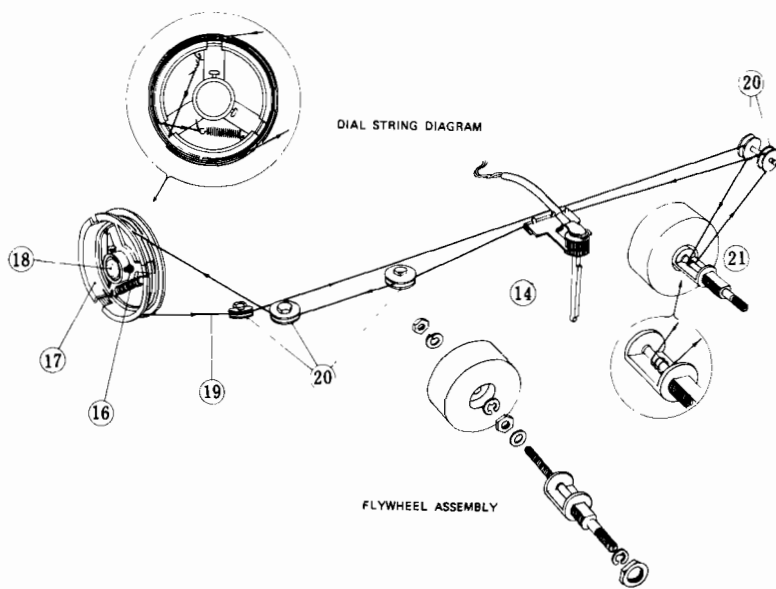
STEP	Signal Source Connected to	Set Signal to	Set Radio Dial to	Output Indicator Connected to	Adjust	Adjust for
61	Output of sweep generator	+40KHz sweep centred at 455KHz generator Output level 70 - 80dB Sweep verocity 3 - 10Hz	Quiet point on band near 1600KHz	Genescope PB460 7	T403 top core	Maximum symmetrical response centered at 455KHz with same hight at 450KHz and 460KHz, and maximum swing.
62	PB460 1 through 1uF mylar capacitor				T403 bottom core	
63					T404 top core	
64					T404 bottom core	
65					T405 core	
66	Remove wiring at step No 60					
67	Set standard radiating loop antenna at the fixed place	600KHz at 400Hz, 30% modulation.	600KHz	Oscilloscope ACVTVM	T402 core	Dial pointer to be tuned at 600KHz
68		Adjust SG to obtain such field strength that signal meter should always swing 30% - 50%.	1400KHz	Output terminal	Bar antenna coil L701	Maximum ACVTVM reading - Slide coil bobbin.
69		1400KHz at 400Hz, 30% modulation Same adjustment for field strength noted at step No49 - No101.			T401 core	Maximum ACVTVM reading.
70					TC703	Dial pointer to be tuned at 1400KHz
71					TC701	Maximum ACVTVM reading
72			TC702			
73	Repeat steps 67 and 70 as necessary to obtain exact tuning point on dial scale. Repeat steps 68, 69, 71 and 72 to obtain maximum sensitivity.					
74	Fix by adhesive agent the core and bobbin on the bar antenna aligned at step 68.					
75	Connect the output of AMSG to antenna terminal through ceramic capacitor of 200pF.	1000KHz at 400Hz, 30% modulation Field strength 80dB	1000KHz	Oscilloscope Distortion meter ACVTVM	VR401	Fix the output level at 525mV.
76		Standard radiating loop antenna at the fixed place.	600KHz at 400Hz, 30% modulation	600KHz		
77		1400KHz at 400Hz, 30% modulation	1400KHz			
78	Set the muting switch at normal position.					
79	Standard radiating loop at the fixed place.	1000KHz at 400Hz, 30% modulation field strength 60dB/m	1000KHz	"	VR501	Fix VR501 at the point where output signals appear.
80	Put the power switch to the "OFF" position. Then all the adjustments are finished.					



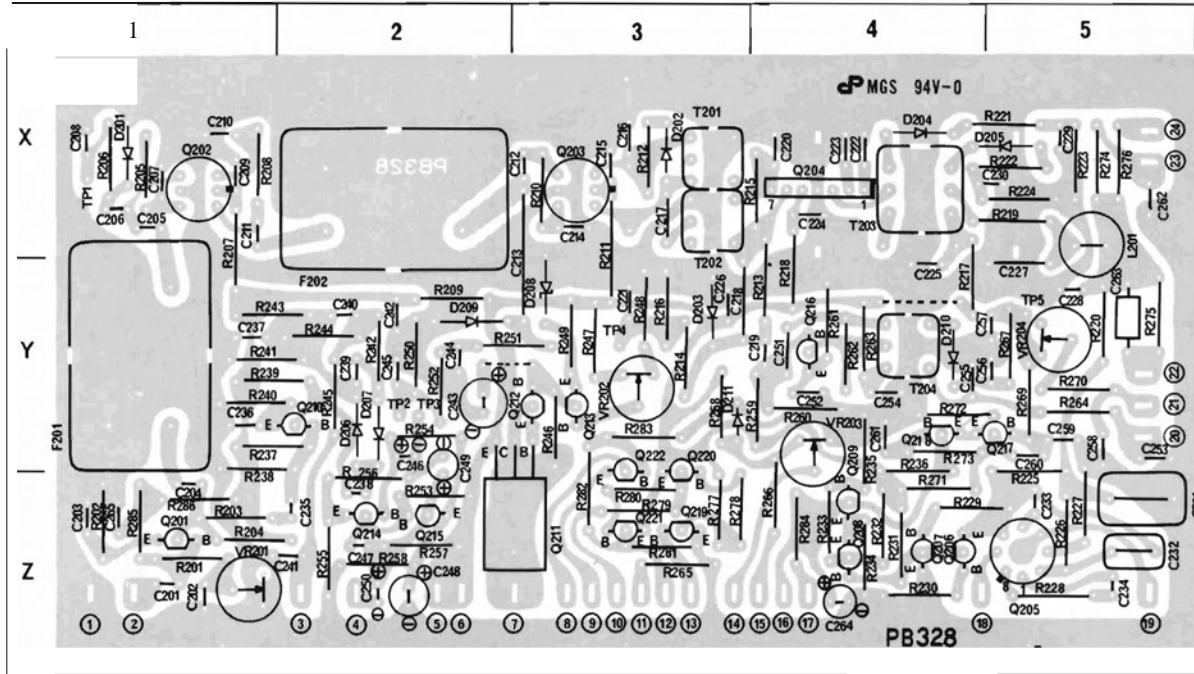
- NOTES
1. S501-S503 IS ON PB203 CIRCUITBOARD
 2. S801 (Lch), S802 (Rch) IS ON PB274.
 3. ALL SIGNAL SYSTEM FOR R-ch IS ABRIDGED.



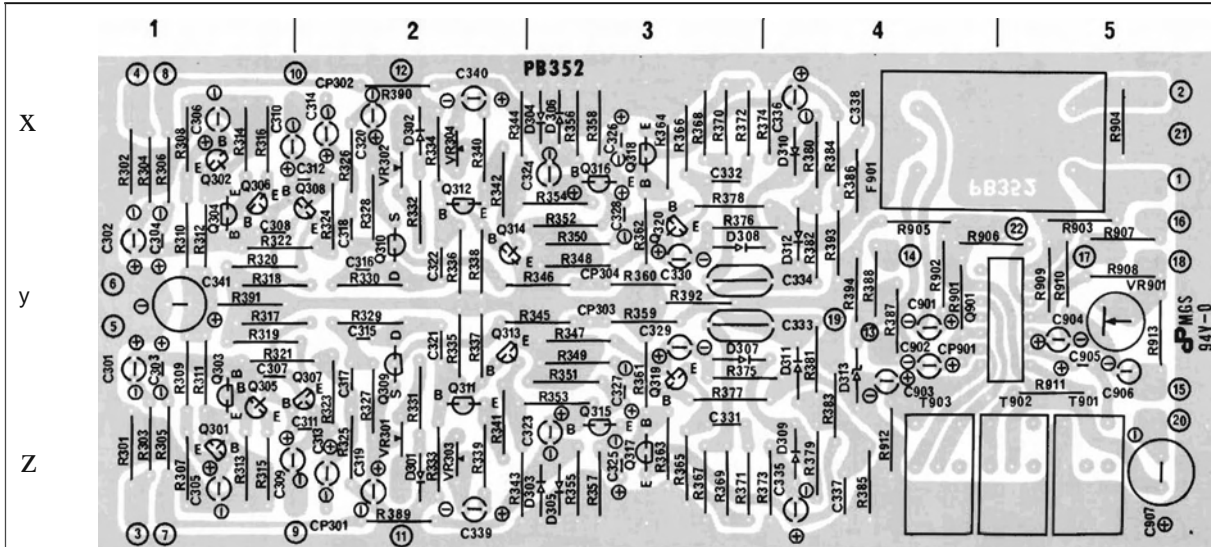
- 1 Wooden Case
- 2 Screw 4mm x 5mm
- 3 Back Panel
- 4 Front Panel
- 5 Mode Selector Knob
- 6 Tuning Knob
- 7 Sub-panel
- 8 Screw 4mm x 6mm
- 9 Screw 3mm x 6mm
- 10 Meter holder
- 11 Screw 3mm x 8mm (Self tapping)
- 12 Screw 3mm x 10mm (Self Countersunk)
- 13 Square tooth washer
- 14 Tuning Pointer Ass'y
- 15 Dial Glass
- 16 Spring (tension for dial cord)
- 17 Drum
- 18 V.C. shaft
- 19 Dial Cord
- 20 Plastic Pulley
- 21 Tuning Shaft and Flywheel Ass'y
- 22 Paper Mask
- 23 Dial Scale
- 24 Bar Antenna
- 25 Balun



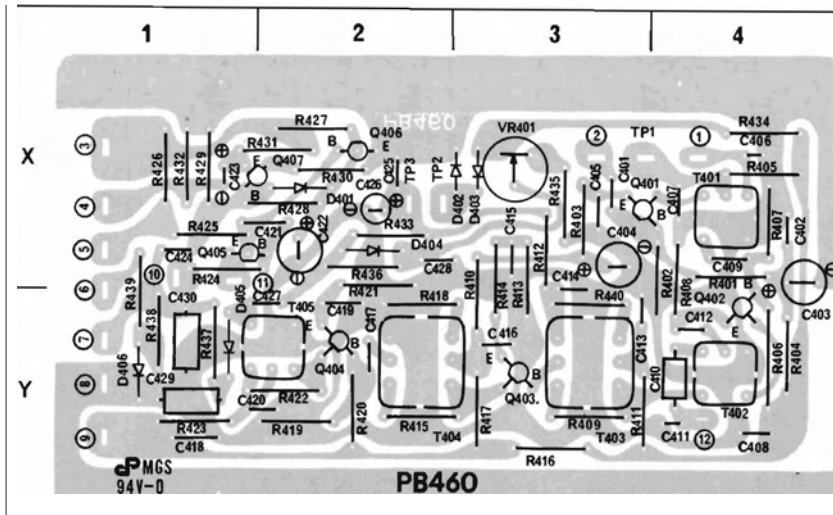
PB328



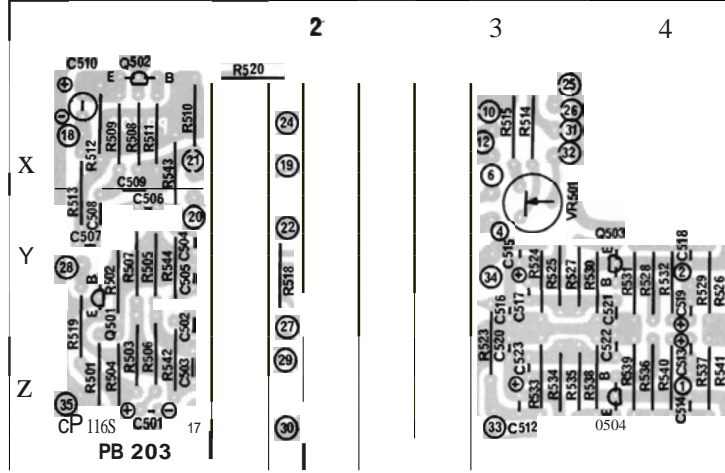
PB352



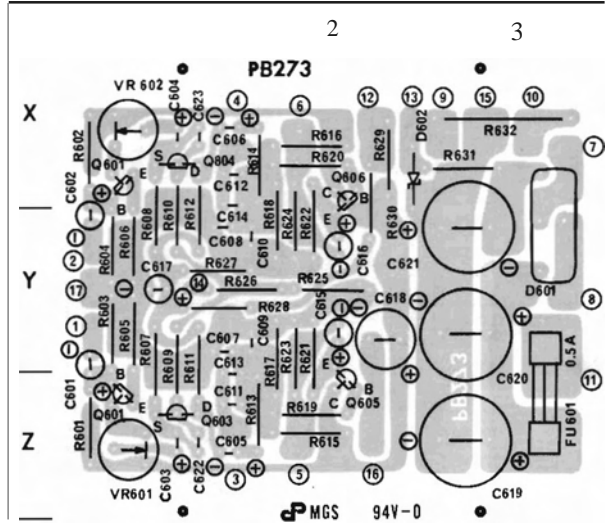
PB460



PB203



PB273



PB-328

SYMBOL NO. (RESISTORS; $\pm 10\%$ 1/4W unless noted otherwise)

R201	470	Z1	R231	100K	Z4	R261	1K	Y4
202	1K	Z1	232	33K	Z4	262	15K	Y4
203	2.2K	Z1	233	56K	Z4	263	470	Y4
204	1.8K	Z1	234	100	Z4	264	22	Y5
205	820	X1	235	47K	Y4	265	120	Z3
206	100K	X1	236	6.8K	Z4	266	470	Z4
207	470	X1	237	22K	Y1	267	470	Y5
208	1.8K	X1	238	3.3K	Y1	268	1.5K	Y3
209	100	Y2	239	4.7K	Y1	269	47K	Y5
210	820	X3	240	1K	Y1	270	1.8K	Y5
211	470	X3	241	47K	Y1	271	33K	Z4
212	470	X3	242	10K	Y2	272	22	Y4
213	1K	Y4	243	68K	Y1	273	33K	Y4
214	10K	Y3	244	100K	Y2	274	33K	X5
215	2.2K	X4	245	100K	Y2	275	10	Y5
216	100K	Y3	246	10K	Y3	276	10K	X5
217	1K	Y4	247	680	Y3	277	390 1/2W	Z3
218	390	Y4	248	1.5K	Y3	279	15K	Z3
219	47	X5	249	6.8K	Y3	280	0	Z3
220	100K	Y5	250	470K	Y2	282	15K	Z3
221	1K	X5	251	10K	Y3	283	15K	Y3
222	1K	X5	252	10K	Y2	284	120K	Z4
223	6.8K	X5	253	100K	Z2	285	3.3K	X1
224	6.8K	X5	254	220K	Y2	286	470	X1
225	150K	Z5	255	1K	Z2			
226	56K	Z5	256	330K	Z2			
227	27K	Z5	257	10K	Z2			
228	1.5K	Z5	258	2.2K	Z2			
229	22K	Z4	259	15K	Y4			
230	22K	Z4	260	2.2K	Y4			

SYMBOL NO. (CAPACITORS)

C201	O.OluF	+80%-20%	25V	ceramic	Z1	C216	0.04uF	$\pm 80\%$ -20%	25V	electrolytic	X3
202	O.OluF	"	25V	"	Z1	217	2.2pF	$\pm 5\%$	500V	ceramic	X3
203	0.04uF	"	25V	"	Z1	218	470pF	$\pm 20\%$	50V	"	Y3
204	O.OluF	"	25V	"	Z1	219	470pF	"	50V	"	Y4
205	O.OluF	"	25V	"	X1	220	0.04uF	+80%-20%	25V	"	X4
206	470pF	$\pm 20\%$	50V	"	X1	221	0.04uF	"	25V	"	Y3
207	0.04uF	+80%-20%	25V	"	X1	222	0.04uF	"	25V	"	X4
208	O.OluF	+80%-20%	25V	"	X1	223	0.04uF	+80%-20%	25V	"	X4
209	0.04uF	+80%-20%	25V	"	X1	224	0.04uF	+80%-20%	25V	"	X4
210	0.04uF	+80%-20%	25V	"	X1	225	0.04uF	+80%-20%	25V	"	Y4
211	O.OluF	"	25V	"	X1	226	0.04uF	"	25V	"	Y3
212	O.OluF	+	25V	"	X3	227	470pF	$\pm 20\%$	50V	"	Y5
213	470pF	-20%	50V	"	X3	228	100pF	$\pm 10\%$	50V	"	Y5
214	0.04uF	+80%-20%	25V	"	X3	229	470pF	$\pm 20\%$	50V	"	X5
215	0.04uF	"	25V	"	X3	230	470pF	"	50V	"	X5

C231	0.39uF	$\pm 10\%$	50V	mylar	Z5	C248	33uF	+80%-20%	16V	electrolytic	Z2
232	0.082uF	"	50V	"	Z5	249	4.7uF	"	25V	"	Y2
233	220pF	"	50V	ceramic	Z5	250	0.1uF	$\pm 50\%$ -20%	35V	tantalum	Z2
234	0.0047uF	"	50V	mylar	Z5	251	0.47pF	$\pm 5\%$	500V	ceramic	Y4
235	470pF	$\pm 20\%$	50V	ceramic	Z2	252	0.04uF	+80%-20%	25V	"	Y4
236	0.04uF	+80%-20%	25V	ceramic	Y1	253	0.04uF	+80%-20%	25V	"	Y5
237	0.04uF	$\pm 80\%$ -20%	25V	"	Y1	254	0.04uF	+80%-20%	25V	"	Y4
238	470pF	$\pm 20\%$	50V	"	Z2	255	0.04uF	+80%-20%	25V	"	Y4
239	O.OluF	+80%-20%	25V	"	Y2	256	O.OluF	+80%-20%	25V	"	Y5
240	O.OluF	"	25V	"	Y2	257	O.OluF	"	25V	"	Y5
241	0.04uF	"	25V	"	Z2	258	0.04uF	"	25V	"	Y5
242	0.04uF	"	25V	"	Y2	259	0.04uF	+80%-20%	25V	"	Y5
243	47uF	"	16V	electrolytic	Y2	260	0.04uF	+80%-20%	25V	"	Y5
244	0.01uF	"	25V	ceramic	Y2	261	0.04uF	"	25V	"	Y4
245	O.OluF	"	25V	"	Y2	262	0.04uF	"	25V	"	X5
246	O.luF	$\pm 50\%$ -20%	35V	tantalum	Y2	264	4.7uF	"	25V	"	Z4
247	470pF	$\pm 20\%$	50V	ceramic	Z2	265	0.04uF	"	25V	"	Z1

SYMBOL NO. (TRANSISTORS)

Q201	2SC381R	FM IF amplifier	Z1	Q211	2SD235	Regulator	Z3
202	uPC555A	FM IF amplifier	X1	212	2SC372Y	"	Y3
203	uPC555A	FM IF amplifier	X3	213	2SC372Y	"	Y3
204	TA7061AP	FM IF amp & limiter	X4	214	2SC372Y	Multi Pass pick up amp.	Z2
205	CUA709C	Bi-phase DC amp.	Z5	215	2SC372Y	"	Z2
206	2SC372Y	Bi-phase detector	Z4	216	2SC381R	FM signal meter amp.	Y4
207	2SC372Y	"	Z4	217	2SC372Y	Shumitt Trigger	Y5
208	2SC372Y	Shumitt Trigger	Z4	218	2SC372Y	"	Y4
209	2SC372Y	"	Z4	219	2SC372Y	Invertor	Z3
210	2SC381R	FM AGC amplifier	Y2				

SYMBOL NO. (DIODES)

D201	1S188	Check point detector	X1	D207	1S188	AGC detector	Y2
202	1S188	FM limiter	X3	208	BZ-071	Voltage stabilizer	Y3
203	1S188	Check point detector	Y3	209	1S188	AM detector for multi pass pick up	Y2
204	1S188	FM ratio detector	X4	210	1S188	FM signal meter detector	Y4
205	1S188	"	X5	211	KB265	Temperature compensation	Y3
206	1S188	AGC detector	Y2				

SYMBOL NO. (VARIABLE RESISTORS)

VR201	470-ohm-B semifixed for IF Gain	Z1
202	470-ohm-B semifixed for DC supply	Y3
203	470-ohm-B semifixed for muting level	Y4
204	4.7K-ohm-B semifixed	Y5

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SYMBOL NO. (RESISTORS; $\pm 10\%$ 1/4W, unless noted otherwise)

R301	100K	Z1	R334	1M	X2	R367	39	Z3
302	100K	X1	335	105M	Y2	368	39	X3
303	33K $\pm 5\%$	Z1	336	105M	Y2	369	1K	Z3
304	33K	X1	337	15K	Y2	370	1K	X3
305	220K	"	338	15K	Y2	371	100 $\pm 5\%$	Z2
306	220K	"	339	270	Z2	372	100	X3
307	39K	Z1	340	270	X2	373	15K	Z4
308	39K	X1	341	8.2K	Z2	374	15K	X4
309	820K	Y1	342	8.2K	X2	375	15K	Y3
310	820K	Y1	343	10K	Z2	376	15K	Y3
311	39K	Y1	344	10K	X2	377	220K	Z3
312	39K	Y1	345	270K	Y3	378	220K	X3
313	18K	Z1	346	270K	Y3	379	1K	Z4
314	18K	X1	347	2.7K	Y3	380	1K	X4
315	470	Z1	348	2.7K	Y3	381	270K	Y4
316	470	X1	349	470K	Y3	382	270K	Y4
317	5.6K	Y1	350	470K	Y3	383	2.7K	Z4
318	5.6K	Y1	351	1.2K	Y3	384	2.7K	X4
319	39	Y1	352	1.2K	Y3	385	270K	Z4
320	39	Y1	353	8.2K	Z3	386	270K	X4
321	33K $\pm 5\%$	Y1	354	8.2K	X3	387	10K	Y4
322	33K	"	355	33K	Z3	388	10K	Y4
323	1.2K	"	356	33K	X3	389	10	Z2
324	1.2K	"	357	1.2K	Z3	390	10	X2
325	150	"	358	1.2K	X3	391	1.2K	Y1
326	150	"	359	10	Y3	392	0	Y3
327	3.3K $\pm 2\%$	Z2	360	10	Y3	393	10	Y4
328	3.3K	"	361	470K	Y3	394	470	Y4
329	39K $\pm 5\%$	Y2	362	470K	Y3			
330	39K	"	363	220K	Z3			
331	1.5K	Z2	364	220K	X3			
332	1.5K	X2	365	1K	Z3			
333	1M	Z2	366	1K	X3			
R901	3.3K	Y4	R906	100K	Y4	R911	47	Z5
902	3.3K	Y4	907	150	Y5	912	4.7K	Z4
903	3.9K	Y5	908	18K	Y5	913	8.2K	Y5
904	3.9K	X5	909	39K	Y5			
905	100	Y4	910	33K	Y5			

SYMBOL NO. (CAPACITORS)

C301	2.2uF +80%-20%	SOV electrolytic	Y1	C321	0.1uF ⁺ -10%	SOV mylar	Y2
302	2.2uF "	SOV "	Y1	322	0.1uF "	SOV "	Y2
303	0.47uF +SO%-20%	3SV tantalum	Y1	323	10uF +80%-20%	16V electrolytic	Z3
304	0.47uF +SO%-20%	3SV tantalum	Y1	324	10uF "	16V "	X3
30S	2.2uF +80%-20%	SOV electrolytic	Z1	32S	0.22uF +SO%-20%	3SV tantalum	Z3
306	2.2uF + "	SOV "	X1	326	0.22uF "	3SV "	X3
307	10pF -1pF	SOV ceramic	Y1	327	0.22uF "	3SV "	Z3
308	10pF "	SOV "	Y1	328	0.22uF "	35V "	X3
309	4.7uF +80%-20%	2SV electrolytic	Z1	329	10uF +80%-20%	16V electrolytic	Y3
310	4.7uF +80%-20%	2SV electrolytic	X1	330	10uF +80%-20%	16V electrolytic	
311	47pF -10%	SOV ceramic	Z2	331	0.047uF -S%	SOV mylar	Z3
312	47pF "	SOV "	X2	332	0.047uF "	SOV mylar	X3
313	4.7uF +80%-20%	2SV electrolytic	Z2	333	0.33uF ±10%	SOV mylar	Y3
314	4.7uF +80%-20%	2SV electrolytic	X2	334	0.33uF "	SOV mylar	Y3
31S	0.0047uF -S%	SOV mylar	Y2	33S	10uF +80%-20%	16V electrolytic	Z4
316	0.0047uF "	SOV mylar		336	10uF +80%-20%	16V "	X4
317	0.033uF "	SOV "	Y2	337	0.1uF -10%	SOV mylar	Z4
318	0.033uF "	SOV "	Y2	338	0.1uF "	SOV mylar	X4
319	10uF +80%-20%	16V electrolytic	Z2	339	10uF +80%-20%	16V electrolytic	Z2
320	10uF +80%-20%	16V "	X2	340	10uF "	16V "	X2
				341	47uF "	16V "	Y1

SYMBOL NO. (CAPACITORS)

C901	10uF +80%-20%	16V electrolytic	Y4	C90S	0.1uF +80%-20%	25V tantalum	YS
902	10uF "	16V "	Y4	906	S60pF -S%	SOV styrol	YS
903	4.7uF "	2SV "	YS	907	470uF +80%-20%	16V electrolytic	ZS
904	4.7uF "	2SV "	YS				

SYMBOL NO. (TRANSISTORS)

Q301	2SA640L	Lch & Rch audio amp,	Z1	Q311	2SC1222F	L _c h , R _c h	Z2
302	2SA640L	DOLBY mixer,	X1	312	2SA640L		X2
303	2SA640L	Calibration meter amp	Z1	313	2SC1222F	DOLBY decode signal	Y2
304	2SA640L		X1	314	2SA640L	amplifier	Y2
30S	2SC1222F		Z1	31S	2SC1222F	E-C sepalator	Z3
306	2SC1222F		X1	316	2SC1222F	E-C sepalator	X3
307	2SA640L		Z2	317	2SC372Y		Z3
308	2SA640L		X2	318	2SC372Y		X3
309	2SK30AD	electric attenuator	Y2	319	2SC372Y		Y3
310	2SK30AD	electric attenuator	Y2	320	2SC372Y		Y3
Q901	uPCSS4C	FM stereo demodulator	YS				

PB-460

SYMBOL NO. (RESISTORS; ±10% 1/4W unless otherwise noted)

MO1	4.7K	X4	R41S	ISOK	Y2	R429	100K	X1
402	22k	X4	416	100	Y3	430	1.5K	X2
403	LSK	X3	417	10K	Y3	431	4.7K	X2
404	22K	Y4	418	ISOK	Y2	432	S6K	X1
40S	10K	X4	419	10K	Y2	433	10K	X3
406	ISK	Y4	420	82K	Y2	434	3.9K	X4
407	2.2K	X4	421	100	X2	43S	3.3K	X3
408	2.2K	X4	422	27K	Y2	436	10K	X2
409	ISOK	Y3	423	100	Y1	437	470	Y1
410	1. SK	X3	424	S6K	X1	438	4.7K	Y1
411	2.7K	Y3	42S	1K	X1	439	L8K	Y1
412	470	X3	426	S6K	X1	440	ISOK	Y3
413	470	X3	427	ISK	X2	441	47K	
414	120	X3	428	330K	X2			

SYMBOL NO. (TRANSISTORS)

Q401	2SC381R	AM RF amplifier	X3	Q40S	2SC372Y	DC amplifier for muting	X1
402	2SC372Y	AM converter	Y4	406	2SC372Y	DC amplifier for muting	X2
403	2SC381R	AM IF & AGC amp	Y3	407	2SC372Y	AM audio amp. & mute gate	X2
404	2SC372Y	AM IF amplifier	Y2				

SYMBOL NO. (CAPACITORS)

C401	0.04uF +80%-20%	25V	ceramic	X3	C416	0.04uF +80%-20%	25V	ceramic	Y3
402	0.04uF "	25V	"		417	0.04uF	25V	"	Y2
403	47uF "	16V	electrolytic	X4	418	0.1uF	25V	"	Y1
404	47uF "	16V	"	X3	419	0.04uF	25V	"	Y2
405	0.04uF + "	25V	ceramic	X3	420	0.04uF	25V	"	Y2
406	10pF -1pF	50WV	"	X4	421	0.1uF	25V	"	X2
407	0.04uF +80%-20%	25V	"	X4	422	33uF	16V	electrolytic	X2
408	0.04uF +80%-20%	25V	"	Y4	423	0.47uF +50%-20%	35V	tantalum	X1
409	0.04uF "	25V	"	X4	424	0.022uF -10%	50V	mylar	X1
410	450pF $\pm 5\%$	50V	styrol	Y4	425	0.04uF +80%-20%	25V	ceramic	X2
411	15pF $\pm 10\%$	50V	ceramic	Y4	426	2.2uF "	50V	electrolytic	X2
412	0.04uF +80%-20%	25V	"	Y4	427	100pF $\pm 10\%$	50V	ceramic	Y2
413	0.04uF "	25V	"	Y3	428	0.04uF +80%-20%	25V	ceramic	X2
414	0.04uF "	25V	"	X3	429	3300pF -5%	50V	styrol	Y1
415	0.04uF "	25V	"	X3	430	3300pF "	50V	"	Y1

SYMBOL NO. (DIODES)

D401	IS188	limitter for muting	X2	D404	IS1554V	AM AGC detector	X2
402	KB265	temperature compensation	X3	405	IS188	AM detector	Y1
403	KB165	temperature compensation	X3	406	IS1554V	limitter for AM signal meter	Y1

SYMBOL NO. (VARIABLE RESISTORS)

VR4011 1K-ohm-B semifixed for AM IF gain X31

PB-203

SYMBOL NO. (RESISTORS; $\pm 10\%$ 1/4W unless noted otherwise)

R501	330K	Z1	R515	390	X3	R529	330K	Y4
502	1K	Y1	516	56K	X3	530	5.6K	Y4
503	5.6K	Z1	517	82K	X2	531	820K	Y4
504	820K	Z1	518	10	Y2	532	22K	Y4
505	6.8K	Y1	519	27K	Z1	533	220K	Z3
506	2.7K	Z1	520	10K	X2	534	3.3K	Z3
507	3.3K	Y1	521	820	Z2	535	330	Z4
508	330K	X1	522	820	Y2	536	1K	Z4
509	18K	X1	523	10	Z3	537	330K	Z4
510	820K	X1	524	220K	Z3	538	5.6K	Z4
511	1K	X1	525	3.3K	Z3	539	820K	Z4
512	5.6K	X1	526	1K	Y4	540	22K	Z4
513	27K	Y1	527	330	Y4	541	1K	Z4
514	12K	X3	528	1K	Y4	542	820K	Z1
						543	820K	X1
						544	820K	Y1

SYMBOL NO. (CAPACITORS)

C501	0.47uF +50%-20%	35V	tantalum	Z1	C512	1uF +80%-20%	50V	electrolytic	Z3
502	0.01uF -10%	50V	mylar	Y1	513	0.47uF +50%-20%	35V	tantalum	Z4
503	0.015uF "	50V	"	Z1	514	47pF -10%	50V	ceramic	Z4
504	0.0022uF "	50V	"	Y1	515	1uF +80%-20%	50V	electrolytic	Y3
505	0.0015uF "	50V	"	Y1	516	470pF $\pm 10\%$	50V	ceramic	Y3
506	0.01uF "	50V	"	Y1	517	0.0068uF $\pm 10\%$	50V	mylar	Y3
507	0.01uF "	50V	"	Y1	518	47pF -10%	50V	ceramic	Y4
508	0.027uF "	50V	"	Y1	519	0.47uF +50%-20%	35V	tantalum	Y4
509	0.027uF "	50V	"	X1	520	470pF -10%	50V	ceramic	Z3
510	2.2uF +80%-20%	50V	electrolytic	X1	521	0.01uF "	50V	mylar	Y4
511	0.022uF -10%	50V	mylar	Y2	522	0.01uF +"	50V	mylar	Z4
					523	0.0068uF -10%	50V	mylar	Z3

SYMBOL NO. (TRANSISTORS)

Q501	2SC372Y	AM active filter	Z1
502	2SC372Y	AM active filter	X1
503	2SC1222F	Lch & Rch tape bias	Y4
504	2SC1222F	rejection filter	Z4

SYMBOL NO. (VARIABLE RESISTORS)

VR501	470-ohm-B semifixed for AM muting level	Y3
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SYMBOL NO. (RESISTORS; $\pm 10\%$ 1/4W unless noted otherwise)

R601	330K	Z1	R612	220K	Y1	R623	56K	Y2
602	330K	X1	613	39K	$\pm 5\%$ Z3	624	56K	Y2
603	56K	Y1	614	39K	" X2	625	47K	Y2
604	56K	Y1	615	330K	Z2	626	100K	Y2
605	1.2K	Y1	616	330K	X2	627	15K	Y1
606	1.2K	Y1	617	820K	Y2	628	47K	Y1
607	220K	Y1	618	820K	Y2	629	10	X2
608	220K	Y1	619	1K	Z1	630	470	X2
609	1M	Y1	620	1K	X2	631	180	X3
610	1M	Y1	621	5.6K	Y2	632	4.7	2W X3
611	220K	Y1	622	5.6K	Y2			

SYMBOL NO. (CAPACITORS)

C601	2.2uF	+80%-20%	50V	electrolytic	Y1	C611	680pF	$\pm 5\%$	50V	styrol	Z1
602	2.2uF	"	50V	"	Y1	612	680pF	"	50V	"	X1
603	0.47uF	+50%-20%	35V	tantalum	Z1	613	1200pF	"	50V	"	Y1
604	0.47uF	+50%-20%	35V	"	X1	614	1200pF	"	50V	"	
605	0.47uF	"	35V	"	Z1	615	2.2uF	+80%-20%	50V	electrolytic	Y1
606	0.47uF	"	35V	"	X1	616	2.2uF	+80%-20%	50V	"	Y2
607	33pF	$\pm 10\%$	50V	ceramic	Y1	617	47uF	"	6.3V	"	Y2
608	33pF	"	50V	"	Y1	618	220uF	+80%-20%	16V	"	Y2
609	220pF	$\pm 5\%$	50V	styrol	Y2	619	470uF	"	25V	"	Z3
610	220pF	"	50V	"	Y2	620	1000uF	+80%-20%	25V	"	Y3
						621	1000uF	"	25V	"	Y3

SYMBOL NO. (TRANSISTORS)

Q601	2SC1222F	FM Lch audio sub amp.	Z1	Q604	2SK30A	FM Rch mute gate	X1
602	2SC1222F	FM Rch audio sub amp.	X1	605	2SC1222F	emitter follower	Z2
603	2SK30A	FM Lch mute gate	Z1	606	2SC1222F	emitter follower	X2

SYMBOL NO. (DIODES)

D601	SIRBIO	bridge rectifier for power supply	Y3
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SYMBOL NO. (VARIABLE RESISTORS)

VR601	10K-ohm-B	semifixed for DOLBY level (Lch)	
602	10K-ohm-B	semifixed for DOLBY level (Rch)	

SYMBOL NO. (RESISTORS; $\pm 10\%$ 1/4W unless noted otherwise)

R801	470	Z1	R812	22K	X3
802	1.5K	Y1	813	390K	Y3
803	3.9K	Y3	814	1.5K	X3
804	270	Y2	815	56	X3
805	390K	Y2	816	33K	Y3
806	15K	Y2	817	2.2K	X2
807	470K	Y2	818	150	X2
808	1M	Z3	819	10	X2
809	3.9K	Y3	820	27K	X1
810	1M	Z3	821	27K	X1
811	15K	Y3			

SYMBOL NO. (CAPACITORS)

C801	1000pF	$\pm 5\%$	50V	tantalum	Z3	C806	1000pF	$\pm 20\%$	50V	tantalum	X3
802	4.7uF	+80%-20%	25V	electrolytic	X2	807	100pF	$\pm 10\%$	50V	tantalum	X3
803	0.1uF	+50%-20%	35V	tantalum	Y2	808	1uF	+80%-20%	50V	electrolytic	X3
804	10uF	+80%-20%	16V	electrolytic	Y3	809	2.2uF	+80%-20%	50V	electrolytic	X3
805	1000pF	-5%	50V	tantalum	Y3						

SYMBOL NO. (TRANSISTORS)

Q801	2SK30A	400Hz oscillator	Y2
802	CUA709C	for DOLBY CAL.	Y3

SYMBOL NO. (DIODES)

D801	IS188	detector for DOLBY CAL.	Z1	D803	IS1554V	AGC detector for oscillator	Z3
802	IS188	detector for DOLBY CAL.	Z1	804	KB165	temperature compensation	Z3

SYMBOL NO. (VARIABLE RESISTORS)

VR801	4.7K-ohm-B	semifixed for DOLBY meter (Lch)	Z2
802	4.7K-ohm-B	semifixed for DOLBY meter (Rch)	Z3
803	470-ohm-B	semifixed for oscillator out level	X2

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SYMBOL NO. (DIODES)

D301	IS188	temperature compensation	Z2	D308	15188	DOLBY detector	Y3
302	IS188	for DOLBY	X2	309	15188	"	Z4
303	IS1554V	limitter for DOLBY	Z3	310	15188	"	X4
304	IS1554V	"	X3	311	IS1554V	"	Y4
305	IS1554V	"	Z3	312	IS1554V	"	Y4
306	IS1554V	"	X3	313	IS1554V	voltage stabilizer	Y4
307	IS188	DOLBY detector	Y3				

SYMBOL NO. (VARIABLE RESISTORS)

VR301	5K-ohm-B	semifixed for DOLBY (Lch)	Z2
302	5K-ohm-B	semifixed for DOLBY (Rch)	X2
303	500-ohm-B	semifixed for DOLBY(Lch)	Z2
304	500-ohm-B	semifixed for DOLBY(Rch)	X2
901	4.7K-ohm-B	semifixed for FM separation	Y5

OTHERS

SYMBOL NO. (SWITCHES)

S501	4 - 3 lever switch for muting	S801	6 - 3 push switch for DOLBY CAL. (Lch)
502	4 - 3 lever switch for high cut	802	6 - 3 push switch for DOLBY CAL. (Rch)
503	6 - 3 lever switch for DOLBY		
S701	2 - 2 power switch		
702	2 - 2 slide switch for FM antenna att.		
703	4 - 8 - 4 rotary switch for MODE		
704	2 - 2 slide switch for illumination		
705	2 - 2 slide switch for FM De-Emphasis		
S801	6 - 3 push switch for DOLBY CAL. (Lch)		
802	6 - 3 push switch for DOLBY CAL. (Rch)		

SYMBOL NO. (TRANSFORMERS & FILTERS)

nOI	FM IF trans	T901	19KHz trans	02-1138
201	Capacitor Coupling Double	902	19KHz trans	02-1138
202	Tune FM IF trans	903	38KHz trans	02-1139
203	FM discriminator trans	F201	FM IF block filter	LUX-17462
204	FM meter trans	202	FM IF block filter	LUX-17462
401	AM RF trans	F901	FM low-pass filter	LUX-14562
402	AM oscillator trans			
403	AM IF trans (double tune)			
404	AM IF trans (double tune)			
405	AM IF trans			

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