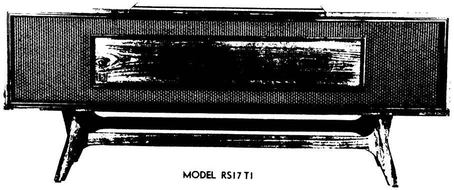
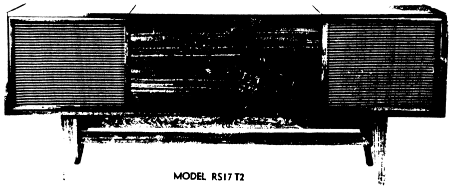


MODEL RS17T1



MODEL RS17T2

the amplifier. Therefore, testing transistors out of circuit should not be a common function during servicing, unless it is physically damaged or gets a lethal shot of current by defect or accident on the technician's part. The best way to check the transistor is in the circuit. Bias voltages (base to emitter) are very critical. A change of .2 volts can mean the difference between operation or not. A bias check is probably the most important test to help localise a transistor circuit problem. The base voltage will always be slightly higher than the emitter voltage; more positive for a NPN and more negative for a PNP. The voltage difference is only a fraction of a volt. A good low-range meter and accurate measurements are a must for the technician to make transistor circuit electrical measurements. Transistor circuit tolerances are about the same as in tube amplifiers.

PRECAUTIONS WHEN SERVICING TRANSISTORISED AMPLIFIERS

1. Never apply full AC power to the amplifier until **all** defective components and transistors have been replaced.
2. Do not accidentally lay tools, or any other metal objects, across heat sinks or the metal cases of power transistors.
3. Do not turn on full AC power to the amplifier components.
4. Be sure AC power to amplifier is OFF when disconnecting leads.
5. Do not apply heat to transistor circuits for intermittent checks, etc. Excessive heat on the transistors can cause a thermal runaway condition which will burn up the transistors.
6. Be careful that alligator clips or connectors from test equipment leads, etc., do not accidentally touch any other point on the amplifier except the intended contact points. Ground leads from AC-operated test equipment should never be connected to or touch the heat sinks, they may not be at chassis ground potential. **Never connect ground leads of AC-operated test equipment to any other point except chassis ground.**
7. Transistors that operate excessively warm should be checked immediately.
8. Be very careful to install all electrolytic capacitors in the correct polarity.
9. Do not operate the amplifier beyond short periods during DC test, if power supply hum or induced hum is present in the output.

SERVICING PROCEDURE

Amplifier servicing may fall into three basic categories — inoperative, distorted or low power. In most cases the step by step trouble shooting procedure to follow for analysis of these symptoms are:

1. Visual observation.
2. Ohmmeter checks.
3. DC voltage-current checks.
4. AC (with signal) test.

Included in this manual are guides and procedures for performing this series of checks.

An amplifier with visual signs of burned or open components should never have AC power applied for diagnosis.

If the line fuse is found to be open, for instance, extremely high currents must have been present in the power supply and output stage.

The following effects may be observed and reasoned. The actual cause, plus all defective or damaged parts must be determined.

1. The maximum current rating of power rectifiers may have been exceeded.
2. The maximum voltage or current rating of one or more of the driver-output transistors may have been exceeded.
3. The power rating of the small (1 ohm) emitter resistors may have been exceeded.

Tests should first be made with an ohmmeter to locate the output stage and power supply defects, then use a DC voltage test procedure with power supplied to the amplifier. Servicing for distorted or low power output faults can usually be accomplished with the amplifier in a DC (no signal) condition by performing DC voltage-current measurements.

TESTS BY USING AN OHMMETER

Resistance checks of the amplifier circuits can be made by using the ohmmeter of a common VOM or VTVM. An understanding of the electrical specifications of the specific instrument and careful application is required to give accurate readings and prevent damage to transistors. The voltage present at the ohmmeter test probes (due to the internal battery voltage) actually produces forward or reverse bias to the transistors. The voltage applied across the junctions produces a forward or backward current and, therefore, the reading obtained is not that of a pure resistance. The resistance reading obtained from a given circuit will be different on each ohmmeter scale and will differ from one meter to another.

N.B. Ohmmeters that supply more than 15 volts at their test probes may be damaging to some transistors and should not be used.

In preparing typical resistance measurements for this manual two popular multimeters have been used, an AVO Model 8, and an AWA Voltohmyst. These serve to indicate the order of variation in measurements to be expected between different instruments.

POWER AMPLIFIER AND POWER SUPPLY TESTS

Both power output channels and the power supply can be evaluated for open or shorted components by one measurement.

Connect the ohmmeter probes from the collector (case) of TR9 or TR16 to chassis. Typical readings are given below.

	AVOMETER				A.W.A. VOLTOHMYST			
	FB	RANGE	RB	RANGE	FB	RANGE	RB	RANGE
Resistance measurement between collector of TR9 or TR16 and chassis.	18 ohms	÷ 100	25K	x 100	17 ohms	R x 1	150 K	R x 10K

Note: FB herein refers to applying the test leads to **Forward Bias** the circuit.
RB refers to **Reverse Bias.**

The following table shows typical resistance readings for the six possible conditions involving forward and reverse bias and all electrode combinations for each transistor used. Typical FB and RB measurements for all diodes are also given.

TYPICAL TRANSISTOR AND DIODE RESISTANCE READINGS WHEN REMOVED FROM CIRCUIT

		AVOMETER				AWA VOLTOHMYST			
TRANSISTOR	JUNCTION	FB	RANGE	RB	RANGE	FB	RANGE	RB	RANGE
AY8104	CE	500 K	R × 100	10M	R × 100	500 M	R × 1M	INF	R × 1M
TR9, 10, 16, 17	BC	19 ohms	R ÷ 100	INF	R × 100	14.5 ohms	R × 1	INF	R × 1M
	BE	20 ohms	R ÷ 100	450K	R × 100	15 ohms	R × 1	INF	R × 1M
AY1104	CE	120 K	R × 100	INF	R × 100	INF	R × 1M	INF	R × 1M
TR8, 15	BC	32 ohms	R ÷ 100	INF	R × 100	28 ohms	R × 1	INF	R × 1M
	BE	33 ohms	R ÷ 100	110K	R × 100	29 ohms	R × 1	INF	R × 1M
AY1103	CE	140 K	R × 100	INF	R × 100	INF	R × 1M	INF	R × 1M
TR7, 14	BC	23 ohms	R ÷ 100	INF	R × 100	17 ohms	R × 1	INF	R × 1M
	BE	24 ohms	R ÷ 100	140K	R × 100	18 ohms	R × 1	INF	R × 1M
AY1108	CE	130 K	R × 100	INF	R × 100	INF	R × 1M	INF	R × 1M
TR9, 13	BC	38 ohms	R ÷ 100	INF	R × 100	29 ohms	R × 1	INF	R × 1M
	BE	39 ohms	R ÷ 100	120K	R × 100	30 ohms	R × 1	INF	R × 1M
AY1112	CE	180 K	R × 100	INF	R × 100	INF	R × 1M	INF	R × 1M
TR4, 5, 11, 12	BC	24 ohms	R ÷ 100	INF	R × 100	20 ohms	R × 1	INF	R × 1M
	BE	28 ohms	R ÷ 100	320K	R × 100	24 ohms	R × 1	INF	R × 1M
SE1001	CE	160 K	R × 100	INF	R × 100	INF	R × 1M	INF	R × 1M
TR1, 2, 3	BC	26 ohms	R ÷ 100	INF	R × 100	19 ohms	R × 1	INF	R × 1M
	BE	29 ohms	R ÷ 100	140K	R × 100	22 ohms	R × 1	INF	R × 1M
DIODES									
1N617		500 ohms	R × 1	4M	R × 100	400 ohms	R × 100	6M	R × 10K
AN1102		20 ohms	R ÷ 100	3M	R × 100	14 ohms	R × 1	INF	R × 1M
1N3194		19 ohms	R ÷ 100	INF	R × 100	14 ohms	R × 1	INF	R × 1M

Application of A.C. power after repairs

After any repairs have been made to the driver-output stages a low input AC power test should be made to determine if a damaging defect still remains in the circuit.

This check should be made with no signal input in the 'Gram' mode, by monitoring the total current drawn from the power supply, whilst applying AC power to the amplifier through a Variac. A suitable DC current meter should be connected in series with the red lead from C41 which is normally connected to the printed circuit board and starting with zero volts the Variac should be advanced slowly whilst observing the reading of the current meter. Excessive currents (500ma or more) may flow with only 20-40 volts AC input if a fault condition still exists. The normal 'no signal' current at the full supply voltage of 240 volts is of the order of 50-60ma.

D.C. Voltage measurements

DC voltages should be measured with a 20,000 ohms per volt multimeter or for better accuracy a VTVM. Typical bias voltages are shown on the circuit diagram. All transistors can be tested in the circuit by DC voltage measurements with the circuit operated in a DC (no signal) condition. Generally, if the emitter voltage is correct, the stage is functioning properly.

FINAL AMPLIFIER TEST – WITH SIGNAL

Following repairs and after the DC voltage test procedure a dynamic (with signal) test of the amplifier should be performed. This is a test for distortion and amplifier sensitivity and will evaluate the performance of each channel. Transistors which appear to be normal during the DC test procedure, may exhibit excessive leakage during a dynamic signal test.

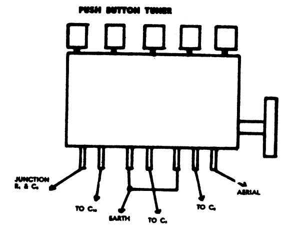
Use the following procedure for each stereo channel —

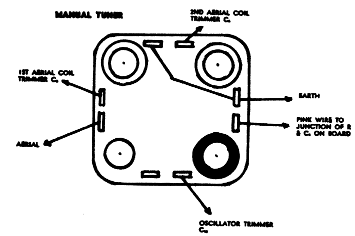
1. Mains input 240 volts.
2. Function switch to 'Gram' position.
3. All controls to maximum except balance control which should be set to mechanical centre.
4. Leave speakers connected or substitute 8 ohm 10 watt load resistors.
5. Connect VOM or VTVM and oscilloscope from centre voltage (DC) feedback loop and ground (Collector of TR10/TR17).
6. Sensitivity power output and distortion test. Connect a 150 mV rms signal at 1,000 cycles from a low impedence audio generator into the appropriate "Tape" input jack. With the 150 mV rms applied to the input, the DC feedback loop voltage shall remain at 50% (± 10%) of the total supply voltage. There shall be no positive or negative clipping of the sine wave viewed on the oscilloscope. The output signal (1,000 cps) must be 6.2 volts rms minimum, (17.5 volts peak to peak).

   Note that the power supply and DC feedback (centre point) bias voltages become progressively less positive, in a linear manner, when the amplifier output signal increases in amplitude, e.g., the power supply voltage falls from approximately 29V with no signal to approximately 24V at full output. However, the division of voltage across the output transistors should remain approximately equal (± 10%) until an amplitude is reached that causes clipping of one or both half cycles of the signal output.

FREQUENCY RESPONSE TEST

8. Proceed as in 1 (through 4) above but substitute a suitable output meter calibrated in db and set for 8 ohms impedence in place of one speaker or load resistor.





Feed a 1,000 cps signal into the appropriate "Tape Input" jack and increase the generator output to produce 5 watts output (6.3 volts rms across 8 ohms). Turn back the amplifier volume control to reduce the output to 100 MW (900 mV rms across 8 ohms). With the signal generator output held constant, the amplifier output relative to the output at 1,000 cps should be within ± 2 db of the indicated response for the various frequencies tabulated below:—

C.P.S.	db
40	+ 13.6
70	+ 13.4
200	+ 8.4
400	+ 2.3
1,000	0.0
2,000	+ 2.0
4,000	+ 4.5
8,000	+ 8.1
10,000	+ 9.2
15,000	+ 10.5

RADIO ALIGNMENT PROCEDURE

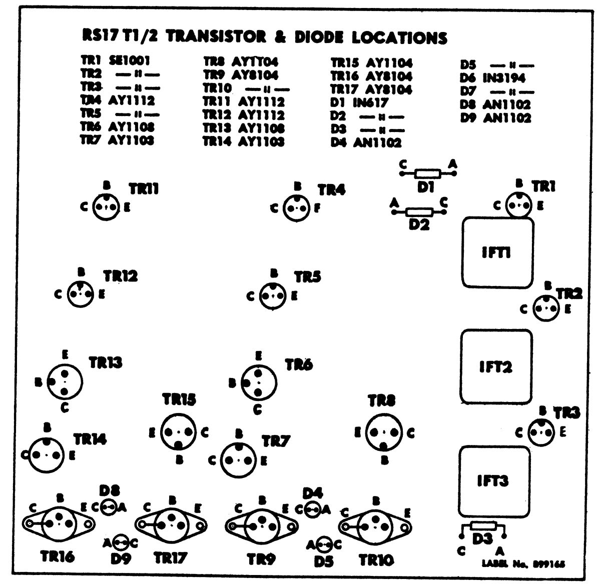
1. Connect a signal generator tuned to 455 Kc/s modulated 30% via a 0.1 mfd condenser to the second antenna trimmer condenser C5 (the middle 5-55 pf trimmer).
2. Connect an audio output meter with the impedence set to 8 ohms to the speaker leads of one channel. Connect a speaker or 8 ohm resistor of suitable wattage to the other channel.
3. Set the tuner so that the slugs are "fully in".
4. Peak the IF coils for maximum output at 455 Kc/s, whilst adjusting the signal generator to maintain an output of approximately 50 mW.
5. Connect the generator to the antenna terminal and tune to 1,620 Kc/s.
6. Set the tuner so that the slugs are "fully out".
7. Adjust oscillator trimmer C13 (20-220 pf) for maximum output.
8. Set generator and tuner to 1,550 Kc/s and peak both antenna trimmers C3 and C5 (both 5-55 pf) for maximum output.
9. Adjust tuner so that the coils slugs are "fully in" and check the frequency to which they are tuned. This should not be higher than 525 Kc/s nor lower than 500 Kc/s.
10. If necessary repeat 5 through 9 above to ensure correct tracking.
11. Set generator and tuner to 840 Kc/s, measure sensitivity and check rejection of spurious response at approximately 780 Kc/s, which should be better than 70 db.
12. Replace Unit in Cabinet and connect internal antenna. Set generator and tuner to 1,550 Kc/s.

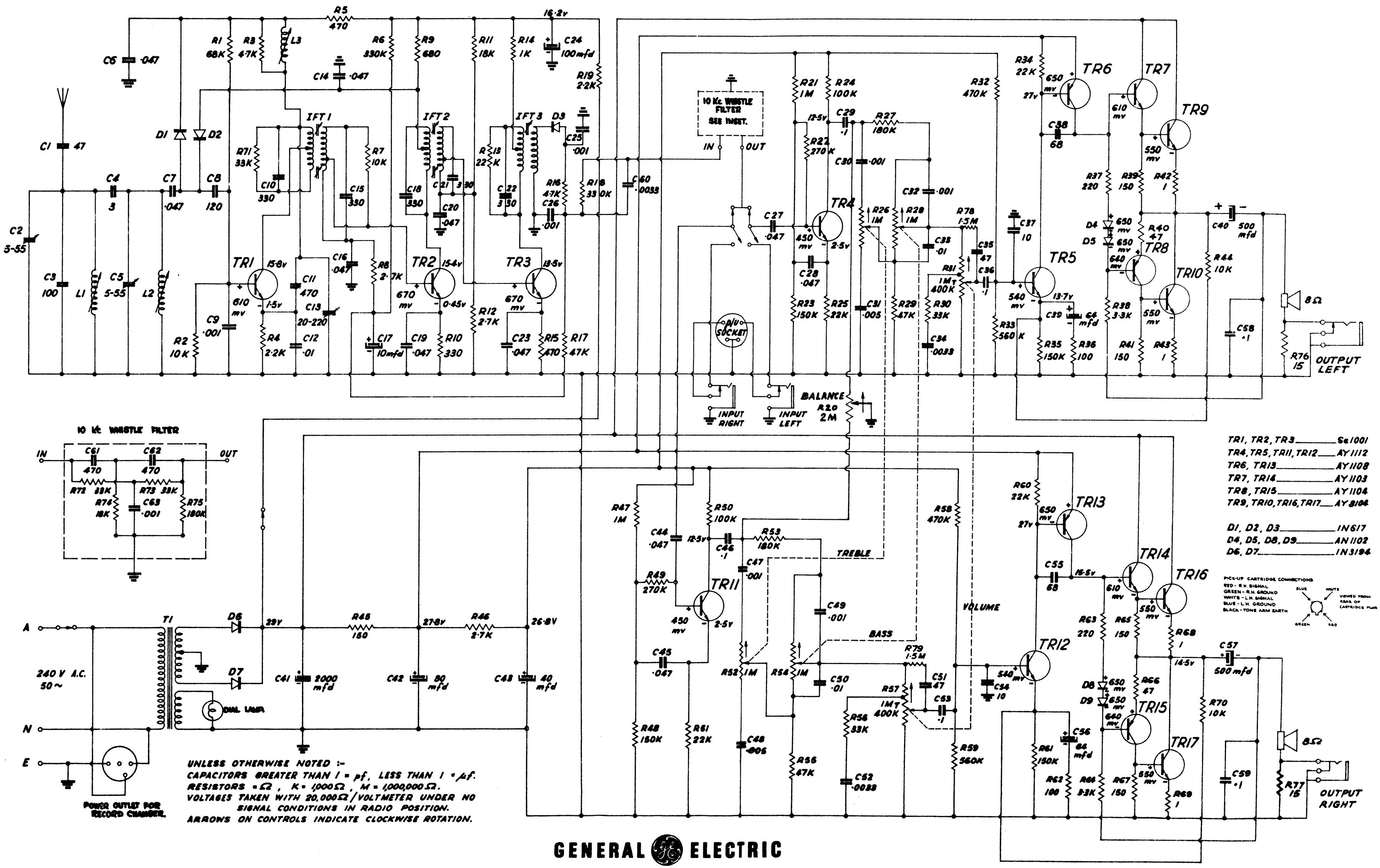
    Connect a length of wire to generator output and place this close to the internal antenna wire. Keep this coupling as loose as possible consistent with useful output. Re-peak antenna trimmer C2 for maximum output.

    I.F. sensitivity 455 Kc/s better than 25 microvolts for 50 mw output.

    R.F. ,, 1,500 Kc/s
    R.F. ,, 1,000 Kc/s } better than 5 microvolts for 50 mw output.
    R.F. ,, 600 Kc/s

    S/N Ratio 1,000 Kc/s better than 10 db below 50 mw output.





GENERAL ELECTRIC

AUSTRALIA

RS 17T1-2 RADIO - STEREOGRAMS