NAVSHIPS 93707 UNCLASSIFIED

TECHNICAL MANUAL

for

TWO TONE GENERATOR MODEL TTG-1 (GENERATOR, SIGNAL, O-579/URT)

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y. OTTAWA, ONTARIO

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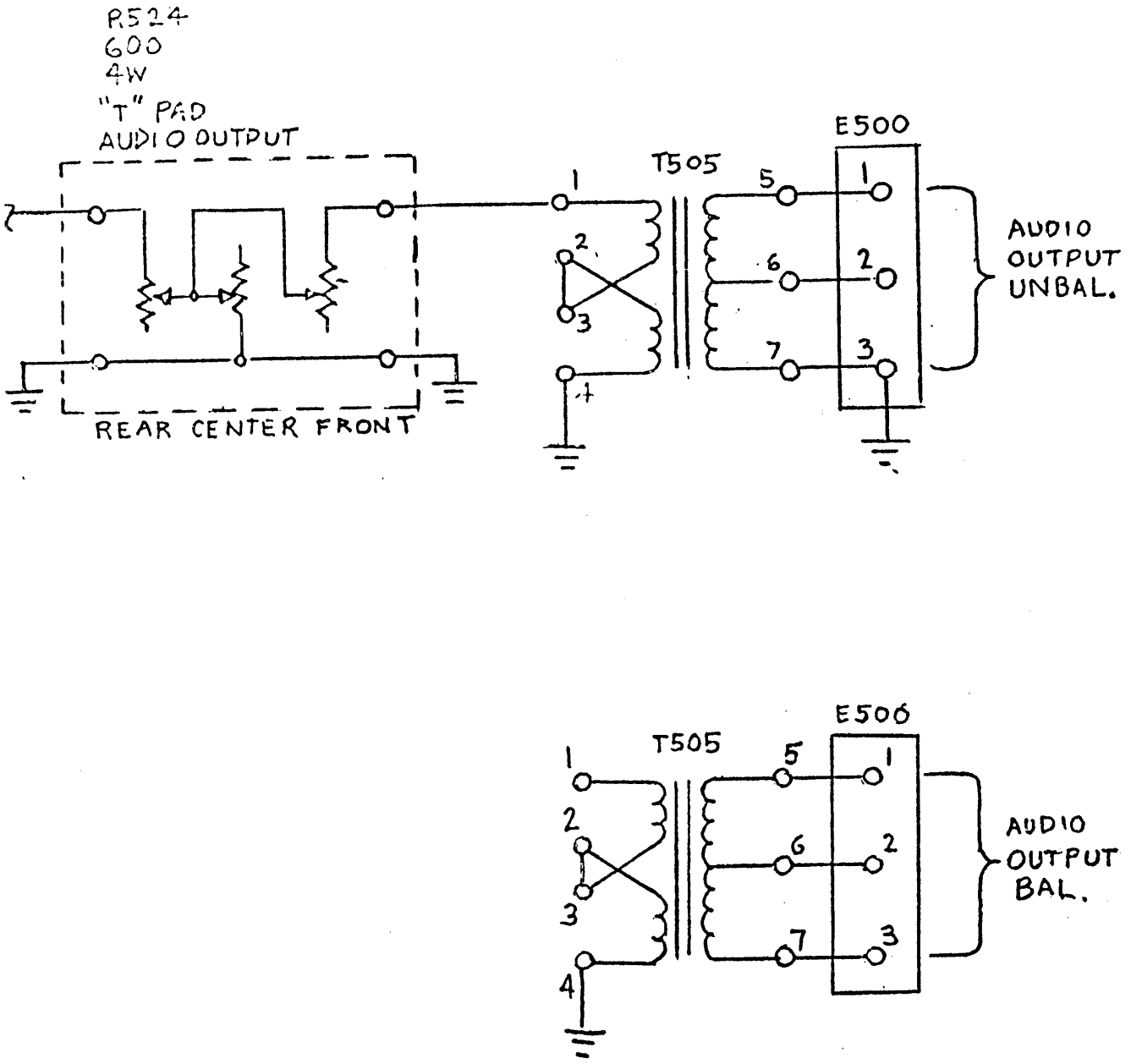

FIGURE I - AUDIO OUTPUT SCHEMATIC

FOR TTG-2

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Figure 1-1. Front View Model TTG

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SECTION I
GENERAL DESCRIPTION

1-1. PURPOSE AND BASIC PRINCIPLES

1-1.1. The TMC Test Generator, Model TTG (0-579/URT), was especially designed for operation with the TMC Model GPT 10K Transmitter (AN/FRT-39), but is readily usable with other transmitting equipment. The unit is a primary source of two groups of test tones. The TTG provides two audio tones, 935 cps and 2805 cps; and two RF output frequencies, 1999 kc and 2001 kc.

1-1.2. The unit features selection of any combination of the four extremely low distortion and stable output frequencies. The audio oscillator has especially low distortion to ensure an accurate check of distortion in the standard two-tone test. Crystal control of the RF oscillators provides stable and dependable frequency output useful for checking proper operation of the spectrum analyzer and the variable oscillator of the transmitting equipment.

1-2. DESCRIPTION OF UNIT

1-2.1. The Model TTG is shown in Figure 1-1. The panel is 3/16 inch thick by 19 inches long by 5-1/4 inches high and finished in TMC grey enamel. The chassis extends 13-1/2 inches behind the panel and is self supporting.

1-2.2. All operational controls are located on the front panel. These controls are clearly marked according to function.

1-2.3. Input and output connections are made on the rear apron.

1-3. TECHNICAL SPECIFICATIONS

AUDIO FREQUENCY OSCILLATOR

OUTPUT FREQUENCIES:
935 cps and 2805 cps

HARMONIC DISTORTION:
65 db down

INTERMODULATION DISTORTION:
55 db down

OUTPUT IMPEDANCE:
600 ohms unbalanced

OUTPUT LEVEL:
0 to 0.5 volts continuously variable

OUTPUT CONNECTION:
Terminal strip

RADIO FREQUENCY OSCILLATOR

OUTPUT FREQUENCIES:
1999 kc crystal controlled
2001 kc crystal controlled

DISTORTION:
60 db down

OUTPUT IMPEDANCE:
70 ohms unbalanced

OUTPUT LEVEL:
1.0 volt

OUTPUT CONNECTOR:
BNC type

CONTROLS:
POWER ON/OFF switch
AF TONE SELECTOR
RF TONE SELECTOR
AUDIO OUTPUT CONTROL

PRIMARY POWER:
115/230 volts, 50/60 cps approximately 35 watts

SIZE:
19 inches wide x 5-1/4 inches high x 13-1/2 inches deep

WEIGHT:
14.5 pounds

TUBE COMPLEMENT:
2 ea. 12AT7
4 ea. 12AU7
1 ea. 6X4

The equipment is manufactured in accordance with JAN/MIL specifications wherever practicable. All parts and assemblies meet or exceed the highest quality standards.

SECTION II
THEORY OF OPERATION

2-1. GENERAL DESCRIPTION OF CIRCUITS

2-1.1. The Model TTG consists of two pairs of oscillators, two similar audio oscillators and two similar RF oscillators. The only difference between the oscillators of each pair is operating frequency. Each generated audio tone is amplified and filtered to assure low distortion. The two audio tones can be used separately or may be combined, and are available at the terminal strip E500. R524 provides a continuously variable output level. The RF signals are generated and amplified in circuits suitable to the frequency of operation. Crystal control of the oscillators assures dependable, stable signal. The individual or combined RF signals are available at the connector, J501. The selectors, S501 and S502 provide a selection of any desired combination of the RF and audio signals.

2-2. CIRCUIT ANALYSIS

2-2.1. The following will describe only one of the audio and RF sections respectively. The other corresponding sections are identical in operation. A check of the block diagram will show which circuits are similar in operation.

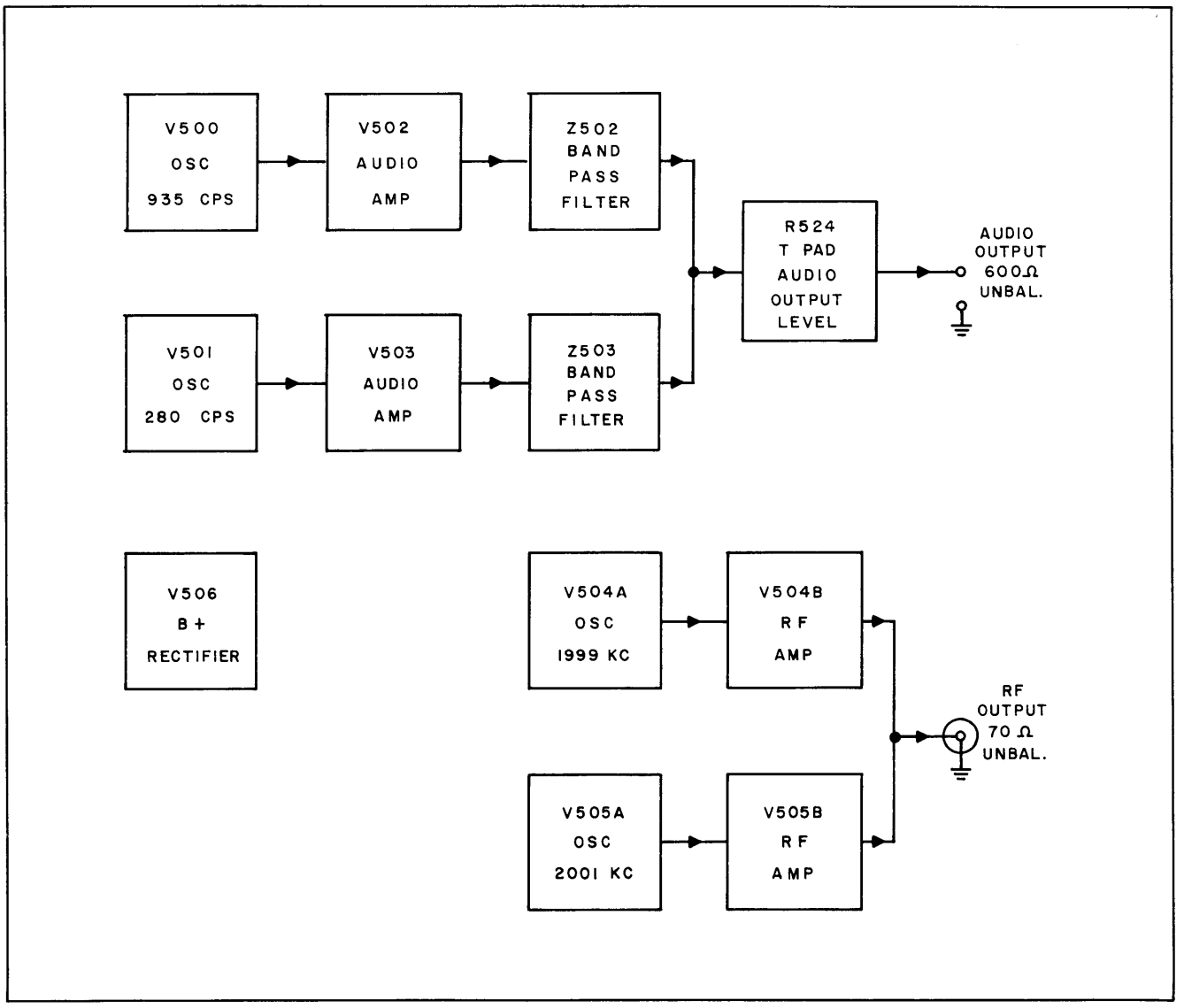

Figure 2-1. Block Diagram Model TTG

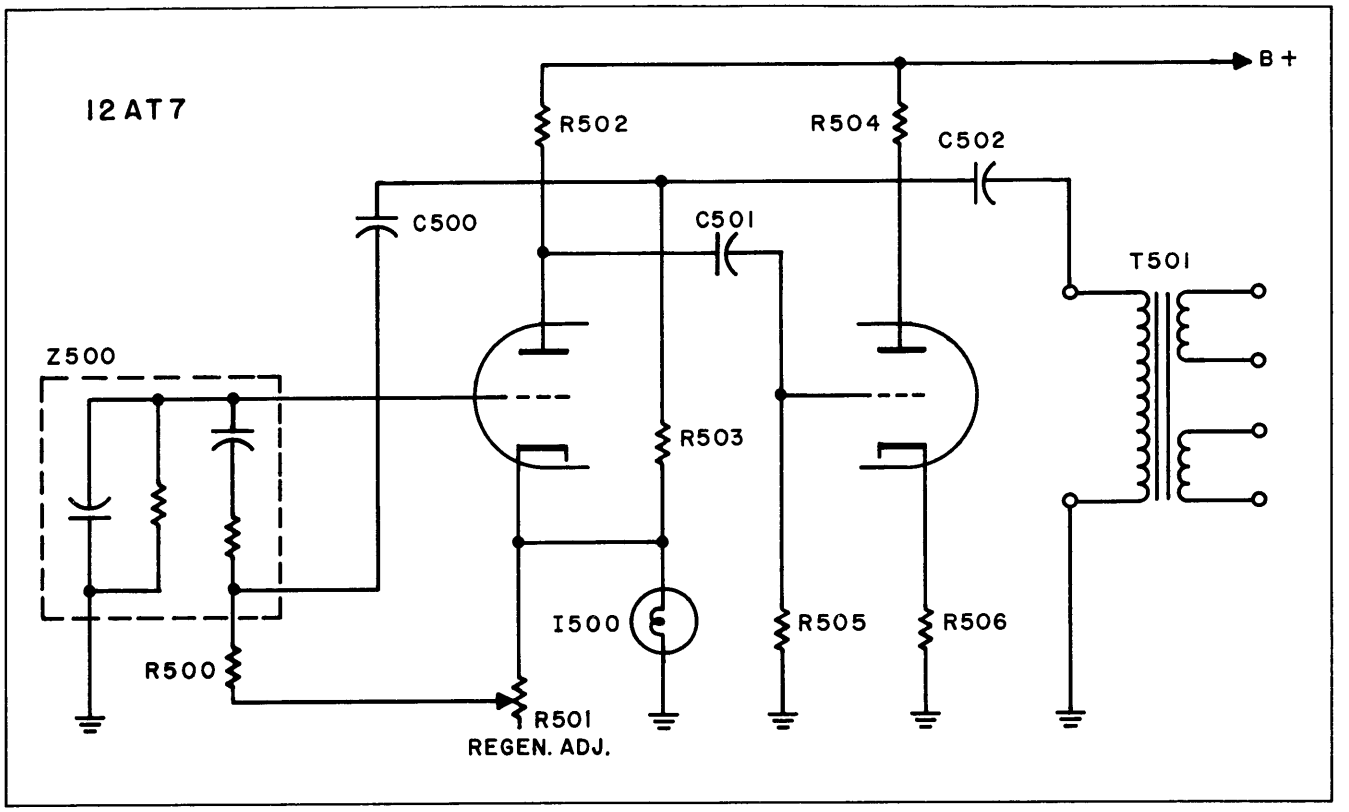

Figure 2-2. Simplified Schematic Audio Oscillator

2-2.2. The Audio Oscillator (V500). A 12AT7 is used in a very low distortion Wein bridge type oscillator. Z500, a sealed unit, is the frequency determining element. R501, regeneration control, provides adjustment of oscillation for optimum operation. A thermal resistor in the form of a lamp, I500, limits current variations to prevent changes in oscillator output level. The output of the oscillator is fed to the audio amplifier through a transformer, T501.

2-2.3. The Audio Amplifier V502. The audio tone from T501 is amplified by a 12AU7 in a push-pull class A circuit. The output of the amplifier is matched to 600 ohms through the transformer, T501.

2-2.4. The Output Network. The output from the transformer is bandpass filtered by Z502 to remove any remaining distortion products. The individual tone level may be varied, for balance with the other tone, by R518. Combined tone level may be adjusted by R524, a front panel control.

2-2.5. The RF Oscillator (V504A). The crystal-controlled RF signal oscillator makes use of the first half of V504 in a modified Pierce oscillator circuit. The output of the oscillator is coupled to the grid of the amplifier through C520. C520, a variable capacitor, adjusts the level of the particular RF signal.

2-2.6. The RF Amplifier (V504B). The second half of the 12AU7 is used as a tuned-output amplifier in order to bring the output to the required level.

2-2.7. The Rectifier (V506). A 6X4 is used in a full-wave rectifier circuit which supplies operating voltages to all stages of the TTG Test Generator.

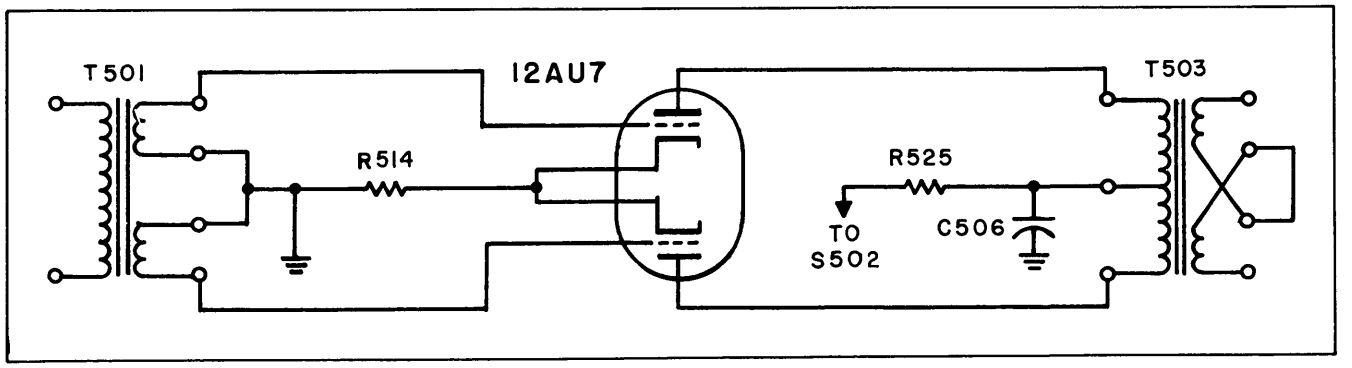

Figure 2-3. Simplified Schematic Audio Amplifier

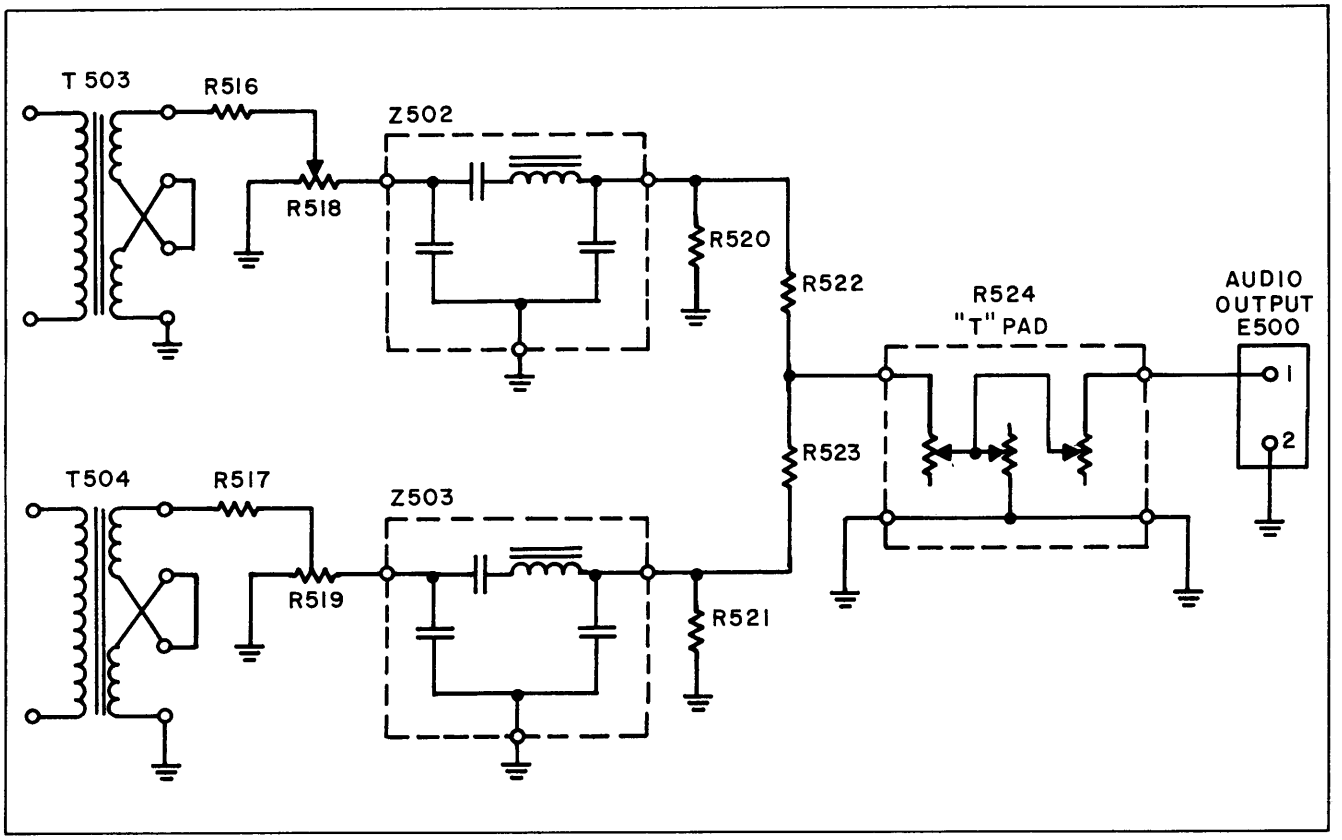

Figure 2-4. Simplified Schematic Output Network

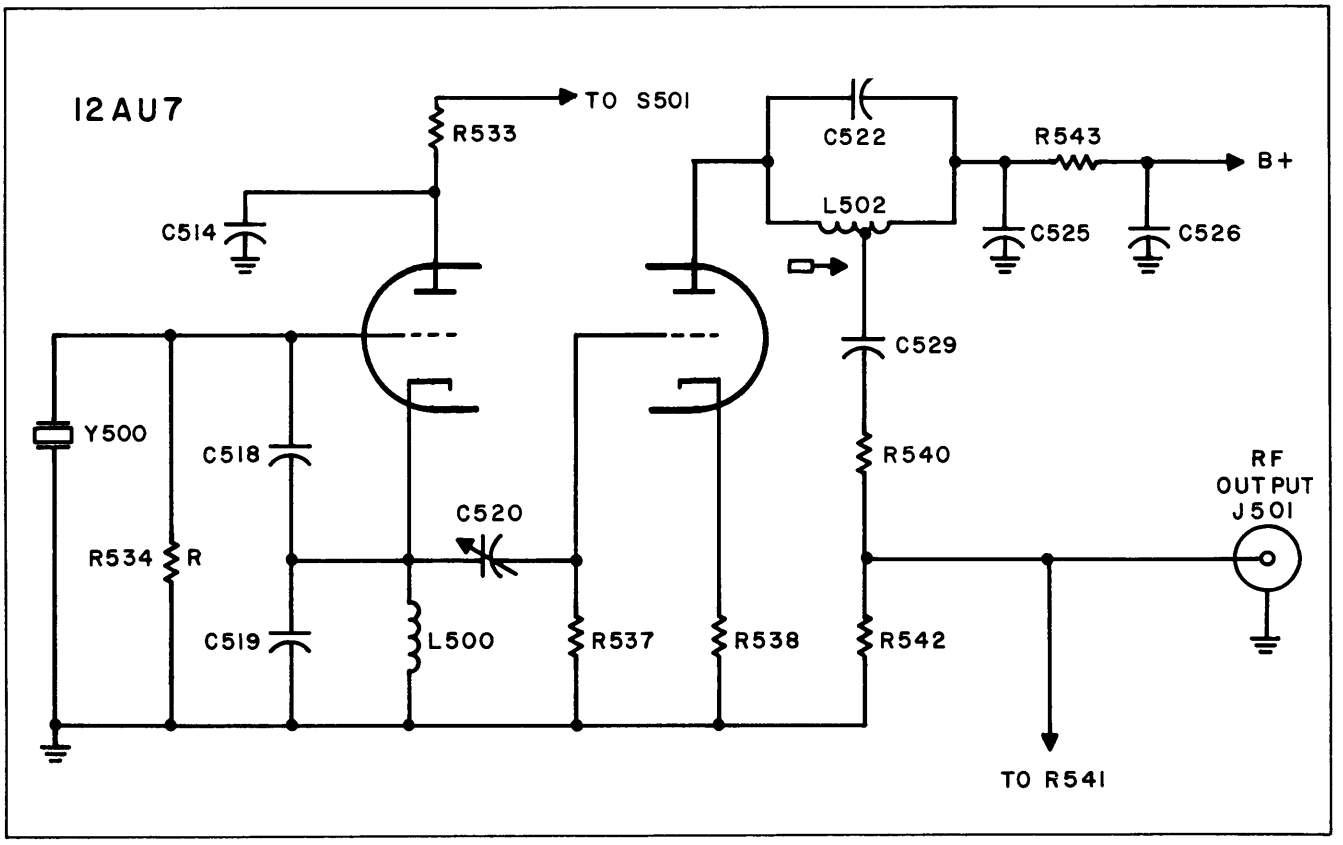

Figure 2-5. Simplified Schematic RF Oscillator and Amplifier

SECTION III
INSTALLATION AND OPERATION

3-1. INSTALLATION

3-1.1. The TMC Model TTG, Test Generator, has been designed for ease of installation and minimum effort in operation.

3-1.2. The unit is packed in an individual shipping container, and should be carefully unpacked. Packing material should be examined for loose items before discarding. A close visual inspection should be made to determine any physical damage due to rough handling during shipment. If damage is found, notify carrier immediately.

3-1.3. The unit is designed for operation from 115/230 volt, 50/60 cycle source. Unless specifically ordered for 230 volt, 50/60 cycle source, the unit is shipped wired for 115 volt AC operation. A simple wiring change in the tapped primary circuit of the power transformer, T500, is necessary to change the Model TTG to 230 volt AC operation. See Figure Schematic diagram. Remove jumpers connecting terminals 1 and 2, 3 and 4 of T500. Connect a jumper between terminal 2 and 3. Note that the other leads on terminal 1 and 4 are not disturbed.

3-1.4. Three external electrical connections are made to the unit. Connect the power cord from J500 to a power source of proper voltage and frequency. The 600 ohm unbalanced audio output may be obtained at E500 terminal strip on the rear apron. Connect a BNC type connector to jack, J501, for the RF output.

3-2. OPERATION

3-2.1. The Model TTG may be used in a variety of ways to test a transmitting system. Figures 3-1, 3-2, and 3-3 show typical installations of the Model TTG with TMC Models VOX, Variable Master Oscillator, and FSA, Frequency Shift Analyzer. Figures 3-4 and 3-5 show typical installations of the TTG with commonly available test equipment.

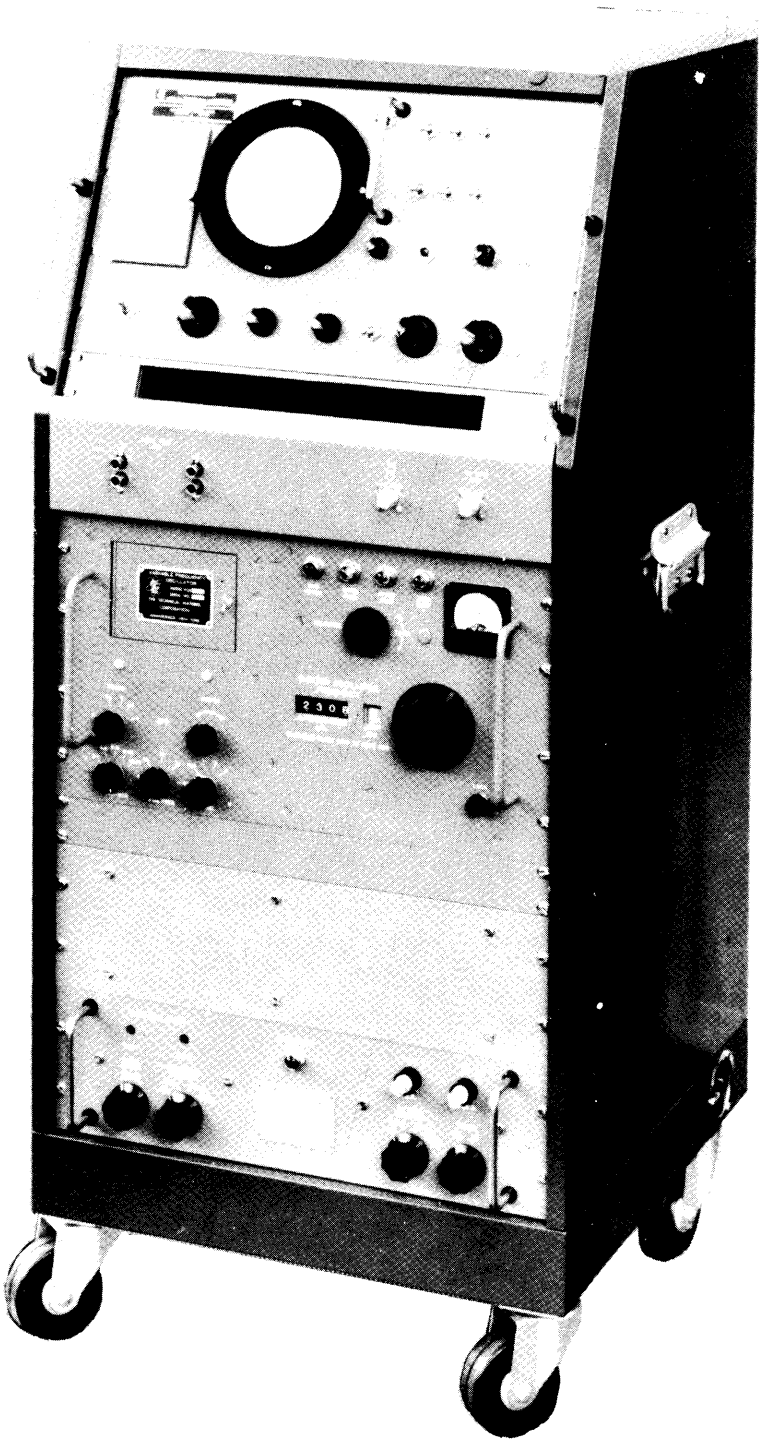

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Figure 3-1. Model PTE Single Sideband Analyzer

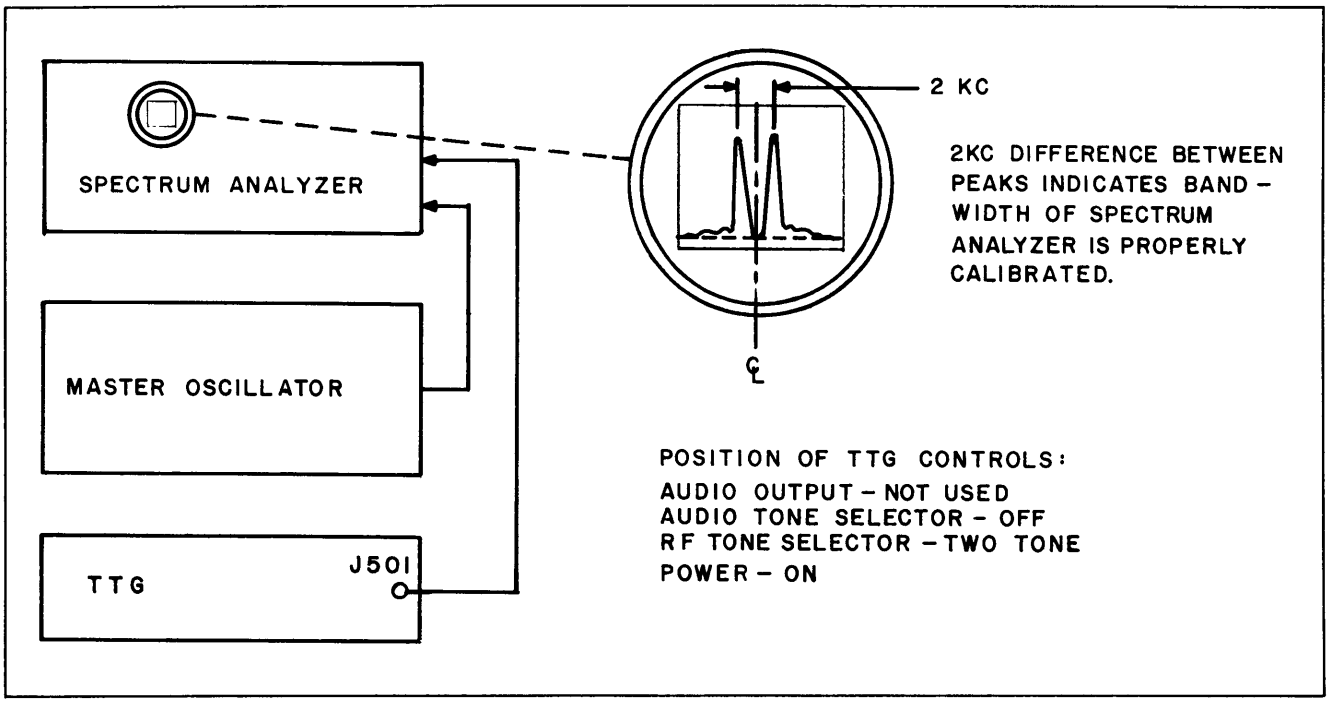


Figure 3-2. Spectrum Analyzer Center Frequency Check

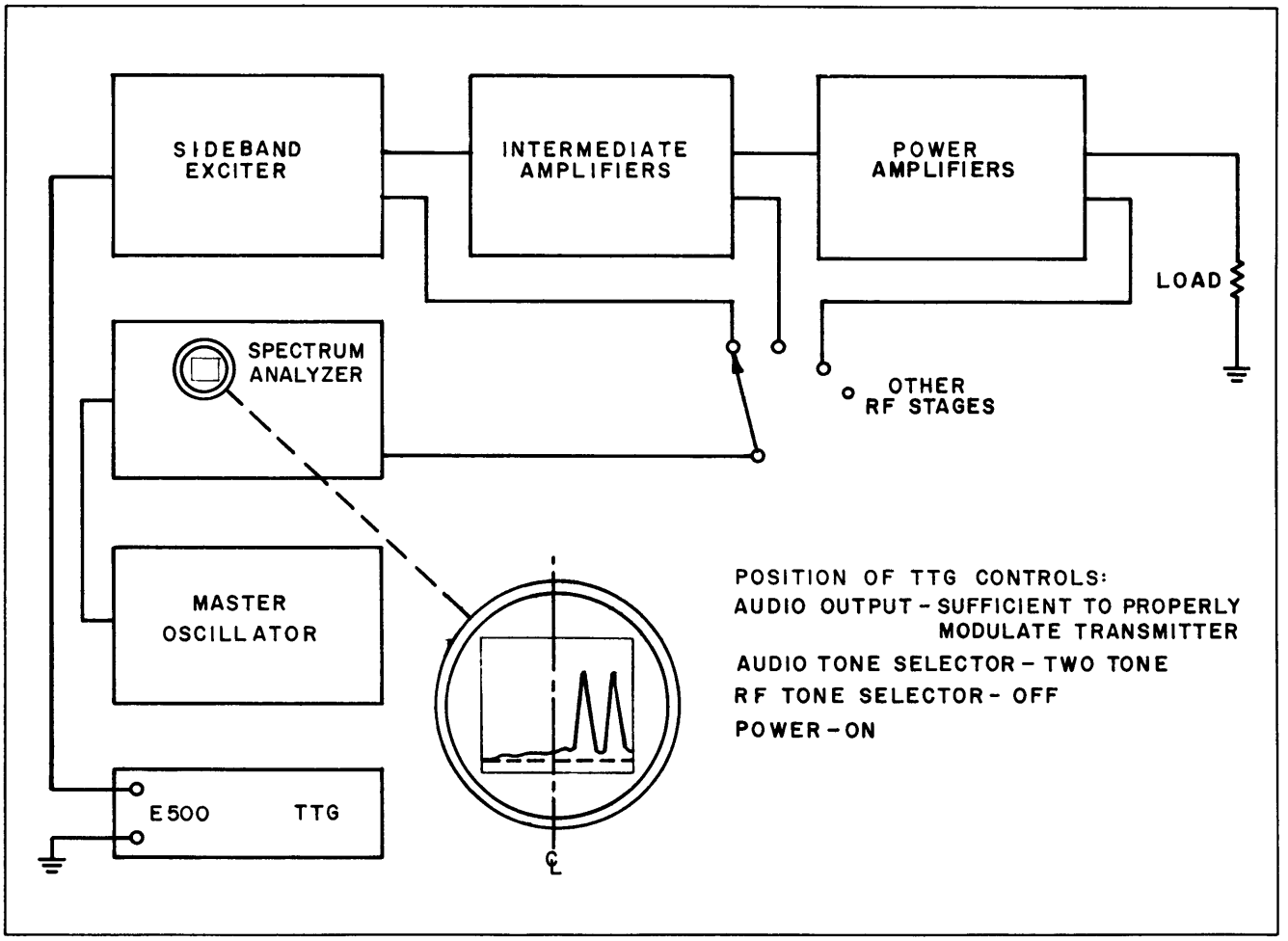


Figure 3-3. Two-Tone Test for Distortion

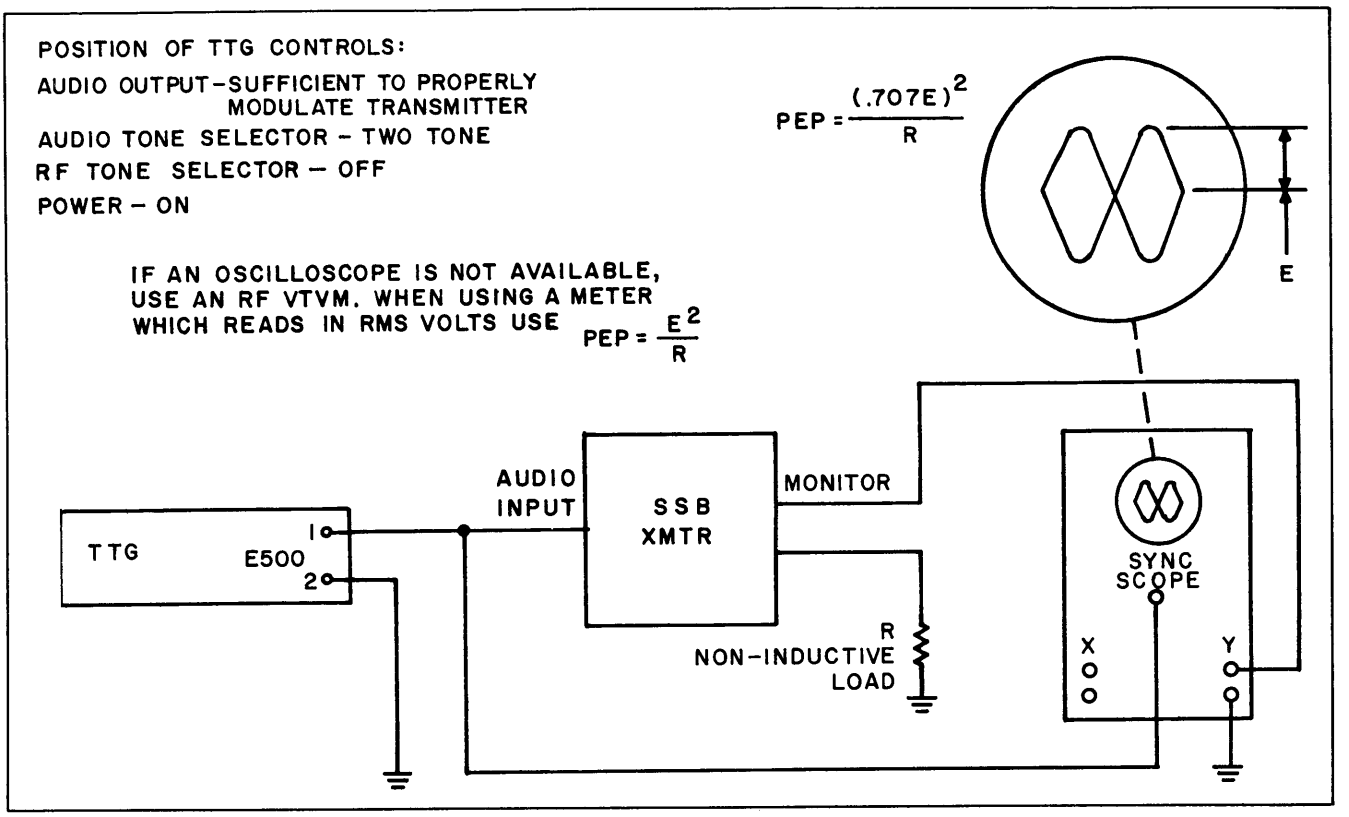


Figure 3-4. Two-Tone Measurement of Peak Envelope Power

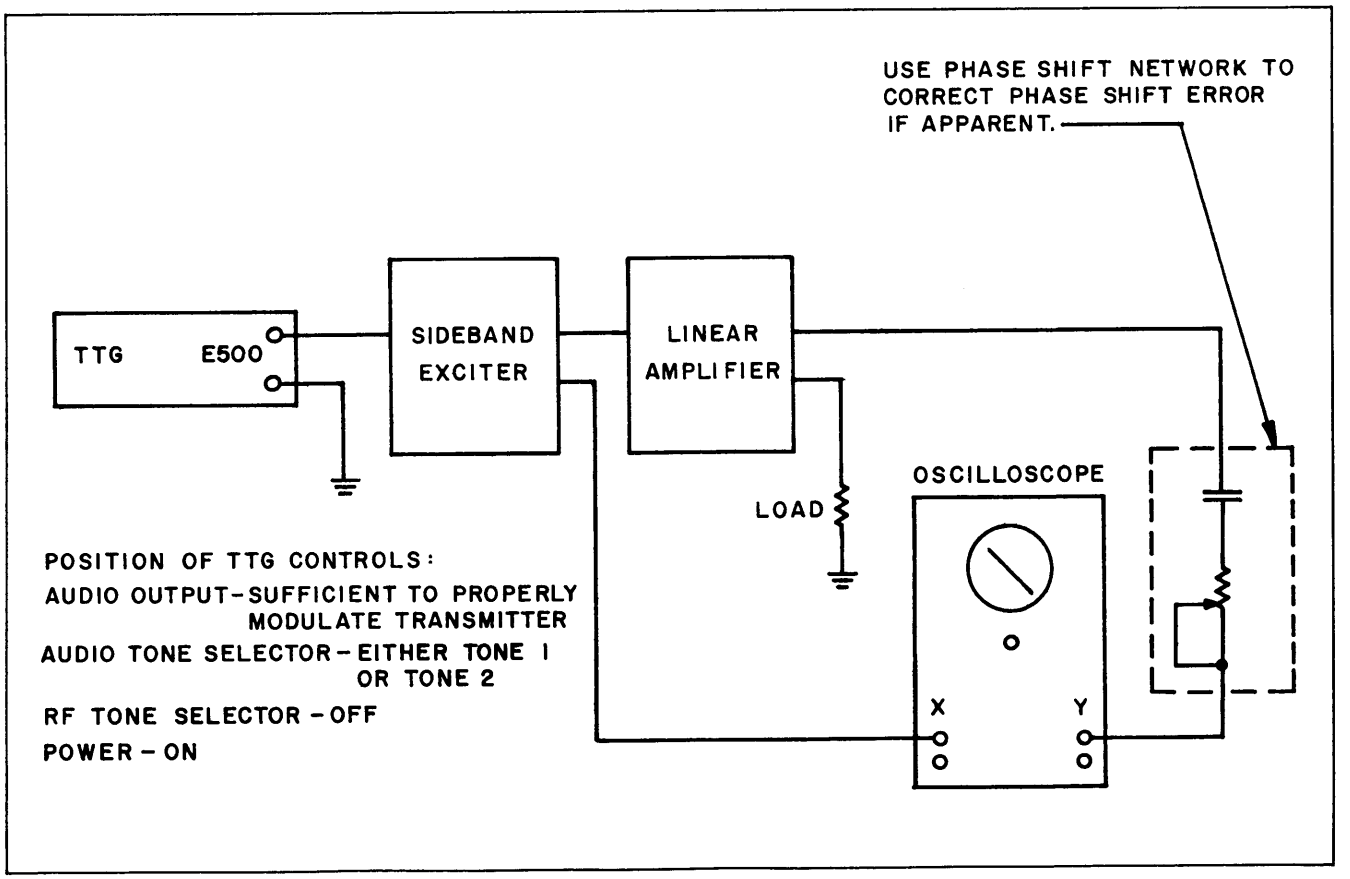


Figure 3-5. Linearity Test

SECTION IV
MAINTENANCE

4–1. GENERAL

4-1.1. The Model TTG has been designed for long term trouble free duty. Little attention beyond normal maintenance is required. Any maintenance to the equipment should be performed by a competent technician.

4–2. OPERATOR'S AND PREVENTIVE MAINTENANCE

4-2.1. The operator is cautioned that no attempt should be made to change the frequency of the audio tones. These are adjusted to their proper frequencies, in conjunction with the band-pass filters. If attempts are made to change frequency, the unit may not function properly as indicated by an increase in distortion and unbalanced or no output.

4-2.2. In order to prevent failure of the equipment due to corrosion, dust, and other destructive ambient conditions, thoroughly inspect the inside of the chassis for signs of dirt, dampness, molding, charring, or corrosion. This should be done periodically depending upon the severity of the conditions. Correct any defect with a cleaning agent of proven quality.

4–3. ADJUSTMENTS, AUDIO

4-3.1. If increased distortion should indicate a need for realignment, the unit may be readjusted according to the procedure outlined below.

EQUIPMENT REQUIRED:

AC VTVM
Sonic analyzer (such as Panoramic LP-1a)*

NOTE

The setting of the regeneration controls is important to achieve minimum distortion. When a control is not advanced far enough, the oscillator will not "start" immediately when that tone is switched on. When the control is advanced too far, the distortion will increase rapidly. There is a point, however, where the oscillator will start immediately, and where distortion is a minimum. This is the correct adjustment.

* If a sonic analyzer is not available, the regeneration control setting likely to produce the least distortion is the minimum rotation of the control at which the oscillator will "start" immediately when that tone is switched on.

1. Connect the AC VTVM and sonic analyzer to output terminal strip, E500; set R524 and R518 to maximum, S502 to TONE 1 position, and adjust the regeneration control, R501, until an indication is observed on the VTVM.
2. Adjust control on Z500 for peak indication on VTVM.
3. Observe analyzer and adjust R501 for minimum second harmonic distortion without affecting oscillator "starting."
4. Recheck Z500 for peak on VTVM.
5. Adjust Tone 1 level control, R518, for 1.0 V AC on VTVM.
6. Tighten lock on R501 and R518.
7. Set R519 to maximum, S502 to TONE 2 position, and adjust regeneration control, R513, until an indication is observed on VTVM.
8. Adjust control on Z501 for peak indication on VTVM.
9. Observe analyzer and adjust R513 for minimum second harmonic distortion without affecting oscillator "starting."
10. Recheck R501 for peak on VTVM.
11. Adjust Tone 2 level control, R519, for 1.0 V AC on VTVM.
12. Tighten lock on R513 and R519.

Note: It is extremely unlikely that I500 or I501 will need replacement. If, however, either one has to be replaced, several lamps may have to be tried to find one which will cause the oscillator to perform properly.

4–4. ADJUSTMENTS, RF

EQUIPMENT REQUIRED:

RF VTVM

1. Connect RF VTVM to J501. Set RF TONE SELECTOR switch to TONE 1 position. Set C520 to maximum capacity.
2. Adjust L502 for maximum reading on RF VTVM. Tighten lock nut on slug.
3. Set C520 for 1.0 V RF on RF VTVM.
4. Set RF TONE SELECTOR switch to TONE 2 position. Set C521 to maximum capacity.
5. Adjust L503 for maximum reading on RF VTVM. Tighten lock nut on slug.
6. Set C521 for 1.0 V RF on RF VTVM.

PIN NO.	1	2	3	4	5	6	7	8	9
V500 12AT7	95	-0.8	0.8	0	0	130	0	2.4	6.3AC
V501 12AT7	95	-0.6	1.2	0	0	130	0	3.2	6.3AC
V502 12AU7	160	0	8	0	0	160	0	8	6.3AC
V503 12AU7	160	0	8	0	0	160	0	8	6.3AC
V504 12AU7	50	0.01	0	0	0	130	0	5.5	6.3AC
V505 12AU7	50	0.01	0	0	0	130	0	5.5	6.3AC
V506 6X4	270AC	0	0	6.3AC	0	270AC	220	—	—

CONDITIONS

AUDIO OUTPUT - FULLY COUNTER-CLOCKWISE
AUDIO TONE SELECTOR - TWO TONE
RF TONE SELECTOR - TWO TONE
POWER - ON

ALL READINGS TO GROUND WITH VTVM

VOLTAGES GIVEN ARE TYPICAL AND MAY VARY AS MUCH AS 20% FROM UNIT TO UNIT.

VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

Figure 4-1. Voltage Chart

PIN NO.	1	2	3	4	5	6	7	8	9
V500 12AT7	18K	470K	470	0	0	85K	170K	470	0^+
V501 12AT7	18K	470K	470	0	0	85K	19K	470	0^+
V502 12AU7	30K	3K	1.2K	0	0	30K	3K	1.2K	0^+
V503 12AU7	30K	3K	1.2K	0	0	30K	3K	1.2K	0^+
V504 12AU7	50K	220K	15	0	0	50K	10K	2.2K	0^+
V505 12AU7	50K	220K	15	0	0	50K	10K	2.2K	0^+
V506 6X4	320	INF	0	0^+	INF	320	30K	—	—

CONDITIONS

AUDIO OUTPUT - FULLY COUNTER-CLOCKWISE
AUDIO TONE SELECTOR - TWO TONE
RF TONE SELECTOR - TWO TONE
POWER - ON

ALL READINGS TO GROUND

Figure 4-2. Resistance Chart

SECTION V
ELECTRICAL PARTS LIST

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
C500	CAPACITOR, fixed: plastic; 2 ufd, ±5%, 200 wvdc.	Coupling	CN108C2004J
C501	CAPACITOR, fixed: paper; .05 ufd, +40%, -20%, 400 wvdc.	Coupling	CN-100-3
C502	CAPACITOR, fixed: paper; .01 ufd, +40% -20%, 400 wvdc.	Blocking	CN-100-1
C503	CAPACITOR, fixed: plastic; 2 ufd, ±5%, 200 wvdc. (Same as C500)	Coupling	CN108C2004J
C504	CAPACITOR, fixed: Paper; .05 ufd, +40% -20%, 400 wvdc. (Same as C501)	Coupling	CN-100-3
C505	CAPACITOR, fixed: paper; .01 ufd, +40% -20%, 400 wvdc. (Same as C502)	Blocking	CN-100-1
C506	CAPACITOR, fixed: paper; .05 ufd, +40% -20%, 400 wvdc. (Same as C501)	Bypass	CN-100-3
C507	CAPACITOR, fixed: paper; .05 ufd, +40% -20%, 400 wvdc. (Same as C501)	Bypass	CN-100-3
C508	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. D, 300 wvdc.	Bypass	CM35D103K
C509	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. D, 300 wvdc. (Same as C508)	Bypass	CM35D103K
C510	CAPACITOR, fixed: dry electrolytic; polarized; dual unit; 20 ufd each section, 450 wvdc, char. E.	Filter	CE52E200R
C511	CAPACITOR, fixed: dry electrolytic; polarized; dual unit; 20 ufd each section, 450 wvdc, char. E. (same as C510)	Filter	CE52E200R
C512	NOT USED		
C513	NOT USED		
C514	CAPACITOR, fixed: ceramic; .01 ufd, +80% -20%, 500 wvdc.	Bypass	CC-100-16
C515	CAPACITOR, fixed: ceramic; .01 ufd, +80% -20%, 500 wvdc. (same as C514)	Bypass	CC-100-16
C516	CAPACITOR, fixed: ceramic; 10 uufd, ±.25 uufd, 500 wvdc, char. RH.	Excitation Control Cap.	CC20RH100G
C517	CAPACITOR, fixed: mica; 51 uufd, ±5%, 500 wvdc, char. C.	Excitation Cap.	CM150510J
C518	CAPACITOR, fixed: ceramic; 10 uufd, ±.25 uufd, 500 wvdc, char. RH. (Same as C516)	Excitation Control Cap.	CC20RH100G

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C519	CAPACITOR, fixed: mica; 51 uufd, ±5%, 500 wvdc, char. C. (Same as C517)	Excitation Cap.	CM15C510J
C520	CAPACITOR, variable: ceramic; 7-45 uufd, 500 wvdc, char. C.	Coupling	CV11C450
C521	CAPACITOR, variable: ceramic; 7-45 uufd, 500 wvdc, char. C. (Same as C520)	Coupling	CV11C450
C522	CAPACITOR, fixed: mica; 220 uufd, ±5%, 500 wvdc, char. C.	Tank Cap.	CM15C221J
C523	CAPACITOR, fixed: mica; 220 uufd, ±5%, 500 wvdc, char. C. (Same as C522)	Tank Cap.	CM15C221J
C524	CAPACITOR, fixed: ceramic; .01 ufd, +80% -20%, 500 wvdc. (Same as C514)	Bypass	CC-100-16
C525	CAPACITOR, fixed: ceramic; .01 ufd, +80% -20%, 500 wvdc. (Same as C514)	Bypass	CC-100-16
C526	CAPACITOR, fixed: ceramic; .01 ufd, +80% -20%, 500 wvdc. (Same as C514)	Bypass	CC-100-16
C527	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. D, 300 wvdc. (Same as C508)	Bypass	CM35D103K
C528	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. D, 300 wvdc. (Same as C508)	Bypass	CM35D103K
C529	CAPACITOR, fixed: ceramic; .01 ufd, +80% -20%, 500 wvdc. (Same as C514)	Blocking	CC-100-16
C530	CAPACITOR, fixed: ceramic; .01 ufd, +80% -20%, 500 wvdc. (Same as C514)	Blocking	CC-100-16
E500	TERMINAL STRIP, barrier type: 2 terminals; 4 6-32 x 1/4 inch screws; bakelite base.	Audio Output	TM-102-2
F500	FUSE, cartridge: 2 amp.	Main Power Fuse	FU-100-2
F501	FUSE, cartridge: 1/8 amp; 250 v, straight through element.	B+ Fuse	FU-100-.125
I500	LAMP, incandescent: double contact bayonet base; 120 volts, 3 watts; S-6 clear bulb.	Osc. Lamp Stabilization	BI-102-3
I501	LAMP, incandescent: double contact bayonet base; 120 volts, 3 watts; S-6 clear bulb. (Same as I500)	Osc. Lamp Stabilization	BI-102-3
I502	LAMP, incandescent: bayonet base; 6-8 volts, 150 ma; T-3-1/4 clear bulb.	Main Power Indicator	BI-101-47

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
J500	CONNECTOR, receptacle: male; two contacts, 10 amps at 250 v., 15 amps at 125 v., twist lock type.	Power Input	JJ-100
J501	CONNECTOR, receptacle: receptacle: female	RF Out	UG-604/U
L500	CHOKE, R.F.: 750 microhenries, ±20%, 100 ma, max. current; DC res. approx. 17 ohms; bakelite body.	Choke, RF	CL-100-5
L501	CHOKE, R.F.: 750 microhenries, ±20%, 100 ma, max. current; DC res. approx. 17 ohms; bakelite body. (same as L500)	Choke, RF	CL-100-5
L502	TRANSFORMER, R.F.: 2-4.3 mc; slug tuned.	RF Transformer	A-1451-2
L503	TRANSFORMER, R.F.: 2-4.3 mc; slug tuned. (Same as L502)	RF Transformer	A-1451-2
L504	REACTOR, filter: 50 henries.; 30 ma. D.C.; DC res. approx. 800 ohms; insulated for 1500 v.	Filter	TF-166
L505	COIL, R.F.: 4 microhenries, 1700 ma. max. current, mica body.	Line Filter	CL-105-2
L506	COIL, R.F.: 4 microhenries, 1700 ma. 1700 ma. max. current, mica body. (Same as L505)	Line Filter	CL-105-2
R500	RESISTOR, fixed: composition; 100 ohms, ±10%, 1/2 watt.	Dropping	RC20GF102K
R501	RESISTOR, variable: composition; 2500 ohms, ±10%, 2 watts, linear taper.	Regen. Adj.	RV4ATXA252A
R502	RESISTOR, fixed: composition; 68,000 ohms, ±10%, 1 watt.	Plate Load	RC30GF683K
R503	RESISTOR, fixed: composition; 47,000 ohms, ±10%, 1 watt.	Dropping	RC30GF473K
R504	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1 watt.	Plate Load	RC30GF223K
R505	RESISTOR, fixed: composition; 470,000 ohms, ±10%, 1/2 w.	Grid Return	RC20GF474K
R506	RESISTOR, fixed: composition; 470 ohms, ±10%, 1/2 watt.	Cathode	RC20GF471K
R507	RESISTOR, fixed: composition; 100 ohms, ±10%, 1/2 watt. (Same as R500)	Dropping	RC20GF102K
R508	RESISTOR, fixed: composition; 68,000 ohms, ±10%, 1 watt. (Same as R502)	Plate Load	RC30GF683K
R509	RESISTOR, fixed: composition; 47,000 ohms, ±10%, 1 watt. (Same as R503)	Dropping	RC30GF473K

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R510	RESISTOR, fixed: composition; 10,000 ohms, ±10%, 1 watt.	Plate Load	RC30GF103K
R511	RESISTOR, fixed: composition; 470,000 ohms, ±10%, 1/2 w. (Same as R505)	Grid Return	RC20GF474K
R512	RESISTOR, fixed: composition; 470 ohms, ±10%, 1/2 watt. (Same as R506)	Cathode	RC20GF471K
R513	RESISTOR, variable: composition; 2500 ohms, ±10%, 2 watts, linear taper. (Same as R501)	Regen. Adj.	RV4ATXA252A
R514	RESISTOR, fixed: composition; 2700 ohms, ±10%, 1/2 watt.	Cathode	RC20GF272K
R515	RESISTOR, fixed: composition; 2700 ohms, ±10%, 1/2 watt. (Same as R514)	Cathode	RC20GF272K
R516	RESISTOR, fixed: composition; 470 ohms, ±10%, 1 watt.	Dropping	RC30GF471K
R517	RESISTOR, fixed: composition; 470 ohms, ±10%, 1 watt. (Same as R516)	Dropping	RC30GF471K
R518	RESISTOR, variable: composition; 500 ohms, ±10%, 2 watts, linear taper.	1 Tone Level	RV4ATXA501A
R519	RESISTOR, variable: composition; 500 ohms, ±10%, 2 watts, linear taper. (Same as R518)	2 Tone Level	RV4ATXA501A
R520	RESISTOR, fixed: composition; 1000 ohms, ±10%, 1/2 watt. (Same as R500)	Imp. Matching	RC20GF102K
R521	RESISTOR, fixed: composition; 1000 ohms, ±10%, 1/2 watt. (Same as R500)	Imp. Matching	RC20GF102K
R522	RESISTOR, fixed: composition; 180 ohms, ±10%, 1/2 watt.	Dropping	RC20GF181K
R523	RESISTOR, fixed: composition; 180 ohms, ±10%, 1/2 watt. (Same as R523)	Dropping	RC20GF181K
R524	RESISTOR, variable: wire wound; 600 ohms, "T" attenuator, 7/8 in. long flatted 1/4 in. dia. shaft.	Level Adj.	RR-108-9-R-C
R525	RESISTOR, fixed: composition; 4700 ohms, ±10%, 1 watt.	Dropping	RC30GF472K
R526	RESISTOR, fixed: composition; 4700 ohms, ±10%, 1 watt. (Same as R525)	Dropping	RC30GF472K

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R527	RESISTOR, fixed: wire wound; 4700 ohms, ±10%, 1 watt.	Dropping	RW-109-39
R528	RESISTOR, fixed: wire wound; 4700 ohms, ±10%, 1 watt. (Same as R527)	Dropping	RW-109-39
R529	RESISTOR, fixed: wire wound; 3000 ohms, ±5%, 10 watts.	Dropping	RW-109-30
R530	RESISTOR, fixed: wire wound; 3000 ohms, ±5%, 10 watts. (Same as R529)	Dropping	RW-109-30
R531	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 1 watt.	Bleeder	RC30GF104K
R532	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1 watt.	Plate Load	RC30GF223K
R533	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1 watt. (Same as R532)	Plate Load	RC30GF223K
R534	RESISTOR, fixed: composition; 220,000 ohms, ±10%, 1/2 watt.	Grid Return	RC20GF224K
R535	RESISTOR, fixed: composition; 220,000 ohms, ±10%, 1/2 watt. (Same as R534)	Grid Return	RC20GF224K
R536	RESISTOR, fixed: composition; 10,000 ohms, ±10%, 1/2 watt.	Grid Return	RC20GF103K
R537	RESISTOR, fixed: composition; 10,000 ohms, ±10%, 1/2 watt. (Same as R536)	Grid Return	RC20GF103K
R538	RESISTOR, fixed: composition; 2200 ohms, ±10%, 1/2 watt.	Cathode	RC20GF222K
R539	RESISTOR, fixed: composition; 2200 ohms, ±10%, 1/2 watt. (Same as R538)	Cathode	RC20GF222K
R540	RESISTOR, fixed: composition; 470 ohms, ±10%, 1/2 watt. (Same as R506)	Dropping	RC20GF471K
R541	RESISTOR, fixed: composition; 470 ohms, ±10%, 1/2 watt. (Same as R506)	Dropping	RC20GF471K
R542	RESISTOR, fixed: composition; 68 ohms, ±10%, 1/2 watt.	Dropping	RC20GF680K
R543	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1 watt. (Same as R504)	Plate Load	RC30GF223K
R544	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1 watt. (Same as R504)	Plate Load	RC30GF223K

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
S500	SWITCH, rotary: shorting; 1 section, 2 positions, bakelite insulation; silver plated brass contacts.	Main Power	SW-253
S501	SWITCH, rotary: 4 positions; 2 poles, 1 section, non-shorting contacts.	RF Tone Selector	SW-120
S502	SWITCH, rotary: 4 positions; 2 poles, 1 section, non-shorting contacts. (Same as S501)	Audio Tone Selector	SW-120
T500	TRANSFORMER, power: primary - 110/220 v, 50/60 cps, single phase: section 1 -250-0-250 v RMS, 35 ma dc: section 2-6.3 v. C.T.	Power Transformer	TF-126
T501	TRANSFORMER, audio: primary - impedance 15000 ohms; secondary impedance 9500 ohms split; unbalanced DC in primary 4 ma; hermetically sealed steel case.	Push-Pull Interstage Transformer	TF-206
T502	TRANSFORMER, audio: primary - impedance 15000 ohms; secondary impedance 95000 ohms split; unbalanced DC in primary 4 ma; hermetically sealed steel case.	Push-Pull Interstage Transformer	TF-206
T503	TRANSFORMER, audio: primary - 20,000 ohms CT: sec. - 150, 600 ohms, 4 ma dc in primary; ±2 db; 200 to 10000 cps.	Audio Transformer	TF-138
T504	TRANSFORMER, audio: primary - 20,000 ohms CT: sec. - 150, 600 ohms, 4 ma dc in primary ±2 db; to 10000 cps. (Same as T503)	Audio Transformer	TF-138
V500	TUBE, electron: duo-triode, 9 pin miniature.	1 Audio Osc. Tone	12AT7
V501	TUBE, electron: duo-triode, 9 pin miniature. (Same as V500)	2 Audio Osc. Tone	12AT7
V502	TUBE, electron: medium-mu duo-triode, 9 pin miniature.	1 Audio Amp. Tone	12AU7
V503	TUBE, electron: medium-mu duo-triode, 9 pin miniature. (Same as V502)	2 Audio Amp. Tone	12AU7
V504	TUBE, electron: medium-mu duo-triode, 9 pin miniature. (Same as V502)	V504A - RF Osc. V504B - RF Ampl.	12AU7
V505	TUBE, electron: medium-mu duo-triode, 9 pin miniature. (Same as V502)	V505A - RF Osc. V505B - RF Ampl.	12AU7
V506	TUBE, electron: full wave rectifier, 7 pin miniature.	HV Rectifier	6X4
XF500	HOLDER, fuse: bayonet type; 100/250 volts, neon lamp, clear knob; accomodates 1/4 x 1-1/4 in. fuse.	Holder for F500	FH-104-3

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
XF501	HOLDER, fuse: bayonet type; 100/250 volts, neon lamp, clear knob; accomodates 1/4 x 1-1/4 inch fuse. (Same as XF500)	Holder for F501	FH-104-3
XI500	SOCKET, lamp; double contact, solder lug type; 1 inch x 1-3/16 inch o/a.	Socket for I500	TS-108-2
X1501	SOCKET, lamp: double contact, solder lug type; 1 inch x 1-3/16 inch o/a. (Same as XI500)	Socket for I501	TS-108-2
XI502	SOCKET, lamp: w/red frosted lens, for miniature bayonet base, T-3-1/4 bulb.	Socket for I502	TS-106-1
XV500	SOCKET, tube: miniature 9 pin.	Socket for V500	TS-103-P01
SV501	SOCKET, tube: miniature 9 pin. (Same as XV500)	Socket for V501	TS-103-P01
XV502	SOCKET, tube: miniature 9 pin. (Same as XV500)	Socket for V502	TS-103-P01
XV503	SOCKET, tube: miniature 9 pin. (Same as XV500)	Socket for V503	TS-103-P01
XV504	SOCKET, tube: miniature 9 pin. (Same as XV500)	Socket for V504	TS-103-P01
XV505	SOCKET, tube: miniature 9 pin. (Same as XV500)	Socket for V505	TS-103-P01
XV506	SOCKET, tube: miniature 7 pin.	Socket for V506	TS-102-P01
XY500	SOCKET, crystal: .486 in. spacing for .050 inch pin dia.	Socket for Y500	TS-104-1
XY501	SOCKET, crystal: .486 in. spacing for .050 inch pin dia. (Same as XY500)	Socket for Y501	TS-104-1
Y500	CRYSTAL UNIT, quartz: 1.999 mc; pin type connectors; ±005% tolerance.	Crystal Osc	CR-18/U-1.999P
Y501	CRYSTAL UNIT, quartz: 2.001 mc; pin type connectors; ±.005% tolerance.	Crystal Osc.	CR-18/U-2.001P
Z500	NETWORK, frequency determining; 935 cps.	p/o Audio Osc.	NF-104-935
Z501	NETWORK, frequency determining: 2805 cps.	p/o Audio Osc.	NF-104-2805
Z502	FILTER, bandpass: 935 cps; 600 ohm input and output impedance; hermetically sealed rectangular steel case.	Bandpass Filter	FX-156
Z503	FILTER, bandpass: 2805 cps: 600 ohm input and output impedance; hermetically sealed rectangular steel case.	Bandpass Filter	FX-157

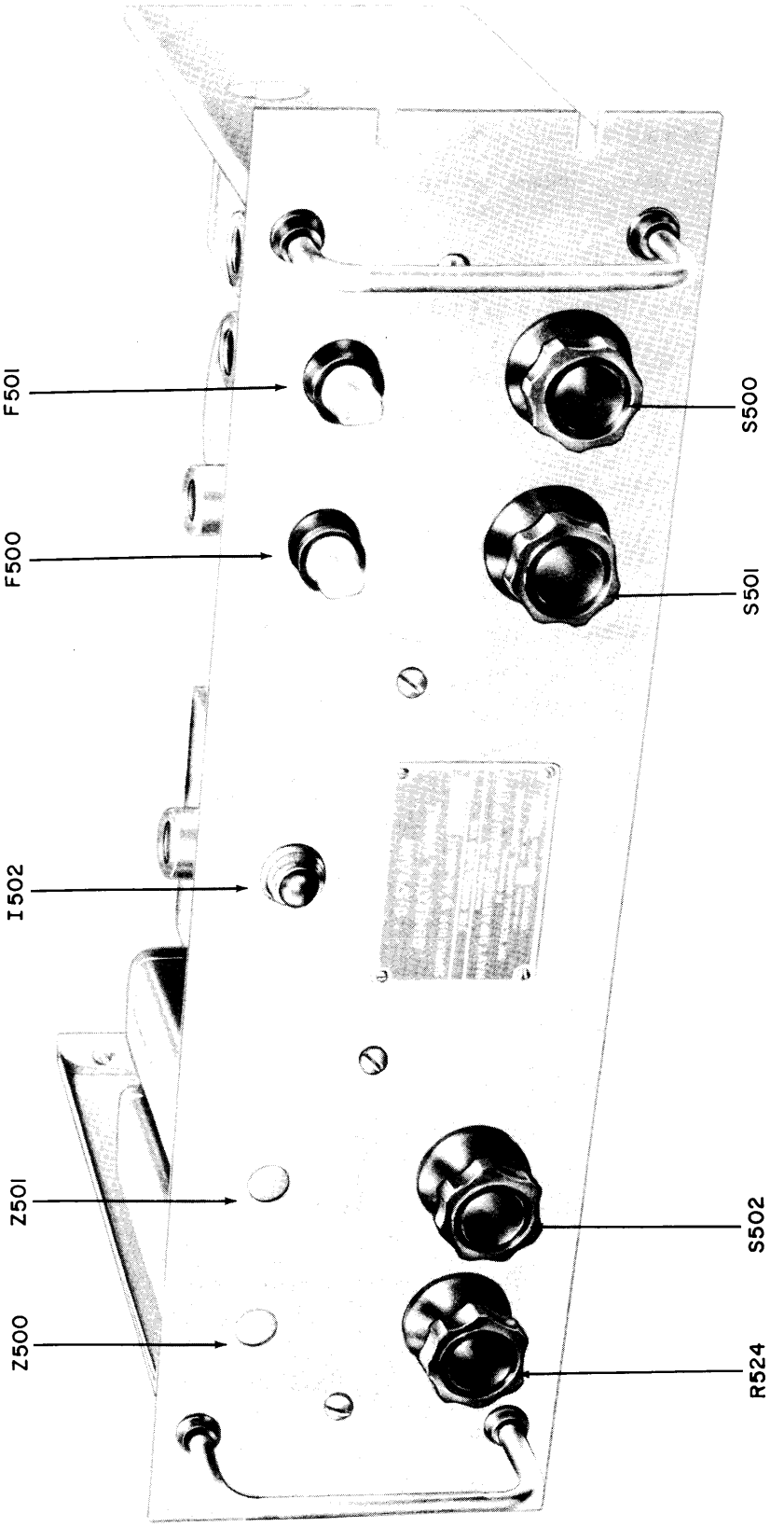


Figure 5-1. Front View, Model TTG

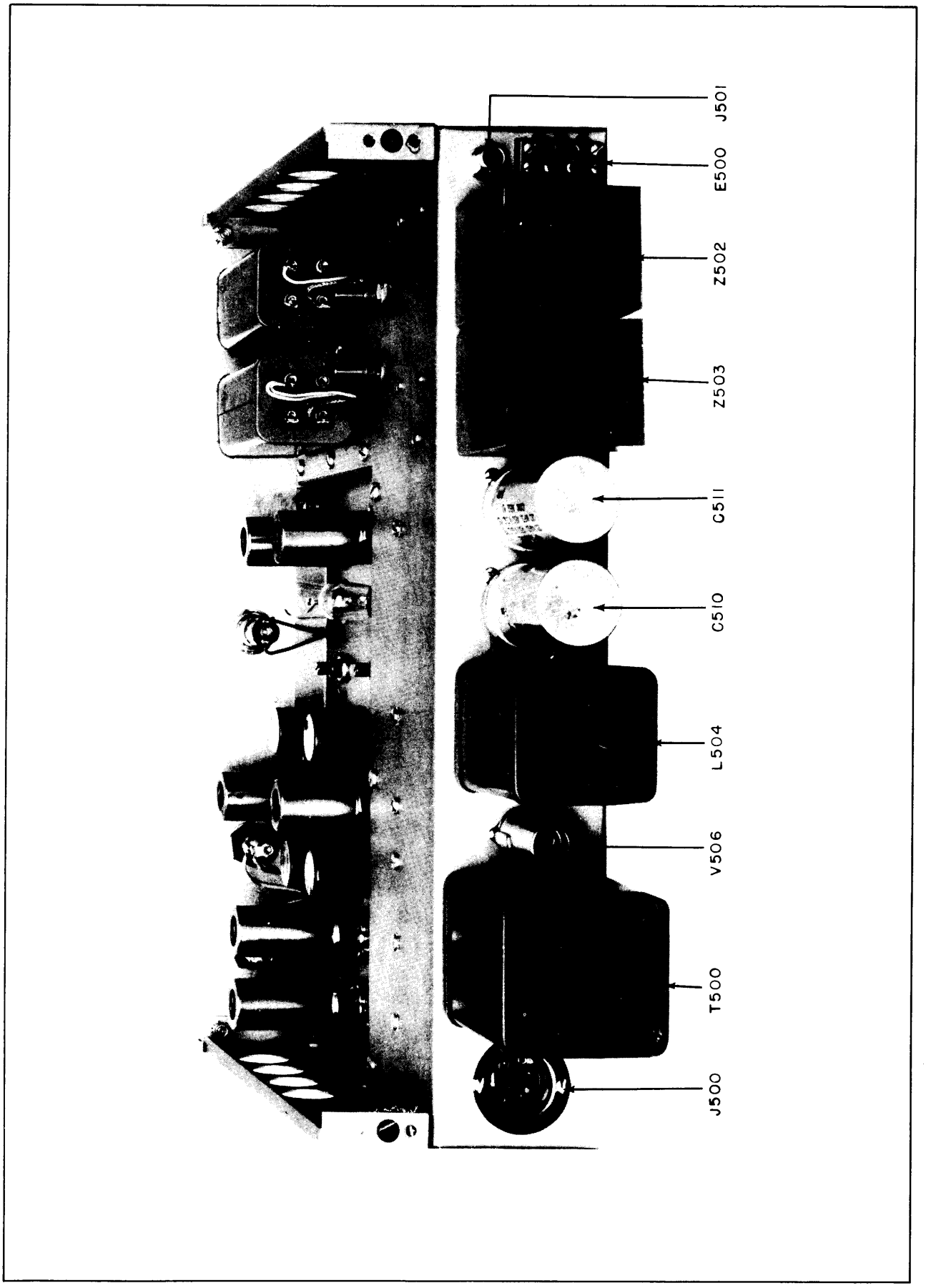


Figure 5-2. Rear View, Model TTG

PH-792

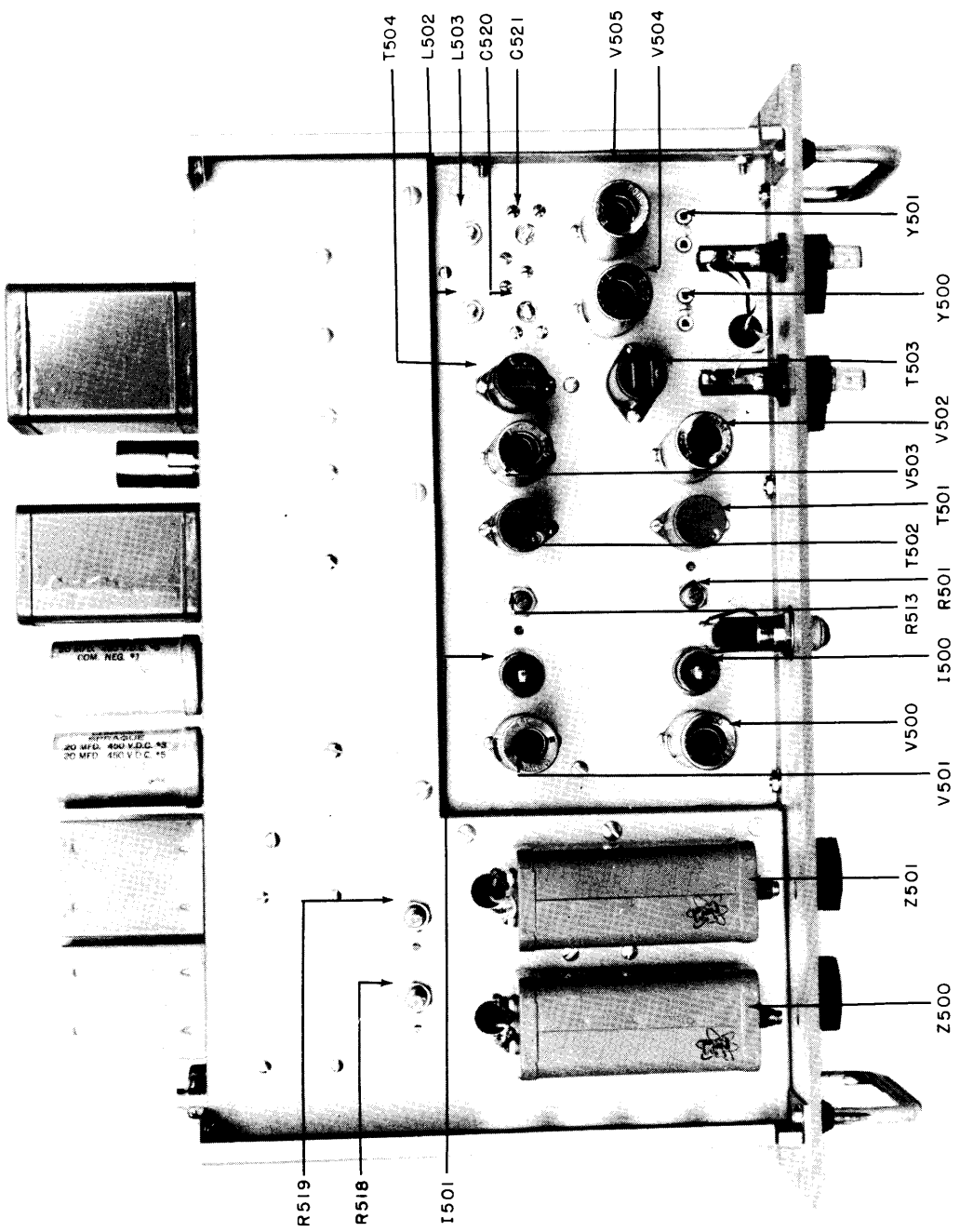


Figure 5-3. Top View, Model TTG

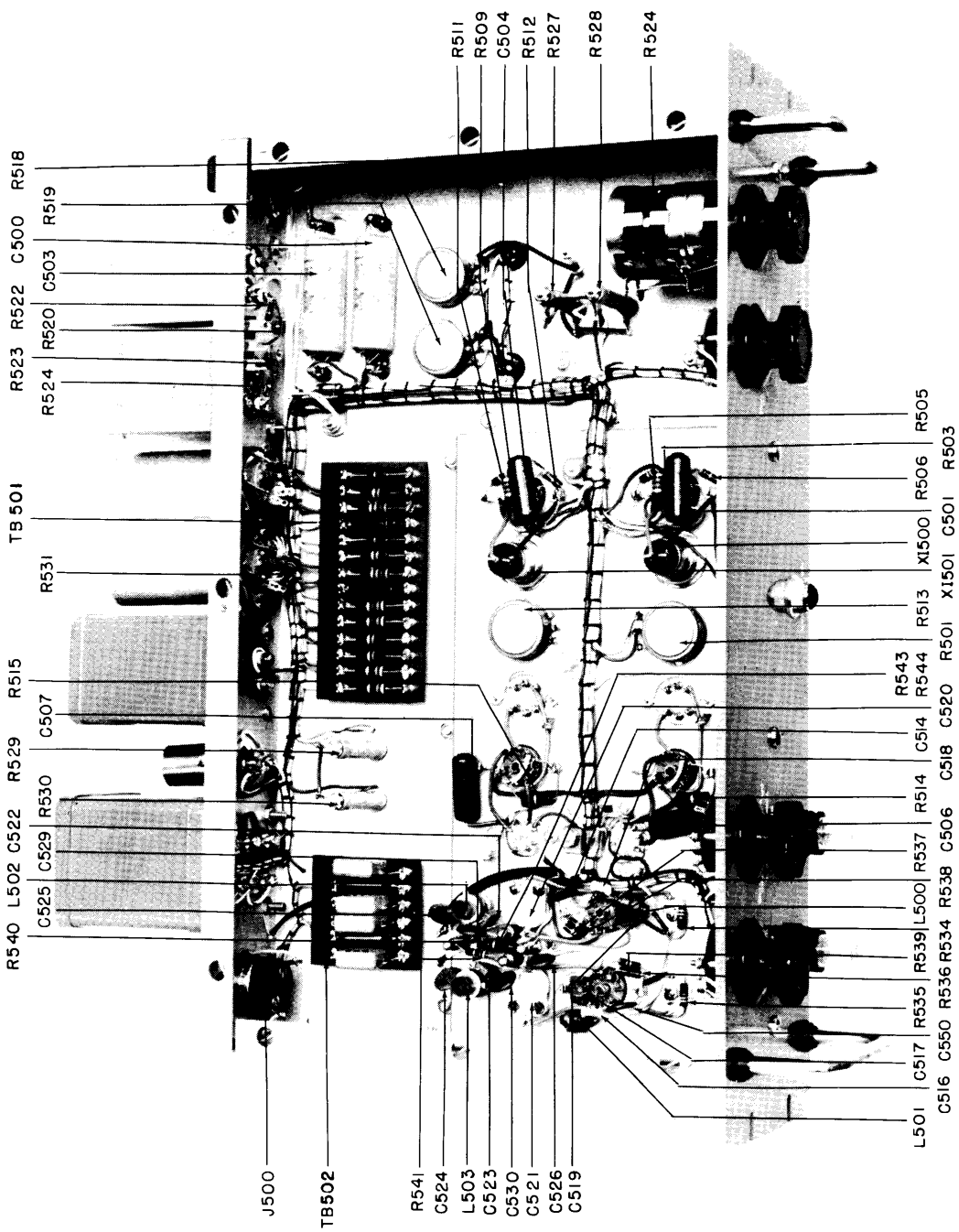


Figure 5-4. Bottom View, Model TTG

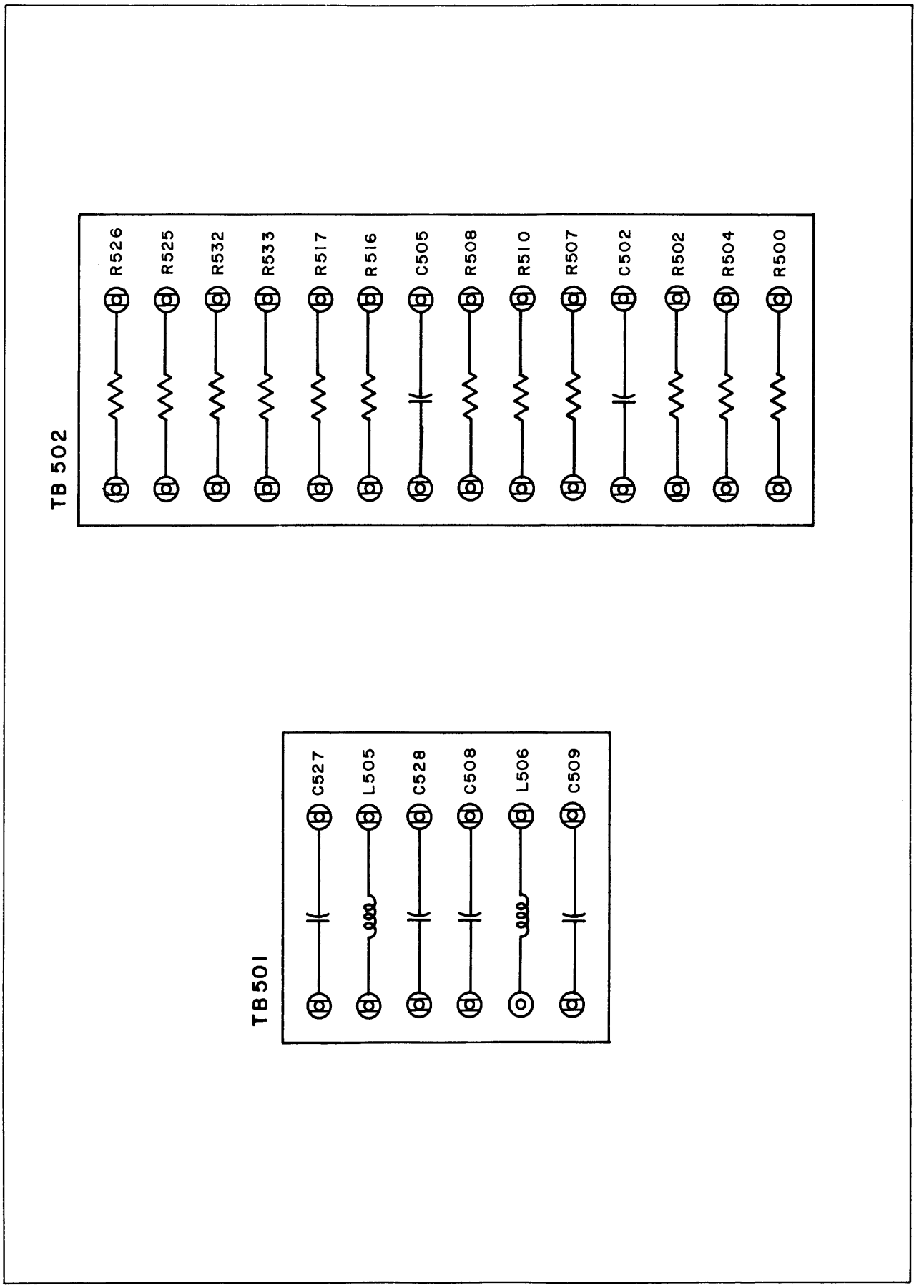
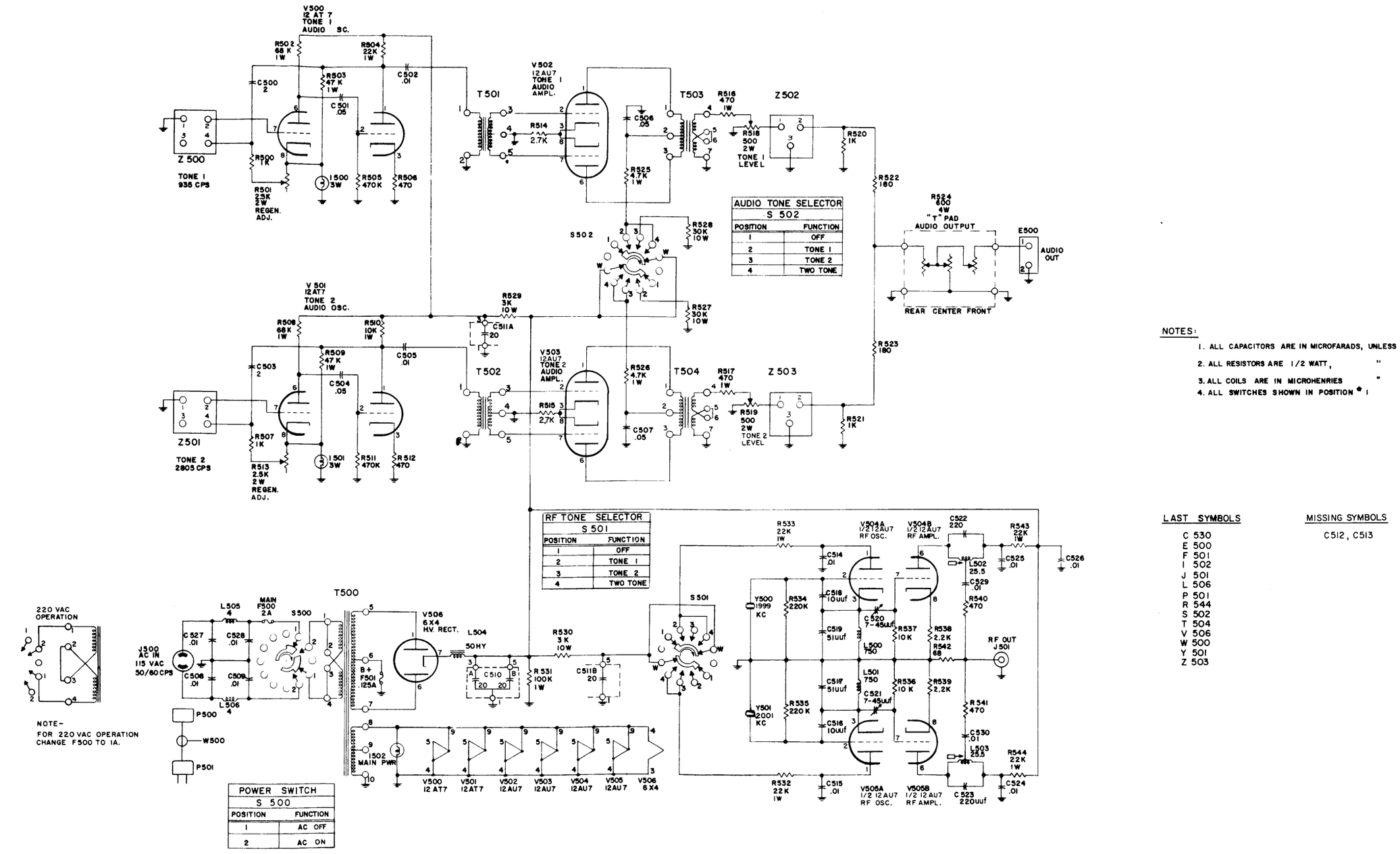


Figure 5-5. Terminal Board Layout Model TTG



NOTES:

1. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE 1/2 WATT, " " "
3. ALL COILS ARE IN MICROHENRIES " " "
4. ALL SWITCHES SHOWN IN POSITION * 1

LAST SYMBOLS	MISSING SYMBOLS
C 530	C512, C513
E 500	
F 501	
I 502	
J 501	
L 506	
P 501	
R 544	
S 502	
T 504	
V 506	
W 500	
Y 501	
Z 503	

CK-394

Figure 5-6. Schematic Diagram, Test Generator