

GLOBE KING 500

INSTRUCTION MANUAL

SECTION I

GENERAL DESCRIPTION

1-1. GENERAL.

1-2. The WRL Globe King Transmitter Model 500 is made by World Radio Laboratories of Council Bluffs, Iowa. This transmitter is rated at 500 Watts input power to the R.F. Power Amplifier, either Radio Telegraphy (CW), Radio Telephony (AM) operation or 430 watts Single Sideband.

1-3. DESCRIPTION.

1-4. The Model 500 transmitter is completely self-contained in a metal relay rack cabinet. Dimensions are 31 inches high, 15 inches deep, and 22 inches wide. Weight is approximately 250 pounds. Ventilating louvres are provided in the cabinet to assure adequate ventilation and heat dissipation. Complete TVI precautions have been taken. The R.F. section of the transmitter is completely shielded, meter leads have been by-passed and all AC leads have been by-passed.

1-5. The components of the transmitter are so arranged that semi-unit construction is employed and are broken down into three units as follows;

- a. Exciter, Buffer and Power Amplifier
- b. Modulator with Integral Power Supply
- c. Main Power Supply

Each unit may be removed from the cabinet independently for inspection and servicing. Power requirements are 115 volts, 50/60 cycles single phase alternating current. Tube complement is shown in Table I.

TABLE I. TUBE COMPLEMENT.

Quantity	Type	Function
1	4-400A 4-400A	RF Power Amplifier
1	6BE6 6BE6	Buffer-Doubler
1	6AG7 6AG7	Crystal Oscillator
1	6SJ7	Microphone Amplifier
2	6C5	Speech Amplifiers
1	6L6G	Audio Driver
2	811 811-A	Modulators
1	6X5	Bias Rectifier
1	5Y3GT	P.A. Screen Grid Rectifier
2	816	Modulator High Voltage Rectifiers
1	5Y3GT	Modulator Low Voltage Rectifier
2	3B2B 3B2B	P.A. High Voltage Rectifiers
1	5U4G	Exciter Voltage Rectifier

1-6. THEORY OF OPERATION.

1-7. A 6V6 tube is employed in a regenerative crystal oscillator circuit. The oscillator has a substantial harmonic output and works very well as a doubler or tripler with a minimum of crystal current; this allows the use of 160, 80 and 40 Meter crystals for complete Amateur band coverage. A VFO with 3 or 4 watts RF output will drive the oscillator stage easily and may be used in place of a crystal. A keying jack in the oscillator cathode circuit allows the operator to work CW. Bandchanging in the plate circuit of the oscillator is accomplished by shorting-out unused portions of the oscillator plate coil (L-1).

1-8. A type ^{L46}6X5 tube functions as a buffer or doubler stage. This stage is capacity coupled to the oscillator. A combination of fixed and excitation bias are applied to the buffer stage; this allows class "C" operation and also insures complete cut-off of buffer plate current when the oscillator is keyed, or in the event of excitation failure. R.F. output to the Power Amplifier is controlled by a potentiometer in the buffer tube screen grid circuit. Bandswitching of the entire Exciter section is simplified by the use of a ganged switch. D.C. voltages are kept off the coil (L-3) and the bandswitch by shunt feeding the plate of the buffer tube. A SSB R.F. signal may be inserted by means of a link in the buffer plate coil (L-3). This same link may be used for VFO control and drive of the Power Amplifier stage. 10 to 15 watts are required for this method of operation. SSB operation requires the removal of low B₊ voltage from the exciter section. A switch in the Exciter B₊ line is provided for this purpose.

1-9. The Power Amplifier employs one type 4-250A tube which operates as a straight-through class "C" AM, or class "B" SSB amplifier. Fixed and excitation bias are employed in the Power Amplifier, as well as in the Buffer stage. Class of operation is determined by a switch which selects the proper fixed bias voltage. The plate circuit is tuned by a Pi network and an additional L matching section may be switched in if necessary. The Pi and L network will match impedances of from 52 to 600 ohms. When properly tuned harmonic output of the Power Amplifier is reduced considerably. The plate of the final is modulated directly while the screen grid is self-modulated by means of a high inductance choke. The Power Amplifier is unique in that the screen grid voltage is self-regulated. A rise in screen grid current automatically reduces voltage and vice versa. By this method the screen grid dissipation rating is not exceeded, giving excellent tube protection, and tube life is extended. A 5Y3GT tube is employed as the low voltage rectifier for the Power Amplifier screen grid supply. A 6X5GT tube operating as a half-wave rectifier supplies all bias voltages to the Power Amplifier and Buffer stages.

1-10. The microphone amplifier consists of a 6SJ7 tube which is capacity coupled to the following speech amplifier stage. Two 6C5 tubes are utilized as speech amplifiers, these are capacity coupled into the 6L6G driver stage. Couplers are used for coupling the aforementioned audio stages. They have a restricted audio range and allow full use of useable audio power, also, they discriminate against power wasting high and low audio frequencies. The 6L6G driver stage is transformer coupled to the modulator stage. All speech and driver stages are thoroughly decoupled and all DC voltages applied to them are well filtered. Two 5514 tubes with zero bias operate as push-pull class B Modulators. Modulator plate current is monitored constantly by a meter in the plate circuit. High voltage for the modulator stage is supplied by two 816 tubes operating in a full wave rectifier circuit. A 5Y3GT tube, operating as a full wave rectifier, supplies the low voltage for the speech and driver stages.

1-11. The high voltage power supply employs two 866A tubes operating as full wave rectifiers. The filter section utilizes choke input. The low voltage supply employs a 5Y4G tube in a full wave rectifier circuit with a single section choke input filter. A Hi B + Lo B + switch has been incorporated into the high voltage supply to enable tuning up the power amplifier stage, or for testing purposes, without the danger of burning up the meter or damaging the tubes. This switch places a resistor in series with the primary of the plate transformer thus reducing the voltage. A terminal strip at the rear provides 115 V AC when the TRANSMIT switch is turned on. This voltage may be used to operate an external relay. The AC input circuit to the transmitter is fused for protection in the event of a component failure.

SECTION II
OPERATING PROCEDURES

2-1. GENERAL

2-2. The following paragraphs describe the various panel controls of the Globe King Transmitter, Model 500. Tune-up and operating procedures are outlined following the description of controls. It is recommended that this section be studied thoroughly before any attempt is made to place the transmitter into operation.

2-3. DESCRIPTION OF CONTROLS

2-4. OSC. TUNING. Tunes Oscillator plate coil to the crystal frequency, or to double or triple the crystal frequency.

2-5. EXCITER BAND SWITCH. Selects proper amount of inductance in Oscillator and Buffer plate circuits.

2-6. BUFFER TUNING. Tunes Buffer plate to Oscillator frequency, or to selected harmonic.

2-7. METER SWITCH. Places Meter M_1 into any one of the following four circuits; Osc. Plate, Buff. Plate, Final Grid or Final Screen.

2-8. FUNCTION SWITCH. Serves three purposes. Inserts high resistance into Power Amplifier screen grid circuit for tune-up, shorts modulation choke for CW operation, inserts modulation choke into Power Amplifier screen grid circuit for AM operation.

2-9. DRIVE CONTROL. Controls amount of RF from Buffer stage, thereby controlling Power Amplifier grid current and drive.

2-10. OUTPUT IMPEDANCE SELECTOR. Inserts added inductance, capacity, or both into output circuit for proper antenna match.

2-11. FINAL PLATE TUNING. Tunes plate circuit of the Power Amplifier stage to resonance. Must be re-tuned after any adjustment of either the Antenna Load Control or the Output Impedance Selector.

2-12. FINAL BAND SWITCH. Inserts proper amount of inductance into the pi network to resonate on selected band.

2-13. ANTENNA LOAD. Varies amount of coupling, and load, between Power Amplifier stage and antenna. Always start with this control in the "Min" position, this corresponds to maximum capacity of condenser in the circuit.

2-14. SSB-AM SWITCH. Changes class of operation of the Power Amplifier tube from class "C" to class "B". Also removes all low B+ voltages from Oscillator and Buffer stages for SSB operation of the Power Amplifier.

2-15. AUDIO GAIN. Controls level of modulation in AM operation.

2-16. FILAMENT SWITCH. (Modulator Section Panel). Applies AC power to the modulator section.

2-17. PLATE SWITCH (Modulator Section Panel). Actuates two relays. One applies AC to the modulator plate transformers; other removes short across modulation transformer.

2-18. FILAMENT SWITCH (Power Supply Panel). Applies AC power to the entire transmitter.

2-19. EXCITER SWITCH. Applies AC power to low B + plate transformer for the Exciter section.

2-20. HI LO B + . In LO B + position inserts resistance in plate transformer circuit reducing high voltage to a safe level for tuning procedure. This resistor will heat excessively if tune-up time exceeds three minutes.

2-21. TRANSMIT SWITCH. Applies AC power to plate transformer for high B + voltage for the Power Amplifier tube. Also applies B + voltages to Exciter section. Push-To-Talk switch on microphone stand will also energize the complete transmitter by relay control.

2-22. KEY JACK. Closed circuit type wired into cathode of the Oscillator stage for Oscillator keying.

2-23. CRYSTAL SOCKET. Insertion of 160, 80 or 40 meter crystals allows operation on all Amateur bands.

2-24. SSB-VFO SOCKET. Optional input for VFO operation. Also used to insert a SSB signal for SSB operation.

2-25. SEQUENCE OF OPERATION.

2-26. Proper tune-up is necessary for optimum performance of the Globe King Model 500 Transmitter. Attempted operation of the transmitter without proper tune-up may result in damage to the equipment.

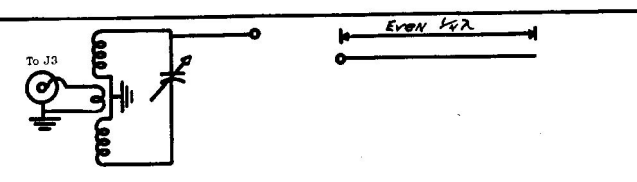
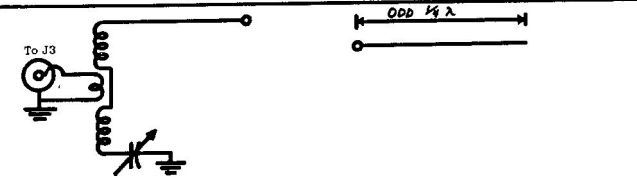
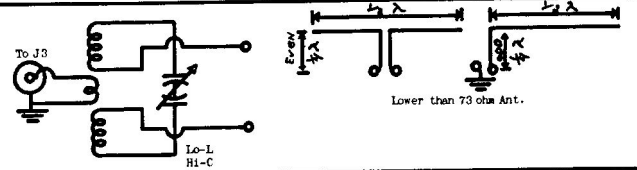
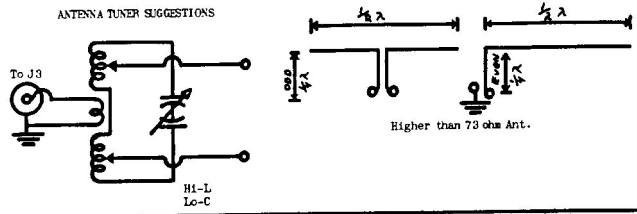
TABLE II. CRYSTAL CHART

BAND	CRYSTAL
160 M	1800-2000 KC
80-75 M	3500-4000 KC
40 M	7000-7300 KC
20-15 M	7000-7200 KC
11 M	6740-6807 KC
10 M	7000-7425 KC

WARNING

Operation of this equipment involves the use of high voltages which are dangerous to life. Observe all safety precautions. Do not attempt to make adjustments inside of equipment, or change tubes, with the high voltage supply ON. Turn the high voltage supply OFF before attempting any such adjustments or changes.

ANTENNA TUNER SUGGESTIONS



2-27. EXTERNAL CONNECTIONS.

WARNING

Before making any external connections remove the AC line cord plug from the AC outlet. Also make certain all panel switches are in the OFF, or down, position.

2-28. MICROPHONE JACK. Located on front panel of modulator section. Plug connections for Push-to-Talk operation; pin 2 to ground through the Push-to-Talk switch; audio input is made to pin 1.

2-29. KEY JACK. Located on front panel of RF section.

2-30. RECEIVER DISABLING RELAY. Connected to terminal strip marked ANT. RLY. Located on rear apron of the power supply chassis.

2-31. The Power Amplifier output network will match impedances of 50 to 600 ohms on all bands providing reactance is held to a minimum. The output is unbalanced with respect to ground, but may be used with balanced lines by the use of Balun coils or an antenna tuner. When using end fed antennas fed directly from the output connector make certain the antenna is not an even multiple of $\frac{1}{2}$ wave length as the impedance is very high and the output circuit will not match into it. The most practical long wire antenna is one that is slightly shorter than an odd multiple of $\frac{1}{4}$ wave length, i.e; slightly shorter than $\frac{1}{4}$, $3/4$, 1 $\frac{1}{4}$, etc. See next page.

2-32. TUNE-UP PROCEDURE.

- a. Select proper crystal for desired frequency from Crystal Chart, TABLE II. Insert into CRYSTAL socket.
- b. Place all panel switches into the OFF position.
- c. Insert AC line cord plug into 115 V 60 cycle single phase Alternating Current source.
- d. Place FILAMENT SWITCH (Power Supply Panel) into the ON position. Allow three minute tube warm-up period.
- e. Set EXCITER and FINAL bandswitches to the desired operating frequency.
- f. Place FUNCTION switch to TUNE position.
- g. Set IMPEDANCE SELECTOR switch to "X" position and ANT. LOADING control counter-clockwise to MIN.
- h. Rotate DRIVE control to extreme left, or minimum position.
- i. Place SSB-AM switch, located on the rear of the RF chassis, to the AM position.
- j. Connect the antenna feed line to the co-axial connector marked ANT. This is located at the rear of the RF chassis.
- k. Place the METER SWITCH to the OSC. PLATE position.
- l. Place EXCITER switch (Power Supply Panel) in the ON position and tune the OSCILLATOR control for minimum dip of plate current.
- m. Place METER switch to BUFF. PLATE position.
- n. Advance DRIVE control clock-wise slowly. When a meter reading of 25 MA is obtained, tune BUFFER control for minimum dip of plate current.
- o. Place METER switch to F. GRID position and note amount of grid current. Should current exceed 15 MA rotate DRIVE control counter-clockwise to decrease this current to the proper value. If grid current is less than 15 MA, advance DRIVE control clockwise until desired current reading is obtained.

p. Place TRANSMIT switch in ON position and carefully tune FINAL PLATE control for minimum dip of plate current.

q. Place TRANSMIT and EXCITER switches in OFF position and place HI-LO B / switch to the HI B / position.

r. Place TRANSMIT switch in ON position. Carefully rotate the ANT. LOADING control clockwise keeping the FINAL PLATE control tuned to resonance by adjusting for minimum dip. When minimum plate current dip has risen to 125 MA, due to antenna loading, set the FUNCTION switch to CW position. Plate current of the Power Amplifier will rise rapidly to approximately 220 MA and the process of loading as described previously is continued until the minimum plate current dip is ^{3.20}~~150~~ MA. This is full load for the Power Amplifier. *260-SSB*

CAUTION

Full load current of ³²⁰~~350~~ MA should not be exceeded, otherwise the Transmitter will be overloaded and damage to components may result. *57A-SSB*

s. Recheck the Power Amplifier grid current for the specified 15 MA and adjust the DRIVE control if necessary. The screen grid current of the Power Amplifier will normally be 25 to 40 MA and is not critical. If the Power Amplifier loading is less than, or more than the required value, the screen current will be affected proportionally, but conversely: ie; heavier load-less screen grid current, lighter load-more screen grid current.

2-33. Tune up procedure is now completed. The Transmitter may now be placed into Radio Telephony (CW) operation as outlined in paragraph 2-34, Radio Telephony (AM) operation as outlined in paragraph 2-35, or SSB operation as outlined in paragraph 2-37.

2-34. The Transmitter may be placed into Radio Telephony (CW) operation by inserting the key plug into the KEY jack. This jack is located on the RF panel.

CAUTION

Do not operate Radio Telephony (CW) with the PLATE switch of the Modulator in the ON position.

2-35. RADIO TELEPHONY (AM) OPERATION.

2-36. After the Transmitter has been properly tuned up it may be placed into Radio Telephony (AM) operation as follows:

- a. Place TRANSMIT switch in OFF position.
- b. Place FILAMENT switch (Modulator panel) in ON position. Allow three minute tube warm-up period.
- c. Connect microphone to MICROPHONE jack (use only high impedance Crystal or Dynamic microphone).
- d. Place MOD. PLATE switch in ON position.
- e. Set FUNCTION switch to PHONE position.
- f. Place TRANSMIT switch in ON position, or actuate press-to-talk lever on microphone handle.
- g. Speak into microphone in normal tone and advance audio GAIN control until Modulator plate current swings up from its static 60 MA reading to 260 MA on peaks. This will result in full modulation of the carrier.

CAUTION

Do not apply modulation unless the Power Amplifier is fully loaded and the FUNCTION switch is in the PHONE position. Do not attempt to change bands while either the high or low B / voltages are on: always place TRANSMIT switch in OFF position, or release press-to-talk lever first. Failure to heed this precaution may result in extensive damage to the equipment.

2-37. SSB OPERATION.

2-38. After the Transmitter has been properly tuned up it may be placed into SSB operation as follows:

- a. Place TRANSMIT, Modulator PLATE and Modulator FILAMENT switches in OFF position.
- b. Place SSB-AM switch in SSB position.
- c. Connect SSB signal source to VFO connector on rear of chassis, SSB signal source must produce between 10 and 15 watts RF power.
- d. Place FUNCTION switch in TUNE position.
- e. Place TRANSMIT switch in ON position.
- f. Feed a steady audio tone into the audio input of the SSB Exciter. A signal generator is excellent for this purpose. Should no signal generator be available, the operator may whistle into the microphone, holding the tone steady as possible.
- g. Tune the BUFFER tuning control until maximum Power Amplifier plate current is indicated; then immediately proceed to tune and load the Power Amplifier as described in paragraph 2-32, steps r and s. Grid current for SSB operation should not exceed 5 MA. The Power Amplifier grid and plate current swings are now fully controlled by the amount of audio impressed on the SSB Exciter. Power Amplifier plate current swing for full input should not exceed 260 MA. The resting plate current for the Power Amplifier in Class B operation is 90 MA and this dissipation is evidenced by a very slight color on the plate of the tube, however, this disappears with modulation.

2-39. SPECIAL NOTICE -- EMERGENCY SHUT-OFF

2-40. For emergency shut-off place FILAMENT switch (Power Supply Panel) in OFF position. This action removes all voltages.

2-41. INSTRUMENT READINGS

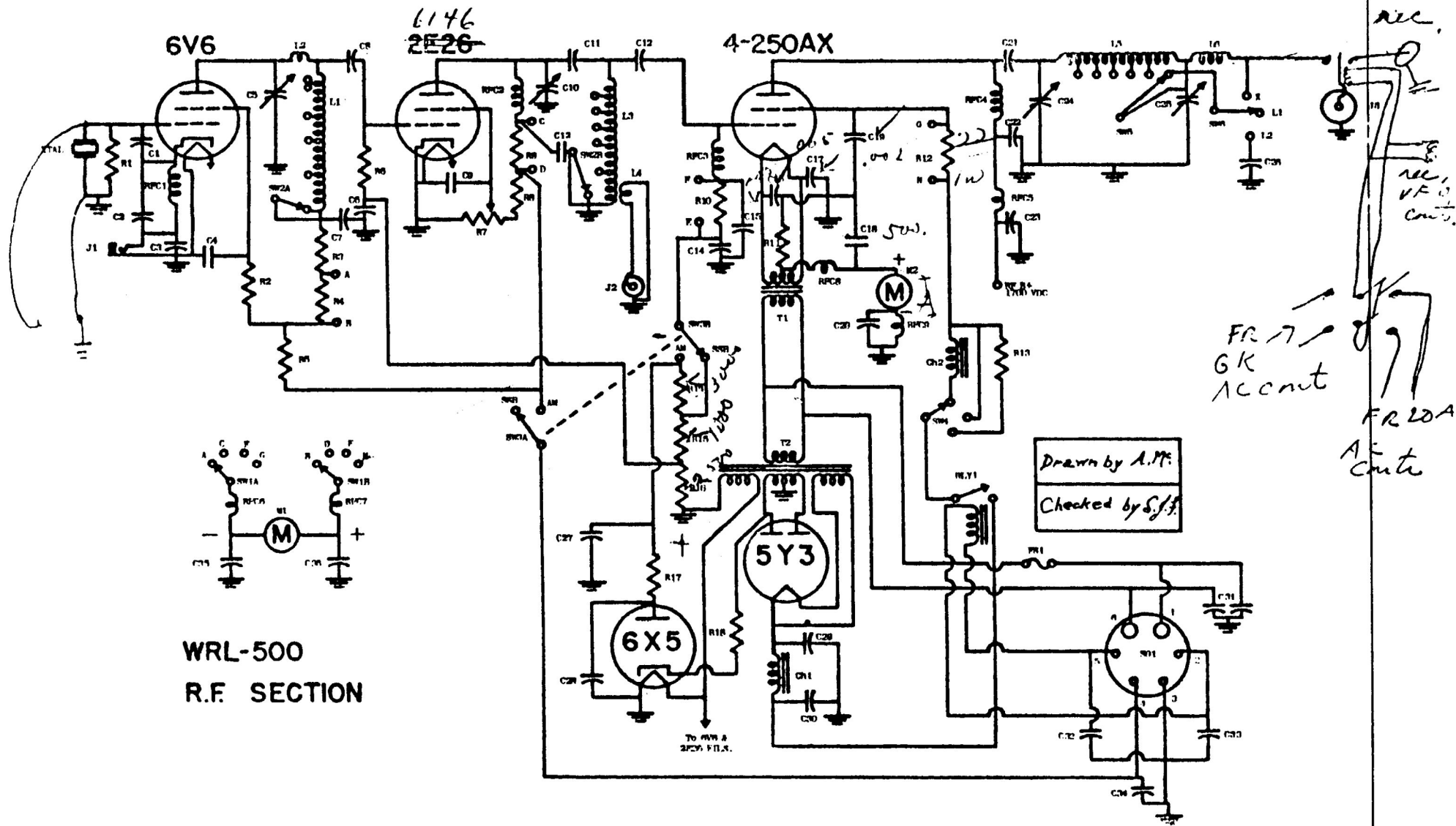
TABLE III. TYPICAL CURRENT READINGS - PHONE OR CW.

Osc. Pl.	Buff. Fl.	P.A. Grid	P.A. Screen	P.A. Plate
20 MA.	25 MA.	15 MA.	42 MA.	350 MA.

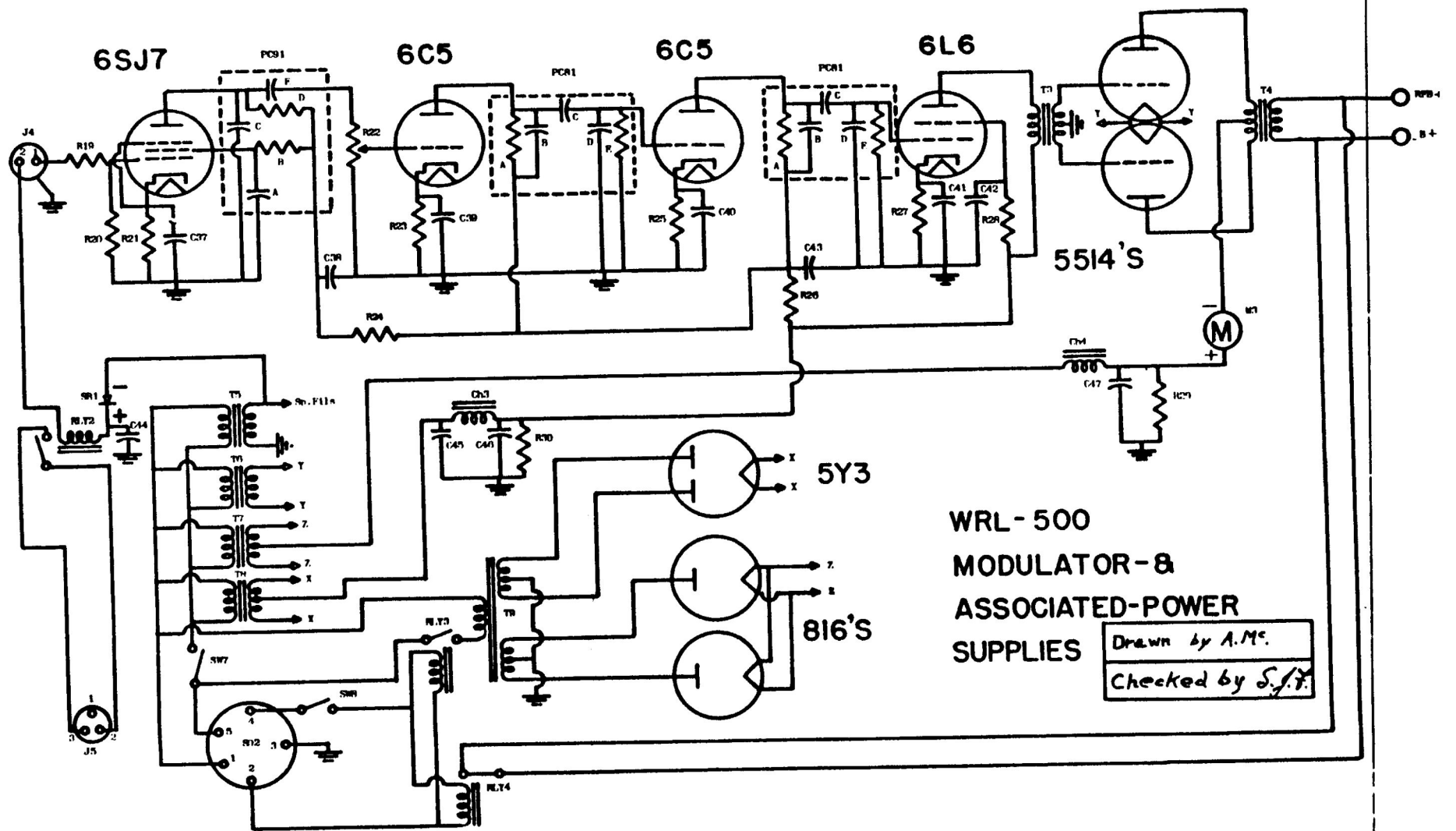
2-42. Typical instrument readings for SSB operation: Power Amplifier grid peak swing 5 MA., P.A. Screen 30 MA., Power Amplifier plate swing 90 MA. to 260 MA.

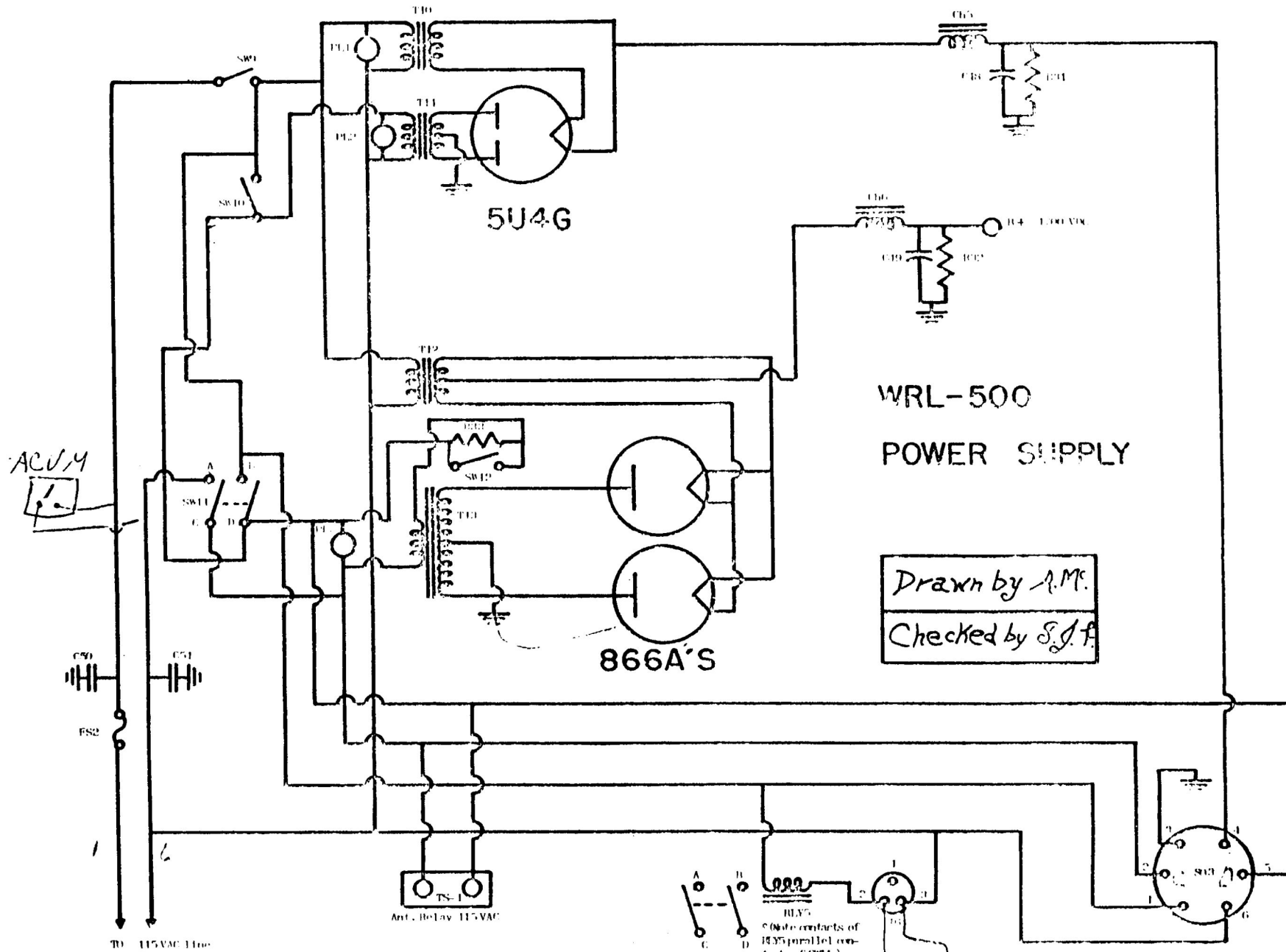
2-43. PRECAUTIONS TO BE OBSERVED.

2-44. All meter readings should be noted periodically during operation. Should meter readings fall below, or rise above, typical readings shown in TABLE III and paragraph 2-42 operation of the Transmitter should be suspended and the cause for improper readings should be determined. Failure to cease operation when improper meter readings are observed may result in damage to the equipment, poor quality of modulation, or carrier splatter.



WRL-500
R.F. SECTION





WRL-500
POWER SUPPLY

Drawn by A.M.
Checked by S.J.F.

ACU 4

866A'S

Ant. Relay 115VAC

115V
C (Note contacts of 1835 parallel contacts of SW11.)

8 9 10 20A

TO 115VAC Line

PARTS LIST

R.F. SECTION

R-1,2,6	47,000 ohms - $\frac{1}{2}$ W.	C-29,30	3x10 - 500 V Electrolytic
R-3	120 ohms - $\frac{1}{2}$ W.	C-31	2x.0008 mfd - 600 V Ceramic
R-4	22 ohms - $\frac{1}{2}$ W.	C-32,33,	34
R-5,18	5000 ohms - 10 W. \downarrow		500 mfd - 600 V Ceramic
R-7	25,000 ohms WW Pot.	L-1	Tapped Osc. Plate Coil
R-8	25,000 ohms - 10 W. \downarrow	L-2	20 M Osc. Plate Coil
R-9,10,12	22 ohms - 1 W.	L-3	Buffer Plate Coil
R-11	22 ohms - 2 W.	L-4	SSB Input Link
R-13	20,000 ohms - 20 W.	L-5	Final - Pi Network Coils
R-14	3,000 ohms - 10 W. \checkmark	J-1	Key Jack
R-15	1,000 ohms - 10 W.	J-2	SSB-VFO Input
R-16	2,500 ohms - 10 W.	J-3	Antenna
R-17	560 ohms - 1 W.	XTAL	Crystal socket
C-1	25 mfd - 600 V Ceramic	RFC-1	Osc. Cathode choke 2.5 ME-50MA
C-2	120 mfd - 600 V Ceramic	RFC-2	Buffer Plate choke 2.5 ME-125MA
C-3,4,6,7,		RFC-3	P.A. Grid choke 2.5 ME-125 MA
9,13,14,15,16,		RFC-4	P.A. Plate choke 1 ME-600 MA
17	.005 mfd - 600 V Ceramic	RFC-5,6,7,	
C-5	70 mfd variable	8,9	B / and Meter TVI Filter chokes
C-8	33 mfd - 600 V Ceramic	T-1	Filament Transformer
C-10	140 mfd variable	T-2	Screen and Bias Transformer
C-11	.001 mfd - 500 V Mica	Ch-1	Screen B / Filter choke
C-12	50 mfd - 500 V Mica	Ch-2	Modulation choke
C-18,20,35,		Sw-1	Meter Switch
36	500 mfd - 600 V Ceramic	Sw-2	Exciter Bandchange Switch
C-19	.002 mfd - 600 V Ceramic	Sw-3	SSB-AM Switch
C-21	500 mfd - 10,000 V Ceramic	Sw-4	Function Switch
C-22,23	500 mfd - 20,000 V Ceramic	Sw-5	P.A. Bandchange Switch
C-24	250 mfd variable	Sw-6	Impedance Selector Switch
C-25	350 mfd variable	PS-1	3 Amp. Fuse
C-26	Two .001 mfd - 2500 WVDC	RLY-1	Screen B / Relay
	in series	M-1	0-150 MA Meter
C-27,28	12 mfd -250V Electrolytic	M-2	0-400 MA Meter

PARTS LIST
MODULATOR SECTION

R-19	100,000 ohms - $\frac{1}{2}$ W.	T-3	Audio Driver Transformer
R-20	2,200,000 ohms - $\frac{1}{2}$ W.	T-4	Modulation Transformer
R-21	2200 ohms - $\frac{1}{2}$ W.	T-5	Speech Filament Transformer
R-22	500,000 carbon pot.	T-6	Modulation Tube Filament Transformer
R-23,25	1500 ohms - $\frac{1}{2}$ W.	T-7	High Voltage Rectifier Filament Transformer
R-24,26	22,000 ohms - $\frac{1}{2}$ W.	T-8	Low Voltage Rectifier Filament Transformer
R-27	220 ohms - 2 W.	T-9	High Voltage Plate Transformer
R-28	22,000 ohms - 2 W.	Ch-3	Lo B / Filter Choke
R-29	50,000 ohms - 50 W.	Ch-4	Hi B / Filter Choke
R-30	50,000 ohms - 20 W.	Sw-7	Modulator Filament Switch
C-37,39,40,41	25 mfd - 25V Electrolytic	Sw-8	Modulator Plate Switch
C-38,42,43	3x8 mfd - 500 V Electrolytic	RLY-2	Push-to-Talk Relay
C-44	50 mfd - 25V Electrolytic	RLY-3	Energizing Relay for T-9
C-45,46	10 mfd - 450 V Electrolytic	RLY-4	Modulation Transformer Shorting Relay
C-47	6 mfd - 1000 V Oil Filled	M-3	Modulation Meter C-300 MA
PC-61	Couplate	SR-1	65 MA Selenium Rectifier
PC-61	Couplate (2)		
J-4	Microphone Input		
J-5	Push-to-Talk Interconnecting Cable Receptacle		

POWER SUPPLY

R-31	50,000 ohms - 20 W.	T-13	Hi B / Plate Transformer
R-32	75,000 ohms - 100 W.	Ch-5	Lo B / Filter Choke
R-33	75 ohms - 50 W.	Ch-6	Hi B / Filter Choke
C-48	4 mfd - 500 V Oil Filled	Sw-9	Filament Switch
C-49	4 mfd - 2000 V Oil Filled	Sw-10	Exciter B / switch
C-50,51	.1 - 250 WVAC Hy-Pass Filter	Sw-11	Transmit switch
J-6	Push-to-Talk Inter-connecting Cable Receptacle	Sw-12	Hi Lo B / switch
T-10	Filament Transformer	FS-2	15 amp fuse
T-11	Lo B / Plate Transformer	RLY-5	Energizing Relay for T-13
T-12	Filament Transformer	PL-1	Filament Pilot Light
		PL-2	Exciter B / Pilot Light
		PL-3	Transmit Pilot Light