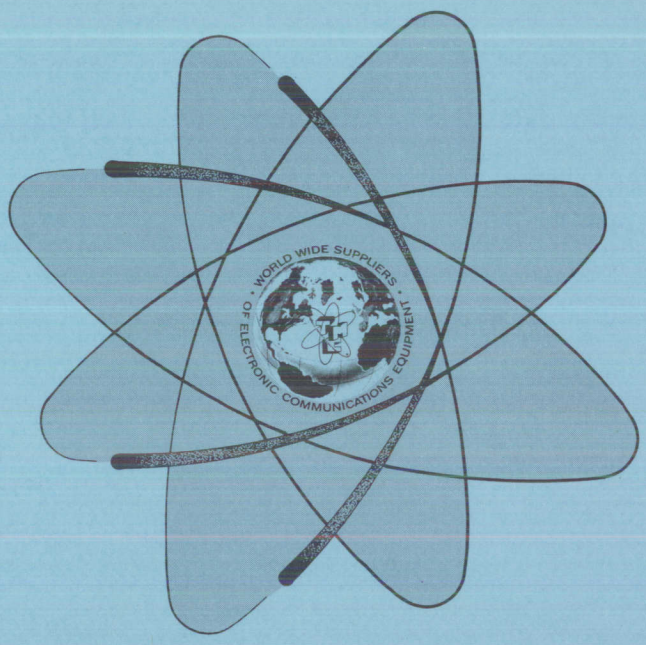
SERVICE MANUAL

FOR

MULTI-MODE,

CHANNELIZED EXCITER

MODEL MFER-1



THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

Printed in U.S.A.

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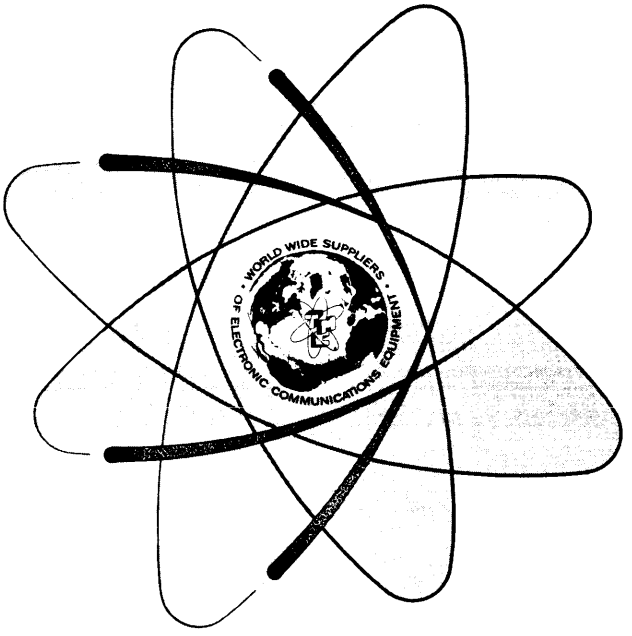

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NOTICE

THE CONTENTS AND INFORMATION CONTAINED IN THIS INSTRUCTION MANUAL IS PROPRIETARY TO THE TECHNICAL MATERIEL CORPORATION TO BE USED AS A GUIDE TO THE OPERATION AND MAINTENANCE OF THE EQUIPMENT FOR WHICH THE MANUAL IS ISSUED AND MAY NOT BE DUPLICATED EITHER IN WHOLE OR IN PART BY ANY MEANS WHATSOEVER WITHOUT THE WRITTEN CONSENT OF THE TECHNICAL MATERIEL CORPORATION.

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes*furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

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1. SCOPE

The servicing techniques for the MFER-1, Multi-Mode, Channelized Exciter are covered in this Service Manual under the following categories:

a. Preventive maintenance procedures are included in paragraph 2, to provide a basis for recognizing future probable causes of equipment malfunction. By adhering to a stringent program of preventive maintenance, the most probable causes of equipment malfunction can be avoided, thereby minimizing equipment downtime and the possibility of compromising important schedules.

b. Trouble shooting procedures are included in paragraph 3, to provide a quick and logical means for localizing the cause of an equipment malfunction. The trouble shooting procedures are covered on two levels (assembly and component). The major portion of MFER-1 circuitry is located on printed circuit board assemblies. When the cause of equipment malfunction has been localized to a particular printed circuit board assembly and if a spare for that assembly is available, the assembly may be replaced, allowing the equipment to become functional immediately and minimizing equipment downtime. Component level trouble shooting of an assembly may be accomplished during a scheduled downtime.

c. Alignment procedures are included in paragraph 4, to facilitate maintaining the MFER-1 in a satisfactory operating condition. Alignment and adjustment of the unit may become necessary when the periodic checks of preventive maintenance show equipment deterioration or when equipment malfunctions require replacement of assemblies or components.

d. The support documentation for servicing the MFER-1 is provided in paragraph 5. Support documentation includes servicing block diagrams, schematic and component location drawings, and parts listing.

2. PREVENTIVE MAINTENANCE

a. INSPECTION AND TESTING. The following paragraphs describe equipment inspection and power supply checks to be performed on a monthly and weekly basis, respectively.

(1) General Inspection. The most important and least expensive tool in the preventive maintenance program is visual inspection. Assemblies and their components should be examined periodically for tell-tale signs of deterioration prior to equipment malfunction and failure. Table 1 provides a monthly inspection checklist for the MFER-1.

TABLE 1. MONTHLY INSPECTION ROUTINE

Assembly	Check
Line Power Cord	Check line power cord for cracks, nicks or fraying.
Main Chassis Assembly	1. Check underside of chassis for dirt and dust. 2. Check all interconnect wiring for cracks, nicks or fraying. 3. Check printed circuit board jacks for tightness against chassis. 4. Check all ground connections for security.
Printed Circuit Board Assemblies	1. Check all printed circuit boards for cracks. 2. Check components on printed circuit boards for loose connections and for evidence of deterioration from possible overheating.
Front and Rear Panels	1. Check panel for general cleanliness. 2. Check all control knobs for smooth action from limit-to-limit; check all switches for positive action.
CAUTION The MODE and CHANNEL selector switches turn clockwise only, due to stepping switch drives. Do not attempt to force these switches in a counterclockwise direction; to do so may damage the stepping switch drive mechanisms.	
	3. Check MONITOR meter face for cracks, scratches, etc. 4. Check indicator faces for cracks. 5. Check all input and output jacks for security against panel.

TABLE 1. MONTHLY INSPECTION ROUTINE (cont)

Assembly	Check
	6. Remove both LINE and SPARES fuses. Check to insure that the fuses are the proper value (1 amp for 115vac, .5 amp for 230vac) and that they are not open.

(2) Power Supply Checks. The following power supply checks should be performed on a weekly basis:

(a) Disconnect the line power cord for the MFER-1 at J116 on the rear panel of the unit.

(b) Remove power supply regulator assembly Z303 from its receptacle. (Refer to Figure 12 for location of Z303 assembly.) Insert the power supply extender board in the vacated receptacle and mount Z303 on the extender board.

(c) Disconnect remote control cable for the MFER-1 at J119 on the rear panel of the unit.

(d) Insure that the ON/STANDBY switch on the front panel is in the STANDBY position, and connect line power cord from vac power source to J116.

(e) Using an HP410B VTVM, or equivalent, check dc voltage at pin F of Z303; voltage should be +12 vdc ±5%.

(f) Check voltage at pin 4 of Z303; voltage should be +24 vdc ±5%.

(g) Check voltage at pin 3 of Z303; voltage should be +30 vdc ±5%.

(h) Remove line cord from power source, and return Z303 to proper chassis socket (J303), after removing extender board.

(3) Functional Testing. Perform the following checkout procedure on the MFER-1, on a weekly basis after completing a check of the power supplies.

(a) Set ON/STANDBY switch to STANDBY position, and connect line power cord from vac power source to MFER-1 at J116. STANDBY indicator should illuminate.

(b) Insure that the remote control cable at J119 is disconnected from the MFER-1.

(c) Set RF OUTPUT control fully counterclockwise.

(d) Set EXCITER switch to ON position.

(e) Set MODE switch to the A1 position and CHANNEL switch to channel 1 position.

(f) Set ON/STANDBY switch to ON position. STANDBY indicator should extinguish and POWER indicator should illuminate.

(g) Set METER switch to Q1 position. MONITOR meter should indicate in the green region marked Q1.

(h) Set METER switch to Q2 position. MONITOR meter should indicate in the green region marked Q2.

(i) Set METER switch to RF position. MONITOR meter should indicate zero with RF OUTPUT control fully counterclockwise.

(j) Connect 50 ohm load to rf output jack J124, and connect VTVM (HP410B or equivalent) across load resistor.

(k) Adjust RF OUTPUT control until VTVM indicates 3.5 volts rms.

(l) Set CHANNEL selector switch to each of the remaining channel positions (2 thru 5), adjusting the RF OUTPUT control at the selected channel for a reading of 3.5 volts rms on the VTVM.

(m) On the last channel checked in step (l) leave the RF OUTPUT control set for a 3.5 volts rms reading on the VTVM, and set the MODE switch to each of the remaining mode positions (A2, A2H and F1). The VTVM should indicate approximately 3.5 volts rms for each selected mode.

NOTE

The MFER-1 may be operated by remote control equipment (i.e. Analog Digital Control System, Model ADC-3(T)). The following procedural steps will check out the remotely controlled functions of the MFER-1, when the controlling system is interconnected with the MFER-1.

(n) Set the EXCITER switch to PTT/VOX position. The MONITOR meter and the external VTVM readings should drop to zero.

(o) Set the ON/STANDBY switch to the STANDBY position. The POWER indicator should go out, and the STANDBY indicator should illuminate.

(p) Connect the remote control cable to the MFER-1 at J119.

(q) Apply power to the MFER-1 using the remote control system. The STANDBY indicator should extinguish and the POWER indicator should illuminate.

(r) Select each mode using the remote control system. The MODE selector switch on the MFER-1 should position automatically as programmed.

(s) Select each channel using the remote control system. The CHANNEL selector switch on the MFER-1 should position automatically as programmed.

(t) Apply keyline closure to the MFER-1 using the remote control system. The MONITOR meter and the external VTVM should indicate rf output.

(u) Remove power from the MFER-1 using the remote control system.

(v) Disconnect test equipment.

b. CLEANING INSTRUCTIONS. In general, the MFER-1 should be cleaned once a month, using a soft camel's hair brush, forced air pressure of not more than 20 psi, and a suitable cleaning agent such as trichlorethylene or methylchloroform.

WARNING

When using toxic solvents, make certain that adequate ventilation is provided; prolonged or repeated breathing of the vapor shall be avoided. Avoid prolonged or repeated contact with skin. Flammable solvents shall not be used on energized equipment from which a spark may be received.

CAUTION

Trichlorethylene contains a paint removing solvent; avoid contact with painted surfaces.

Remove dirt or grease from wiring and chassis surfaces using cleaning solvent; dry with compressed air. Remove dust from printed circuit boards using a soft camel's hair brush. Blow out accumulated dust from inaccessible areas of chassis using forced air.

3. TROUBLE SHOOTING

a. GENERAL. Prior to trouble shooting the MFER-1, it should be determined that the MFER-1 unit itself is definitely the cause of failure or malfunction within a system and not faulty related equipment, external to the MFER-1. This may be accomplished by checking for proper external inputs to the unit and in certain instances, by isolating the MFER-1 from the external equipment. The following steps will help to determine that the MFER-1 is the cause of failure or malfunction within a system.

(1) Power Input. Insure that the MFER-1 is receiving proper input power (115 vac or 230 vac, depending upon specific wiring of equipment). Power input voltage can be measured across pins A and C of J301.

(2) Power On Control. Insure that an external closure is being provided to the MFER-1 across pins A and K of J119 for a power on condition, or bypass the external power on control by setting the ON/STANDBY switch on the MFER-1 front panel to the ON position..

(3) Keyline Closure. Insure that an external keyline closure is being provided to the MFER-1 across pins 19 and 20 of TB105, or bypass the external keyline closure by setting the EXCITER switch on the MFER-1 front panel to the ON position.

(4) RF Output Line. Disconnect rf output cable at J124 on the rear panel of the MFER-1. Connect a 50 ohm load to J124 and connect a VTVM (HP410B or equivalent) across the load resistor.

Upon completion of steps (1) thru (4), the operation of the MFER-1 should be checked. On each of the five channels and in each of the four modes, there should be a minimum rf output of 250 milliwatts (a minimum of 3.5 volts rms indicated on the external VTVM; the RF OUTPUT control may be adjusted to obtain this reading). If the MFER-1 continues to malfunction, the technician should proceed with trouble shooting the unit on an assembly level, in order to localize the cause of malfunction.

b. ASSEMBLY LEVEL TROUBLE SHOOTING. (Reference Figure 1. Overall Functional Block Diagram) The various functional assemblies of the MFER-1 are shown in Figure 1, along with the primary signal flow between assemblies. Convenient points for measurement of signal flow are also shown. Figure 1 and the paragraphs which follow, describing the functional assemblies of the MFER-1, will guide the technician in localizing the faulty assembly. Those assemblies which are referenced with Z numbers (Z101, Z102, etc.) are printed circuit board assemblies and may be replaced in entirety if spares are available. For trouble shooting a particular assembly, or to localize the faulty component(s), refer to paragraph 3.c. Component Level Trouble Shooting.

(1) Power Supply Assembly. The power supply assembly provides the dc operating potentials for all printed circuit boards. In some instances these supply voltages are routed via the MODE and CHANNEL selector switches, enabling certain assemblies only in a particular mode or on a particular channel. The power supply assembly also houses a frequency standard, which

provides a 1 mhz signal to the carrier generator Z104 and to frequency shift generator Z107, and an oscillator, which provides a 3 mhz VXCO signal to the frequency shift generator Z107. Refer to paragraph 3.c.(1) for component level trouble shooting of the power supply assembly.

(2) Carrier Generator Assembly Z104. The printed circuit board assembly Z104 utilizes the 1 mhz input signal to generate 250 khz and 1.666 mhz signals. The 1.666 mhz signal is routed to the converter/ALDC assembly Z103. The operation of the 250 khz circuitry is controlled by the keyline input, which is routed via the MODE switch, when in the A1, A2 or A2H positions, to the carrier generator Z104. There are three separate 250 khz outputs from Z104: (1) The 250 khz output signal at J104-K is routed via the MODE switch to the A2 modulator Z108 or to the A2H generator Z105, when the respective modes are selected. (2) The 250 khz output signal at J104-11 is routed via the MODE switch, when in the A1 position, to the converter/ALDC assembly Z103. (3) The 250 khz output signal at J104-12 is routed via the carrier suppression network, which controls the level of carrier reinsertion for the A2H mode. Refer to paragraph 3.c.(2) for component level trouble shooting of the carrier generator assembly.

(3) Tone Generator/A2 Modulator Assembly Z108. The tone generator section of the Z108 assembly generates an audio tone of approximately 1 khz. The audio tone is routed within the Z108 assembly to the A2 modulator section and also routed to Z105, the A2H generator. The Z108 assembly has an input of 250 khz from the MODE switch, when the A2 mode is selected. This 250 khz signal is mixed with the audio tone in the A2 modulator, providing the A2 output signal from Z108 (250 khz $\pm$1 khz) to the MODE switch. Refer to paragraph 3.c.(3) for component level trouble shooting of the tone generator/A2 modulator assembly.

(4) A2H Generator Z105. The printed circuit board assembly Z105 receives the audio tone input from Z108 and a 250 khz input from the MODE switch, when the MODE swtich is in the A2H position. The operation of the A2H generator is controlled by the keyline input. When keyline closure is provided, the Z105 output signal is an upper sideband signal with the 250 khz sub-carrier suppressed. The 250 khz sub-carrier from the carrier suppression network is reinserted at the output of Z105. The 250 khz may be reinserted at fixed levels of 0db, -6db, -26 db, or fully suppressed. It may also be reinserted at any level between the fixed levels, since carrier suppression is continuously variable. For normal A2H operation, however, the carrier reinsertion is set by the CARR SUPPR (DB) switch at -6db suppression. The composite A2H signal from Z105 and from the carrier suppression network is routed to the MODE switch. Refer to paragraph 3.c.(4) for component level trouble shooting of the A2H generator assembly.

(5) Frequency Shift Generator/Oscillator-Mixer Z107. The printed circuit board assembly Z107 is divided into two sections. The oscillator-mixer section of Z107 utilizes the 3.0 mhz VXCO input from the power supply assembly to provide an output signal of 1.416 mhz to the converter/ALDC assembly Z103. The frequency shift generator section of Z107 utilizes the 1 mhz input from the power supply assembly and the keyline input or FSK input, via FS loop, SENSE, and SHIFT switches. Additionally, Z107 has a FAX input and output; however, this is only utilized in certain system configurations. The MODE switch routes the keying voltage for FSK in the F1 mode to the 3.0 mhz VXCO oscillator in the power supply assembly. In system configurations where facsimile is utilized,

the variable dc voltage (FAX output) from Z107 would be routed via the MODE switch in the FAX mode (not marked on front panel) to the same 3.0 mhz oscillator in the power supply assembly. Refer to paragraph 3.c.(5) for component level trouble shooting of the frequency shift generator/oscillator-mixer assembly.

(6) Converter/ALDC Assembly Z103. The printed circuit board assembly Z103 utilizes the 250 khz input signal from the MODE switch in the A2, A2H and A1 modes and the 1.666 mhz input from Z104 to provide an output signal of 1.416 mhz. In the F1 mode the 1.416 mhz input from Z107 is utilized. The 1.416 mhz output from Z103 is routed via R102, the RF OUTPUT control, to each of the five rf amplifiers, Z101, Z102, Z111, Z112 and Z113. The Z103 assembly also has ALDC circuitry which is utilized in certain system configurations, when an external rf voltage is applied at the ALDC jack J123. Refer to paragraph 3.c.(6) for component level trouble shooting of the converter/ALDC assembly.

(7) RF Amplifiers Z101, Z102, Z111, Z112, Z113. There are five rf amplifier printed circuit board assemblies; however, only one rf amplifier is operative at a time. The enabling of rf amplifiers is controlled by the CHANNEL selector switch S101. Each rf amplifier receives an input of 1.416 mhz from the RF OUTPUT control R102 and provides an rf output at the frequency (f) of the selected channel. Refer to paragraph 3.c.(7) for component level trouble shooting of the rf amplifier assemblies.

(8) RF Output Assembly Z115. The printed circuit board assembly Z115 receives an rf input from the enabled rf amplifier Z101, Z102, Z111, Z112 or Z113. The rf output assembly amplifies the input signal and provides the rf output of the MFER-1 to J124. Additionally, Z115 provides monitoring of current for its two stages of amplification and monitoring of the rf output signal level. These monitoring signals are routed from Z115 to the meter selector switch S104. Refer to paragraph 3.c.(8) for component level trouble shooting of the rf output assembly.

c. COMPONENT LEVEL TROUBLE SHOOTING. The various functional assemblies of the MFER-1 are shown in Figure 1. Those assemblies which are referenced with Z numbers are described individually in the paragraphs which follow. Each paragraph references a figure for the particular assembly being described. These figures (servicing block diagrams) show the primary signal flow and necessary operating potentials within each assembly and will aid the technician in localizing the faulty component(s).

(1) Power Supply Assembly. (Reference Figure 2. Servicing Block Diagram, Power Supply Assembly Z300 Series) Power input of 115 vac or 230 vac is applied to the power transformer T301 of Z300. From the secondary of T301, approximately 60 vac is routed to a bridge rectifier circuit on Z304. The rectified dc outputs of Z304 are applied to regulator circuitry on Z303. The heat sink assembly Z305 also contains a portion of the regulator circuitry. There are three separate dc outputs from the power supply assembly: +12 vdc, +24 vdc and +30 vdc. The +24 and +30 vdc potentials are also applied within the power supply assembly to Z301 for operation of the 1 mhz standard. The Z302 assembly is an ovenized oscillator which provides a nominal frequency of 3 mhz. The Z302 assembly receives +12 vdc for operation from the MODE switch when the F1

mode is selected (or in the FAX mode for certain system configurations). Additionally, Z302 receives the frequency shift keying voltage (or facsimile modulating voltage), and the 3 mhz oscillator frequency varies in accordance with this input.

For further isolation of the faulty component(s) refer to the following figures for the power supply assembly: Figure 27. Overall Schematic Diagram and Parts List, Power Supply Assembly Z300 Series, Figure 28. Schematic Diagrams, Power Supply A Z304 and Power Supply B Z303, and Figure 29. Component Locations and Parts Lists, Power Supply A Z304 and Power Supply B Z303.

(2) Carrier Generator Assembly Z104. (Reference Figure 3. Servicing Block Diagram, Carrier Generator Z104) The carrier generator assembly receives an input of 1 mhz. This input is applied to shaper/amplifier circuitry and then to a 4 to 1 divider network which provides a signal of 250 khz. The 250 khz is applied to two tuned amplifier stages. The tuned amplifier stages are enabled by a switched ground (keyline input to Z104). The 250 khz is further applied to both an emitter follower stage and to potentiometer R24. The emitter follower output is applied via carrier level adjust R27 to J104-12. This 250 khz output is utilized for carrier reinsertion in the A2H mode. The 250 khz signal, applied via output adjust R24 to J104-K, is utilized for mixing in the A2 and A2H modes. The 250 khz signal, applied via level adjust R23 to J104-11, is utilized in the A1 mode.

The 1 mhz input to Z104 is also applied to a harmonic selector circuit which is tuned to the fifth harmonic, providing a 5 mhz signal. The 5 mhz signal is applied via two tuned amplifier stages and a shaper/amplifier stage to a 3 to 1 divider network. The divider stage output of 1.666 mhz is applied via two tuned amplifier circuits to J104-A. The 1.666 mhz is utilized for mixing by the converter/ALDC assembly Z103. The 1.666 mhz circuitry is enabled by a switched voltage (+12 vdc) from the MODE switch in the A2, A2H and A1 modes.

A meter amplifier is also located on the carrier generator assembly, which is utilized in the audio monitoring circuitry.

For further isolation of the faulty component(s) refer to the following figures for the carrier generator assembly: Figure 13. Schematic Diagram, Carrier Generator Z104 and Figure 14. Component Location and Parts List, Carrier Generator Z104.

(3) Tone Generator/A2 Modulator Assembly Z108. (Reference Figure 4. Servicing Block Diagram, Tone Generator/A2 Modulator Z108) The tone generator portion of Z108 is an audio oscillator which generates an audio tone of approximately 1 khz for A2 and A2H modulation. The oscillator is enabled at all times by +12 vdc from the power switch S105. The tone level is adjusted by potentiometer R27. The tone output at J108-13 is routed to the A2H generator Z105 and also back into the Z108 assembly for use in the A2 modulation portion of Z108. The A2 modulator also receives a 250 khz input from the MODE swtich in the A2 mode. The A2 modulator is enabled by +12 vdc from the MODE switch. Both inputs of 1 khz and 250 khz are amplified separately and applied to the A2 mixer. The mixer output of 250 khz $\pm$1 khz is applied via output adjust R20 and J108-E to the MODE switch.

For further isolation of the faulty component(s) refer to the following figures for the tone generator/A2 modulator assembly: Figure 15. Schematic Diagram, Tone Generator/A2 Modulator Z108 and Figure 16. Component Location and Parts List, Tone Generator/ A2 Modulator Z108.

(4) A2H Generator Z105. (Reference Figure 5. Servicing Block Diagram, A2H Generator Z105) The audio portion of Z105 is used only when external audio inputs are applied to the MFER-1. In normal operation the MFER-1 utilizes the audio tone from Z108 for A2 and A2H modulation; however, when an external mike audio input is applied to the MFER-1, it is amplified on Z105 and routed from J105-A to the MODE switch. When an external line audio input (600 ohm) is applied to the MFER-1, it is applied to an audio transformer on Z105, the secondary output of which is routed from J105-1 to the USB gain control and MODE switch.

A +30 vdc input is applied to Z105K1 at J105-10. The ground return for K1 is provided by relay driver circuitry, which is controlled by the keyline input at J105-9. Keyline closure causes K1 to energize. With K1 energized the following functions occur: (1) A ground is routed to a gate circuit which in turn enables USB amplifier circuitry. (2) A closure is provided between J105-H and J and routed to the transmitter in which the MFER-1 is configured (via TB103-5,6).

Audio input is applied to the A2H generator at J105-13. In normal operation of the MFER-1 the audio input is the 1 khz tone from Z108; however, if an external audio input is applied to the MFER-1, it will also be routed to J105-13 from the MODE switch. The audio input is amplified on Z105 and applied to a balanced modulator. The balanced modulator also receives a 250 khz signal from the MODE switch (in the A2H mode) via an amplifier circuit. The output of the balanced modulator (250 khz $\pm$ audio) is applied to two tuned amplifier stages. A sample of the signal is sent to an AGC section on Z105, which controls the gain of the two tuned amplifier stages in accordance with the setting of R56, AGC adjust potentiometer. The signal is further amplified by Q12, which is enabled by a keyline closure. The signal is then applied to a filter, which passes only the USB portion of the signal, and then to emitter follower stages. The USB output signal at J105-11 is routed to the MODE switch, where a 250 khz signal from the carrier suppression network is reinserted for A2H modulation.

For further isolation of the faulty component(s) refer to the following figures for the A2H generator assembly: Figure 17. Schematic Diagram, A2H Generator Z105 and Figure 18. Component Location and Parts List, A2H Generator Z105.

(5) Frequency Shift Generator/Oscillator-Mixer Z107. (Reference Figure 6. Servicing Block Diagram, Frequency Shift Generator/Oscillator-Mixer Z107) The oscillator-mixer portion of Z107 is enabled only in the F1 mode by a +12 vdc input at J107-J. The oscillator provides a 4.416 mhz signal to a mixer circuit. The second input to the mixer is the 3.0 mhz VXCO signal at J107-M. The mixer output of 1.416 mhz is applied to a limiter/amplifier circuit and then via level adjust R16 to J107-H. The 1.416 mhz output is applied to the converter/ALDC assembly Z103.

The dc operating potentials for the frequency shift keying portion of Z107 are +24 vdc at J107-9 and +12 vdc at J107-J; both are applied to dc regulator circuitry. The 1 mhz input at J107-4 is applied to a keyer circuit which is, in effect, a modulator. The 1 mhz input is interrupted by a dc current input at J107-E,F, representing marks and spaces from an externally connected dry contact keyer or teletype input at TB105-15,16. (Refer also to Figure 10. Overall Schematic Diagram, MFER-1 Multi-Mode, Channelized Exciter.) When dry contact keying is used the FS loop switch S111 is set to 100 v or 50 v positions; when teletype keying is used S111 is set to 20 ma or 60 ma positions to match the dc battery loop. By keying the 1 mhz input, a frequency shift above and below center frequency is obtained, corresponding to marks and spaces of the teletype input. This signal is rectified, and the resultant varying dc signal is applied to a series of dc amplifiers, Q3 thru Q5, and an output emitter follower Q6. Amplifier Q4 is inserted in the circuit when sense switch S109 is in the positive (+) position; otherwise, in the negative (-) position, Q4 is by-passed. The variable dc output is developed across FSK balance potentiometer R22 and applied to FSK shift potentiometer R23; the dc output is coupled from J107-5 to the SHIFT switch S110. FSK center frequency adjust potentiometer R25 sets the average level about which the dc signal varies (J107-7) and thus the center frequency of the 3.0 mhz VXCO oscillator in the power supply assembly. A regulated +12 vdc is also applied to the SHIFT switch S110 (J107-6). SHIFT switch S110 effectively sets the amplitude of the dc signal varying about the average dc level as set by R25.

The remaining circuitry on Z107 is applicable to facsimile operation and only utilized in special system configurations of the MFER-1.

For further isolation of the faulty component(s) refer to the following figures for the Z107 assembly: Figure 19. Schematic Diagram, Frequency Shift Generator/Oscillator-Mixer Z107 and Figure 20. Component Location and Parts List, Frequency Shift Generator/Oscillator-Mixer Z107.

(6) Converter/ALDC Assembly Z103. (Reference Figure 7. Servicing Block Diagram, Converter/ALDC Assembly Z103) The converter portion of Z103 receives a nominal 250 khz signal input at J103-L. With the A1 mode selected the signal is 250 khz; with the A2 mode selected the signal is 250 khz ±1 khz, or with the A2H mode selected the signal is 250 khz +1 khz. This nominal 250 khz signal is applied to a difference mixer on Z103, which also receives a 1.666 mhz signal from the carrier generator Z104, via J103-15 and an amplifier circuit. The difference mixer provides a nominal output of 1.416 mhz to an amplifier stage in the A1, A2 and A2H modes. In the F1 mode the 1.416 mhz is provided by the frequency shift generator Z107, via J103-8, to the same 1.416 mhz amplifier stage. The gain of the amplifier stage is controlled by ALDC in certain system configurations. With an ALDC input connected at J123, the ALDC signal is routed via J103-E to an ALDC circuit, the control voltage output, of which, is applied to the 1.416 mhz amplifier. The 1.416 mhz signal output from the first amplifier stage is applied to a filter and two additional stages of amplification. The 1.416 mhz output signal at J103-A is applied to the RF OUTPUT control R102.

For further isolation of the faulty component(s) refer to the following figures for the converter/ALDC assembly: Figure 21, Schematic

Diagram, Converter/ALDC Z103 and Figure 22. Component Location and Parts List, Converter/ALDC Z103.

(7) RF Amplifiers Z101, Z102, Z111, Z112, Z113. (Reference Figure 8. Servicing Block Diagram, RF Amplifiers Z101, Z102, Z111, Z112, Z113) There are up to five separate rf amplifier assemblies in the MFER-1, each one representing a separate channel output. Only one rf amplifier is enabled at a time by a switched +24 vdc from the CHANNEL selector switch to pin P of the respective assembly (Z101, Z102, Z111, Z112 or Z113). Each rf assembly has an oscillator, the frequency, of which, is determined by the channel output frequency (f). The oscillator frequency is the channel output frequency plus 1.416 mhz (f + 1.416 mhz): i.e. - when the channel output frequency is 500 khz, the oscillator frequency on the rf amplifier assembly will be 500 khz plus 1.416 mhz or 1.916 mhz. The oscillator output is applied, via an amplifier stage, to a balance mixer circuit. Each rf amplifier assembly also receives a 1.416 mhz input from the RF OUTPUT control at pin N. The 1.416 mhz input is also applied, via an amplifier stage, to the balanced mixer circuit. The output of the balanced mixer is applied to four stages of amplification. The amplifier stages are tuned to the channel output frequency, (f + 1.416 mhz) - (1.416 mhz) = f. The level of rf output is controlled by level adjust R9 between the 1st and 2nd rf amplifier stages. The output of the rf amplifiers is fed via pin A to the rf output assembly Z115.

For further isolation of the faulty component(s) refer to the following figures for the rf amplifier assemblies: Figure 23. Schematic Diagram, RF Amplifiers Z101, Z102, Z111, Z112, Z113 and Figure 24. Component Location and Parts List, RF Amplifiers Z101, Z102, Z111, Z112, Z113.

(8) RF Output Assembly Z115. (Reference Figure 9. Servicing Block Diagram, RF Output Assembly Z115) The rf output assembly Z115 receives an rf input at J115-B from the enabled rf amplifier assembly (Z101, Z102, Z111, Z112, or Z113). There are two stages of rf amplification on Z115. The +24 vdc and +30 vdc supply line inputs at J115-F and J115-9, respectively, are also coupled to the METER switch S104, effectively placing MONITOR M101 in series with the supply lines and rf amplifiers. (Refer to Figure 10 for this interconnect.) With the METER switch S104 in the Q1 or Q2 positions, the collector current of the respective amplifier stages is monitored. The rf output signal is applied via J115-P to the rf output jack J124 and also applied to an rf metering circuit on the Z115 assembly. The dc output from the metering circuit is applied via J115-12 to the RF output position of the meter switch S104. In this position the MONITOR M101 displays the relative amplitude of the output signal.

For further isolation of the faulty component(s) refer to the following figures for the rf output assembly: Figure 25. Schematic Diagram, RF Output Assembly Z115 and Figure 26. Component Location and Parts List, RF Output Assembly Z115.

4. ALIGNMENT

a. GENERAL. The following paragraphs present the alignment procedures required to maintain the MFER-1 Multi Mode, Channelized Exciter in satisfactory operating condition. When performing the alignment procedures, the

technician should refer to Figure 12. Overall Component Location, MFER-1 and to the individual component location figures for the printed circuit board assemblies.

CAUTION

When removing printed circuit board assemblies to mount on the extender board for alignment, it is good practice to set the ON/STANDBY switch to the STANDBY position before removing an assembly. Once the assembly has been mounted in the extender board and inserted in the proper chassis socket, the ON/STANDBY switch should be set to ON. When removing an assembly from the extender board and returning it to its chassis socket, the same procedure applies.

b. TEST EQUIPMENT REQUIRED. The following test equipment, or its equivalent, is required to perform the complete alignment of the MFER-1:

(1) VOM, Simpson Model 260A.

(2) RF VTVM, Hewlett-Packard Model 410B.

(3) AC VTVM, Ballantine Model 314.

(4) Millivolt Meter, Millivac Model MV-28B.

(5) Audio Generator, Hewlett-Packard Model 200CD.

(6) RF Signal Generator, Hewlett-Packard Model 606A.

(7) Oscilloscope, Tektronix Model 535A with high gain preamplifier L-type plug in.

(8) Spectrun Analyzer, Lavoie Laboratories, Model LA-40A.

(9) Frequency Counter, Hewlett-Packard Model 5244L.

c. POWER SUPPLY ASSEMBLY. Perform the alignment of the power supply assembly as follows:

(1) Remove the rf output assembly Z115 from the MFER-1.

(2) With the ON/STANDBY switch in the STANDBY position, connect the line power cord from the ac power source to J116 on the MFER-1. The STANDBY indicator should illuminate.

(3) Set the ON/STANDBY switch to the ON position. The POWER indicator should illuminate and the STANDBY indicator should extinguish.

NOTE

Allow atleast 30 minutes for equipment to warm up.

(4) Mount the Z303 assembly on an extender board, and with the ON/STANDBY switch in the STANDBY position, set potentiometers R3 and R12 fully clockwise. Set the ON/STANDBY swtich to the ON position.

(5) With a VOM, measure the dc voltage level at J304-6; it should be approximately +45 vdc.

(6) With a VOM, measure the dc voltage level at J304-A; it should be approximately +40 vdc.

(7) With a VOM, measure the dc voltage level at J304-E; it should be approximately +20 vdc.

(8) With a VOM, measure the dc voltage level at J303-A; it should be approximately +40 vdc.

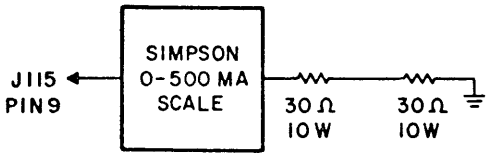
(9) With a VOM, measure the dc voltage level at J303-E; it should be approximately +20 vdc.

(10) Monitor the dc voltage level at J303-F with the VOM, and adjust R8 on Z303 for exactly +12 vdc (all cards inserted except Z115). Adjust R3 until the voltage level just commences to drop, and then back off R3 for a meter reading of exactly +12 vdc.

(11) Monitor the dc voltage level at J304-4 with the VOM, and adjust R12 until the voltage level just commen es to drop, and then back off R12 for a meter reading of exactly +24 vdc.

(12) With a VOM, measure the dc voltage level at J301-E; it should be 30 $\pm$1 vdc.

(13) Set the ON/STANDBY switch to the STANDBY position and the METER switch to the Q1 position. Connect the test arrangement shown in the following sketch:



(14) Observe the current reading on the VOM. Let the 0-5 dial divisions on the MONITOR meter of the MFER-1 represent 0-500 millamperes. Adjust R142 so that the MONITOR reading is the same as observed on the VOM.

(15) Disconnect test equipment, and return the Z303 assembly to the proper chassis socket.

d. CARRIER GENERATOR ASSEMBLY Z104. Perform the alignment of the carrier generator assembly as follows:

(1) Mount the Z104 assembly on the extender board.

(2) Connect an oscilloscope between J104-15 and ground; a 1 mhz signal at approximately 2.4 volts peak-to-peak should be displayed.

(3) Connect the oscilloscope to TP10, and adjust transformers T3 through T7 for maximum 5 mhz signal (level of approximatell 0.7 volt peak-to-peak).

(4) Connect the oscilloscope to Z2 pin 9; a 1.666 mhz square-wave signal should be displayed (level of approximately 4 volts peak-to-peak.

(5) Connect the oscilloscope to the base of transistor Q11; a 1.666 mhz sinewave signal should be displayed (level of approximately 0.14 volt peak-to-peak).

(6) Connect the oscilloscope to TP13, and adjust transformers T8 through T10 for maximum 1.666 mhz signal (level of approximately 0.8 volt peak-to-peak).

(7) Set the EXCITER switch to the ON position.

(8) Connect the oscilloscope to Z1 pin 9; a 250 khz squarewave signal should be displayed (level of approximately 4 volts peak-to-peak).

(9) Connect the oscilloscope to the base of transistor Q3; a 250 khz sinewave signal should be displayed (level of approximately 0.4 volt peak-to-peak).

(10) Connect the oscilloscope to TP2, and adjust transformers T1 and T2 for maximum 250 khz signal (level of approximately 2.0 volts peak-to-peak).

(11) Set the MODE switch to the A1 position, and connect the millivolt meter to J103-L. Adjust potentiometer R23 on the Z104 assembly for 10 millivolts rms.

(12) With the millivolt meter still connected to J103-L, set the MODE switch to the A2H position and the CARR SUPPR switch to the -6 db position. Remove the Z108 assembly from the MFER-1 chassis. Adjust potentiometer R27 on the Z104 assembly for 5 millivolts rms.

(13) Return the Z108 assembly to the proper chassis socket.

(14) Connect the millivolt meter to J104-K and adjust R24 on the Z104 assembly for .61 volts rms.

(15) Disconnect test equipment, and return the Z104 assembly to the proper chassis socket.

e. CONVERTER/ALDC ASSEMBLY Z103. Perform the alignment of the converter/ALDC assembly as follows:

(1) Mount the Z103 assembly on the extender board.

(2) Set the EXCITER switch to the ON position and the MODE switch to the A1 position.

(3) Connect the oscilloscope to J103-15. The 1.666 mhz signal should be displayed (level of approximately 3.5 volts peak-to-peak).

(4) Connect the oscilloscope to the collector of transistor Q1 and adjust transformer T1 for maximum signal output (approximately 0.5 volt peak-to-peak).

(5) Set the following controls on the front panel of the MFER-1 to minimum levels: RF OUTPUT, USB and LSB LINE GAIN, MIKE GAIN and VOX GAIN.

(6) Connect the oscilloscope to the cathode of diode CR1 (junction of CR1 and R10), and adjust transformer T2 for maximum signal output.

(7) Adjust potentiometer R6 for minimum 1.666 mhz signal, and repeat steps (6) and (7) until maximum tuning is obtained.

(8) Connect the oscilloscope on the hot side of R23 and adjust T3 for maximum output.

(9) Connect the oscilloscope to J103-A and adjust transformers T2 through T4 for maximum signal output. The output should be a 1.416 mhz signal at an approximate level of 1.0 volt peak-to-peak.

(10) Disconnect test equipment, and return the Z103 assembly to the proper chassis socket.

f. TONE GENERATOR/A2 MODULATOR ASSEMBLY Z108. Perform the alignment of the tone generator/A2 modulator assembly as follows:

(1) Mount the Z108 assembly on the extender board.

(2) Set the EXCITER switch to the ON position and the MODE switch to the A2 position.

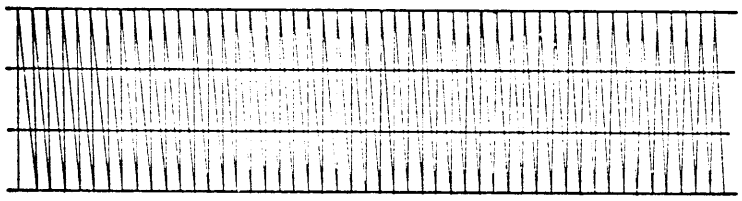
(3) Connect the oscilloscope to J108-13 and adjust potentiometer R27 for maximum signal output. (The frequency of the audio tone should be approximately 1 khz.)

(4) Connect the oscilloscope to J108-15; the audio tone input signal should be displayed.

(5) Connect the oscilloscope to J108-L; a 250 khz signal should be displayed,

(6) Connect the oscilloscope to J108-E and adjust T2 for maximum signal output. (It may be necessary to increase the signal level with R20 for a convenient display on the oscilloscope.)

(7) Connect the oscilloscope to J103-A and set the MODE switch to the A1 position. A 1.416 nmhz sinewave signal should be displayed at a level of approximately 1.0 volt peak-to-peak. Adjust the volts/cm switch and variable volts/cm control on the oscilloscope so that the displayed sinewave occupies a total of 3 cm divisions.

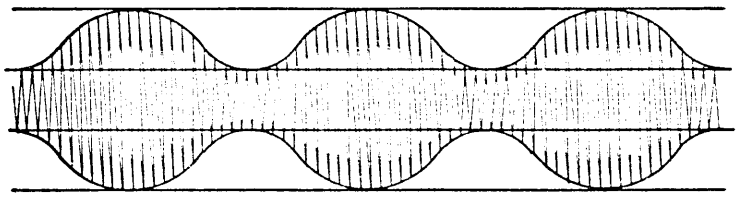


A1 Mode Peak-to-Peak Representation

NOTE

Do not change the volts/cm controls on the oscilloscope as set in step (7) for the adjustment outlined in step (8).

(8) With the oscilloscope still connected to J103-A and adjusted as per step (7), set the MODE switch to the A2 position. Alternately adjust R20 on Z108 for peak-to-peak amplitude and R24 on Z104 for percent of modulation until a 50% modulated signal at 3 cm divisions peak-to-peak on the oscilloscope is obtained.



A2 Mode, 50% Modulation, Peak-to-Peak Representation

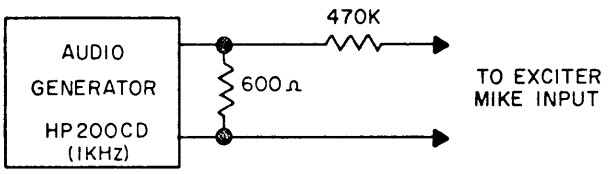
(9) Disconnect test equipment, and return the Z108 (and Z104) assemblies to the proper chassis sockets.

g. A2H GENERATOR Z105. Perform the alignment of the A2H generator as follows:

(1) Mount the Z105 assembly on the extender board.

(2) Set the EXCITER switch to the ON position and the MODE switch to the A2H position.

(3) Connect the audio generator to the MFER-1 MIKE input jack as shown in the following sketch.



(4) Adjust the audio generator to 1 khz at a level of 1.4 millivolts rms (measure level at J105-D with the millivolt meter).

(5) Connect the meter to J105-A, and adjust potentiometer R8 for a level of 50 millivolts rms.

(6) Connect the millivolt meter to J105-15 (the 250 khz input). The signal level should be approximately 0.6 volt rms.

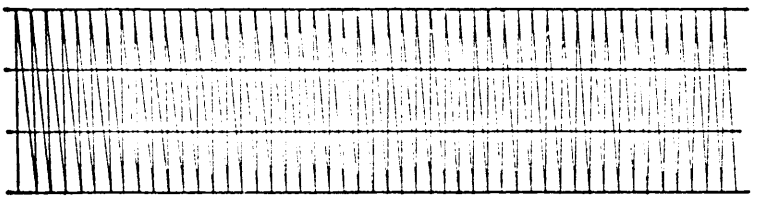
(7) Set the AGC potentiometer R56 fully clockwise.

(8) Connect the millivolt meter to the base of the transistor Q11, and adjust transformer T2 for maximum output.

(9) Connect the millivolt meter to the collector of Q12 (junction of R60 and R40), and adjust transformer T3 for maximum output.

(10) Connect the millivolt meter to the cathode of CR3 and adjust potentiometer R56 for a level of 0.2 volt rms; adjust transformer T4 for maximum indication.

(11) Connect the oscilloscope to J103-A and set the MODE switch to the A1 position and the CARR SUPPR switch to the -6 db position. A 1.416 mhz sinewave signal should be displayed at a level of approximately 1.0 volt peak-to-peak. Adjust the volts/cm switch and variable volts/cm control on the oscilloscope so that the displayed sinewave occupies a total of 3 cm divisions.

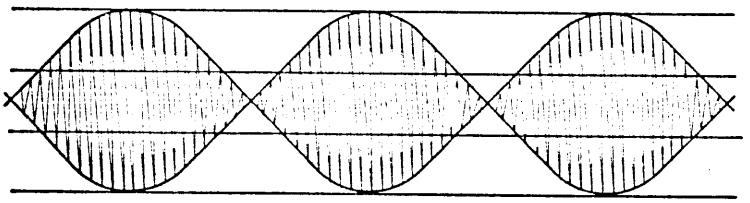


A1 Mode Peak-to-Peak Representation

NOTE

Do not change the volts/cm controls on the oscilloscope as set in step (11) for the adjustment outlined in step (12).

(12) With the oscilloscope still connected to J103-A and adjusted as per step (11), set the MODE switch to the A2H position. Alternately adjust R56 on Z105 for peak-to-peak amplitude and R27 on Z104 for sharp crossover until the following waveform is obtained at 3 cm divisions peak-to-peak on the oscilloscope.



A2H Mode Peak-to-Peak Representation

(13) Using the resistance function, connect the VOM across J105-H and J; a o ohm indication should be read on the VOM. Set the EXCITER switch to the PTT/VOX position; the VOM should read infinity.

(14) Disconnect test equipment, and return the Z105 (and Z104) assemblies to the proper chassis sockets.

h. FREQUENCY SHIFT GENERATOR/OSCILLATOR-MIXER Z107. Perform the alignment of the frequency shift generator/oscillator-mixer as follows:

(1) Connect the frequency counter to the vertical output terminals of the oscilloscope. Set the MODE switch to the F1 position and the EXCITER switch to the ON position. On the rear panel of the MFER-1, set potentiometer R101 to mid-range, SHIFT switch to ±425 hz (maximum shift position), SENSE switch to the (+) position, and S111 to the CONT. position.

NOTE

FSK adjustments must be made after the 3.0 mhz oscillator oven has warmed up for at least an hour.

(2) Set R22 and R23 on Z107 fully counterclockwise.

(3) Connect the oscilloscope to J107-M, and adjust R25 for a reading of 3.000000 mhz on the frequency counter.

(4) Mount the Z107 assembly on the extender board.

(5) Connect the oscilloscope to J105-H, and adjust potentiometer R16 for maximum signal output level on the oscilloscope and C20 for a frequency reading of 1.416666 mhz on the counter.

(6) Return the Z107 assembly to the proper chassis socket.

(7) With the oscilloscope connected to J105, adjust R25 (if required) for a frequency reading of 1.416666 mhz on the counter.

(8) Adjust potentiometer R23 for a frequency of 1.416241 mhz on the counter. Set the SENSE switch to the (-) position and adjust potentiometer R22 for a frequency reading of 1.417091 mhz on the counter.

(9) Repeat step (8) until the frequencies are within 5 hz.

(10) Set the SHIFT switch to the ±212 hz position and the SENSE switch to the (+) position. The frequency counter should read 1.416878 mhz ±15 hz.

(11) Repeat step (10) for the +106 hz SENSE switch position and for the ±53 hz position. The tolerance is ±7 hz for the ±53 hz position.

(12) Mount the Z107 assembly on the extender board.

(13) Connect the oscilloscope to J103-A and set the MODE switch to the A1 position. Observe the peak-to-peak amplitude on the oscilloscope. Set the MODE switch to the F1 position, and adjust R16 on Z107 for the same peak-to-peak amplitude displayed in the A1 mode.

(14) Disconnect test equipment, and return the Z107 assembly to the proper chassis socket.

i. RF AMPLIFIERS Z101, Z102, Z111, Z112, Z113. Perform the alignment of the rf amplifier assemblies as follows:

(1) Mount the rf amplifier assembly (Z101, Z102, Z111, Z112 or Z113) on the extender board. (Insure that Z115 is removed from MFER-1 chassis for this alignment.)

(2) Set the MODE switch to the A1 position, and the CHANNEL switch to the proper position for the rf amplifier being aligned.

NOTE

The oscillator frequency for a particular rf amplifier is determined by adding 1.416667 mhz to the channel output frequency of the rf amplifier.

.500000 mhz	output frequency
+ 1.416667	
1.916667 mhz	oscillator frequency

(3) Determine the oscillator frequency for the rf amplifier being aligned, and adjust the signal generator to that frequency (use a counter for this adjustment.) Set the signal generator output to minimum.

(4) Set the RF OUTPUT control on the MFER-1 to minimum (fully counterclockwise).

(5) Connect the signal generator to the junction of R40, R41, and R39.

(6) Connect the oscilloscope to the junction of R2 and R3, and check the level of the oscillator output. It should be 0.5 volt peak-to-peak.

(7) Connect the oscilloscope to the hot side of C2. Set the signal generator output for an oscilloscope reading of 0.1 volt peak-to-peak and adjust C2 for maximum signal output.

(8) Connect the oscilloscope to the hot side of C7, and adjust C2 and C7 for maximum signal output. Maintain the signal generator output level so that the maximum signal displayed on the oscilloscope is 0.1 volt peak-to-peak.

(9) Connect the oscilloscope to the hot side of C20, and adjust C14 and C20 for maximum signal output. Continue to maintain the signal generator output so that the maximum signal displayed on the oscilloscope is 0.1 volt peak-to-peak.

(10) Connect the oscilloscope to pin A of the amplifier being aligned, and adjust C20 for maximum signal output.

(11) Disconnect the signal generator. Set the EXCITER switch to the ON position and the RF OUTPUT control fully clockwise (maximum output).

(12) Connect the oscilloscope to the hot side of C7, and adjust C2 and C7 for maximum signal output.

(13) Connect the oscilloscope to the hot side of C14, and adjust C7 and C14 for maximum signal output.

(14) Connect the oscilloscope to the hot side of C20, and adjust C14 and C20 for maximum signal output.

(15) Connect the oscilloscope to pin A of the rf amplifier being aligned, and adjust C20 for maximum signal output. Adjust potentiometer R9 for approximately 0.1 volt peak-to-peak.

NOTE

This completes the alignment of the rf amplifier. Final adjustment of potentiometer R9 is performed in the final alignment.

(16) Disconnect test equipment, and return the rf amplifier assembly to the proper chassis socket.

j. RF OUTPUT ASSEMBLY Z115. Perform the alignment of the rf output assembly as follows:

(1) Before inserting the Z115 assembly into the MFER-1 chassis, adjust potentiometers R3 and R8 for maximum resistance. Adjust RF OUTPUT control on the front panel of the MFER-1 fully counterclockwise. Set the MODE switch to the A1 position, the CARR SUPPR switch to -6 db, the CHANNEL switch to the channel 1 position, and the EXCITER switch to the ON position.

(2) Mount the Z115 assembly on the extender board.

(3) Recheck the power supply voltages and readjust as outlined in the power supply alignment procedures in paragraph 4.c.

(4) Set the METER switch to the Q1 position, and adjust R8 on Z115 until the MONITOR on the front panel reads in the green region marked Q1.

(5) Set the METER switch to the Q2 position, and adjust R3 on Z115 until the MONITOR on the front panel reads in the green region marked Q2.

(6) Connect a 50 ohm load to the RF OUT jack J124 on the rear panel of the MFER-1 and connect the RF VTVM across the load.

(7) Adjust the RF OUTPUT control fully clockwise, and adjust T1 and L11 for maximum output level on the VTVM.

(8) Readjust RF OUTPUT control fully counterclockwise.

(9) Disconnect test equipment, and return the Z115 assembly to the proper chassis socket.

k. FINAL ALIGNMENT. Perform the overall final alignment of the MFER-1 as follows:

(1) Set the MODE switch to the A1 position, the CARR SUPPR switch to -6 db, the CHANNEL switch to the channel 1 position, the EXCITER switch to the ON position, and the RF OUTPUT control fully clockwise.

(2) Connect a 50 ohm load to the RF OUT jack J124 on the rear panel of the MFER-1 and connect the RF VTVM and an oscilloscope across the load.

(3) Adjust R9 on the proper rf amplifier assembly for the selected channel (Z101, Z102, Z111, Z112, Z113) for a level of 3.5 volts rms on the RF VTVM. Repeat this adjustment for all channels.

(4) Connect the spectrum analyzer controls so that the signal displayed is at the 0 db reference. (A sinewave should be displayed on the oscilloscope.)

NOTE

The peak-to-peak relationship displayed on the oscilloscope should be the same for all modes in the final alignment.

(5) Set the MODE switch to the F1 position, and adjust R16 on Z107 for 3.5 volts rms on the RF VTVM. (A sinewave should be displayed on the oscilloscope and a signal at 0 db reference should be displayed on the spectrum analyzer.)

(6) Set the MODE switch to the A2H position. Alternately adjust R56 on Z105 for 3.5 volts rms on the RF VTVM and R27 on Z104 so that the two signals displayed on the spectrum amalyzer are equal in amplitude. The level of the two signals on the spectrum amalyzer should be approximately -6 db from the 0 db reference, with 3.5 volts rms output. (A two tone envelope with sharp crossover should be displayed on the oscilloscope.)

(7) Set the MODE switch to the A2 position. (This mode will now be adjusted for approximately 80% modulation.) Alternately adjust R20 on Z108 for 3.5 volts rms on the RF VTVM and R24 on Z104 for percent of modulation. The carrier level on the spectrum analyzer should be approximately -5.4 db from the 0 db reference and the tone level should be approximately -7.8 db from the carrier level, with 3.5 volts rms output. (An A2 modulation envelope of 80% modulation should be displayed on the oscilloscope.)

(8) Disconnect test equipment, and return all assemblies to the proper chassis sockets. Replace top and bottom covers on the MFER-1, and reconnect unit into system.

5. SUPPORT DOCUMENTATION.

The support documentation for servicing the MFER-1, Multi-Mode, Channelized Exciter consists of 29 figures, located in the rear of this Service Manual. Figures 1 thru 9 are servicing block diagrams: figure 1 is an overall block diagram of the MFER-1; figures 2 thru 9 are servicing block diagrams of the individual printed circuit board assemblies. Figure 10 is a schematic wiring diagram of the overall unit, figure 11 is the parts list for the overall unit, and figure 12 is a component location diagram for, assemblies and components located on the overall exciter chassis. Figures 13 thru 29 are schematic and component location diagrams and parts lists for each individual printed circuit board assembly within the MFER-1.

Table 2. lists the manufacturer's engineering drawing numbers for applicable figures. Each number includes a revision letter under which this equipment was manufactured.

TABLE 2. TMC ENGINEERING DRAWINGS

Figure Number	TMC Drawing Number
10	CK1919 Ø
13	CK1918 Ø
14	A4908 Ø
15	CK1913 Ø
16	A4901 Ø
17	CK1917 Ø
18	A4907 Ø
19	CK1920 Ø
20	A4905 Ø
21	CK1495 C
22	A4717 B
23	CK1925 Ø
24	A4894 A
25	CK1399 B
26	A4620 B
27	CK1330 E
28	CK1328 A
	CK1291 B
29	A4512 A
	A4513 B

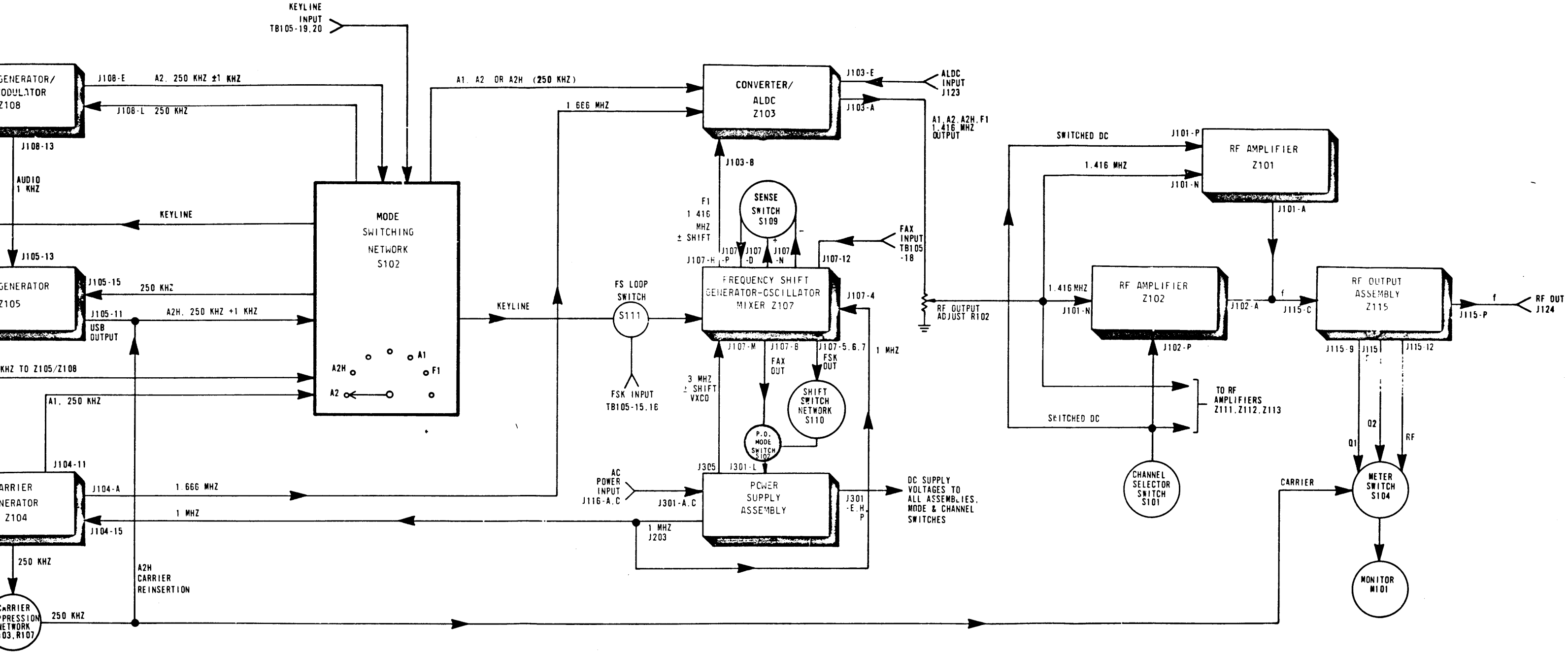
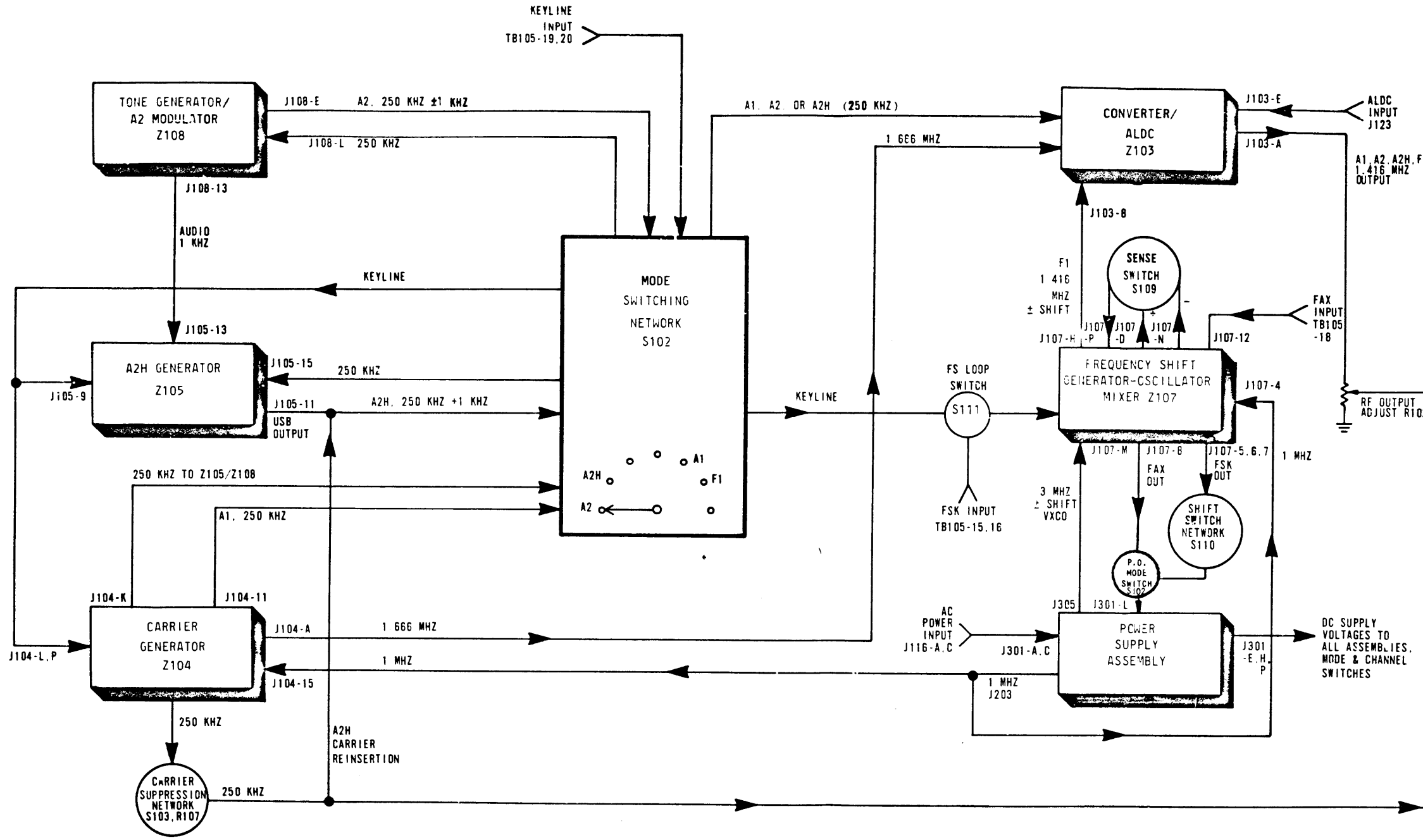


FIGURE 1. OVERALL BLOCK DIAGRAM.
MFER-1 MULTI-MODE, CHANNELIZED EXCITER


KEYLINE INPUT TB105-19,20
TONE GENERATOR/ A2 MODULATOR Z108
J108-E
A2, 250 KHZ ±1 KHZ
J108-L 250 KHZ
J108-13
AUDIO 1 KHZ
KEYLINE
J105-13
A2H GENERATOR Z105
J105-9
J105-15
250 KHZ
J105-11
USB OUTPUT
A2H, 250 KHZ +1 KHZ
250 KHZ TO Z105/Z108
A1, 250 KHZ
MODE SWITCHING NETWORK S102
A1
A2H
F1
A2
KEYLINE
A1, A2, OR A2H (250 KHZ)
1 666 MHZ
CONVERTER/ ALDC Z103
J103-E
ALDC INPUT J123
J103-A
A1, A2, A2H, F1 1.416 MHZ OUTPUT
J103-8
F1 1 416 MHZ ± SHIFT
SENSE SWITCH S109
J107-H
J107 -P
J107 -D
J107 -N
FAX INPUT TB105 -18
J107-12
FS LOOP SWITCH S111
FREQUENCY SHIFT GENERATOR-OSCILLATOR MIXER Z107
J107-4
RF OUTPUT ADJUST R102
J107-M
J107-8
J107-5,6,7
1 MHZ
FAX OUT
FSK OUT
FSK INPUT TB105-15,16
3 MHZ ± SHIFT VXCO
SHIFT SWITCH NETWORK S110
P.O. MODE SWITCH S107
J305
J301-L
AC POWER INPUT J116-A,C
J301-A,C
POWER SUPPLY ASSEMBLY
J301 -E,H, P
DC SUPPLY VOLTAGES TO ALL ASSEMBLIES, MODE & CHANNEL SWITCHES
1 MHZ J203
J104-K
J104-11
CARRIER GENERATOR Z104
J104-L,P
J104-A
1 666 MHZ
1 MHZ
J104-15
250 KHZ
A2H CARRIER REINSERTION
CARRIER SUPPRESSION NETWORK S103, R107
250 KHZ

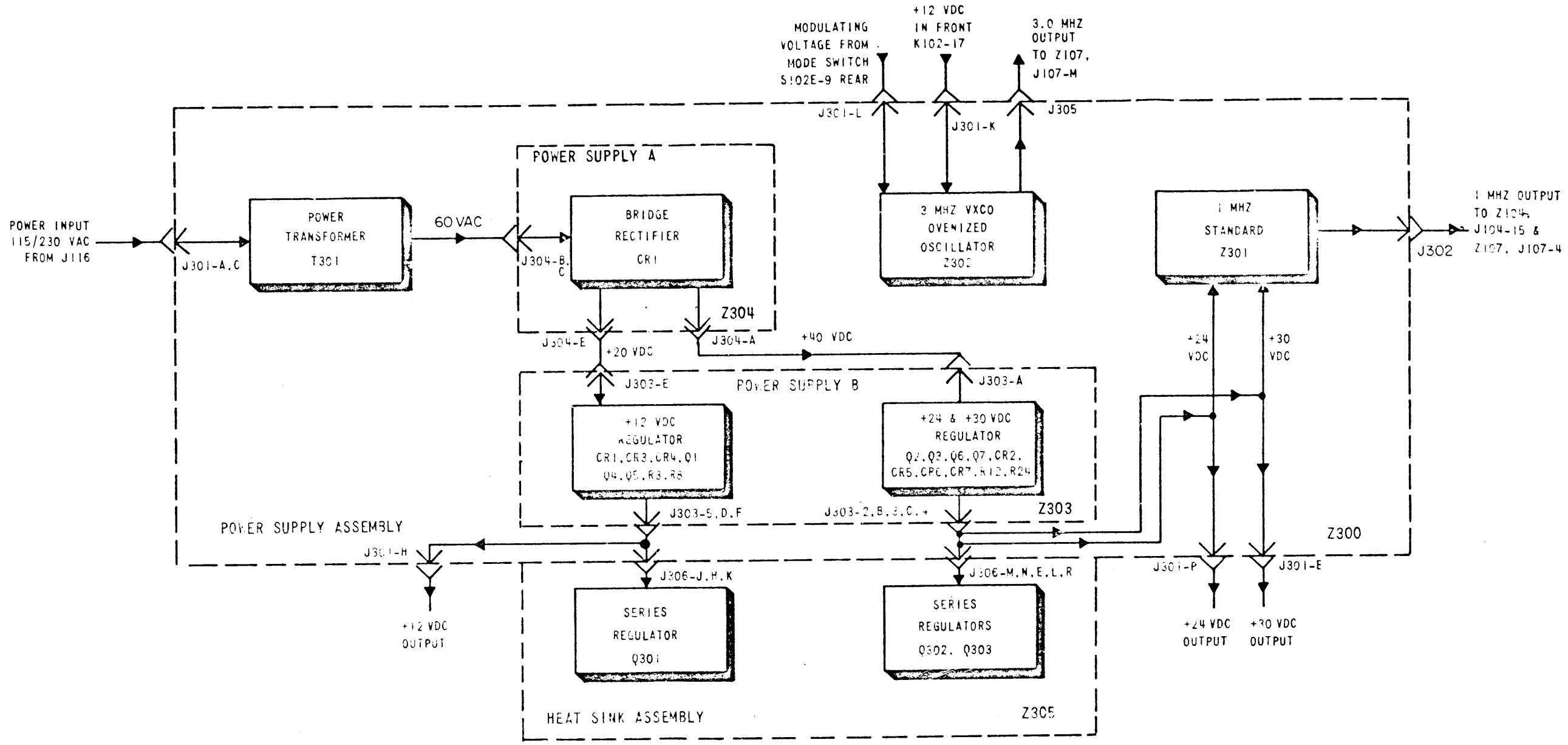


FIGURE 2. SERVICING BLOCK DIAGRAM, POWER SUPPLY ASSEMBLY Z300 SERIES

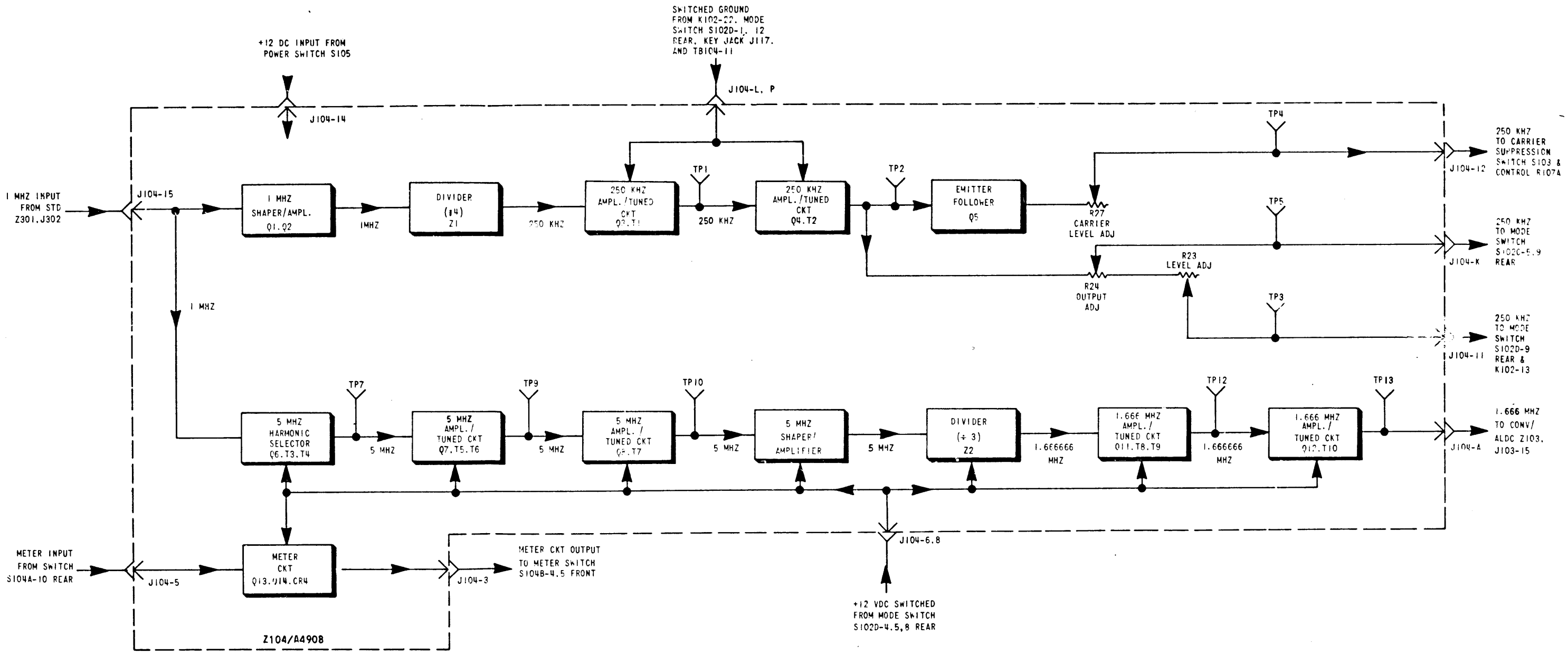
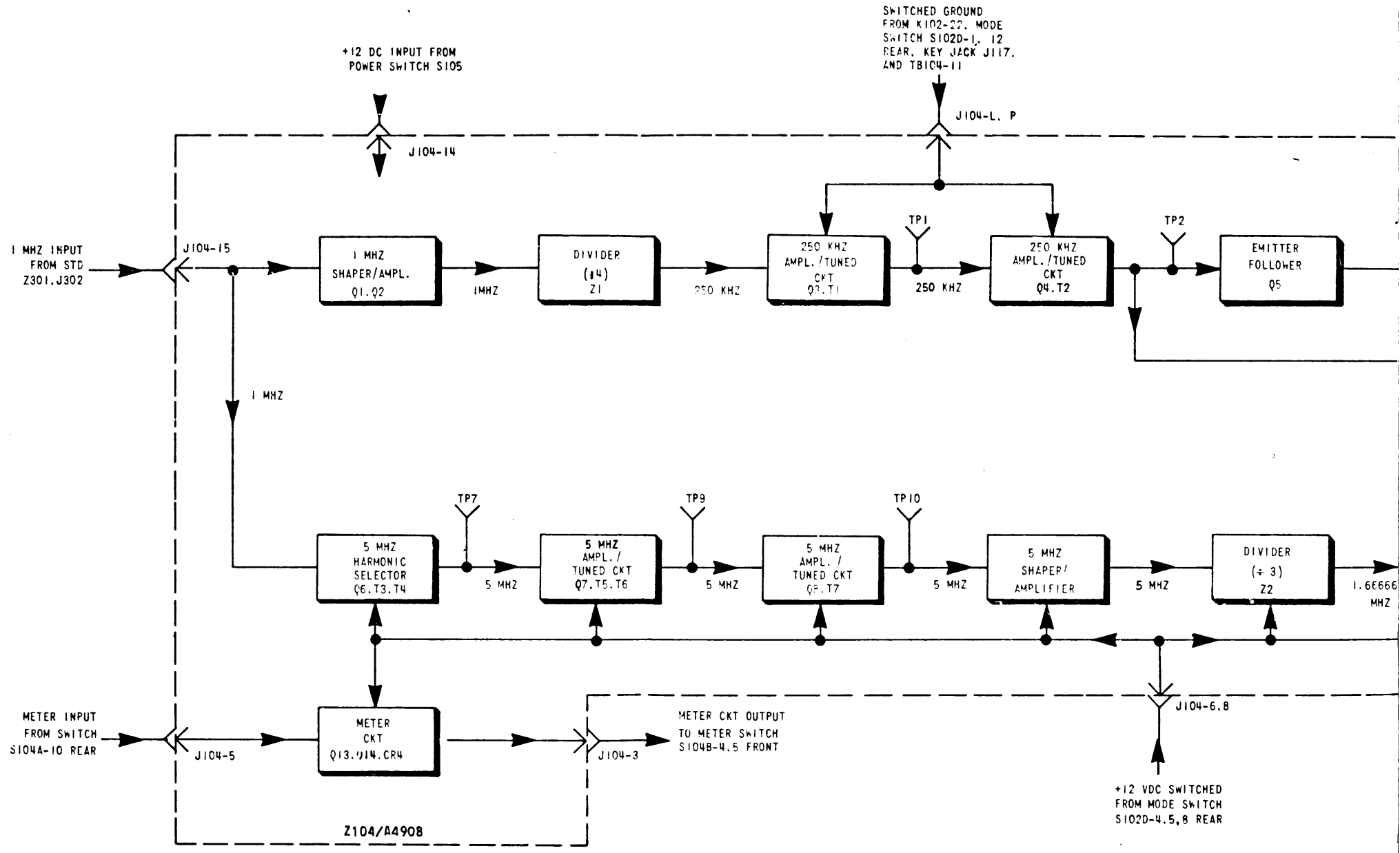


FIGURE 3. SERVICING BLOCK DIAGRAM. CARRIER GENERATOR Z104


+12 DC INPUT FROM POWER SWITCH S105
SWITCHED GROUND FROM K102-22, MODE SWITCH S102D-1, 12 REAR, KEY JACK J117, AND TB1C4-11
J104-L, P
J104-14
1 MHZ INPUT FROM STD Z301, J302
J104-15
1 MHZ SHAPER/AMPL. Q1, Q2
1MHZ
DIVIDER (÷4) Z1
250 KHZ
250 KHZ AMPL./TUNED CKT Q3, T1
TP1
250 KHZ
250 KHZ AMPL./TUNED CKT Q4, T2
TP2
EMITTER FOLLOWER Q5
1 MHZ
TP7
5 MHZ HARMONIC SELECTOR Q6, T3, T4
5 MHZ
TP9
5 MHZ AMPL./TUNED CKT Q7, T5, T6
5 MHZ
TP10
5 MHZ AMPL./TUNED CKT Q8, T7
5 MHZ
5 MHZ SHAPER/AMPLIFIER
5 MHZ
DIVIDER (÷ 3) Z2
1.66666 MHZ
METER INPUT FROM SWITCH S104A-10 REAR
J104-5
METER CKT Q13, Q14, CR4
J104-3
METER CKT OUTPUT TO METER SWITCH S104B-4,5 FRONT
J104-6,8
+12 VDC SWITCHED FROM MODE SWITCH S102D-4,5,8 REAR
Z104/A4908

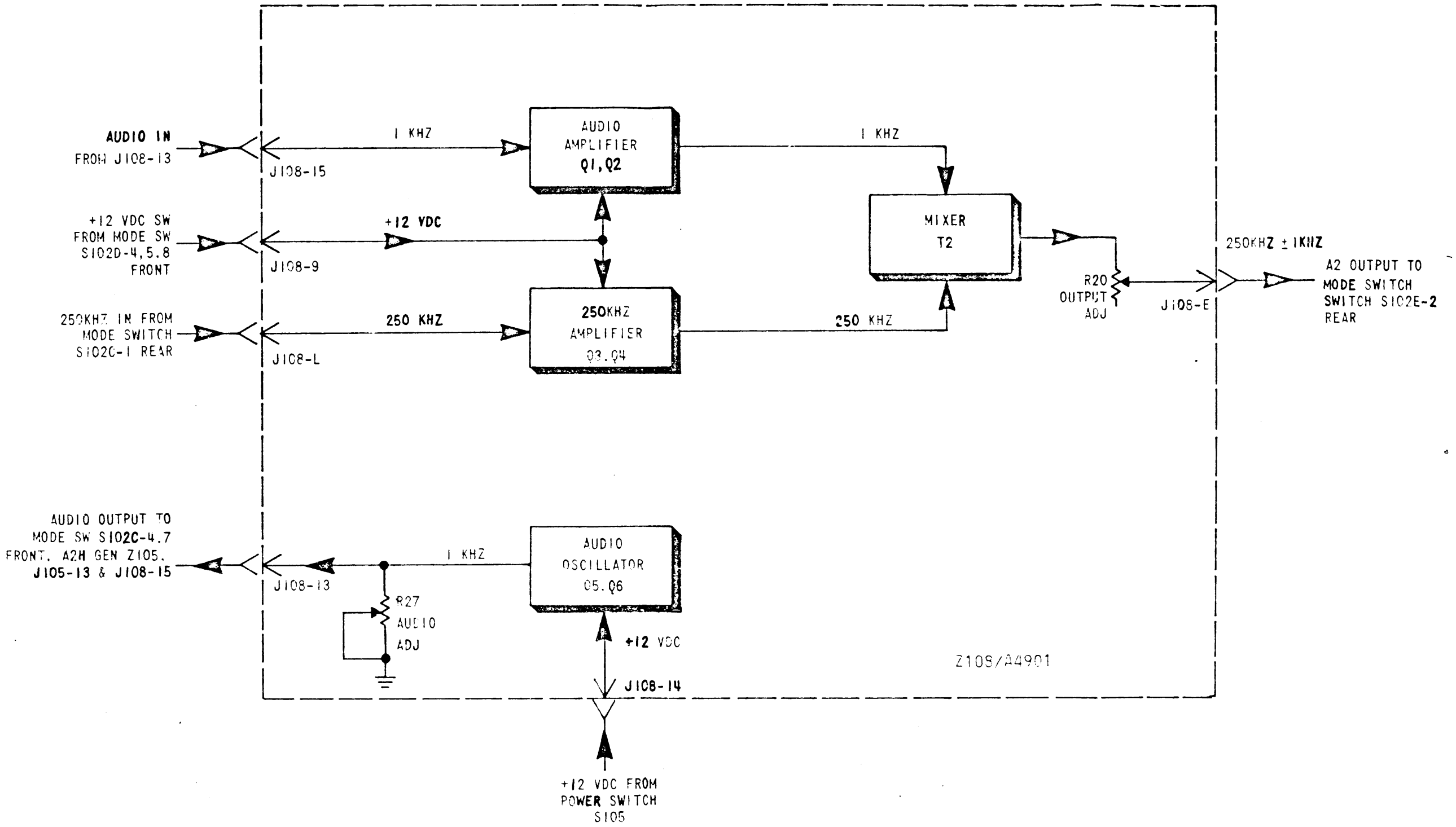


FIGURE 4. SERVICING BLOCK DIAGRAM, TONE GENERATOR/A2 MODULATOR Z108

AUDIO INPUT FROM J118 MIKE INPUT JACK

J104-D

MIKE AMPLIFIER Q1, Q2

R8 LEVEL ADJ

AUDIO AMPLIFIER Q3, Q4, Q5

MIKE AUDIO

J105-A

AUDIO OUT TO MODE SWITCH S102A-5 FRONT

600Ω LINE AUDIO INPUT FROM TB103-1, 2, 3

J105-2, 4, C

AUDIO TRANSFORMER T1

LINE AUDIO

J105-1

500Ω AUDIO OUT TO R104 USB GAIN CONT. & TO MODE SWITCH S102A-3 FRONT

+30 VDC FROM J301-E

J105-10

K1

KEY LINE INPUT SW GROUND FROM K102-22. ODE SW S102D-1, 12 R, KEY JACK J117. & TB104-11

J105-9

RELAY DRIVER CIRCUITRY Q22, Q23, Q24, Q25, Q26, Q27

RELAY CONT.

J105-H

J105-J

TO TRANSMITTER TB103-5, 6

GATE Q15

CONTROL

250 KHZ IN FROM MODE SW S102C-2, 8 REAR

J105-15

250 KHZ AMPLIFIER Q7

250 KHZ

BALANCED MODULATOR Z1

250 KHZ ± AUDIO

USB AMPLIFIER TUNED CKT Q8, T2

USB AMPLIFIER TUNED CKT Q11, T3, Y1, C37

USB AMPLIFIER Q12

USB FILTER Z2

USB EMITTER FOLLOWERS Q17, Q18

J105-11

USB AUDIO TRANSLATED TO 250 KHZ. OUTPUT TO MODE Sw S102E-3 REAR

AUDIO

AGC

AGC

SB AUDIO IN M Z108, J108-15 OR MODE SWITCH S102C-4 FRONT

J105-13

AUDIO AMPLIFIER Q28, Q6

AGC CONTROL Q9

AGC CONTROL Q10

AGC DC AMPLIFIER Q16, Q14, Q13

AGC AMPLIFIER TUNED CKT Q19, T4

R56 AGC ADJ

AGC AMPLIFIER Q20, Q21

+12 VDC

+24 VDC

+12 VDC

J105- 8 R 14

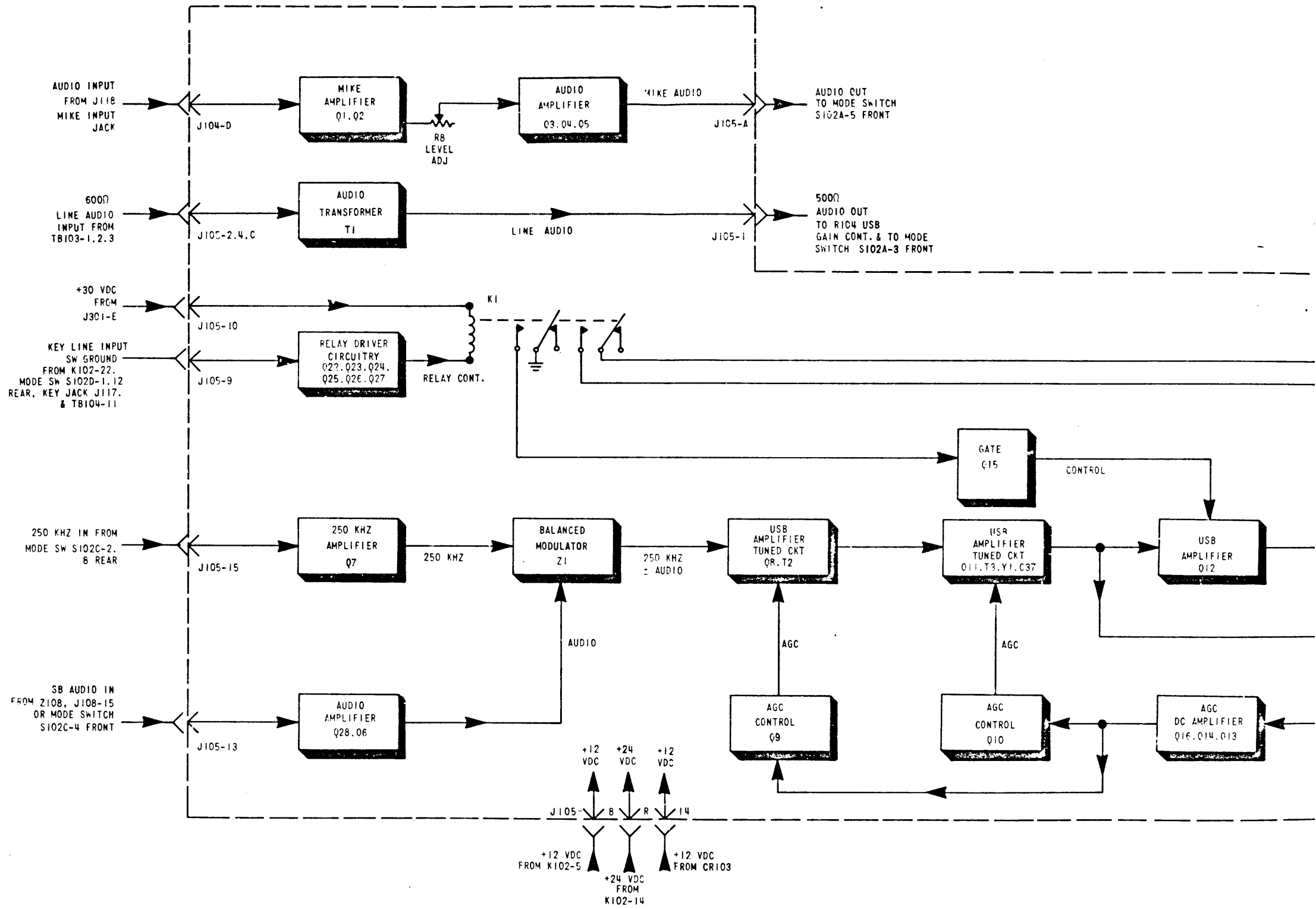
+12 VDC FROM K102-5

+24 VDC FROM K102-14

+12 VDC FROM CR103

Z105/A4907

FIGURE 5. SERVICING BLOCK DIAGRAM. A2H GENERATOR Z105


AUDIO INPUT
FROM J118
MIKE INPUT
JACK
J104-D
MIKE
AMPLIFIER
Q1,Q2
R8
LEVEL
ADJ
AUDIO
AMPLIFIER
Q3,Q4,Q5
MIKE AUDIO
J105-A
AUDIO OUT
TO MODE SWITCH
S102A-5 FRONT
600Ω
LINE AUDIO
INPUT FROM
TB103-1,2,3
J105-2,4,C
AUDIO
TRANSFORMER
T1
LINE AUDIO
J105-1
500Ω
AUDIO OUT
TO R104 USB
GAIN CONT. & TO MODE
SWITCH S102A-3 FRONT
+30 VDC
FROM
J301-E
J105-10
K1
KEY LINE INPUT
SW GROUND
FROM K102-22.
MODE SW S102D-1,12
REAR, KEY JACK J117.
& TB104-11
J105-9
RELAY DRIVER
CIRCUITRY
Q22,Q23,Q24,
Q25,Q26,Q27
RELAY CONT.
GATE
Q15
CONTROL
250 KHZ IN FROM
MODE SW S102C-2,
6 REAR
J105-15
250 KHZ
AMPLIFIER
Q7
250 KHZ
BALANCED
MODULATOR
Z1
250 KHZ
± AUDIO
USB
AMPLIFIER
TUNED CKT
Q8,T2
USB
AMPLIFIER
TUNED CKT
Q11,T3,Y1,C37
USB
AMPLIFIER
Q12
AUDIO
AGC
AGC
SB AUDIO IN
FROM Z108, J108-15
OR MODE SWITCH
S102C-4 FRONT
J105-13
AUDIO
AMPLIFIER
Q28,Q6
AGC
CONTROL
Q9
AGC
CONTROL
Q10
AGC
DC AMPLIFIER
Q16,Q14,Q13
+12
VDC
+24
VDC
+12
VDC
J105-
8
R
14
+12 VDC
FROM K102-5
+24 VDC
FROM
K102-14
+12 VDC
FROM CR103

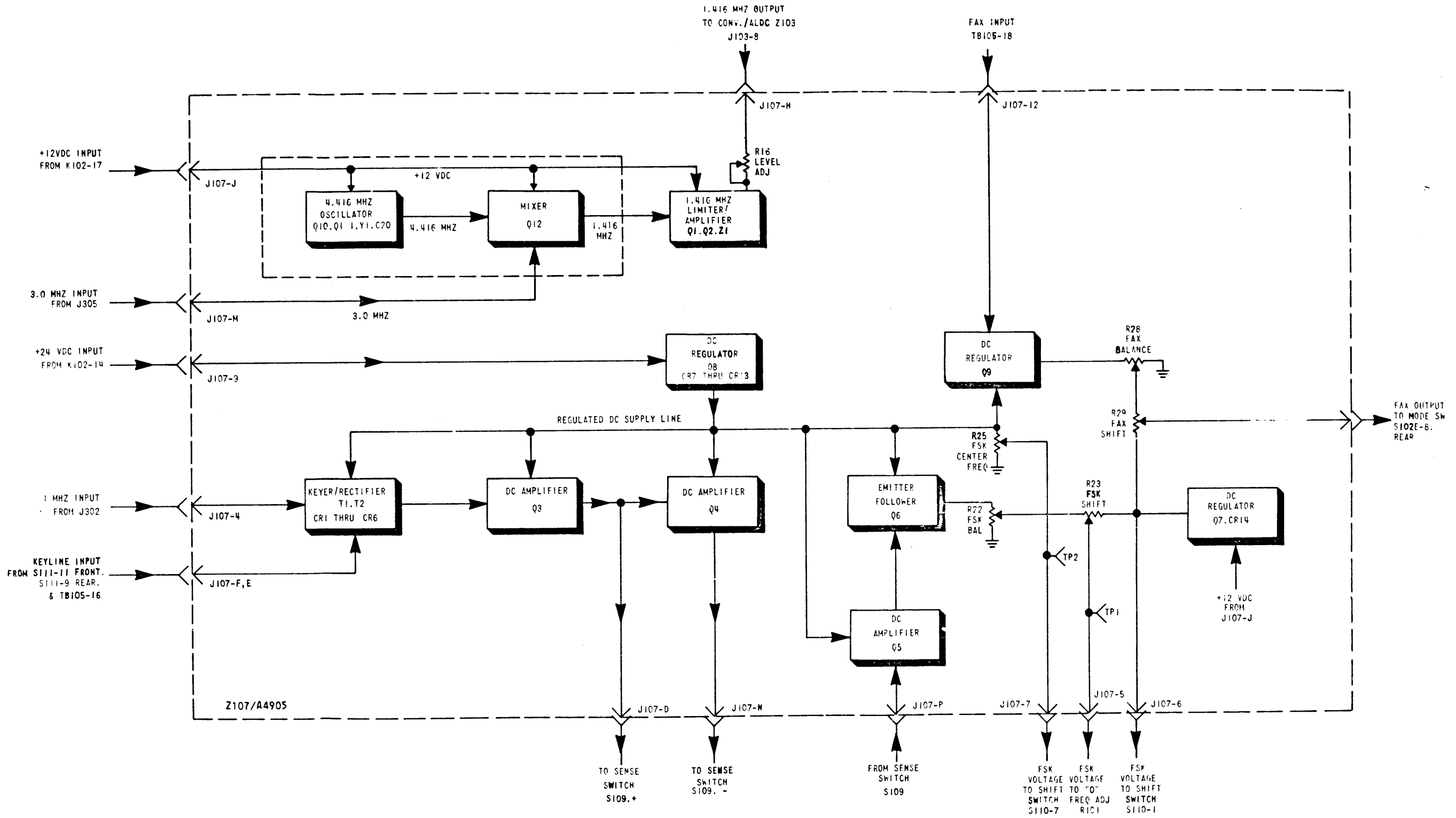
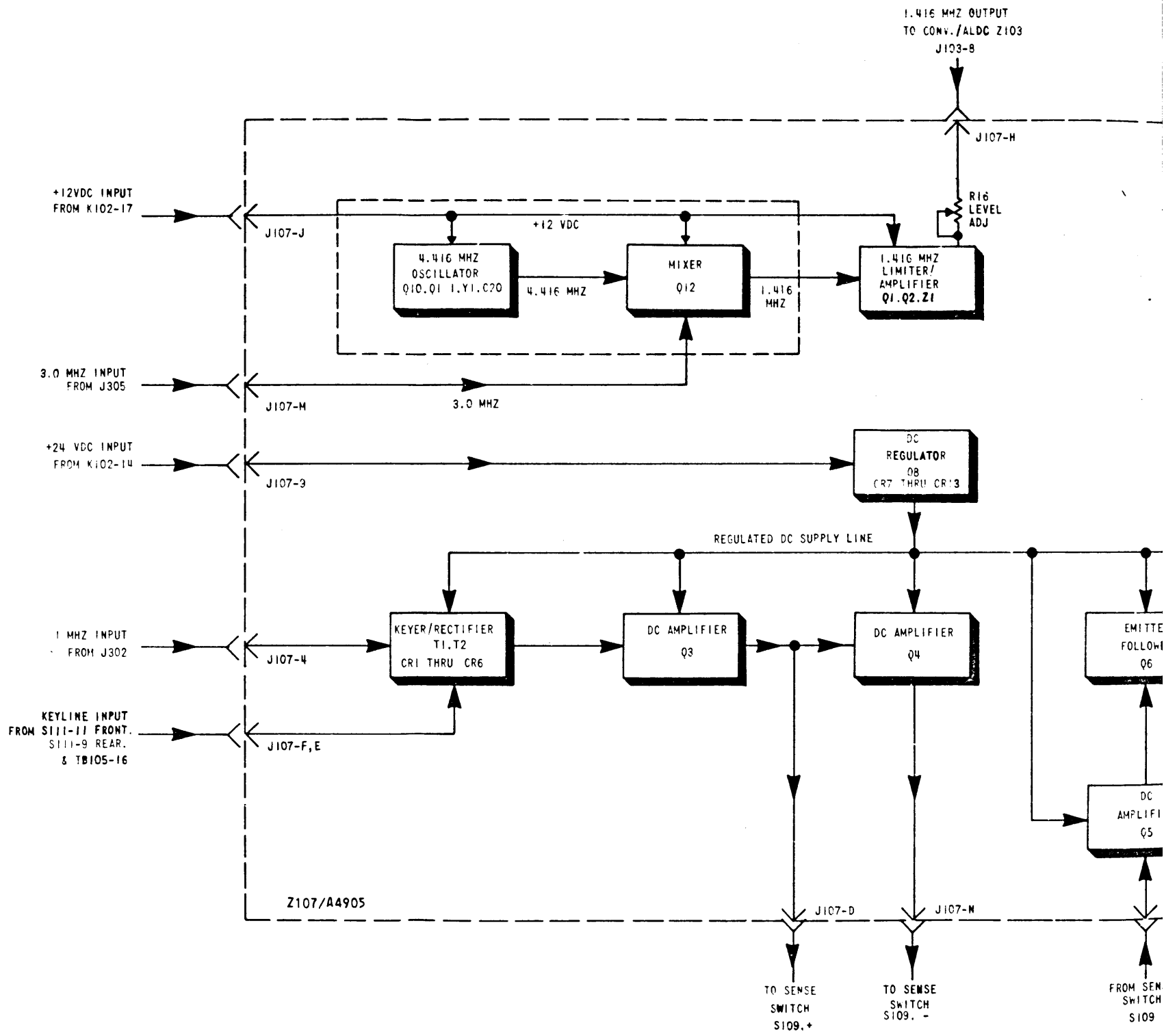


FIGURE 6. SERVICING BLOCK DIAGRAM. FREQUENCY SHIFT GENERATOR/ OSCILLATOR-MIXER Z107


1.416 MHZ OUTPUT
TO CONV./ALDC Z103
J103-8
J107-H
R16
LEVEL
ADJ
+12VDC INPUT
FROM K102-17
J107-J
+12 VDC
4.416 MHZ
OSCILLATOR
Q10,Q1 1,Y1,C20
4.416 MHZ
MIXER
Q12
1.416
MHZ
1.416 MHZ
LIMITER/
AMPLIFIER
Q1,Q2,Z1
3.0 MHZ INPUT
FROM J305
J107-M
3.0 MHZ
+24 VDC INPUT
FROM K102-14
J107-9
DC
REGULATOR
Q8
CR7 THRU CR13
REGULATED DC SUPPLY LINE
1 MHZ INPUT
FROM J302
J107-4
KEYER/RECTIFIER
T1,T2
CR1 THRU CR6
DC AMPLIFIER
Q3
DC AMPLIFIER
Q4
EMITTE
FOLLOWI
Q6
KEYLINE INPUT
FROM S111-11 FRONT.
S111-9 REAR.
& TB105-16
J107-F,E
DC
AMPLIFI
Q5
Z107/A4905
J107-D
J107-N
TO SENSE
SWITCH
S109,+
TO SENSE
SWITCH
S109, -
FROM SEN
SWITCH
S109

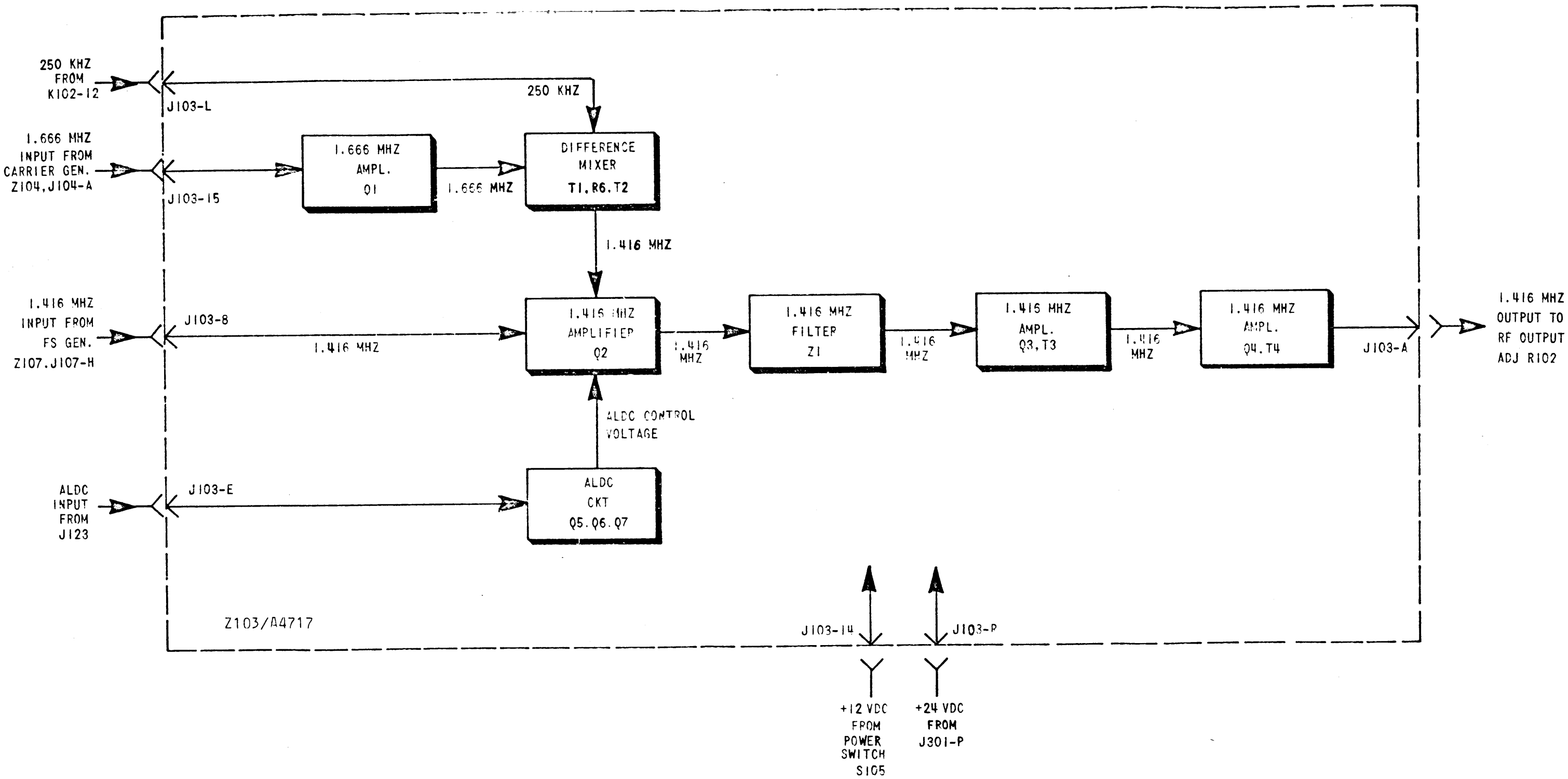


FIGURE 7. SERVICING BLOCK DIAGRAM, CONVERTER/ALDC Z103

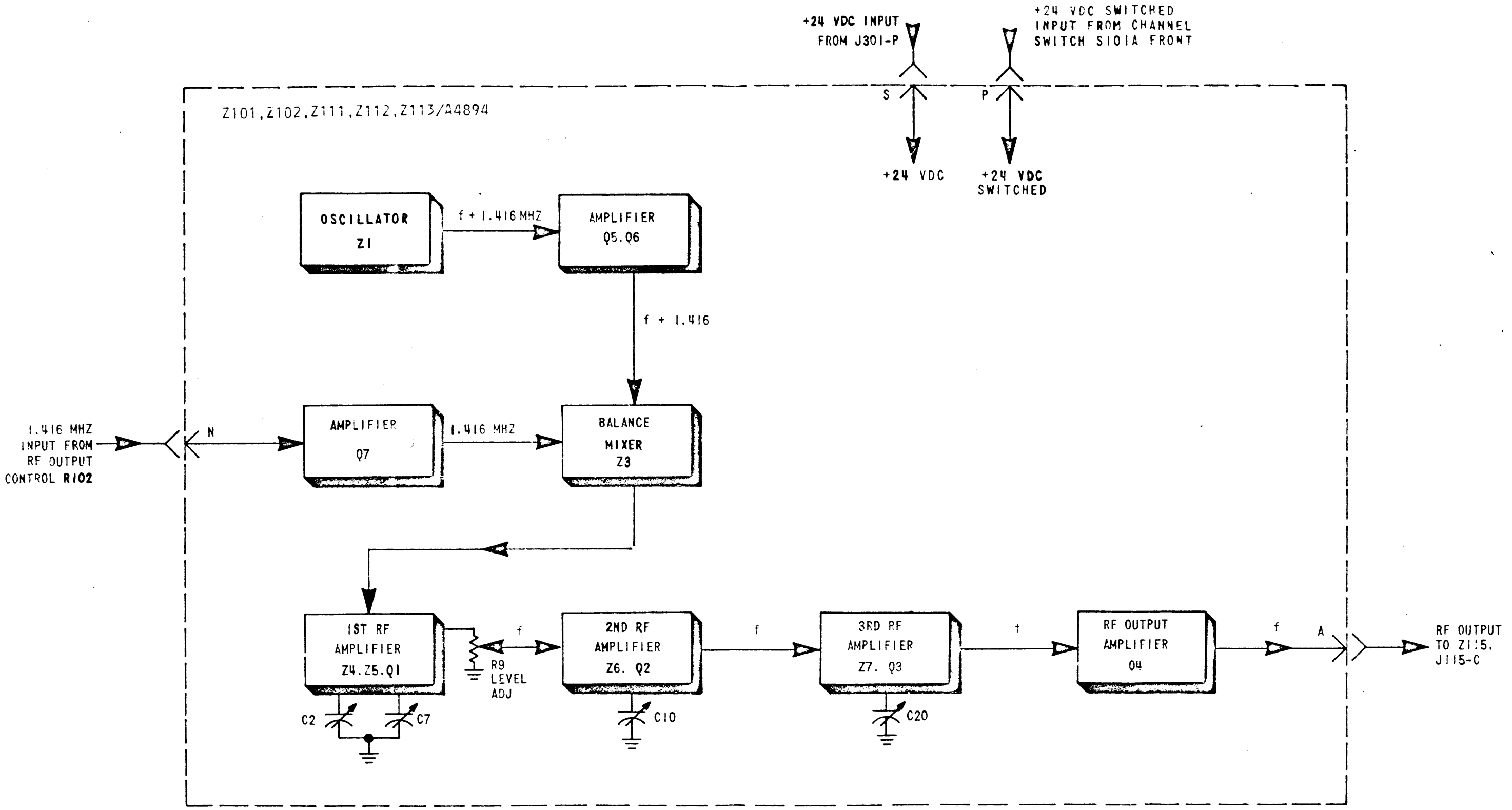


FIGURE 8. SERVICING BLOCK DIAGRAM, RF AMPLIFIERS Z101, Z102, Z111, Z112, Z113

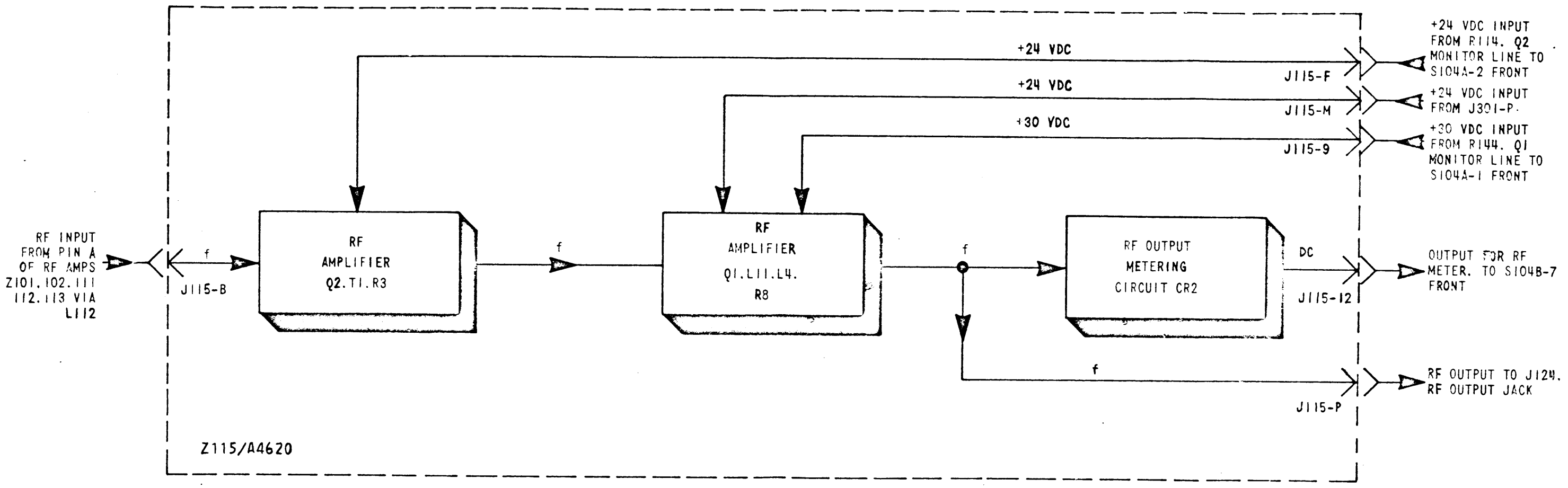


FIGURE 9. SERVICING BLOCK DIAGRAM, RF OUTPUT ASSEMBLY Z115

NOTE

Figure 10 (sheets 1 and 2, of 2) is supplied separately in an envelope, attached to the back cover of this Service Manual.

Figure 10. Overall Schematic Diagram, MFER-1 Multi-Mode, Channelized Exciter

OVERALL PARTS LIST FOR MFE-1

SYMBOL	DESCRIPTION	TMC P/N
C101	Capacitor, Fixed, Mica	CB21Q102K
C102	Same as C101	
C103	Same as C101	
C104	Capacitor, Fixed, Ceramic	CC100-24
C105	Same as C101	
thru		
C109		
C110	Same as C104	
C111	Same as C101	
C112	Capacitor, Fixed, Ceramic	CC100-43
C113	Same as C101	
C114	Same as C101	
C115	Same as C112	
C116	Same as C101	
C117	Same as C101	
C118	Same as C112	
C119	Same as C112	
C120	Same as C112	
C121	Capacitor, Fixed, Ceramic	CC100-29
thru		
C124		
C125	Same as C112	
C126	Same as C112	
C127	Same as C112	
C128	Same as C121	
thru		
C132		
C133	Same as C112	
C134	Same as C121	
C135	Not Used	
C136	Same as C121	
C137	Same as C121	
C138	Same as C112	
thru		
C149		
C150	Capacitor, Fixed, Paper	CN114-1R05J
C151	Same as C112	
C152	Same as C121	
thru		
C160		
C161	Same as C101	
C162	Same as C112	
C163	Same as C112	
C164	Capacitor, Fixed, Mica	CM112E113J5S
C165	Capacitor, Fixed, Mica	CM112E243J5S
C166	Capacitor, Fixed, Elec	CE107-3
C167	Capacitor,	
C168	Same as	
CR101	Semiconductor, Dev, Diode	1N914
CR103		
DS101	Lamp, Incandescent	BI110-7
DS102	Same as DS101	
F101	Fuse, Slow-Blow	FU102-1.00
F102	Same as F101	
J101	Connector, Receptacle, FML	JJ319A15DFE
thru		
J105		
J106	Not Used	
J107	Same as J101	
J108	Same as J101	
J109	Same as J101	
J110	Not Used	
J111	Same as J101	
thru		
J115		
J116	Connector,	
J117	Jack, Telephone	JJ034
J118	Jack	JJ033
J119	Connector, Receptacle, ML	JJ333-10PFS4
K101	Relay, Armature, Min	RL143-4
K102	Relay	RL156-5
L101	Coil, Rf, Fixed	CL240-120
thru		
L104		
L105	Coil, Rf, Fixed	CL349-1
L106	Same as L105	
L107	Same as L101	
thru		
L109		
L110	Choke, Rf	TF418
L111	Same as L105	
L112	Coil, Rf, Fixed	CL275-180
L113	Same as L101	
L114	Same as L101	
L115	Coil, Fixed	CL117
L116	Same as L101	
L117	Same as L101	
L118	Same as L105	
L119	Same as L101	
L120	Same as L101	
M101	Meter	MR191-9
R101	Resistor, Variable, Composition	RV106UX8B102A
R102	Resistor, Variable, Composition	RV4NAYSD101A
R103	Resistor, Variable, Composition	RV4ATRD501B
R104	Same as R103	
R105	Resistor, Variable, Composition	RV4NAYSD253A
R106	Resistor, Variable, Composition	RV110-1
R107A & B	Resistor, Variable, Composition	RV108-2
R108	Resistor, Fixed, Composition	RC07GF681J
R109	Resistor, Fixed, Composition	RC07GF221J
R110	Same as R109	
R111	Resistor, Fixed, Composition	RC07GF222J
R112	Resistor, Fixed, Composition	RC07GF391J
R113	Resistor, Fixed, Composition	RW126-4-1R0
R114	Same as R113	
R115	Resistor, Fixed, Composition	RC07GF473J
R116	Same as R115	
R117	Resistor, Fixed, Composition	RC07GF102J
R118	Same as R117	
R119	Same as R111	
R120	Resistor, Fixed, Composition	RC07GF392J
R121	Resistor, Fixed, Composition	RC07GF563J
R122	Resistor, Fixed, Composition	RC07GF273J
R123	Resistor, Fixed, Composition	RC07GF152J
R124	Resistor, Fixed, Composition	RC42GF151J
R125	Same as R124	
R126	Resistor, Fixed, Composition	RC07GF562J
R127	Resistor, Fixed, Composition	RC07GF822J
R128	Resistor, Fixed, Composition	RC07GF103J
R129	Same as R117	
R130	Same as R117	
R131	Same as R128	
thru		
R133		
R134	Same as R117	
thru		
R137		
R138	Same as R109	
R139	Resistor, Fixed, Composition	RC20GF222J
R140	Same as R139	
R141	Resistor, Fixed, Composition	RC20GF471J
R142	Resistor, Variable, Composition	RV106UX8B103A
R143	Resistor, Fixed, Composition	RC07GF334J
R144	Same as R113	
R145	Resistor, Fixed, Composition	RC07GF104J
R146	Resistor, Fixed, Composition	RC07GF10LJ
R147	Same as R146	
S101	Switch, Rotary	SW473
S102	Switch, Rotary	SW475
S103	Switch, Rotary	SW474
S104	Switch, Rotary	SW476
S105	Switch, Toggle, DPDT	ST22N
S106	Same as S105	
S107	Switch,	
S108	Switch,	
S109	Switch, Toggle, SPDT	ST103-11-62
S110	Switch, Rotary,	SW447
S111	Switch, Rotary	SW466
TB101	Not Used	
TB102	Not Used	
TB103	Term, Board, Barrier	TM100-6
TB104	Same as TB103	
TB105	Term, Board, Barrier	TM100-8
XDS101	Lamp, Incandescent, Red	TS153-2
XDS102	Lamp, Incandescent, White	TS153-5
XF101	Fuse, Holder	FH104-3
XF102	Same as XF101	
XK101	Not Used	
XK102	Socket, Relay	TS171-2
* Z101	RF, Amplifier, Assembly	A-4894
* Z102	Same as Z101	
Z103	Converter/ALDC Assembly	A-4717
Z104	Carrier Generator, Assembly	A-4908
Z105	Sideband Generator Assembly	A-4907
Z106	Not Used	
Z107	FS Generator, Assembly	A-4905
Z108	AM/MCW Assembly	A-4901
Z109	Not Used	
Z110	Not Used	
* Z111	Same as Z101	
thru		
Z113		
Z114	Not Used	
Z115	RF, Output, Assembly	A-4620

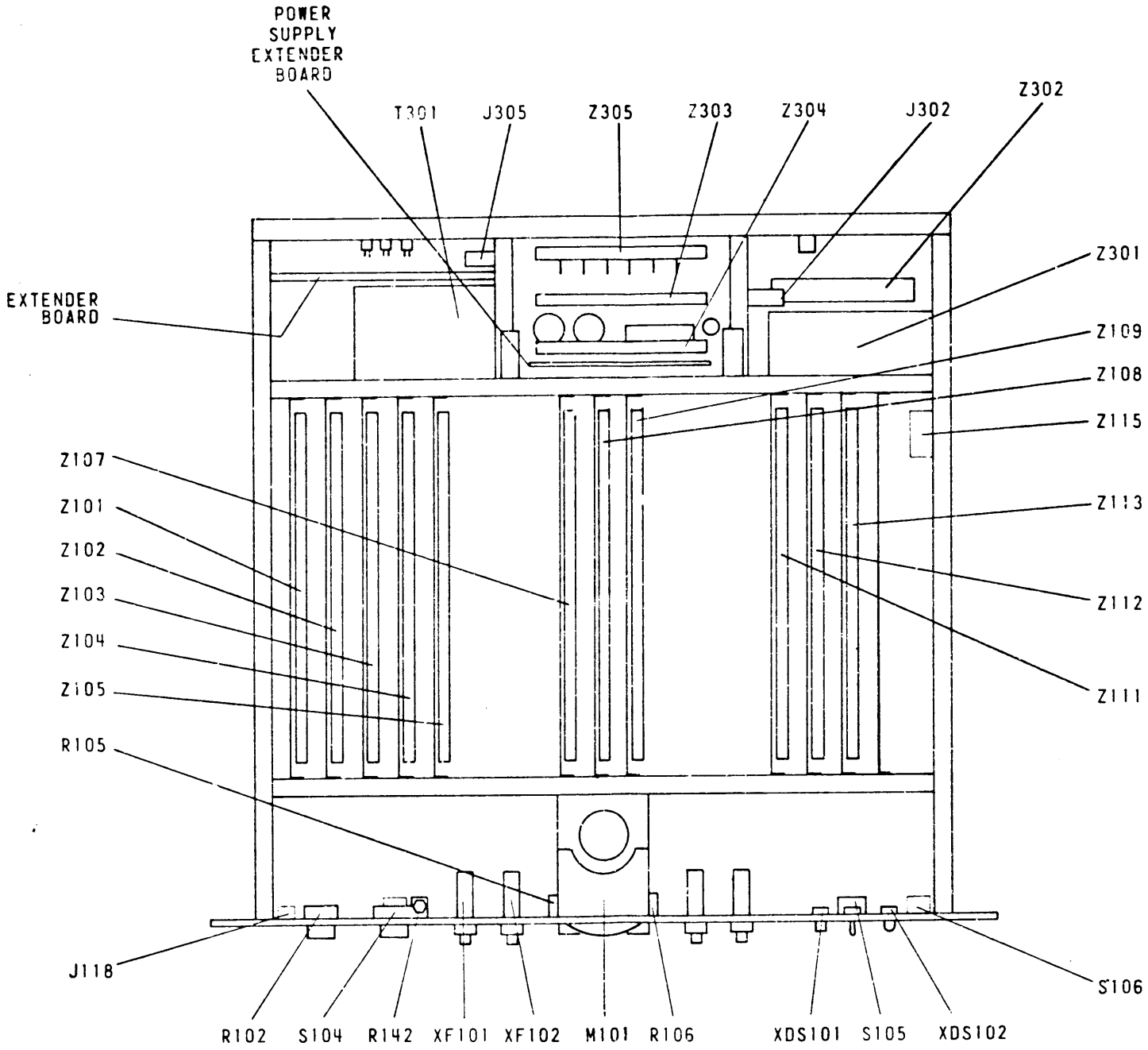
*NOTE: Frequency must be specified when ordering.

FIGURE 11 OVERALL PARTS LIST.
MFER-1 MULTI-MODE. CHANNELIZED EXCITER

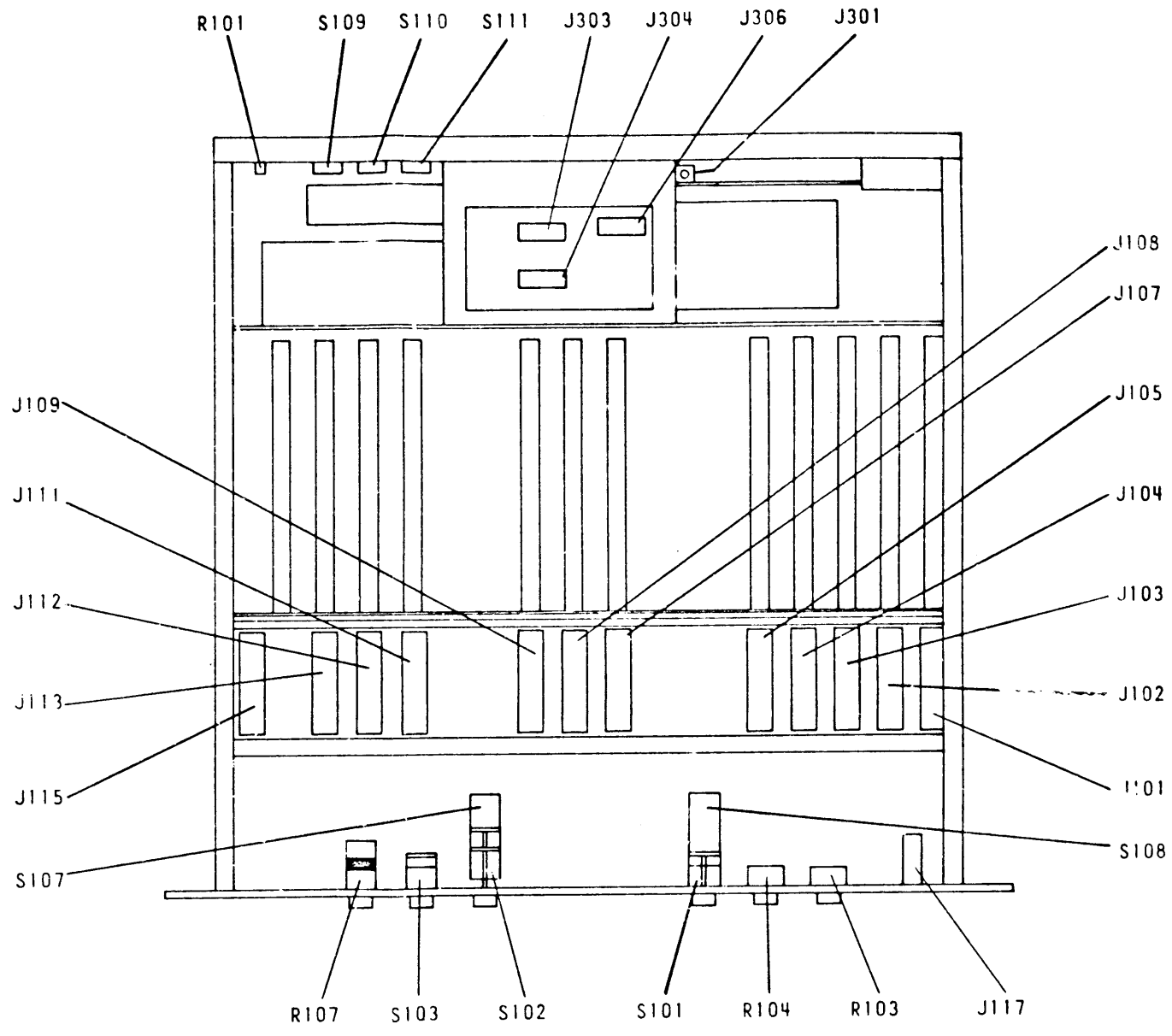
OVERALL PARTS LIST FOR MFE-1

SYMBOL	DESCRIPTION	TMC P/N
C101	Capacitor, Fixed, Mica	CB21Q102K
C102	Same as C101	
C103	Same as C101	
C104	Capacitor, Fixed, Ceramic	CC100-24
C105	Same as C101	
thru		
C109		
C110	Same as C104	
C111	Same as C101	
C112	Capacitor, Fixed, Ceramic	CC100-43
C113	Same as C101	
C114	Same as C101	
C115	Same as C112	
C116	Same as C101	
C117	Same as C101	
C118	Same as C112	
C119	Same as C112	
C120	Same as C112	
C121	Capacitor, Fixed, Ceramic	CC100-29
thru		
C124		
C125	Same as C112	
C126	Same as C112	
C127	Same as C112	
C128	Same as C121	
thru		
C132		
C133	Same as C112	
C134	Same as C121	
C135	Not Used	
C136	Same as C121	
C137	Same as C121	
C138	Same as C112	
thru		
C149		
C150	Capacitor, Fixed, Paper	CN114-1R05J
C151	Same as C112	
C152	Same as C121	
thru		
C160		
C161	Same as C101	
C162	Same as C112	
C163	Same as C112	
C164	Capacitor, Fixed, Mica	CM112E113J5S
C165	Capacitor, Fixed, Mica	CM112E243J5S
C166	Capacitor, Fixed, Elec	CE107-3
C167	Capacitor,	
C168	Same as	
CR101	Semiconductor, Dev, Diode	1N914
CR103		
DS101	Lamp, Incandescent	BI110-7
DS102	Same as DS101	
F101	Fuse, Slow-Blow	FU102-1.00
F102	Same as F101	
J101	Connector, Receptacle, FML	JJ319A15DFE
thru		
J105		
J106	Not Used	
J107	Same as J101	
J108	Same as J101	
J109	Same as J101	
J110	Not Used	
J111	Same as J101	
thru		
J115		
J116	Connector,	
J117	Jack, Telephone	JJ034
J118	Jack	JJ033
J119	Connector, Receptacle, ML	JJ333-10PFS4
K101	Relay, Armature, Min	RL143-4
K102	Relay	RL156-5
L101	Coil, Rf, Fixed	CL240-120
thru		
L104		
L105	Coil, Rf, Fixed	CL349-1
L106	Same as L105	
L107	Same as L101	
thru		
L109		
L110	Choke, Rf	TF418
L111	Same as L105	
L112	Coil, Rf, Fixed	CL275-180
L113	Same as L101	
L114	Same as L101	
L115	Coil, Fixed	CL117
L116	Same as L101	
L117	Same as L101	
L118	Same as L105	
L119	Same as L101	
L120	Same as L101	
M101	Meter	MR191-9
R101	Resistor, Variable, Composition	RV106UX8B102A
R102	Resistor, Variable, Composition	RV4NAYSD101A
R103	Resistor, Variable, Composition	RV4ATRD501B
R104	Same as R103	
R105	Resistor, Variable, Composition	RV4NAYSD253A
R106	Resistor, Variable, Composition	RV110-1
R107A & B	Resistor, Variable, Composition	RV108-2
R108	Resistor, Fixed, Composition	RC07GF681J
R109	Resistor, Fixed, Composition	RC07GF221J
R110	Same as R109	
R111	Resistor, Fixed, Composition	RC07GF222J
R112	Resistor, Fixed, Composition	RC07GF391J
R113	Resistor, Fixed, Composition	RW126-4-1R0
R114	Same as R113	
R115	Resistor, Fixed, Composition	RC07GF473J
R116	Same as R115	
R117	Resistor, Fixed, Composition	RC07GF102J
R118	Same as R117	
R119	Same as R111	
R120	Resistor, Fixed, Composition	RC07GF392J
R121	Resistor, Fixed, Composition	RC07GF563J
R122	Resistor, Fixed, Composition	RC07GF273J
R123	Resistor, Fixed, Composition	RC07GF152J
R124	Resistor, Fixed, Composition	RC42GF151J
R125	Same as R124	
R126	Resistor, Fixed, Composition	RC07GF562J
R127	Resistor, Fixed, Composition	RC07GF822J
R128	Resistor, Fixed, Composition	
R129	Same as R117	
R130	Same as R117	
R131	Same as R128	
thru		
R133		
R134	Same as R117	
thru		
R137		
R138	Same as R109	
R139	Resistor, Fixed, Composition	
R140	Same as R139	
R141	Resistor, Fixed, Composition	
R142	Resistor, Variable, Composition	
R143	Resistor, Fixed, Composition	
R144	Same as R113	
R145	Resistor, Fixed, Composition	
R146	Resistor, Fixed, Composition	
R147	Same as R146	
S101	Switch, Rotary	
S102	Switch, Rotary	
S103	Switch, Rotary	
S104	Switch, Rotary	
S105	Switch, Toggle, DPDT	
S106	Same as S105	
S107	Switch, ,	
S108	Switch,	
S109	Switch, Toggle, SPDT	
S110	Switch, Rotary,	
S111	Switch, Rotary	
TB101	Not Used	
TB102	Not Used	
TB103	Term, Board, Barrier	
TB104	Same as TB103	
TB105	Term, Board, Barrier	
XDS101	Lamp, Incandescent, Red	
XDS102	Lamp, Incandescent, White	
XF101	Fuse, Holder	
XF102	Same as XF101	
XK101	Not Used	
XK102	Socket, Relay	
* Z101	RF, Amplifier, Assembly	
* Z102	Same as Z101	
Z103	Converter/ALDC Assembly	
Z104	Carrier Generator, Assembly	
Z105	Sideband Generator Assembly	
Z106	Not Used	
Z107	FS Generator, Assembly	
Z108	AM/MCW Assembly	
Z109	Not Used	
Z110	Not Used	
* Z111	Same as Z101	
thru		
Z113		
Z114	Not Used	
Z115	RF, Output, Assembly	

*NOTE: Frequency must be specified when orde

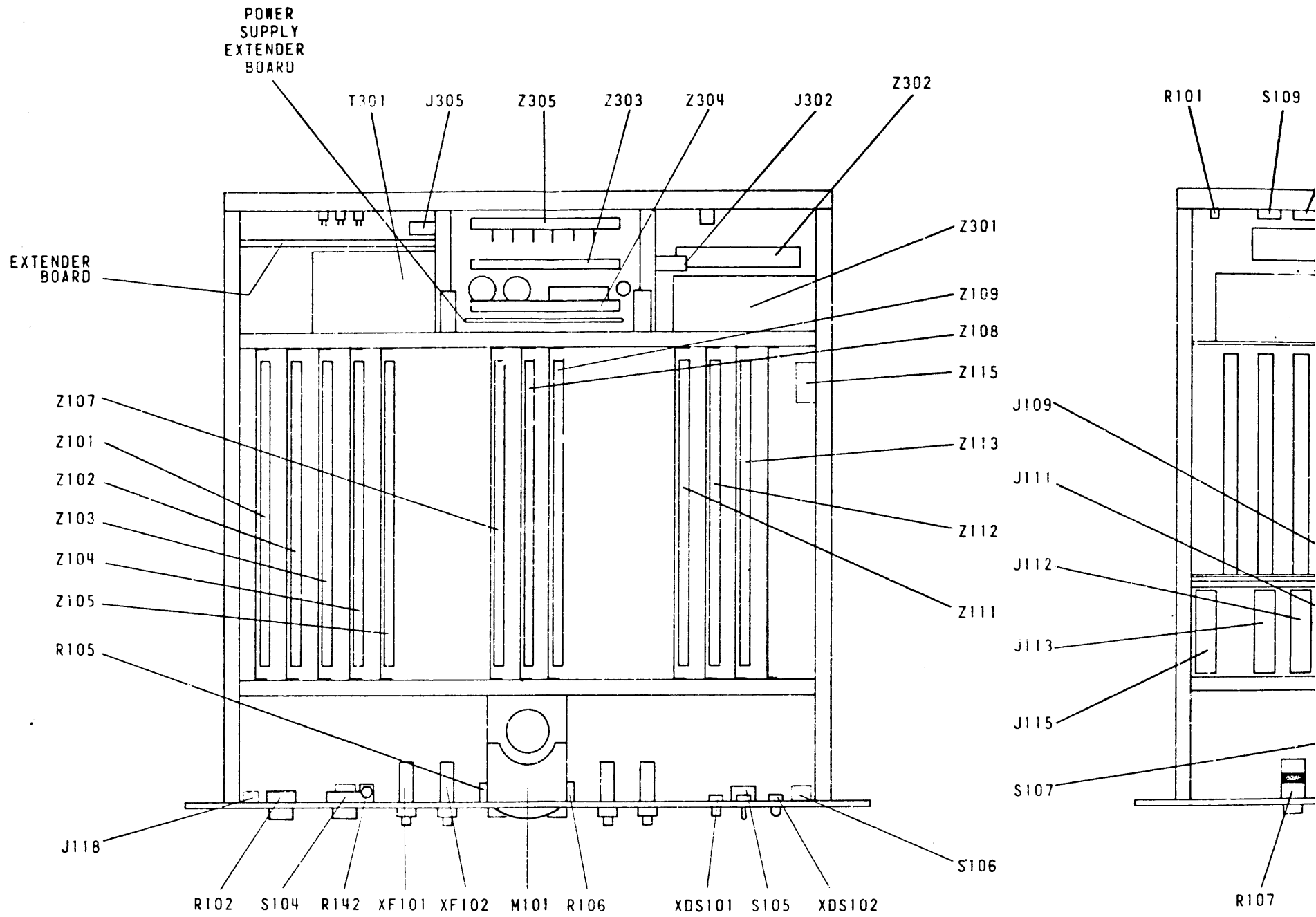


TOP VIEW

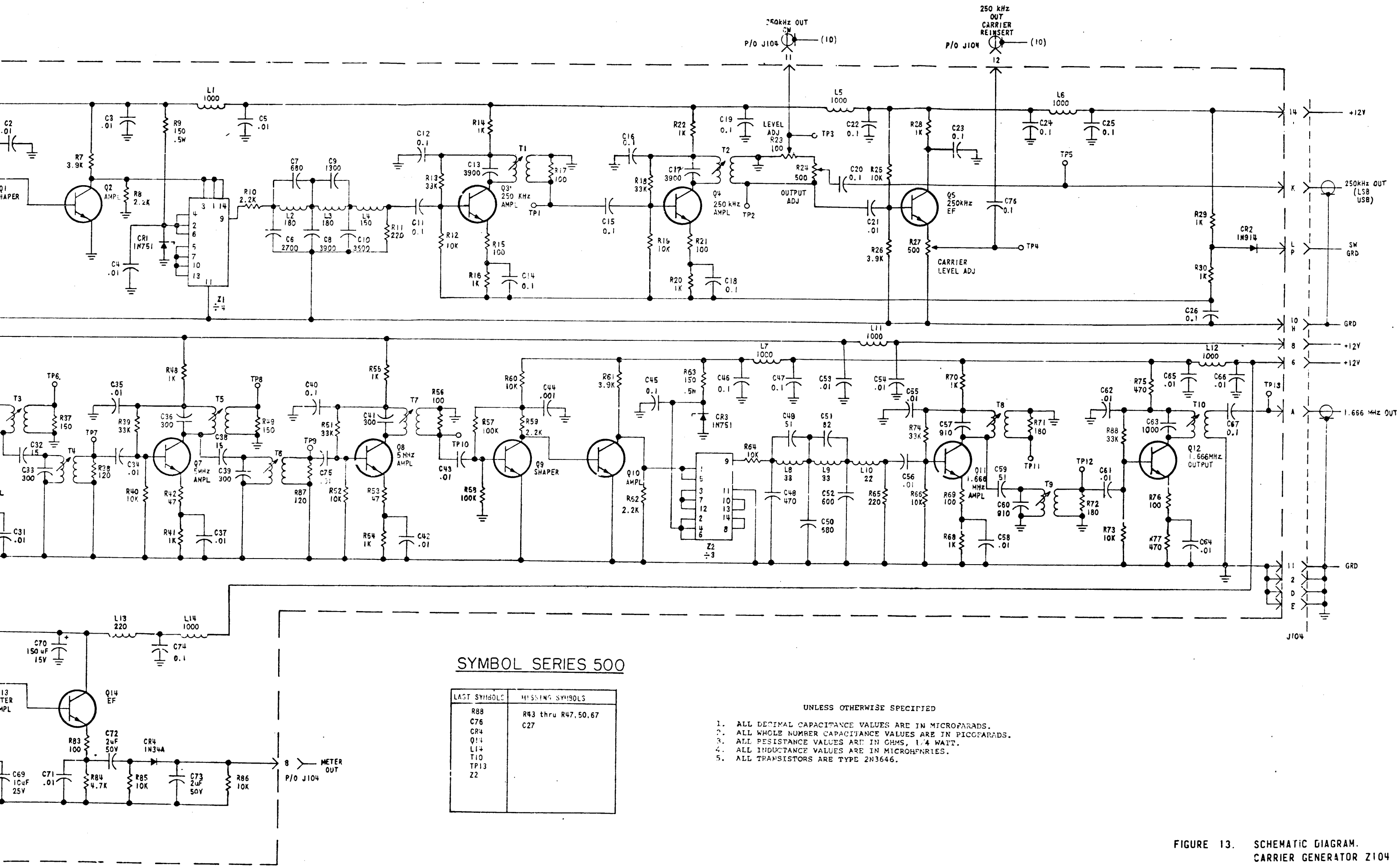


BOTTOM VIEW

FIGURE 12 OVERALL COMPONENT LOCATION. MFER-1 MULTI-MODE. CHANNELIZED EXCITER


POWER SUPPLY EXTENDER BOARD
EXTENDER BOARD
T301
J305
Z305
Z303
Z304
J302
Z302
Z301
Z109
Z108
Z115
Z113
Z112
Z111
Z107
Z101
Z102
Z103
Z104
Z105
R105
J118
R102
S104
R142
XF101
XF102
M101
R106
XDS101
S105
XDS102
S106
R101
S109
J109
J111
J112
J113
J115
S107
R107

TOP VIEW



SYMBOL SERIES 500

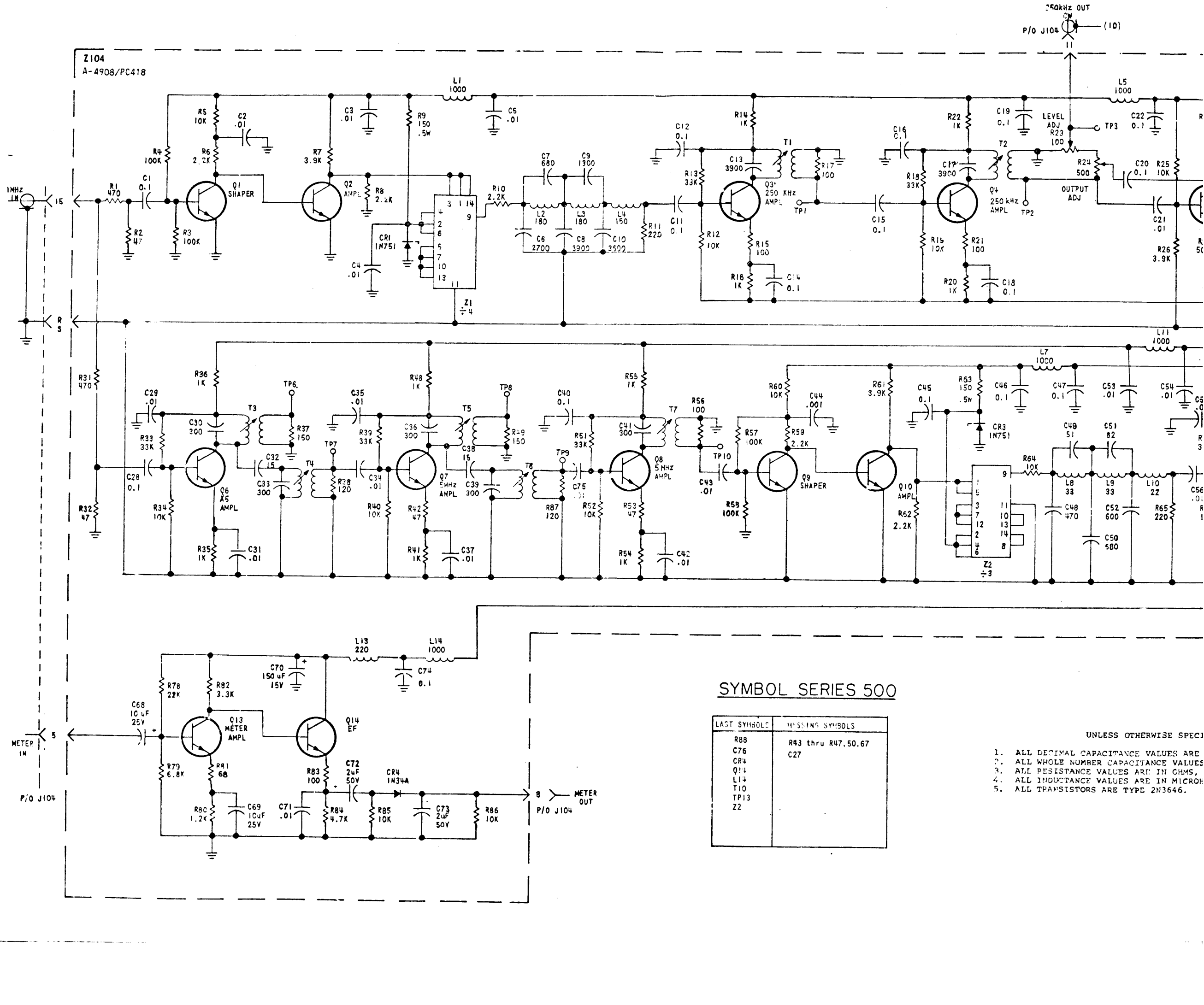
LAST SYMBOLS	MISSING SYMBOLS
R88	R43 thru R47, 50, 67
C76	C27
CR4	
Q14	
L14	
T10	
TP13	
Z2	

UNLESS OTHERWISE SPECIFIED

1. ALL DECIMAL CAPACITANCE VALUES ARE IN MICROFARADS.
2. ALL WHOLE NUMBER CAPACITANCE VALUES ARE IN PICOFARADS.
3. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT.
4. ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
5. ALL TRANSISTORS ARE TYPE 2N3646.

FIGURE 13. SCHEMATIC DIAGRAM. CARRIER GENERATOR Z104

Z104
A-4908/PC418



SYMBOL SERIES 500

LAST SYMBOLS	MISSING SYMBOLS
R88	R43 thru R47, 50, 67
C76	C27
CR4	
Q14	
L14	
T10	
TP13	
Z2	

UNLESS OTHERWISE SPECI

1. ALL DECIMAL CAPACITANCE VALUES ARE
2. ALL WHOLE NUMBER CAPACITANCE VALUES
3. ALL RESISTANCE VALUES ARE IN OHMS,
4. ALL INDUCTANCE VALUES ARE IN MICROH
5. ALL TRANSISTORS ARE TYPE 2N3646.

TMC P/N			
	C68	Capacitor, Elect	CE105-10-25
	C69	Same as C68	
	C70	Capacitor, Elect	CE105-150-15
	C71	Same as C2	
	C72	Capacitor, Elect	CE105-2-50
CC100-44	C73	Same as C72	
CC100-16	C74	Same as C1	
	C75	Same as C2	
	C76	Same as C1	
	CR1	Semiconductor, Dev, Diode	1N751
CM112F272F5S	CR2	Semiconductor, Dev, Diode	1N914
CM111F681J3S	CR3	Same as CR1	
CM112F332G3S	CR4	Semiconductor, Dev, Diode	1N34A
CM112F132F5S	L1	Coil	CL275-102
CM112F362G5S	L2	Coil	CL275 181
	L3	Same as L2	
	L4	Coil	CL275-151
	L5	Same as L1	
	L6	Same as L1	
	L7	Same as L1	
	L8	Coil	CL275-330
	L9	Same as L8	
	L10	Coil	CL275-220
	L11	Same as L1	
	L12	Same as L1	
	L13	Coil	CL275-221
	L14	Same as L1	
	Q1 thru Q14	Transistor	2N3646
	R1	Resistor, Fixed, Composition	RC07GF471J
	R2	Resistor, Fixed, Composition	RC07GF470J
CM111F301J5S	R3	Resistor, Fixed, Composition	RC07GF104J
	R4	Same as R3	
CM111C150J5S	R5	Resistor, Fixed, Composition	RC07GF103J
	R6	Resistor, Fixed, Composition	RC07GF222J
	R7	Resistor, Fixed, Composition	RC07GF392J
	R8	Same as R6	
	R9	Resistor, Fixed, Composition	RC20GF151J
	R10	Same as R6	
	R11	Resistor, Fixed, Composition	RC07GF221J
	R12	Same as R5	
	R13	Resistor, Fixed, Composition	RC07GF333J
	R14	Resistor, Fixed, Composition	RC07GF102J
	R15	Resistor, Fixed, Composition	RC07GF10LJ
	R16	Same as R14	
CC100-29	R17	Same as R15	
	R18	Same as R13	
	R19	Same as R5	
	R20	Same as R14	
CM111F471F5S	R21	Same as R15	
CM111E510G5S	R22	Same as R14	
	R23	Resistor, Variable, Composition	RV124-1-101
CM111E820F5S	R24	Resistor, Variable, Composition	RV124-1-501
CM111F60LJ3S	R25	Same as R5	
	R26	Same as R7	
	R27	Same as R24	
	R28	Same as R14	
	R29	Same as R14	
CM111F91LJ1S	R30	Same as R14	
	R31	Same as R1	
	R32	Same as R2	
	R33	Same as R13	
	R34	Same as R5	
	R35	Same as R14	
CM111F102F1S	R36	Same as R14	
	R37	Resistor, Fixed, Composition	RC07GF151J
	R38	Resistor, Fixed, Composition	RC07GF121J
	R39	Same as R13	
	R40	Same as R5	
	R41	Same as R14	
	R42	Same as R2	
	R43 thru R47	Not Used	
	R48	Same as R14	
	R49	Same as R37	
	R50	Not Used	
	R51	Same as R13	
	R52	Same as R5	
	R53	Same as R2	
	R54	Same as R14	
	R55	Same as R14	
	R56	Same as R15	
	R57	Same as R3	
	R58	Same as R3	
	R60	Same as R5	
	R61	Same as R7	
	R62	Same as R6	
	R63	Same as R9	
	R64	Same as R5	
	R65	Same as R11	
	R66	Same as R5	
	R67	**Not Used**	
	R68	Same as R14	
	R69	Same as R15	
	R70	Same as R14	
	R71	Resistor, Fixed, Composition	RC07GF181J
	R72	Same as R71	
	R73	Same as R5	
	R74	Same as R13	
	R75	Same as R1	
	R76	Sam as R15	
	R77	Sam as R1	
	R78	Resistor, Fixed, Composition	RC07GF223J
	R79	Resistor, Fixed, Composition	RC07GF682J
	R80	Resistor, Fixed, Composition	RC07GF122J
	R81	Resistor, Fixed, Composition	RC07GF680J
	R82	Resistor, Fixed, Composition	RC07GF332J
	R83	Same as R15	
	R84	Resistor, Fixed, Composition	RC07GF472J
	R85	Same as R5	
	R86	Same as R5	
	R87	Same as R38	
	R88	Same as R13	
	T1	Transformer, RF, Adj	TT285-12
	T2	Transformer, RF, Adj	TT285-11
	T3	Transformer, RF, Tune	TT296-6
	T4 thru T7		
	T8	Transformer, RF, Tune	TT296-4
	T9	Same as T8	
	T10	Transformer, RF, Tune	TT296-5
	Z1	Dual Flip-Flop	NW159
	Z2	Same as Z1	

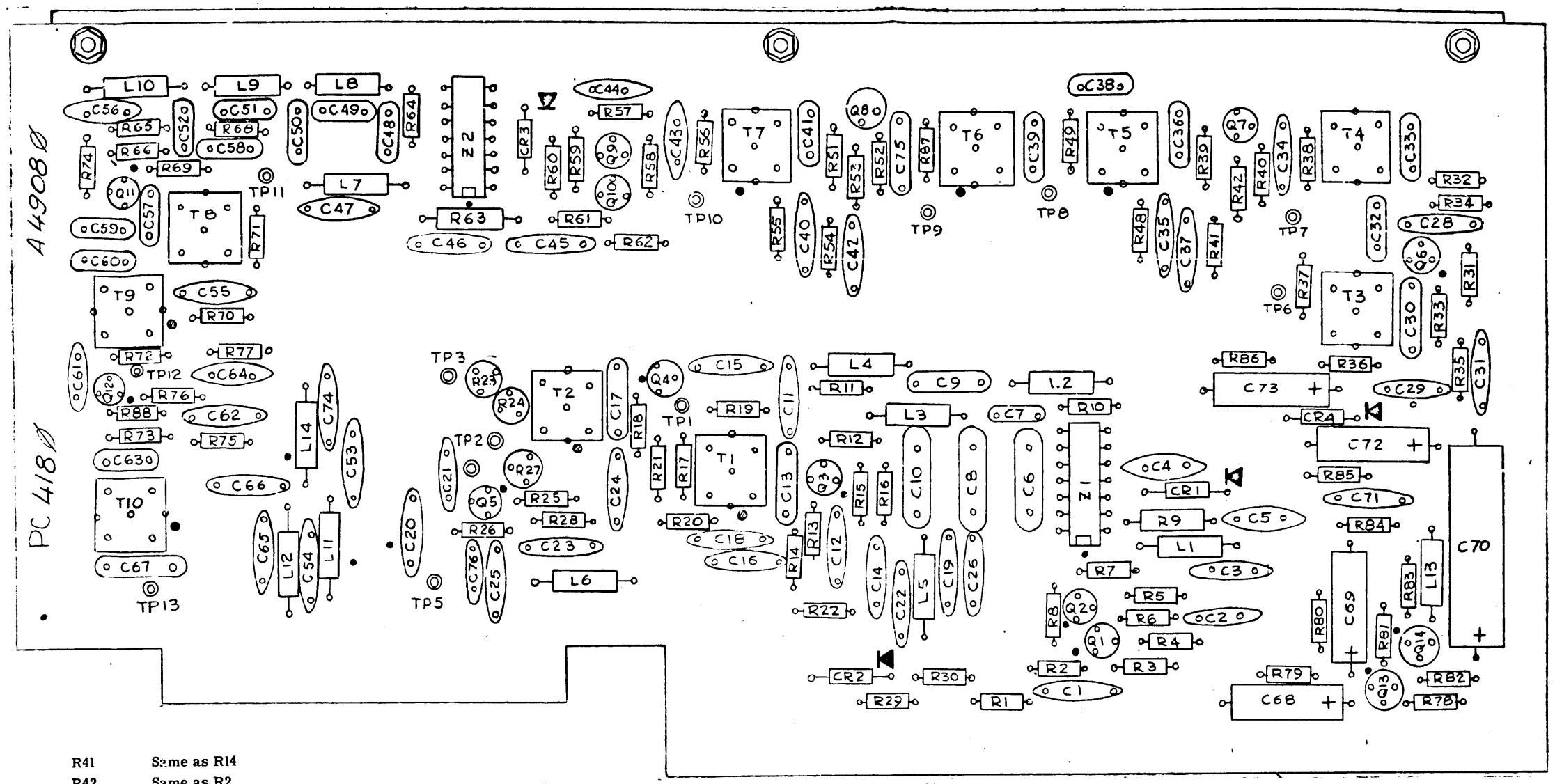
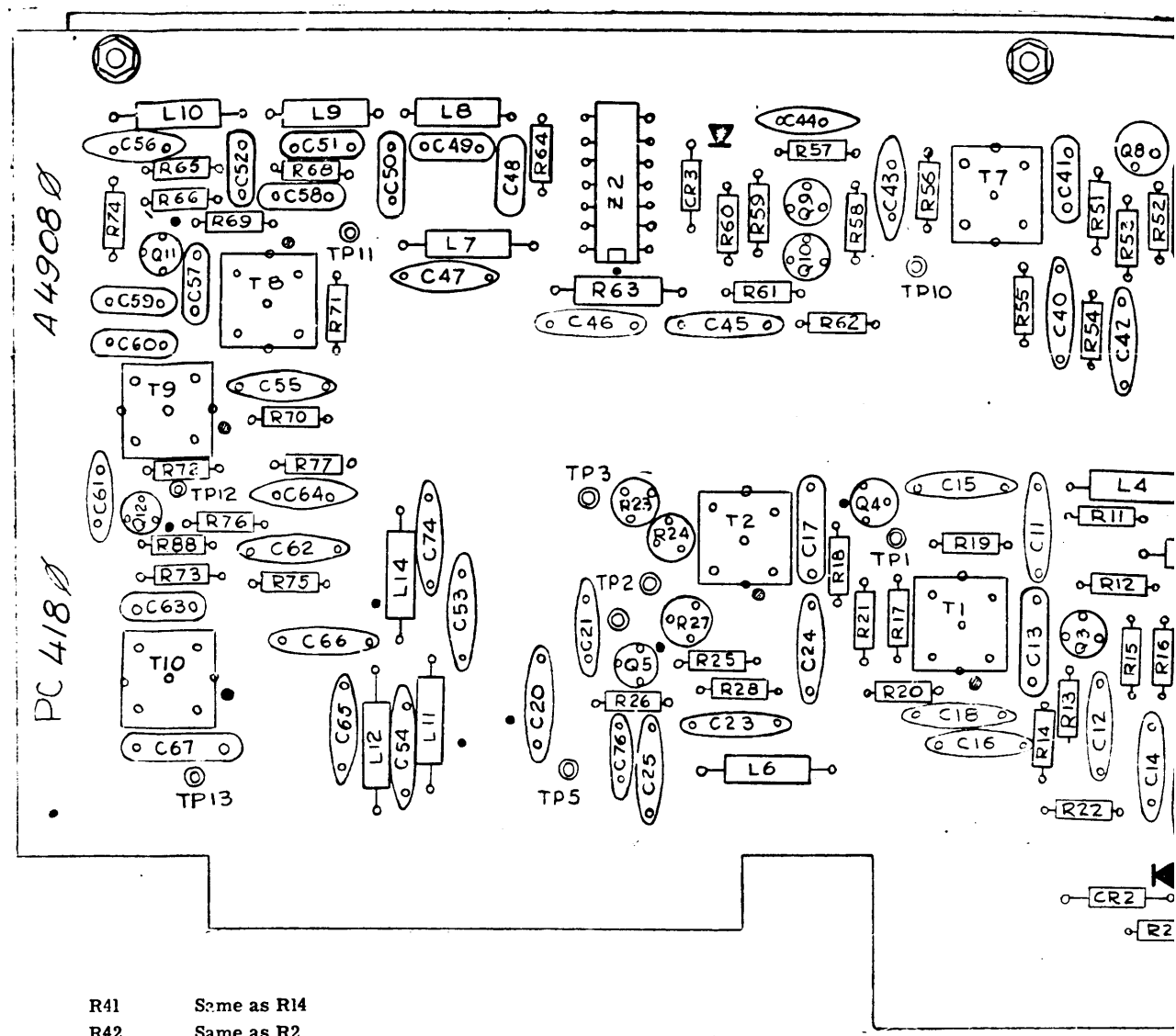
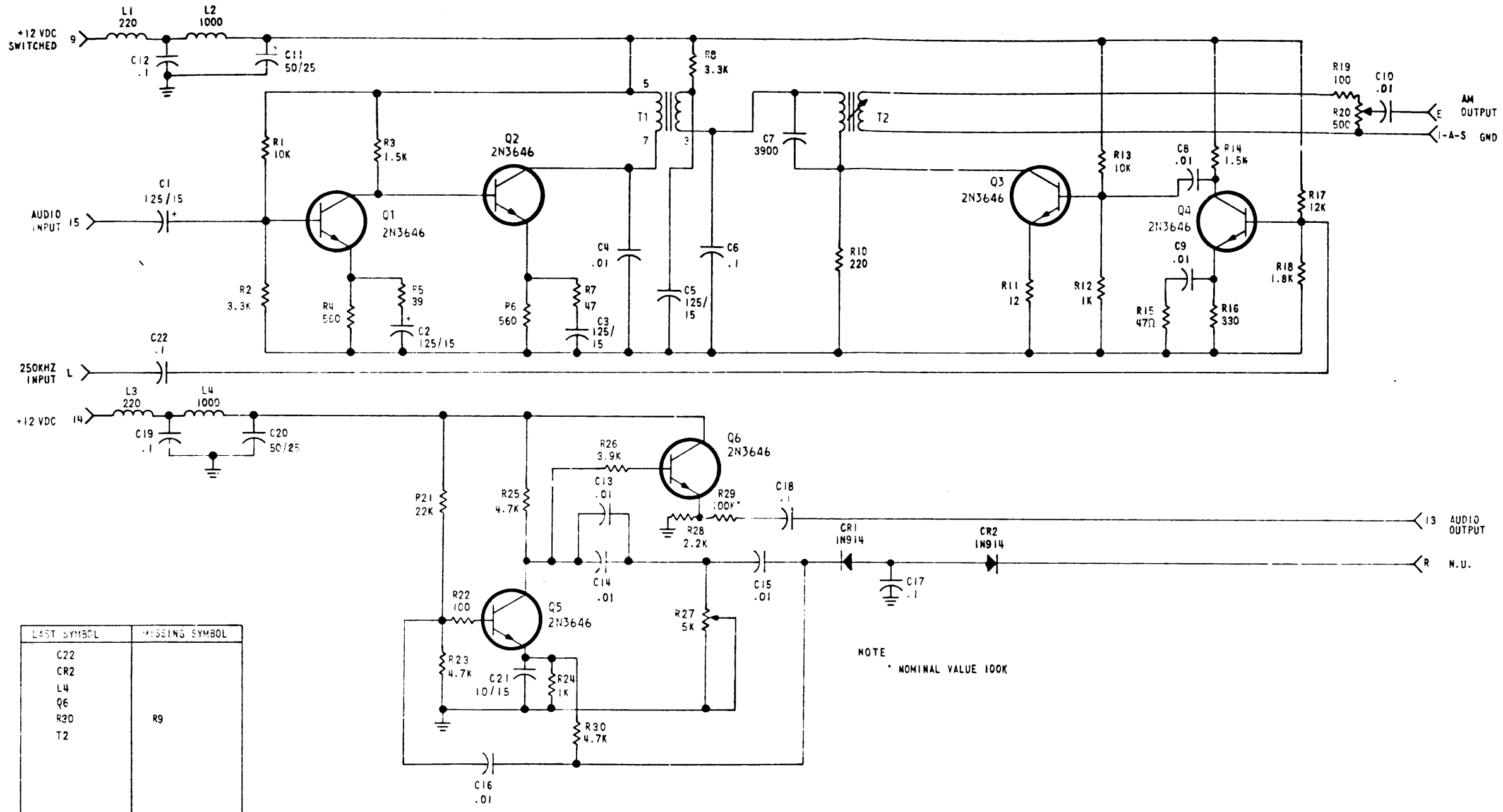


FIGURE 14. COMPONENT LOCATION AND PARTS LIST. CARRIER GENERATOR Z104

Parts List for A-4908

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-44
C2	Capacitor, Fixed, Ceramic	CC100-16
C3	Same as C2	
C4	Same as C2	
C5	Same as C2	
C6	Capacitor, Fixed, Mica	CM112F272F5S
C7	Capacitor, Fixed, Mica	CM111F681J3S
C8	Capacitor, Fixed, Mica	CM112F392G3S
C9	Capacitor, Fixed, Mica	CM112F132F5S
C10	Capacitor, Fixed, Mica	CM112F362G5S
C11	Same as C1	
C12	Same as C1	
C13	Same as C8	
C14	Same as C1	
thru		
C16		
C17	Same as C8	
C18	Same as C1	
thru		
C20		
C21	Same as C2	
C22	Same as C1	
thru		
C26		
C27	Not Used	
C28	Same as C1	
C29	Same as C2	
C30	Capacitor, Fixed, Mica	CM111F301J5S
C31	Same as C2	
C32	Capacitor, Fixed, Mica	CM111C150J5S
C33	Same as C30	
C34	Same as C2	
C35	Same as C2	
C36	Same as C30	
C37	Same as C2	
C38	Same as C32	
C39	Same as C30	
C40	Same as C1	
C41	Same as C30	
C42	Same as C2	
C43	Same as C2	
C44	Capacitor, Fixed, Ceramic	CC100-29
C45	Same as C1	
C46	Same as C1	
C47	Same as C1	
C48	Capacitor, Fixed, Mica	CM111F471F5S
C49	Capacitor, Fixed, Mica	CM111E510G5S
C50	Same as C7	
C51	Capacitor, Fixed, Mica	CM111E820F5S
C52	Capacitor, Fixed, Mica	CM111F601J3S
C53	Same as C2	
C54	Same as C2	
C55	Same as C2	
C56	Same as C2	
C57	Capacitor, Fixed, Mica	CM111F911J1S
C58	Same as C2	
C59	Same as C49	
C60	Same as C57	
C61	Same as C2	
C62	Same as C2	
C63	Capacitor, Fixed, Mica	CM111F102F1S
C64	Same as C2	
C65	Same as C2	
C66	Same as C2	
C67	Same as C1	
C68	Capacitor, El ct	CE105-10-25
C69	Same as C68	
C70	Capacitor, Elect	CE105-150-15
C71	Same as C2	
C72	Capacitor, Elect	CE105-2-50
C73	Same as C72	
C74	Same as C1	
C75	Same as C2	
C76	Same as C1	
CR1	Semiconductor, Dev, Diode	1N751
CR2	Semiconductor, Dev, Diode	1N914
CR3	Same as CR1	
CR4	Semiconductor, Dev, Diode	1N34A
L1	Coil	CL275-102
L2	Coil	CL275 181
L3	Same as L2	
L4	Coil	CL275-151
L5	Same as L1	
L6	Same as L1	
L7	Same as L1	
L8	Coil	CL275-330
L9	Same as L8	
L10	Coil	CL275-220
L11	Same as L1	
L12	Same as L1	
L13	Coil	CL275-221
L14	Same as L1	
Q1	Transistor	2N3646
thru		
Q14		
R1	Resistor, Fixed, Composition	RC07GF471J
R2	Resistor, Fixed, Composition	RC07GF470J
R3	Resistor, Fixed, Composition	RC07GF104J
R4	Same as R3	
R5	Resistor, Fixed, Composition	RC07GF103J
R6	Resistor, Fixed, Composition	RC07GF222J
R7	Resistor, Fixed, Composition	RC07GF392J
R8	Same as R6	
R9	Resistor, Fixed, Composition	RC20GF15LJ
R10	Same as R6	
R11	Resistor, Fixed, Composition	RC07GF22LJ
R12	Same as R5	
R13	Resistor, Fixed, Composition	RC07GF333J
R14	Resistor, Fixed, Composition	RC07GF102J
R15	Resistor, Fixed, Composition	RC07GF10LJ
R16	Same as R14	
R17	Same as R15	
R18	Same as R13	
R19	Same as R5	
R20	Same as R14	
R21	Same as R15	
R22	Same as R14	
R23	Resistor, Variable, Composition	RV124-1-101
R24	Resistor, Variable, Composition	RV124-1-501
R25	Same as R5	
R26	Same as R7	
R27	Same as R24	
R28	Same as R14	
R29	Same as R14	
R30	Same as R14	
R31	Same as R1	
R32	Same as R2	
R33	Same as R13	
R34	Same as R5	
R35	Same as R14	
R36	Same as R14	
R37	Resistor, Fixed, Composition	RC07GF15LJ
R38	Resistor, Fixed, Composition	RC07GF12LJ
R39	Same as R13	
R40	Same as R5	
R41	Same as R14	
R42	Same as R2	
R43	Not Used	
thru		
R47		
R48	Same as R14	
R49	Same as R37	
R50	Not Used	
R51	Same as R13	
R52	Same as R5	
R53	Same as R2	
R54	Same as R14	
R55	Same as R14	
R56	Same as R15	
R57	Same as R3	
R58	Same as R3	
R60	Same as R5	
R61	Same as R7	
R62	Same as R6	
R63	Same as R9	
R64	Same as R5	
R65	Same as R11	
R66	Same as R5	
R67	Not Used	
R68	Same as R14	
R69	Same as R15	
R70	Same as R14	
R71	Resistor, Fixed, Composition	RC07GF18LJ
R72	Same as R71	
R73	Same as R5	
R74	Same as R13	
R75	Same as R1	
R76	Sam as R15	
R77	Same as R1	
R78	Resistor, Fixed, Composition	RC
R79	Resistor, Fixed, Composition	RC
R80	Resistor, Fixed, Composition	RC
R81	Resistor, Fixed, Composition	RC
R82	Resistor, Fixed, Composition	RC
R83	Same as R15	
R84	Resistor, Fixed, Composition	RC
R85	Same as R5	
R86	Same as R5	
R87	Same as R38	
R88	Same as R13	
T1	Transformer, RF, Adj	TT2
T2	Transformer, RF, Adj	TT2
T3	Transformer, RF, Tune	TT2
thru		
T7		
T8	Transformer, RF, Tune	TT2
T9	Same as T8	
T10	Transformer, RF, Tune	TT2
Z1	Dual Flip-Flop	NWI
Z2	Same as Z1	





LAST SYMBOL	MISSING SYMBOL
C22	
CR2	
L4	
Q6	
R30	R9
T2	

FIGURE 15. SCHEMATIC DIAGRAM.
TONE GENERATOR/A2 MODULATOR Z108

Parts List for A-4901

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Elec	CE105-125-15
C2	Same as C1	
C3	Same as C1	
C4	Capacitor, Fixed, Ceramic	CC100-43
C5	Same as C1	
C6	Capacitor, Fixed, Ceramic	CC100-44
C7	Capacitor, Mica, Dip	CM112F392G
C8	Same as C4	
C9	Same as C4	
C10	Same as C4	
C11	Capacitor, Fixed, Elec	CE105-50-25
C12	Same as C6	
C13 thru C16	Capacitor, Fixed, Paper	CN100-1
C17	Same as C6	
C18	Same as C6	
C19	Same as C6	
C20	Same as C11	
C21	Capacitor, Fixed, Elec	CE105-10-15
C22	Same as C6	
CR1	Semiconductor, Dev, Diode	1N914
CR2	Same as CR1	
L1	Coil, RF	CL275-221
L2	Coil RF	CL275-102
L3	Same as L1	
L4	Same as L2	
Q1 thru Q6	Transistor	2N3646
R1	Resistor, Fixed, Composition	RC07GF103J
R2	Resistor, Fixed, Composition	RC07GF332J
R3	Resistor, Fixed, Composition	RC07GF152J
R4	Resistor, Fixed, Composition	RC07GF561J
R5	Resistor, Fixed, Composition	RC07GF390J
R6	Same as R4	
R7	Resistor, Fixed, Composition	RC07GF470J
R8	Same as R2	
R9	Not Used	
R10	Resistor, Fixed, Composition	RC07GF271J
R11	Resistor, Fixed, Composition	RC07GF120J
R12	Resistor, Fixed, Composition	RC07GF102J
R13	Same as R1	
R14	Same as R3	
R15	Same as R7	
R16	Resistor, Fixed, Composition	RC07GF331J
R17	Resistor, Fixed, Composition	RC07GF122J
R18	Resistor, Fixed, Composition	RC07GF182J
R19	Resistor, Fixed, Composition	RC07GF101J
R20	Resistor, Variable, Composition	RV124-501
R21	Resistor, Fixed, Composition	RC07GF223J
R22	Same as R19	
R23	Resistor, Fixed, Composition	RC07GF472J
R24	Same as R12	
R25	Same as R23	
R26	Resistor, Fixed, Composition	RC07GF392J
R27	Resistor, Variable, Composition	RV111V502A
R28	Resistor, Fixed, Composition	RC07GF222J
R29	Resistor, Fixed, Composition	RC07GF104J
R30	Same as R23	
T1	Transformer, Audio	TF420
T2	Transformer, Tune	TT285-15

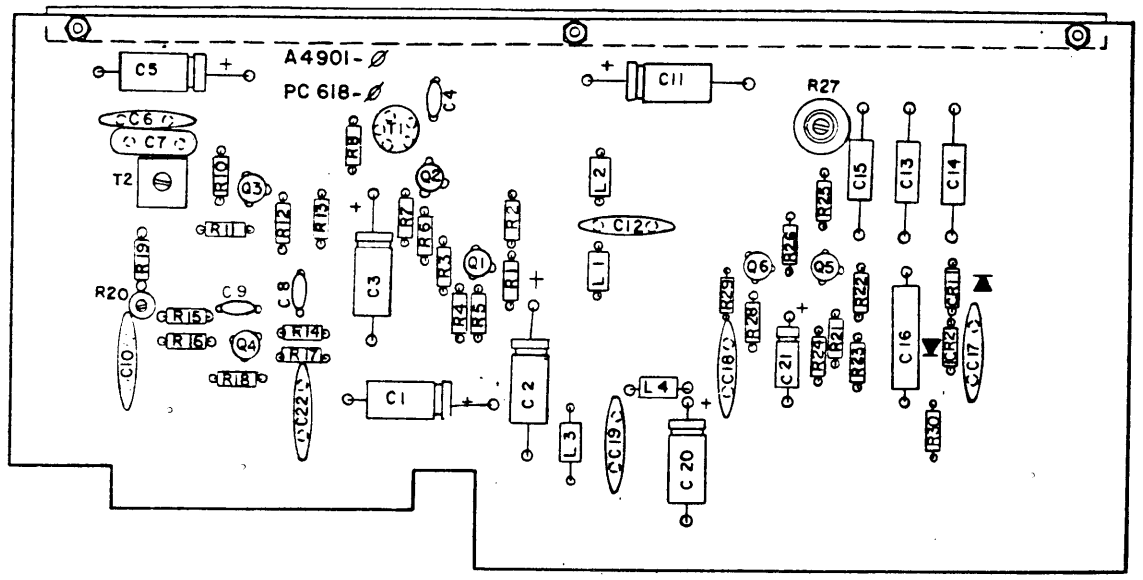


FIGURE 16. COMPONENT LOCATION AND PARTS LIST. TONE GENERATOR/A2 MODULATOR Z108

SYMBOL SERIES (SEE TABLE)

LAST SYMBOLS	MISSING SYMBOLS
C81	C16.19.20.61.62.63.72.
CR7	C75.76.77.78.79.80
K1	L4.6.11
L17	R52.62.63.64.65.88.89
Q28	
R95	
T4	
Y1	
Z2	

UNLESS OTHERWISE SPECIFIED

1-ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT.
2-ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3-ALL INDUCTANCE VALUES ARE IN MICROHENRIES.

AUDIO PREAMPLIFIER

Q1 2N3646 MIKE AMPL
Q2 2N3646 EF
Q3 2N3646 AUDIO AMPL
Q4 2N3646 AUDIO AMPL
Q5 2N3646 AUDIO AMPL
R8 5K LEVEL ADJ
C4 10 25V
C5 .01
R9 10K
R10 22K
R11 1.5K
R12 100
R13 470
R14 22K
R15 10K
R16 470
R17 100
R18 1.5K
R19 47K
R20 15K
R21 1K
C6 10 25V
C7 6.8 25V
C8 .01
C9 10 25V
C10 6.8 25V
C11 10 25V
C12 22 16V
C13 6.8 25V
C14 6.8 25V
L1 1000
L2 1000

Q7 2N3646 250 kHz AMPL
Q8 2N1225 USB AMPL
Q9 2N863 AGC CONTROL
Q10 2N863 AGC CONTROL
Q11 2N1225 USB AMPL
Q12 2N1225 USB AMPL
Q13 2N863 EF
Q14 2N863 DC AMPL
Q15 2N863 GATE
Q16 2N863 DC AMPL
Q17 2N3646 EF
Q18 2N3646 EF
Q19 2N1225 AGC AMPL
Q20 2N3646 EF
Q21 2N3646 AGC AMPL
Q22 2N3646
Q23 2N3646 AMPL
Q24 2N3646 DC AMPL
Q25 2N3646 SCHM TRIG.
Q26 2N3646 SCHM TRIG.
Q27 2N696 RELAY DRIVER
Z1 BAL MOD
Z2
Y1
C37 9-35 pF
T2
T3
T4
K1 SHOWN UNENERGIZED
CR1 IN914
CR2 IN914
CR3 IN914
CR4 IN961
CR5 IN914
CR6 IN914
CR7 IN4245
L3 1000
L4 1000
L5 1000
L6 1000
L7 1000
L8 1000
L9 1000
L10 1000
L12 1000
L13 1000
L14 1000
L15 1000
L16 1000
L17 1000
C21 0.1
C22 0.1
C23 0.1
C24 0.1
C25 0.1
C26 0.1
C27 0.1
C28 3900 pF
C29 0.1
C30 0.1
C31 0.1
C32 0.1
C33 3900 pF
C34 0.1
C35 0.1
C36 0.1
C40 0.1
C41 0.1
C42 0.1
C43 0.1
C44 0.1
C45 22 16V
C46 0.1
C47 0.1
C48 0.1
C49 0.1
C50 0.1
C51 0.1
C52 10,000
C53 0.1
C54 0.1
C55 0.1
C56 0.1
C57 0.1
C58 0.1
C59 0.1
C60 0.1
C61 0.1
C64 22 16V
C65 6.8 25V
C66 22 16V
C67 300pF
C74 0.1
C75 0.1
R25 47
R26 330
R27 1K
R28 1K
R29 22
R30 3.3K
R31 270
R32 270
R33 3.3K
R34 22
R35 1K
R36 3.3K
R37 10K
R38 10K
R39 680
R40 8.2K
R41 390
R42 3.3K
R43 47
R44 100K
R45 330K
R46 5.6K
R47 100
R48 6.8K
R49 10K
R50 6.8K
R51 1K
R53 2.2K
R54 47
R55 4.7K
R56 5K
R57 2.2K
R58 100
R59 47
R60 820
R61 150K
R66 10K
R67 2.2K
R68 5.6 K
R69 5.6K
R70 1.2K
R71 1.5K
R72 1K
R73 5.6K
R74 22K
R75 8.2K
R76 47
R85 270
R93 4.7K
R96 100
C70 6.8 35V
C71 10 25V
L5 1000
L7 1000

AGC ADJ
11
M
250 KHz OUT
10
+30V
P
PTT
H
J
P/O J105
VOX OUT

PC455/A4907

FIGURE 17. SCHEMATIC DIAGRAM. A2H GENERATOR Z105

AUDIO PREAMPLIFIER

SYMBOL SERIES (SEE TABLE)

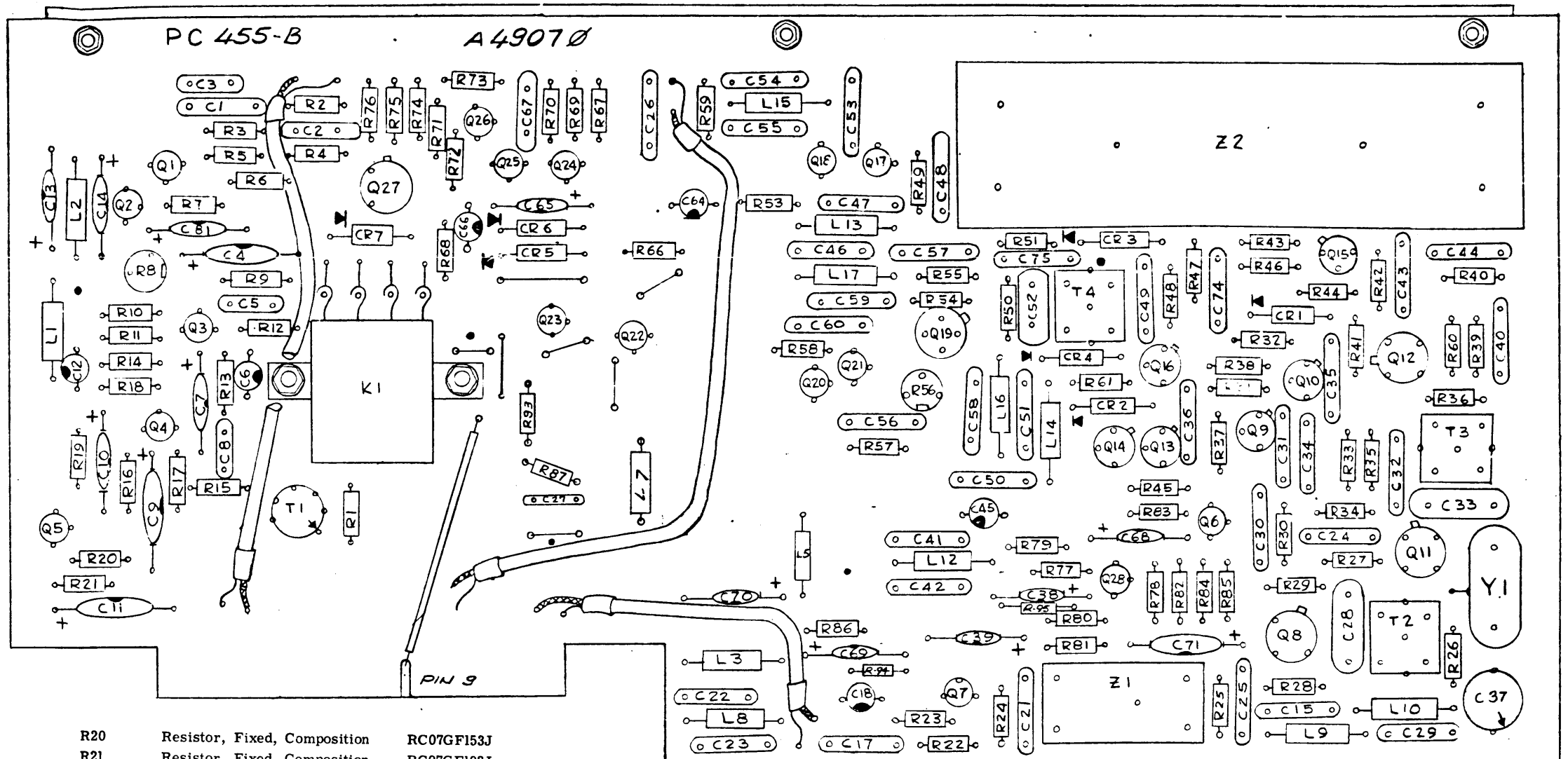
LAST SYMBOLS	MISSING SYMBOLS
C81	C16.19 20.61.62.63.72.
CR7	C75.76.77.78.79.80
K1	L4.6.11
L17	R52.62.63.64.65.88.89
Q28	
R95	
T4	
Y1	
Z2	

GRD B
600Ω SB LINE IN 4
C
2
500Ω OUT 1
MIKE IN D
GRD 3
AUDIO OUT A
+12 V SW 14
250KHz IN 15
GRD S
SB AUDIO IN 13
+24 V R
+12 V PERM. 8
KEY LINE 9
GRD N
P/O J105

T1 R1 1.2K
C1 0.1
R2 47K
R3 10K
C2 22pF
R4 56K
R5 100K
R6 56K
C3 .01
C81 6.8 25V
R7 470K
Q1 2N3646 MIKE AMPL
Q2 2N3646 EF
C4 25V
R8 5K LEVEL ADJ
C5 .01
R9 10K
R10 22K
R11 1.5K
C7 25V
R12 100
R13 470
R14 22K
C6 10 25V
C8 .01
R15 10K
Q3 2N3646 AUDIO AMPL
R16 470
R17 100
R18 1.5K
C10 6.8 25V
C9 10 25V
Q4 2N3646 AUDIO AMPL
R19 47K
R20 15K
R21 1K
C11 10 25V
C12 22 16V
Q5 2N3646 AUDIO AMPL
C13 6.8 25V
L1 1000
C14 6.8 25V
L2 1000

C15 0.1
L3 1000
L8 1000
C22 0.1
C23 0.1
L9 1000
L10 1000
C29 0.1
C18 22 16V
R23 5.6K
C17 0.1
Q7 2N3646 250kHz AMPL
R22 5.6K
R24 270
C21 0.1
Z1 BAL MOD
C24 0.1
R27 1K
T2
C28 3900 pF
R28 1K
C25 0.1
Q8 2N1225 USB AMPL
R25 47
R29 22
R30 3.3K
C30 0.1
R31 270
C31 0.1
Q9 2N863 AGC CONTROL
C26 0.1
L5 1000
C27 0.1
L7 1000
C32 0.1
R35 1K
T3
C33 3900 pF
R26 330
R36 3.3K
Q11 2N1225 USB AMPL
R34 22
R33 3.3K
C34 0.1
Y1
C37 9-35 pF
R32 270
C35 0.1
R37 10K
Q10 2N863 AGC CONTROL
R38 10K
C36 0.1
Q13 2N863 EF
C40 0.1
R39 680
R40 8.2K
C44 0.1
Z2
R41 390
R42 3.3K
C43 0.1
Q12 2N1225 USB AMPL
Q15 2N863 GATE
R44 100K
CR1 IN914
R43 47
CR2 IN914
R45 330K
C45 22 16V
R61 150K
R46 5.6K
Q14 2N863 DC AMPL
C46 0.1
L13 1000
C47 0.1
C48 0.1
R49 10K
Q17 2N3646 EF
Q16 2N863 DC AMPL
R48 6.8K
CR3 IN914
C49 0.1
T4
R50 6.8K
R51 1K
C52 10,000
C75 0.1
CR4 IN961
L14 1000
C50 0.1
C51 0.1
R47 100
C74 0.1
L12 1000
C41 0.1
C42 0.1
R54 47
R55 4.7K
L16 1000
Q18 2N3
C55 0.1
R53 2.2K
C53 0.1

R87 100K
Q22 2N3646
R93 4.7K
R66 10K
Q23 2N3646 AMPL
C64 22 16V
CR6 IN914
CR5 IN914
R67 2.2K
Q24 2N3646 DC AMPL
C65 6.8 25V
R68 5.6 K
C66 22 16V
Q25 2N3646 SCHM TRIG.
R69 5.6K
R70 1.2K
C67 300pF
R71 1.5K
Q26 2N3646 SCHM TRIG.
R72 1K
R73 5.6K
R74 22K
R75 8.2K
Q27 2N696 RELAY DRIVER
R76 47
CR7 IN4245
K1
SHOWN UNENERGIZED
10 +30V
P PTT
H J P/O J105
VOX OUT

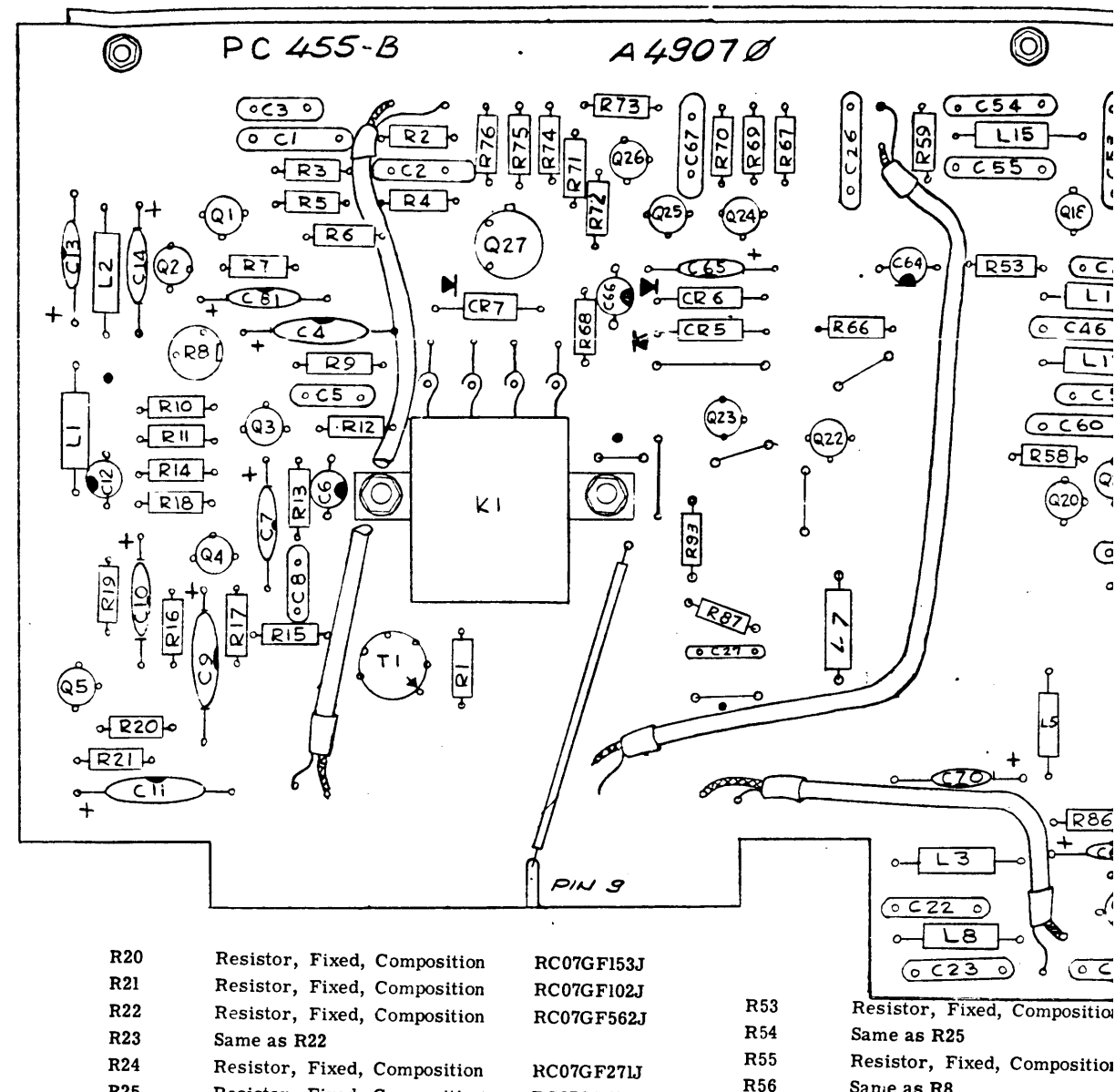


TMC P/N			
	C73	Not Used	
	C74	Same as C41	
	C75	Same as C41	
	C76	Not Used	
CC100-44	C77	Not Used	
CM111C220J5S	C78	Not Used	
CC100-42	C79	Not Used	
CE122-10-25	C80	Not Used	
	C81	Same as C7	
	CR1	Semiconductor, Dev, Diode	1N914
CE122-6R8-25	CR2	Sam as CR1	
	CR3	Same as CR1	
	CR4	Semiconductor, Dev, Diode	1N961
	CR5	Same as CR1	
	CR6	Same as CR1	
CE122-22-16	CR7	Semiconductor, Dev, Diode	1N4245
	K1	Relay	RL143-4
	L1	Coil	CL275-102
	L2	Same as L1	
	L3	Same as L1	
	L4	Not Used	
	L5	Same as L1	
	L6	Not Used	
	L7	Same as L1	
	thru		
	L10		
	L11	Not Used	
CM112F392G3S	L12	Same as L1	
	thru		
	L17		
	Q1	Transistor	2N3646
	thru		
	Q7		
	Q8	Transistor	2N1225
	Q9	Transistor	2N863
CV112-8	Q10	Same as Q9	
	Q11	Same as Q8	
	Q12	Same as Q8	
	Q13	Same as Q9	
CC100-28	thru		
	Q16		
	Q17	Same as Q1	
	Q18	Same as Q1	
	Q19	Same as Q8	
	Q20	Same as Q1	
	thru		
	Q26		
	Q27	Transistor	2N696
	Q28	Same as Q1	
	R1	Resistor, Fixed, Composition	RC07GF122J
CM112F103J1S	R2	Resistor, Fixed, Composition	RC07GF473J
	R3	Resistor, Fixed, Composition	RC07GF103J
	R4	Resistor, Fixed, Composition	RC07GF563J
	R5	Resistor, Fixed, Composition	RC07GF104J
	R6	Same as R4	
	R7	Resistor, Fixed, Composition	RC07GF474J
	R8	Resistor, Variable	RV124-1-502
	R9	Same as R3	
	R10	Resistor, Fixed, Composition	RC07GF223J
	R11	Resistor, Fixed, Composition	RC07GF152J
	R12	Resistor, Fixed, Composition	RC07GF101J
	R13	Resistor, Fixed, Composition	RC07GF471J
	R14	Same as R10	
CM111F301K5S	R15	Same as R3	
	R16	Same as R13	
CE122-6R8-35	R17	Same as R12	
	R18	Same as R11	
	R19	Same as R2	
	R20	Resistor, Fixed, Composition	RC07GF153J
	R21	Resistor, Fixed, Composition	RC07GF102J
	R22	Resistor, Fixed, Composition	RC07GF562J
	R23	Same as R22	
	R24	Resistor, Fixed, Composition	RC07GF271J
	R25	Resistor, Fixed, Composition	RC07GF470J
	R26	Resistor, Fixed, Composition	RC07GF331J
	R27	Same as R21	
	R28	Same as R21	
	R29	Resistor, Fixed, Composition	RC07GF220J
	R30	Resistor, Fixed, Composition	RC07GF332J
	R31	Same as R24	
	R32	Same as R24	
	R33	Same as R30	
	R34	Same as R29	
	R35	Same as R21	
	R36	Same as R30	
	R37	Same as R3	
	R38	Same as R3	
	R39	Resistor, Fixed, Composition	RC07GF681J
	R40	Resistor, Fixed, Composition	RC07GF822J
	R41	Resistor, Fixed, Composition	RC07GF391J
	R42	Same as R30	
	R43	Same as R25	
	R44	Same as R5	
	R45	Resistor, Fixed, Composition	RC07GF334J
	R46	Same as R22	
	R47	Same as R12	
	R48	Resistor, Fixed, Composition	RC07GF682J
	R49	Same as R3	
	R50	Same as R48	
	R51	Same as R21	
	R52	Not Used	
	R53	Resistor, Fixed, Composition	RC07GF222J
	R54	Same as R25	
	R55	Resistor, Fixed, Composition	RC07GF472J
	R56	Same as R8	
	R57	Same as R53	
	R58	Same as R12	
	R59	Same as R25	
	R60	Resistor, Fixed, Composition	RC07GF821J
	R61	Resistor, Fixed, Composition	RC07GF154J
	R62	Not Used	
	thru		
	R65		
	R66	Same as R3	
	R67	Same as R53	
	R68	Same as R22	
	R69	Same as R22	
	R70	Same as R1	
	R71	Same as R11	
	R72	Same as R21	
	R73	Same as R22	
	R74	Same as R10	
	R75	Same as R40	
	R76	Same as R25	
	R77	Same as R20	
	R78	Resistor, Fixed, Composition	RC07GF392J
	R79	Same as R21	
	R80	Resistor, Fixed, Composition	RC07GF100J
	R81	Same as R13	
	R82	Same as R22	
	R83	Same as R10	
	R84	Same as R21	
	R85	Same as R24	
	R86	Same as R12	
	R87	Same as R5	
	R88	Not Used	
	thru		
	R92		
	R93	Same as R55	
	R94	Same as R1	
	R95	Resistor, Fixed, Composition	RC07GF181J
	T1	Transformer	TF0359
	T2	Transformer, Variable	TT285-11
	T3	Same as T2	
	T4	Transformer, Variable	TT296-7
	Y1	Crystal, Quartz	CR109-147
	Z1	Network Mix., Dbl. Balanced	NW163
	Z2	Sideband, Filter	FX195-4

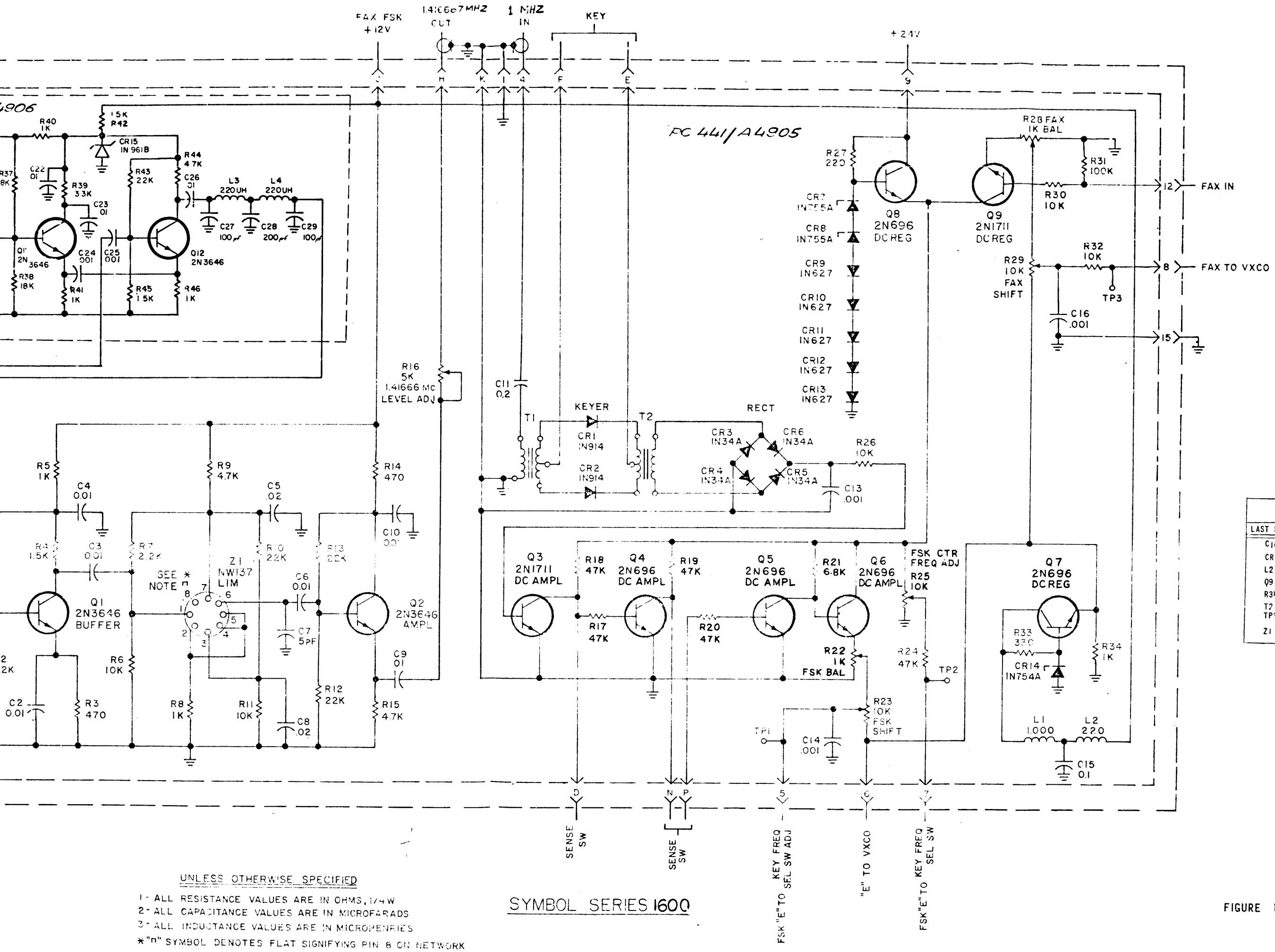
FIGURE 18. COMPONENT LOCATION AND PARTS LIST. A2H GENERATOR Z105

Parts List for A-4907

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-44
C2	Capacitor, Fixed, Mica	CM111C220J5S
C3	Capacitor, Fixed, Ceramic	CC100-42
C4	Capacitor, Fixed, Elec	CE122-10-25
C5	Same as C3	
C6	Same as C4	
C7	Capacitor, Fixed, Elec	CE122-6R8-25
C8	Same as C3	
C9	Same as C4	
C10	Same as C7	
C11	Same as C4	
C12	Capacitor, Fixed, Elec	CE122-22-16
C13	Same as C7	
C14	Same as C7	
C15	Same as C1	
C16	Not Used	
C17	Same as C1	
C18	Same as C12	
C19	Not Used	
C20	Not Used	
C21	Same as C1	
thru		
C27		
C28	Capacitor, Fixed, Mica	CM112F392G3S
C29	Same as C1	
thru		
C32		
C33	Same as C28	
C34	Same as C1	
C35	Same as C1	
C36	Same as C1	
C37	Capacitor, Variable	CV112-8
C38	Same as C7	
C39	Same as C12	
C40	Same as C1	
C41	Capacitor, Fixed, Ceramic	CC100-28
C42	Same as C41	
C43	Same as C1	
C44	Same as C1	
C45	Same as C12	
C46	Same as C1	
C47	Same as C1	
C48	Same as C1	
C49	Same as C41	
C50	Same as C1	
C51	Same as C1	
C52	Capacitor, Fixed, Mica	CM112F103J1S
C53	Same as C41	
C54	Same as C41	
C55	Same as C1	
C56	Same as C1	
C57	Same as C41	
C60	Same as C41	
C61	Not Used	
thru		
C63		
C64	Same as C12	
C65	Same as C7	
C66	Same as C12	
C67	Capacitor, Fixed, Mica	CM111F301K5S
C68	Same as C7	
C69	Capacitor, Fixed, Elec	CE122-6R8-35
C70	Same as C69	
C71	Same as C4	
C72	Not Used	
C73	Not Used	
C74	Sam as C41	
C75	Same as C41	
C76	Not Used	
C77	Not Used	
C78	Not Used	
C79	Not Used	
C80	Not Used	
C81	Same as C7	
CR1	Semiconductor, Dev, Diode	1N914
CR2	Sam as CR1	
CR3	Same as CR1	
CR4	Semiconductor, Dev, Diode	1N961
CR5	Same as CR1	
CR6	Same as CR1	
CR7	Semiconductor, Dev, Diode	IN4245
K1	Relay	RL143-4
L1	Coil	CL275-102
L2	Same as L1	
L3	Same as L1	
L4	Not Used	
L5	Same as L1	
L6	Not Used	
L7	Same as L1	
thru		
L10		
L11	Not Used	
L12	Same as L1	
thru		
L17		
Q1	Transistor	2N3646
thru		
Q7		
Q8	Transistor	2N1225
Q9	Transistor	2N863
Q10	Same as Q9	
Q11	Same as Q8	
Q12	Same as Q8	
Q13	Same as Q9	
thru		
Q16		
Q17	Same as Q1	
Q18	Same as Q1	
Q19	Same as Q8	
Q20	Same as Q1	
thru		
Q26		
Q27	Transistor	2N696
Q28	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF122J
R2	Resistor, Fixed, Composition	RC07GF473J
R3	Resistor, Fixed, Composition	RC07GF103J
R4	Resistor, Fixed, Composition	RC07GF563J
R5	Resistor, Fixed, Composition	RC07GF104J
R6	Same as R4	
R7	Resistor, Fixed, Composition	RC07GF474J
R8	Resistor, Variable	RV124-1-502
R9	Same as R3	
R10	Resistor, Fixed, Composition	RC07GF223J
R11	Resistor, Fixed, Composition	RC07GF152J
R12	Resistor, Fixed, Composition	RC07GF101J
R13	Resistor, Fixed, Composition	RC07GF471J
R14	Same as R10	
R15	Same as R3	
R16	Same as R13	
R17	Same as R12	
R18	Same as R11	
R19	Same as R2	



R20	Resistor, Fixed, Composition	RC07GF153J
R21	Resistor, Fixed, Composition	RC07GF102J
R22	Resistor, Fixed, Composition	RC07GF562J
R23	Same as R22	
R24	Resistor, Fixed, Composition	RC07GF271J
R25	Resistor, Fixed, Composition	RC07GF470J
R26	Resistor, Fixed, Composition	RC07GF331J
R27	Same as R21	
R28	Same as R21	
R29	Resistor, Fixed, Composition	RC07GF220J
R30	Resistor, Fixed, Composition	RC07GF332J
R31	Same as R24	
R32	Same as R24	
R33	Same as R30	
R34	Same as R29	
R35	Same as R21	
R36	Same as R30	
R37	Same as R3	
R38	Same as R3	
R39	Resistor, Fixed, Composition	RC07GF681J
R40	Resistor, Fixed, Composition	RC07GF822J
R41	Resistor, Fixed, Composition	RC07GF391J
R42	Same as R30	
R43	Same as R25	
R44	Same as R5	
R45	Resistor, Fixed, Composition	RC07GF334J
R46	Same as R22	
R47	Same as R12	
R48	Resistor, Fixed, Composition	RC07GF682J
R49	Same as R3	
R50	Same as R48	
R51	Same as R21	
R52	Not Used	
R53	Resistor, Fixed, Composition	
R54	Same as R25	
R55	Resistor, Fixed, Composition	
R56	Same as R8	
R57	Same as R53	
R58	Same as R12	
R59	Same as R25	
R60	Resistor, Fixed, Composition	
R61	Resistor, Fixed, Composition	
R62	Not Used	
thru		
R65		
R66	Same as R3	
R67	Same as R53	
R68	Same as R22	
R69	Same as R22	
R70	Same as R1	
R71	Same as R11	
R72	Same as R21	
R73	Same as R22	
R74	Same as R10	
R75	Same as R40	
R76	Same as R25	
R77	Same as R20	
R78	Resistor, Fixed, Composition	
R79	Same as R21	
R80	Resistor, Fixed, Composition	
R81	Same as R13	
R82	Same as R22	
R83	Same as R10	
R84	Same as R21	
R85	Same as R24	



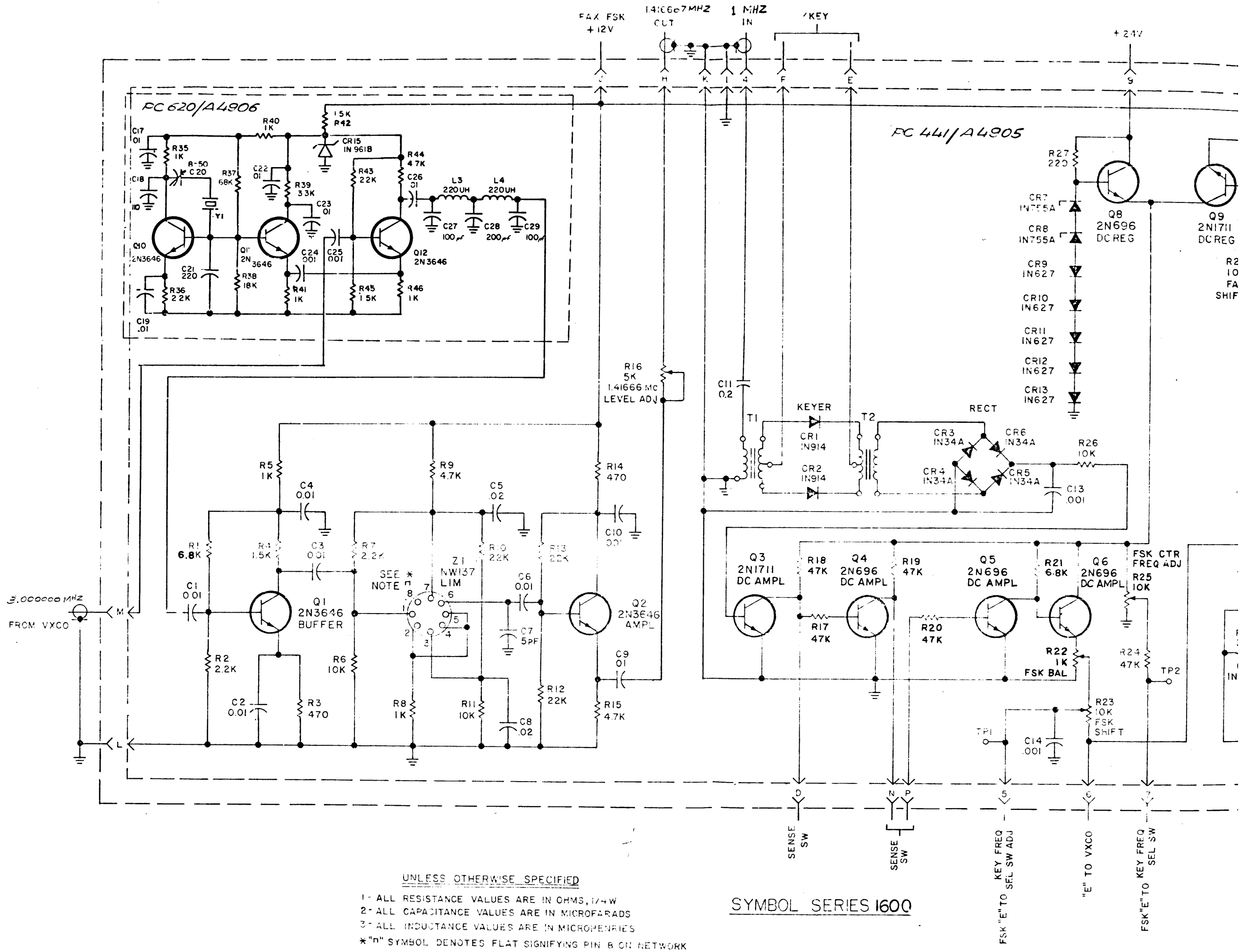
A-4905		A-4906	
LAST SYMBOL	MISSING SYMBOL	LAST SYMBOL	MISSING SYMBOL
C16	C12	C29	C1 thru C16
CR14		CR15	CR1 thru CR14
L2		L4	L1,2
Q9		Q12	Q1 thru Q9
R34		R46	R1 thru R34
T2		Y1	
TP3			
Z1			

UNLESS OTHERWISE SPECIFIED

1- ALL RESISTANCE VALUES ARE IN OHMS, 1/4W
2- ALL CAPACITANCE VALUES ARE IN MICROFARADS
3- ALL INDUCTANCE VALUES ARE IN MICROHENRIES
*"n" SYMBOL DENOTES FLAT SIGNIFYING PIN 8 ON NETWORK

SYMBOL SERIES 1600

FIGURE 19. SCHEMATIC DIAGRAM. FREQUENCY SHIFT GENERATOR/ OSCILLATOR-MIXER Z107



UNLESS OTHERWISE SPECIFIED

1- ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W
2- ALL CAPACITANCE VALUES ARE IN MICROFARADS
3- ALL INDUCTANCE VALUES ARE IN MICROHENRIES
*"n" SYMBOL DENOTES FLAT SIGNIFYING PIN 8 ON NETWORK

SYMBOL SERIES 1600

Parts List for A-4905

TMC P/N	SYMBOL	DESCRIPTION	TMC P/N
	C1 thru C4	Capacitor, Fixed, Ceramic	CC100-41
CC100-41	C5	Capacitor, Fixed, Ceramic	CC100-40
CM111F110G5S	C6	Same as C1	
	C7	Capacitor, Fixed, Mica	CM111C050K5
CV109-9	C8	Same as C5	
CM111F221G5S	C9	Same as C1	
	C10	Same as C1	
	C11	Capacitor, Fixed, Ceramic	CC100-33
CC100-29	C12	Not Used	
	C13	Capacitor, Fixed, Ceramic	CC100-29
	C14	Same as C13	
CM111F101G5S	C15	Capacitor, Fixed, Ceramic	CC100-44
CM111F201G5S	C16	Same as C13	
	CR1	Semiconductor, Dev., Diode	1N914
	CR2	Same as CR1	
	CR3 thru CR6	Semiconductor, Dev., Diode	1N34A
1N961B	CR7	Semiconductor, Dev., Diode	1N755A
	CR8	Same as CR7	
CL275-221	CR9 thru CR13	Semiconductor, Dev., Diode	1N627
	CR14	Semiconductor, Dev., Diode	1N754A
	L1	Coil	CL275-102
2N3646	L2	Coil	CL275-221
	Q1	Transistor	2N3646
	Q2	Same as Q1	
	Q3	Transistor	2N1711
	Q4 thru Q8	Transistor	2N696
RC07GF102J	Q9	Same as Q3	
RC07GF222J	R1	Resistor, Fixed, Composition	RC07GF682J
RC07GF683J	R2	Resistor, Fixed, Composition	RC07GF222J
RC07GF183J	R3	Resistor, Fixed, Composition	RC07GF47LJ
RC07GF332J	R4	Resistor, Fixed, Composition	RC07GF152J
	R5	Resistor, Fixed, Composition	RC07GF102J
RC07GF152J	R6	Resistor, Fixed, Composition	RC07GF103J
RC07GF223J	R7	Same as R2	
RC07GF472J	R8	Same as R5	
	R9	Resistor, Fixed, Composition	RC07GF472J
	R10	Resistor, Fixed, Composition	RC07GF223J
CR18/AU-4, 416667 MHZ	R11	Same as R6	
	R12	Same as R10	
	R13	Same as R10	
	R14	Same as R3	
	R15	Same as R9	
	R16	Resistor, Variable	RV124-1-102
	R17 thru R20	Resistor, Fixed, Composition	RC07GF473J
	R21	Same as R1	
	R22	Same as R1	
	R23	Resistor, Variable	RV119-2-103D
	R24	Same as R17	
	R25	Same as R23	
	R26	Same as R6	
	R27	Resistor, Fixed, Composition	RC07GF221J
	R28	Same as R1	
	R29	Same as R23	
	R30	Same as R6	
	R31	Resistor, Fixed, Composition	RC07GF104J
	R32	Same as R6	
	R33	Resistor, Fixed, Composition	RC07GF331J
	R34	Same as R5	
	T1	Transformer, Rf	TZ216
	T2	Transformer, Toroidal	TZ218
	Z1	Network, Gate, Elect	NW137

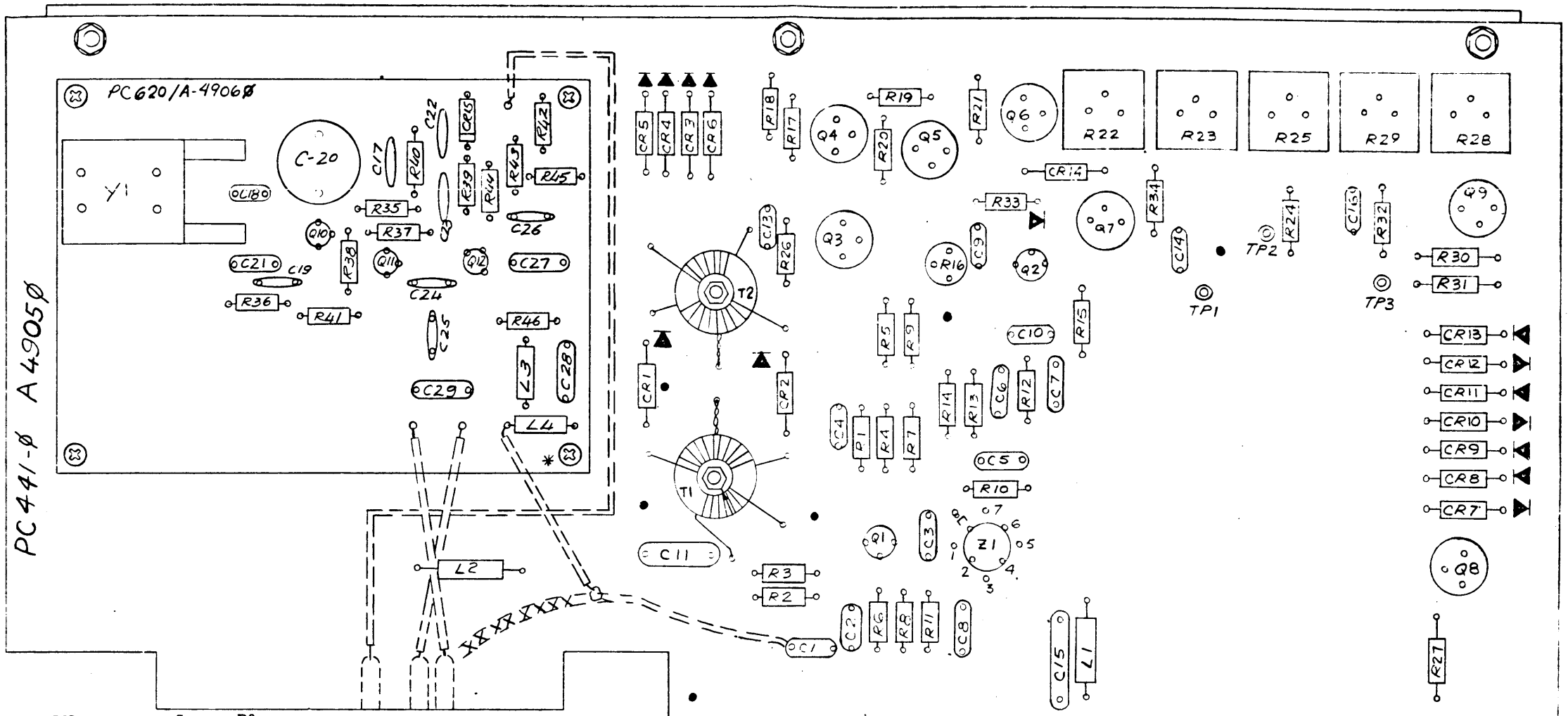


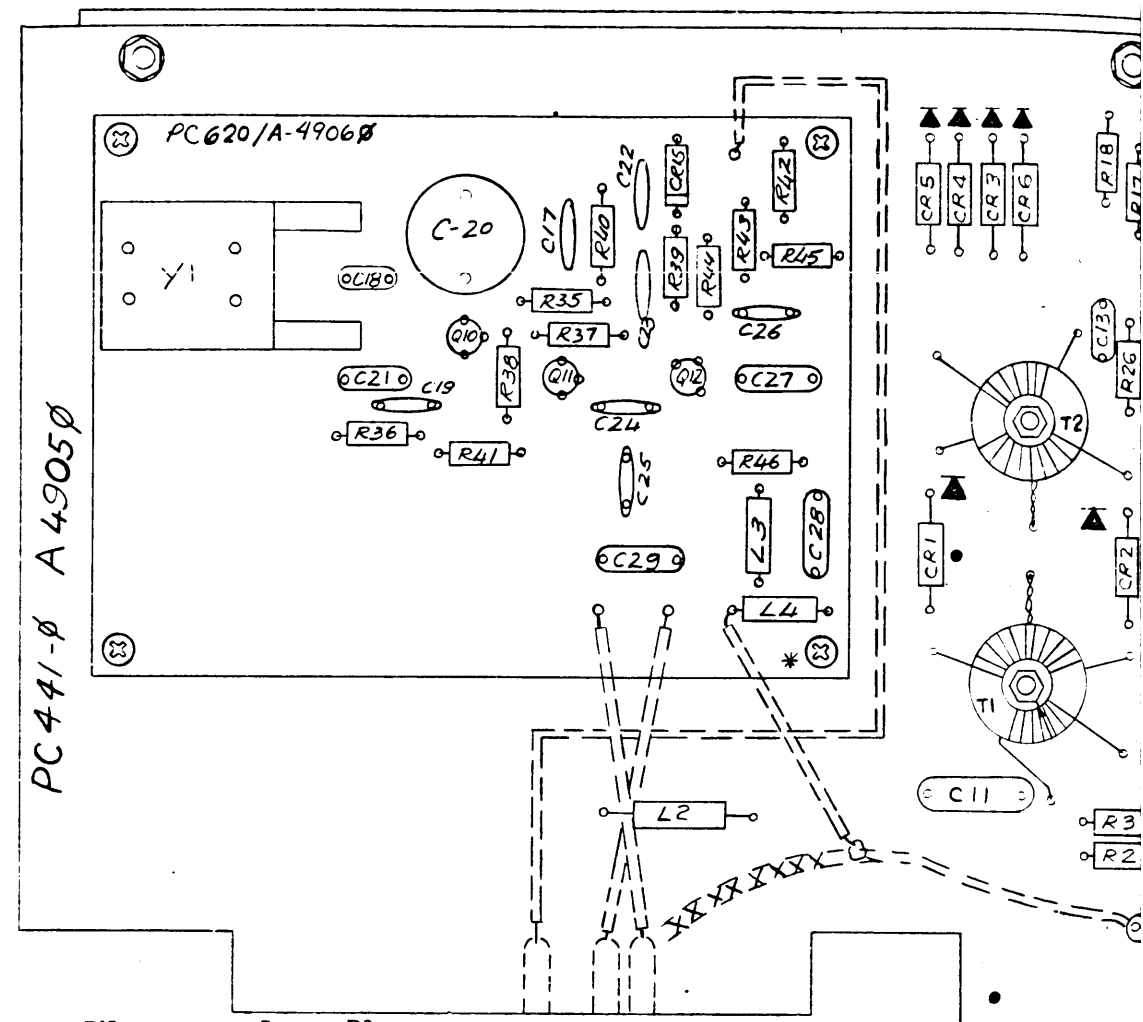
FIGURE 20. COMPONENT LOCATION AND PARTS LIST. FREQUENCY SHIFT GENERATOR/ OSCILLATOR-MIXER Z107

Parts List for A-4906

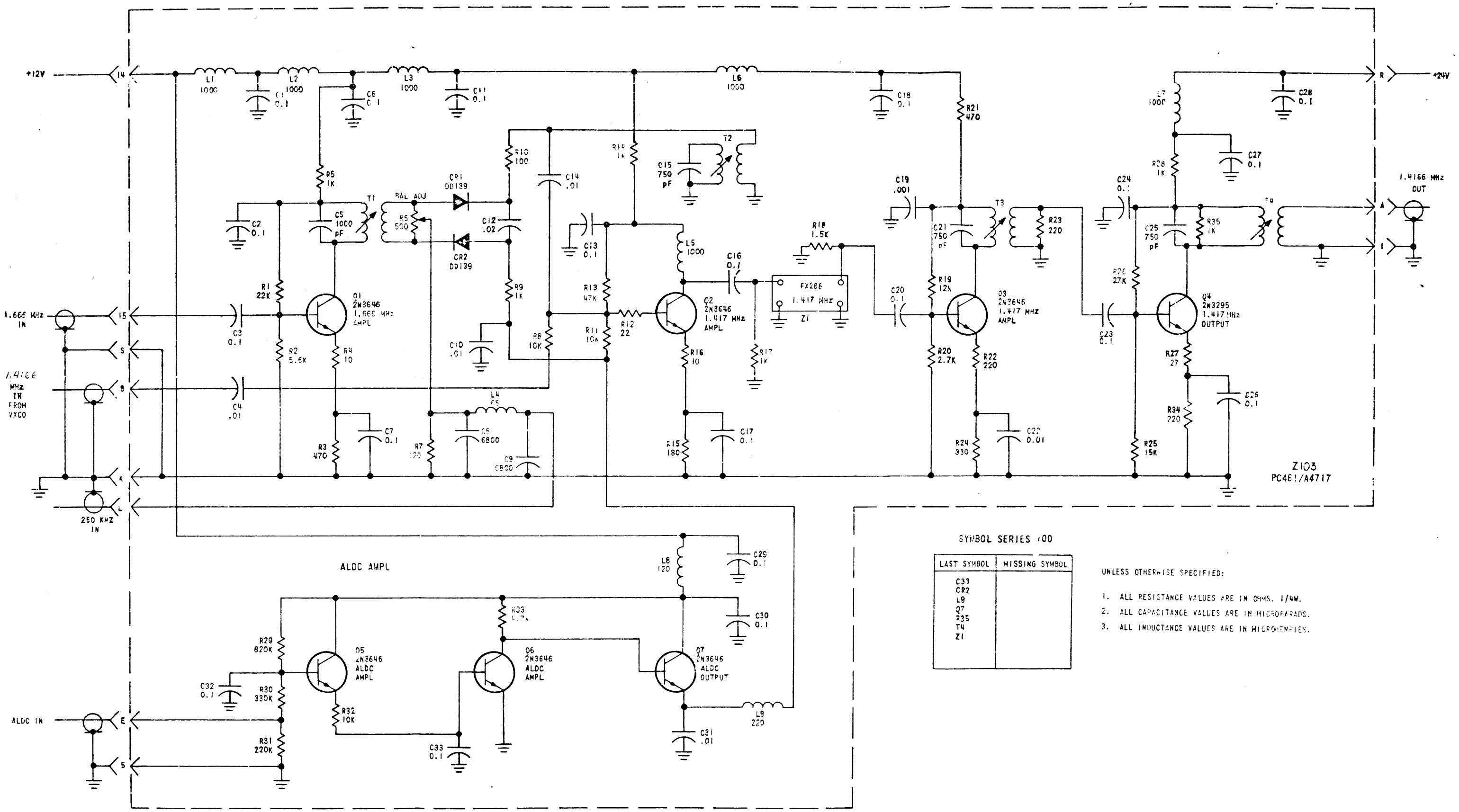
SYMBOL	DESCRIPTION	TMC P/N
C1 thru C16	Not Used	
C17	Capacitor, Fixed, Ceramic	CC100-41
C18	Capacitor, Fixed, Mica	CM111F110G5S
C19	Same as C17	
C20	Capacitor, Variable, Ceramic	CV109-9
C21	Capacitor, Fixed, Mica	CM111F221G5S
C22	Same as C17	
C23	Same as C17	
C24	Capacitor, Fixed, Ceramic	CC100-29
C25	Same as C24	
C26	Same as C17	
C27	Capacitor, Fixed, Mica	CM111F101G5S
C28	Capacitor, Fixed, Mica	CM111F201G5S
C29	Same as C27	
CR1 thru CR14	Not Used	
CR15	Semiconductor, Dev, Diode	1N961B
L1	Not Used	
L2	Not Used	
L3	Coil, RF	CL275-221
L4	Same as L3	
Q1 thru Q9	Not Used	
Q10 thru Q12	Semiconductor, Dev, Diode	2N3646
R1 thru R34	Not Used	
R35	Resistor, Fixed, Composition	RC07GF102J
R36	Resistor, Fixed, Composition	RC07GF222J
R37	Resistor, Fixed, Composition	RC07GF683J
R38	Resistor, Fixed, Composition	RC07GF183J
R39	Resistor, Fixed, Composition	RC07GF332J
R40	Same as R35	
R41	Same as R35	
R42	Resistor, Fixed, Composition	RC07GF152J
R43	Resistor, Fixed, Composition	RC07GF223J
R44	Resistor, Fixed, Composition	RC07GF472J
R45	Same as R42	
R46	Same as R35	
Y1	Crystal, Unit, Quartz	CR18/AU-4. 416667 MHZ

Parts List for A-4905

SYMBOL	DESCRIPTION	TMC P/N
C1 thru C4	Capacitor, Fixed, Ceramic	CC100-41
C5	Capacitor, Fixed, Ceramic	CC100-40
C6	Same as C1	
C7	Capacitor, Fixed, Mica	CM111C050K5
C8	Same as C5	
C9	Same as C1	
C10	Same as C1	
C11	Capacitor, Fixed, Ceramic	CC100-33
C12	Not Used	
C13	Capacitor, Fixed, Ceramic	CC100-29
C14	Same as C13	
C15	Capacitor, Fixed, Ceramic	CC100-44
C16	Same as C13	
CR1	Semiconductor, Dev., Diode	1N914
CR2	Same as CR1	
CR3 thru CR6	Semiconductor, Dev., Diode	1N34A
CR7	Semiconductor, Dev., Diode	1N755A
CR8	Same as CR7	
CR9 thru CR13	Semiconductor, Dev., Diode	1N627
CR14	Semiconductor, Dev., Diode	1N754A
L1	Coil	CL275-102
L2	Coil	CL275-221
Q1	Transistor	2N3646
Q2	Same as Q1	
Q3	Transistor	2N1711
Q4 thru Q8	Transistor	2N696
Q9	Same as Q3	
R1	Resistor, Fixed, Composition	RC07GF682J
R2	Resistor, Fixed, Composition	RC07GF222J
R3	Resistor, Fixed, Composition	RC07GF47LJ
R4	Resistor, Fixed, Composition	RC07GF152J
R5	Resistor, Fixed, Composition	RC07GF102J
R6	Resistor, Fixed, Composition	RC07GF103J
R7	Same as R2	
R8	Same as R5	
R9	Resistor, Fixed, Composition	RC07GF472J
R10	Resistor, Fixed, Composition	RC07GF223J
R11	Same as R6	
R12	Same as R10	
R13	Same as R10	
R14	Same as R3	



R15	Same as R9	
R16	Resistor, Variable	RV124-1-102
R17	Resistor, Fixed, Composition	RC07GF473J
R18 thru R20		
R21	Same as R1	
R22	Same as R1	
R23	Resistor, Variable	RV119-2-103D
R24	Same as R17	
R25	Same as R23	
R26	Same as R6	
R27	Resistor, Fixed, Composition	RC07GF22LJ
R28	Same as R1	
R29	Same as R23	
R30	Same as R6	
R31	Resistor, Fixed, Composition	RC07GF104J
R32	Same as R6	
R33	Resistor, Fixed, Composition	RC07GF33LJ
R34	Same as R5	
T1	Transformer, Rf	TZ216
T2	Transformer, Toroidal	TZ218
Z1	Network, Gate, Elect	NW137



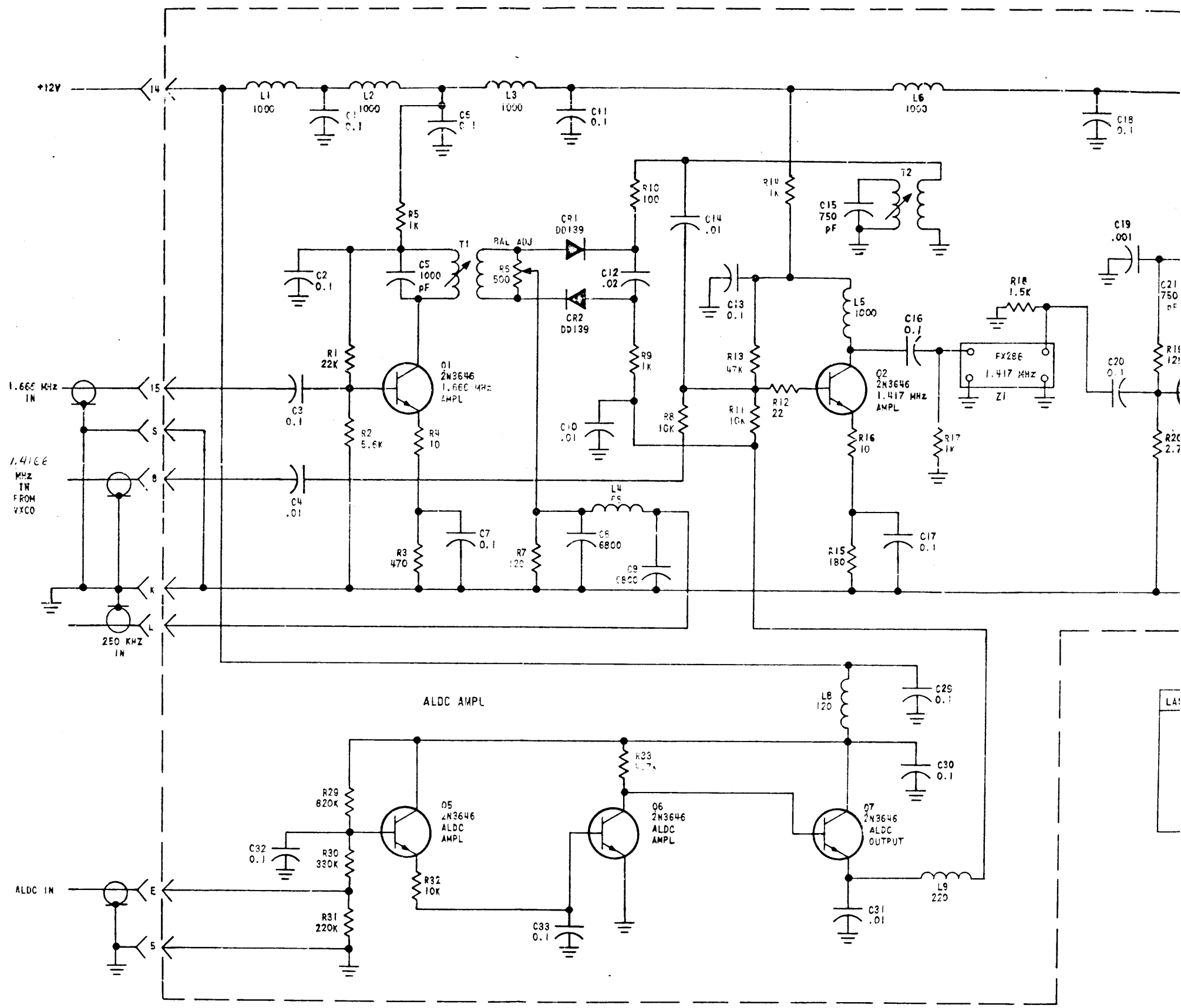
SYMBOL SERIES 100

LAST SYMBOL	MISSING SYMBOL
C33	
CR2	
L9	
Q7	
R35	
T4	
Z1	

UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS. 1/4W.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3. ALL INDUCTANCE VALUES ARE IN MICROHENRIES.

FIGURE 21. SCHEMATIC DIAGRAM. CONVERTER/ALDC Z103


+12V
14
L1 1000
C1 0.1
L2 1000
C5 0.1
L3 1000
C11 0.1
L6 1000
C18 0.1
R5 1K
T1
BAL ADJ
CR1 DD139
R10 100
C14 .01
R14 1K
T2
C15 750 pF
C19 .001
C2 0.1
C6 1000 pF
R6 500
C12 .02
CR2 DD139
C13 0.1
L5 1000
C16 0.1
R18 1.5K
FX286 1.417 MHz
Z1
C20 0.1
C21 750 pF
R1 22K
Q1 2N3646 1.666 MHz AMPL
R9 1K
R13 47K
Q2 2N3646 1.417 MHz AMPL
1.666 MHz IN
15
C3 0.1
R2 5.6K
R4 10
C10 .01
R8 10K
R11 10K
R12 22
R16 10
R17 1K
S
1.4166 MHz IN FROM VXCO
B
C4 .01
L4
C7 0.1
C8 6800
R3 470
R7 120
C9 6800
R15 180
C17 0.1
K
L
250 KHZ IN
ALDC AMPL
L8 120
C29 0.1
R33
C30 0.1
R29 820K
Q5 2N3646 ALDC AMPL
Q6 2N3646 ALDC AMPL
Q7 2N3646 ALDC OUTPUT
C32 0.1
R30 330K
R32 10K
L9 220
ALDC IN
E
R31 220K
C33 0.1
C31 .01
5

	TMC P/N			
ic	CC100-44	R3	Resistor, Fixed, Composition	RC07GF471J
		R4	Resistor, Fixed, Composition	RC07GF100J
		R5	Resistor, Fixed, Composition	RC07GF102J
ic	CC100-42	R6	Resistor, Variable	RV124-1-501
	CM111F102F1	R7	Resistor, Fixed, Composition	RC07GF121J
		R8	Resistor, Fixed, Composition	RC07GF103J
		R9	Same as R5	
	CM112F682G3S	R10	Resistor, Fixed, Composition	RC07GF101J
		R11	Same as R8	
		R12	Resistor, Fixed, Composition	RC07GF220J
		R13	Resistor, Fixed, Composition	RC07GF473J
ic	CC100-40	R14	Same as R5	
		R15	Resistor, Fixed, Composition	RC07GF181J
		R16	Same as R4	
	CM111F751J3	R17	Same as R5	
		R18	Resistor, Fixed, Composition	RC07GF152J
		R19	Resistor, Fixed, Composition	RC07GF123J
		R20	Resistor, Fixed, Composition	RC07GF272J
ic	CC100-29	R21	Same as R3	
		R22	Resistor, Fixed, Composition	RC07GF221J
		R23	Same as R22	
		R24	Resistor, Fixed, Composition	RC07GF331J
		R25	Resistor, Fixed, Composition	RC07GF153J
ic	CC100-28	R26	Resistor, Fixed, Composition	RC07GF273J
		R27	Resistor, Fixed, Composition	RC07GF270J
		R28	Same as R5	
		R29	Resistor, Fixed, Composition	RC07GF824J
		R30	Resistor, Fixed, Composition	RC07GF334J
		R31	Resistor, Fixed, Composition	RC07GF224J
		R32	Same as R8	
		R33	Resistor, Fixed, Composition	RC07GF472J
		R34	Same as R22	
		T1	Transformer, Variable	TT296-1
Diode	DD139	T2	Transformer, Variable	TT296-2
		T3	Transformer, Variable	TT296-3
	CL275-102	T4	Same as T3	
		Z1	Filter, Bandpass	FX286
	CL275-680			
	CL275-121			
	CL275-221			
	2N3646			
	2N3295			
sition	RC07GF223J			
sition	RC07GF562J			

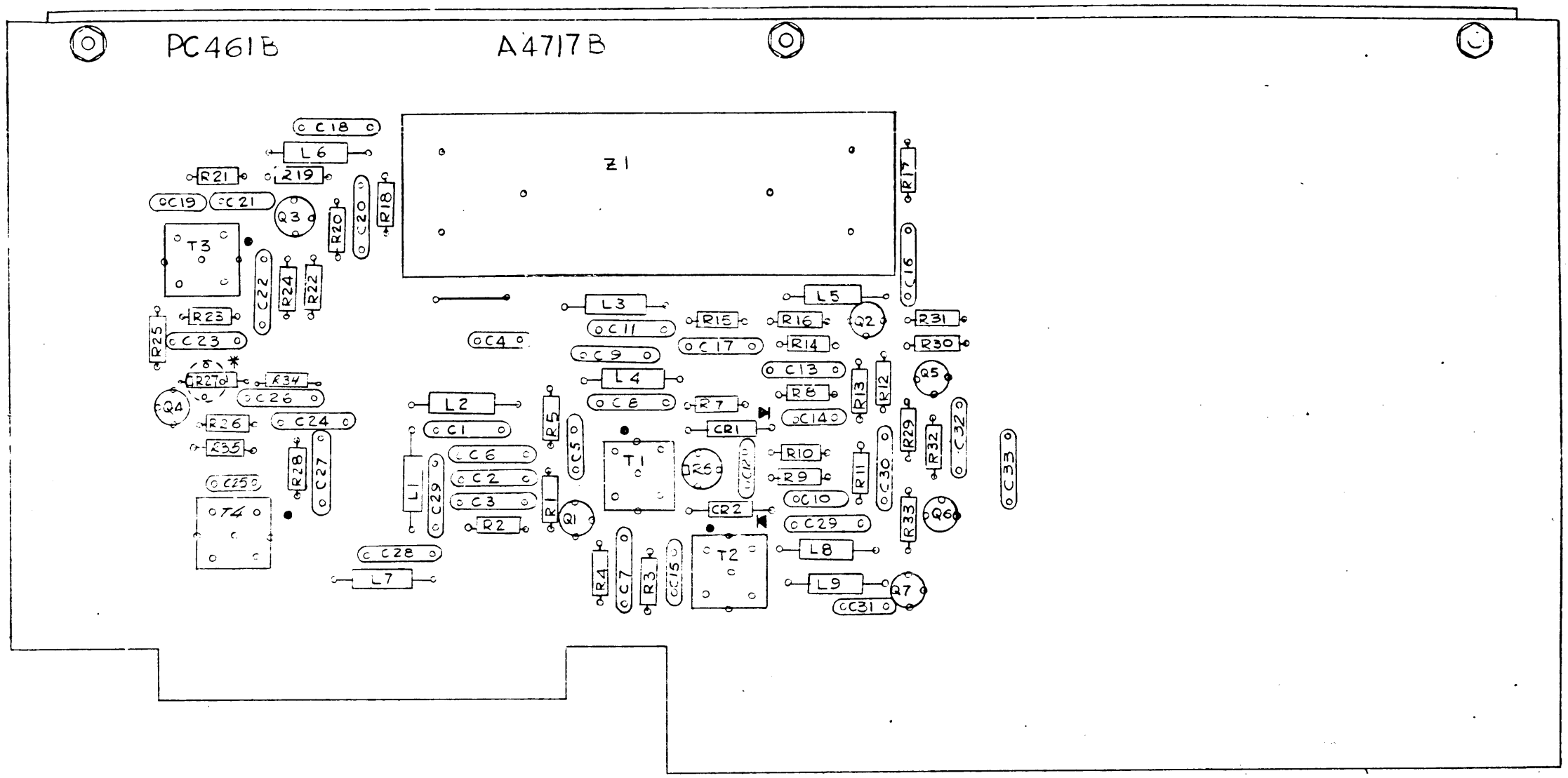
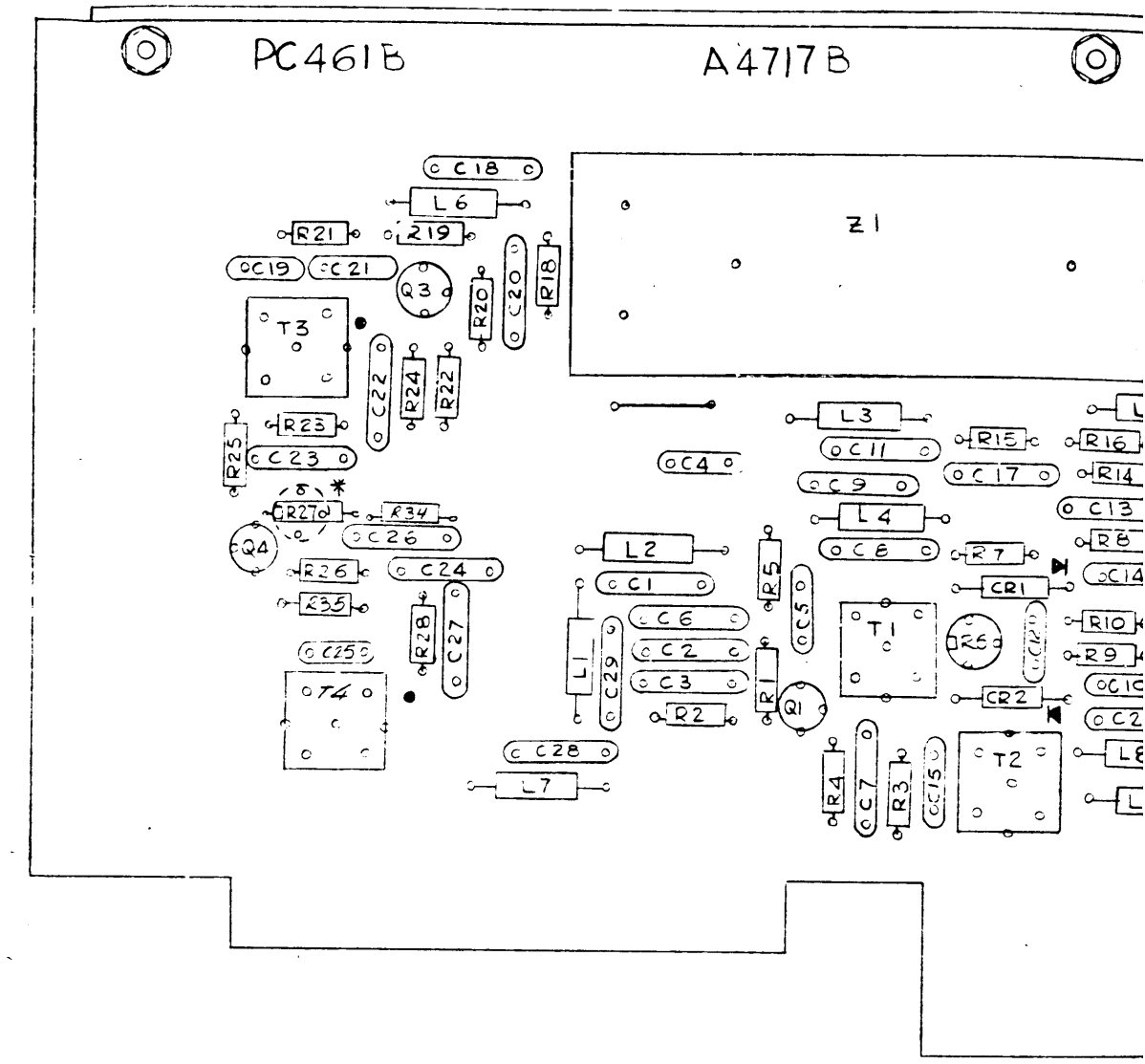
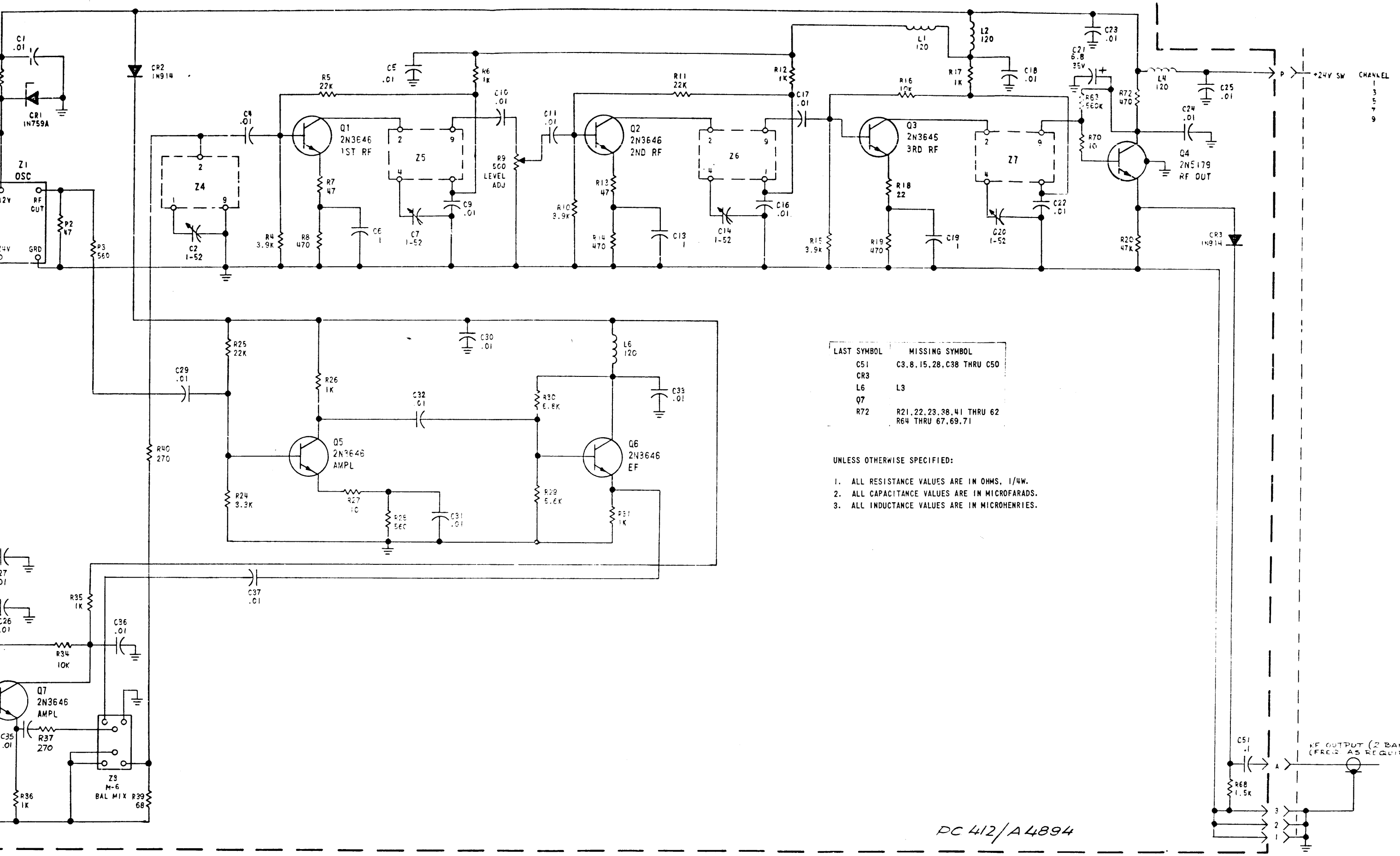


FIGURE 22. COMPONENT LOCATION AND PARTS LIST. CONVERTER/ALDC Z103

Parts List for A-4717

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-44
C2	Same as C1	
C3	Same as C1	
C4	Capacitor, Fixed, Ceramic	CC100-42
C5	Capacitor, Fixed, Mica	CM11F102F1
C6	Same as C1	
C7	Same as C1	
C8	Capacitor, Fixed, Mica	CM112F682G3S
C9	Same as C8	
C10	Same as C4	
C11	Same as C1	
C12	Capacitor, Fixed, Ceramic	CC100-40
C13	Same as C1	
C14	Same as C4	
C15	Capacitor, Fixed, Mica	CM11F751J3
C16	Same as C1	
thru		
C18		
C19	Capacitor, Fixed, Ceramic	CC100-29
C20	Same as C1	
C21	Same as C15	
C22	Same as C4	
C23	Same as C1	
C24	Capacitor, Fixed, Ceramic	CC100-28
C25	Same as C15	
C26	Same as C1	
C27	Same as C24	
C28	Same as C24	
C29	Same as C1	
C30	Same as C1	
C31	Same as C4	
C32	Same as C24	
C33	Same as C24	
CR1	Semiconductor, Device, Diode	DD139
CR2	Same as CR1	
L1	Coil	CL275-102
thru		
L3		
L4	Coil	CL275-680
L5	Same as L1	
thru		
L7		
L8	Coil	CL275-121
L9	Coil	CL275-221
Q1	Transistor	2N3646
thru		
Q3		
Q4	Transistor	2N3295
Q5	Same as Q1	
thru		
Q7		
R1	Resistor, Fixed, Composition	RC07GF223J
R2	Resistor, Fixed, Composition	RC07GF562J
R3	Resistor, Fixed, Composition	RC07GF471J
R4	Resistor, Fixed, Composition	RC07GF100J
R5	Resistor, Fixed, Composition	RC07GF102J
R6	Resistor, Variable	RV124-1-501
R7	Resistor, Fixed, Composition	RC07GF121J
R8	Resistor, Fixed, Composition	RC07GF103J
R9	Same as R5	
R10	Resistor, Fixed, Composition	RC07GF101J
R11	Same as R8	
R12	Resistor, Fixed, Composition	RC07GF220J
R13	Resistor, Fixed, Composition	RC07GF473J
R14	Same as R5	
R15	Resistor, Fixed, Composition	RC07GF181J
R16	Same as R4	
R17	Same as R5	
R18	Resistor, Fixed, Composition	RC07GF152J
R19	Resistor, Fixed, Composition	RC07GF123J
R20	Resistor, Fixed, Composition	RC07GF272J
R21	Same as R3	
R22	Resistor, Fixed, Composition	RC07GF221J
R23	Same as R22	
R24	Resistor, Fixed, Composition	RC07GF331J
R25	Resistor, Fixed, Composition	RC07GF153J
R26	Resistor, Fixed, Composition	RC07GF273J
R27	Resistor, Fixed, Composition	RC07GF270J
R28	Same as R5	
R29	Resistor, Fixed, Composition	RC07GF824J
R30	Resistor, Fixed, Composition	RC07GF334J
R31	Resistor, Fixed, Composition	RC07GF224J
R32	Same as R8	
R33	Resistor, Fixed, Composition	RC07GF472J
R34	Same as R22	
T1	Transformer, Variable	TT296-1
T2	Transformer, Variable	TT296-2
T3	Transformer, Variable	TT296-3
T4	Same as T3	
Z1	Filter, Bandpass	FX286





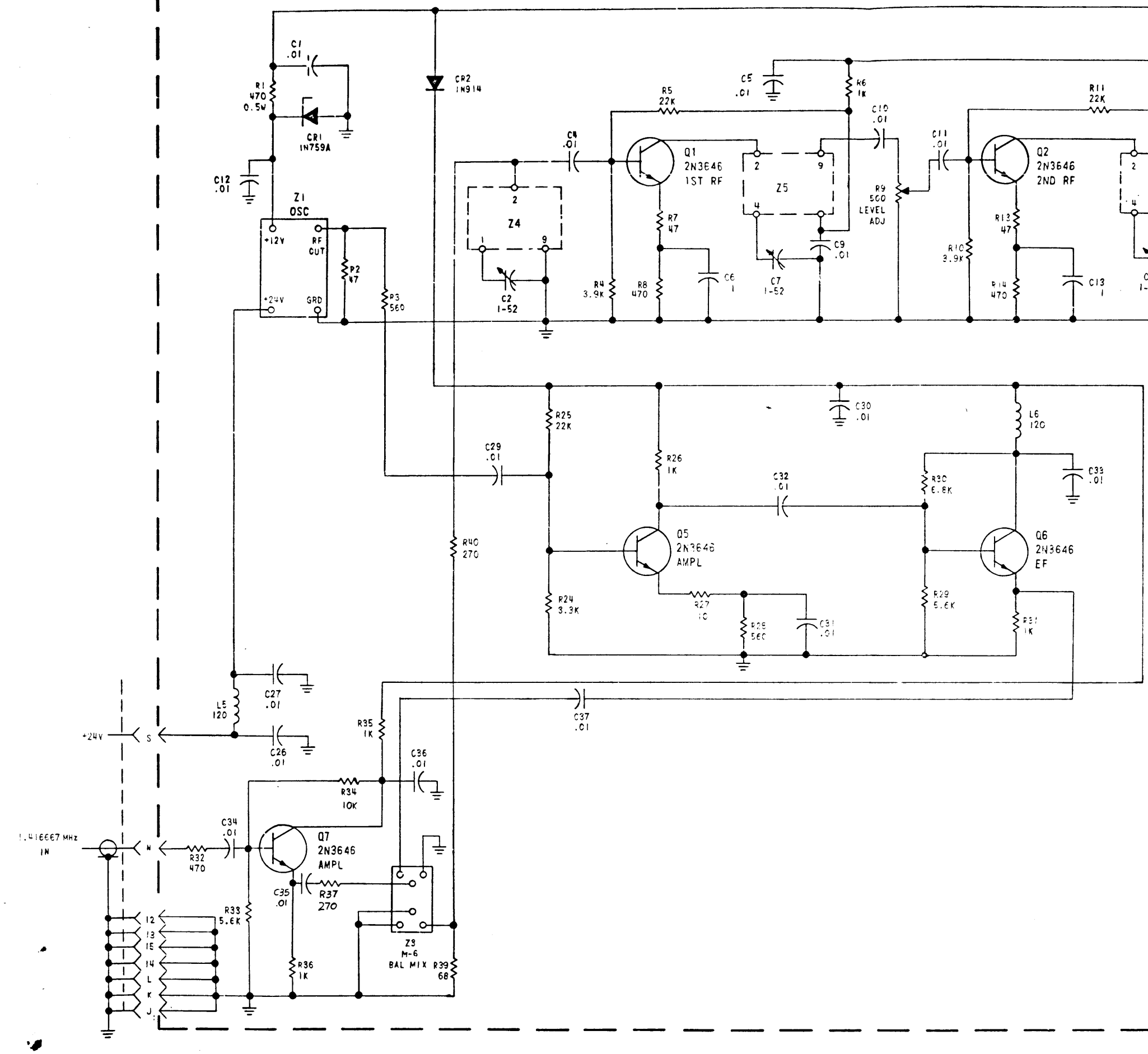
LAST SYMBOL	MISSING SYMBOL
C51	C3,8,15,28,C38 THRU C50
CR3	
L6	L3
Q7	
R72	R21,22,23,38,41 THRU 62 R64 THRU 67,69,71

UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4W.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3. ALL INDUCTANCE VALUES ARE IN MICROHENRIES.

PC 412/A4894

FIGURE 23. SCHEMATIC DIAGRAM.
RF AMPLIFIERS Z101, Z102, Z111, Z112, Z113



LAST SYMBOL	MISSING SYMBOL
C51	C3.8.15.28.C38 THRU C50
CR3	
L6	L3
Q7	
R72	R21.22.23.38.41 THRU 62 R64 THRU 67.69.71

UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL CAPACITANCE VALUES ARE IN MIC
3. ALL INDUCTANCE VALUES ARE IN MICR

PC 412

-4894				
ON	TMC P/N			
, Ceramic	CC100-43	R10	Same as R4	
ble, Glass	CV116-2	R11	Same as R5	
		R12	Same as R6	
		R13	Same as R2	
		R14	Same as R8	
, Ceramic	CC100-28	R15	Same as R4	
		R16	Resistor, Fixed, Composition	RC07GF103J
		R17	Same as R6	
		R18	Resistor, Fixed, Composition	RC07GF220J
		R19	Same as R8	
		R20	Resistor, Fixed, Composition	RC07GF473J
		R21	Not Used	
		thru		
		R23		
		R24	Resistor, Fixed, Composition	RC07GF332J
		R25	Same as R5	
		R26	Same as R6	
		R27	Resistor, Fixed, Composition	RC07GF100J
		R28	Same as R3	
, Elec	CE122-6R8-35	R29	Resistor, Fixed, Composition	RC07GF562J
		R30	Resistor, Fixed, Composition	RC07GF682J
		R31	Same as R6	
		R32	Same as R8	
		R33	Same as R29	
		R34	Same as R16	
		R35	Same as R6	
		R36	Same as R6	
		R37	Resistor, Fixed, Composition	RC07GF271J
		R38	Not Used	
		R39	Resistor, Fixed, Composition	RC07GF680J
		R40	Same as R37	
Dev, Diode	1N759A	R41	Not Used	
Dev, Diode	1N914	thru		
		R62		
	CL275-121	R63	Resistor, Fixed, Composition	RC07GF564J
		R64	Not Used	
		thru		
		R67		
		R68	Resistor, Fixed, Composition	RC07GF152J
		R69	Not Used	
	2N3646	R70	Same as R27	
		R71	Not Used	
		R72	Same as R8	
	2N5179	*Z1	Oscillator	A0125
		Z2	Not Used	
		Z3	Network, Mixer, Urbalanced	NW163
		*Z4	Transformer	TZ223
Composition	RC20GF471J	*Z5	Transformer	TZ225
Composition	RC07GF470J	*Z6	Same as Z5	
Composition	RC07GF561J	*Z7	Transformer	TZ226
Composition	RC07GF392J			
Composition	RC07GF223J			
Composition	RC07GF102J	* Note: Frequency must be specifiied when ordering		
Composition	RC07GF471J			
le, Comp	RV124-2-501			

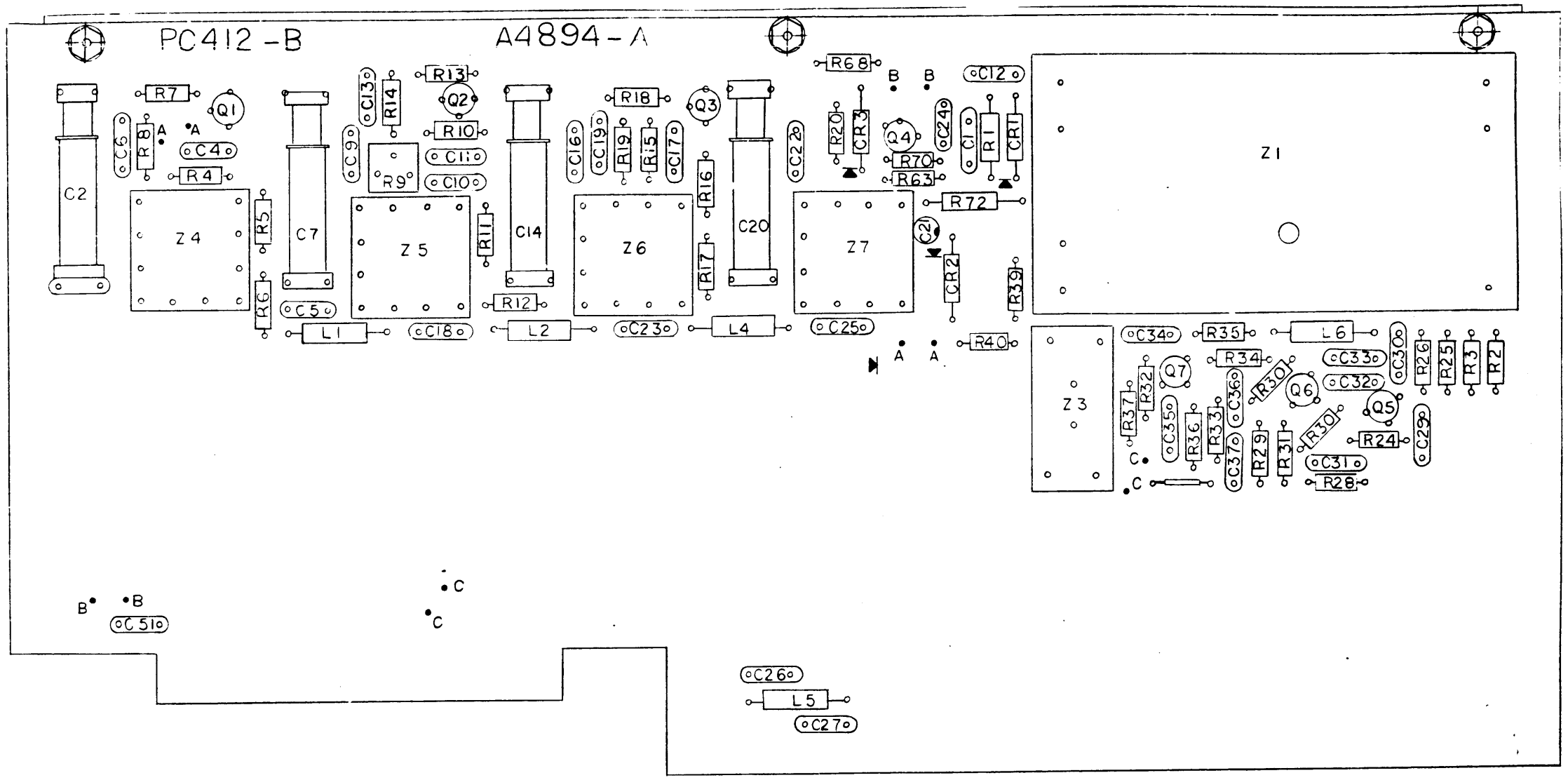
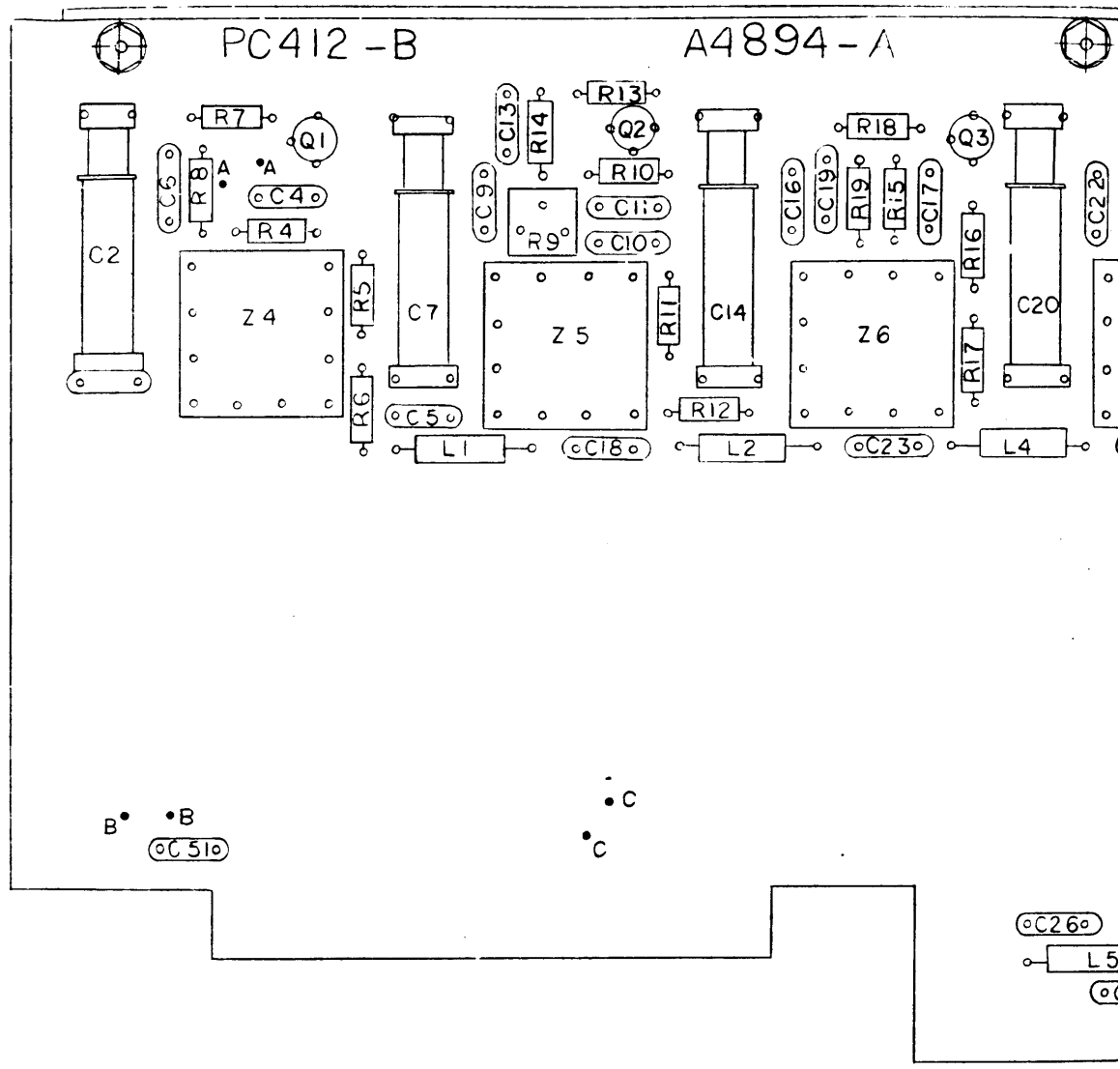


FIGURE 24. COMPONENT LOCATION AND PARTS LIST.
RF AMPLIFIERS Z101, Z102, Z111, Z112, Z113

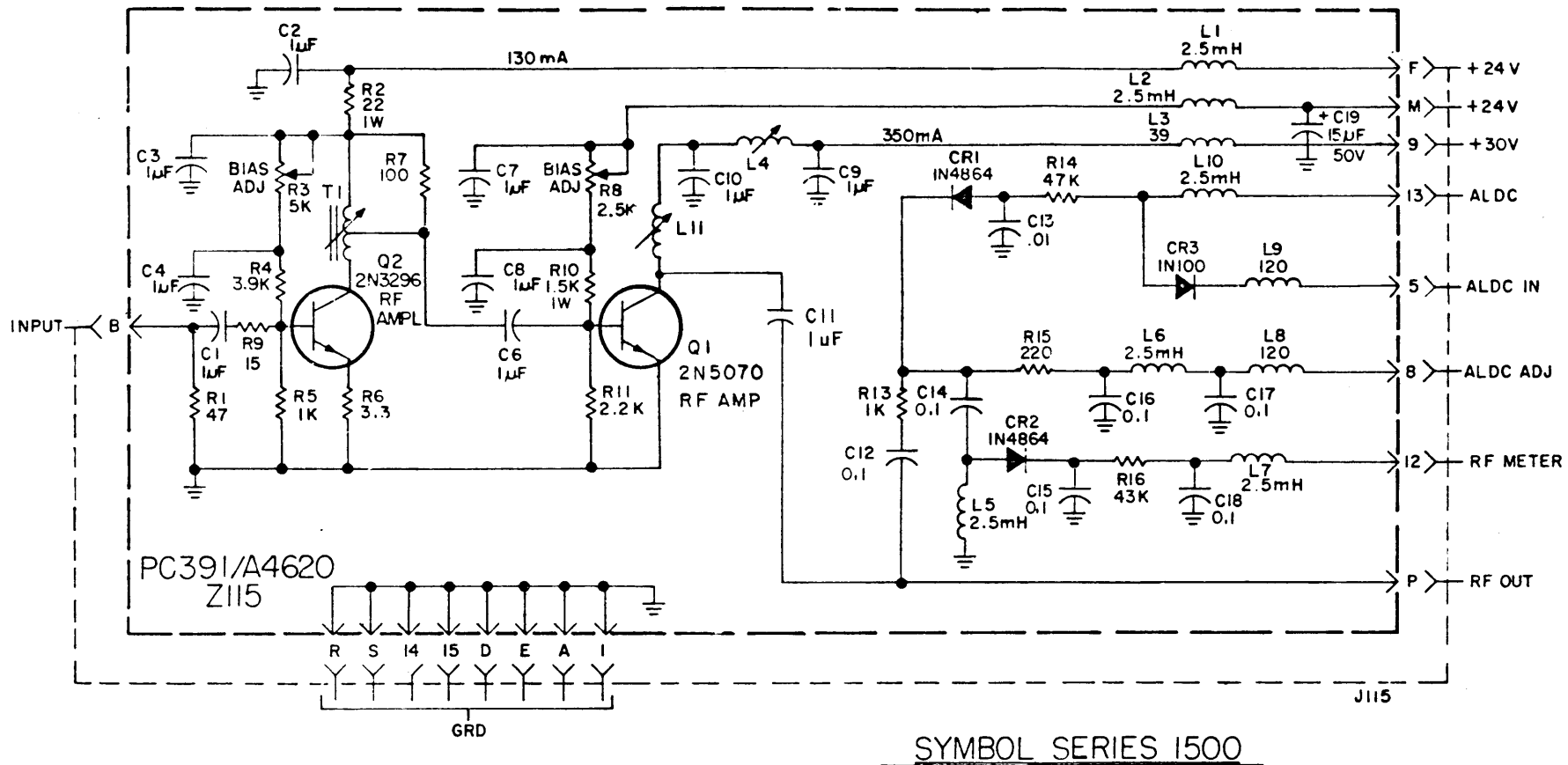
Parts List for A-4894

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-43
C2	Capacitor, Variable, Glass	CV116-2
C3	Not Used	
C4	Same as C1	
C5	Same as C1	
C6	Capacitor, Fixed, Ceramic	CC100-28
C7	Same as C2	
C8	Not Used	
C9	Same as C1	
thru		
C12		
C13	Same as C6	
C14	Same as C2	
C15	Not Used	
C16	Same as C1	
C17	Same as C1	
C18	Same as C1	
C19	Same as C6	
C20	Same as C2	
C21	Capacitor, Fixed, Elec	CE122-6R8-35
C22	Same as C1	
thru		
C27		
C28	Not Used	
C29	Same as C1	
thru		
C37		
C38	Not Used	
thru		
C50		
C51	Same as C6	
CR1	Semiconductor, Dev, Diode	1N759A
CR2	Semiconductor, Dev, Diode	1N914
CR3	Same as CR2	
L1	Coil	CL275-121
L2	Same as L1	
L3	Not Used	
L4	Same as L1	
thru		
L6		
Q1	Transistor	2N3646
Q2	Same as Q1	
Q3	Same as Q1	
Q4	Transistor	2N5179
Q5	Same as Q1	
thru		
Q7		
R1	Resistor, Fixed, Composition	RC20GF471J
R2	Resistor, Fixed, Composition	RC07GF470J
R3	Resistor, Fixed, Composition	RC07GF561J
R4	Resistor, Fixed, Composition	RC07GF392J
R5	Resistor, Fixed, Composition	RC07GF223J
R6	Resistor, Fixed, Composition	RC07GF102J
R7	Same as R2	
R8	Resistor, Fixed, Composition	RC07GF471J
R9	Resistor, Variable, Comp	RV124-2-501
R10	Same as R4	
R11	Same as R5	
R12	Same as R6	
R13	Same as R2	
R14	Same as R8	
R15	Same as R4	
R16	Resistor, Fixed, Composition	RC07GF103J
R17	Same as R6	
R18	Resistor, Fixed, Composition	RC07GF220J
R19	Same as R8	
R20	Resistor, Fixed, Composition	RC07GF473J
R21	Not Used	
thru		
R23		
R24	Resistor, Fixed, Composition	RC07GF332J
R25	Same as R5	
R26	Same as R6	
R27	Resistor, Fixed, Composition	RC07GF100J
R28	Same as R3	
R29	Resistor, Fixed, Composition	RC07GF562J
R30	Resistor, Fixed, Composition	RC07GF682J
R31	Same as R6	
R32	Same as R8	
R33	Same as R29	
R34	Same as R16	
R35	Same as R6	
R36	Same as R6	
R37	Resistor, Fixed, Composition	RC07GF271J
R38	Not Used	
R39	Resistor, Fixed, Composition	RC07GF680J
R40	Same as R37	
R41	Not Used	
thru		
R62		
R63	Resistor, Fixed, Composition	RC07GF564J
R64	Not Used	
thru		
R67		
R68	Resistor, Fixed, Composition	RC07GF152J
R69	Not Used	
R70	Same as R27	
R71	Not Used	
R72	Same as R8	
*Z1	Oscillator	AO125
Z2	Not Used	
Z3	Network, Mixer, Urbalanced	NW163
*Z4	Transformer	TZ223
*Z5	Transformer	TZ225
*Z6	Same as Z5	
*Z7	Transformer	TZ226

* Note: Frequency must be specifiifed when ordering



LAST SYMBOLS	MISSING SYMBOLS
C19	C5
CR3	
L11	
Q2	
R16	R12
T1	



SYMBOL SERIES 1500

UNLESS OTHERWISE SPECIFIED:

1-ALL RESISTANCE VALUES ARE IN OHMS, 1/2 W.
2-ALL DECIMAL NUMBER CAPACITANCE VALUES ARE IN MICROFARADS.
ALL WHOLE NUMBER VALUES ARE IN PICOFARADS.
3-ALL INDUCTANCE VALUES ARE IN MICROHENRIES.

FIGURE 25. SCHEMATIC DIAGRAM.
RF OUTPUT ASSEMBLY Z115

Parts List for A-4620

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Mtlz	CN114-1RO-5J
thru		
C4		
C5	Not Used	
C6	Same as C1	
thru		
C11		
C12	Capacitor, Fixed, Ceramic	CC100-28
C13	Capacitor, Fixed, Ceramic	CC100-16
C14	Same as C12	
thru		
C18		
C19	Capacitor, Fixed, Electrolytic	CE105-15-50
CR1	Semiconductor, Device, Diode	1N4864
CR2	Same as CR1	
CR3	Semiconductor, Device, Diode	1N100
L1	Coil, Rf, Fixed	CL140-1
L2	Same as L1	
L3	Coil, Rf, Fixed	CL270-39
L4	Choke, Rf, Adjust	CL240
L5	Same as L1	
thru		
L7		
L8	Coil, Rf, Fixed	CL240-120
L9	Same as L8	
L10	Same as L1	
L11	Same as L4	
Q1	Transistor	2N5070
Q2	Transistor	2N3296
R1	Resistor, Fixed, Composition	RC20GF470J
R2	Resistor, Fixed, Composition	RC32GF220J
R3	Resistor, Variable	RV124-1-502
R4	Resistor, Fixed, Composition	RC20GF392J
R5	Resistor, Fixed, Composition	RC20GF102J
R6	Resistor, Fixed, Composition	RC20GF3R3J
R7	Resistor, Fixed, Composition	RC20GF101J
R8	Resistor, Variable	RV124-1-252
R9	Resistor, Fixed, Composition	RC20GF150J
R10	Resistor, Fixed, Composition	RC32GF152J
R11	Resistor, Fixed, Composition	RC20GF222J
R12	Not Used	
R13	Same as R5	
R14	Resistor, Fixed, Composition	RC20GF473J
R15	Resistor, Fixed, Composition	RC20GF221J
R16	Resistor, Fixed, Composition	RC20GF433J
T1	Transformer, Rf, Adjust	TT288

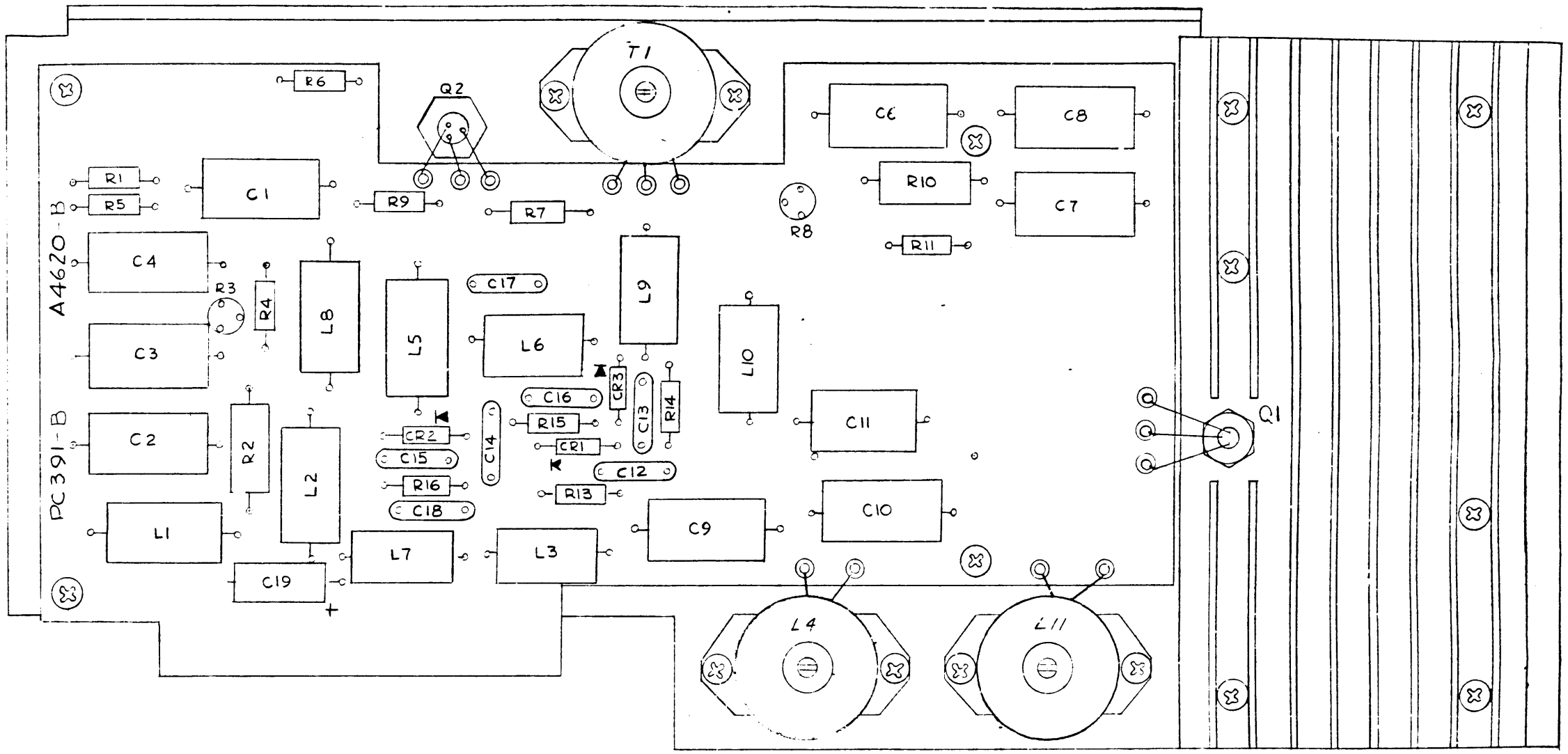
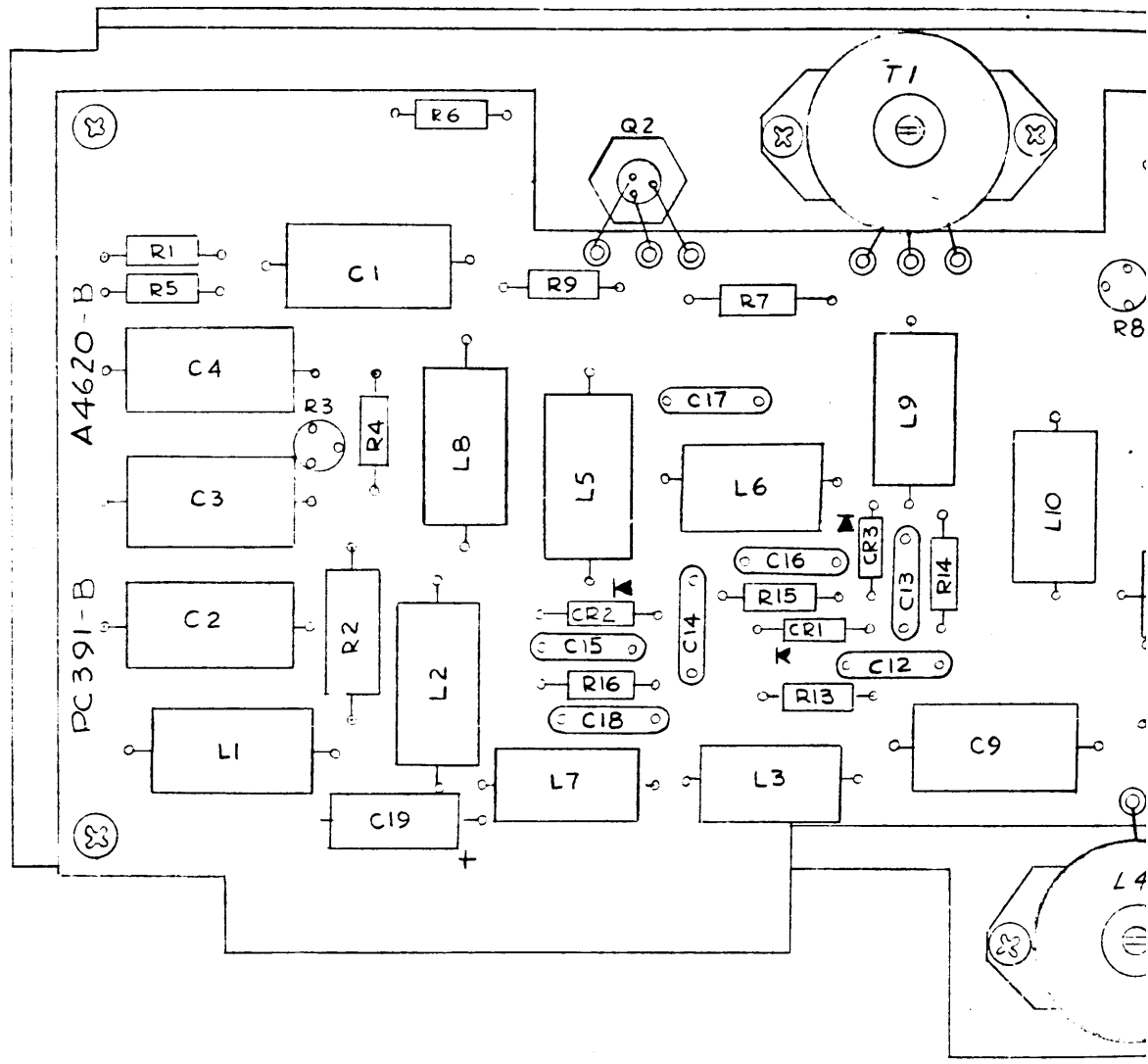


FIGURE 26. COMPONENT LOCATION AND PARTS LIST. RF OUTPUT ASSEMBLY Z115

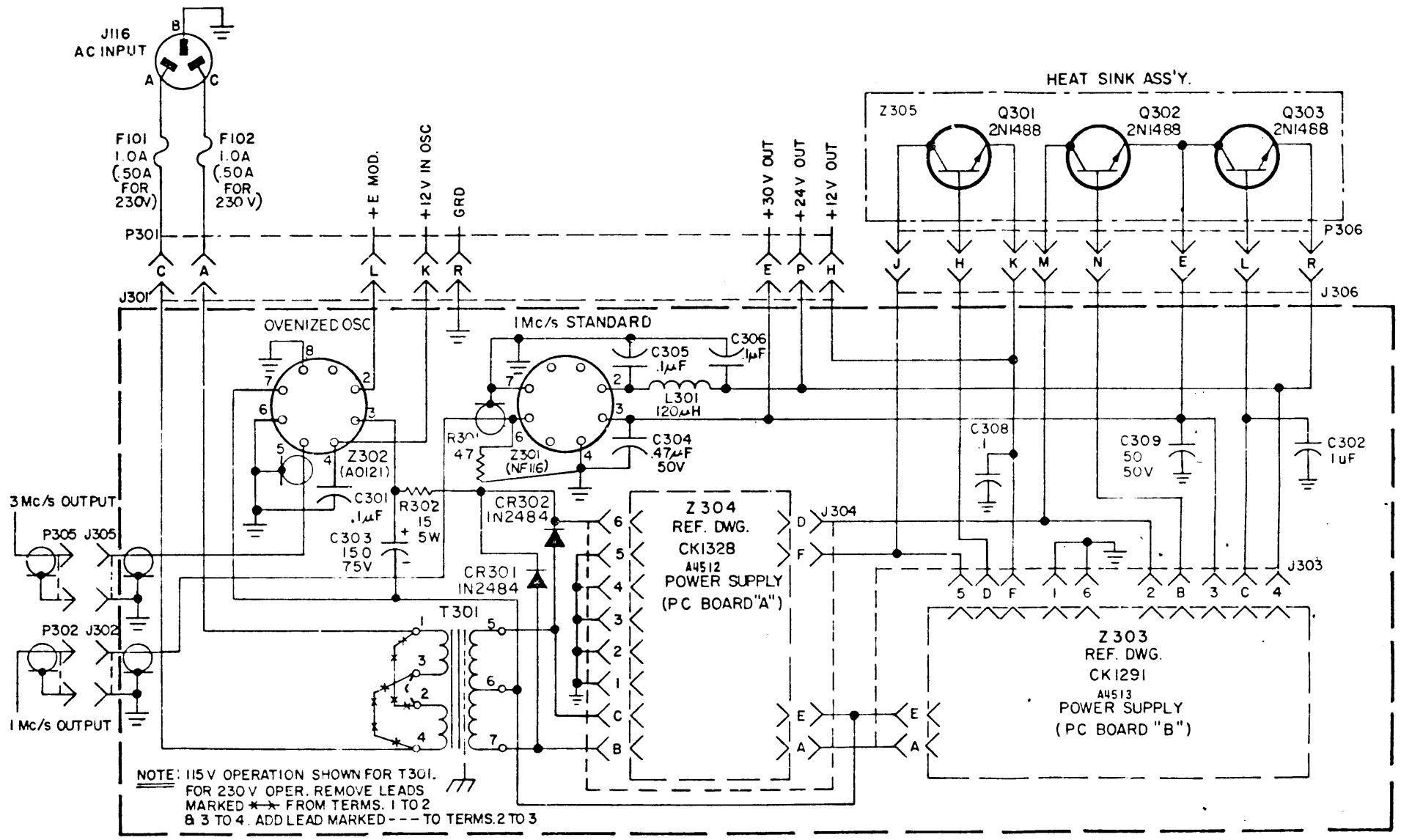
Parts List for A-4620

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Mila	CN114-iRO-5J
thru		
C4		
C5	Not Used	
C6	Same as C1	
thru		
C11		
C12	Capacitor, Fixed, Ceramic	CC100-28
C13	Capacitor, Fixed, Ceramic	CC100-16
C14	Same as C12	
thru		
C18		
C19	Capacitor, Fixed, Electrolytic	CE105-15-50
CR1	Semiconductor, Device, Diode	1N4864
CR2	Same as CR1	
CR3	Semiconductor, Device, Diode	1N100
L1	Coil, Rf, Fixed	CL140-1
L2	Same as L1	
L3	Coil, Rf, Fixed	CL270-39
L4	Choke, Rf, Adjust	CL240
L5	Same as L1	
thru		
L7		
L8	Coil, Rf, Fixed	CL240-120
L9	Same as L8	
L10	Same as L1	
L11	Same as L4	
Q1	Transistor	2N5070
Q2	Transistor	2N3296
R1	Resistor, Fixed, Composition	RC20GF470J
R2	Resistor, Fixed, Composition	RC32GF220J
R3	Resistor, Variable	RV124-1-502
R4	Resistor, Fixed, Composition	RC20GF392J
R5	Resistor, Fixed, Composition	RC20GF102J
R6	Resistor, Fixed, Composition	RC20GF3R3J
R7	Resistor, Fixed, Composition	RC20GF10iJ
R8	Resistor, Variable	RV124-1-252
R9	Resistor, Fixed, Composition	RC20GF150J
R10	Resistor, Fixed, Composition	RC32GF152J
R11	Resistor, Fixed, Composition	RC20GF222J
R12	Not Used	
R13	Same as R5	
R14	Resistor, Fixed, Composition	RC20GF473J
R15	Resistor, Fixed, Composition	RC20GF22IJ
R16	Resistor, Fixed, Composition	RC20GF433J
T1	Transformer, Rf, Adjust	TT288



Parts List for Power Supply Assembly

SYMBOL	DESCRIPTION	TMC P/N
C301	Capacitor, Fixed, Ceramic	CC100-37
C302	Capacitor, Fixed, Mylar	CN112A-105-M2
C303	Capacitor, Fixed, Electrolytic	CE105-150-75
C304	Capacitor, Fixed, Mtlz	CN114R47-5J
C305	Same as C301	
C306	Same as C301	
C307	Not Used	
C308	Same as C301	
C309	Capacitor, Fixed, Electrolytic	CE105-50-50
CR301	Semiconductor, Device, Diode	1N2484
CR302	Same as CR301	
J301	Connector, Receptacle, ML	JJ242-5P
J302	Connector, Receptacle, RF	JJ211
J303	Connector, Receptacle, FML	JJ319-6DPE
J304	Same as J303	
J305	Same as J302	
J306	Connector, Receptacle, FML	JJ242-5S
L301	Coil, Rf, Fixed	CL275-121
P301	Connector, Pl, FML	PL225-8S
R301	Resistor, Fixed, Composition	RC20GF470J
R302	Resistor, Fixed, WW-5W	RW107-10
T301	Transformer	TF352
XZ301	Socket, El, Tube	TS100-3
XZ302	Same as XZ301	
Z301	1 Mhz Standard	NF116-1
Z302	Ovenized Oscillator	AO121
Z303	Printed Circuit Board B	A-4513
Z304	Printed Circuit Board A	A-4512
Z305	Heat Sink Assembly	BMA173

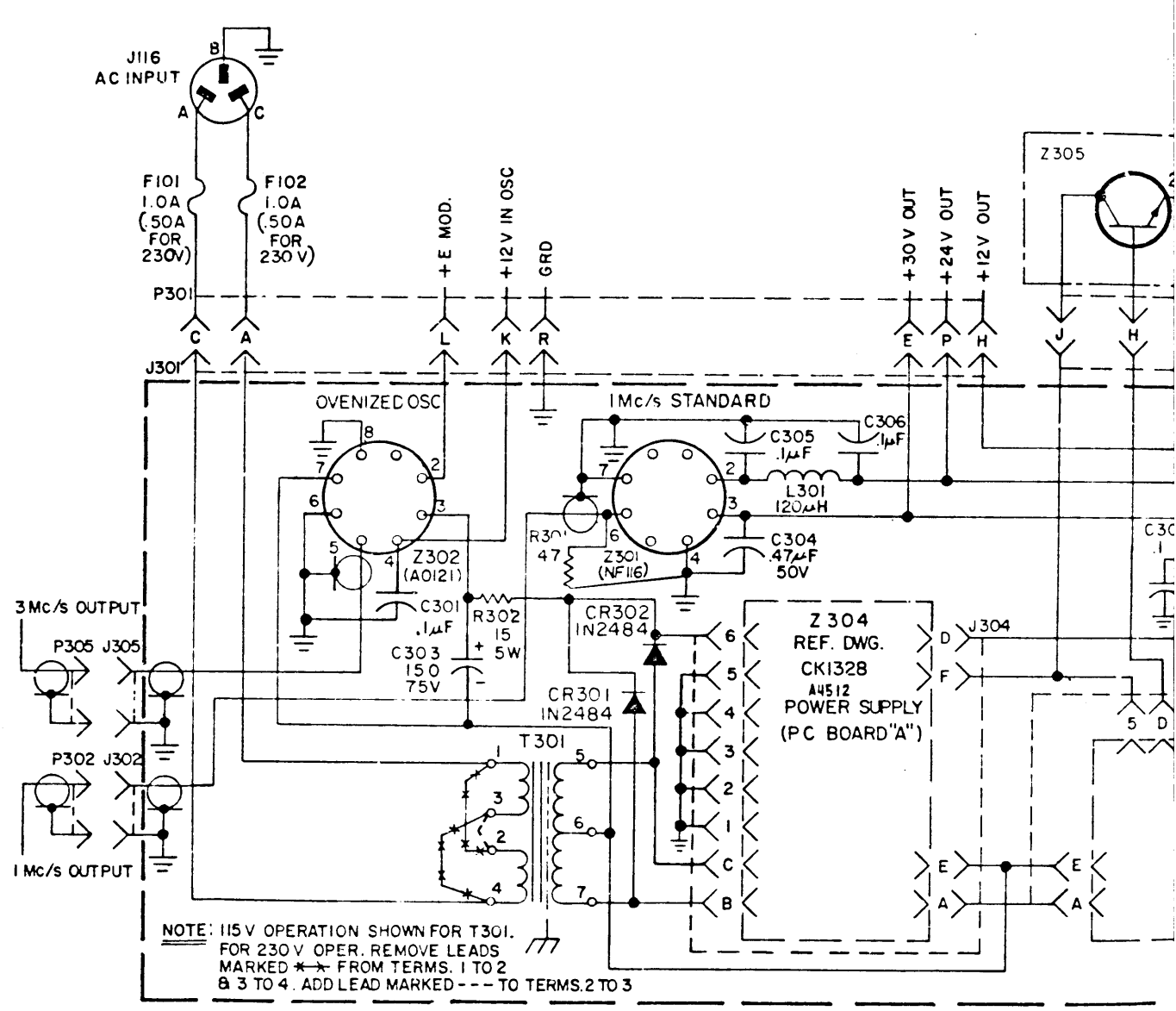


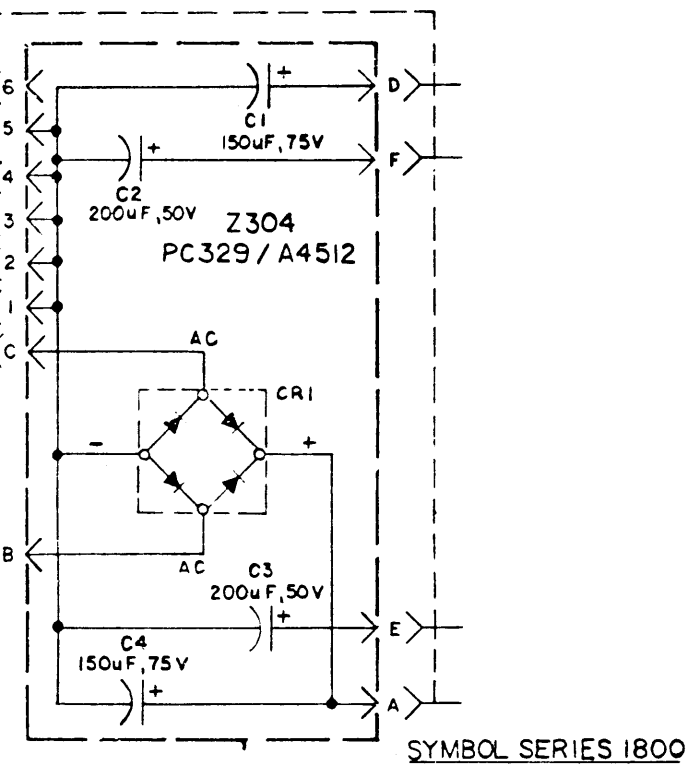
LAST SYMBOLS	MISSING SYMBOLS
C309 CR302 F102 J306 L301 P306 Q303 R302 T301 Z305	C307 P303, P304

FIGURE 27. OVERALL SCHEMATIC DIAGRAM. AND PARTS LIST. POWER SUPPLY ASSEMBLY Z300 SERIES

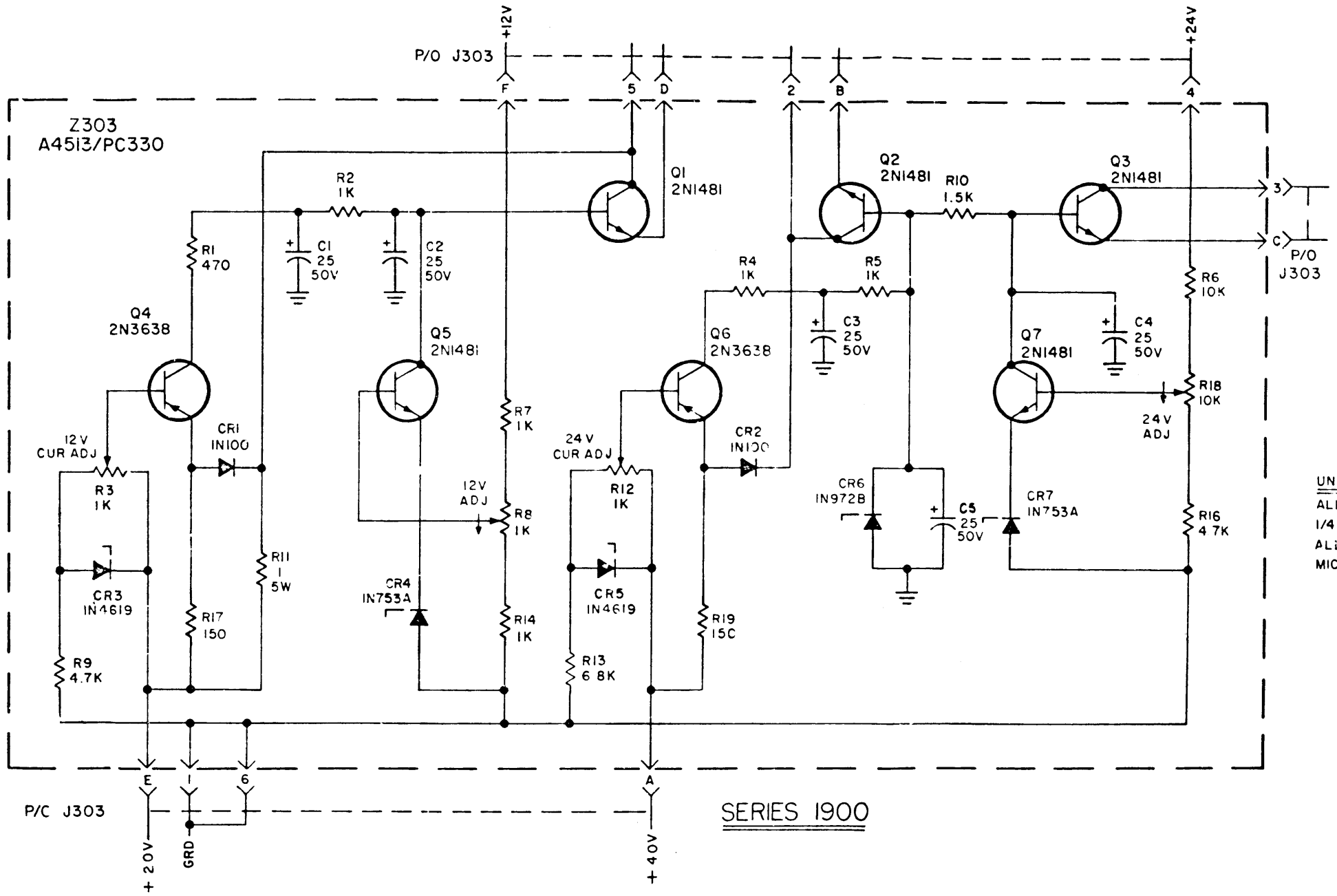
Parts List for Power Supply Assembly

SYMBOL	DESCRIPTION	TMC P/N
C301	Capacitor, Fixed, Ceramic	CC100-37
C302	Capacitor, Fixed, Mylar	CN112A-105-M2
C303	Capacitor, Fixed, Electrolytic	CE105-150-75
C304	Capacitor, Fixed, Mtlz	CN114R47-5J
C305	Same as C301	
C306	Same as C301	
C307	Not Used	
C308	Same as C301	
C309	Capacitor, Fixed, Electrolytic	CE105-50-50
CR301	Semiconductor, Device, Diode	1N2484
CR302	Same as CR301	
J301	Connector, Receptacle, ML	JJ242-5P
J302	Connector, Receptacle, RF	JJ211
J303	Connector, Receptacle, FML	JJ319-6DPE
J304	Same as J303	
J305	Same as J302	
J306	Connector, Receptacle, FML	JJ242-5S
L301	Coil, Rf, Fixed	CL275-121
P301	Connector, Pl, FML	PL225-8S
R301	Resistor, Fixed, Composition	RC20GF470J
R302	Resistor, Fixed, WW-5W	RW107-10
T301	Transformer	TF352
XZ301	Socket, El, Tube	TS100-3
XZ302	Same as XZ301	
Z301	1 Mhz Standard	NF116-1
Z302	Ovenized Oscillator	AO121
Z303	Printed Circuit Board B	A-4513
Z304	Printed Circuit Board A	A-4512
Z305	Heat Sink Assembly	BMA173





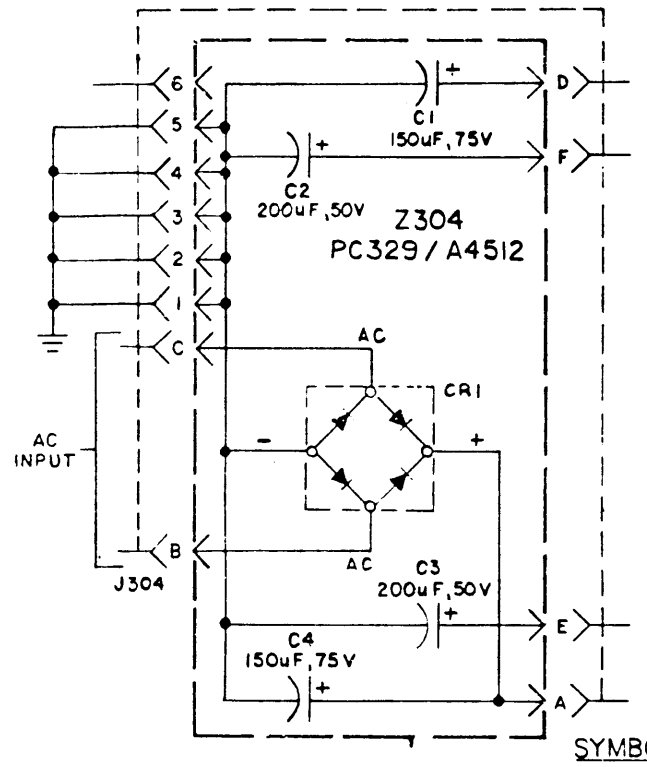
SYMBOL SERIES 1800



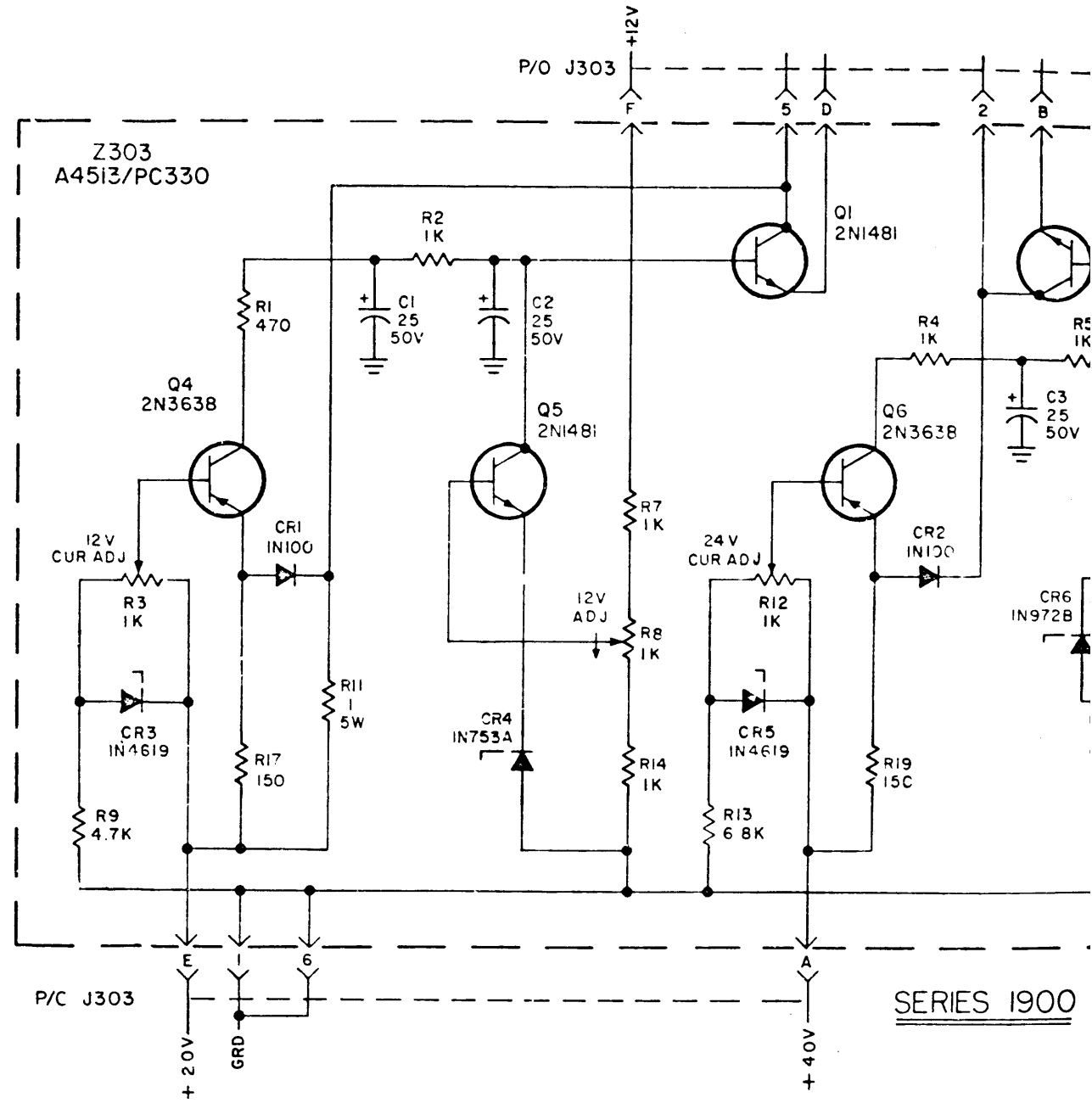
SYMBOLS	
LAST	MISSING
C1905	R15
CR1907	
Q1907	
R1919	

UNLESS OTHERWISE SPECIFIED:
ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT.
ALL CAPACITANCE VALUES ARE IN MICROFARADS.

FIGURE 28. SCHEMATIC DIAGRAMS.
POWER SUPPLY A Z304
POWER SUPPLY B Z303



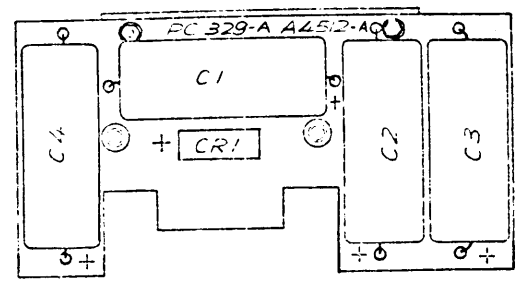
SYMBOL SERIES 1800



SERIES 1900

Parts List for Power Supply Board A

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Electrolytic	CE105-150-75
C2	Capacitor, Fixed, Electrolytic	CE105-200-50
C3	Same as C2	
C4	Same as C1	
CR1	Semiconductor, Rectifier	DD146-6



Parts List for Power Supply Board B

SYMBOL	DESCRIPTION	TMC P/N
C1 thru C5	Capacitor, Fixed, Electrolytic	CE107-6
CR1	Semiconductor, Device, Diode	1N100
CR2	Same as CR1	
CR3	Semiconductor, Device, Diode	1N4619
CR4	Semiconductor, Device, Diode	1N753A
CR5	Same as CR3	
CR6	Semiconductor, Device, Diode	1N972B
CR7	Same as CR4	
Q1 thru Q3	Transistor	2N1481
Q4	Transistor	2N3638
Q5	Same as Q1	
Q6	Same as Q4	
Q7	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF471J
R2	Resistor, Fixed, Composition	RC07GF102J
R3	Resistor, Variable, Composition	RV124-1-102
R4	Same as R2	
R5	Same as R2	
R6	Resistor, Fixed, Composition	RC07GF103J
R7	Same as R2	
R8	Same as R3	
R9	Resistor, Fixed, Composition	RC07GF472J
R10	Resistor, Fixed, Composition	RC07GF152J
R11	Resistor, Fixed, WW-5W	RR114-1.0W
R12	Same as R3	
R13	Resistor, Fixed, Composition	RC07GF682J
R14	Same as R2	
R15	Not Used	
R16	Same as R9	
R17	Resistor, Fixed, Composition	RC07GF15LJ
R18	Resistor, Variable, Composition	RV124-1-103
R19	Same as R17	

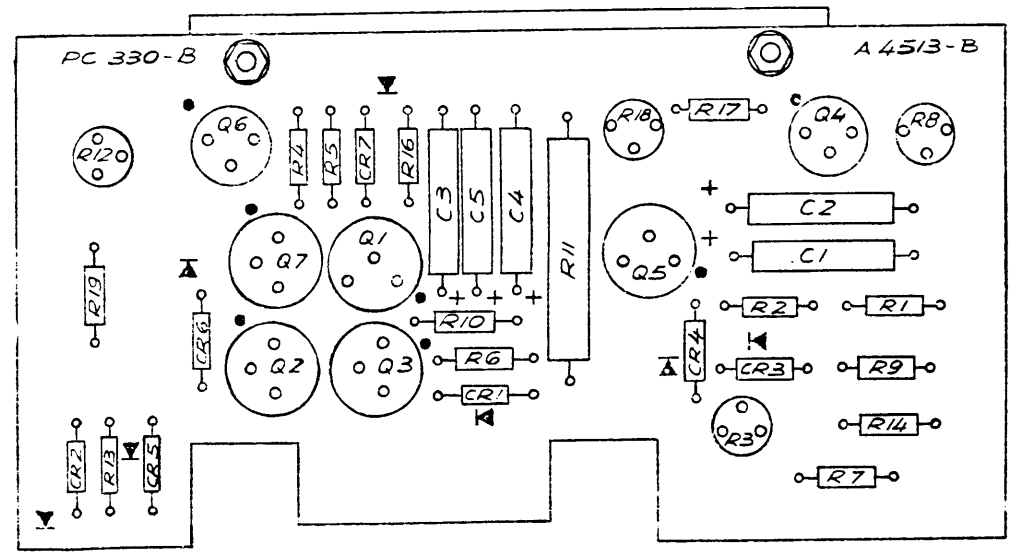


FIGURE 29. COMPONENT LOCATIONS AND PARTS LIST. POWER SUPPLY A Z304. POWER SUPPLY B Z303