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SERVICE MANUAL

for

SIDEBAND TRANSCEIVER

MODEL TM125(D)

800 228 9290

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

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SM 1075 ISSUE DATE: December 1972

NOTICE

WORLD WIDE SUPPLIERS OF ELECTRONIC COMMUNICATIONS EQUIPMENT

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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SCOPE OF MANUAL

The servicing techniques for the TM125(D), Sideband Transceiver (hereinafter referred to as the TM125(D)), are covered in this service manual under the following categories:

a. Preventive maintenance procedures are contained in Section 1 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 comprimizing important schedules.

b. Troubleshooting procedures are contained in Section 2 to provide a quick and logical means for localizing the cause of an equipment malfunction. The troubleshooting procedures are covered on two levels; assembly and component. The major portion of TM125(D) 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 troubleshooting of an assembly may be accomplished during a scheduled downtime.

c. Alignment procedures are contained in Section 3, to facilitate maintaining the TM125(D) in a satisfactory operating condition. Alignment and adjustment of the unit may become necessary when the periodic checks of preventive maintenance indicate equipment deterioration or when equipment malfunctions require replacement of assemblies or components.

d. The drawings and parts listings for servicing the TM125(D) are contained in Section 4. These include servicing block diagrams, schematic and component location drawings, and parts listings.

SECTION 1

PREVENTIVE MAINTENANCE

1-1. INSPECTION AND TESTING.

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

a. 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 1-1 provides a monthly inspection checklist for the TM125(D).

TABLE 1-1. MONTHLY INSPECTION ROUTINE

Assembly	Check
AC Line Power Cord, or DC Power Cables	Check AC line power cord or DC power cables 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 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.

Assembly	Check
Front and Rear Panels (cont)	3. Check meter face for cracks, scratches, etc.
	4. Check all input and output jacks for security against panel.
	5. Remove both AC and DC fuses. Check to insure that the fuses are the proper value (5 amp for AC and 30 amp for DC) and that they are not open.

b. POWER SUPPLY CHECKS. The following power supply checks should be performed on a weekly basis:

(1) Set front panel controls as follows:

CHANNEL switch	-	Channel 1
MODE	-	LSB
REC/PTT/CW	-	PTT
METER	-	Ip

(2) Connect line power cord from vac power source to power jack J101. Observe that the filaments are illuminated on power amplifier tubes and driver tubes V101, V102 and V103.

(3) Check ac filament voltage at pin 2 of V101. Filament voltage should be 12 vac $\pm$15%.

(4) Set R114 (bias adjust) at maximum counterclockwise position and measure negative voltage at pin 5 of V101 and V102. The negative voltage at pin 5 should be approximately -35 vdc. Check dc voltage on the coil of transmit/receive relay K101, the dc voltage should be +30 vdc, $\pm$10%.

(5) Connect a 50 ohm dummy load to output connector J101 and close push-to-talk line.

(6) Connect multimeter to pin 1 of V101 (cathode) and adjust R114 (bias adjust) until multimeter indicates .455 vdc. Remove meter leads and observe front panel meter indication of 50 ma $\pm$5% with meter switch in Ip position.

(7) Use CAUTION and measure the plate voltage on power amplifier tubes V101 and V102. The plate voltage should be 800 vdc.

(8) Measure the dc voltage on pin 7 of V102 (plate). The dc voltage on pin 7 should be 250 vdc.

(9) Measure the dc voltage on pin 8 of driver tube V103 (screen). The dc voltage on pin 8 should be 250 vdc ±10%.

(10) Measure the dc voltage on pin 1 of driver tube V103 (cathode). The dc voltage on pin 1 should be 4 vdc ±10%.

(11) Measure the dc voltage on transmit/receive relay K101 contact arm connect to +12 vdc supply. This voltage should be +12 vdc ±12%.

c. FUNCTIONAL TESTS. Perform the following checkout procedure on the TM125(D), on a weekly basis after completing a check of the power supply.

(1) Set REC/PTT/CW switch to PTT position, and line power cord from vac power source to TM125(D) at J101. Set MODE switch to LSB position.

NOTE

When +12 vdc input power is used connect dc jumper plug to J101 and connect 12 vdc to terminals on rear panel.

(2) Insure that the remote input cable at J102 is disconnected from the TM125(D) and a 50 ohm dummy load is connected to output connector J103.

(3) Set METER switch to REC position.

(4) Set CHANNEL switch to an active channel position.

(5) Observe a received signal or background noise on built in speaker.

(6) Adjust AF and RF GAIN controls for normal receiver operation. Front panel meter will indicate received signal strength.

(7) Set METER switch to Ip position. Meter should indicate zero in the Ip position with the PTT line open.

(8) Close PTT line via microphone and observe an Ip reading of 50 ma when PTT line is activated.

(9) Set METER switch to RF position and modulate TM125(D) with microphone. Meter should indicate rf output into 50 ohm load.

(10) Set CHANNEL selector switch to each of the remaining active channel positions (2 through 8) and observe RF output meter indication as in preceding step.

(11) Set Mode switch and REC/PTT/CW switch to the CW positions. Remove microphone or open PTT line and insert CW contact keying device in KEY jack. Operate CW key and observe output meter indication as in step 9. (Meter indications will flucuate with operation of CW keying).

(12) Connect the remote cable to the TM125(D) at remote jack J102 and remove microphone and CW keying device.

(13) Set MODE switch to USB and REC/PTT/CW switch to PTT positions. Activate remote PTT line by connection of PTT device between J102-8 and ground.

(14) Observe front panel meter indication of 50 ma with meter switch in Ip position.

(15) Set METER switch to RF position and externally modulate 600 ohm audio input line. Observe meter indication of RF into 50 ohm load.

1-2. CLEANING INSTRUCTIONS.

In general, the TM125(D) 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.

SECTION 2

TROUBLESHOOTING

2-1. GENERAL.

a. EXTERNAL INPUT CHECKS. Prior to troubleshooting the TM125(D), it should be determined that the TM125(D) unit itself is definitely the cause of failure and not faulty related equipment that is external to the TM125(D). This may be accomplished by checking for proper power supply voltages and using the front panel METER. The following steps will help to determine that the TM125(D) is the cause of malfunction within a system:

(1) Verify all power supply voltages.

(2) With the unit set up in the receive mode, set METER switch to REC and check for a METER deflection on all active channels.

(3) With the unit set up in the transmit mode, set METER switch to IP and RF positions and check for a METER deflection on all active channels.

2-2. FREQUENCY CONSIDERATIONS.

a. The TM125(D) is an eight channel transceiver covering the frequency range of 1.6 to 26 mhz, and having the capability of simplex or half duplex operation. The particular transmitting or receiving frequency on a channel is governed by the selection of the associated transmitting and receiving crystals, which are a function of the transmitting or receiving assigned operating frequencies, respectively. When operating from 1.6 to 8.0 mhz, the transceiver performs one frequency conversion; from 8 to 12 mhz, 3.5 mhz is inserted and a double conversion is performed; and from 12 to 26 mhz, 3.5 mhz is inserted and the second harmonic of the hfo crystal frequency is used, again performing a double conversion.

b. In addition to the frequency conversions, the unit also operates about a fixed 455-khz frequency for am, and a displacement of 1.4 khz about 455-khz in usb and lsb. Because of the various frequency mixing processes, the crystal frequencies must be properly determined in order to arrive at the desired assigned operating frequency.

c. Since the bfo injection frequencies of 456.4 and 453.6 khz and the 3.5 mhz frequencies are fixed, the only crystal frequencies that must be determined are the hfo frequencies. Further, because of the 3.5 mhz, 455-khz, 456.4-khz and 453.6-khz injection frequencies and the conversion processes at different operating frequency ranges, these must be taken into account when selecting the hfo crystal. The following equations apply for determining the hfo crystal frequencies (in mhz):

AM: 1.6 - 8 mhz; $F_x = f_o + .455000$

8 -12 mhz; $F_x = f_o + 3.955000$

12 -26 mhz; $F_x = \frac{f_o + 3.955000}{2}$

LSB: 1.6 - 8 mhz; $F_x = f_o + .453600$

8 -12 mhz; $F_x = f_o + 3.953600$ (See Note)

12 -26 mhz; $F_x = \frac{f_o + 3.953600}{2}$

USB: 1.6 - 8 mhz; $F_x = f_o + .456400$

8 -12 mhz; $F_x = f_o + 3.956400$ (See Note)

12 -26 mhz; $F_x = \frac{f_o + 3.956400}{2}$

Where F_x is the hfo crystal frequency

f_o is the assigned operating frequency

NOTE

In some units, the bfo crystal frequencies are .453650 and .456350 khz. In units with these bfo cystal frequencies, the following equations apply for determining the lsb and usb hfo crystal frequencies:

LSB: 1.6 - 8 mhz; $F_x = f_o + .4536500$

8 -12 mhz; $F_x = f_o + 3.9536500$

12 -26 mhz; $F_x = \frac{f_o + 3.9536500}{2}$

USB: 1.6 - 8 mhz; $F_x = f_o + .456350$

8 -12 mhz; $F_x = f_o + 3.956350$

12 -26 mhz; $F_x = \frac{f_o + 3.956350}{2}$

d. Once a frequency is assigned to a channel, the conversion frequencies become a function of the assigned frequency. Also, certain components are selected as a function of the assigned frequency. Therefore, assigned operating frequencies cannot be changed randomly and the associated hfo frequency determined with the preceding equations without a detailed understanding of the conversions and frequencies involved.

2-3. ASSEMBLY LEVEL TROUBLESHOOTING.

a. GENERAL. The various functional assemblies of the TM125(D) are shown in figure 1, overall block diagram. The overall block diagram indicates the primary signal flow between assemblies. Convenient points for measurement of signal flow are also shown. Figure 1 and 2 and the following servicing block diagrams describe the functional assemblies of the TM125(D) and provide a guide for the technician in localizing the faulty assembly. The assemblies that are referenced with Z numbers (Z101, Z102 etc.) are printed circuit board assemblies and may be replaced if spares are available. For troubleshooting a particular assembly, or to localize the faulty component(s), refer to paragraph 2-4, component level troubleshooting.

b. OVERALL FUNCTIONAL DESCRIPTION.

(1) Exciter Section. (See figure 1.)

(a) The TM125(D) is placed in the transmit mode when OFF/REC/PTT/CW switch S103 is set to the PTT or CW positions. When the push-to-talk button or the key is activated, a ground is routed through switch S103 and energizes transmit/receive relay K101. With K101 energized, the +12v dc output of the power supply is applied to the exciter hfo section of crystal oscillator Z101 and to CHANNEL switch S101. The CHANNEL switch selects one of the eight preset transmitting frequencies and routes the +12v dc to the selected channel line on crystal oscillator Z101 and exciter rf assembly Z102.

(b) The mode of transmission is controlled by MODE switch S102 for USB, LSB, AME and CW operation. If voice intelligence is transmitted, the audio is routed through the MIKE jack to exciter if board Z103. The exciter if board mixes the audio first with a bfo input from crystal oscillator board Z101 and then with the 3.5 mhz signal from Z101 if operating above 8 mhz. For c-w operation, the information is applied from the key to Z103.

(c) The exciter if board Z103 contains a sidetone generator circuit which routes the audio to an audio amplifier in receiver if board Z104 to apply the audio to the 600-ohm output connectors and to the speaker. In addition, Z103 also contains a delay circuit on the c-w key input line which automatically places the transceiver in the receive mode if the key is not depressed for approximately 2 seconds. This feature eliminates the necessity of placing the unit in the receive mode after making a c-w transmission and awaiting a reply.

(d) The output of the exciter if Z103 is applied to exciter rf assembly Z102. The exciter rf assembly injects the hfo signal from crystal oscillator Z101 into the signal to obtain the final assigned operating frequency. The resultant signal is amplified in Z102 and applied to broad band driver V103. The output of V103 is applied to final r-f amplifiers V101, V102 which are connected in parallel and develop the 125-watt output and applies the signal to ANTENNA jack J103 via loading coil L114 and contacts of transmit/receive relay K101.

(2) Receiver Section. (See figure 2.)

(a) The TM125(D) is placed in the receive mode when the OFF/REC/PTT/CW switch S103 is in the REC position, when S103 is in the PTT or CW position and the unit is not keyed, or when S103 is in the CW position and the c-w key is not operated for 2 seconds. Control of the mode of operation is obtained through transmit/receive relay K101. In the normal deenergized condition, relay K101 places the unit in the receive mode. Therefore, the three methods indicated above place K101 in the deenergized condition, and the unit in the receive mode.

(b) In the receive mode, the receiver r-f input at ANTENNA jack J103 is routed to the antenna input of receiver rf assembly Z105 via normally closed contacts of transmit/receive relay K101. The receiver rf assembly contains an r-f amplifier that amplifies the signal. The level of the received signal is also controlled in the r-f amplifier by an agc feedback signal from receiver if assembly Z104. The resultant output signal of the r-f amplifier is applied to a mixer in Z105 which receives the hfo injection frequency from crystal oscillator Z101. The resultant difference signal is applied to receiver if assembly Z104.

(c) The input stage of Z104 is a mixer into which the 3.5 mhz signal from Z101 is injected which is activated above 8 mhz. Below 8 mhz, the mixer is bypassed and the signal is applied to an r-f amplifier. Above 8 mhz, the signal from Z105 is mixed with 3.5 mhz crystal oscillator Z101 and the different frequency is extracted, and applied to the r-f amplifier. The resultant signal is amplified, filtered, detected, and the resultant audio amplified and applied to 600-ohm output connectors via a line transformer and to the front panel speaker.

(d) The receiver if assembly also contains an agc amplifier which amplifies the r-f input signal. The signal is then rectified and filtered with the resultant d-c signal applied to the r-f amplifier in Z105 as the agc signal to control the amplification of the first stage. The rectified and filtered output is also applied to the front panel S meter via the METER switch to obtain an indication of the relative received signal strength with the METER switch set to the REC position. The receiver if assembly also contains a squelch circuit which can be adjusted to eliminate circuit noise from the front panel speaker between received signals.

c. POWER SUPPLY SECTION. (See figure 3.)

(1) General. The TM125(D) can operate from 12-volt d-c battery power or from 115/230 volt a-c power. Different adapter plugs are provided for use with the corresponding mode of operation. Both modes of operation result in the same voltages applied to the circuit of the TM125(D).

(2) D-c Operation.

(a) In the 12-volt d-c battery mode of operation, the d-c jumper plug P102 is attached to jack J101. The +12-volt d-c battery power is applied through 30-ampere fuse F2 to OFF/REC/PTT/CW switch S103A to pin 12 of J101. When S103 is set to any position except OFF, the +12-volt d-c battery power is routed through pins 12 of J101 and P102 to pins 9 and 16 of J101 and P102. The 12-volt output at pin 16 is applied to transmit/receive relay K101 and is applied to the receiver section in the receive mode and to the exciter section in the transmit mode. The 12-volt output at pin 9 is applied to PTT relay K102. Relay K102 is energized in two modes of operation. The first mode is via the MIKE jack J106 when the push-to-talk switch is depressed. The second mode is in c-w operation via the key. In both modes of operation, a ground potential is applied to relay K102, energizing the PTT relay.

(b) With relay K102 energized, the 12-volt d-c power from pin 9 of J101 is routed through the relay contacts and applied to multivibrator Q101, Q102 and Q103. The multivibrator develops a 12-volt a-c output. The resultant 12-volt a-c output of the multivibrator is applied through pins 3 and 7 and 1 and 4 of J101 and P102 respectively, to power transformer T101. Power transformer T101 has three secondary windings that provide 30, 85 and 800 volts ac. The 30-volt a-c output is rectified by CR103 to 30-volts dc and applied as relay excitation voltage to transmit/receive relay K101. The 85-volt a-c output is rectified by CR102 to -48-volts dc and applied to power amplifiers V101, V102 to provide bias potential. The 800-volt a-c output is applied to rectifier CR101 via contacts of transmit/receive relay K101. When the TM125(D) is in the transmit mode, the 800-volts ac is routed through the contacts of K101 to rectifier CR101. The output of CR101 has a +250-volt d-c output that is applied to the plate circuit of driver V103 and to the screen grid of power amplifier V101, V102. The output of CR101 also has an 800-volt d-c output that is applied to the plate circuit of power amplifier V101, V102. Because the 800-volt a-c output of transformer T101 is routed through relay K101, high voltage is not applied to the driver and power amplifier unless the unit is in the transmit mode of operation.

(3) A-c Operation.

(a) The same power supply circuits are activated in the a-c mode of operation as in the d-c mode, except for the multivibrator circuit. In the 12-volt a-c mode of operation, the a-c jumper plug P101 is attached to jack J101. One side of the a-c input is routed through pin 2 to the primary of power transformer T101. The second side of the a-c input is routed through pin 6, through

5-ampere fuse F1, and to the primary of power transformer T101 when the OFF/REC/PTT/CW switch S103B is set to any position except OFF.

(b) Power transformer T101 has three secondary windings that provide 30, 85 and 800 volts ac. The 30-volt a-c output is rectified by CR103 to 30-volts dc an applied as relay excitation voltage to transmit/receive relay K101. The +30-volt d-c output is also dropped to +12 volts dc and applied to pin 11 of J101. From pin 11, the +12 volts dc is routed to pins 14 and 15. The +12 volts dc is applied to regulator CR107 whose output is the +12-volt d-c permanent voltage.

(c) The 85-volt a-c output is rectified by CR102 to -48-volts dc and applied to power amplifier V101, V102 and provides bias potential for the power amplifier. The 800-volt a-c output is applied to rectifier CR101 via contacts of transmit/receive relay K101. When the TM125(D) is in the transmit mode, the 800-volts ac is routed through the contacts of K101 to rectifier CR101. The output of CR101 has a +250-volt d-c output that is applied to the plate circuit of driver V103 and to the screen grid of power amplifier V101, V102. The output of CR101 also has an 800-volt d-c output that is applied to the plate circuit of power amplifier V101, V102. Because the 800-volt a-c output of transformer T101 is routed through relay K101, high voltage is not applied to the driver and power amplifier unless the unit is in the transmit mode of operation.

d. CRYSTAL OSCILLATOR Z101. (See figure 4.)

(1) Crystal oscillator Z101 contains a receiver hfo, exciter hfo, 3.5 mhz oscillator, and bfo circuits. The receiver and exciter hfo circuits each contain eight crystal oscillator circuits, one for each channel. The front panel CHANNEL switch selects one of the crystal oscillator circuits by applying B+ operating voltage to the selected oscillator circuit. A second voltage is applied to the receiver hfo circuit via transmit/receive relay K101 when the unit is in the receive mode and to the exciter hfo circuit via K101 when the unit is in the transmit mode. CLARIFIER control R129 is connected to the receiver hfo circuits to provide a slight adjustment of the hfo oscillator side tone for c-w keying and sideband reception. The resultant output of the receiver hfo is applied to receiver rf assembly Z105. The exciter hfo output is applied to exciter rf assembly Z102.

(2) The 3.5-mhz oscillator circuit is used in both the receiver and exciter section, when the assigned channel operating frequency is above 8 mhz, and is activated in both the receive and transmit modes. The 3.5-mhz output is applied to the receiver if assembly Z104 and to the exciter if assembly Z103.

(3) The bfo circuits consist of two oscillators. A 456.4 khz oscillator is activated when MODE switch S102 is set to USE, AME, or CW. A 453.6 khz oscillator is activated when the MODE switch is set to LSB. The selected bfo output is applied to the receiver if assembly Z104 and to the exciter if assembly Z103.

e. EXCITER RF ASSEMBLY Z102. (See figure 5.)

(1) The exciter rf assembly Z102 contains eight exciter r-f boards Z102Z1 through Z102Z8; one for each channel. The r-f input at pin 3 of the board is applied to pin E of each subassembly. The particular subassembly that is energized depends on the setting of CHANNEL switch S101, which applies operating voltage to the selected exciter r-f subassembly.

(2) The r-f input from exciter if assembly Z103 is applied to mixer amplifier Q2, T2, T3. Also applied to the mixer amplifier is the hfo injection frequency from crystal oscillator Z101 via amplifier Q1, T1. The resultant sum frequency is selected and developed across potentiometer R16 and applied to amplifier Q3, T4. The output of Q3, T4 is again amplified by Q1 and applied to the control grid of driver V103.

f. EXCITER IF ASSEMBLY Z103. (See figure 6.)

(1) The exciter if assembly Z103 receives audio or c-w intelligence, injects the appropriate sideband frequency if necessary, injects the 3.5-mhz signal if operating above 8 mhz, and applies the resultant amplified signal to exciter rf assembly Z102. Audio intelligence can be injected via pins 2, 3, and 4 of Z103 if a 600-ohm line must be matched, or from the front panel MIKE jack J106 to pin 1 of Z103. If a 600-ohm line must be matched, the audio is routed through transformer T4 to audio amplifier Q1. If audio from the MIKE jack is applied, the signal is applied directly to audio amplifier Q1. The audio output of Q1 is applied to a pad and to a sidetone generator.

(2) The sidetone generator provides a means of monitoring the transmission. The audio output of sidetone generator Q2 is amplified by Q5 and applied to circuitry in receiver if assembly Z104. If the c-w mode of operation is selected, the key input at pin 10 of Z103 is applied to sidetone generator Q2 and the resultant amplified output is applied to receiver if assembly Z104 to monitor the c-w transmissions.

(3) The audio output of amplifier Q1 is also applied to pad R43, R50, and R51 which buffers the signal and applies the audio output to balanced mixer CR6 through CR9. The balanced mixer combines the audio signal with a bfo injection frequency from crystal oscillator Z101. The bfo frequency that is injected is a function of the mode of operation. When the USB mode is selected on MODE switch S102, a 453-6 khz signal is injected. When the LSB, AME, or CW mode is selected on MODE switch S102, a 456.4 khz signal is injected.

(4) The resultant output signal from the balanced mixer is applied to 455-khz filter FL1 to remove the unwanted signal frequencies resulting from the mixing operation and applies the desired signal to amplifier Q3. The amplified output of Q3 is again amplified by Q4. If the assigned operating frequency is below 8 mhz, the output of amplifier Q4 is applied to rf output pin 7 and to exciter rf assembly Z102 where the hfo frequency is injected. If the assigned operating frequency is above 8 mhz, the output of amplifier Q4 is applied to mixer Q9.

(5) Mixer Q9 receives the 3.5-mhz injection signal from crystal oscillator Z101 and mixes the 3.5-mhz frequency with the 455-khz frequency to obtain 3.955 mhz. The 3.955 mhz signal is amplified by Q6 and buffered by emitter follower Q7, Q8 and the resultant signal applied to pin 7.

(6) The exciter if assembly Z103 also contains a delay circuit Q10, Q11 which is controlled by the c-w key input at pin 10. The delay circuit is incorporated to eliminate the necessity of switching to the receive mode of operation after performing a c-w transmission. The delay circuit maintains a ground on the push-to-talk line for 2 seconds after the key is depressed. If the key is again depressed before the expiration of the 2-second time delay, another 2-second time delay is started. Thus, if the operator has concluded a c-w transmission, or pauses for 2 seconds between key depressions, the 2-second time delay will elapse and unground the PTT line. Ungrounding the PTT line deenergizes transmit/receive relay K101 and automatically places the unit in the receive mode of operation.

g. RECEIVER IF ASSEMBLY Z104. (See figure 7.)

(1) The receiver if assembly Z104 receives the r-f input from receiver rf assembly Z105 via RF GAIN control R127, mixes the signal with a 3.5-mhz input from crystal oscillator Z101 if the assigned operating frequency is above 8 mhz, and detects and amplifies the resultant 455-khz signal to extract the desired intelligence. The r-f input at pin 2 is the difference frequency obtained by mixing the hfo injection frequency with the r-f input signal. The signal is filtered by C1, C2, C3, L1 and L2 and applied to difference mixer Q1, T1. For assigned operating frequencies above 8 mhz, the r-f input to Z102 has a 3.5-mhz signal product that must be removed. Therefore, above 8 mhz, a 3.5-mhz signal from crystal oscillator Z101 is mixed in Q1, T1 and the resultant signal which is at 455 khz $\pm$1.4 khz is extracted. Below 8 mhz, the r-f input at pin 2 is at 455 khz $\pm$1.4 khz and is applied to filter C6, C7, L3, L4 and L5.

(2) The resultant signal is amplified by Z1 and applied to 455-khz filter FL1. A noise limiter circuit consisting of CR1, CR2, C11, C12 and R13 is activated by the front panel ANL switch S105 to eliminate noise pulses from the received signal.

(3) The output of amplifier Z1 is filtered by 455-khz filter FL1 to remove the unwanted signal frequencies resulting from the mixing operation(s) and applies the resultant signal to two circuits. The first circuit is the normal receiver i-f path and the second circuit is to an agc and squelch circuit.

(4) The normal receiver i-f path is applied to envelope detector Z2 and to product detector Z3. The product detector receives the bfo input from crystal oscillator Z101, whose frequency is a function of the setting of the front panel MODE switch. The resultant audio output of Z2 and Z3 is applied to low pass filters and d-c switching CR3 and CR4. The audio output is applied to power amplifier Z2 and to the front panel AF GAIN control R128 via pin 13 of Z104.

(5) The output of power amplifier Z2 is applied to line audio transformer T2 which matches the audio output to a 600-ohm line available at pins 14, 15 and 16 of Z104 to J102. The front panel AF GAIN control controls the audio level applied to power amplifier Z2 via pin 12 of Z104. The resultant output of Z2 is amplified by power amplifier Q2, Q3 and applied to speaker audio transformer T3 which matches impedance with the front panel speaker. Also applied to T3 is the sidetone output from exciter if assembly Z103 to provide monitoring of the transmissions.

(6) The output of 455-khz filter FL1 is also applied to an agc and squelch circuit. The output of FL1 is amplified by Q8 and rectified and filtered by CR10, C37, C38, C39, R19 and R20. The resultant d-c output is the agc voltage that is applied to the r-f amplifier in receiver rf assembly Z105 to control the amplification of the input r-f amplifier stage. The d-c voltage is also applied to the front panel METER via emitter follower Q7 to obtain a relative indication of received signal strength when the METER switch is set to REC.

(7) The d-c voltage is also applied to emitter follower Q9 whose output is applied to differential amplifier Z4 via front panel SQUELCH control R130. The SQUELCH control varies the balancing between the negative and positive inputs to differential amplifier Z4, to obtain an output as a function of the setting of the control. The resultant output of Z4 is applied to switching circuit Q4, Q5, and Q6 to control application of 12v dc to power amplifier Q2, Q3. The SQUELCH potentiometer controls the negative input to differential amplifier Z4. Thus, if the signal strength decreases when no intelligence is received, the differential amplifier has a negative output that activates the switching circuit and opens the 12v dc input to power amplifier Q2, Q3, thereby preventing noise from reaching the front panel speaker. When intelligence is of sufficient strength to overcome the SQUELCH control setting, the differential amplifier has a positive output that closes the switching circuit and applies 12v dc to power amplifier Q2, Q3. The squelch line only controls the front panel speaker noise and not the 600-ohm audio output available at J102.

h. RECEIVER RF ASSEMBLY Z105. (See figure 8.)

(1) The receiver rf assembly Z105 contains eight receiver rf boards Z105Z1 through Z105Z8; one for each channel. The r-f input from the antenna is applied to pin A of all eight subassemblies via the receive contacts of transmit/receiver relay K101. Also applied to pin D of all eight subassemblies is the agc signal from receiver if assembly Z104 to control the gain of the r-f amplifier stage. The particular subassembly that is energized depends on the setting of CHANNEL switch S101, which applies operating voltage to the selected receiver r-f board.

(2) The r-f input is amplified by Q1, T1 and T2 whose gain is controlled by the agc voltage. The resultant output of the r-f amplifier is applied to mixer amplifier Q2, T3. Also applied to the mixer amplifier is the hfo injection frequency from crystal oscillator Z101. The hfo injected frequency is a

function of the assigned operating frequency as detailed in paragraph 2-2. For frequencies above 12 mhz, the hfo frequency is multiplied by 2 in Q3, T4 and the resultant second harmonic of the hfo signal is used for mixing with the r-f input signal. The resultant amplified output is applied to receiver if assembly Z104 via front panel AF GAIN control R127.

2-4. COMPONENT LEVEL TROUBLESHOOTING.

a. GENERAL. The various functional assemblies of the TM125(D) are shown in figure 9. Those assemblies that are referenced with Z numbers are described individually on the schematic level in the following paragraphs. Each paragraph references the schematic diagram for the particular assembly being described. The schematic diagrams indicate the primary signal flow and necessary operating potentials within each assembly and will aid the technician in localizing the faulty component(s).

b. CRYSTAL OSCILLATOR Z101. (See figure 12.)

(1) Crystal oscillator Z101 contains the four crystal oscillator circuits used throughout the TM125(D). The board is divided into four circuits; a receiver hfo, and exciter hfo, a 3.5-mhz crystal oscillator, and two bfo oscillator circuits. The receiver hfo circuit is activated when the transmit/receive relay K101 is in the deenergized receive mode. The exciter hfo circuit is activated when the transmit/receive relay K101 is in the energized transmit mode. The 3.5-mhz oscillator is activated when the front panel CHANNEL switch is set to a position whose assigned operating frequency is above 8 mhz. The 456.4 khz bfo oscillator circuit is activated when the front panel MODE switch S102 is set to LSB, AME, or CW. The 453.6 khz bfo oscillator circuit is activated when the front panel MODE switch is set to USB.

(2) The receiver hfo circuit consists of eight crystal oscillator circuits; one for each channel. The receiver hfo circuits are activated when the transmit/receive relay K101 is in the deenergized receive mode. In the receive mode, B+ is routed to pin 17 of Z101 and applied to all eight crystal oscillator circuits. The particular crystal oscillator circuit that is activated is a function of the front panel CHANNEL switch which applies 12v dc B+ to the oscillator circuit via pin 1, 3, 5, 7, 9, 11, 13, or 15.

(3) Each crystal oscillator circuit consists of a pass transistor that controls application of base voltage to the oscillator transistor. A crystal in the base circuit and an associated trimmer capacitor control the oscillator frequency. The receiver hfo frequency is a function of the assigned operating frequency and is determined as indicated in paragraph 2-2. The same pin that routes the 12v dc B+ to the selected crystal oscillator circuit also carries the resultant crystal oscillator output frequency and applies the signal to the mixer in receiver rf board Z105. Pins 18 and 19 are connected across front panel CLARIFIER control R129 and provide a slight adjustment of each crystal oscillator frequency to optimize the hfo sidetone for c-w keying and sideband reception.

(4) The 3.5-mhz crystal oscillator circuit is used for both the receive and transmit mode when operating above 8 mhz. In the receiver mode, the 3.5-mhz crystal oscillator receives B+ operating voltage via the outer conductors of the lines that route 12v dc B+ and the hfo signal frequency. Thus, in the receive mode, the front panel CHANNEL switch controls the activation of the 3.5-mhz oscillator. In turn, the assigned operating frequencies are allocated to each channel. Therefore, for those channels whose assigned operating frequencies are greater than 8 mhz, the 3.5-mhz oscillator is activated and applies the resultant 3.5-mhz output signal to receiver if board Z104 via pin 21.

(5) In the transmit mode, the 3.5-mhz crystal oscillator is also activated when the assigned operating frequency is above 8 mhz. Control of application of B+ in the transmit mode is via pin 20 which receives its input from exciter rf board Z102. The exciter rf board contains eight subassemblies. The subassembly associated with the channel whose frequency is above 8 mhz contains a routing diode that applies operating voltage for the 3.5-mhz oscillator when the front panel CHANNEL switch is set to a position whose assigned operating frequency is above 8 mhz. Diodes CR3 and CR4 provide isolation between the two circuits that apply B+ voltage to the oscillator.

(6) The 3.5-mhz oscillator consists of 3.5-mhz crystal Y9 that is tuned by capacitor C41. The oscillations developed in Q17 are amplified by Q18 and applied to the mixer on exciter if board Z103.

(7) The exciter hfo circuit consists of eight crystal oscillator circuits; one for each channel. The exciter hfo circuits receive operating voltage at pin 31 when the transmit/receive relay K101 is energized, in the transmit mode. The B+ at pin 31 is applied to the collector of each oscillator transistor. The particular oscillator circuit that is activated is controlled by the setting of the front panel CHANNEL switch S101 which applies exciter B+ voltage to the base of the two transistors in each oscillator circuit. The selection of hfo crystal frequencies for each channel is a function of the assigned operating frequency as indicated in paragraph 2-2. The resultant oscillator output frequency is routed through the activated transistor to pin 32 and applied to exciter rf board Z102.

(8) The bfo oscillator circuits consists of two virtually independent oscillators, each controlled by a crystal; the first is tuned to 456.4 khz and the second is tuned to 453.6 khz. The 456.4 khz oscillator is activated when the front panel MODE switch is set to LSB, AME, or CW. The 453.6 khz oscillator is activated when the MODE switch is set to USB.

(9) Each crystal is tuned by an associated capacitor. The resultant oscillator output is amplified by a transistor and applied to pin 36 whose output is applied to exciter if board Z103 and receiver if board Z104.

c. EXCITER RF ASSEMBLY Z102. (See figures 14 and 16.)

(1) The exciter rf assembly Z102 consists of an exciter mother board and eight exciter rf boards Z102Z1 through Z102Z8; one for each channel. Each subassembly contains a mixer amplifier Q2 which receives the r-f input from exciter if board Z103 and whose output circuit is tuned by transformer T2. The resultant signal developed the secondary of T2 is again tuned by transformer T3. The hfo signal from crystal oscillator Z101 is applied to the mixer amplifier circuit via amplifier Q1 and tuned transformer T1. When the assigned operating frequency is above 12 mhz, transformer T1 is tuned to the second harmonic of the hfo input signal frequency, as indicated in paragraph 2-2.

(2) The resultant mixed and amplified signal is tapped off potentiometer R16 and applied to amplifier Q3. The output circuit of Q3 is tuned by transformer T4 to the assigned operating frequency. The output signal at pin B of each subassembly is amplified by Q1 on the exciter mother board and the resultant output is applied to driver V103.

(3) When an assigned transmitting frequency is above 8 mhz, the signal must be injected with the 3.5-mhz output of crystal oscillator Z101. This is accomplished by routing 12v dc B+ from pin D of the subassembly to pin C via diode CR1 to the 3.5-mhz crystal oscillator Z101. Thus, the subassembly associated with the setting of the CHANNEL switch whose assigned operating frequency is above 8 mhz controls the application of 12v dc to the 3.5-mhz oscillator and the resultant injection of the frequency in the output signal.

(4) The particular subassembly that is activated is controlled by the setting of the front panel CHANNEL switch which applied 12v dc B+ to pin D of the selected subassembly via pin 5, 6, 7, 8, 9, 10, 11, or 12, for channels 1 through 8, respectively. The exciter mother board also contains filter coils and capacitors at the B+ input to each subassembly. The r-f input is applied to pin E of each subassembly from exciter if board Z103 via pin 3 of the mother board. The hfo input is applied to pin F of each subassembly from crystal oscillator Z101 via pin 4 of the mother board.

d. EXCITER IF ASSEMBLY Z103. (See figure 18.)

(1) The exciter if assembly Z103 receives audio or c-w intelligence, injects the appropriate sideband frequency if necessary, injects the 3.5-mhz signal if operating above 8 mhz, and applies the resultant amplified signal to exciter rf assembly Z102. The audio input to Z103 can be applied to audio amplifier Q1 via a 600-ohm input or the mike input. When applied from a 600-ohm input, the signal is applied to Q1 via matching transformer T4. The mike input is applied directly via pin 1. The amplified audio output of Q1 is routed to a sidetone generator Q2 and to the normal audio path to balanced mixer CR6 through CR9 via pad R43, R50 and R51.

(2) The sidetone generator is basically an amplifier whose output is amplified by Q5 and applied to receiver if board Z104 to enable monitoring the transmission. Amplifier Q5 receives operating voltage via transmit/receive relay K101 when the relay is in the energized transmit mode.

(3) The normal audio path output of amplifier Q1 is applied to balanced mixer CR6 through CR9 via a pad formed by resistors R43, R50 and R51. The balanced mixer also receives the bfo input frequency from crystal oscillator Z101 via pin 6. The resultant output of the balanced mixer is applied to amplifier Q3 via 455-khz filter FL1 to remove unwanted products resulting from the mixing operation.

(4) The signal is amplified by Q3 and again by Q4. If the assigned transmitting frequency is between 1.6 and 8 mhz, diode CR12 is forward biased and the resultant output of Q4 is applied to exciter rf board Z102 via pin 7. However, if the assigned operating frequency is greater than 8 mhz, the 3.5-mhz output of crystal oscillator Z101 must be injected into the signal. Therefore, above 8 mhz, pin 8 receives 12v dc B+ which activated the mixer and amplifier circuit and also back biases diode CR12 via coil L2 and diode CR17. With diode CR12 back biased, the output of amplifier Q4 is applied to mixer Q9 via coupling capacitor C34 and resistor R49.

(5) Mixer Q9 mixes the 455 khz $\pm$1.4 khz signal with 3.5-mhz and selects the sum frequency in tuned circuits consisting of transformer T1 and T2 and capacitors C37 and C40. The signal is amplified by Q6 whose output circuit is tuned by transformer T3 and capacitor C41 to 3.955 mhz. The resultant output of Q6 is buffered by emitter follower Q7 and Q8 and applied to exciter rf board Z102 via pin 7. Control of 3.5-mhz injection is performed by the 3.5-mhz crystal oscillator circuit on Z101 which, in turn, is controlled by the setting of the front panel CHANNEL switch and the subassemblies on exciter rf assembly Z102.

(6) The exciter if board also contains a delay circuit Q10 and Q11 which is controlled by the key input at pin 10. The delay circuit is activated for 2 seconds each time the key is depressed. This time delay feature eliminates the necessity of manually placing the unit in the receive mode after a c-w transmission. The 2-second time delay is reactivated each time the key is depressed.

(7) The time delay is controlled by capacitors C22 and C23. With the key line open, capacitors C22 and C23 charge to 12v dc permanent input voltage. After approximately 2 seconds, transistor Q11 is forward baised which places the base of Q10 at ground, back biasing Q10. As a result, the PTT output line at pin 14 is open and the unit is placed in the receive mode. If the key is depressed, the junction of diodes CR10 and CR18 are grounded, discharging capacitors C22 and C23. With capacitors C22 and C23 discharged, the base of Q11 is grounded, back biasing Q11. With Q11 back biased, Q10 is forward biased and places a ground on PTT line 14, placing the unit in the transmit mode via transmit/receive relay K101. When the key ground is removed, as when the key is raised, capacitors C22

and C23 are again allowed to charge. If 2 seconds are allowed to elapse, Q11 becomes forward biased which back biases Q10, and removes the ground from the PTT line, deenergizing transmit/receiver relay K101.

e. RECEIVER IF ASSEMBLY Z104. (See figure 20.)

(1) The receiver if assembly Z104 receives the r-f input from receiver rf assembly Z105 via RF GAIN control R127, mixes the signal with a 3.5-mhz input from crystal oscillator Z101 if the assigned operating frequency is above 8 mhz, and detects and amplifies the resultant 455-khz signal to extract the desired intelligence. If the received signal is above 8 mhz, a 3.5 mhz input from crystal oscillator Z101 is applied to mixer Q1 via pin 3. The input r-f signal at pin 2 is the difference between the hfo and rf frequencies obtained in receiver rf assembly Z105. If the received operating frequency is below 8 mhz, the hfo-rf difference frequency is 455 ±1.4 khz and is applied directly to low pass filter L3, L4, L5, C6 and C7. Below 8 mhz, the 3.5-mhz oscillator is not activated and the low pass filter output is applied to amplifier Z1.

(2) If the received operating frequency is above 8 mhz, the hfo-rf input signal contains a 3.5-mhz component which must be removed. Above 8 mhz, a 3.5-mhz input from crystal oscillator Z101 is applied to difference mixer Q1 via pin 3. Also applied to the difference mixer Q1 is the hfo-rf input signal via high pass filter C1, C2, C3, L1 and L2. The resultant difference output of Q1 is selected in tuned circuit consisting of transformer T1 and capacitor C43. The difference output is 455 ±1.4 khz and is applied to amplifier Z1 via the low pass filter.

(3) The output of amplifier Z1 is applied to 455 khz filter FL1 via noise limiter consisting of diodes CR1 and CR2, capacitors C11 and C12, and resistor R13. When the front panel ANL switch is set to ON, noise pulses on the signal are bypassed to ground via the diodes. The filtered output of FL1 is applied to detector circuits in Z2 and Z3, in addition to an agc and squelch line.

(4) Z2 is an envelope detector and power amplifier and Z3 is a product detector and power amplifier. The input to Z2 is the receiver if output of FL1. The input to Z3 is the receiver if output of FL1 in addition to a bfo input signal from crystal oscillator Z101. The particular detector activated is a function of the selected mode of operation.

(5) The resultant audio output of power amplifiers Z2 and Z3 follow two paths. The first path is to a 600-ohm line output via matching transformer T2. The level of the 600-ohm line audio output is controlled by line gain potentiometer R116 and the level cannot be further controlled from the front panel of the unit. The audio is also applied to front panel AF GAIN control R128 via pin 13. The resultant audio input from the AF GAIN control is applied to power amplifier Z3 via pin 12. The output of Z3 is amplified by push-pull amplifier

Q2 and Q3 and the resultant output developed across transformer T3. The transformer secondary is connected to the front panel speaker. Also applied to the primary of transformer T3 is the sidetone output of the exciter if board Z103, providing a means of monitoring the transmissions. Notice that the level of the audio applied to the front panel speaker can be controlled via the front panel AF GAIN control, but the sidetone audio level cannot be adjusted.

(6) The agc and squelch line receives the 455-khz output of FL1 which is applied to amplifier Q8. The amplified output of Q8 is rectified and filtered by diode CR10, capacitors C37, C38 and C39, and resistors R19 and R20. The d-c output is the desired agc and is a function of the amplitude of the received signal. The agc output is applied to the r-f amplifier in receiver rf board Z105 to control the amplification of the first r-f amplifier stage, thereby maintaining a relatively constant signal level. The d-c agc signal is also applied to the front panel METER with the METER switch set to REC to obtain a relative indication of signal strength. The signal is applied to the METER via emitter follower Q7 and pin 4.

(7) The d-c agc voltage is also applied to a squelch line. The d-c voltage is applied to differential amplifier Z4 via emitter follower Q9. Connected across pins 6, 7 and 8 of Z104 is the front panel SQUELCH control. The normal d-c signal output of emitter follower Q9 is applied to the positive input of differential amplifier Z4. The SQUELCH potentiometer forms a bridge circuit with the input resistors to Z4. The setting of the SQUELCH potentiometer controls the balancing of the bridge circuit such that the negative level established by the control must be exceeded by the level of the input d-c signal in order to obtain a positive output from Z4.

(8) If the output of differential amplifier Z4 is positive, diodes CR7 and CR8 are forward biased, closing switching transistor Q4. The resultant ground is applied to the base of Q6 back biasing Q6. With Q6 back biased, series pass transistor Q5 is forward biased and +12v dc is applied to power amplifier Q2 and Q3. The power amplifier then operates on the normal audio input and applies the signal to the front panel speaker.

(9) If the output of differential amplifier Z4 is negative, diodes CR7 and CR8 are back biased, forward biasing switch Q4. As a result, Q6 is forward biased and Q5 is back biased. With Q5 back biased, +12v dc is removed from power amplifier Q2 and Q3. Disabling the power amplifiers in the absense of sufficient signal strength prevents noise from reaching the front panel speaker.

f. RECEIVER RF ASSEMBLY Z105. (See figures 22 and 24.)

(1) The receiver rf assembly Z105 consists of a receiver mother board Z105 and eight receiver rf subassemblies Z105Z1 through Z105Z8; one for each

channel. Each subassembly contains an r-f amplifier, a mixer amplifier, and a frequency doubler if the assigned operating frequency for the associated channel is above 12 mhz. The r-f input to the receiver mother board is applied to pin 5 from the antenna via the transmit/receive relay K101 when the relay is in the deenergized receive state. The antenna signal at pin 5 is applied to pin F of each of the eight subassemblies. The particular subassembly selected is controlled by the front panel CHANNEL switch which routes 12v dc operating voltage to the associated subassembly in addition to applying the hfo signal from the crystal oscillator Z101. Also applied to pin D of each subassembly is the agc voltage from receiver if Z104 via pin 3.

(2) The r-f input is applied to amplifier Q1 via tuned transformer T1. Also applied to Q1 is the agc voltage at pin D which controls the gain of the amplifier. The resultant amplified output is developed across tuned transformer T2. Both transformers T1 and T2 are tuned to the assigned operating frequency for the particular channel.

(3) The amplified output of Q1 is applied to mixer amplifier Q2. If the assigned operating frequency is below 12 mhz, a jumper is connected across the frequency doubler Q3 and T4. The hfo input frequency from crystal oscillator Z101 is then applied directly to mixer Q2. Tuned transformer T3 selects the difference frequency which is 455 khz if the assigned operating frequency is between 1.6 and 8 mhz or a difference frequency of 3.955 mhz if the assigned operating frequency is between 8 and 12 mhz. The resultant difference frequency is applied to receiver if Z104.

(4) If the assigned operating frequency is between 12 and 26 mhz, the jumper is not used and the frequency doubler circuit is activated. The hfo input is then applied to Q3 whose transformer T4 is tuned to twice the input frequency. The resultant doubled hfo frequency is applied to mixer Q2 as the mixing frequency, to obtain a difference frequency of 3.955 mhz that is applied to receiver if Z104.

(5) Notice that the 3.5 mhz oscillator B+ voltage is obtained from the hfo in B+ voltage at pin C via coil L1 and diode CR2. If the particular subassembly is assoicated with a channel whose assigned operating frequency is above 8 mhz, the 3.5 mhz oscillator must be activated to remove the 3.5 mhz component. Activation of the 3.5 mhz oscillator is controlled by the hfo B+ input. Diode CR2 is included on those subassemblies whose assigned operating frequency is above 8 mhz. Below 8 mhz, the diode is not included and the 3.5 mhz oscillator is not activated.

SECTION 3

ALIGNMENT

3-1. GENERAL.

This section contains the alignment procedures required to maintain the TM125(D), in satisfactory operating condition. When performing the alignment procedures, refer to figure 11, overall component location, and to the individ ual component location diagrams for the printed circuit board assemblies.

3-2. TEST EQUIPMENT REQUIRED.

The following test equipment, or its equivalent, is required to perform the complete alignment of the TM125(D).

a. Multimeter, Simpson 260, or equivalent.

b. Frequency counter HP5244L, or equivalent.

c. Oscilloscope, Tektronix 541, or equivalent.

d. R-f signal generator, HP606A, or equivalent.

e. Dummy load and wattmeter, Waters 334, or equivalent.

f. Vtvm, HP410B, or equivalent.

3-3. ALIGNMENT.

a. PRELIMINARY PROCEDURES. Before energizing the TM125(D) perform the following procedures.

(1) Connect multimeter to K1-B arm (12v dc supply). Resistance should be greater than 100 ohms. Depress relay armature manually. Resistance should be greater than 150 ohms.

(2) Connect multimeter to L1 of +800-volt d-c power supply. Resistance should be greater than 20,000 ohms.

(3) Connect multimeter to L4 of +200-volt d-c power supply. Resistance should be greater than 50,000 ohms.

(4) Connect multimeter to arm of R14 of -48-volt d-c power supply. Resistance should be greater than 18,000 ohms.

(5) Check a-c line cord for short circuits. Ensure that 5-ampere slow-blow fuse is in a-c fuse holder. Set OFF/REC/PTT/CW switch to REC and measure resistance across a-c line plug. Resistance should be approximately 1 ohm.

b. POWER SUPPLY.

(1) Set RF GAIN, AF GAIN and SQUELCH controls to minimum, CLARIFIER control to center range, CHANNEL switch to position 1, MODE switch to CW, OFF/REC/PTT/CW switch to OFF, ANL switch to OFF, and METER switch to IP.

(2) Set bias potentiometer R14 at rear of unit fully clockwise.

(3) Connect a-c cable to 115-volt a-c source.

(4) Set OFF/REC/PTT/CW switch to REC. Filaments should light.

(5) Measure a-c voltage at pin 2 of V1 with multimeter. Voltage should be 12v ac $\pm$15%.

(6) Measure d-c voltage on relay coil K1. Voltage should be +24v dc $\pm$20%.

(7) Measure a-c voltage between pin 6 of power transformer T1 and ground. Voltage should be 9v ac $\pm$20%.

(8) Measure voltage between pin 8 of power transformer T1 and ground. Voltage should be 9v ac $\pm$20%.

(9) Connect vtvm to pin 1 of V1, depress the armature of relay 1 with an insulated tool, and adjust potentiometer R14 for an indication of 0.6v dc $\pm$15%. Check voltage at pin 1 of V2 with vtvm. It should be 0.6v dc $\pm$20%.

(10) With armature of relay K1 depressed with an insulated tool and METER switch set to Ip position, the METER should indicate 100 ma $\pm$10%.

(11) Measure d-c voltage on pin 3 of V1 and V2 with armature of relay K1 depressed with an insulated tool. Voltage should be 200v dc $\pm$10%.

CAUTION

Excercise extreme care when performing the following measurements.

(12) Measure d-c voltage on plates of V1 and V2 with armature of relay K1 depressed with an insulated tool. Voltage should be 800v dc $\pm$15%.

(13) Measure d-c voltage on pins 7 and 8 of V3 with armature of relay K1 depressed with an insulated tool. Voltage should be 250v dc ±10%.

(14) Measure d-c voltage on pin 1 of V3 with armature of relay K1 depressed with an insulated tool. Voltage should be 4v dc ±10%.

(15) Measure d-c voltage on K1-B arm. Voltage should be +12v dc ±10%.

c. CRYSTAL OSCILLATOR Z101 (A4723).

(1) Check that the bfo and hfo crystals are inserted in proper locations.

(2) Set MODE switch to USB.

(3) Connect oscilloscope to pin 36 of crystal oscillator board. Connect frequency counter to vertical output of oscilloscope.

(4) Adjust capacitor C90 for USB crystal frequency reading on counter. Oscilloscope should indicate a level of 0.5 v peak-to-peak minimum.

(5) Set MODE switch to CW. Frequency and level should remain unchanged.

(6) Set MODE switch to LSB.

(7) Adjust capacitor C91 for LSB crystal frequency reading on counter. Oscilloscope should indicate a level of 0.5 v peak-to-peak minimum.

(8) Adjust all receiver hfo crystals for correct frequency by connecting oscilloscope and frequency counter to each receiver hfo output (L1-L8) and by setting CHANNEL switch to corresponding position. Adjust appropriate hfo capacitor for 500 mv peak-to-peak minimum.

(9) Connect oscilloscope and frequency counter to 3.5-mhz oscillator output terminal 21 and insert a receiver rf board wired for double conversion (above 12 mhz).

(10) Adjust oscillator capacitor C41 for 3.5 mhz at a level of 500 mv peak-to-peak minimum.

(11) Insert an exciter rf board and manually depress armature of relay K1 with an insulated tool. Adjust all exciter hfo crystal capacitors C52, C56, C60, C64, C68, C72, C76, C81 for correct frequency.

d. EXCITER RF ASSEMBLY Z102 (A4918).

(1) Set MODE switch to CW, and OFF/REC/PTT/CW switch to CW.

(2) Set CHANNEL switch to channel 1.

(3) Connect frequency counter to junction or resistors R8 and R9.

(4) If subassembly assigned operating frequency is below 12 mhz, tune transformer T1 to the hfo frequency. If subassembly assigned operating frequency is above 12 mhz, tune transformer T1 to twice the hfo frequency.

(5) Connect frequency counter to r-f output pin of board.

(6) Tune transformers T2, T3 and T4 to assigned operating frequency value.

(7) Adjust potentiometer R16 for maximum output level.

(8) Repeat steps 3 through 7 for channels 2 through 8, setting front panel CHANNEL switch to appropriate position for each channel.

e. EXCITER IF ASSEMBLY Z103 (A4730).

(1) Set MODE switch to USB and OFF/REC/PTT/CW switch to CW.

(2) Set CHANNEL switch to channel 1.

(3) Connect frequency counter and oscilloscope to pin 7.

(4) If channel 1 assigned operating frequency is below 8 mhz, adjust potentiometers R14 and R16 and capacitor C18 for maximum output at 455 khz. If channel 1 assigned operating frequency is above 8 mhz, adjust potentiometers R14 and R16, capacitor C18, and transformers T1, T2 and T3 for maximum output at 3.955 mhz.

f. RECEIVER IF ASSEMBLY Z104 (A4721).

(1) Set MODE switch to AME and OFF/REC/PTT/CW switch to REC.

(2) Connect a 600-ohm resistor across pins 14 and 16.

(3) Connect vtvm across 600-ohm resistor.

(4) Adjust potentiometer R16 for 0.75-volt indication on vtvm.

g. RECEIVER RF ASSEMBLY Z105 (A4917).

(1) Set SQUELCH control fully counterclockwise, RF GAIN and AF GAIN control fully clockwise, and MODE switch to AME.

(2) If assigned operating frequency of channel board is above 8 mhz connect frequency counter to junction of resistors R6 and R8. Adjust transformer T4 for twice the hfo frequency.

(3) Connect frequency counter and oscilloscope to pin 1 of mother board. If assigned operating frequency is below 8 mhz, adjust transformer T3 for maximum output at 455 khz. If assigned operating frequency is above 8 mhz, adjust transformer T3 for maximum output at 3.955 mhz.

(4) Connect signal generator through a 0.1 microfarad capacitor to ANTENNA jack. Set signal generator to frequency of rf board, at a level of 300 microvolts, modulated 50%, and vary frequency until an audible signal is heard.

(5) Tune transformers T1 and T2 for maximum, reducing signal generator input level to 100 microvolts as signal strength increases. Continue reducing signal generator output until sensitivity of 1 microvolt is achieved.

h. FINAL TRANSMITTER ADJUSTMENTS.

(1) Connect dummy load and wattmeter to ANTENNA jack.

(2) Key the transmitter and adjust capacitor C27, C28, C29, C30, C31, C32, C33 and C34 with CHANNEL switch set to positions 1 through 8, respectively for an output of 125 watts on each channel.

SECTION 4

DRAWINGS AND PARTS LISTINGS

This section contains the drawings and parts listings for the TM125(D). The diagrams that are referenced in the troubleshooting section are contained in this section. The drawings start with the overall block diagrams of the TM125(D) in figures 1 and 2. Figures 3 through 8 are the servicing block diagrams of the power supply circuitry and of each printed circuit board assembly. Figure 9 is the overall schematic diagram, followed by the parts list and overall component location diagrams in figures 10 and 11, respectively. Figures 12 through 25 are the schematic and component location and parts list diagrams for each printed circuit board assembly.

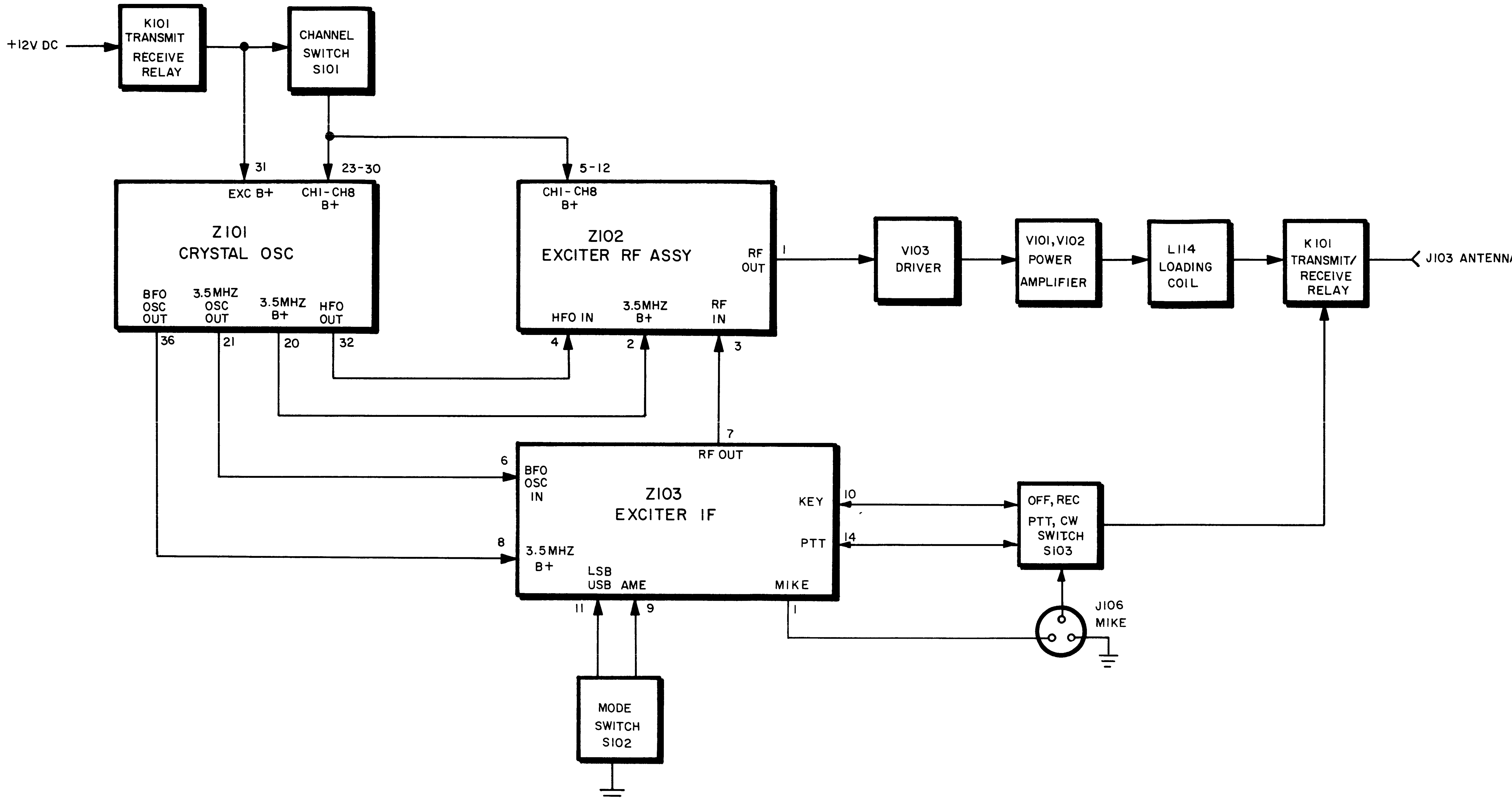

Figure 1. Overall Block Diagram, Exciter Section

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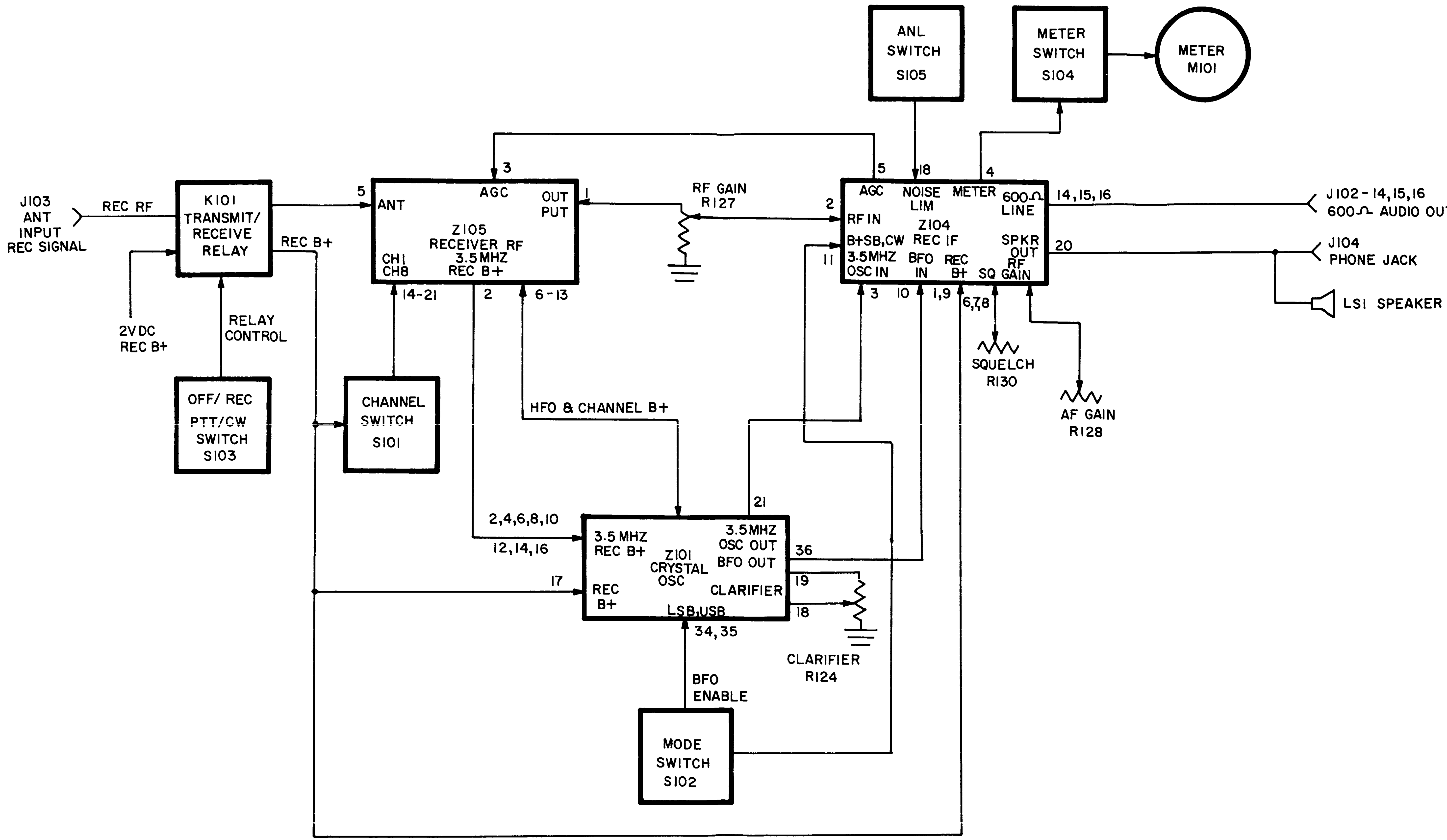


Figure 2. Overall Block Diagram, Receiver Section

012721075

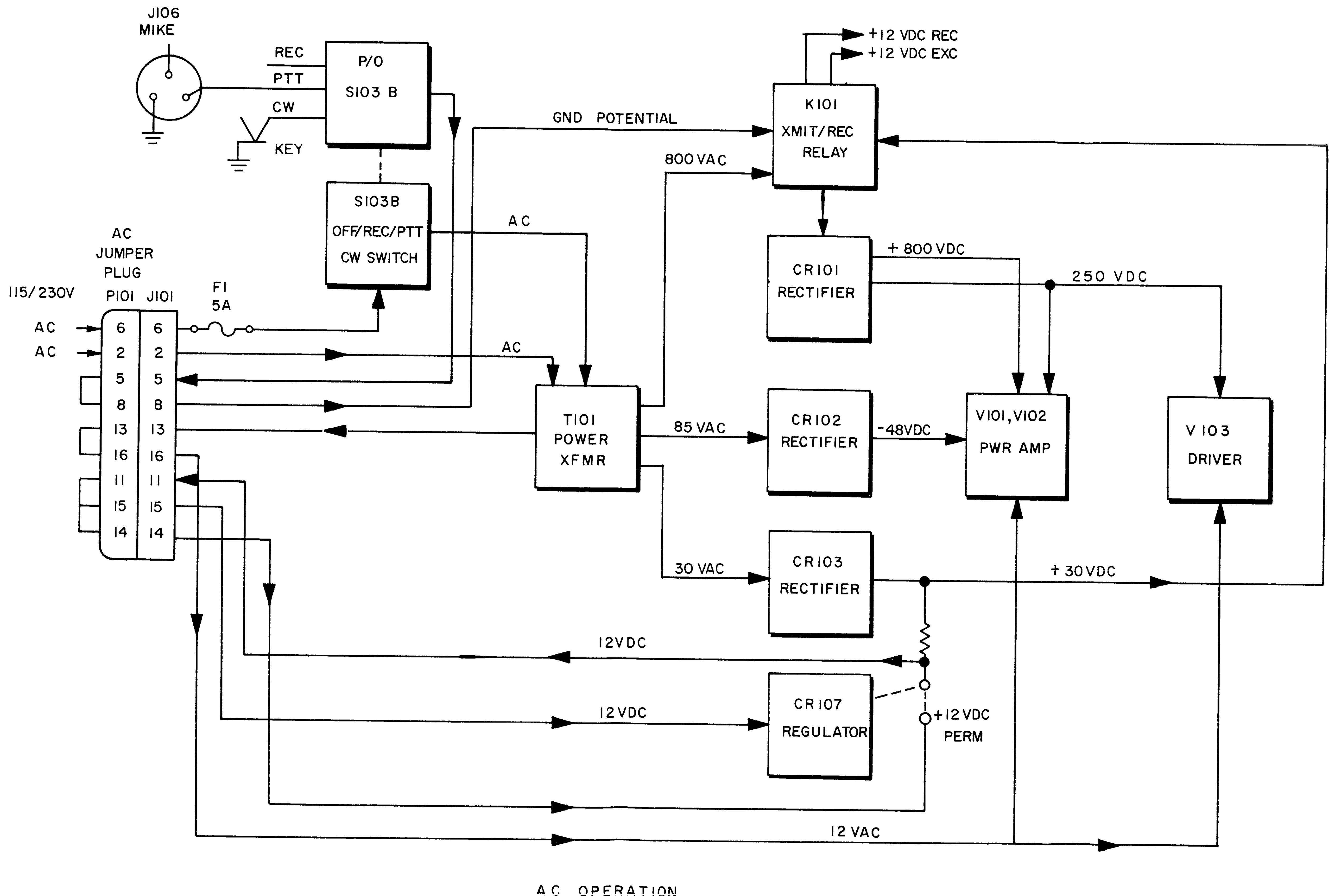
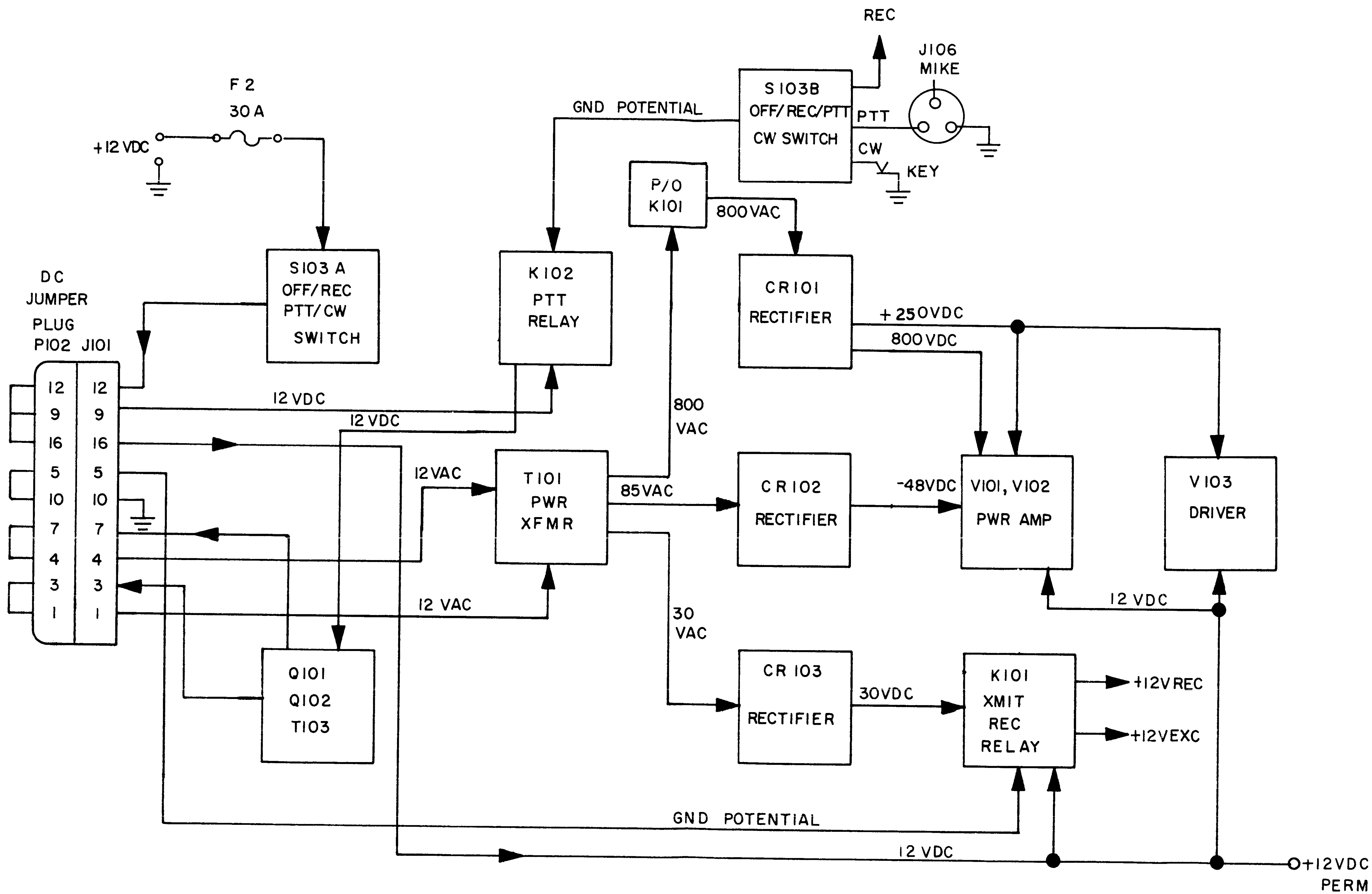


Figure 3. Servicing Block Diagram,
Power Supply Section
(Sheet 1 of 2)



DC OPERATION

Figure 3. Servicing Block Diagram, Power Supply Section (Sheet 2 of 2)

012721075

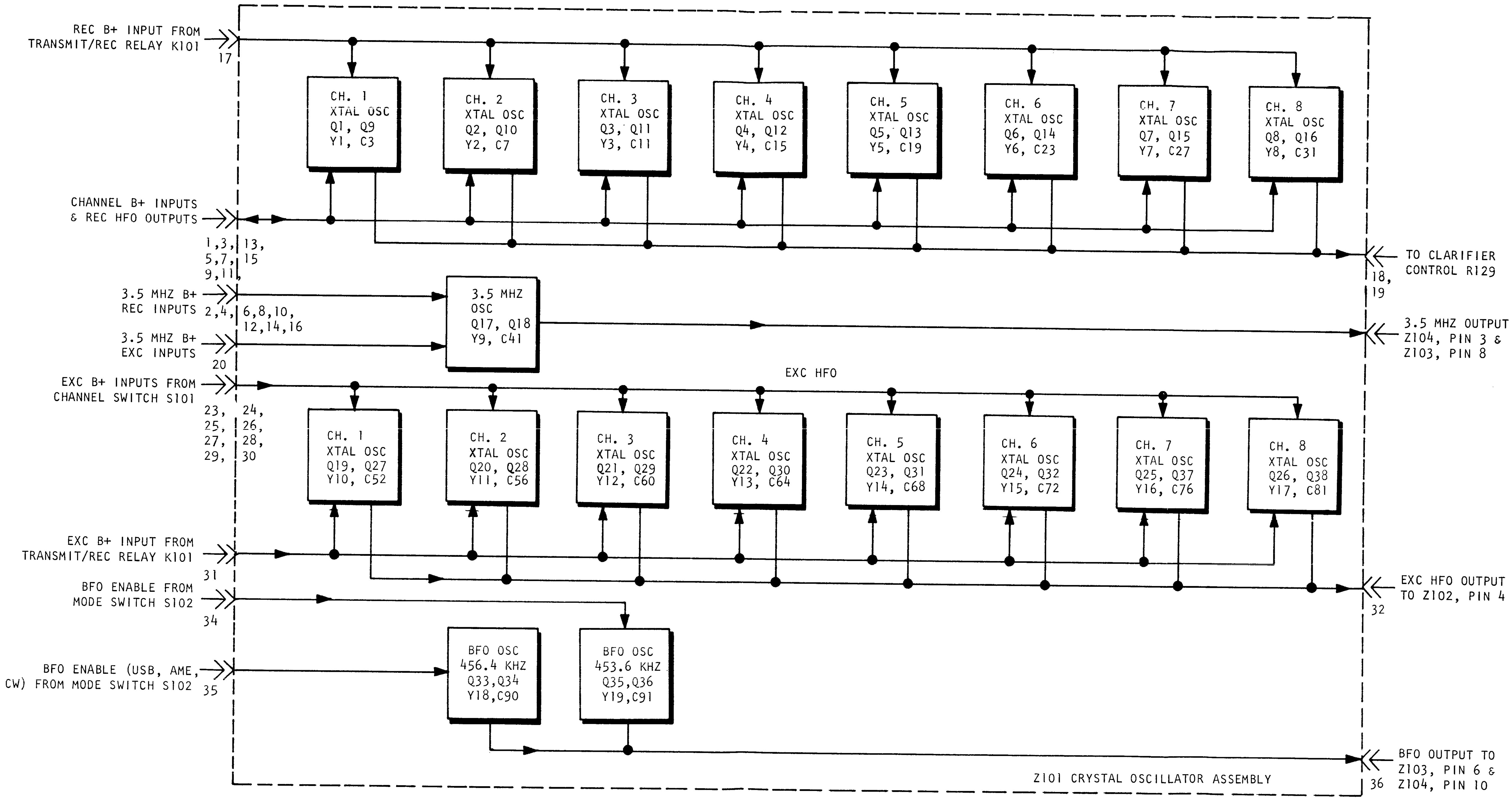


Figure 4. Servicing Block Diagram, Crystal Oscillator Z101

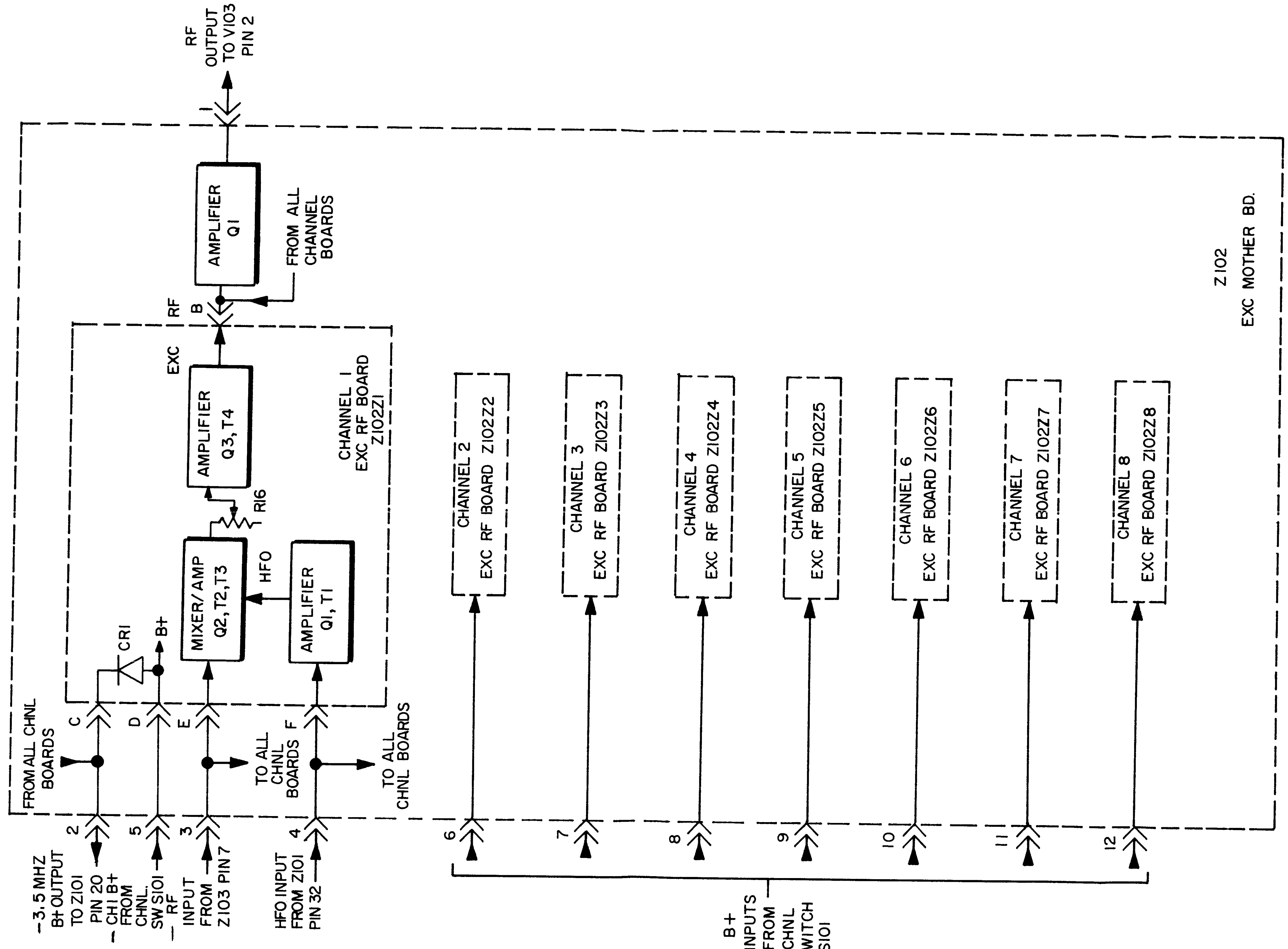


Figure 5. Servicing Block Diagram, Exciter RF Assembly Z102

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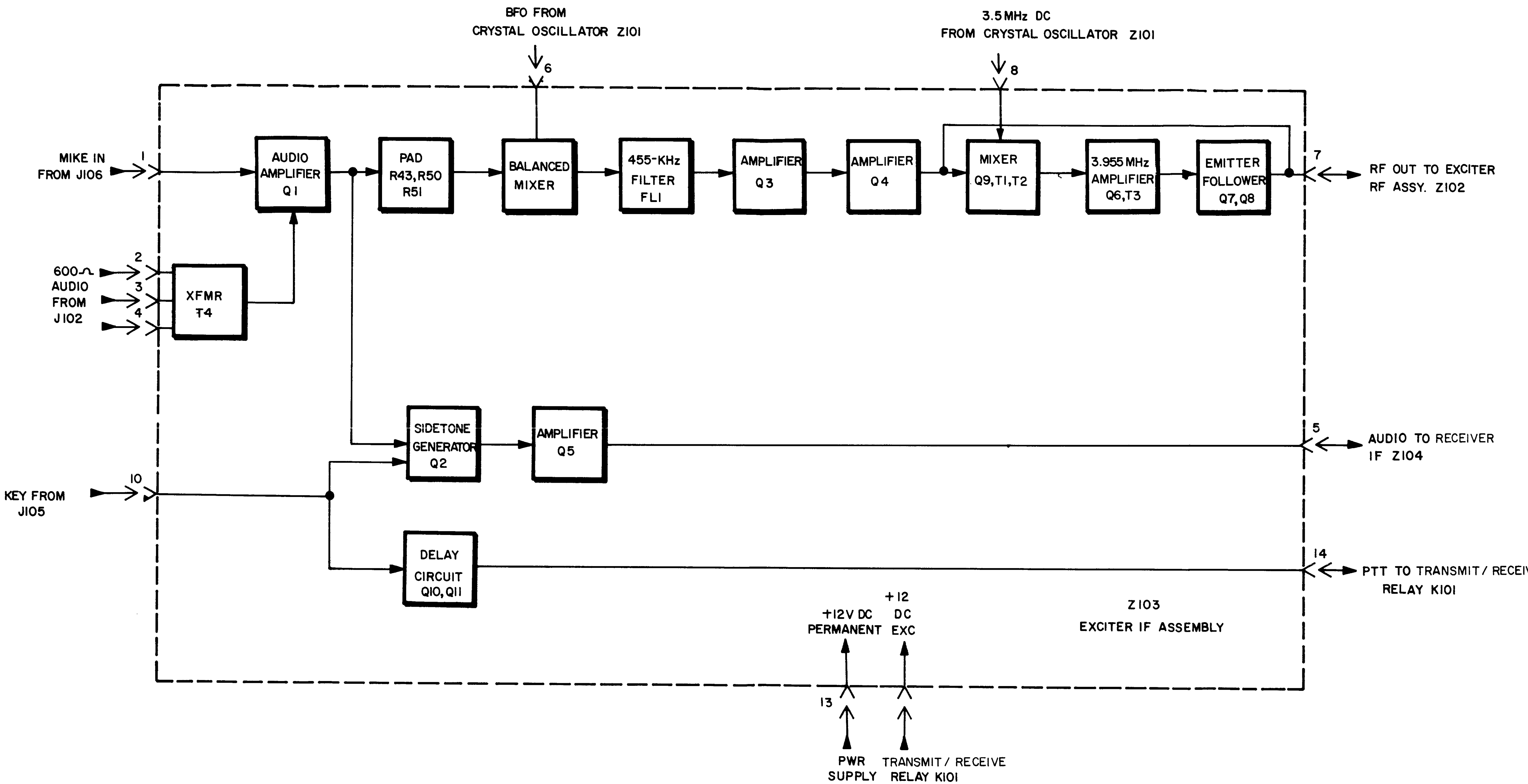

Figure 6. Servicing Block Diagram, Exciter IF Assembly Z103

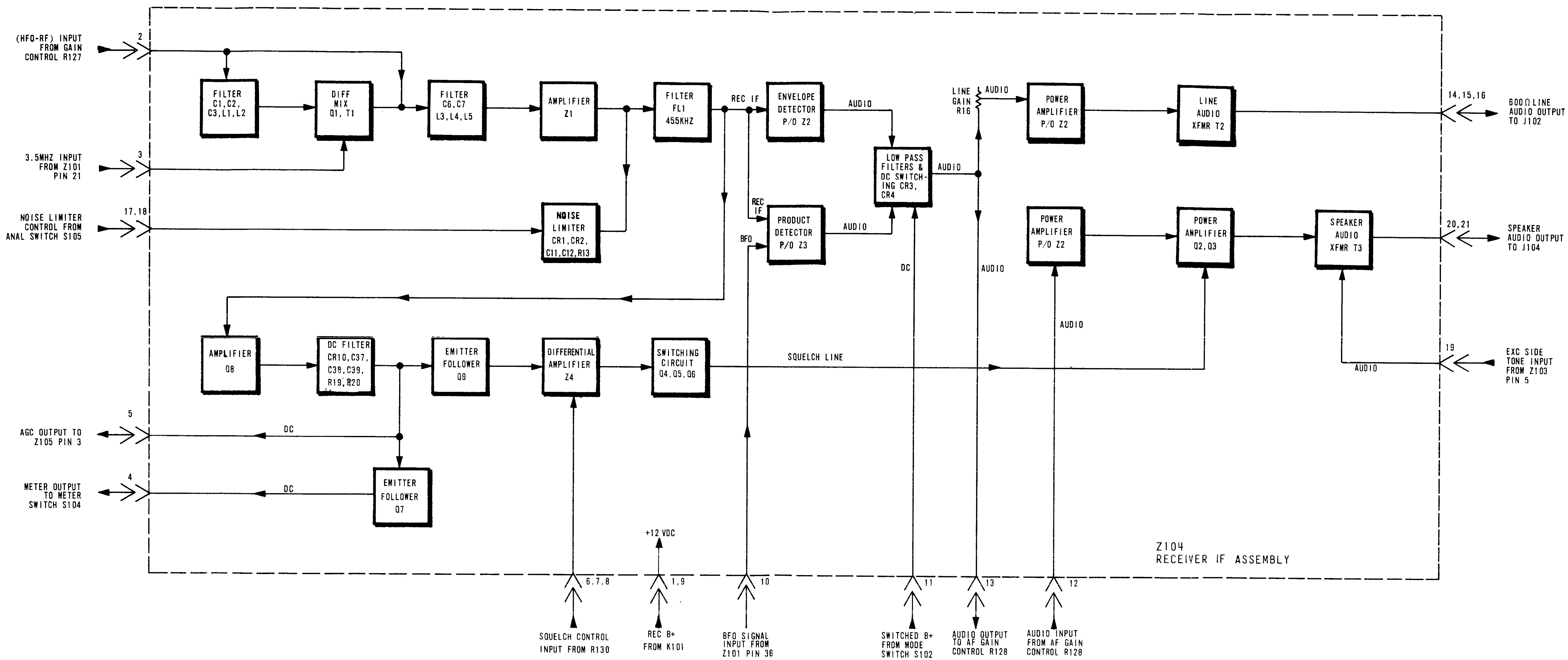

Figure 7. Servicing Block Diagram, Receiver IF Assembly Z104

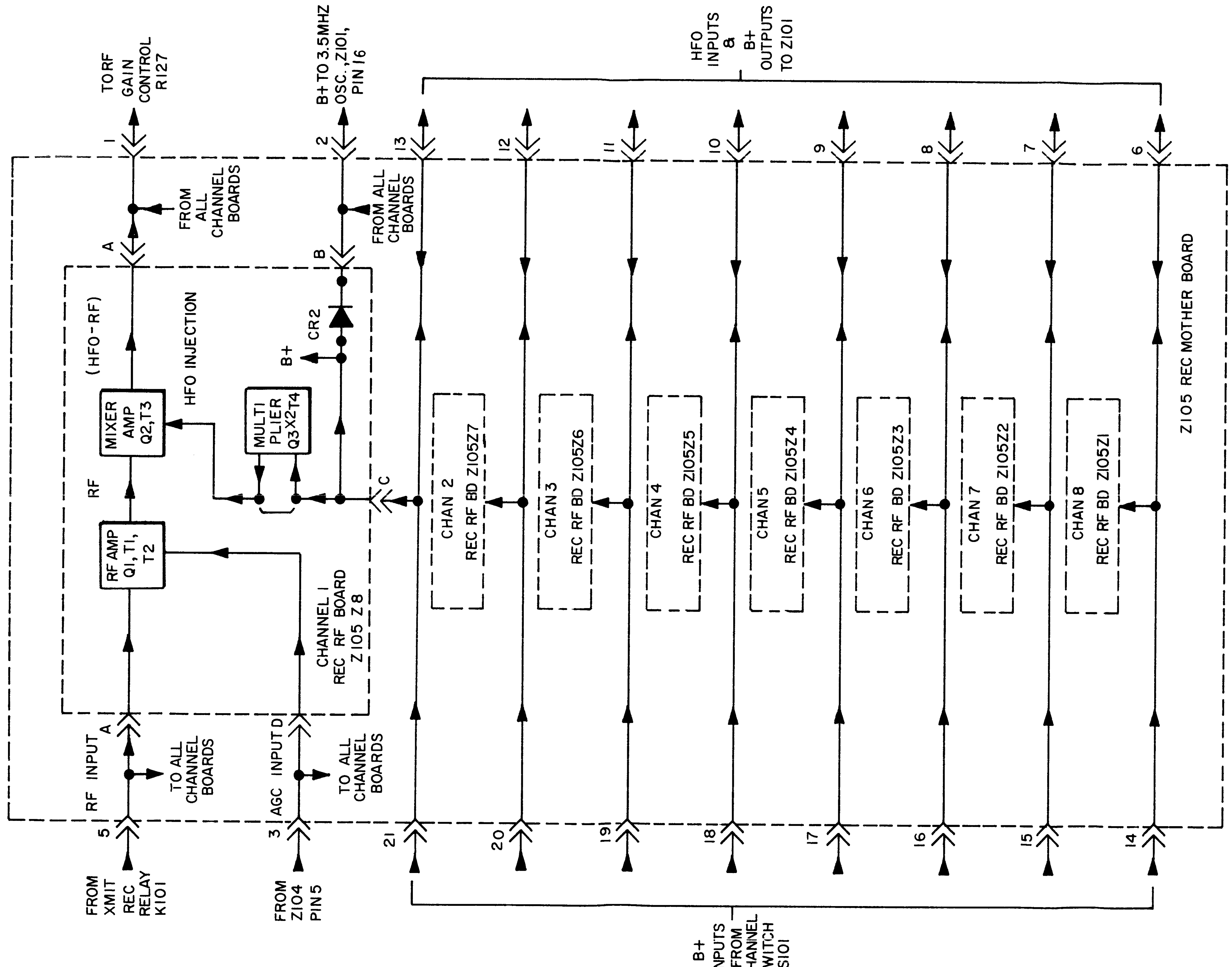

Figure 8. Servicing Block Diagram, Receiver RF Assembly Z105

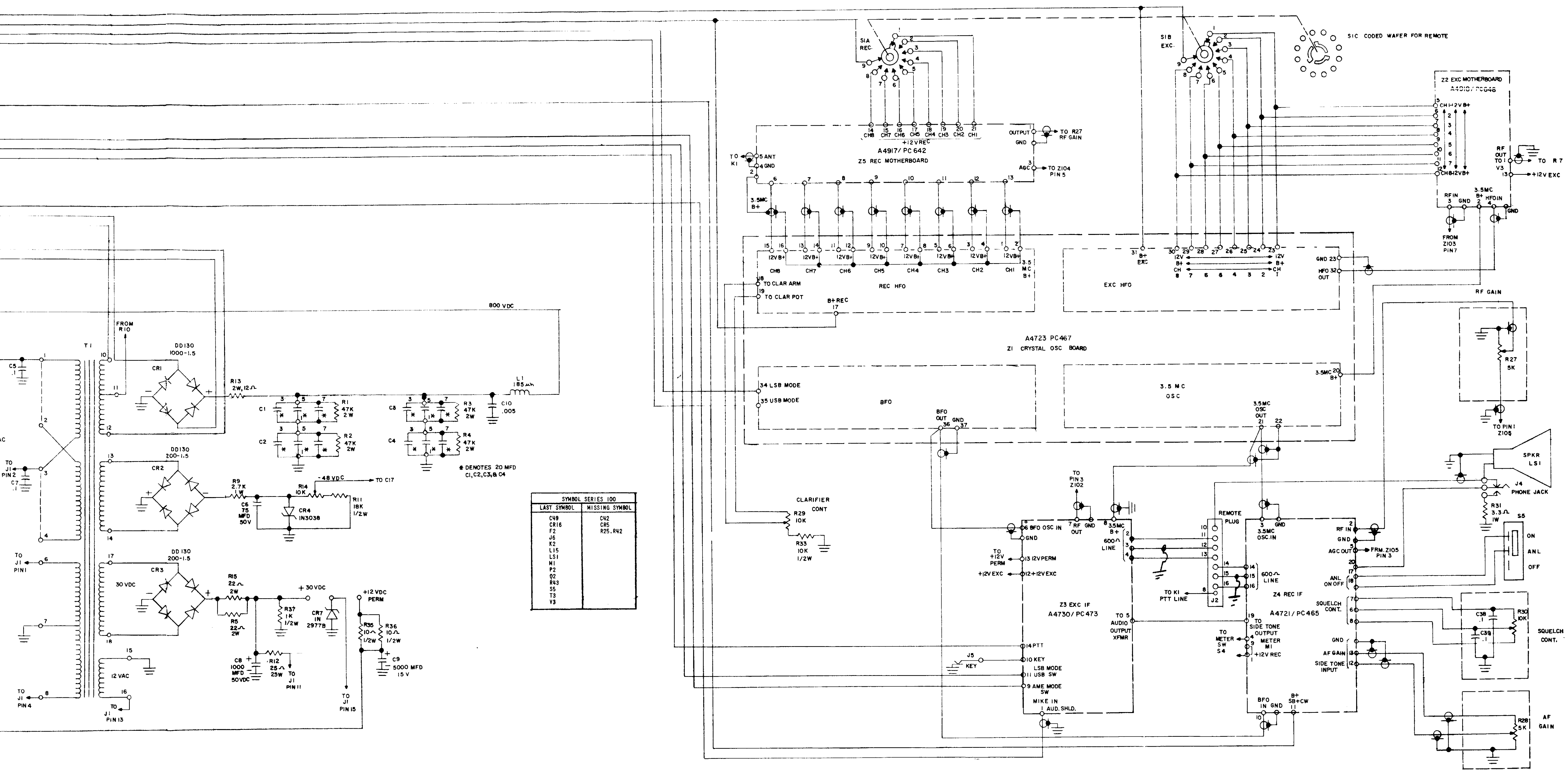

Figure 9. Overall Schematic Diagram, TM125(D) Transceiver

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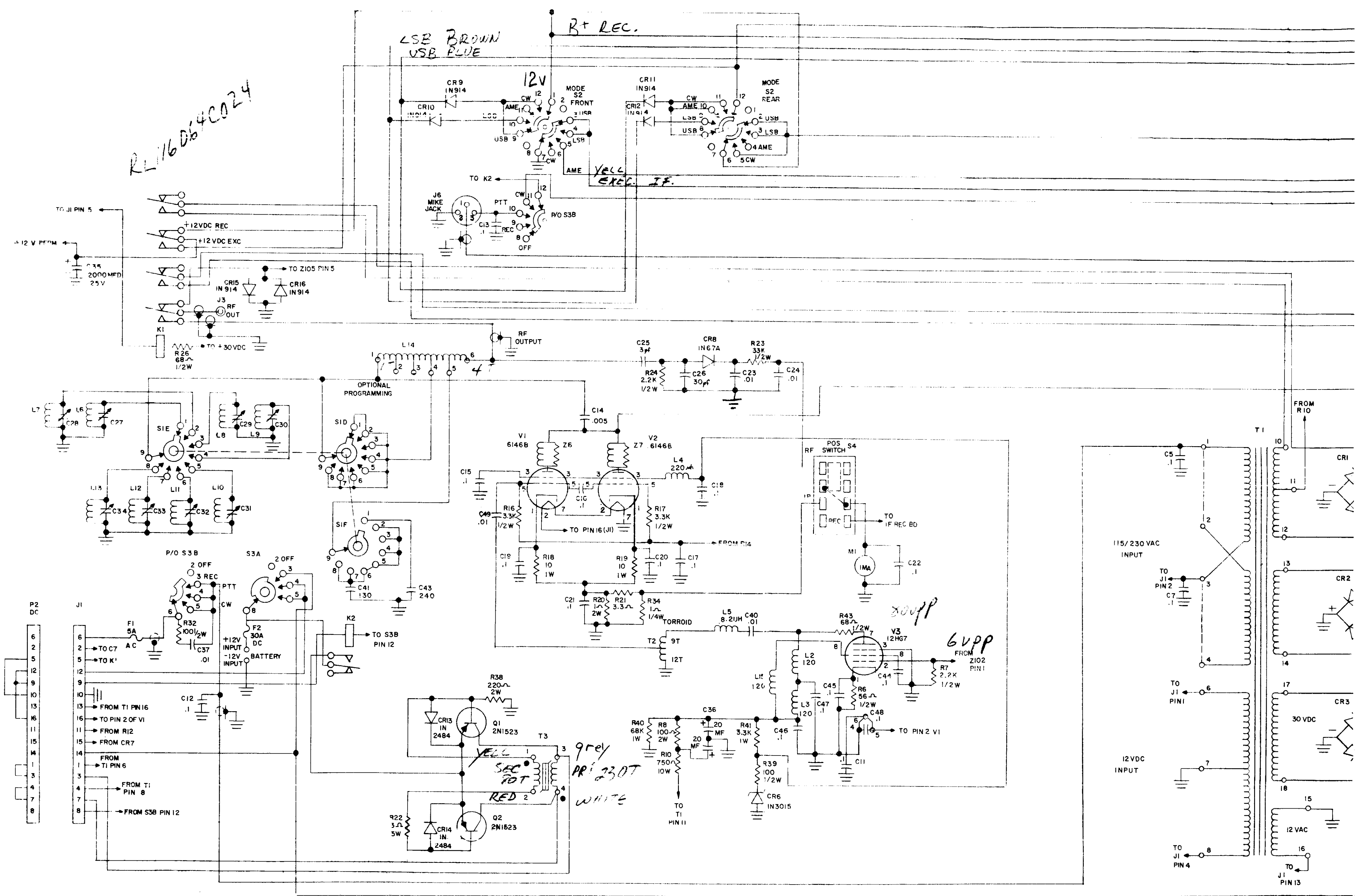
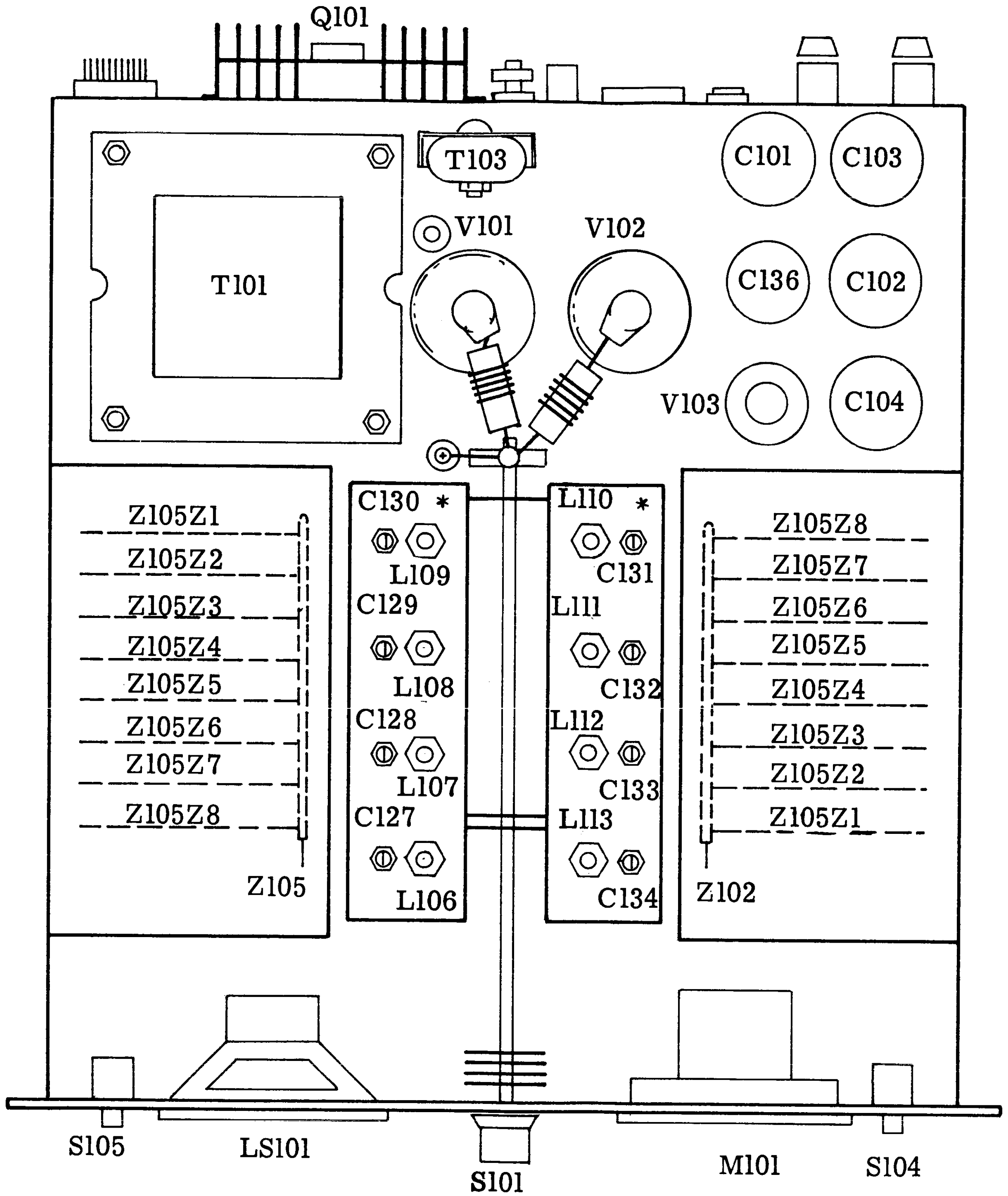


MODE S2 FRONT
MODE S2 REAR
P/O S3B
S3A
J6 MIKE JACK
RF OUTPUT
OPTIONAL PROGRAMMING
RF POS SWITCH S4
TO IF REC BD
115/230 VAC INPUT
12 VDC INPUT
30 VDC
12 VAC
+12V INPUT
-12V INPUT
BATTERY
TORROID
V1 6146B
V2 6146B
V3 12HG7
Q1 2N1523
Q2 2N1523
P1 AC
P2 DC
J1
B+ REC.
LSB BROWN
USB BLUE
12V
YELL EXC. I.F.
grey PRI 230T
SEC POT
RED
WHITE
6VPP
RL 16064C024

SYMBOL	DESCRIPTION	TMC P/N
C101 thru C104	Capacitor, Fixed, Electrolytic	CE108-1
C105	Capacitor, Fixed, Ceramic	CC100-37
C106	Capacitor, Fixed, Electrolytic	CE105-75-50
C107	Same as C105	
C108	Capacitor, Fixed, Electrolytic	CE116-8VN
C109	Capacitor, Fixed, Electrolytic	CE116-17VN
C110	Capacitor, Fixed, Ceramic	CC100-23
C111 thru C113	Same as C105	
C114	Same as C110	
C115 thru C122	Same as C105	
C123	Capacitor, Fixed, Ceramic	CC100-16
C124	Same as C123	
C125	Capacitor, Fixed, Mica	CM111C030J5S
C126	Capacitor, Fixed, Mica	CM111E300J5S
C127 thru C134	Capacitor, Variable, Air	CB132-140-A
C135	Capacitor, Fixed, Electrolytic	CE116-5VN
C136	Capacitor, Fixed, Electrolytic	CE111-2
C137	Same as C123	
C138	Same as C105	
C139	Same as C105	
C140	Same as C123	
C141	Capacitor, Fixed, Mica	CM15B131J
C142	Not Used	
C143	Capacitor, Fixed, Mica	CM15B241J
C144 thru C148	Same as C105	
C149	Same as C123	
CR101	Semiconductor, Bridge Rectifier	DD130-1000-1.5
CR102	Semiconductor, Bridge Rectifier	DD130-200-15
CR103	Same as CR102	
CR104	Semiconductor, Diode, Zener	1N3038
CR105	Not Used	
CR106	Semiconductor, Device, Diode	1N3015
CR107	Semiconductor, Device, Zener	1N2977B
CR108	Semiconductor, Device, Diode	1N67A
CR109 thru CR112	Semiconductor, Device, Diode	1N914
CR113	Semiconductor, Device, Diode	1N2484
CR114	Same as CR113	
CR115	Same as CR109	
CR116	Same as CR109	
F101	Fuse, (115 vac)	FU100-5
F102	Fuse, (230 vac)	FU100-2.5
F102	Fuse	FU102-30
J101	Connector, Receptacle, Male	JJ351
J102	Connector, Receptacle, Female	JJ352
J103	Connector, Receptacle, BNC	UG625/U
J104	Jack, Phone	JJ315
J105	Jack, Key	JJ034
J106	Jack, Mike	JJ133-3
K101	Relay	RL116DC4C024
K102	Relay	RL196
L101	Coil, RF	CL178
L102	Coil	CL240-120
L103	Same as L102	
L104	Coil, RF	CL140-6
L105	Coil, RF	CL270-8.2
L106 thru L113	Coil, RF	CL475-*
L114	Coil, Output Load	CL476
L115	Same as L102	
LS101	Speaker	LS106
M101	Meter	MR231
Q101	Transistor	2N1523
Q102	Same as Q101	
R101 thru R104	Resistor, Fixed, Composition	RC42GF473J
R105	Resistor, Fixed, Composition	RC42GF220J
R106	Resistor, Fixed, Composition	RC20GF560J
R107	Resistor, Fixed, Composition	RC20GF222J
R108	Resistor, Fixed, Composition	RC42GF101J
R109	Resistor, Fixed, Composition	RC32GF272J
R110	Resistor, Fixed, Wirewound	RW109-21
R111	Resistor, Fixed, Composition	RC20GF183J
R112	Resistor, Fixed, Wirewound	RW111-7
R113	Resistor, Fixed, Composition	RC42GF120J
R114	Resistor, Variable, Composition	RV4LAY5A103A
R115	Same as R105	
R116	Resistor, Fixed, Composition	RC20GF332J
R117	Same as R116	
R118	Resistor, Fixed, Composition	RC32GF100J
R119	Same as R118	
R120	Resistor, Fixed, Composition	RC42GF1R0J
R121	Resistor, Fixed, Composition	RC07GF3R3J
R122	Resistor, Fixed, Wirewound	RR114-3W
R123	Resistor, Fixed, Composition	RC20GF333J
R124	Same as R107	
R125	Not Used	
R126	Resistor, Fixed, Composition	RC20GF680J
R127	Resistor, Variable, Composition	RV4NAYSD502AYY
R128	Same as R127	
R129	Resistor, Variable, Composition	RV4NAYSD103A
R130	Same as R129	
R131	Resistor, Fixed, Composition	RC32GF3R3J
R132	Resistor, Fixed, Composition	RC20GF101J
R133	Resistor, Fixed, Composition	RC20GF103J
R134	Resistor, Fixed, Composition	RC07GF1R0J
R135	Resistor, Fixed, Composition	RC20GF100J
R136	Same as R135	
R137	Resistor, Fixed, Composition	RC20GF102J
R138	Resistor, Fixed, Composition	RC42GF221J
R139	Same as R132	
R140	Resistor, Fixed, Composition	RC32GF683J
R141	Resistor, Fixed, Composition	RC32GF472J
R142	Not Used	
R143	Same as R126	
S101	Switch, Rotary	SW511
S102	Switch, Rotary	SW550
S103	Switch, Rotary	SW551
S104	Switch, Sliding, DP TT	SW552
S105	Switch, Sliding, DP DT	SW163
T101	Transformer	TF411
T102	Torroid	TZ210
T103	Torroid	TZ231
V101	Tube	6146B
V102	Same as V101	
V103	Tube	12HG7
XF101	Fuseholder	FH100-1
XF102	Same as ZF101	
XV101	Socket, Octagonal	TS101-4
XV102	Same as XV101	
XV103	Socket, Tube	TS103P01
Z101	Xtal Oscillator Board Assembly	A-4723
Z102	Exciter Mother Board Assembly	A-4918
Z103	Exciter IF Board	A-4730
Z104	Receiver IF Board Assembly	A-4721
Z105	Receiver Mother Board Assembly	A-4917
Z106	Suppressor Assembly	AX561
Z107	Same as Z106	

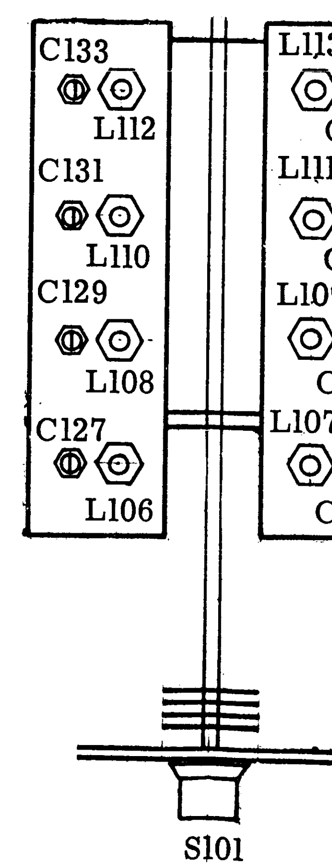
* When ordering replacement parts, the channel frequency must be specified.

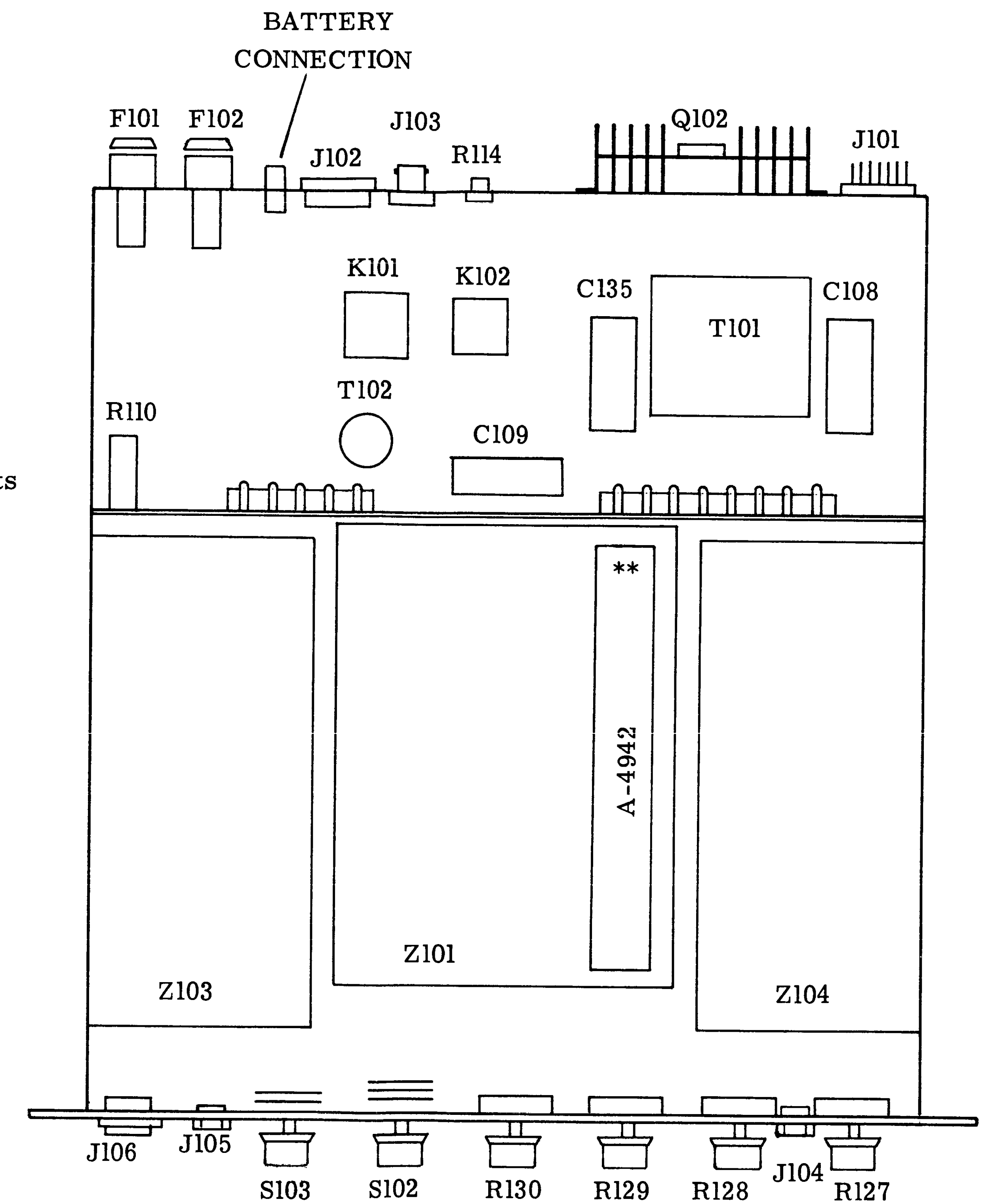
Figure 10. Overall Parts List, TM125(D) Transceiver



TOP VIEW

* NOTE: In some model TM125(D) units (particularly those with high frequency channels above 26 mhz), the channel output tuning components have been located as shown below:





BOTTOM VIEW

** Diode assembly A-4942, not used on model TM125(D).

Figure 11. Overall Component Location, TM125( ) Transceiver

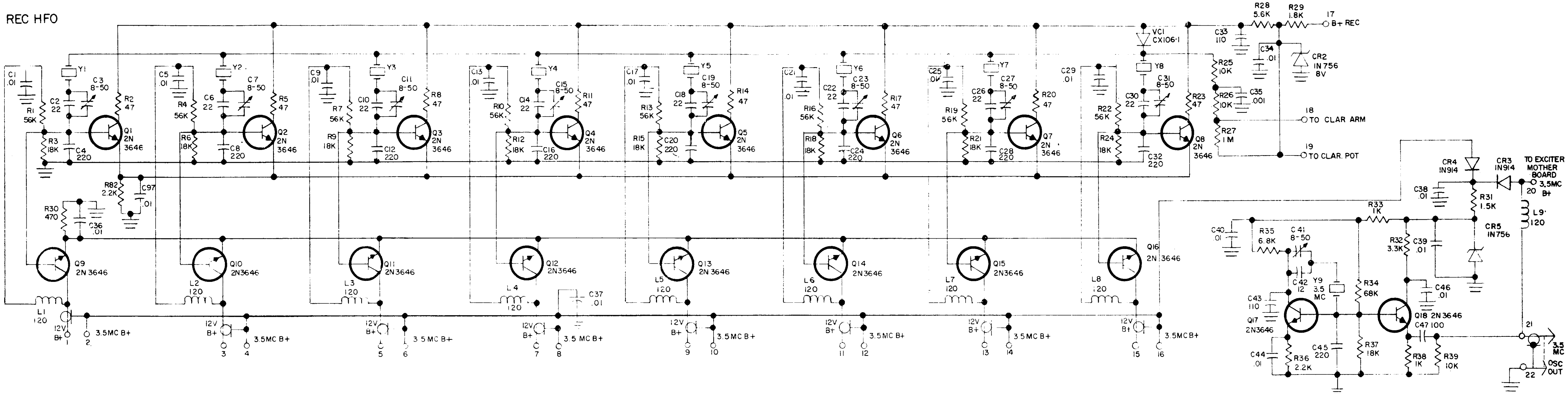
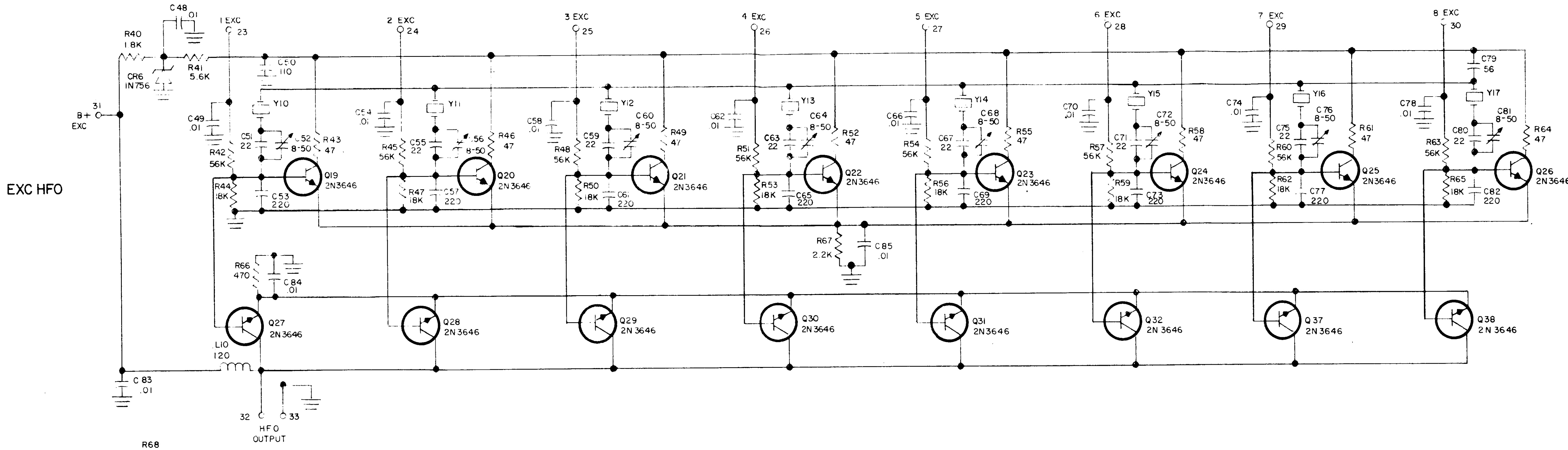
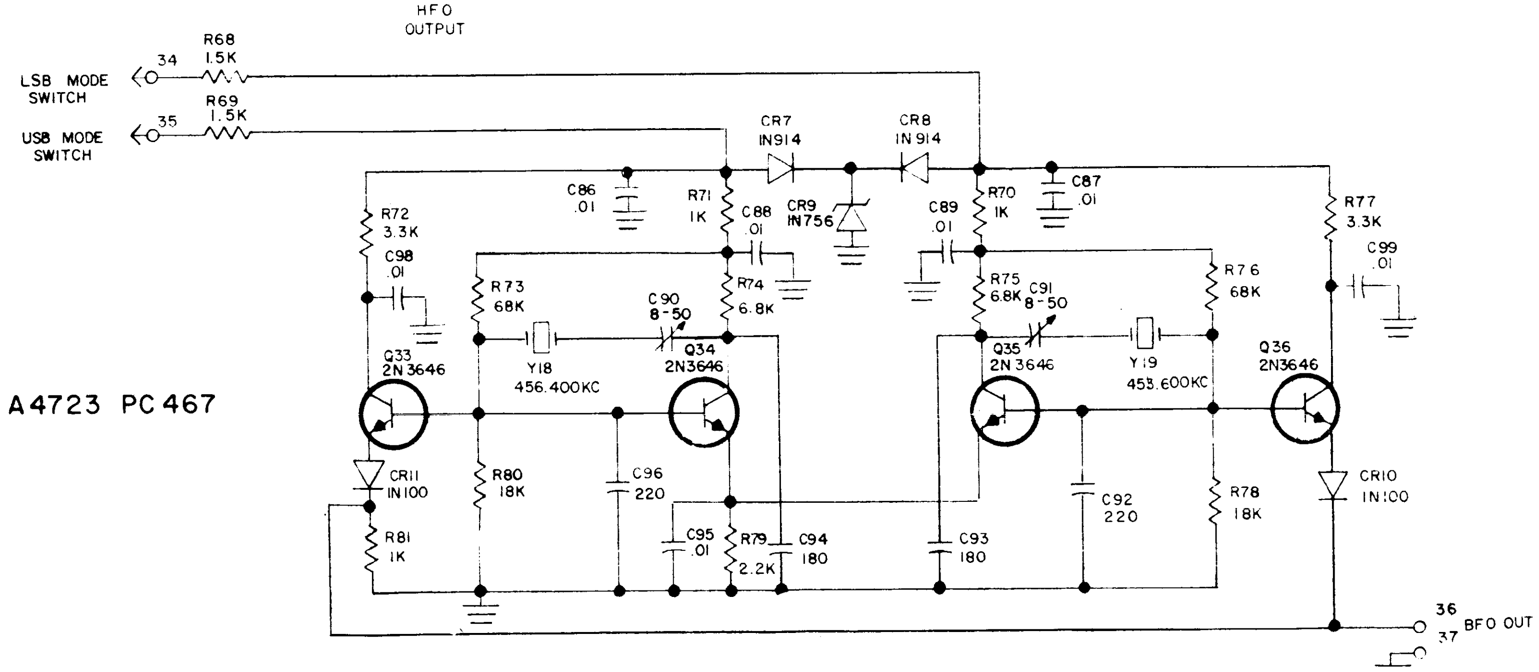


Figure 12. Schematic Diagram,
Crystal Oscillator Z101
(Sheet 1 of 2)





LAST SYMBOL	MISSING SYMBOL
Q38	CR1
Y19	
R82	
C99	
CR11	
L10	

Figure 12. Schematic Diagram,
Crystal Oscillator Z101
(Sheet 2 of 2)

Parts List for A-4723

SYMBOL	DESCRIPTION	TMC P/N
Z101C1	Capacitor, Fixed, Ceramic	CC100-41
Z101C2	Capacitor, Fixed, Mica	CM111C220M5S
Z101C3	Capacitor, Variable, Ceramic	CV109-9
Z101C4	Capacitor, Fixed, Mica	CM111E221J5S
Z101C5	Same as Z101C1	
Z101C6	Same as Z101C2	
Z101C7	Same as Z101C3	
Z101C8	Same as Z101C4	
Z101C9	Same as Z101C1	
Z101C10	Same as Z101C2	
Z101C11	Same as Z101C3	
Z101C12	Same as Z101C4	
Z101C13	Same as Z101C1	
Z101C14	Same as Z101C2	
Z101C15	Same as Z101C3	
Z101C16	Same as Z101C4	
Z101C17	Same as Z101C1	
Z101C18	Same as Z101C2	
Z101C19	Same as Z101C3	
Z101C20	Same as Z101C4	
Z101C21	Same as Z101C1	
Z101C22	Same as Z101C2	
Z101C23	Same as Z101C3	
Z101C24	Same as Z101C4	
Z101C25	Same as Z101C1	
Z101C26	Same as Z101C2	
Z101C27	Same as Z101C3	
Z101C28	Same as Z101C4	
Z101C29	Same as Z101C1	
Z101C30	Same as Z101C2	
Z101C31	Same as Z101C3	
Z101C32	Same as Z101C4	
Z101C33	Capacitor, Fixed, Mica	CM111E111J5S
Z101C34	Same as Z101C1	
Z101C35	Capacitor, Fixed, Ceramic	CC100-29
Z101C36	Same as Z101C1	
thru		
Z101C40		
Z101C41	Same as Z101C3	
Z101C42	Capacitor, Fixed, Mica	CM111C120J5S
Z101C43	Same as Z101C33	
Z101C44	Same as Z101C1	
Z101C45	Same as Z101C4	
Z101C46	Same as Z101C1	
Z101C47	Capacitor, Fixed, Mica	CM111C101J5S
Z101C48	Same as Z101C1	
Z101C49	Same as Z101C1	
Z101C50	Same as Z101C33	
Z101C51	Same as Z101C2	
Z101C52	Same as Z101C3	
Z101C53	Same as Z101C4	
Z101C54	Same as Z101C1	
Z101C55	Same as Z101C2	
Z101C56	Same as Z101C3	
Z101C57	Same as Z101C4	
Z101C58	Same as Z101C1	
Z101C59	Same as Z101C2	
Z101C60	Same as Z101C33	
Z101C61	Same as Z101C4	
Z101C62	Same as Z101C1	
Z101C63	Same as Z101C2	
Z101C64	Same as Z101C3	
Z101C65	Same as Z101C4	
Z101C66	Same as Z101C1	
Z101C67	Same as Z101C2	
Z101C68	Same as Z101C3	
Z101C69	Same as Z101C4	
Z101C70	Same as Z101C1	
Z101C71	Same as Z101C2	
Z101C72	Same as Z101C3	
Z101C73	Same as Z101C4	
Z101C74	Same as Z101C1	
Z101C75	Same as Z101C2	
Z101C76	Same as Z101C3	
Z101C77	Same as Z101C4	
Z101C78	Same as Z101C1	
Z101C79	Capacitor, Fixed, Mica	CM111E560J5S
Z101C80	Same as Z101C2	
Z101C81	Same as Z101C3	
Z101C82	Same as Z101C4	
Z101C83	Same as Z101C1	
thru		
Z101C89		
Z101C90	Same as Z101C3	
Z101C91	Same as Z101C3	
Z101C92	Same as Z101C4	
Z101C93	Capacitor, Fixed, Mica	CM111E181J5S
Z101C94	Same as Z101C93	
Z101C95	Same as Z101C1	
Z101C96	Same as Z101C4	
Z101C97	Same as Z101C1	
and		
Z101C98		
Z101CR1	Not Used	
Z101CR2	Diode, Zener	1N756
Z101CR3	Semiconductor, Device, Diode	1N914
Z101CR4	Same as Z101CR3	
Z101CR5	Same as Z101CR2	
Z101CR6	Same as Z101CR2	
Z101CR7	Same as Z101CR3	
Z101CR8	Same as Z101CR3	
Z101CR9	Same as Z101CR2	
Z101CR10	Semiconductor, Device, Diode	1N100
Z101CR11	Same as Z101CR10	
Z101L1	Coil, Fixed, RF	CL240-120
thru		
Z101L10		
Z101Q1	Transistor	2N3646
thru		
Z101Q38		
Z101R1	Resistor, Fixed, Composition	RC07GF563J
Z101R2	Resistor, Fixed, Composition	RC07GF470J
Z101R3	Resistor, Fixed, Composition	RC07GF183J
Z101R4	Same as Z101R1	
Z101R5	Same as Z101R2	
Z101R6	Same as Z101R3	
Z101R7	Same as Z101R1	
Z101R8	Same as Z101R2	
Z101R9	Same as Z101R3	
Z101R10	Same as Z101R1	
Z101R11	Same as Z101R2	
Z101R12	Same as Z101R3	
Z101R13	Same as Z101R1	
Z101R14	Same as Z101R2	
Z101R15	Same as Z101R3	
Z101R16	Same as Z101R1	
Z101R17	Same as Z101R2	
Z101R18	Same as Z101R3	
Z101R19	Same as Z101R1	
Z101R20	Same as Z101R2	
Z101R21	Same as Z101R3	
Z101R22	Same as Z101R1	
Z101R23	Same as Z101R2	
Z101R24	Same as Z101R3	
Z101R25	Resistor, Fixed, Composition	RC07GF103J
Z101R26	Same as Z101R25	
Z101R27	Resistor, Fixed, Composition	RC07GF105J
Z101R28	Resistor, Fixed, Composition	RC07GF562J
Z101R29	Resistor, Fixed, Composition	RC07GF182J
Z101R30	Resistor, Fixed, Composition	RC07GF471J
Z101R31	Resistor, Fixed, Composition	RC07GF152J
Z101R32	Resistor, Fixed, Composition	RC07GF332J
Z101R33	Resistor, Fixed, Composition	RC07GF102J
Z101R34	Resistor, Fixed, Composition	RC07GF683J
Z101R35	Resistor, Fixed, Composition	RC07GF682J
Z101R36	Resistor, Fixed, Composition	RC07GF222J
Z101R37	Same as Z101R3	
Z101R38	Same as Z101R25	
Z101R39	Same as Z101R25	
Z101R40	Same as Z101R29	
Z101R41	Same as Z101R28	
Z101R42	Same as Z101R1	
Z101R43	Same as Z101R2	
Z101R44	Same as Z101R3	
Z101R45	Same as Z101R1	
Z101R46	Same as Z101R2	
Z101R47	Same as Z101R3	
Z101R48	Same as Z101R1	
Z101R49	Same as Z101R2	
Z101R50	Same as Z101R3	
Z101R51	Same as Z101R1	
Z101R52	Same as Z101R2	
Z101R53	Same as Z101R3	
Z101R54	Same as Z101R1	
Z101R55	Same as Z101R2	
Z101R56	Same as Z101R3	
Z101R57	Same as Z101R1	
Z101R58	Same as Z101R2	
Z101R59	Same as Z101R3	
Z101R60	Same as Z101R1	
Z101R61	Same as Z101R2	
Z101R62	Same as Z101R3	
Z101R63	Same as Z101R1	
Z101R64	Same as Z101R2	
Z101R65	Same as Z101R3	
Z101R66	Same as Z101R30	
Z101R67	Same as Z101R36	
Z101R68	Same as Z101R31	
Z101R69	Same as Z101R31	
Z101R70	Same as Z101R33	
Z101R71	Same as Z101R33	
Z101R72	Same as Z101R32	
Z101R73	Same as Z101R34	
Z101R74	Same as Z101R35	
Z101R75	Same as Z101R35	
Z101R76	Same as Z101R34	
Z101R77	Same as Z101R32	
Z101R78	Same as Z101R3	
Z101R79	Same as Z101R36	
Z101R80	Same as Z101R3	
Z101R81	Same as Z101R33	
Z101R82	Same as Z101R36	
Z101Y1	Exciter Crystal, Quartz	*CR18A/U-
thru		
Z101Y8		
Z101Y9	3.5mhz Oscillator Crystal, Quartz	CR18A/U3.5mhz
Z101Y10	Receiver Crystal, Quartz	*CR18A/U-
thru		
Z101Y17		
Z101Y18	BFO Crystal, Quartz	CR46A/U456.4khz
Z101Y19	BFO Crystal, Quartz	CR46A/U453.6khz

* When ordering replacement parts, the channel frequency must be specified.

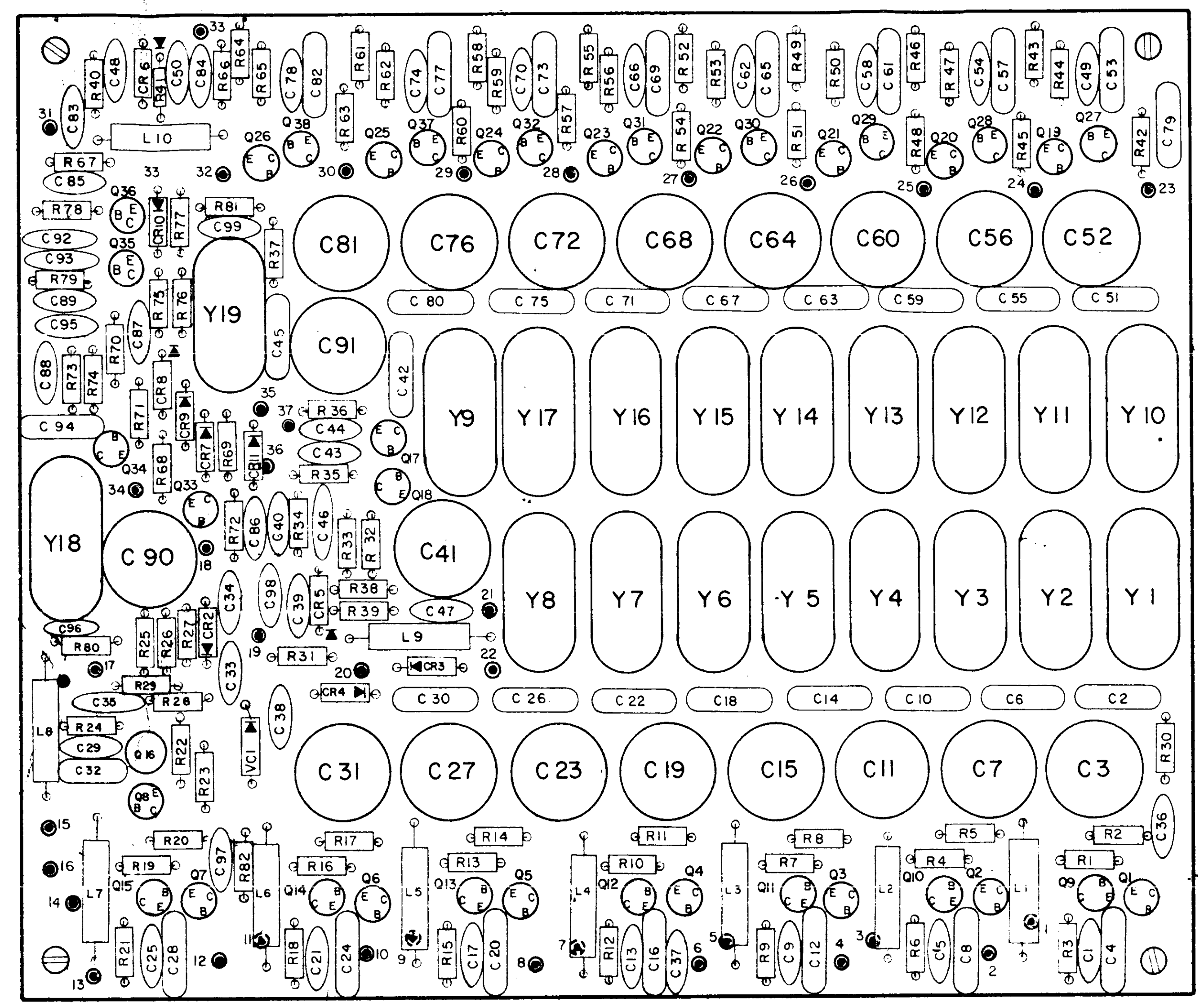


Figure 13. Component Location and Parts List, Crystal Oscillator Z101

A4723-Ø
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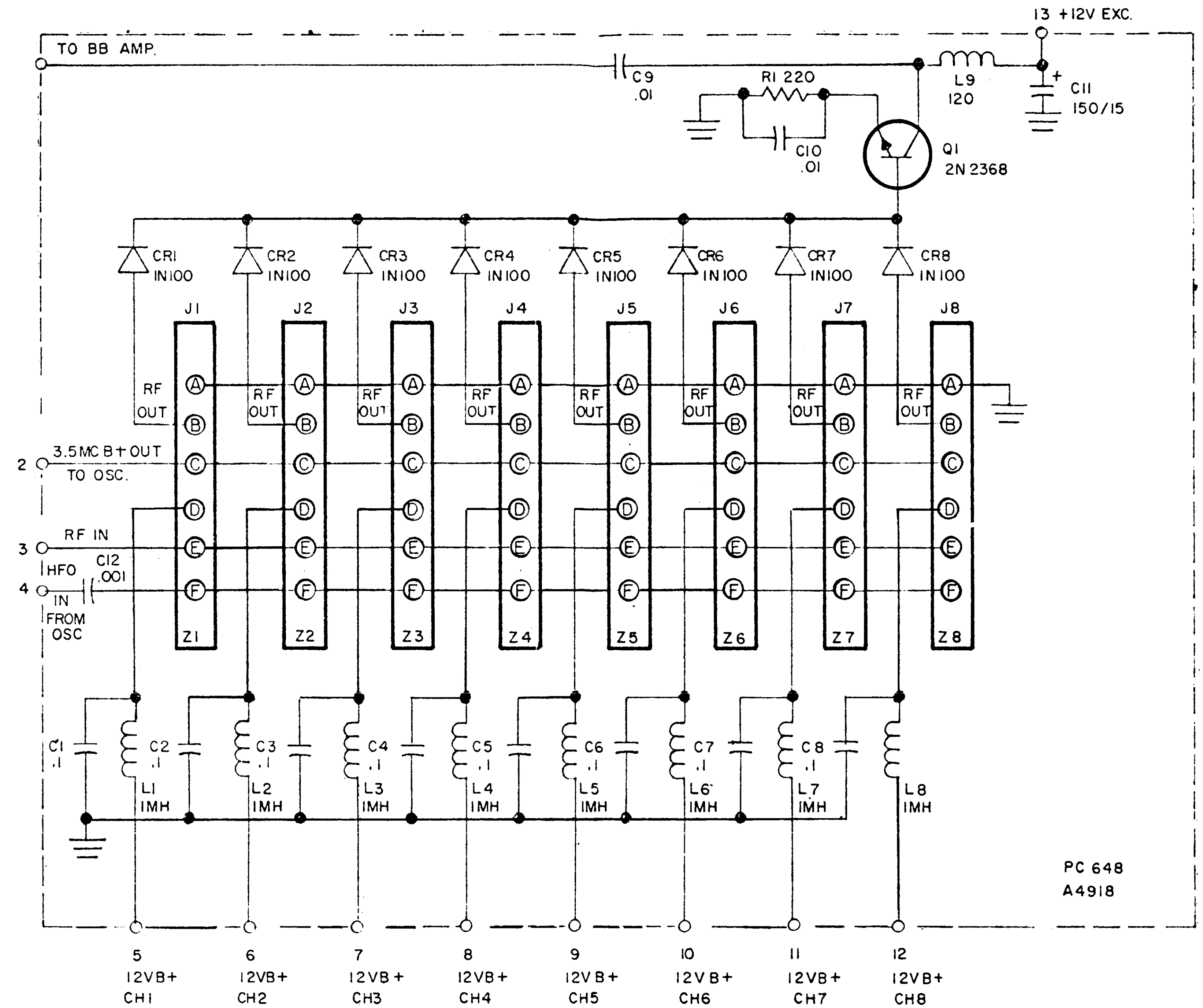

LAST SYMBOL	MISSING SYMBOL
C12	
CR8	
J8	
L9	
Q1	
R1	
Z8	

Figure 14. Schematic Diagram, Exciter Mother Board Z102

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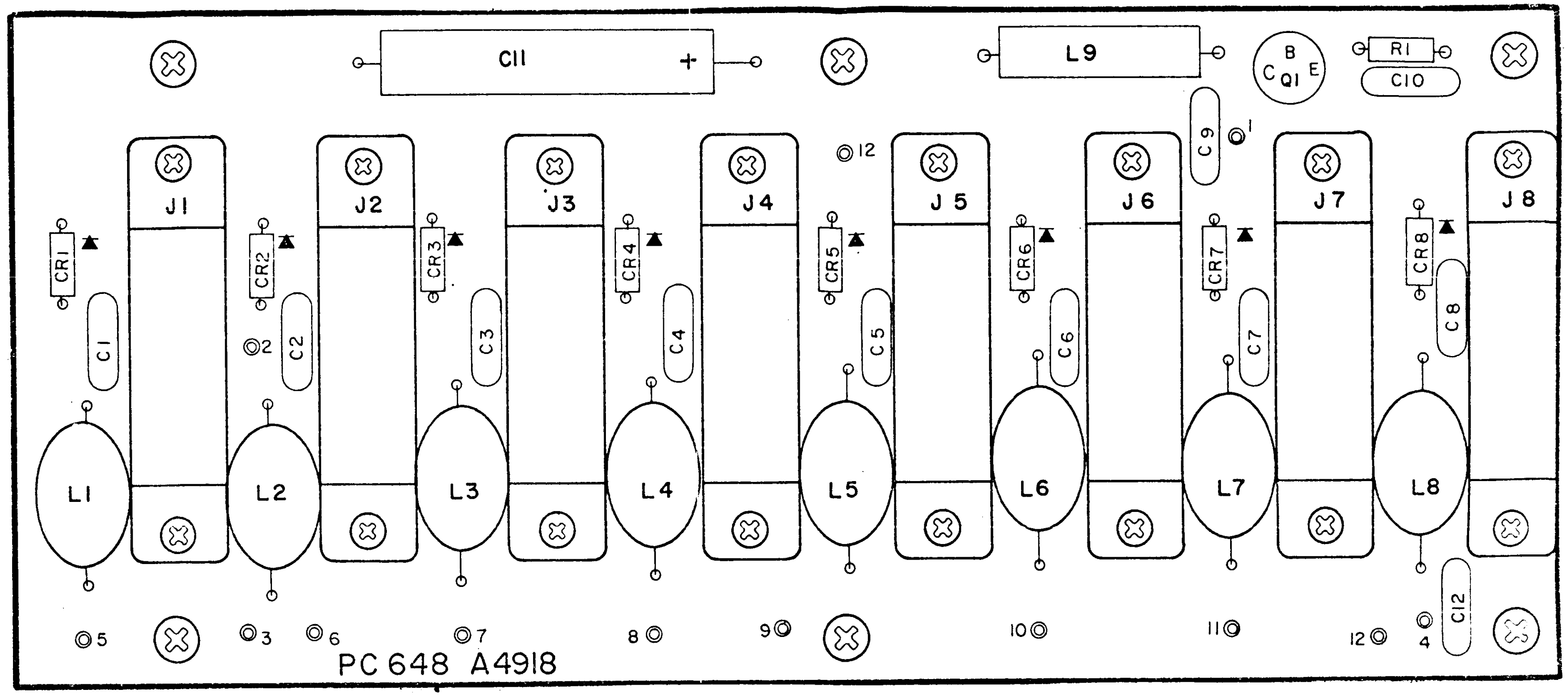
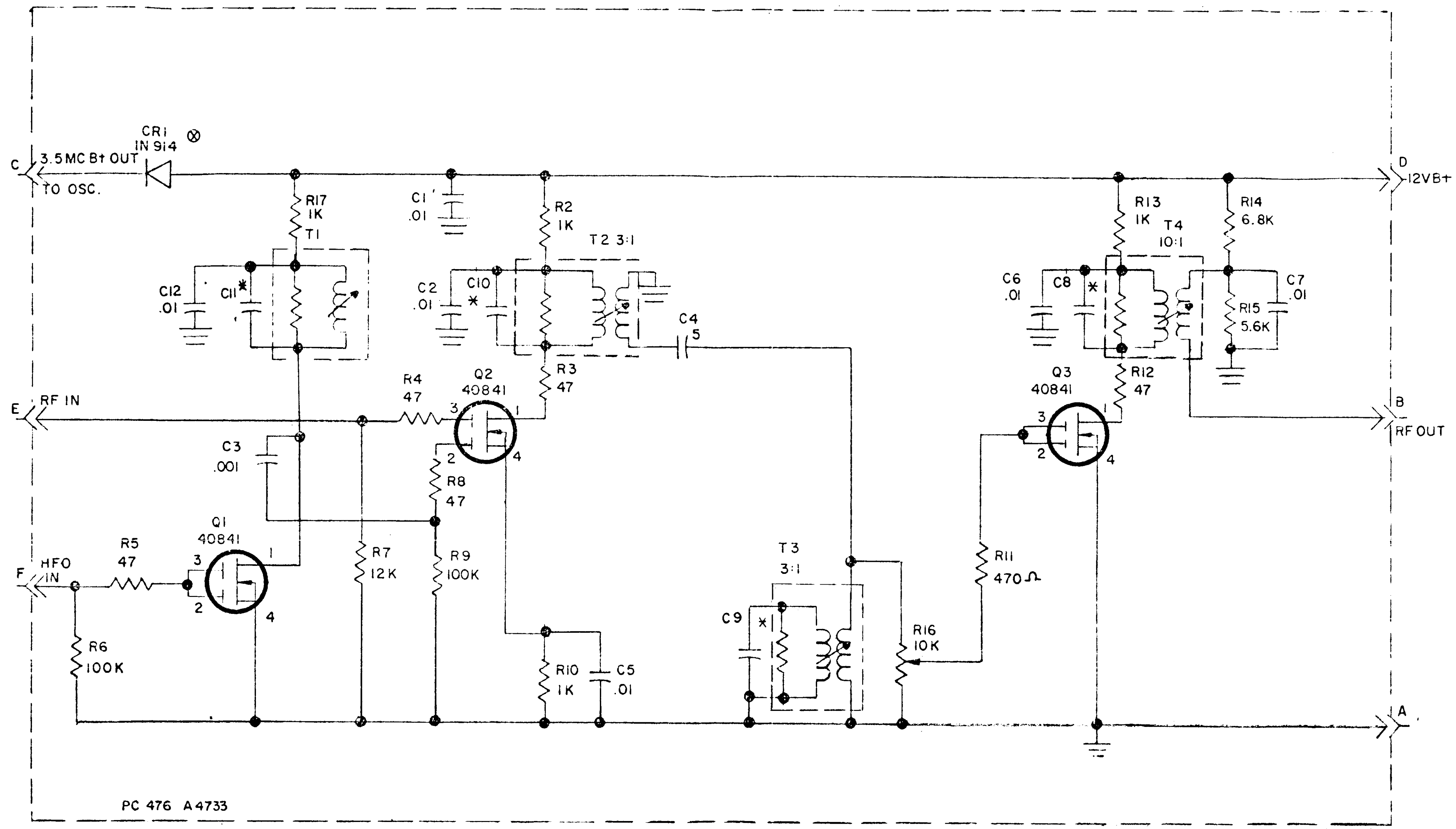


Parts List for A-4918

SYMBOL	DESCRIPTION	TMC P/N
Z102C1 thru Z102C8	Capacitor, Fixed, Ceramic	CC100-44
Z102C9	Capacitor, Fixed, Ceramic	CC100-41
Z102C10	Same as Z102C9	
Z102C11	Capacitor, Fixed, Electrolytic	CE105-150-15
Z102C12	Capacitor, Fixed, Ceramic	CC100-29
Z102CR1 thru Z102CR8	Semiconductor, Device, Diode	1N100
Z102J1 thru Z102J8	Connector, Receptacle, PC Bd.	JJ319-6SPD
Z102L1 thru Z102L8	Coil, Fixed, RF	CL140-4
Z102L9	Coil, Fixed, RF	CL240-120
Z102Q1	Transistor	2N2368
Z102R1	Resistor, Fixed, Composition	RC07GF221J
Z102Z1 thru Z102Z8	Assembly, Exciter, RF Board	*A-4733

* When ordering replacement parts, the channel frequency must be specified.

Figure 15. Component Location and Parts List, Exciter Mother Board Z102

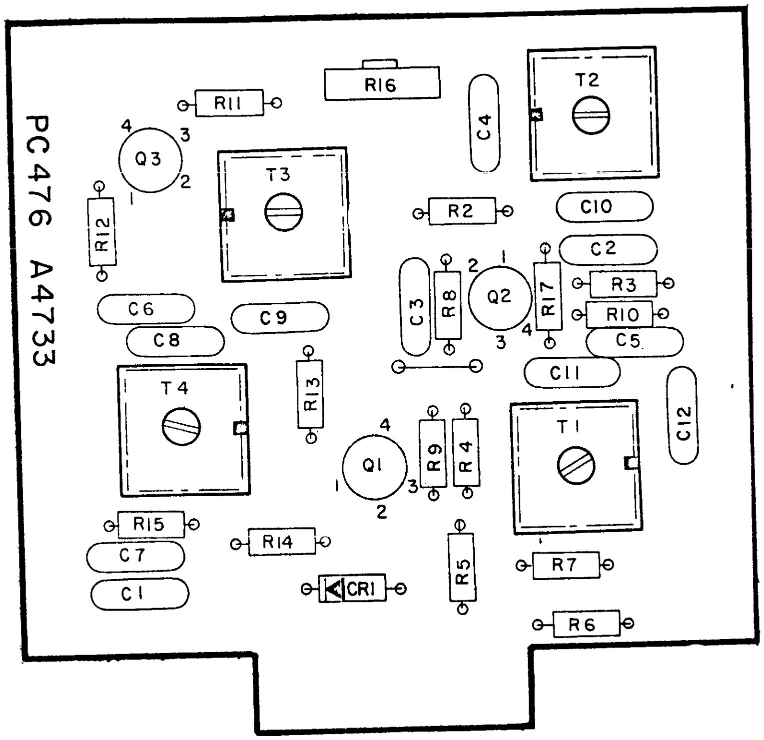


LAST SYMBOL	MISSING SYMBOL
C12	R1
CR1	
Q3	
R17	
T4	

⊠ Above 8 mc add diode
Below 8 mc no diode

* Capacitors are selected according to frequency chart.

Figure 16. Schematic Diagram,
Exciter RF Boards
Z102Z1 thru Z102Z8



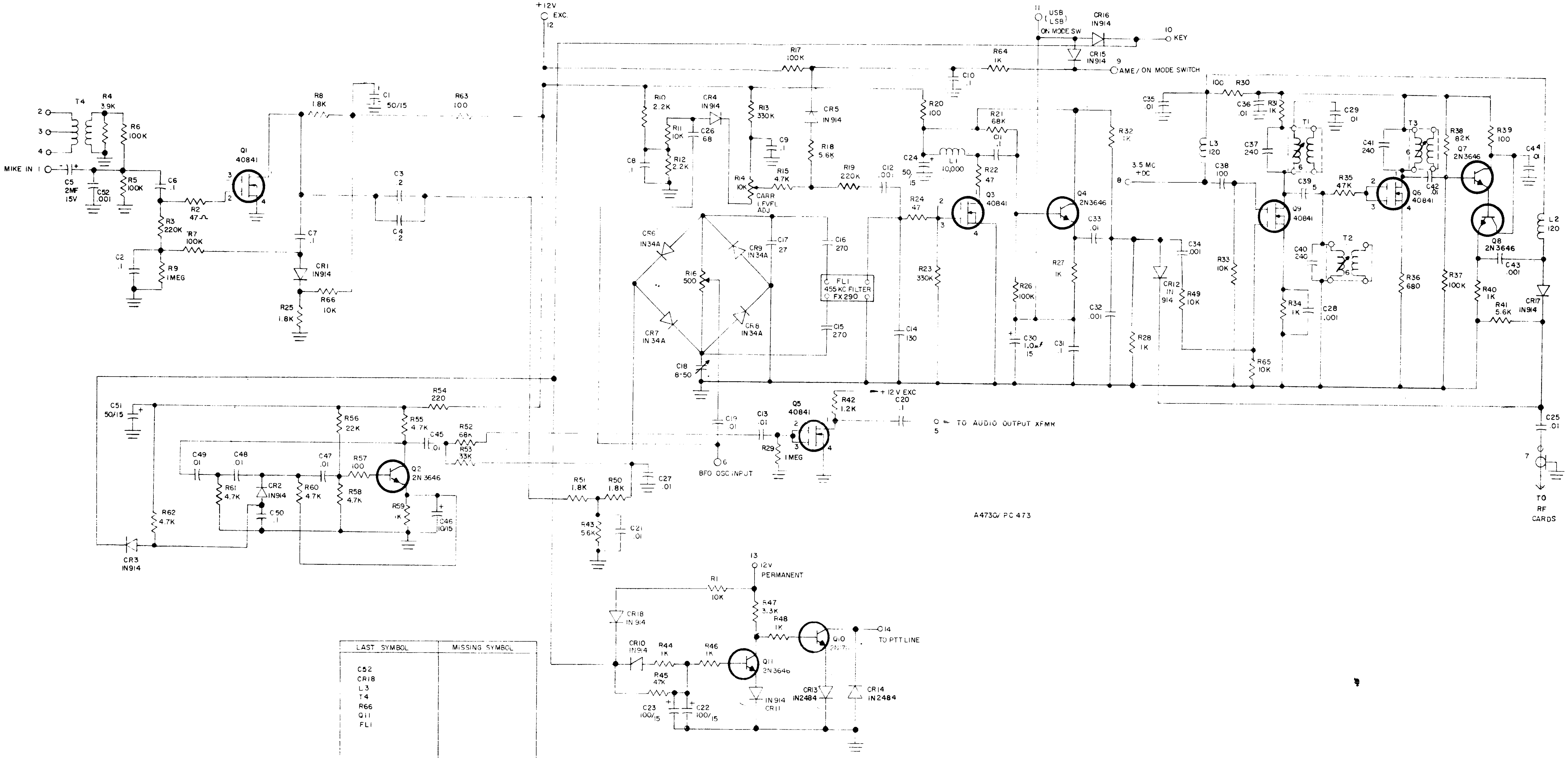
Parts List for A-4733

SYMBOL	DESCRIPTION	TMC P/N
Z102Z1C1	Capacitor, Fixed, Ceramic	CC100-41
Z102Z1C2	Same as Z102Z1C1	
Z102Z1C3	Capacitor, Fixed, Ceramic	CC100-29
Z102Z1C4	Capacitor, Fixed, Mica	CM111C050J5S
Z102Z1C5 thru Z102Z1C7	Same as Z102Z1C1	
Z102Z1C8	Capacitor, Fixed, Ceramic	**
Z102Z1C9	Capacitor, Fixed, Ceramic	**
Z102Z1C10	Capacitor, Fixed, Ceramic	**
Z102Z1C11	Capacitor, Fixed, Ceramic	**
Z102Z1C12	Same as Z102Z1C1	
* Z102Z1CR1	Semiconductor, Device, Diode	1N914
Z102Z1Q1 thru Z102Z1Q3	Transistor	40841
Z102Z1R1	Not Used	
Z102Z1R2	Resistor, Fixed, Composition	RC07GF102J
Z102Z1R3 thru Z102Z1R5	Resistor, Fixed, Composition	RC07GF470J
Z102Z1R6	Resistor, Fixed, Composition	RC07GF104J
Z102Z1R7	Resistor, Fixed, Composition	RC07GF123J
Z102Z1R8	Same as Z102Z1R3	
Z102Z1R9	Same as Z102Z1R6	
Z102Z1R10	Same as Z102Z1R2	
Z102Z1R11	Resistor, Fixed, Composition	RC07GF471J
Z102Z1R12	Same as Z102Z1R3	
Z102Z1R13	Same as Z102Z1R2	
Z102Z1R14	Resistor, Fixed, Composition	RC07GF682J
Z102Z1R15	Resistor, Fixed, Composition	RC07GF562J
Z102Z1R16	Resistor, Variable, Composition	RV139-2-103
Z102Z1T1 thru Z102Z1T4	Transformer, Adjustable, RF	TT305-**

* These items are used only on assemblies Z102Z1 thru Z102Z8 which are designated for channel frequencies above 8 mhz.

** When ordering replacement parts, the channel frequency must be specified.

Figure 17. Component Location and Parts List, Exciter RF Boards Z102Z1 thru Z102Z8



LAST SYMBOL	MISSING SYMBOL
C52	
CR18	
L3	
T4	
R66	
Q11	
FL1	

Figure 18. Schematic Diagram, Exciter IF Z103

Parts List for A-4730

SYMBOL	DESCRIPTION	TMC P/N
Z103C1	Capacitor, Fixed, Electrolytic	CE105-50-15
Z103C2	Capacitor, Fixed, Ceramic	CC100-44
Z103C3	Capacitor, Fixed, Ceramic	CC100-33
Z103C4	Same as Z103C3	
Z103C5	Capacitor, Fixed, Electrolytic	CE105-2-15
Z103C6 thru Z103C11	Same as Z103C2	
Z103C12	Capacitor, Fixed, Ceramic	CC100-29
Z103C13	Capacitor, Fixed, Ceramic	CC100-41
Z103C14	Capacitor, Fixed, Mica	CM111E131J5S
Z103C15	Capacitor, Fixed, Mica	CM111E271J5S
Z103C16	Same as Z103C15	
Z103C17	Capacitor, Fixed, Mica	CM111E270J5S
Z103C18	Capacitor, Variable	CV109-9
Z103C19	Same as Z103C13	
Z103C20	Same as Z103C2	
Z103C21	Same as Z103C13	
Z103C22	Capacitor, Fixed, Electrolytic	CE105-100-15
Z103C23	Same as Z103C22	
Z103C24	Same as Z103C1	
Z103C25	Same as Z103C13	
Z103C26	Capacitor, Fixed, Mica	CM111E680J5S
Z103C27	Same as Z103C13	
Z103C28	Same as Z103C12	
Z103C29	Same as Z103C13	
Z103C30	Capacitor, Fixed, Electrolytic	CE105-1-15
Z103C31	Same as Z103C2	
Z103C32	Same as Z103C12	
Z103C33	Same as Z103C13	
Z103C34	Same as Z103C12	
Z103C35	Same as Z103C13	
Z103C36	Same as Z103C13	
Z103C37	Capacitor, Fixed, Mica	CM111F241J5S
Z103C38	Capacitor, Fixed, Mica	CM111F101J5S
Z103C39	Capacitor, Fixed, Mica	CM111C050J5S
Z103C40	Same as Z103C37	
Z103C41	Same as Z103C37	
Z103C42	Same as Z103C13	
Z103C43	Same as Z103C12	
Z103C44	Same as Z103C13	
Z103C45	Same as Z103C13	
Z103C46	Capacitor, Fixed, Electrolytic	CE105-10-15
Z103C47 thru Z103C49	Same as Z103C13	
Z103C50	Same as Z103C2	
Z103C51	Same as Z103C1	
Z103C52	Same as Z103C12	
Z103CR1 thru Z103CR5	Semiconductor, Device, Diode	1N914
Z103CR6 thru Z103CR9	Semiconductor, Device, Diode	1N34A
Z103CR10 thru Z103CR12	Same as Z103CR1	
Z103CR13	Semiconductor, Device, Diode	1N2484
Z103CR14	Same as Z103CR13	
Z103CR15 thru Z103CR18	Same as Z103CR1	
Z103FL1	Filter, Bandpass, 455 khz	FX290
Z103L1	Coil, Fixed, RF	CL275-103
Z103L2	Coil, Fixed, RF	CL240-120
Z103L3	Same as Z103L2	
Z103Q1	Transistor	40841
Z103Q2	Transistor	2N3646
Z103Q3	Same as Z103Q1	
Z103Q4	Same as Z103Q2	
Z103Q5	Same as Z103Q1	
Z103Q6	Same as Z103Q1	
Z103Q7	Same as Z103Q2	
Z103Q8	Same as Z103Q2	
Z103Q9	Same as Z103Q1	
Z103Q10	Transistor	2N1711
Z103Q11	Same as Z103Q2	
Z103R1	Resistor, Fixed, Composition	RC07GF103J
Z103R2	Resistor, Fixed, Composition	RC07GF470J
Z103R3	Resistor, Fixed, Composition	RC07GF224J
Z103R4	Resistor, Fixed, Composition	RC07GF392J
Z103R5 thru Z103R7	Resistor, Fixed, Composition	RC07GF104J
Z103R8	Resistor, Fixed, Composition	RC07GF182J
Z103R9	Resistor, Fixed, Composition	RC07GF105J
Z103R10	Resistor, Fixed, Composition	RC07GF222J
Z103R11	Same as Z103R1	
Z103R12	Same as Z103R10	
Z103R13	Resistor, Fixed, Composition	RC07GF334J
Z103R14	Resistor, Variable, Composition	RV124-103
Z103R15	Resistor, Fixed, Composition	RC07GF472J
Z103R16	Resistor, Variable, Composition	RV124-501
Z103R17	Same as Z103R5	
Z103R18	Resistor, Fixed, Composition	RC07GF562J
Z103R19	Same as Z103R3	
Z103R20	Resistor, Fixed, Composition	RC07GF101J
Z103R21	Resistor, Fixed, Composition	RC07GF683J
Z103R22	Same as Z103R2	
Z103R23	Same as Z103R13	
Z103R24	Same as Z103R2	
Z103R25	Same as Z103R8	
Z103R26	Same as Z103R5	
Z103R27	Resistor, Fixed, Composition	RC07GF102J
Z103R28	Same as Z103R27	
Z103R29	Same as Z103R9	
Z103R30	Same as Z103R20	
Z103R31	Same as Z103R27	
Z103R32	Same as Z103R27	
Z103R33	Same as Z103R1	
Z103R34	Same as Z103R27	
Z103R35	Resistor, Fixed, Composition	RC07GF473J
Z103R36	Resistor, Fixed, Composition	RC07GF681J
Z103R37	Same as Z103R5	
Z103R38	Resistor, Fixed, Composition	RC07GF823J
Z103R39	Same as Z103R20	
Z103R40	Same as Z103R27	
Z103R41	Same as Z103R18	
Z103R42	Resistor, Fixed, Composition	RC07GF122J
Z103R43	Same as Z103R18	
Z103R44	Same as Z103R27	
Z103R45	Same as Z103R35	
Z103R46	Same as Z103R27	
Z103R47	Resistor, Fixed, Composition	RC07GF332J
Z103R48	Same as Z103R27	
Z103R49	Same as Z103R1	
Z103R50	Same as Z103R8	
Z103R51	Same as Z103R8	
Z103R52	Same as Z103R21	
Z103R53	Resistor, Fixed, Composition	RC07GF333J
Z103R54	Resistor, Fixed, Composition	RC07GF221J
Z103R55	Same as Z103R15	
Z103R56	Resistor, Fixed, Composition	RC07GF223J
Z103R57	Same as Z103R20	
Z103R58	Same as Z103R15	
Z103R59	Same as Z103R27	
Z103R60 thru Z103R62	Same as Z103R15	
Z103R63	Same as Z103R20	
Z103R64	Same as Z103R27	
Z103R65	Same as Z103R1	
Z103R66	Same as Z103R1	
Z103T1 thru Z103T3	Coil, Adjustable, RF	TT306-7
Z103T4	Transformer, AF	TF267-3

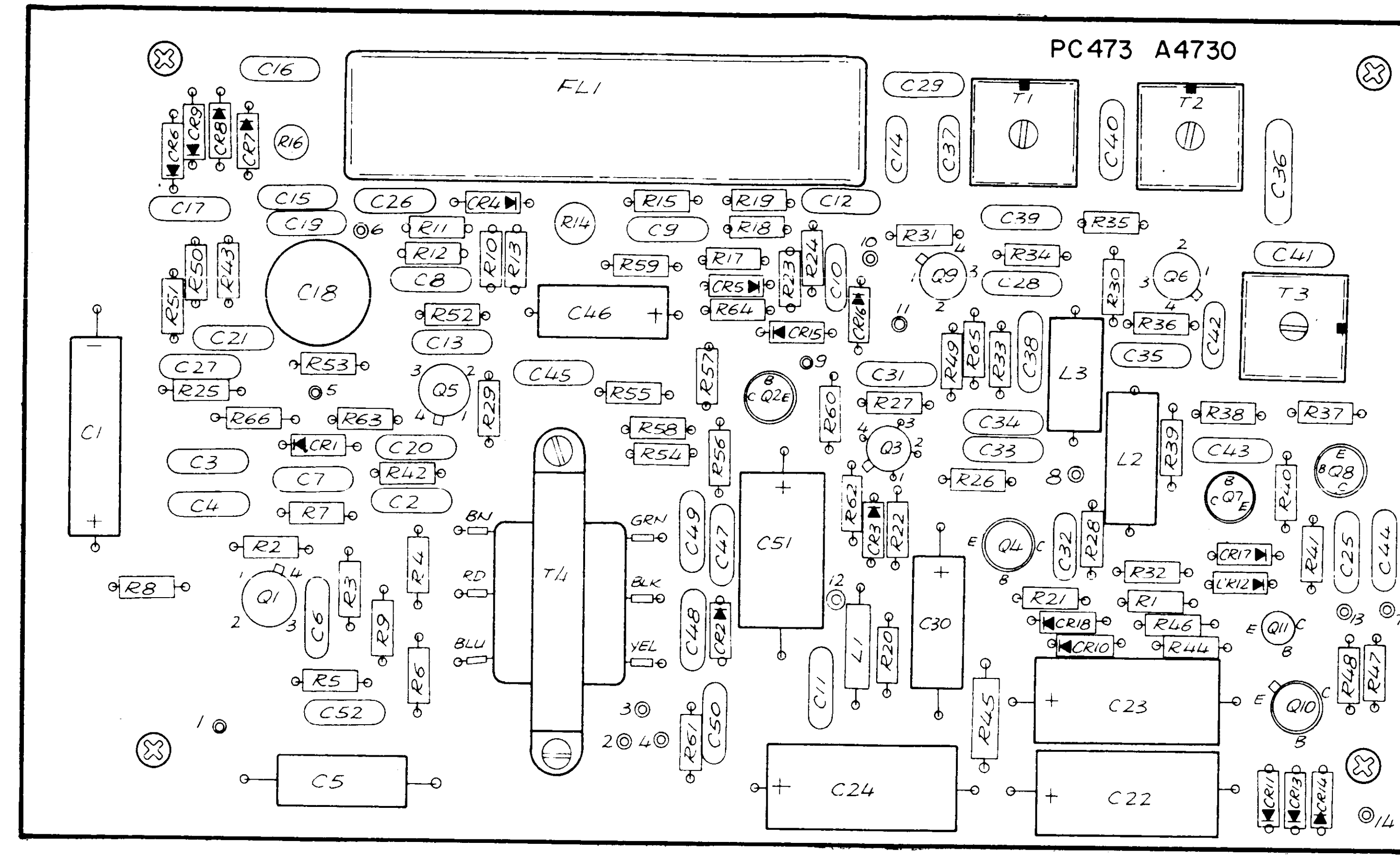


Figure 19. Component Location and Parts List, Exciter IF Z103

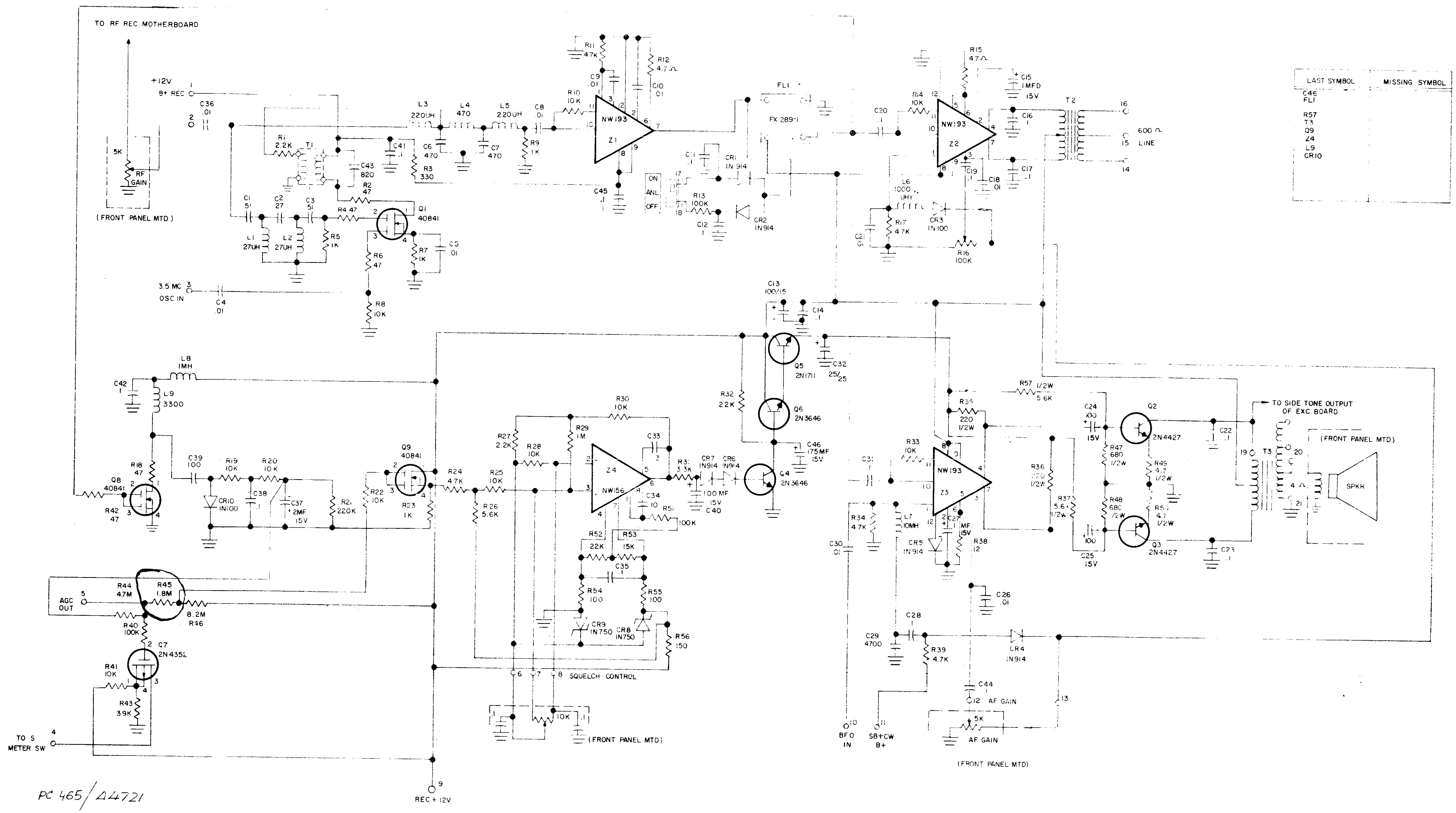


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Figure 20. Schematic Diagram, Receiver IF Z104

Parts List for A-4721

SYMBOL	DESCRIPTION	TMC P/N
Z104C1	Capacitor, Fixed, Mica	CM111E510J5S
Z104C2	Capacitor, Fixed, Mica	CM111E270J5S
Z104C3	Same as Z104C1	
Z104C4	Capacitor, Fixed, Ceramic	CC100-41
Z104C5	Same as Z104C4	
Z104C6	Capacitor, Fixed, Mica	CM111E471J5S
Z104C7	Same as Z104C6	
Z104C8 thru Z104C10	Same as Z104C4	
Z104C11	Capacitor, Fixed, Ceramic	CC100-44
Z104C12	Same as Z104C11	
Z104C13	Capacitor, Fixed, Electrolytic	CE105-100-15
Z104C14	Same as Z104C11	
Z104C15	Capacitor, Fixed, Electrolytic	CE105-1-15
Z104C16	Same as Z104C11	
Z104C17	Same as Z104C11	
Z104C18	Same as Z104C4	
Z104C19	Same as Z104C11	
Z104C20	Same as Z104C11	
Z104C21	Same as Z104C4	
Z104C22	Same as Z104C11	
Z104C23	Same as Z104C11	
Z104C24	Same as Z104C13	
Z104C25	Same as Z104C13	
Z104C26	Same as Z104C4	
Z104C27	Same as Z104C15	
Z104C28	Same as Z104C11	
Z104C29	Capacitor, Fixed, Mica	CM111E472J5S
Z104C30	Same as Z104C4	
Z104C31	Same as Z104C11	
Z104C32	Capacitor, Fixed, Electrolytic	CE105-25-25
Z104C33	Capacitor, Fixed, Mica	CM111C030M5
Z104C34	Capacitor, Fixed, Mica	CM111C100J5S
Z104C35	Same as Z104C11	
Z104C36	Same as Z104C4	
Z104C37	Capacitor, Fixed, Electrolytic	CE105-2-15
Z104C38	Same as Z104C11	
Z104C39	Capacitor, Fixed, Mica	CM111F101J5S
Z104C40	Same as Z104C13	
Z104C41	Same as Z104C11	
Z104C42	Same as Z104C11	
Z104C43	Capacitor, Fixed, Mica	CM111F821J5S
Z104C44	Same as Z104C11	
Z104C45	Same as Z104C11	
Z104C46	Capacitor, Fixed, Electrolytic	CE105-175-15
Z104CR1	Semiconductor, Device, Diode	1N914
Z104CR2	Same as Z104CR1	
Z104CR3	Semiconductor, Device, Diode	1N100
Z104CR4 thru Z104CR7	Same as Z104CR1	
Z104CR8	Semiconductor, Device, Diode	1N750
Z104CR9	Same as Z104CR8	
Z104FL1	Filter	FX289-1
Z104L1	Coil, Fixed, RF	CL275-270
Z104L2	Same as Z104L1	
Z104L3	Coil, Fixed, RF	CL275-221
Z104L4	Coil, Fixed, RF	CL275-471
Z104L5	Same as Z104L3	
Z104L6	Coil, Fixed, RF	CL275-102
Z104L7	Coil, Fixed, RF	CL275-103
Z104L8	Same as Z104L6	
Z104L9	Coil, Fixed, RF	CL275-332
Z104Q1	Transistor	40841
Z104Q2	Transistor	2N4427
Z104Q3	Same as Z104Q2	
Z104Q4	Transistor	2N3646
Z104Q5	Transistor	2N1711
Z104Q6	Same as Z104Q4	
Z104Q7	Transistor	2N4352
Z104Q8	Same as Z104Q1	
Z104Q9	Same as Z104Q1	
Z104R1	Resistor, Fixed, Composition	RC07GF222J
Z104R2	Resistor, Fixed, Composition	RC07GF470J
Z104R3	Resistor, Fixed, Composition	RC07GF331J
Z104R4	Same as Z104R2	
Z104R5	Resistor, Fixed, Composition	RC07GF102J
Z104R6	Same as Z104R2	
Z104R7	Same as Z104R5	
Z104R8	Resistor, Fixed, Composition	RC07GF103J
Z104R9	Same as Z104R5	
Z104R10	Same as Z104R8	
Z104R11	Resistor, Fixed, Composition	RC07GF472J
Z104R12	Resistor, Fixed, Composition	RC07GF4R7J
Z104R13	Resistor, Fixed, Composition	RC07GF104J
Z104R14	Same as Z104R8	
Z104R15	Same as Z104R12	
Z104R16	Resistor, Variable, Composition	RV124-104
Z104R17	Same as Z104R11	
Z104R18	Same as Z104R2	
Z104R19	Same as Z104R8	
Z104R20	Same as Z104R8	
Z104R21	Resistor, Fixed, Composition	RC07GF224J
Z104R22	Same as Z104R8	
Z104R23	Same as Z104R5	
Z104R24	Same as Z104R11	
Z104R25	Same as Z104R8	
Z104R26	Resistor, Fixed, Composition	RC07GF562J
Z104R27	Same as Z104R1	
Z104R28	Same as Z104R8	
Z104R29	Resistor, Fixed, Composition	RC07GF105J
Z104R30	Same as Z104R8	
Z104R31	Resistor, Fixed, Composition	RC07GF332J
Z104R32	Same as Z104R1	
Z104R33	Same as Z104R8	
Z104R34	Same as Z104R11	
Z104R35	Resistor, Fixed, Composition	RC20GF221J
Z104R36	Same as Z104R35	
Z104R37	Resistor, Fixed, Composition	RC20GF562J
Z104R38	Resistor, Fixed, Composition	RC07GF120J
Z104R39	Same as Z104R11	
Z104R40	Same as Z104R13	
Z104R41	Same as Z104R8	
Z104R42	Same as Z104R2	
Z104R43	Resistor, Fixed, Composition	RC07GF392J
Z104R44	Resistor, Fixed, Composition	RC07GF475J
Z104R45	Resistor, Fixed, Composition	RC07GF185J
Z104R46	Resistor, Fixed, Composition	RC07GF825J
Z104R47	Resistor, Fixed, Composition	RC07GF681J
Z104R48	Same as Z104R47	
Z104R49	Resistor, Fixed, Composition	RC20GF4R7J
Z104R50	Same as Z104R49	
Z104R51	Same as Z104R13	
Z104R52	Resistor, Fixed, Composition	RC07GF223J
Z104R53	Resistor, Fixed, Composition	RC07GF153J
Z104R54	Resistor, Fixed, Composition	RC07GF101J
Z104R55	Same as Z104R54	
Z104R56	Resistor, Fixed, Composition	RC07GF151J
Z104R57	Same as Z104R37	
Z104T1	Transformer, Variable, RF	TT306-13
Z104T2	Transformer, AF	TF424
Z104T3	Transformer	TF267-6
Z104Z1 thru Z104Z3	Network, IC, Power Amplifier	NW193
Z104Z4	Network, IC, Operational Amplifier	NW156

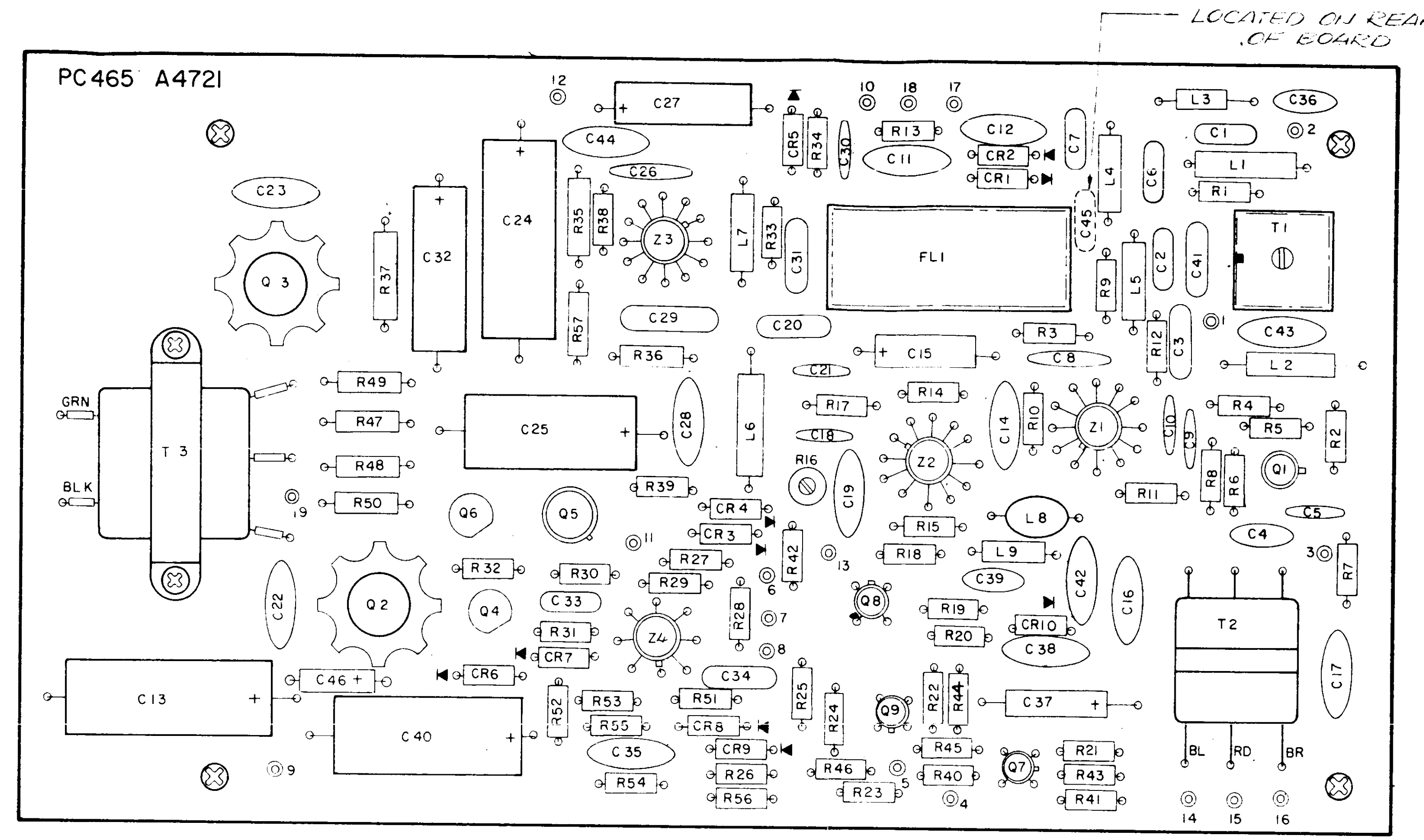

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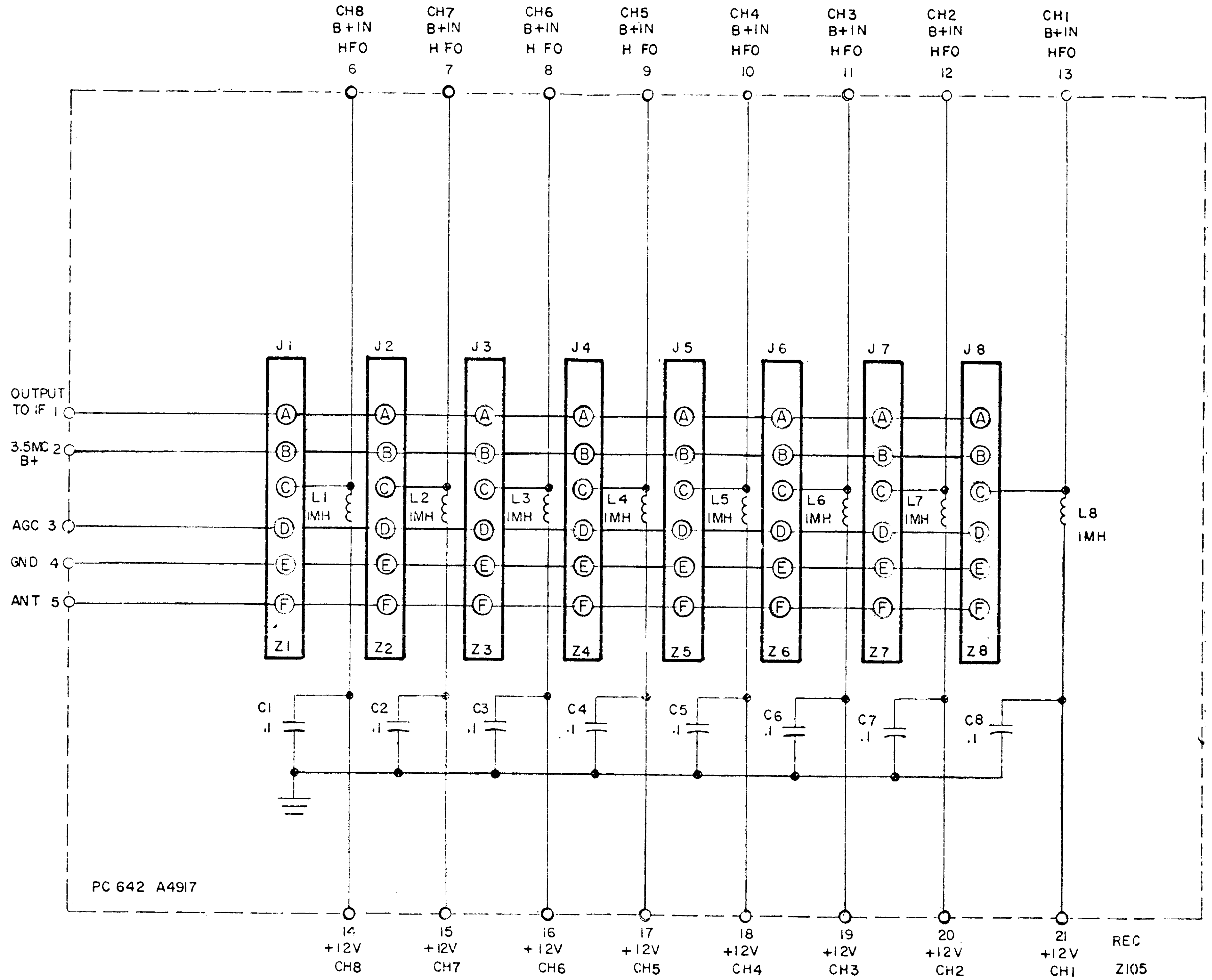
Figure 21. Component Location and Parts List, Receiver IF Z104



LAST SYMBOL	MISSING SYMBOL
C8	
J8	
L8	
Z8	

Figure 22. Schematic Diagram, Receiver Mother Board Z105

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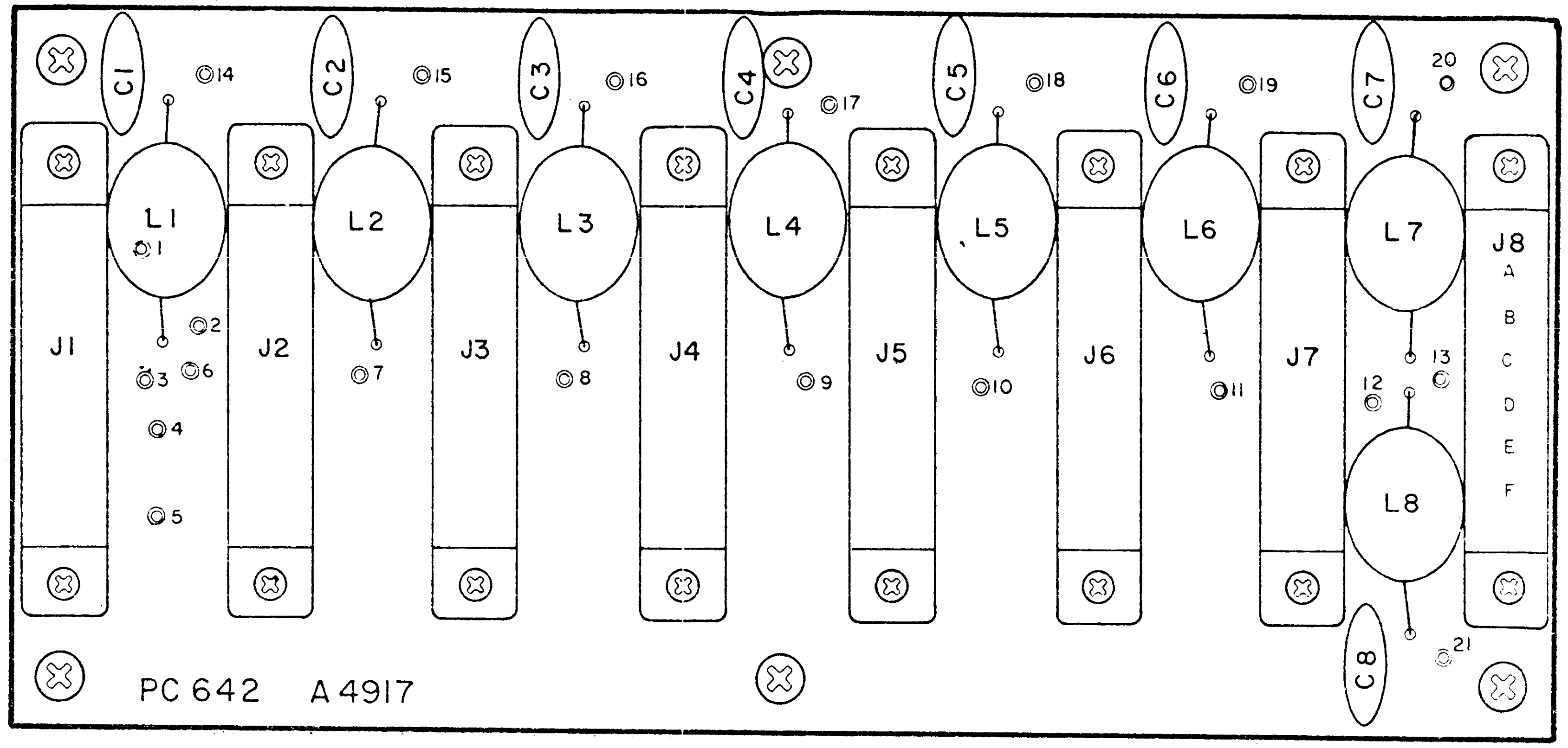
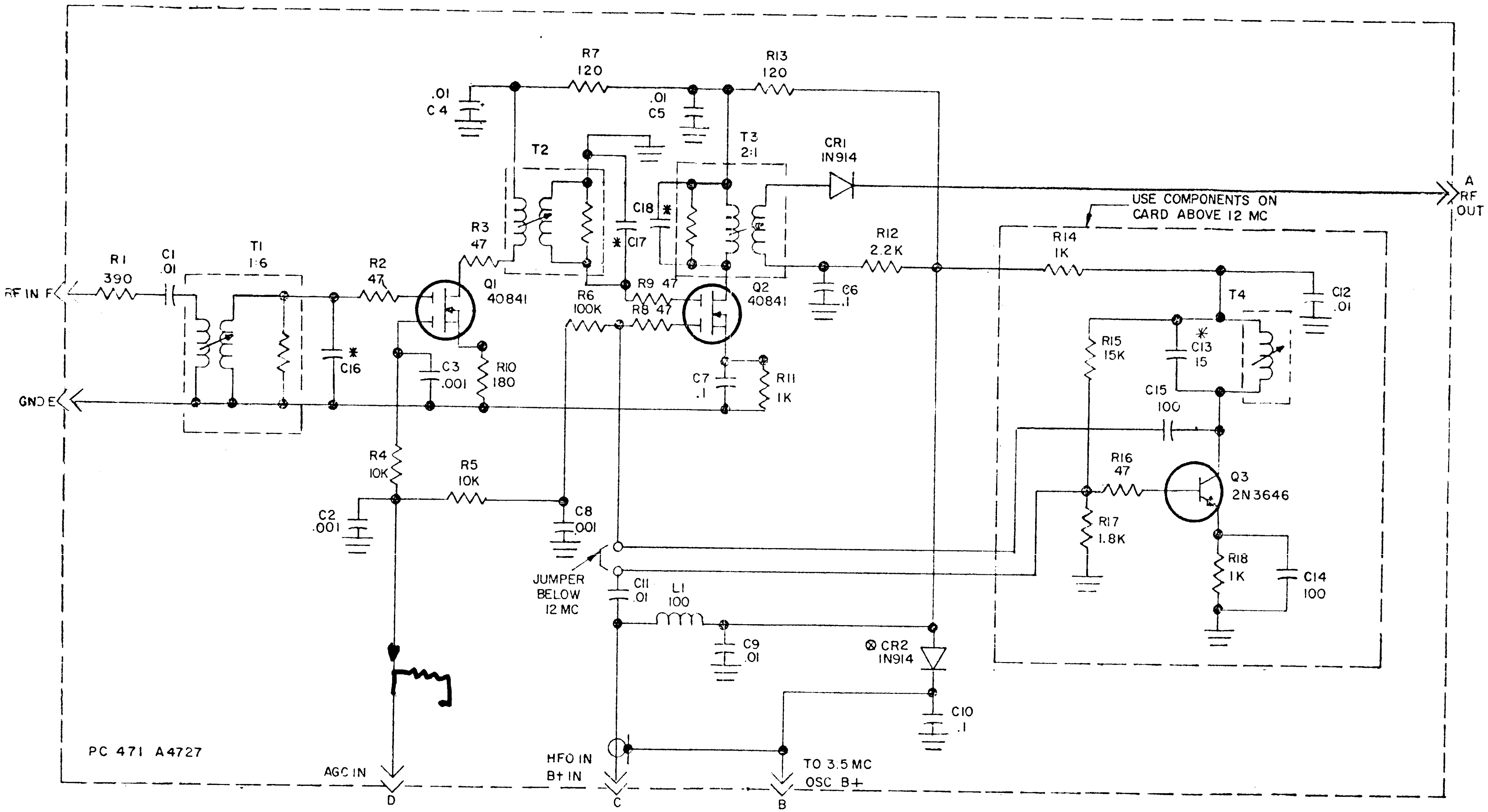


Parts List for A-4917

SYMBOL	DESCRIPTION	TMC P/N
Z105C1 thru Z105C8	Capacitor, Fixed, Ceramic	CC100-44
Z105J1 thru Z105J8	Connector, Receptacle, PC Board	JJ319-6SPD
Z105L1 thru Z105L8	Coil, Fixed, RF	CL140-4
Z105Z1 thru Z105Z8	Assembly, Receiver RF Board	*A-4727

* When ordering replacement parts, the channel frequency must be specified.

Figure 23. Component Location and Parts List, Receiver Mother Board Z105



LAST SYMBOL	MISSING SYMBOL
C18	
CR2	
L1	
Q3	
R18	
T4	

⊗ Above 8 mc add diode
Below 8 mc no diode

* Capacitors are selected according to frequency chart.

Figure 24. Schematic Diagram, Receiver RF Boards Z105Z1 thru Z105Z8

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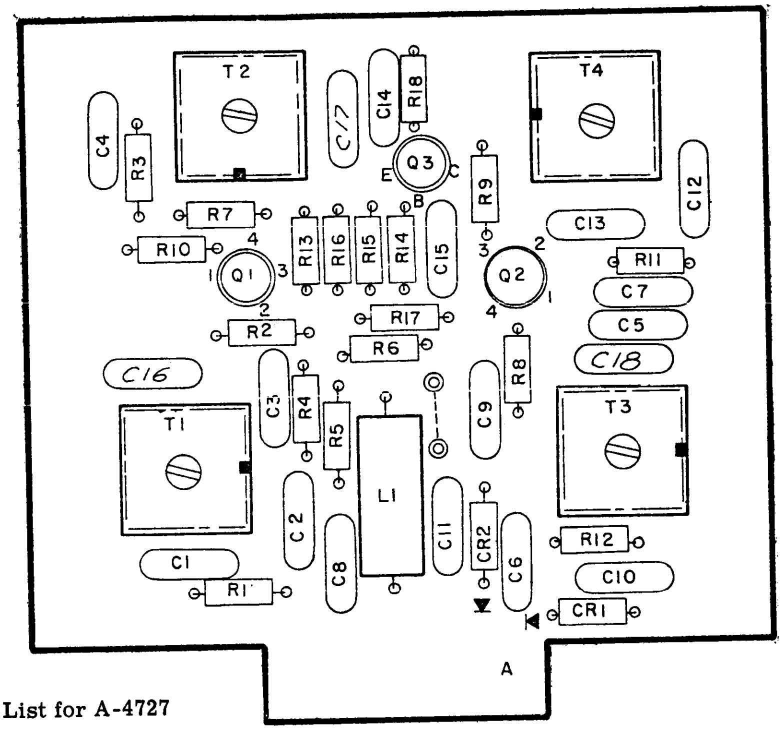

Parts List for A-4727

SYMBOL	DESCRIPTION	TMC P/N
Z105Z1C1	Capacitor, Fixed, Ceramic	CC100-41
Z105Z1C2	Capacitor, Fixed, Ceramic	CC100-29
Z105Z1C3	Same as Z102Z1C2	
Z105Z1C4	Same as Z101Z1C1	
Z105Z1C5	Same as Z102Z1C1	
Z105Z1C6	Capacitor, Fixed, Ceramic	CC100-44
Z105Z1C7	Same as Z105Z1C6	
Z105Z1C8	Same as Z105Z1C2	
Z105Z1C9	Same as Z105Z1C1	
Z105Z1C10	Same as Z105Z1C6	
Z105Z1C11	Same as Z105Z1C1	
* Z105Z1C12	Same as Z105Z1C1	
* Z105Z1C13	Capacitor, Fixed, Mica	**
* Z105Z1C14	Capacitor, Fixed, Mica	CM111F101J5S
* Z105Z1C15	Same as Z105Z1C14	
* Z105Z1C16	Capacitor, Fixed, Ceramic	**
* Z105Z1C17	Capacitor, Fixed, Ceramic	**
* Z105Z1C18	Capacitor, Fixed, Ceramic	**
Z105Z1CR1	Semiconductor, Device, Diode	1N914
Z105Z1CR2	Same as Z105Z1CR1	
Z105Z1L1	Coil, Fixed, RF	CL240-100
Z105Z1Q1	Transistor	40841
Z105Z1Q2	Same as Z105Z1Q1	
* Z105Z1Q3	Transistor	2N3646
Z105Z1R1	Resistor, Fixed, Composition	RC07GF391J
Z105Z1R2	Resistor, Fixed, Composition	RC07GF470J
Z105Z1R3	Same as Z105Z1R2	
Z105Z1R4	Resistor, Fixed, Composition	RC07GF103J
Z105Z1R5	Same as Z105Z1R4	
Z105Z1R6	Resistor, Fixed, Composition	RC07GF104J
Z105Z1R7	Resistor, Fixed, Composition	RC07GF121J
Z105Z1R8	Same as Z105Z1R2	
Z105Z1R9	Same as Z105Z1R2	
Z105Z1R10	Resistor, Fixed, Composition	RC07GF181J
Z105Z1R11	Resistor, Fixed, Composition	RC07GF102J
Z105Z1R12	Resistor, Fixed, Composition	RC07GF222J
Z105Z1R13	Same as Z105Z1R7	
* Z105Z1R14	Same as Z105Z1R11	
* Z105Z1R15	Resistor, Fixed, Composition	RC07GF153J
* Z105Z1R16	Same as Z105Z1R2	
* Z105Z1R17	Same as Z105Z1R10	
* Z105Z1R18	Same as Z105Z1R11	
Z105Z1T1 thru Z105Z1T3	Transformer, Adjustable, RF	TT306-**
* Z105Z1T4	Transformer, Adjustable, RF	TT306-**

* These items are used only on assemblies Z105Z1 thru Z105Z8 which are designated for channel frequencies above 12 mhz.

** When ordering replacement parts, the channel frequency must be specified.

Figure 25. Component Location and Parts List, Receiver RF Boards Z105Z1 thru Z105Z8

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