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FOR
GPR-110B

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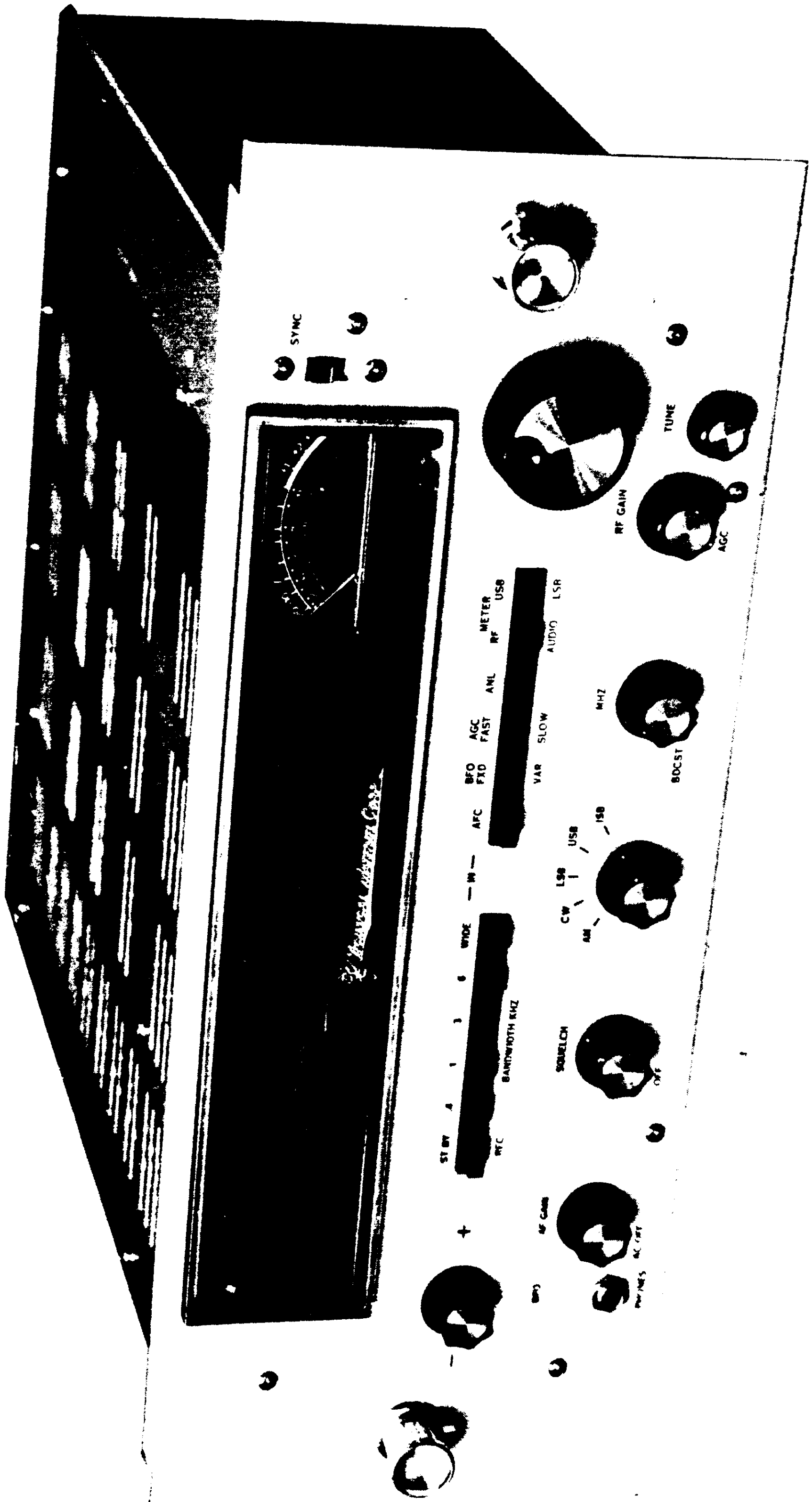


Figure 1-1

General Purpose Receiver
Model GPR-110B

SECTION 1

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION

General Purpose Receiver GPR-110B (figure 1-1) is a solid state, triple conversion superheterodyne communications receiver that provides high-stability multimode operation over a frequency range of 100 KHz to 30 MHz. It can be utilized alone as a communications receiver for CW and voice reception, or as part of a communications system, such as a teletype system. The receiver is operable in five modes: the three standard modes (continuous wave, amplitude modulation, upper sideband), and two optional modes (lower sideband and independent sideband). Symmetrical filters are included for use in the AM and CW modes, providing .4 MHz, 1 KHz 3 KHz, 6 KHz or wide IF bandwidths. Selection of the proper filters provides optimum selectivity for the specific mode in use.

Receiver stability is determined by a digital frequency synthesizer and a phase detector/AFC system. The frequency synthesizer is controlled by a high-stability, oven-controlled one MHz crystal oscillator, which provides a stability factor of one part in 10^8 after warmup.

The receiver operating frequency is continuously displayed, in MHz, on a segmented-filament digital readout located on the front panel. The first two digits indicate the tens and units of the frequency in MHz, and the last four digits indicate the remaining .9999 MHz to the nearest 100 MHz increment.

Three front panel knobs are used to tune the receiver through its operating range. The MHz switch is used to select the coarse operating frequency in one MHz discrete steps, a frequency selector/TUNE control is used to tune the remaining four digits to the nearest 100 Hz increment, and the fine TUNE control is used in conjunction with the front panel meter to tune the receiver to sync.

Complete local operation is implemented by using the controls located on the front panel of the receiver. Remote control options are also available.

The receiver has an internal speaker and audio outputs for an external speaker and 600 ohm audio lines for each sideband. Terminations are provided on the rear panel for applicable input and output connections.

1-2. PHYSICAL DESCRIPTION

a. EXTERNAL DESCRIPTION. The GPR-110B is packaged for rack-mounting in a standard 19 inch rack unit or a table-top cabinet. The rack-mounted model is 19 inches wide, by 7 inches high, by 19 ¼ inches deep; the dimensions of the cabinet model are 16 3/4 inches wide, by 7 inches high, by 19 1/4 deep.

The front panel contains the controls and indicators used to operate the unit. The rear panel has input and output connectors for routing of various signals; a lamp test pushbutton; two fuse-holders for the power fuses; and line gain controls for USB and LSB audio line outputs.

b. INTERNAL DESCRIPTION. The main chassis contains two printed circuit mother boards, mounted back-to-back and hard-wired to the receiver. These two boards contain the printed circuit assemblies for the Digital Logic and Control Section, and the Audio Section. Each printed circuit assembly slides in a guide track, and plugs into one of the mother boards to form a positive connection. The chassis also contains the Preselector Section, Front End Section, Front Panel Assembly, and the Power Supply Section.

TABLE 1-1

REPLACEABLE ASSEMBLIES

Reference Symbol	TMC Part Number	Description
Z101	A4959	Readout Display Assembly
Z102	A4955	Digital Counter Assembly
Z103	A4958	MHz Display/Divider Assembly
Z104	A5636	Comparator Assembly
Z105	A5633	Memory Assembly
Z106	A5635	7 MHz Generator Assembly
Z107	A5634	Sample Divide/Phase Detector Assembly
Z108	-----	-------------------
Z109	A4957	Mixer/Oscillator Control Assembly
Z110	A4950	100 Hz Synthesizer Assembly
Z111	A4960	Digital Logic Mother Board
Z112	A4961-1	Symmetrical Filter (.4 KHz, 1 KHz) Assembly
Z113	A4961-2	Symmetrical Filter (3 KHz, 6 KHz, WB) Assembly
Z114	A4962	Audio Assembly
Z115	A4963-1	USB Filter Assembly
Z116	A4963-2	LSB Filter Assembly
Z117	A4964	Sync/AFC Assembly
Z118	A4965	BFO Assembly
Z119	A4966	Audio/Filter Mother Board
Z120	A5628	Preselector Assembly
Z121	A5646 A5645	Multiband Preselector
Z122	A5658	Bypass Filter Assembly
Z201	A4970	Power Supply Assembly
Z202	A4972	1 MHz Standard Assembly
Z301	A4977	Tunable IF Assembly
Z302	A5632	Single HF MHz Oscillator Assembly
Z303	A4979	Sample Mixer Assembly
Z304	A4976	Dual HF MHz Oscillator Assembly
Z305	A4973	IF Output Mixer Assembly
Z306	A5638	HF IF Assembly
Z307	A4974	Mixer IF Input Assembly

SECTION 2

INSTALLATION

2-1. GENERAL

The GPR-110B receiver is shipped from the factory in a crated box, as shown in figure 2-1 (typical equipment packaging) to insure maximum protection against damage in transit. This section outlines the unpacking, installation, inspection and pre-operation instructions, as well as power requirements and information which will aid the operator in the fabrication of external cables for use with the receiver.

Paragraph 2-2 details the uncrating and unpacking instructions; paragraph 2-3 contains guidelines for an initial visual inspection of the receiver; paragraph 2-4 lists the power requirements of the receiver; paragraph 2-5 gives detailed installation instructions, fabrication of external cables, and an overall wiring diagram showing interconnections of all the circuits of the receiver; and paragraph 2-6 contains a brief operating procedure to be used in determining if the receiver is operational and therefore undamaged internally during shipment.

2-2. UNCRATING AND UNPACKING INSTRUCTIONS

The following procedural steps outline general unpacking methods. These instructions should be adhered to when uncrating and unpacking the GPR-110B receiver to insure prevention of injury to personnel or damage to equipment. Before beginning the uncrating procedure, inspect the outside of the crate and note any damage which may show evidence of possible damage to the equipment during transit.

With respect to damage for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and furnishing of replacement parts.

a. Cut wire straps or steel bands from around the crate with a pair of tin snips.

WARNING

> Insure that all personnel are in proper position to avoid injury from backlash of the straps or bands when they are cut.

b. Carefully remove the nails from three sides of the crate.

NOTE

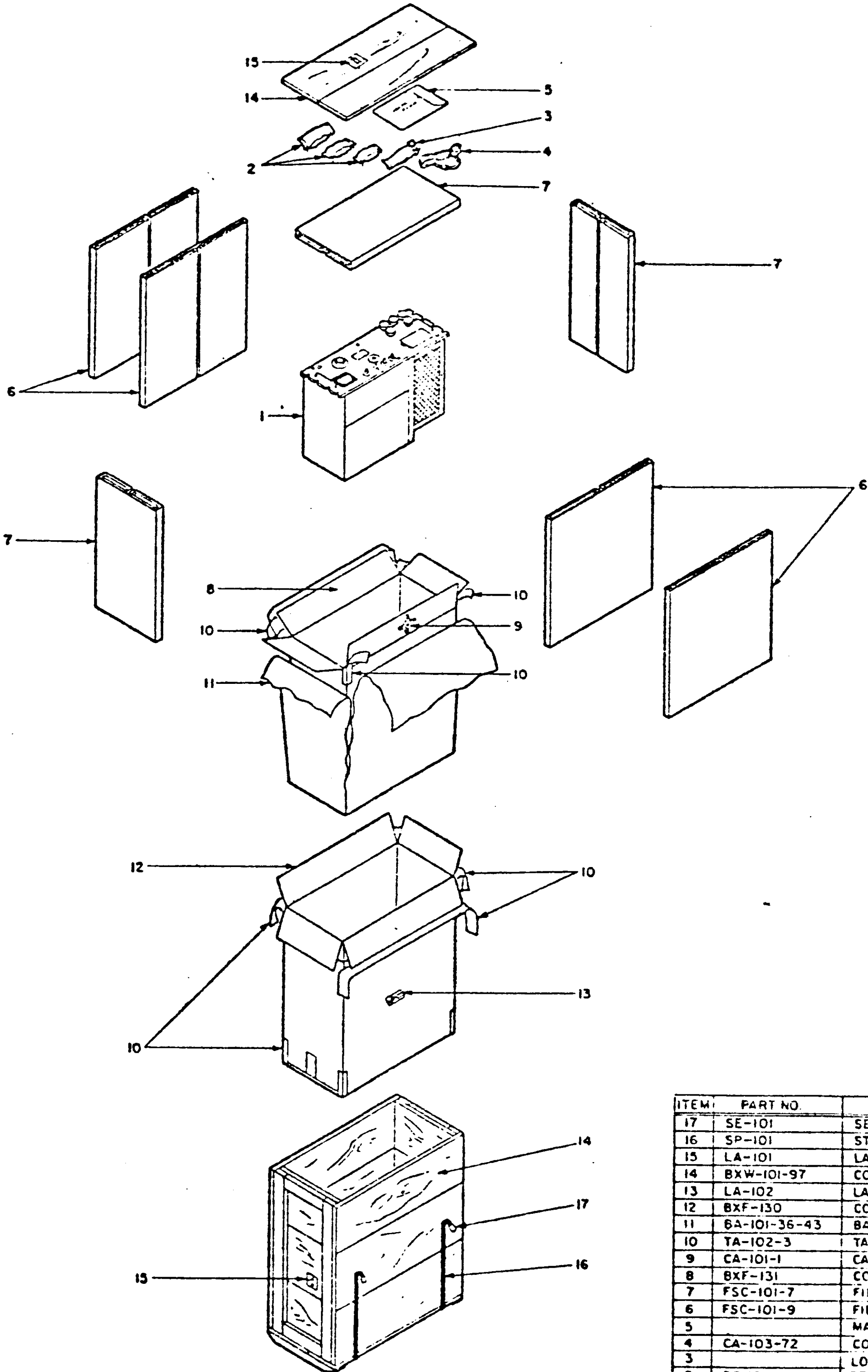
> Anticipating the possibility of reshipment of the receiver to a new location, it is suggested that the crate and packaging materials be retained and stored for future use.

c. Open the outer carton and remove the inner carton. Check for loose items before storing the outer carton. Remove the moisture-proof paper from the inner carton.

d. Carefully open the inner carton.

CAUTION

> Excerise extreme care not to damage or mar the equipment while opening the inner carton.



ITEM	PART NO.	DESCRIPTION
17	SE-101	SEALS, STRAPPING
16	SP-101	STRAPPING, STEEL
15	LA-101	LABEL, FRAGILE
14	BXW-101-97	CONTAINER, SHIPPING
13	LA-102	LA-, METHOD II
12	BXF-130	CONTAINER, OUTER
11	BA-101-36-43	BAG, BARRIER
10	TA-102-3	TAPE, PRESSURE SENSITIVE
9	CA-101-1	CARD, HUMIDITY INDICATOR
8	BXF-131	CONTAINER
7	FSC-101-7	FIBERBOARD SHEET, CREASED
6	FSC-101-9	FIBERBOARD SHEET, CREASED
5		MANUALS, INSTRUCTION
4	CA-103-72	CORD, LINE
3		LOOSE ITEMS
2	DS-101-1	DESICCANT, 16 UNIT
1		MODULAR UNIT

Figure 2-1. Typical Equipment Packaging

e. Carefully remove the equipment from the inner carton. Check for loose items before storing the inner carton. Table 2-1 lists all loose items which are included with the receiver.

NOTE

Where applicable, remove the following:

1. Corrugated cardboard inserts
2. Barrier bags
3. Tape
4. Molded cushioning
5. Cellulose wadding
6. Tissue paper

f. Check off items which have been unpacked on the packing list, or equipment supplied list.

2-3. INSPECTION

As soon as the receiver has been unpacked, it should be visually inspected for damage which may have occurred in shipping. Use the following procedural steps as a guide to determine the condition of the GPR-110B, as well as the pre-operational checkout described in paragraph 2-6.

a. Visually inspect the receiver externally for dents, broken controls, scratches, etc.

2-4. POWER REQUIREMENT

The receiver is designed to operate from an ac power source of 115 vac $\pm$ 10%, or 230 vac $\pm$ 10% single phase, with a line frequency of 50 - 60 Hz, or a 12 volt dc source with a negative ground. The receiver requires 60 watts of continuous power when used on ac, and 40 watts continuous for dc operation.

The receiver is normally wired for operation on 115 vac power (see figure 2-2A) before being shipped from the factory, unless otherwise specified by the user. If the receiver is to be operated from a 230 vac source, the transformer primary windings must be rewired as shown in figure 2-2B. Terminal strip TB201 referred to in figure 2-2 is located at the front panel end of the underside of the Power Supply Section. (The cover plate must be removed to gain access.) The dc power input jack J201 is located on the rear panel of the receiver.

CAUTION

When operating the receiver on 230 vac, the ac fuse F201 must be changed from the 1.5 ampere rating to .75 ampere.

2-5. INSTALLATION

a. SITE SELECTION. In order to achieve optimum performance and ease of maintenance of the receiver, consideration must be given, before installing the receiver in its ultimate location, to the following factors:

(1) Accessibility. The receiver must be located so that an operator can comfortably reach all operating controls, and see all indicators, on the front panel. Sufficient clearance must be allowed around the unit so that the rear panel is accessible and the receiver can be removed for servicing.

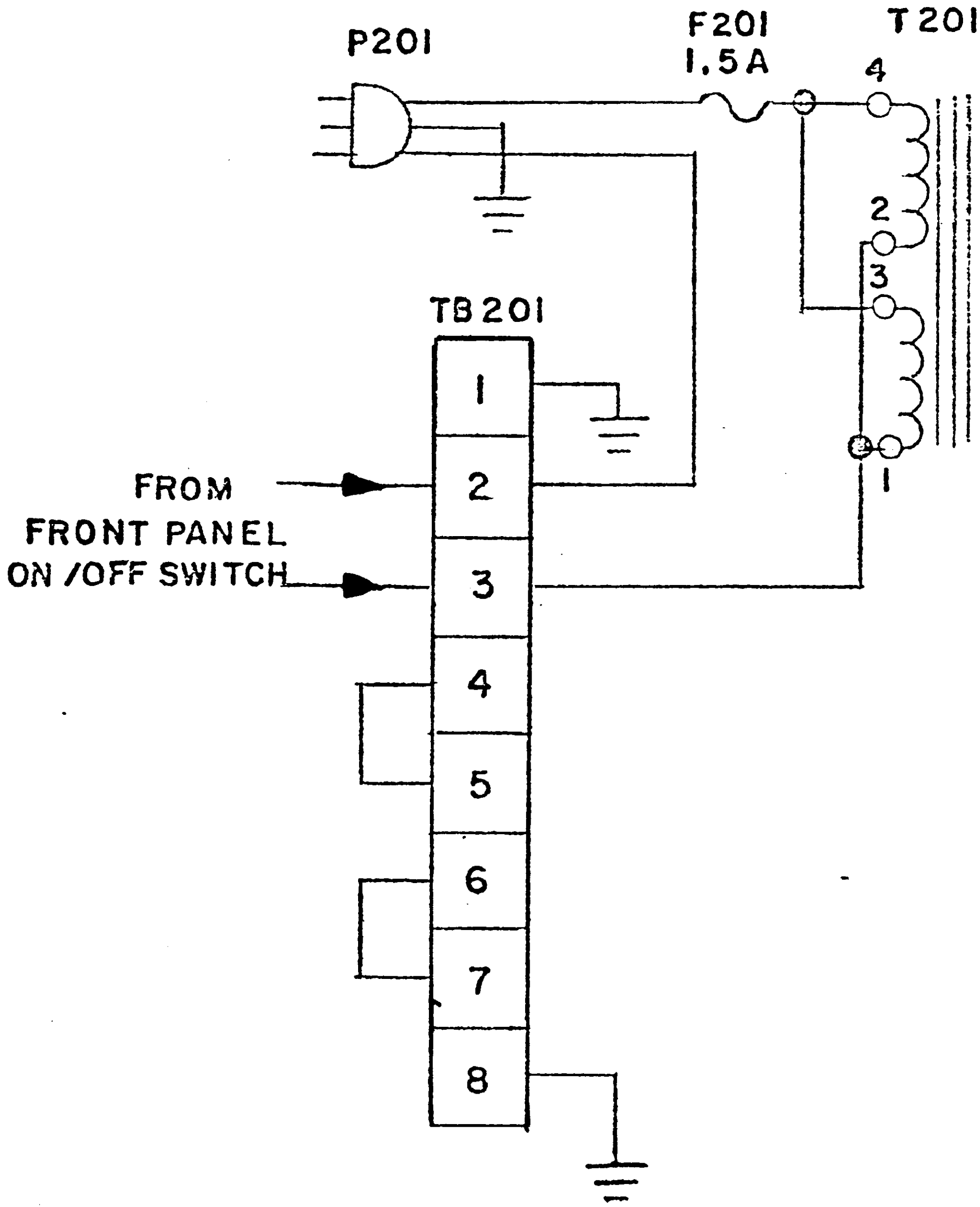


Figure 2-2A. Wiring for 115 vac Operation

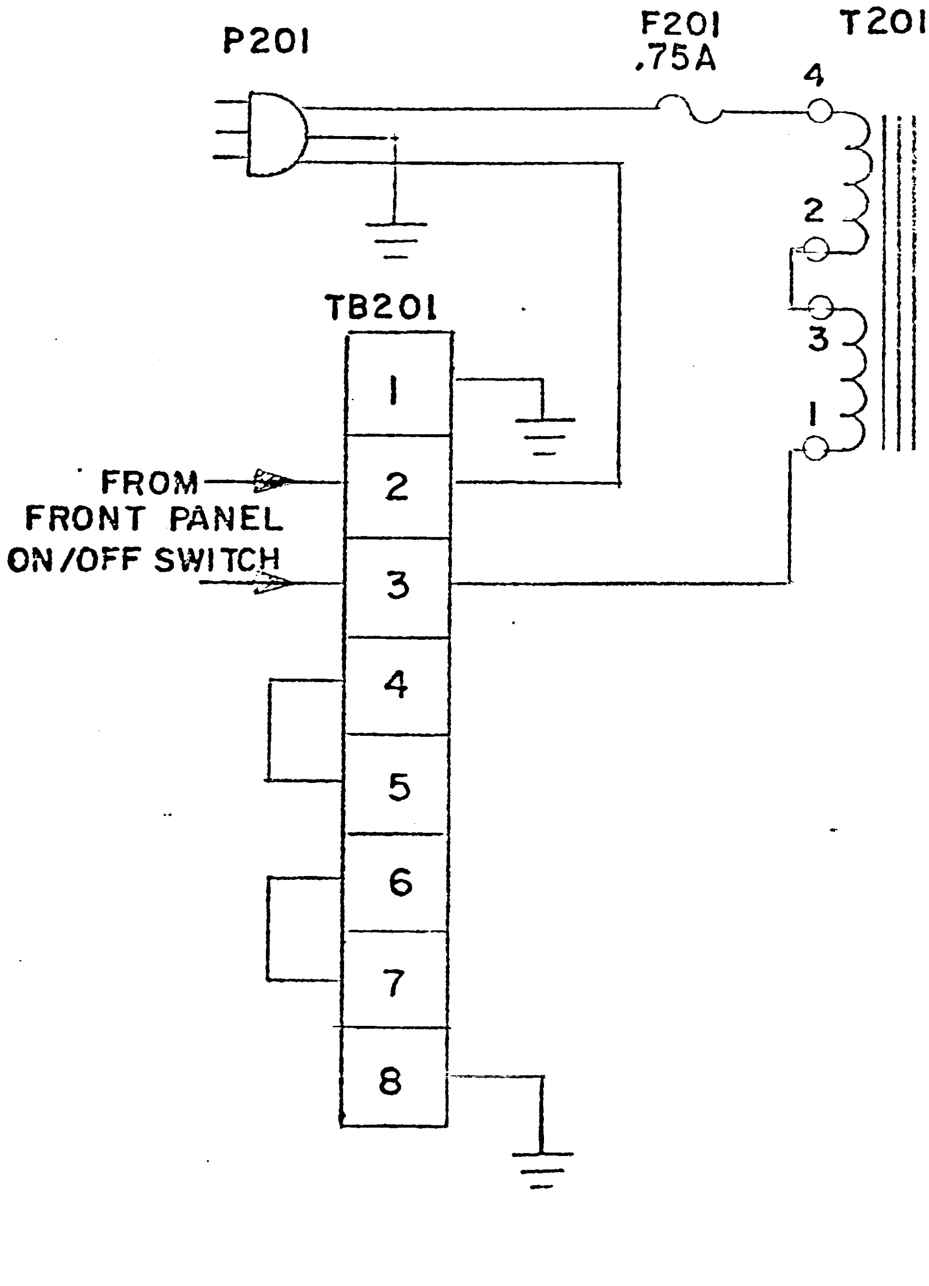


Figure 2-2B. Wiring for 230 vac Operation

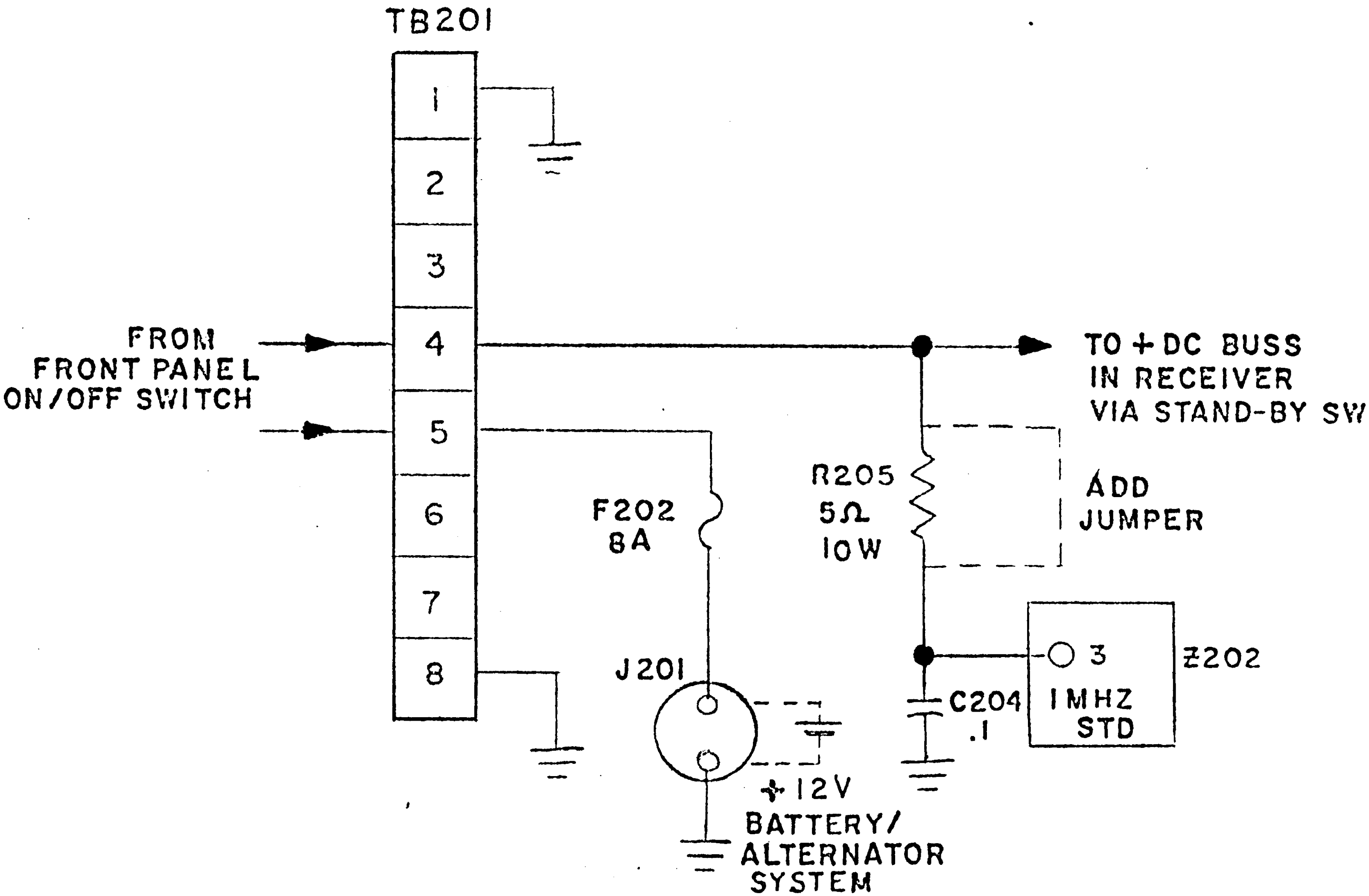


Figure 2-2C. **Wiring for 12 vdc Operation**

TABLE 2-1. LOOSE ITEMS SUPPLIED

Quantity	TMC Part Number	Purpose
1 each	PJ055	phone plug connection
6 each	UG88/U	coaxial BNC plugs for connection to the following connectors: Antenna jack VFO Input jack 250 KHz Input jack 250 KHz Output jack 1 MHz Input jack 1 MHz Output jack

(2) Ventilation. To prevent heat build-up from the power transformer and various power transistors, sufficient clearance must be allowed to insure proper air circulation.

(3) Interference. To achieve optimum performance and ease of tuning, the GPR-110B should be located so the RF interference from other high-frequency equipment, and strong magnetic fields such as those generated by high power transformers, power lines, and motor-generator sets are kept to a minimum. Check that the third pin of the ac power line is grounded to eliminate power line conducted interference and static.

(4) Antenna. The type of antenna used with the GPR-110B receiver is dependent upon the location and the application for which the receiver is being used. In the selection and installation of an antenna, the user should take particular note of the sensitivity and input impedance characteristics of the receiver, in addition to the frequency range of the signals to be received.

Selection of the antenna and its installation location, as well as supervision of the installation of the antenna and its transmission lines, should be made by an expert. This will insure that the input level to the receiver, even on the weakest signals, will meet the .5 microvolt approximate sensitivity characteristic of the receiver. A coaxial antenna plug is provided as a loose item (see table 2-1), so that it can be assembled and connected to the end of the coaxial line from the antenna and plugged into ANT jack J104 on the rear panel of the receiver.

TABLE 2-2. REAR PANEL INPUT AND OUTPUT CONNECTORS

ITEM	INDEX	FUNCTION
Antenna jack J104	1	Coaxial receptacle for connection of 50 ohm antenna to input of preselector assembly.
Digital Mother Board Connector J102	2	Multi-pin connector for remote frequency control inputs and indicator outputs from the digital logic section of the receiver.
Audio Mother Board Connector J103	3	Multi-pin connector for remote bandwidth control inputs to the receiver, and line audio outputs to external equipment.
EXT SPKR jack J105	4	2-pin polarized receptacle; connects audio output signal from the receiver to an external speaker via wired cable.
VFO IN jack J106	5	BNC coaxial receptacle for connection of external variable frequency oscillator to input of the Tunable IF Assembly, when required.

TABLE 2-2. REAR PANEL INPUT AND OUTPUT CONNECTORS (cont.)

ITEM	INDEX	FUNCTION
EXT SPKR jack J105	4	2-pin polarized receptacle; connects audio output signal from the receiver to an external speaker via wired cable.
VFO IN jack J106	5	BNC coaxial receptacle for connection of external variable frequency oscillator to input of the Tunable IF Assmebly, when required.
250 KHz IN jack J107	6	BNC coaxial receptacle for connection of external source of 250 KHz signal into the USB, LSB, and Symmetrical Filter Assemblies, when required. During normal operation, the 250 KHz signal from the receiver's Tunable IF Assembly is routed to this jack from the 250 KHz OUT jack J108 via a coaxial jumper.
250 KHz OUT jack J108	7	BNC coaxial receptacle for connection of 250 KHz IF signal output from the receiver's Tunable IF Assembly. During normal operation, this 250 KHz output signal is routed to the 250 KHz IN jack J107 via a coaxial jumper.
1 MHz IN jack J109	8	BNC coaxial receptacle for connection of external 1 MHz standard in place of the receiver's internal 1 MHz standard.
1 MHz OUT jack J110	9	BNC coaxial receptacle for connection of coaxial jumper to 1 MHz IN jack J109, routing the 1 MHz signal from the internal standard to various circuits in the receiver.

TABLE 2-2. REAR PANEL INPUT AND OUTPUT CONNECTORS (cont.)

ITEM	INDEX	FUNCTION
BATTERY jack J201	10	2-pin receptacle for connection of 12 vdc battery.
P201	11	AC power plug for connection to AC power line (115 vac or 230 vac).

b. MECHANICAL INSTALLATION. The GPR-110B table model receiver is installed on a workbench, with sufficient workspace around the receiver for ventilation, and any accessories which may be required for use with the receiver. The rack-mount unit is installed in a system equipment rack by performing the following procedural steps:

(1) Mount the slide tracks, when supplied as a loose item, on the inside walls of the rack at the height prescribed by the system installation drawing, using the hardware (machine screws and star washers) provided as loose items.

(2) Pull out to its full length the extendable section of each slide track.

WARNING

BEFORE ATTEMPTING TO INSTALL THE RECEIVER IN THE SYSTEM RACK, INSURE THAT THE RACK WILL NOT TIP FORWARD AND INJURE PERSONNEL OR DAMAGE THE EQUIPMENT, BY BOLTING THE RACK TO THE FLOOR OR ASCERTAINING THAT THE RACK IS SUFFICIENTLY WEIGHTED AT THE BOTTOM BY PREVIOUSLY INSTALLED UNITS OF THE SYSTEM TO OFFSET THE SHIFT IN CENTER OF GRAVITY WHEN THE RECEIVER IS PLACED ON THE EXTENDED SLIDE TRACKS.

(3) Position the unit-mounted sections of the slides in the tracks of the rack-mounted sections, and slide the receiver into the rack until the release buttons of the slides engage the holes in the tracks.

(4) Insure that one end of the coaxial jumper (located on rear panel) is connected to the 250 KHz OUT jack J108, and the other end to the 250 KHz IN jack J107.

(5) Insure that one end of the coaxial jumper (loacted on rear panel) is connected to the 1 MHz OUT jack J110, and the other end to the 1 MHz IN jack J109.

c. ELECTRICAL INSTALLATION. For electrical installation of the GPR-110B receiver refer to figure 2-3, which locates the input and output connectors on the rear panel, and to table 2-2, which lists the function of each connector shown in figure 2-3. Reference should also be made to figure 2-4, the interconnect wiring diagram for the receiver, and to paragraph 2-5 d for fabrication of cables required for specific installations. Electrically install the receiver by performing the following procedural steps.

(1) Connect the antenna cable to the ANT input jack J104. (Refer to paragraph 2-5 d (1) for cable fabrication.)

(2) If an external speaker is to be used, connect the external speaker cable to EXT SPKR output jack J105. (Refer to paragraph 2-5 d (2) for cable fabrication.)

(3) If remote control inputs, remote readback outputs, and/or audio line outputs are to be used, connect the remote cable(s) to J102 and J103. (Refer to paragraph 2-5 d (3) for cable fabrication.)

(4) If the receiver is to be operated on ac power, connect the ac line cord plug P201 to the power source receptacle. (Refer to paragraph 2-4 for receiver power requirements and ac wiring details.)

(5) If the receiver is to be operated on dc/battery power, connect the dc power cable to BATTERY input jack J201. (Refer to paragraph 2-5 d (4) for cable fabrication. Refer to paragraph 2-4 for receiver power requirements and dc wiring details.)

(6) Pass the ac line cord of the receiver through the rear opening of the rack. Turn the knobs of the panel locks on the receiver panel counterclockwise to their extreme CCW position. Depress the release buttons on the slides, and push the receiver all the way into the rack until the receiver panel is flush with the rack panel. Turn the panel lock tabs clockwise, and turn the panel lock knobs clockwise until they are tight.

d. CABLE FABRICATION. The connectors which are required for the fabrication of external connection cables for the GPR-110B are either supplied in the loose items package (reference table 2-1), or supplied already connected on the rear panel to their mating jacks. When the receiver is shipped as a modular part of system, the external connection cables made directly to the receiver are a part of the system interconnect wiring. The technical manual for the system itself should be used in lieu of this paragraph for fabrication of external connection cables for the system.

(1) Remove the BNC coaxial plug (UG88/U) from loose items package and assemble the plug to a length of RG58/U coaxial cable long enough to reach the receiving antenna location. Connect the coaxial plug to ANT, jack J104.

NOTE

Use one continuous length of cable from the receiver to the antenna; splices in coaxial cable may change the impedance, standing wave ratio, or other characteristics of the cable.

(2) External Speaker Cable. Using a screwdriver or flat blade of a knife, carefully separate the polarized 2-pin plug from EXT SPKR jack J105. Solder the 2-pin plug to a length of 2-conductor speaker wire long enough to reach from the receiver to the location of the external speaker.

NOTE

Do not use low impedance cable, such as RG58/U, to connect the receiver to the external speaker, as it will change the reflected impedance into the audio output transformer of the receiver, resulting in degradation of the frequency response.

(3) Remote Operation Cable. Using the two 22-pin connectors (located on rear panel) and multicolored insulated wires as required, construct a cable (or cables) long enough to reach from the GPR-110B receiver to the remote control/readback equipment and/or to the associated TTY terminal equipment. Refer to table 2-3 for wire run list of connections to J102 and J103.

NOTE

When wiring the connectors, be sure to connect the wires listed for J102 to the upper connector, and the wires for J103 to the lower connector.

The binary coded decimal (BCD) signal inputs required to tune the receiver must be generated by external bandswitches and binary level switches, and applied to the pins of connector J102. The signals from the remote readback protion of J102 must be applied to a digital readout assembly and display readout assembly and display with six display tubes, such as the one used in the GPR-110B receiver or an equivalent NIXIE indicator with a BCD translator.

(4) DC Power Cable. Using a screwdriver or the flat blade of a knife, separate the polarized 2-pin plug from BATTERY jack J201 (refer to figure 2-3). Observe polarity and solder the plug on the end of two No. 14 wires long enough to reach the 12-volt battery or dc power source for the receiver.

2-6. PRE-OPERATIONAL CHECKOUT

Before installing the receiver in its permanent location, check that it is operative by performing the procedure outlined below:

a. After connecting an antenna to receiver jack J104 on the rear panel, plug the line cord into an appropriate power receptacle having the line voltage specified for the receiver (see paragraph 2-4, Power Requirement).

b. Release the STBY/REC pushbutton on the front panel of the receiver to the REC position by depressing one of the BANDWIDTH pushbuttons.

c. Apply power to the receiver by turning the AF GAIN control clockwise. The numeric indicators on the front panel display light immediately; if they do not, press the TEST LAMP pushbutton S105 on the rear panel of the receiver. Each of the six display an "8", indicating that all filament segments are in proper operating condition.

CAUTION

If the lamps do not light when TEST LAMP pushbutton is pressed, turn power off and check fuses on rear panel.

d. Follow the procedure in paragraph 3-3, AM Operation, and AM Tuning Procedure, of the same paragraph. Tune the receiver to any available local AM station, if there is no station in the area transmitting on the frequency given as an example in paragraph 3-3.

e. Turn the MHz switch to each of its 32 positions while observing the first 2 digits of the numeric display. The numbers change from "00" through "29".

f. Depress and turn the frequency selector/TUNE control through all of its positions while observing the numeric display. The first number after the decimal, changes from "0" through "9". Release the frequency selector/TUNE control and turn it through its range while observing the numeric display. The last 3 digits each change from "0" to "9".

g. Set the MODE switch to CW, and the BFO pushbutton to the VAR position. Tune the MHz switch and frequency selector/TUNE control to any CW station of known frequency in the area. Vary the BFO control to produce a tone in the speaker.

h. Shut the power off by turning the AF GAIN control to fully CCW position.

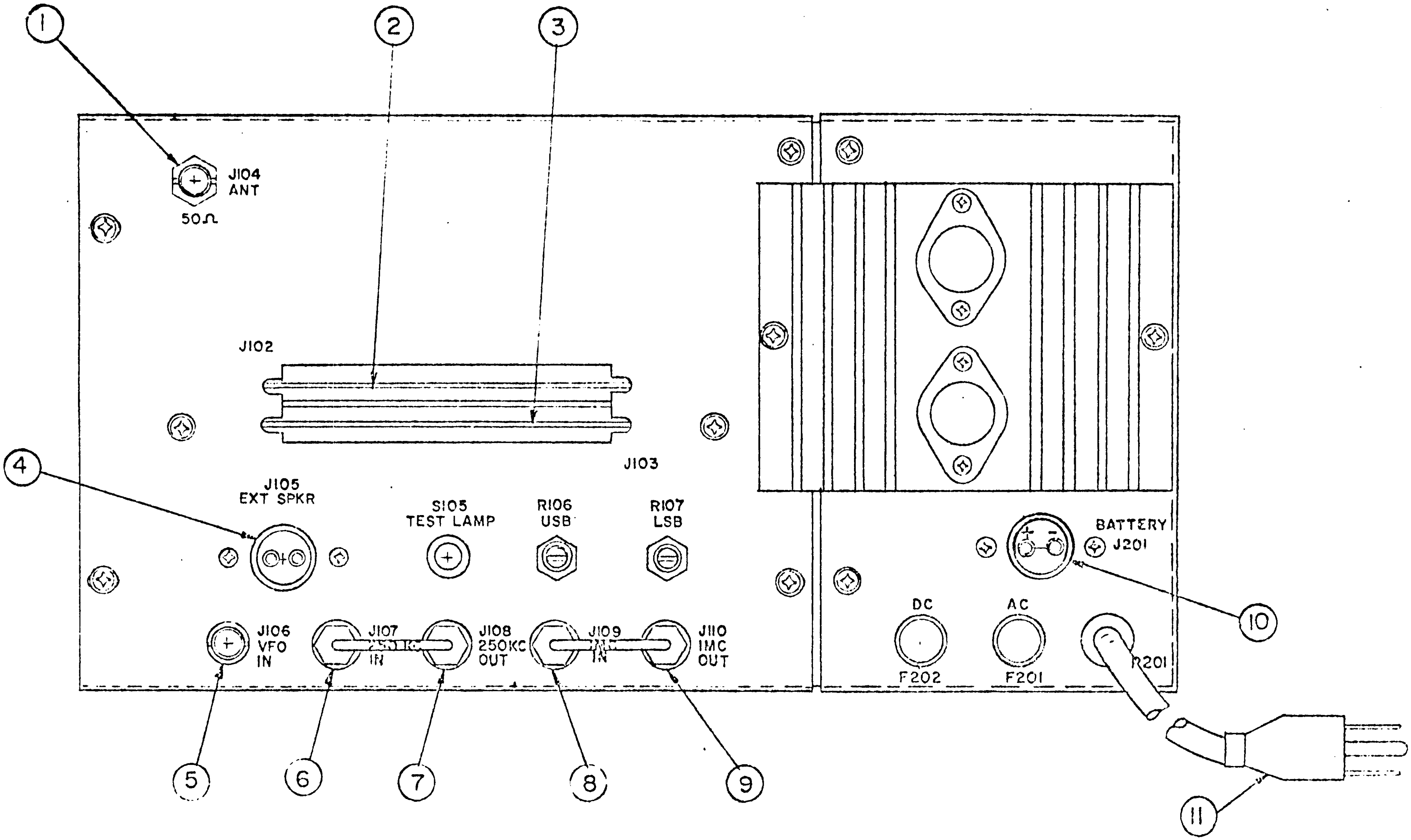


Figure 2-3. GPR-110 Receiver, Rear-Panel

TABLE 2-3. WIRE RUN LIST FOR REMOTE CABLE

Receiver Connection	Type of Signal	External Connection
J102-1 J102-2 J102-3 J102-4	8 line BCD, 1 KHz readback 1 line BCD, 1 KHz readback 4 line BCD, 1 KHz readback 2 line BCD, 1 KHz readback	To a decoder/driver IC for a 1 KHz display tube.
J102-5 J102-6 J102-7 J102-8	8 line BCD,10 KHz readback 1 line BCD,10 KHz readback 4 line BCD,10 KHz readback 2 line BCD,10 KHz readback	To a decoder/driver IC for a 10 KHz display tube.
J102-9 J102-10 J102-11 J102-12	8 line BCD,100 KHz readback 1 line BCD,100 KHz readback 4 line BCD,100 KHz readback 2 line BCD,100 KHz readback	To a decoder/driver IC for a 100 KHz display tube.
J102-13 J102-14 J102-15 J102-16	8 line BCD, 1 MHz readback 1 line BCD, 1 MHz readback 4 line BCD, 1 MHz readback 2 line BCD, 1 MHz readback	To a decoder/driver IC for a 1 MHz display tube.
J102-17 J102-18	2 line BCD,10 MHz readback 1 line BCE,10 MHz readback	To a decoder/driver IC for a 10 MHz display tube.
J102-19 J102-20 J102-21 J102-22	2 line BCD,.1 KHz readback 4 line BCD,.1 KHz readback 1 line BCD,.1 KHz readback 8 line BCD,11 KHz readback	To a decoder/driver IC for a .1 KHz display tube.
J102-A J102-B J102-C J102-D J102-E	2 line BCD, MHz control 4 line BCD, MHz control 8 line BCD, MHz control 16 line BCD, MHz control 32 line BCD, MHz control	From remote MHz control, six bit input control lines.
J102-F	+5 vdc supply output	To remote equipment, if required.
J102-H	Remote preset signal line (momentary ground)	From remote preset switch for MHz control.
J102-J	+9 vdc supply output	To remote equipment, if required.

TABLE 2-3. WIRE RUN LIST FOR REMOTE CABLE (cont.)

Receiver Connection	Type of Signal	External Connection
J102-K	———	
J102-L	———	
J102-M	———	
J102-N	———	
J102-P	———	
J102-R	———	
J102-S	* tune high input signal (ground)	From remote tune control.
J102-T	———	
J102-U	* tune low input signal (ground)	From remote tune control.
J102-V	———	
J102-W	———	
J102-X	1 line BCD, MHz control	From remote MHz control, six bit input control lines.
J102-Y	MHz switch common input (ground)	From remote local/remote switch or receiver chassis ground.
J102-Z	———	
J103-1	———	
J103-2	AM mode selection input (ground)	From remote mode control.
J103-3	———	
J103-4	———	
J103-5	———	
J103-6	———	
J103-7	+20 vdc unregulated supply output	To remote equipment if required.
J103-8	Receiver disable input (ground)	From remote receiver disablce switch.
J103-9	———	
J103-10	———	
J103-11	———	
J103-12	———	
J103-13	USB line audio output (600 ohm)	To TTY terminal equipment.

TABLE 2-3. WIRE RUN LIST FOR REMOTE CABLE (cont.)

Receiver Connection	Type of Signal	External Connection
J103-16	LSB/ISB mode selection input (ground)	From remote mode control.
J103-17 J103-18 J103-19	LSB line audio input (600 ohm)	To TTY terminal equipment.
J103-20	____	
J103-21	____	
J103-22	____	
J103-A	.4 KHz bandwidth selection input (ground)	From remote bandwidth control.
J103-B	1 KHz bandwidth selection input (ground)	
J103-C	3 KHz bandwidth selection input (ground)	
J103-D	6 KHz bandwidth selection input (ground)	
J103-E	wideband selection input (ground)	
J103-F	mode switch common input (ground)	From remote local/remote switch or chassis ground.
J103-H	chassis ground	
J103-J	chassis ground	
J103-K	chassis ground	
J103-L	____	
J103-M	____	
J103-N	____	
J103-P	____	
J103-R	____	
J103-S	USB/ISB mode selection input (ground)	From remote mode control.
J103-T	____	
J103-U	____	
J103-V	____	
J103-W	____	
J103-X	____	
J103-Y	____	
J103-Z	____	

* Refer to Service Manual

Figure 7-1, page 7-2.

* Figure 2-4. Interconnect Wiring Diagram

SECTION 3

OPERATION

3-1. GENERAL

The procedures for operating the GPR-110B receiver are discussed in detail in this section. In addition, two sub-sections cover both operator's maintenance procedures and the functions of all controls and indicators.

The GPR-110B operating frequencies are selected by controls on the front panel. The knob marked MHz controls the megahertz (MHz) increment of the desired frequency. By rotating this control and noting the indication on the digital readout, the correct MHz frequency is obtained. The large knob marked TUNE controls the remaining increments of the desired frequency below 1 MHz. By depressing this control and rotating it, the 100 KHz frequency position is incremented. Releasing the control and rotating it enables tuning to the nearest 100 Hz increment. A red "SYNC" light on the digital readout display turns on when the receiver is tuned to within 40 Hz of the incoming transmitter signal. The tuning control below the large tuning control is used with the front panel meter to fine tune the receiver to an "IN SYNC" condition. The same front panel meter is used to monitor the relative strength of both audio or RF signals.

Additional functions controlled at the front panel include:

POWER ON/OFF
AF GAIN WITH METERING
STANDBY/RECEIVE
IF BANDWIDTH SELECTION
AUDIO SQUELCH
OPERATING MODE SELECTION WITH METERING
AUTOMATIC FREQUENCY CONTROL (AFC)
BEAT FREQUENCY OSCILLATOR SELECTION AND TUNING
AUTOMATIC GAIN CONTROL (AGC)
AUTOMATIC NOISE LIMITING (ANL)
METER FUNCTION SELECTION

3-2. CONTROLS AND INDICATORS.

All of the controls and indicators used in the operation of the receiver are mounted on the front panel. The operator should be familiar with them before attempting to operate the receiver. (Refer to Table 3-1 and descriptions.) The index numbers used in Table 3-1 correspond to the features indicated in Figure 3-1. Special attention should be given to the two rows of pushbuttons below the digital display. When any pushbutton is pressed to the IN position, it activates the function which is marked above it. When it is released to the "OUT" position, it activates the function marked below it. If no function name is shown below the pushbutton, the function is considered to be "OFF".

The display lamp test button and all output adjustment controls are mounted on the rear panel of the receiver. (See Table 3-1 and corresponding locations in Figure 3-1.) The TEST LAMP pushbutton (S105) is used only when it is necessary to test the filament segments of the display tubes. The USB control (R106) or LSB control (R107) is used only when adjustment of each 600-ohm speaker line for remote control operation is required. The LSB control can be used only when the LSB option is included in the receiver.

TABLE 3-1. OPERATOR CONTROLS AND INDICATORS

Control or Indicator	Index No.	Function
Digital Readout Display	1	Indicates operating frequency in MHz to 4 decimal places.
AFC Indicator (LED IN DISPLAY)	2	Indicates when the receiver is tuned to within ± 40 Hz of the transmitted signal. Used in AFC to indicate "capture" range of the incoming carriers.

TABLE 3-1. OPERATOR CONTROLS AND INDICATORS (cont.)

Control or Indicator	Index No.	Function
RF/Audio Level/Sync Meter	3	Monitors relative RF level of receiver by measuring AGC voltage when METER RF/AUDIO pushbutton is set to RF, and AFC pushbutton is set to "off". Monitors relative audio output level when METER RF/AUDIO pushbutton is set to "off". Monitors "In Sync" condition when SYNC switch is set to on.
SYNC switch	4	Connects the front panel meter to the meter amplifier in the SYNC/AFC circuit while the receiver frequency is being fine-tuned.
BFO control	5	Varies the pitch of the audio signal at the speaker or phones by adjusting the frequency of the beat frequency oscillator +1 KHz from IF center frequency.
STBY/REC switch	6	When set to STBY, disables the digital display and the 12 vdc line in the power supply (crystal oven in 1 MHz standard oscillator is not affected). When set to REC, activates all receiver circuits.
.4 KHz, 1 KHz, 3 KHz, and 6 KHz BANDWIDTH pushbuttons	7 thru 10 respectively	With any one pushbutton set "IN" (pressed in), changes the IF bandwidth via the upper and lower sideband circuits. Pressing any of the pushbuttons causes all other pushbuttons in this row, including the STBY/REC pushbutton, to release.
WIDE BANDWIDTH pushbutton	11	With this pushbutton set to WIDE (pressed in), provides wide IF bandwidth via the upper and lower sideband cards.

TABLE 3-1. OPERATOR CONTROLS AND INDICATORS (cont.)

Control or Indicator	Index No.	Function
AFC pushbutton switch	12	With this pushbutton set to AFC, the AFC circuit locks the receiver frequency to that of the incoming carrier and continuously compensates for any drift in the transmitter frequency. (Used only with a signal which has a carrier.)
BFO pushbutton switch	13	With this pushbutton set to FXD, the frequency of the BFO is fixed at 250 KHz. When it is set to VAR, the pitch of the audio can be varied ± 1000 Hz.
AGC pushbutton switch	14	With this pushbutton set to FAST, the response to variations in signal level is relatively rapid (used especially when receiving CW signals). When set to SLOW, the slow compensating response provides more constant audio levels on voice reception.
ANL switch	15	With this pushbutton set to ANL position, the automatic noise limiting circuit provides a quieting effect to background noise and pulse-type transmission noise during low level reception.
METER RF/AUDIO switch	16	With this pushbutton set to METER RF, the meter on the front panel provides continuous monitoring of the relative RF level of the incoming signal. With the pushbutton set to AUDIO, the meter indicates the relative audio level. NOTE: The AFC and SYNC must be in the "OFF" positions to provide monitoring of either level.

TABLE 3-1. OPERATOR CONTROLS AND INDICATORS (cont.)

Control or Indicator	Index No.	Function
METER USB/LSB switch	17	With this pushbutton set to METER USB, the operator can monitor the USB AUDIO level. When the switch is set to METER LSB,the audio signal from the lower sideband circuit can be monitored.
Frequency Selector/ TUNE control	18	By pressing knob in and rotating the third digit of frequency (100 KHz) is selected. By releasing knob and rotating the last 3 digits of the frequency are tuned. The selector switch detent hits a mechanical stop at the last position. Turn the selector switch in the opposite direction to tune back through the band, or switch to the next higher/lower MHz frequency by rotating the MHz control.
PHONES jack	19	Used to disconnect the speaker and monitor the audio output signal of the receiver by plugging in pair of low-impedance headphones.
AF GAIN control, AC OFF	20	Used to vary the volume of the audio signal to the internal/ external speakers by attenuating it before it enters the Audio Assembly. Turning the control fully counterclockwise to the AC OFF position shuts off all line power to the receiver.
SQUELCH control	21	Adjusts the threshold voltage for the squelch circuit. If the RF voltage drops below the threshold level, the audio is disabled to avoid amplification of the resulting noise. Turning control clockwise, squelchs signals.

TABLE 3-1. OPERATOR CONTROLS AND INDICATORS (cont.)

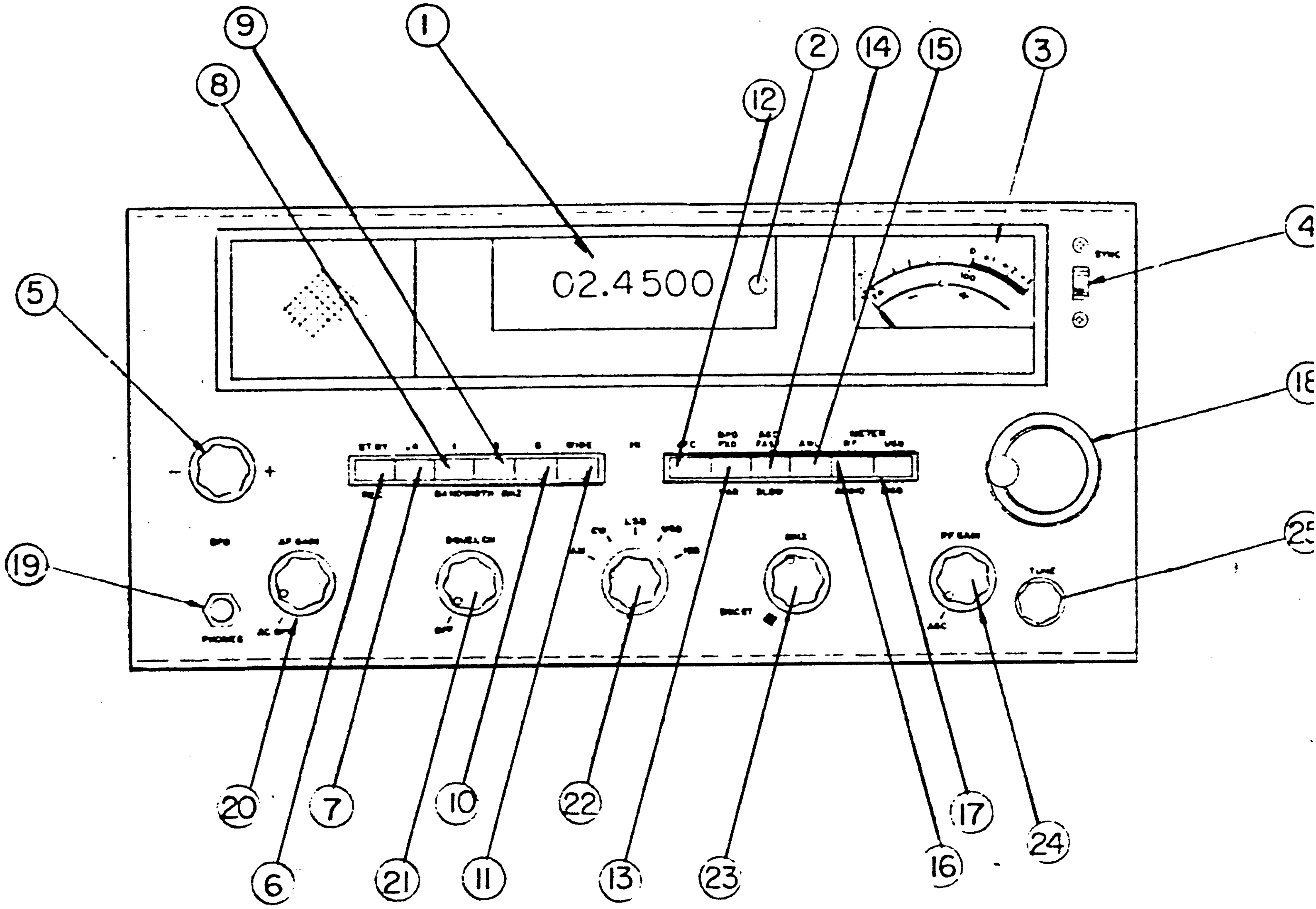
Control or Indicator	Index No.	Function
MODE selector switch	22	Selects the appropriate circuits for the type of signal being received. When set to AM, activates the amplifier and detector circuits in the USB card and applies a ground to the BANDWIDTH pushbuttons for selection of the appropriate symmetrical filter. When set to CW, a ground is connected to the BANDWIDTH pushbuttons to enable selection of the desired filter. When set to LSB, activates the 250 KHz amplifiers for lower sideband reception. When set to USB, activates the 250 KHz amplifiers for upper sideband reception. When set to ISB, activates the 250 KHz amplifiers for upper and lower sideband reception.
MHz switch	23	Used to select the operating frequency band in 1 MHz steps. Turning clockwise, the first switch position (00 band) in the shaded area is for broadcast frequencies in the range of 00.0000 to 00.9999 MHz; the 2nd band in the shaded area (01 band) is for broadcast frequencies from 01.0000 to 01.9999 MHz; the remaining switch positions cover SSB (or ISB) frequencies from 02.0000 to 29.9999 MHz, except for the last position before the shaded area, which covers SSB frequencies in the range from 00.0000 to 00.9999 (00 band). In all switch positions except the 2 broadcast positions, a broadcast filter in the preselector assembly is switched into the circuit.

TABLE 3-1. OPERATOR CONTROLS AND INDICATORS (cont.)

Control or Indicator	Index No.	Function
RF GAIN control	24	Used to manually control the gain of the amplifiers in the IF, Tunable IF, and Audio assemblies. When the control is turned to the extreme CCW position (AGC), the switch disconnects the gain control and connects the AGC line to the AGC inputs of these assemblies instead.
Fine TUNE control	25	Used to fine-tune the receiver frequency by varying the frequency of the oscillator assembly on the SYNC/AFC.
Rear Panel		
TEST LAMP (S105)	26	Lights all segments of the display lamps simultaneously (all 8's).
USB control (R106)	27	Adjusts feedback loop to provide correct audio power level to 600-ohm speaker distribution line for USB channel.
LSB control (R107)	28	Adjusts feedback loop to provide correct audio power level to 600-ohm speaker distribution line for LSB channel.

3-3. OPERATING PROCEDURE

a. GENERAL. To turn on and operate the GPR-110B receiver, perform the following procedures. For best results and to prevent damage to the receiver, perform the steps within each procedure in the order given. For example, paragraph 3-3 d the RF and AF gain should be turned down first, in order to avoid damage from an exceptionally strong signal to the front panel meter in case the AFC pushbutton is already in released position (meter connected).



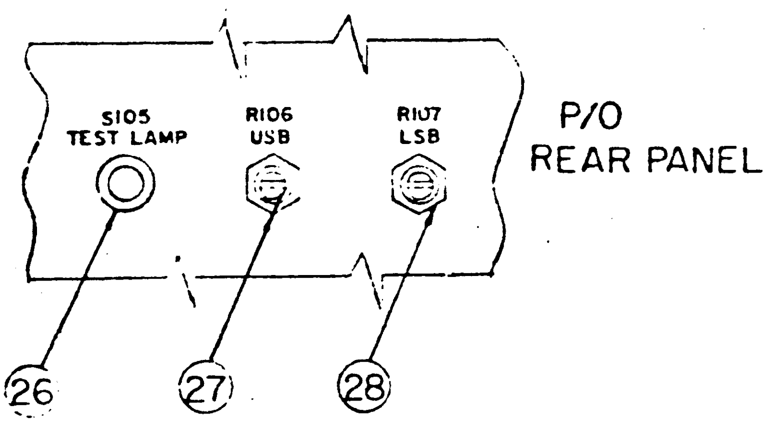


Figure 3-1. Controls and Indicators

The two major visual indicators of receiver performance are the Digital Readout Display and the RF/Audio/Sync Meter, both located on the front panel of the receiver. A general description of each is given in this paragraph, and a detailed description and function of each is included in table 3-1.

(1) Digital Readout Display - The operating frequency of the receiver is continuously displayed on a direct-reading 6-digit, 7-segment filament display. The display tubes are mounted behind a dark red plastic faceplate causing each incandescent filament segment to appear bright red. A light emitting diode (LED) tuning indicator is also mounted behind the red faceplate at the extreme right hand of the digital display. The digital readout displays frequency in Megahertz, to the nearest 100 Hz i.e., 00.0000 to 29.9999 MHz.

(2) RF/Audio/Sync Meter - The front panel meter is utilized to monitor three separate circuit functions using three separate scales.

Top scale - indicates relative audio signal level. When METER pushbutton is set to AUDIO, it monitors the rectified output of the audio output amplifier circuit.

Middle scale - indicates relative RF signal strength. When METER pushbutton is set to RF, the meter is connected to the AGC amplifier in the Audio Assembly.

Lower scale - indicates dc null from phase detector circuit in AFC assembly. When zero is obtained on the meter, it indicates that the receiver is tuned to the carrier frequency of the incoming signal.

b. START-UP PROCEDURE

(1) Turn AF GAIN control (20) clockwise until the receiver power comes one.

(2) Release STBY/REC pushbutton (6) to REC position by pressing in one of the bandwidth KHz pushbuttons.

c. FREQUENCY SELECTION PROCEDURE

IMPORTANT

Each type of operation requires a different tuning procedure. Refer to the appropriate section before starting this procedure.

Paragraph	Type Operation	Page
3-3 d.	AM	3-10
e.	CW	3-11
f.	USB, LSB, ISB	3-13
g.	AFC	3-14

(1A) For AM reception only - Rotate the MHz switch (23) clockwise to the first BDCST position if the frequency of the incoming carrier is between 00.0001 and 00.9999. Rotate the switch to the second BDCST position if the frequency is between 01.0000 and 01.9999.

(1B) For CW, USB, LSB and ISB reception - Rotate the MHz switch (23) clockwise from the broadcast position until the first two digits of the signal frequency are displayed on the first two (left-hand) display positions to the left of the decimal.

(2) Depress and hold the knob of the frequency selector/TUNE control (18) to engage the 100 KHz frequency selector switch. Turn the knob while observing the digital display (1) on the front panel of the receiver until the first digit to the right of the decimal agrees with that of the signal frequency.

Release the knob and turn the TUNE control until all digits of the digital readout agree with those of the signal frequency.

NOTE

> If no signal is present at the antenna, the receiver may still be tuned to the appropriate frequency. Once a signal is received steps (3) and (4) are performed to complete the tuning sequence.

During tuning, the RF Gain Control may be set to the AGC position. If greater sensitivity is required, adjust the RF GAIN control to obtain maximum signal strength on the RF meter (3) while maintaining minimum background noise. Adjust the AF GAIN control to a comfortable level in the speaker or headphones.

(3) Turn the TUNE control for maximum reading on the middle scale (RF) of the front panel meter. (3). Note this maximum reading, and the approximate setting of the RF GAIN control for later comparison during performance tests of the receiver.

(4) Set the SYNC switch (4) to SYNC. While observing the front panel meter, turn the fine TUNE control (25) to obtain zero on the bottom scale. The receiver is now tuned to the desired signal frequency.

d. AM OPERATION

(1) Set MODE switch (22) to AM.

(2) Turn AF GAIN control to midrange.

(3) Turn RF GAIN control (24) to AGC position or midrange. Release AFC pushbutton (12) to "off" position.

CAUTION

When tuning the receiver with AFC push-button set to "off", the RF GAIN or AF GAIN control must be adjusted as low as necessary to avoid "pegging" the meter needle.

(4) Set the SYNC switch to "off".

(5) Set the following pushbuttons to the positions indicated:

Pushbutton	Position
METER USB/LSB (17)	USB
METER RF/AUDIO (16)	RF
BFO (5)	FXD
ANL (15)	off
AGC (14)	SLOW
6 KHz BANDWIDTH (10)	6 KHz

(6) Turn SQUELCH control fully counterclockwise to OFF.

(7) Tuning Procedure-AM Reception.

(a) Follow the procedure for FREQUENCY SELECTION described in paragraph 3-3c.

(b) Turn the RF GAIN control fully CCW to the AGC position.

(c) If the noise level between signals is too high, turn the SQUELCH control CW until the audio is disabled, then CCW to the point that enables the audio but not the noise between signals. If the noise level is still too high, or causes interference with the incoming signal, depress the ANL pushbutton (15) to the ANL position.

(d) Set the SYNC switch to "off". Release the METER RF/AUDIO pushbutton to the AUDIO position. Note the relative strength of the audio level shown on the top scale of the front panel meter and the approximate settings of the AF GAIN and RF GAIN controls.

e. CW OPERATION

(1) Set the MODE switch to CW.

(2) Turn the AF GAIN control to midrange.

(3) Turn RF GAIN control (24) to AGC position or midrange.

Release AFC pushbutton (12) to "off" position.

CAUTION

When tuning the receiver with AFC pushbutton set "off", RF GAIN or AF GAIN must be adjusted as low as necessary to avoid "pegging" the meter needle.

(4) Set the SYNC switch to "off".

(5) Set the following pushbuttons to the positions indicated:

Pushbutton	Position
METER USB/LSB (17)	USB (LSB if optional mode is in use)
METER RF/AUDIO (16)	RF
BFO (5)	FXD
ANL (15)	off
AGC (14)	FAST
6 KHz BANDWIDTH (10)	6 KHz

(6) Turn the SQUELCH control fully CCW to OFF.

(7) Tuning Procedure - CW Reception.

(a) Follow the procedure for FREQUENCY SELECTION described in paragraph 3-3c.

(b) Release BFO pushbutton to VAR. Adjust BFO control (5) to obtain a comfortable audio tone in the headphones or speaker.

(c) Depress the lowest frequency BANDWIDTH pushbutton which will obtain maximum noise attenuation with minimum audio frequency distortion.

(d) Set RF GAIN control fully CCW to AGC position.

(e) Follow the procedure in paragraphs (c) and (d) of the Tuning Procedure - AM Reception page 3-12 (Squelch and ANL).

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL.

4-2. This section details the principles of operation of General Purpose Receiver GPR-110B as an independently operated communications receiver. The principles of operation of the GPR-110B are presented on three levels. The first level is an overall block diagram discussion where the function of a group of circuits (generally a circuit board) is described, with the emphasis on an overall understanding of the operation of the receiver. The second level is a detailed block diagram discussion, where each circuit board is described on a block diagram level. The third level is a circuit analysis of each circuit board which traces the signal flow through each board.

4-3. The GPR-110B capabilities can be expanded through the addition of certain accessory units. This section does not include the principles of operation of the accessory units; a full description of the accessory units is covered in the applicable system operating manuals.

4-4. BLOCK DIAGRAM DISCUSSION.

4-5. The receiver consists of two basic sections; the signal flow section and the digital logic and control section. The signal flow section contains the RF, IF, and audio circuits and the digital logic and control section contains the digital circuits which established and maintain the receiver at the selected frequency.

4-6. The signal flow section includes the circuits shown in figure 4-1 and the digital logic and control section includes the circuits shown in figure 4-2. Some circuit boards function in both the signal flow and digital logic and control circuits; these circuit boards are shown on both figures to clarify the functioning of each section.

4-7. The signal present at the antenna is routed through J104 to BDCST Band preselector Z120. The preselector contains relays and a bandpass filter. The filter rejects the broadcast frequencies from approximately 500 to 1600 KHz and is inserted by the relays at all frequencies except the broadcast band. The preselector also contains a receiver disable relay which disconnects the receiver antenna and audio when an associated transmitter is enabled. The resultant output of the preselector is applied to Multi-Band Preselector Z121.

4-8. The Multi-Band Preselector (Z121) is controlled by the Megahertz dial of the receiver and contains circuitry to divide the 100 KHz to 29.9999 MHz coverage into nine (9) bands.

A Programmable Read Only Memory (PROM) and decoder (1 C's) are used to select each band from the binary information provided by the MHz switch. Each band filter is diode switched. The output of each filter is capacitively combined into a wide dynamic range, low noise, FET type broad band amplifier. The broad band amplifier provides approximately 6 db of gain throughout each band. The output of the preselector is applied to RF input mixer assembly Z307.

4-9. The RF input mixer assembly is basically a balanced modulator which receives the preselector output signal, and also receives an oscillator signal in the frequency range from 163.5 to 192.5 MHz from Z304. The output frequency of 163.5-192.5 MHz oscillator assembly Z304 is always 163.5 MHz above the receiver MHz frequency and is mixed in RF input mixer assembly Z307. As a result, the output of Z307 is in the range of 162.5 to 163.5 MHz and is applied to differential amplifier Z306. Differential amplifier Z306 is tuned to 163 $\pm$ 0.5 MHz and amplifies the signal.

4-10. The resultant output of the differential amplifier is applied to IF output mixer assembly Z305. Also applied to Z305 is a 160.5 MHz signal from oscillator assembly Z302. The two signal frequencies are mixed in Z305 to produce a 3-2 MHz output that is applied to tuned IF amplifiers and to a third mixer in tunable if assembly Z301.

4-11. Also applied to the mixer in tunable IF assembly Z301 is a 3.25-2.25 MHz signal developed by an oscillator in Z301. Both the 1-MHz range between 3-2 MHz and the 1-MHz range between 3.25-2.25 MHz are divided into 10 bands to obtain the optinum selectivity from the varicap controlled elements, and provide tight tracking. The result of the mixing frequencies yields a difference frequency of 250 KHz.

4-12. The 250-KHz signal from the mixer in the tunable IF assembly is the result of the third frequency conversion and this signal is applied to USB filter assembly Z115 (and LSB filter assembly Z116 if this optional assembly is included in the receiver). The filters amplify and detect the 250-KHz signal. If the receiver is set to AM, the signal is detected by the AM detector in the USB assembly. The sideband filter assemblies have two outputs. One is a 600-ohm balanced output for signals to auxiliary equipment such as a teletype converter input. The second output is an amplified audio signal which is routed to the AF GAIN control, the USB or LSB line adjustment potentiometer, and the METER USB/LSB pushbutton switch. The signal level derived form the AF GAIN control is applied to audio assembly Z114. the audio assembly amplifies the audio before it is routed to the internal speaker and external speaker jack, the PHONES jack on the front panel, meter-adjustment circuitry, audio squelch circuitry tying into an audio disable relay located in the preselector assembly, and a d-c bridge rectifier circuit for the front panel meter.

4-13. The preceding signal flow section discussion is fairly straight forward and is basic triple conversion receiver, with the added feature of a high IF frequency for good image rejection. The uniqueness of the GPR-110B lies in the digital and control section and the afc circuitry.

4-14. The sync/afc assembly Z117 contains an XVCO tuned to 1.25 MHz whose output is mixed with the 1-MHz standard signal. The resultant 250-KHz signal is applied to a phase detector. Also applied to the pase detector is the 250-KHz output signal from tunable IF assembly Z301 via the AFC position of the front panel AFC/SYNTH switch and 250 kHz ±50 Hz FL1 in sync/afc assembly Z117. The FINE TUNE control is used to adjust the XVCO for the plus and minus 50 Hz of filter FL1. The sync indicator senses the output of the FL1; when the frequency is within the bandpass of the filter, the sync indicator lights indicating that the signal is through within 50 Hz. Therefore, the sync indicator acts as a carrier indicator in this situation. The phase detector compares the 250-KHz signal output from the XVCO mixer with the 250-KHz otuput signal of the filter. Any difference in frequency results in a d-c output voltage from the phase detector which is applied to the 3.25-2.25 MHz oscillator in tunable IF assembly Z301 and corrects the oscillator output in such a manner as to bring the 250-KHz output signal of the filter IF assembly closer to 250 KHz. A second d-c output of the phase detector is applied to the sync switch which is in a metering circuit. When in sync position it permits visually monitoring the fine tuning as the FINE TUNE control is varied. When the meter is zeroed, the sync indicator remains lighted on both sides of the bandwidth. This enables tuning while the meter monitors the RF or audio levels.

4-15. Establishing and maintaining the selected frequency is a function of the digital logic and control section which operates through memory assembly Z105 to apply a 0 to 20 volt d-c tune signal to 163.5-192.5 MHz oscillator Z304. The level of the d-c tune signal voltage determines the frequency output of the oscillator, thereby maintaining the receiver at the selected frequency. In turn, the memory assembly receives various inputs from the comparator assembly Z104 which receives tune information via sample divide/phase detector assembly Z107. A number of closed loops are established that set and maintain the selected frequency.

4-16. Sample divide/phase detector assembly Z107 receives a signal in the range of 3-32 MHz from sample mixer assembly Z303. The 3-32 MHz frequency is the result of mixing the 163.5-192.5 MHz oscillator output with the 160.5 MHz oscillator signal. The sample divide circuitry of Z107 utilizes this signal frequency as one input to programmable divider circuits. The divide factor for each programmable divider circuit is controlled by the binary coded signals resulting from the setting of the front panel MHZ switch, indicating the desired operating frequency of the receiver. The sample divide circuitry of Z107 forms a closed loop with comparator assembly Z104, memory assembly Z105, 163.5-192.5 MHz oscillator assembly Z304, and sample mixer assembly Z303.

4-17. The sample divide circuit divides the 3-32 MHz input from the sample mixer by the dividing factor determined by the MHZ switch, setting, and is seeking an output of 333333 Hz. The difference from the desired frequency output of the sample divide circuit indicates to the comparator assembly the direction and amount of voltage change required of the memory assembly. The d-c tune output of the memory assembly then changes accordingly and varies the frequency of the 163.5-192.5 MHz oscillator output. A sample of the oscillator output is then applied back to the sample divide circuit. The process continues until the output of the sample divide circuit is 333,333Hz, at which point the frequency is in locking range of the phase detector.

4-18. SIGNAL FLOW CIRCUITS, BLOCK DIAGRAM DISCUSSION.

4-19. BDCST BAND PRESELECTOR ASSEMBLY Z120.

4-20. Preselector assembly Z120 receives the antenna signal and controls the insertion of a 500 to 1600 KHz filter in the signal path. Signal routing through the preselector assembly is controlled by relays K1 and K2. In the normally deenergized state, the relays route the antenna signal through the filter and out of the assembly to Multi Band Preselector Z121. When the receiver is operated in the broadcast band frequency range, relay K2 is energized by a control signal from the front panel MHz switch via MHz display/divider assembly Z103. With K2 energized, the filter is bypassed and the antenna signal is effectively routed through the two relays to Z121. When operated in other than the broadcast band, the relays K2 is deenergized and the filter is inserted in the signal path. Relay K1 is energized by a receiver disable signal when an associated transmitter antenna is used in conjunction with the GPR-110B. When energized, K1 grounds the input signal an- removes the positive potential from the audio preamplifier.

4-21. MULTI-BAND PRESELECTOR Z121

4-22. MULTI-BAND PRESELECTOR (Z121) is controlled by binary information provided by the MHz switch through bit lines X_0 through X_5. The binary information is monitored by Programmable Read Only Memory (PROM). The output of the PROM is connected to Z2 which is a 4 line to 10 line decoder (BCD to decimal). Each output of the decoder is connected to a different filter section for a total of nine (9) filters. The nine(9) bands of frequencies that are covered are as follows:

BAND	FREQUENCY (MHz)
1	.1-1
2	1-2
3	2-3
4	3-4
5	4-6
6	6-10
7	10-15
8	15-20
9	20-29.9999

4-23. The first two filters (bands 1 and 2) are of the low pass type with cut-off frequencies at 1.0 and 2.2 MHz respectively. The third filter is a double filter unit which covers the region of 2-2MHz. The next two filters, 3-4 MHz and 4-6 MHz are triple tuned coupled circuits. The rest of the filters employ double tuned circuits.

4-24. The output of the filters enters a wide dynamic range, low noise, broad band FET amplifier which provides a gain of 6 db (overall gain including residual losses in the filters).

4-25. 163.5-192.5 MHZ OSCILLATOR ASSEMBLY Z304.

4-26. The 163.5-102.5 MHz oscillator assembly Z304 develops the first mixing frequency which is 163.5 MHz above the receiver MHz frequency. The oscillator output is mixed with the antenna signal output of the preselector assembly to produce the first IF conversion. The initial frequency output of Z304 is established by a d-c tune signal voltage from memory assembly Z105 and places the oscillator at the the required frequency. A sample of the oscillator frequency is applied to sample mixer assembly Z303 where it is mixed with the 160.5 MHz output of Z302 to yield a 3-32 MHz output frequency that is applied to sample divide/phase detector assembly Z107. The sample divide/phase detector assembly then produces a fast loop error control signal voltage that corrects and/or maintains the required output frequency of Z304.

4-27. The 163.5-192.5 MHz oscillator assembly Z304 contains two oscillator circuits; one operates in the lower half of the required frequency range of 163.5-175.5 MHz and the second operates in the upper half of the required frequency range of 176.5-192.5 MHz. Oscillator selection is controlled by a low and high signal from mixer/oscillator control assembly Z109 which activates the required oscillator from the information received from the front panel MHZ switch setting via MHz display divider Z103.

4-28. RF INPUT MIXER ASSEMBLY Z307.

4-29. RF input mixer assembly Z307 receives the preselector output signal, and also receives the oscillator frequency from the 163.5-192.5 MHz oscillator assembly, and mixes the two signals. The resultant difference signals are applied to difference amplifier assembly Z306. The mixing element is a double balanced diode mixer circuit Z1 on the RF input mixer assembly Z307.

4-30. DIFFERENCE AMPLIFIER ASSEMBLY Z306

4-31. Difference amplifier assembly Z306 receives the difference output signals from RF input mixer assembly Z307. The difference amplifier assembly contains a three-stage amplifier which is tuned to 163 MHz and has a bandwidth of 1.0 MHz Two of the amplifier stages consist of triple tuned circuits. The resultant amplified 163 ± 0.5 MHz output signal is applied to IF output mixer assembly Z305.

4-32. IF OUTPUT MIXER ASSEMBLY Z305.

4-33. IF output mixer assembly Z305 receives the 163 ±0.5 MHz output signal from difference amplifier assembly Z306, mixes the signal with a 160.5 MHz signal from oscillator Z302, and develops a resultant 3-2 MHz signal that is applied to tunable IF assembly Z301. The 3-2 MHz IF signal is a result of the second frequency conversion in the receiver. The exact output frequency in the 1-MHz range from 3-2 MHz is determined by the operating frequency of the receiver. For example, with an incoming signal of 100 KHz, the carrier frequency of the IF output is 2.900 MHz, with plus and minus 3-KHz sidebands. The mixing element is a double balanced mixer circuit Z1 on the IF output mixer assembly Z305.

4-34. 160.5 MHZ OSCILLATOR ASSEMBLY Z302.

4-35. The 160.5 MHz oscillator assembly Z302 develops a 160.5 MHz output that is applied to IF output mixer assembly Z305 where it is mixed with the IF signal from difference amplifier Z306 to produce a second IF conversion frequency.

4-36. TUNABLE IF ASSEMBLY Z301.

4-37. Tunable IF assembly Z301 receives the 3-2 MHz signal from IF output mixer assembly Z305 and mixes the signal with an internally generated 3.25-2.25 MHz signal to develop the third frequency conversion yielding 250 KHz. The exact frequency output of the internally generated 3.25-2.25 MHz signal is a function of the receiver frequency setting and is configured in such a manner that, when mixed with the incoming 3-2 MHz signal, produces a 250-KHz output signal. The 3.25-2.25 MHz oscillator is voltage controlled and receives a d-c loop signal from sync/afc assembly Z117 that corrects and/or maintians the output of the tunable IF assembly at 250 KHz. The 250-KHz output signal is applied to the symmetrical filters Z112, Z113, USB filter assembly Z115, and (optional) LSB filter assembly Z116. The 250-KHz output signal is also applied to sync/afc assembly Z117 via the AFC position of the front panel AFC/SYNTH switch.

4-38. MIXER/OSCILLATOR CONTROL ASSEMBLY Z109.

4-39. Mixer/oscillator control assembly Z109 develops the high and low oscillator voltage control for the 163.5-192.5 MHz oscillator assembly Z304 in response to information received from MHz display divider assembly Z103 to activate the required high or low frequency oscillator section in Z304. The mixer/oscillator control assembly also mixes the 3.25-2.25 MHz signal from tunable IF assembly Z301 with a 4.25 MHz signal derived from the 17th harmonic of the 250 KHz signal input from display divider assembly Z103. The resultant 1-2 MHz output signal is applied to digital counter assembly Z102 where it is counted and read out as the exact operating frequency of the receiver.

4-40. SYNC/AFC ASSEMBLY Z117.

4-41. Sync/afc assembly Z117 develops a d-c voltage that is used to correct the frequency of the 3.25-2.25 MHz oscillator in the tunable IF assembly. A 250-KHz IF signal is received from the tunable IF assembly when the front panel AFC/SYNTH switch is set to SYNTH. The signal passes through a 250-KHz filter with a bandpass characteristic of 50 Hz and is applied to one input of a phase detector circuit. The second input to the phase detector circuit is a 250-KHz signal developed within the sync/afc assembly by mixing a 1-MHz signal from the 1-MHz standard with a 1.25 MHz signal from a crystal controlled oscillator (XVCO) in the assembly.

When the phase detector circuit generates a difference voltage, the XVCO oscillator receives a d-c correction voltage, and a d-c error correction voltage is also routed back to the oscillator in the tunable IF assembly to correct the 3.25-2.25 MHz oscillator output in such a manner as to result in a 250-KHz output from the tunable IF assembly. The frequency of the XVCO oscillator can be shifted slightly by adjusting the front panel fine TUNE control. When a 250-KHz signal from either the 100 Hz synthesizer or the tunable IF assembly passes through the bandpass filter in the sync/afc assembly, the SYNC indicator on the front panel lights to indicate that the receiver is tuned within 100 Hz of the incoming signal (in sync).

4-42. 100 HZ SYNTHESIZER ASSEMBLY Z110.

4-43. The 100 Hz synthesizer assembly Z110 provides a 250-KHz signal to the sync/afc assembly when the front panel AFC/SYNTH switch is set to SYNTH, thereby applying the internal synthesizer output to the sync/afc assembly. The 250-KHz signal is derived by mixing the 3.25-2.25 MHz signal from tunable IF assembly Z301 (via mixer/oscillator control assembly Z109), with a 2-3 MHz signal derived from harmonics of the 100-Hz input from digital counter assembly. Z102. The resultant 250-KHz output is directly related to the 3.25-2.25 MHz oscillator output and provides a phase detector lock every 100 Hz. In turn, the phase detector in the sync/afc assembly (Z117) develops a d-c voltage that is applied to the 3.25-2.25 MHz oscillator in the tunable IF assembly. Therefore, if the oscillator frequency has an inaccuracy of 100 Hz, the phase detector d-c voltage derived from the 100-Hz synthesizer output signal locks it at that frequency. For frequencies between 100 Hz increments, the front panel FINE TUNE control varies the 1.25 MHz XVCO oscillator in the sync/afc assembly to offset the 1.25 MHz frequency to lock both signals at a 100-Hz incremental lock.

4-44. SAMPLE MIXER ASSEMBLY Z303.

4-45. Sample mixer assembly Z303 receives a sample signal from the 163.5-192.5 and 160.5 MHz oscillators and mixes them to generate an output frequency in the range of 3-32 MHz. Because the frequency of the 163.5-192.5-Hz oscillator varies with the receiver operating frequency, the precise 3-32 MHz output frequency is proportional to the operating frequency. The 3-32 MHz output frequency is applied to the sample divide/phase detector assembly Z107.

4-46. 1 MHZ STANDARD Z202.

4-47. The 1 MHz standard assembly Z202 provides an extremely stable 1-MHz signal to the 7 MHz generator assembly Z106, MHz display/divider assembly Z103, BFO assembly Z118. Sample divider Ø detector assembly Z107 and to sync afc assembly Z117.

4-48. BFO ASSEMBLY Z118.

4-49. The BFO assembly Z118 receives a 1-MHz square wave, divides it by four, and applies the resultant 250-KHz signal to the USB assembly Z115, and to the LSB assembly Z116 (if used). In the USB and/or LSB assemblies, the 250-KHz signal is mixed with incoming c-w signals to provide an audible tone. A front panel BFO pushbutton switch enables a fixed 250-KHz beat frequency signal, or a variable BFO, the control of tone approximately 1000 Hz on either side of zero.

4-50. SYMMETRICAL FILTER ASSEMBLIES Z112 AND Z113.

4-51. The symmetrical filters provide the signal bandwidth selected from front panel pushbuttons. The symmetrical filters receive the 250-KHz IF signal from tunable IF assembly Z301 when operating in the a-m and c-w mode. The signal is then passed through a narrow band filter which is designed to meet the user's requirement. Symmetrical filter Z112 contains two filter and amplifier circuits. with a 0.4 and 1 KHz bandpass, respectively, and Z113 contains two filters and amplifiers, with a 3 and 6 KHz bandpass, respectively, in addition to a wideband amplifier with approximately a 12-kHz bandwidth. The desired bandwidth is selected by a pushbutton switch on the front panel. The symmetrical filters are disabled in SSB operation.

4-52. USB FILTER ASSEMBLY Z115.

4-53. During USB or ISB operation, the USB filter assembly Z115 receives a 250-KHz IF signal from the tunable IF assembly Z301 (in a-m or c-w operation, the signal is received through one of the narrow band symmetrical filters), and mixes it with a 250-KHz signal from the BFO assembly (derived from the 1 MHz standard), to produce an audio tone. The resultant audio is amplified in the audio circuit of the USB filter assembly and applied to the rear panel output terminals for the USB 600 ohm distribution line. The audio signal is also applied via the AF GAIN control, to an audio amplifier circuit in audio assembly Z114 where sufficient audio drive is developed for the internal and external speakers.

4-54. LSB FILTER ASSEMBLY Z116.

4-55. The LSB filter assembly Z116 is similar to USB filter assembly Z116 except for the filter bandpass range. During LSB or ISB operation, the LSB filter assembly receives the 250-KHz signals from the tunable IF and BFO assemblies and applies the resultant audio to the rear panel terminals of the LSB 600 ohm line.

4-56. AUDIO ASSEMBLY Z114.

4-57. Audio assembly Z114 receives an audio signal from the output of the side-band filter assembly via the METER USB/LSB switch and the AF GAIN control, amplifies it to the speaker via the PHONES jack. It applies the same signal, after rectification, to the front panel meter, via the sync switch. (The sync switch is set to off when a relative audio reading is desired.) The audio assembly also contains a squelch circuit, controlled by the SQUELCH control on the front panel, which operates in conjunction with the audio disable relay in the preselector assembly.

4-58. DIGITAL LOGIC AND CONTROL CIRCUITS, BLOCK DIAGRAM DISCUSSION.

4-59. MHZ SWITCH S101.

4-60. The MHZ switch controls the tuning of the receiver. The switch wafers are constructed in such a manner as to generate a group of opens and closures to ground for each band setting (00, 01, etc.). These opens and closures are excess three binary codes which represent each frequency setting. A total of six binary levels are generated by the MHZ switch, from X0 to X5. Thus, the Xo signal represents a binary 2^0, the X1 signal represents a binary 2^1, ..., and the X5 signal represents a binary 2^5. A group of signals applied simultaneously to an assembly represents a binary code; for example, with X3 open, X2 ground, X1 ground, and X0 open, the group represents a binary code of 1001. The codes are applied to the multi-band preselector assembly Z121, the MHz display/divider assembly Z103, and the sample divide/phase detector assembly Z107.

4-61. 7 MHZ GENERATOR ASSEMBLY Z106.

4-62. The 7 Hz generator assembly Z106 develops a 7 MHz signal that is applied to sample/divider assembly Z107. The 7 MHz signal is generated by utilizing a 1-MHz square-wave which originated in the 1-MHz standard as a sine wave. The 1-MHz square wave is applied to the 7 MHz oscillator through a crystal filter (7MHz). The output is passed through a second crystal filter tuned to the same frequency. The resultant output is applied through a logic inverter to the memory assembly Z105.

4-63. MHZ DISPLAY/DIVIDER ASSEMBLY Z103.

4-64. The MHz display/divider assembly Z103 receives: a 1-MHz signal; a binary coded signal X0 through X5 from the MHZ switch; and two inputs from the flip-flops in the digital counter assembly. The binary coded signals from the MHZ switch program logic gates in the assembly, which provide a HI/LO signal for the mixer/oscillator control assembly Z109, a true complement signal for the comparator assembly Z104, a control signal for the preselector assembly relay, which disables the high pass filter during a-m operation, a preset signal for the memory assembly, and 1-MHz and 10-MHz digital logic outputs for the digital counter assemblies. An input is also provided to receive preset pulses from a remote control installation, and an output of -8 volts dc is provided to the RF GAIN control for distribution to the agc line of the receiver. In addition, outputs are provided for 250 KHz, 1 KHz, and Gating and control signals for the comparator assembly Z104 and memory assembly Z105.

4-65. SAMPLE DIVIDE/PHASE DETECTOR Z107.

4-66. Sample divide/phase detector assembly Z107 receives a signal in the range of 3-32 MHz from sample mixer assembly Z303 and utilizes it as one input to programmable divider circuits. The divide factor of each programmable divider circuit is controlled by the binary coded signals resulting from the setting of the front panel MHz switch S101, indicating the desired operating frequency of the receiver. For example, when the MHz switch S101 is set to 10 MHz, the sample divider is programmed to divide by 13.

4-67. The sample divide circuitry of Z107 assembly forms a closed loop with assembly Z104, memory assembly Z105, 163.5-192.5 MHz oscillator assembly Z304, and sample mixer assembly Z303. With the MHz switch set to 10 MHz the resultant output of sample mixer assembly Z303 will be 13 MHz. The output of the sample divide circuitry of Z107 programmed to divide by a factor of 13 will result in a frequency of 1 MHz. Therefore, for each setting of the MHz switch S101, the resulting output of the sample divide circuitry of Z107 will be 1 MHz. The 1 MHz signal is applied to two areas. First of all the 1 MHz signal is divided by a factor of three (333,333 Hz), and is applied to Comparator assembly Z304. The difference from the resulting 333,333 Hz output of the sample divide circuit indicates to the comparator assembly the direction and amount of voltage change required of the memory assembly. The d-c tune output of the memory assembly then changes accordingly and varies the frequency of the 163.5-192.5 MHz oscillator output. A sample of the oscillator output is then applied to the sample mixer assembly, resulting in a 3-32 MHz frequency output that is applied back to the sample divide circuit. The process continues until the output of the sample divide circuit is 333,333 Hz at which point the memory assembly maintains the d-c tune output voltage.

4-68. The 1 MHz signal is also applied to a phase detector circuit which compares the "loop" frequency divided to 1 MHz with the stable 1 MHz signal from 1 MHz Standard Z202. This phase detector serves to correct the 163.5-192.5 MHz oscillator Z304 for any slight changes with a d-c correction voltage in the proper direction.

4-69. COMPARATOR ASSEMBLY Z104.

4-70. Comparator assembly Z104 receives a square wave frequency of 333,333 Hz from the Sample/Divide Phase Detector assembly Z107 when the 163.5-192.5 MHz oscillator is tuned to the correct frequency. The circuitry within the comparator assembly Z104 counts the frequency from the sample divide/phase detector assembly Z107 and applies this data to four digital comparators. The comparators are set to identify the magnitude of 3334. When the input data is greater or less than the stored data, the comparators activate logic circuits to generate logic levels and counter control for the memory assembly. They are: tune high/low - logic levels for determination of the direction of change in oscillator retuning; fast tune (logic 1 level) causes the memory to generate large d-c tuning steps until the oscillator change reflects through the comparator to switch to; coarse tune (logic 1 level) causing a medium magnitude of d-c tuning steps until the oscillator change brings about a "sync" or "locked" condition. The fast inhibit is activated when the magnitude of 333X (X denotes any digit) is identified. The coarse inhibit is activated when the magnitude of 3334 is identified. A two speed memory shift (Ø) circuit is used which is controlled as follows: For low bands 00-09 MHz the fast shift is used up to 3XXX and then the slow shift is used up to 3334. For high bands 10-29 MHz the fast shift is used up to 33XX and then the slow shift is used up to 3334.

4-71. MEMORY ASSEMBLY Z105.

4-72. Memory assembly Z105 receives logic levels from the comparator assembly and, depending on whether the levels are high or low, generates a d-c tune voltage for the 163.5-192.5 mHz oscillator. If the oscillator frequency is only slightly different from the frequency set by the MHZ switch, the memory receives a fast inhibit level (low) from the comparator, and a high enable for the input gates to the coarse and tune HI/LO circuits, The coarse tune circuit generates a relatively small d-c tune signal which is just enough to retune the oscillator assembly. However, if the MHZ switch is set to a new position, the memory assembly receives a coarse inhibit (low logic level) from the comparator assembly which will inhibit the input gate for the coarse tune circuit. The fast input receives a high logic level, and the fast tune circuit generates a large d-c tune signal to bring the oscillator frequency within capture range of the coarse tune circuit in the comparator assembly. When this occurs, the fast tune memory input receives an inhibit level and the coarse tune circuit receives an enable level (logic high). The coarse tune circuit then generates a d-c tune signal to bring the oscillator frequency within capture range of the phase detector and error signal voltage circuits, at which time the memory receives an inhibit signal for the coarse tune and tune HI/LO circuits. The DC tune signal is generating by a frequency-to-voltage conversion performed by a discriminator circuit. The discriminator circuits for the two tune circuits are in series, resulting in one averaged output. The memory assembly also receives from the comparator assembly the following signals: a tune HI/LO signal which determines the direction of the change in the d-c tune signal for the oscillator; a "two speed" clock pulse and a preset pulse from the MHz display/ divider assembly Z103; and a 7- MHzclock pulse from the 7 MHz generator assembly

Z106 which activates the gates and counters of the memory circuits.

4-73. 1-MHZ STANDARD Z202.

4-74. The 1-MHz standard generates a high-stability sine wave, and distributes it to the MHz display divider assembly, 7 MHz generator, BFO assembly, sample/divider/Ø detector assembly, and to sync afc assembly.

4-75. DIGITAL COUNTER ASSEMBLY Z102.

4-76. Digital counter assembly Z102 receives binary coded 10-MHz and 1-MHz signals from the MHZ switch via the MHz display/divider assembly Z103, and a 1-KHz clock pulse directly from the MHz display/divider assembly. The binary code applied to the 10-MHz input generates outputs to the 10-MHz driver circuit in the readout display assembly, and the binary code applied to the 1-MHz input generates outputs for the 1-MHz driver circuits in the readout display assembly. The 1-KHz clock pulse triggers the operation of some of the decade counters and flip-flops in the digital counter. In addition. a 1 to 2 MHz square wave signal from the mixer oscillator assembly provides clock pulses for the counting circuits. A 100-Hz signal for the 100 Hz synthesizer assembly is generated by passing the 1-KHz clock pulse through a decade counter circuit. Outputs from FF-1 and FF-2 in the digital counter are applied to the gate circuits of the MHz display divider Z103. The binary coded decimal outputs of the 10 MHz, 1 MHz, 100 KHz, 10 KHz, 1 KHz, and 0.1 KHz circuits are applied to the corresponding inputs of the readout display.

4-77. READOUT DISPLAY ASSEMBLY Z101.

4-78. Readout display assembly Z101 receives binary coded decimal inputs from the 10 MHz, 1 MHz, 100 KHz, 10 KHz, 1 KHz, and 0.1 KHz circuits of the digital counter assembly and applies them to the appropriate decoder-driver circuits 10 MHz, 1 MHz, 100 KHz, 10 KHz, 1 KHz, and 0.1 KHz, respectively. The driver circuits activate the appropriate filament segments of each numeric indicator thereby displaying the proper numbers for the receiver operating frequency. The blanking circuit will blank the display when tuning below 00.0000 MHz or above 29.9999 MHz.

4-79. SIGNAL FLOW CIRCUITS, CIRCUIT ANALYSIS.

4-80. BDCST PRESELECTOR ASSEMBLY Z120. (See figure 7-35)

4-81. Preselector assembly Z120 receives the antenna signal via ANT IN Jack J2 and controls the insertion of a 500 to 1600 KHz filter in the signal path. Relays K1 and K2 are in the normally deenergized state. Under these conditions, the antenna input signal is routed through normally closed contacts of relay K1, through the normally closed contacts of relay K2, through the filter, and applied to Multi-band preselector assembly Z121 via normally closed contacts of relay K2 and RF OUT Jack J1. This signal routing is applicable only when the receiver is tuned to any frequency not in the broadcast band range. In the broadcast band range, relay K2 is energized with the result that the two sets of contacts of K2 bypass the filter and route the input antenna signal directly through the preselector and out to the Multi-band preselector assembly. The energizing of relay K2 is controlled by the MHZ switch setting and a signal routed via the MHz display/divider assembly Z103.

4-82. Relay K1 is energized by a receiver disable signal at terminal 2 when an associated transmitter antenna is used in conjunction with the receiver, and grounds the input signal in the preselector assembly. Relay K1 also disables the audio on the audio assembly Z114.

4-83. MULTI-BAND PRESELECTOR Z121. (See figure 7-38)

4-84. Multi-band preselector (Z121) receives its input signal from the BDCST Band Preselector (Z120) via RF input connector P1. The input signal is capacitively coupled into a common RF input line for each filter section. Filter selection is accomplished by the binary coded information obtianed by the MHz switch (S101) through bit lines X_0 thru X_5. Programmable Read Only Memory (PROM) Z1 monitors the bit lines and provides 4 line band information for BCD to decimal decoder Z2. BCD to decimal decoder Z2 converts the 4 line information into band information for the filter sections (nine lines). A low (logic 0) on the selected filter section will turn that filter section ON. Consider filter 1 (.1-1 MHz). A low from Z2 pin 2 will switch Q1 off which will provide a high at R1 to reverse bias CR2 and CR4. The RF input signal will then flow thru C11 and CR1 into the low pass filter section and out CR3, C19 into the common RF output line. When another filter section is selected pin 2 of Z2 will switch to a high (logic 1) causing Q1 to conduct thru R1. The level at R1 will drop to a low causing CR2 and CR4 to conduct thru L11, L12 and R3. CR1 and CR3 will be reversed biased and no RF signal will pass through the filter section.

4-85. Bands 1 and 2 filters are of the low pass type with cut-off frequencies of 1 and 2.2 MHz. respectively. Band 3 filter is double tuned and covers the range of 2-3 MHz. Bands 4 and 5 are triple tuned and covers the ranges of 3-4 MHz and 4-6 MHz respectively. Bands 6 thru 9 are double tuned circuits covering the following ranges in order: 6-10 MHz, 10-15 MHz, 15-20 MHz, and 20-29.9999 MHz. The output of the filters are combined and presented to Q5 which is a FET broad band amplifier. Q6 (2N2222) acts as a constant current regulator for the grounded gate FET circuit. The FET is transformer coupled by a broad-band transformer T6 to RF input mixer assembly Z307.

4-86. 163.5-192.5 MHZ OSCILLATOR ASSEMBLY Z304. (See figure 7-47)

4-87. The 163.5-192.5 MHz oscillator assembly Z304 develops the first mixing frequency which is 163.5 MHz above the receiver MHz frequency. The initial frequency input to Z304 is established by the oscillator d-c control input at terminal E15 which is derived from memory assembly Z105 and places the oscillator at the required frequency.

4-88. The 163.5-192.5 mHz oscillator assembly Z304 contains two oscillator circuits; one operates in the upper half of the required operating range, and the second oscillator operates in the lower half of the range. When the front panel MHZ switch is set to any band which requires an oscillator signal in the range of 163.5-175.5 MHz, low band oscillator circuit Q1, Q2 is activated by +8 volts dc at terminal E17 from the low-band control circuit in mixer/oscillator control assembly Z109. When the MHZ switch is set to a band which requires an oscillator signal in the range of 176.5-192.5 MHz, oscillator circuit Q6, Q7 is activated by +8 volts dc at terminal E16 from the high-band control circuit in the mixer/oscillator control assembly. The output of the selected oscillator is amplified by Q5, Q4 and applied to RF input mixer Z307 via terminal E21.

4-89. A sample of the oscillator output frequency at terminal E20 is applied to sample mixer assembly Z303 where it is mixed with the 160.5 MHz output of Z302 to yield a 3-32 MHz output frequency that is applied to sample divide/phase detector assembly Z107. The sample divide/phase detector assembly then produces the fast loop error control signal voltage that is applied to terminal E14 and corrects and/or maintains the required output frequency of the selected oscillator.

4-90. RF INPUT MIXER ASSEMBLY Z307. (See figure 7-51)

4-91. RF input mixer assembly Z307, is shown in figure 7-50. The RF input mixer assembly receives the output signal of multi band preselector Z121 at pin E23 and applied the received signal to terminal 6 of mixer Z1. Also applied to mixer Z1 is the 163.5 to 192.5 MHz oscillator signal from 163.5-192.5 MHz oscillator assembly Z304 via pin E25 and is applied to terminal 1 of Z1. Mixer Z1 combines the two input frequencies and applies the resulting sum and difference frequencies to difference amplifier assembly Z306.

4-92. DIFFERENCE AMPLIFIER ASSEMBLY Z306. (See figure 7-49)

4-93. Difference amplifier assembly Z306 contains three stages of tuned amplifier circuits centered at 163 MHz and a bandwidth of ±0.5 MHz. In all, there are 8 tuned sections which help to achieve a 1.0 MHz bandwidth with sharp slopes, The tuned circuits selectedthe difference output signal from IF input mixer assembly Z307. The agc signal from USB and LSB filter assemblies Z115 and Z116, respectively is applied to E39 and Z306 and controls the amplification of Q1, Q2, and Q3. The resultant amplified signal is applied to pin E43 of IF output mixer assembly Z305.

4-94. IF OUTPUT MIXER ASSEMBLY Z305. (See figure 7-50)

4-95. The 163.0 ±0.5 MHz signal from difference amplifier assembly Z306 is received at input terminal E43 and applied to input terminal 6 of mixer Z1. The 160.5 MHz signal from the 160.5 MHz oscillator assembly Z302 is applied to terminal 1 of Z1 via terminal E45. Z1 mixes the two frequencies to obtain the sum and difference frequencies. The band pass filter from output terminal 4 of Z1 passes the difference frequency in the range of 2-3 MHz to output terminal E47 of Z305 where it is then connected to the input of the tunable IF assembly Z301.

4-96. 160.5 MHz OSCILLATOR ASSEMBLY Z302 (See figure 7-43)

4-97. The 160.5 MHz oscillator assembly Z302 develops a 160.5 MHz-signal that is derived from a 53.5 MHz crystal. The oscillator circuit consists of Y1, C2, and Q1. Amplifiers Q2 and Q3 are tuned to the third overtone of the basic xtal frequency on 160.5 MHz. The oscillator output is routed via terminal E3 to terminal E45 of IF output mixer assembly Z305 to provide the second IF conversion in the receiver. In addition, a sample of the amplified oscillator signal is applied via terminal E4 to terminal E9 of the sample mixer assembly Z303.

4-98. TUNABLE IF ASSEMBLY Z301. (See figure 7-41)

4-99. Tunable IF assembly Z301 amplifies and mixes the 3-2 MHz input signal from IF output mixer assembly Z305 with an internally generated 3.25-2.25 MHz signal to produce the desired 250 KHz IF output signal. In turn, the internal 3-25-2.25 MHz oscillator frequency is controlled by the front panel TUNE control, is adjusted by a d-c signal returned from the sync/afc assembly Z117, and is divided into 10 bands, as a function of frequency change to optimize the selectivity of the receiver. The resultant exact output frequency of the 3.25-2.25 MHz oscillator controls a number of parameters in the receiver. The output of the 3.25-2.25 MHz oscillator is applied to mixer/oscillator control assembly Z109 where it develops the 1-2 MHz signal frequency for display of the exact receiver operating frequency. The frequency is also applied, via Z109, to the 100 Hz synthesizer assembly Z110. The 250-KHz output signal is also applied to sync/afc assembly Z117 via the AFC position of the front panel AFC/SYNTH switch.

4-100. The tunable IF assembly receives a 3-2 MHz signal at pin E1 from IF output mixer assembly Z305. The input signal is amplifier by dual gate field effect transistors (FET's) Q1, Q2, and Q3. Transformers T1, T2, and T3 enable tuning the amplifier circuits to provide a 1-MHz bandwidth for the input signal. The resultant amplified output of Q3 is applied to FET mixer Q6. All amplifiers are tracked with the 3.25-2.25 MHz oscillator and are tuned by the front panel tune control.

4-101. Also applied to FET mixer Q6 is the output of 3.25-2.25 MHz oscillator Q4. The difference frequency is selected by transformer T6 and the resultant 250-KHz output signal is applied to the USB filter Z115, symmetrical filters Z112 and Z113 (optional) LSB filter Z116, and also to the sync/afc assembly Z117 when the front panel AFC switch is set to AFC (depressed). The 3.25-2.25 MHz oscillator output signal is also made available at pin E5 and is applied to mixer/oscillator control assembly Z109.

4-102. The oscillator control voltage input at pin E4 is a d-c voltage derived from sync/afc assembly Z117 and represents a correction voltage creating a closed loop to correct the oscillator.

4-103. The sections of TUNE switch divide the tunable IF assembly into 10 bands as a function of frequency change to optimize the selectivity of the receiver. Since the amplifier stages are varicap controlled, each band is individually optimized. Similarly, the 3.25-2.25 MHz oscillator is divided into 10 bands. This feature results in extremely tight tracking and minimum tracking error.

4-104. The voltage at E10 is routed to the 100 Hz Synthesizer assembly Z110 and is applied to the varicap controlled amplifiers.

4-105. MIXER/OSCILLATOR CONTROL ASSEMBLY Z109. (See figure 7-16)

4-106. Mixer/oscillator control assembly Z109 contains two discrete circuits. The mixer portion of the assembly mixes the 2.25-3.25 MHz signal from tunable IF assembly C301 with a 4.25 MHz signal derived from the 17th harmonic of the 250 kHz signal input from display divider assembly Z103. The oscillator d-c switching portion of the assembly develops the high and low oscillator switching voltage for the 163.5-192.5 MHz oscillator assembly as a result of receiving information from display divider assembly Z103.

4-107. The mixer portion of the assembly receives the 2.25-3.25 MHz signal from tunable IF assembly Z301. The exact frequency within this received frequency range is determined by the setting of the front panel TUNE control and is corrected by the dc loop signal from the sync/afc assembly Z117. Thus, when the last four digits of the display are set to XX.000 (low end of band), a 3.25 MHz signal is applied to the mixer portion. When the last four digits are XX.9999, a 2.2499 MHz signal is applied to the mixer portion.

4-108. The 250 KHz signal from display divider Z103 is applied to tuned multiplier/amplifier circuit consisting of Q4 and Q5. Tuned circuits, adjsutable by L2, L3, and L4 are set for the 17th harmonic of the 250 KHz input signal, resulting in a 4.25 MHz signal. The 4.25 MHz signal is mixed with the 3.25-2.25 MHz signal in Q6, resulting in a 1-2 MHz output signal frequency. The signal is buffered by emitter follower Q7, filtered by L8, L9, L10, C15, C17, C19, and C21, and amplified by Q8 and Q9 and the resultant 1-2 MHz signal is applied to digital counter assembly Z102 where it is counted and displayed as the exact operating frequency of the receiver.

4-109. The oscillator d-c switching portion of mixer/oscillator control assembly Z109 receives a HI/LO (logic 1 or logic 0, respectively) signal from display/divider Z103. When the front panel MHZ switch is set between 00 and 12 MHZ, a logic 0 (ground) level is applied at pin C. As a result, Q1 turns on Q3 and +8 volts is applied through Q3 to pin 2 to activate the low oscillator in the 163.5-192.5 mHz oscillator assembly. When the MHZ switch is set between 13 and 29 MHz, a logic 1 (+5 volt) level is applied to pin C, Q1 turns on Q2, and +8 volts is applied through Q2 and pin D to activate the high oscillator in the 163.5-192.5 MHz oscillator assembly.

4-110. SYNC/AFC ASSEMBLY Z117. (See figure 7-28)

4-111. Sync/afc assembly Z117 develops a d-c voltage that is used to correct the frequency of the 3.25-2.25 MHz oscillator in the tunable IF assembly. The sync/afc assembly also provides two outputs that indicate that tuning of the receiver is correct via a visual SYNC indicator lighting and a zero centered indication on the front panel meter when the meter switch is set to SYNC.

4-112. The 250-KHz input to the sync/afc assembly is from tunable IF assembly Z301 when the AFC switch is in the AFC position or is from 100 Hz synthesizer Z110 when the AFC/SYNTH switch is in the SYNTH position. The 250-KHz input at pin A is amplified by Q1 and applied to filter FL1. The filter is tuned to 250 KHz with a bandpass of ±50 Hz. The resultant output signal is then amplified by Q2, Q3, Q4, Q6, and Q7. The output of Q7 is applied to center tap of transformer T1 which operates in conjunction with Q5 to form a phase detector circuit.

4-113. The second 250-KHz input to the phase detector circuit is derived on the XVCO (voltage controlled crystal oscillator) subassembly of the sync/afc assembly. Crystal Y1 operates in conjunction with Q1 to develop 1.25-MHz signals that are applied to mixer Q2. The fine tune input at pin E2 of the subassembly via terminal J of the sync/afc assembly provides a means of correcting the XVCO oscillator frequency ±50 Hz to coincide with the ±50 Hz band width of filter FL1.

4-114. Fine tuning is provided by the front panel FINE TUNE control. Also applied to the mixer circuit Q2 is a 1-MHz signal at pin E6 of the subassembly via terminal 2 of the sync/afc assembly and is derived from the 1-MHz standard. The resultant 250-KHz output signal of mixer Q2 is the second input to the phase detector circuit and is routed between the subassemblies and applied to the base of Q5.

4-115. The resultant phase detector output is a d-c voltage which controls direction and the frequency of the 3.25-2.25 MHz oscillator in tunable IF assembly Z301 to return to a 250 KHz output signal. The magnitude of the d-c voltage indicates the amount of frequency correction. The d-c voltage is amplified by integrated circuit Z1 with the resultant output of Z1 applied to the tunable IF assembly via pin 7.

4-116. The output of Z1 is also made available at pin 3 via FET Q8 and meter adjust potentiometer R44. The output at pin 3 is applied to the front panel meter via the SYNC position of the meter select switch.

4-117. Two types of visual tuning are made available. One type is via the center-reading meter and is derived from the d-c output at pin 3. However, since the front panel meter is capable of monitoring a number of parameters, a sync indicator lights to indicate proper tuning. This second indication is derived by the 250-kHz

4-118. 100 HZ SYNTHESIZER ASSEMBLY Z110. (See figure)

4-119. The 100 Hz synthesizer assembly Z110 provides a 250-KHz signal at every

100-Hz increment to the sync/afc assembly when the AFC/SYNTH switch is set to SYNTH. The 100-Hz synthesizer receives the 3.25-2.25 MHz signal at pin 9 which is derived in the tunable IF assembly Z301, and also receives a 100 Hz square wave at pin L from digital counter assembly Z102. A third input to the synthesizer at pin D is the varicap input voltage derived from the TUNE selector switch.

4-120. The 100-Hz square wave input at pin L is applied to harmonic generator Q4 which develops a spectrum of 100-Hz signals. The resultant signals are applied through tuned circuits adjusted by T3 and T4 which extracts the 2-3 MHz frequency range of the 100-Hz signals. The varicap input voltage at pin D is derived from a wafer on the TUNE control and is also divided into 10 bands for increased selectivity. A voltage is selected that approximately tunes the tuned circuits in the region required in the 2-3 MHz range.

4-121. The 100-Hz signals in the 2-3 MHz range are then mixed with the 3.25-2.25 MHz signal returned from the tunable IF assembly. The 3.25-2.25 MHz input signal is applied to pin 9, is amplified by tuned amplifier Q3, and applied to mixer Q2. The second input to mixer Q2 is the 2-3 MHz signal filled with 100-Hz signals. The difference output frequency of the mixer is selected by T1, T2, and Q1 and is the desired 250-KHz output signal.

4-122. The 250-KHz output signal is applied to the 250-KHz filter in the sync/afc assembly Z117 when the front panel AFC/SYNTH switch is set to SYNTH. The 250-KHz output is directly related to the 3.25-2.25 MHz oscillator and provides a phase detector lock every 100 Hz in that band. The phase detector in the sync/afc assembly develops a d-c voltage that is applied to the 3.25-2.25 MHz oscillator in the tunable IF assembly. Therefore, if the oscillator frequency has an inaccuracy of 100 Hz, the phase detector d-c voltage derived from the 100-Hz synthesizer output signal will lock it at that frequency. For frequencies between 100-Hz increments, the front panel FINE TUNE control varies the 1.25-MHz oscillator in the sync/afc assembly sufficiently to offset the 1.25 MHz frequency to lock both signals at a 100-Hz increments lock. The FINE TUNE provides ±50 Hz. This system provides a very accurate means of controlling frequency, because only the 3.25-2.25 MHz oscillator, a low frequency oscillator, is controlled.

4-123. SAMPLE MIXER ASSEMBLY Z303. (See figure 7-45)

4-124. Sample mixer assembly Z303 compares a sample of the 163.5-192.5 MHz oscillator output against a sample of the 160.5 mHz oscillator frequency and develops a 3-32 MHz output. Pin E7 receives a sample voltage from the 163.5-192.5 MHz oscillator and applies it to one input of amplifier Z1. Pin E9 receives a sample voltage from the 160.5 MHz oscillator assembly and applies it to the other input of amplifier Z1. The two signals are mixed, and their difference frequency in the range of 3-32 MHz is amplified in Z1, Q1, and Q2, and then applied to output pin E12. The signal is then routed to Sample Divide/Phase detector assembly Z107.

4-125. BFO ASSEMBLY Z118. (See figure 7-31)

4-126. The BFO assembly Z118 receives the 1-MHz standard input at pin 2 and squares it in Q2. The squared output of Q2 is applied to divide-by-four dual J-K flip-flop Z1. The resultant 250-kHz square wave output is applied through a NAND gate in logic circuit Z2, to pin K and is routed from there to the USB and LSB assemblies. In all modes except AM, integrated circuit Z1 receives an enabling voltage through BFO control transistor Q4. In AM operation, the base of Q4 receives a ground logic level via pin H from the mode switch and Q4 cuts off, thereby disabling Z1. The variable 250-kHz BFO signal is generated by audio oscillator Q1 via amplifier Q3 and the logic gate in Z2. The frequency is adjusted by the BFO control on the front panel which varies the voltage on varicap CR2 from zero to +9 volts dc, resulting in a ±1-KHz swing. The BFO frequency is fixed at 250 KHz when the BFO pushbutton is set to FXD by applying a ground to logic circuit X2 via pin D.

4-127. SYMMETRICAL FILTER (0.4 KHZ, 1 KHZ) Z112 AND SYMMETRICAL FILTER (3 KHZ, 6 KHZ, WB) Z113 ASSEMBLIES (See figure 7-22)

4-128. Either one, or both, of these filter assemblies may in incorporated in the receiver. If both are installed, internal circuitry and external pin connections are identical, except for narrow band filters FL1 and FL2. In the Z112 assembly, the bandpass of FL1 is 0.4 KHz centered at 250 KHz and the bandpass of FL2 is 1 KHz, centered at 250 KHz. In the C113 assembly, the bandpass of FL1 is 3 KHz, and the bandpass of FL2 is 6 KHz. Also, in Z113, the wide band amplifier (approximately 12 KHz bandpass) can be used instead of the narrow band filters. Selection of the desired narrow annd filter is accomplished by pressing one of the BANDWIDTH pushbuttons on the front panel, which applies a control ground level via pin B, Pin L, or Pin 6 to amplifier Q2, Q4, or Q6, respectively. The ground activates the amplifier, passing the signal applied to that circuit to the SYM OUT line via pin 3. The input to each of the filter section is a 250 KHz sine wave applied to all of the inputs simultaneously from terminal E9 of the tunable IF assembly.

4-129. UPPER SIDEBAND FILTER ASSEMBLY Z115. (See figure 7-26) .

4-130. When the receiver MODE switch is set to USB position (or ISB, if this option is incorporated in the receiver), a USB control ground from the MODE switch, via pin A, turns on transistors Q1 and Q2 and applies the 250 kHz signal to FET amplifier Q3. A 3-KHz bandpass filter Z115FL1 establishes the bandwidth and frequency range of the sideband signal while it passes through the Q1, Q2, amplifier. The 250-KHz input at pin 3 is enabled when the MODE switch is set to AM or CW position; the 250-kHz signal then comes from symmetrical filter Z112 or Z113 via pin 3. The specific symmetrical filter required depends on the desired bandwidth.

4-131. Q3 amplifies the signal and clamping diodes CR1, CR2 provide automatic noise limiting when the ANL switch is set to ON and grounds pin 2. The 250-KHz signal is then amplified by Q4 and Q5, and is applied to one of the gates of product detector Q8. A 250-KHz BFO signal at pin D during c-w operation is applied to the second gate of product detector Q8, producing an audio tone. The pitch of the tone is varied by the BFO control on the front panel. The audio is applied to audio output amplifier Z1 which, in turn, drives the 600-ohm audio distribution line connected to pins J, K, and L. A second audio signal from Z1 is applied to pin 8 where it is connected through the audio line adjust potentiometer and back through pin 9 to the feedback input of Z1. The audio signal from pin 8 is also connected through the METER USB pushbutton to pin B of audio assembly Z114 where it is again amplified and connected to the internal speaker and the external speaker terminals on the rear panel.

4-132. The current path for the source of product detector Q8 is provided by Q10; however, during AM operation, the AM control ground from the MODE switch turns off Q10 via pin 6 and disables product detector Q8. The AM control ground from pin 6 also turns on amplifier Q9 during AM operation, providing the 250-KHz signal with a path to a-m detector CR6. The audio signal on the carrier is recovered by CR6 and applied to the input of audio output amplifier Z1 (the audio signal from the product detector is now disabled and does not interfere). The audio is applied to the 600-ohm line and the internal speaker and external speaker jack as in c-w operation.

4-133. In all modes of operation, AGC voltage is developed by tapping off the 250-KHz signal at the output of amplifier Q5 through AGC level adjust potentiometer R38, through amplifiers Q6 and Q7, with AGC detector CR3, CR4 providing the d-c voltage for automatic gain control of the various IF amplifiers. The AGC voltage is connected to the AGC distribution line through pin 7 and the AGC switch on the front panel.

4-134. LOWER SIDEBAND FILTER ASSEMBLY Z116. (See figure 7-26)

4-135. Functional operation of the lower sideband filter assembly is the same as the upper sideband filter assembly with the following exceptions:

1. Bandpass filter Z116FL1 passes 3 KHz in the lower sideband range instead of the upper sideband range; i.e., the filter passes 247.0 to 249.7 KHz.

2. The ground signal which activates transistors Q1 and Q2 via pin A comes from the LSB control line instead of the USB control line.

3. The 600-ohm line adjustment potentiometer, connected across pins 8 and 9, is the lower sideband line adjust potentiometer instead of the upper sideband adjust potentiometer.

4. The audio signal from pin 8 is connected to pin B through the METER LSB pushbutton instead of the METER USB pushbutton.

4-136. AUDIO ASSEMBLY Z114. (See figure 7-24)

4-137. The audio signal from pin 8 of USB (or LSB) assembly is applied via the METER USB (or LSB) switch and AF GAIN control to pin B. Pin B is connected to input pin 10 of power driver amplifier Z1. The amplified outputs of Z1 are applied to push-pull transistors Q1 and Q2 which, in turn, drive the internal speaker of the receiver via pin A. The output is also applied through a rectifier bridge, pins 3 and J, and the METER and AFC switches, to the RF/audio/sync meter on the front panel to provide monitoring of the audio signal.

4-138. AGC voltage at pin 9 from the AGC line is applied to FET amplifier Q3. The amplified output is then applied to the METER switch via pin 7 to provide monitoring of the RF level of the signal. The AGC voltage at pin 9 is also applied to source follower Q4 which provides regulation and isolation to the AGC voltage.

4-139. Squelching of the audio and RF under excessively strong signal conditions is also accomplished on Z114.

The output voltage of source-follower Q4 is applied to the non-inverting input of squelch amplifier Z2, and to one end of the squelch control. The output of the squelch amplifier is connected back to its inputs in a feedback configuration consisting of the squelch control and a network of resistors.

4-140. DIGITAL LOGIC AND CONTROL CIRCUITS, CIRCUIT ANALYSIS.

4-141. 7 MHZ GENERATOR ASSEMBLY Z106. (See figure 7-13)

4-142. The 7 MHz generator assembly develops a 7-MHz square-wave output that is applied to memory assembly Z105, and provides a interconnection for the 1 MHz signal that is applied to sample divider assembly Z107.

4-143. A 1-MHz input at pin 7 is squared by Q4 and is applied to a NAND gate in Z1. The NAND gate develops sufficient drive for the output signal at pin 6 of Z1 to trigger the input of the 7 MHz crystal controlled oscillator. The 7 MHz oscillator is resonant at a frequency determined by the input crystal Y2. A second crystal (Y1) is tuned to the same frequency as the input crystal. The 7 MHz signal is then squared by Q3 and routed through Z1 to pin C.

4-144. MHZ DISPLAY/DIVIDER ASSEMBLY Z103. (See figure 7-6)

4-145. 1-MHZ DIGIT DISPLAY. Z103 receives the excess 3 binary coded signals X0 through X5 from the MHZ switch. Binary signals X0 through X3 are applied via input pis S. T, U, and V directly to the A-inputs of 4-bit binary adder Z14. An output level from flip-flop No. 1 in the digital counter assembly is also applied via pin M, to the B1 input of Z14. The B3 input of Z14 is wired to the +5-volt bus, and is therefore always at a logic 1 level. An output level from flip-flop No. 2 in the digital counter assembly is applied via pin E and NAND gates in Z6 to the B2 input of Z14. Summing outputs 1 through 4 of Z14 are applied via pins 16, 13, 14, and 15, respectively, to the 1 MHz circuit in the digital counter assembly causing the correct digit to appear on the digit display. Whenever the last four digits of the digital display are dialed above 9999, the logic inputs of Z14 add one binary digit to its output. The 1-MHz circuit in the digital counter therefore receives a higher binary number and the 1-MHz digit displays the next higher number. Conversely, if the last four digits are dialed above 0000, the 1-MHz digit changes to the next lower number.

4-146. 10-MHZ DIGIT DISPLAY. Binary signals X4 and X5 are applied via input pins W and X, respectively, to the inputs of a 2-bit binary adder consisting of three exclusive-OR gates in Z15, and an AND gate Z13. Two inverters in Z11 provide binary carry inputs from the 1-MHz adder circuit. Whenever the 1-MHz digit is dialed from 9 up to 0, the binary carry from the 1-MHz logic circuit causes the 10 MHz digit to advance to the next higher number. Conversely, when the 1-MHz digit is dialed from 0 to 9, the binary carry from the 1-MHz logic causes the 10-MHz digit to decrease to the next lower number.

4-147. SIGNALS GENERATED BY DECADE DIVIDERS. Decade divider Z1 receives a 1-MHz square-wave via pin B and divides it by 10. The resultant 100-KHz output is divided by 10 in Z3 and again by 10 in Z5. The 1-KHz output of Z5 is applied to the digital counter assembly via pin D. The 1-KHz output of Z5 also provides clock inputs for decade divider Z4 and dual J-K fkip-flop Z2. The 10-KHz output of Z3 provides a clock input for dual J-K flip-flop Z8, and is also used as an input power source for low-level regulated power supply Q3, Q4, Q5. The -8 volts dc output is applied via pin K to the RF GAIN control and to the sync/afc assembly. The output of Z4 is applied through a NAND gate in Z6 to the K input of dual J-K flip-flop Z2 and is routed via pin 7 to the clear input of the comparator; the output of the NAND gate is inverted in Z7 and applied to the J input of Z2. The output of pin 13 of Z2 is routed via pin 5 as a 10-millisecond positive gating pulse to pin 6 of the sample divide/phase detector assembly and to pins 3 and C of the memory assembly. The output at pin 8 of the second flip-flop in Z2 generates a 250-KHz output by dividing the 500 KHz clock inputs at pin 5 by 2. This signal is routed via pin 3 to pin B of the mixer/oscillator control.

4-148. MEMORY PRESET SIGNAL. The preset pulse circuit consists of two exclusive OR gates in Z9, a dual J-K flip-flop in Z8, three inverters in Z7, and a NAND gate in Z10. It detects any change on the X0 or X4 input lines (pins S and W, respectively) from the MHZ switch. On the next clock pulse, after any change in logic level on the X0 or X4 lines, the appropriate flip-flop in Z8 (inputs connected to the exclusive OR gate in that line) will change state. This change is applied from the Q output of the flip-flop into the gate which carried the level change, and disables the gate and the flip-flop. The result is a narrow, negative-going pulse applied through the inverters in Z7 and the NAND gate in Z10 to pin H, where it is routed to the preset input of the memory assembly.

4-149. REMOTE PRESET INPUT. When the MHZ switch setting is changed at a remote location, pin P of the MHz display/divider receives a ground level via pin H of' the remote input jack J102. The ground is applied to one input of a NAND gate in Z10, enabling the gate, even if the other two inputs (from X0 and 4 lines) are logic 1 levels. The output level (logic 1) of the NAND gate is then applied through an inverter in Z7 as a logic 0 level (negative-going) pulse to pin H as in memory preset signal circuitry and activates the preset input of the memory assembly.

4-150. PRESELECTOR CONTROL SIGNAL (BDCST BAND). When the MHZ switch is set to any position except BCST, it generates two logic 1 levels on the X4 and X5 lines which are received simultaneously via pins W and X, respectively, at the inputs of a 2-input NAND gate in Z6. The gate generates an output which activates Q1 and Q2, developing a logic 0 level output at Q1. This level is routed via pin 8 to terminal E1 on the preselector assembly and applies it to the preselector filter control relay.

4-151. HI/LO SIGNAL TO MIXER/OSCILLATOR CONTROL. The high/low oscillator signal is generated in the NAND gate of Z10 which has its output connected to pin R of the assembly. This NAND gate monitors the binary code lines (X0 through X5) from the

MHZ switch via pins S through X, logic gates in Z10, Z12, and an inverter in Z7, and generates a logic 1 level at its output when any of its inputs are logic 0 levels. This occurs when the MHZ switch is set to any position from 13 through 29 MHZ. The logic 1 level is then applied to pin C of the mixer/oscillator control. When the MHZ switch is set to 00 through 12 MHZ, the NAND gate in Z10 generates a logic 0 level at its output and this level is applied to pin C of the mixer/oscillator control.

4-152. TRUE COMPLEMENT SIGNAL. When binary coded signals X4 and X5 at pins W and X are dissimilar (one is a logic 1 and the other is a logic 0), an exclusive OR gate in Z15 is enabled and the resultant logic 1 output level is applied via pin 10 to the comparator assembly. This occurs when the MHZ switch is set to any position from 10 through 29 MHZ, and causes the comparator assembly to switch a clock frequency for the memory assembly.

4-153. SAMPLE DIVIDE/PHASE DETECTOR ASSEMBLY Z107 (See figure 7-14)

4-154. The 3-32 MHz output frequency of the sample mixer assembly Z303 is applied to switching amplifier Q1. The resulting square wave signal is routed to the digital logic section of the sample divider where it is divided by a factor determined by the MHz switch S101. MHZ switch S101 provides the sample divider with excess three binary coded levels (X0 thru X5). Full and half adder modules Z4 and Z5 respectively convert the excess three codes to straight binary codes. The binary codes are then presented to programmable dividers Z2 and Z3 and determine the count or division factor of each divider.

4-155. Integrated circuit Z6 is a frequency extender module which enables the programmable divider to operate at higher frequencies.

4-156. The resulting 1 MHz signal obtained from the programmable dividers is divided by three (3) by dual JK flip-flop Z1 which provides the comparator assembly Z104 with a proper signal for its operation and control of the memory assembly Z105.

Z6 is applied to the "A" inputs of the comparators. When the input data ("A" inputs) is greater or less than the stored data ("B" inputs) the comparators will activate logic circuits which generate the following signals that control the memory assembly Z105.

1. TUNE HIGH/LOW - Determination of the direction of change in memory tuning which results in the direction of the 163.5-192.5 MHz oscillator tuning. The signal is a logic level that comes from Z7. When the incoming frequency from the sample divider is above 333,333 Hz the TUNE HIGH/LOW signal at pin A will be a logic high and will result in the memory tuning the 163.5 to 192.5 oscillator lower in frequency. Conversely, when the incoming frequency is below 333,333 Hz, the level at pin A will be a logic low and the memory will tune the oscillator higher in frequency.

2. FAST INHIBIT - A logic level that comes from inverter Z11 and is used to control the fast tune portion of the memory assembly. The fast inhibit will be low when the comparator senses a 333X (X denotes any digit) and will inhibit the fast tune portion of the memory. For all other conditions the fast inhibit will be a logic high level.

3. COARSE INHIBIT - A logic level that is developed by Z11, Z14 and Z13 and is used to control the coarse tune portion of the memory assembly. During fast tuning, the coarse tune level will remain low until the fast tune inhibit goes low. At this time the coarse inhibit output will go to a logic high and allow the coarse tune section of the memory assembly to operate. Coarse tuning will continue until the magnitude of 3334 is identified. At this time the coarse level will switch to a logic low.

4. MEMORY SHIFT - The memory shift (Ø) line controls the speed at which the memory operates. AND - OR - INVERT module Z12 performs the monitor functions for the above control. A slow and fast speed shift signal is switched to the memory assembly under the following conditions.

A. For the 00-09 MHz bands the fast shift operates until the mag-

The 1 MHZ signal also goes to Single Shot module Z7 which adds pulse width to the signal for its use in the phase detector circuit.

4-157. The phase detector section of this assembly compares the 1 MHz signal from the sample divide thru Q2 with the 1 MHz standard frequency at pin V thru Q3. The two signals are combined by T1, with any difference in frequency resulting in a ±DC voltage via CR3 and CR4, being provided to the fast loop (pin Y) output. This connection voltage out of pin 4 is applied to the Dual HF oscillator assembly Z304 and corrects the oscillator for any slight changes that may occur.

4-158. COMPARATOR ASSEMBLY Z104 (See figure 7-8)

4-159. The Comparator assembly Z104 receives a square wave frequency of 333,333Hz from the Sample/Divide Phase Detector assembly Z107 when the 163.5-192.5 MHz oscillator is locked to the desired frequency. Initially the output of the sample divider is applied to pin L and then to NAND gate Z14 along with a gating signal from MHZ display divider. The gated frequency is now counted by decade dividers Z4, Z3, Z2, and Z1. The output of the decade dividers is then read into dual latch modules Z5 and Z6 where the data is stored as a temporary memory for the comparators. Reset and read pulses for the divider and latch modules are developed in the following manner. The clear pulse and gating pulse are combined into NAND gate Z14. RC combination C3 and R2 integrate the trailing edge of the resulting pulse from Z14 into Z11 where the clear and reset pulses of the counters. The data present from the counters must be read into the latch modules before the counters are cleared. Therefore the leading edge of the resulting pulse from Z14 is integrated by C1, R1, and applied thru Z11 to the read or clock input of latch modules Z5 and Z6.

4-160. Comparator modules Z7, Z8, Z9, and Z10 contain a fixed program on their "B" inputs which is 3, 3, 3, 4 respectively. The data from the latch modules Z5 and nitude of 3XXX is identified then the slow shift will be switched in.

B. For the 10-29 MHz bands the fast shift operates until the magnitude of 33XX is identified then the slow shift is switched in.

4-161. MEMORY ASSEMBLY Z105. (See figure 7-10)

4-162. The memory assembly has two basic memory sections that are connected in series to generate a d-c control voltage (d-c tune) for the 163.5-192.5 MHz oscillator assembly. These sections are fast tune, and coarse tune. Each section consists of an input NAND gate, two or more up/down counters, two or more programmable counters, a flip-flop, and a discriminator circuit.

4-163. The up/down counters at the input of the memory assembly continuously receive direction control data from the comparator assembly tune high/low circuit via pin 9 and logic signals and clock pulses at appropriate times to enable the gates and initiate counting. Preset pulses are received from the MHz display/divider assembly whenever the MHZ switch setting is changed in order to preset the counters to a preliminary tuning point. The outputs of the up/down counters provide control levels for the counting of the programmable counters. The programmable counters divide a fixed 7-MHz frequency by the divide-by-N number generated by the up/down counters. The resulting pulses from the programmable counters are then applied to the flip-flop which, in turn, convert the pulses to square waves. The square wave voltages are averaged by the discriminator circuit to provide a d-c tune level for the 163.5-192.5 MHz oscillator assembly.

4-164. FAST, AND COARSE MEMORY CIRCUIT OPERATION. The direction control inputs (tune high/low) of the up/down counters in the memory assembly Z1 through Z5, are received via pin 9 from the comparator assembly. This data represents the frequency position of the oscillator in the 163.5-192.5 MHz oscillator assembly, as compared to the desired frequency. When any one of the inhibit inputs at pins 6, or 7 receives a logic high level from the comparator assembly, the appropriate input AND gate is enabled, and a clock pulse is applied to the first of the up/down counters in the appropriate circuits as soon as a clock pulse arrives from the comparator assembly via pin 2. The up/down counter is enabled and begins to count in the proper direction according to the tune high/low input signal. The following events occur when the MHZ switch on the front panel is reset to select a new frequency.

1. A preset pulse is received at pin 8 from the MHz display/divider assembly and applied to the loading input of each up/down counter, Z1 through Z5. The outputs of each up/down counter are applied to its respective programmable counter. The up/down counters in each section operate serially, providing binary data for the appropriate programmable counter which, with its respective flip-flop, generates a square-wave output for the amplifiers and discriminator in that section. The discriminator develops a d-c level from the averaged voltages and applies it to output pin 10.

2. The programmable counters in the fast tune section (which is usually activated first), continues to count the last data received from its up/down counters. This data is stored by the up/down counters even after the fast tune inhibit line is disabled by a logic low level from the comparator.

3. The coarse tune inhibit input at pin 7 receives a logic high level which gates the up/down counters data to the respective programmable counters, and a d-c voltage is developed in the coarse tune discriminator circuit. When the coarse tune inhibit input receives a low level from the comparator, the input AND gate is disabled, the up/down counters stop counting up or down, and they continue to store the data for the programmable counters.

4. The d-c outputs of the two discriminator circuits add or subtract from each other, resulting in one d-c output at pin 10.

4-165. FAST TUNE MEMORY CIRCUIT. The tune high/low data is continuously applied from the comparator assembly via pin 9 to the down/up inputs of up/down counters Z5, Z1, and Z2, When the MHZ switch setting is changed, a preset pulse is received at pin 8 from the MHz display/divider assembly and applied to the loading inputs of Z5, Z1, and Z2. At the same time, the fast tune inhibit input AND gate A in Z11 receives a logic high level via pin 6; and a clock pulse from the comparator assembly. via pin 2, enables input gate A so that its output clocks up/down counter Z2. This causes Z2 to count and provide its output pulses to programmable counter Z8. On the next clock pulse, Z2 begins an up or down count, depending on the data received at its down/up input from the tune high/low line; Z8 begins to count its 7-MHz input by the binary input data from Z2 as memory data. Z1 begins to count in the same direction as Z2. Z1 also applies its output to programmable counter Z7 and generates a clock pulse for up/down counter Z5. When further clock pulses arrive, Z2 continues to count and store data in Z8; Z1 continues to count and store the data in Z7; and Z5 applies its data to programmable counter Z6. Programmable counters Z8, Z7, and Z6 receive a continuous 7 MHz clock pulse from the 7 MHz assembly, via pin 4 and input AND gate D of Z11, enalbing an output for each of these counters whenever they receive inputs. Their outputs operate serially (first one, and then the second), and combine to produce a clock pulse for flip-flop A in Z12 which, in turn, generates a square wave for application to amplifiers Q1 and Q2, and discriminator circuit CR1 through CR4. The discriminator circuit produces a d-c level which is filtered and applied to output pin 10 as the d-c tune signal for the 163.5-192.5 MHz oscillator assembly.

4-166. COARSE TUNE MEMORY CIRCUIT. The tune high/low data is continuously applied from the comparator assembly via pin 9 to the down/up inputs of up/down counters Z3 and Z4. When the MHZ switch setting is changed, the preset pulses are also received from pin 8 by the loading inputs of up/down counters Z3 and Z4. At the same time, a clock pulse is applied to AND gate B and a logic high level from the coarse tune inhibit input at pin 7 enables gate B. The output of the gate provides a clock pulse for up/down counter Z4. This causes Z4 to count and generate an output pulse for programmable counter.Z10. When the next clock pulse arrives from pin 2, Z4 begins an up or down count, depending on the tune high/low data at its down/up input; programmable counter Z10 begins to count its 7-MHz input by the binary input data from Z4 as memory data; and up/down counter Z3 begins to count in the same direction as Z4. When further clock pulses arrive, Z4 continues to count and store data for programmable counter Z10; Z3 continues to count and now begins to store its output in programmalbe counter Z9. Programmable counters Z10 and Z9 receive a continuous 7-MHz clock pulse from the 7-MHz generator assembly, via pin 4 and gate D of Z13, enabling an output for each of these counters whenever they receive an input. The outputs of Z9 and Z10 operate serially, as the programmable counters in the fast tune circuit, and combine to provide a clock pulse for flip-flop B in Z12 which, in turn, generates a square wave for application to amplifiers Q3 and Q4, and discriminator CR5 through CR8. The discriminator circuit, connected in series with the discriminator of the fast tune circuit, develops a d-c level which adds or subtracts from the d-c level produced by the fast tune discriminator, and the resultant voltage is applied to the d-c tune signal output at pin 10.

4-167. 1 MHZ STANDARD.

4-168. The 1-MHz standard is a factory adjusted hermetically sealed unit which contains a high stability, crystal controlled oscillator circuit. The temperature within the unit is stabilized by a filament heated oven, powered by +12 vdc ± 10% at 1.2 amperes maximum current. The oven remains heated even when the receiver is set to STANDBY. The crystal oscillator requires a power input of +9 vdc ±5% at 30 milliamperes and generates a sine wave of 1.0 volt rms +50%, -10% into 50 ohms impedance. The stability of the oscillator reaches one part in 10^7 after a 4-hour warmup, and one part in 10^8 after a 24-hour warmup. The sine wave output is applied to the 7 MHz generator, MHz display/divider, BFO, and AFC assemblies.

4-169. DIGITAL COUNTER ASSEMBLY Z102. (See figure 7-4)

4-170. The digital counter receives a 1-KHz clock pulse from the MHz display/divider which is divided by 10 in decade counter Z13. The output of Z13 provides a 100 Hz square wave for the 100 Hz synthesizer via pin 18 and a 10 Hz clock pulse for Z14. Decade counter Z14 divides the pulse again by 10, providing a 10-Hz clock pulse for flip-flop No. 1 in dual J-K master/slave flip-flop Z12. Flip-flop No.2 generates gating pulses. The gating pulses from pin 12 of Z12 are applied to NAND GATE Z10 along with the counter frequency input in the range of 1-2 MHz from pin Y. This signal (the exact frequency is determined by the operating frequency of the receiver) comes from pin J of the mixer/oscillator control assembly. Z9 is the first divider in the counter chain and provides clock input signals to Z8. After dividing by 10, the 4-bit binary outputs at pins 12, 9, 8, and 11, are applied to the input pins 22, 16, 15, and 21 of one-half of 8-bit bistable latch Z3. The data is stored at the inputs until a clock pulse arriving at pin 12 and pin 23 from flip-flop No. 1 in Z12, via the gates and inverters of Z10 and Z11, reads them into the outputs at pins 19, 17, 18, and 20. They are then applied via pins 11, 9, 10, and 12 of the assembly to the binary coded decimal (BCD) 1, 2, 4, and 8 inputs of the 0.1 KHz digit on the readout display assembly. Z8 applies the counting during the counting enable time to the clock input pin 14 of Z7, and the same sequence of events occurs as in Z8, except now, the outputs of Z7 are applied to the inputs of the second half of Z3 and its output goes to the 1-KHz digit on the readout display via pins U, S, T, and V. Z7 applies the count to Z6, Z6 to Z5, and Z5 to flip-flop No. FF-1 in Z4, and the identical sequence of events occurs in each case as in Z7, each set of outputs being applied to its appropriate 4-bit bistable latch and to the appropriate digit of the readout display. The binary data for the 10 MHz digit, however, is received via pins 1 and 2 directly from the MHz display/divider assembly to Z1, and the data for the 1 MHz digit is received for Z1 via pins 8, 6, 5, and 7.' When the TUNE control on the front panel is set above 9999 on the last four digits of the display, Z4 generates a binary carry 1 output, changing the 1 MHz digit to the next higher number, For example, if the display reads 02.9999 and the TUNE control changes the (1's to 0's, the number will change to 03.0000. If the last three digits change from 0000 to 9999, Z4 generates a binary carry which subtracts 1 from the MHz digit.

4-171. READOUT DISPLAY ASSEMBLY Z101. (See figure 7-2)

4-172. Binary coded decimal inputs representing the operating frequency of the receiver are received by the BCD-to-7 segment decoder/drivers, Z1 through Z6, via their respective input pins, from the digital counter assembly. Four binary bits are received by each decoder/driver corresponsing to binary 1, 2, 4, and 8, respectively, except the 10 MHz decoder/driver. Z1 has only two inputs, binary 1 and 2, since the highest number to be displayed on this digit is 2. The outputs of the decoder/driver logic circuits cause the appropriate filament segments of the associated display lamp to glow, and the combination of the glowing segments form a lighted number to be displayed. The blanking circuit formed by Z7 will blank the display when tuning below 00.0000 MHz or above 29.9999 mHz.

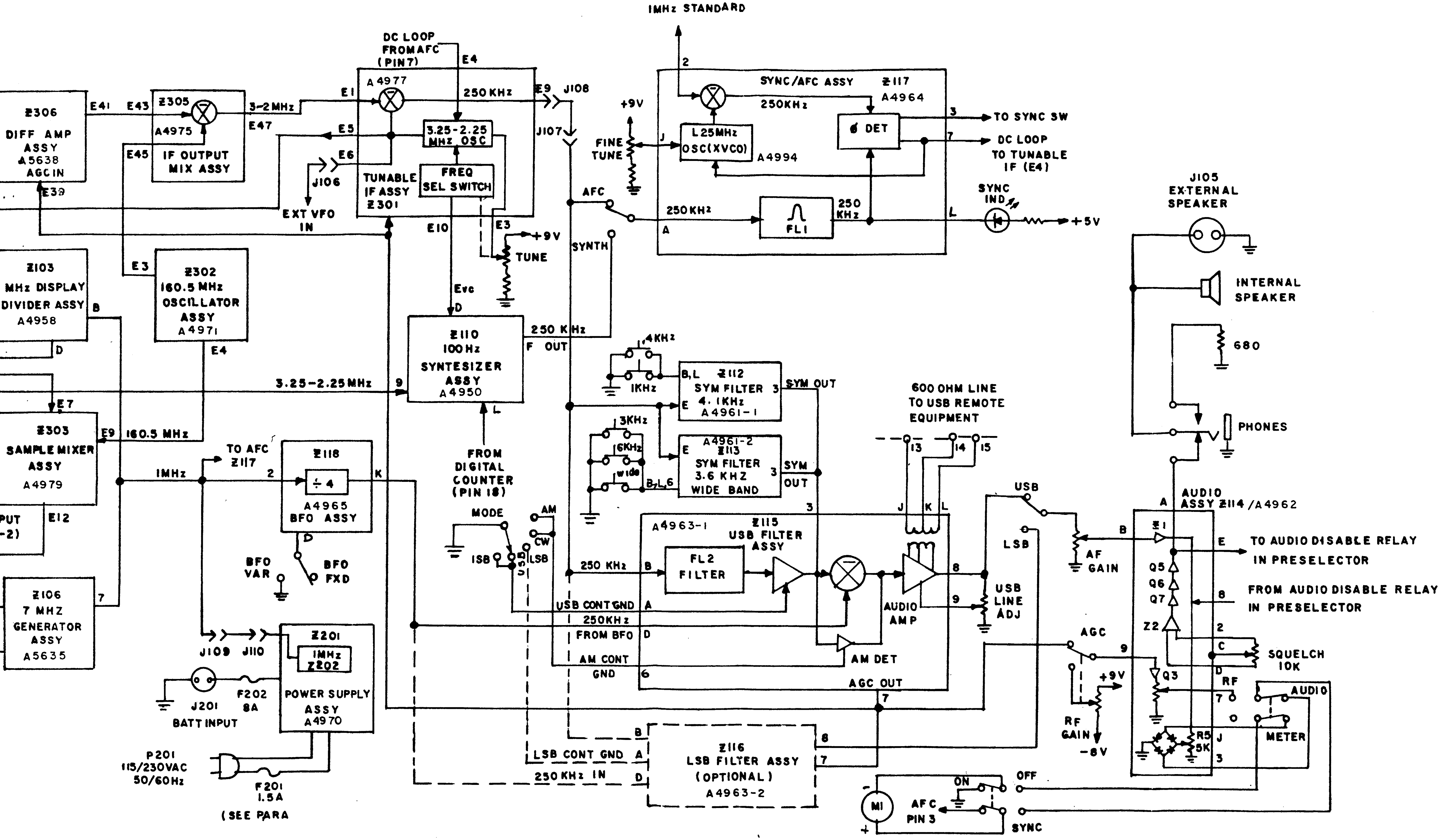
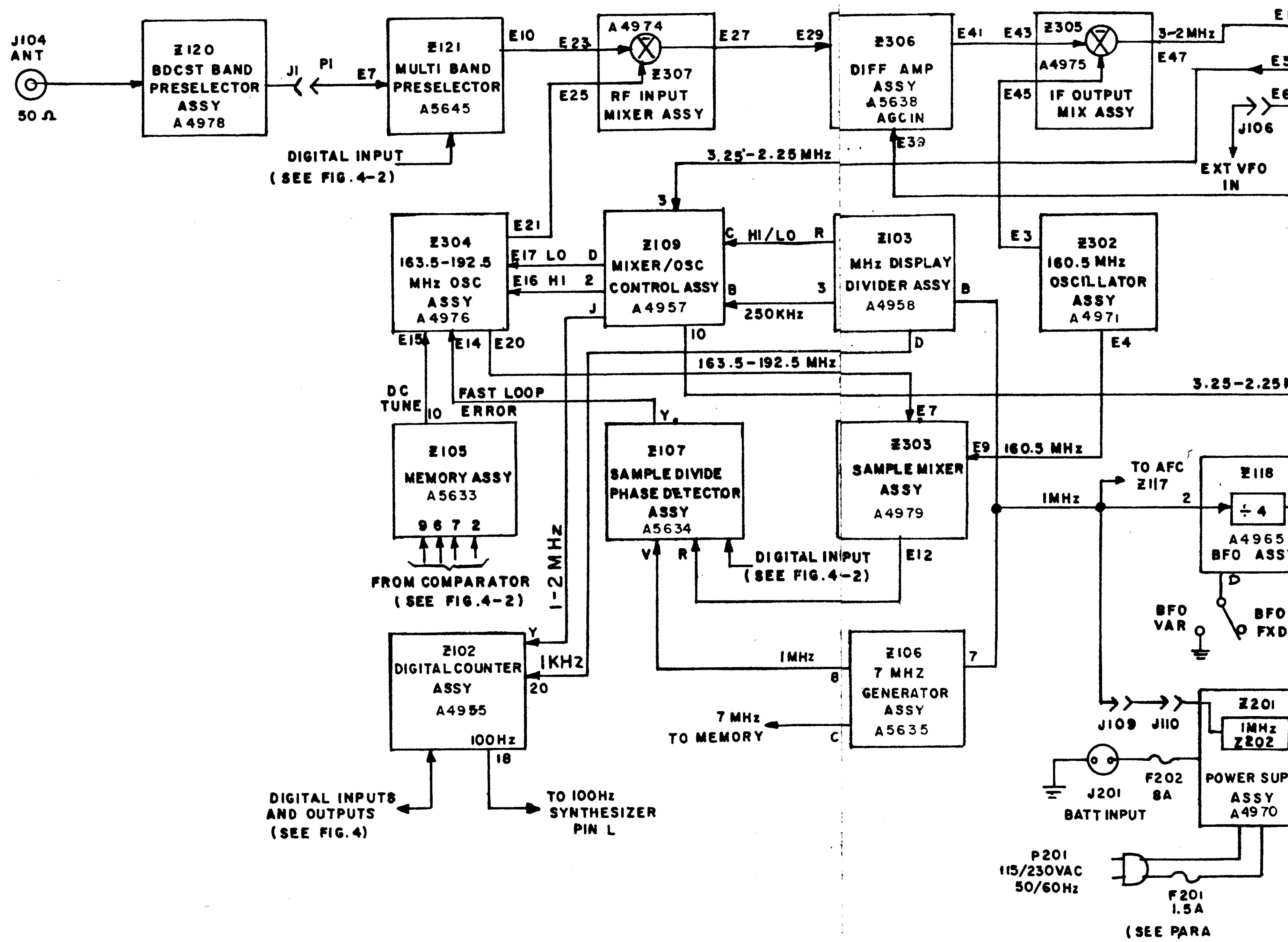


FIGURE 4-1 GPR110-B SIGNAL FLOW SECTION BLOCK DIAGRAM


J104 ANT
50 Ω
Z120 BDCST BAND PRESELECTOR ASSY A4978
J1
P1
E7
Z121 MULTI BAND PRESELECTOR A5645
DIGITAL INPUT (SEE FIG.4-2)
E10
E23
E25
A4974
Z307 RF INPUT MIXER ASSY
E27
E29
Z306 DIFF AMP ASSY A5638 AGC IN
E39
E41
E43
Z305 A4975 IF OUTPUT MIX ASSY
E45
E47
3-2MHz
J106
EXT VFO IN
3.25-2.25 MHz
Z304 163.5-192.5 MHz OSC ASSY A4976
E21
E17 LO
E16 HI
E15
E14
E20
Z109 MIXER/OSC CONTROL ASSY A4957
HI/LO
250KHz
Z103 MHz DISPLAY DIVIDER ASSY A4958
E3
Z302 160.5 MHz OSCILLATOR ASSY A4971
E4
163.5-192.5 MHz
DC TUNE
FAST LOOP ERROR
Z105 MEMORY ASSY A5633
9 6 7 2
FROM COMPARATOR (SEE FIG.4-2)
Z107 SAMPLE DIVIDE PHASE DETECTOR ASSY A5634
DIGITAL INPUT (SEE FIG.4-2)
E7
Z303 SAMPLE MIXER ASSY A4979
E9
160.5 MHz
E12
1-2 MHz
1KHz
Z102 DIGITAL COUNTER ASSY A4955
100Hz
DIGITAL INPUTS AND OUTPUTS (SEE FIG.4)
TO 100Hz SYNTHESIZER PIN L
1MHz
Z106 7 MHz GENERATOR ASSY A5635
7 MHz TO MEMORY
TO AFC Z117
Z118
÷ 4
A4965 BFO ASSY
BFO VAR
BFO FXD
J109
J110
Z201
1MHz Z202
POWER SUPPLY ASSY A4970
J201 BATT INPUT
F202 8A
P201 115/230VAC 50/60Hz
F201 1.5A
(SEE PARA

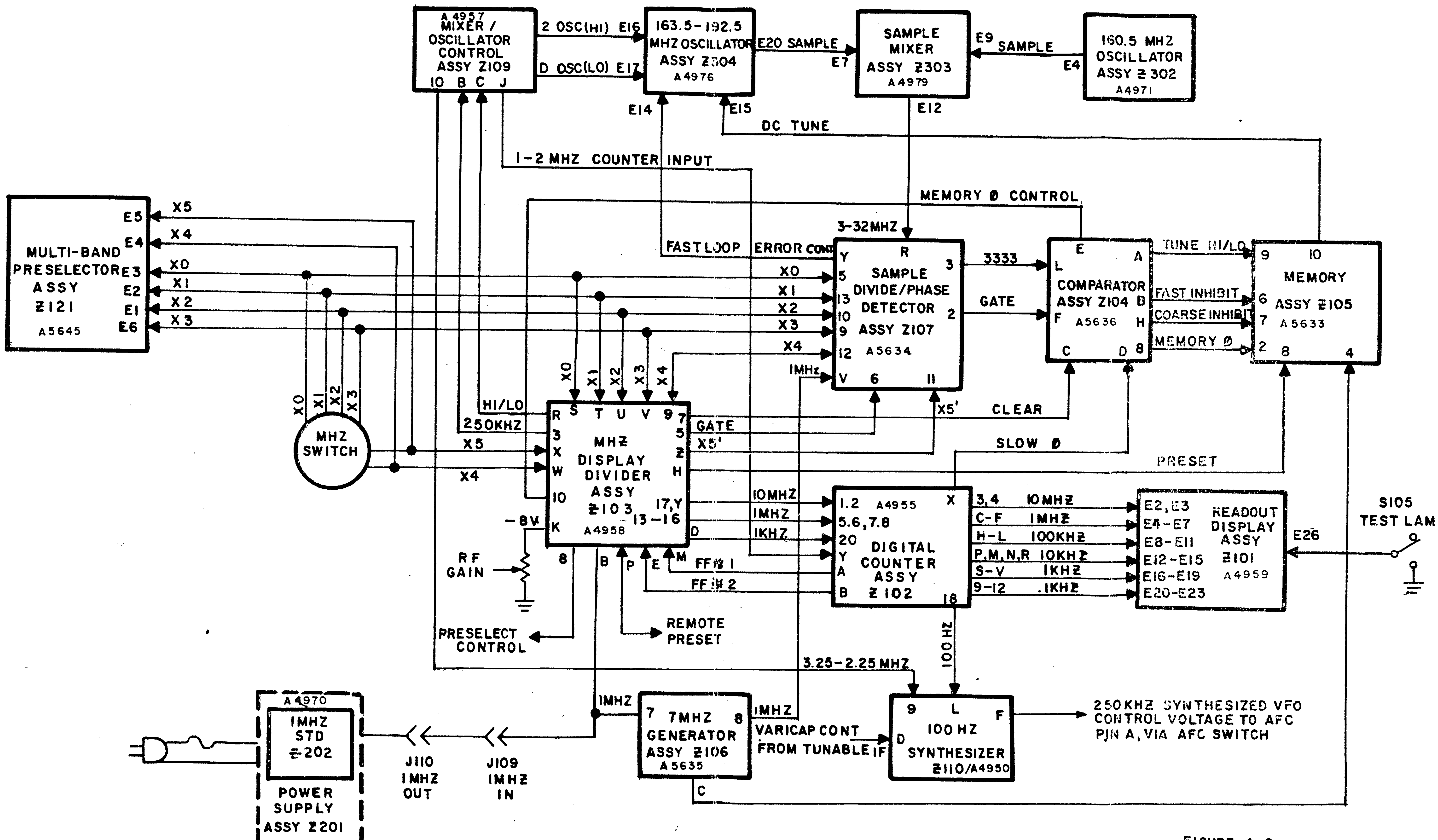


FIGURE 4-2
DIGITAL LOGIC AND CONTROL SECTION, BLOCK DIAGRAM

SECTION 5

MAINTENANCE

5-1. GENERAL.

5-2. This section contains the procedures required to maintain General Purpose Receiver GPR-110B in satisfactory operating condition. When performing the alignment and checkout procedures, refer to Section 6 for the overall component location diagrams and to the individual component location diagrams for the printed circuit board assemblies.

Note

> Some of the adjustments in the GPR-110B are in high frequency circuits and require the use of suitable test equipment. These adjustments have been performed at the factory and are sealed. It is not recommended that these seals be broken unless it is definitely ascertained that the circuit requires adjustment and the proper test equipment is available.

5-3. PREVENTIVE MAINTENANCE.

5-4. The following paragraphs describe procedures to inspect, check, and clean the components of the GPR-110B. In general, preventive maintenance provides a basis for recognizing future probable causes of equipment malfunction in the early stages of deterioration. Many such cases are apparent to the senses of sight, touch, and smell. Therefore, by adhering to a stringent program of preventive maintenance, involving periodic inspection and checks, the most probable causes of equipment malfunction can be avoided, thereby minimizing equipment downtime and the possibility of compromising important schedules.

a. INSPECTION. A most important and least expensive tool in the preventive maintenance program is the sense of sight; a thorough visual inspection of an assembly or component for tell-tale signs of deterioration prior to failure can save hours of test and trouble shooting time after a complete breakdown. Table 5-1 presents a weekly inspection check-list for the GPR-110.

TABLE 5-1. WEEKLY INSPECTION ROUTINE

Assembly or Subassembly	Check
Line Power Cord	Check three-wire line power cord for cracks, nicks, or fraying.
Main Chassis Assemblies	1. Check underside of chassis for dirt and dust.
	2. Check all inter-connecting wiring for nicks, cracks, or fraying.
	3. Check all printed circuit boards for cracks; check components for looseness and evidence of deterioration from possible overheating.
	4. Check printed circuit board jacks for tightness against chassis.
	5. Check ground connections for security.
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.
	3. Check meter face for cracks, scratches, etc.
	4. Check digital readout face for cracks.
	5. Remove line fuses and check for proper a-c 1.5-ampere or 0.75-ampere value and condition (0.75-ampere with 230 vac line). The d-c line fuse should have an 8-ampere rating.
	6. Check all input/output jacks for security against panel.

b. CLEANING. In general, the GPR-110B 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 trichloroethylene 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 should not be used on energized equipment or near other equipment from which a spark may be received.

CAUTION

Trichloroethylene 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.

5-5. <u>TROUBLESHOOTING</u>.

5-6. In general, a malfunction of the GPR-110B will usually manifest itself by lack of, or improper reading on the digital readout or front panel meter. If a second GPR-110B is obtainable, or a set of spare PC boards is available, troubleshooting can be facilitated by the board substitution method. In some instances, a particular board may require alignment or adjustment as outlined in paragraph 5-7. Table 5-2 presents a troubleshooting chart for the GPR-110B.

5-7. <u>CHECKOUT AND ALIGNMENT</u>.

5-8. The following paragraphs detail the checkout and alignment procedures for the GPR-110B. Perform the procedures in the order presented.

TABLE 5-2. TROUBLESHOOTING CHART

Trouble	Probable Cause	Remedy
Receiver inoperative	AF GAIN control is not turned clockwise.	Turn AF GAIN control clockwise until receiver power comes on.
	STBY/REC pushbutton is not released to REC position.	Release STBY/REC pushbutton to REC position by pressing in one of the BANDWIDTH KHZ pushbuttons.
	Power supply assembly Z201 defective.	Check power supply assembly and replace defective component(s).
	External power inoperative.	Check external power.
	Line fuse(s) inoperative.	Check a-c line fuse (1.5 ampere for 115 vac line and 0.75 ampere for 230 vac line) and check d-c line fuse (8 ampere), and replace fuse if defective.
No receiver output on the broadcast band.	MHZ switch in incorrect BDCST position.	Check that MHZ switch is in first BDCST position if frequency of incoming carrier is between 00.0001 and 00.9999 and is in second BDCST position if frequency of incoming carrier is between 01.0000 and 01.9999.
No receiver output on any frequency.	Malfunctioning circuit in signal flow section or digital logic and control section.	1. Check for d-c tune voltage output (0 to 40 volts) at terminal 10 of memory assembly Z105. If d-c tune voltage present, proceed to step 2. If d-c tune voltage not present, proceed to step 3. 2. Insert a 250-kHz signal at approximately 150 millivolts into J107 and check for

TABLE 5-2. TROUBLESHOOTING CHART (Continued)

Trouble	Probable Cause	Remedy
		loudspeaker output. If speaker output is not present, check symmetrical filters Z112 and Z113, audio assembly Z114, and USB filter Z115. If speaker output is present, insert a 3-2 mHz signal at a 0.5 microvolt level into terminal E1 of tunable IF assembly Z301 and check for a loudspeaker output. If speaker output is not present, check tunable IF assembly Z301 and replace defective component(s). If speaker output is present, insert a 0.5 microvolt level signal at the antenna input at the receiver operating frequency and signal trace through preselector Z120, Z121 RF input mixer Z307, differential amplifier Z306, and IF output mixer Z305 and replace defective component(s).
		3. The absence of a d-c tune voltage indicates a malfunction in the digital logic and control section. Proceed to initial checkout section paragraphs.

5-9. INITIAL CHECKOUT.

1. Connect a-c power to the GPR-110B.

2. Rotate the AF GAIN/AC OFF control clockwise and depress any one of the BANDWIDTH KHZ pushbuttons.

3. Depress the TEST LAMP pushbutton on the rear panel of the unit. All six digits of the counter display should indicate the number 8.

4. The decimal point on the display should be on at all times.

5. Monitor the +5 and +9 volt terminals on upper mother board A4960 and adjust, if necessary. Voltage adjustments are found in the panel supply section.

6. Monitor the 1-mHz terminal on the upper mother board A4960 for a sine-wave signal that is exactly 1 mHz.

Note

The 1-mHz standard must be on for at least 30 minutes before it stabilizes.

5-10. AUDIO ASSEMBLY Z114.

1. Connect a 3-ohm 5-watt resistor from terminal A to ground (can be inserted into PHONES jack).

2. Connect an audio generator to terminal B with audio gain fully clockwise (USB and LSB removed).

3. Adjust audio level for approximately 5.6 volts peak-to-peak across a 3-ohm load (approximately 1 watt). The input should be approximately 40 millivolts peak-to-peak.

5-11. DIFFERENTIAL AMPLIFIER ASSEMBLY Z306.

1. Adjust signal generator to 163 mHz.

2. Lift coaxial cable on terminal E27 of Z307 and connect signal generator output to coaxial cable.

3. Set RF GAIN control fully clockwise.

4. Adjust T1,T2,T3,T4,T5,T6,T7, and T8 for maximum gain (approximately 20 dB).

5-12. COMPARATOR ASSEMBLY Z104.

1. Remove the memory assembly from Z105 and insert a variable voltage supply (0 to +40 vdc) to terminal 10 of Z105.

2. S t MHz switch to 00 and monitor terminal R of Z107.

3. Set the frequency at terminal R of Z107 above 3 MHz using the variable voltage supply.

4. Monitor terminal A of Z104 and observe a high level.

5. Adjust the frequency below 3 MHz and observe a low level on term. A of Z104.

6. Check fast and coarse terminals B and H respectively. As the frequency is approached, the inhibit lines go low. When a sync condition is attained, lines B, and H go low. Also, terminal J is low and terminal 2 of Z107 is high. Test points 5, 6, 8, 9, 12, 13, 16, and 17 are high and test points 7, 10, 11, 14, 15, 18, and 19 are low.

7. Insert memory assembly Z105 and monitor terminal R of Z107. Check for sync in all positions (3-32 mHz).

5-13. Z108 NOT USED

5-14. SAMPLE DIVIDE/PHASE DETECTOR ASSEMBLY Z107.

1. Insert a variable voltage power supply (0 to +40 vdc) in place of memory assembly Z105 at terminal 10.

2. Open terminal 6 of Z107.

3. Monitor terminal R with a high frequency counter and monitor terminal 3 with a scope/counter.

4. Set MHZ switch to 00 and vary power supply voltage until terminal R indicates 3.000 mHz. Terminal 3 should indicate 3.333.

5. Set MHZ switch to 01 and vary power supply voltage until terminal R indicates 4.000 mHz. Terminal 3 should indicate 3.333.

6. Set MHZ switch to 02 and vary power supply voltage until terminal R indicates 5.000 mHz. Terminal 3 should indicate 3.333.

7. Adjust variable supply accordingly. Terminal R reads 3.0 mHz higher than display. Check all MHZ positions (00 through 29). Check terminal 2 for a high when frequency is locked (ex. 3.333).

5-15. 160.5 MHZ OSCILLATOR ASSEMBLY Z302.

1. Place extender card in Z107 and ground pins 17, Y, and Z. The output at terminal E5 of Z302 should be approximately 0.5 to 1.0 volt rms.

2. Connect a high frequency counter to terminal E5 and adjust the oscillator coil for a reading of 160.5 mHz.

5-16. 163.5-192.5 MHZ OSCILLATOR ASSEMBLY Z304.

1. Monitor terminal E21 with a high frequency counter.

2. Connect a variable power supply (0-40 vdc) to terminal 10 of memory assembly Z105.

3. Set MHZ switch to 00 and monitor terminal R of sample divide/phase detector assembly Z107 with an oscilloscope.

4. Adjust power supply for an output of approximately 3.0 vdc and adjust low frequency oscillator to 163.5 mHz.

5. Adjust power supply for an output of approximately 15-20 vdc. The low frequency oscillator output should be 175.5 mHz. The output range at terminal R should be 3-15 mHz.

6. Set MHZ switch to 13, adjust power supply for an output of 3.0 vdc, and adjust high frequency oscillator to 176.5 mHz.

7. Adjust power supply for an output of approximately 15-20 vdc. The high frequency oscillator output should be 192.5 mHz. The output range at terminal R should be 16-32 mHz.

Note

If the high end adjustments of the low and high frequency oscillators cannot be made with 20 vdc maximum, shift the low frequency end with less than 3.0 vdc.

5-17. 100 HZ SYNTHESIZER ASSEMBLY Z110.

1. Lift terminals 9 and L on the extender card.

2. Set bandswitch to band 1.

3. Measure the d-c voltage on terminal D. The voltage should increase as the bandswitch is turned clockwise. Return bandswitch to full counterclockwise position.

4. Apply 250 kHz to terminal 9.

5. Connect oscilloscope to R3 and adjust T5 and T6 for 250 kHz (minimum level).

6. Connect signal generator (250 kHz) to R7 and connect oscilloscope to pin F. Adjust T1 and T2 for maximum output.

7. Connect signal generator to terminal L and adjust R26 and R28 to mid range.

8. Set signal generator to 2.060 mHz.

9. Connect oscilloscope to R7 and adjust T3 and T4 for maximum output.

10. Set bandswitch fully clockwise, set signal generator to 2.9 mHz, and adjust R26 and R28 for maximum output.

11. Check for approximately 8 vdc at terminal D.

12. Repeat steps 8 through 11 until no further improvement can be obtained.

13. Reconnect terminals 9 and L.

5-18. PRESELECTOR ASSEMBLY Z120.

1. Remove preselector assembly and connect output of an r-f signal generator to the ANT input connector.

2. Set signal generator to 880 kHz at an output level of approximately 1 volt rms.

3. Monitor the junction of L5 and C5 on the preselector assembly. Adjust C5 for maximum signal. Reduce the signal generator output level and tune C5 for maximum signal using a minimum input signal.

4. Monitor the preselector assembly output.

5. Sweep the signal generator frequency from 100 kHz to 2 mHz. The filter in the preselector assembly should cut off all frequencies from 500 kHz to 1.5 mHz.

6. Replace the preselector assembly.

5-19. DIGITAL COUNTER ASSEMBLY Z102.

1. Press the WIDE BANDWIDTH KHZ pushbutton.

2. Monitor terminal 18 of Z102 for a 100-Hz square-wave signal at approximately +4 volts.

3. Rotate the MHZ switch clockwise until the counter display indicates the SECOND 00MHZ position.

4. If necessary, adjust the MHZ knob so that the white dot on the knob indicates the first broadcast band position as the counter display is indicating the SECOND 00MHZ.

5. Rotate the MHZ control through all of the positions. The MHZ display should indicate the following positions in order:

00MHZ, 00MHZ, 01MHZ, 01MHZ thru 29MHZ
└BDCST┘

6. Set the tunable IF to band 1. Adjust the frequency control fully clockwise. The MHZ display should indicate the following positions in order:

01MHZ, 01MHZ, 02MHZ, 02MHZ thru 30MHZ
└BDCST┘

7. Set the tunable IF to band 10. Adjust the frequency control fully counterclockwise. The MHZ display should indicate the following positions in order:

39MHZ, 39MHZ, 00MHZ, 00MHZ thru 28MHZ
└BDCST┘

8. Check of the display digits (100 kHz, 10 kHz, 1 kHz, and 0.1 kHz) and verify each digit from 0 through 9.

9. Press the STBY pushbutton and remove extender card A5601 from Z102 and insert A4955 into Z102.

5-20. MHZ DISPLAY/DIVIDER ASSEMBLY Z103.

1. Extend Z103 and press the WIDE BANDWIDTH KHZ pushbutton.

2. Monitor the signal at terminal D. A 1-kHz square wave signal at approximately +4 volts should be present.

3. Monitor the signal at terminal 3. A 250-kHz square-wave signal at approximately +4 volts should be present.

4. Monitor the signal at terminals 5 and 7. A 11-millisecond period square wave (10-millisecond positive excursion and 1-millisecond negative excursion) at approximately +4 volts should be observed.

5. Monitor the voltage at terminal K. The voltage should be -8 volts.

6. Monitor the signal at terminal 8. With the MHZ switch in the BDCST position, a low level should be observed (semiconductor virtual ground). All other positions of the MHZ switch result in a high level of approximately +20 volts.

7. Monitor the signal at terminal R. A low level (semiconductor virtual ground) should be observed for positions 00 MHZ through 12 MHZ. Positions 13 MHZ through 29 MHZ result in a high level of approximately +4 volts.

8. Monitor the signal at terminal 10. A low level should be observed for positions 00 MHZ through 09 MHZ. Positions 10 MHZ through 29 MHZ result in a high level of approximately +4 volts.

9. Monitor the signal at terminal H. A negative going pulse (positive voltage to ground) should be observed every time the MHZ switch is changed in either direction.

10. Rotate the MHZ switch through all of its positions in a clockwise direction and then all positions in a counterclockwise direction.

11. Ground terminal P. The level at terminal H should go from a high to a low.

12. Press the STBY pushbutton, remove extender card A5601 from Z103, and insert A4958 into Z103.

5-21. MIXER/OSCILLATOR ASSEMBLY Z109.

1. Extend A4957 from Z109 and press the WIDE BANDWIDTH KHZ pushbutton.

2. Monitor TP5 and adjust L2, L3, and L4 for a maximum signal at 4.25 mHz.

3. Monitor terminal J using a frequency counter. The frequency on the external counter should agree with the frequency displayed on the receiver.

Note

The MHZ digits will not agree.

4. Monitor the signal at terminal 2. A level of +8 volts should be observed for MHZ switch positions 00MHZ through 12MHZ.

5. Monitor the signal at terminal D. A level of +8 volts should be observed for MHZ switch positions 13MHZ through 29MHZ.

6. Press the STBY pushbutton, remove extender card A4984 from Z109, and insert A4957 into Z109.

5-22. 7 MHZ GENERATOR ASSEMBLY Z106.

1. Extend A5635 from Z106 and depress the WIDE pushbutton.

2. Monitor the signal at terminal C. A 7-mHz square-wave signal at approximately +4 volts should be observed.

3. Monitor the signal at terminal E. A 10-mHz square-wave signal at approximately +4 volts should be observed.

4. Monitor the signal at terminal 8 for the following frequencies:

MHZ Switch Position	Frequency at Terminal 8 (mHz)
00	3
BDCST 00	3
BDCST 01	4
01	4
02	5
03	6
04	7
05	8
06	9
07	10
08	11
09	12
10	12
11	11

MHZ Switch Position	Frequency at Terminal 8 (mHz)
12	10
13	9
14	8
15	7
16	6
17	5
18	4
19	3
20	12
21	11
22	10
23	9
24	8
25	7
26	6
27	5
28	4
29	3

5. Press the STBY pushbutton, remove extender card A5635 from Z106, and insert A5635 into Z106.

5-23 MEMORY ASSEMBLY Z105.

1. Extend A5633 from Z105.

2. Press the WIDE pushbutton.

3. It may be necessary to check the +5-volt line because of the amount of power used by A5633. Retest if necessary.

4. Set MHZ switch to 00MHZ.

5. Monitor the signal at terminal R of Z107 for exactly 3 mHz.

6. Step the MHZ switch through each position and observe a corresponding sync frequency for each position.

Note

Because of frequency limitation of the test equipment used and also the availability of test equipment, terminal R may be difficult to observe at the higher frequencies. In this case, terminal X may be used as a monitor point instead of terminal R. However, the sync frequencies observed will be the same as shown in paragraph 5-22. For each of the frequencies checked, terminal 3 will indicate a frequency of 333.3 kHz.

7. A d-c tuning voltage should be observed at terminal 10 of Z105.

8. Press the STBY pushbutton and remove extender card. Insert A5633 into Z105.

5-24. SYNC/AFC ASSEMBLY Z117.

1. Remove Y1 (1.25 mHz crystal) and adjust R10 fully clockwise

2. Connect a signal generator set at 250-kHz with no modulation on FL1 output. Adjust signal generator for a 2-millivolt (lowest) output possible.

3. Connect oscilloscope to junction of C12 and R15 and adjust L4 for maximum output, keeping signal as low as possible (150 millivolts).

4. Connect oscilloscope to junction of C17 and R17 and adjust L5 input as low as possible. Input should be approximately 220 microvolts for 150 millivolt output.

5. Connect oscilloscope to junction of C26 and R31. Keeping input as low as possible, tune L6 to maximum. Input should be approximately 12 microvolts for 150 millivolt output.

6. Connect oscilloscope to C27. Keeping input as low as possible, tune L10 to maximum. Input should be approximately 2 microvolts for 150 millivolt output.

7. Connect oscilloscope to C31. Input should be 15 microvolts for 1.5 volt output.

8. Carrier indicator on readout assembly should be lit with approximately 10 microvolt input.

9. With 10 microvolt input, pin 1 of Q10 should be approximately 0.6 volt. Collector of Q11 should be 5 volts peak-to-peak. The base of Q12 should be +0.7 volt and the collector should be low.

10. Adjust R10 1/4 turn from full counterclockwise position. Reconnect oscilloscope to C31 and connect 250-kHz input at 150 microvolts to pin A. Output should be approximately

1.2 volts peak-to-peak. (Readjust R10 for 1.2 volts peak-to-peak, if necessary. Check filter FL1 for proper ±40 Hz bandwidth.)

11. Insert 1.25-mHz crystal. Remove wire going to E MOD terminal on oscillator assembly, and ground E MOD to PC712. Set FINE TUNE to center and check output frequency of XVCO (set to 250 kHz). Also check range of FINE TUNE with oscilloscope on C31. Oscillator leakage should be no greater than 0.2 volt with 250 kHz disconnected. Connect Hewlett-Packard 410B to P7 (1 volt scale, 0 center) and adjust R29 (BAL) to 0 volt and adjust front panel meter (in SYNC position) to center scale with R44. If zero cannot be attained, check at cathode of CR9 for balance.

12. Recheck that carrier indicator is off until 150 microvolt input 250 kHz ± 40 Hz is inserted. Check XVCO output which should be 150 millivolts peak-to-peak.

13. The AFC should now be operating. Check by varying 250-kHz input with FINE TUNE control in center carrier. Light should stay lit for full range of AFC. Set front panel meter to 0 center frequency and turn FINE TUNE control to both extremes. The SYNC meter should follow. Also, the carrier indicator should stay lit.

14. Connect signal generator to REC INPUT and reconnect 250-kHz to REC. Set signal generator to 2.3 mHz and tune receiver on CW to light carrier indicator. The AFC loop should now have control of VFO oscillator and lock in signal. A slight adjustment of R10 may be necessary.

5-25. XVCO ASSEMBLY.

1. Adjust C5 and R1 to mid range.

2. Measure level and frequency of oscillator with oscilloscope at junction of Y1 and C5. Adjust C5 to 1.25000 mHz. The level should be 125 millivolts.

3. Measure level at junction of C6 and R9. The level should be 1.2 volts.

4. Connect oscilloscope to E4. The frequency should be 250 kHz at a 0.9 volt level.

5. Adjust FINE TUNE control from minimum to maximum. The output frequency should change approximately ±40 Hz. A readjustment of C5 may be necessary.

5-26. AUDIO SECTION.

1. Connect a 600-ohm load resistor across pins 13 and 15 of audio mother board. Replace speaker with a 3-ohm 10-watt resistor load. Place MODE switch on USB, BFO on fixed, ANL on off, squelch on off, and RF GAIN switch to AGC. Apply a 250 kHz sine wave at 1 millivolt into rear of unit.

2. Monitor pin j of PC689 and vary input frequency for maximum output. Monitor the following points on PC689 and adjust corresponding resistors for desired voltage:

Pin 1 of Q4	0.5 Vpp	Approximately 250 kHz	Adjust R31
Pin 10 of Z1	0.5 Vpp	Approximately 500 Hz	Adjust R31
Pin J of PC689	8 Vpp	Approximately 500 Hz	USB line adjust
Collector of Q7	8 volt square wave	Approximately 250 kHz	Adjust R38
Pin 7 of PC689	-7 vdc	Approximately 250 kHz	Adjust R38
Pin D of PC689	6 Vpp	250 kHz	Check values
Pin 8 of PC689	0.24 Vpp	500 Hz	Check values

5-27. BFO ASSEMBLY Z118.

1. Monitor pin K. There should be a 250-Hz sine wave at 6 volts peak-to-peak.

2. If the output is not exact, check accuracy of 1-mHz input.

5-28. TUNABLE IF ASSEMBLY Z301.

1. Connect +9 vdc to pin 7 and to one end of frequency control potentiometer. Position selector switch on band 1. Adjust R52 fully clockwise. Monitor pin 5 with oscilloscope and counter. Set frequency control potentiometer fully clockwise (lowest frequency). Adjust T5 until output frequency is 2.248 mHz (0.25 Vpp).

2. Select band 10. With frequency control potentiometer still fully clockwise, adjust C36 until output frequency is 3.062 mHz. Turn frequency control fully counterclockwise. Adjust R42 until output is 3.284 mHz. Select band 1 and return frequency control fully clockwise. Output should return to 2.248 mHz. If frequency does not return, retune T5 and repeat the procedure.

3. Select band 2. Set frequency control fully clockwise (lowest frequency). By adjusting C28, set output frequency to 2.306 mHz. The remaining bands follow the same procedure as band 2.

Band	Adjustment	Osc. Output (MHz)
3	C29	2.388
4	C30	2.462
5	C31	2.548
6	C32	2.629
7	C33	2.739
8	C34	2.822
9	C35	2.989

4. Turn frequency control fully counterclockwise. Keeping control in this position, switch through bands 1 to 9. Record the highest frequency on each band. The outputs for this example which are only approximate values, are:

Band	Highest Osc. Output (MHz)
1	2.328
2	2.289
3	2.482
4	2.564
5	2.667
6	2.754
7	2.892
8	2.992
9	3.195

5. To obtain the midband frequency for each band, take the difference of the highest and lowest frequency, divide by 2, add to the low frequency, and record values. For this example, frequencies are:

Band	Osc. Midband Frequency (MHz)
1	2.288
2	2.348
3	2.434
4	2.513
5	2.608
6	2.692
7	2.816
8	2.907
9	3.092
10	3.173 (Exact Value)

6. To obtain the r-f limits of each band, subtract 250 kHz from the highest, lowest, and midband frequencies of the oscillator bands.

Band	Lowest (MHz) (Exact Values)	Highest (MHz) (Approximate Examples)	Midband (MHz) (Approximate Examples)
1	1.998	2.078	2.038
2	2.056	2.139	2.098
3	2.138	2.232	2.184
4	2.212	2.314	2.263
5	2.298	2.417	2.358
6	2.379	2.504	2.442
7	2.484	2.642	2.566
8	2.572	2.742	2.657
9	2.739	2.945	2.842
10	2.812	3.034 (Exact)	2.923 (Exact)

7. Apply a 2-3 mHz sine wave at 30 millivolts into pin 1. Select band 1. Using frequency control, adjust oscillator to midband frequency (in this case, 2.288 mHz). Monitoring TP1, set r-f input to midband (2.038 mHz). Monitoring TP3, adjust T1 for maximum

output. Monitoring TP2 and TP4, adjust T2 and T3, respectively, for maximum output. Voltage at TP4 should be approximately 1.1 Vpp.

8. Select band 2. Set oscillator frequency to midband (2.348 mHz). Monitoring TP1, set r-f input to midband (2.098). Monitor output at each stage (TP3, TP2, TP4) and peak output by adjusting C1, C10, and C19, respectively. The procedure for the remaining bands is the same as for band 2.

Band	Osc. Midband Frequency	R-f Midband Frequency	TP3	TP2	TP4
3	2.434	2.184	C2	C11	C20
4	2.513	2.263	C3	C12	C21
5	2.608	2.358	C4	C13	C22
6	2.692	2.442	C5	C14	C23
7	2.816	2.566	C6	C15	C24
8	2.907	2.657	C7	C16	C25
9	3.092	2.842	C8	C17	C26
10	3.173 (Exact)	2.923 (Exact)	C9	C18	C27

9. Select band 1. Set oscillator at midband (2.288 mHz) and r-f input at midband (2.038 mHz). Monitor pin 9. Output at this point should be 250 kHz ± 0.1%. At exactly 250 kHz, adjust T4 and T6 for maximum output (1.7 Vpp).

10. Set r-f input to 1.998 mHz. Set frequency control potentiometer fully clockwise. Output at pin 9 should be 250 kHz ± 0.1%.

11. Set r-f input to upper limit of r-f input for band 1 (in this case, 2.078 mHz). Set frequency control potentiometer fully counterclockwise. Output at pin 9 should be 250 kHz ± 0.1%. Repeat this procedure for the remaining 9 bands.

5-29. SAMPLE MIXER ASSEMBLY Z303.

1. Monitor terminal E12.

2. Check for the following output levels at the indicated frequency:

1.5 Vpp at 3 mHz — 0.8 Vpp at 25 mHz

1.0 Vpp at 20 mHz — 0.5 Vpp at 32 mHz

SECTION 6

PARTS LIST

6-1. GENERAL.

6-2. This section contains the parts list for the GPR-110B. The parts list first lists the mechanical assemblies and continues in reference designation order of the assemblies comprising the unit.

REF SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		FINAL ASSEMBLY AX5184			
	Test Card	A4984		Jumper, Coax. Rear Panel	CA480-3-4 inch
	Test Card	A5601		Marking, Plate Right Side	LD3013
	Power Supply Assembly	BMA513		1 MHz Standard	NF120
	Main Chassis Assembly	BMA515		Top Cover	MS6499-1
	Front End Assembly	BMA516		Bottom Cover	MS6499-2
		FRONT END ASSEMBLY			
Z101	Readout Display Assembly	A4959		Capacitor, Fixed, Ceramic (28)	CC131-39
	Tuning Gear Assembly	AX5186		Handle, Locking	LD108
	Diode, Light Emitting	BI132(LED 5082-4880)		Marking, Front Panel	LD3014

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
	Marking, Escutcheon	LD3020		Resistor, Variable, Composition (AF GAIN)	RV4BTSC502D
	Speaker, Per. Mag.	LS108		Resistor, Variable, Composition (RF GAIN)	RV4BTSC102B
	KNOB (5)	MP127-3FB		Resistor, Variable, Composition (FINE TUNE)	RV106UF12 A101A
	Knob, BFO	MP127-5FB		Switch, Slide (SYNC)	SW163
	Knob, TUNE	MP146		Switch, Rotary	SW454
	Knob, SYNC	MP127-2FB		Switch, MHZ, Step	SW548
	Meter, Milliamp	MR236		Switch, Multi, Interlock (MODE)	SW558
	Housing, Readout	MS5694		Switch, Multi, Push Lock (MODE)	SW559
	Cover, Housing	MS6495		Terminal (3)	TE115-1
	Grill, Speaker	MS6504			
	Bracket, Meter	MS6506			
	Spacer, Switch (8)	PX1242-1			
	Spacer, Switch (4)	PX1242-2			
	Window, Display	PX1244			
	Resistor, Variable, Composition (BFO)	RV4ATSA103A			
	Resistor Variable Composition (SQUELCH)	RV4NAYSA103CY			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

MAIN CHASSIS AND REAR PANEL ASSEMBLY

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
J102	Connector, Receptacle	JJ319-22D-F-E	Z108	Not Used	
J103	Same as J102		Z109	Mixer/Oscil- lator Control Assembly	A4957
J105	Connector, Receptacle	JJ146			
J106 thru J110	Connector	UG625/U	Z110	100 Hz Synthesizer Assembly	A4950
R106	Resistor, Variable, Composition	RV4NAYSA502A	Z111	Digital Logic and Control Mother Board	A4960
R107	Same as R106		Z114	Audio Assembly	A4962
Z102	Digital Counter Assembly	A4955	Z117	Sync/AFC Assembly	A4964
Z103	MHZ Display Divider Assembly	A4958	Z118	BFO Assembly	A4965
			Z119	Audio Filter Mother Board	A4966
Z104	Comparator Assembly	A5636	Z120	Preselector Assembly	AX5196
Z105	Memory Assembly	A5633	Z121	Preselector, BDCST BAND Multi-Band	AX
Z106	7 MHz Generator Assembly	A5635		Cable, Main	CA1755
Z107	Sample Divide/ Phase Detector Assembly	A5634		Cable, Main	CA1756
	Cable, Coaxial	CA480-178-5			
	Cable, Pre- selector Input	CA1778			

FRONT END ASSEMBLY

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
Z301	Tunable IF Assembly	A4977	Z305	IF Output Mixer Assy	A4975

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		FRONT END ASSEMBLY (Continued)			
Z302	160.5 MHz Oscillator Assembly	A5632	Z306	Differential Amplifier Assembly	A5638
Z303	Sample Mixer Assembly	A4979	Z307	RF Input Mixer Assy	A4974
Z304	163.5-192.5 MHz Oscillator Assembly	A4976			
		TUNING GEAR ASSEMBLY			
	Bearing, Nylon Panel	BB117-5		Plate, Switch, Front	MS6527
	Gasket, Neoprene	GA137-2		Shaft, Switch	PM1574
	Gear, Pinion	GR109-3		Resistor, Variable, Composition	RV117-2-102
	Gear, Spur Hub	GR205-22		Spring	SP103
	Plate, Switch Rear	MS6526		Spacer, Threaded	TE0440BN58H
		TEST CARD A5601			
	Connector, Receptacle	JJ319-22D-P-E		Terminal Stud (44)	TE127-2
	Test Card, PC	PC718			
		TEST CARD A4984			
	Connector, Receptacle	JJ319-10D-P-E		Terminal Stud (20)	TE127-2
	Test Card, PC	PC708			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		BYPASS FILTER ASSEMBLY A5658-1			
C1 thru C5	Capacitor, Fixed, Ceramic	CC131-39	L2, L3	Coil, RF	CL275-103
			L4	Same as L1	
L1	Coil, RF	CL275-102	L5	Same as L2	
			L6 thru L11	Not Used	
			L12	Same as L2	
			L13	Coil, RF	CL499
		READOUT DISPLAY ASSEMBLY A4959 (Z101)			
C1	Capacitor, Fixed, Ceramic	CC100-43	DS3	Lamp, Digital Display	BI131-2
C2	Capacitor, Fixed, Ceramic	CC131-39	DS4 thru DS6	Same as DS1	
CR1	Semiconductor Device, Diode	1N3821A	E1 thru E27	Terminal, Miniature	TE168-4-B
DS1	Lamp, Digital Display	BI131	R1	Resistor, Fixed, composition	RC32GF3R3J
DS2	Same as DS1				

READOUT DISPLAY ASSEMBLY Z4959 (Z101) (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
XDS1 thru XDS6	Socket, Lamp	TS210
Z1 thru Z6	Microcircuit, Microcircuit DIGital	NW211 NW176

DIGITAL COUNTER ASSEMLBY A4955 (Z102)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1 thru C4	Capacitor, Fixed, Ceramic	CC100-43
L1	Coil, RF, Fixed	CL275-100
R1	Resistor, Fixed, Composition	RC07GF102J
R2	Same as R1	
R3	Resistor, Fixed, Composition	RC07GF182J
R4	Resistor, Fixed, Composition	RC07GF332J
Z1	Microcircuit, Digital	NW201
Z2	Same as Z1	
Z3	Same as Z1	
Z4	Microcircuit, Digital	NW207
Z5 thru Z29	Microcircuit, Digital	NW204
Z10	Microcircuit, Digital	NW206
Z11	Microcircuit, Digital	NW187
Z12	Microcircuit, Digital	NW159
Z13	Same as Z5	
Z14	Same As Z5	

MHz DISPLAY/DIVIDER ASSEMBLY A4958 (Z103)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1	Capacitor, Fixed, Electrolytic	CE105-200-16
C4	Capacitor, Fixed, Electrolytic	CE105-1-16
C5 and C6	Capacitor, Fixed, Electrolytic	CE105-100-16
C7	Same As C2	
C2 and C3	Capacitor, Fixed, Ceramic	CC100-41
R6	Resistor, Fixed, Composition	RC07GF390J
R7	Resistor, Fixed, Composition	RC07GF182J
R8 thru R13	Resistor, Fixed, Composition	RC07GF103J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

MHz DISPLAY/DIVIDER ASSEMBLY Z4958 (Z103) (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
C8 thru C10	Capacitor, Fixed, Ceramic	CC131-39	Z1	Microcircuit, Digital	NW204
CR1 thru CR3	Semiconductor, Device, Diode	1N914	Z2	Microcircuit, Digital	NW207
CR4	Semiconductor, Device, Diode	1N756	Z3 thru Z5	Same as Z1	
Q1	Transistor	2N697	Z6	Microcircuit, Digital	NW206
Q2 and Q3	Transistor	2N3646	Z7	Microcircuit, Digital	NW205
Q4 and Q5	Transistor,	2N1711	Z8	Same as Z2	
R1 thru R3	Resistor, Fixed, composition	RC07GF472J	Z9	Microcircuit, Digital	NW189
			Z10		
R4	Resistor, Fixed, Composition	RC07GF102J	Z10	Microcircuit,	NW199
			Z11	Same as Z7	
R5	Resistor, Fixed, composition	RC07GF332J	Z12	Same as Z10	
			Z13	Microcircuit, Digital	NW208
			Z14	Microcircuit, Digital	NW200
			Z15	Same as Z9	
			Z16	1 MHz Switching Assembly	A4982

PARTS LIST

For

COMPARATOR ASSEMBLY
(Z104) Z5636

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, Mica	CM111C681J5S
C2	Capacitor, Fixed, Ceramic	CC131-39
C3	Same as C1	
C4	Same as C2	
L1	Coil, Rf, Fixed	CL275-100
R1	Resistor, Fixed, Composition	RC07GF331J
R2	Same as R1	
TP1-22	Terminal, Stud	TE127-2
Z1	Microcircuit, Digital	NW204
Z2	Same as Z1	
Z3	Same as Z1	
Z4	Microcircuit, Digital	NW190
Z5	Microcircuit, Digital	NW201
Z6	Same as Z5	
Z7	Microcircuit, Digital	NW209
Z8	Same as Z7	
Z9	Same as Z7	
Z10	Same as Z7	
Z11	Microcircuit, Digital	NW187
Z12	Microcircuit, Digital	NW215
Z13	Same as Z11	
Z14	Microcircuit, Digital	NW176
XZ1 thru XZ4	Socket, 14 Pin	TS211-1
XZ5	Socket, 24 Pin	TS211-3
XZ6	Same as XZ5	
XZ7 thru XZ10	Socket, 16 Pin	TS211-2
XZ11 thru XZ14	Same as XZ1	

PARTS LIST

For

MEMORY ASSEMBLY
(Z105) A5633

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, Ceramic	CC131-39
C2	Same as C1	
C3	Capacitor, Fixed, Mylar	CN112B474K1
C4	Capacitor, Fixed, Electrolytic	CE105-50-16
C5	Same as C1	
C6	Same as C1	
C7	Same as C1	
C8	Same as C1	
C9	Capacitor, Fixed, Mica	CM112E103J5S
C10	Same as C1	
C11	Capacitor, Fixed, Electrolytic	CE105-2-50
C12	Same as C11	
C13	Same as C1	
C14	Capacitor, Fixed, Electrolytic	CE105-15-25
C15	Same as C1	
C16	Same as C1	
C17	Same as C1	
C18	Same as C1	
C19	Same as C1	
CR1 thru CR8	Semiconductor, Device, Diode	1N463
CR9	Semiconductor, Device, Diode	1N751A
L1 thru L3	Coil, Rf, Fixed	CL275-101
Q1	transistor	2N3646
Q2	Transistor	2N1711
Q3	Same as Q1	
Q4	Same as Q2	
R1	Resistor, Fixed, Composition	RC07GF152J
R2	Resistor, Fixed, Composition	RC07GF222J
R3	Resistor, Fixed, Composition	RC07GF471J
R4	Resistor, Fixed, Composition	RC07GF332J
R5	Resistor, Fixed, Composition	RC07GF821J
R6	Resistor, Fixed, Composition	RC07GF470J
R7	Resistor, Fixed, Composition	RC07GF151J
R8	Resistor, Fixed, Composition	RC07GF123J
R9	Same as R8	
R10	Resistor, Fixed, Composition	RC07GF224J
R11	Resistor, Fixed, Composition	RC07GF4R7J
R12	Same as R1	
R13	Same as R6	
R14	Same as R3	

PARTS LIST (cont)

For

MEMORY ASSEMBLY
Z105 - A5633

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R15	Same as R2	
R16	Same as R2	
R17	Same as R6	
R18	Same as R3	
R19	Same as R3	
R20	Resistor, Fixed, Composition	RC07GF102J
R21	Resistor, Fixed, Composition	RC07GF103J
R22	Resistor, Fixed, Composition	RC07GF121J
R23*	Resistor, Fixed, Composition	RC07GF153J
R24	Resistor, Variable	RV124-3-502
T1	Transformer	TF267-4
Z1 thru Z5	Microcirc uit, Digital	NW202
Z6 thru Z10	Microcircuit, Digital	NW212
Z11	Microcircuit, Digital	NW176
Z12	Microcircuit, Digital	NW159
XZ1 thru XZ10	Socket, 16 Pin	TS211-2
XZ11	Socket, 14 Pin	TS211-1
XZ12	Same as XZ11	
	*R23 value is factory adjusted. It may differ from unit to unit verify actual value used	

PARTS LIST

For

7 MHz Generator Assembly

Z106 A5635

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1 thru C3	Capacitor, Fixed, Ceramic	CC131-39
C4 thru C6	Capacitor, Fixed, Ceramic	CC100-29
C7	Capacitor, Fixed, Mica	CM111E471J5S
C8	Same as C4	
C9	Same as C4	
CR1	Semiconductor, Device, Diode	1N914
L1	Coil, Rf, Fixed	CL275-100
L2	Coil, Rf, Fixed	CL275-103
Q1 thru Q4	Transistor	2N3646
R1	Resistor, Fixed, Composition	RC07GF392J
R2	Resistor, Fixed, Composition	RC07GF102J
R3	Same as R2	
R4	Same as R2	
R5	Resistor, Fixed, Composition	RC07GF682J
R6	Same as R2	
R7	Resistor, Fixed, Composition	RC07GF272J
R8	Resistor, Fixed, Composition	RC07GF152J
R9	Resistor, Fixed, Composition	RC07GF470J
R10	Resistor, Fixed, Composition	RC07GF331J
R11	Same as R2	
R12	Resistor, Fixed, Composition	RC07GF101J
R13	Same as R12	
R14	Resistor, Fixed, Composition	RC07GF242J
R15	Same as R9	
TP1	Terminal, Stud	TE127-2
Y1	Crystal	CR119-7R0
Y2	Same as Y1	
Z1	Microcircuit, Digital	NW166
XZ1	Socket, 14 Pin	TS211-1

PARTS LIST

For

Sample Divide/Phase Detector Assembly

Z107 A5634

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, Ceramic	CC100-41
C2	Same as C1	
C3	Capacitor, Fixed, Ceramic	CC131-39
C4	Same as C3	
C5	Same as C3	
C6	Same as C3	
C7	Same as C3	
C8	Same as C3	
C9	Capacitor, Fixed	CX118E5R5N30C1
C10	Same as C1	
C11	Same as C1	
C12	Same as C1	
C13	Same as C1	
C14	Same as C1	
C15	Same as C3	
C16	Capacitor, Fixed, Mica	CM111C111J5S
C17	Capacitor, Fixed, Mica	CM111C500J5S
CR1	Semiconductor, Device, Diode	1N914
CR2	Semiconductor, Device, Diode	1N756
CR3	Semiconductor, Device, Diode	1N100
CR4	Same as CR3	
L1	Coil, Rf, Fi xed	CL275-121
L2	Coil, Rf, Fixed	CL275-100
L3	Same as L1	
L4	Coil, Rf, Fixed	CL275-102
Q1	Transistor	2N2368
Q2	Same as Q1	
Q3	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF562J
R2	Resistor, Fixed, Composition	RC07GF471J
R3	Resistor, Fixed, Composition	RC07GF470J
R4	Resistor, Variable	RV124-3-103
R5	Resistor, Fixed, Composition	RC07GF242J
R6	Resistor, Fixed, Composition	RC07GF180J
R7	Resistor, Fixed, Composition	RC07GF10eJ
R8	Resistor, Fixed, Composition	RC07GF101J
R9	Same as R1	
R10	Resistor, Fixed, Composttion	RC07GF102J
R11	Same as R1	
R12	Same as R1	
R13	Saem as R3	
R14	Resistor, Fixed, Composition	RC07GF392J
R15	Same as R2	

PARTS LIST (cont)

For

Sample Divide/Phase Detector Assembly

Z107 A5634

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R16	Same as R14	
R17	Same as R2	
T1	Transformer	TR205
Z1	Microcircuit, Digital	NW198
Z2	Microcircuit, Digital	NW212
Z3	Same as Z2	
Z4	Microcircuit, Digital	NW200
Z5	Microcircuit, Digital	
Z6	Microcircuit, Digital	NW213
Z7	Microcircuit, Digital	NW214
Z8	Microcircuit, Digital	NW187
XZ1	Socket, 14 Pin	TS211-1
XZ2	Socket, 16 Pin	TS211-2
XZ3	Same as XZ2	
XZ4	Same as XZ2	
XZ5	Same as XZ1	
XZ6	Same as XZ2	
XZ7	Same as XZ1	
XZ8	Same as XZ1	

MIXER/OSCILLATOR CONTROL ASSEMBLY A4957 (Z109)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1	Capacitor, Fixed, Ceramic	CC100-41
C2	Capacitor, Fixed, Mica	CM111C100D5S
C3	Capacitor, Fixed, Mica	CM111F391J5S
C4	Capacitor, Fixed, Ceramic	CC131-39
C5	Same as C2	
C6 and C7	Same as C3	
C8	Same as C2	
C9	Same as C4	
C10	Capacitor, Fixed, Electrolytic	CE105-25-16
C11	Same as C4	
C12 and C13	Same as C1	
C14	Same as C4	
C15	Capacitor, Fixed, Mica	CM111F201J5S
C16	Capacitor, Fixed, Mica	CM111E240J5S
C17	Capacitor, Fixed, Mica	CM111F241J5S
C18	Capacitor, Fixed, Mica	CM111F151J5S
C19	Same as C17	
C20	Capacitor, Fixed, Mica	CM111E820J5S
C21	Same as C18	
C22	Same as C1	
C23	Not Used	
C24 and C25	Same as C1	
C26 thru C28	Same as C4	
CR1 and CR2	Semiconductor, Device, Diode	1N914
CR3	Semiconductor, Device, Diode	1N756
CR4	Same as CR1	
L1	Coil, RF, Fixed	CL275-100
L2 thru L4	Transformer	TT307-19
L5	Coil, RF, Fixed	CL275-102

REF. SYMBOL	DESCRIPTION	TMC PART NO.
L6 and L7	Same as L1	
L8	Coil, RF, Fixed	CL275-470
L9 and L10	Coil, RF, Fixed	CL275-330
L11	Same as L1	
Q1	Transistor	2N3646
Q2 and Q3	Transistor	2N3638
Q4 thru Q6	Transistor	40841
Q7 thru Q9	Transistor	2N706
R1	Resistor, Fixed, Composition	RC07GF472J
R2	Resistor, Fixed, Composition	RC07GF103J
R3 and R4	Resistor, Fixed, Composition	RC07GF473J
R5	Same as R2	
R6	Not Used	

REF. SYMBOL	DESCRIPTION	TMC PART NO.
R7	Resistor, Fixed, Composition	RC07GF100J
R8 and R9	Resistor, Fixed, Composition	RC07GF470J
R10	Resistor, Fixed, Composition	RC07GF102J
R11	Same as R8	
R12	Resistor, Fixed, Composition	RC07GF331j
R13 and R14	Same as R8	
R15	Same as R12	
R16	Same as R8	
R17	Resistor, Fixed, Composition	RC07GF104J
R18	Same as R8	
R19	Same as R2	
R20	Same as R10	
R21	Same as R8	
R22 and R23	Same as R2	
R24	Resistor, Fixed, Composition	RC07GF152J
R25	Resistor, Fixed, Composition	RC07GF273J
R26	Resistor, Fixed, Composition	RC07GF562J

REF. SYMBOL	DESCRIPTINN	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
MIXER/OSCILLATOR CONTROL ASSEMBLY A4957 (Z109) (Continued)					
R27	Same as R10		R31 thru R38	Not Used	
R28	Resistgr, Fixed, composition	RC07GF822J	R39	Same as R10	
R29	Same as R10		TP1 thru TP6	Terminal, Stud	TE127-2
R30	Resistor, Fixed, Composition	RC07GF221J			
100-Hz SYNTHESIZER ASSEMBLY A4950 (Z110)					
C1	Capacitor, Fixed, Mica	CM112E272J5S	C18	Capacitor, Fixed, Mica	CM111E910J5S
C2	Capacitor, Fixed, Ceramic	CC131-39	C19	Same as C5	
C3	Same as C1		C20	Not Used	
C4	Same as C2		C21	Capacitor, Tan, Foil	CX118E10N15C1
C5	Capacitor, Fixed, Electrolytic	CE105-100-16	C22 and C23	Same as C2	
C6	Same as C2		C24	Same as C7	
C7	Capacitor, Fixed, Ceramic	CC100-41	C25	Same as C1	
			C26	Same as C2	
C8 thru C10	Same C2		C27	Same as C1	
C11 and C12	Capacitor, Fixed, Mica	CM111E470J5S	C28	Same as C16	
C13 thru C15	Same as C2		C29	Capacitor, Fixed, Mica	CM111F131J5S
			C30	Same as C7	
C16	Capacitor, Fixed, Mica	CM111E331J5S	C31 and C32	Capacitor, Fixed, Mica	CM111E681J5S
C17	Not Used		C33	Same as C5	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
	100-Hz SYNTHESIZER ASSEMBLY A4950 (Z110) (Continued)				
L1 and L2	Coil, RF, Fixed	CL275-103	R13	Resistor,	RC07GF682J
L3 and L4	Coil, RF, Fixed	CL275-221	R14 thru R17	Same as R1	
L5	Same as L1		R18	Resistor, Fixed, Composition	RC07GF561J
L6	Coil, RF, Fixed,	CL275-681	R19	Same as R1	
L7	Coil, RF, Fixed	CL275-100	R20	Resistor, Fixed, Composition	RC07GF151J
L8 and L9	Same as L1		R21	Same as R1	
Q1 and Q2	Transistor	40822 or 40841	R22	Sameaas R20	
Q3	Transistor	2N697	R23	Same as R10	
Q4 and Q5	Same as Q1		R24	Same as R1	
			R25	Same as R5	
R1 thru R3	Resistor,	RC07GF470J	R26	Resistor, Variable	RV124-1-104
R4	Resistor Fixed, Composition	RC07GF221J	R27	Same as R5	
			R28	Same as R26	
R5	Resistor, Fixed, Composition	RC07GF103J	R29	Same as R5	
			CR1 and CR2	Semiconductor,	MV1404
R6	Same as R4				
R7	Same as R5		T1 and T2	Transformer, RF, Tuned	TT307-20
R8	Same as R1		T3 and T4	Transformer, RF Tuned	TT307-25
R9	Same as R5				
R10 and R11	Resistor, Fixed, Composition	RC07GF102J	T5 and T6	Same as T1	
R12	Same as R1				

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
DIGITAL LOGIC AND CONTROL MOTHER BOARD A4960 (Z111)					
XZ101	Not Used		XZ107	Same as XZ102	
XZ102 and XZ103	Connector, Receptacle	JJ319-22DPD	XZ108	Not Used	
			XZ109 thru XZ110	Same as XZ104	
XZ104 thru XZ106	Connector, Recepacle	JJ319-10DPD			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
SYMMETRICAL FILTER ASSEMBLY A4961-1 (Z112)					
C1 thru C13	Capacitor, Fixed, Ceramic	CC131-39	R10	Resistor, Fixed, composition	RC07GF473J
C14 thru C18	Not Used		R11	Same as R6	
C19 and C20	Same as C1		R12	Same as R2	
FL1	Filter, 0.4 kHz, Symmetrical	FX306	R13 and R14	Same as R6	
FL2	Fllter, 1 kHz Symmetrical	FX305	R15	Resistor, Fixed, Composition	RC07GF151J
L1	Coil, RF, Fixed	CL275-103	R16	Same as R2	
Q1 thru Q4	Transistor	2n1711	R17	Same as R4	
			R18	Same as R2	
R1	Resistor, Fixed, Composition	RC07GF822J	R19	Same as R7	
			R20	Same as R4	
R2	Resistor, Fixed, Composition	RC07GF470J	R21	Same as R10	
			R22	Same as R2	
R3	Resistor, Fixed, Composition	RC07GF102J	R23	Same as R6	
			R24	Resistor, Fixed, Composition	RC07GF391J
R4	Resistor, Fixed, Composition	RC07GF561J	R25 thru R34	Not Used	
R5	Same as R2		R35	Same as R2	
R6	Resistor, Fixed, Composition	RC07GF101J			
R7	Resistor, Fixed, composition	RC07GF393J			
R8	Same as R2				
R9	Same as R4				

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PATT NO.
		SYMMETRICAL FILTER ASEEMBLY A4961-2 (Z113)			
C1 thru C20	Capacitor, Fixed, Ceramic	CC131-39	R12	Same as R2	
FL1	Filter, 3kHz Symmetrical	FX304	R13 and R14	Same as R6	
FL2	Filter, 6kHz Symmetrical	FX303	R15	Resistor, Fixed, Composition	RC07GF151J
L1	Coil, RF, Fixed	CL275-103	R16	Same as R2	
Q1 thru Q6	Transistor	2N1711	R17	Same as R4	
			R18	Same as R2	
R1	Resistor, Fixed, Composition	RC07GF822J	R19	Same as R7	
			R20	Same as R4	
R2	Resistor, Fixed, Composition	RC07GF470J	R21	Same as R10	
			R22	Same as R2	
R3	Resistor, Fixed, Composition	RC07GF102J	R23	Same as R6	
			R24	Resistor, Fixed, Composition	RC07GF391J
R4	Resistor, Fixed, Composition	RC07GF561J	R25	Same as R2	
R5	Same as R2		R26	Same as R4	
R6	Resistor, Fixed, Composition	RC07GF101J	R27	Same as R6	
			R28	Same as R7	
R7	Resistor, Fixed, Composition	RC07GF393J	R29	Same as R6	
			R30	Same as R2	
R8	Same as R2		R31	Same as R10	
R9	Saem as R4		R32	Same as R2	
R10	Resistor, Fixed, Composition	RC07GF473J	R33	Same as R6	
			R34 and R35	Same as R2	
R11	Same as R6				

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		AUDIO ASSEMBLY A4962 (Z114)			
C1	Capacitor, Fixed, Electrolytic	CE105-100-16	C22	Not Used	
			C23	Same as C1	
C2	Capacitor, Fixed, Ceramic	CC131-39	C24 and C25	Not Used	
C3	Ca acitor, Fixed, Ceramic	CC100-43	C26 thru C29	Same as C2	
C4 and C5	Capacitor, Fixed, Ceramic	CC100-33	CR1 and CR2	Semiconductor, Device, Diode	1N914
C6	Capacitor, Fixed, Electrolytic	CE105-1-15	CR3 and CR4	Semiconductor, Device, Diode	1N750
			CR5	Semiconductor, Device, Diode	1N757
C7 and C8	Same as C3				
C9	Same as C1		CR6 thru CR9	Semiconductor, Device, Diode	1N100
C10	Capacitor, Fixed, Electrolytic	CE105-200-15	L1	Coil, RF, Fixed	CL275-103
			Q1 and Q2	Transistor	2N301
C11	Capacitlr, Fixed, Electrolytic	CE105-25-15			
			Q3	Transistor	2N4352
C12	Same as C1		Q4	Transistor	40822
C13	Same as C2		Q5	Transistor	2N1711
C14	Same as C1		Q6 and Q7	Transistor	2N3646
C15 and C16	Same as C2				
			R1	Resistor, Fixed, Composition	RC07GF474J
C17	Capacitor, Fixed, Ce amic	CC100-40			
			R2	Resistor, Fixed, Composition	RC07GF562J
C18 and C19	Same as C2				
C20	Capacitor, Fixed, Mica	CM111C100D5S	R3	Resistor, Fixed, Composition	RC07GF472J
C21	Capacitor, Fixed, Mica	CM111C030D5S			
			R4	Resistor, Fixed, Composition	RC07GF332J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
AUDIO ASSEMBLY A4962 (Z114) (Continued)					
R5	Resistor, Variable Composition	RV124-3-502	R21	Resistor, Fixed, Composition	RC07GF182J
R6	Resistor, Fixed, Composition	RC07GF2R7J	R22	Resistor, Fixed, Composition	RC07GF103J
R7 and R8	Resistor, Fixed, Composition	RC07GF221J	R23	Resistor, Fixed, Composition	RC07GF825J
R9	Resistor, Fixed, Composition	RC32GF470J	R24	Resistor, Fixed, Composition	RC07GF102J
R10	Resistor, Fixed, Composotion	RC32GF101J	R25	Same as R3	
			R26	Same as R22	
R11	Resistor, Fixed, Composition	RC20GF4R7J	R27	Resistor, Fixed, Composition	RC07GF101J
R12	Same as R10		R28	Same as R22	
R13	Same as R9		R29	Resistor, Fixed, Composition	RC07GF222J
R14	Same as R11				
R15	Not Used		R30	Resistor, Fixed, Composition	RC07GF105J
R16	Resistor, Fixed, Composition	RC07GF471J	R31	Same as R22	
R17	Resistor, Fixed, Composition	RC07GF335J	R32	Resistor, Fixed, Composition	RC07GF223J
R88	Resistor, Fixed, Composition	RC07GF104J	R33	Same as R27	
			R34	Same as R32	
R19	Resistor, Fixed, Composition	RC07GF392J	R35	Same as R4	
			R36	Resistor, Fixed, Composition	RC07GF153J
R20	Resistor, Fixed, composition	RC07GF185J	R37	Same as R2	

AUDIO ASSEMBLY A4962 (Z114) (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
R38	Not Used		R43	Not Used	
R39	Same as R27		R44	Same as R27	
R40	Same as R18		R45	Resistor, Fixed, Composition	RC32GF121J
R41	Resistor, Fixed, Composition	RC07GF151J	R46*	Resistor, Fixed, Composition	RC07GF221J
R42	Resistor, Variable, Composition	RV124-3-103	Z1	Microcircuit, Linear	NW193
			Z2	Microcircuit, Linear	NW156

*R46 Value is factory adjusted; it may differ from unit to unit. Verify actual value used.

USB AND LSB FILTER ASSEMBLIES A4963-1 AND A4963-2 (Z115, Z116)

C1 thru C6	Capacitor, Fixed, Ceramic	CC131-39	C8 thru C14	Same as C1	
C7	Not Used		C15	Capacitor, Fixed, electrolytic	CE105-50-16

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
USB AND LSB FILTER ASSEMBLIES A4963-1 AND A4963-2 (Z115, Z116) (Continued)					
C16 and C17	Same as C1		C39	Capacitor, Fixed, Ceramic	CC100-22
C18	Capacitor, Fixed, Mica	CM111E390J5S	C40	Capacitor, Fixed, Ceramic	CC100-29
C19 thru C21	Same as C1		C41	Same as C15	
C22	Same as C15		C42 and C43	Same as C1	
C23 thru C26	Same as C1		C44	Capacitor, Fixed, Mica	CM111E471J5S
C27	Capacitor, Fixed, Electrolytic	CE105-1-25	C45	Capacitor, Fixed, Ceramic	CC100-20
C28	Same as C15		C46	Same as C40	
C29 thru C33	Same as C1		C47	Same as C1	
C34	Capacitor, Fixed, Electrolytic	CE105-10-16	C48	Capacitor, Fixed, Electrolytic	CE105-1-16
C35 and C36	Same as C1		C49	Not Used	
C37	Capacitor, Fixed, Ceramic	CC100-33	C50	Same as C37	
C38	Capacitor, Fixed, Ceramic	CC100-19	C51 thru C59	Same as C1	
			CR1 and CR2	Semiconductor, Device, Diode	1N100

REF. SYMBOL	DESCRIPTION	TMC PART NO.
USB AND LSB FILTER ASSEMBLIES A4963-1 AND A4963-2 (Z115, Z116) (Continued)		
CR3 thru CR5	Semiconductor, Device, Diode	1N914
CR6	Same as CR1	
FL1	Filter, Upper Sideband	FX301
FL2	Filter, Lower Sideband	FX302
L1	Coil, RF, Fixed	CL275-103
L2	Coil, RF, Fixed	CL275-102
L3	Same as L1	
L4	Same as L2	
L5	Same as L1	
L6	Same as L2	
L7 thru L9	Same as L1	
L10	Coil, RF, Fixed	CL275-104
L11	Same as L10	
L12 and L13	Same as L2	
L14 thru L16	Same as L1	
Q1 and Q2	Transistor	2N1711
Q3 thru Q6	Transistor	40841
Q7	Same as Q1	
Q8 and Q9	Same as Q3	
Q10	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF822J
R2	Resistor, Fixed, Composition	RC07GF470J
R3	Resistor, Fixed, Composition	RC07GF102J
R4	Resistor, Fixed, Composition	RC07GF561J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
USB AND LSB FILTER ASSEMBLIES A4963-1 and A4963-2 (Z115, Z116) (Continued)					
R5	Resistor, Fixed, Composition	RC07GF101J	R19	Same as R10	
			R20	Same as R2	
R6 and R7	Same as R2		R21 and R22	Resistor, Fixed, Composition	RC07GF104J
R8	Same as R4				
			R23	Resistor, Fixed, Composition	RC07GF103J
R9	Resistor, Fixed, Composition	RC07GF273J			
			R24	Resistor, Fixed, Composition	RC07GF473J
R10	Resistor, Fixed, Composition	RC07GF472J			
			R25	Same as R2	
R11	Same as R2				
			R26	Same as R10	
R12	Resistor, Fixed, Composition	RC07GF391J	R27 and R28	Same as R2	
R13 and R14	Same as R5		R29	Same as R23	
R15	Resistor, Fixed, Composition	RC07GF223J	R30	Same as R18	
			R31	Resistor, Variable	RV124-3-503
R16 and R17	Same as R2				
			R32 and R33	Same as R2	
R18	Resistor, Fixed, Composition	RC07GF151J	R34	Same as R10	

REF. SYMBOL	DESCRIPTION	TMC PART NO.
USB AND LSB FILTER ASSEMBLIES A4963-1 and A4963-2 (Z115, Z116) (Continued)		
R35	Same as R2	
R36	Same as R23	
R37	Same as R18	
R38	Same as R31	
R39 and R40	Same as R2	
R41	Resistor, Fixed, Composition	RC07GF333J
R42	Same as R10	
R43	Same as R3	
R44	Same as R5	
R45	Same as R23	
R46	Resistor, Fixed, Composition	RC07GF105J
R47	Resistor, Fixed, Composition	RC07GF125J
R48	Same as R21	
R49	Same as R15	
R50 and R51	Same as R2	
R52	Resistor, Fixed, Composition	RC07GF562J
R53	Resistor, Fixed, Composition	RC07GF331J
R54	Same as R2	
R55 and R56	Same as R23	
R57	Same as R3	
R58	Same as R23	
R59 and R60	Same as R2	
R61	Same as R15	
R62	Same as R52	
R63	Same as R21	
R64 and R65	Same as R2	
R66	Same as R15	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
USB AND LSB FILTER ASSEMBLIES A4963-1 and A4963-2 (Z115, Z116) (Continued)					
R67	Same as R21				
R68	Same as R24				
R69	Same as R52				
R70	Same as R24				
R71	Resistor, Fixed, Composition	RC07GF474J			
R72	Same as R5				
R73	Resistor, Fixed, Composition	RC07GF3R9J			
R74	Same as R3				
T1	Transformer, Audio	TF428			
Z1	Microcircuit, Linear	NW193			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		SYNC/AFC ASSEMBLY A4964 (Z117)			
C1 thru C3	Capacitor, Fixed, Ceramic	CC131-39	C23 thru C25	Same as C1	
C4 and C5	Capacitor, Fixed, Mica	CM112E272J5S	C26	Same as C11	
C6	Same as C1		C27 thru C31	Same as C1	
C7	Same as C4		C32	Not Used	
C8 thru C10	Same as C1		C33 and C34	Same as C1	
C11 thru C13	Capacitor, Fixed, Ceramic	CC100-29	C35	Capacitor, Fixed, Mica	CM111E471J5S
C14	Capacitor, Fixed, Electrolytic	CE105-200-16	C36	Capacitor, Fixed, Mica	CM111C220J5S
C15 thru C18	Same as C1		C37	Capacitor, Fixed, Ceramic	CC100-41
C19	Capacitor, Fixed, Mica	CM111E621J5S	C38	Same as C1	
C20	Capacitor, Fixed, Mica	CM112E332J5S	C39 and C40	Same as C14	
C21	Same as C1		C41	Not Used	
C22	Same as C4		C42	Same as C14	
			C43	Same as C1	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

SYNC/AFC ASSEMBLY A4964 (Z117) (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C44 thru C46	Same as C37	
C47 thru C49	Same as C1	
C50	Capacitor	CX118E10N15C1
CR1 thru CR6	Semiconductor, Device, Diode	1N914
CR7	Semiconductor, Device, Diode	1N756
CR8	Same as CR1	
CR9 and CR10	Semiconductor, Device, Diode	1N100
CR11 and CR12	Same as CR1	
FL1	Filter	FX300
L1 thru L3	Coil, RF, Fixed	CL275-102
L4 thru L6	Transformer, RF, Adjustable	TT307-20
L7 thru L9	Same as L1	
L10	Same as L4	
L11	Coil, RF, Fixed	CL275-472
L12 and L13	Same as L1	
Q1	Transistor	2N706
Q2 thru Q4	Transistor	2N4221
Q5	Same as Q1	
Q6	Same as Q2	
Q7	Same as Q1	
Q8	Transistor	3N128
Q9	Not Used	
Q10	Transistor	40841
Q11 and Q12	Transistor	2N2368
R1	Resistor, Fixed, Composition	RC07GF822J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
SYNC/AFC ASSEMBLY A4964 (Z117) (Continued)					
R2	Resistor, Fixed, Composition	RC07GF561J	R13	Resistor, Fixed, Composition	RC07GF154J
R3	Resistor, Fixed, Composition	RC07GF474J	R14	Same as R9	
			R15	Same as R13	
R4	Resistor, Fixed, Composition	RC07GF473J	R16	Same as R9	
			R17	Same as R13	
R5	Same as R3		R18	Same as R9	
R6	Same as R4		R19 thru R22	Resistor, Fixed, Composition	RC07GF472J
R7	Same as R3				
R8	Same as R4		R23	Same as R3	
R9	Resistor, Fixed, Composition	RC07GF470J	R24	Resistor, Fixed, Composition	RC07GF223J
R10	Resistor, Variable	RV124-3-501	R25	Resistor, Fixed, Composition	RC07GF471J
R11	Resistor, Fixed, Composition	RC07GF102J	R26	Resistor, Fixed, Composition	RC07GF103J
R12	Same as R9		R27	Same as R26	

SYNC/AFC ASSEMBLY A4964 (Z117) (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
R28	Same as R9	
R29	Resistor, Variable	RV124-3-103
R30	Not Used	
R31	Same as R13	
R32	Same as R9	
R33	Resistor, Fixed, Composition	RC07GF221J
R34 thru R36	Same as R19	
R37	Same as R26	
R38	Resistor, Fixed, Composition	RC07GF152J
R39	Resistor, Fixed, Composition	RC07GF823J
R40	Resistor, Fixed, Composition	RC07GF390J
R42	Same as R19	

REF. SYMBOL	DESCRIPTION	TMC PART NO.
R43	Same as R26	
R44	Same as R10	
R45	Same as R25	
R46	Same as R26	
R47 and R48	Same as R1	
R49	Same as R11	
R50	Resistor, Fixed, Composition	RC07GF222J
R51	Not Used	
T1	Transformer, RF, Adjustable	TT300
Z1	Microcircuit, Linear	NW156

XVCO ASSEMBLY A4994 (P/O Z117)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1	Capacitor, Fixed, Ceramic	CC100-41
C2	Capacitor, Fixed, Ceramic	CC131-39
C3	Capacitor, Fixed, Mica	CM111E221J5S
C4	Capacitor, Fixed, Mica	CM111E331J5S
C5	Capacitor, Variable	CV112-4
C6 and C7	Same as C1	
C8	Same as C2	
C9	Capacitor, Fixed, Mica	CM111E122J5S
C10	Same as C2	
C11 and C12	Capacitor, Fixed, Mica	CM111E470J5S
C13	Same as C2	
CR1	Semiconductor, Device, Diode	MV1404
L1	Coil, RF, Fixed	CL275-102
L2 and L3	Coil, RF, Fixed	CL275-103
L4	Coil, RF, Fixed	CL275-331
Q1	Transistor	2N706
Q2	Transistor	40841
R1	Resistor, Fixed, Composition	RC07GF224J
R2	Resistor, Fixed, Composition	RC07GF393J
R3	Resistor Fixed, Composition	RC07GF104J
R4	Resistor, Fixed, Composition	RC07GF223J
R5	Resistor, Fixed, Composition	RC07GF333J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
AVCO ASSEMBLY A4994 (P/O Z117)					
R6	Resistor, Fixed, Composition	RC07GF470J			
R7	Resistor, Fixed, Composition	RC07GF101J			
R8	Resistor Fixed, Composition	RC07GF472J			
R9	Resistor, Fixed, Composition	RC07GF103J			
R10	Resistor, Fixed, Composition	RC07GF123J			
R11 and R12	Same as R6				
R13 and R14	Resistor, Fixed, Composition	RC07GF102J			
Y1	Crystal, Quartz	CR27/U1.250000			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
BFO ASSEMBLY A4965 (Z118)					
C1 and C2	Capacitor, Fixed, Ceramic	CC131-39	CR1	Semiconductor, Device, Diode	1N756
C3	Capacitor, Fixed, Electrolytic	CE105-50-16	CR2	Capacitor, Voltage Variable	CX106-16
C4	Same as C1		CR3	Semiconductor, Device, Diode	1N3826
C5	Capacitor, Fixed, Ceramic	CC100-43	CR4	Semiconductor, Device, Diode	1N914
C6 thru C9	Same as C1		L1 and L2	Coil, RF, Fixed	CL275-103
C10	Same as C3		L3 thru L5	Coil, RF, Fixed	CL275-102
C11 and C12	Same as C1		L6	Coil, RF, Fixed	CL275-682
C13	Capacitor, Fixed, Mica	CM112E202J5S	Q1	Transistor	40841
C14 thru C16	Same as C1		Q2	Transistor	2N3646
C17	Capacitor, Fixed, Mica	CM111E470J5S	Q3	Same as Q1	
C18 thru C20	Same as C1		Q4	Transistor	2N697
			R1	Resistor, Fixed, Composition	RC07GF220J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
BFO ASSEMBLY A4965 (Z118) (Continued)					
R2	Resistor, Fixed, Composition	RC07GF101J	R11	Same as R4	
			R12	Same as R5	
R3	Resistor, Fixed, Composition	RC07GF223J	R13	Same as R4	
R4	Resistor, Fixed, Composition	RC07GF102J	R14	Same as R7	
			R15	Same as R4	
R5	Resistor, Fixed, Composition	RC07GF470J	R16	Resistor, Fixed, Composition	RC07GF121J
R6	Resistor, Fixed, Composition	RC07GF621J	R17	Resistor, Fixed, Composition	RC07GF272J
R7	Resistor, Fixed, Composition	RC07GF103J	R18	Resistor, Fixed, Composition	RC07GF182J
R8	Resistor, Fixed, Composition	RC07GF104J	R19	Resistor, Fixed, Composition	RC07GF123J
R9	Same as R5		R20	Resistor, Fixed, Composition	RC07GF273J
R10	Resistor, Fixed, Composition	RC07GF820J	R21	Resistor, Fixed, Composition	RC07GF103J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		BFO ASSEMBLY A4965 (Z118) (Continued)			
T1	Transformer, Adjustable	TT307-20			
Z1	Microcircuit, Digital	NW159			
Z2	Microcircuit, Digital	NW176			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

AUDIO FILTER MOTHER BOARD A4966 (Z119)

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1 thru C6	Capacitor, Fixed, Ceramic	CC131-39	CR1 and CR2	Semiconductor, Device, Diode	1N914
C7 thru C17	Capacitor, Fixed, Electrolytic	CE105-100-16	XZ1 thru XZ11	Not used	
			XZ12 thru XZ18	Connector, Receptacle	JJ319-10DPD

PRESELECTOR ASSEMBLY A5628 (Z120)
BDCST BAND

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1 thru C4	Capacitor, Fixed, Ceramic	CC100-28	C12	Capacitor, Fixed, Mica	CM112E222J5S
C5	Capacitor, Variable	CV112-9	C13	Same as C11	
C6	Capacitor, Fixed, Mica	CM112E432J5S	C14	Capacitor, Fixed, Mica	CM112E562J5S
C7	Capacitor, Fixed, Mica	CM112E512J5S	C15	Capacitor, Fixed, Ceramic	CC100-13
C8	Capacitor, Fixed, Mica	CM112E752J5S	C16	Capacitor, Fixed, Ceramic	CC100-6
C9 and C10	Capacitor, Fixed, Mica	CM112E622J5S	K1 and K2	Relay (26.5 vdc)	RL160-3
C11	Capacitor, Fixed, Ceramic	CC100-43	L1 and L2	Coil, RF, Fixed	CL275-102

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
PRESELECTOR ASSEMBLY A5628 (Z120) (Continued) BDCST BAND					
L3 and L4	Coil, RF, Fixed	CL275-103			
L5	Coil, RF, Fixed,	CL275-681			
L6	Coil, RF, Fixed	CL275-8R2			
L7	Coil, RF, Fixed	CL275-4R7			
L8	Coil, RF, Fixed	CL275-6R8			
L9	Coil, RF, Fixed	CL275-5R6			
L10	Coil, RF, Fixed	CL275-2R7			
L11 thru L13	Same as L9				
L14	Coil, RF, Fixed	CL275-100			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
MULTIBAND PRE-SELECTOR P/O (Z121) A5645					
C11,C12, C13,C14, C18 thru C23, C27 thru C33, C37 thru C44, C48,C49, C50	Cap, Fxd, Cer	CC100-42	R8,R10, R16,R20	Resistor	RC07GF153J
			R1,R4, R5,R7, R11,R12, R13,R14, R17,R19	Resistor	RC07GF471J
			L1 thru L10	Coil	CL275-221
C1,C2, C3,C8, C9,C10, C51	Cap, Fxd, Cer	CC131-39	Q1 thru Q5	Transistor	2N2222
C35	Cap, Fxd, Cer	CM111E470J5S	T1 thru T11	Transformer	
C16,C25, C46	Cap, Fxd, Cer	CM111E560J5S			
C45	Cap, Fxd, Cer	CM111E680J5S			
C15,C17	Cap, Fxd, Cer	CM111E750J5S			
C24,C34, C47	Cap, Fxd, Cer	CM111E820J5S			
C26	Cap, Fxd, Cer	CM111F101J5S			
C36	Cap, Fxd, Cer	CM111F121J5S			
C6	Cap, Fxd, Cer	CM111F131J5S			
C5	Cap, Fxd, Cer	CM111F161J5S			
C4	Cap, Fxd, Cer	CM111F301J5S			
C7	Cap, Fxd, Cer	CM111F331J5S			
C52	Cap, Fxd, Cer	CM112F601J5S			
CR1 thru CR20	Scond Dev Dio	1N914			
R2,R3, R6,R9, R15,R18	Resistor	RC07GF103J			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

MULTIBAND PRE-SELECTOR

P/O (Z121) A5646

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1 thru C6, C11, C13,C15, C16,C17, C19,C20, C22,C24, C25,C26, C28,C29, C30,C31, C35,C36, C37,C38, C39,C44, C45,C46, C47,C48, C49,C50, C52,C54, C55	Capacitor	CC131-39	CR1 thru CR17	Scond Dev Dio	1N914
			R16	Resistor	RC07GF682J
			R1,R5, R8,R12	Resistor	RC07GF103J
			R2,R6, R9,R13	Resistor	RC07GF153J
			R3,R4	Resistor	RC07GF241J
			R15	Resistor	RC07GF330J
			R7,R10, R11,R14, R17	Resistor	RC07GF471J
C7	Capacitor	CC100-33	L7,L8	Coil, Rf	CL2750R39
C12,C18, C23	Capacitor	CC100-15	L25	Coil, Rf	
C14	Capacitor	CC100-42	L15,L16	Coil, Rf	CL275-3R9
C21,C27	Capacitor	CC100-31	L11,L12	Coil, Rf	CL275-8R2
C53	Capacitor		L9,L10, L13,L14, L17,L18, L19,L20 thru L24	Coil, Rf	CL275-221
C51	Capacitor	CE105-20-15			
C8	Capacitor	CM111E500J5S			
C42	Capacitor	CM111E510J5S	L1 thru L6	Coil, Rf	
C10	Capacitor	CM111F151J5S	Q1 thru Q4,Q6	Transistor	2N2222
C33	Capacitor	CM111F161J5S	Q5	Transistor	CP640
C40,C43	Capacitor	CM111F201J5S	T1 thru T6	Transformer	TF418
C41	Capacitor	CM111F221J5S			
C32	Capacitor	CM111F241J5S	Z1,Z2	Transformer	TS211-2
C34	Capacitor	CM111F301J5S	J1 thru J10	Transformer	460-2971-02

REF. SYMBOL	DESCRIPTION	TMC PART NO.
	POWER SUPPLY ASSEMBLY BMA513	
C201	Capacitor, Fixed, Electrolytic	CE112-3
C202	Capacitor, Fixed, Ceramic	CC100-37
C203	Capacitor, Fixed, Electrolytic	CE116-5V
C204 and C205	Same as C202	
C206	Capacitor, Fixed, Metallized	CN112A105K2
C207 and C208	Same as C202	
CR201	Semiconductor, Device, Rectifier	RX108-2
CR202	Diode, Zener	1N2976B
CR203	Same as CR202	
F201	Fuse, Cartridge	FU102-1.5
F202	Fuse, Cartridge	FU102-8
J201	Connector, Receptacle	JJ146
L201	Coil, Fixed	CL485
P201	Cord, Line, A-c	CA1754
P202	P/OJ201	PL123
Q201 and Q202	Transistor	2N3442
R201	Resistor, Fixed, Wire Wound	RW110-1
R202	Resistor, Fixed, Wire Wound	RW109-1
R203	Resistor, Fixed, Wire Wound	RW107-20
R204 and R205	Resistor, Fixed, Wire Wound	RW109-5
R206	Same as R201	
R207	Resistor, Fixed, Wire Wound	RW110-2

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

POWER SUPPLY ASSEMBLY BMA513 (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
R208	Not Used	
R209	Same as R204	
R210 thru R212	Resistor, Fixed, Composition	RC07GF470J
R213	Resistor, Fixed, Composition	RC07GF103J
T201	Transformer, Power	TF434
TB201	Terminal, Barrier	TM117-35
XF201 and XF202	Holder, Fuse	FH100-1
XQ201 and XQ202	Socket, Semiconductor Device	TS166-1
XZ201	Not Used	
XZ202	Socket, Electron Tube	TS165-P01
X201	Power Supply Board Assembly	A4970

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

POWER SUPPLY BOARD ASSEMBLY A4970 (Z201)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1 and C2	Capacitor, Fixed, Electrolytic	CE105-200-16
C3	Capacitor, Fixed, Electrolytic	CE105-10-25
C4	Capacitor, Fixed, Ceramic	CC100-28
C5 and C6	Same as C1	
C7	Same as C3	
C8	Same as C4	
C9 and C10	Same as C1	
CR1 and CR2	Semiconductor Device, Diode	1N4370A
CR3 thru CR8	Semiconductor Device, Diode	1N914
CR9	Same as CR1	
CR10	Semiconductor Device, Diode	1N754A
CR11 and CR12	Same as CR3	
E1 thru E11	Terminal, Stud	TE127-2
Q1	Transistor	2N4036
Q2	Transistor	2N2631
Q3 and Q4	Transistor	2N706
Q5	Same as Q1	
Q6	Same as Q2	
Q7 and Q8	Same as Q3	
R1	Resistor, Fixed, Composition	RC07GF152J
R2	Resistor, Fixed, Composition	RC07GF151J
R3	Resistor, Fixed, Composition	RC07GF101J

POWER SUPPLY BOARD ASSEMBLY A4970 (Z201) (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
R4	Resistor, Variable	RV111U101A
R5	Resistor, Fixed, Composition	RC07GF560J
R6	Same as R3	
R7	Same as R4	
R8	Resistor, Fixed, Composition	RC07GF2R7J
R9	Same as R1	
R10	Same as R2	
R11	Same as R3	
R12	Resistor, Variable	RV111U102A
R13	Same as R4	
R14	Resistor, Fixed, Composition	RC07GF181J
R15	Same as R3	
R16	Resistor, Fixed, Composition	RC07GF102J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
TUNABLE IF ASSEMBLY A4977 (Z301)					
C1 thru C35	Capacitor, Variable	CV112-9	C58	Capacitor, Fixed, Mica	CM111E131J5S
C36	Capacitor, Variable	CV112-4	C59	Capacitor, Fixed, Mica	CM111E301J5S
C37	Capacitor, Fixed, Mica	CM111E271J5S	C60	Same as C49	
			C61	Same as C44	
C38	Capacitor, Fixed, Mica	CM111E221J5S	C62	Capacitor, Fixed, Mica	CM111E431J5S
C39	Capacitor, Fixed, Mica	CM111E181J5S	C63	Same as C49	
C40	Capacitor, Fixed, Mica	CM111E151J5S	C64	Same as C47	
			C65	Capacitor, Fixed, Mica	CM112E272J5S
C41	Capacitor, Fixed, Mica	CM111E121J5S	C66 and C67	Same as C49	
C42	Capacitor, Fixed, Mica	CM111E820J5S	C68	Same as C65	
C43	Capacitor, Fixed, Mica	CM111E560J5S	C69	Capacitor, Fixed, Mica	CM111E391J5S
C44	Capacitor, Fixed, Mica	CM111E201J5S	C70	Capacitor, Fixed, Mica	CM111C240J5S
C45	Capacitr, Fixed, Mica	CM111E241J5S	C71	Capacitor, Fixed, Mica	CM111C050J5S
C46	Capacitor, Fixed, Mica	CM111E681J5S	C72	Same as C47	
C47	Capacitor, Fixed, Ceramic	CC131-39	C73	Same as C71	
			C74 and C75	Same as C49	
C48	Capacitor, Fixed, Mica	CM111E331J5S	C76	Same as C47	
C49 thru C52	Capacitor, Fixed, Ceramic	CC100-43	C77	Capacitor, Fixed, Mica	CM112E332J5S
C53	Same as C44		C78	Same as C41	
C54 thru C57	Same as C49		C79	Same as C38	
			C80	Capacitor, Fixed, Mica	CM111C150J5S

TUNABLE IF ASSEMBLY A4977 (Z301) (Cnntinued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C81	Same as C48	
C82	Same as C43	
C83	Same as C47	
C84	Capacitor, Fixed, Mica	CM111E361J5S
C85	Same as C37	
C86	Same as C38	
C87	Same as C39	
C88	Same as C40	
C89	Same as C41	
C90	Same as C42	
C91	Same as C43	
C92	Same as C48	
C93	Same as C37	
C94	Same as C38	
C95	Same as C39	
C96	Same as C40	
C97	Same as C41	
C98	Same as C42	
C99	Same as C43	
C100	Capacitor, Fixed, Mica	CM111C270J5S
C101	Same as C37	
C102	Same as C44	
C103	Capacitor, Fixed, Mica	CM111E161J5S
C104	Same as C58	
C105	Capacitor, Fixed, Mica	CM111E750J5S
C106 thru C108	Same as C49	
C109	Capacitor, Fixed, Mica	CM111E511J5S
C110	Same as C47	
C111 thru C113	Capacitor, Fixed, Mica	CM111E120J5S
C114	Same as C47	
C115	Same as C49	
C116	Same as C47	
C117 thru C119		
CR1 thru CR4	Capacitor, Voltage Variable	CX106-14
CR5	Semiconductor, Device, Diode	1N756
CR6	Capacitor, Voltage Variable	CX106-5
L1 and L2	Coil, RF, Fixed,	CL275-121
L3	Coil, RF, Fixed,	CL275-221
L4 thru L8	Coil, RF,	CL275-102
L9	Coil, RF, Fixed	CL275-103

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

TUNABLE IF ASSEMBLY A4977 (Z301) (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
Q1 thru Q6	Transistor	40841
R1	Resistor, Fixed, Composition	RC07GF103J
R2	Resistor, Fixed, Composition	RC07GF101J
R3	Resistor, Fixed, Composition	RC07GF105J
R4	Resistor, Fixed, Composition	RC07GF224J
R5	Resistor, Fixed, Composition	RC07GF475J
R6	Same as R1	
R7	Resistor, Fixed, Compositon	RC07GF151J
R8	Resistor, Fixed, Composition	RC07GF106J
R9	Resistor, Fixed, Composition	RC07GF102J
R10	Same as R1	
R11	Resistor, Fixed, Composition	RC07GF334J
R12	Same as R2	
R13	Same as R3	
R14	Same as R8	
R15	Same as R1	
R16	Same as R5	
R17	Same as R1	
R18	Same as R9	
R19	Same as R7	
R20	Same as R11	
R21	Same as R3	
R22	Same as R2	
R23	Resistor, Fixed, Composition	RC07GF822J
R24	Same as R9	
R25	Same as R2	
R26	Same as R2	
R27	Same as R9	
R28	Same as R2	
R29	Same as R1	
R30 thru R32	Resistor, Fixed, Composition	RC07GF470J
R33 thru R35	Resistor, Fixed, Composition	RC07GF104J
R36	Resistor, Fixed, Composition	RC07GF471J
R37	Same as R33	
R38	Same as R2	
R39	Same as R9	
R40	Same as R11	
R41	Same as R2	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
TUNABLE IF ASSEMBLY A4977 (Z301) (Continued)					
R42	Resistor, Variable	RV124-1-104	R49	Same as R9	
			S1	Switch, Detent	DT110
R43	Same as R11		T1	Transformer, Tunable	TT307-21
R44	Same as R2				
R45	Same as R4		T2 and T3	Transformer,	TT307-22
R46	Same as R2				
R47	Same as R30		T4	Transformer, Tunable	TT307-24
R48	Same as R1		T5	Transformer, Tunable	TT307-23
			T6		TT307-20
VOLTAGE DIVIDER ASSEMBLY A4999 (P/O Z301)					
C1 and C2	Capacitor, Fixed, Ceramic	CC131-39	R5	Resistor, Fixed, Composition	RC07GF122J
L1	Coil, RF, Fixed	CL275-102	R6 and R7	Resistor, Fixed, Composition	RC07GF331J
R1	Resistor, Fixed, Composition	RC07GF102J	R8	Resistor, Fixed, Composition	RC07GF271J
R2	Resistor, Fixed, Composition	RC07GF222J	R9 thru R11	Resistor, Fixed, Composition	RC07GF820J
R3 and R4	Resistor, Fixed, Composition	RC07GF182J			
DECOUPLING ASSEMBLY A5623 (P/O Z301)					
L1	Coil, RF, Fixed,	CL275-103	L3 thru L5	Same as L1	
L2	Coil, RF, Fixed	CL275-102			

PARTS LIST

for

160.5 mHz OSCILLAGOR ASSEMBLY
Z302
A5632

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, Ceramic	CC100-29
C2	Capacitor, Variable	CV112-3
C3	Capacitor, Fixed, Mica	CM111C100J5S
C4	Same as C1	
C5	Capacitor, Variable	CV112-7
C6	Same as C3	
C7	Same as C5	
C8	Capacitor, Fixed, Mica	CM111F101G5S
C9	Same as C3	
C10	Same as C8	
C11	Same as C5	
C12	Same as C8	
C13	Not Used	
C14	Capacitor, Fixed, Mica	CM111E020D5S
C15	Same as C1	
C16	Same as C1	
L1	Coil, Rf, Fixed	CL275-102
L2	Coil, Rf, Fixed	CL275-3R3
L3	Coil, 3 Tapped	CL496-2
L4	Coil, Rf, Fixed	CL275-1R0
L5	Same as L3	
L6	Same as L4	
L7	Coil, 2 Tapped	CL496-1
Q1	Transistor	2N1745
Q2	Transistor	2N2368
Q3	Same as Q2	
R1	Resistor, Fixed, Composition	RC07GF123J
R2	Resistor, Fixed, Composition	RC07GF473J
R3	Resistor, Fixed, Composition	RC07GF221J
R4	Resistor, Fixed, Composition	RC07GF682J
R5	Resistor, Fixed, Composition	RC07GF222J
R6	Resistor, Fixed, Composition	RC07GF121J
R7	Resistor, Fixed, Composition	RC07GF100J
R8	Resistor, Fixed, Composition	RC07GF332J
R9	Same as R6	
R10	Same as R4	
R11	Not Used	
R12	Resistor, Fixed, Composition	RC07GF471J
Y1	Crystal	CR119-53R5

REF. SYMBOL	DESCRIPTION	TMC PART NO.
SAMPLE MIXER ASSEMBLY A4979 (Z303)		
C1 thru C3	Capacitor, Fixed, Ceramic	CC100-43
C4	Not Used	
C5 and C6	Capacitor, Fixed, Mica	CM111E101J5S
C7	Capacitor, Fixed, Mica	CM111E240J5S
C8	Same as C5	
C9	Same as C1	
C10	Same as C5	
C11	Not Used	
C12	Capacitor, Fixed, Ceramic	CC100-29
C13	Same as C1	
C14 and C15	Capacitor, Fixed, Mica	CM111E470J5S
L1 and L2	Coil, RF	CL275-101
L3	Coil, RF	CL275-150
L4	Coil, RF	CL275-102
L5	Coil, RF	CL275-0R47
L6	Coil, RF	CL275-0R22
Q1 and Q2	Transistor	2N2368
R1	Resistor, Fixed, Composition	RC07GF221J
R2	Resistor, Fixed, Composition	RC07GF681J
R3	Resistor, Fixed, Composition	RC07GF562J
R4	Resistor, Fixed, Composition	RC07GF471J
R5	Resistor, Fixed, Composition	RC07GF682J
R6	Same as R4	
R7	Resistor, Fixed, Composition	RC07GF560J
R8 thru R10	Resistor, Fixed, Composition	RC07GF470J
R11 thru R13	Same as R7	
R14	Resistor, Fixed, Composition	RC07GF821J
R15	Same as R8	
R16	Resistor, Fixed, Composition	RC07GF822J
R17	Same as R1	
Z1	Microcircuit, Linear	NW195

163.5-192.5 MHz OSCILLATOR ASSEMBLY A4976 (Z304)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1 and C2	Capacitor, Fixed, Mica	CM111E101J5S
C3	Capacitor, Fixed, Mica	CM111C050J5S
C4 thru C7	Capacitor, Fixed, Ceramic	CC100-29
C8	Capacitor, Fixed, Mica	CM111C030J5S
C9 and C10	Same as C1	
C11	Capacitor, Fixed, Mica	CM111C330J5S
C12	Same as C1	
C13	Capacitor, Fixed, Mica	CM111C150J5S
C14 thru C18	Same as C1	
C19	Same as C3	
C20	Same as C8	
C21 thru C23	Same as C1	
C24 and C25	Same as C4	
C26	Capacitor, Fixed, Ceramic	CC100-41
CR1 and CR2	Capacitor, Voltage Variable	CX106-5
L1	Coil, RF	CL275-0R82
L2	Coil, HFO	CL486-2
L3	Coil, HFO	CL484-1
L4 and L5	Same as L1	
L6	Coil, HFO	CL484-3
L7 and L8	Same as L1	
L9	Coil, HFO	CL486-3
Q1	Transistor	2N3819
Q2	Transistor	3N128
Q3	Not Used	
Q4 and Q5	Transistor	2N2368
Q6	Same as Q1	
Q7	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF100J
R2 and R3	Resistor, Fixed, Composition	RC07GF270J
R4	Resistor, Fixed, Composition	RC07GF104J
R5	Resistor, Fixed, Composition	RC07GF154J
R6	Same as R4	
R7	Resistor, Fixed, Composition	RC07GF682J
R8	Resistor, Fixed, Composition	RC07GF221J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		163.5-192.5 MHz OSCILLATOR ASSEMBLY A4976 (Z304) (Continued)			
R9	Resistor, Fixed, Composition	RC07GF103J	R14 and R15	Same as R9	
R10	Resistor, Fixed, Composition	RC07GF562J	R16	Same as R1	
			R17	Same as R4	
R11	Resistor, Fixed, Composition	RC07GF101J	R18	Same as R5	
			R19 and R20	Same as R9	
R12	Resistor, Fixed, Composition	RC07GF680J	R21 thru R23	Same as R4	
R13	Resistor, Fixed, Composition	RC07GF121J			
		IF OUTPUT MIXER ASSEMBLY A4975 (Z305)			
C1	Capacitor, Fixed, Mica	CM111E911J5S	L1	Coil, RF, Fixed	CL275-1R5
C2 and C3	Capacitor, Fixed, Mica	CM112E162J5S	Z1	Rectifier	DD148
		RF INPUT MIXER ASSEMBLY A4974 (Z307)			
C1	Capacitor, Fixed, Mica	CM111E360D5S	L1	Coil, RF, Fixed	CL275-0R18
C2 and C3	Capacitor,	CM111E181J5S	Z1	Rectifier	DD148

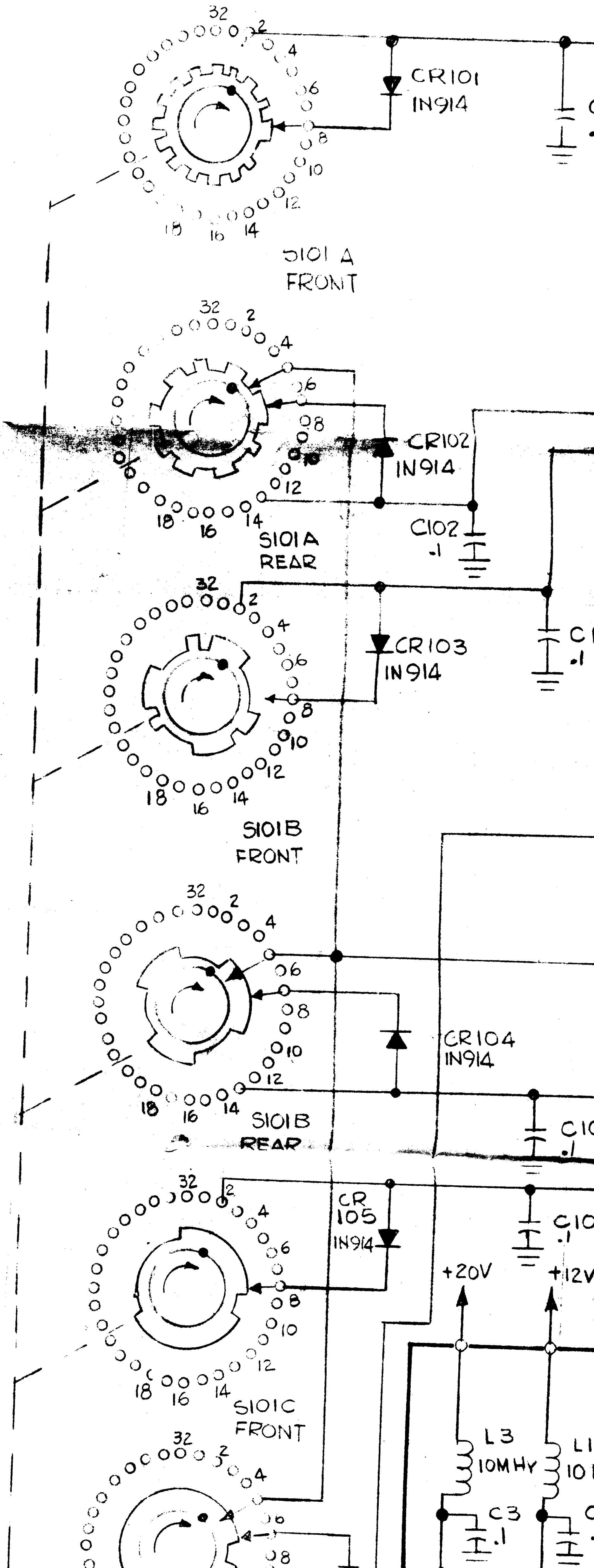
REF. SYMBOL	DESCRIPTION	TMC PART NO.
DIFFERENTIAL AMPLIFIER ASSEMBLY A5638 (Z306)		
C16,C18	Cap, Fxd, Mica	CC132-101
C24,C26, C28	Erie Feed Thru	2404000X-54010M
C8,C9, C11,C13, C15,C20, C22	Cap, Fxd, Mica	CM04CD120-D03
C1 thru C5,C10, C12,C17, C19,C21, C23,C25, C27,C29, C30,C31, C6,C7	Cap, Fxd, Cer Chip	CX132C47-1K1GAH
L1,L2	Coil, Rf, Fxd	CL275-1R0
L3,L4	Coil, Rf, Fxd	CL275-221
R5,R6, R7	Res, Fxd, Comp	RC05GF100J
R1 thru R3,R11, R13,R15	Res, Fxd, Comp	RC05GF101J
R4,R8, R9,R10, R12,R14, R17 thru R20	Res, Fxd, Comp	RC05GF104J
R21	Res, Fxd, Comp	RC05GF225J
R16	Res, Fxd, Comp	RC05GF751J
T7	Xfmr Rf, Adj	TT316-1
T6	Xfmr Rf, Adj	TT316-2
T2,T4, T8	Xfmr Rf, Adj	TT316-3
T5	Xfmr Rf, Adj	TT316-4
T3	Xfmr Rf, Adj	TT316-5
T1	Xfmr Rf, Adj	TT316-6
Q1,Q2, Q3	Transistor	3N200

SECTION 7

DIAGRAMS

7-1. GENERAL.

This section contains the schematic and component location diagrams of the GPR-110B. The overall schematic diagram of the unit is first presented, followed by the schematic, interconnection, and component location diagrams of the assemblies. The diagrams are arranged in reference designation order.



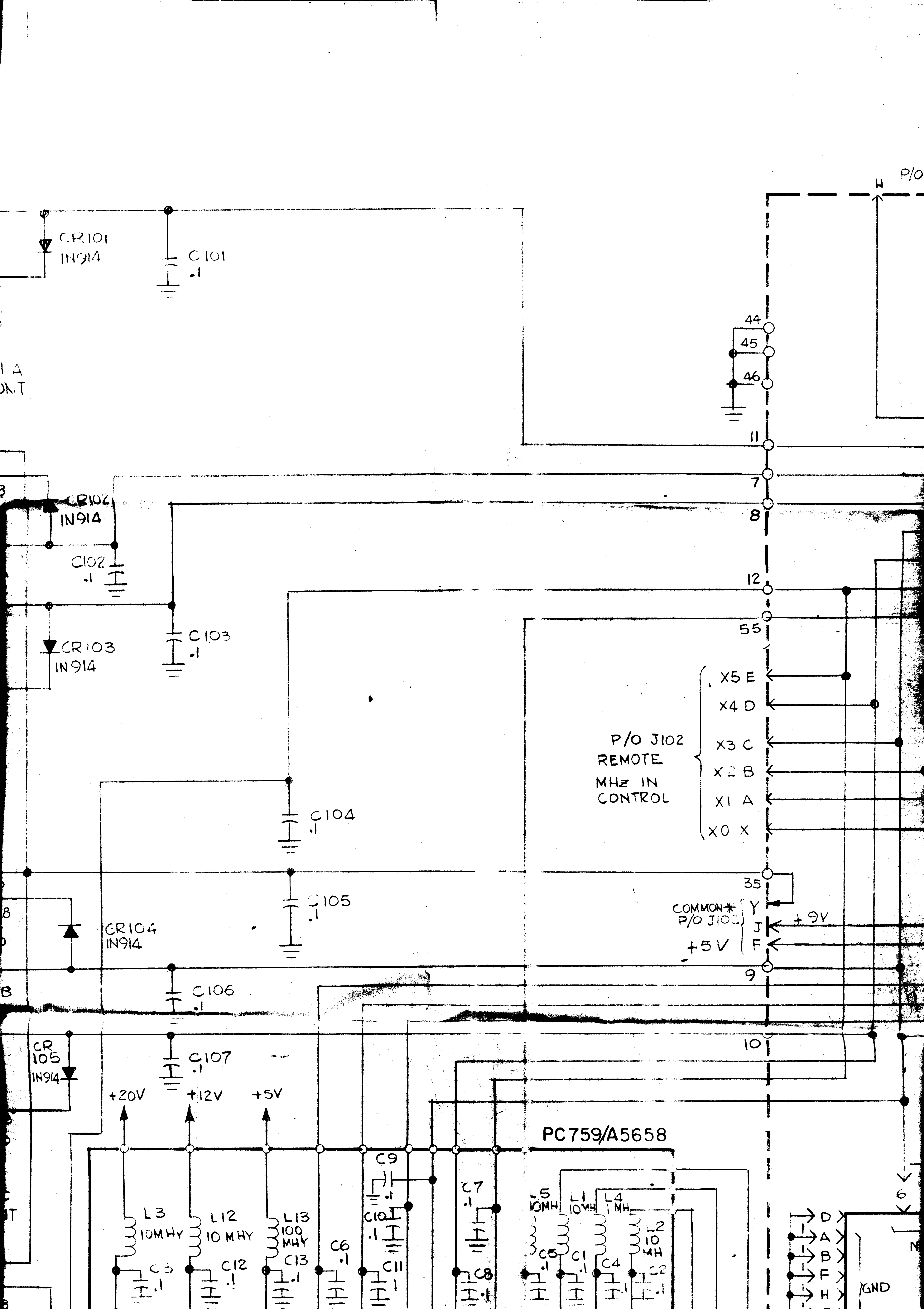
NOTES:
UNLESS OTHERWISE SPECIFIED

1-ALL RESISTANCE VALUES ARE IN OHMS

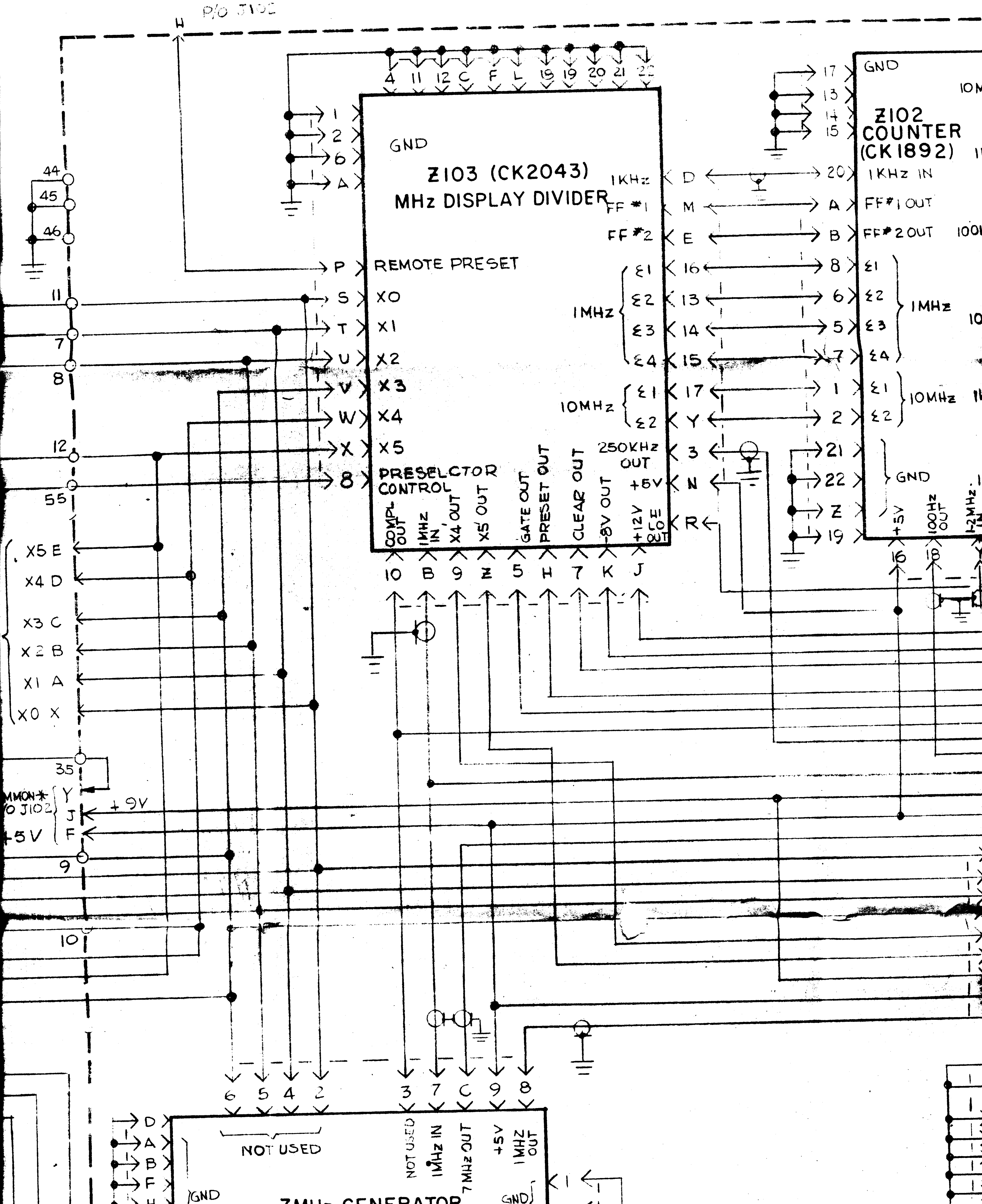
2-ALL DECIMALS CAPACITANCE VALUES ARE IN MICROFARADS

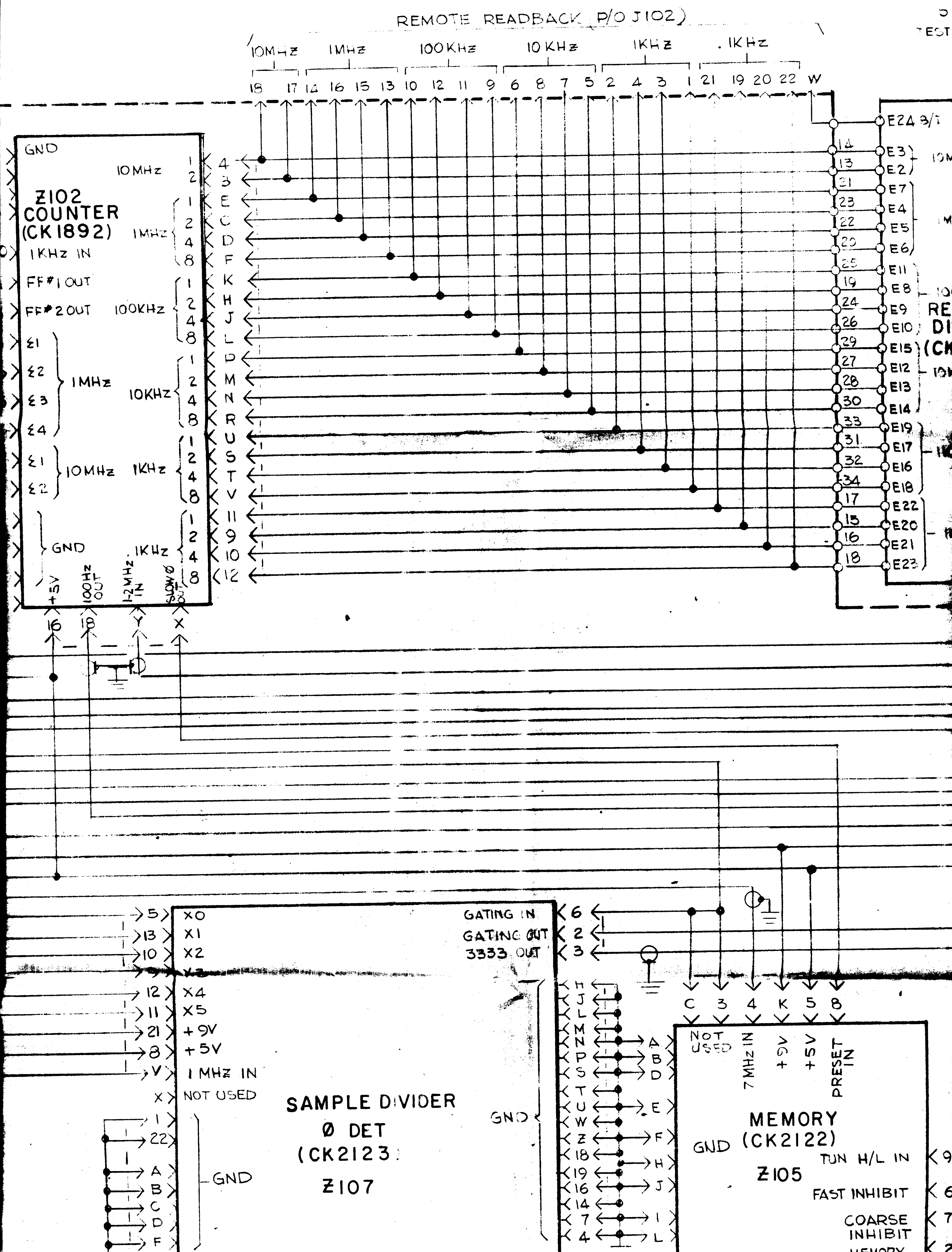
* CONNECT TO GND FOR LOC-L

PC692	A4965
LAST SYMB	MISSING SYMB
L6	
C13	

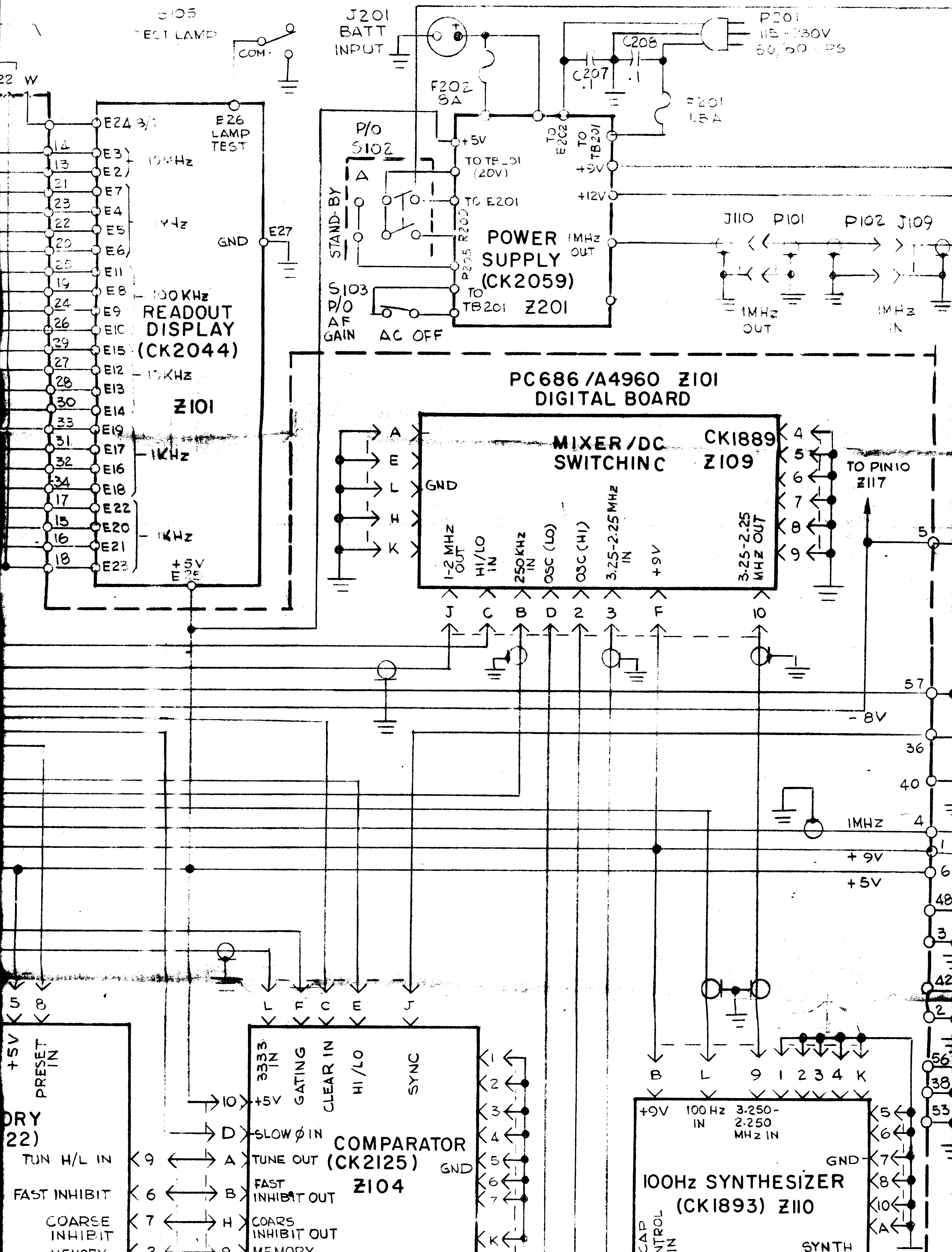


CR101
IN914
C101
.1
CR102
IN914
C102
.1
C103
.1
CR103
IN914
C104
.1
C105
.1
CR104
IN914
C106
.1
CR
105
IN914
C107
.1
+20V
+12V
+5V
PC759/A5658
L3
10MHY
L12
10 MHY
L13
100
MHY
C3
.1
C12
.1
C13
.1
C6
.1
C9
.1
C10
.1
C11
.1
C7
.1
C8
.1
L5
10MH
L1
10MH
L4
1MH
L2
10
MH
C5
.1
C1
.1
C4
.1
C2
.1
44
45
46
11
7
8
12
55
X5 E
X4 D
X3 C
X2 B
X1 A
X0 X
P/O J102
REMOTE
MHz IN
CONTROL
35
COMMON*
P/O J102
Y
J
F
+9V
+5V
9
10
6
D
A
B
F
H
GND
P/O

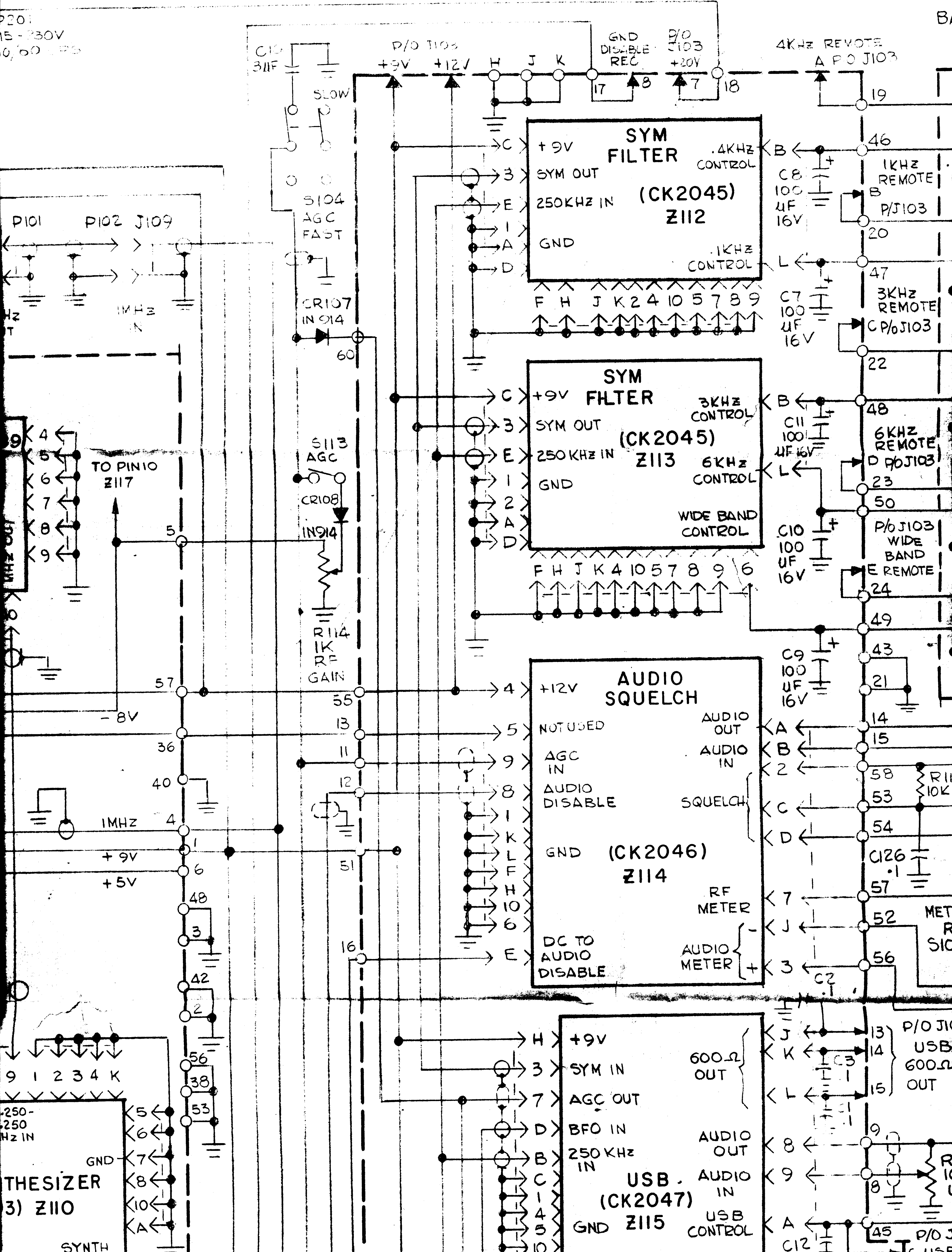

P/O J102
Z103 (CK2043)
MHz DISPLAY DIVIDER
GND
REMOTE PRESET
X0
X1
X2
X3
X4
X5
PRESELCTOR CONTROL
1KHz
FF #1
FF #2
1MHz
10MHz
250KHz OUT
+5V
COMPL OUT
1MHz IN
X4 OUT
X5 OUT
GATE OUT
PRESET OUT
CLEAR OUT
-8V OUT
+12V
HI LO OUT
Z102
COUNTER
(CK1892)
1KHz IN
FF#1 OUT
FF#2 OUT
+5V
100Hz OUT
X5 E
X4 D
X3 C
X2 B
X1 A
X0 X
+9V
+5V
NOT USED
7MHz GENERATOR
1MHz IN
7MHz OUT
1MHz OUT



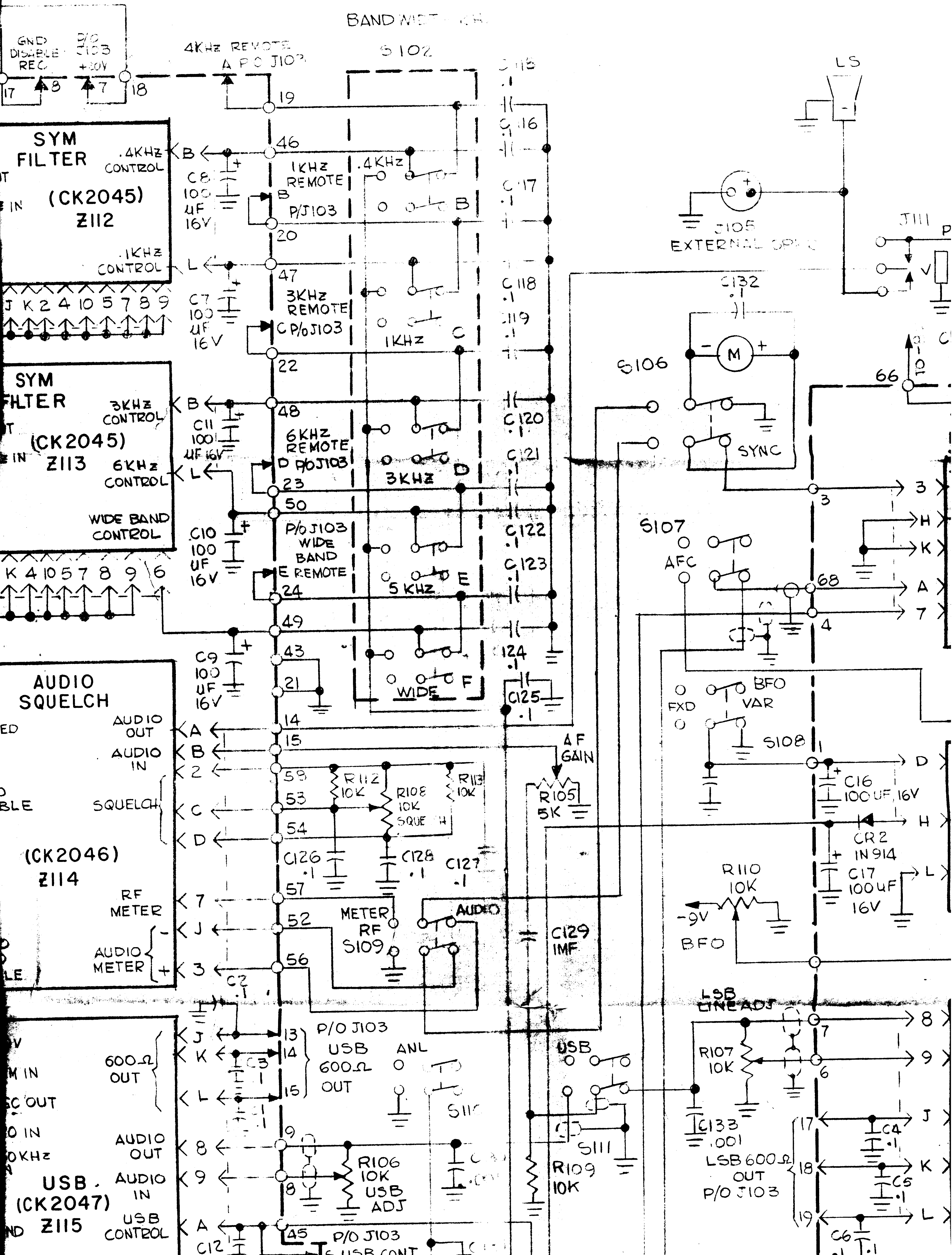
REMOTE READBACK (P/O J102)
10MHz
1MHz
100KHz
10KHz
1KHz
.1KHz
Z102
COUNTER
(CK1892)
GND
10MHz
1MHz
100KHz
10KHz
1KHz
1KHz IN
FF#1 OUT
FF#2 OUT
+5V
100Hz OUT
1-2MHz IN
SLOW Ø
SAMPLE DIVIDER
Ø DET
(CK2123)
Z107
X0
X1
X2
X3
X4
X5
+9V
+5V
1 MHz IN
NOT USED
GATING IN
GATING OUT
3333 OUT
GND
MEMORY
(CK2122)
Z105
NOT USED
7 MHz IN
+9V
+5V
PRESET IN
TUN H/L IN
FAST INHIBIT
COARSE INHIBIT
TEST



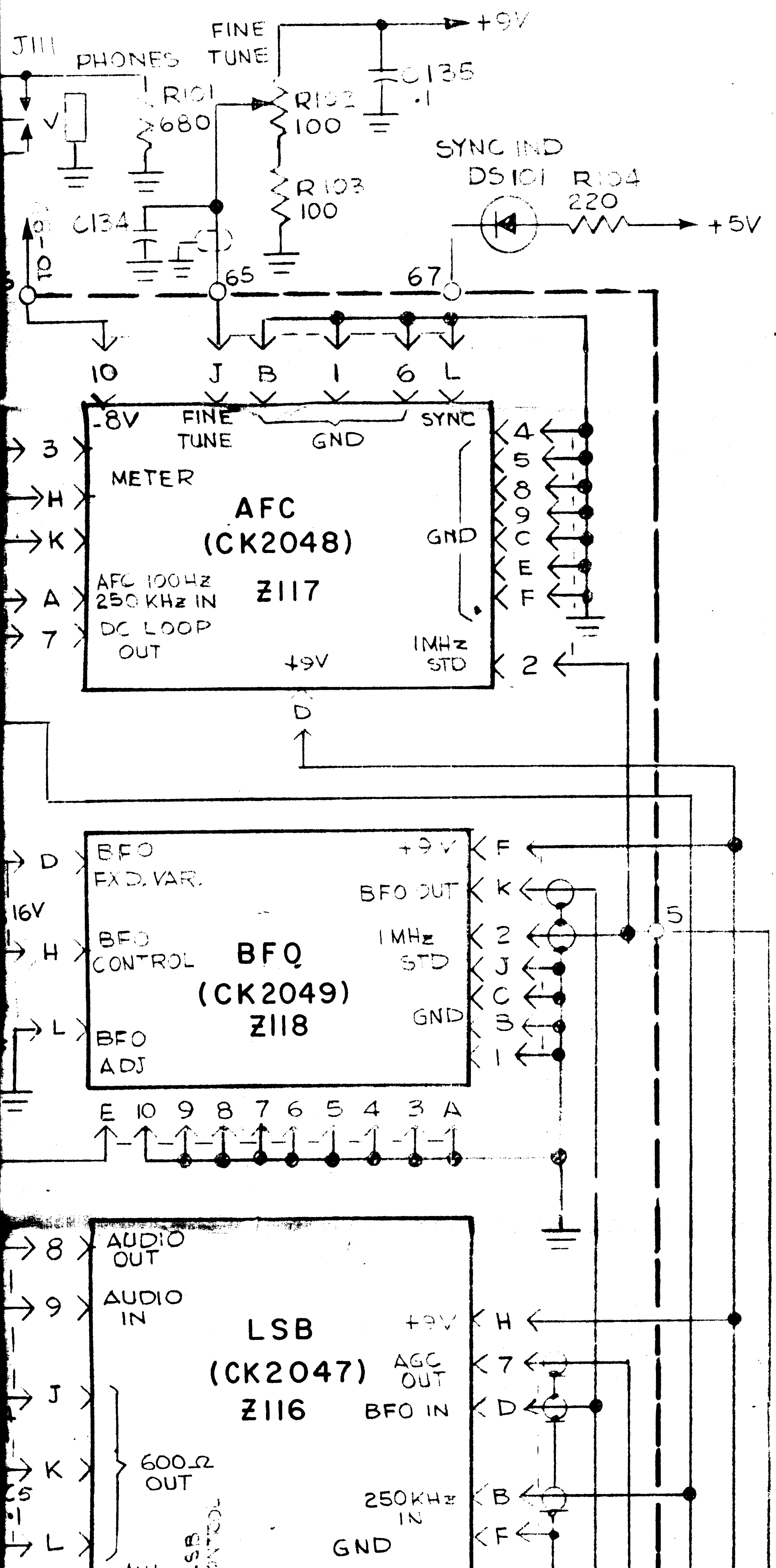
S105
TEST LAMP
COM
J201
BATT
INPUT
P201
115-230V
50/60 CPS
C208
C207
.1
F202
5A
F201
1.5A
E24 B/T
E26
LAMP
TEST
E3
E2
10 MHz
E7
E4
E5
E6
1 MHz
GND
E27
E11
E8
100 KHz
E9
E10
E15
READOUT
DISPLAY
(CK2044)
E12
E13
E14
10 KHz
Z101
E19
E17
E16
E18
1 KHz
E22
E20
E21
E23
1 KHz
+5V
E25
P/O
S102
STAND-BY
A
+5V
TO TB201 (20V)
TO E201
TO E202
TO TB201
+9V
+12V
POWER
SUPPLY
(CK2059)
Z201
1MHz
OUT
S103
P/O
AF
GAIN
AC OFF
TO
TB201
J110
P101
P102
J109
1MHz
OUT
1MHz
IN
PC686/A4960 Z101
DIGITAL BOARD
MIXER/DC
SWITCHING
CK1889
Z109
GND
1-2 MHz OUT
HI/LO IN
250KHz IN
OSC (LO)
OSC (HI)
3.25-2.25 MHz IN
+9V
3.25-2.25 MHz OUT
TO PIN10
Z117
-8V
IMHZ
+9V
+5V
+5V
PRESET IN
ORY
22)
TUN H/L IN
FAST INHIBIT
COARSE
INHIBIT
3333 IN
GATING
CLEAR IN
HI/LO
SYNC
+5V
SLOW Ø IN
TUNE OUT
FAST
INHIBIT OUT
COARS
INHIBIT OUT
MEMORY
COMPARATOR
(CK2125)
Z104
GND
+9V
100 Hz IN
3.250-2.250 MHz IN
GND
100Hz SYNTHESIZER
(CK1893) Z110
CAP
NTROL
IN
SYNTH



P201
115-230V
50/60 CPS
C13
311F
SLOW
S104
AGC
FAST
P/O J103
+9V
+12V
H
J
K
GND
DISABLE
REC
P/O
J103
+20V
4KHz REMOTE
A P/O J103
P101
P102 J109
1MHz
IN
CR107
IN914
SYM
FILTER
+9V
SYM OUT
250KHz IN
GND
.4KHz
CONTROL
(CK2045)
Z112
.1KHz
CONTROL
C8
100
UF
16V
C7
100
UF
16V
1KHz
REMOTE
P/J103
3KHz
REMOTE
C P/O J103
SYM
FILTER
+9V
SYM OUT
250KHz IN
GND
3KHz
CONTROL
(CK2045)
Z113
6KHz
CONTROL
WIDE BAND
CONTROL
C11
100
UF 16V
C10
100
UF
16V
6KHZ
REMOTE
D P/O J103
P/O J103
WIDE
BAND
E REMOTE
S113
AGC
CR108
IN914
TO PIN 10
Z117
R114
1K
RF
GAIN
C9
100
UF
16V
AUDIO
SQUELCH
+12V
NOT USED
AGC
IN
AUDIO
DISABLE
GND
(CK2046)
Z114
DC TO
AUDIO
DISABLE
AUDIO
OUT
AUDIO
IN
SQUELCH
RF
METER
AUDIO
METER
-8V
1MHZ
+9V
+5V
C126
.1
METER
C2
+9V
SYM IN
AGC OUT
BFO IN
250 KHz
IN
USB
(CK2047)
Z115
GND
600Ω
OUT
AUDIO
OUT
AUDIO
IN
USB
CONTROL
C3
C12
P/O J10
USB
600Ω
OUT
SYNTHESIZER
3) Z110
GND
SYNTH


BAND WIDTH
S102
4KHz REMOTE
A P/O J103
GND DISABLE REC
P/O J103 +20V
LS
SYM FILTER
.4KHz CONTROL
(CK2045)
Z112
.1KHz CONTROL
C8 100 UF 16V
1KHz REMOTE
P/J103
.4KHz
C116
C117
C118
C119
C7 100 UF 16V
3KHz REMOTE
C P/o J103
1KHz
J105
EXTERNAL SPKR
J111
C132
S106
SYNC
SYM FILTER
3KHz CONTROL
(CK2045)
Z113
6KHz CONTROL
WIDE BAND CONTROL
C11 100 UF 16V
6KHz REMOTE
D P/o J103
3KHZ
C120
C121
C122
C123
C124
C125
C10 100 UF 16V
P/o J103 WIDE BAND
E REMOTE
5 KHZ
WIDE
C9 100 UF 16V
S107
AFC
BFO
FXD
VAR
S108
AUDIO SQUELCH
AUDIO OUT
AUDIO IN
SQUELCH
(CK2046)
Z114
RF METER
AUDIO METER
R112 10K
R108 10K SQUELCH
R113 10K
C126 .1
C128 .1
C127 .1
AF GAIN
R105 5K
C16 100 UF, 16V
CR2 IN914
C17 100 UF 16V
R110 10K
-9V
BFO
METER RF S109
AUDIO
C129 1MF
C2 .1
USB (CK2047) Z115
600Ω OUT
AUDIO OUT
AUDIO IN
USB CONTROL
C3 .1
P/O J103 USB 600Ω OUT
ANL
S110
R106 10K USB ADJ
USB
S111
R109 10K
LSB LINE ADJ
R107 10K
C133 .001
LSB 600Ω OUT P/O J103
C4 .1
C5 .1
C6 .1
C12
P/O J103 USB CONT

ZONE	LTR
	X



J111
PHONES
FINE TUNE
+9V
C135 .1
R101 680
R102 100
R103 100
SYNC IND
DS101
R104 220
+5V
C134
65
67
10
J
B
1
6
L
-8V
FINE TUNE
GND
SYNC
METER
AFC
(CK2048)
Z117
AFC 100Hz 250 KHz IN
DC LOOP OUT
+9V
1MHz STD
3
H
K
A
7
4
5
8
9
C
E
F
2
D
BFO FXD. VAR.
BFO CONTROL
BFO ADJ
BFO
(CK2049)
Z118
+9V
BFO OUT
1MHz STD
GND
16V
5
E 10 9 8 7 6 5 4 3 A
AUDIO OUT
AUDIO IN
LSB
(CK2047)
Z116
600Ω OUT
+9V
AGC OUT
BFO IN
250KHz IN
GND

REVISIONS							
ZONE	LTR	DESCRIPTION	DATE	E M N NO	DRAFT	CHKD	APPD
	X	REF. R112 & R113 ADD REF. DES [illegible]					

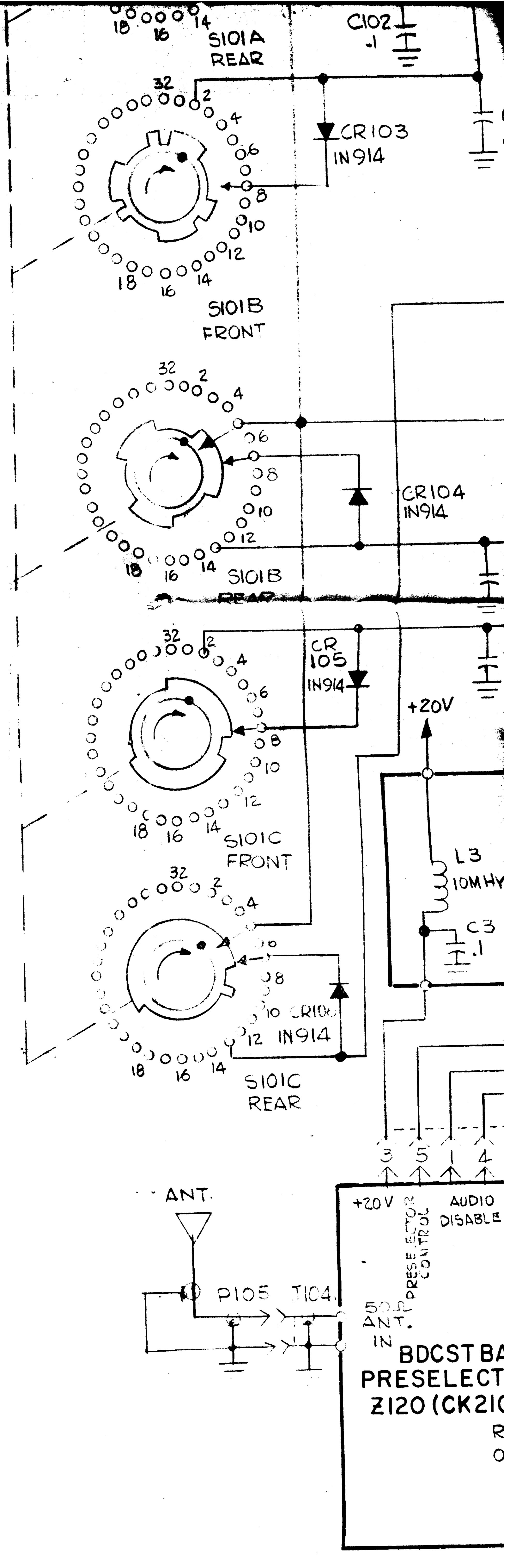
NOTES:
UNLESS OTHERWISE SPECIFIED

1- ALL RESISTANCE VALUES ARE IN OHMS

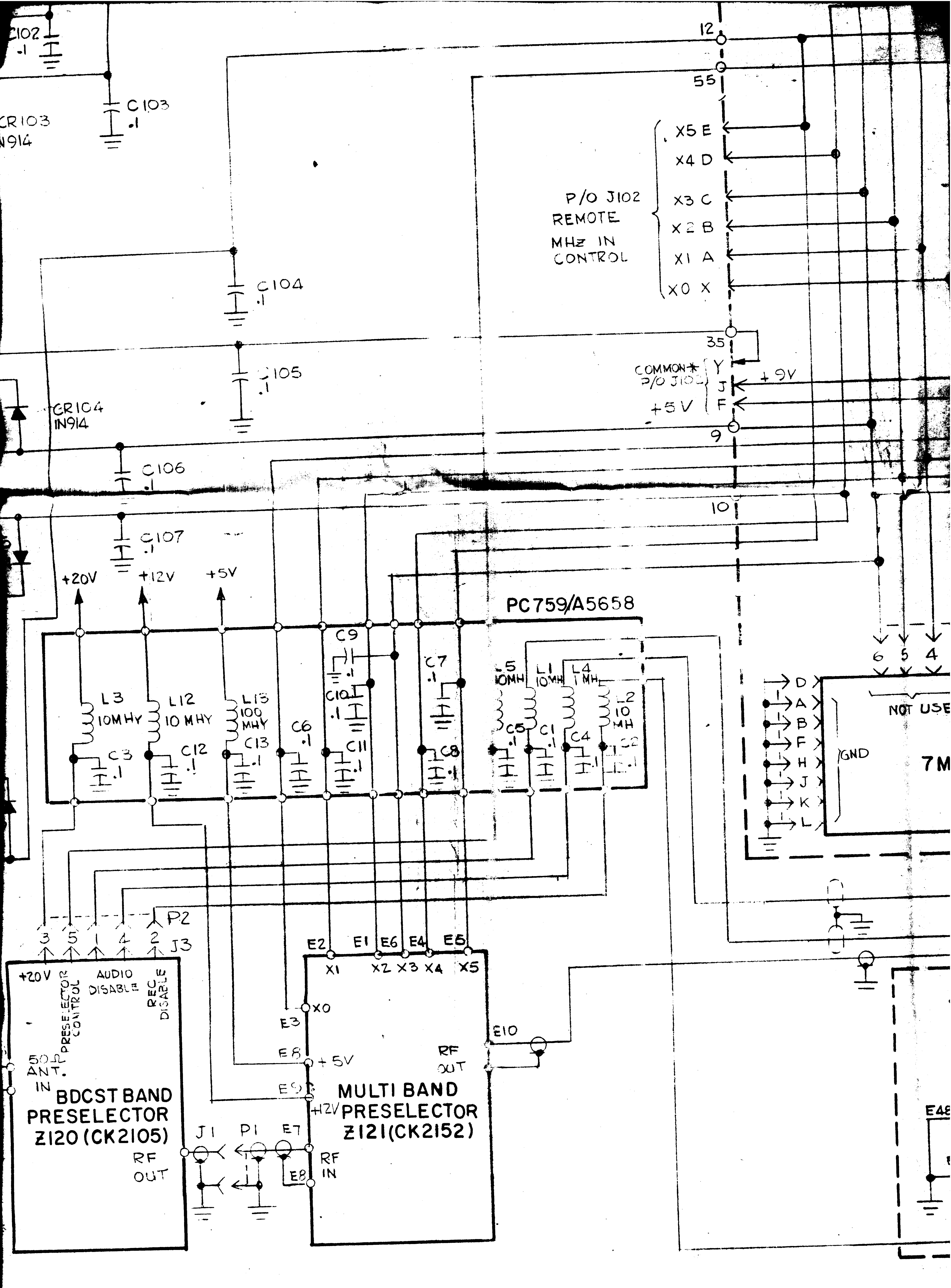
2- ALL DECIMALS CAPACITANCE VALUES ARE IN MICROFARADS

* CONNECT TO GND FOR LOC-L

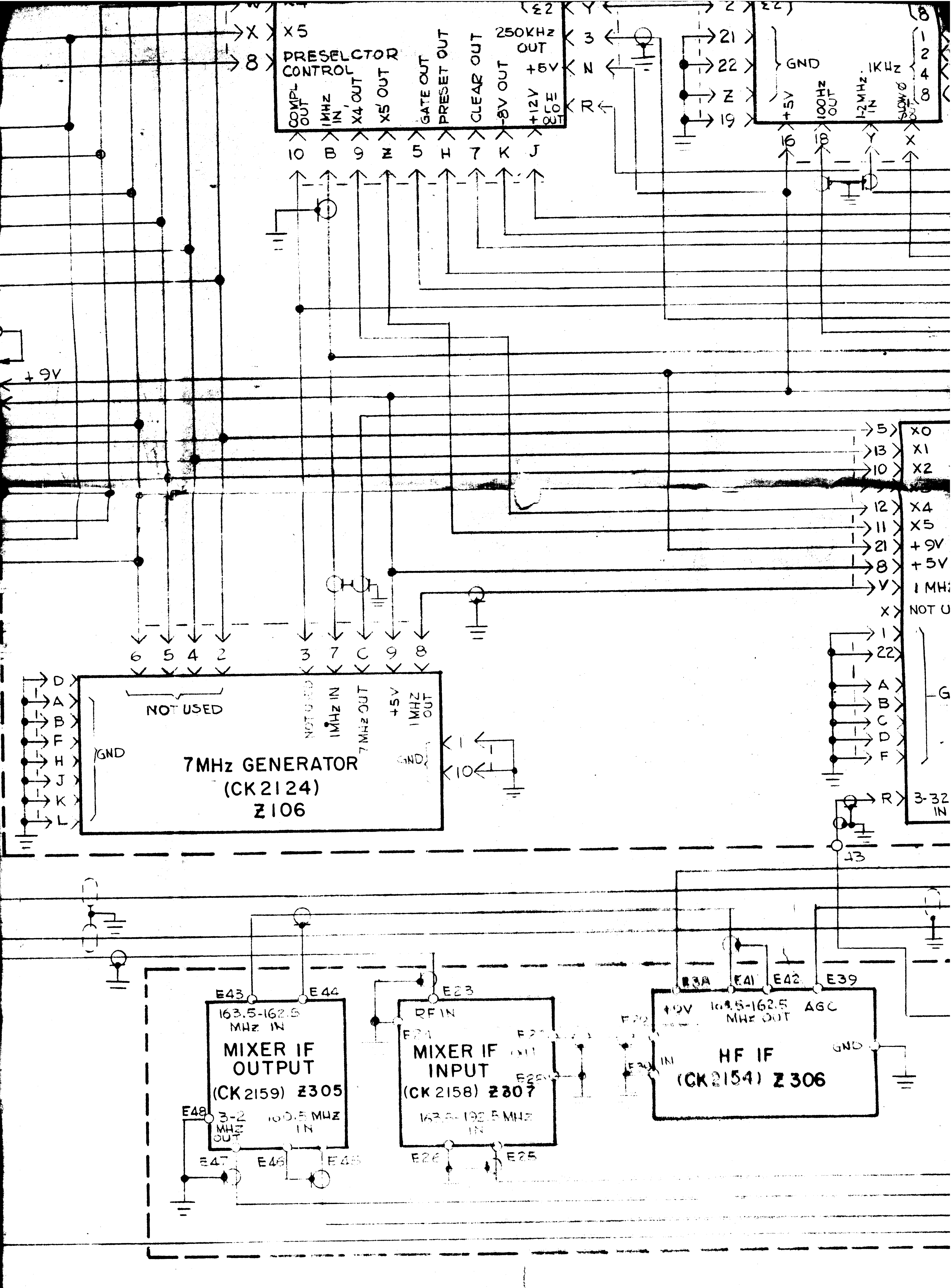
PC692 A4965	
LAST SYMB	MISSING SYMB
L6	
C13	

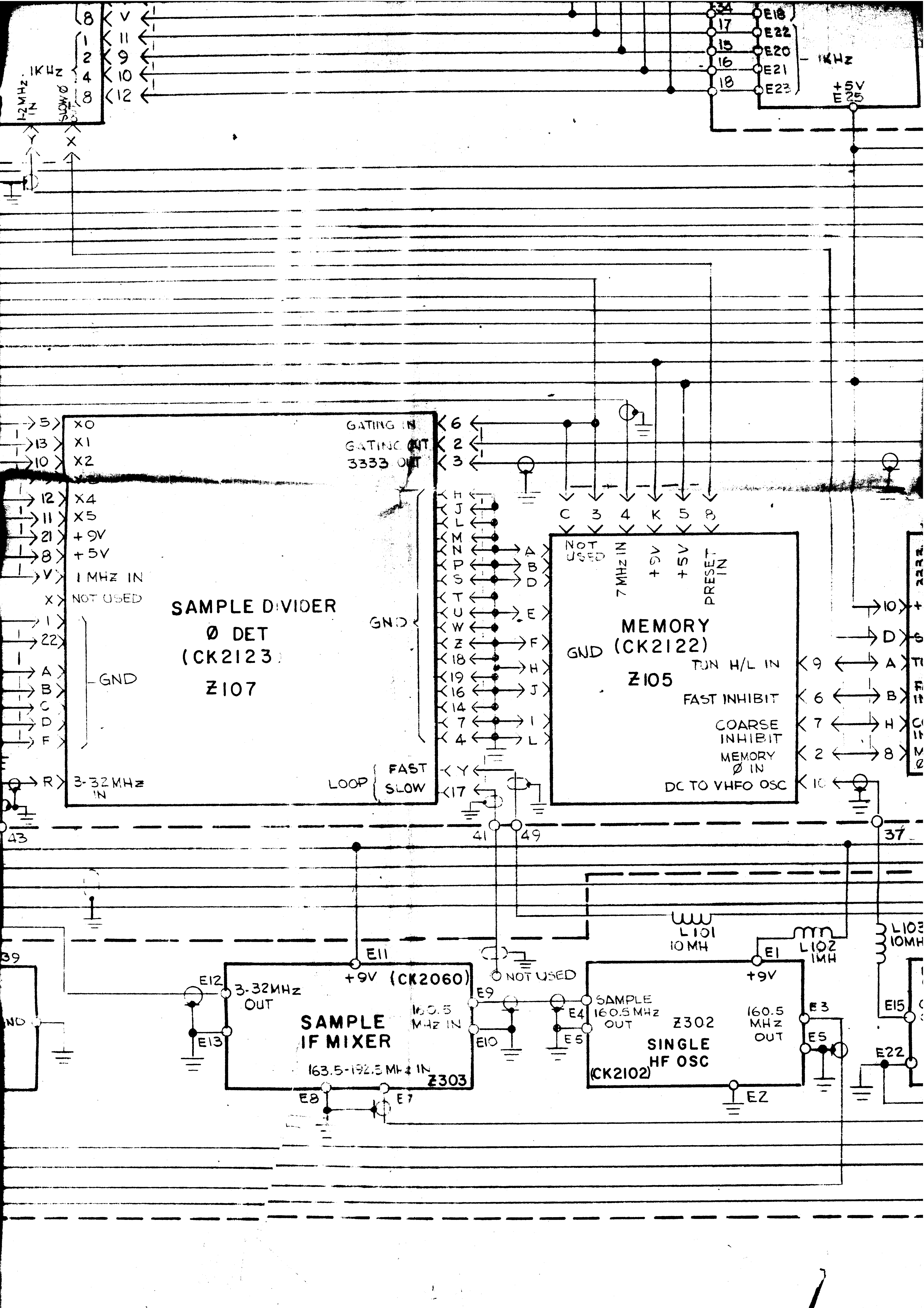


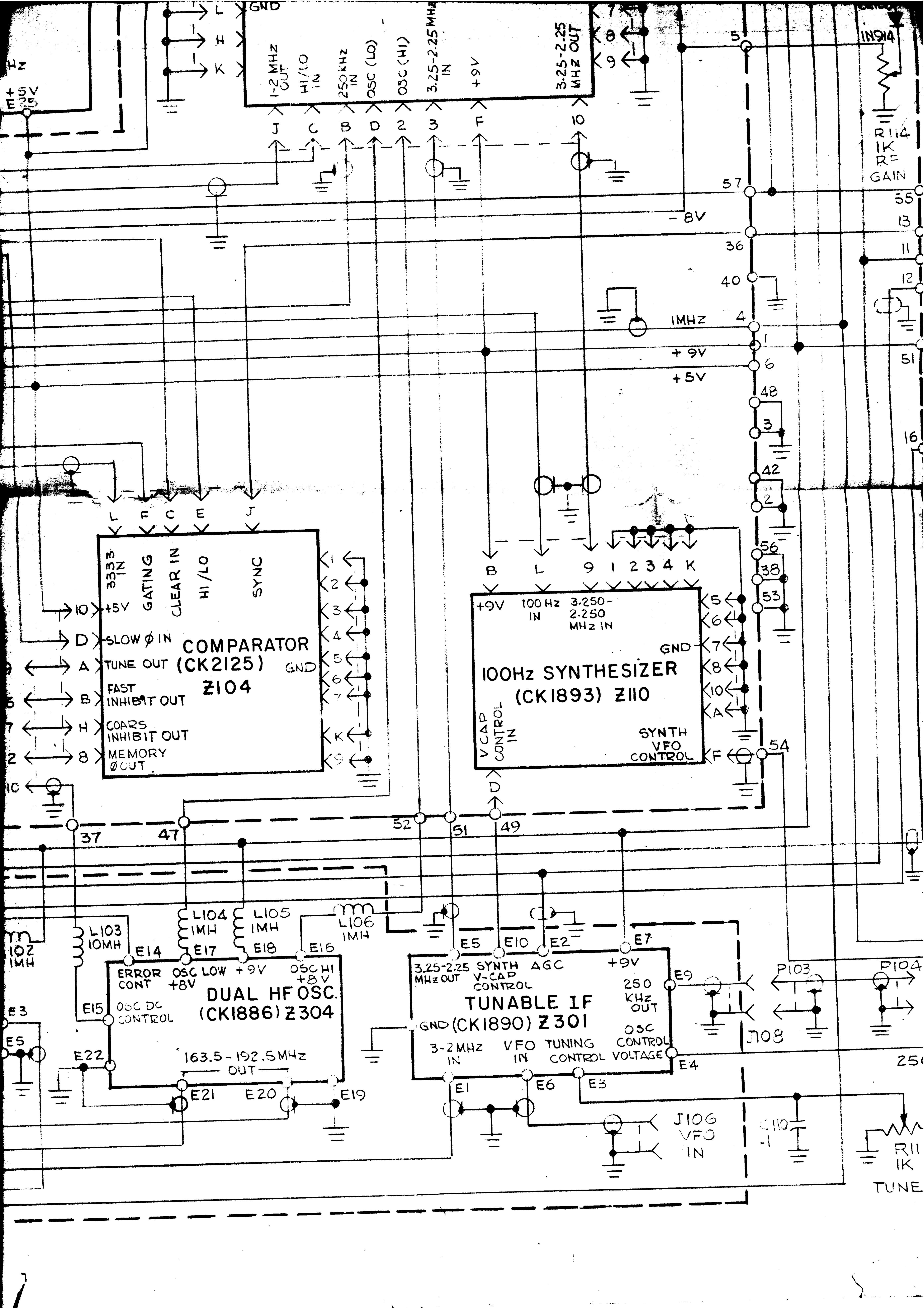
SYMBOLS SERIES 10[illegible]	
LAST SYMBOL	MISSING SYMBOL
C135	[illegible]
CR108	C105
DS101 Z121	
L106	
J111	
P105	
R114	
S113	



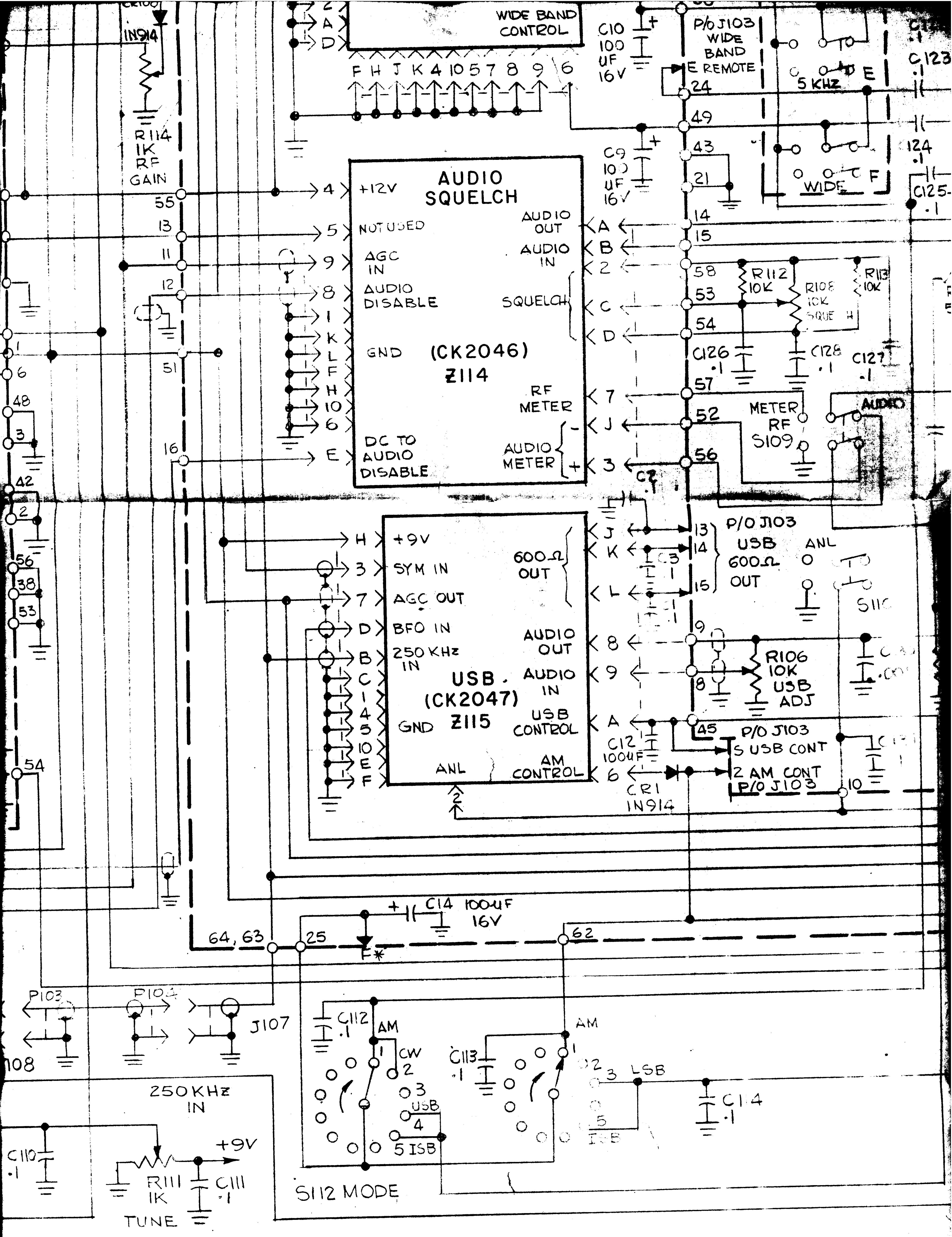
C102
.1
C103
.1
CR103
IN914
P/O J102
REMOTE
MHz IN
CONTROL
X5 E
X4 D
X3 C
X2 B
X1 A
X0 X
12
55
35
9
10
COMMON*
P/O J102
Y
J
F
+9V
+5V
C104
.1
C105
.1
CR104
IN914
C106
.1
C107
.1
+20V
+12V
+5V
PC759/A5658
L3
10MHY
L12
10 MHY
L13
100
MHY
C3
.1
C12
.1
C13
.1
C6
.1
C9
.1
C10
.1
C11
.1
C7
.1
C8
.1
L5
10MH
L1
10MH
L4
1MH
L2
10
MH
C5
.1
C1
.1
C4
.1
C2
.1
6
5
4
D
A
B
F
H
J
K
L
GND
NOT USE
7M
P2
J3
3
5
1
4
2
+20V
PRESELECTOR CONTROL
AUDIO DISABLE
REC DISABLE
50Ω ANT. IN
BDCST BAND
PRESELECTOR
Z120 (CK2105)
RF
OUT
J1
P1
E7
E8
E2
E1
E6
E4
E5
X1
X2
X3
X4
X5
X0
E3
E8
+5V
E9
+12V
E10
RF
OUT
RF
IN
MULTI BAND
PRESELECTOR
Z121(CK2152)
E48


X5
PRESELECTOR CONTROL
COMPL OUT
1MHz IN
X4 OUT
X5' OUT
GATE OUT
PRESET OUT
CLEAR OUT
8V OUT
+12V
HI LO OUT
250KHz OUT
+5V
GND
+5V
100Hz OUT
1KHz
1-2MHz IN
+9V
X0
X1
X2
X4
X5
+9V
+5V
NOT USED
NOT USED
1MHz IN
7MHz OUT
+5V
1MHz OUT
GND
7MHz GENERATOR
(CK2124)
Z106
E43
E44
163.5-162.5 MHz IN
MIXER IF OUTPUT
(CK2159) Z305
E48
3-2 MHz OUT
160.5 MHz IN
E47
E46
E45
E23
RF IN
MIXER IF INPUT
(CK2158) Z307
163.5-192.5 MHz IN
E26
E25
E41
E42
E39
+9V
163.5-162.5 MHz OUT
AGC
IN
GND
HF IF
(CK2154) Z306

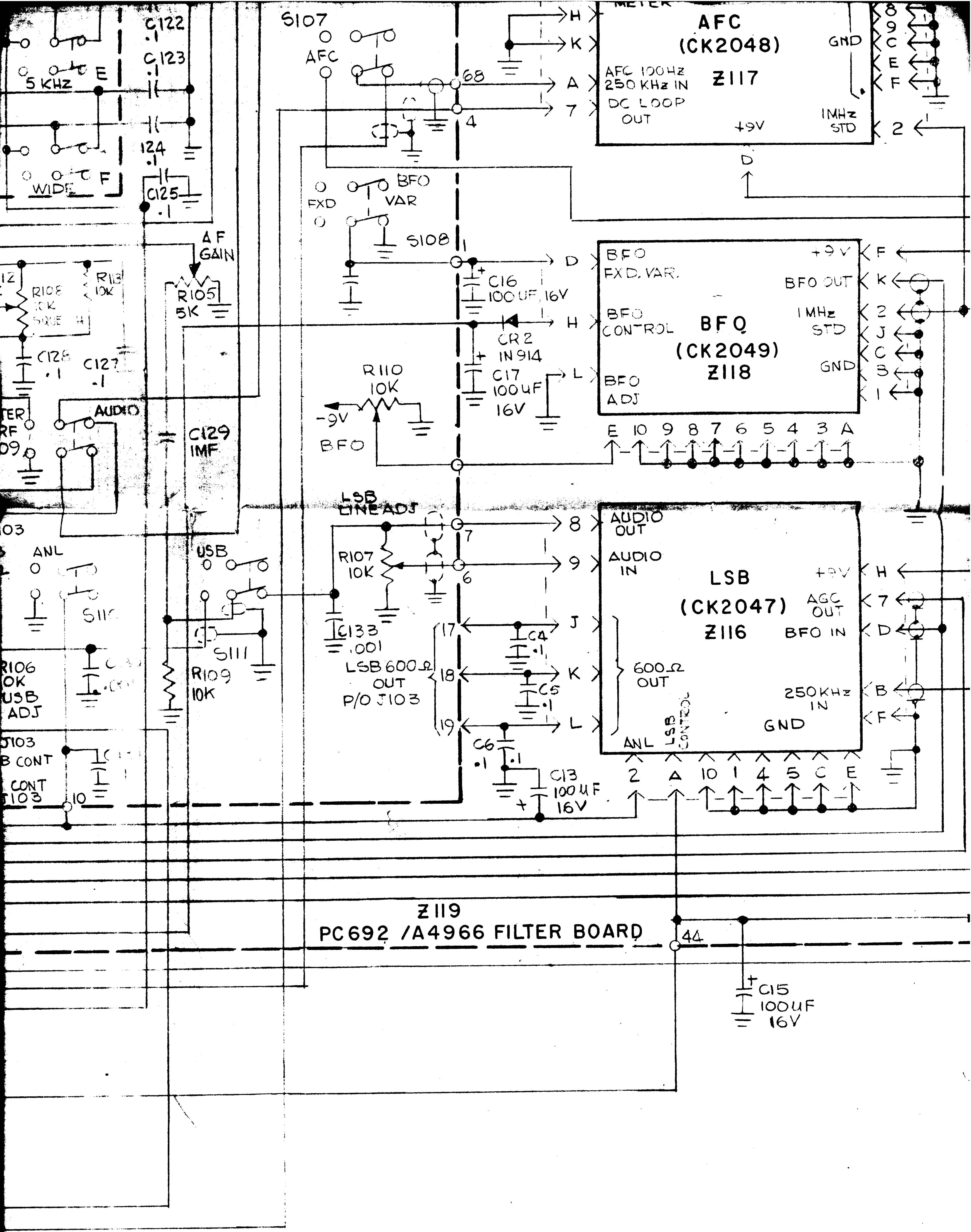

1KHz
1-2MHz IN
SLOW Ø
E18
E22
E20
E21
E23
- 1KHz
+5V E25
SAMPLE DIVIDER
Ø DET
(CK2123)
Z107
X0
X1
X2
X4
X5
+9V
+5V
1 MHz IN
NOT USED
GND
GATING IN
GATING OUT
3333 OUT
3-32 MHz IN
LOOP
FAST
SLOW
MEMORY
(CK2122)
Z105
NOT USED
7 MHz IN
+9V
+5V
PRESET IN
GND
TUN H/L IN
FAST INHIBIT
COARSE INHIBIT
MEMORY Ø IN
DC TO VHFO OSC
SAMPLE IF MIXER
(CK2060)
Z303
+9V
3-32MHz OUT
160.5 MHz IN
163.5-192.5 MHz IN
E11
E12
E13
E9
E10
E8
E7
NOT USED
L101 10 MH
L102 1MH
L103 10MH
SINGLE HF OSC
(CK2102)
Z302
+9V
SAMPLE 160.5 MHz OUT
160.5 MHz OUT
E1
E3
E4
E5
EZ
E15
E22
41
43
49
37
39



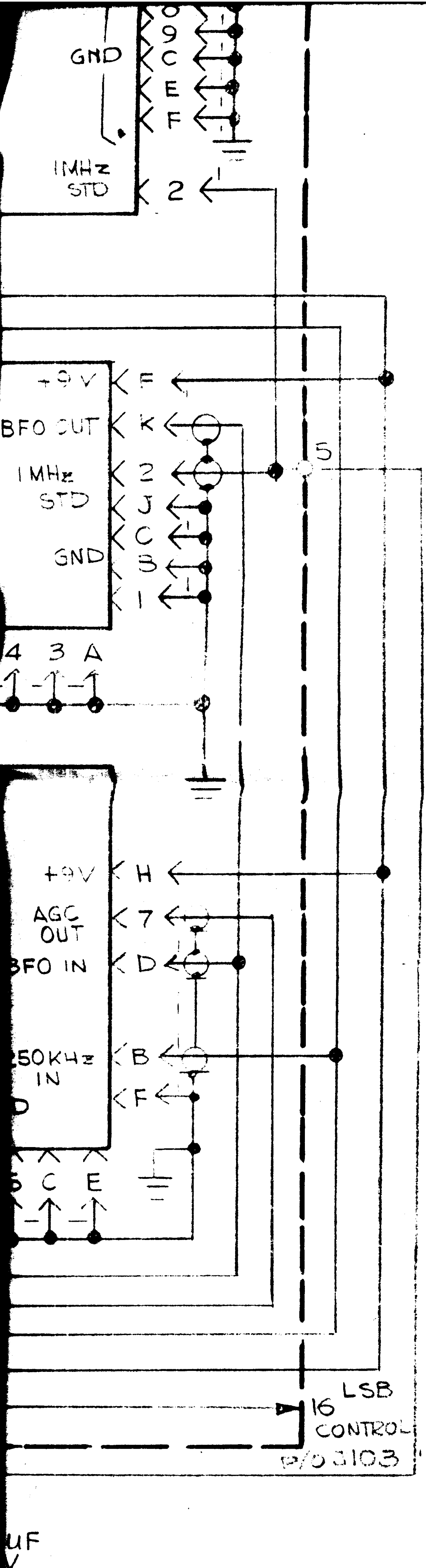
COMPARATOR (CK2125) Z104
3333 IN
GATING
CLEAR IN
HI/LO
SYNC
+5V
SLOW Ø IN
TUNE OUT
FAST INHIBIT OUT
COARS INHIBIT OUT
MEMORY ØOUT
GND
100Hz SYNTHESIZER (CK1893) Z110
+9V
100 Hz IN
3.250-2.250 MHz IN
GND
V CAP CONTROL IN
SYNTH VFO CONTROL
DUAL HF OSC. (CK1886) Z304
ERROR CONT
OSC LOW +8V
+9V
OSC HI +8V
OSC DC CONTROL
163.5-192.5MHz OUT
TUNABLE IF (CK1890) Z301
3.25-2.25 MHz OUT
SYNTH V-CAP CONTROL
AGC
+9V
250 KHz OUT
GND
3-2 MHz IN
VFO IN
TUNING CONTROL
OSC CONTROL VOLTAGE
1-2 MHz OUT
HI/LO IN
250 KHz IN
OSC (LO)
OSC (HI)
3.25-2.25 MHz IN
3.25-2.25 MHz OUT
L104 1MH
L105 1MH
L106 1MH
L103 10MH
102 1MH
IMHz
+9V
+5V
-8V
1N914
R114 1K RF GAIN
R11 1K TUNE
J106 VFO IN
J108
P103
P104
C110 .1



WIDE BAND CONTROL
C10 100 UF 16V
C9 100 UF 16V
P/O J103 WIDE BAND
E REMOTE
5 KHZ
WIDE
C123 .1
124 .1
C125 .1
R114 1K RF GAIN
AUDIO SQUELCH
+12V
NOT USED
AGC IN
AUDIO DISABLE
GND
(CK2046) Z114
AUDIO OUT
AUDIO IN
SQUELCH
RF METER
AUDIO METER
DC TO AUDIO DISABLE
R112 10K
R108 10K SQUELCH
R113 10K
C126 .1
C128 .1
C127 .1
METER RF S109
AUDIO
C2
P/O J103 USB 600Ω OUT
ANL
S110
+9V
SYM IN
AGC OUT
BFO IN
250 KHz IN
GND
USB (CK2047) Z115
600Ω OUT
AUDIO OUT
AUDIO IN
USB CONTROL
AM CONTROL
ANL
C3 .1
R106 10K USB ADJ
P/O J103
S USB CONT
2 AM CONT
P/O J103
C12 100UF
CR1 IN914
C14 100UF 16V
64, 63
25
62
P103
P104
J107
108
C112 .1
AM
CW
USB
5 ISB
S112 MODE
C113 .1
LSB
ISB
C14 .1
250 KHz IN
+9V
C110 .1
R111 1K TUNE
C111 .1



AFC
(CK2048)
Z117
AFC 100Hz
250 KHz IN
DC LOOP
OUT
+9V
1MHz
STD
GND
S107
AFC
BFO
FXD
VAR
S108
C16
100 UF 16V
CR2
IN914
C17
100 UF
16V
R110
10K
-9V
BFO
BFO
FXD. VAR.
BFO
CONTROL
BFO
ADJ
BFO
(CK2049)
Z118
+9V
BFO OUT
1 MHz
STD
GND
C122
.1
C123
.1
124
.1
C125
.1
5 KHZ
WIDE
AF
GAIN
R105
5K
R108
10K
R113
10K
C128
.1
C127
.1
AUDIO
C129
IMF
LSB
LINEADJ
R107
10K
C133
.001
LSB 600Ω
OUT
P/O J103
USB
S111
ANL
R109
10K
R106
10K
USB
ADJ
J103
C4
.1
C5
.1
C6
.1
C13
100 UF
16V
AUDIO
OUT
AUDIO
IN
LSB
(CK2047)
Z116
600Ω
OUT
+9V
AGC
OUT
BFO IN
250KHz
IN
GND
ANL
LSB
CONTROL
Z119
PC692 /A4966 FILTER BOARD
C15
100 UF
16V



QTY REQ	ITEM	PART NO.	DESCR
			LIST OF MATERIAL

FINAL APPROVAL	DATE	THE TECHNICA MAMARONE
MECH DES.	DATE	
ELEC DES.	DATE	
CHECKED	DATE	Figure 7-1
DRAWN GDL	DATE 2-1-77	
		S GPR-
		S

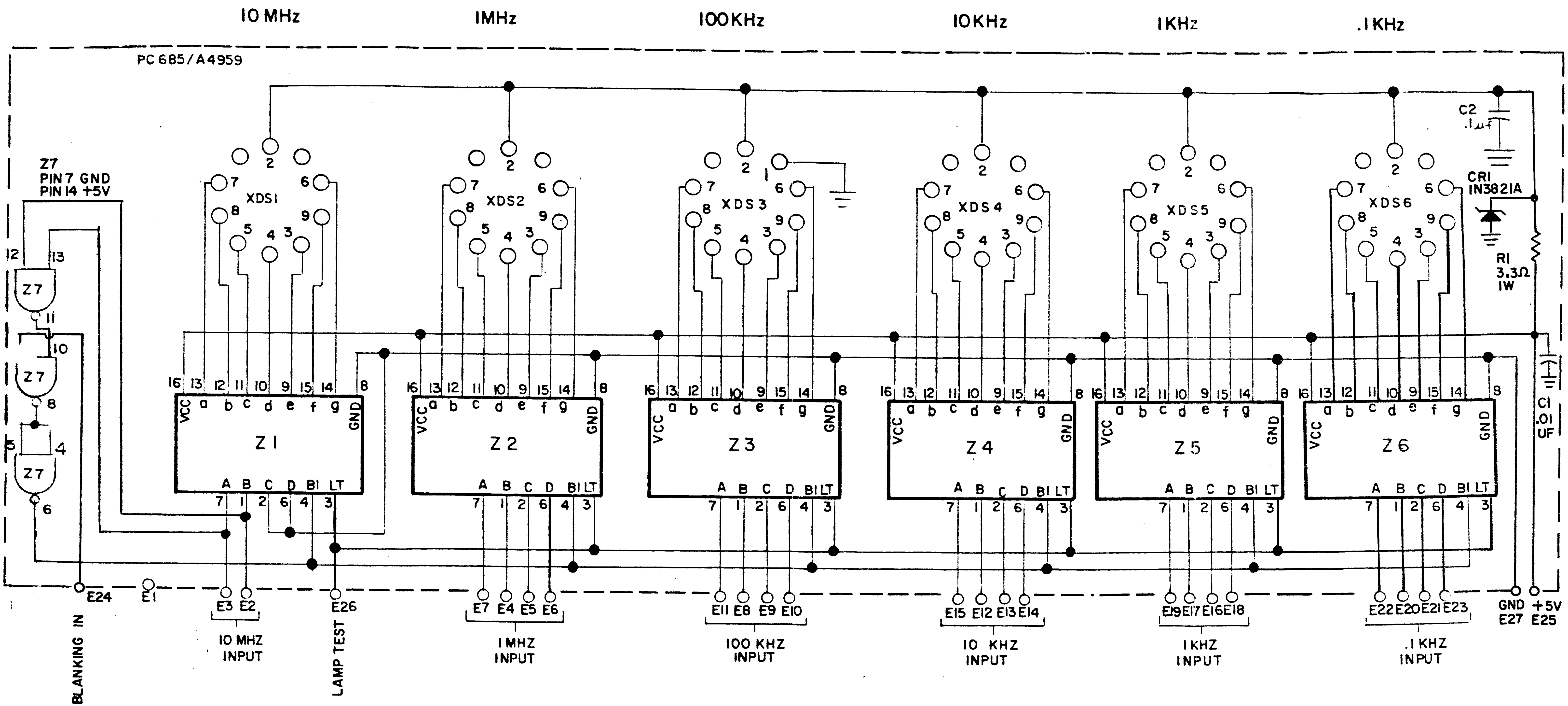
QTY REQ	ITEM	PART NO.	DESCRIPTION	SYM

LIST OF MATERIAL

FINAL APPROVAL	DATE	THE TECHNICAL MATERIEL CORP. MAMARONECK, NEW YORK
MECH. DES.	DATE	
ELEC. DES.	DATE	
CHECKED	DATE	
DRAWN GDL	DATE 2-1-77	

Figure 7-1

GPR-110B Overall Schematic Diagram



CK2044-X2

Figure 7-2. Readout Display Assembly Z101, Schematic Diagram

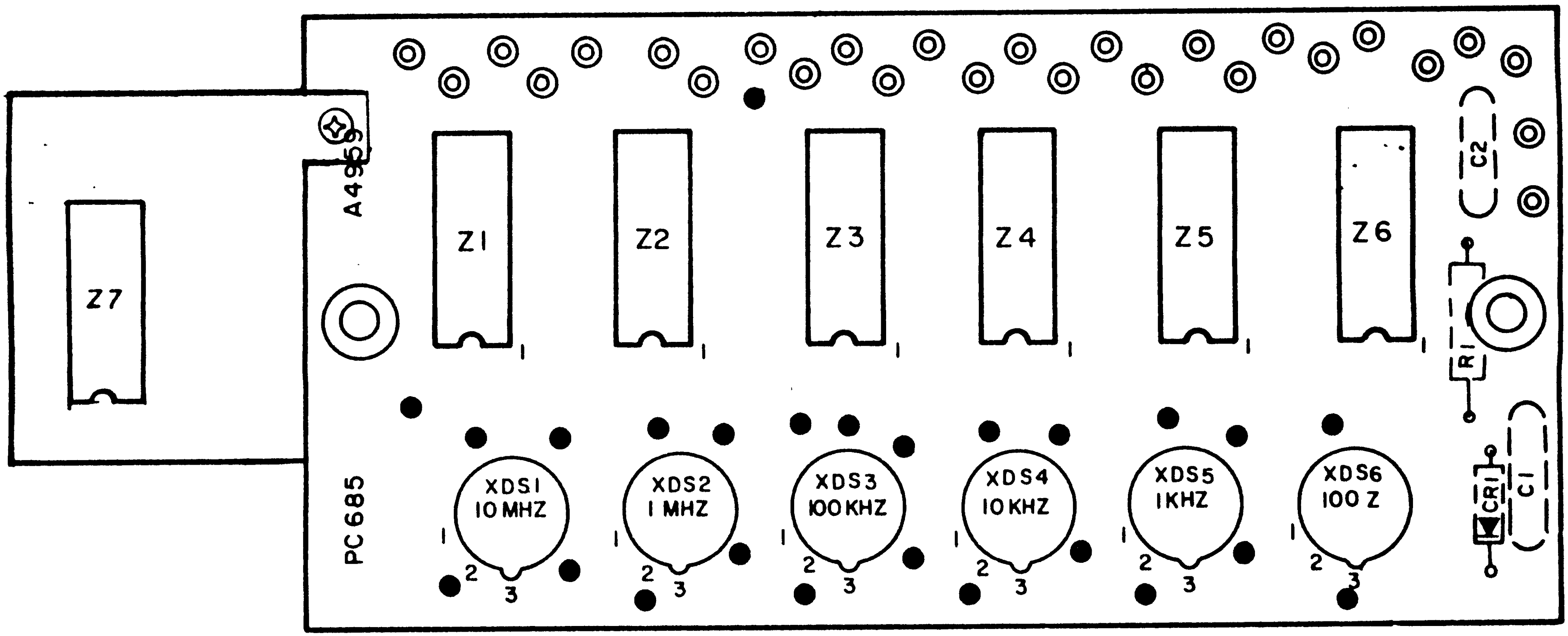
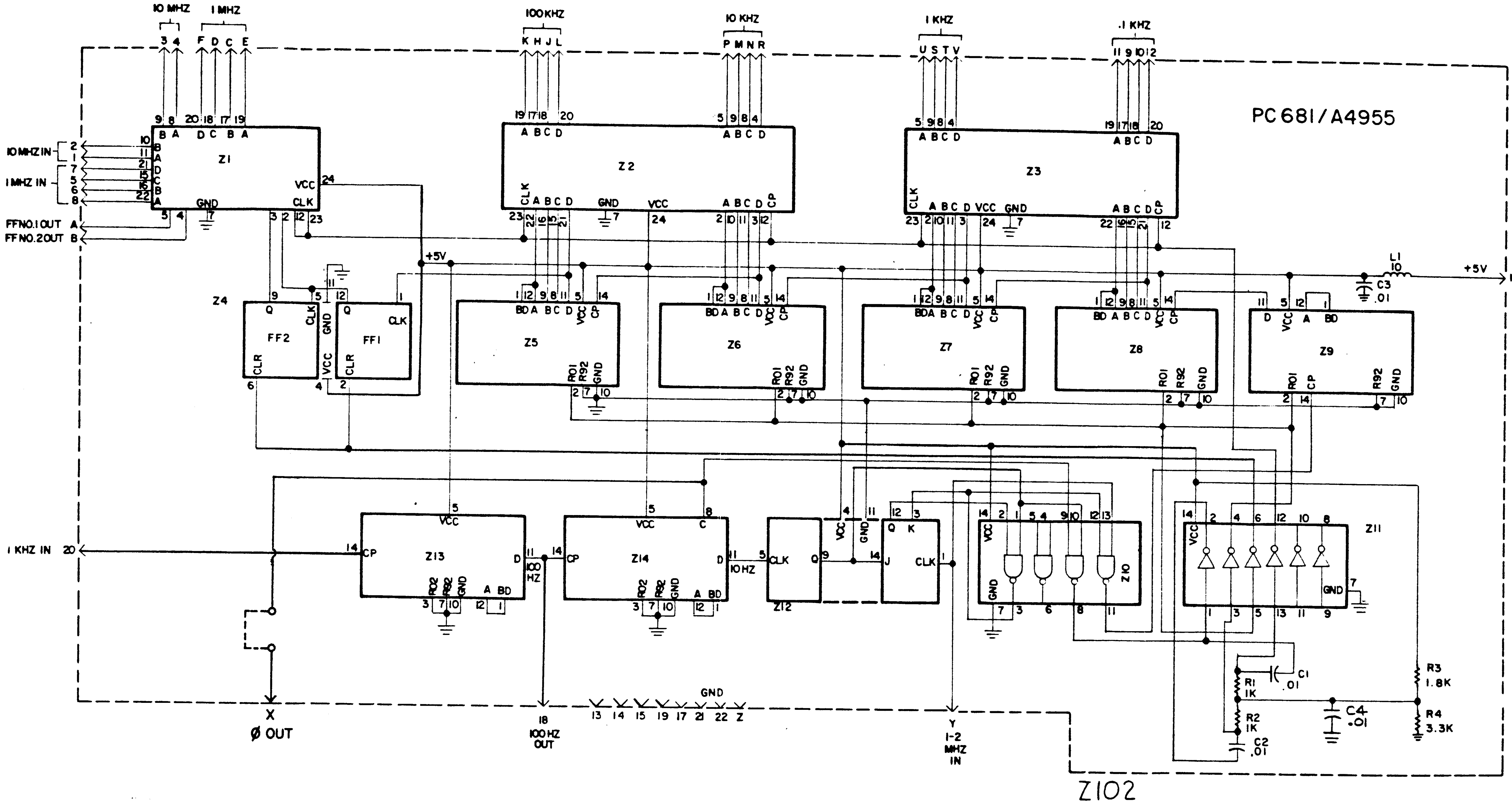


Figure 7-3. Readout Display Assembly, Location of Components

A4959-X1

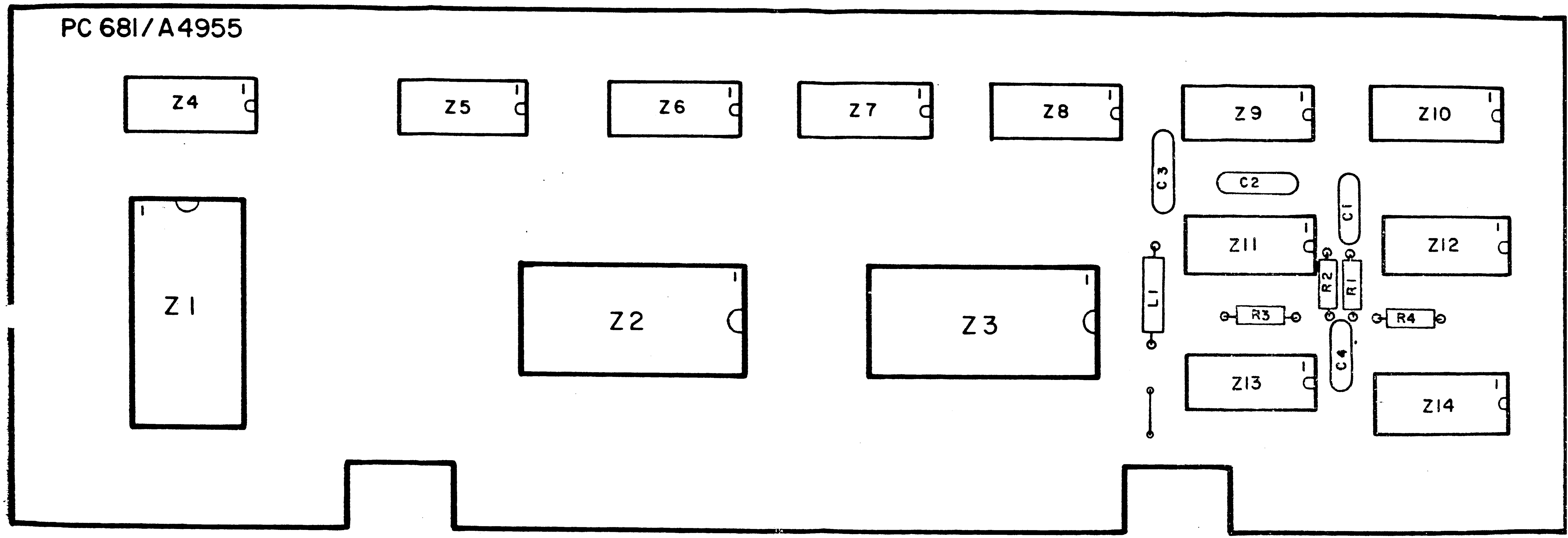


UNLESS OTHERWISE SPECIFIED

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

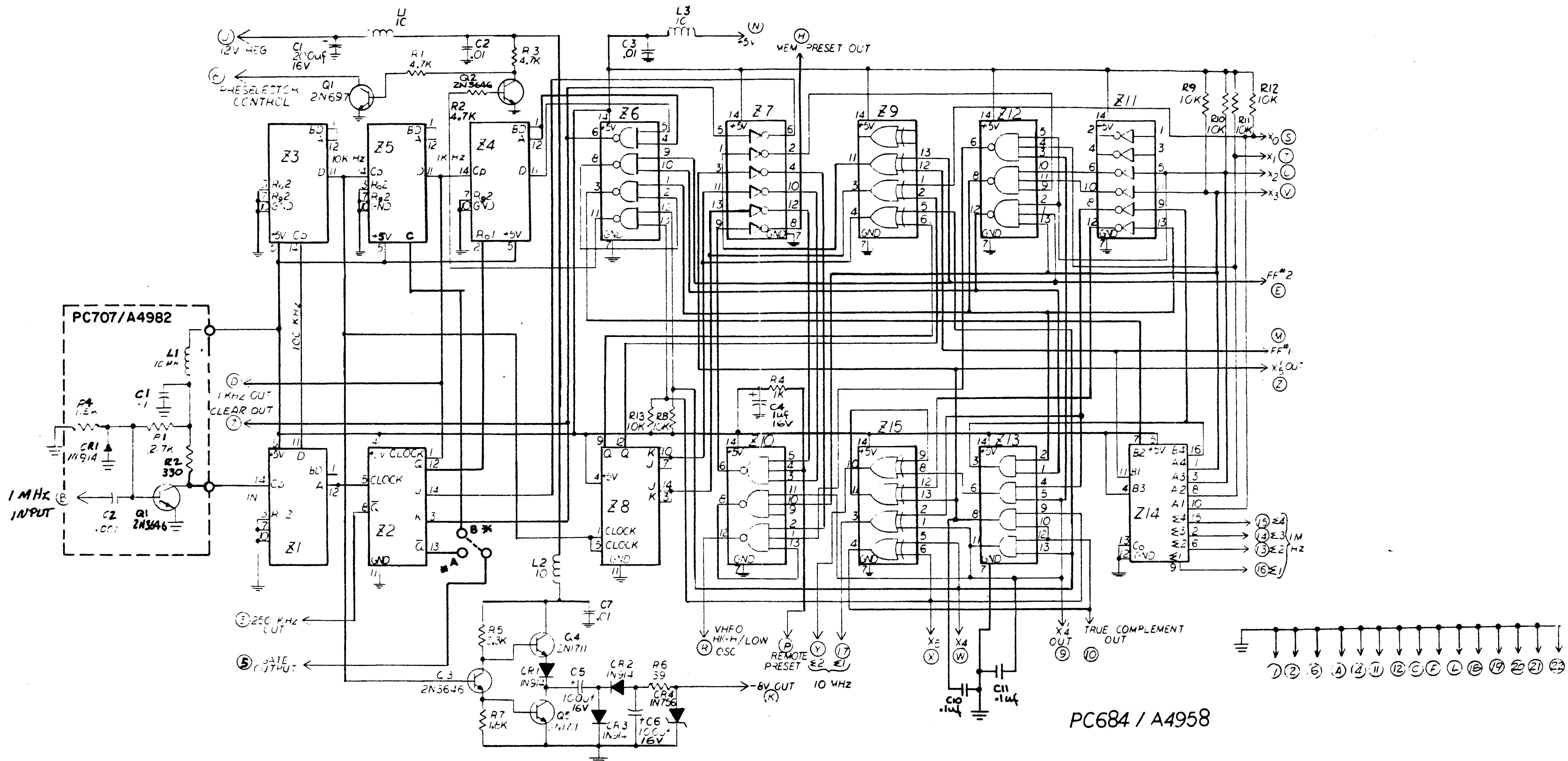
Figure 7-4. Digital Counter Assembly Z102, Schematic Diagram

CK1892-X3



Figur 7-5. Digital Counter Assembly Z102, Location of Compon nts

A4955-X2



UNLESS OTHERWISE SPECIFIED

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

*** USE JUMPER "A" FOR GPR-110 ONLY**
USE JUMPER "B" FOR GPR-110A OR GPR110B

Figure 7-6. MHz Display/Divider Assembly Z103, Schematic Diagram

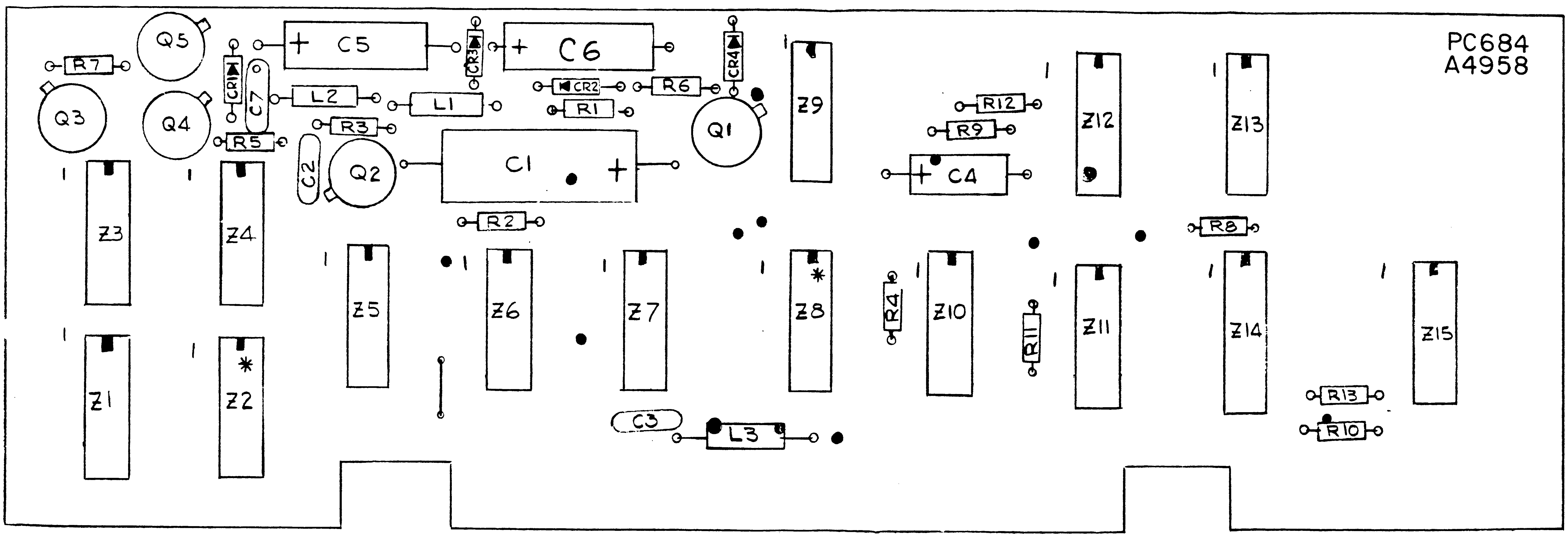
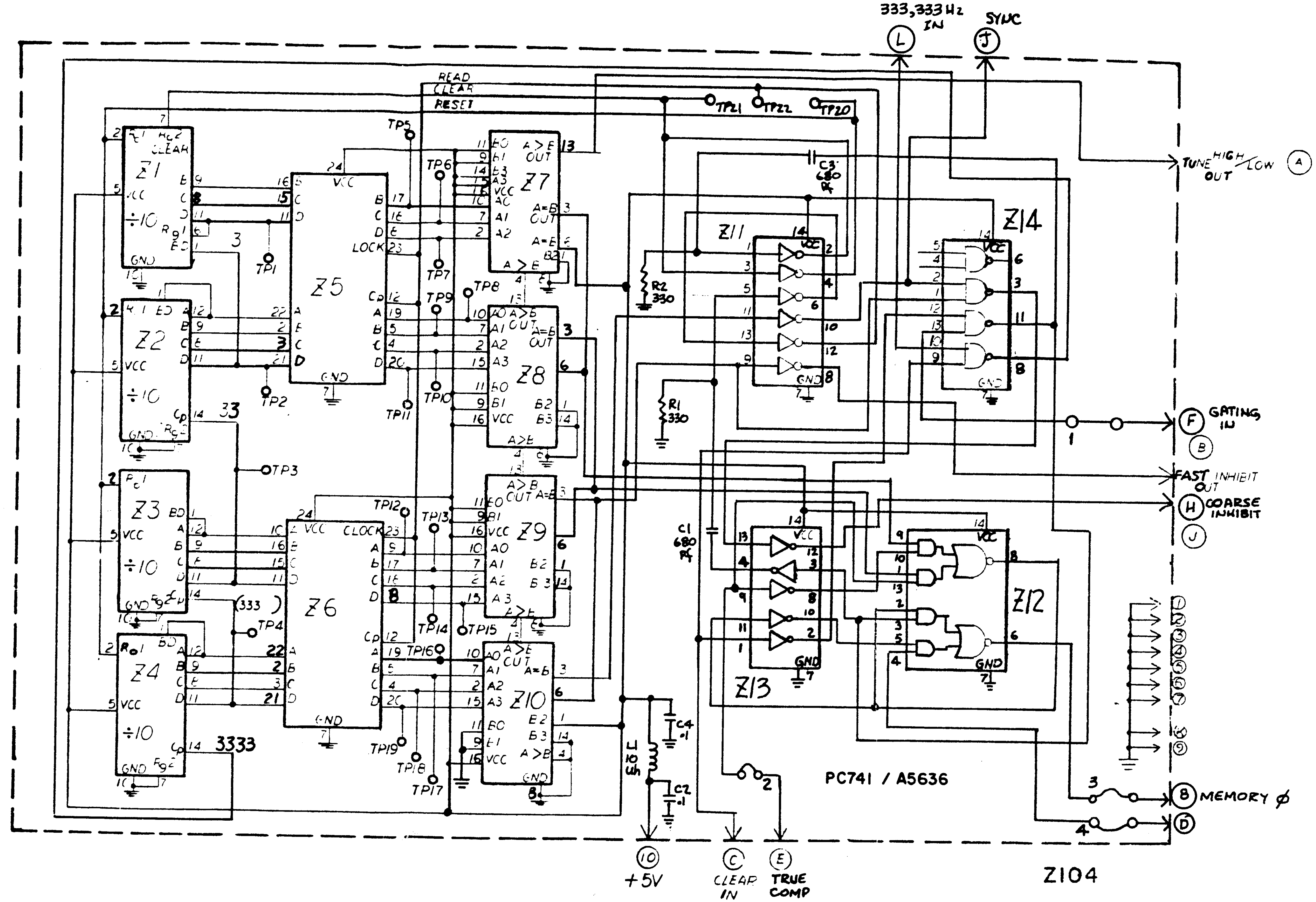


Figure 7-7. MHz Display/Divider Assembly Z103, Location of Components



UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4W.
2. ALL DECIMAL CAPACITANCE VALUES ARE IN MICROFARADS.

Figure 7-8. Comparator Assembly Z104, Schematic Diagram

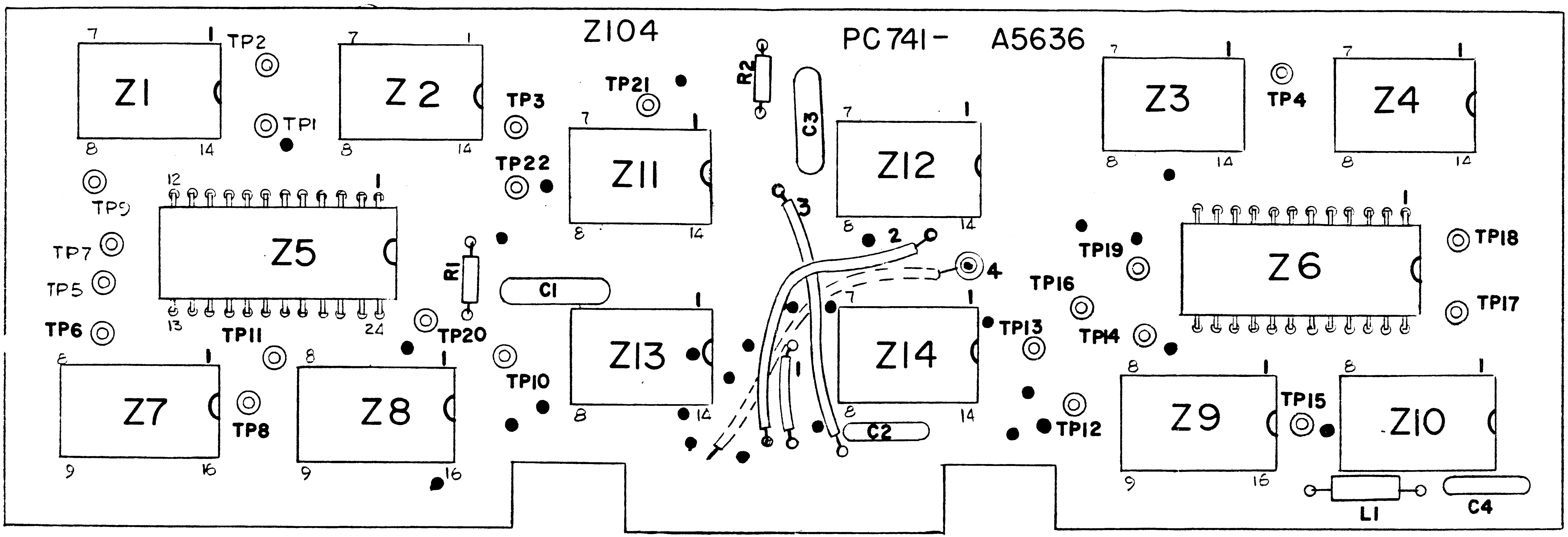


Figure 7-9. Comparator Assembly Z104,
Location of Components

A5636-XI

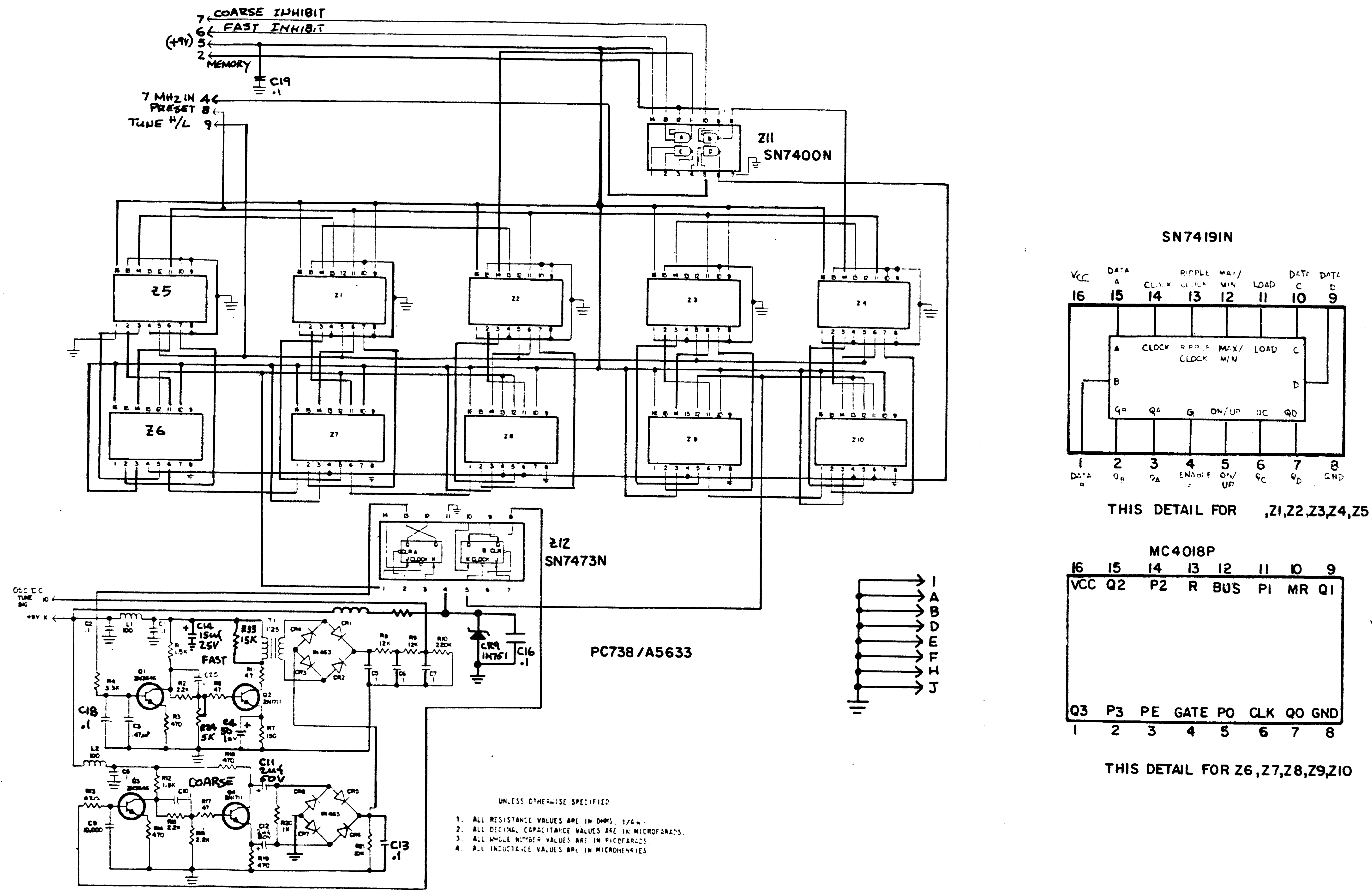


Figure 7-10. Memory Assembly Z105, Schematic Diagram

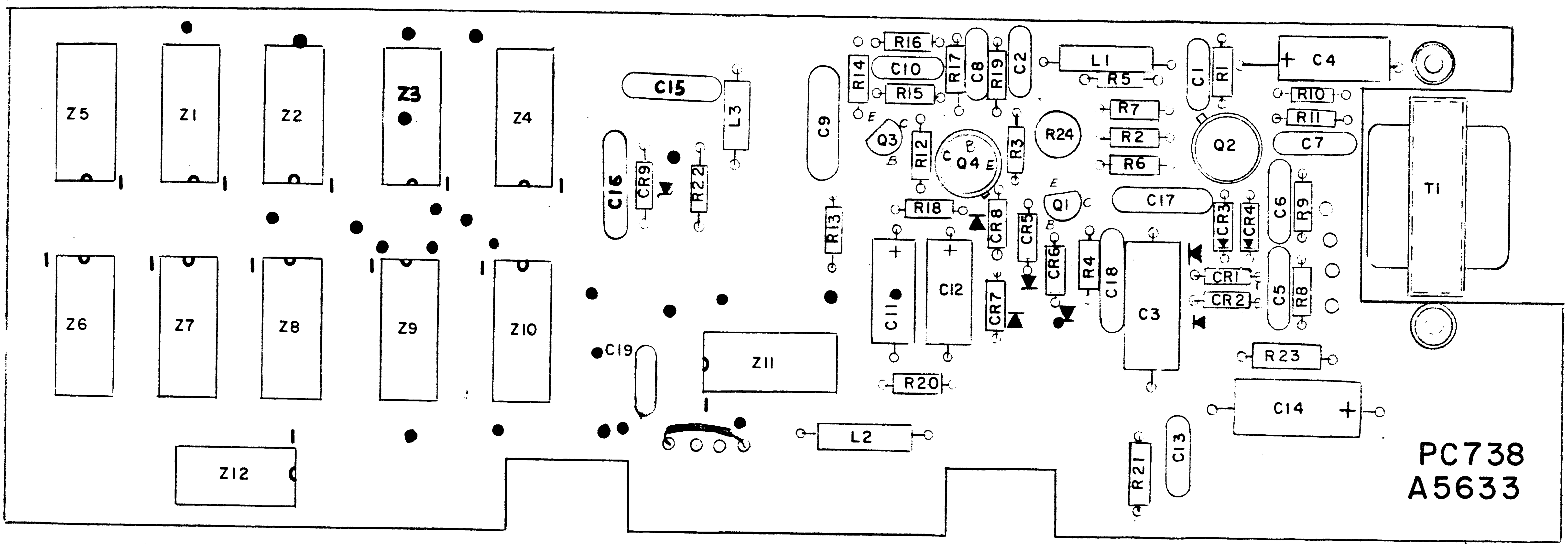


Figure 7-11. Memory Assembly Z105, Location of Components

A5633-X

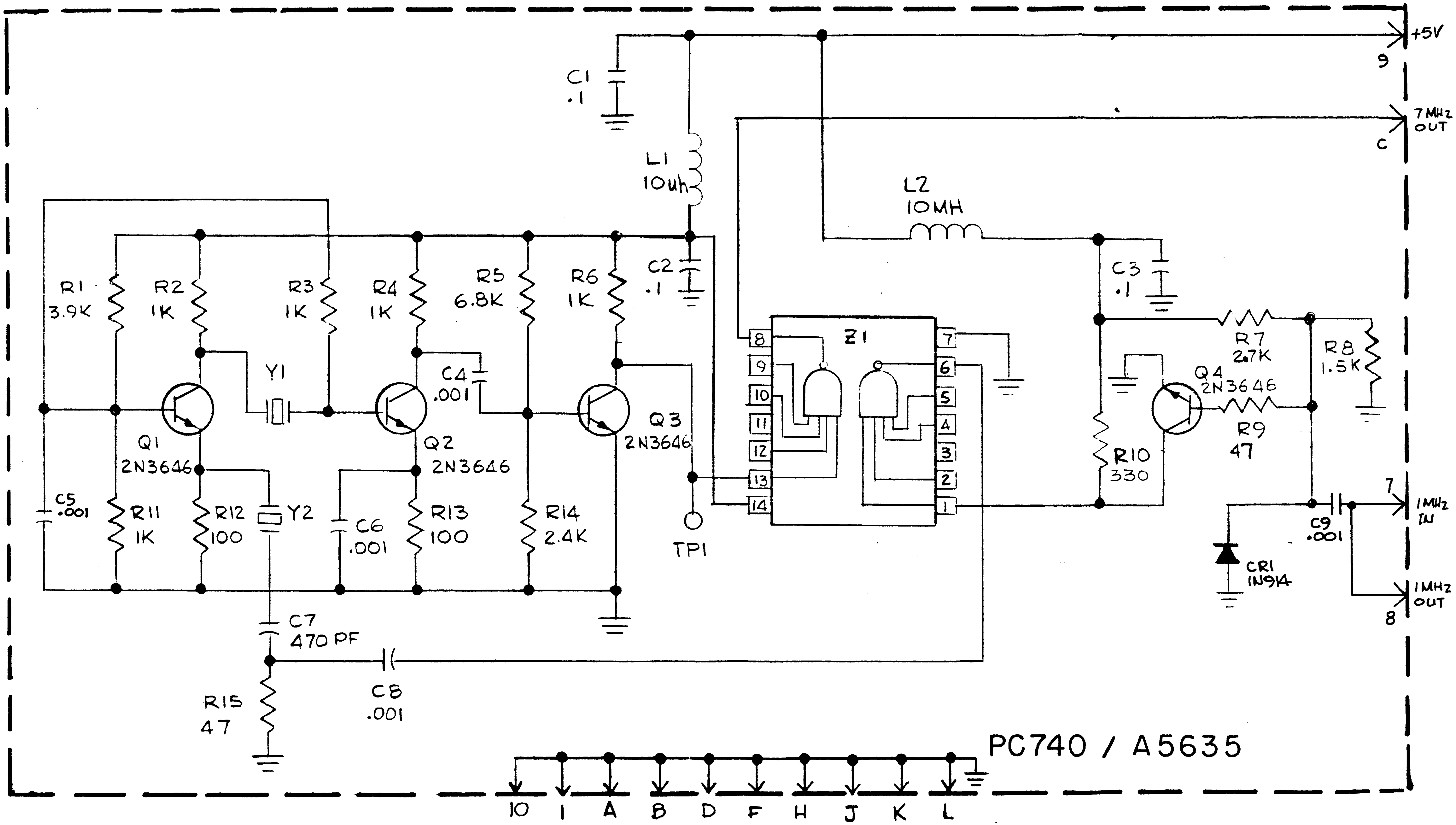


Figure 7-12. 7 MHz Generator Assembly Z106, Schematic Diagram

CK2124-X

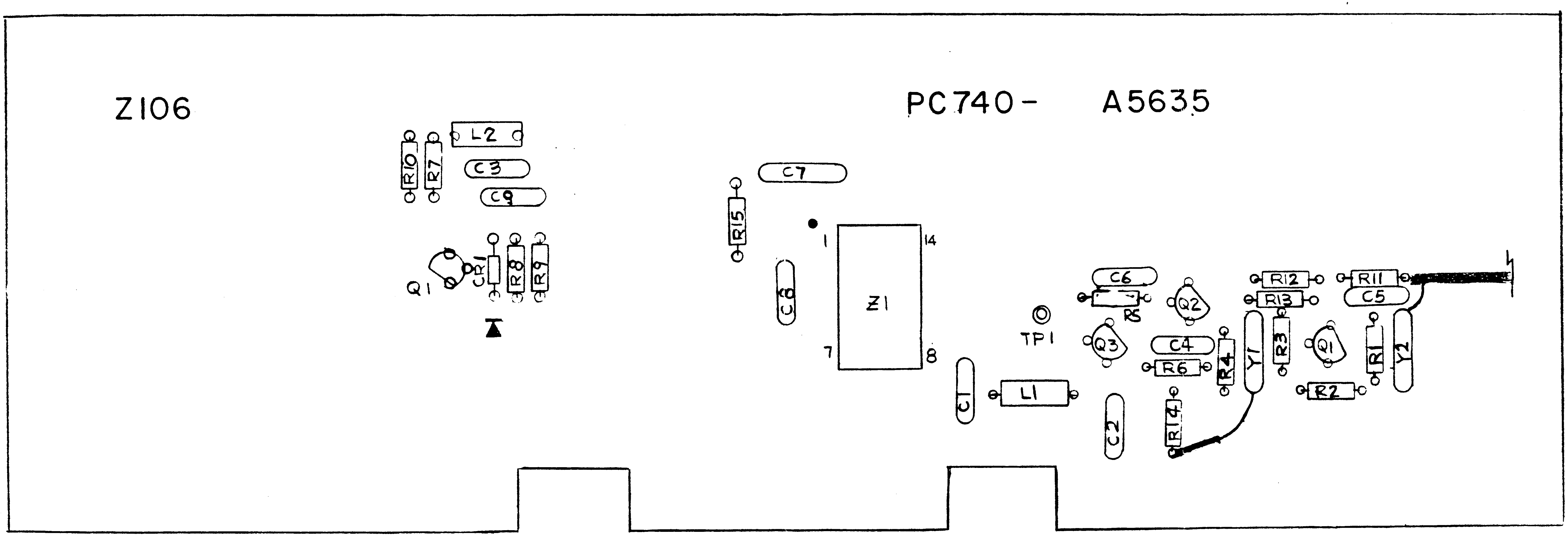
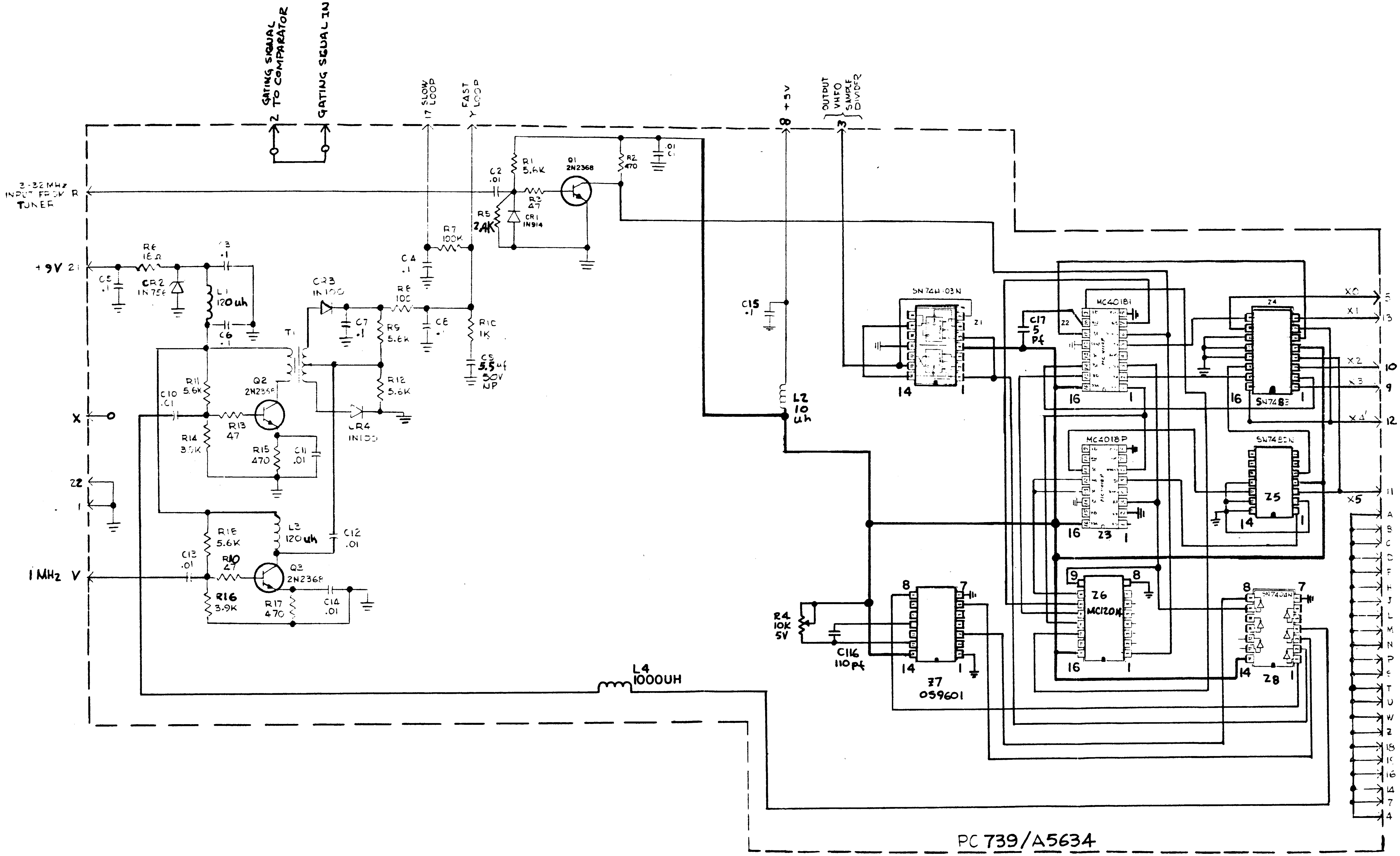


Figure 7-13. 7 MHz Generator Assembly Z106, Location of Components

A5635-Ø



REF: Z107

UNLESS OTHERWISE SPECIFIED
1-ALL RESISTANCE VALUES ARE IN OHMS 1/4W
2-ALL CAPACITANCE VALUES ARE IN MICROFARADS

CK2123-X1

Figure 7-14. Sample Divide/Phase Detector Assembly Z107, Schematic Diagram

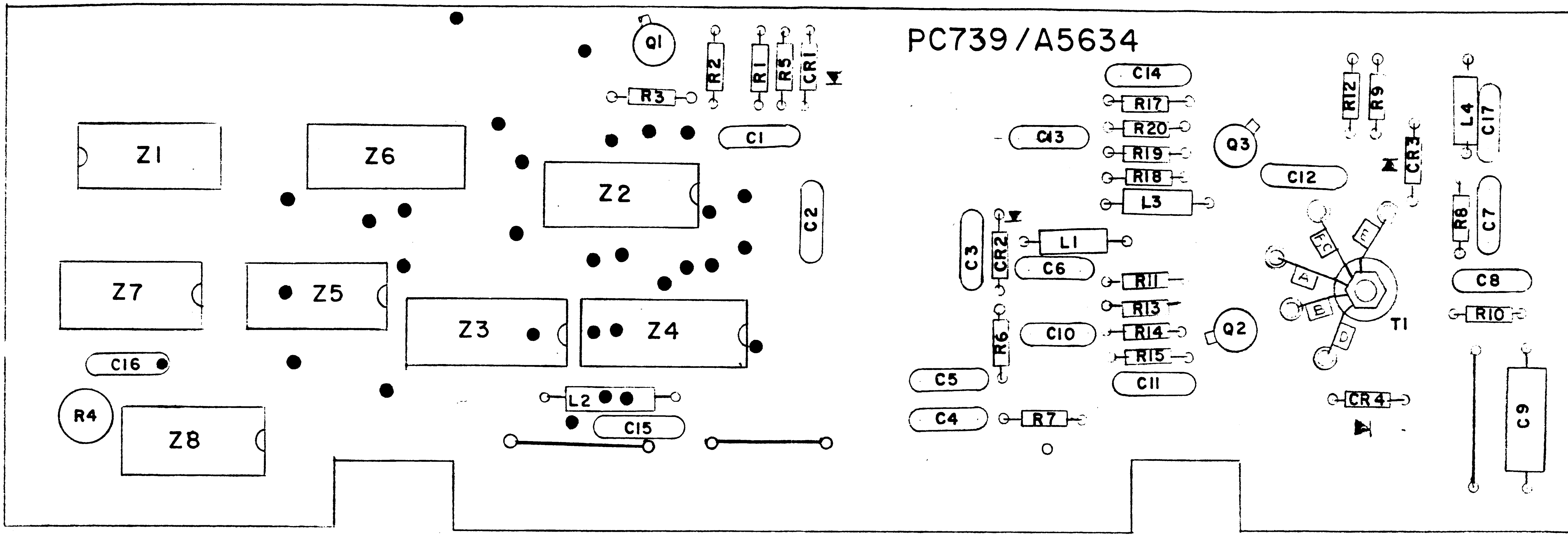
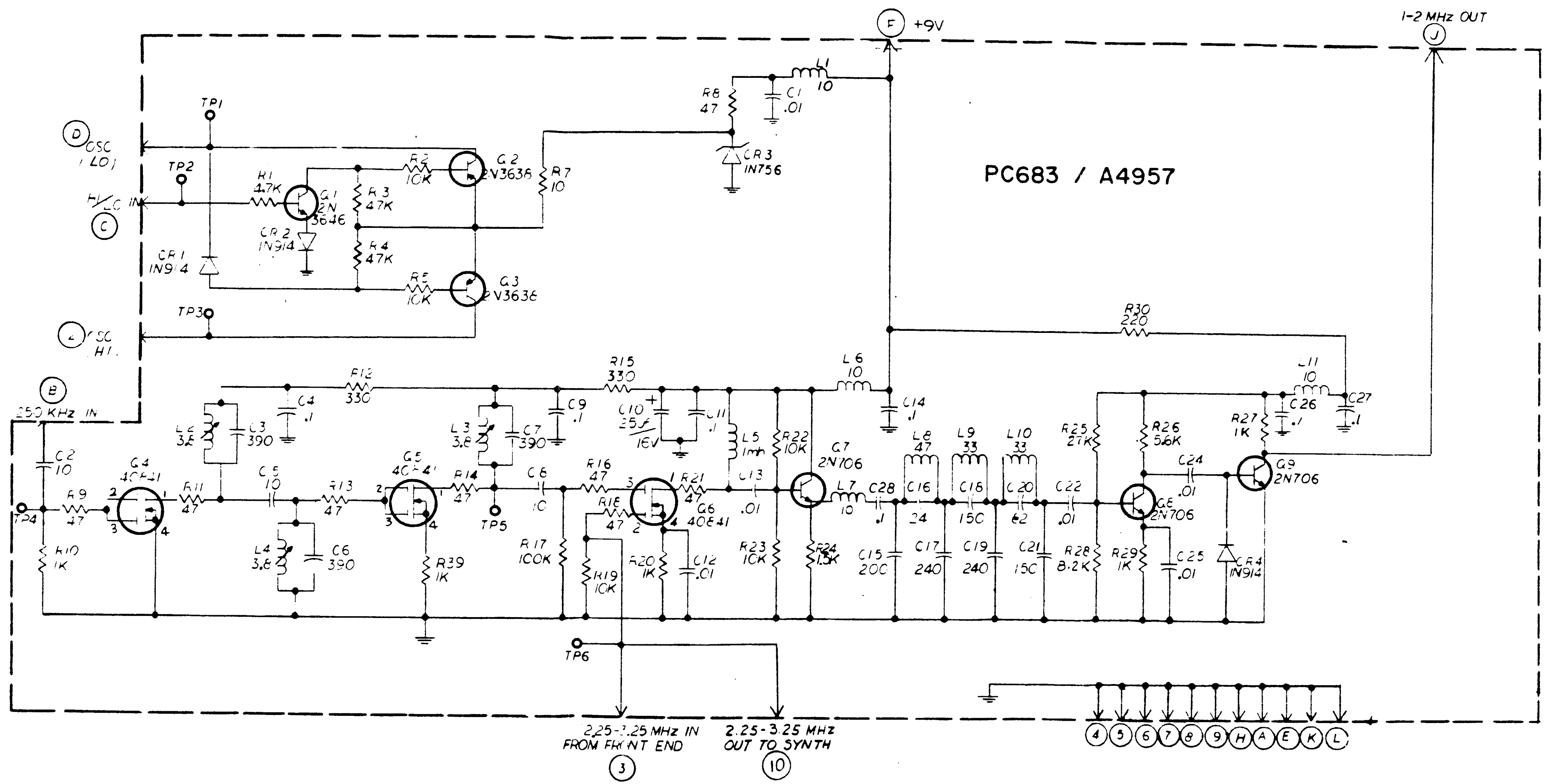


Figure 7-15. Sample Divide/Phase Detector Assembly Z107, Location of Components



UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4W.
2. ALL DECIMAL CAPACITANCE VALUES ARE IN MICROFARADS.
3. ALL WHOLE NUMBER VALUES ARE IN PICOFARADS.

Figure 7-16 Mixer/Oscillator Control Assembly Z109, Schematic Diagram

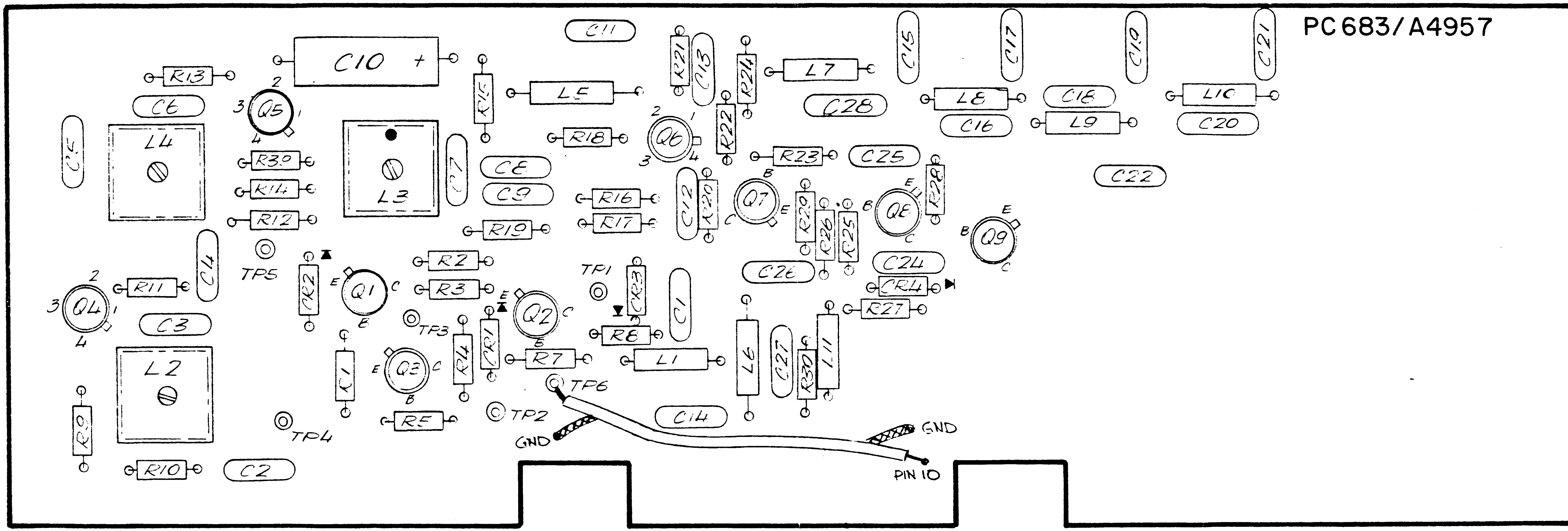


Figure 7-17 Mixer/Oscillator Control Assembly Z109, Location of Components

A4957-XI

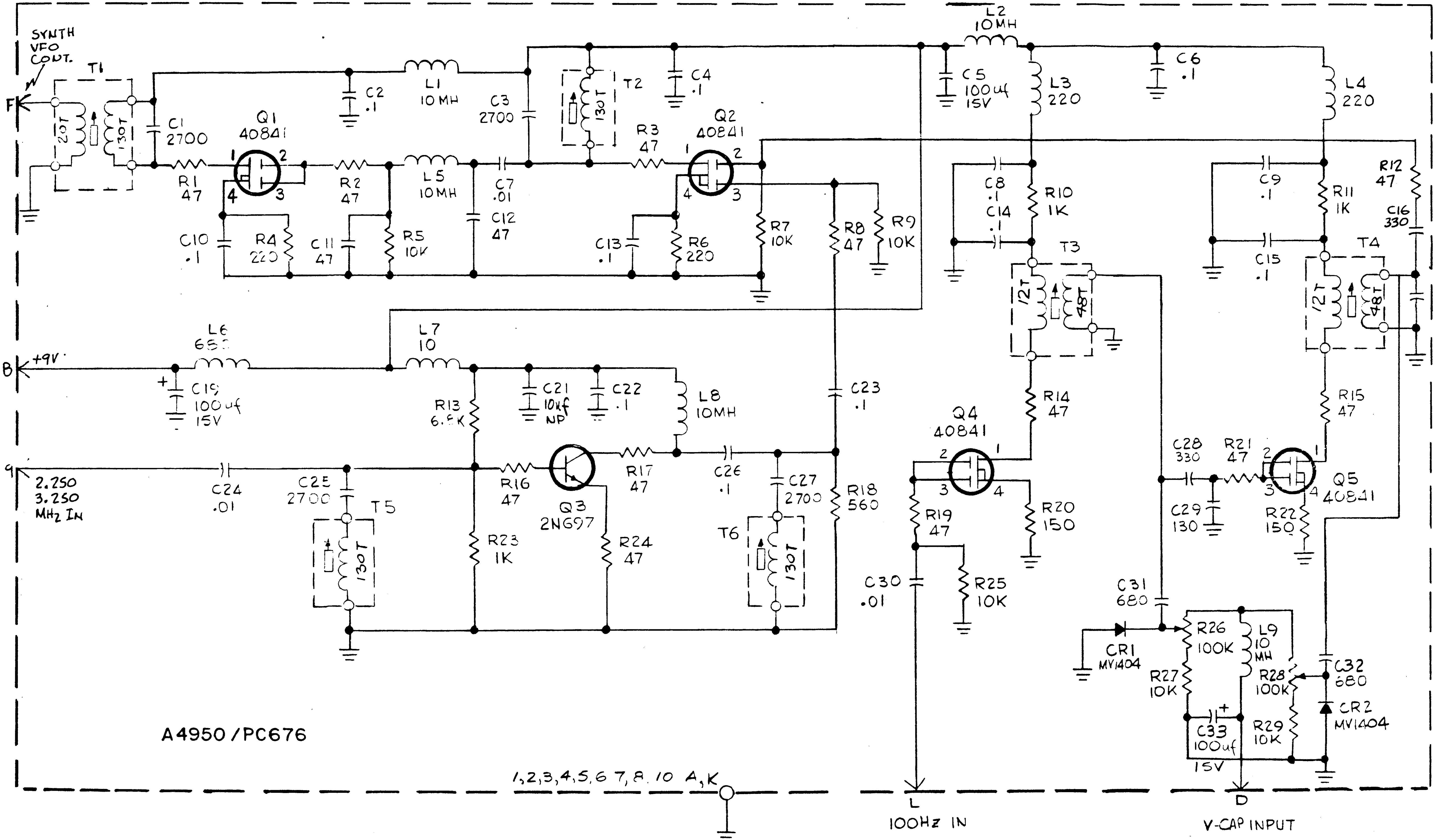


Figure 7-18 100-Hz Synthesizer Assembly Z110, Schematic Diagram

CK1893-XI

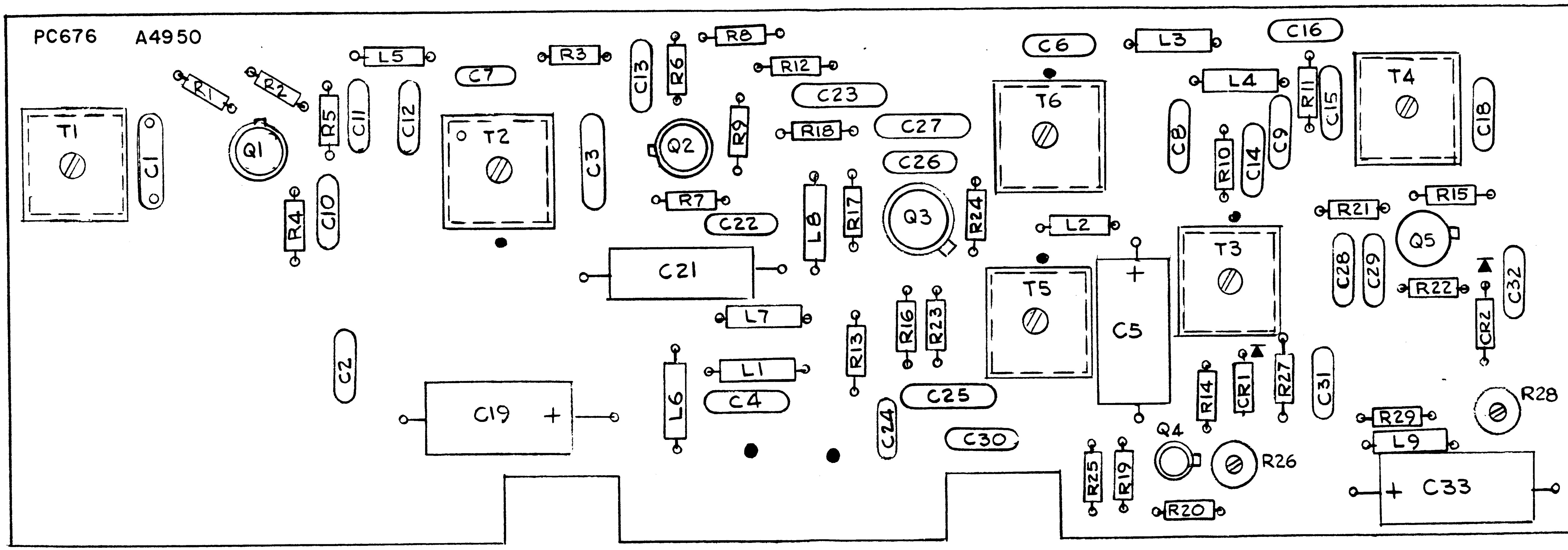
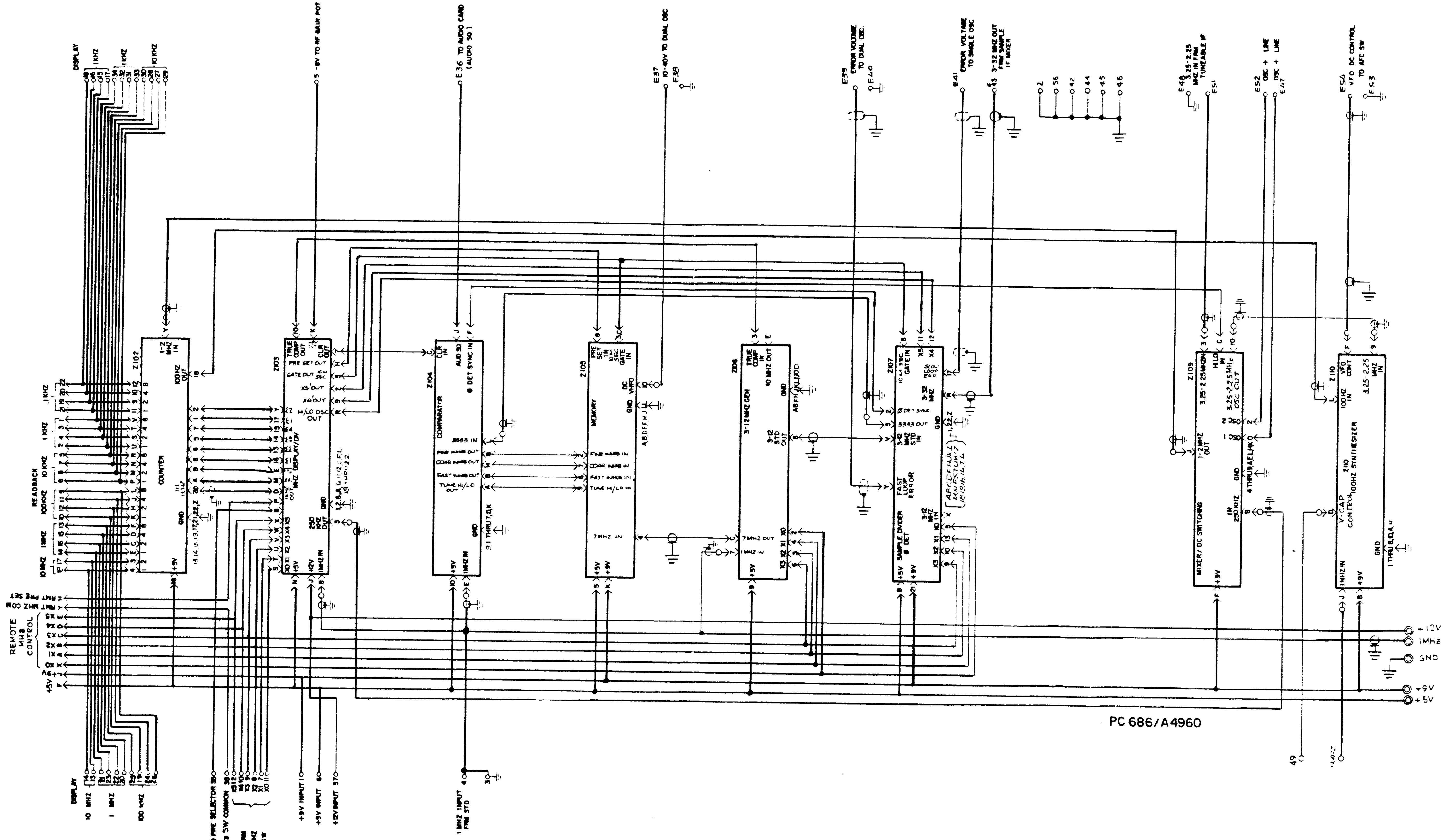


Figure 7-19 100-Hz Synthesizer Assembly Z110, Location of Components



008753011
CK2065-Ø

Figure 7-20 Digital Logic and Control Mother Board Z111, Interconnection Diagram

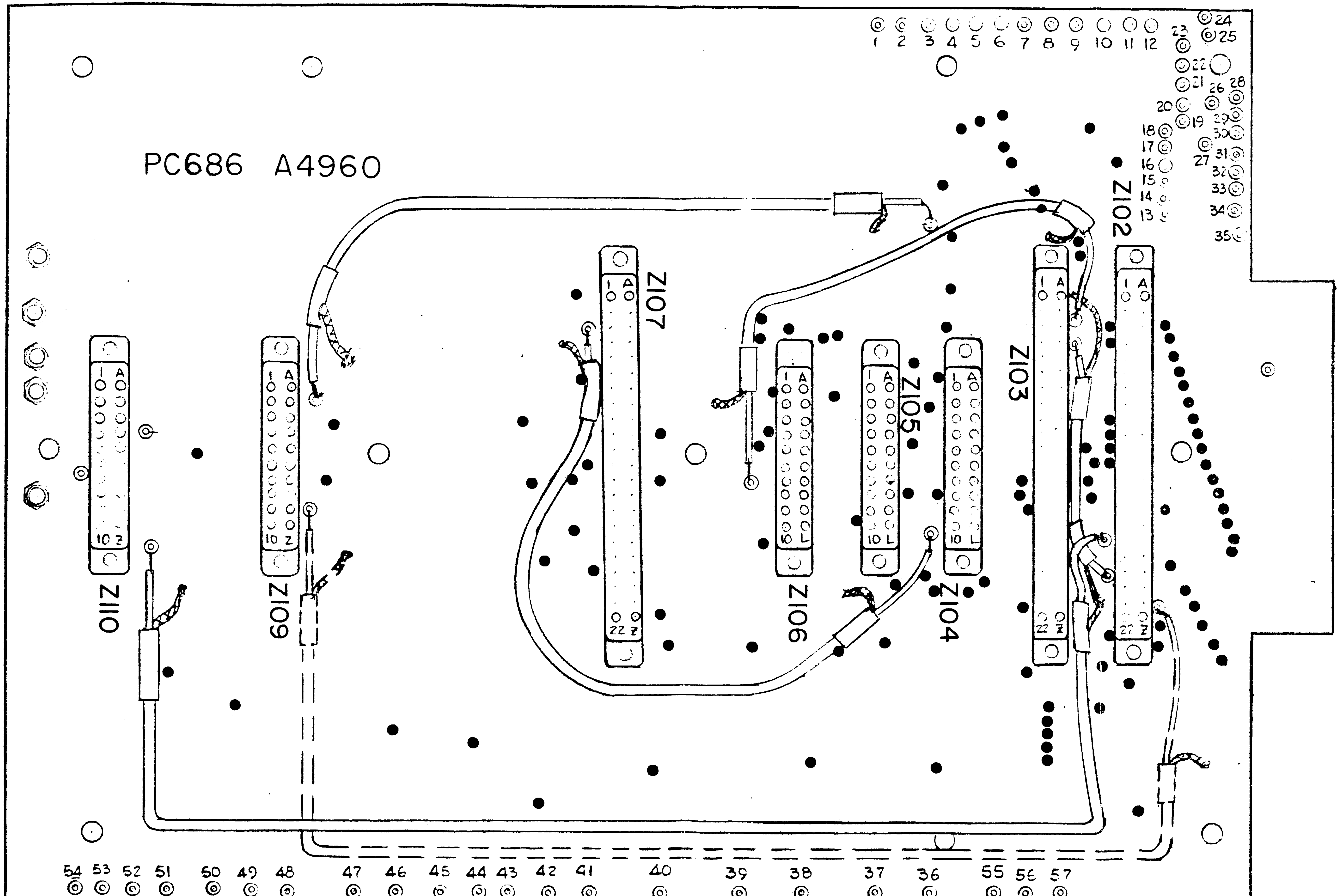
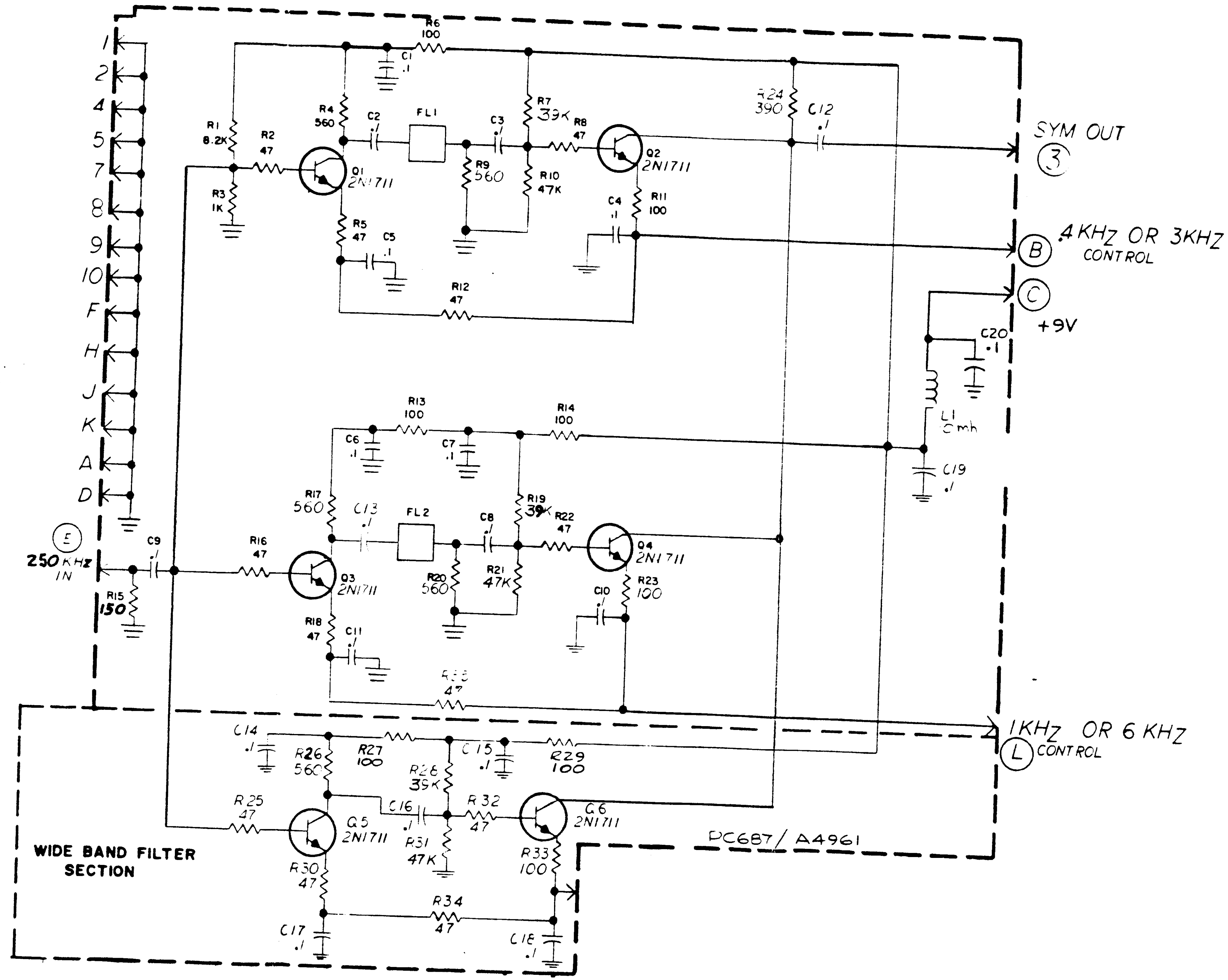


Figure 7-21 Digital Logic and Control Mother Board Z111, Location of Components

TMC P/N	FILTER FREQUENCIES FL1	FL2	
A4961-1	.4KHZ	1 KHZ	WIDE BAND FILTER SECTION NOT USED
A4961-2	3KHZ	6KHZ WITH WIDE BAND	
A4961-3	WIDE BAND FILTER ONLY		

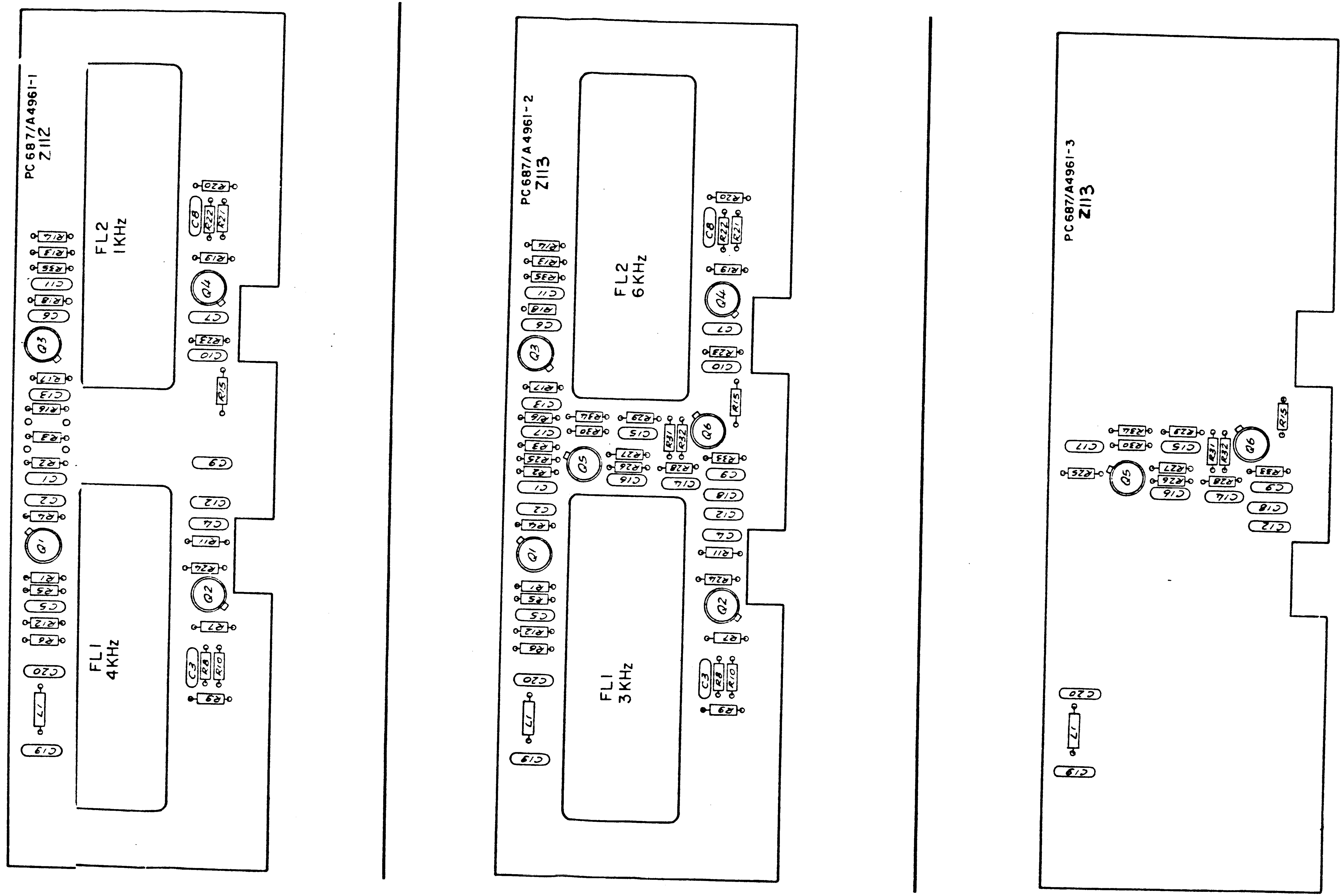


UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4W.
2. ALL DECIMAL CAPACITANCE VALUES ARE IN MICROFARADS.

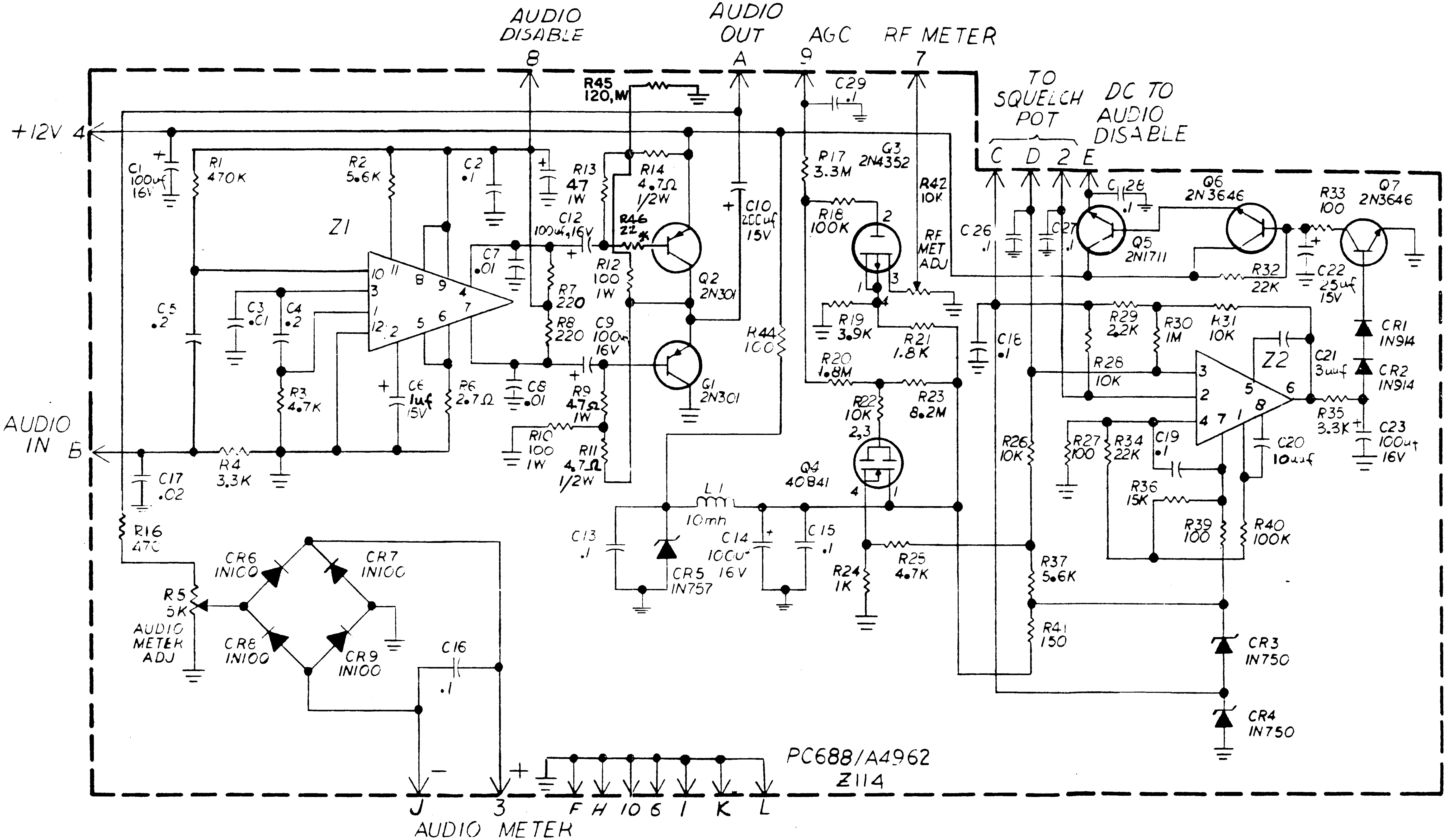
CK2045-Ø

Figure 7-22 Symmetrical Filter Assemblies Z112 and Z113, Schematic Diagram



A4961-X1

Figure 7-23 Symmetrical Filter Assemblies Z112 and Z113, Location of Components



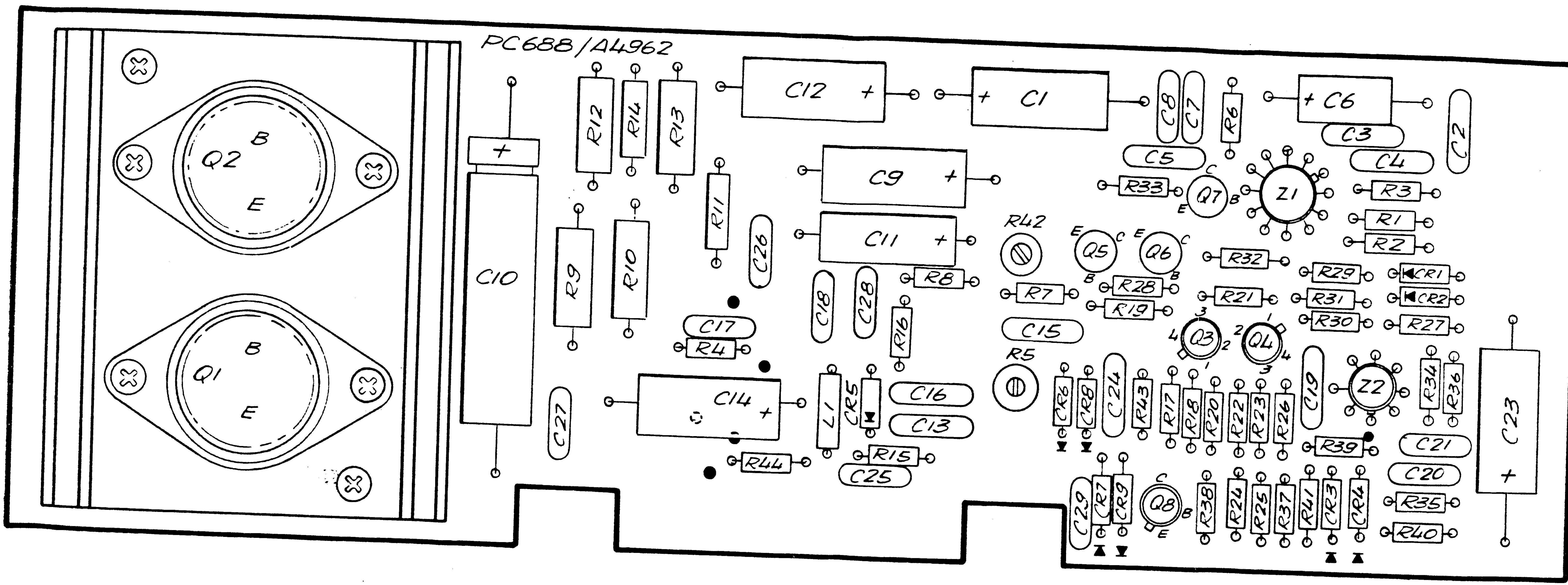
UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W.
2. ALL DECIMAL CAPACITANCE VALUES ARE IN MICROFARADS.

* FACTORY ADJUST VALUE

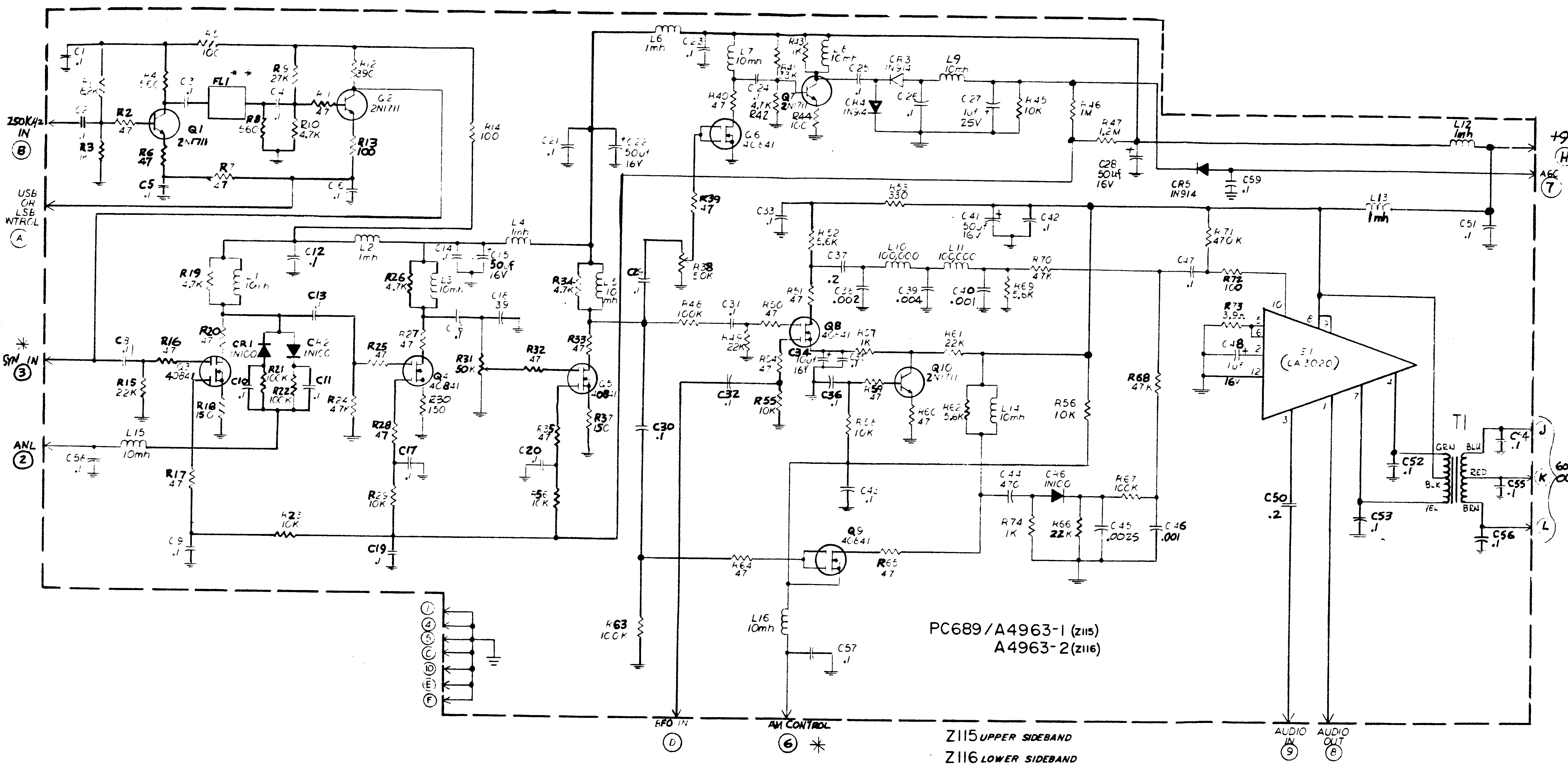
Figure 7-24 Audio Assembly Z114, Schematic Diagram

CK2046-X4



008753011
A4962-XI

Figure 7-25 Audio Assembly Z114, Location of Components



UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W.
2. ALL DECIMAL CAPACITANCE VALUES ARE IN MICROFARADS.
3. ALL WHOLE NUMBER VALUES ARE IN PICOFARADS.
4. ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
5. * ONLY IN USB
   ** USB or LSB Filter

CK2047-X

Figure 7-26 USB and LSB Filter Assemblies Z115 and Z116, Schematic Diagram

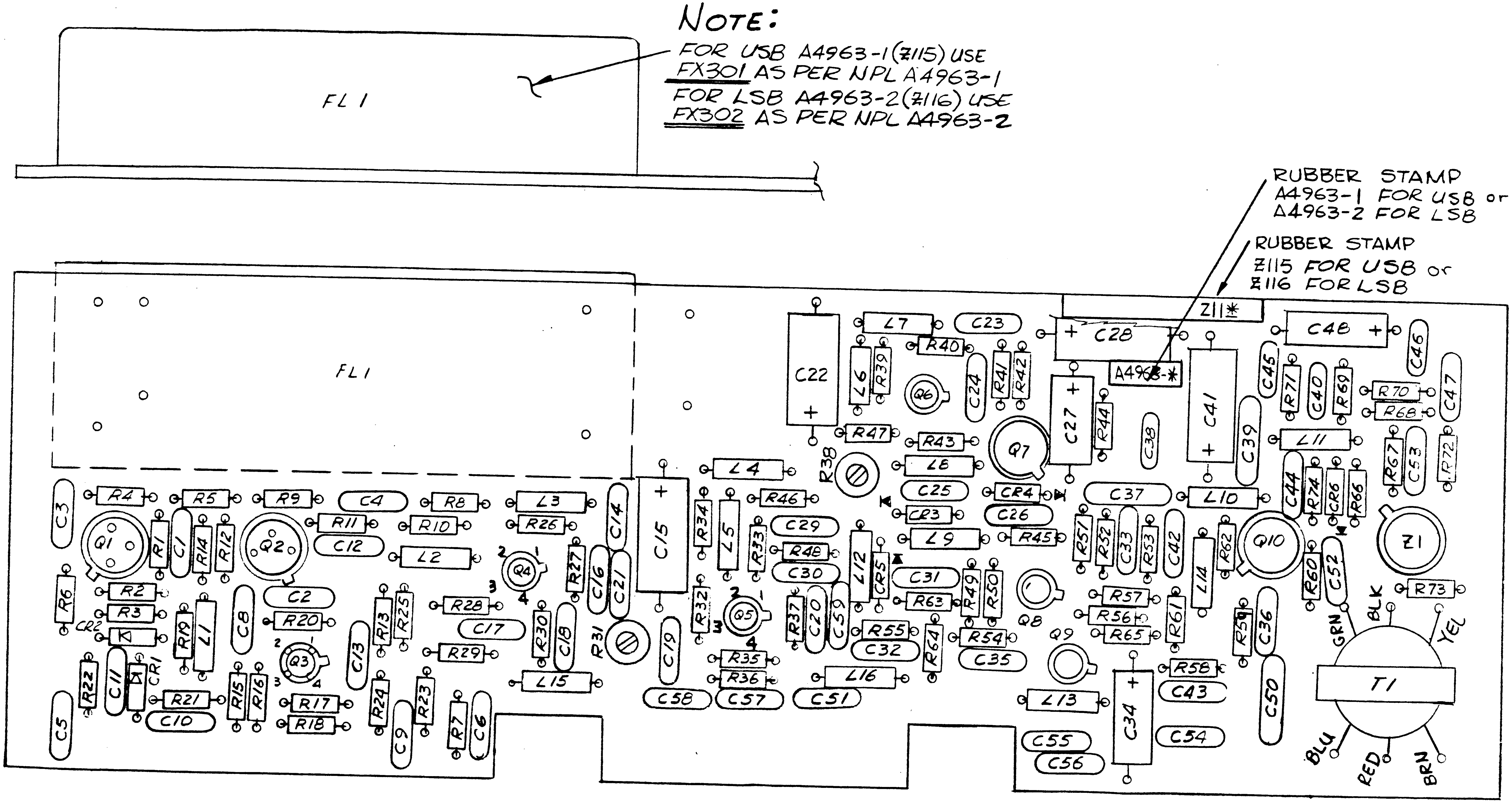
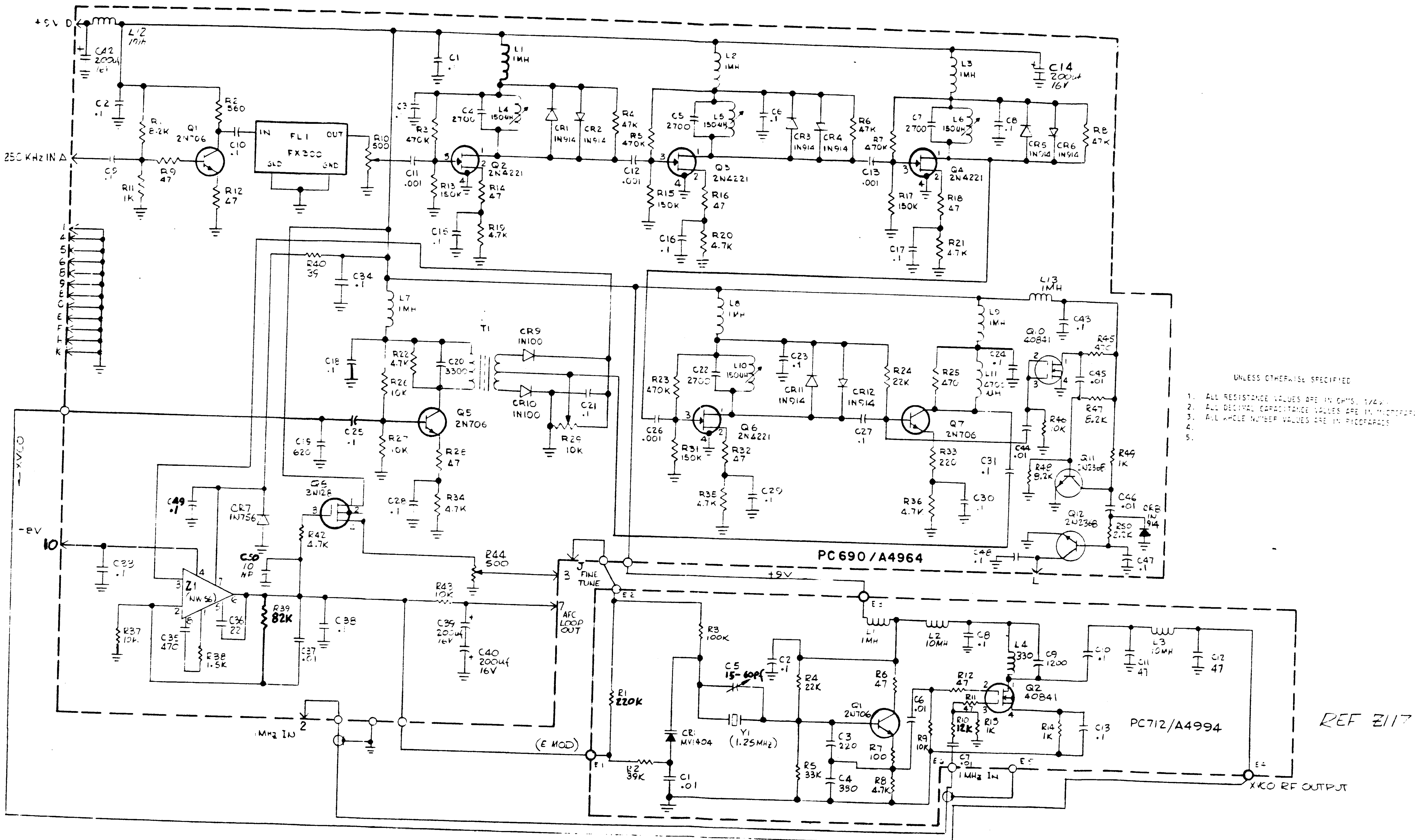


Figure 7-27 USB and LSB Filter Assemblies Z115 and Z116, Location of Components



CK2048-X2

Figure 7-28 Sync/AFC Assembly Z117, Schematic Diagram

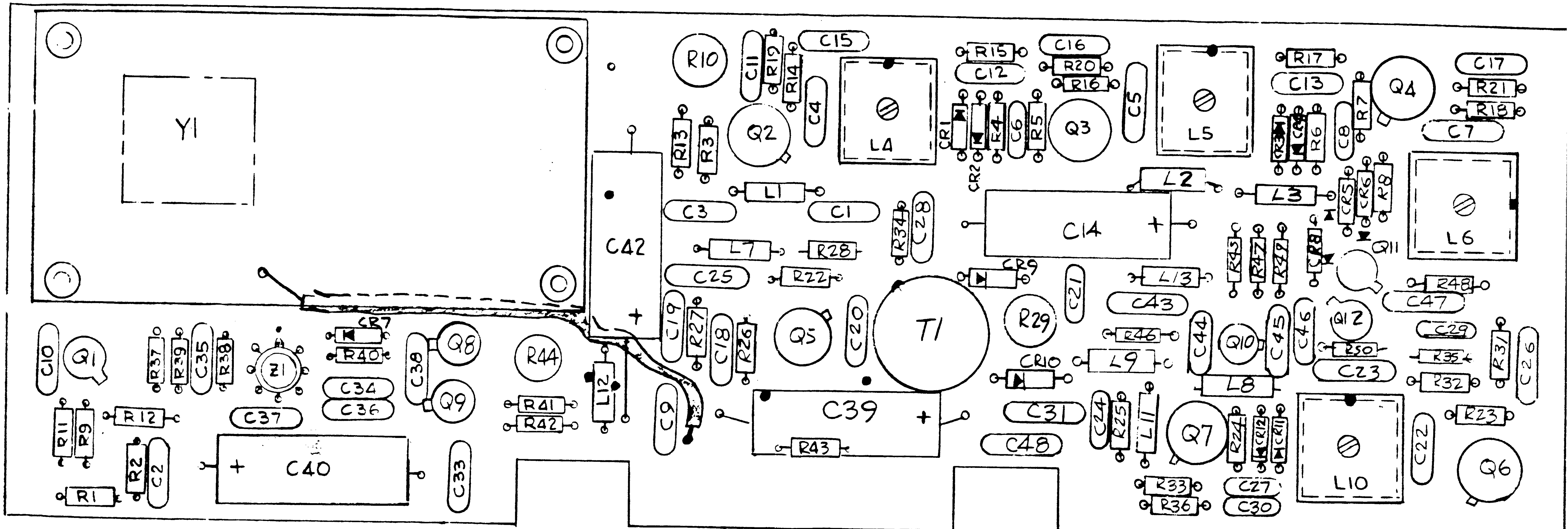


Figure 7-29 Sync/AFC Assembly Z117, Location of Components

A4964

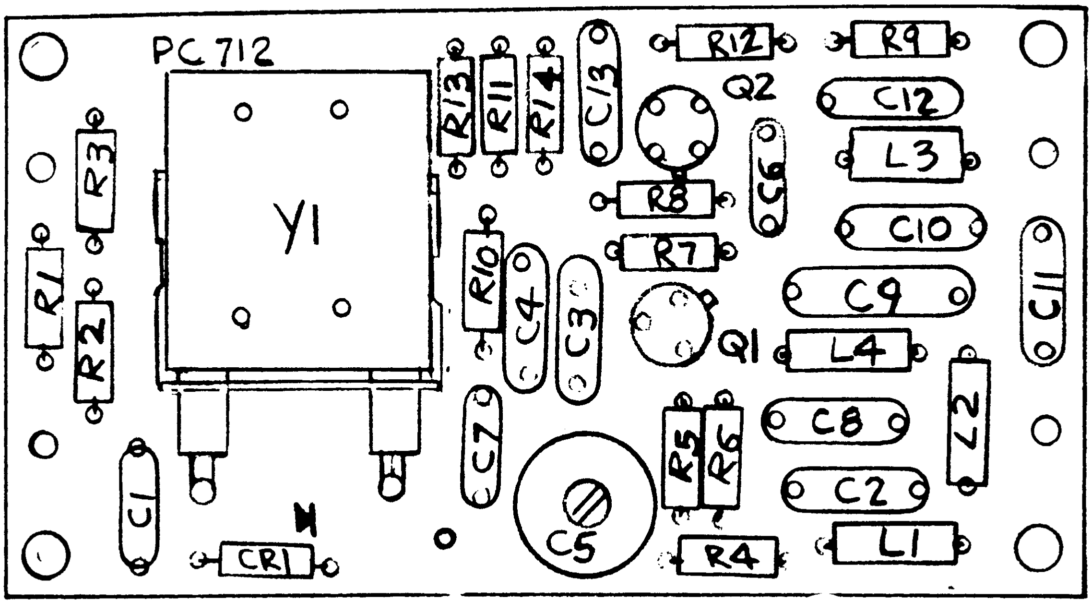
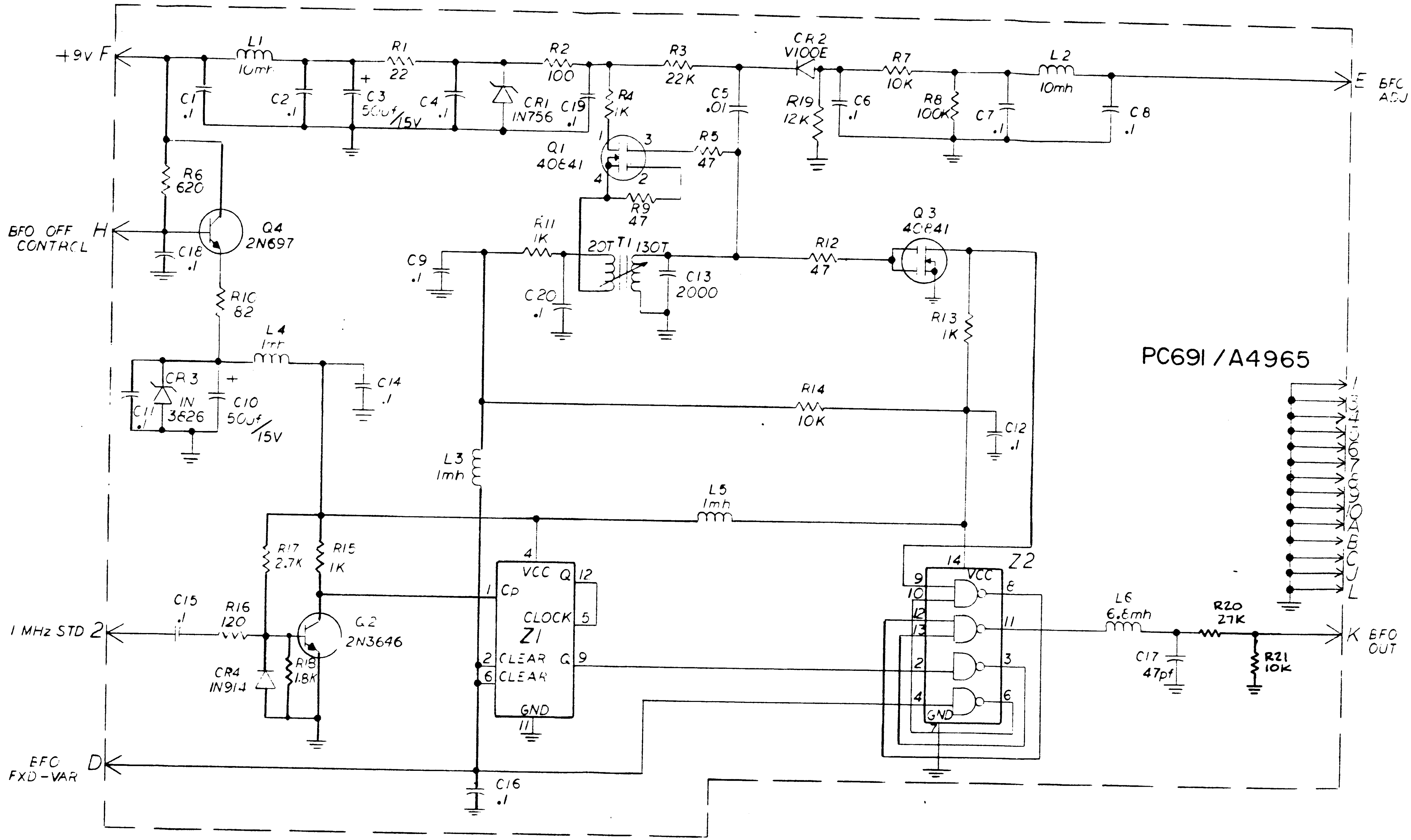


Figure 7-30 XVCO Assembly (P/O Z117), Location of Components



UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4W.
2. ALL DECIMAL CAPACITANCE VALUES ARE IN MICROFARADS.
3. ALL WHOLE NUMBER VALUES ARE IN PICOFARADS.

Figure 7-31 BFO Assembly Z118, Schematic Diagram

CK2049-X2

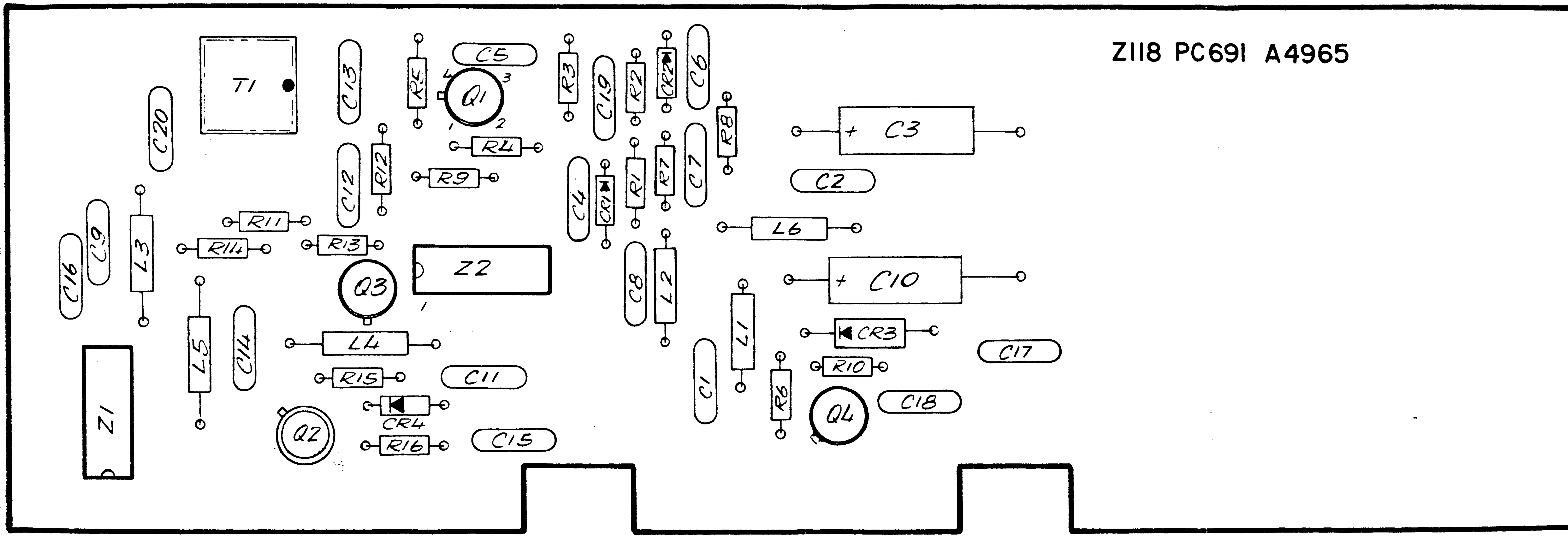


Figure 7-32 **BFO Assembly Z118, Location of Components**

A4965-X

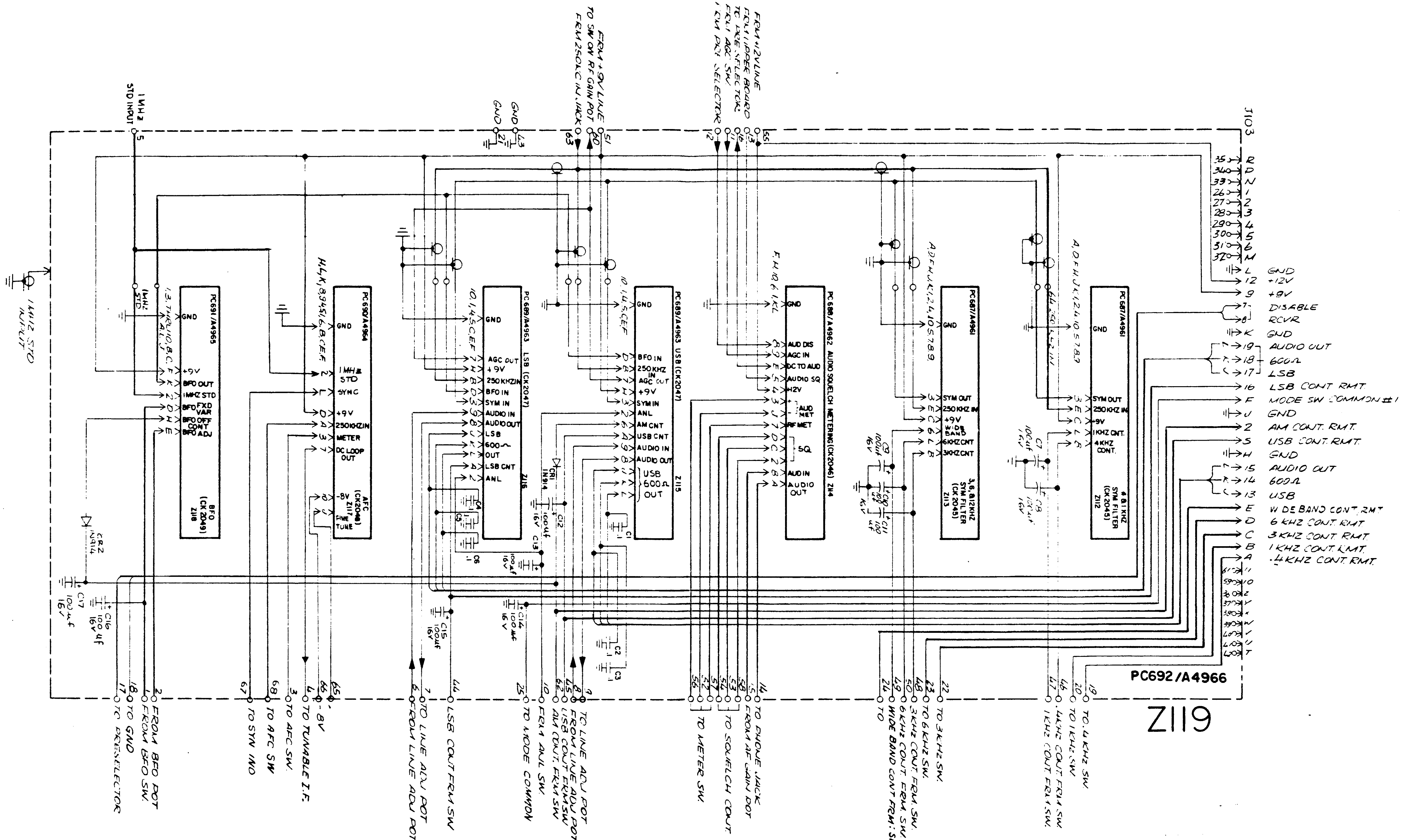


Figure 7-33 Audio Filter Mother Board Z119, Interconnection Diagram

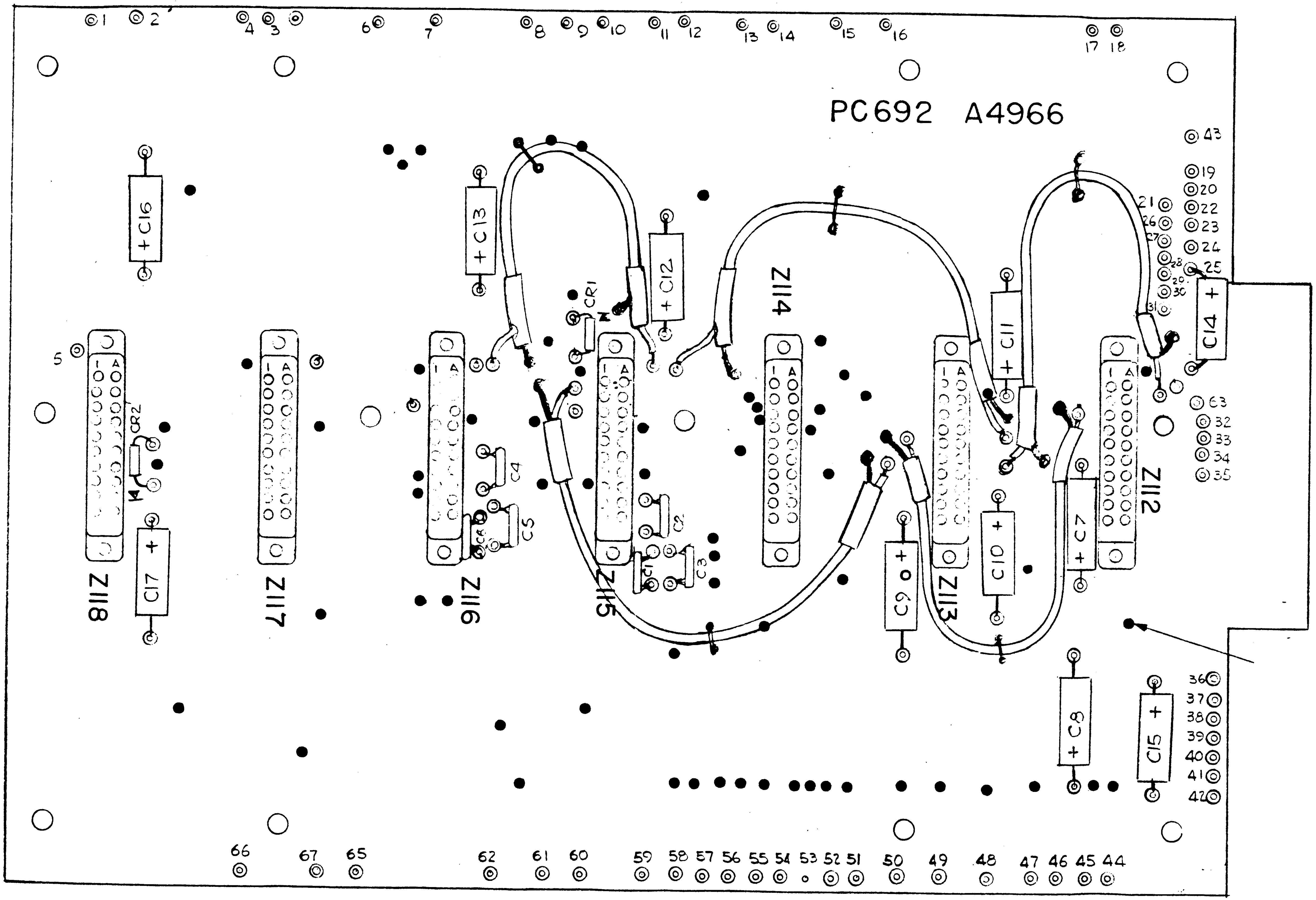
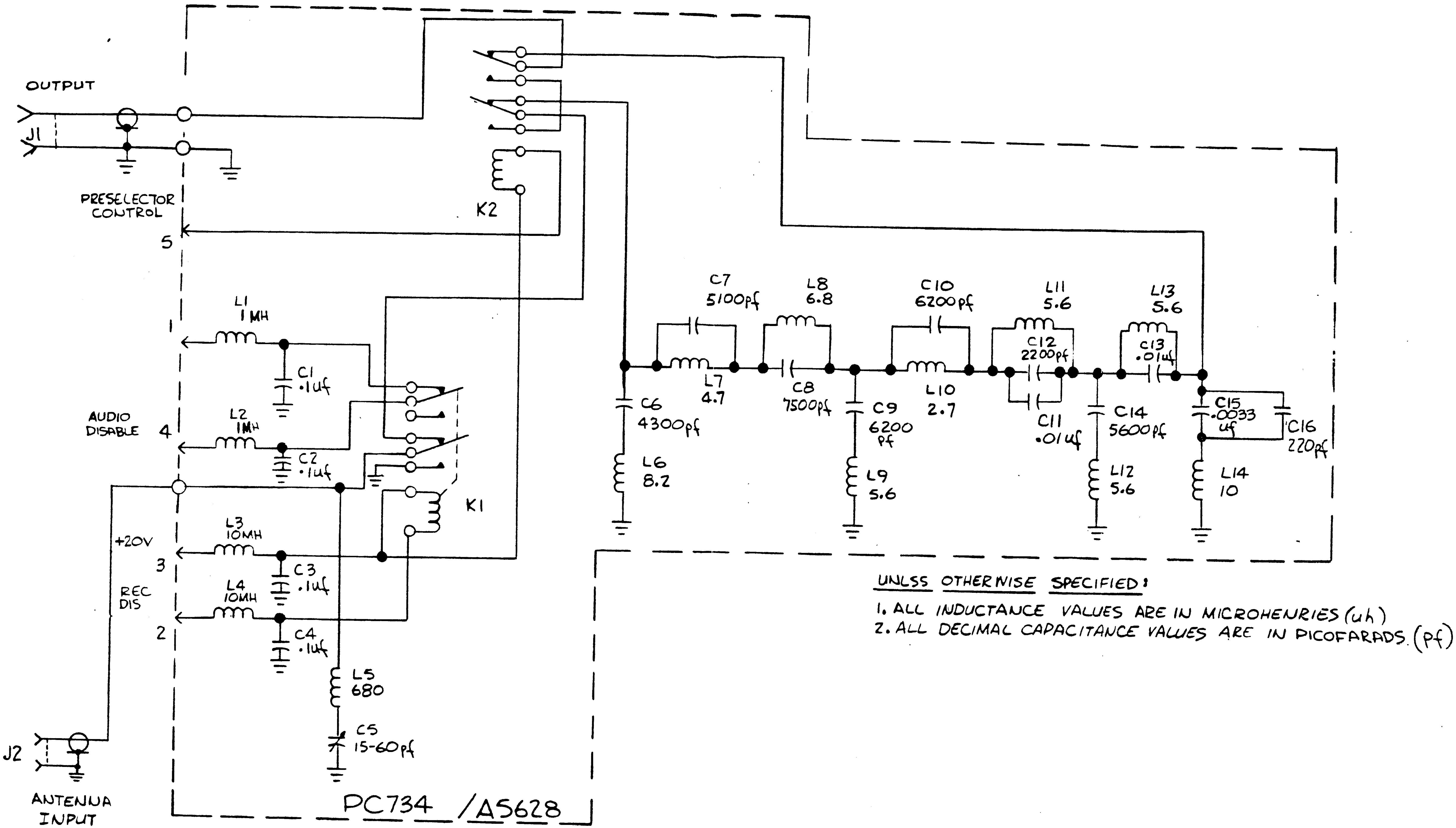


Figure 7-34 Audio Filter Mother Board Z119, Location of Components

A4966-X2



CK2105-X1

Figure 7-35 Preselector Assembly Z120, Schematic Diagram

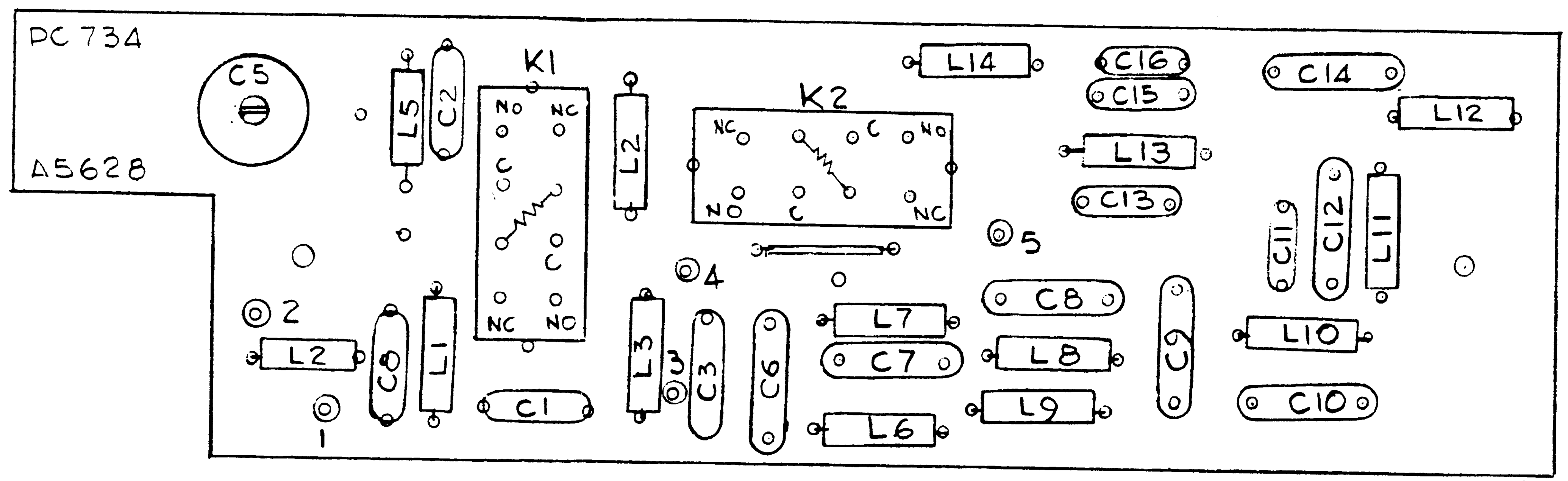
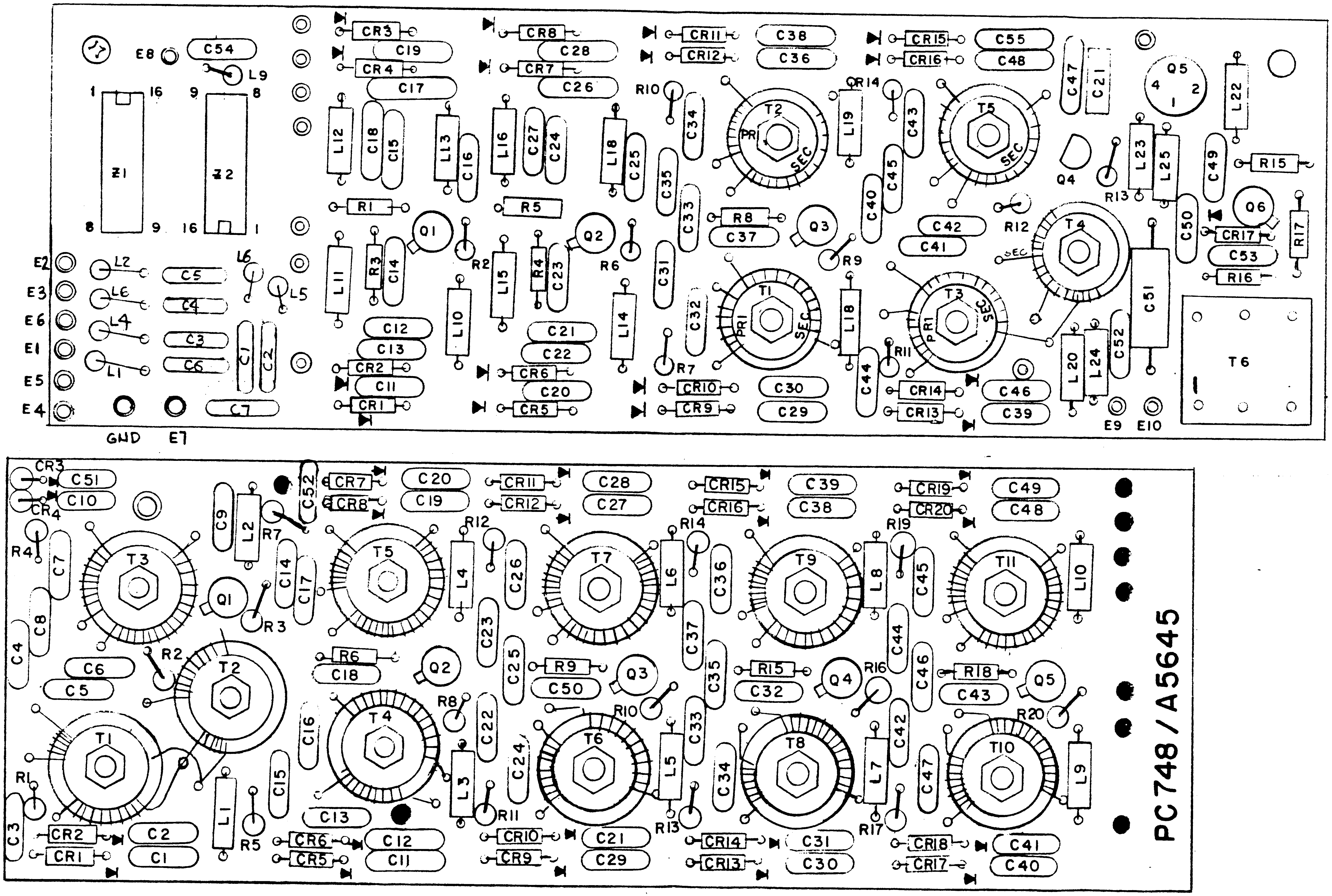


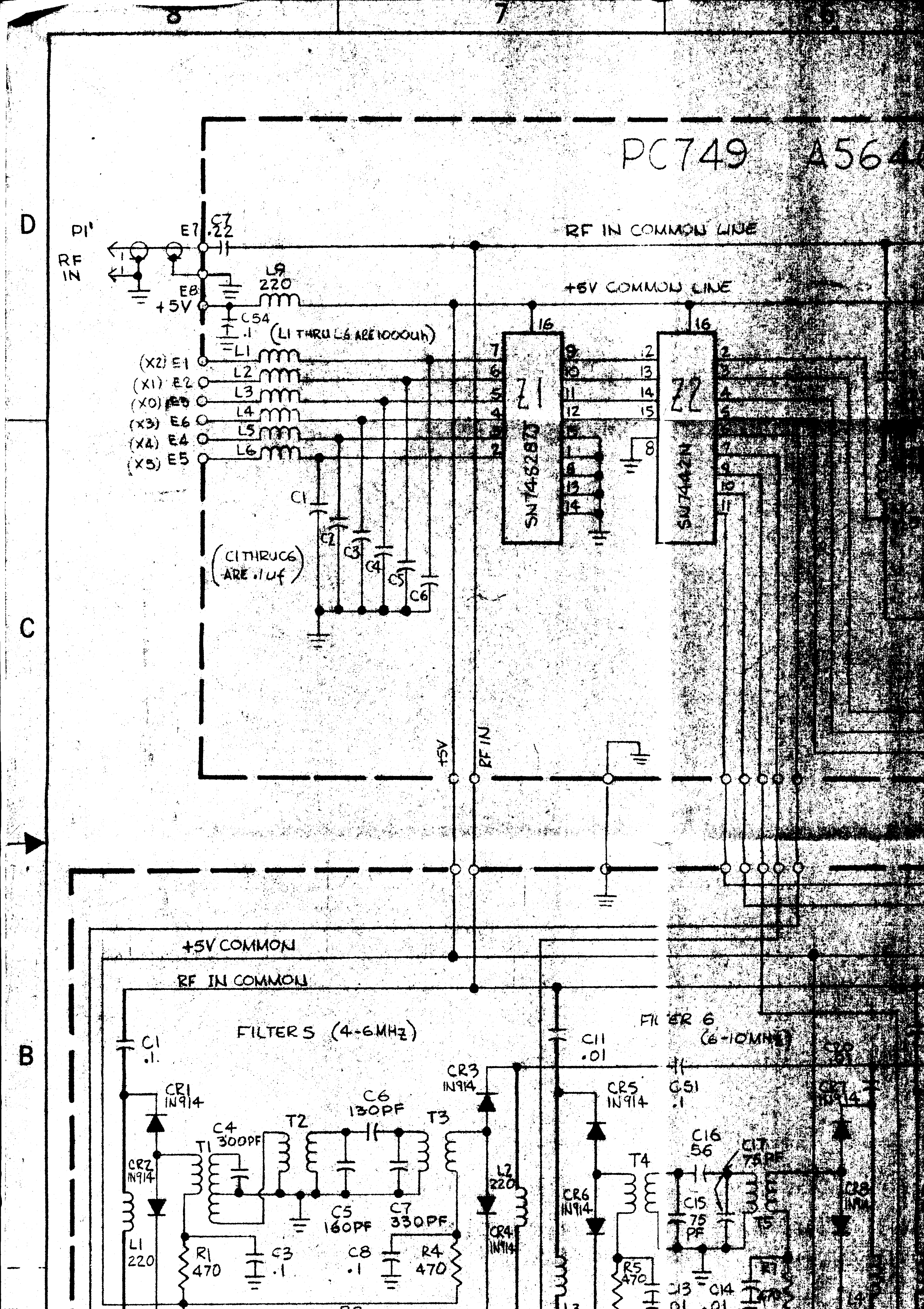
Figure 7-36 Preselector Assembly Z120, Location of Components

A5628-X

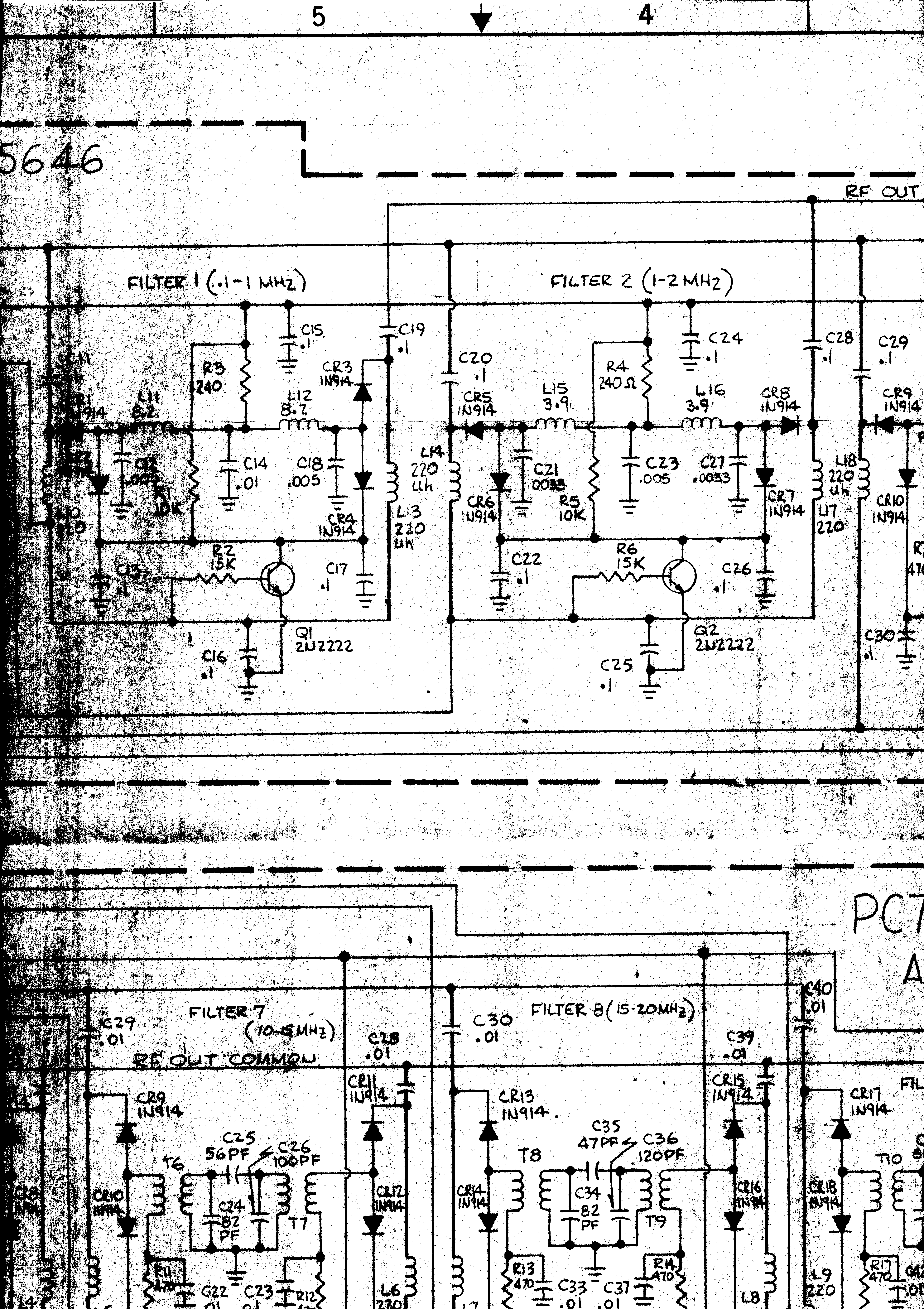


A5646-X1
A5645-X

Figure 7-37 MULTIBAND PRE-SELECTOR ASS'Y Z121



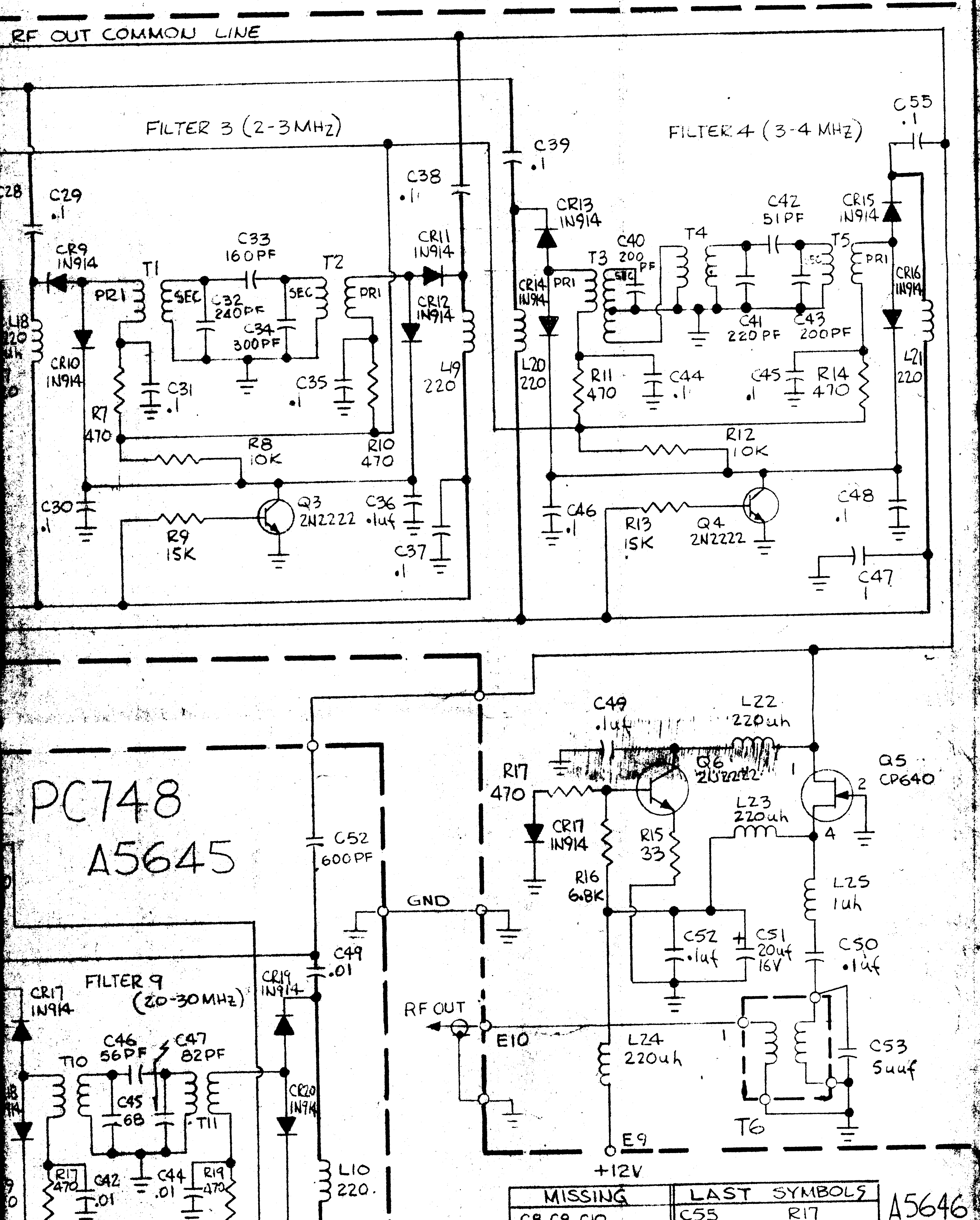
8
7
6
D
C
B
PC749
A564
P1'
RF IN
E7
C7 .22
E8
+5V
L9 220
C54 .1
(L1 THRU L6 ARE 1000uh)
RF IN COMMON LINE
+5V COMMON LINE
(X2) E1
(X1) E2
(X0) E3
(X3) E6
(X4) E4
(X5) E5
L1
L2
L3
L4
L5
L6
C1
C2
C3
C4
C5
C6
(C1 THRU C6 ARE .1uf)
Z1
SN74S287N
Z2
SN7442N
+5V
RF IN
+5V COMMON
RF IN COMMON
FILTERS (4-6MHz)
FILTER 6 (6-10MHz)
C1 .1
CR1 1N914
CR2 1N914
L1 220
C4 300PF
T1
T2
C6 130PF
T3
CR3 1N914
C5 160PF
C7 330PF
R1 470
C3 .1
C8 .1
R4 470
L2 220
CR4 1N914
C11 .01
CR5 1N914
C51 .1
CR6 1N914
T4
C16 56
C17 75PF
C15 75 PF
T5
R5 470
C13 .01
C14 .01
CR7 1N914
CR8 1N914



5
4
5646
RF OUT
FILTER 1 (.1-1 MHz)
FILTER 2 (1-2 MHz)
C15 .1
C19 .1
C20 .1
C24 .1
C28 .1
C29 .1
R3 240
R4 240 Ω
CR1 1N914
L11 8.2
L12 8.2
CR3 1N914
CR5 1N914
L15 3.9
L16 3.9
CR8 1N914
CR9 1N914
C12 .005
R1 10K
C14 .01
C18 .005
L14 220 uh
C21 .0033
R5 10K
C23 .005
C27 .0033
L18 220 uh
L10 220
CR4 1N914
L13 220 uh
CR6 1N914
CR7 1N914
L17 220
CR10 1N914
R2 15K
C13 .1
C17 .1
R6 15K
C22 .1
C26 .1
C30 .1
Q1 2N2222
C16 .1
Q2 2N2222
C25 .1
PC
A
C40 .01
FILTER 7 (10-15 MHz)
C29 .01
RF OUT COMMON
C28 .01
C30 .01
FILTER 8 (15-20 MHz)
C39 .01
CR9 1N914
CR11 1N914
CR13 1N914
CR15 1N914
CR17 1N914
C25 56PF
C26 100PF
C35 47PF
C36 120PF
T6
T7
T8
T9
T10
CR10 1N914
C24 82 PF
CR12 1N914
CR14 1N914
C34 82 PF
CR16 1N914
CR18 1N914
R11 470
C22 .01
C23 .01
R12
L6 220
R13 470
C33 .01
C37 .01
R14 470
L8
L9 220
R17 470

3 | 2 | 1

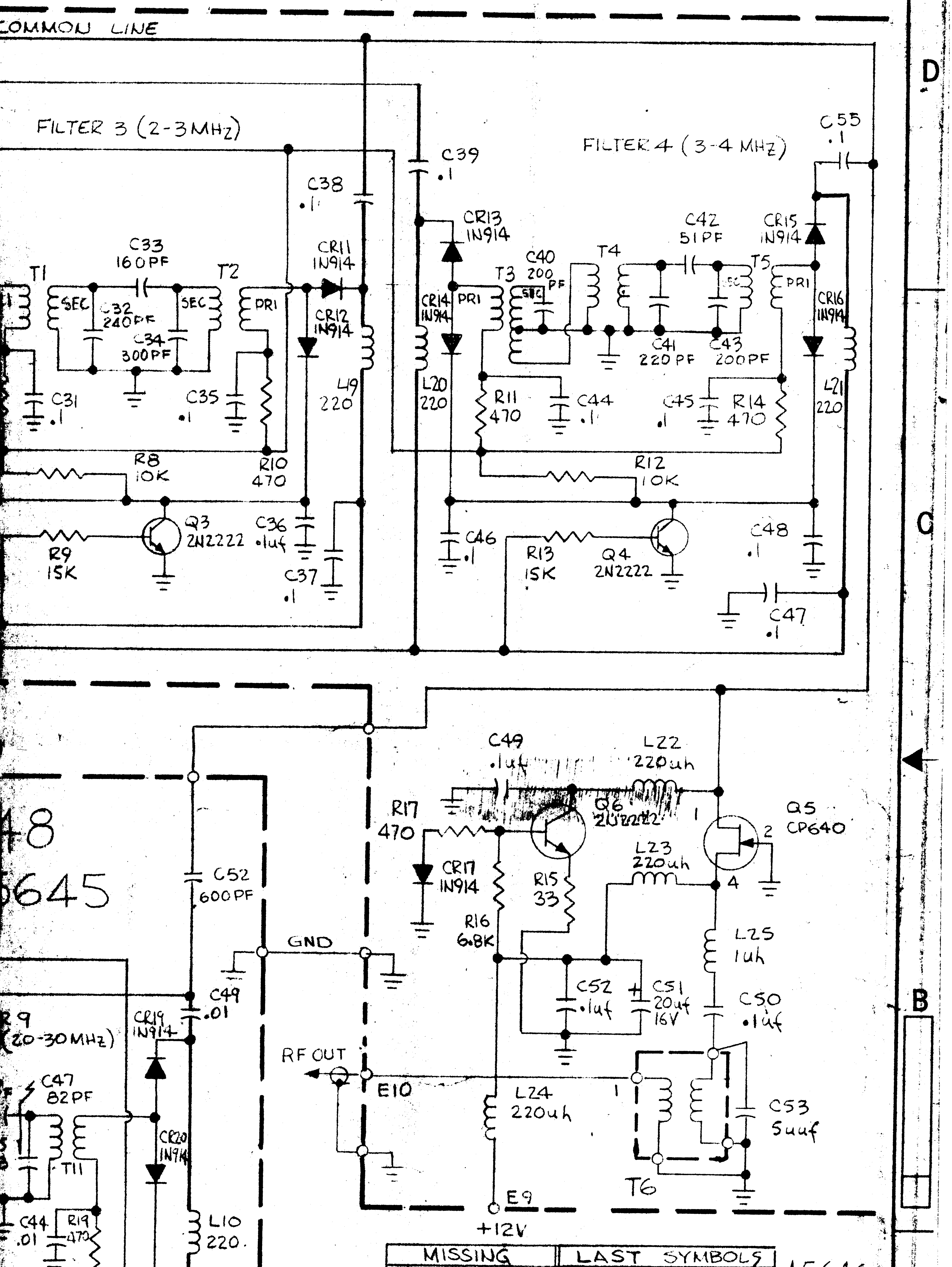
					REVISIONS		
E.M.N.NO	DRAFT	CHKD	ZONE	LTR	DESCRIPTION	DATE	APPROVED
	GDL			X1	OUTPUT DESIGNATIONS CLARIFIED	12-13-76	
				X2	AT TERMINAL E10 J1 DELETED	2-3-77	

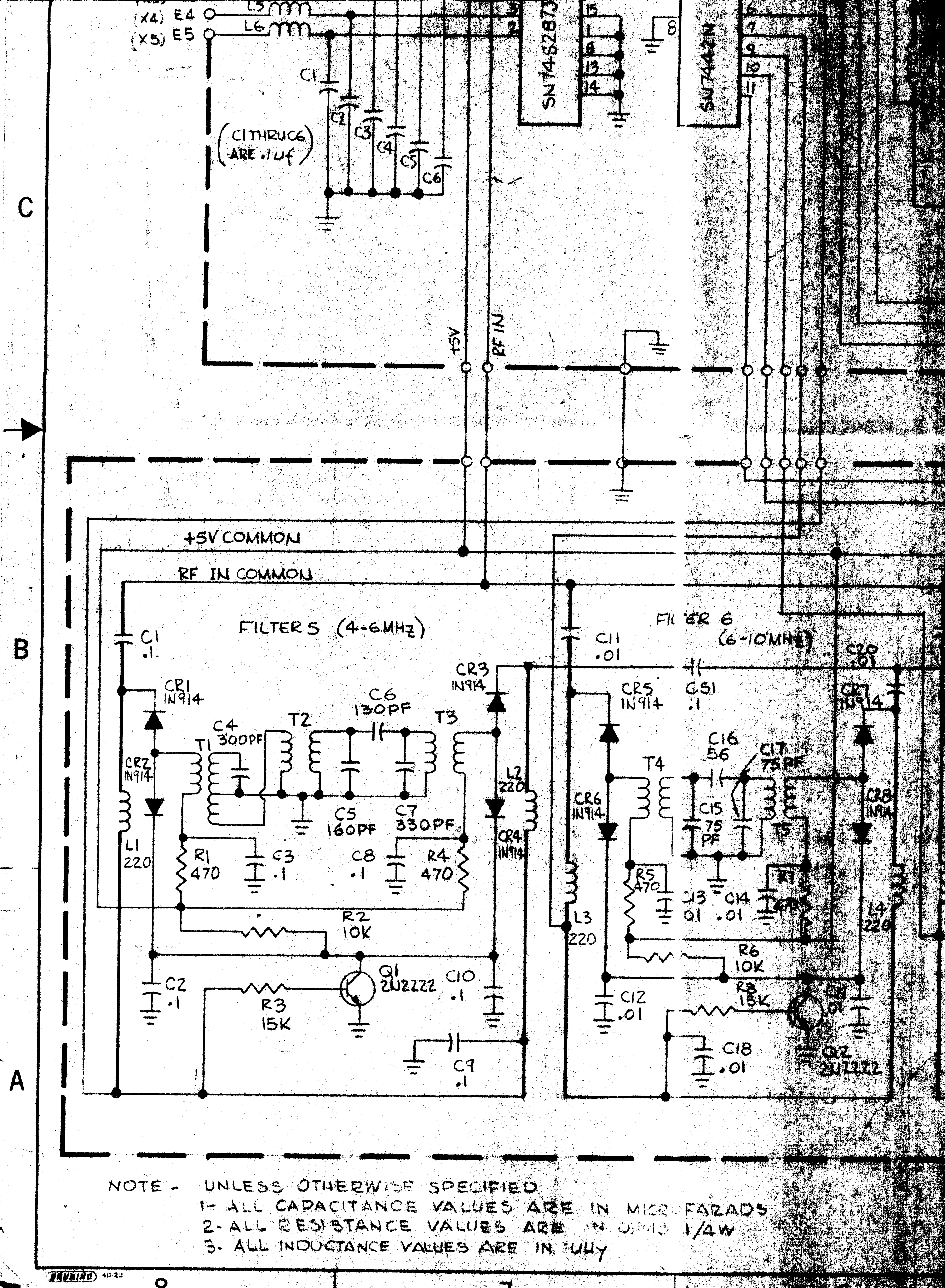


3	2	1

REVISIONS

E.M.N.NO	DRAFT	CHKD	ZONE	LTR	DESCRIPTION	DATE	APPROVED
	GDL			X1	OUTPUT DESIGNATIONS CLARIFIED	12-13-76	
				X2	AT TERMINAL E10 J1 DELETED	2-3-77	

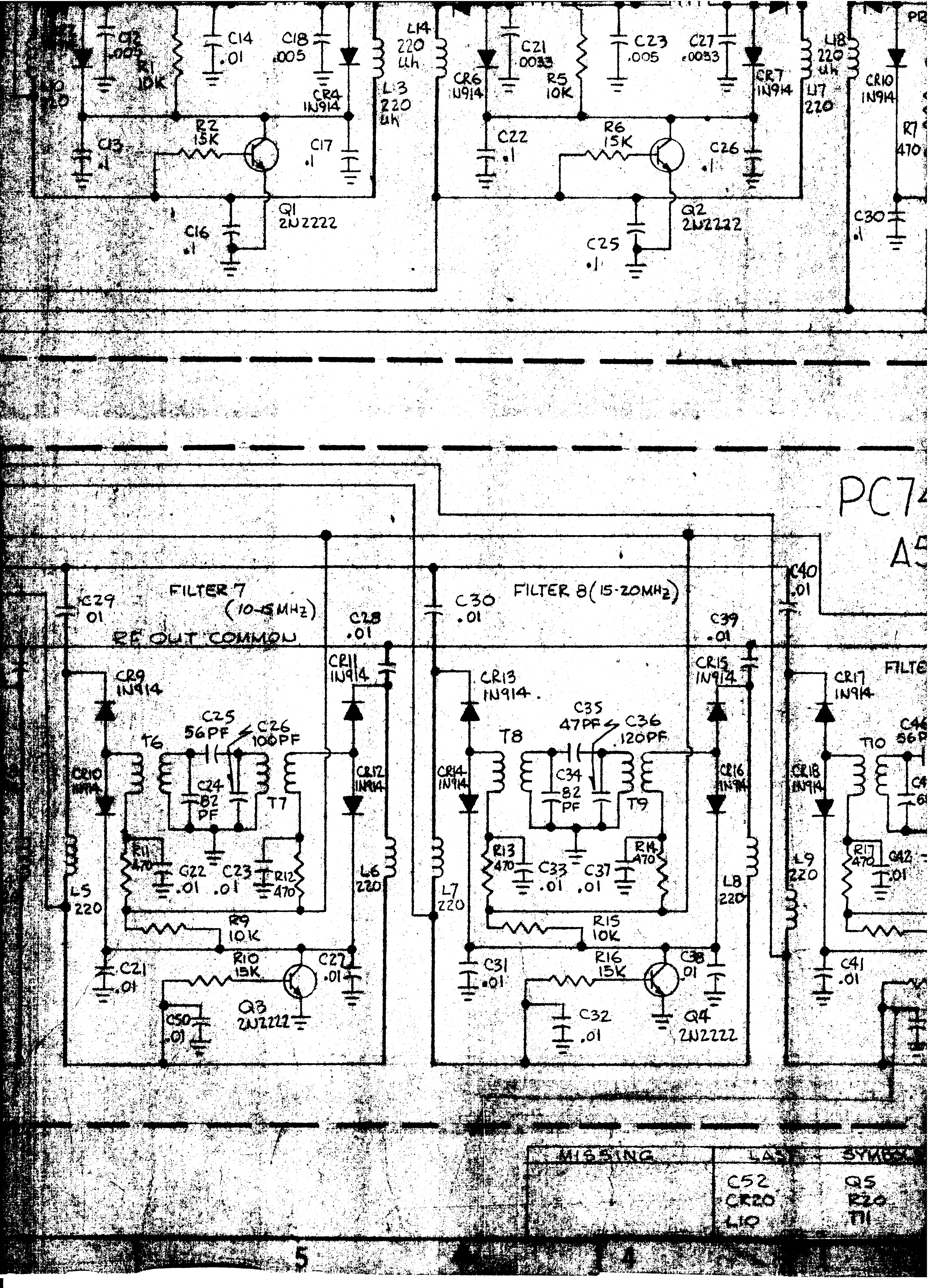




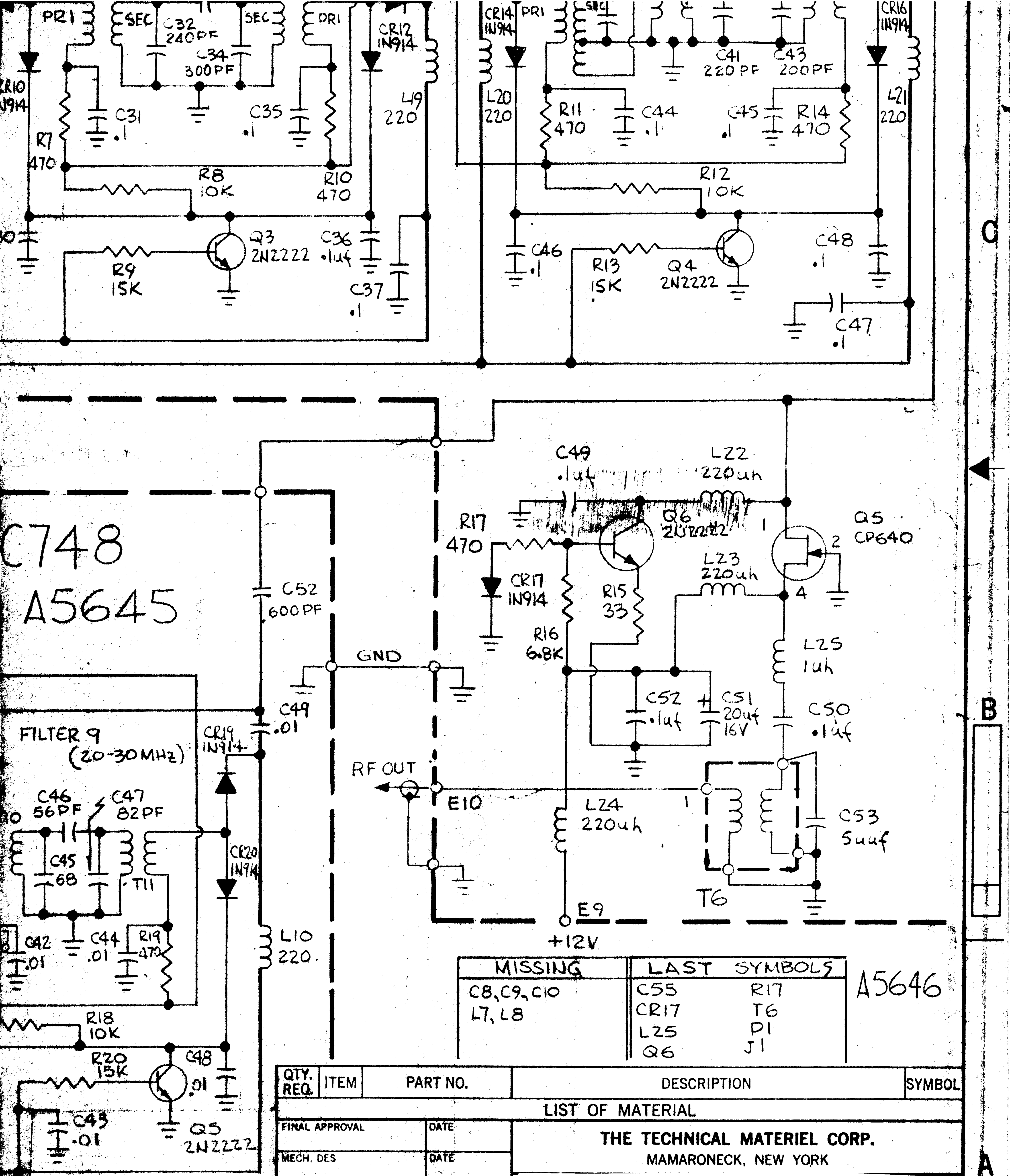
NOTE - UNLESS OTHERWISE SPECIFIED

1- ALL CAPACITANCE VALUES ARE IN MICRO FARADS
2- ALL RESISTANCE VALUES ARE IN OHMS 1/4W
3- ALL INDUCTANCE VALUES ARE IN uHy

8 7 6



C12 .005
R1 10K
C14 .01
C18 .005
CR4 1N914
L14 220 uh
L13 220 uh
C13 .1
R2 15K
C17 .1
C16 .1
Q1 2N2222
CR6 1N914
C21 .0033
R5 10K
C23 .005
C27 .0033
CR7 1N914
L18 220 uh
L17 220
C22 .1
R6 15K
C26 .1
C25 .1
Q2 2N2222
CR10 1N914
R7
470
C30 .1
PC7
A5
FILTER 7 (10-15MHz)
RF OUT COMMON
C29 .01
C28 .01
CR9 1N914
CR11 1N914
C25 56PF
C26 100PF
T6
T7
CR10 1N914
C24 82 PF
CR12 1N914
R11 470
C22 .01
C23 .01
R12 470
L6 220
L5 220
R9 10K
R10 15K
C21 .01
C27 .01
Q3 2N2222
C50 .01
FILTER 8 (15-20MHz)
C30 .01
C39 .01
CR13 1N914
CR15 1N914
C35 47PF
C36 120PF
T8
T9
CR14 1N914
C34 82 PF
CR16 1N914
R13 470
C33 .01
C37 .01
R14 470
L7 220
L8 220
R15 10K
R16 15K
C31 .01
C38 .01
C32 .01
Q4 2N2222
C40 .01
CR17 1N914
T10
CR18 1N914
R17 470
L9 220
C41 .01
MISSING
LAST
SYMBOL
C52
CR20
L10
Q5
R20
T11
5
4



MISSING	LAST SYMBOLS	
C8, C9, C10	C55	R17
L7, L8	CR17	T6
	L25	P1
	Q6	J1

QTY. REQ.	ITEM	PART NO.	DESCRIPTION	SYMBOL

LIST OF MATERIAL

FINAL APPROVAL	DATE
MECH. DES	DATE
ELECT. DES.	DATE
CHECKED	DATE
DRAWN R. Uzzo	DATE 11-23-76

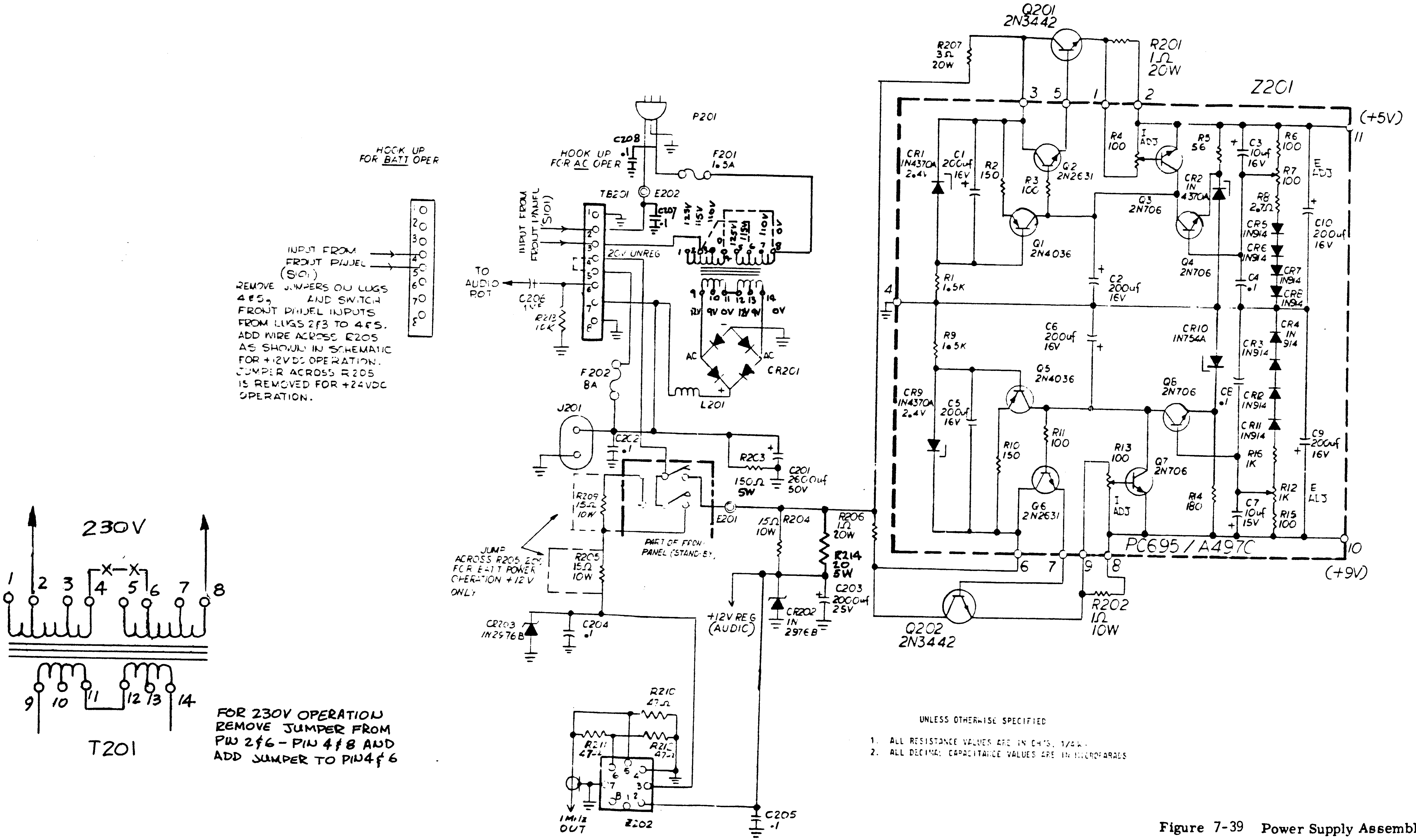
THE TECHNICAL MATERIEL CORP.
MAMARONECK, NEW YORK

SYMBOLS A5645

Figure 7-38 Multiband Pre-Selector (Z121) Schematic Diagram

CK2152-X2

3 2 1



CK2059-F

Figure 7-39 Power Supply Assembly Z201, Schematic Diagram

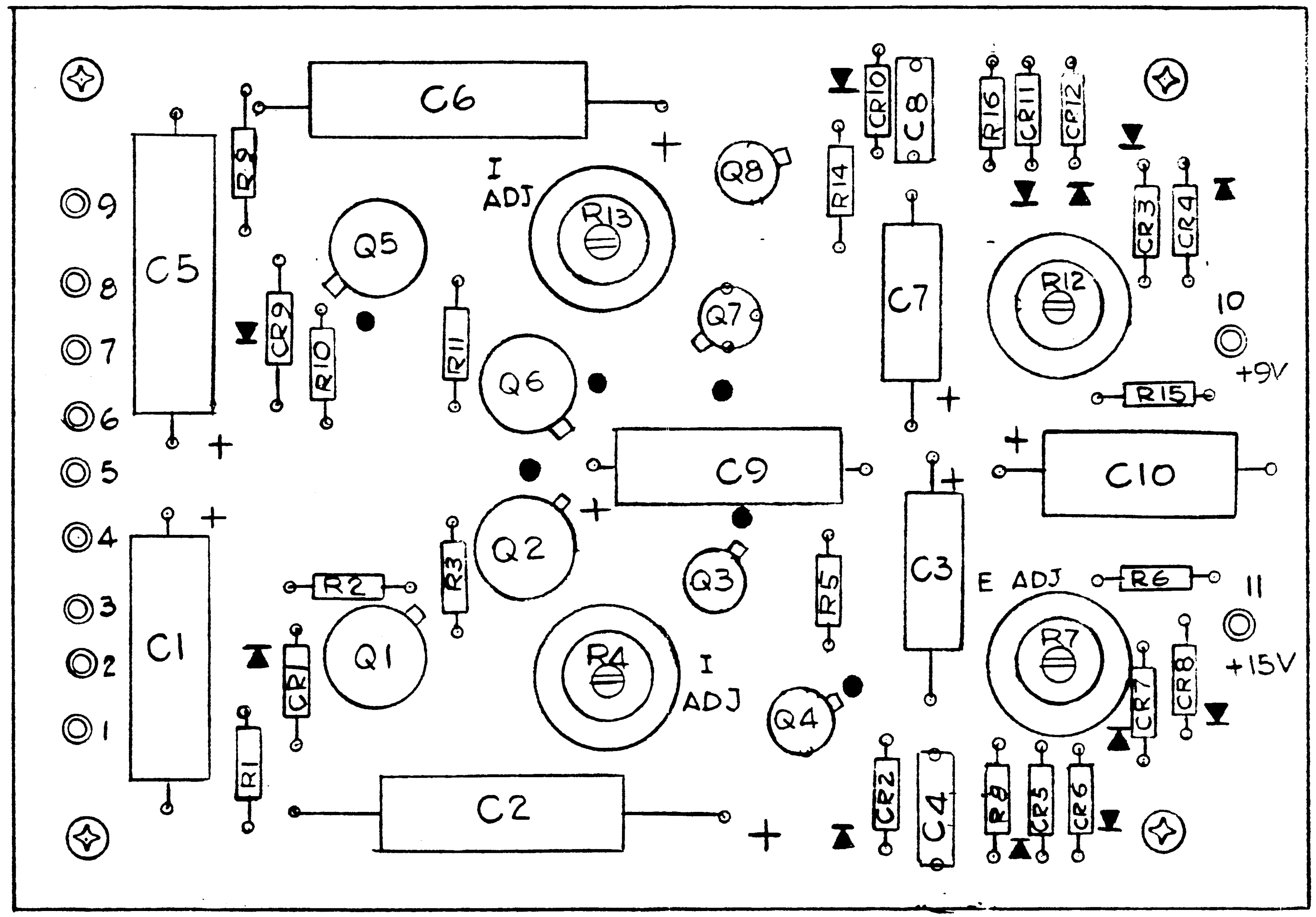
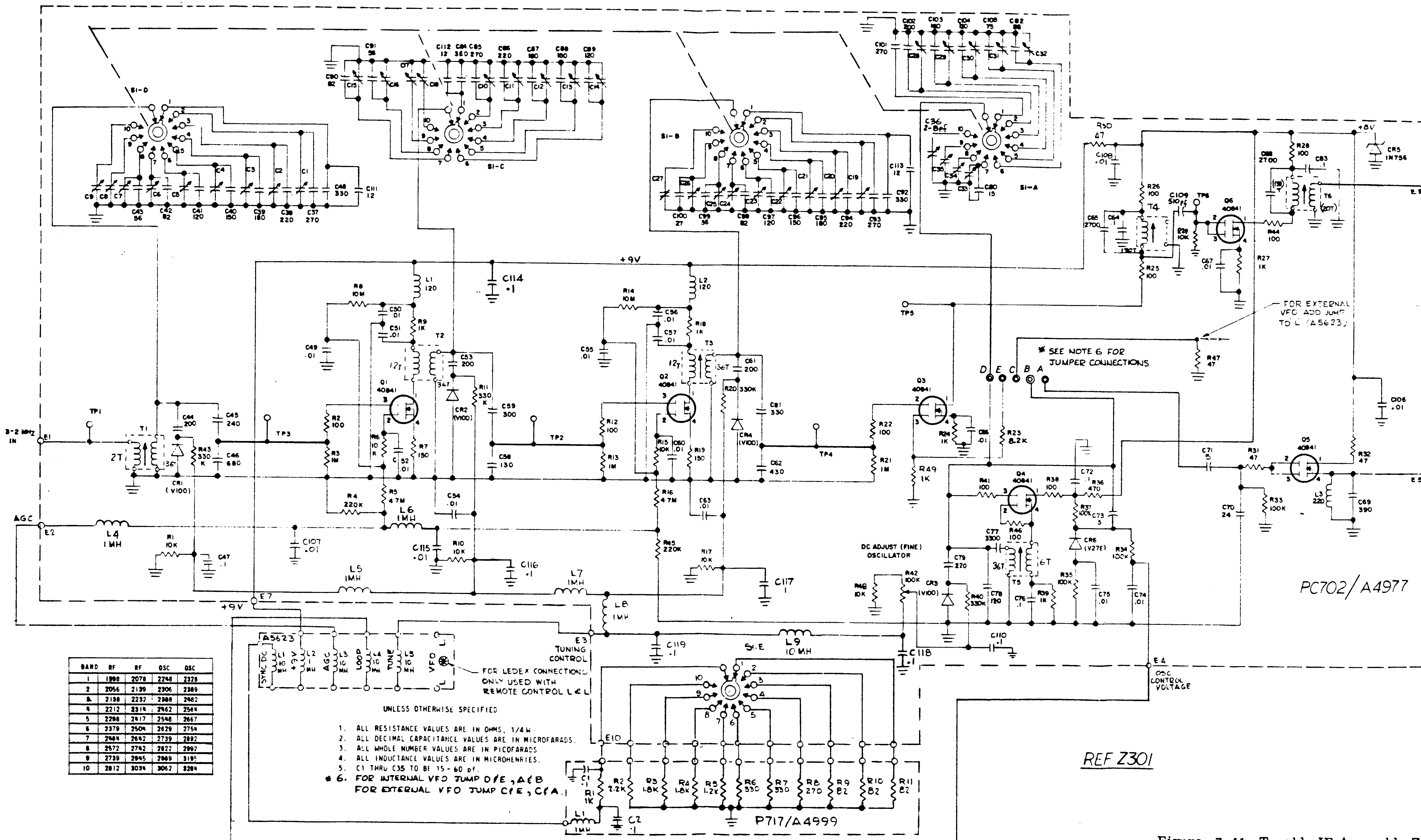


FIGURE 7-40 POWER SUPPLY COMPONENT LOCATION
(Z201)



BAND	RF	RF	OSC	OSC
1	1998	2078	2248	2328
2	2056	2139	2306	2389
3	2138	2232	2388	2482
4	2212	2314	2462	2564
5	2298	2417	2548	2667
6	2379	2504	2629	2754
7	2484	2642	2739	2892
8	2572	2742	2822	2992
9	2739	2945	2989	3195
10	2812	3034	3062	3284

Figure 7-41 Tunable IF Assembly Z301, Schematic Diagram

CK1890-X7

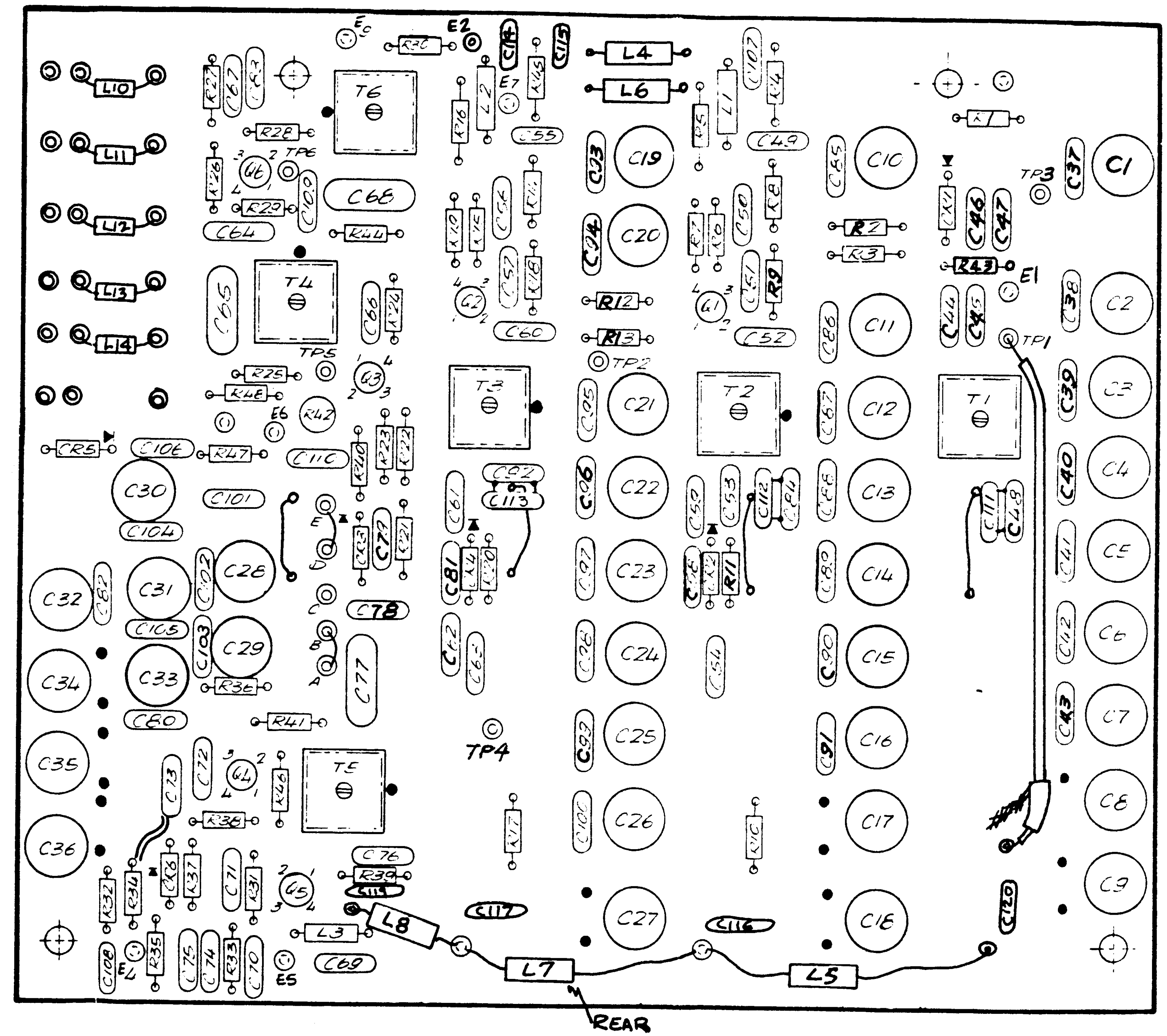


Figure 7-42 Tunable IF Assembly Z301, Location of Components

A4977-X1

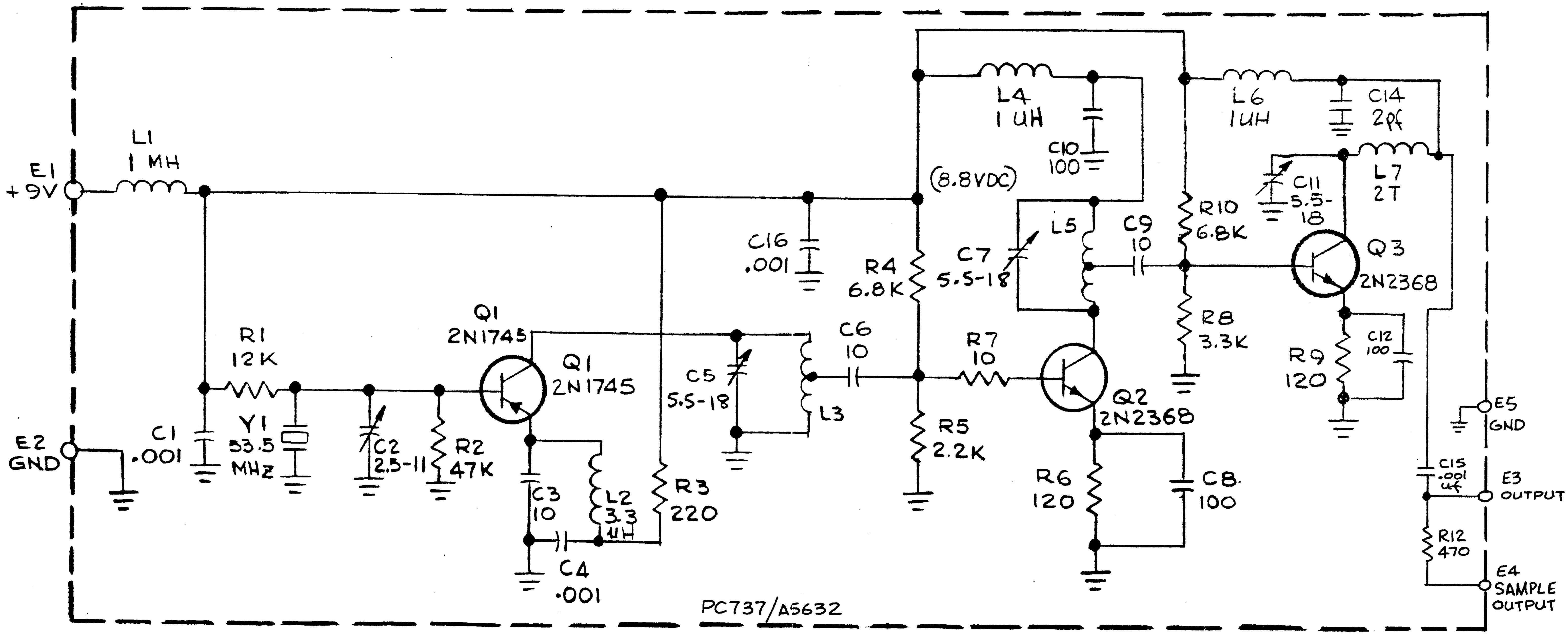


Figure 7-43 **SINGLE HF** Oscillator Assembly Z302, Schematic Diagram

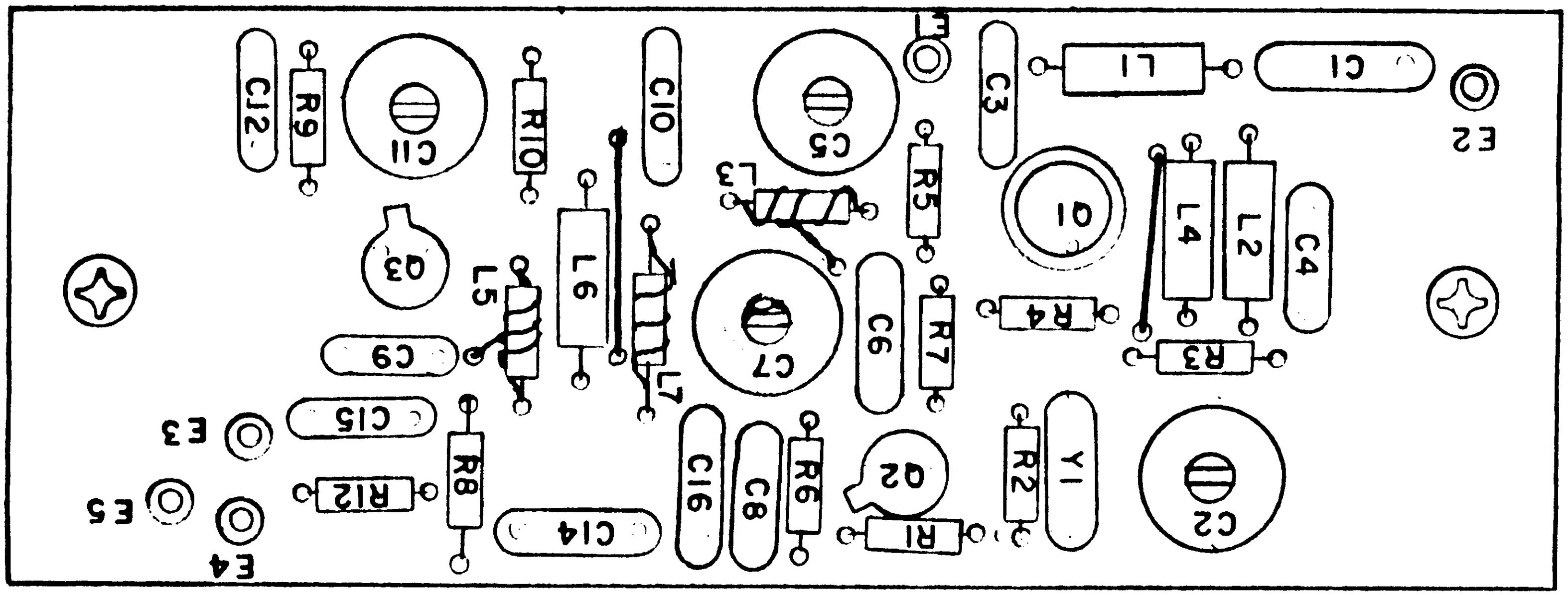
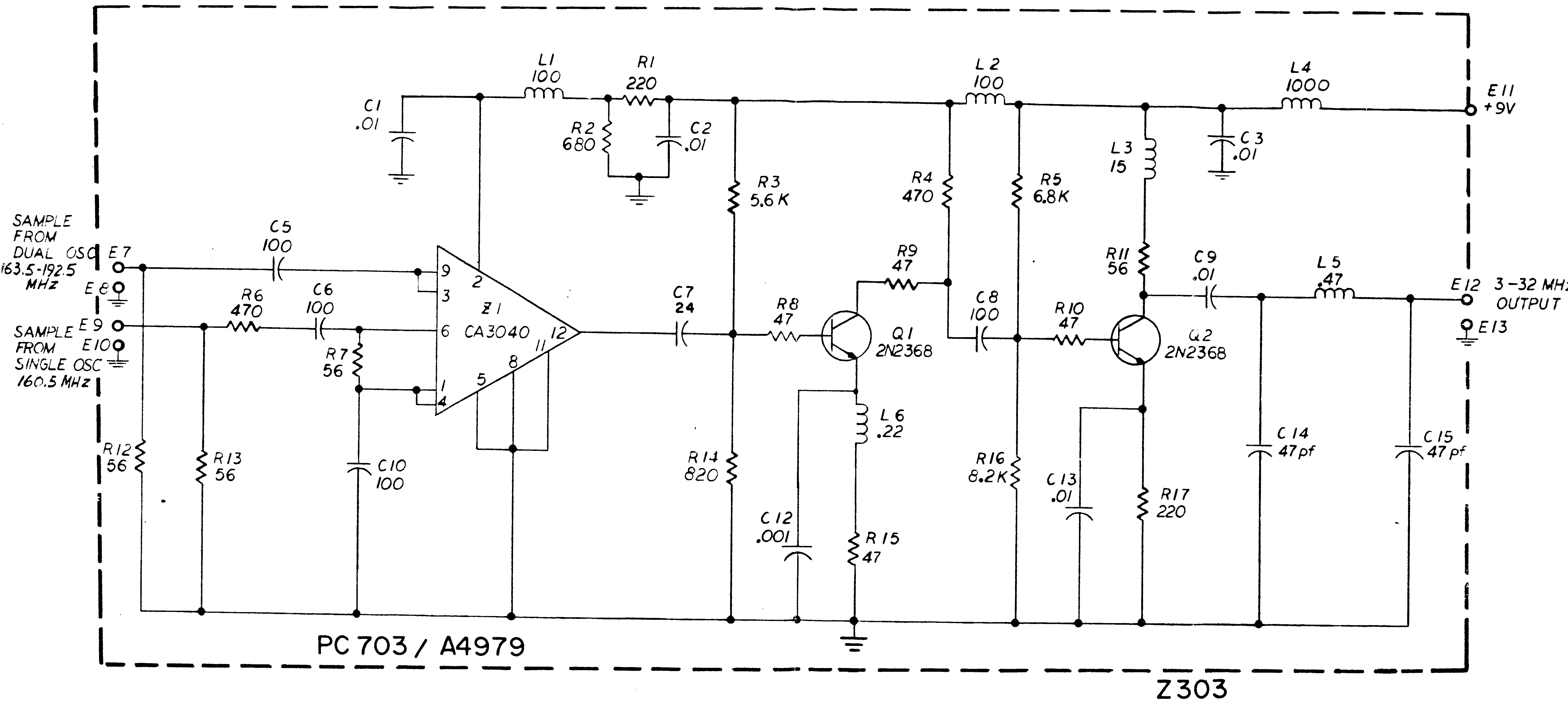


Figure 7-44. **SINGLE HF** Oscillator Assembly Z302, Location of Components



UNLESS OTHERWISE SPECIFIED

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

Figure 7-45 Sample Mixer Assembly Z303, Schematic Diagram

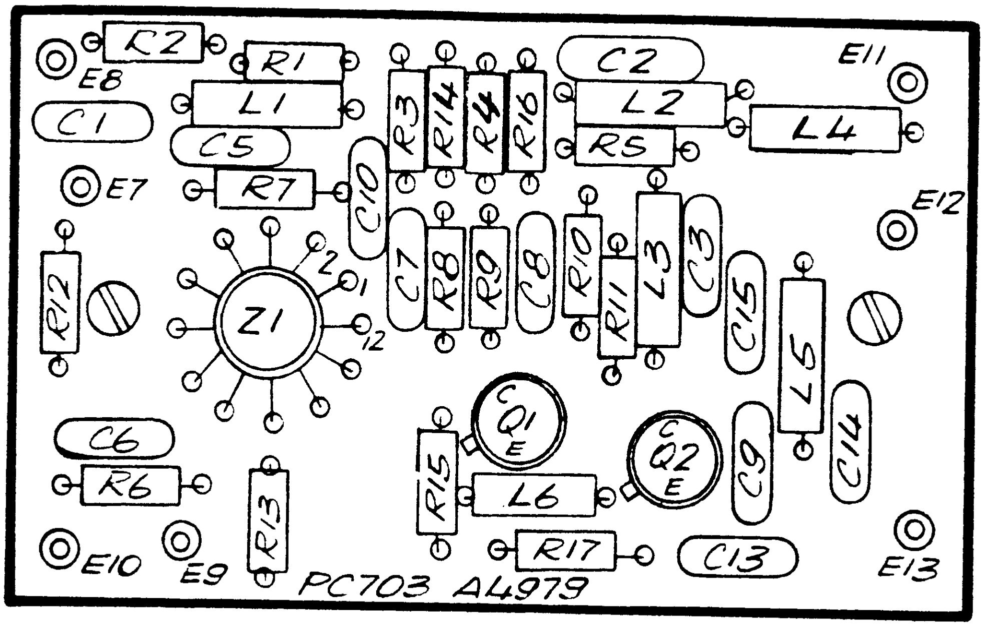


Figure 7-46. Sample Mixer Assembly Z303, Location of Components

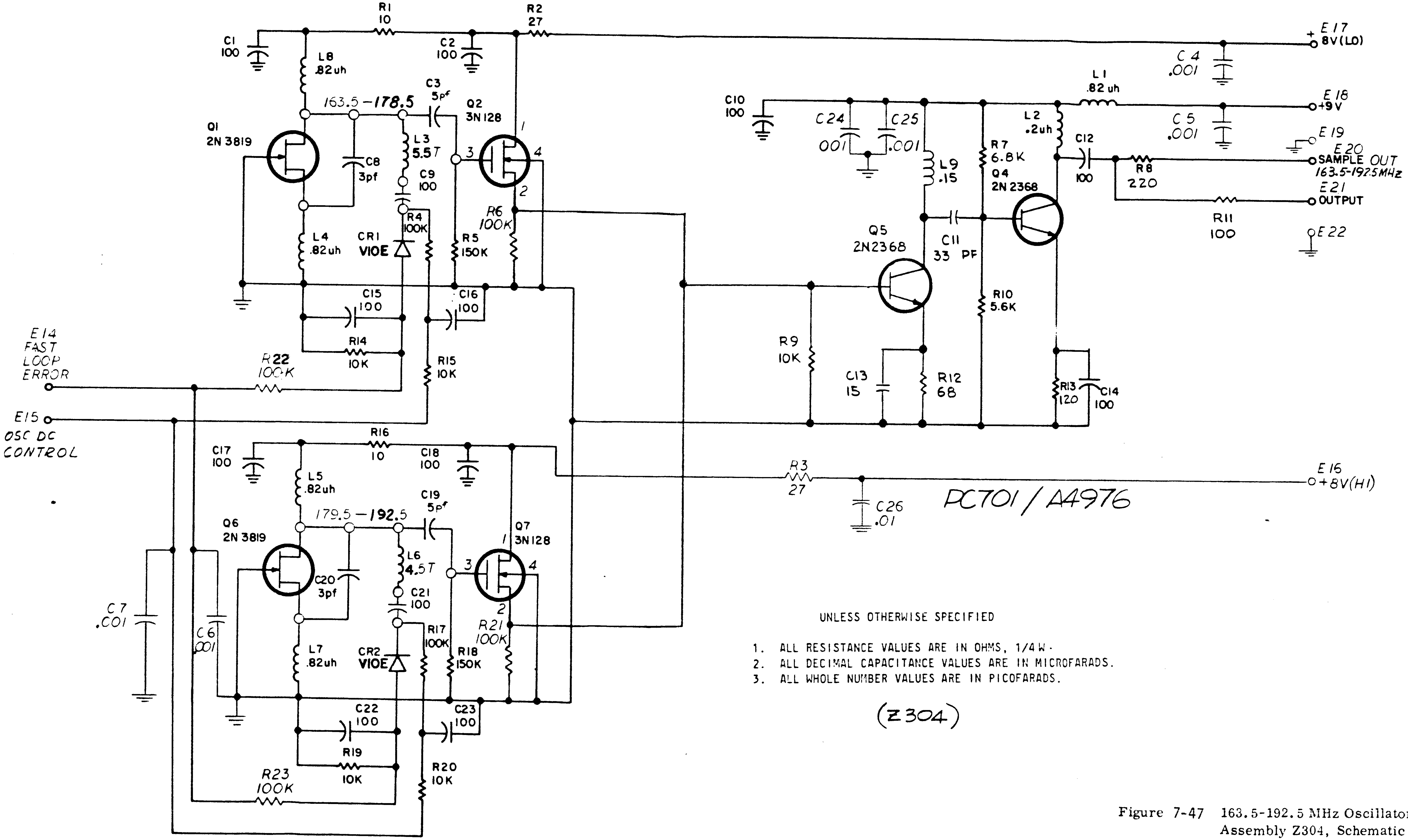


Figure 7-47 163.5-192.5 MHz Oscillator Assembly Z304, Schematic Diagram

CK1886-X4

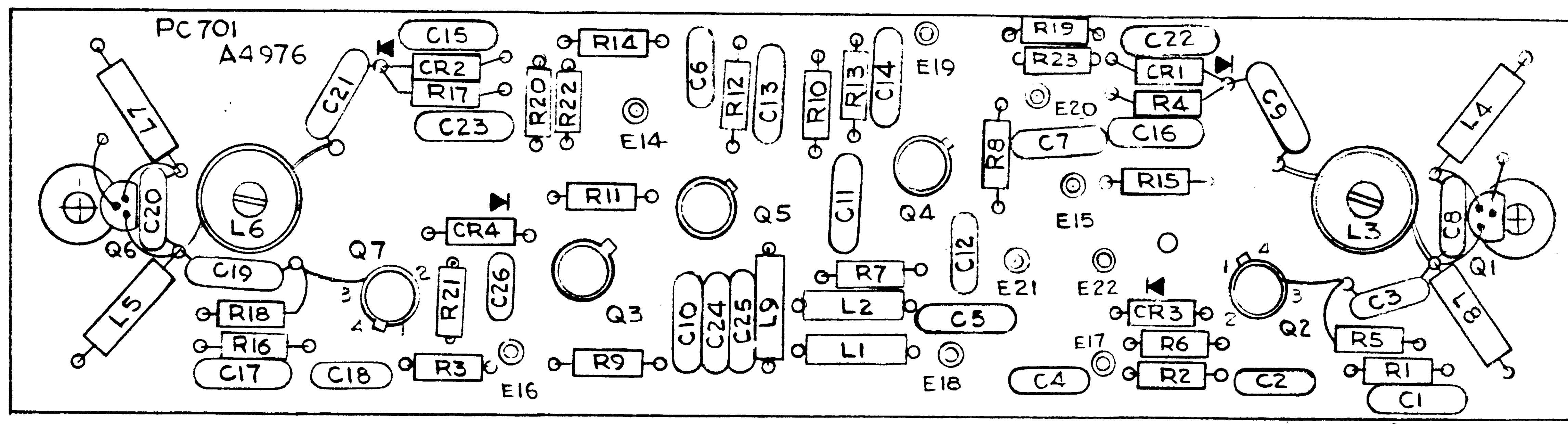


Figure 7-48 163.5-192.5 MHz Oscillator Assembly Z304, Location of Components

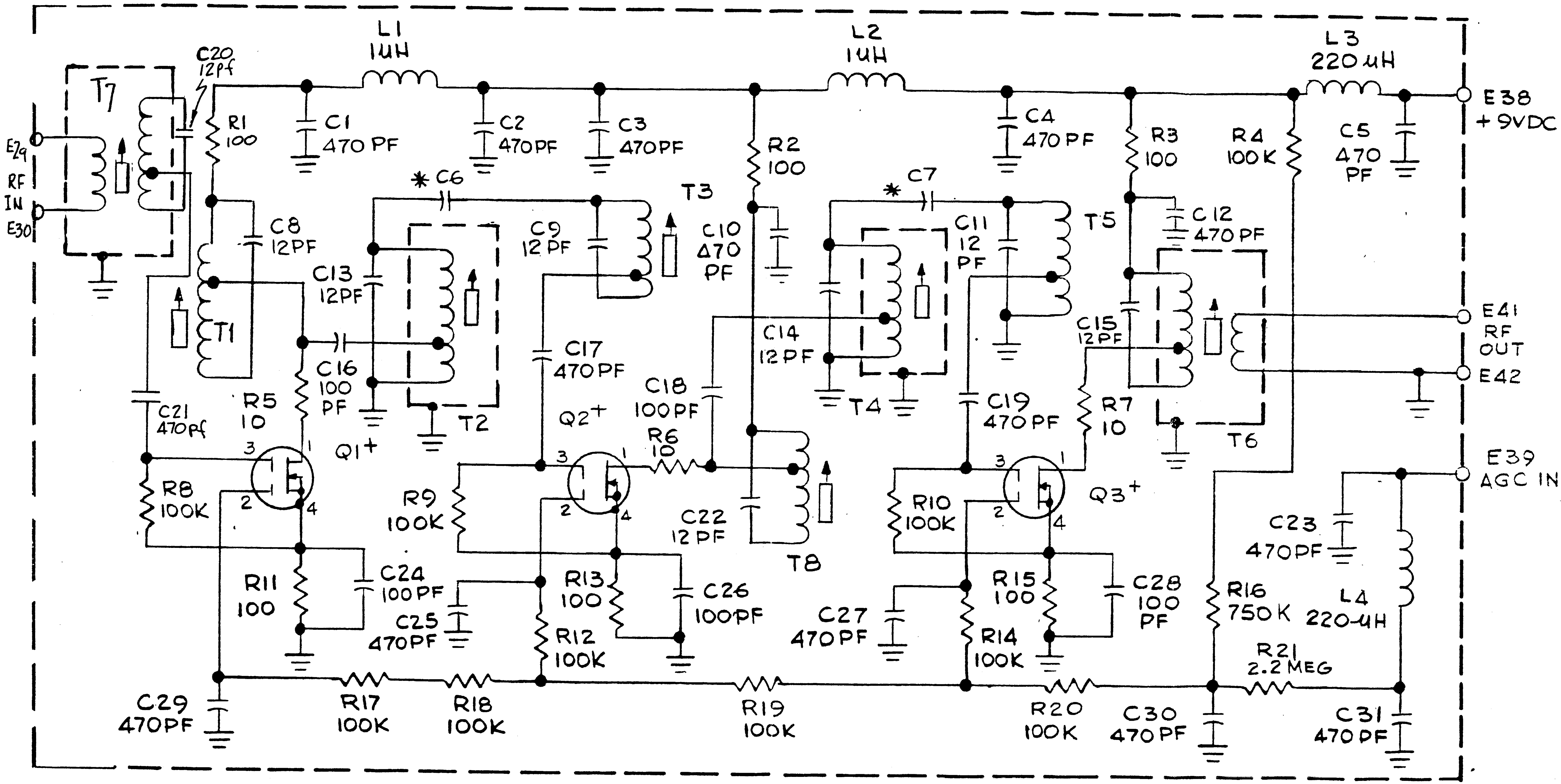
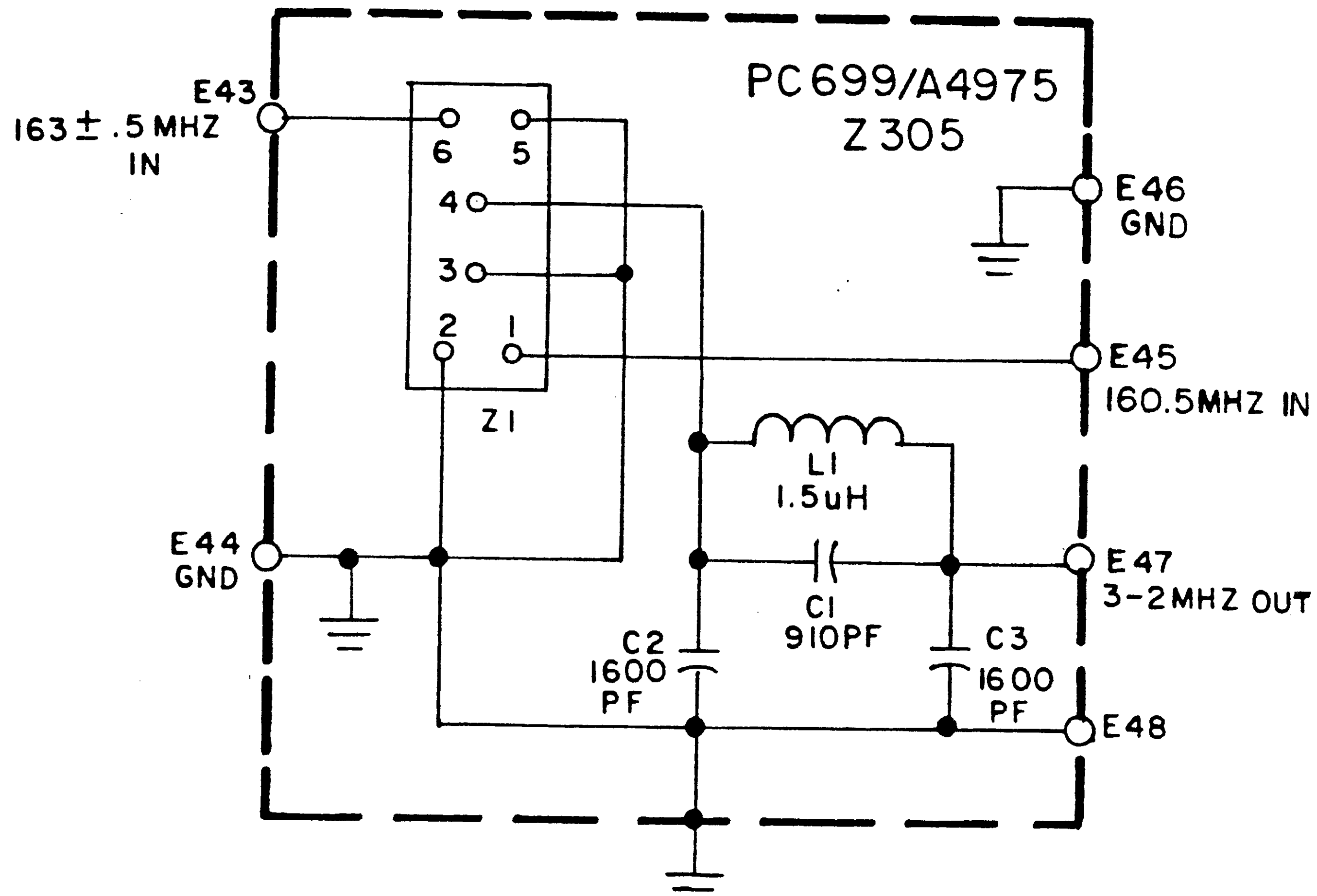


FIGURE 7-49 HF, IF DIFFERENTIAL AMPLIFER (Z106)

CK2154-X



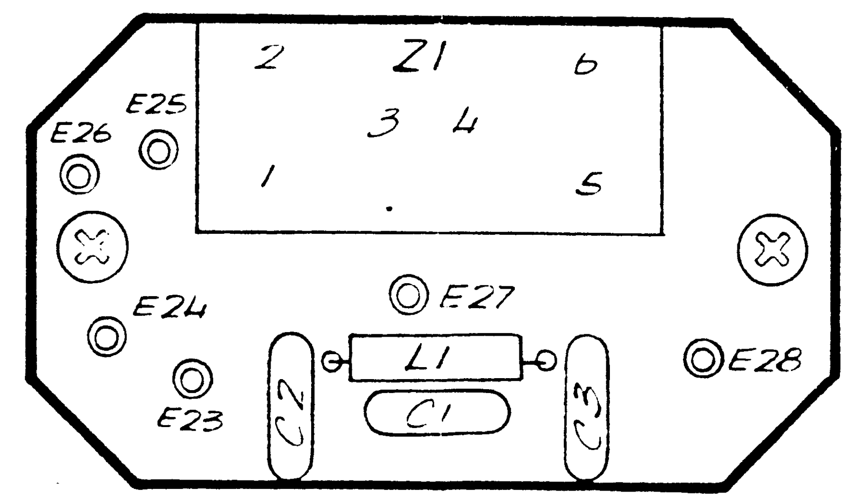
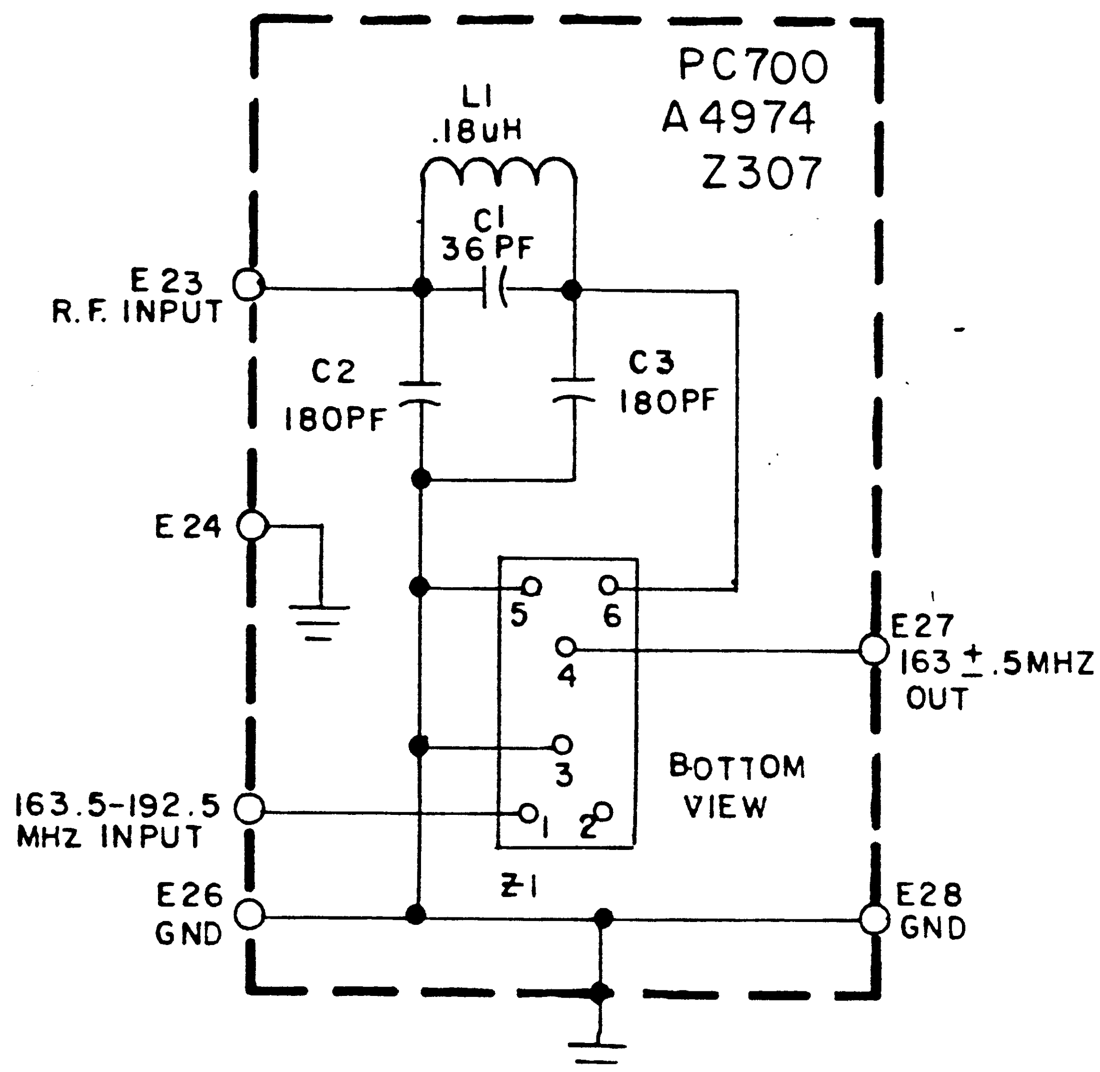


Figure 7-50 IF Output Mixer Assembly Z305, Location of Components AND SCHEMATIC



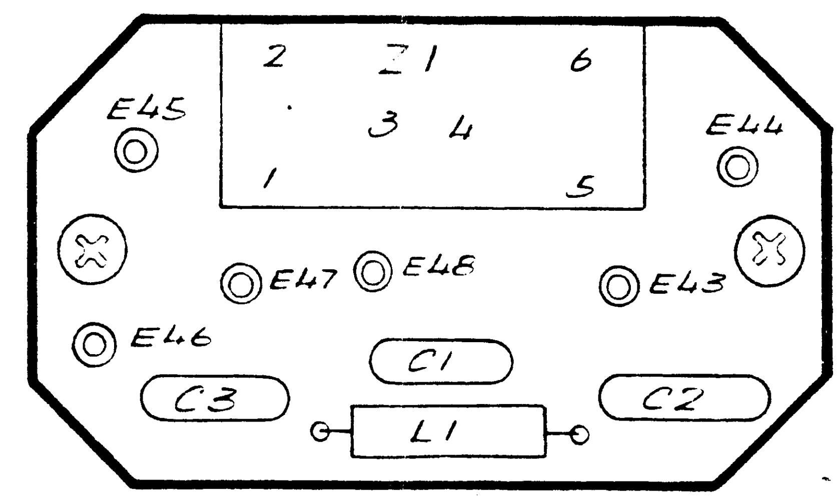


Figure 7-51. RF Input Mixer Assembly Z307, Location of Components & SCHEMATIC

A4974-X1
CK2158-X