SERVICE MANUAL

FOR

RECEIVER STABILIZATION UNIT

MODEL RSU-1

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DO NOT DESTROY

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

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

Warranty

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

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2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

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

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

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

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

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

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

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

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

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

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SCOPE OF MANUAL

The servicing techniques for the Receiver Stabilization Unit, Model RSU-1 (hereinafter referred to as the RSU-1), are covered in this service manual under the following categories:

a. Preventive maintenance procedures are contained in Section 1 to provide a basis for recognizing future probable causes of equipment malfunction. By adhering to a stringent program of preventive maintenance, the most probable causes of equipment malfunction can be avoided, thereby minimizing equipment downtime and the possibility of compromising important schedules.

b. Troubleshooting procedures are contained in Section 2 to provide a quick and logical means for localizing the cause of an equipment malfunction. The troubleshooting procedures are covered on two levels; assembly and component. The major portion of the RSU-1 circuitry is located on printed circuit board assemblies. When the cause of equipment malfunction has been localized to a particular printed circuit board assembly and if a spare for that assembly is available, the assembly may be replaced, allowing the equipment to become functional immediately and minimizing equipment downtime. Component level troubleshooting of an assembly may be accomplished during a scheduled downtime.

c. Alignment procedures are contained in Section 3, to facilitate maintining the RSU-1 in a satisfactory operating condition. Alignment and adjustment of the unit may become necessary when the periodic checks of preventive maintenance indicate equipment deterioration or when equipment malfunctions require replacement of assemblies or components.

d. The drawings and parts listings for servicing the RSU-1 are contained in Section 4. These include servicing block diagrams, schematic and component location drawings, and parts listings.

SECTION 1

PREVENTIVE MAINTENANCE

1-1. INSPECTION AND TESTING.

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

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

TABLE 1-1. MONTHLY INSPECTION ROUTINE

Assembly	Check
Line power cord	Check line power cord for cracks, nicks, or fraying
	1. Check underside of chassis for dirt and dust.
	2. Check all interconnecting wiring for cracks, nicks, or fraying.
	3. Check printed circuit board jacks for tightness against chassis.
	4. Check all ground connections for security.
Printed circuit board assemblies	1. Check all printed circuit boards for cracks.
	2. Check components on printed circuit boards for loose connections and for evidence of deterioration from possible overheating.

TABLE 1-1. MONTHLY INSPECTION ROUTINE (Continued)

Assembly	Check
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 PHASE COMPARATOR meter face for cracks, scratches, etc.
	4. Check LINE and SYNC indicator faces for cracks.
	5. Check all input and output jacks for security against panel.
	6. Remove both LINE and SPARES fuses. Check to ensure that the fuses are the proper value (1 ampere for 115 vac; 0.5 ampere for 230 vac) and that they are not open.

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

(1) +5-volt supply from Z102, E13 to ground.

(2) +15-volt supply from Z104, E3 to ground.

(3) +12-volt supply from Z102, E14 to ground.

(4) +24-volt supply from Z105, E4 to ground.

(5) +30-volt supply from Z105, E5 to ground.

(6) +24-volt (unreg) from Z105, E8 to ground.

NOTE

If the RSU-1 is not connected to the associated receiving equipment, the voltage reading at Z105, E8 will be +30 volts in step (6).

c. FUNCTIONAL TESTS. Perform the following checkout procedures on the RSU-1 on a weekly basis after completing a check of the power supply:

(1) Check the associated receiver and RSU-1 for at least one frequency on each band of the associated receiver (0.5-31.99 mhz).

(2) In each case, the RSU-1 SYNC indicator must light. A 0 center reading must be obtained on the PHASE COMPARATOR meter. The receiver is then in a phase-locked condition.

1-2. CLEANING INSTRUCTIONS.

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

WARNING

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

CAUTION

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

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

SECTION 2

TROUBLESHOOTING

2-1. GENERAL.

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

(1) Verify all power supply voltages.

(2) Check the phase lock loop in the following manner:

(a) Monitor E6 on Z101 for 19 mhz out.

(b) Monitor E5 on Z107 for 15.545 to 16.545 mhz out.

(c) Monitor E7 on Z106 for 1-2 mhz out.

(d) Monitor E5 on Z104 for 1 khz out.

(e) Monitor E11 on Z108 for 100 khz out.

(f) Monitor J107 (ERROR VOLTAGE) for approximately -2- to +2 volts dc out.

2-2. ASSEMBLY LEVEL TROUBLESHOOTING.

a. GENERAL. The various functional assemblies of the RSU-1 are shown in figure 4-1, overall functional block diagram. The overall functional block diagram indicates the primary signal flow between assemblies. Convenient points for measurement of signal flow are also shown. Figure 4-1 and the following servicing block diagrams describe the functional assemblies of the RSU-1 and provide a guide for the technician in localizing the faulty assembly. In addition to the functional block diagrams, a signal flow diagram (figure 4-2) is provided as a further guide for localizing a faulty assembly. The assemblies that are referenced with Z numbers (Z101, Z102, etc.) are printed circuit board assemblies and may be replaced if spares are available. For troubleshooting a particular assembly, or to localize the faulty component(s), refer to paragraph 2-3, component level troubleshooting.

b. OVERALL FUNCTIONAL DESCRIPTION. (See figures 4-1 and 4-2.)

(1) The 1-mhz signal, derived either from the internal or external standard, is routed to three circuits in spectrum generator assembly Z102: a harmonic generator; a divide-by-10 circuit; and to mixer 7. The harmonic generator produces harmonics every megahertz up to 15 mhz. All frequencies above 15 mha are undesired; therefore, the output of the harmonic generator is routed through a low pass filter which allows all frequencies below 15 mhz to pass. The harmonic generator also produces 15 mhz through a crystal filter which is applied to mixer 3A in third mixer assembly Z106.

(2) The 1 to 15 mhz output of the low pass filter is applied to mixer 1 in the first mixer assembly. Also applied to mixer 1 is the 11 to 34 mhz output of the crystal oscillator of the associated receiver. The setting of the RSU-1 front panel 10 and 1 mhz FREQUENCY switches controls which 1-mhz increment is applied to mixer 1 from the low pass filter. The switch settings are routed to the spectrum generator assembly via programmable divider assembly Z104. The frequency of the associated receiver crystal oscillator has a frequency range of 11 to 34 mhz; however, not in increasing numerical increments through the frequency range of the system. Table 2-1 is a chart which indicates the frequency band of the associated receiver and the RSU-1, the corresponding output of the associated receiver crystal oscillator, and the corresponding harmonic frequency that is selected and passed by the low pass filter. The output of mixer 1 is applied to affixed 19-mhz bandpass filter. The combination of frequencies applied to mixer 1 must be such that the output is 19 mhz. Therefore, consider the 2- to 3-mhz band. According to table 2-1, the associated receiver crystal oscillator output is 22 mhz. In order to obtain a resultant 19-mhz output from mixer 1, 3 mhz is required. Thus, the 3-mhz harmonic is selected and passed to the mixer in this frequency band. The resultant 19-mhz output of mixer 1 is filtered and applied to mixer 2 in second mixer assembly Z107.

TABLE 2-1. FREQUENCY GATING LOGIC

Receiving Frequency Band (mhz)	Associated Receiver Crystal Oscillator Output Frequency (mhz)	S103 Frequency mhz		Spectrum Generator 1-mhz Harmonic Gated
		10 mhz	1 mhz	
0.5 - 0.9999	20.0	0	0	1
1 - 1.9999	21.0	0	1	2
2 - 2.9999	22.0	0	2	3
3 - 3.9999	23.0	0	3	4
4 - 4.9999	24.0	0	4	5
5 - 5.9999	25.0	0	5	6
6 - 6.9999	26.0	0	6	7
7 - 7.9999	27.0	0	7	8
8 - 8.9999	11.0	0	8	8
9 - 9.9999	12.0	0	9	7
10 - 10.9999	13.0	1	0	6
11 - 11.9999	14.0	1	1	5
12 - 12.9999	15.0	1	2	4
13 - 13.9999	16.0	1	3	3
14 - 14.9999	17.0	1	4	2
15 - 15.9999	18.0	1	5	1
16 - 16.9999	19.0	1	6	None
17 - 17.9999	20.0	1	7	1
18 - 18.9999	21.0	1	8	2
19 - 19.9999	22.0	1	9	3
20 - 20.9999	23.0	2	0	4
21 - 21.9999	24.0	2	1	5
22 - 22.9999	25.0	2	2	6
23 - 23.9999	26.0	2	3	7
24 - 24.9999	27.0	2	4	8

TABLE 2-1. FREQUENCY GATING LOGIC (Continued)

Receiving Frequency Band (mhz)	Associated Receiver Crystal Oscillator Output Frequency (mhz)	S103 Frequency mhz		Spectrum Generator 1-mhz Harmonic Gated
		10 mhz	1 mhz	
25 - 25.9999	28.0	2	5	9
26 - 26.9999	29.0	2	6	10
27 - 27.9999	30.0	2	7	11
28 - 28.9999	31.0	2	8	12
29 - 29.9999	32.0	2	9	13
30 - 30.9999	33.0	3	0	14
31 - 31.9999	34.0	3	1	15

(3) Also applied to mixer 2 is the associated receiver vfo (variable frequency oscillator) output, which is a function of the remainder of the tuned frequency digits (100, 10, 1, and 0.1 khz). When the associated receiver frequency is set at an exact megahertz increment (i.e., 2.0000 mhz used in our example above), the associated receiver vfo output is 3.455 mhz. As the associated receiver frequency is increased from 2 to 3 mhz, the vfo output decreases towards 2.455 mhz. At 3 mhz, the vfo output is again 3.455 mhz and will decrease towards 2.455 mhz as the associated receiver frequency is increased from 3 to 4 mhz, and the cycle is repeated. Mixer 2 beats the two frequencies and selects the difference which will always be between 15.545 and 16.545 mhz. The output of mixer 2 is applied to mixer 3B in third mixer assembly Z106.

(4) The second input to mixer 3B is derived from a free-running crystal-controlled 555-khz oscillator in fourth mixer assembly Z103. The 555-khz output of the oscillator is applied to mixer 4. The second input to mixer 4 is a 100-khz signal that is derived by dividing the 1-mhz output of the standard by 10 in the spectrum generator assembly. The resultant output of mixer 4 is 455 khz which is amplified and applied to mixer 3A in the third mixer assembly. The second input to mixer 3A is 15 mhz derived via the

1-mhz standard, harmonic generator, and crystal filter. The resultant output of mixer 3A is 14.545 mhz which is filtered and applied as the second input to mixer 3B.

(5) Therefore, the two frequencies applied to mixer 3B are a fixed 14.545-mhz signal and a variable signal in the 15.545 to 16.545-mhz range. Mixer 3B selects the difference frequency signal which is always between 1 and 2 mhz. (Actually, mixer 3B does not have a 2-mhz output; it can come to within 100 hz of 2 mhz.) The output signal of mixer 3B is applied to the programmable divider assembly.

(6) The programmable divider is a device that divides the input signal such that the output is always 100 hz. For example, with a 1-mhz input, the programmable divider yields 100 hz by dividing the input by 10,000. The resultant 100-hz output of the programmable divider is applied to a series of mixer and multiplier circuits. Mixer 5 adds the 100-hz signal to a 900-hz signal (derived from the 1-mhz standard) to yield 1 khz. The 1-khz signal is multiplied by 10 in 10 and 100 khz multiplier comparator assembly Z108 to yield 10 khz and applied to mixer 6. The 10-khz signal is combined with 90 khz to yield 100 khz and the resultant 100-khz signal is applied to phase detector assembly Z109. The 100-khz signal is the desired frequency and contains a combination of all errors of the associated receiver oscillators. The 100-khz signal is compared against the standard 100-khz signal derived from the 1-mhz standard. Any difference (error) is obtained as a d-c error voltage that is applied to the associated receiver variable frequency oscillator.

(7) It is only necessary to correct one associated receiver oscillator. Since the variable frequency oscillator is an inductor-capacitor network, it is the easiest oscillator to correct. The d-c voltage cancels any error in the associated receiver variable frequency oscillator. Further, any tendency for the vfo to drift is corrected by the error voltage. By correcting the associated receiver variable frequency oscillator, all other oscillators in the associated receiver loop are also corrected.

(8) In the discussion above, certain frequencies are required for mixing with the output signal of the programmable divider. These signals are derived from the 1-mhz standard. The 1-mhz signal is divided by 10 to yield 100 khz. The 100-khz signal is the standard that is also applied to the associated receiving system and to mixer 7. The second

input to mixer 7 is 1 mhz. The resultant output of mixer 7 is the difference frequency which is 900 khz (1000 khz - 100 khz). The 900 khz is divided by 10 to yield 90 khz which is used as one of the mixing frequencies in mixer 6. The 90 khz is also divided by 100 to yield 900 hz which is used as a mixing frequency in mixer 5.

(9) Notice that when the RSU-1 is electrically connected to the associated receiving system, it effectively closes the frequency loops of the system while, at the same time, injects a d-c error voltage to correct any frequency drift. If the RSU-1 is electrically disconnected from the associated receiving system, the system will operate independent of the RSU-1.

c. SPECTRUM GENERATOR ASSEMBLY Z102. (See figure 4-3.)

(1) The spectrum generator assembly develops the various mixing frequencies used throughout the RSU-1. The 1-mhz internal standard is applied to amplifier Q1 and the external standard (when available) is applied to amplifier Q2 via RSU-1 rear panel EXT STD INPUT jack J104 and pin E3 of the spectrum generator assembly. The output of amplifier Q1 is applied directly to a 1-mhz standard selection gating network Z1. The output of external standard amplifier Q2 is also applied to Z1, in addition to d-c switch Q3. With an external standard input of 0.7 volt rms, the d-c switch will select the external 1-mhz standard. If the external 1-mhz signal drops below 0.4 volt rms, the external standard is automatically inhibited via the d-c switch and the internal standard is selected. Since the internal standard is always maintained at operating temperature for stability as long as the RSU-1 is connected to a source of power, the gating arrangement prevents the loss of information due to any malfunction in the external standard. The selected 1-mhz output of Z1 is applied to amplifiers Q4 and Q6. The 1-mhz output of Q4 is made available at RSU-1 rear panel 1 MHZ OUT jack J105 via pin E5 of the spectrum generator assembly. The 1-mhz output of amplifier Q6 is routed to various circuits throughout the spectrum generator assembly.

(2) The 1-mhz output of amplifier Q6 is applied to amplifier Q7 which develops a spectrum of harmonics. The output of Q7 is differentiated and the resultant waveform is applied to crystal selectors Y1, Y3, ... Y15, and Y17. The output of each crystal selector is amplified and again passed through a second crystal selector Y2, Y4, ... Y16,

and Y18. The output of the second crystal selector is again amplified and the resultant output is a very pure signal at that frequency. The 17-mhz output is applied to RSU-1 rear panel 17 MHZ jack J103 and the 15-mhz output is applied to third mixer assembly Z106. The remaining frequencies of 8 through 14 and 15 mhz are applied to logic circuits Z14 through Z26.

(3) The logic circuits select one of the input frequencies according to the setting of the front panel 1 mhz and 10 mhz FREQUENCY switches. The four-bit bcd (binary coded decimal) complementary output (1, 2, 4, 8) of 1 mhz FREQUENCY switch S103B and the two-bit complementary bcd output (1, 2) of the 10 mhz FREQUENCY switch S103A are inverted in Z4 in programmable divider assembly Z104. The inverted outputs of Z4 are applied to bcd-to-binary converter Z7 in the spectrum generator. The resultant binary information is routed through exclusive OR-gates Z10 and applied to switches Z8 and Z9. In turn, switches Z8 and Z9 control 1-of-16 decoder Z11 and 1-of-8 decoder Z12, respectively. The decoders control the gating of the 1 to 15 mhz output frequency.

(4) The gating operates as a function of the frequency band and corresponding crystal oscillator output of the associated receiver. From table 2-1, as the frequency band increases from 0.5 to 8.0 mhz, the crystal oscillator output increases from 20.0 to 27.0, respectively. Therefore, in order to achieve a 19-mhz intermediate frequency, the 1-mhz harmonic selected increases from 1 to 8 mhz, respectively. In the 8.0 to 17.0 mhz band, the crystal oscillator output starts at 11 mhz and increases to 19 mhz, respectively. In this frequency band spread, the 1-mhz harmonic used starts at 8 mhz and decreases to 0 (no harmonic used), respectively. In the 17.0 and 32.0 mhz band, the crystal oscillator output starts at 20.0 and increases to 34.0 mhz, respectively. In this frequency band spread, the 1-mhz harmonic used starts at 1 and increases to 15 mhz, respectively. The crystal oscillator output frequency is a function of the associated receiver frequency band. Since the RSU-1 and the associated receiver are set to the same frequency, the required 1-mhz harmonic can be selected by sensing the position of the 10 and 1 mhz switches. In addition, because of the sequencing of the required 1-mhz harmonic, it is necessary to utilize some sort of gating network. The exclusive OR-gates in Z10 and the associated decoders provide the necessary control for gating the required 1-mhz harmonic as a function of the 10 mhz and

1 mhz FREQUENCY switch settings. The ultimate result is to select one of 15 output frequencies, 1 to 15 mhz, and apply it to first mixer assembly Z101 via pin E30.

(5) The 1-mhz output of amplifier Q6 is also applied to mixer Q8 and to divide-by-10 circuit Z3. The 100-khz output of Z3 is mixed with the 1-mhz signal in mixer Z8 to yield 900 khz. The 900-khz signal is amplified by Q9 and Q10, switched by Q11, and applied to a series of divider networks. The 90-khz output of Z4 is applied to 10 khz and 100 khz multiplier comparator assembly Z108 via pin E15. The 0.9 khz output of Z6 is applied to programmable divider assembly Z104 via pin E17.

(6) The 100-khz output of Z3 is also applied to amplifier Q5 via fan-out network Z2. The three 100-khz outputs are applied to RSU-1 rear panel 100 KHZ jack J102, to fourth mixer Z103, and to phase detector assembly Z109.

d. FIRST MIXER ASSEMBLY Z101. (See figure 4-4.)

(1) The first mixer assembly mixes the 11 to 34 mhz crystal oscillator input frequency from the associated receiver with a frequency developed by spectrum generator assembly Z102 in the 1 to 15 mhz range, to develop a 19-mhz output signal that is applied to second mixer assembly Z107. The 11 to 34 mhz crystal oscillator output of the associated receiver is applied to pin E1 of the first mixer assembly via jack J109. The input frequency is amplified by Z1 and Q1 and applied to mixer Q2. Also applied to mixer Q2 is the 1 to 15 mhz output of the spectrum generator assembly. The spectrum generator input frequency is always of such a value as to develop a difference frequency of 19 mhz at the output of mixer Q2. The spectrum generator frequency is controlled by the setting of the 10 and 1 mhz FREQUENCY switches as described in paragraph 2-2c.(4).

(2) The 19-mhz output of Q2 is tuned via transformer T1 and passed through a 19-mhz bandpass filter consisting of crystal Y1 which is tuned via capacitor C14. The resultant 19-mhz output is amplified by Q3 and again passed through a 19-mhz bandpass filter consisting of crystal Y2. The two stages of bandpass filtering ensure that undesired frequencies are (almost entirely) removed and a pure 19-mhz signal is obtained. The signal is amplified again by Q4. Q4 emitter output is tuned to 19 mhz by transformer T2. The

resultant 19-mhz output developed across the secondary of T2 is applied to second mixer assembly Z107 via pin E6.

e. SECOND MIXER ASSEMBLY Z107. (See figure 4-5.)

(1) The second mixer assembly receives the 19-mhz output of first mixer assembly Z101 and heterodynes it with the 2.455 to 3.455 mhz output from the associated receiver variable frequency oscillator, to develop a bandwidth of 15.545 to 16.545 mhz that is applied to third mixer assembly Z106. The 19-mhz output of the first mixer assembly is applied to amplifier Q1 via pin E1. The 19-mhz output of Q1 is applied to mixer Q2. Also applied to mixer Q2 is the 2.455 to 3.455 mhz input from the variable frequency oscillator of the associated receiver. The signal is applied to E3 via RSU-1 rear panel VFO IN jack J108. The output of mixer Q2 selects the difference frequency in a tank circuit that is tuned via coil L12.

(2) In order to pass the wide band of frequencies from 15.545 to 16.545 mhz, the mixer output is passed through variable transformer T1 which is over critically coupled to develop a double peak, thereby increasing its band pass response. The resultant output of T1 is buffered by emitter follower Q3, passed through a high pass filter which passes all frequencies above 15.545 mhz, buffered again by emitter follower Q4, and passed through a low pass filter which passes all frequencies below 16.545 mhz. The high and low pass filtering results in a bandwidth of 15.545 to 16.545 mhz that is amplified by Q5 and applied to third mixer assembly Z106 via pin E5.

f. FOURTH MIXER ASSEMBLY Z103. (See figure 4-6.)

(1) The fourth mixer assembly contains a 555-khz crystal oscillator whose output is mixed with a 100-khz signal from spectrum generator assembly Z102 to develop a 455-khz output that is applied to third mixer assembly Z106. The 555-khz is developed by crystal Y1 and amplifier Q1. The 555-khz output is buffered by source follower Q2 and amplified by Q3. The amplified 555-khz signal is applied to mixer Q4.

(2) Also applied to mixer Q4 is a 100-khz signal from spectrum generator assembly Z102 via pin E6. The resultant 455-khz output of the mixer is amplified by 5,

tuned by transformer T1, and applied to third mixer assembly Z106 via pin E4. The 555-khz output of amplifier Q3 is also made available at RSU-1 rear panel 555 KHZ jack J106.

g. THIRD MIXER ASSEMBLY Z106. (See figure 4-7.)

(1) The third mixer assembly receives a fixed 15-mhz signal from spectrum generator assembly Z102, mixes it with the 455-khz signal from fourth mixer assembly Z103 to obtain 14.545 mhz, and again mixes the resultant 14.545 mhz with the 15.545 to 16.545 mhz signal from second mixer assembly Z107 to obtain the desired 1 to 2 mhz signal that is applied to programmable divider assembly Z104. The fixed 15-mhz input from the spectrum generator assembly is applied to amplifier Q1 via pin E1. The amplified output of Q1 is applied to double balanced mixer Z1. Also applied to Z1 is the 455-khz signal from the fourth mixer assembly via pin E4. The resultant outputs of Z1 are the sum and difference frequencies of 15.545 and 14.545 mhz, respectively.

(2) The sum frequency is removed by passing the signal through a 14.545 mhz band pass filter consisting of Y1 which is tuned by capacitor C5. The 14.545-mhz signal is amplified by Q2 and passed through a second 14.545-mhz band pass filter consisting of crystal Y2 to ensure that unwanted frequencies are removed from the signal. The output of Y2 is again amplified by Q3 and applied to mixer Q4.

(3) The second input to Q4 is the 15.545 to 16.545 mhz output of the second mixer assembly which is applied to Q4 via pin E5. The resultant output of Q14 is a signal in the 1 to 2 mhz frequency range that is applied to 2-mhz low pass filter consisting of capacitors C12, C14, and C15, and coils L6 and L7. The low pass filter removes all frequencies above 2 mhz. The resultant 1 to 2 mhz output of the low pass filter is amplified by Q5 and applied to the programmable divider assembly via pin E7.

h. PROGRAMMABLE DIVIDER ASSEMBLY Z104. (See figure 4-8.)

(1) The programmable divider assembly receives the 1 to 2 mhz signal from third mixer assembly Z106 and performs the appropriate division to always arrive at a 100-hz signal. The resultant 100-hz signal is then mixed with a 900-hz input from spectrum generator assembly Z102 to obtain a 1-khz output that is applied to 10 and 100 khz multiplier comparator assembly Z108. The 1 to 2 mhz input signal from the third mixer assembly is

applied to amplifier Q1 via pin E1. The amplified output of Q1 is applied to a series of divider networks Z5 through Z9. The divisor is a function of the setting of the front panel 100, 10, 1, and 0.1 khz FREQUENCY switches. The divisor is 10,000 plus the setting of each switch times its division factor. For example; an input frequency of 1.2345 mhz at E1 would require a division of 12,345 to obtain 100 hz at Q2.

Frequency Digit	Mhz Switch Setting		Division Factor			
					10,000	- Fixed Divisor
100 khz	2	x	1000	=	2,000	
10 khz	3	x	100	=	300	
1 khz	4	x	10	=	40	
0.1 khz	5	x	1	=	5	
					12,345	Divisor

The four-bit binary complementary coded output (1, 2, 4, 8) of each switch section is inverted by Z1, Z2, and Z3, and applied to Z6 through Z9. The resultant output of Z5 through Z9 is a composite 100-hz signal that is amplified by Q2 and applied to flip-flop Z12.

(2) Also applied to flip-flop Z12 is the amplified 1 to 2 mhz signal, divided by 10,000 via Z10, Z11, Z14, and Z13. The resultant output of flip-flop Z12 is applied to double balanced modulator CR3 through CR6. Also applied to the double balanced modulator is the 900-hz signal from the spectrum generator assembly. The additive output of the modulator is a 1-khz signal that is tuned by tank circuits C9-L3, C11-L4, and C14-L5, amplified by Q3, buffered by emitter follower Q4, and applied to the 10 and 100 khz multiplier comparator assembly via pin E5.

i. 10 AND 100 KHZ MULTIPLIER COMPARATOR ASSEMBLY Z108. (See figure 4-9.)

(1) The 10 and 100 khz multiplier comparator assembly Z103 receives the 1-khz signal from programmable divider assembly Z104, multiplies it by 10 and 10 khz, and

mixes the 10-khz signal with a 90-khz input from spectrum generator assembly Z102 to yield a 100-khz output that is applied to phase detector assembly Z109. In addition, the 10 and 100 khz multiplier comparator assembly also contains a phase comparator that compares the phase of an external 1-mhz standard, when available, against the phase of the internal standard, and provides a d-c standard compare output that is applied to the front panel center-reading PHASE COMPARATOR meter M101.

(2) The 1-khz signal from the programmable divider assembly is amplified by Q3 and applied to X5 multiplier Q1. The resultant 5-khz output of Q1 is applied to X2 multiplier Q4, Q5, via switch Q2. The 10-khz output of the X2 multiplier is applied to a double balanced modulator via emitter follower Q6. Also applied to the double balanced modulator is the 90-khz signal from the spectrum generator assembly. The resultant output of the modulator is a 100-khz signal that is amplified by Q10, buffered by emitter follower Q1, and applied to phase detector assembly Z109 via pin E11.

(3) The 10 and 100 khz multiplier comparator assembly also receives the 1-mhz signal from the internal standard and the 1-mhz signal from the external standard, when available. The internal standard signal is applied directly to phase comparator Q7, Q9. The external signal is amplified by Q8 and also applied to the phase comparator. The resultant output of the phase comparator is rectified and applied as a d-c standard compare voltage to the front panel center-reading PHASE COMPARATOR meter.

j. PHASE DETECTOR ASSEMBLY Z109. (See figure 4-10.)

(1) The phase detector assembly Z109 compares the 100-khz reference signal from spectrum generator assembly Z102 against the 100-khz signal from the 10 and 100 khz multiplier comparator assembly Z108 (which contains a combination of all the errors of the associated receiver system errors), and develops a resultant d-c error voltage that is used to correct the associated receiver system variable frequency oscillator. The 100-khz reference signal from the spectrum generator assembly is applied to amplifier Q4 via pin E7. The 100-khz (error) signal from the 10 and 100 khz multiplier comparator assembly is applied to amplifier Q1 via pin E6. The amplified outputs of Q4 and Q1 are applied to a phase detector which develops a corresponding d-c voltage that represents the phase error

between the reference and error input signals. The error voltage output is applied to the associated receiving system via pin E2 and RSU-1 rear panel ERROR VOLTAGE jack J107, in addition to being applied to the front panel PHASE COMPARATOR meter M101 for a visual indication of the error.

(2) The phase comparator assembly also contains circuitry that is used to illuminate the front panel SYNC lamp to obtain a visual indication of error difference. The 100-khz reference signal is amplified by Q6 and applied to a phase detector circuit. The 100-khz signal from the 10 and 100 khz multiplier comparator assembly is amplified by Q2 and applied to a 90-degree lagging phase shift network. When the error signal is in phase with the reference signal, it is desired to illuminate the SYNC lamp. An in-phase condition indicates that the phase detector is perfectly balanced, resulting in a zero output. However, with an in-phase condition, it is desired to obtain a maximum phase detector output, which is obtained with a maximum out-of-phase condition of 90 degrees. Therefore, the error signal is passed through the 90-degree lagging phase shift network, resulting in a maximum phase detector circuit output on an in-phase condition. The output of the phase detector circuit operates switch Q3 which, in turn, operates lamp switch Q5. Lamp switch Q5 applies a ground output to SYNC indicator DS102 via pin E9.

(3) As the frequency of the associated receiver is adjusted to the frequency setting of the RSU-1, the phase detector output will increase from a minimum output towards a maximum output, as the two frequencies are aligned. As the phase detector output increases, the front panel PHASE COMPARATOR meter will approach a center reading zero indication and the front panel SYNC lamp will first flicker, and then remain illuminated.

k. POWER SUPPLY ASSEMBLY Z105 AND ASSOCIATED CIRCUITRY. (See figure 4-11.)

(1) The 115/230 vac input is applied to transformer T101 via fuses F101 and F102. The output across the secondary windings of T101 is applied to rectifiers CR101, CR102, and CR103. The rectifiers, in conjunction with various voltage regulators, develop the required d-c operating voltages used throughout the RSU-1. The rectified output of CR103 is regulated to +5 vdc by VR102 and to +5 vdc by VR103.

(2) The power supply assembly Z106 contains a series regulator consisting of Q1 and CR1 which receives a d-c voltage from rectifier CR101. The series regulator operates in conjunction with regulator Q101 to develop a +24 vdc output that is regulated by Zener diode CR104. In addition, the power supply assembly contains an r-c filtering network that receives a +24 vdc output from rectifier CR102 and applies the filtered voltage to voltage regulator VR101 that develops +12 vdc.

(3) The unregulated voltage on E8 is routed to R103 (voltage dropping resistor). One output of R103 goes to TB101 terminal 2, which is connected to the associated receiving system. The other output of R103 is connected to E5 of 17 mhz oscillator relay control Z110. This control circuit uses a diode matrix and a transistor switch to supply power to the associated receiver when the 10 mhz switch is in position zero (0). Power is switched off in positions 1, 2, and 3.

2-3. COMPONENT LEVEL TROUBLESHOOTING.

a. GENERAL. The various functional assemblies of the RSU-1 are shown in figure 4-12. Those assemblies that are referenced with Z numbers are described individually on the schematic diagram level in the following paragraphs. Each paragraph references the schematic diagram for the particular assembly being described. The schematic diagrams indicate the primary signal flow and necessary operating potentials within each assembly and will aid the technician in localizing the faulty component(s).

b. SPECTRUM GENERATOR ASSEMBLY Z102. (See figure 4-14.)

(1) The internal 1-mhz standard signal is applied to amplifier Q1. When available, the external 1-mhz standard signal is applied to amplifier Q2. The amplifier outputs are applied to gating network Z1. The external standard signal is applied through diode CR3 which rectifies the signal and applies it to d-c amplifier Q3. The d-c amplifier functions as a switch to switch the gating network to pass the external or internal signal, depending on the amplitude of the external signal. The amplifier configuration and gating circuit is such that when the signal from the external 1-mhz signal is at least 0.7 volt rms, the internal 1-mhz standard signal is inhibited and the external signal is gated. If the external 1-mhz signal drops below 0.7 volt rms, the external signal is automatically

inhibited and the internal signal is gated. Since the internal standard is always maintained at operating temperature for stability as long as the RSU-1 is connected to a source of power, this gating arrangement prevents the loss of information due to any malfunction in the external standard.

(2) The selected 1-mhz signal is amplified by Q6 and applied to divide-by-10 network Z3 and to mixer Q8. The resultant 100-khz output of Z3 is applied to a fan-out device Z2. One output of Z2 is amplified by Q5 and the output applied to the associated receiving system via pin E7 and rear panel 100 KHZ jack J102. A second output of Z2 is applied to a mixer on fourth mixer assembly Z103. A third output of Z2 is applied to phase detector assembly Z109.

(3) Mixer Q8 receives a 1-mhz input at the emitter and the 100-khz output of Z3 at the base. The mixer is double tuned by indicators L4 and by L6 via coupling capacitor C19 to a difference frequency of 900 khz. The 900-khz output is amplified by an insulated gate field effect transistor Q9 which has a high input impedance. The 900-khz signal is again amplified by Q10 and applied to Q11. Transistor Q11 acts as a switching device with diode CR5 clipping the negative signal inputs. The resultant signal is developed across resistor R39 and applied to Z4.

(4) Z4 is a divide-by-10 network that develops a resultant 90-khz output signal which is applied to 10 and 100 khz multiplier comparator assembly Z108 via pin E15, and to Z5. Z5 and Z6 are each divide-by-10 networks that provide a 900-hz output from Z6 which is applied to programmable divider assembly Z104 via pin E17.

(5) The 1-mhz output of amplifier Q6 is also applied to Q7 which is an over driven amplifier. Over driving Q7 produces a high output rise time at the output, thereby functioning as a harmonic generator. The output is differentiated by capacitor C12 and resistor R25. The resultant spike is applied to crystal selectors via capacitor C13. Capacitor C13 provides signal coupling in addition to providing tuning for the crystal selectors.

(6) The crystal selectors each contain two crystals at the desired output frequency and amplifiers. The circuits that are selected are controlled via the RSU-1 front panel 10 and 1 mhz FREQUENCY switches via integrated logic circuits.

(7) Integrated circuit Z7 is a bcd-to-binary converter that receives bcd information from the 10 and 1 mhz FREQUENCY switches. Z7 converts the input into a binary output that is continuous from 0 to 31 mhz, and applies the output to exclusive-OR gates Z10. A detailed discussion of the purpose of the exclusive-OR gates is contained in paragraph 2-2c.(4). The outputs of Z7 are applied to switches Z8 and Z9 which, in turn, control 1-of-16 decoder Z11 and 1-of-8 decoder Z12. Therefore, with a four line input, 1 of 16 outputs is obtained for the selection of the desired 1-mhz frequency increment from 1 to 15 mhz at pin E30.

(8) The remaining integrated circuits are used to switch on or off the various tuned stages. For example, the junction at resistor R117 and capacitor C92 is the return for transistor Q36 and is connected to a switching inverter on Z20. In turn, Z20 receives its input from Z15 which is in the output line of Z11. The logic selects one of the inverters, turns it on in accordance with the setting of the 10 and 1 mhz FREQUENCY switches, and selects one of the 15 output frequencies.

c. FIRST MIXER ASSEMBLY Z101. (See figure 4-16.) The crystal oscillator output of the associated receiver, in the 11 to 34 mhz frequency range, is applied to amplifier Z1 via pin E1. The amplified output of Z1 is again amplified by Q1 and applied to mixer Q2. The second input to mixer Q2 is the spectrum generator assembly output of one of the frequencies from 1 to 15 mhz, in 1-mhz increments, according to the chart in table 2-1. The collector circuit of Q2 is tuned to 19 mhz by transformer T1 and capacitor C11. The signal is also crystal selected via Y1, amplified by Q3, and again crystal selected by Y2. The resultant signal is amplified by Q4. Q4 output is tuned to 19 mhz by transformer T2 and capacitor C17 and applied to second mixer assembly Z107 via pin E6.

d. SECOND MIXER ASSEMBLY Z107. (See figure 4-18.)

(1) The second mixer assembly Z107 receives the 19-mhz output of first mixer assembly Z101 via pin E1. The second mixer assembly also receives the associated

receiver variable frequency oscillator output of 2.455 to 3.455 mhz at pin E3. The 19-mhz input is amplified by Q1 and mixed with the associated receiver input to mixer Q2. The output of mixer Q2 is applied to double tuned transformer T2. T2 is over critically coupled to produce a double peak to pass the wide-band difference frequency of 15.454 to 16.545 mhz. The transformer is tuned at the mid points between these two frequencies and is sufficiently over coupled to enable passing the frequency range about the mid point.

(2) The difference frequency is applied to an impedance matching circuit Q3 followed by a high-pass filter which passes all frequencies above 15.454 mhz. From the high-pass filter, the signal is applied to an impedance matching stage Q4 which also provides isolation. From Q4, the signal is routed through a low-pass filter which passes all frequencies below 16.545 mhz. The resultant output is a bandwidth from 15.545 to 16.545 mhz. The bandwidth is amplified by Q5 and applied to third mixer assembly Z106 via pin E5.

e. FOURTH MIXER ASSEMBLY Z103. (See figure 4-20.) The fourth mixer assembly contains a 555-khz crystal controlled oscillator circuit consisting of Y1 and Q1. The 555-khz output is buffered by source follower Q2 and amplified by tuned amplifier Q3. The resultant 555-khz output signal is applied to the associated receiving system via pin E2 and RSU-1 rear panel 555 KHZ jack J106. The 555-khz signal is also applied to mixer Q4. The second input to mixer Q4 is a 100-khz signal from spectrum generator assembly Z102. The output circuit of Q4 is tuned to the difference frequency of 455 khz by inductor L7. The resultant signal is amplified by Q5 and applied to third mixer assembly Z106 via pin E4.

f. THIRD MIXER ASSEMBLY Z106. (See figure 4-22.)

(1) The third mixer assembly contains two mixer circuits that develop the 1 to 2 mhz signal that is applied to the programmable divider assembly Z104. The fixed 15-mhz output of the spectrum generator assembly Z102 is applied to double balanced mixer Z1 via pin E1 and amplifier Q1. The second input to Z1 is the 455-khz signal from fourth mixer assembly Z103 via pin E4. The double balanced mixer eliminates its own frequency components and only the sum and difference frequencies are present at terminal 5. The output frequencies are passed through 114.545-mhz crystal Y1 which acts as a very narrow band

pass filter. The resultant signal is amplified by Q2 and again passed through a second 14.545-mhz crystal Y2 which provides a second stage of narrow band pass filtering.

(2) The resultant 14.545-mhz signal is amplified by Q3 and applied to mixer Q4. The second input to Q4 is the 16.545 to 15.545 mhz signal from second mixer assembly Z107 via pin E5. The output of mixer Q4 is a composite signal containing the desired 1 to 2 mhz signal. The sum frequency is rejected by the following 2-mhz low pass filter. The desired 1 to 2 mhz signal is then amplified by Q5 and applied to the programmable divider assembly via pin E7.

g. PROGRAMMABLE DIVIDER ASSEMBLY Z104. (See figure 4-24.)

(1) The 1 to 2 mhz input signal from the third mixer assembly Z106 is applied to amplifier Q1 via pin E1. The amplified output of Q1 is applied to a series of divider networks Z5 through Z9. The divisor is a function of the setting of the front panel 100, 10, 1, and 0.1 khz FREQUENCY switches. The programming is such that the divisor is between 10,000 and 19,999, depending on the setting of the switches. If the last four decades are set for 0000, it divides by 10,000. If the last four decades are set for 9999, it divides by 19,999. The four-bit binary coded output (1, 2, 4, 8) of each switch section is inverted by Z1, Z2 and Z3 and applied to Z6 through Z9. The resultant output of Z5 through Z9 is a composite 100-hz signal that is amplified by Q2 and applied to flip-flop Z12.

(2) Also applied to flip-flop Z12 is the amplified 1 to 2 mhz signal, divide by 10,000 via Z10 through Z13. The resultant output of flip-flop Z12 is applied to double balanced modulator CR3 through CR6. The double balanced modulator also receives the 900-hz signal from the spectrum generator assembly. The additive output of the modulator is a 1-khz signal that is amplified by Q3, buffered by emitter follower Q4, and applied to the 10 and 100 khz multiplier comparator assembly via pin E5.

h. 10 AND 100 KHZ MULTIPLIER COMPARATOR ASSEMBLY Z108. (See figure 4-26.)

(1) The 10 and 100 khz multiplier comparator assembly receives the 1-khz output of programmable divider assembly Z104, multiplies it by 10 to 10 khz, and mixes the resultant 10-khz signal with a 90-khz signal from spectrum generator assembly Z102 to

develop a 100-khz signal that is applied to phase detector assembly Z109. The 1-khz input signal from the programmable divider assembly is applied to amplifier Q3 via pin E1. Q3 matches the input impedance to the following tank circuit. The following tank circuit is a double tuned input of X5 multiplier Q1. The output of Q1 is applied to d-c switch Q2 which supplies bias for X2 multiplier Q4. In Q4, the 5-khz input is multiplies by two to yield 10 khz. The resultant 10-khz output of Q5 is buffered by emitter follower Q6. The output of Q6 is applied to a double balanced modulator consisting of transformer T1, diodes CR1 through CR4, and associated components. In the modulator, the 10-khz signal is combined with 90 khz from the spectrum generator assembly. The resultant output of the modulator is a complex wave containing 100 khz among its components. The tank circuit of Q10 is tuned via inductors L12 and L13 to 100 khz. The output of Q10 is applied to emitter follower Q11. Q11 output at pin E11 is a pure 100-khz signal with no side products.

(2) Transistors Q7, Q8, and Q9 form a 1-mhz comparator that compares the phase of the external 1-mhz standard signal with the internal 1-mhz standard signal. The resultant difference is rectified and applied to the front panel center-reading PHASE COMPARATOR meter M101 via pin E8.

i. PHASE DETECTOR ASSEMBLY Z109. (See figure 4-28.)

(1) The phase detector assembly receives a 100-khz input from the spectrum generator assembly Z102 that is the reference against which the 100-khz input from the 10 and 100 khz multiplier comparator assembly Z108 is compared. The 100-khz reference is applied to phase detector circuit Q4. Also applied to phase detector circuit of Q4 is the 100-khz input from the 10 and 100 khz multiplier comparator assembly via amplifier Q1. The phase detector circuit consists of transformer T1, diodes CR1 and CR2, and resistors R8 and R7. The phase detector output at the junction of diode CR1 and resistor R7 is in the form of a d-c error-correcting voltage. The error voltage is applied to the variable frequency oscillator of the associated receiver via pin E2 and rear panel ERROR VOLTAGE jack J107. The error voltage is also applied to the RSU-1 front panel PHASE COMPARATOR meter M101 via dropping resistor R14 and pin E1. Resistor R12 and capacitors C11 and C12 connected across the error voltage output, form a lagging network that provides a stability in the circuit to prevent oscillations at high frequencies.

(2) The remaining circuitry on the phase detector assembly is used to illuminate the front panel SYNC indicator. The 100-khz reference input at pin E7 is also applied to amplifier Q6. The amplified output is applied to a phase detector circuit consisting of transformer T2 in the collector circuit of Q6, diodes CR3 and CR4, and resistors R9 and R10. The second input to the phase detector is 100 khz from the 10 and 100 khz multiplier comparator assembly which is amplified by Q2. The amplified output is applied to a 90-degree lagging phase shift network consisting of capacitors C14, C15, and C16 and resistors R15, R16, and R17. When the two 100-khz signals are in phase, the phase detector is perfectly balanced. Under these conditions, the phase of the 100-khz input at pin E6 is shifted by 90 degrees, and the phase detector output is at a maximum. At maximum, diode CR3 conducts, forward biasing switch Q3. As a result, lamp switch Q5 is forward biased, which virtually grounds pin E9, illuminating the front panel SYNC lamp.

j. POWER SUPPLY ASSEMBLY Z105. (See figure 4-30.) The power supply assembly contains a series regulator Q1 whose base voltage is regulated at 30 volts by Zener diode CR1. The assembly also contains a resistor-capacitor filtering network R1 and C1 that filters the +24-vdc output of CR102 and applies the resultant voltage to voltage regulator VR101.

k. 17 MHZ OSCILLATOR RELAY CONTROL Z110. (See figure 4-32.)

(1) The 17 mhz oscillator relay control assembly contains a diode switching matrix and a transistor switch which is used to control d-c power to the 17 mhz tuning circuit and relay control on the associated receiver.

(2) With the 10 mhz switch in position 0, CR3 and CR4 are open circuited. This forward biases Q1 which allows the unregulated voltage to be applied to E6 through TB101 terminal 4 to the associated receiver. When the 10 mhz switch is in positions 1, 2, or 3, the ground on the appropriate diode back biases, resulting in zero voltage at terminal E6. Diodes CR1 and CR2 provide isolation between the programmable logic and the switching circuit.

SECTION 3

ALIGNMENT

3-1. GENERAL.

This section contains the alignment procedures required to maintain the RSU-1 in satisfactory operating condition. When performing the alignment procedures, refer to figure 4-13 overall component location, and to the individual component location diagrams for the printed circuit board assemblies.

3-2. TEST EQUIPMENT REQUIRED.

The following test equipment, or its equivalent, is required to perform the complete alignment of the RSU-1:

a. Multimeter, Simpson 260, or equivalent.

b. Frequency counter, HP5244, or equivalent.

c. Oscilloscope, Tektronix 541, or equivalent.

d. R-f cable, RG-58/U, 50-feet long.

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

3-3. ALIGNMENT.

a. SPECTRUM GENERATOR Z102 (A4922).

(1) On the RSU-1, set the SYNTH/STANDBY switch to SYNTH, SYNC COMPARE/STD COMPARE switch to SYNC COMPARE, and FREQUENCY switch to 00.0000.

(2) Monitor E30 (1-15 mhz output) on Z102 with the oscilloscope. Connect the frequency counter to the oscilloscope vertical signal output.

(3) Refer to table 3-1 and tune the proper coils for a maximum voltage at the indicated frequency. Each output should be approximately 0.4 volt peak-to-peak ±10%.

TABLE 3-1. SPECTRUM GENERATOR Z102 ALIGNMENT

Frequency (mhz)	Tune	Output Frequency (mhz)
00.0000	T17	1
01.0000	T16	2
02.0000	T15	3
03.0000	T14	4
04.0000	T6	5
05.0000	T13	6
06.0000	T5	7
07.0000	T8	8
08.0000	T8	8
09.0000	T5	7
10.0000	T13	6
11.0000	T6	5
12.0000	T14	4
13.0000	T15	3
14.0000	T16	2
15.0000	T17	1
16.0000		No output
17.0000	T17	1
18.0000	T16	2
19.0000	T15	3
20.0000	T14	4
21.0000	T6	5
22.0000	T13	6
23.0000	T5	7
24.0000	T8	8
25.0000	T10	9

TABLE 3-1. SPECTRUM GENERATOR Z102 ALIGNMENT (Continued)

Frequency (mhz)	Tune	Output Frequency (mhz)
26.0000	T7	10
27.0000	T12	11
28.0000	T9	12
29.0000	T11	13
30.0000	T4	14
31.0000	T3	15

(4) Set FREQUENCY switch to 00.0000.

(5) Monitor E21 on Z102 and tune transformer T2 for maximum output voltage at 15 mhz.

(6) Monitor J103 (17 mhz) and tune transformer T1 for maximum voltage. The output should be approximately 4.0 volts peak-to-peak ±10% at 17 mhz.

(7) Monitor J102 (100 khz) and tune coil L1 for maximum voltage. The output should be 1.15 volts peak-to-peak minimum at 100 khz.

(8) Monitor E9 on Z102. The output frequency should be 100 khz.

(9) Monitor E11 on Z102. The output should be 3.0 volts peak-to-peak minimum at 100 khz.

(10) Monitor the junction of capacitor C23 and resistor R35 on Z102 and tune coils L4, L5, and L6 for maximum output voltage output at 900 khz.

(11) Monitor E15 on Z102. The square wave output should be 90 khz.

(12) Monitor E17 on Z102. The square wave output should be 3.0 volts peak-to-peak minimum at 0.9 khz.

b. FIRST MIXER Z101 (A4932). The first mixer Z101 is used to compare the associated receiver hfo frequency with the RSU-1, resulting in a difference frequency of 19 mhz. To align the first mixer, the associated receiver must be connected to the RSU-1.

(1) Set the RSU-1 FREQUENCY switch to 16.0000.

(2) Set the associated receiver to 16.0000 mhz.

(3) Connect the hfo output of the associated receiver to J109 (crystal oscillator input) of the RSU-1.

(4) Monitor the junction of resistor R10 and transformer T1 on Z101. Tune transformer T1 for maximum output voltage at 19 mhz.

(5) Monitor E6 on Z101 and tune transformer T2 for maximum output voltage at 19 mhz.

c. SECOND MIXER Z107 (A4927).

(1) Remove the hfo signal from J109.

(2) Connect 16 mhz at 1.5 volts peak-to-peak to J108 (vfo input).

NOTE

Use an r-f signal generator and verify the frequency using a frequency counter.

(3) Monitor the junction of capacitor C11 and resistor R17 and tune coil L12 and transformer T1 for maximum output voltage.

(4) Remove the 16-mhz signal from J108 and reconnect the hfo signal to J109.

d. FOURTH MIXER Z103 (A4925).

(1) Connect the frequency counter to J106 (555 khz output).

(2) Adjust capacitor C3 for 555.000 khz.

(3) Remove frequency counter and connect the RG-58/U r-f cable to J106.

(4) Monitor J106 (555 khz) with an oscilloscope and tune coil L6 for maximum output voltage. The output should be 15 volts peak-to-peak minimum at 555 khz.

(5) Remove the RG-58/U r-f cable from J106.

(6) Monitor E4 on Z103 and tune coils L7 and L8 and transformer T1 for a maximum output voltage at 455 khz.

e. THIRD MIXER Z106 (A4923) AND PROGRAMMABLE DIVIDER Z104 (A4928). The third mixer Z106 and programmable divider Z104 do not have adjustment controls. The programmable divider is controlled by the last four digits of the RSU-1 FREQUENCY switch. Although these assemblies do not require adjusting, it is necessary to check these assemblies and adjust the associated receiver front panel switches in order to continue aligning the remaining RSU-1 assemblies.

(1) Connect the associated receiver vfo output to J108 (vfo input).

(2) Set the associated receiver to 16.0000 mhz.

(3) Set the RSU-1 FREQUENCY switch to 16.0000 mhz.

(4) Monitor E7 on Z106 and adjust the associated receiver frequency switch for an indication of 1 mhz ±50 hz at E7. The output level should be approximately 5 volts peak-to-peak minimum.

(5) Connect the oscilloscope lead on the positive side of capacitor C4 on Z104.

(6) Connect the frequency counter to the vertical signal output of the oscilloscope.

(7) On the frequency counter, set the FUNCTION switch to PERIOD AVERAGE -10 and the TIME BASE switch to 10 microseconds.

(8) Adjust the associated receiver frequency switch for an indication of 10,000 microseconds.

(9) Change the last four digits on the RSU-1 FREQUENCY switch, one step at a time. The corresponding digit should be indicated on the frequency counter. For example, a FREQUENCY switch setting of 16.1234 results in a frequency counter indication of 11234 microseconds. After each digit is checked, set the FREQUENCY switch to 16.0000.

(10) Monitor E5 on Z104 for a 0.5 volt peak-to-peak output at 1 khz.

(11) Do not disturb the associated receiver settings.

f. 10 AND 100 KHZ MULTIPLIER COMPARATOR Z108 (A4929). Before aligning the 10 and 100 khz multiplier comparator Z108, perform the third mixer Z106 and programmable divider Z104 checks, paragraph 3-3e. After performing these checks, do not disturb the associated receiver control settings.

(1) Monitor E1 on Z108 and verify a frequency or exactly 1 khz.

(2) Monitor the base of transistor Q2 and adjust coils L1, L2, and L3 for maximum output voltage at 5 khz.

(3) Monitor the base of transistor Q6 and adjust coils L6, L7, and L8 for maximum output voltage at 10 khz.

(4) Monitor E11 on Z108 and adjust coils L9, L12, and L13 for maximum output voltage. The output should be 0.8 volt peak-to-peak ±10% at 100 khz.

g. FINAL ADJUSTMENTS. After the assemblies of the RSU-1 have been adjusted and the RSU-1 is connected into the associated receiving system, it may be necessary to peak a few adjustment controls to obtain optimum output. After connecting the RSU-1 into the associated receiving system, proceed as follows:

(1) Monitor J103 and adjust transformer T1 on spectrum generator Z102 for maximum output voltage.

(2) Monitor J102 and adjust coil L1 on Z102 for maximum output voltage.

(3) Monitor J106 and adjust coil L6 on Z103 for maximum output voltage.

SECTION 4

DRAWINGS AND PARTS LISTINGS

This section contains the drawings and parts listings for the RSU-1. The diagrams that are referenced in the troubleshooting section are contained in this section. The drawings start with the overall block diagram of the RSU-1 in figure 4-1. Figure 4-2 is a signal flow diagram to provide an additional aid in understanding the functioning of the RSU-1. Figures 4-3 through 4-11 are the servicing block diagrams of each printed circuit board assembly. Figure 4-12 is the overall schematic diagram, followed by the overall component location and parts list diagram in figure 4-13. Figures 4-14 through 4-33 are the schematic and component location and parts list diagrams for each printed circuit board assembly.

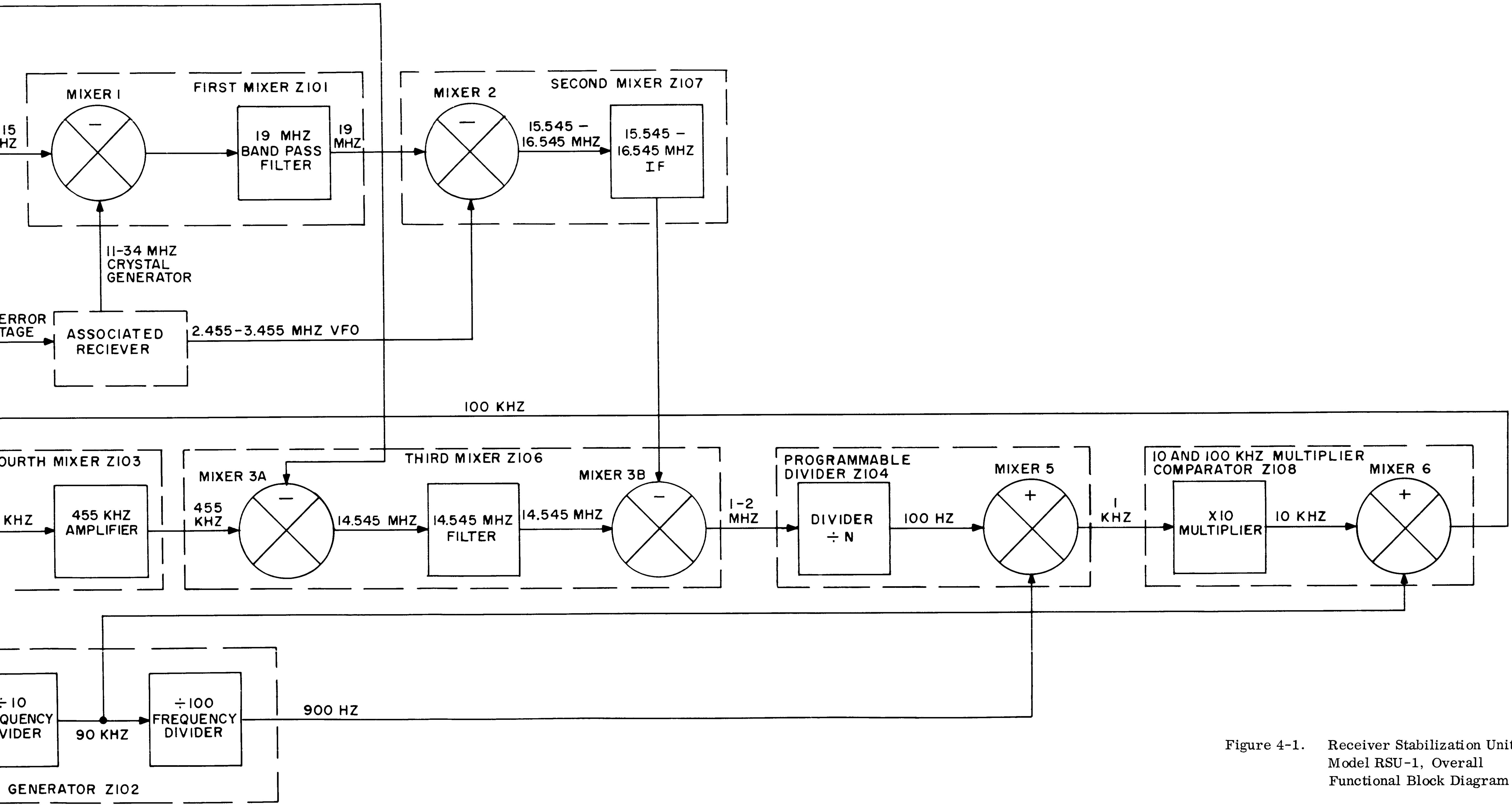
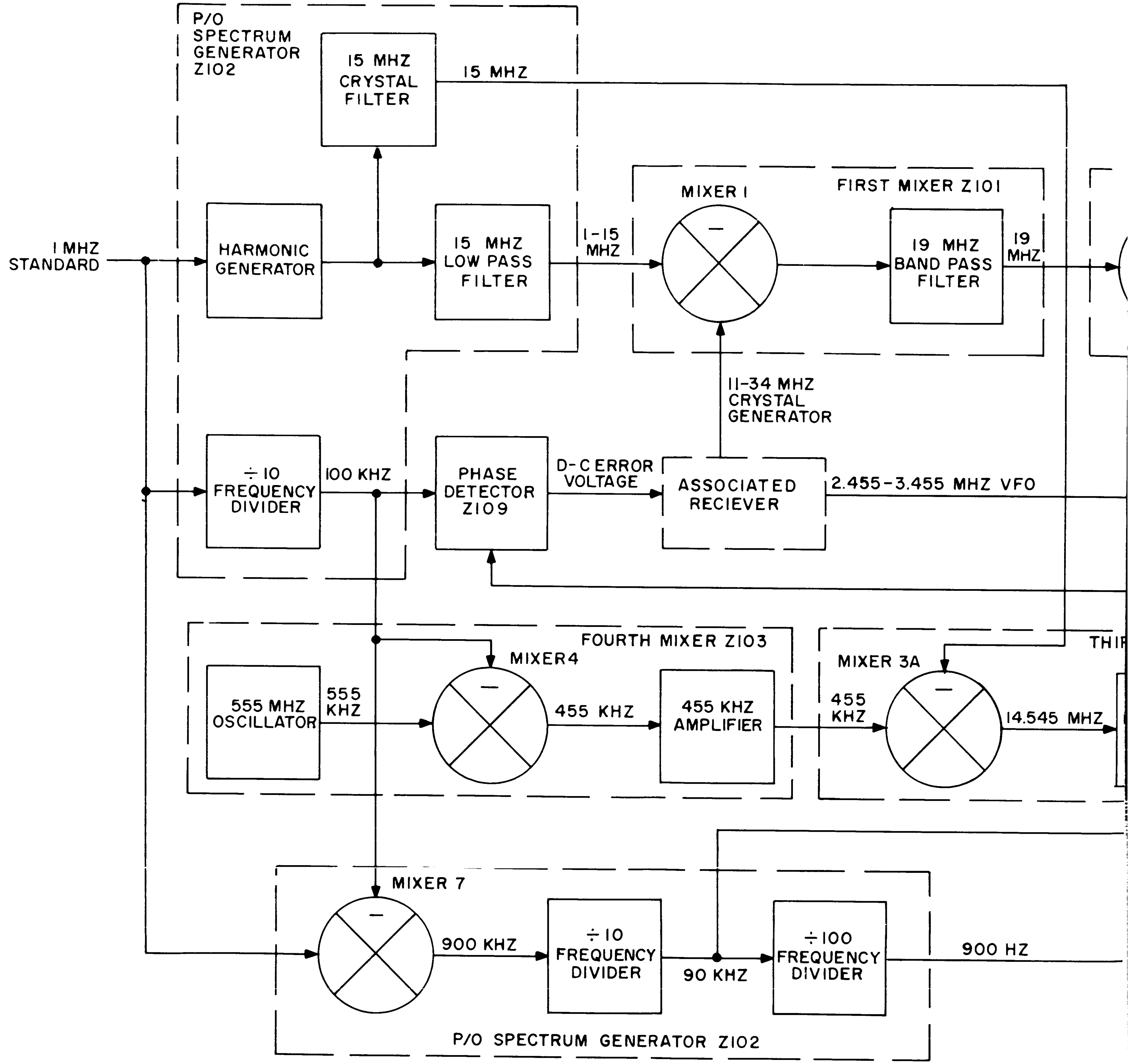


Figure 4-1. Receiver Stabilization Unit, Model RSU-1, Overall Functional Block Diagram



P/O SPECTRUM GENERATOR Z102
15 MHZ CRYSTAL FILTER
15 MHZ
1 MHZ STANDARD
HARMONIC GENERATOR
15 MHZ LOW PASS FILTER
1-15 MHZ
MIXER 1
FIRST MIXER Z101
19 MHZ BAND PASS FILTER
19 MHZ
11-34 MHZ CRYSTAL GENERATOR
÷ 10 FREQUENCY DIVIDER
100 KHZ
PHASE DETECTOR Z109
D-C ERROR VOLTAGE
ASSOCIATED RECIEVER
2.455-3.455 MHZ VFO
FOURTH MIXER Z103
MIXER4
555 MHZ OSCILLATOR
555 KHZ
455 KHZ
455 KHZ AMPLIFIER
MIXER 3A
455 KHZ
14.545 MHZ
THI
MIXER 7
900 KHZ
÷ 10 FREQUENCY DIVIDER
90 KHZ
÷ 100 FREQUENCY DIVIDER
900 HZ
P/O SPECTRUM GENERATOR Z102

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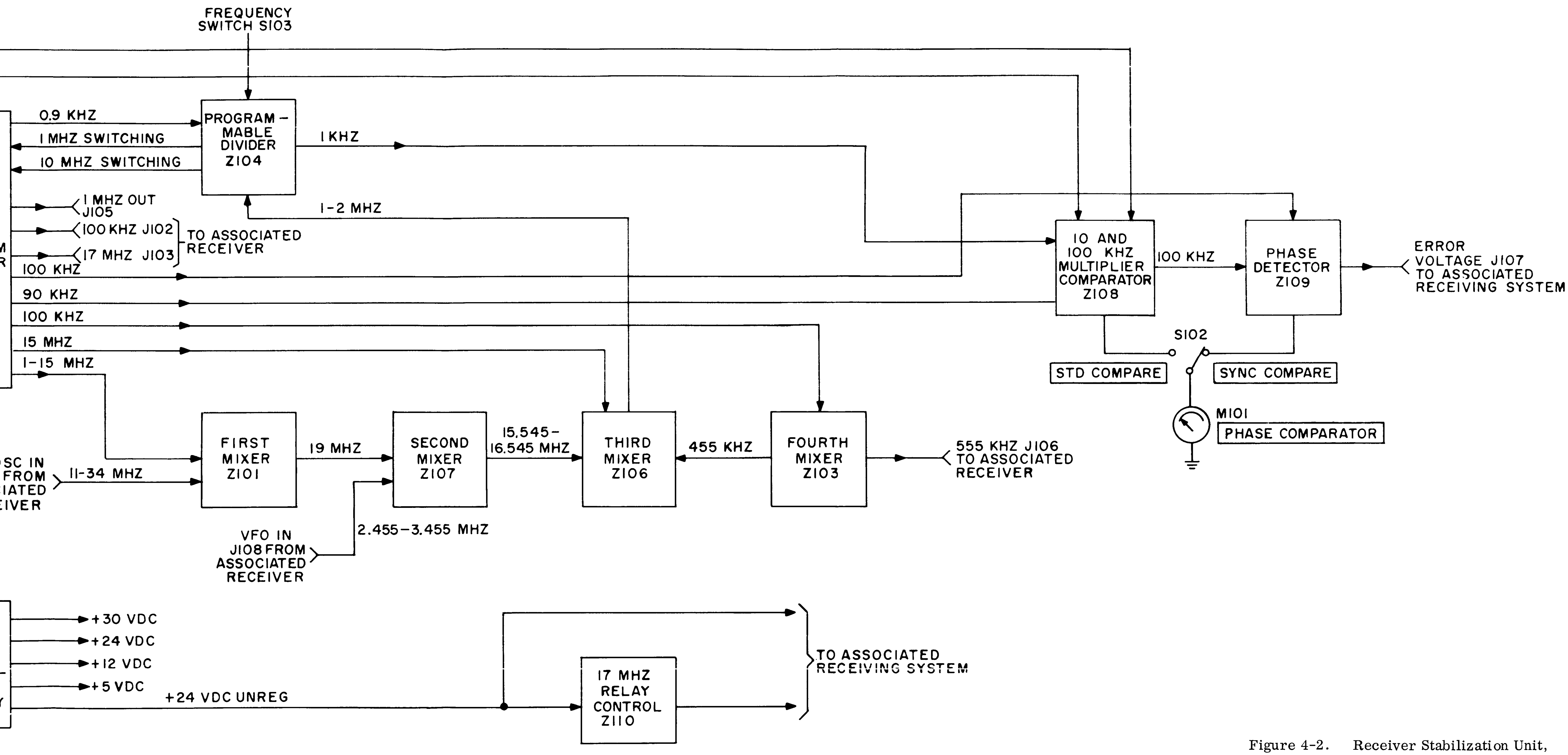
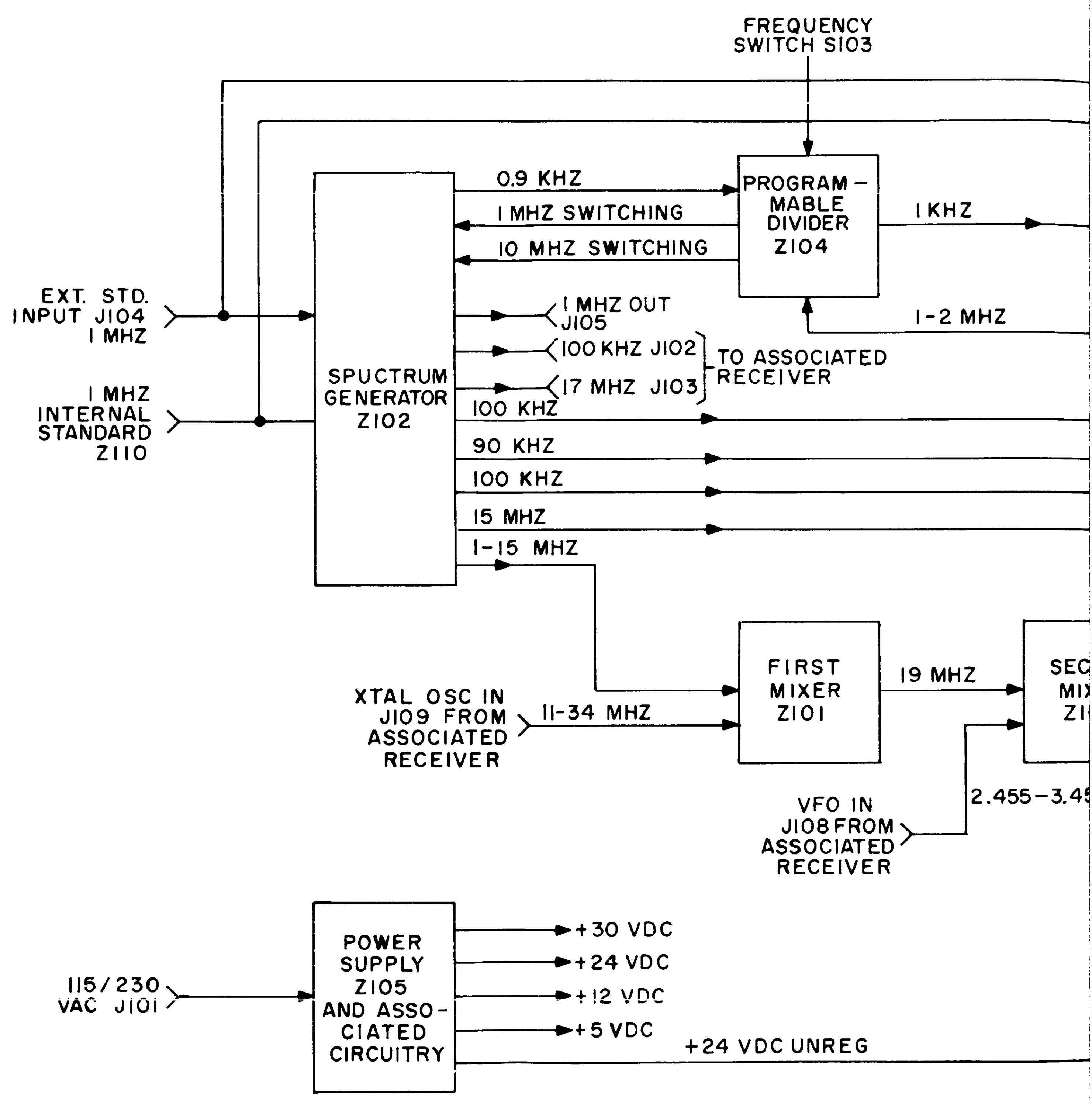


Figure 4-2. Receiver Stabilization Unit, Model RSU-1, Signal Flow Diagram


FREQUENCY SWITCH S103
PROGRAM-MABLE DIVIDER Z104
1 KHZ
1-2 MHZ
0.9 KHZ
1 MHZ SWITCHING
10 MHZ SWITCHING
EXT. STD. INPUT J104 1 MHZ
1 MHZ INTERNAL STANDARD Z110
SPUCTRUM GENERATOR Z102
1 MHZ OUT J105
100 KHZ J102
17 MHZ J103
TO ASSOCIATED RECEIVER
100 KHZ
90 KHZ
100 KHZ
15 MHZ
1-15 MHZ
FIRST MIXER Z101
19 MHZ
XTAL OSC IN J109 FROM ASSOCIATED RECEIVER
11-34 MHZ
VFO IN J108 FROM ASSOCIATED RECEIVER
115/230 VAC J101
POWER SUPPLY Z105 AND ASSO-CIATED CIRCUITRY
+30 VDC
+24 VDC
+12 VDC
+5 VDC
+24 VDC UNREG

Ø12724018

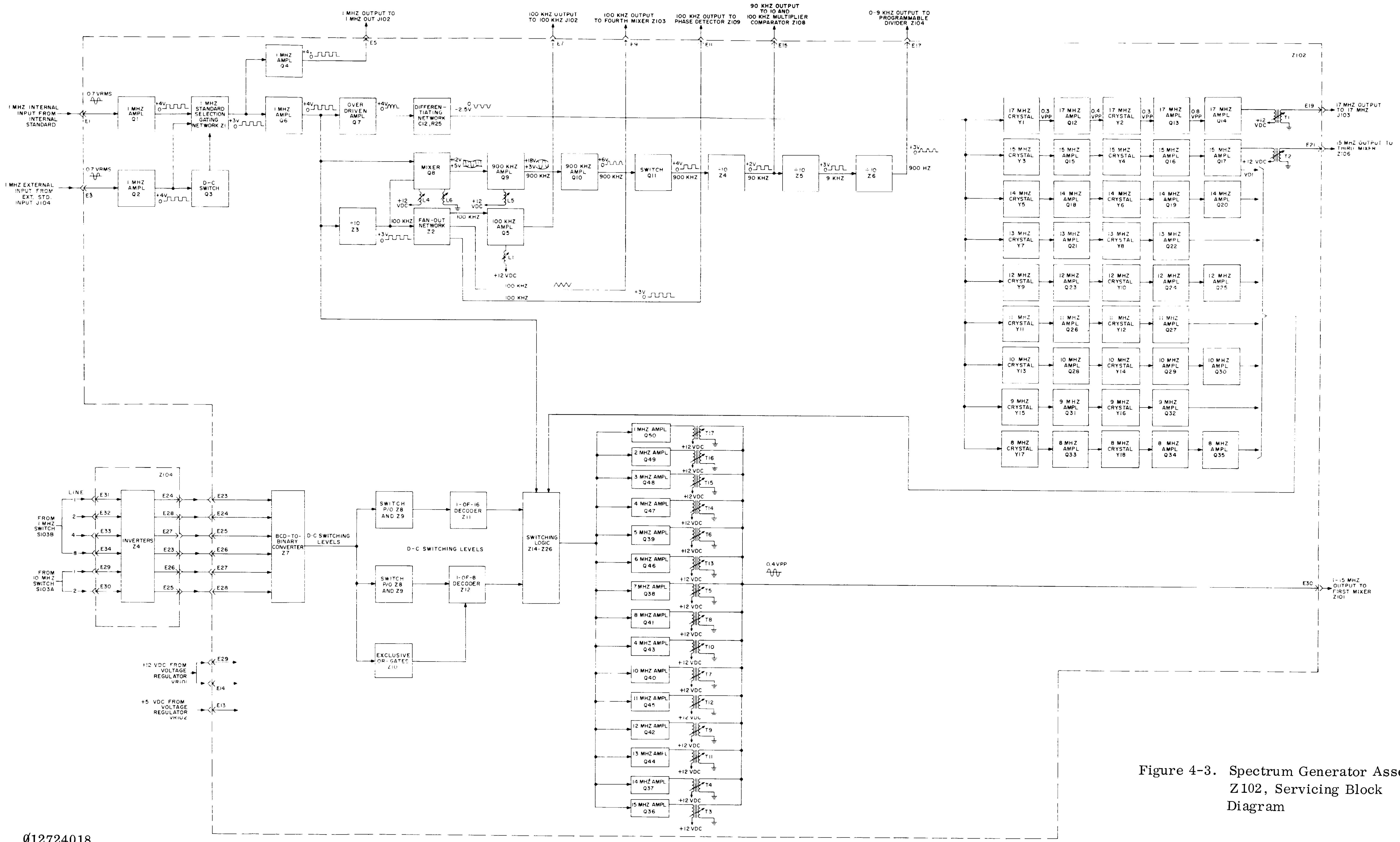


Figure 4-3. Spectrum Generator Assembly Z102, Servicing Block Diagram

ø12724018

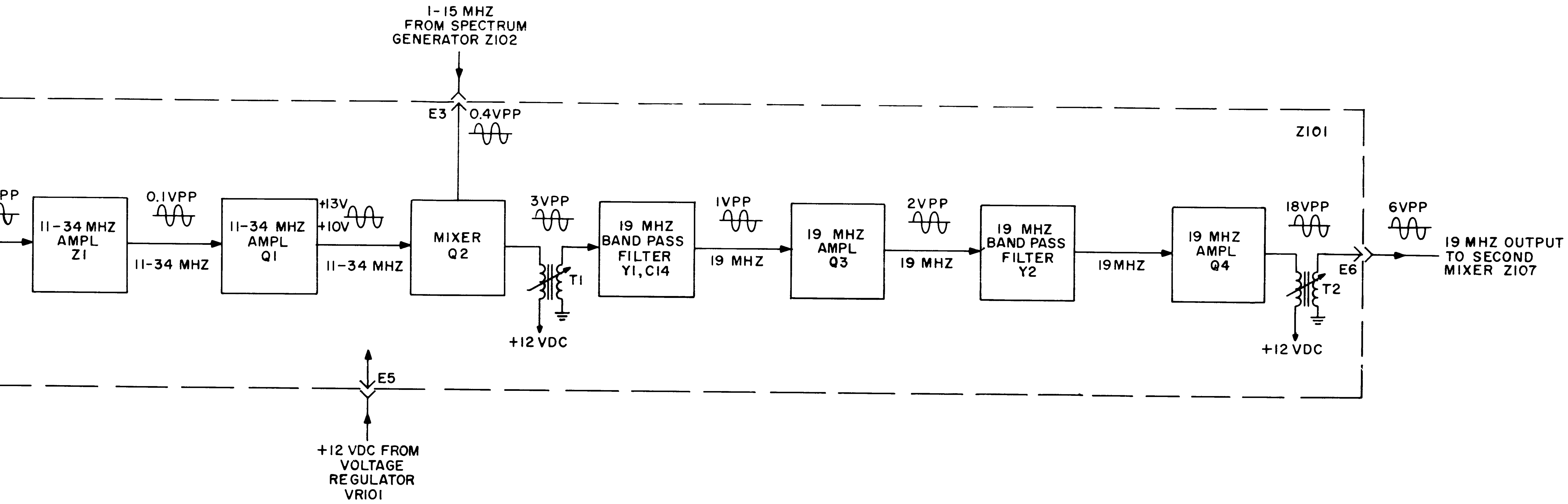
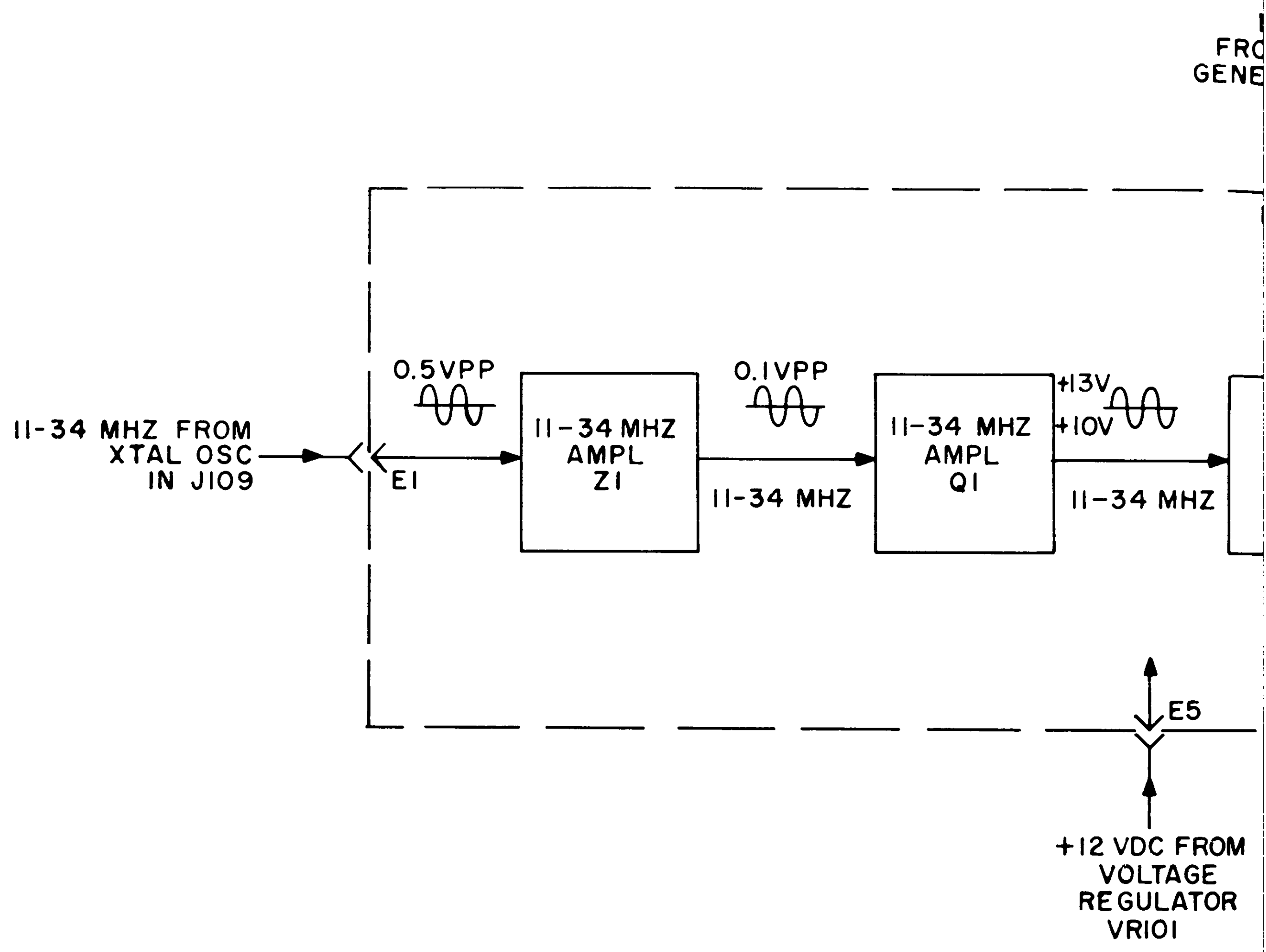


Figure 4-4. First Mixer Assembly Z101, Servicing Block Diagram


11-34 MHZ FROM
XTAL OSC
IN J109
E1
0.5VPP
11-34 MHZ
AMPL
Z1
0.1VPP
11-34 MHZ
11-34 MHZ
AMPL
Q1
+13V
+10V
11-34 MHZ
E5
+12 VDC FROM
VOLTAGE
REGULATOR
VR101
FRO
GENE

Ø12724018

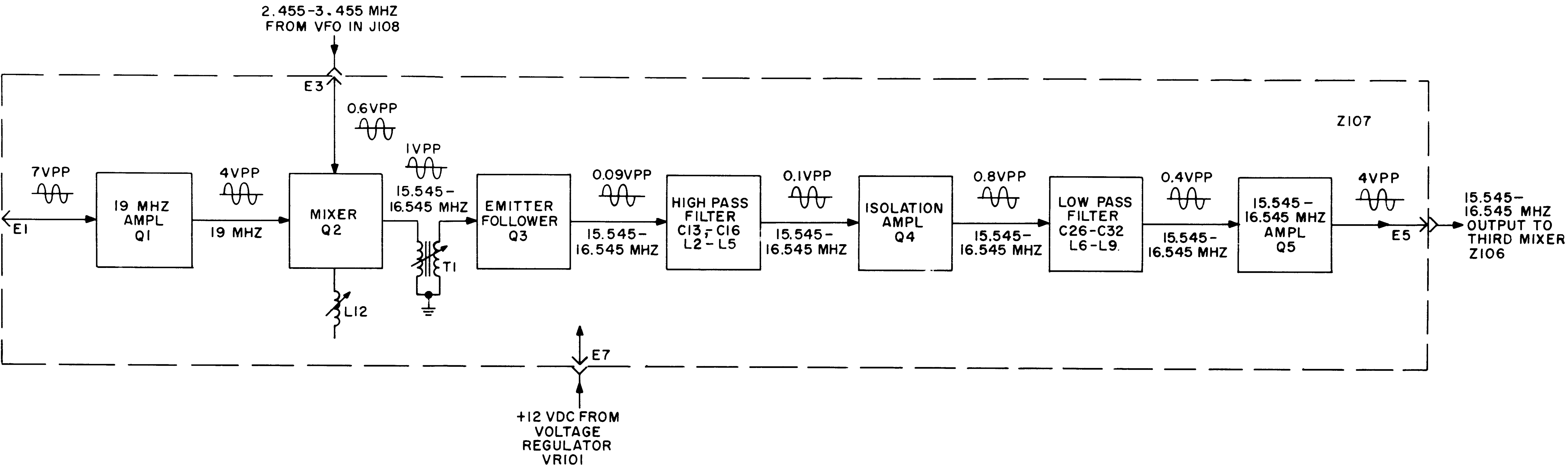
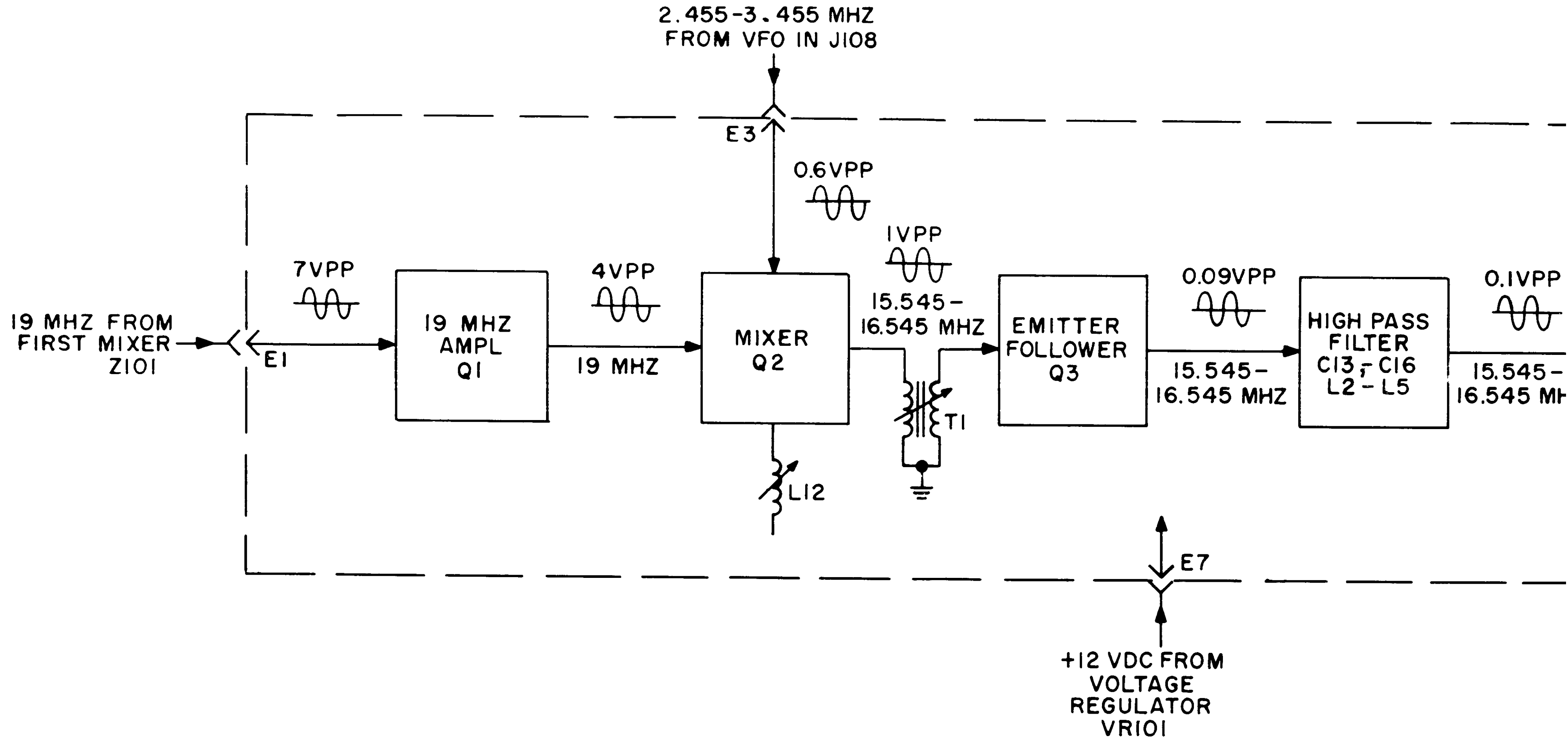


Figure 4-5. Second Mixer Assembly Z107, Servicing Block Diagram


2.455-3.455 MHZ
FROM VFO IN J108
E3
0.6VPP
19 MHZ FROM
FIRST MIXER
Z101
E1
7VPP
19 MHZ
AMPL
Q1
4VPP
19 MHZ
MIXER
Q2
L12
1VPP
15.545-
16.545 MHZ
T1
EMITTER
FOLLOWER
Q3
0.09VPP
15.545-
16.545 MHZ
HIGH PASS
FILTER
C13-C16
L2-L5
0.1VPP
15.545-
E7
+12 VDC FROM
VOLTAGE
REGULATOR
VR101

Ø12724018

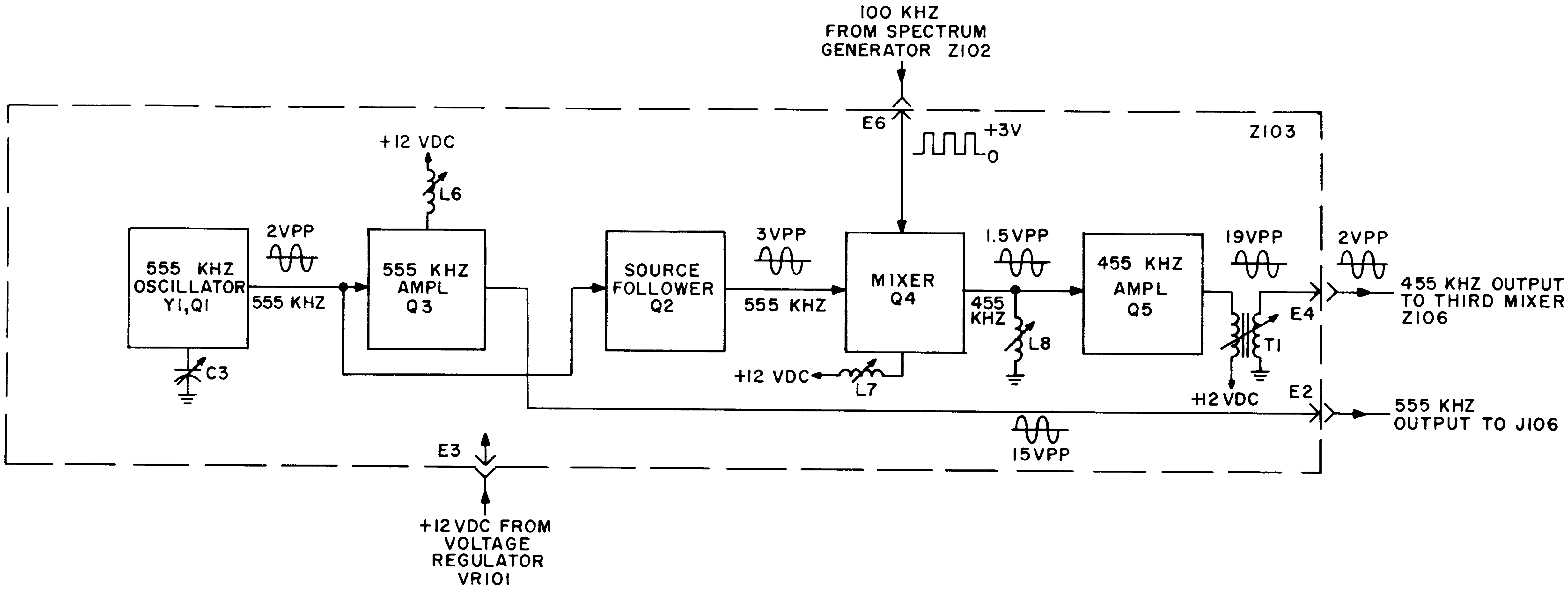


Figure 4-6. Fourth Mixer Assembly Z103, Servicing Block Diagram

Ø12724018

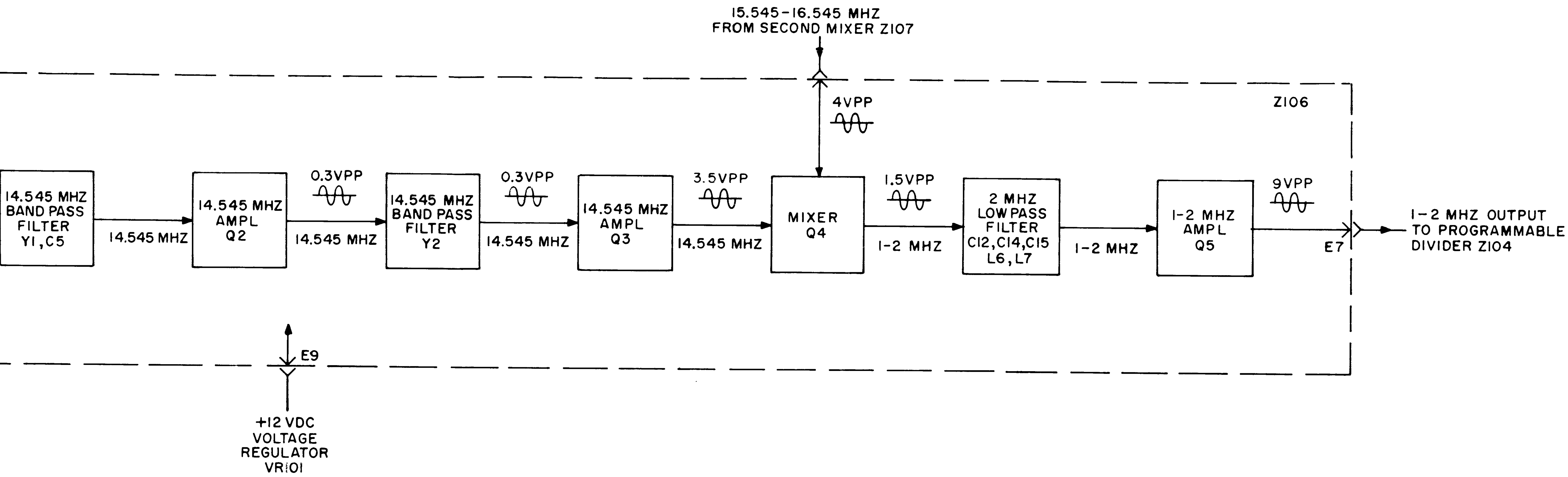
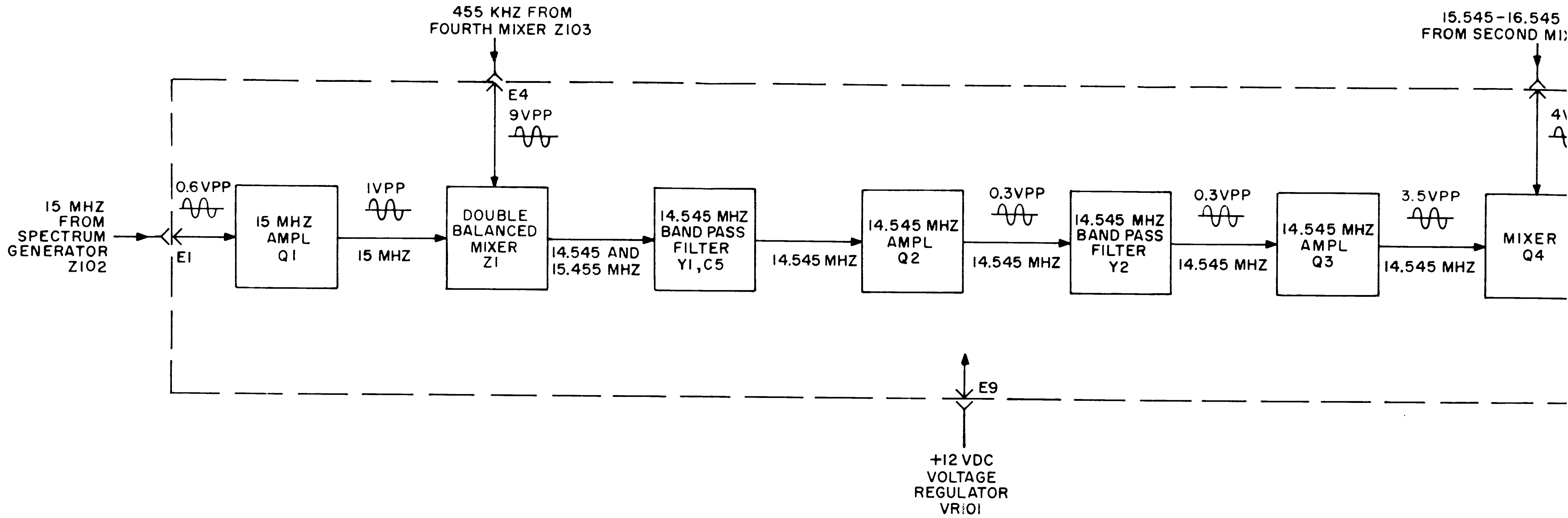


Figure 4-7. Third Mixer Assembly Z106, Servicing Block Diagram


455 KHZ FROM
FOURTH MIXER Z103
15.545-16.545
15 MHZ
FROM
SPECTRUM
GENERATOR
Z102
E1
0.6VPP
15 MHZ
AMPL
Q1
1VPP
15 MHZ
E4
9VPP
DOUBLE
BALANCED
MIXER
Z1
14.545 AND
15.455 MHZ
14.545 MHZ
BAND PASS
FILTER
Y1, C5
14.545 MHZ
14.545 MHZ
AMPL
Q2
0.3VPP
14.545 MHZ
14.545 MHZ
BAND PASS
FILTER
Y2
0.3VPP
14.545 MHZ
14.545 MHZ
AMPL
Q3
3.5VPP
14.545 MHZ
MIXER
Q4
E9
+12 VDC
VOLTAGE
REGULATOR
VR101

ø12724018

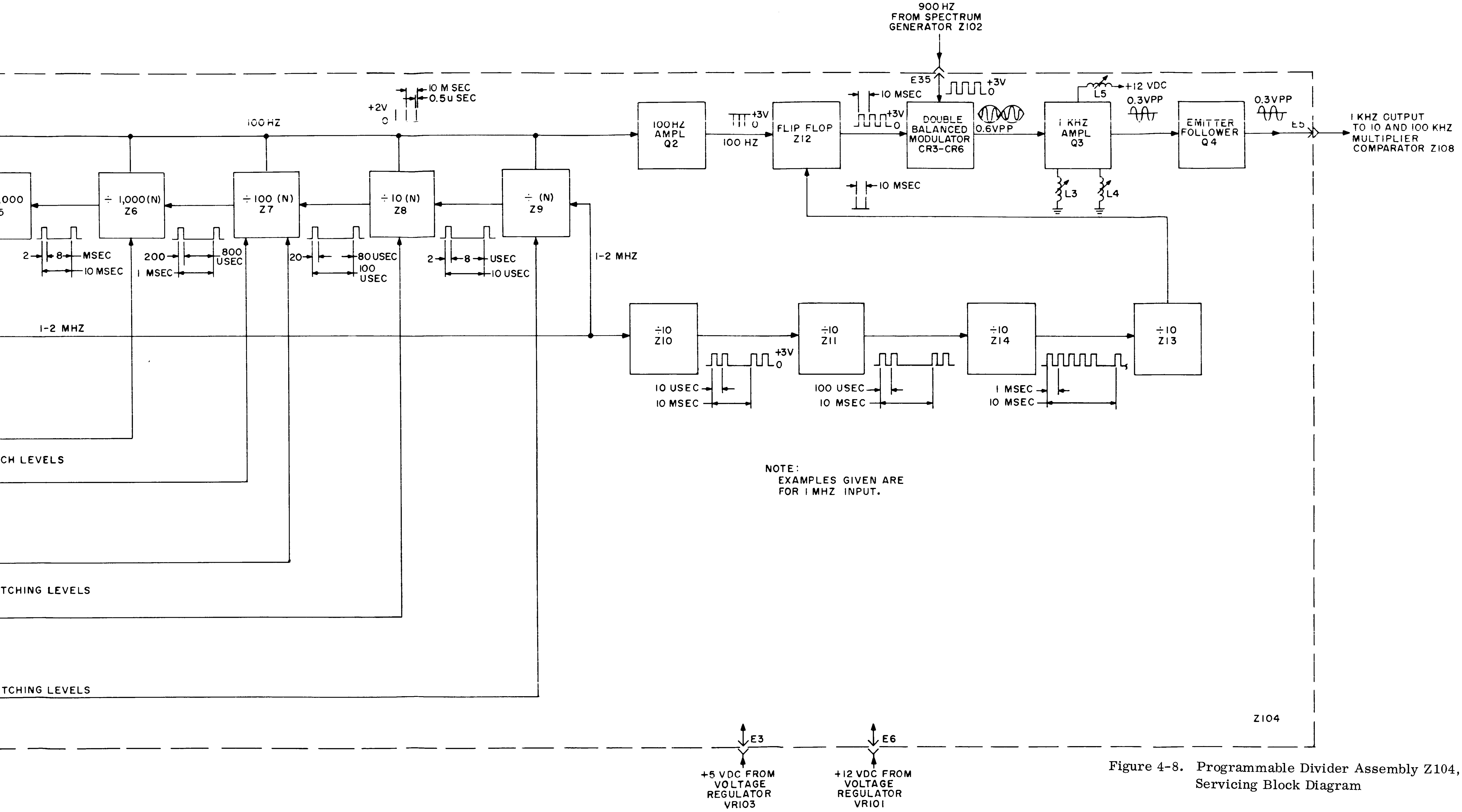
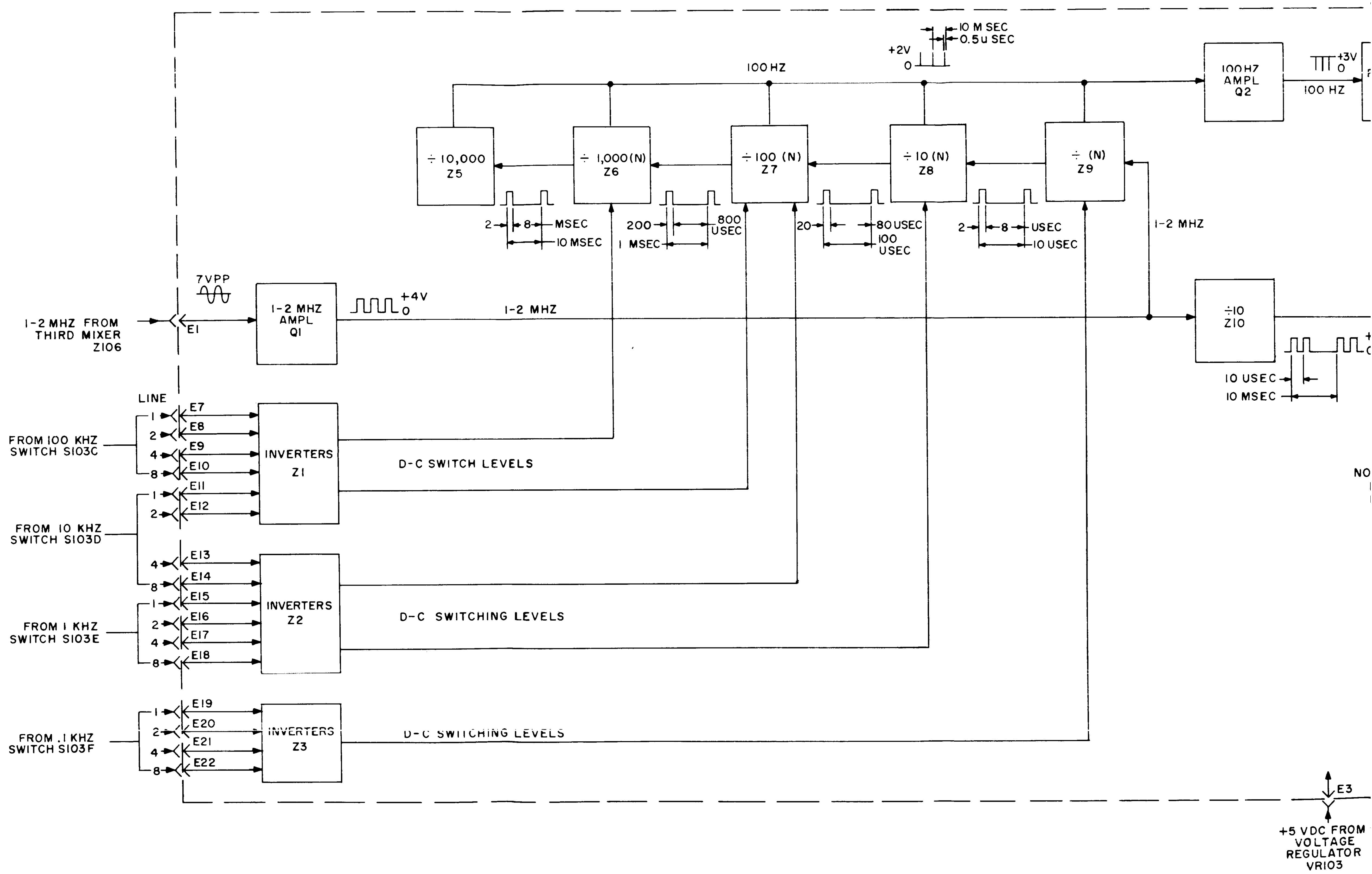


Figure 4-8. Programmable Divider Assembly Z104, Servicing Block Diagram



÷ 10,000
Z5
÷ 1,000(N)
Z6
÷ 100 (N)
Z7
÷ 10 (N)
Z8
÷ (N)
Z9
100HZ
AMPL
Q2
100 HZ
+3V
0
100 HZ
+2V
0
10 M SEC
0.5u SEC
2
8
MSEC
10 MSEC
200
800
USEC
1 MSEC
20
80 USEC
100
USEC
2
8
USEC
10 USEC
1-2 MHZ
÷10
Z10
10 USEC
10 MSEC
7VPP
1-2 MHZ FROM
THIRD MIXER
Z106
E1
1-2 MHZ
AMPL
Q1
+4V
0
1-2 MHZ
LINE
E7
E8
E9
E10
E11
E12
E13
E14
E15
E16
E17
E18
E19
E20
E21
E22
FROM 100 KHZ
SWITCH S103C
FROM 10 KHZ
SWITCH S103D
FROM 1 KHZ
SWITCH S103E
FROM .1 KHZ
SWITCH S103F
INVERTERS
Z1
INVERTERS
Z2
INVERTERS
Z3
D-C SWITCH LEVELS
D-C SWITCHING LEVELS
D-C SWITCHING LEVELS
E3
+5 VDC FROM
VOLTAGE
REGULATOR
VR103

Ø12724018

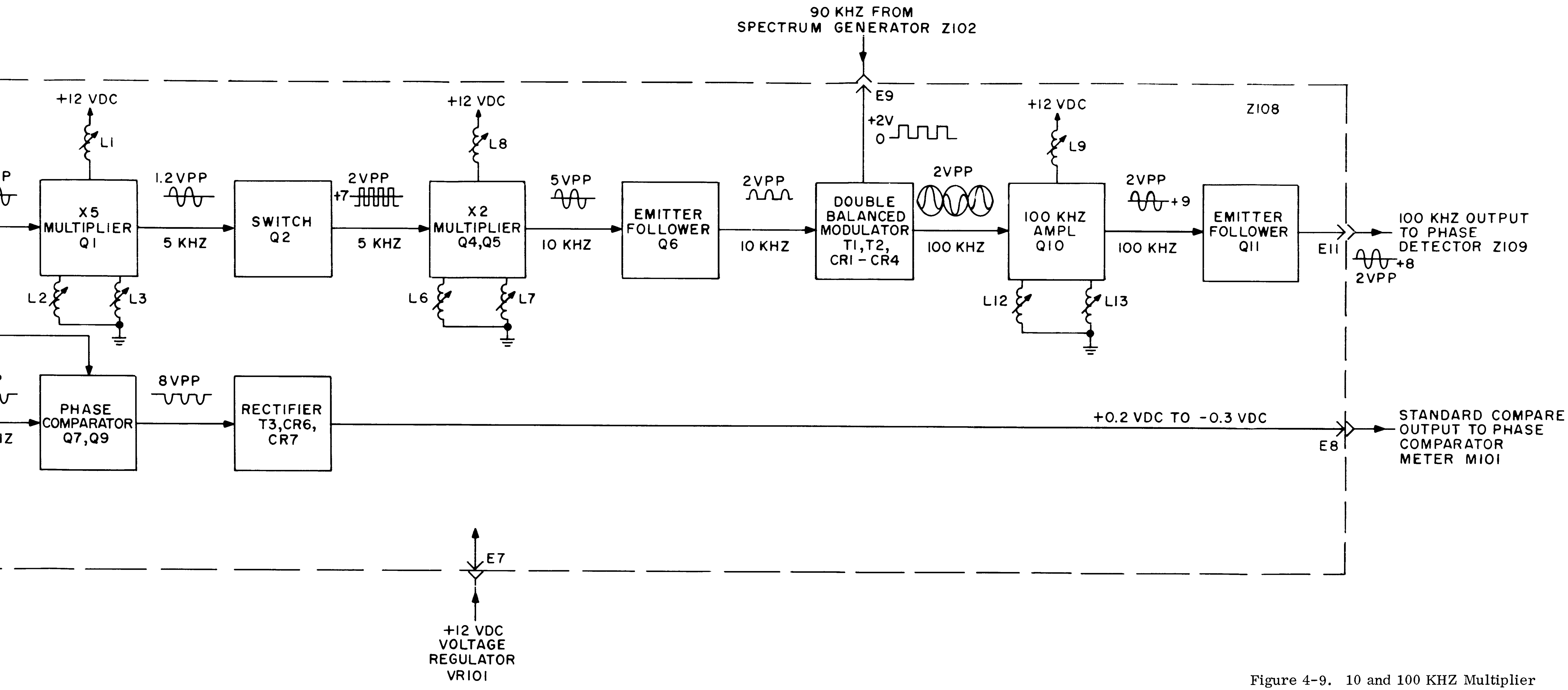
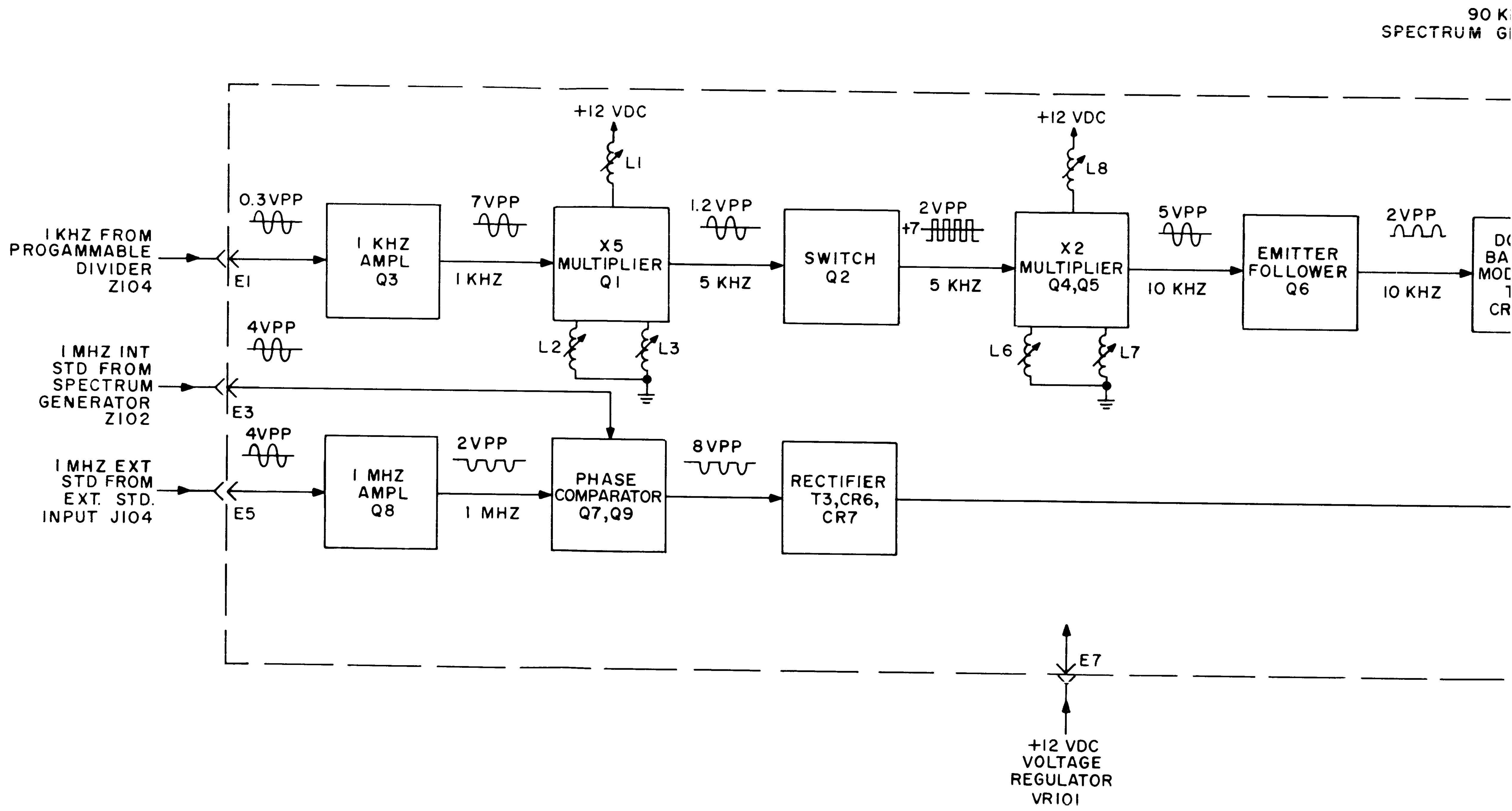


Figure 4-9. 10 and 100 KHZ Multiplier Comparator Assembly Z108, Servicing Block Diagram


90 K
SPECTRUM G
1 KHZ FROM PROGAMMABLE DIVIDER Z104
1 MHZ INT STD FROM SPECTRUM GENERATOR Z102
1 MHZ EXT STD FROM EXT. STD. INPUT J104
E1
E3
E5
E7
0.3VPP
4VPP
4VPP
1 KHZ AMPL Q3
7VPP
1 KHZ
X5 MULTIPLIER Q1
+12 VDC
L1
L2
L3
1.2VPP
5 KHZ
SWITCH Q2
2VPP
+7
5 KHZ
X2 MULTIPLIER Q4,Q5
+12 VDC
L8
L6
L7
5VPP
10 KHZ
EMITTER FOLLOWER Q6
2VPP
10 KHZ
1 MHZ AMPL Q8
2VPP
1 MHZ
PHASE COMPARATOR Q7,Q9
8VPP
RECTIFIER T3,CR6, CR7
+12 VDC VOLTAGE REGULATOR VR101

ø12724018

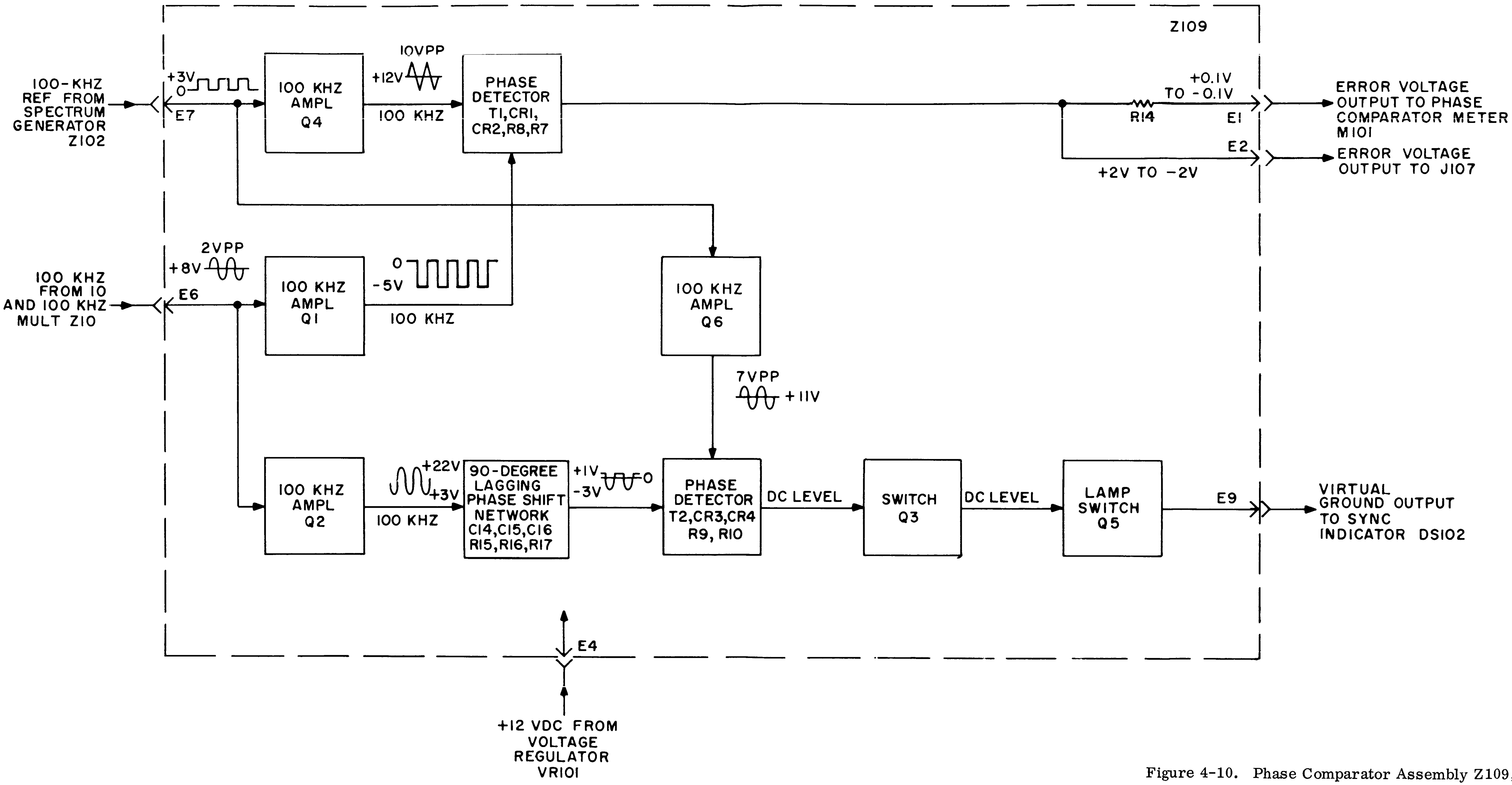


Figure 4-10. Phase Comparator Assembly Z109, Servicing Block Diagram

ø12724018

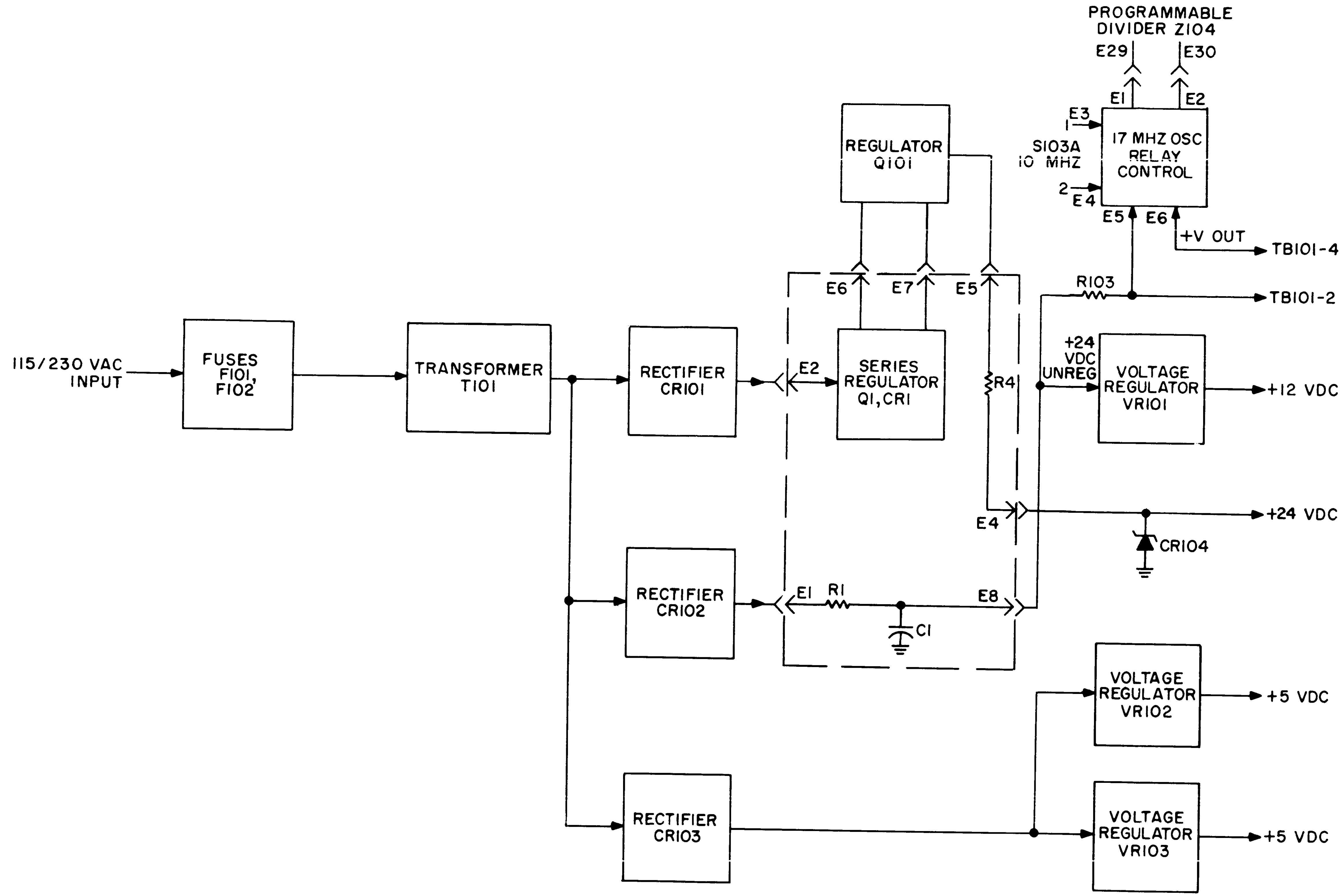


Figure 4-11. Power Supply Assembly Z105 and Associated Circuiting, Servicing Block Diagram

Ø12724018

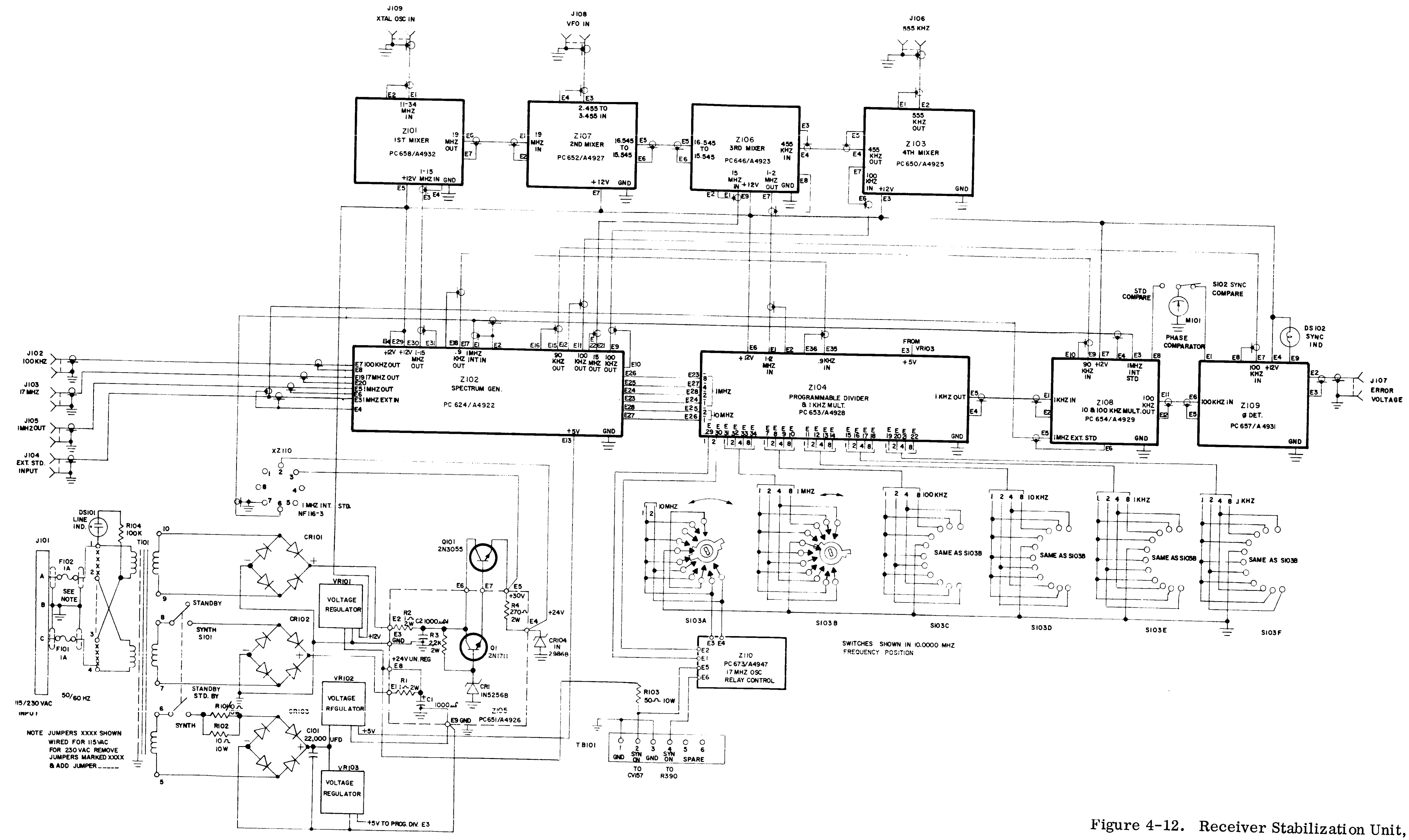


Figure 4-12. Receiver Stabilization Unit, Model RSU-1, Overall Schematic Diagram

Ø12724018
CK1971-C

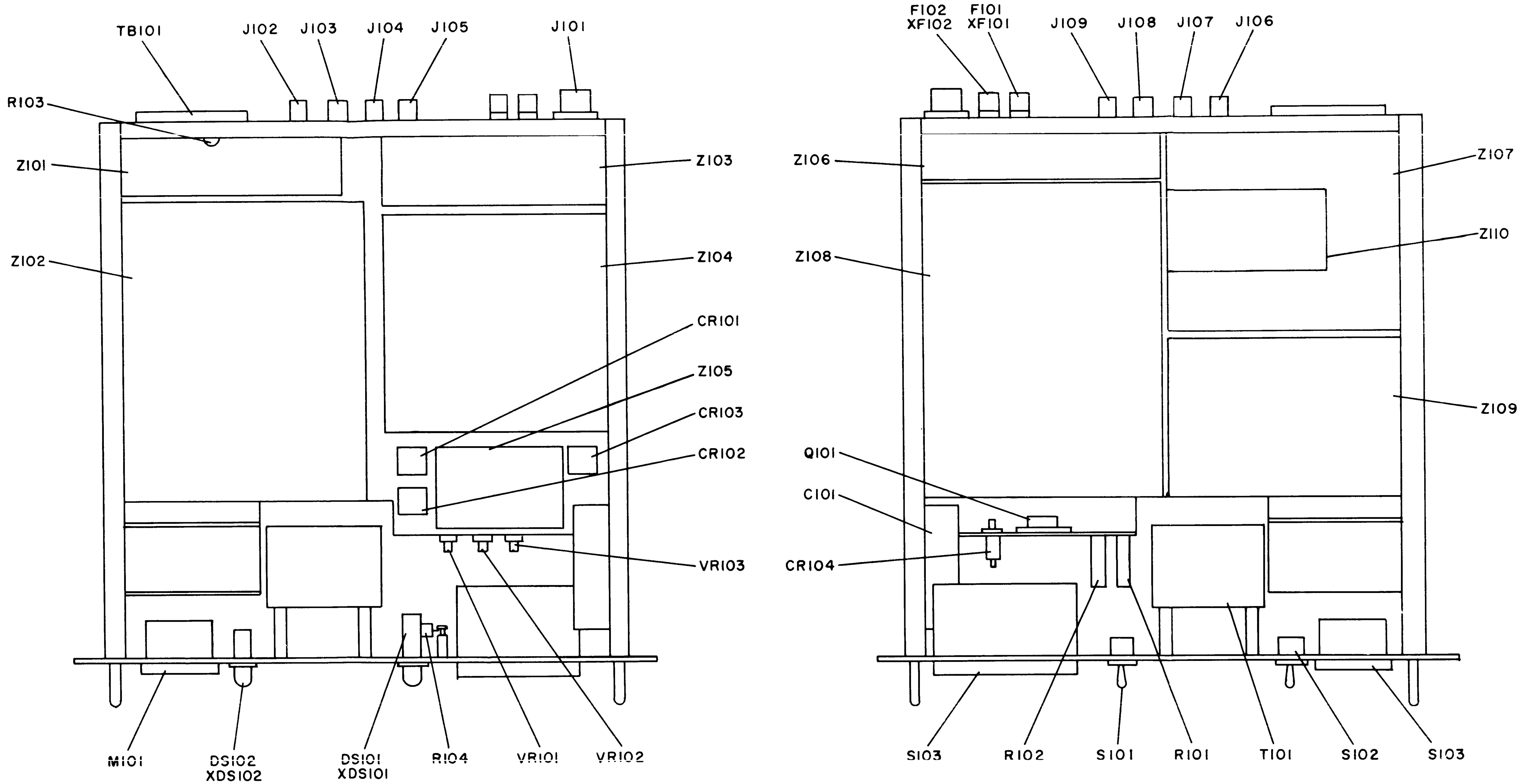


Figure 4-13. Receiver Stabilization Unit, Model RSU-1, Overall Component Location and Parts List

Parts List for RSU-1

SYMBOL	DESCRIPTION	TMC P/N
C101	Capacitor, Electrolytic	CE112-18
CR101	Diode	DD144-3
CR102	Same as CR101	
CR103	Same as CR101	
CR104	Diode, Zener	1N2986B
DS101	Lamp, Neon	BI111-1
DS102	Lamp, Incandescent	BI110-6
F101	Fuse, Slow Blow	FU102-1
F102	Same as F101	
J101	Connector, A-C	MS3102A-16S-5P
J102 thru J109	Connector, BNC	UG625*/U
M101	Meter	MR206
Q101	Transistor	2N3055
R101	Resistor, Fixed, Composition	RW109-4
R102	Same as R101	
R103	Resistor, Fixed, Composition	RW109-7
R104	Resistor, Fixed, Composition	RC20GF104J
S101	Switch, DPDT	ST103-25-62
S102	Same as S101	
S103	Switch, Frequency Select	SW549
T101	Transformer, Power	TF372
TB101	Terminal Strip	TM100-6
VR101	Voltage Regulator	UGH7805
VR102	Voltage Regulator	UGH7812
VR103	Same as VR101	
XDS101	Socket, Lamp	TS154-5
XDS102	Socket, Lamp	TS153-9
XF101	Holder, Fuxe	FH100-1
XF102	Same as XF101	
Z101	First Mixer Assembly	A-4932
Z102	Spectrum Generator Assembly	A-4922
Z103	Fourth Mixer Assembly	A-4925
Z104	Programmable Divider Assembly	A-4928
Z105	Power Supply Assembly	A-4926
Z106	Third Mixer Assembly	A-4923
Z107	Second Mixer Assembly	A-4927
Z108	10 and 100 khz Multiplier Comparator Assembly	A-4929
Z109	Phase Detector Assembly	A-4931
Z110	Oscillator Relay Control Assembly	A-4947

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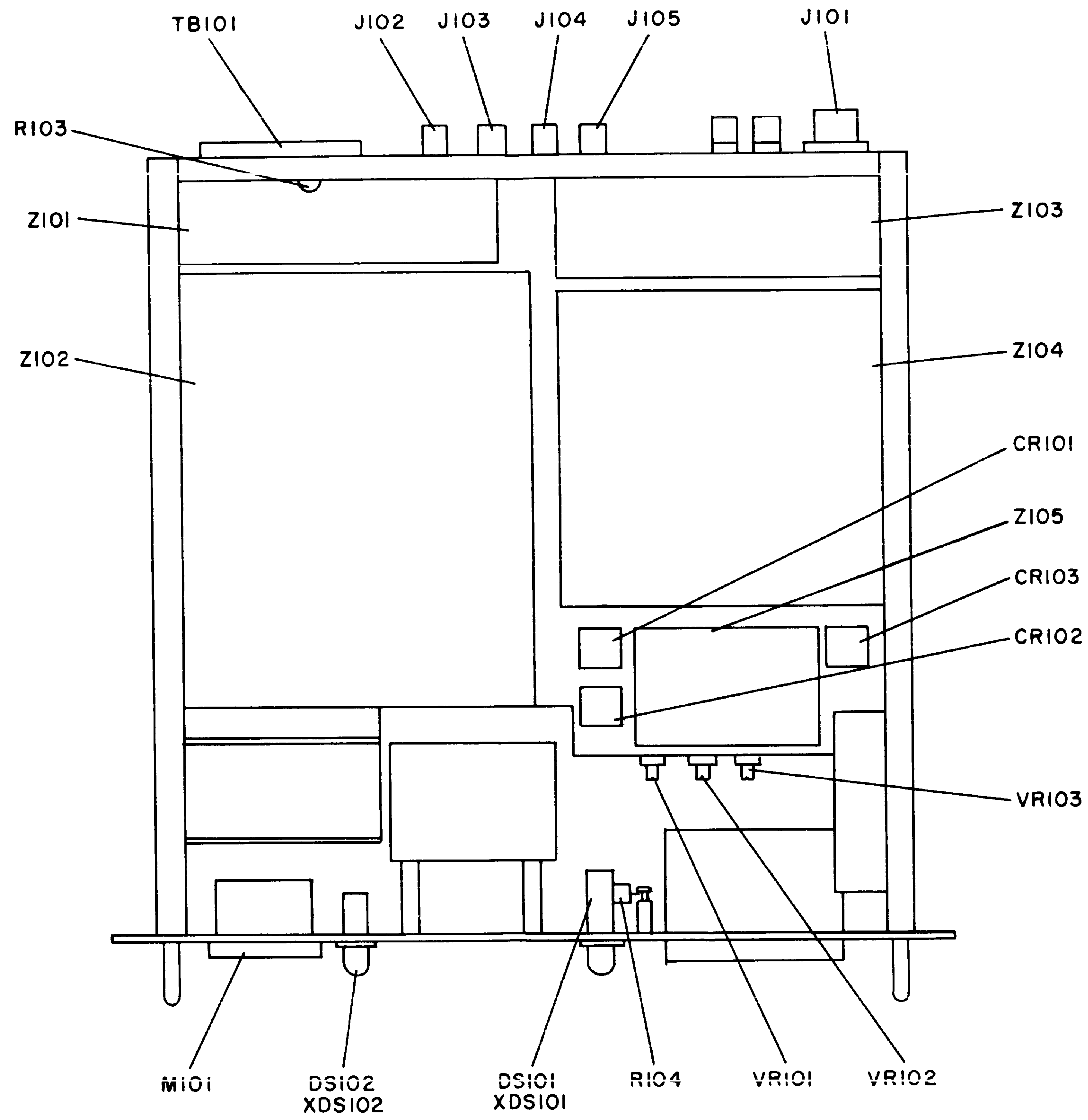

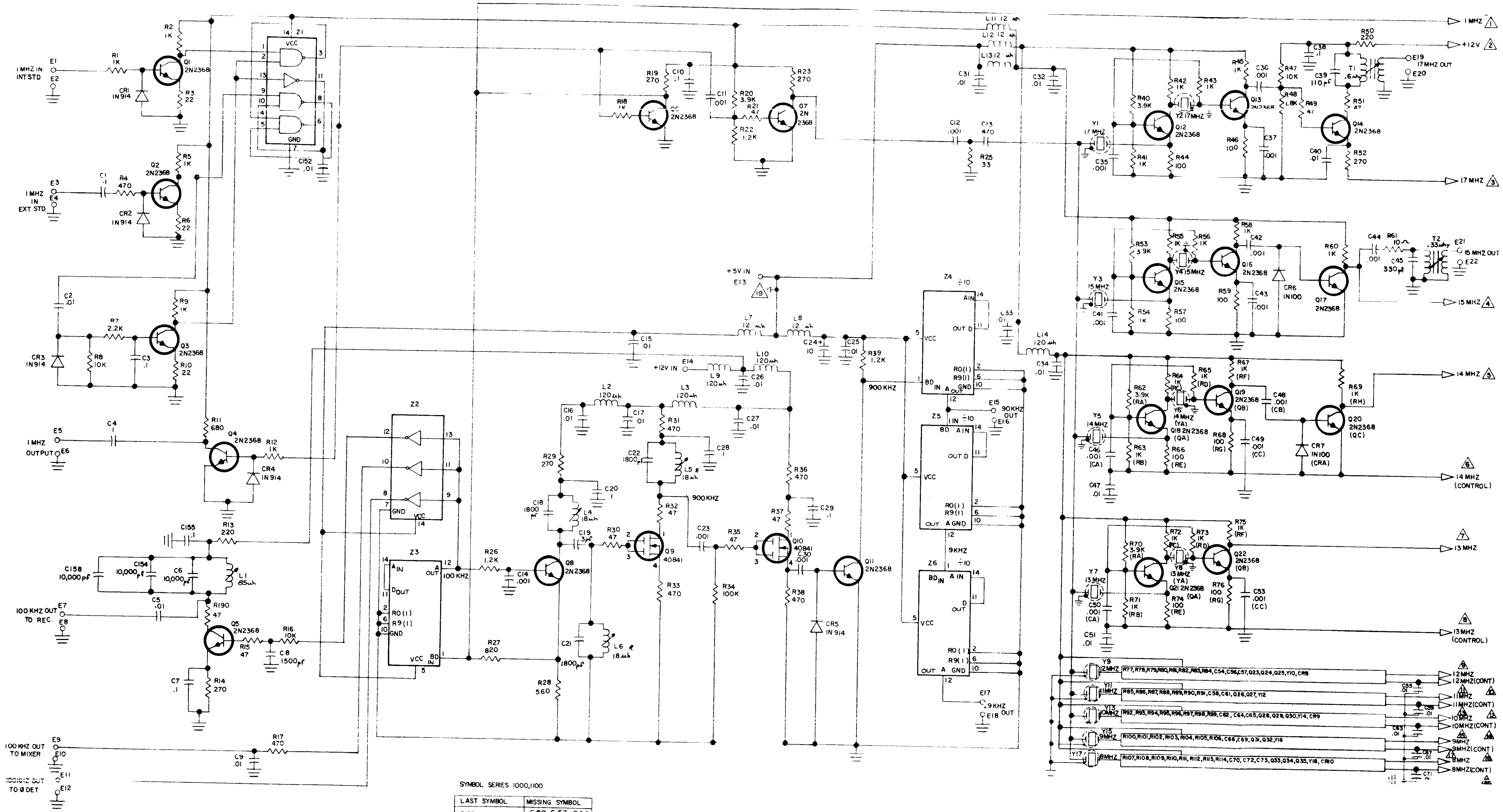

SYMBOL SERIES 1000,1100

LAST SYMBOL	MISSING SYMBOL
C158	C89, C52, C60
CR10	C68
E31	
L16	
Q50	
R189	R24
T17	
Y18	
Z26	

Figure 4-14. Spectrum Generator Assembly Z102, Schematic Diagram (Sheet 1 of 2)

Ø12724018
CK1959-C

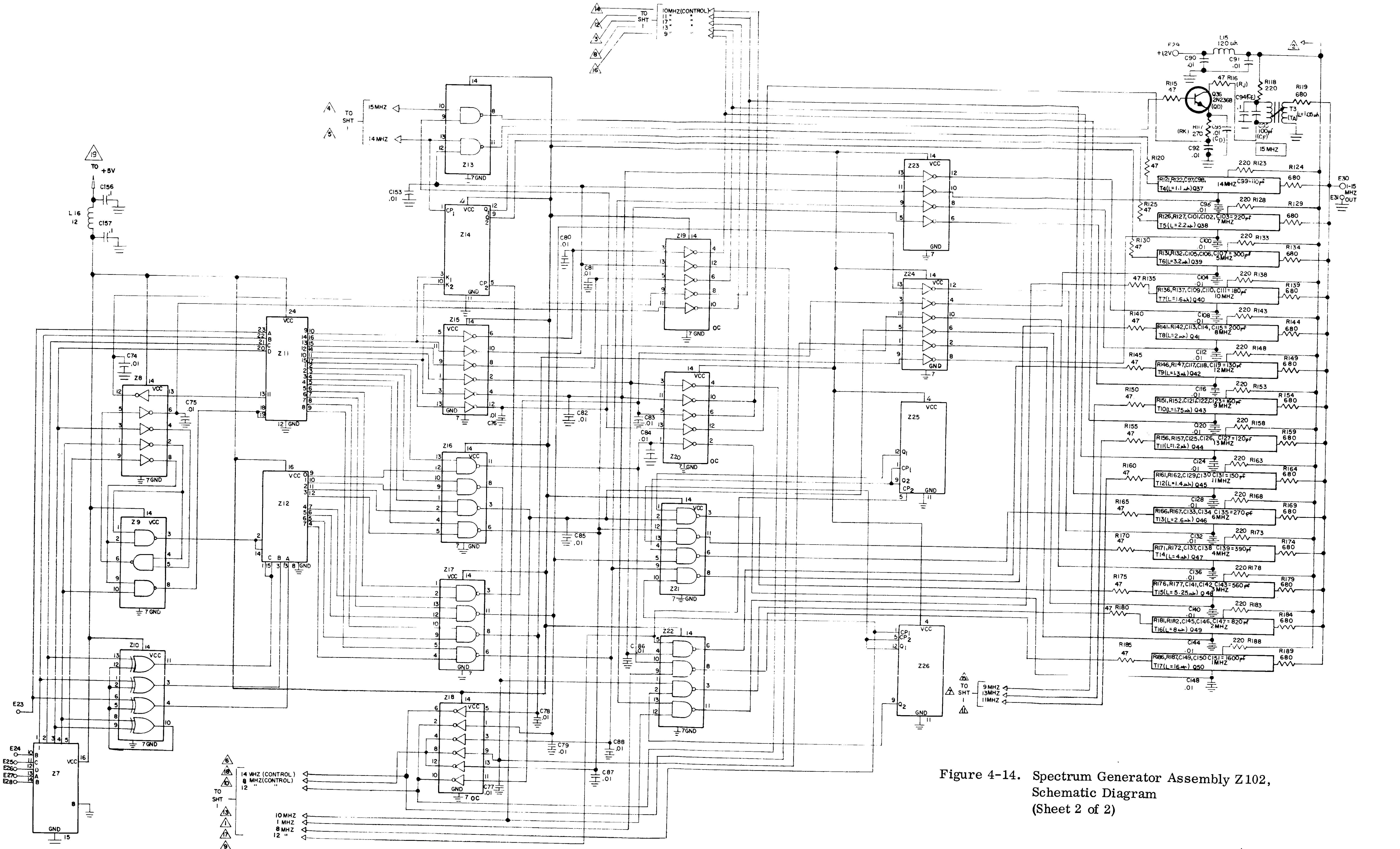

Figure 4-14. Spectrum Generator Assembly Z102, Schematic Diagram (Sheet 2 of 2)

Ø12724018
CK1959-C

C46	Same as C11	
C47	Same as C2	
C48	Same as C11	
C49	Same as C11	
C50	Same as C11	
C51	Same as C2	
C52	Not used	
C53	Same as C11	
C54	Same as C11	
C55	Same as C2	
C56	Same as C11	
C57	Same as C11	
C58	Same as C11	
C59	Same as C2	
C60	Not used	
C61	Same as C11	
C62	Same as C11	
C63	Same as C2	
C64	Same as C11	
C65	Same as C11	
C66	Same as C11	
C67	Same as C2	
C68	Not used	
C69	Same as C11	
C70	Same as C11	
C71	Same as C2	
C72	Same as C11	
C73	Same as C11	
C74 thru C88	Same as C2	
C89	Not used	
C90 thru C93	Same as C2	
C94	Same as C1	
C95	Capacitor, Fixed, Mica	CM111E101J1S
C96	Same as C2	
C97	Same as C2	
C98	Capacitor, Fixed, Ceramic	CC100-28
C99	Same as C39	
C100	Same as C2	
C101	Same as C2	
C102	Same as C98	
C103	Capacitor, Fixed, Mica	CM111E221J1S
C104	Same as C2	
C105	Same as C2	
C106	Same as C98	
C107	Capacitor, Fixed, Mica	CM111E301J1S
C108	Same as C2	
C109	Same as C2	
C110	Same as C98	
C111	Capacitor, Fixed, Mica	CM111E181J1S
C112	Same as C2	
C113	Same as C2	
C114	Same as C98	
C115	Capacitor, Fixed, Mica	CM111E201J1S
C116	Same as C2	
C117	Same as C2	
C118	Same as C98	
C119	Capacitor, Fixed, Mica	CM111E131J1S
C120	Same as C2	
C121	Same as C2	
C122	Same as C98	
C123	Capacitor, Fixed, Mica	CM111E161J1S
C124	Same as C2	
C125	Same as C2	
C126	Same as C98	
C127	Capacitor, Fixed, Mica	CM111E121J1S
C128	Same as C2	
C129	Same as C2	
C130	Same as C98	
C131	Capacitor, Fixed, Mica	CM111E151J1S
C132	Not used	
C133	Same as C2	
C134	Same as C98	
C135	Capacitor, Fixed, Mica	CM111E271J1S
C136	Same as C2	
C137	Same as C2	
C138	Same as C98	
C139	Capacitor, Fixed, Mica	CM111E391J1S
C140	Same as C2	
C141	Same as C2	
C142	Same as C98	
C143	Capacitor, Fixed, Mica	CM111E561J1S
C144	Same as C2	
C145	Same as C2	
C146	Same as C98	
C147	Capacitor, Fixed, Mica	CM111E821J1S
C148	Same as C2	
C149	Same as C2	
C150	Same as C98	
C151	Capacitor, Fixed, Mica	CM112E162J1S
C152	Same as C2	
C153	Same as C2	
C154	Same as C6	
C155	Same as C1	
C156	Same as C1	
C157	Same as C1	
C158	Same as C6	
CR1 thru CR5	Semiconductor, Device, Diode	1N914
CR6 thru CR10	Semiconductor, Device, Diode	1N100
L1	Coil, Variable	TT307-14
L2	Coil, Fixed	CL275-121
L3	Same as L2	
L4	Coil, Variable	TT307-6
L5	Same as L4	
L6	Same as L4	
L7	Coil, Fixed	CL275-120
L8	Same as L1	
L9	Same as L2	
L10	Same as L2	
L11	Same as L8	
L12	Same as L7	
L13	Same as L7	
L14	Same as L2	
L15	Same as L2	
L16	Same as L7	
Q1 thru Q8	Transistor	2N2368
Q9	Transistor, Field Effect	40841
Q10	Same as Q9	
Q11 thru Q50	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF102J
R2	Same as R1	
R3	Resistor, Fixed, Composition	RC07GF220J

Figure 4-15. Spectrum Generator Assembly Z102, Component Location and Parts List (Sheet 1 of 3)

Parts List for A-4922

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-28
C2	Capacitor, Fixed, Ceramic	CC100-43
C3	Same as C1	
C4	Same as C1	
C5	Same as C2	
C6	Capacitor, Fixed, Mica	CM112E103J1S
C7	Same as C1	
C8	Capacitor, Fixed, Mica	CM112E152J1S
C9	Same as C2	
C10	Same as C1	
C11	Capacitor, Fixed, Ceramic	CC100-29
C12	Same as C11	
C13	Capacitor, Fixed, Mica	CM111E491J1S
C14	Same as C11	
C15	Same as C2	
C16	Same as C2	
C17	Same as C2	
C18	Capacitor, Fixed, Mica	CM112E182J1S
C19	Capacitor, Fixed, Mica	CM111E030J1S
C20	Capacitor, Fixed, Mylar	CN-114-1R05J
C21	Same as C18	
C22	Same as C18	
C23	Same as C11	
C24	Capacitor, Electrolytic	CE-105-10-25
C25	Same as C2	
C26	Same as C2	
C27	Same as C2	
C28	Same as C1	
C29	Same as C1	
C30	Same as C11	
C31	Same as C2	
thru		
C34		
C35	Same as C11	
C36	Same as C11	
C37	Same as C11	
C38	Same as C1	
C39	Capacitor, Fixed, Mica	CM111E111J1S
C40	Same as C2	
C41	Same as C11	
thru		
C44		
C45	Capacitor, Fixed, Electrolytic	CM111E331JS
C46	Same as C11	
C47	Same as C2	
C48	Same as C11	
C49	Same as C11	
C50	Same as C11	
C51	Same as C2	
C52	Not used	
C53	Same as C11	
C54	Same as C11	
C55	Same as C2	
C56	Same as C11	
C57	Same as C11	
C58	Same as C11	
C59	Same as C2	
C60	Not used	
C61	Same as C11	
C62	Same as C11	
C63	Same as C2	
C64	Same as C11	
C65	Same as C11	
C66	Same as C11	
C67	Same as C2	
C68	Not used	
C69	Same as C11	
C70	Same as C11	
C71	Same as C2	
C72	Same as C11	
C73	Same as C11	
C74	Same as C2	
thru		
C88		
C89	Not used	
C90	Same as C2	
thru		
C93		
C94	Same as C1	
C95	Capacitor, Fixed, Mica	CM111E101J1S
C96	Same as C2	
C97	Same as C2	
C98	Capacitor, Fixed, Ceramic	CC100-28
C99	Same as C39	
C100	Same as C2	
C101	Same as C2	
C102	Same as C98	
C103	Capacitor, Fixed, Mica	CM111E221J1S
C104	Same as C2	
C105	Same as C2	
C106	Same as C98	
C107	Capacitor, Fixed, Mica	
C108	Same as C2	
C109	Same as C2	
C110	Same as C98	
C111	Capacitor, Fixed, Mica	
C112	Same as C2	
C113	Same as C2	
C114	Same as C98	
C115	Capacitor, Fixed, Mica	
C116	Same as C2	
C117	Same as C2	
C118	Same as C98	
C119	Capacitor, Fixed, Mica	
C120	Same as C2	
C121	Same as C2	
C122	Same as C98	
C123	Capacitor, Fixed, Mica	
C124	Same as C2	
C125	Same as C2	
C126	Same as C98	
C127	Capacitor, Fixed, Mica	
C128	Same as C2	
C129	Same as C2	
C130	Same as C98	
C131	Capacitor, Fixed, Mica	
C132	Not used	
C133	Same as C2	
C134	Same as C98	
C135	Capacitor, Fixed, Mica	
C136	Same as C2	
C137	Same as C2	
C138	Same as C98	
C139	Capacitor, Fixed, Mica	
C140	Same as C2	
C141	Same as C2	
C142	Same as C98	
C143	Capacitor, Fixed, Mica	
C144	Same as C2	
C145	Same as C2	
C146	Same as C98	
C147	Capacitor, Fixed, Mica	
C148	Same as C2	
C149	Same as C2	
C150	Same as C98	
C151	Capacitor, Fixed, Mica	
C152	Same as C2	

List for A-4922

RIPTION	TMC P/N
xed, Composition	RC07GF471J
xed, Composition	RC07GF222J
xed, Composition	RC07GF103J
xed, Composition	RC07GF681J
xed, Composition	RC07GF221J
xed. Composition	RC07GF271J
xed, Composition	RC07GF470J
xed, Composition	RC07GF392J
xed, Composition	RC07GF122J
xed, Composition	RC07GF330J
xed, Composition	RC07GF821J
xed, Composition	RC07GF561J
xed, Composition	RC07GF104J
xed, Composition	RC07GF101J
xed, Composition	RC07GF182J

R49	Same as R15	
R50	Same as R13	
R51	Same as R15	
R52	Same as R14	
R53	Same as R20	
R54	Same as R1	
R55	Same as R1	
R57	Same as R46	
R58	Same as R1	
R59	Same as R46	
R60	Same as R1	
R61	Resistor, Fixed, Composition	RC07GF100J
R62	Same as R20	
R63	Same as R1	
R64	Same as R1	
R65	Same as R1	
R66	Same as R46	
R67	Same as R1	
R68	Same as R46	
R69	Same as R1	
R70	Same as R20	
R71	Same as R1	
R72	Same as R1	
R73	Same as R1	
R74	Same as R46	
R75	Same as R1	
R76	Same as R46	
R77	Same as R20	
R78	Same as R1	
R79	Same as R1	
R80	Same as R1	
R81	Same as R46	
R82	Same as R1	
R83	Same as R46	
R84	Same as R1	
R85	Same as R20	
R86	Same as R1	
R87	Same as R1	
R88	Same as R1	
R89	Same as R46	
R90	Same as R1	
R91	Same as R46	
R92	Same as R20	
R93	Same as R1	
R94	Same as R1	
R95	Same as R1	

R143

R96	Same as R46
R97	Same as R1
R98	Same as R46
R99	Same as R1
R100	Same as R20
R101	Same as R1
R102	Same as R1
R103	Same as R1
R104	Same as R46
R105	Same as R1
R106	Same as R46
R107	Same as R20
R108	Same as R1
R109	Same as R1
R110	Same as R1
R111	Same as R46
R112	Same as R1
R113	Same as R1
R115	Same as R15
R116	Same as R15
R117	Same as R14
R118	Same as R13
R119	Same as R11
R120	Same as R15
R121	Same as R15
R122	Same as R14
R123	Same as R13
R124	Same as R11
R125	Same as R15
R126	Same as R15
R127	Same as R14
R128	Same as R13
R129	Same as R11
R130	Same as R15
R131	Same as R15
R132	Same as R14
R133	Same as R13
R134	Same as R11
R135	Same as R15
R136	Same as R15
R137	Same as R14
R138	Same as R13
R139	Same as R11
R140	Same as R15
R141	Same as R15
R142	Same as R14
R143	Same as R13

R144	Same as R11
R145	Same as R15
R146	Same as R15
R147	Same as R14
R148	Same as R13
R149	Same as R11
R150	Same as R15
R151	Same as R15
R152	Same as R14
R153	Same as R13
R154	Same as R11
R155	Same as R15
R156	Same as R15
R157	Same as R14
R158	Same as R13
R159	Same as R11
R160	Same as R15
R161	Same as R15
R162	Same as R14
R163	Same as R13
R164	Same as R11
R165	Same as R15
R166	Same as R15
R167	Same as R14
R168	Same as R13
R169	Same as R11
R170	Same as R15
R171	Same as R15
R172	Same as R14
R173	Same as R13
R174	Same as R11
R175	Same as R15
R176	Same as R15
R177	Same as R14
R178	Same as R13
R179	Same as R11
R180	Same as R15
R181	Same as R15
R182	Same as R14

Figure 4-15. Spectrum Generator Assembly Z102, Component Location and Parts List (Sheet 2 of 3)

Parts List for A-4922

SYMBOL	DESCRIPTION	TMC P/N
R4	Resistor, Fixed, Composition	RC07GF471J
R5	Same as R1	
R6	Same as R3	
R7	Resistor, Fixed, Composition	RC07GF222J
R8	Resistor, Fixed, Composition	RC07GF103J
R9	Same as R1	
R10	Same as R3	
R11	Resistor, Fixed, Composition	RC07GF681J
R12	Same as R1	
R13	Resistor, Fixed, Composition	RC07GF221J
R14	Resistor, Fixed, Composition	RC07GF271J
R15	Resistor, Fixed, Composition	RC07GF470J
R16	Same as R8	
R17	Same as R4	
R18	Same as R1	
R19	Same as R14	
R20	Resistor, Fixed, Composition	RC07GF392J
R21	Same as R15	
R22	Resistor, Fixed, Composition	RC07GF122J
R23	Same as R14	
R24	Not used	
R25	Resistor, Fixed, Composition	RC07GF330J
R26	Same as R22	
R27	Resistor, Fixed, Composition	RC07GF821J
R28	Resistor, Fixed, Composition	RC07GF561J
R29	Same as R14	
R30	Same as R15	
R31	Same as R4	
R32	Same as R15	
R33	Same as R4	
R34	Resistor, Fixed, Composition	RC07GF104J
R35	Same as R15	
R36	Same as R4	
R37	Same as R15	
R38	Same as R4	
R39	Same as R22	
R40	Same as R20	
R41 thru R45	Same as R1	
R46	Resistor, Fixed, Composition	RC07GF101J
R47	Same as R8	
R48	Resistor, Fixed, Composition	RC07GF182J

SYMBOL	DESCRIPTION	TMC P/N
R49	Same as R15	
R50	Same as R13	
R51	Same as R15	
R52	Same as R14	
R53	Same as R20	
R54	Same as R1	
R55	Same as R1	
R57	Same as R46	
R58	Same as R1	
R59	Same as R46	
R60	Same as R1	
R61	Resistor, Fixed, Composition	RC07GF100J
R62	Same as R20	
R63	Same as R1	
R64	Same as R1	
R65	Same as R1	
R66	Same as R46	
R67	Same as R1	
R68	Same as R46	
R69	Same as R1	
R70	Same as R20	
R71	Same as R1	
R72	Same as R1	
R73	Same as R1	
R74	Same as R46	
R75	Same as R1	
R76	Same as R46	
R77	Same as R20	
R78	Same as R1	
R79	Same as R1	
R80	Same as R1	
R81	Same as R46	
R82	Same as R1	
R83	Same as R46	
R84	Same as R1	
R85	Same as R20	
R86	Same as R1	
R87	Same as R1	
R88	Same as R1	
R89	Same as R46	
R90	Same as R1	
R91	Same as R46	
R92	Same as R20	
R93	Same as R1	
R94	Same as R1	
R95	Same as R1	

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11R0

10R0

9R0

8R0

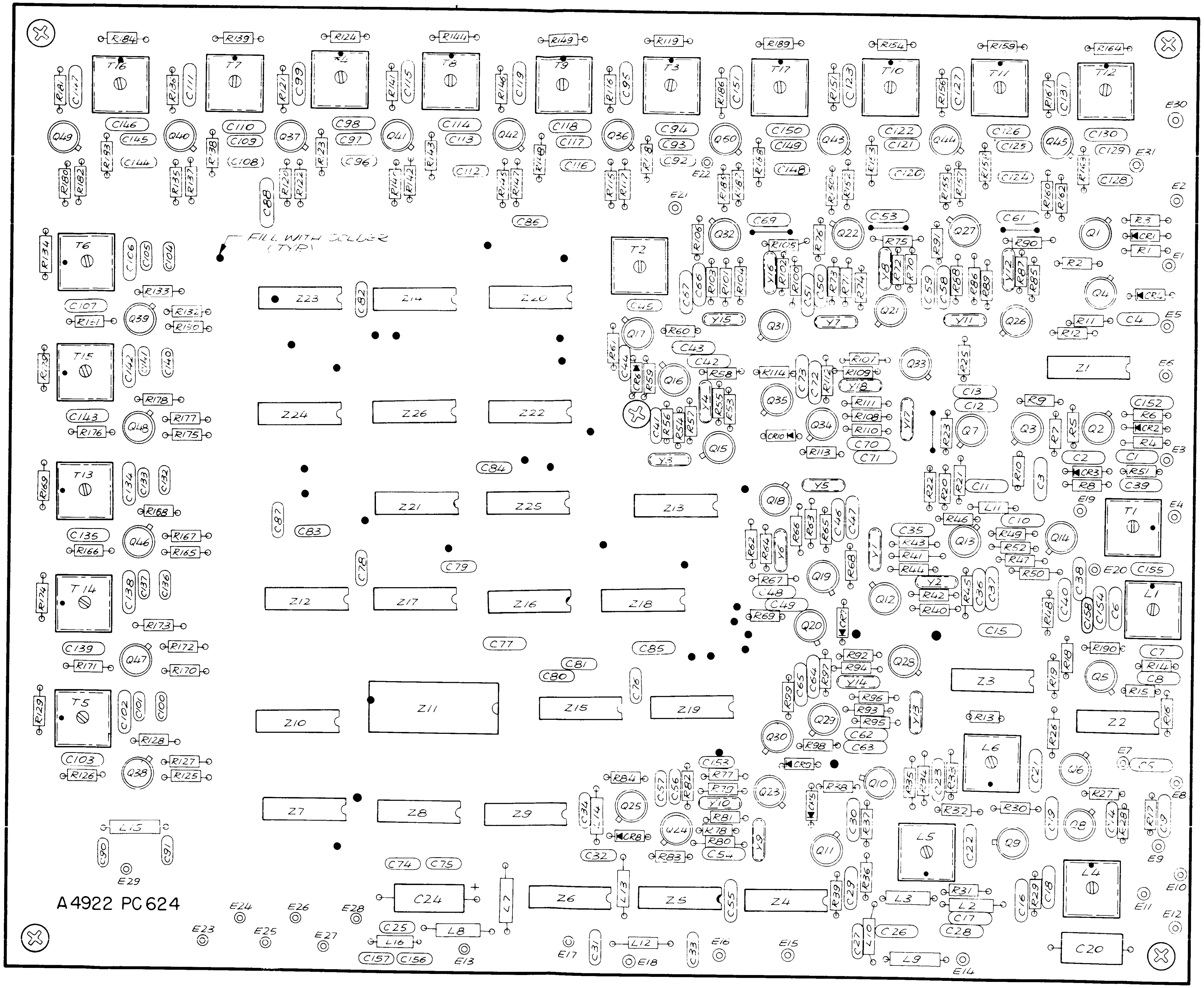

Figure 4-15. Spectrum Generator Assembly Z102, Component Location and Parts List (Sheet 3 of 3)

Parts List for A-4922

SYMBOL	DESCRIPTION	TMC P/N			
R183	Same as R13		Y10	Same as Y9	
R184	Same as R11		Y11	Crystal	CR119-11R0
R185	Same as R15		Y12	Same as Y11	
R186	Same as R15		Y13	Crystal	CR119-10R0
R187	Same as R14		Y14	Same as Y13	
R188	Same as R13		Y15	Crystal	CR119-9R0
R189	Same as R11		Y16	Same as Y15	
R190	Same as R15		Y17	Crystal	CR119-8R0
T1	Transformer	TT307-16	Y18	Same as Y17	
T2	Transformer	TT307-15	Z1	Integrated Circuit	NW176
T3	Transformer	TT307-1	Z2	Integrated Circuit	NW187
T4	Same as T3		Z3	Integrated Circuit	NW190
T5	Transformer	TT307-2	thru		
T6	Transformer	TT307-3	Z6		
T7	Same as T3		Z7	Integrated Circuit	NW191
T8	Same as T5		Z8	Same as Z2	
T9	Same as T3		Z9	Same as Z1	
T10	Same as T5		Z10	Integrated Circuit	NW189
T11	Same as T3		Z11	Integrated Circuit	NW185
T12	Same as T3		Z12	Integrated Circuit	NW186
T13	Same as T5		Z13	Same as Z1	
T14	Same as T6		Z14	Integrated Circuit	NW159
T15	Same as T6		Z15	Same as Z2	
T16	Transformer	TT307-4	Z16	Same as Z1	
T17	Transformer	TT307-5	Z17	Same as Z1	
Y1	Crystal	CR119-17R0	Z18	Integrated Circuit	NW188
Y2	Same as Y1		Z19	Same as Z18	
Y3	Crystal	CR119-15R0	Z20	Same as Z18	
Y4	Same as Y3		Z21	Same as Z1	
Y5	Crystal	CR119-14R0	Z22	Same as Z1	
Y6	Same as Y5		Z23	Same as Z18	
Y7	Crystal	CR114-13R0	Z24	Same as Z18	
Y8	Same as Y7		Z25	Same as Z14	
Y9	Crystal	CR119-12R0	Z26	Same as Z14	

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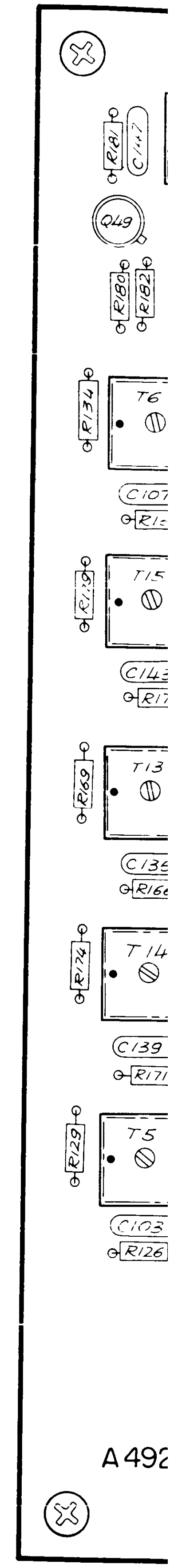

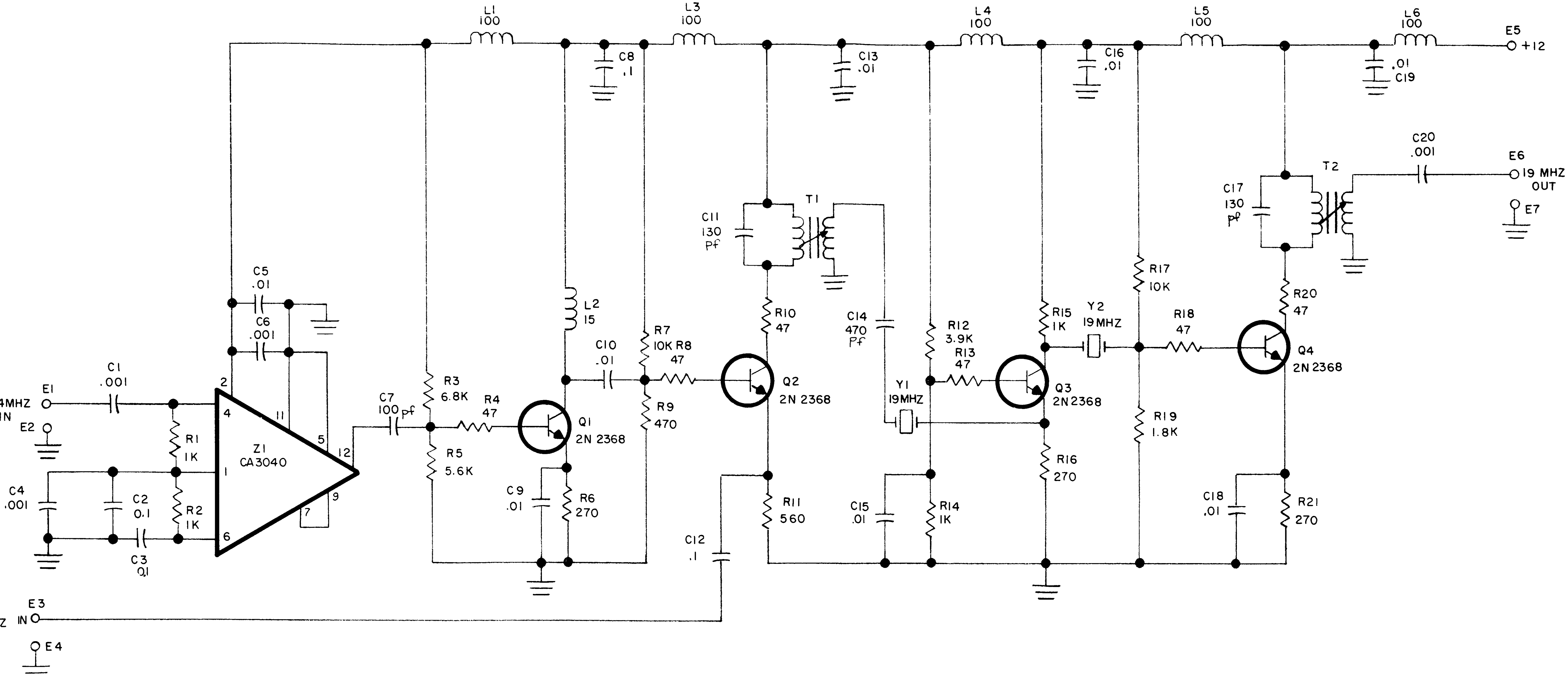

SYMBOL SERIES 200

LAST SYMBOL	MISSING SYMBOL
C20 E7 L6 Q4 R21 T2 Y2 Z1	

UNLESS OTHERWISE SPECIFIED:

RESISTORS IN OHMS (Ω) 1/4 W
ALL INDUCTANCE VALUES IN MICROHENRIES
ALL CAPACITANCE VALUES ARE IN MICROFARADS

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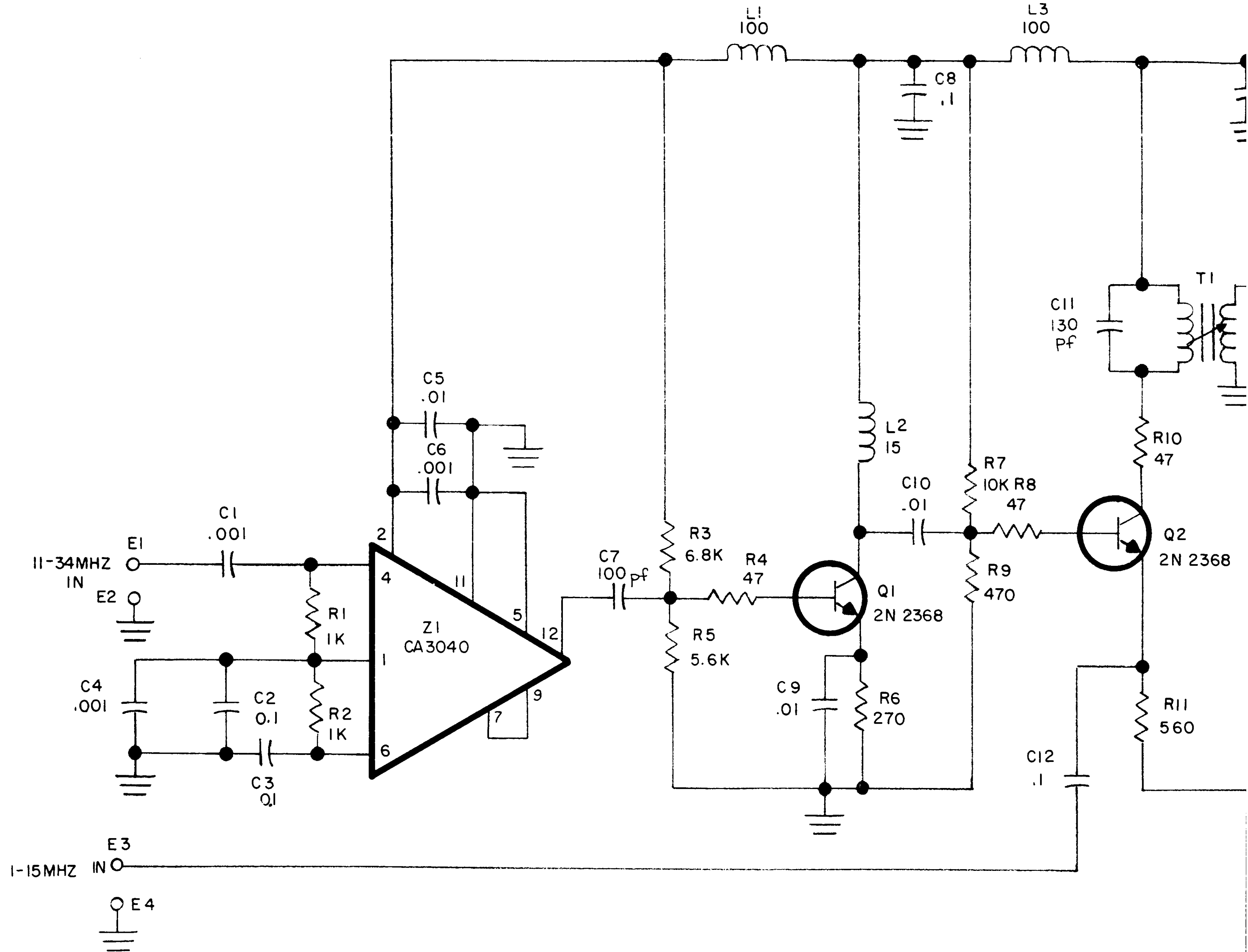
K1960-A

Figure 4-16. First Mixer Assembly Z101, Schematic Diagram



UNLESS OTHERWISE SPECIFIED:

RESISTORS IN OHMS (Ω) 1/4 W
ALL INDUCTANCE VALUES IN MICROHENRIES
ALL CAPACITANCE VALUES ARE IN MICROFARADS

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CK1960-A

SYMBOL SERIES 200

LAST SYMBOL	MISSING SYMBOL
C20	
E7	
L6	
Q4	
R21	
T2	
Y2	
Z1	

32

	TMC P/N			
c	CC100-29	R1	Resistor, Fixed, Composition	RC07GF102J
c	CC100-28	R2	Same as R1	
		R3	Resistor, Fixed, Composition	RC07GF682J
		R4	Resistor, Fixed, Composition	RC07GF470J
c	CC100-43	R5	Resistor, Fixed, Composition	RC07GF562J
		R6	Resistor, Fixed, Composition	RC07GF271J
	CM111E101F1S	R7	Resistor, Fixed, Composition	RC07GF103J
		R8	Same as R4	
		R9	Resistor, Fixed, Composition	RC07GF471J
		R10	Same as R4	
	CM111E131F1S	R11	Resistor, Fixed, Composition	RC07GF561J
		R12	Resistor, Fixed, Composition	RC07GF392J
		R13	Same as R4	
	CM111E471F1S	R14	Same as R1	
		R15	Same as R1	
		R16	Same as R6	
		R17	Same as R7	
		R18	Same as R4	
		R19	Resistor, Fixed, Composition	RC07GF182J
		R20	Same as R4	
	CL275-101	R21	Same as R6	
	CL275-150	T1	Transformer, Variable	TT307-8
		T2	Same as T1	
		Y1	Crystal	CR119-19R0
		Y2	Same as Y1	
	1N2368	Z1	Integrated Circuit	CA3040

2N

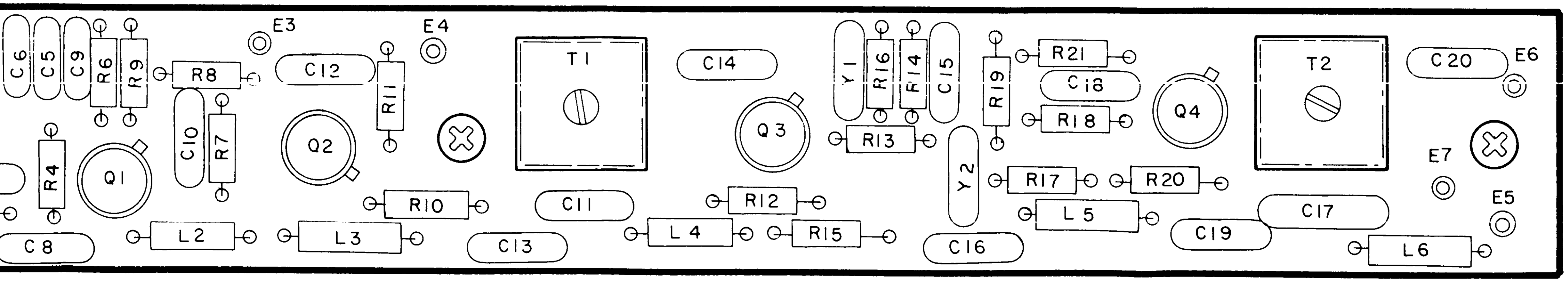
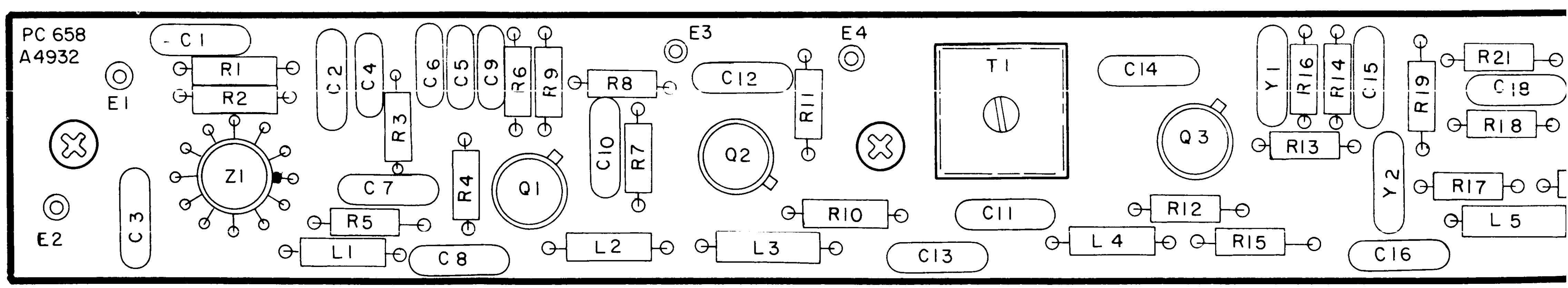


Figure 4-17. First Mixer Assembly Z101, Component Location and Parts List

Parts List for A-4932

SYMBOL	DESCRIPTION	TMC P/N			
C1	Capacitor, Fixed, Ceramic	CC100-29	R1	Resistor, Fixed, Composition	RC07GF102J
C2	Capacitor, Fixed, Ceramic	CC100-28	R2	Same as R1	
C3	Same as C2		R3	Resistor, Fixed, Composition	RC07GF682J
C4	Same as C1		R4	Resistor, Fixed, Composition	RC07GF470J
C5	Capacitor, Fixed, Ceramic	CC100-43	R5	Resistor, Fixed, Composition	RC07GF562J
C6	Same as C1		R6	Resistor, Fixed, Composition	RC07GF271J
C7	Capacitor, Fixed, Mica	CM111E101F1S	R7	Resistor, Fixed, Composition	RC07GF103J
C8	Same as C2		R8	Same as R4	
C9	Same as C5		R9	Resistor, Fixed, Composition	RC07GF471J
C10	Same as C5		R10	Same as R4	
C11	Capacitor, Fixed, Mica	CM111E131F1S	R11	Resistor, Fixed, Composition	RC07GF561J
C12	Same as C2		R12	Resistor, Fixed, Composition	RC07GF392J
C13	Same as C5		R13	Same as R4	
C14	Capacitor, Fixed, Mica	CM111E471F1S	R14	Same as R1	
C15	Same as C5		R15	Same as R1	
C16	Same as C5		R16	Same as R6	
C17	Same as C11		R17	Same as R7	
C18	Same as C5		R18	Same as R4	
C19	Same as C5		R19	Resistor, Fixed, Composition	RC07GF182J
C20	Same as C1		R20	Same as R4	
L1	Coil, Fixed, RF	CL275-101	R21	Same as R6	
L2	Coil, Fixed, RF	CL275-150	T1	Transformer, Variable	TT307-8
L3 thru L6	Same as L1		T2	Same as T1	
			Y1	Crystal	CR119-19R0
			Y2	Same as Y1	
Q1 thru Q4	Transistor	1N2368 2N	Z1	Integrated Circuit	CA3040



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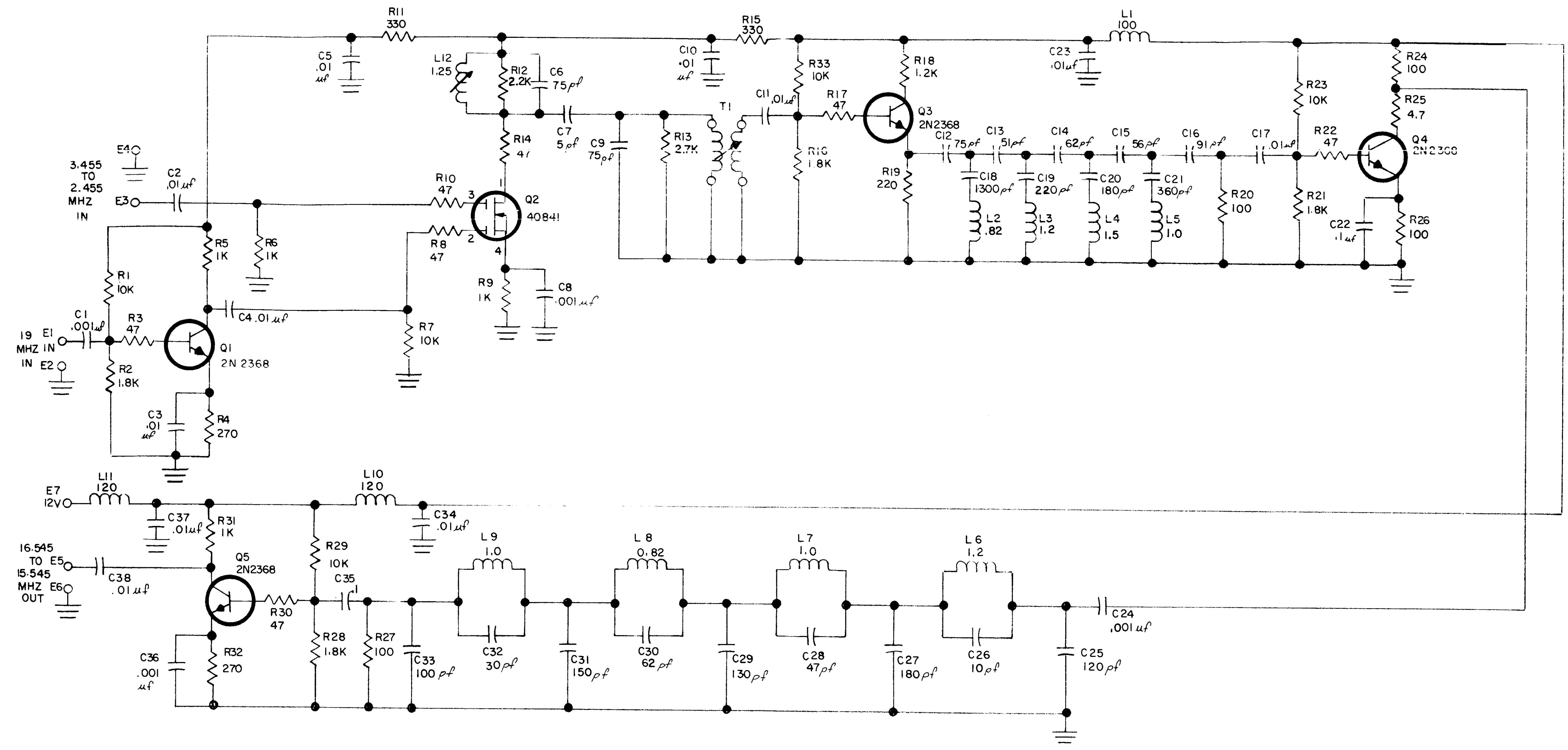

SYMBOL SERIES 800

MISSING SYMBOL	LAST SYMBOL
	C38
	E7
	L12
	Q5
	R33
	T1

NOTE: UNLESS OTHERWISE SPECIFIED

RESISTORS IN OHMS (Ω) 1/4W
ALL INDUCTANCE VALUES IN MICROHENRIES

Figure 4-18. Second Mixer Assembly Z107, Schematic Diagram

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	CL275-121
	TT307-9
	2N2368
	40841
n	RC07GF103J
n	RC07GF182J
n	RC07GF470J
n	RC07GF271J
n	RC07GF102J
n	RC07GF331J
n	RC07GF222J
n	RC07GF272J
n	RC07GF122J
n	RC07GF221J
n	RC07GF101J
n	RC07GF4R7J
	TT307-10

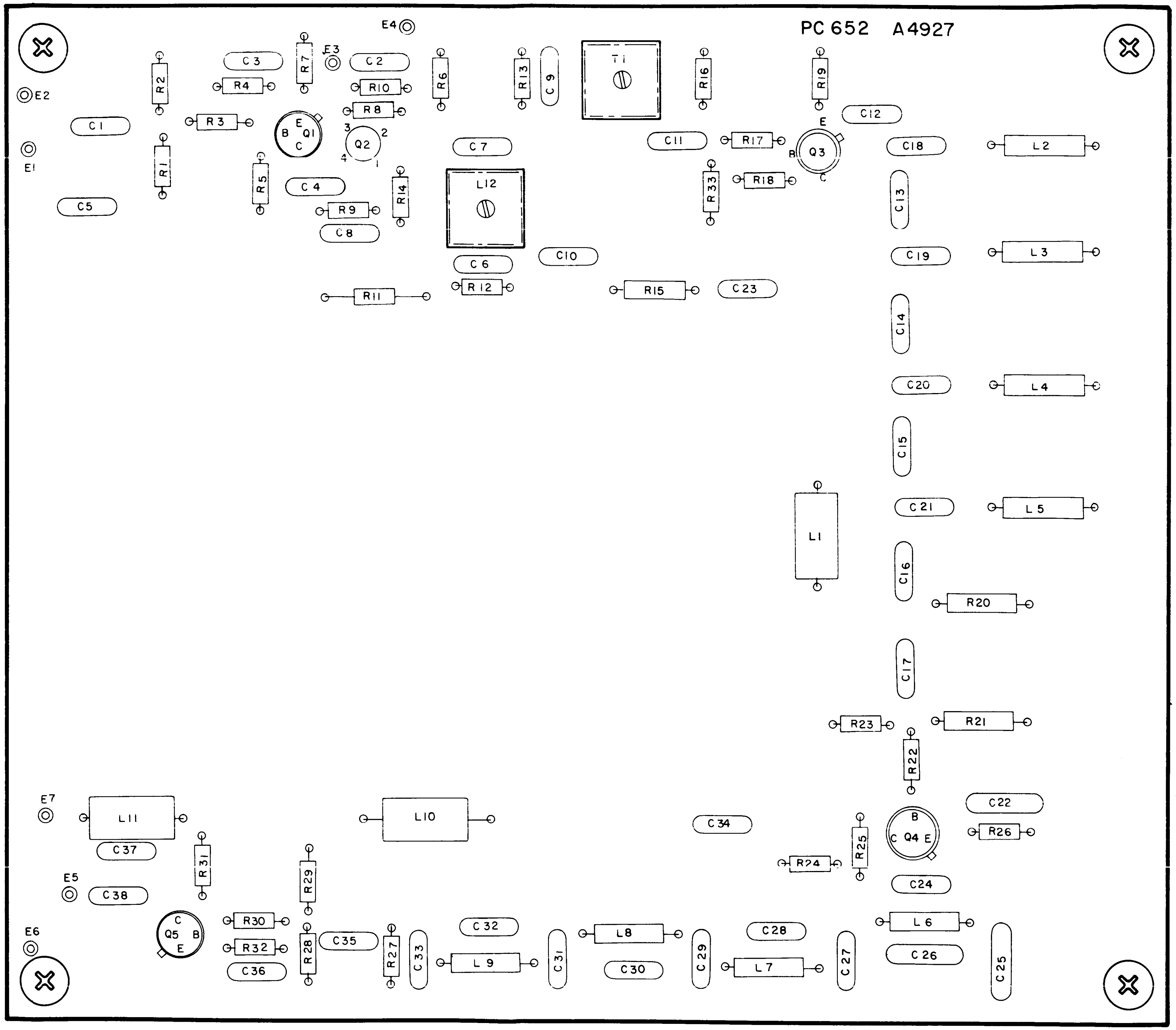

Figure 4-19. Second Mixer Assembly Z107, Component Location and Parts List

Parts List for A-4927

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-29
C2 thru C5	Capacitor, Fixed, Ceramic	CC100-43
C6	Capacitor, Fixed, Mica	CM111E750G1S
C7	Capacitor, Fixed, Mica	CM111E050D1S
C8	Same as C1	
C9	Same as C6	
C10	Same as C2	
C11	Same as C2	
C12	Same as C6	
C13	Capacitor, Fixed, Mica	CM111E510G1S
C14	Capacitor, Fixed, Mica	CM111E620G1S
C15	Capacitor, Fixed, Mica	CM111E560G1S
C16	Capacitor, Fixed, Mica	CM111E910G1S
C17	Same as C2	
C18	Capacitor, Fixed, Mica	CM111E132G1S
C19	Capacitor, Fixed, Mica	CM111E221G1S
C20	Capacitor, Fixed, Mica	CM111E181G1S
C21	Capacitor, Fixed, Mica	CM111E361G1S
C22	Capacitor, Fixed, Ceramic	CC100-28
C23	Same as C2	
C24	Same as C1	
C25	Capacitor, Fixed, Mica	CM111E121G1S
C26	Capacitor, Fixed, Mica	CM111E100D1S
C27	Same as C20	
C28	Capacitor, Fixed, Mica	CM111E470G1S
C29	Capacitor, Fixed, Mica	CM111E131G1S
C30	Same as C14	
C31	Capacitor, Fixed, Mica	CM111E151G1S
C32	Capacitor, Fixed, Mica	CM111E300G1S
C34	Same as C2	
C35	Same as C22	
C36	Same as C1	
C37	Same as C2	
C38	Same as C2	
L1	Coil, Fixed, RF	CL275-101
L2	Coil, Fixed, RF	CL275-OR82
L3	Coil, Fixed, RF	CL275-1R2
L4	Coil, Fixed, RF	CL275-1R5
L5	Coil, Fixed, RF	CL275-1R0
L6	Same as L3	
L7	Same as L5	
L8	Same as L2	
L9	Same as L5	
L10	Coil, Fixed, RF	CL275-121
L11	Same as L10	
L12	Coil, Variable	TT307-9
Q1	Transistor	2N2368
Q2	Transistor, FET, Dual Gate	40841
Q3	Same as Q1	
Q4	Same as Q1	
Q5	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF103J
R2	Resistor, Fixed, Composition	RC07GF182J
R3	Resistor, Fixed, Composition	RC07GF470J
R4	Resistor, Fixed, Composition	RC07GF271J
R5	Resistor, Fixed, Composition	RC07GF102J
R6	Same as R5	
R7	Same as R1	
R8	Same as R3	
R9	Same as R5	
R10	Same as R3	
R11	Resistor, Fixed, Composition	RC07GF331J
R12	Resistor, Fixed, Composition	RC07GF222J
R13	Resistor, Fixed, Composition	RC07GF272J
R14	Same as R3	
R15	Same as R11	
R16	Same as R2	
R17	Same as R3	
R18	Resistor, Fixed, Composition	RC07GF122J
R19	Resistor, Fixed, Composition	RC07GF221J
R20	Resistor, Fixed, Composition	RC07GF101J
R21	Same as R2	
R22	Same as R3	
R23	Same as R1	
R24	Same as R20	
R25	Resistor, Fixed, Composition	RC07GF4R7J
R26	Same as R20	
R27	Same as R20	
R28	Same as R2	
R29	Same as R1	
R30	Same as R3	
R31	Same as R5	
R32	Same as R4	
R33	Same as R1	
T1	Transformer, Variable	TT307-10

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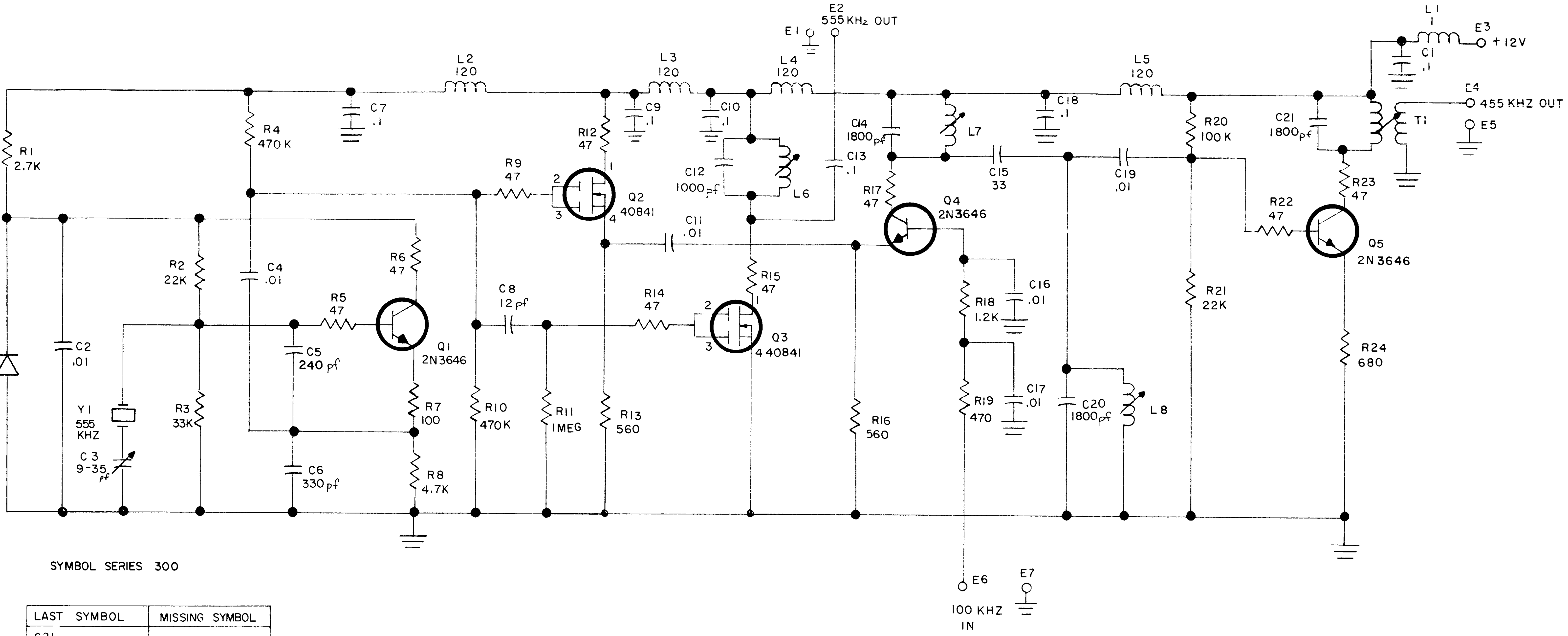


SYMBOL SERIES 300

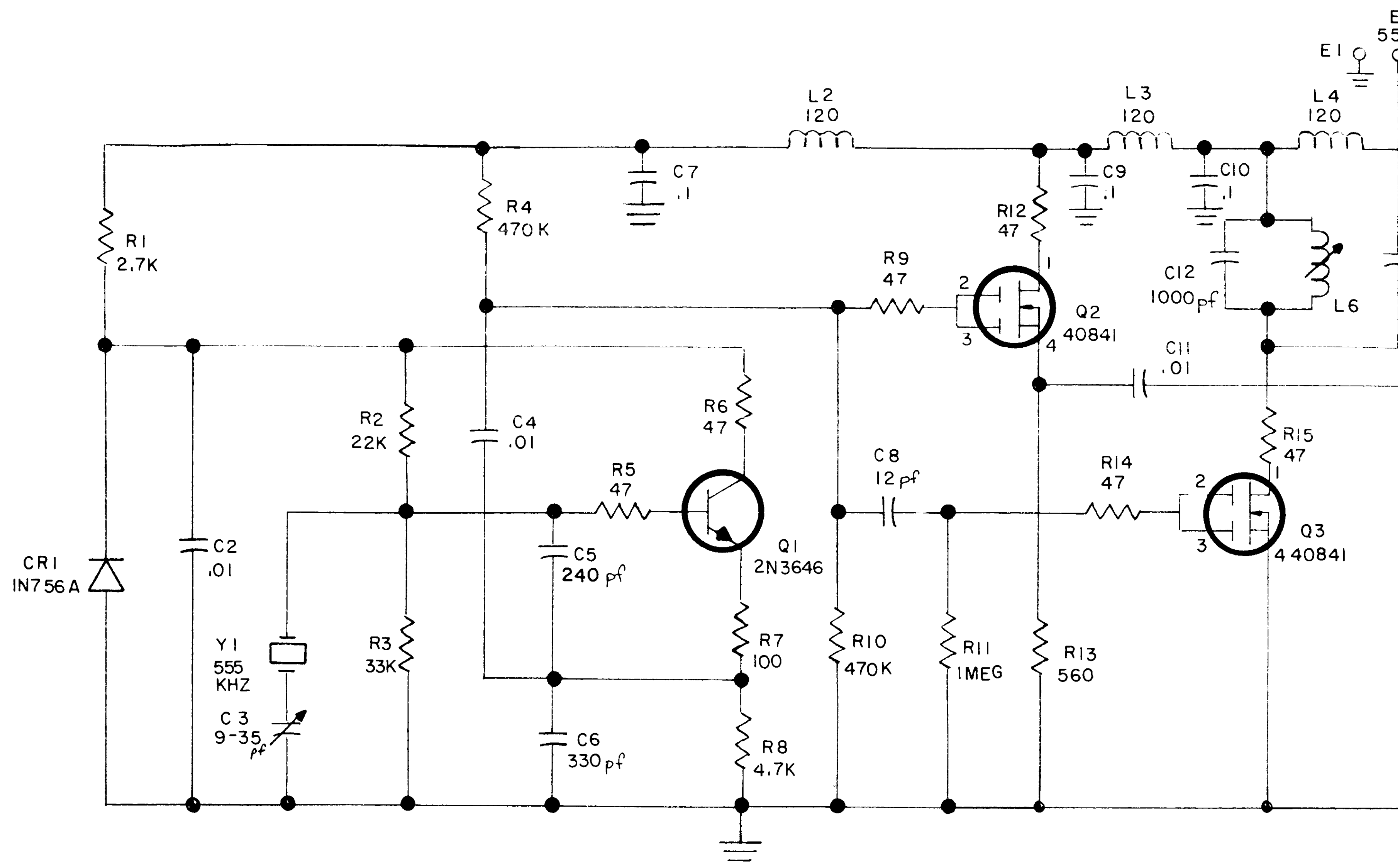
LAST SYMBOL	MISSING SYMBOL
C21	
CR1	
E7	
L8	
Q5	
R24	
T1	
Y1	

UNLESS OTHERWISE SPECIFIED

RESISTORS ARE IN OHMS(Ω) 1/4 W

ALL INDUCTANCE VALUES ARE IN MILLIHENRIES
ALL CAPACITANCE VALUES IN MICROFARADS

Figure 4-20. Fourth Mixer Assembly Z103, Schematic Diagram



SYMBOL SERIES 300

LAST SYMBOL	MISSING SYMBOL
C21	
CR1	
E7	
L8	
Q5	
R24	
T1	
Y1	

UNLESS OTHERWISE SPECIFIED

RESISTORS ARE IN OHMS(Ω) 1/4 W

ALL INDUCTANCE VALUES ARE IN MILLIHENRIES

ALL CAPACITANCE VALUES IN MICROFARADS

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R19	Resistor, Fixed, Composition	RC07GF471J
R20	Resistor, Fixed, Composition	RC07GF104J
R21	Same as R2	
R22	Same as R5	
R23	Same as R5	
R24	Resistor, Fixed, Composition	RC07GF681J
T1	Transformer, Variable	TT307-12
Y1	Crystal	CR109-141

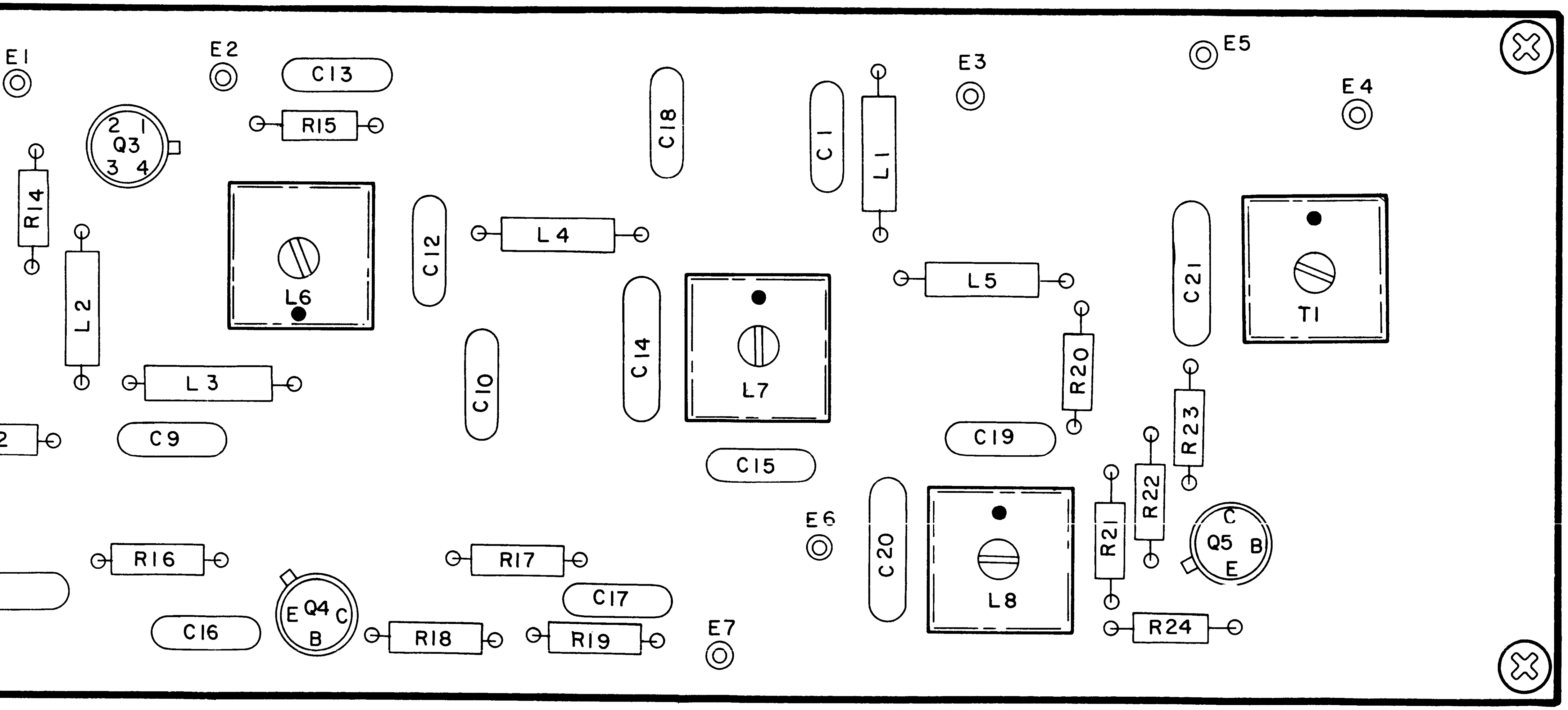

Figure 4-21. Fourth Mixer Assembly Z103, Component Location and Parts List

Parts List for A-4925

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-28
C2	Capacitor, Fixed, Ceramic	CC100-43
C3	Capacitor, Variable, Ceramic	CV112-8
C4	Same as C2	
C5	Capacitor, Fixed, Mica	CM111E241J1S
C6	Capacitor, Fixed, Mica	CM111E331J1S
C7	Same as C1	
C8	Capacitor, Fixed, Mica	CM111E120J1S
C9	Same as C1	
C10	Same as C1	
C11	Same as C2	
C12	Capacitor, Fixed, Mica	CM111E102J1S
C13	Same as C1	
C14	Capacitor, Fixed, Mica	CM112F182F1S
C15	Capacitor, Fixed, Mica	CM111E330J1S
C16	Same as C2	
C17	Same as C2	
C18	Same as C1	
C19	Same as C2	
C20	Same as C14	
C21	Same as C14	
CR1	Diode	1N756A
L1	Coil, Fixed, RF	CL275-1R0
L2 thru L5	Coil, Fixed, RF	CL275-121
L6	Coil, Variable	TT307-13
L7	Coil, Variable	TT307-11
L8	Same as L7	
Q1	Transistor	2N3646
Q2	Transistor, FET, Dual Gate	40841
Q3	Same as Q2	
Q4	Same as Q1	
Q5	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF272J
R2	Resistor, Fixed, Composition	RC07GF223J
R3	Resistor, Fixed, Composition	RC07GF333J
R4	Resistor, Fixed, Composition	RC07GF474J
R5	Resistor, Fixed, Composition	RC07GF470J
R6	Same as R5	
R7	Resistor, Fixed, Composition	RC07GF101J
R8	Resistor, Fixed, Composition	RC07GF472J
R9	Same as R5	
R10	Same as R4	
R11	Resistor, Fixed, Composition	RC07GF105J
R12	Same as R5	
R13	Resistor, Fixed, Composition	RC07GF561J
R14	Same as R5	
R15	Same as R5	
R16	Same as R13	
R17	Same as R5	
R18	Resistor, Fixed, Composition	RC07GF122J
R19		
R20		
R21		
R22		
R23		
R24		
T1		
Y1		

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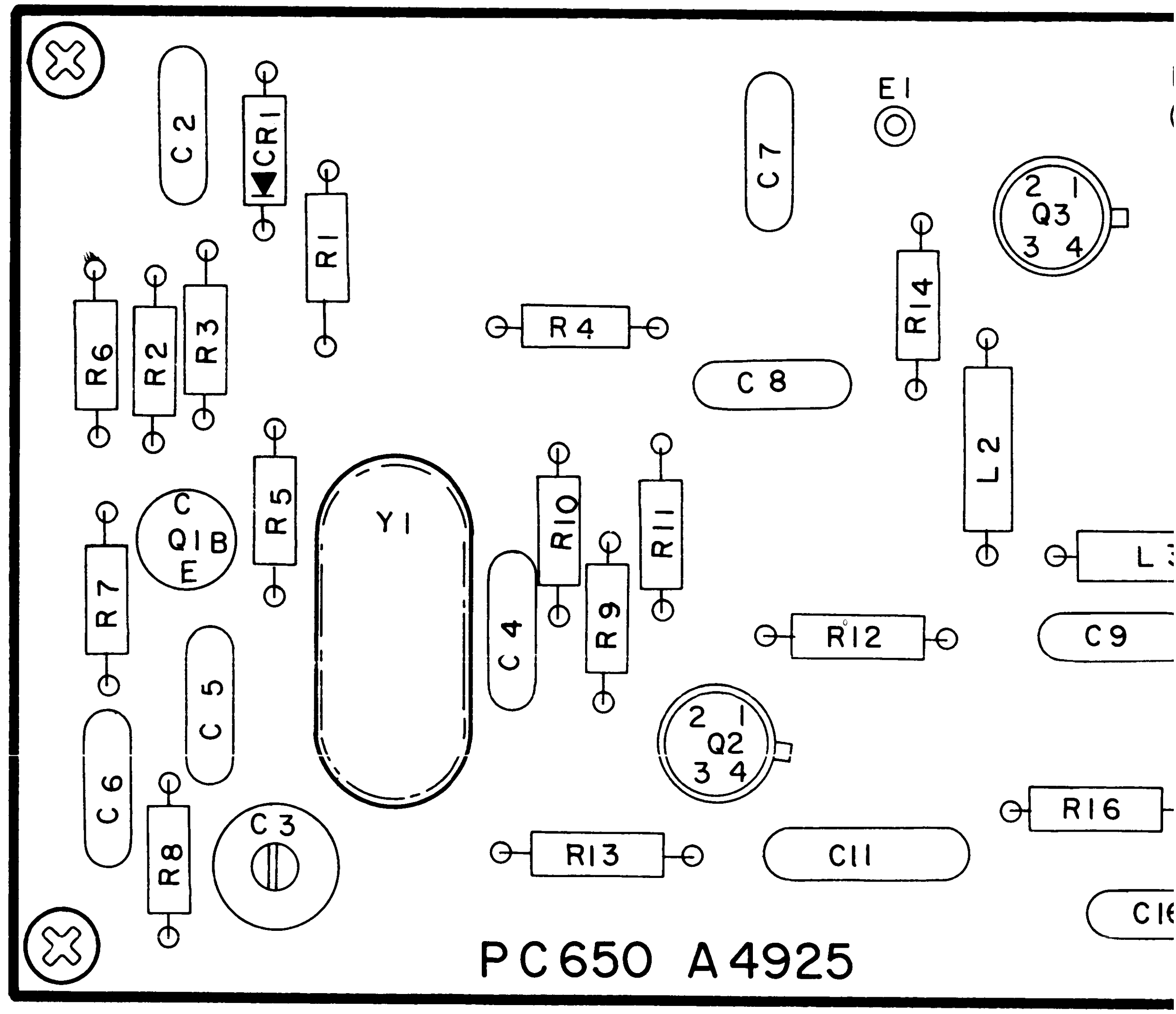
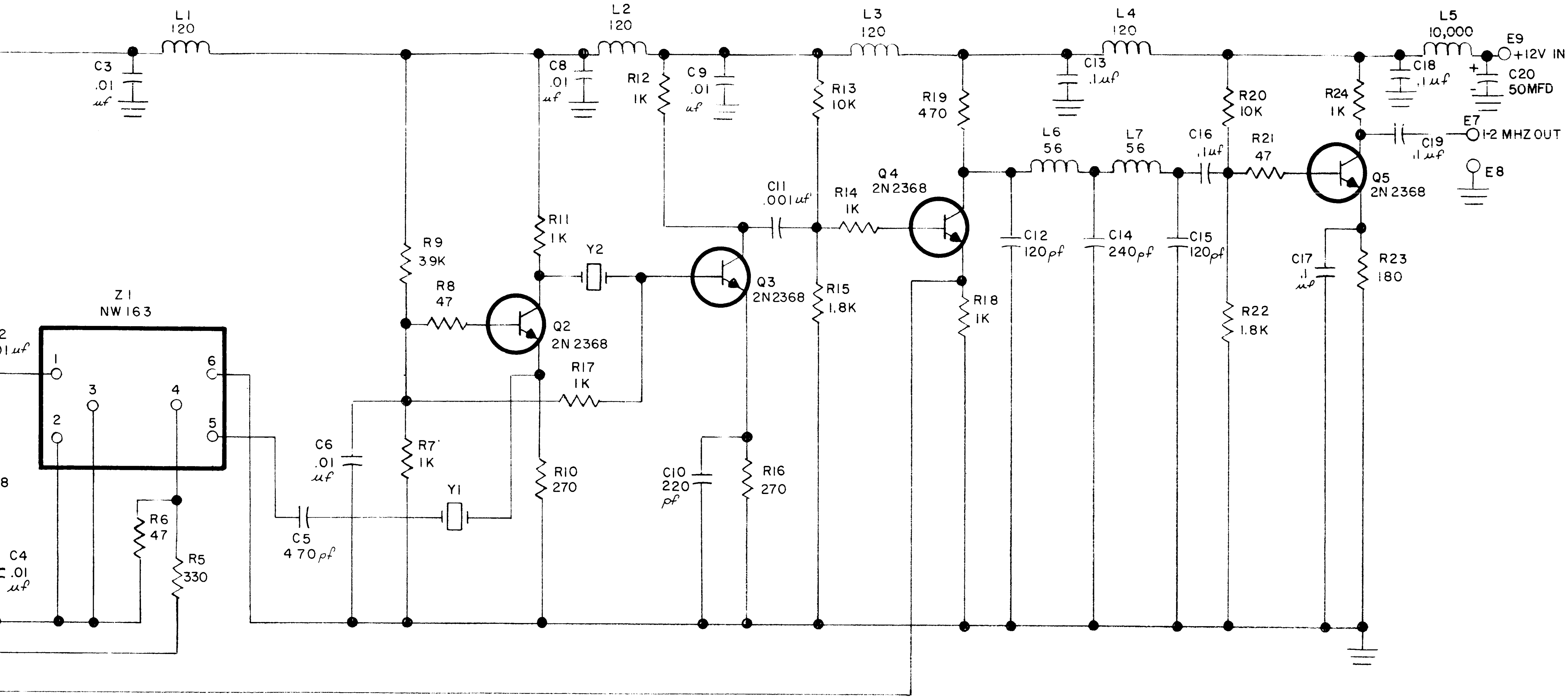




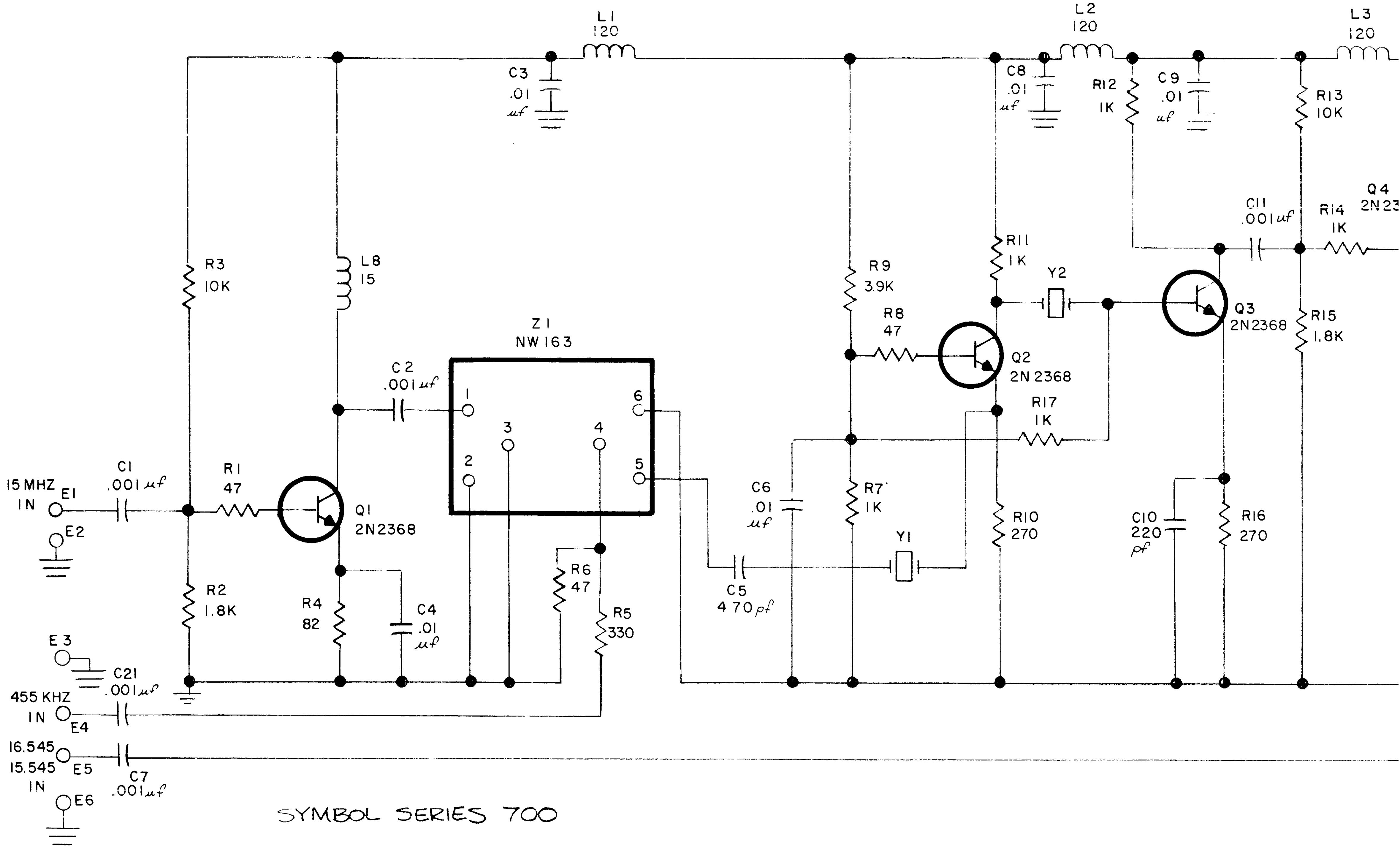
SERIES 700

ISSING SYMBOL

NOTE UNLESS OTHERWISE SPECIFIED

RESISTORS IN OHMS (Ω) 1/4W
ALL INDUCTANCE VALUES IN MICROHENRIES

Figure 4-22. Third Mixer Assembly Z106, Schematic Diagram



SYMBOL SERIES 700

LAST SYMBOL	MISSING SYMBOL
C21	
E9	
L8	
Q5	
Y2	
Z1	

NOTE UNLESS OTHERWISE SPECIFIED

RESISTORS IN OHMS (Ω) 1/4W
ALL INDUCTANCE VALUES IN MICROHENRIES

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Parts List for A-4923

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-29
C2	Same as C1	
C3	Capacitor, Fixed, Ceramic	CC100-43
C4	Same as C3	
C5	Capacitor, Fixed, Mica	CM111E471J1S
C6	Same as C3	
C7	Same as C1	
C8	Same as C3	
C9	Same as C3	
C10	Capacitor, Fixed, Mica	CM111E221J1S
C11	Same as C1	
C12	Capacitor, Fixed, Mica	CM111E121J1S
C13	Capacitor, Fixed, Ceramic	CC100-28
C14	Capacitor, Fixed, Mica	CM111E241J1S
C15	Same as C12	
C16 thru C19	Same as C13	
C20	Capacitor, Electrolytic	CE105-50-16
C21	Same as C1	
L1 thru L4	Coil, Fixed, RF	CL275-121
L5	Coil, Fixed, RF	CL275-103
L6	Coil, Fixed, RF	CL275-560
L7	Same as L6	
L8	Coil, Fixed, RF	CL275-150
Q1 thru Q5	Transistor	2N2368
R1	Resistor, Fixed, Composition	RC07GF470J
R2	Resistor, Fixed, Composition	RC07GF182J
R3	Resistor, Fixed, Composition	RC07GF103J
R4	Resistor, Fixed, Composition	RC07GF820J
R5	Resistor, Fixed, Composition	RC07GF331J
R6	Same as R1	
R7	Resistor, Fixed, Composition	RC07GF102J
R8	Same as R1	
R9	Resistor, Fixed, Composition	RC07GF392J
R10	Resistor, Fixed, Composition	RC07GF271J
R11	Same as R7	
R12	Same as R7	
R13	Same as R3	
R14	Same as R7	
R15	Same as R2	
R16	Same as R10	
R17	Same as R7	
R18	Same as R7	
R19	Resistor, Fixed, Composition	RC07GF471J
R20	Same as R3	
R21	Same as R1	
R22	Same as R2	
R23	Resistor, Fixed, Composition	RC07GF181J
R24	Same as R7	
Y1	Crystal, Quartz	CR119-14R545
Y2	Same as Y1	
Z1	Integrated Circuit, Mixer, Balanced	NW163

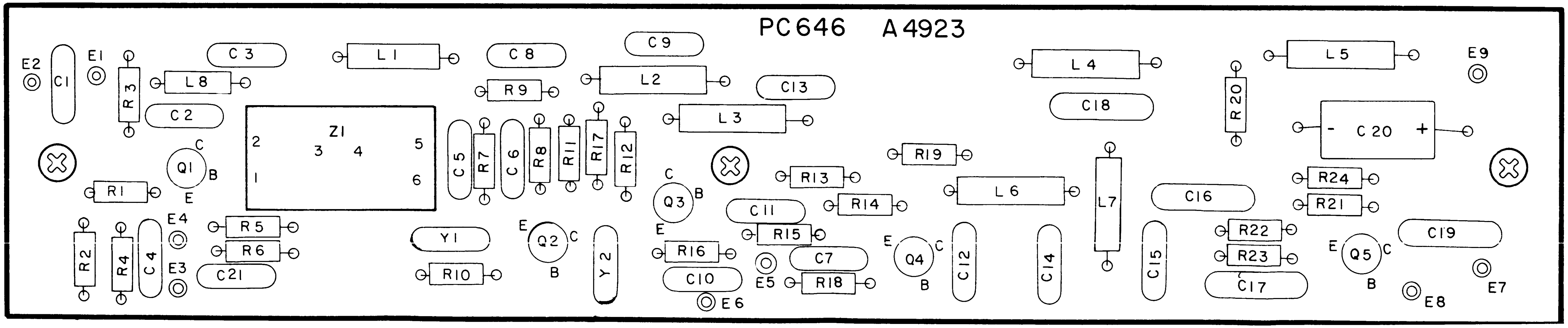

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Figure 4-23. Third Mixer Assembly Z106, Component Location and Parts List

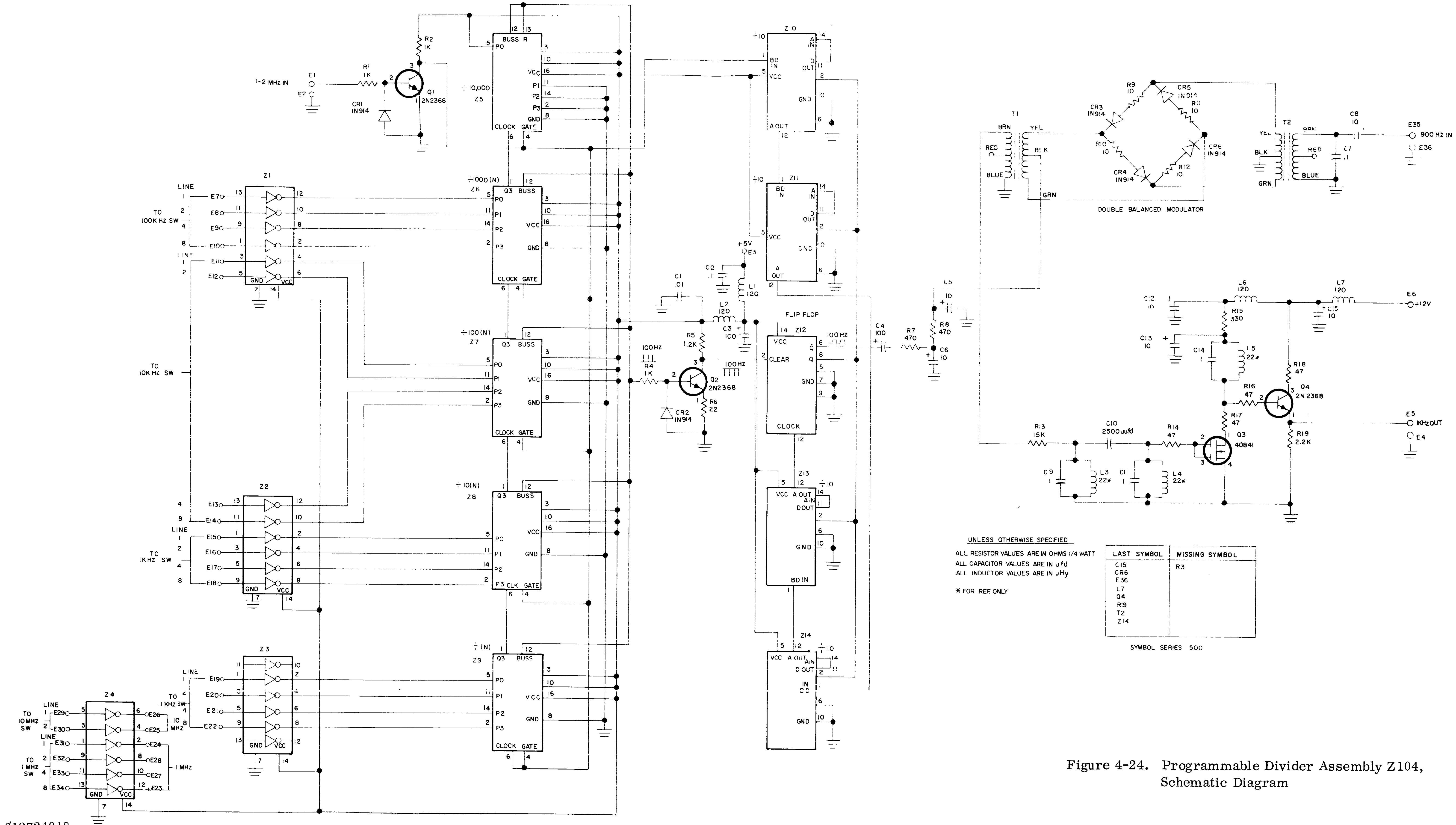

Figure 4-24. Programmable Divider Assembly Z104, Schematic Diagram

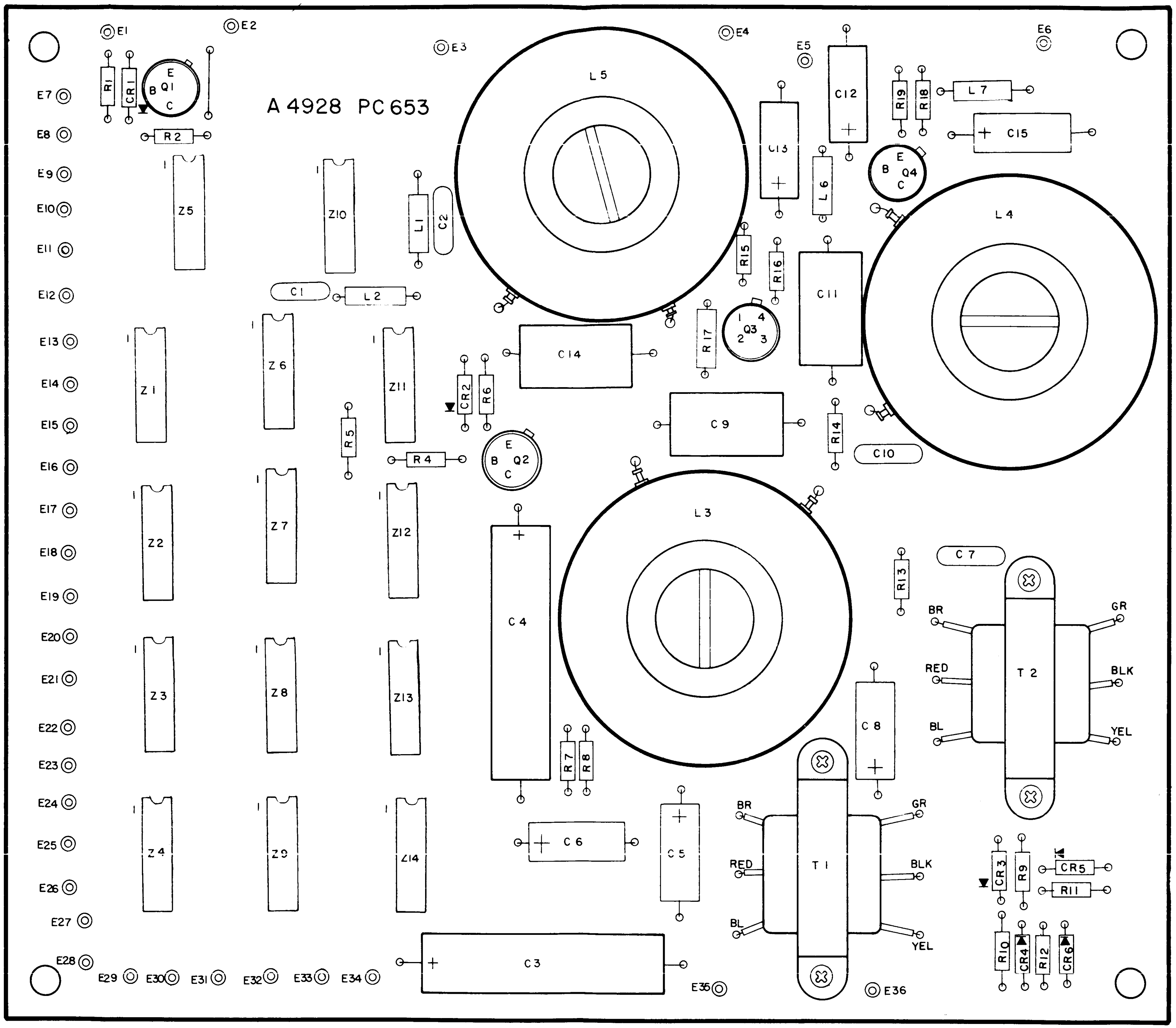

Figure 4-25. Programmable Divider Assembly Z104, Component Location and Parts List

Parts List for A-4928

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-43
C2	Capacitor, Fixed, Ceramic	CC100-28
C3	Capacitor, Electrolytic	CE105-100-25
C4	Same as C3	
C5	Capacitor, Electrolytic	CE105-10-25
C6	Same as C5	
C7	Same as C2	
C8	Same as C5	
C9	Capacitor, Fixed, Mylar	CN127-A-1R0
C10	Capacitor, Fixed, Mylar	CM112E252J1S
C11	Same as C9	
C12	Same as C5	
C13	Same as C5	
C14	Same as C9	
C15	Same as C5	
CR1 thru CR6	Diode	1N914
L1	Coil, Fixed, RF	CL275-121
L2	Same as L1	
L3	Coil, Toroid	CL481
L4	Same as L3	
L5	Same as L3	
L6	Same as L1	
L7	Same as L1	
Q1	Transistor	2N2368
Q2	Same as Q1	
Q3	Transistor, FET, Dual Gate	40841
Q4	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF102J
R2	Same as R1	
R3	Resistor, Fixed, Composition	RC07GF220J
R4	Same as R1	
R5	Resistor, Fixed, Composition	RC07GF122J
R6	Not used	
R7	Resistor, Fixed, Composition	RC07GF471J
R8	Same as R7	
R9 thru R12	Resistor, Fixed, Composition	RC07GF100J
R13	Resistor, Fixed, Composition	RC07GF153J
R14	Resistor, Fixed, Composition	RC07GF470J
R15	Resistor, Fixed, Composition	RC07GF331J
R16	Same as R14	
R17	Same as R14	
R18	Same as R14	
R19	Resistor, Fixed, Composition	RC07GF222J
T1	Transformer	TF267-2
T2	Same as T1	
Z1 thru Z4	Integrated Circuit	NW187
Z5 thru Z9	Integrated Circuit	NW192
Z10	Integrated Circuit	NW190
Z11	Same as Z10	
Z12	Integrated Circuit	NW157
Z13	Same as Z10	
Z14	Same as Z10	

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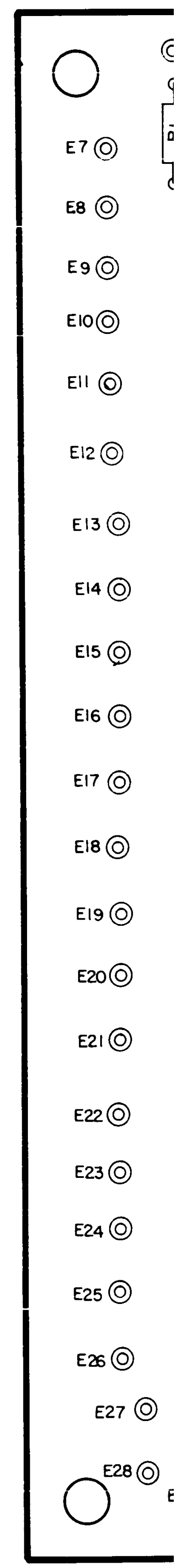

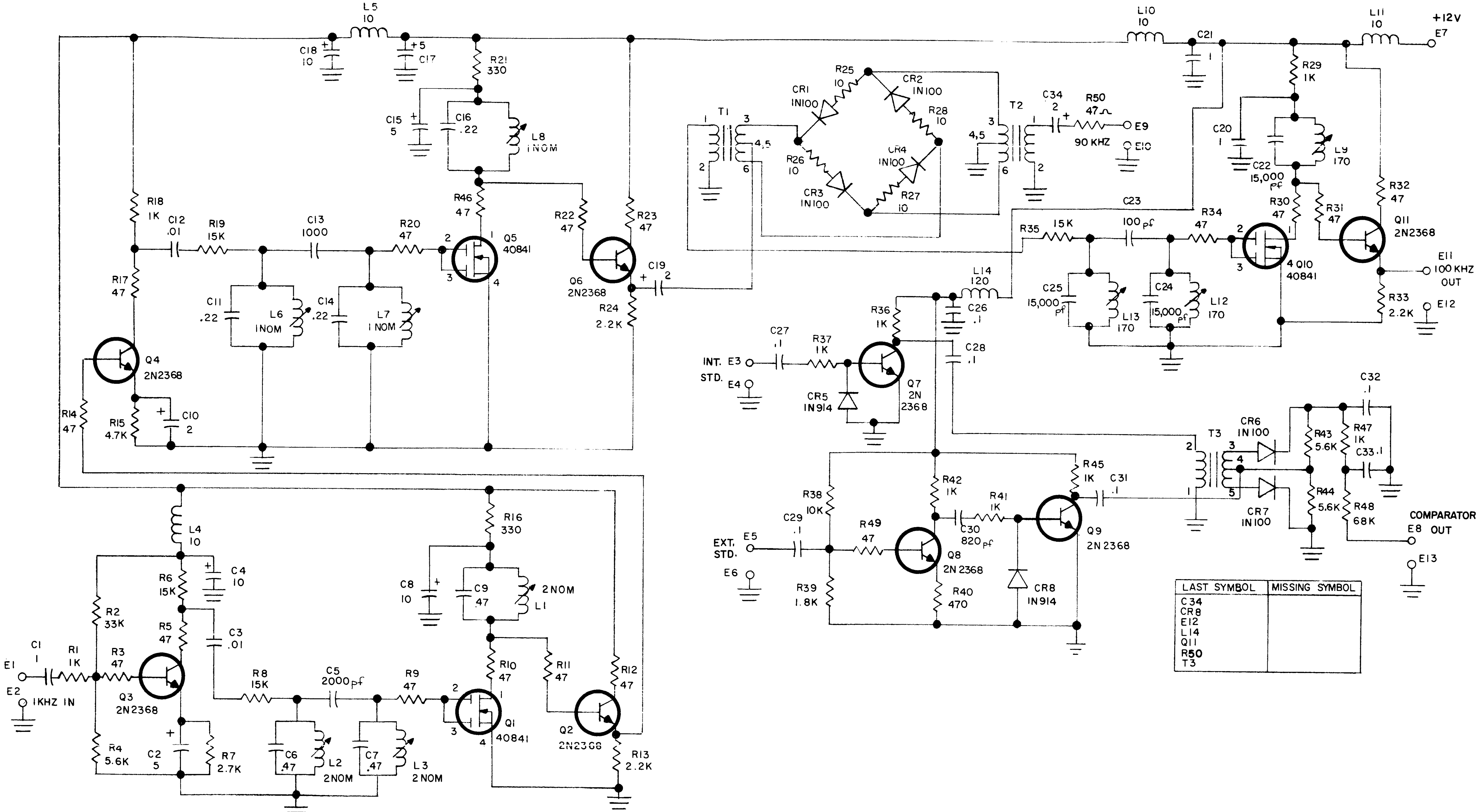

LAST SYMBOL	MISSING SYMBOL
C34 CR8 E12 L14 Q11 R50 T3	

UNLESS OTHERWISE SPECIFIED

RESISTORS ARE IN OHMS (Ω) 1/4W
ALL INDUCTANCE VALUES ARE IN MILLIHENRIES
ALL CAPACITANCE VALUES ARE IN MICROFARADS

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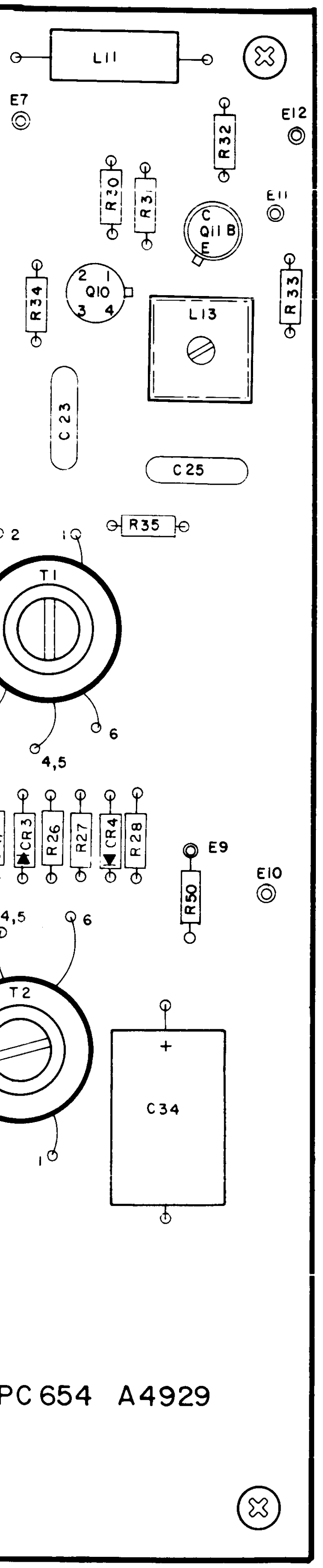
Figure 4-26. 10 and 100 KHZ Multiplier Comparator Assembly Z108, Schematic Diagram



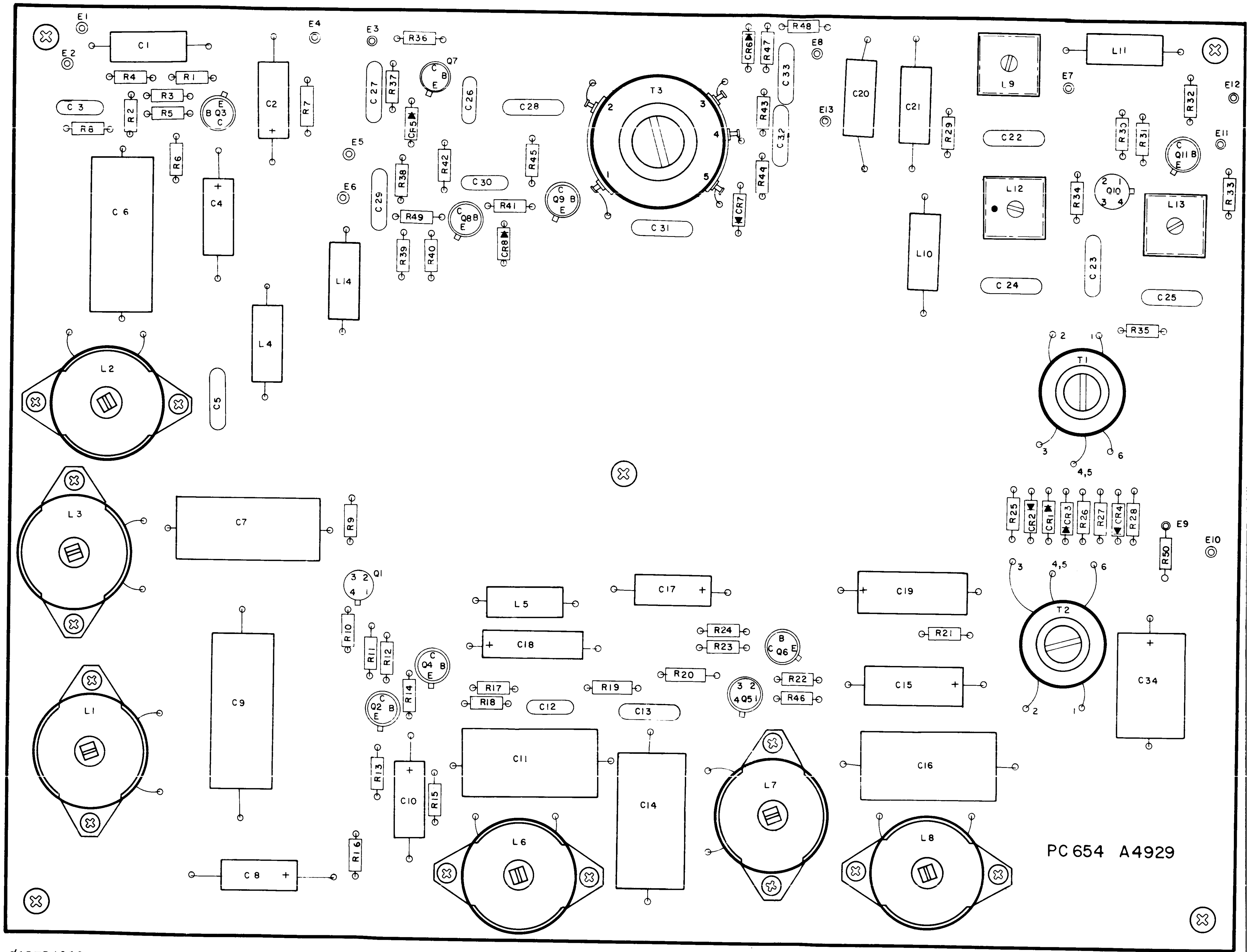
Parts List for A-4929

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CN114-1R0
C2	Capacitor, Electrolytic	CL105-5-25
C3	Capacitor. Fixed. Ceramic	CC100-43
C4	Capacitor, Electrolytic	CE105-10-25
C5	Capacitor, Fixed, Mica	CM112F202F1S
C6	Capacitor, Fixed, Ceramic	CN127-A-R47
C7	Same as C6	
C8	Same as C4	
C9	Same as C6	
C10	Capacitor, Electrolytic	CE105-2-25
C11	Capacitor, Polycarbonite	CN127-A-R22
C12	Same as C3	
C13	Capacitor, Fixed, Mica	CM111E102F1S
C14	Same as C11	
C15	Same as C2	
C16	Same as C11	
C17	Same as C2	
C18	Same as C4	
C19	Same as C10	
C20	Same as C1	
C21	Same as C1	
C22	Capacitor, Fixed, Mica	CM112E153F1S
C23	Capacitor, Fixed, Mica	CM111E101J1S
C24	Same as C22	
C25	Same as C22	
C26 thru C29	Capacitor, Fixed, Ceramic	CC100-28
C30	Capacitor, Fixed, Mica	CM111E821J1S
C31	Same as C26	
C32	Same as C26	
C33	Same as C26	
C34	Same as C10	
CR1 thru CR4	Diode	1N100
CR5	Diode	1N914
CR6	Same as CR1	
CR7	Same as CR1	
CR8	Same as CR5	
L1	Coil, Variable	CL482-1
L2	Same as L1	
L3	Same as L1	
L4	Coil, Fixed	CL275-103

SYMBOL	DESCRIPTION	TMC P/N
L5	Same as L4	
L6	Coil, Variable	CL482-2
L7	Same as L6	
L8	Same as L6	
L9	Coil, Variable	TT307-7
L10	Same as L4	
L11	Same as L4	
L12	Same as L9	
L13	Same as L9	
L14	Coil, Fixed	CL275-121
Q1	Transistor, FET, Dual Gate	40841
Q2	Transistor	2N2368
Q3	Same as Q2	
Q4	Same as Q2	
Q5	Same as Q1	
Q6 thru Q10	Same as Q2	
Q11	Same as Q2	
R1	Resistor, Fixed, Composition	RC07GF102J
R2	Resistor, Fixed, Composition	RC07GF333J
R3	Resistor, Fixed, Composition	RC07GF562J
R5	Same as R3	
R6	Resistor, Fixed, Composition	RC07GF153J
R7	Resistor, Fixed, Composition	RC07GF272J
R8	Same as R6	
R9 thru R12	Same as R3	
R13	Resistor, Fixed, Composition	RC07GF222J
R14	Same as R3	
R15	Resistor, Fixed, Composition	RC07GF472J
R16	Resistor, Fixed, Composition	RC07GF331J
R17	Same as R3	
R18	Same as R1	
R19	Same as R6	
R20	Same as R3	
R21	Same as R16	
R22	Same as R3	
R23	Same as R3	
R24	Same as R13	
R25 thru R28	Resistor, Fixed, Composition	RC07GF100J

SYMBOL	DESCRIPTION	TMC P/N
R29	Same as R1	
R30	Same as R3	
R31	Same as R3	
R32	Same as R3	
R33	Same as R13	
R34	Same as R3	
R35	Same as R6	
R36	Same as R1	
R37	Same as R1	
R38	Resistor, Fixed, Composition	RC07GF103J
R39	Resistor, Fixed, Composition	RC07GF471J
R40	Resistor, Fixed, Composition	RC07GF471J
R41	Same as R1	
R42	Same as R1	
R43	Same as R4	
R44	Same as R4	
R45	Same as R1	
R46	Same as R3	
R47	Same as R1	
R48	Resistor, Fixed, Composition	RC07GF683J
R49	Same as R3	
R50	Same as R3	
T1	Transformer	TT309
T2	Same as T1	
T3	Transformer	TT308

Figure 4-27. 10 and 100 KHZ Multiplier Comparator Assembly Z108, Component Location and Parts List



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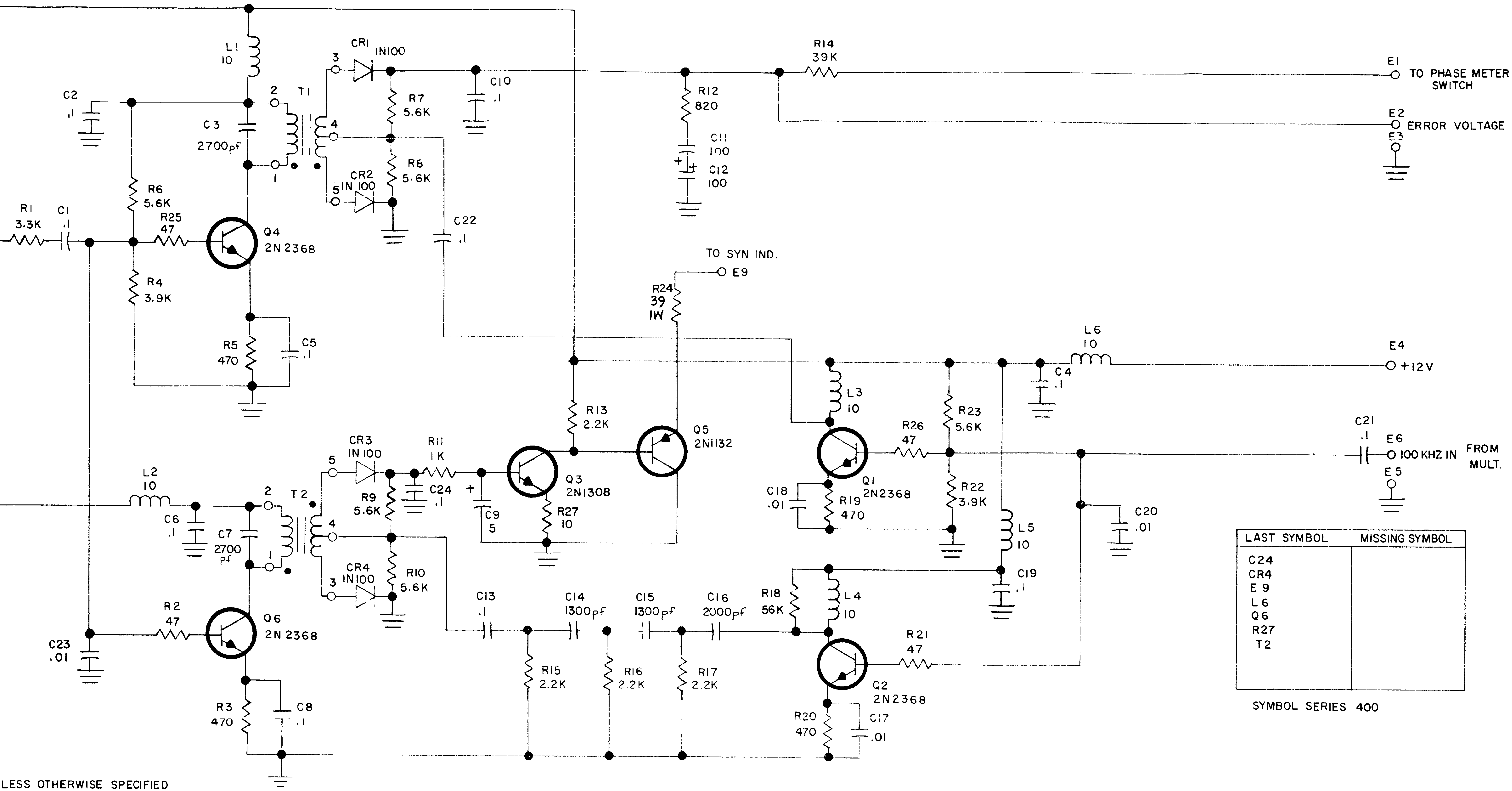
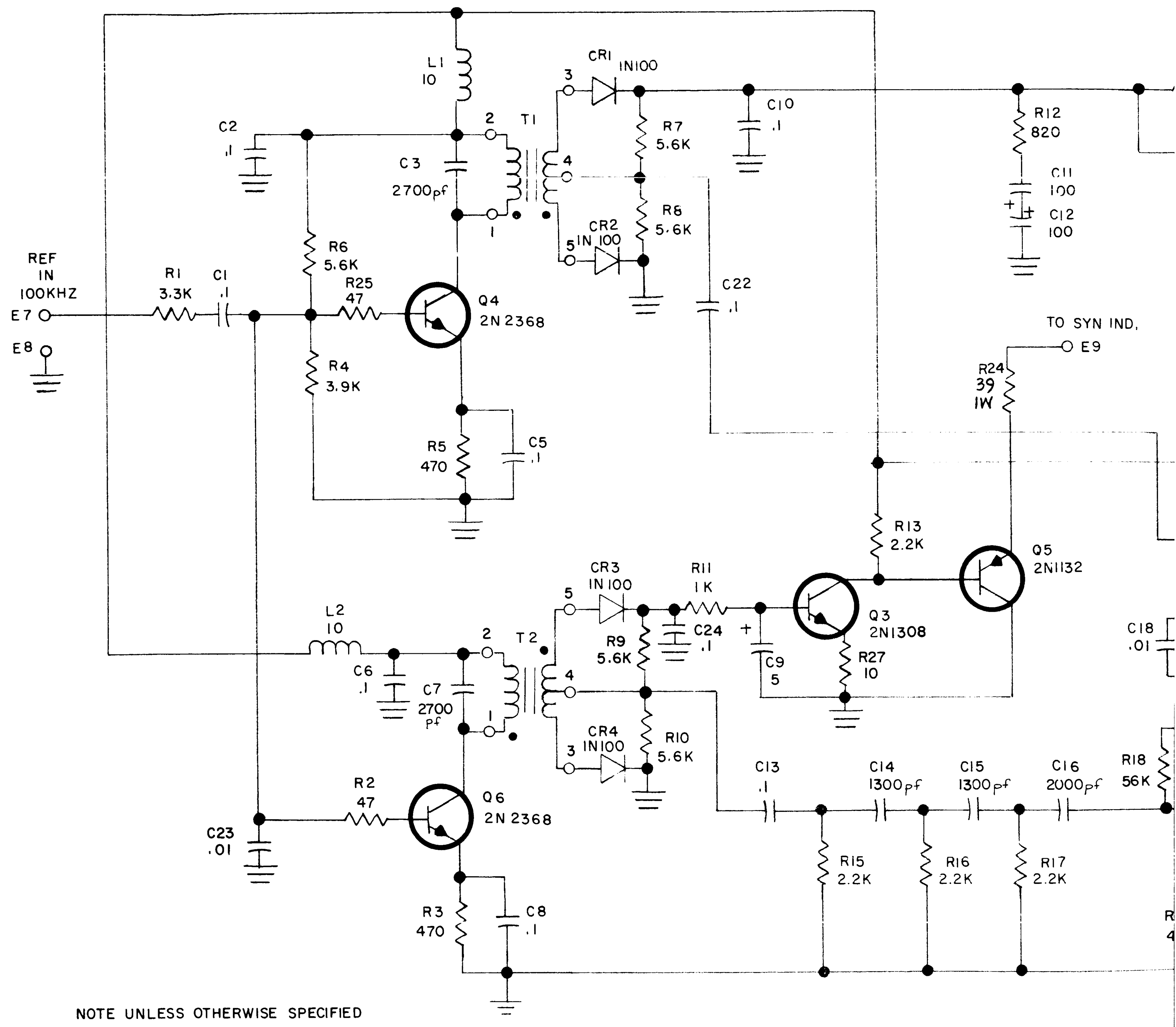


LAST SYMBOL	MISSING SYMBOL
C24 CR4 E 9 L 6 Q 6 R27 T2	

SYMBOL SERIES 400

LESS OTHERWISE SPECIFIED
RS ARE IN OHMS (Ω) 1/4W
CTANCE VALUES ARE IN MILLIHENRIES
ACITANCE VALUES IN MICROFARADS

Figure 4-28. Phase Detector Assembly Z109, Schematic Diagram



NOTE UNLESS OTHERWISE SPECIFIED
RESISTORS ARE IN OHMS (Ω) 1/4W
ALL INDUCTANCE VALUES ARE IN MILLIHENRIES
ALL CAPACITANCE VALUES IN MICROFARADS

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Q2	Same as Q1	
Q3	Transistor	2N1308
Q4	Same as Q1	
Q5	Transistor	2N1132
Q6	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF332J
R2	Resistor, Fixed, Composition	RC07GF470J
R3	Resistor, Fixed, Composition	RC07GF471J
R4	Resistor, Fixed, Composition	RC07GF392J
R5	Same as R3	
R6 thru R10	Resistor, Fixed, Composition	RC07GF562J
R11	Resistor, Fixed, Composition	RC07GF102J
R12	Resistor, Fixed, Composition	RC07GF821J
R13	Resistor, Fixed, Composition	RC07GF222J
R14	Resistor, Fixed, Composition	RC07GF393J
R15	Same as R13	
R16	Same as R13	
R17	Same as R13	
R18	Resistor, Fixed, Composition	RC07GF563J
R19	Same as R3	
R20	Same as R3	
R21	Same as R2	
R22	Same as R4	
R23	Same as R6	
R24	Resistor, Fixed, Composition	RC32GF390J
R25	Same as R2	
R26	Same as R2	
R27	Resistor, Fixed, Composition	RC07GF100J
T1	Transformer	TT308
T2	Same as T1	

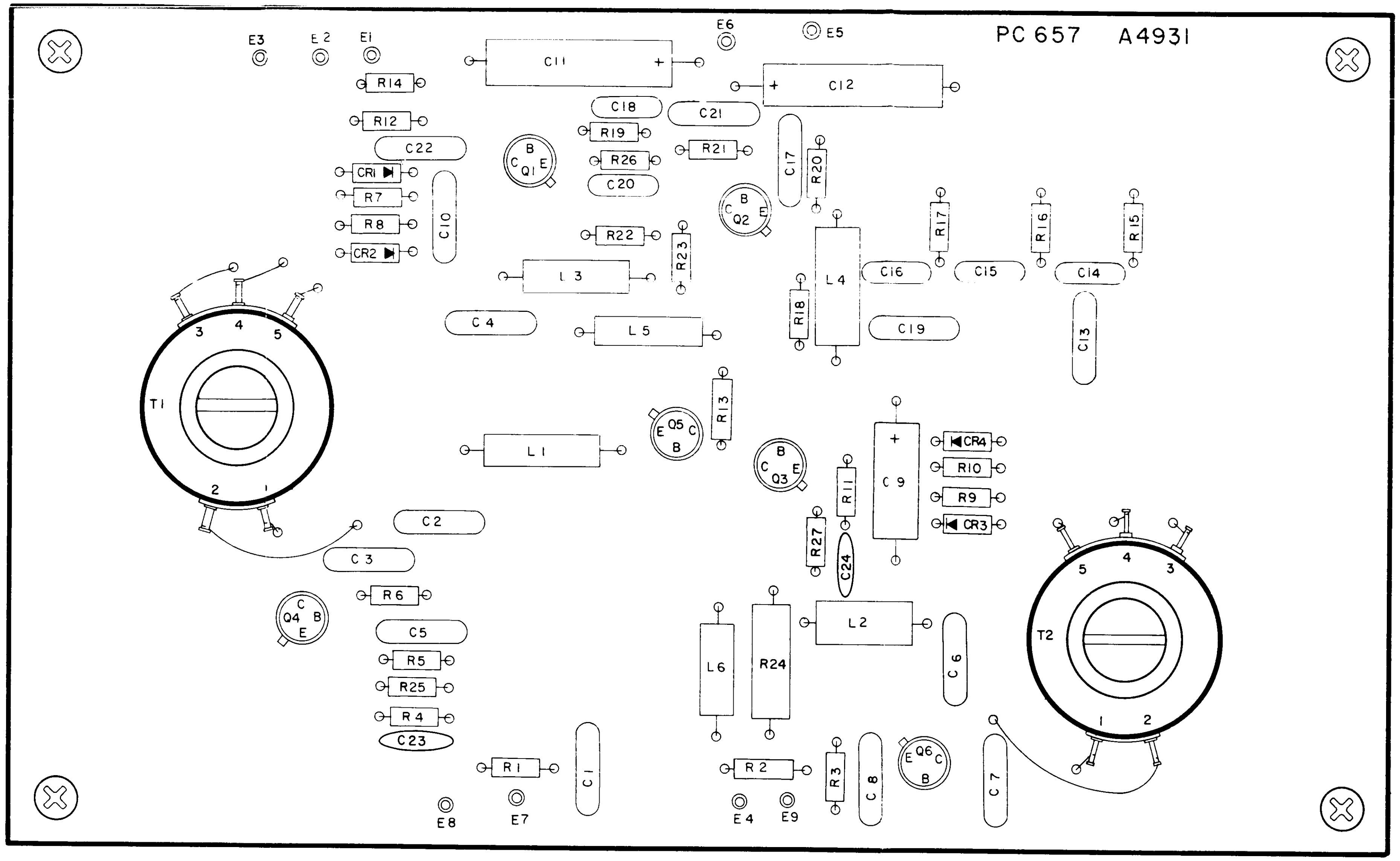
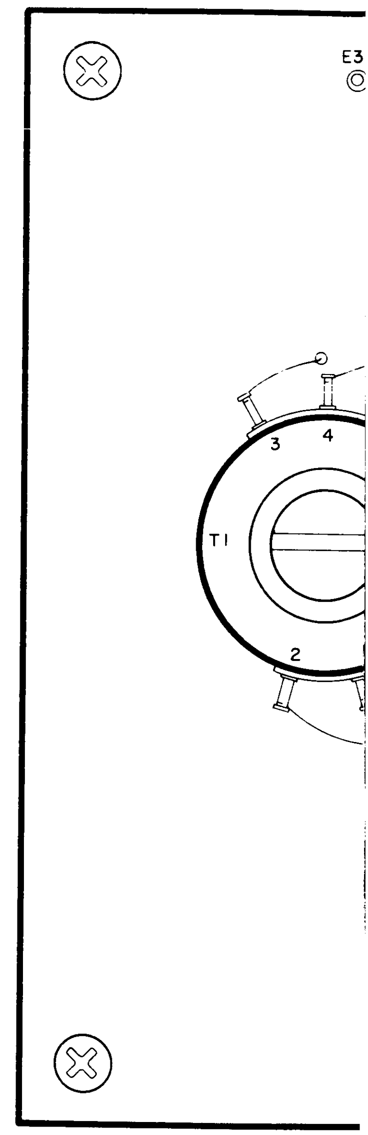


Figure 4-29. Phase Detector Assembly Z109, Component Location and Parts List

Parts List for A-4931

SYMBOL	DESCRIPTION	TMC P/N	SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Fixed, Ceramic	CC100-28	Q2	Same as Q1	
C2	Same as C1		Q3	Transistor	2N1308
C3	Capacitor, Fixed, Mica	CM112F272F1S	Q4	Same as Q1	
C4	Same as C1		Q5	Transistor	2N1132
C5	Same as C1		Q6	Same as Q1	
C6	Same as C1		R1	Resistor, Fixed, Composition	RC07GF332J
C7	Same as C3		R2	Resistor, Fixed, Composition	RC07GF470J
C8	Same as C1		R3	Resistor, Fixed, Composition	RC07GF471J
C9	Capacitor, Electrolytic	CE105-5-25	R4	Resistor, Fixed, Composition	RC07GF392J
C10	Same as C1		R5	Same as R3	
C11	Capacitor, Electrolytic	CE105-100-25	R6	Resistor, Fixed, Composition	RC07GF562J
C12	Same as C11		thru		
C13	Same as C1		R10		
C14	Capacitor, Fixed, Mica	CM112F132F1S	R11	Resistor, Fixed, Composition	RC07GF102J
C15	Same as C14		R12	Resistor, Fixed, Composition	RC07GF821J
C16	Capacitor, Fixed, Mica	CM110E202F1S	R13	Resistor, Fixed, Composition	RC07GF222J
C17	Capacitor, Fixed, Ceramic	CC100-43	R14	Resistor, Fixed, Composition	RC07GF393J
C18	Same as C17		R15	Same as R13	
C19	Same as C1		R16	Same as R13	
C20	Same as C17		R17	Same as R13	
C21	Same as C1		R18	Resistor, Fixed, Composition	RC07GF563J
C22	Same as C1		R19	Same as R3	
C23	Same as C17		R20	Same as R3	
C24	Same as C1		R21	Same as R2	
CR1	Diode	1N100	R22	Same as R4	
thru			R23	Same as R6	
CR4			R24	Resistor, Fixed, Composition	RC32GF390J
CR5	Diode	1N914	R25	Same as R2	
L1	Coil, Fixed, RF	CL275-103	R26	Same as R2	
thru			R27	Resistor, Fixed, Composition	RC07GF100J
L6			T1	Transformer	TT308
Q1	Transistor	2N2368	T2	Same as T1	



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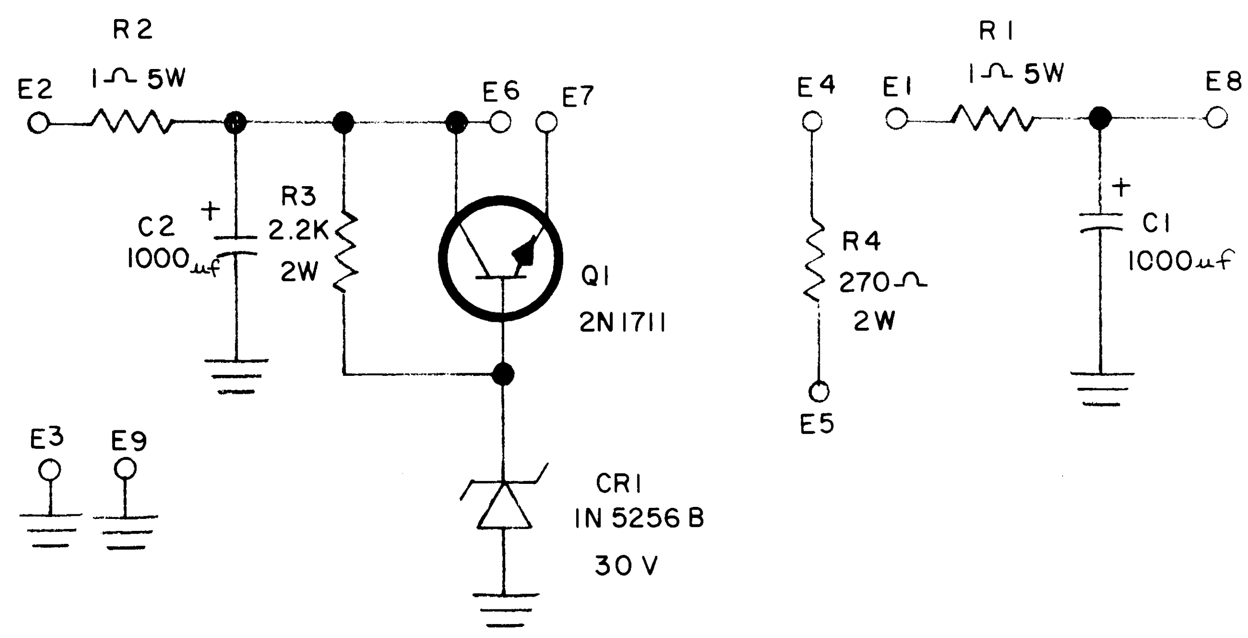

SYMBOL SERIES 600

LAST SYMBOL	MISSING SYMBOL
C2 CR1 E9 Q1 R4	

Figure 4-30. Power Supply Assembly Z105, Schematic Diagram

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Parts List for A-4926

SYMBOL	DESCRIPTION	TMC P/N
C1	Capacitor, Electrolytic	CE116-8VN
C2	Same as C1	
CR1	Diode, Zener	1N5256B
Q1	Transistor	2N1711
R1	Resistor, Fixed, Composition	RW107-1
R2	Same as R1	
R3	Resistor, Fixed, Composition	RC42GF222J
R4	Resistor, Fixed, Composition	RC42GF271J

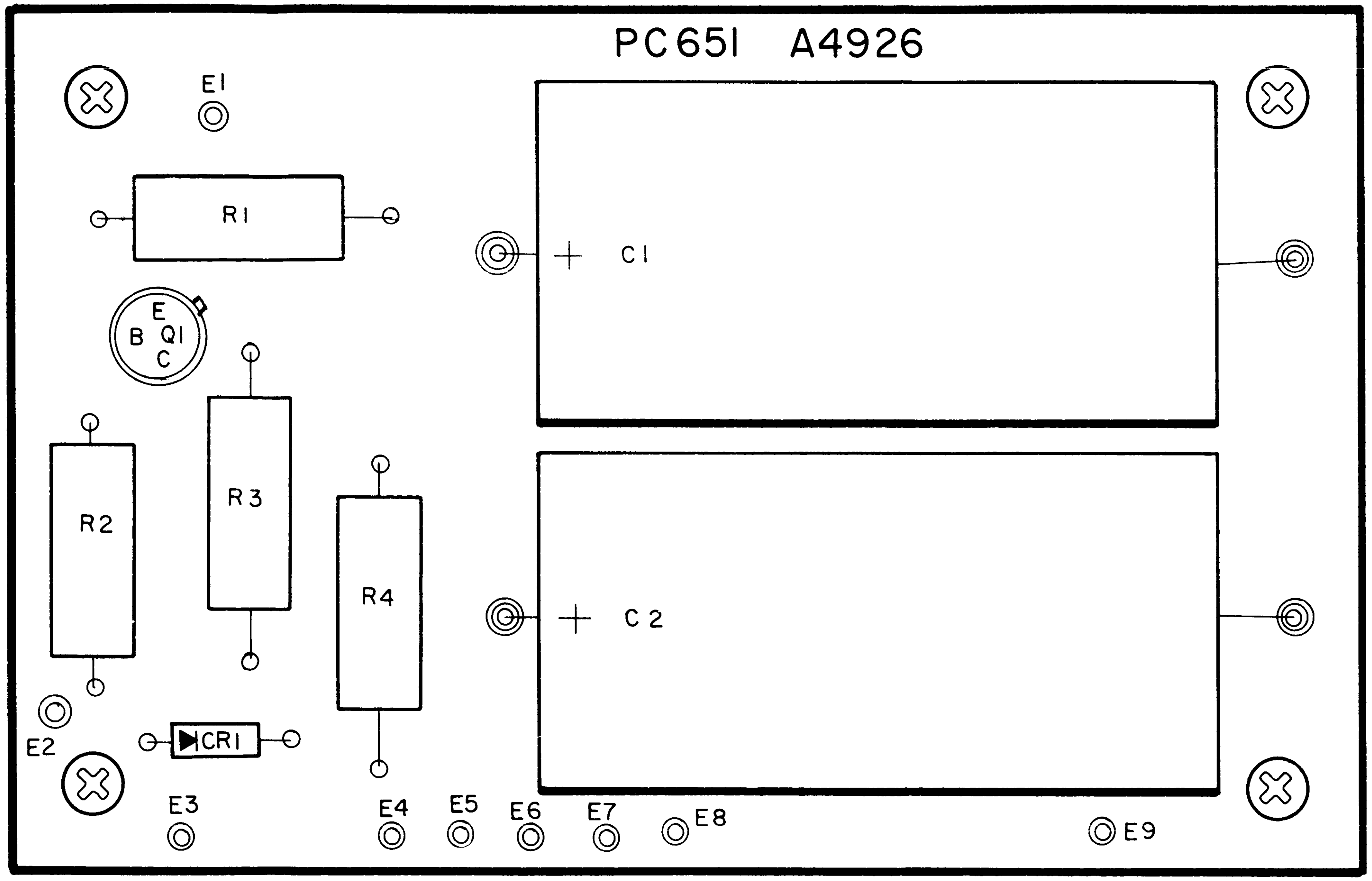

Figure 4-31. Power Supply Assembly Z105, Component Location and Parts List

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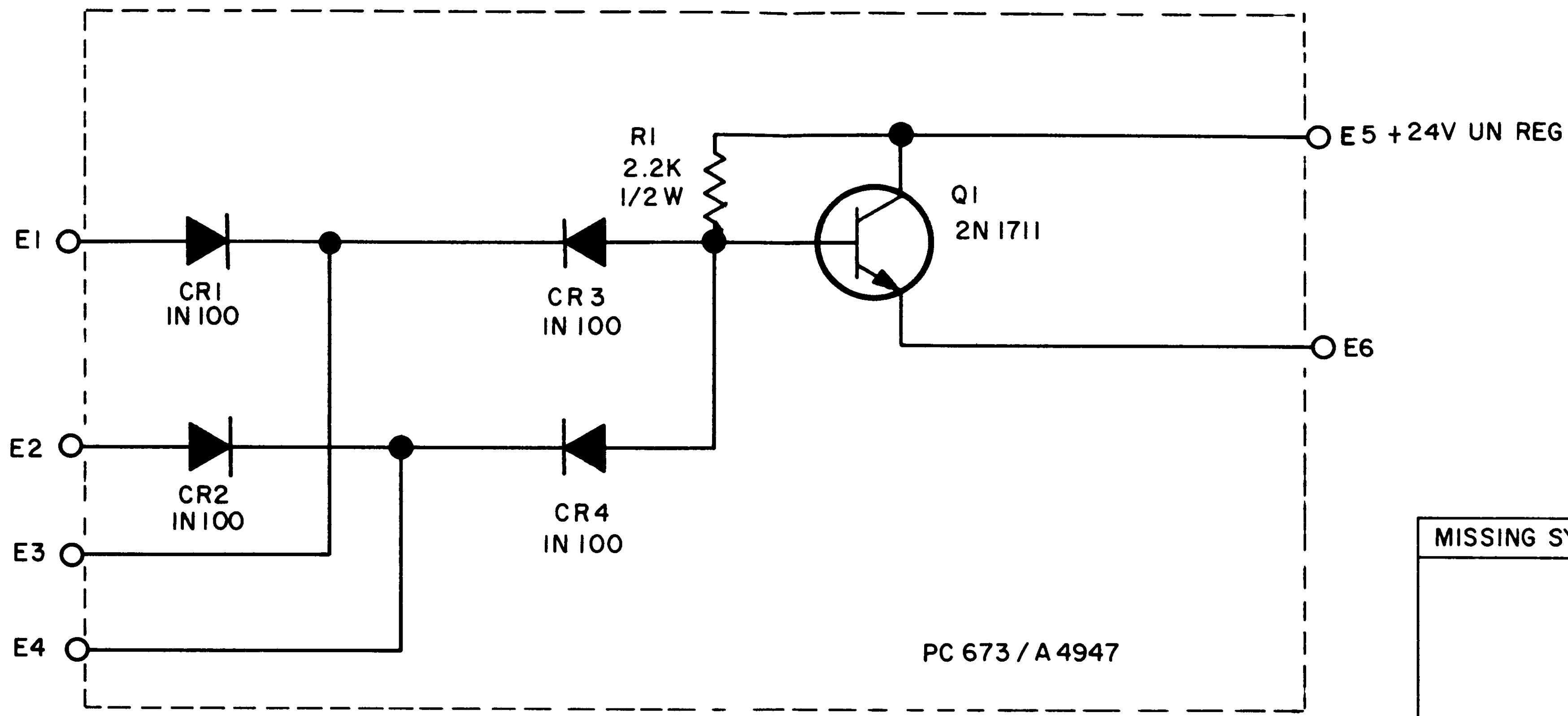

MISSING SYMBOL	LAST SYMBOL
	CR4 E6 QI RI

Figure 4-32. Oscillator Relay Control Assembly Z110, Schematic Diagram

Parts List for A-4947

SYMBOL	DESCRIPTION	TMC P/N
CR1 thru CR4	Diode	1N100
Q1	Transistor	2N1711
R1	Resistor, Fixed, Composition	RC20GF222J

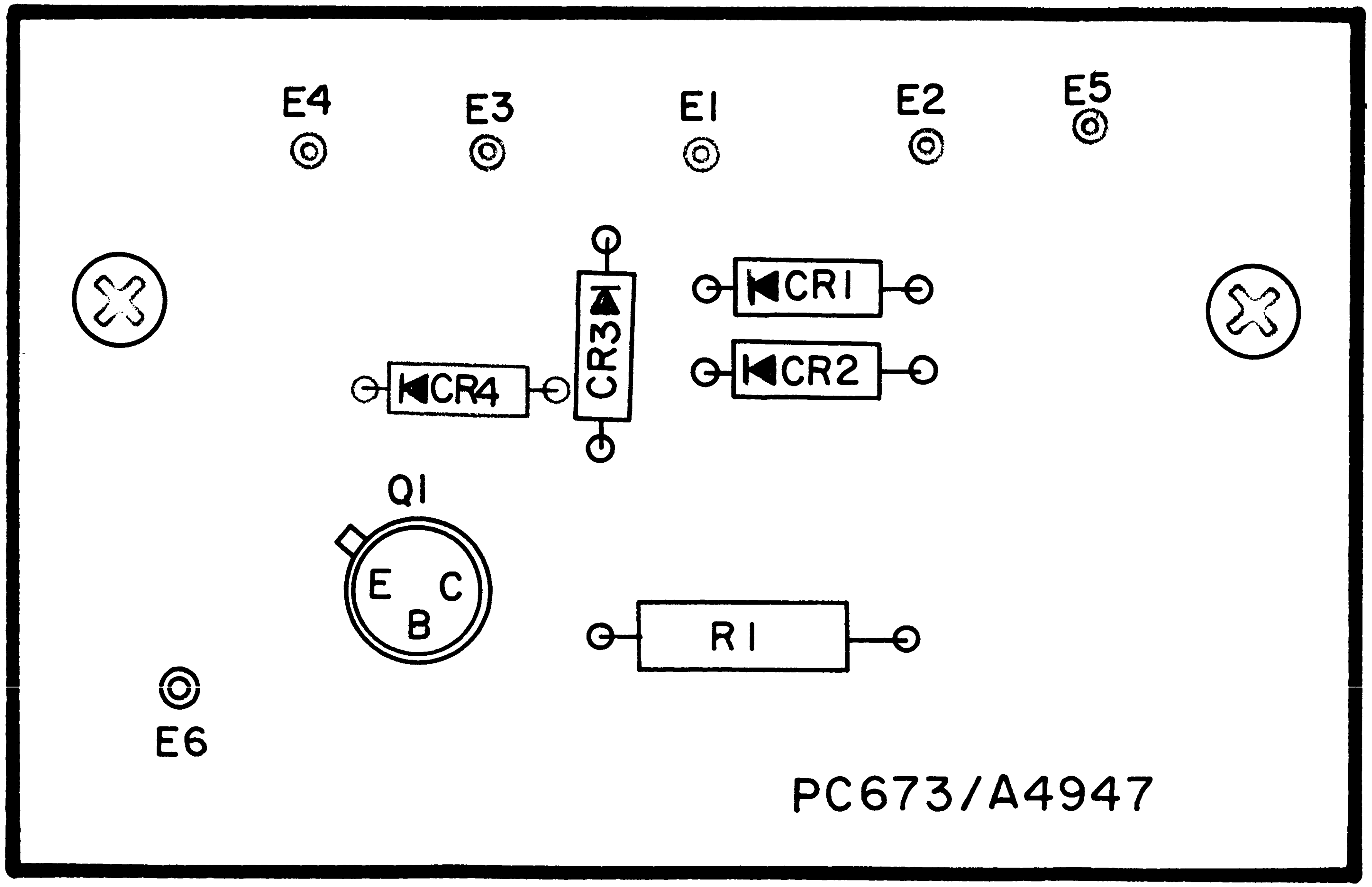

Figure 4-33. Oscillator Relay Control Assembly Z110, Component Location and Parts List