



Mobile Communication Equipment



Series 700 Transmitter

Mobile and Base Station
150 MHz Band
25 Watts



NOTE: FOR REPLACEMENT PARTS, SEE IB-8027351-P.

INITIAL ADJUSTMENTS

The only tuning necessary at the time of installation is peaking of the PA and antenna loading.

1. Equipment needed:

- a. Non-metallic screwdriver.
- b. In-line wattmeter with 50 watt element - Bird Model 43 or equivalent.
- c. Multi-frequency transmitters, if frequencies are widely spaced:
Center Frequency Alignment Oscillator (MI-559408 - see Exciter Parts List for ordering information.)

2. Multi-frequency transmitters: if highest and lowest transmit frequencies are less than $\pm 0.25\%$ of center frequency apart, set frequency selector to any position. If frequencies are more than $\pm 0.25\%$ of center frequency apart, remove F1 TCXO from Exciter circuit board, plug in Center Frequency Alignment Oscillator, and set frequency selector to F1. (Alternate procedure: if Center Frequency Alignment Oscillator is not available, set frequency selector to closest frequency above center frequency. Tuning in this manner may degrade performance on lower frequencies.)

3. Connect in-line wattmeter and antenna to antenna jack.

4. Turn ON/OFF Switch ON.

5. During tuning, key transmitter with Test Switch.

NOTE: Do not exceed a 20% duty cycle. Key only when making an adjustment. If the transmitter is keyed for excessive periods, the thermal protection circuit may cause RF output to fall off abruptly - this is normal. Allowing the unit to cool will restore full output.

NOTE: FCC rules specify that all tuning adjustments to the transmitter must be made by, or under the supervision of, a holder of a current FIRST- or SECOND-CLASS Commercial Radio Operator License.

6. Using a NON-METALLIC SCREWDRIVER, peak for maximum on wattmeter: (13) and (14) alternately; (15) and (16) alternately; (12). Repeat for maximum RF output. DO NOT ADJUST (17).

TRANSMITTER TUNING

GENERAL

To perform initial tuning at the time of installation, see Initial Adjustments section. To set deviation, see Exciter section. To adjust Antenna Switch, see Power Amplifier section.

This transmitter is tuned for maximum RF output as well as proper DC input. Therefore, an RF wattmeter is essential for proper tuning.

NOTE: FCC rules specify that all tuning adjustments to the transmitter must be made, by or under the supervision of, a holder of a current FIRST- or SECOND-CLASS Commercial Radio Operator License.

PRELIMINARY

1. Equipment needed:

- a. RCA CX-40 Test Adapter (MI-559234) for Simpson VOM, and a properly calibrated Simpson Model 260 or 270 VOM (or equivalent 50 uA, 5000 ohm meter).
- b. Hexagonal alignment tool, 0.1 inch across flats (RCA Stock Number 228788).
- c. Hexagonal alignment tool, 0.075 inch across flats (RCA Stock Number 244885).
- d. Non-metallic screwdriver, 0.1 inch blade.
- e. In-line wattmeter with 50 watt element - Bird Model 43 or equivalent.
- f. Dummy load, 50 ohm, 50 watt capacity.
- g. Multi-frequency transmitters, if transmit frequencies are widely spaced: Center Frequency Alignment Oscillator (MI-559408 - see Exciter Parts List for ordering information).
- h. Phillips screwdriver.
- i. Long-nose pliers.

2. Multi-frequency transmitters: if highest and lowest transmit frequencies are less than $\pm 0.25\%$ of center frequency apart, set frequency selector to any position. If frequencies are more than $\pm 0.25\%$ of center frequency apart, remove F1 TCXO from Exciter circuit board, plug in Center Frequency Alignment Oscillator, and set frequency selector to F1. (Alternate procedure: if Center Frequency Alignment Oscillator is not available, set frequency selector to closest frequency above center frequency. Tuning in this manner may degrade performance on lower frequency.)

3. Connect dummy load to antenna jack.

4. Connect CX-40 adapter to VOM and cables to RECEIVER/EXCITER and TRANSMITTER test sockets. Use 50 uA range on VOM. (If CX-40 is not available, use 50 uA input on VOM and connect probes to test socket pins as shown in Tuning Table. A 50 uA meter is required for accurate calculation of DC input power.)

5. Perform these steps ONLY if transmitter frequencies are being changed, or if unit is severely out of alignment:

- a. Preset all Exciter and Multiplier board slugs (① through ⑨) to top of coil forms.

b. Make sure Multiplier board has the proper plug-in capacitors:

132-148 MHz	C19 = 15 pF	C24 = 10 pF
148-162 MHz	C19 = 6 pF	C24 = 7 pF
162-174 MHz	C19 not used	C24 not used

6. Turn ON/OFF Switch to ON.

7. During tuning, key transmitter with Test Switch

NOTE: Do not exceed a 20% duty cycle. Key only when making an adjustment. Use of a cooling blower is recommended. If the transmitter is keyed for excessive periods, the thermal protection circuit may cause RF output to fall off abruptly - this is normal. Allowing the unit to cool will restore full output.

8. Proceed to Tuning Table.

TRANSMITTER TUNING TABLE

Step	Adjustment	CX-40 Switch	Typical Reading uA or Watts	Reading This Unit	VOM Probes to Socket Pins		Description
					+	-	
1	PERFORM STEPS IN TRANSMITTER TUNING PRELIMINARY BEFORE ALIGNING UNIT						
RECEIVER TEST SOCKET							
2	Phase Mod	1	10-35		1	9	Peak (1) and (2).
3	Tripler	6	15-50		6	9	Peak (3). Dip (4) to minimum.
TRANSMITTER TEST SOCKET							
4	1st Doubler Base	A	20-40		14	12	Peak (5). Repeak (1), (2), (3), (4), (5). Tune (6) for slight dip.
5	1st Doubler Coll	B	20-40		11	5	Peak (7) and (6). Tune (8) for slight dip.
6	2nd Doubler Coll	C	25-40		9	4	Peak (8), (9), (10). USE NON-METALLIC SCREWDRIVER FOR ALL PA BOARD ADJUSTMENTS.
7	1st Amp	D	35-50		8	3	Peak (11). Repeak (8), (9), (10), (11).
8	2nd Amp	E	35-50		7	2	Peak (12).
Remove dummy load from output jack and connect in-line wattmeter and antenna.							
9	3rd & 4th Amps	-	25W		-	-	Peak for max on wattmeter: (13) & (14) alternately; (15) & (16) alternately; (12). Repeat. DO NOT ADJUST (17).
This completes transmitter tuning. DC input should also be checked. Make sure unit is cool and output power is normal (25W) before checking input.							
10	PA I _c	F	25 uA (5 A)		6	1	Divide uA reading by 5 for current in amps.
11	PA E _c	-	+12.5V		6	7	If using CX-40, remove TRANSMITTER plug from test socket. Measure + voltage at test socket pin 6.
12	DC Input	-	62.5W		-	-	Multiply readings (steps 10 & 11) together for input in watts.

DO NOT USE

1000 PAGES OF ADDENDUM

GENERAL

When troubleshooting, pinpoint the trouble to a specific board or assembly by using these diagrams in the System Instruction Book:

Signal flow and keying: 150 MHz Transmitter Functional Diagram; appropriate Control Functional Diagram. (A copy of the Transmitter Functional Diagram is included in this book.)

Power: 150 MHz Power Functional Diagram for appropriate control system.

Once the difficulty is isolated, refer in this book to the diagram of the faulty board or assembly for detail.

When troubleshooting individual circuit boards or assemblies, use the station power supply. If it is necessary to use an external supply, the supply should be voltage-regulated and current-limited.

Code designations, e. g., CODE A, CODE B, are marked on all assemblies and circuit boards for purposes of serialization. In the event of circuit refinements, the code letter designation is correspondingly changed to facilitate identification.

Each transmit frequency is determined by a sealed TCXO (Temperature Compensated Crystal Oscillator) plug-in. The desired transmit frequency is selected by grounding pin 1 of the proper TCXO. Frequencies may be added or changed by changing TCXOs (and retuning the transmitter).

Pre-emphasis (6dB/octave) is provided by R15, R16, C16. Symmetrical series diode clipper CR5-CR6 prevents deviation peaks from exceeding 5.0 kHz. For audio levels below limiting, de-emphasis network C21-R23 (6dB/octave) compensates for the pre-emphasis at the input. In limiting, this network filters out the high-frequency components generated by the limiting process. Frequencies above 2500 Hz are further attenuated by 18 dB/octave roll-off filter L3, C23, C24.

Phase modulation is accomplished in two resonant circuits made up of T1, T3, and varactor diodes CR1, CR3. The audio modulating voltage varies the bias on the diodes, causing their capacitance to vary. This causes instantaneous phase shift of the TCXO signal, thus producing phase modulation.

Keying the transmitter places a positive voltage on Q6 base, making Q6 conduct. This lowers the potential on Q5 base, which makes it conduct, connecting the +9.5 supply to the TCXOs and Q1.

Modulation Check

Deviation is correctly set at the factory and should not require adjustment unless a component of the modulation circuit is replaced. If adjustment is necessary, perform the following steps:

NOTE: FCC rules specify that all tuning adjustments to the transmitter must be made by, or under the supervision of, a holder of a current FIRST- or SECOND-CLASS Commercial Radio Operator License.

CAUTION

Do not adjust Exciter Deviation Limit Control R27 or Quiet Channel Deviation Limit Control 82R16 unless an accurate means of checking deviation is available.

1. Connect deviation meter as recommended in the Instruction Book for the instrument being used.

2. Connect audio generator to Exciter board.

EXCITER CIRCUIT BOARD/TCXO**Circuit Description**

See Exciter Schematic.

3a. Units *without* Quiet Channel: Adjust Exciter Deviation Limit Control R27 for +5.0 kHz or -5.0 kHz deviation, whichever is greater.

3b. Units *with* Quiet Channel: Adjust Quiet Channel Deviation Limit Control 82R16 (accessible through hole in Exciter board) for 500 Hz deviation; then adjust Exciter Deviation Limit Control R27 for a *combined* deviation of 5.0 kHz.

Servicing

The TCXO is a factory-sealed unit and should not be opened. If found to be defective, it must be replaced with a new TCXO of the same frequency. To order additional or replacement TCXOs, see parts list.

An RCA WV-98C VTVM is recommended for troubleshooting and signal-tracing in the Exciter circuits.

Exciter Board Removal

1. Remove clamp(s) holding TCXO(s) in place.
2. Remove 4 screws from Exciter board and lift out for servicing.

NOTE: If operational tests are made with the board in this position, the board ground copperpath must be jumpered to chassis ground.

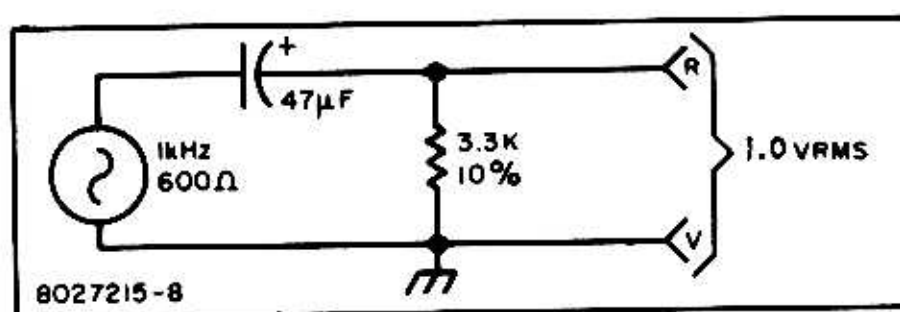


Figure 1. Deviation Test Set-up

POWER AMPLIFIER

Circuit Description

When the transmitter is keyed, +12 is applied to the Antenna Switch, forward-biasing CR5 and CR6. CR6 grounds one end of quarter-wavelength line L18, reflecting a high impedance at the other end. This blocks transmitter RF from the receiver input. All RF is routed through the low-pass filter to the antenna jack.

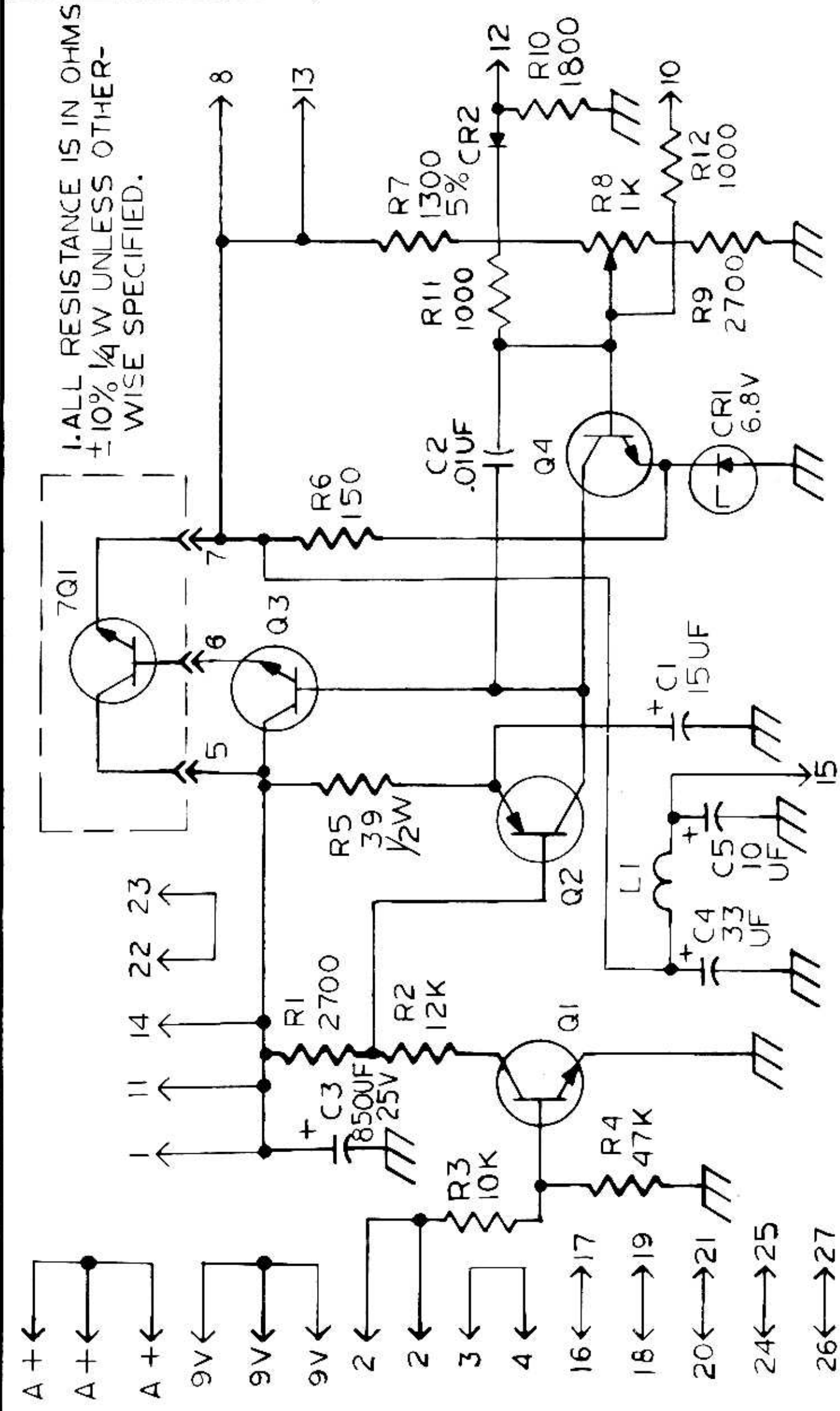
In the receive mode, CR5 and CR6 are non-conducting. CR5, L17, C37 are parallel-resonant at the receive frequency, blocking received signal from the transmitter. L18 functions as a transmission line from the low-pass filter to the receiver input.

Adjustment

C37 (adjustment **(17)**) is set at the factory and should never require adjustment unless frequencies are changed or parts are replaced in the Antenna Switch circuit.

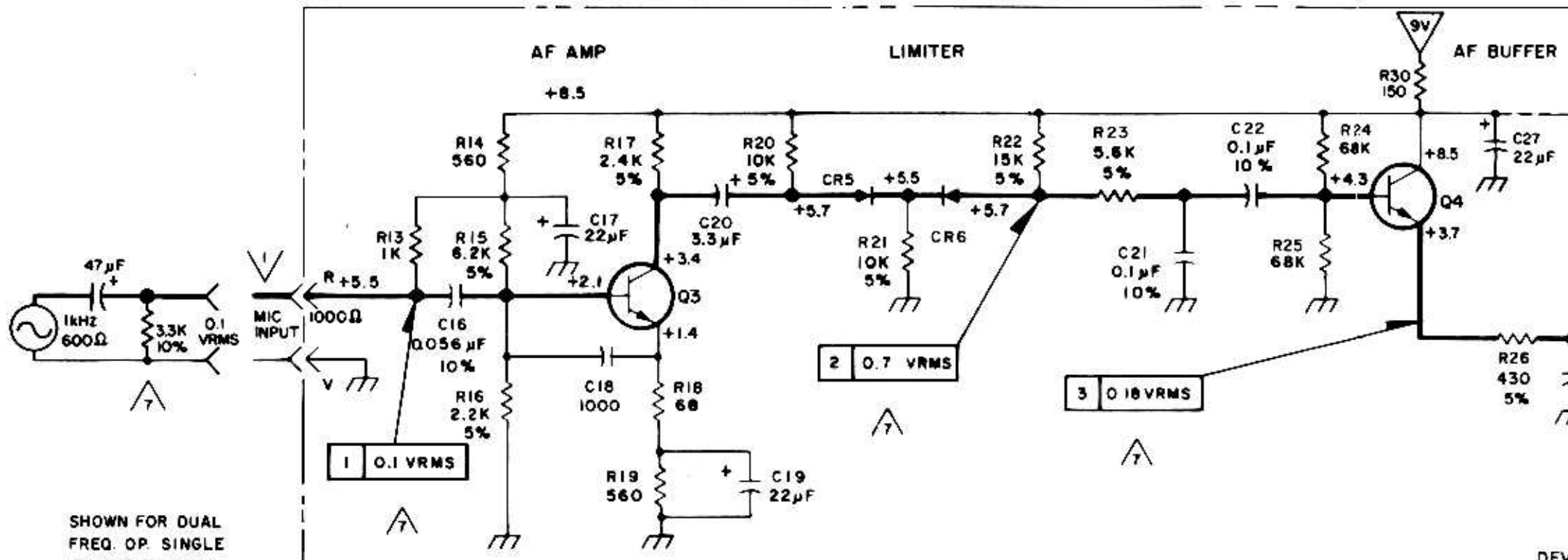
1. Make sure transmitter is properly tuned and heat sink is cool to the touch.
2. Remove lead from pin 17 on Exciter circuit board (this disables keying).
3. Connect an RF signal generator to the antenna jack.
4. Set generator to receive frequency (or to center frequency in multi-frequency receivers).
5. Adjust generator output level so receiver audibly just begins to limit.
6. Adjust **(17)** for maximum receiver quieting.
7. Reduce generator output and readjust **(17)** for maximum quieting.
8. Repeat until no further improvement is possible.
9. Disconnect generator and replace lead on Exciter board pin 17.

3457873-8



1. ALL RESISTANCE IS IN OHMS
±10% 1/4 W UNLESS OTHER-
WISE SPECIFIED.

FIGURE 2.
SCHEMATIC-
VOLTAGE REGULATOR
BOARD

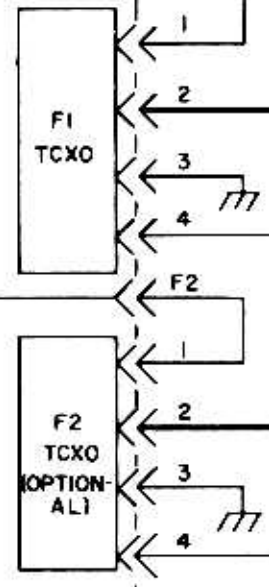


SHOWN FOR DUAL FREQ. OP. SINGLE FREQ. OP. LEAD TO F1 IS PARKED ON F1 DRST; PIN F1 IS JUMPED TO GND PIN

F1 DRST NC

GND

F1



F2 TCXO (OPTIONAL)

F3

F4

F4

F4

F4

F4

F4

F4

F4

F4

F4

F4

F4

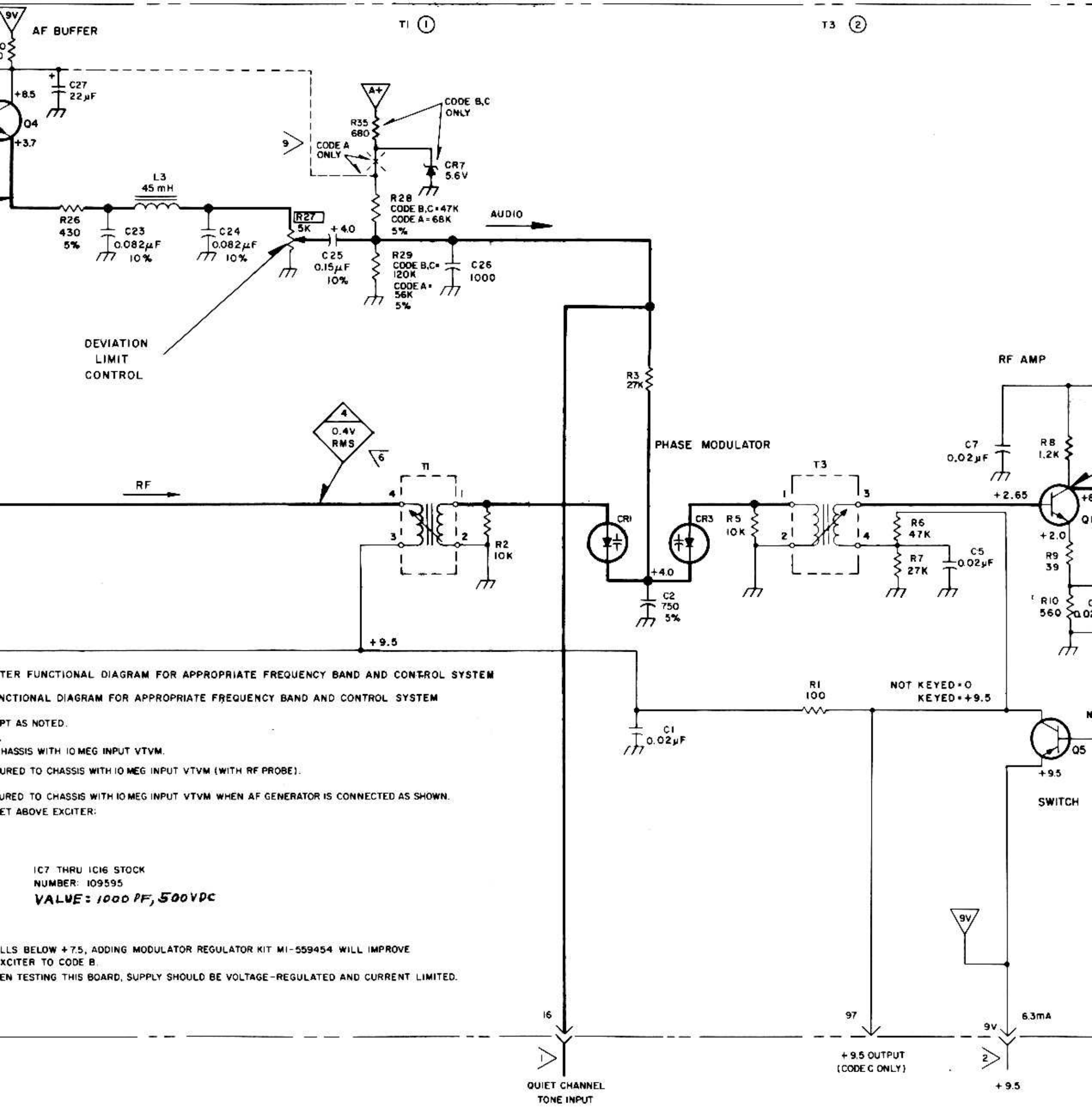
FREQUENCY SELECTION



NOTES:

- 1. FOR INTERCONNECTIONS, SEE TRANSMITTER FUNCTIONAL DIAGRAM IN SYSTEM INSTRUCTION BOOK.
 - 2. FOR INTERCONNECTIONS, SEE POWER FUNCTIONAL DIAGRAM IN SYSTEM INSTRUCTION BOOK.
 - 3. ALL RESISTANCES IN OHMS, 10%, 1/4 W EXCEPT AS NOTED.
 - 4. ALL CAPACITANCES IN pF EXCEPT AS NOTED.
 - 5. DC VOLTAGES ARE TYPICAL, MEASURED TO CHASSIS WITH 10 MEG OHM METER.
 - 6. AC RMS VOLTAGES ARE TYPICAL, MEASURED TO CHASSIS WITH 10 MEG OHM METER.
 - 7. AC RMS VOLTAGES ARE TYPICAL, MEASURED TO CHASSIS WITH 10 MEG OHM METER.
 - 8. PHYSICAL LOCATION OF FEEDTHRU ON BRACKET ABOVE EXCITER:
-
- IC7 THRU IC16
NUMBER: 1095
VALUE: 10
- 9. CODE A EXCITERS: IN SYSTEMS WHERE A+ FALLS BELOW +7.5, ADD MODULATOR PERFORMANCE, AND CONVERT EXCITER TO CODE B.
 - 10. IF AN EXTERNAL POWER SUPPLY IS USED WHEN TESTING THIS BOARD...

DERIVED FROM 3476343 REV 5
8027215-12



INTER FUNCTIONAL DIAGRAM FOR APPROPRIATE FREQUENCY BAND AND CONTROL SYSTEM
 FUNCTIONAL DIAGRAM FOR APPROPRIATE FREQUENCY BAND AND CONTROL SYSTEM
 PT AS NOTED.
 CHASSIS WITH 10 MEG INPUT VTVM.
 MURED TO CHASSIS WITH 10 MEG INPUT VTVM (WITH RF PROBE).
 MURED TO CHASSIS WITH 10 MEG INPUT VTVM WHEN AF GENERATOR IS CONNECTED AS SHOWN.
 ET ABOVE EXCITER:

IC7 THRU IC16 STOCK
 NUMBER: 109595
 VALUE: 1000 PF, 500VDC

ALLS BELOW + 7.5, ADDING MODULATOR REGULATOR KIT MI-559454 WILL IMPROVE
 XCITER TO CODE B.
 EN TESTING THIS BOARD, SUPPLY SHOULD BE VOLTAGE-REGULATED AND CURRENT LIMITED.

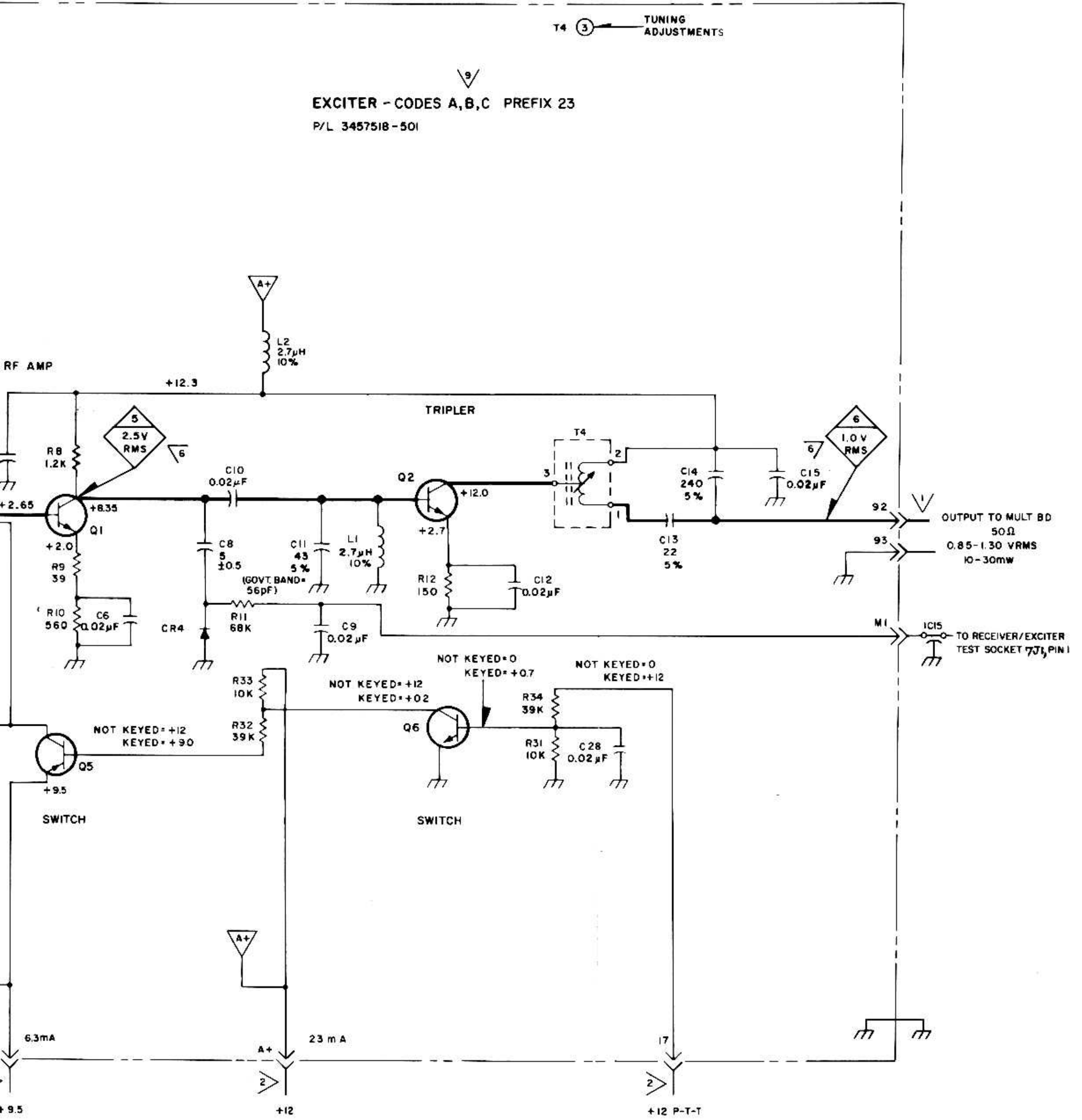
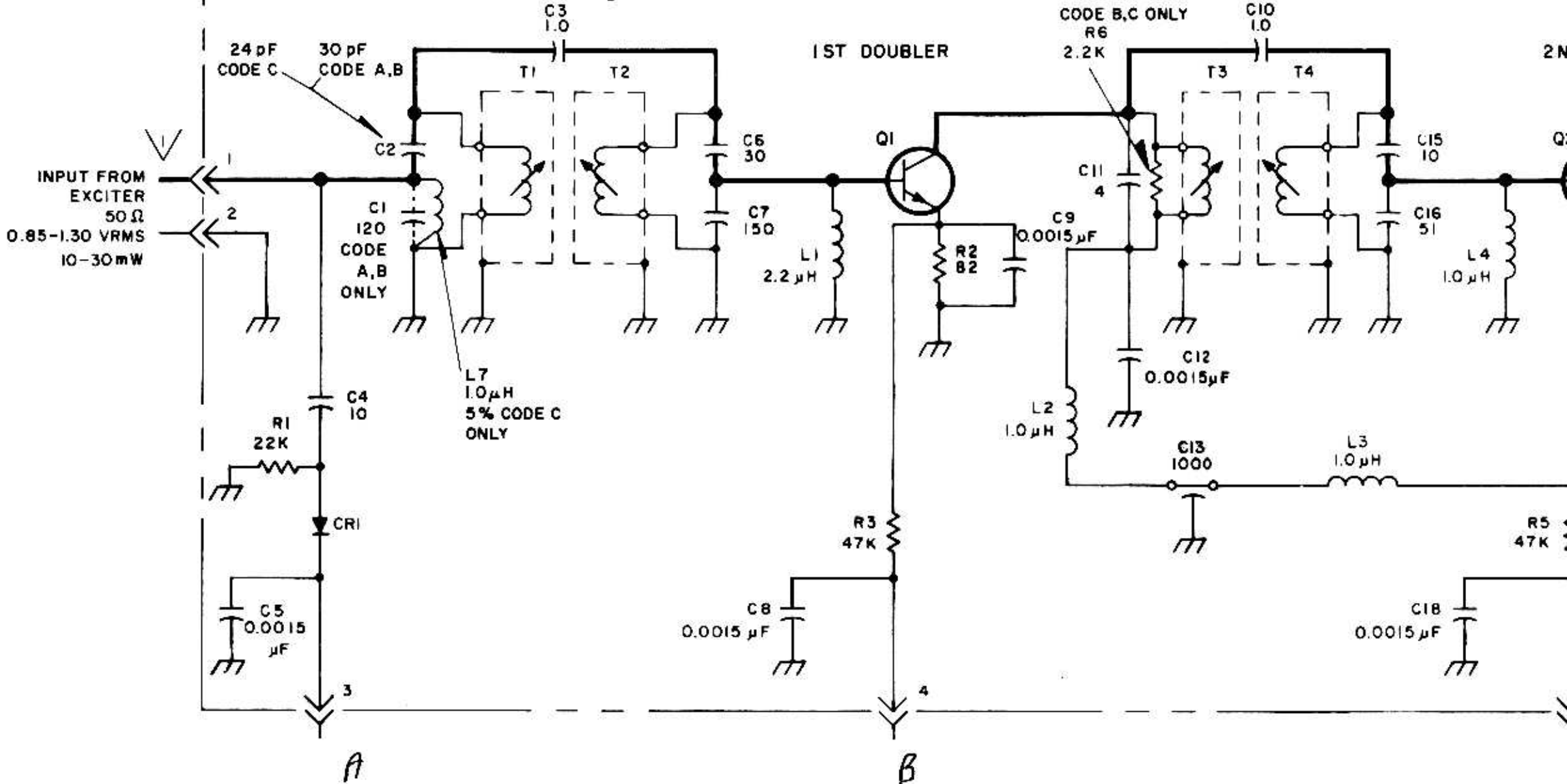


Figure 3. Schematic - Exciter Circuit Board

MULTIPLIER
P/L 3457643-501
CODES A,B,C PREFIX 24

TUNING ADJUSTMENTS → (4) (5)

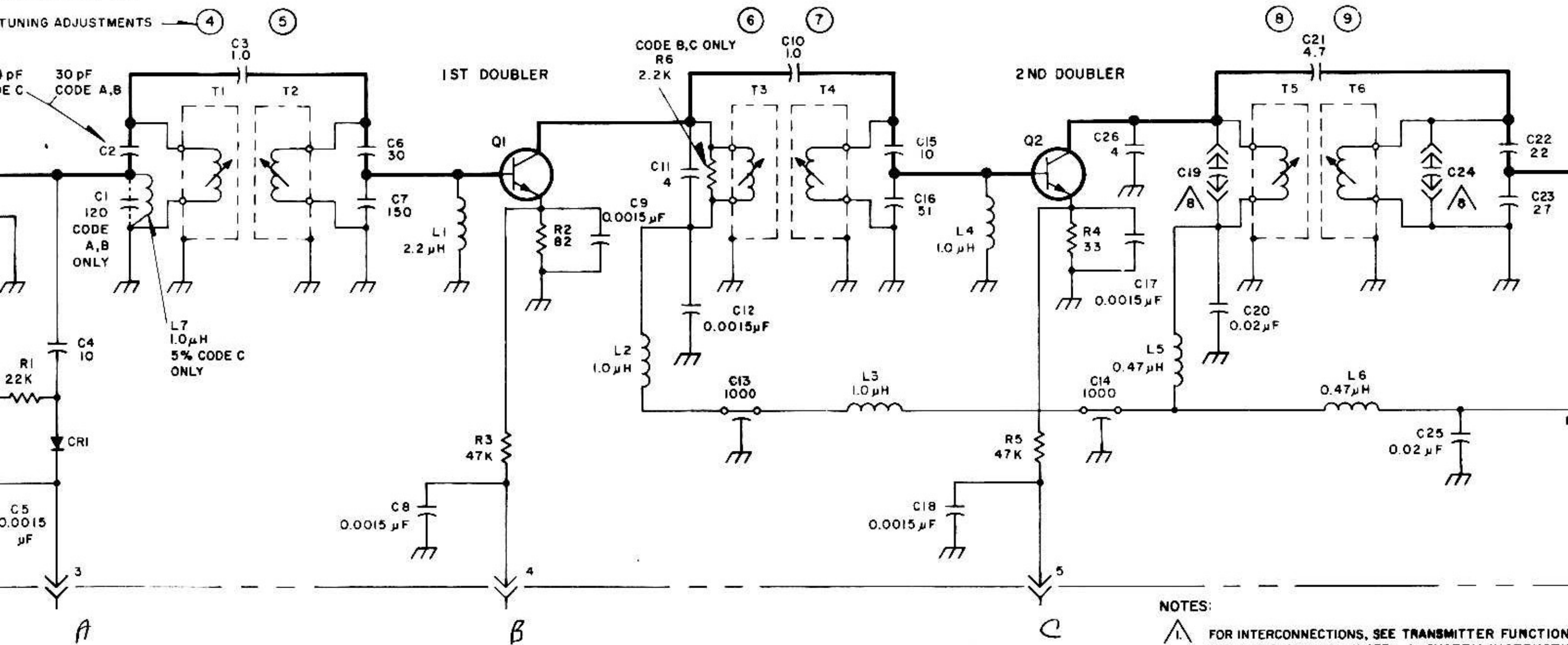


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 8027215-15

MULTIPLIER
P/L 3457643-501

CODES A,B,C PREFIX 24

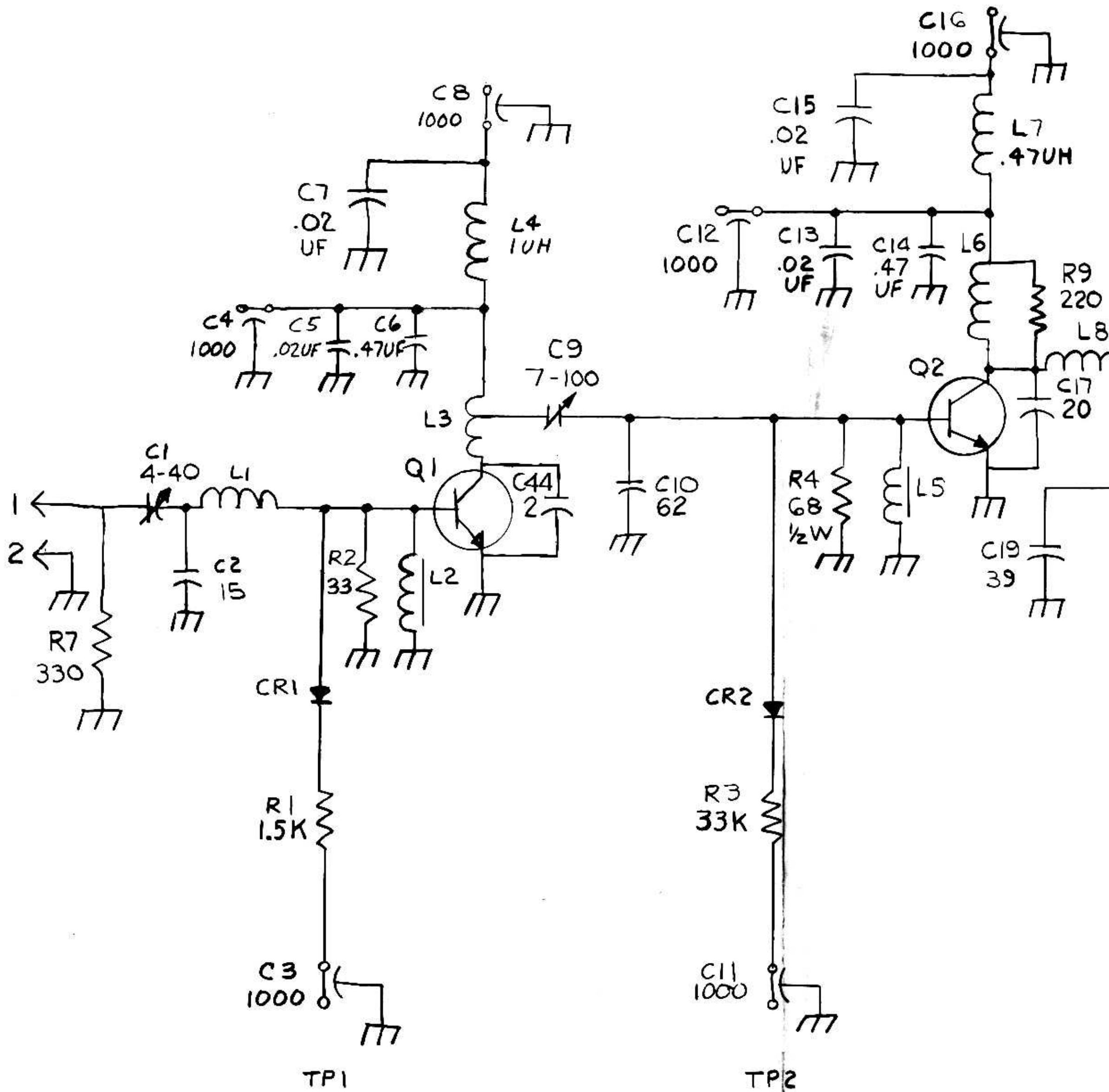
TUNING ADJUSTMENTS



NOTES:

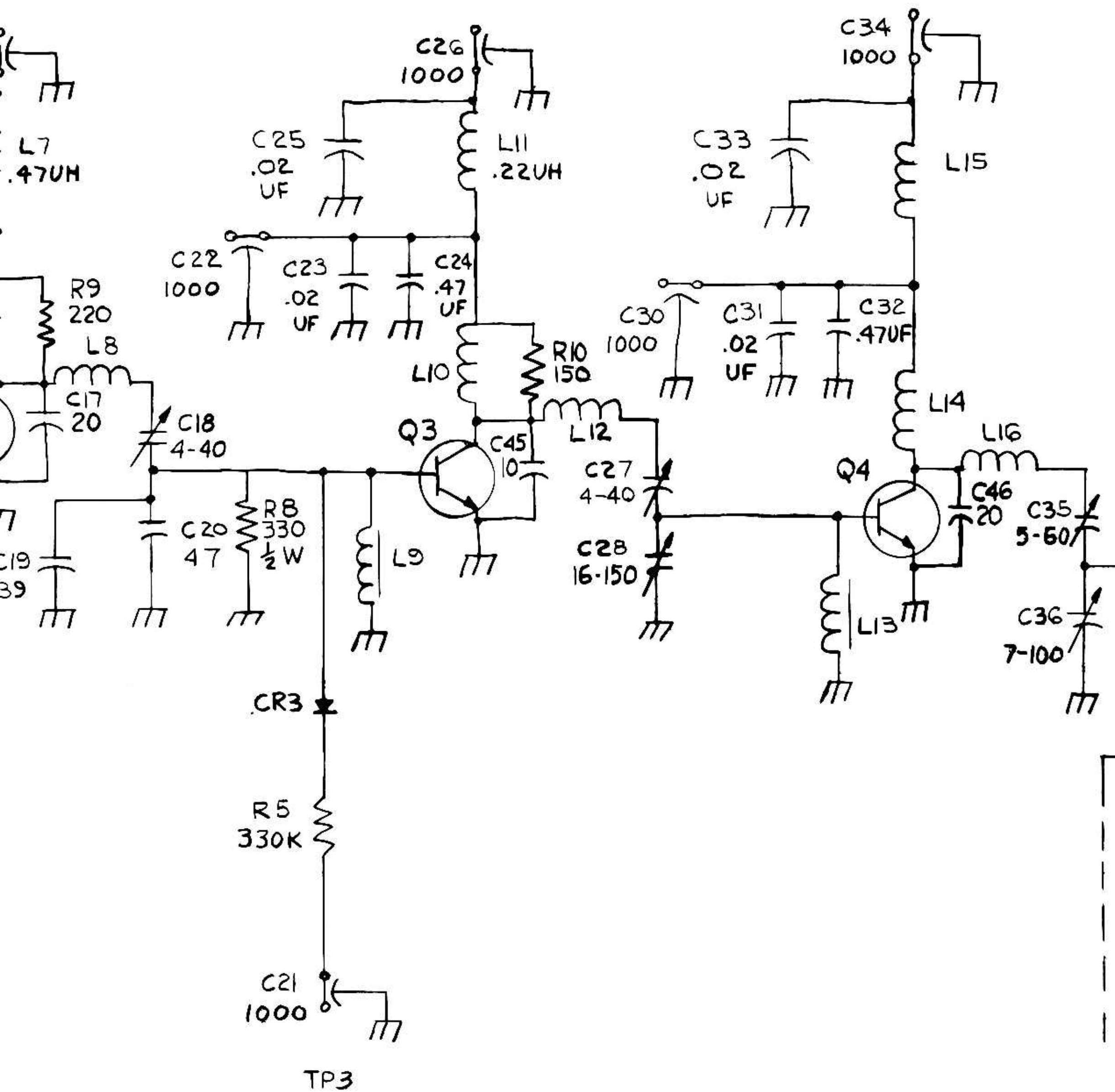
1. FOR INTERCONNECTIONS, SEE TRANSMITTER FUNCTION BAND AND CONTROL SYSTEM IN SYSTEM INSTRUCTION
 2. FOR INTERCONNECTIONS, SEE POWER FUNCTIONAL DIA BAND AND CONTROL SYSTEM IN SYSTEM INSTRUCTION
 3. ALL RESISTANCES IN OHMS, 10%, 1/4 WATT EXCEPT AS NOTED.
 4. ALL CAPACITANCES IN PF EXCEPT AS NOTED.
 5. DC VOLTAGES ARE TYPICAL, MEASURED TO CHASSIS W
 6. AC RMS VOLTAGES ARE TYPICAL, MEASURED TO CHASSIS
 7. IF AN EXTERNAL POWER SUPPLY IS USED WHEN TESTING VOLTAGE-REGULATED AND CURRENT-LIMITED.
- | | | |
|-----------------|------------------------------|------------------------------|
| 8. 148-162 MHZ: | C19 = 6 PF | C24 = 7 PF |
| 162-174 MHZ: | C19 NOT USED | C24 NOT USED |
| GOVT. BAND: | C19 REPLACED BY C101 = 15 PF | C24 REPLACED BY C102 = 10 PF |

DERIVED FROM 3476359 REV. 8
8027215-15



SYMBOL PREFIX 32
 3472741-1 REV 5

RESISTORS IN OHMS
 CAPACITORS IN PICO FARADS



S IN OHMS, 1/4W EXCEPT AS NOTED.
 C IN PF EXCEPT AS NOTED.

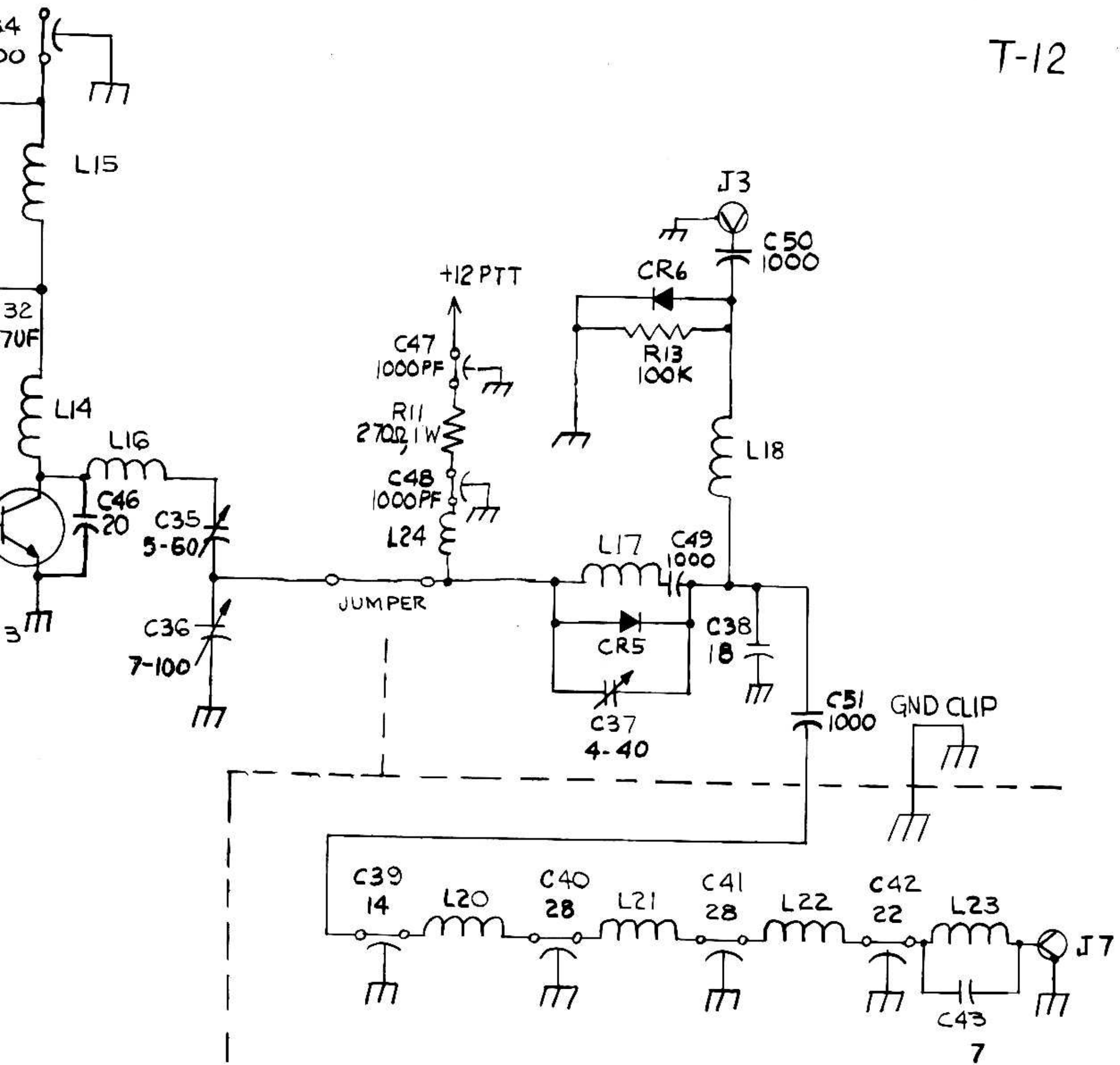
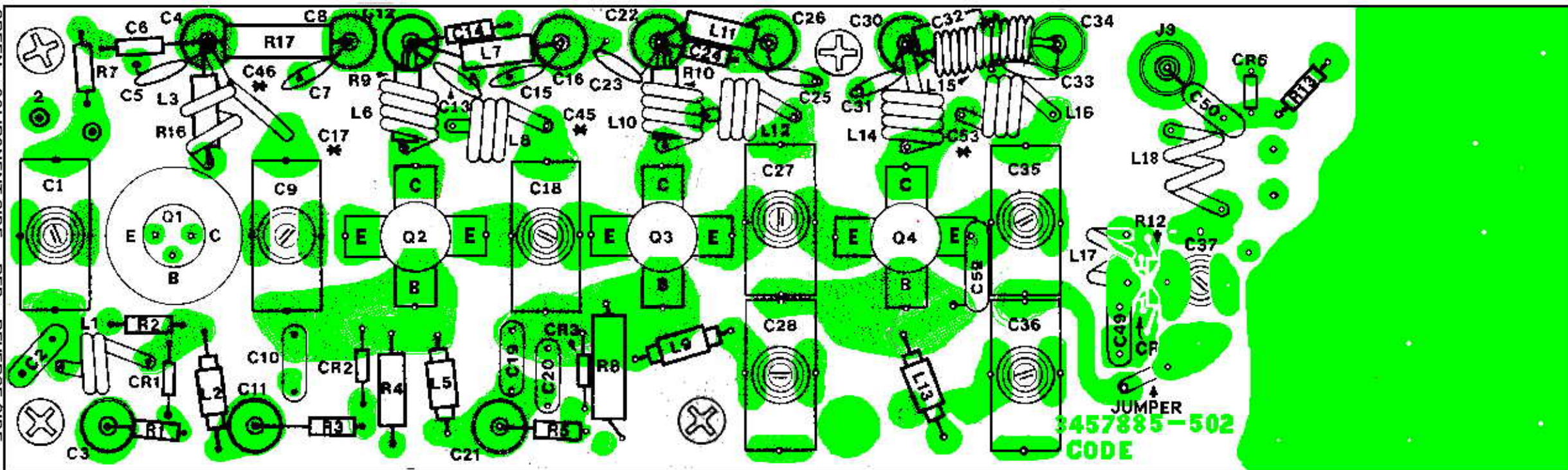


FIGURE 5.
SCHEMATIC- 150 MHZ PA BOARD

GREEN = COMPONENT SIDE
RED = REVERSE SIDE



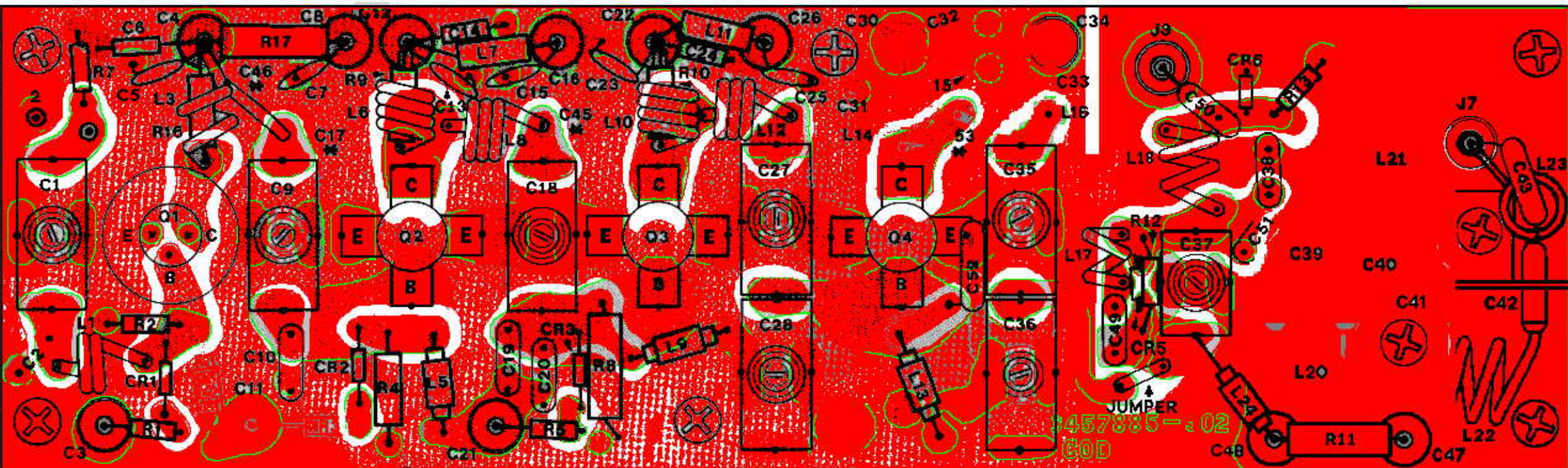
3457885-502
CODE

3B033

*C17, C45, C46, C53 CAPACITORS ARE MOUNTED ON OTHER SIDE OF BOARD

N3LKL

GREEN = COMPONENT SIDE
RED = REVERSE SIDE



3B033

✱ C17, C45, C46, C53 CAPACITORS ARE MOUNTED ON OTHER SIDE OF BOARD

N3LKL