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Specifications

General

Frequency Range	26.965 – 27.405 MHz
Channels	40 (PLL synthesized)
Antenna Input Impedance	50 Ohms
Power Source	12 – 15 VDC (13.8V nom.)
Size (W x D x H)	5-1/2" x 7-13/16" x 1-5/8"
Weight	3 lbs

Transmitter

Emission	Type 6A3
RF Power Output	4 Watts
Modulation	AM
Modulation Level	Up to 100% Max (FCC specs)
Attenuation of Spurious and Harmonic Radiation	Better than -70 dB
Hum and Noise	Better than -60 dB
Frequency Tolerance	0.002%

Receiver

Sensitivity at 10 dB S + N/N	0.5 uV
Sensitivity at 500 mW audio output	0.5 uV
Squelch Threshold	0.5 uV
Squelch Tight	1000 uV
Audio Power Output (Max)	5 Watts
Audio Power Output (10% Dist.)	4 Watts
Selectivity (@ 6 dB down)	7 kHz
Adjacent Channel Rejection	-60 dB
Image Rejection	-70 dB
Speaker Impedance	16 Ohms

Important Notice

FCC Regulations stipulate that the transmitter portion of the transceiver described in this manual must be serviced by (or only under the direct supervision of) a technician holding a First Class or Second Class FCC Radiotelephone License.

Servicing is defined as any internal adjustments or replacement of crystals, transistors and/or any other components which affect proper transmitter performance.

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General Description

Model 14T276 Citizens Band Transceiver is a solid state, 40 channel, concealed chassis, AM radio transmitter/receiver designed for two-way communication in the 27 MHz citizens band. All controls are contained on a specially designed hand-held microphone/speaker unit.

The main chassis unit is intended for a concealed mounting location in cars or trucks, such as behind vehicle dash on firewall, under front seat or (with optional extension cable) in the trunk or under rear seat.

The 14T276 features include electronic channel selection, channel lock switch, channel 9 (emergency channel) switch, digital channel readout, ANL on/off switch and a transmit/receive indicator light. The hand-held microphone/control unit incorporates all controls and includes the unit speaker. A separate speaker may be connected to an external speaker jack provided on the main chassis.

The unit may be used in any car, truck, boat or recreational vehicle that uses a 12 volt (nominal) DC positive or negative ground system. Components comprising the 14T276 package include: – the microphone/control unit with coiled cord; the main chassis unit; under-dash microphone bracket; power cord, and a 6-foot cable for connection from the concealed chassis location to the microphone bracket.

Circuit Description

The 14T276 transceiver employs electronic channel selection and digital channel readout. Both functions are contained in the microphone/speaker unit, which incorporates all controls. An external speaker jack is provided on the main chassis for use of an external speaker.

Phase Lock Loop Circuitry

Model 14T276 uses a phase-lock loop (PLL) system for synthesis of the highly precise carrier and control oscillator signals developed for use by the transmitter and receiver sections of the transceiver unit.

A free-running voltage controlled oscillator (VCO) TR19 derives its control from IC1 which contains a programmable divider, buffer and phase detector. These in turn are controlled by the 10.24 MHz oscillator TR21.

The VCO generates signals of 16.27 MHz to 16.71 MHz in the "RECEIVE" mode, and 16.725 MHz to 17.165 MHz in the "TRANSMIT" mode. (See Table Page 5.) Control voltages for receive and transmit are furnished by IC1, which changes output to the VCO depending on whether the mode is receive or transmit.

The crystal-controlled reference oscillator TR21 operates at 10.24 MHz and feeds a buffer in IC1. A 1/1024 divider in IC1 produces a highly precise 10 kHz signal for VCO control, via the phase detector in IC1. The phase detector develops a DC voltage in proportion to the phase difference between the divided down reference oscillator signal and the signal developed in the channel selection circuit. Any difference alters the VCO frequency shifting the VCO until it locks with the reference oscillator, resulting in a VCO frequency 10.695 MHz below the channel frequency in the RECEIVE mode, or 10.24 MHz in the TRANSMIT mode.

Electronic Channel Selection

With the operating controls in the microphone/speaker unit, channel selection is made by an UP/DOWN switch on the hand-held unit, rather than the familiar rotary channel switch or pushbutton selection. Channel selection is actually performed as a function of IC301 in the microphone/speaker unit. This IC performs two basic functions; channel selection and digital channel readout. A read-only memory (ROM) in the IC is programmed with the channel digital code, see chart Page 5. When the UP/DOWN switch is actuated, an UP/DOWN counter in the IC shifts the operating channel at a preset rate causing an LED in the IC to switch sections in the LED display to change the indicated channel. Simultaneously this code feeds to IC1 in the main chassis unit programming the PLL for the corresponding channel selection. During channel selection the receiver and transmitter are temporarily rendered inoperative.

Transmitter RF System

Carrier frequency for transmission is generated in IC2 by beating a 10.24 MHz signal from the reference oscillator TR21 with the VCO signal developed through IC1 by the channel selection programmed in IC301. This VCO signal is always 10.24 MHz below the selected channel frequency, therefore the output of IC2 will be the carrier frequency of the channel selected. For example: the channel frequency for channel 19 is 27.185 MHz. By selecting channel 19 on the hand unit, the proper code is fed to pins 1 – 6 in IC1 (see Table page 5) creating an output signal to produce a frequency of 16.945 MHz by the VCO. This signal beat with a signal from the 10.24 MHz reference oscillator in IC2, produces an output which is the sum of these two frequencies, namely 27.185 MHz, the carrier frequency for channel 19. This signal is then passed through L13 to predriver T24, then to Driver TR26 and Power Amplifier TR26, and on to the antenna.

Audio and Modulator System

The voice signal in the transmit mode feeds from the speaker/microphone in the hand-held unit to TR12, then on to Modulator TR16. The output feeds to the collectors of TR25 and TR26 to modulate the amplifiers in the RF chain. TR13 is an ALC transistor whose circuitry acts to prevent overmodulation by controlling the audio gain from the microphone.

Receiver System

The receiver comprises a double conversion system with a two-stage 455 kHz IF amplifier circuit. In the 1st Mixer TR2, the RF channel signal from TR1, RF Amplifier, is beat with the 16 MHz "RECEIVE" signal from the VCO TR19. This results in a 10.695 MHz signal out of the 1st Mixer. This signal is fed to the Second Mixer TR3 through filter CF1. This signal is beat in the 2nd Mixer with a 10.24 MHz signal from reference oscillator TR21. The resultant difference frequency of 455 kHz becomes the receiver intermediate frequency.

The second mixer output at 455 kHz is passed through filter CF2 (for amplifier selectivity) and on to IF amplifier TR4. Cascaded grounded emitter amplifiers TR5 and TR6 amplify the IF signal fed to the detector circuit.

Squelch voltage is developed in TR8 to determine the squelch level of the receiver. At low level, TR8 conducts heavily and the output blocks the audio amplifier. If the incoming signal level is of a higher order, TR8 is unsaturated and the audio amplifier is allowed to operate and pass on the audio signal. The setting of the SQUELCH control determines the point at which the squelch circuit opens, passing the audio signal.

CHAN. NO.	CHAN. FREQ. MHz	VCO FREQ. (RECEIVE)	VCO FREQ. (TRANSMIT)	CHANNEL CODE FROM IC301 OUTPUT TO IC1 INPUT					
				*P1	P2	P3	P4	P5	P6
1	26.965	16.27	16.725	1	0	0	0	0	0
2	26.975	16.28	16.735	0	1	0	0	0	0
3	26.985	16.29	16.745	1	1	0	0	0	0
4	27.005	16.31	16.765	0	0	1	0	0	0
5	27.015	16.32	16.775	1	0	1	0	0	0
6	27.025	16.33	16.785	0	1	1	0	0	0
7	27.035	16.34	16.795	1	1	1	0	0	0
8	27.055	16.36	16.815	0	0	0	1	0	0
9	27.065	16.37	16.825	1	0	0	1	0	0
10	27.075	16.38	16.835	0	0	0	0	1	0
11	27.085	16.39	16.845	1	0	0	0	1	0
12	27.105	16.41	16.865	0	1	0	0	1	0
13	27.115	16.42	16.875	1	1	0	0	1	0
14	27.125	16.43	16.885	0	0	1	0	1	0
15	27.135	16.44	16.895	1	0	1	0	1	0
16	27.155	16.46	16.915	0	1	1	0	1	0
17	27.165	16.47	16.925	1	1	1	0	1	0
18	27.175	16.48	16.935	0	0	0	1	1	0
19	27.185	16.49	16.945	1	0	0	1	1	0
20	27.205	16.51	16.965	0	0	0	0	0	1
21	27.215	16.52	16.975	1	0	0	0	0	1
22	27.225	16.53	16.985	0	1	0	0	0	1
23	27.255	16.56	17.015	1	1	0	0	0	1
24	27.235	16.54	16.995	0	0	1	0	0	1
25	27.245	16.55	17.005	1	0	1	0	0	1
26	27.265	16.57	17.025	0	1	1	0	0	1
27	27.275	16.58	17.035	1	1	1	0	0	1
28	27.285	16.59	17.045	0	0	0	1	0	1
29	27.295	16.60	17.055	1	0	0	1	0	1
30	27.305	16.61	17.065	0	0	0	0	1	1
31	27.315	16.62	17.075	1	0	0	0	1	1
32	27.325	16.63	17.085	0	1	0	0	1	1
33	27.335	16.64	17.095	1	1	0	0	1	1
34	27.345	16.65	17.105	0	0	1	0	1	1
35	27.355	16.66	17.115	1	0	1	0	1	1
36	27.365	16.67	17.125	0	1	1	0	1	1
37	27.375	16.68	17.135	1	1	1	0	1	1
38	27.385	16.69	17.145	0	0	0	1	1	1
39	27.395	16.70	17.155	1	0	0	1	1	1
40	27.405	16.71	17.165	0	0	0	0	0	0

***P1 to P6 indicate pin numbers on IC1**

Channel Frequency Table

Servicing

Model 14T276 Citizens Band Transceiver performance depends upon the high quality of components used and upon proper servicing techniques. Servicing must be performed by FCC licensed, fully qualified technical personnel. Only use of the replacement parts given in the parts list of this booklet should be employed in repair of this unit.

Illustrations to aid in servicing and adjustment, such as top views, superimposed printed board views, wiring diagrams and exploded views, are provided to assist in proper and competent servicing. An overall schematic diagram is included on pages 19 – 20. The main printed board shows map grid coordinates which are keyed to the component. location guide for fast location of component locations on the board. Exploded views of the main chassis unit and microphone/speaker unit identify mechanical parts by balloon callouts. These balloons correspond to identical numbers in the mechanical parts at the end of the parts list.

Test Equipment

The following test equipment is required for servicing the 14T276 Transceiver.

1. A 50 ohm resistive antenna load with a power capability of 5 watts or more, such as Bird Model 43 "thru line" wattmeter with a 5A Element and a Model 8053 RF Coaxial Load Resistor, or equivalent.
2. A frequency counter operable in the required CB range, such as Hewlett-Packard Model HP 5283A or suitable equivalent.
3. A HF Signal Generator which operates in the 50 kHz to 65 MHz frequency range with +1% accuracy, such as Hewlett-Packard HP-606B, Wavetek Model 3000 or equivalent.
4. An oscilloscope capable of accurate monitoring of DC to 50 MHz.
5. High Input impedance Electronic Voltmeter such as a WV-500B or equivalent.
6. A 4 ohm 5 watt resistive dummy speaker load.
7. An Audio Signal Generator, 10 Hz to 20 kHz range.
8. An RF Voltmeter. (WV-500B with WG-301A Probe)
9. A regulated bench DC power supply capable of supplying 0 – 20 VDC at least 2 amperes.
10. DC Voltmeter with 20k ohms/V rating.
11. A VTVM such as RCA Volt Ohmyst.

Caution

The operating controls being in the hand-held mic./speaker unit, means that operation of the transceiver with the hand-held unit disconnected is impossible. As a result, a dummy mic. connector cannot be used. This presents a serious danger to test equipment used in troubleshooting receiver circuitry in that inadvertent keying of the transmitter could damage the test gear. *As a result, we recommend that you disable the push-to-talk switch while troubleshooting and/or aligning receiver circuits.* The easiest way is to remove, temporarily, the push-to-talk lever from the hand-held unit. See page 16 for assembly drawing of hand-held unit.

PLL Alignment

1. Connect the DC Voltmeter to test point TP2 as shown in Figure 1. Set receiver to Channel 40. Adjust L10 for a reading of 4.0 VDC on meter.
2. Set receiver to Channel 1 and with DC Voltmeter still connected to TP2, check that the DC voltage reading on the meter is more than 2 VDC.
3. Connect the oscilloscope to the PLL test point, see Figure 1, reset the receiver to Channel 40 and adjust coil L8 for maximum indication on the oscilloscope.

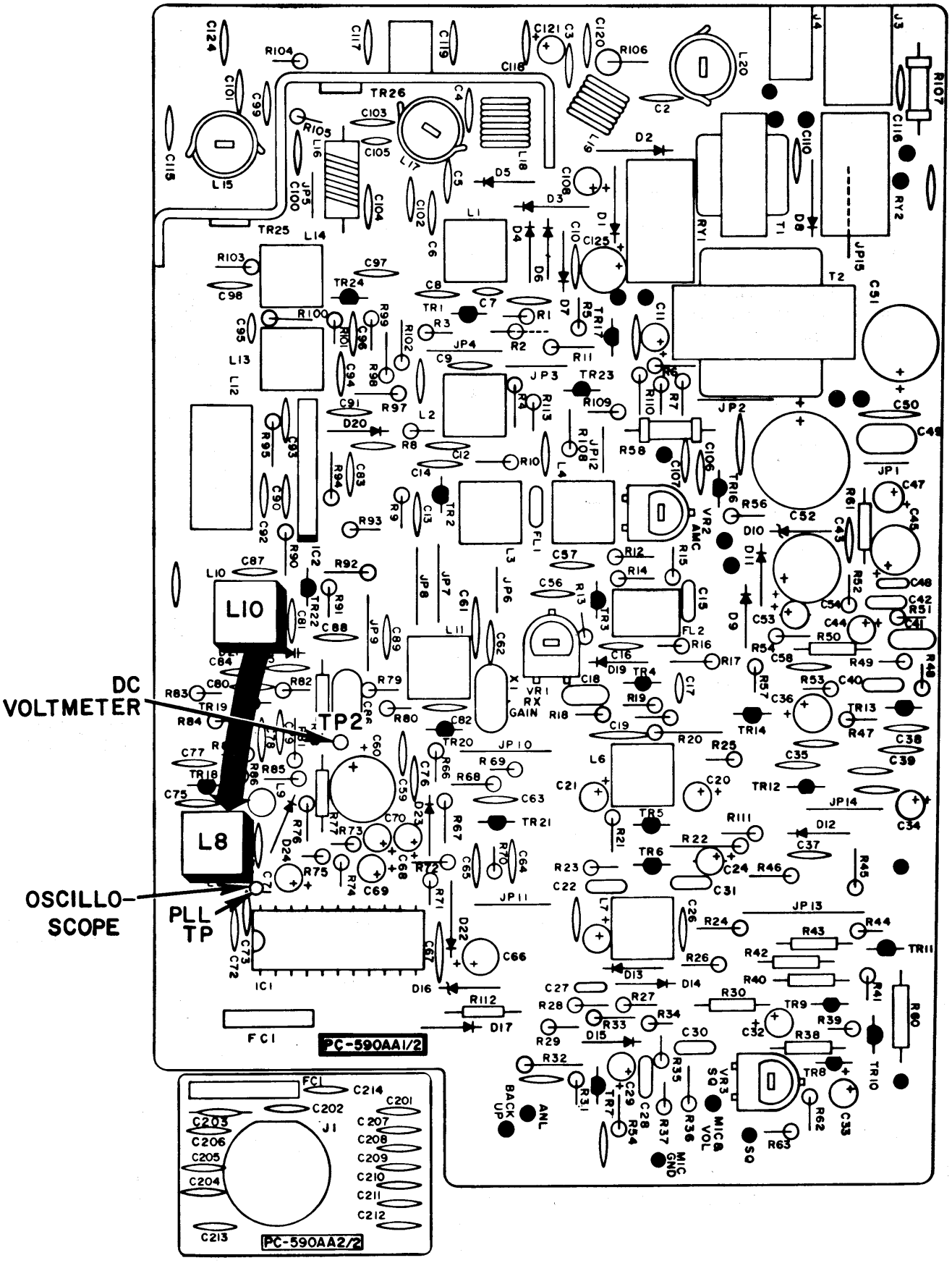

Figure 1 – PLL Alignment Points

Receiver Alignment

Connect test equipment to transceiver unit as shown in block diagram Figure 2. Preset the transceiver to Receive Channel 19, with SQUELCH control fully counter-clockwise and ANL switch to OFF.

1. Adjust signal generator for a 1 uV signal input to the antenna.

2. Adjust L1, L2, L3, L4, L11, L6 and L7, in this order for maximum reading on the AF V.T.V.M. Refer to Figure 3.

3. Reduce signal output from generator for 0.7 uV input to the antenna. Adjust VR1, see Figure 3, for 1.4 volts RMS on the AF VTVM.

4. Turn SQUELCH control clockwise. Introduce a 1 mV signal from the generator into the antenna jack. Adjust VR3, see Figure 3, so that the AF signal just begins to appear on the oscilloscope.

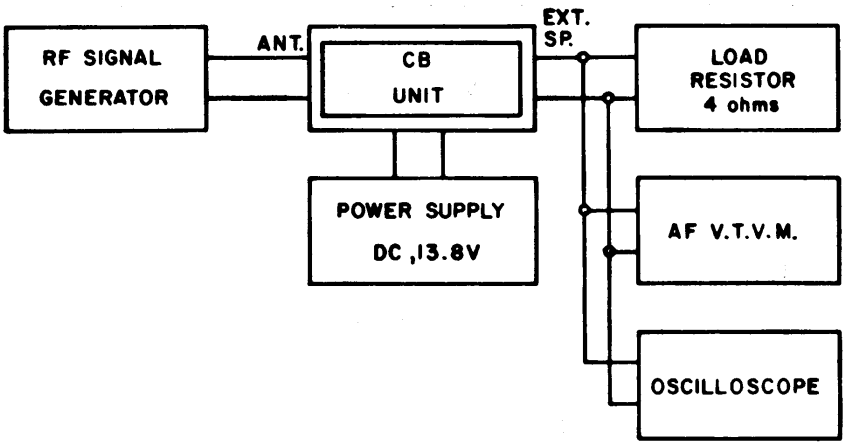

Figure 2 – Receiver Alignment Test Equipment Set–Up

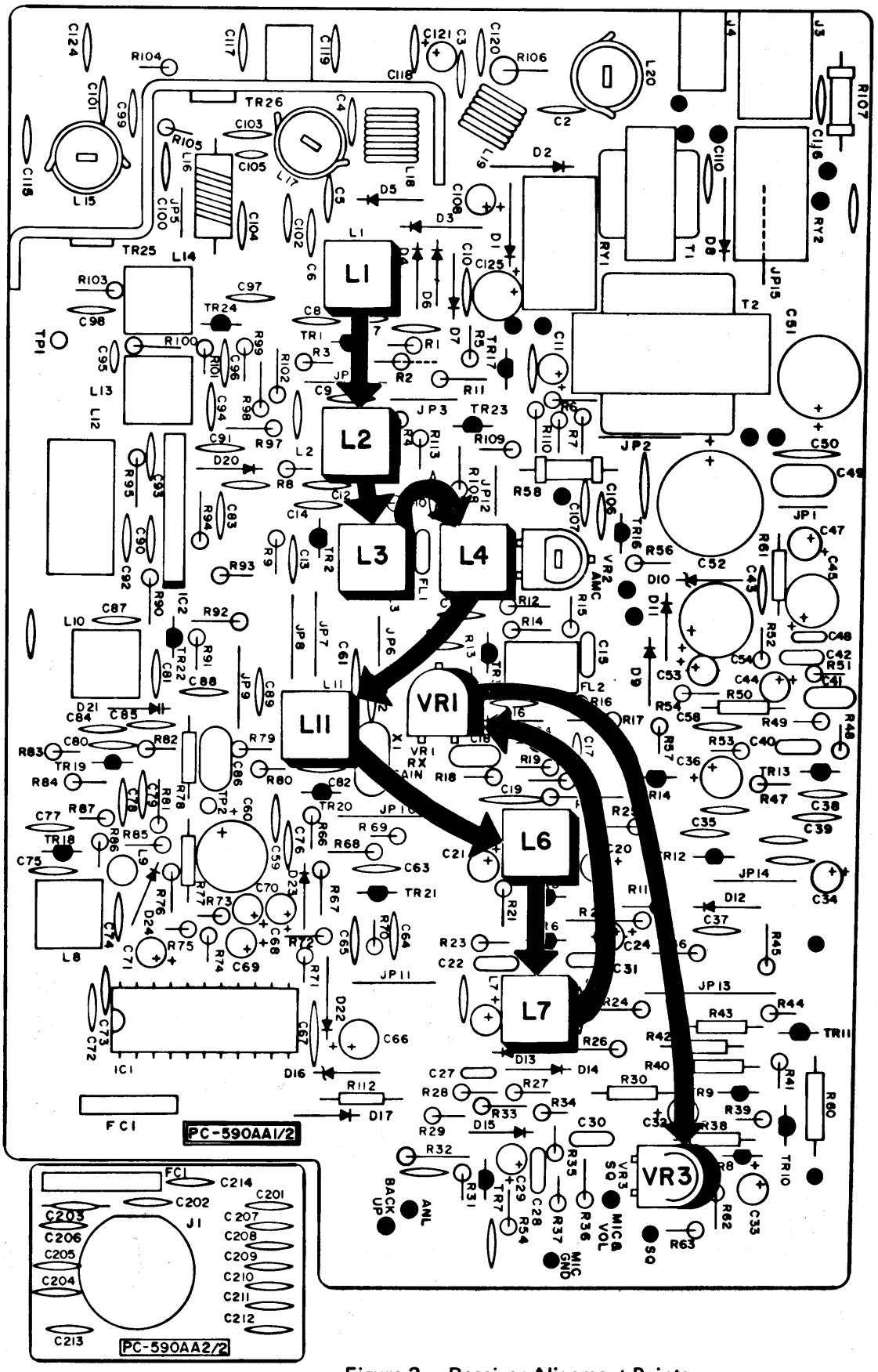

Figure 3 — Receiver Alignment Points

Transmitter Alignment

Connect the test equipment as indicated in the block diagram Figure 4. Preset the transceiver to Channel 40. Disconnect one end of the lead between pin 19 of the microphone jack (usually pink wire) and the main PC board at the PC board end. This is physically located between R36 and VR3 at the junction of R36 and R46. (see Figure 5). Connect the AF Oscillator to the junction of R46 and R36 at point shown in Figure 5. The push-to-talk switch is depressed for each of the following steps.

1. Connect the oscilloscope to TP1 on the Main PC board, see Figure 5. Activate the transmitter and adjust L12, L13 then L14, in this order, for maximum indication on the oscilloscope.
2. Set the transceiver to Channel 19. Activate the transmitter and adjust L14, L15 and L17 for maximum reading on the Wattmeter.
3. Set the transceiver to Channel 40 and adjust L20 for minimum harmonic output.
4. Set the AF Oscillator output for a 150 mV signal on the AF VTVM.
5. Set the transceiver to Channel 19 and adjust VR2, see Figure 5, for 100% modulation on the oscilloscope.

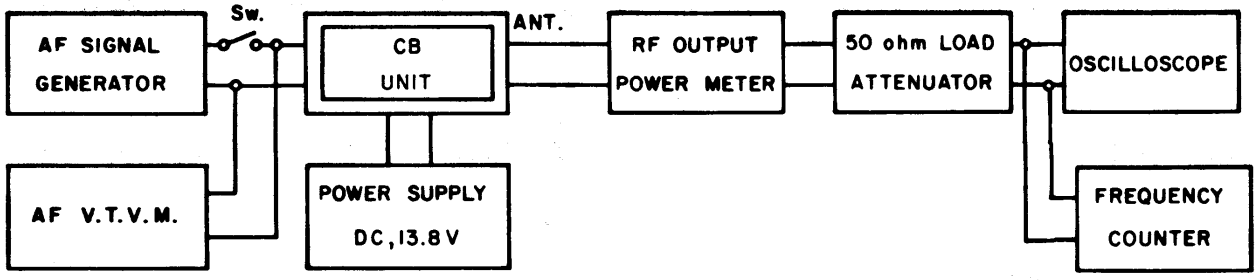

Figure 4 – Transmitter Alignment Test Equipment Set–Up

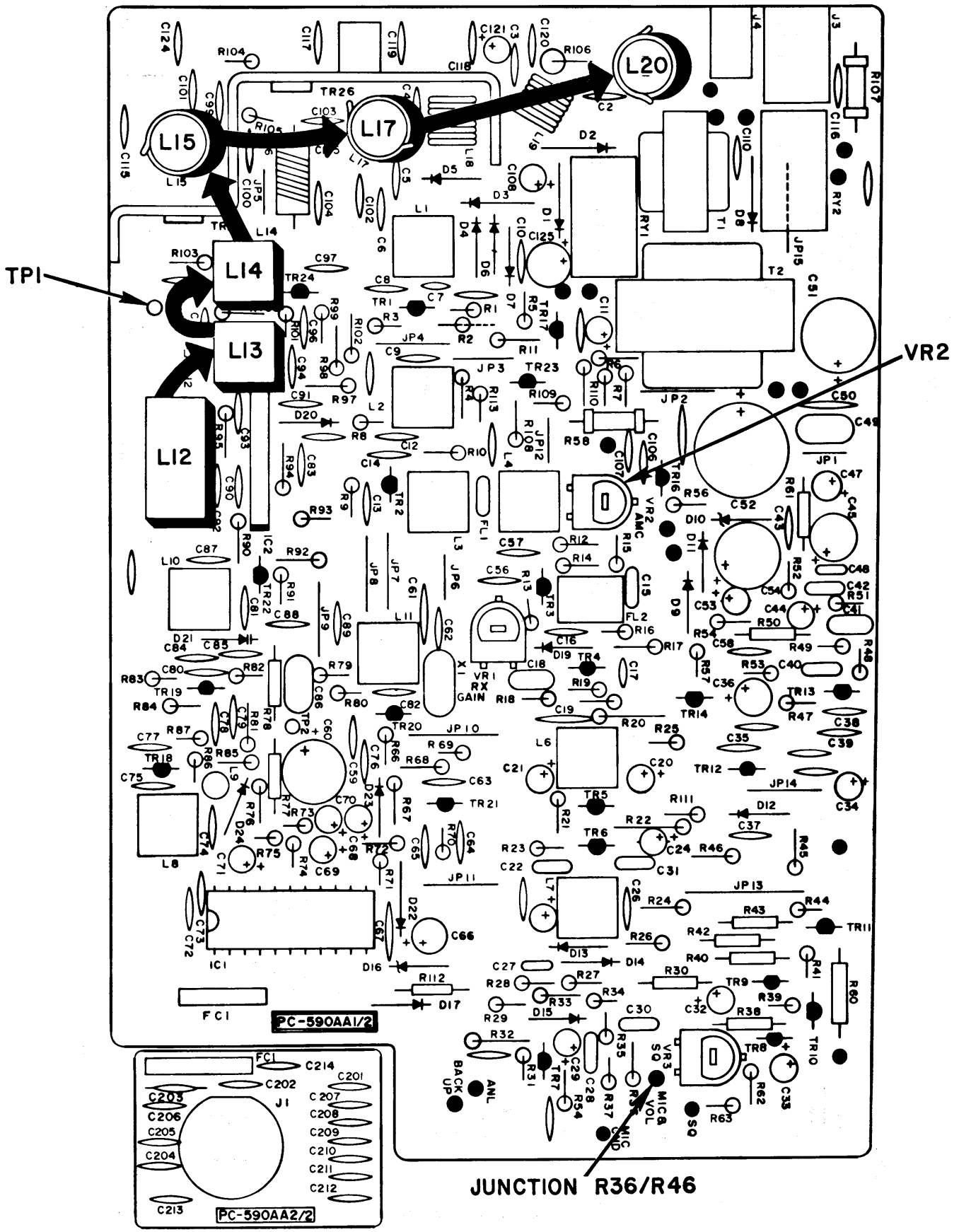

Figure 5 — Transmitter Alignment Points

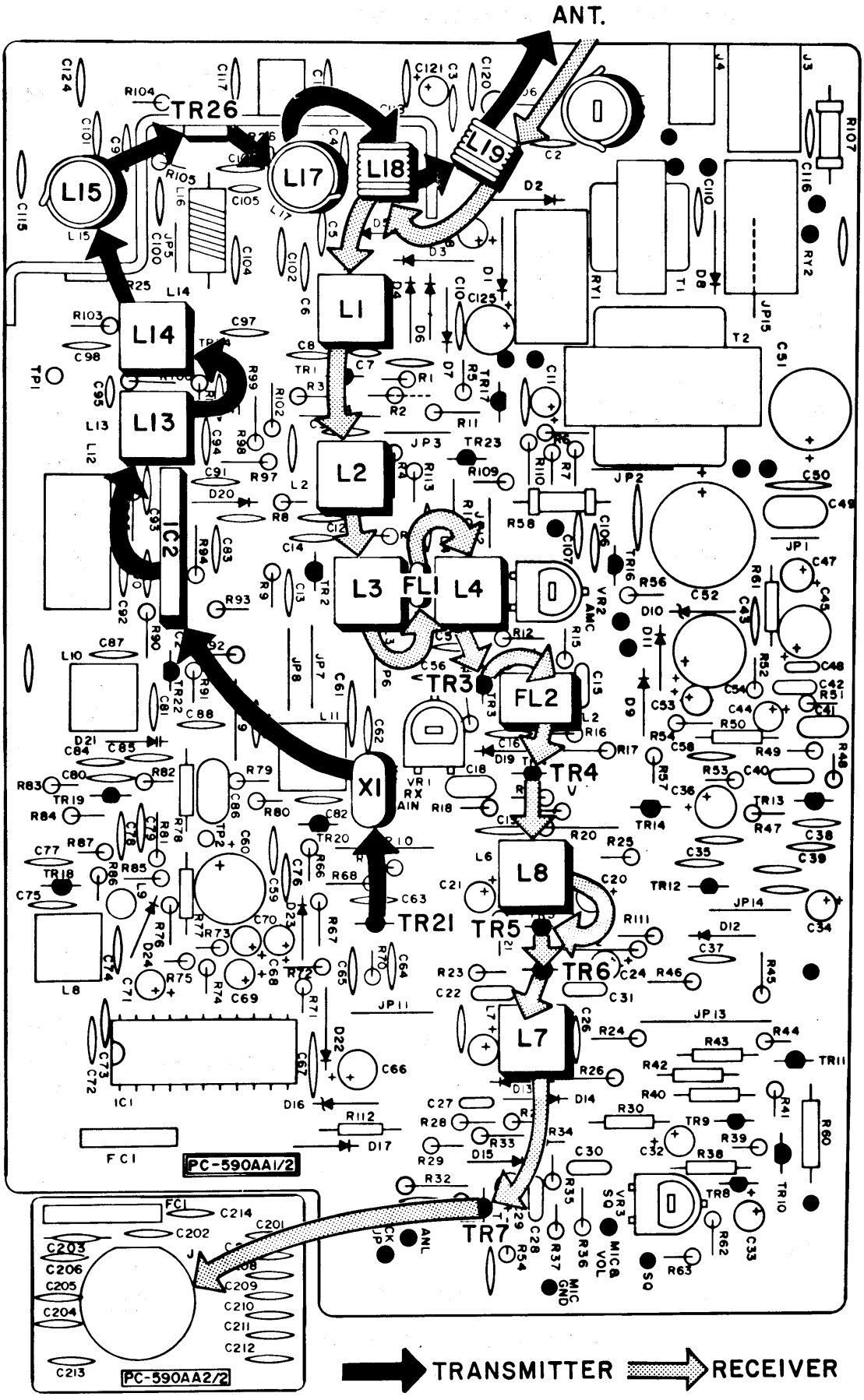

Figure 6 — Transceiver Signal Paths

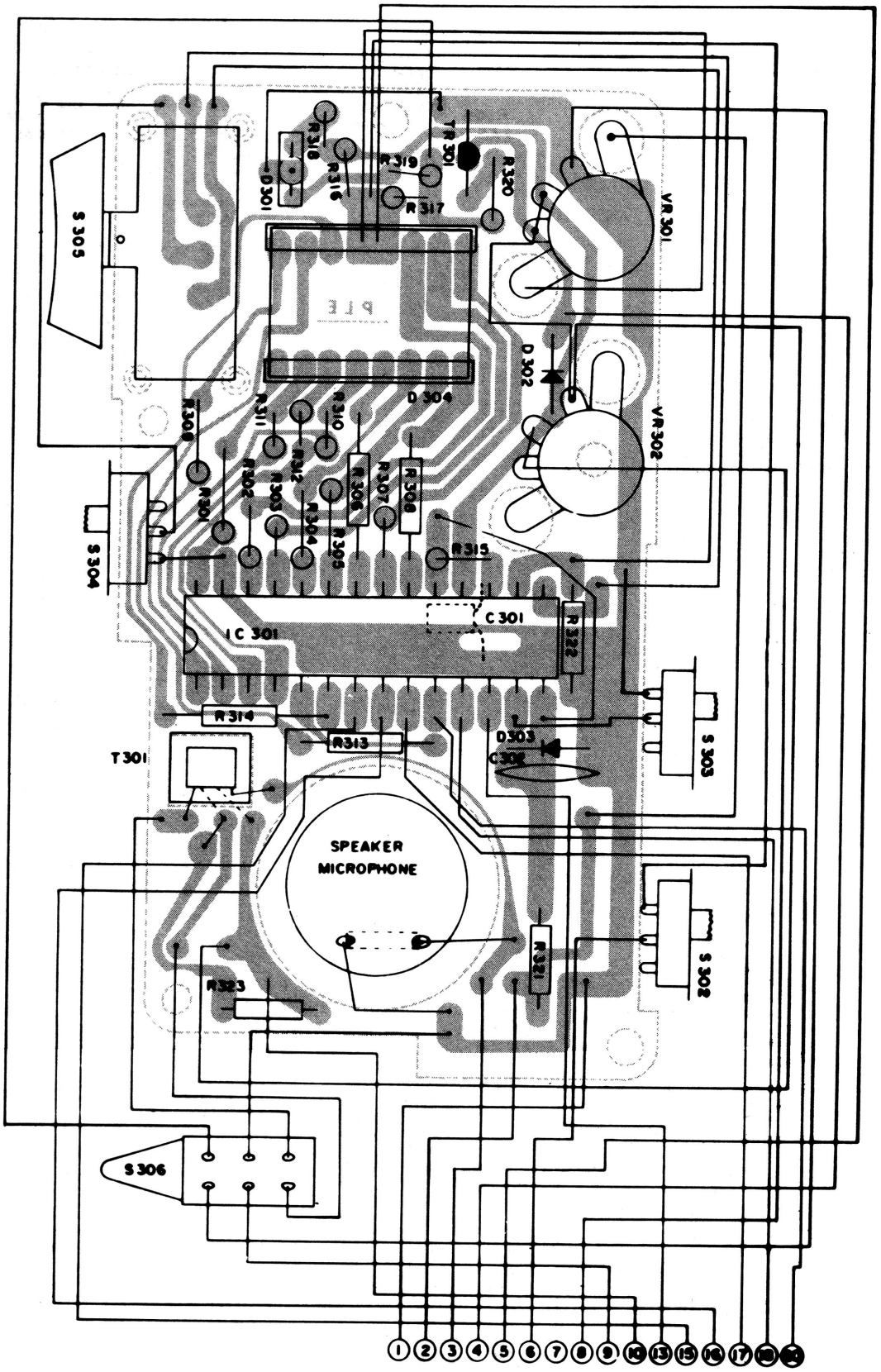

Figure 7 – Printed Board – Microphone/Speaker Assembly