Midland 77-824B Service Manual

MIDLAND INTERNATIONAL®

77 — 824 B

4-WATT 40-CHANNEL MOBILE TRANSCEIVER

MANUAL NO. **77-824002**
DATE: **August 22, 1978**

SPECIFICATIONS

GENERAL

Channels	: 40 channel LED channel display
Frequency range	: 26.965 to 27.405 MHz
Semiconductors	: 21 transistors, 29 diodes, 2 ICs
Crystal	: 1
Microphone	: 500 ohms dynamic microphone with PRESS-TO-TALK switch
Speaker	: 8 or 16 ohms, 3W, 4 inches
Antenna connector	: 50 ohms, coaxial
Jacks and connector	: EXT SP.; 3.5ø, PA SP.; 3.5ø, Mike; 4P
Controls	: VOLUME control with POWER ON-OFF switch SQUELCH control TONE control PA/EXT CB/CB switch RF GAIN HI-LOW switch ANL-OFF switch CHANNEL SELECTOR switch
Indicators	: LED digital channel display LED RX/TX indicator LED AWI indicator
Meter	: Indicates received signal strength and relative TX power output
Size	: 10-3/16"(D) x 6-5/16"(W) x 2-3/16"(H) [219.5(D) x 160(W) x 55(H)mm]
Weight	: 4-1/2 Pounds (2.04 kg)
Accessories	: Microphone Microphone hanger DC POWER cord Owner's Guide F.C.C. Application forms 505 and 555B Citizens Band Booklet for F.C.C. Part 95 Customer Registration Card Window Sticker

TRANSMITTER

Frequency tolerance at 25°C (5 minutes after switch on)	: ±0.002%
Carrier power at no modulation	: 4W, F.C.C. Max.
Spurious harmonic emission	: -65 dB
Battery drain at no modulation	: 850 mA
Battery drain at max. modulation	: 1250 mA
Modulation frequency response (1 KHz, 0 dB reference) Lower at 450 Hz, EIA Upper at 2.5 KHz, EIA	 : -12 dB : -12 dB
Microphone sensitivity for 50% mod.	: 0.5 mV
AMC range 50 – 100% mod.	: 40 dB

RECEIVER (ANL & Noise Blanker Switch Off)

Maximum sensitivity	: 0.5 μV
Sensitivity for 10 dB S/N	: 0.5 μV
AGC figure of merit 50 mV for 10 dB change in audio output	: 90 dB
Overall audio fidelity at 6 dB down Upper frequency Lower frequency	 : 2500 Hz : 300 Hz
Cross modulation	: 60 dB
Adjacent channel selectivity (10 KHz)	: 60 dB
Maximum audio output power	: 5 W
Audio output power at 10% THD	: 4 W
Hum and noise ratio at Input 1 mV	: 46 dB
Squelch sensitivity at threshold	: 0.5 μV
Squelch sensitivity at tight	: 1,000 μV
S meter sensitivity at "S-9"	: 100 μV
Image rejection ratio	: 70 dB
IF rejection ratio	: 70 dB
Oscillator dropout voltage	: 9 V
Battery drain at no signal	: 350 mA
Battery drain at max. output	: 1000 mA
PA output power at 10% distortion	: 4 W

MIDLAND INTERNATIONAL®

Distribution and Service Center
1690 North Topping Street
Kansas City, Missouri 64120
Telephone: (913) 384-4200

UNDERSTANDING YOUR NEW 77-824B

RECEIVER:

Sensitive dual conversion circuit with all crystals supplied for 40-channel reception. One microvolt sensitivity, built-in controlled squelch circuit and noise limiting give low noise operation. Active AGC circuit reduces fading and over driving.

TRANSMITTER:

Precision crystal-controlled oscillator circuit with all 40 Citizens Band channels built-in. The transmitter final is a conservatively rated high gain RF power transistor. A maximum of TVI filtering is employed.

SIGNAL-TRANSMIT POWER METER:

A combination meter on front panel provides a constant visual monitor of incoming "Signal Strength" when receiving and "Relative Output Power" when transmitting.

CONTROLS:

A full set of controls is employed, featuring and including a Volume ON-OFF switch, 40 channel selector switch, Squelch control, Automatic Noise Limiter switch, Tone control PA/EXT CB/CB switch, RF Gain Hi-Low switch.

PUBLIC ADDRESS

In the "PA" position, your transceiver is converted to a Public Address system. A convenient pin jack on the back panel is provided for connection to standard 8 or 16 ohm PA speaker.

MOBILE INSTALLATIONS

A location in the car or truck should be chosen carefully for convenience of operation and non-interference with normal driving functions. Mounting may be under the dash or instrument panel or any place a secure installation can be made. The carrying handle again serves as the mounting bracket or additional perforated straps or brackets may be used as desired.

GROUND INFORMATION:

NOTE: This transceiver may be installed and used in any 12 volt DC negative or positive ground system vehicle.

Most newer U. S. and foreign made cars and small trucks use a negative ground system while some older cars and some newer large trucks may use a positive ground system.

A negative ground system is generally identified by the (-) battery terminal being connected to the vehicle motor block, but if you cannot determine the polarity system of your vehicle, it is suggested that you consult your vehicle dealer for definite information.

NEGATIVE GROUND SYSTEM:

In the case of a negative ground system connect the red DC power cord from the transceiver to the positive or (+) battery terminal or other convenient point and connect the black power lead to the chassis or vehicle frame or (-) battery terminal.

POSITIVE GROUND SYSTEM:

In the case of a positive ground system connect the black DC power cord from the transceiver to the negative or (-) battery terminal or other convenient point and connect the red power lead to the chassis or vehicle frame or (+) battery terminal.

With regard to the connection of the power cords, it may be possible or desirable to connect the (red lead for negative ground system) or (black lead for positive ground system) to the ignition switch accessory terminal so that the transceiver is automatically turned off when the ignition switch (key) is turned off.

Alternately, the power lead may be connected to an available terminal on the fuse block or even to a point in the wiring harness. Care must be taken however to guard against a short circuit condition so when in doubt, please contact your vehicle dealer for specific information for your vehicle.

IGNITION INTERFERENCE:

Engine ignition interference should not be a problem and vehicles equipped with standard broadcast radios will have enough suppression to eliminate ignition interference. If interference is present, any skilled auto radio repairman should be able to eliminate it for you.

ANTENNA REQUIREMENT:

This transceiver will operate with any standard 52 ohm CB antenna. A standard SO239 type connector is provided on the back panel for use with popular PL 259 antenna plug.

FREQUENCY:

Each unit is completely, equipped with crystals for operation on any of the 40 Citizens Band channels. It is not necessary to purchase any additional crystals for this unit. Refer to part 95 of the F.C.C. rules and regulations to determine which channels may be used for various kinds of communication.

ANTENNA INSTALLATIONS

BASE STATION:

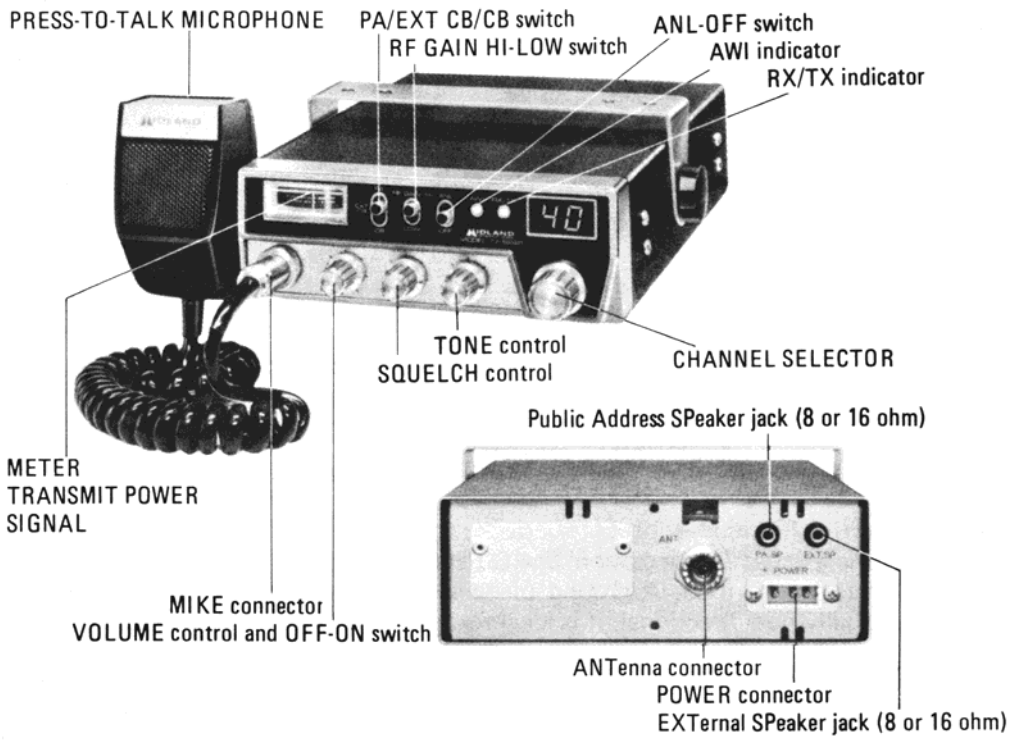
When 77-824B is used as a base station, any Citizens Band beam, dipole, ground plane or vertical antenna may be used. A ground plane type will provide greater coverage and since it is essentially non-directional, it is ideal for base station to mobile operation. From base station to base station, or point to point operation, a directional beam will give greater distance even under adverse conditions. The range of the transceiver depends mainly on the height of the antenna and, whenever possible, select the highest location within F.C.C. limits. Generally a minimum of lead-in cable should be used due to line losses. However, a desirable antenna location may justify the loss in longer cable runs.

MOBILE ANTENNAS:

A vertical whip antenna is best suited for mobile use. A non-directional antenna should be used for best results in any case. The base loaded whip antenna will normally provide effective communication. For greater range and more reliable operation, a full quarter wave whip should be used.

Both of these antennas use the metal car body as a ground plane and the shield of the base lead as well as the metal case of the transceiver should be grounded. A standard antenna connector (type SO 239) is provided on the transceiver for easy connection to a standard PL-259 cable termination.

OPERATION OF CONTROLS



VOLUME CONTROL AND OFF-ON SWITCH:

The VOLUME control varies the sound output of the loudspeaker. It also functions as OFF-ON switch. Clockwise rotation increases volume.

CHANNEL SELECTOR:

This switch selects any one of the forty Citizens Band channels desired. The selected channel appears on the LED readout directly above the CHANNEL SELECTOR knob. Channel 9 has been reserved by the F.C.C. for emergency communications involving the immediate safety of life of individuals or immediate protection of property. Channel 9 may also be used to render assistance to a motorist.

SQUELCH CONTROL:

SQUELCH quiets the receiver when signals are not being received and allows quiet standby operation. It functions only in the receive mode and does not affect the receiver volume when signals are being received. To adjust, when no signals are present, rotate the SQUELCH control clockwise until the receiver is quieted. Incoming signals will automatically release the SQUELCH. Careful adjustment is necessary since a setting too far to the right will not allow weaker signals to release the SQUELCH.

PA/EXT CB/CB SWITCH:

It is designed to enable you to monitor CB calls through a PA SPeaker connected to the PA jack on the back panel. For example; if you leave your car and you are expecting a call on your radio, simply set the PA/EXT CB/CB switch in the EXT CB position. This channels incoming signals through the PA SPeaker and cuts off the built-in speaker (or speaker connected to the EXT SPeaker jack). It is possible for you to transmit while the unit is in the EXT CB mode although the unit's built-in speaker (or EXTernal speaker) will not be operational until the PA/EXT CB/CB switch is moved to the CB position. To use your unit as a PA amplifier, place this switch in the PA position and press the PRESS-TO-TALK switch on the microphone. When the unit is in the PA mode. It will not act as an EXTernal CB monitor.

ANL-OFF SWITCH (Automatic Noise Limiter)

ANL is designed to reduce excessive noise from electrical and atmospheric conditions.

TONE CONTROL:

The TONE control is designed to adjust TONE to your listening preference by rotating the control knob.

PRESS-TO-TALK MICROPHONE:

The receiver and transmitter are controlled by the PRESS-TO-TALK switch on the microphone. Press in this switch and the transmitter is activated. Release this switch to receive. When transmitting, hold the microphone 3 to 4 inches from your mouth and speak clearly and in a normal voice.

RX/TX INDICATOR:

The light located to the left of the LED readout lights in red when the transmitter is in operation and it lights in green when the receiver is in operation.

RF GAIN HI-LOW SWITCH:

This switch adjusts the strength of the incoming signal. When too strong signal comes in, place LOW position to set the desired level. If the signal you receive is weak, place HIGH position.

AWI (ANTENNA WARNING INDICATOR):

This indicator alerts you to trouble in your antenna system. The light (marked "AWI") is a warning indicator which is activated when the antenna or connecting cable is damaged or badly mismatched or not connected. When this light is activated you should stop transmitting until the antenna condition or problem is corrected.

GENERAL OPERATING INSTRUCTIONS

CAUTION:

Before operating your transceiver, you are required by law to read and thoroughly understand part 95 of the F.C.C. rules and regulations.

1. Check to see if the proper connections have been made on power cable, antenna system and microphone and that the correct cables have been used. Be sure that the transceiver is adequately grounded (if not mounted directly to a metal surface).
2. Place the PA/EXT CB/CB switch in the "CB" position.
3. Turn the Power on and adjust the VOLUME control for proper sound level.
4. Turn the SQUELCH control slowly clockwise until the background noise just disappears. (No signal should be present.) Leave the control at this setting.
5. Rotate the CHANNEL SELECTOR to a desired channel.
6. To transmit, press the PRESS-TO-TALK switch on the microphone. Hold the microphone at a slight angle about 3 – 4" from your mouth and speak in a normal voice. Shouting will not increase the range of your transmission in any way and may actually cause distortion. You will notice the SIGNAL-TRANSMIT POWER METER moving as you transmit. This indicates that you are transmitting.
7. To receive release the PRESS-TO TALK switch.

SERVICING YOUR TRANSCEIVER

The technical information and diagrams provided in this manual are supplied for the use of a qualified holder of a first or second class radiotelephone license in servicing this transceiver. It is the user's responsibility to see that this unit is operating at all times in accordance with the F.C.C. Citizens Radio Service regulation.

If you install your own transceiver, do not attempt to make any transmitter tuning adjustments. They are prohibited by the F.C.C. unless you hold or are in the presence and under the supervision of a first or second class radiotelephone licensed person. A Citizens Band or Amateur license is not sufficient.

When service is performed by an authorized and licensed person, care must be taken in the replacement of parts to use only authorized parts, in order not to void the type acceptance of this model.

NOTE: When ordering parts, it is essential to specify the model number, the date of manufacture and the serial number (engraved on F.C.C. plate located at the rear of your radio)

CIRCUIT DESCRIPTIONS

PLL CIRCUIT: (REFER TO THE P.L.L. BLOCK DIAGRAM)

The PLL circuit used in 77-824B consists of 7 major parts: Voltage Controlled Oscillator(VCO), 1/N Divider, Phase Detector, Low Pass Filter, Reference Oscillator (10.24 MHz), 1/2048 divider and Code Converter ROM(Read Only Memory).

The VCO is an oscillator which controls oscillation frequency in accordance with input voltage change. The VCO output is mixed with a signal in the transmitter or receiver circuitry. A portion of the VCO frequency is fed to IC1 (1/N divider).

"N" for the 1/N divider is determined by Channel Selector Switch whose output is selected by a Code Converter ROM.

As shown in the frequency chart, N is difference between transmit and receive mode since only one crystal is used with this PLL circuitry.

The output from the 1/N divider is fed to Phase Detector. On the other hand, the frequency from the Reference OSC, 10.24 MHz, is divided to 5 kHz by 1/2048 divider and applied to another input of Phase Detector.

Thus the Phase Detector receives two input signals (both 5 kHz). It compares the phase difference between the two, generating an error voltage (DO), which acts on the VCO to bring the two frequencies exactly in-phase. When this condition occurs, the PLL circuit is locked.

The Low Pass Filter integrates the output of the Phase Detector which controls the VCO frequency.

Fvco (the Frequency of the VCO) is changeable in 10 kHz increments, by varying the program divide ratio, N.

For example, the divide ratio, N is programmed to 3345 for channel No. 1 Transmit; therefore Fvco is calculated as follows:

$$Fvco = 5 \times 3345 = 16.725 \text{ (kHz)}$$

In the same manner, Fvco for channel No. 2 through No. 40 is determined as shown in Table A.

Transmitter Local Oscillator

The Transmitter local oscillator frequency of 10.240 MHz is produced by TR17 and crystal, X'tal 1.

Channel Selection Program

The divide ratio of the Programmable Frequency Divider in IC1 is determined through the Code Converter and Transmit/Receive mode switch in IC1 by the voltage supplied to the program input terminals, Pin No.10 through Pin No.17 of IC1.

The program input voltage for Pins 10 through 17 is supplied from the Channel Selector switch according to the Channel Number.

The Transmit/Receive mode switch in IC1 changes the divide ratio of the Programmable Divider by changing Pin 8 voltage (Low level for Receive, High level for Transmit), to produce a 455 kHz change in VCO frequency when changing between the two modes.

Table A shows the Frequency Chart of Fvco and Divide Ratio vs. Antenna Frequency, and Program input data.

CIRCUIT FOR DETERMINING FREQUENCY:

Output Frequency of the Transmitter

Transmit frequency, Ft, is taken from the output of the Transmitter Mixer IC2.

One of the inputs of IC2 is the 1st local oscillator frequency, Fvco, which is produced by the PLL Local Oscillator circuit. The other input is the transmitter local oscillator frequency of 10.240 MHz produced by TR17.

The sum of these frequencies determines the transmit frequency as follows:

$$Ft = Fvco + 10.240 \text{ (MHz)}$$

CIRCUIT FOR PREVENTION OF UNAUTHORIZED FREQUENCY EMISSION:

This Transceiver has a built-in circuit which prevents transmission of unauthorized frequencies during the time when the PLL circuit is not locked or when the Channel Selector switch is between channels.

When the PLL circuit is not locked or the program data input is not for channel 1 – 40, pin 4 in IC1 produces a low level digital control signal. This signal is fed to the base of TR10 buffer amplifier and pin 7 of IC2 transmitter mixer through D17 diode. When this signal is at low level, both TR10 and IC2 are disabled thus no RF signals are fed to the next stages.

When the Channel Selector is switched from one channel to another, it may produce a non-valid input (other than data required for channels 1-40). However, IC1 is so designed internally that it operates only with valid data required for channels 1-40. This eliminates the RF signal output, and prevents any unauthorized frequencies.

TABLE A: FREQUENCY CHART OF Fvco AND DIVIDE RATIO N

Antenna Frequency (MHz)	Channel Number	For Transmit (Pin 8 of IC1 = H)		For Receive (Pin 8 of IC1 = L)		Program input data							
		Divide Ratio (N)	VCO Frequency (MHz)	Divide Ratio (N)	VCO Frequency (MHz)	P_0	P_1	P_2	P_3	P_4	P_5	P_6	P_7
26.965	1	3,345	16.725	3,254	16.270	H	H	H	H	H	H	H	H
26.975	2	3,347	16.735	3,256	16.280	H	L	L	L	L	H	H	H
26.985	3	3,349	16.745	3,258	16.290	H	L	L	H	L	H	H	H
27.005	4	3,353	16.765	3,262	16.310	L	H	L	H	H	H	H	H
27.015	5	3,355	16.775	3,264	16.320	L	L	L	H	L	H	H	H
27.025	6	3,357	16.785	3,266	16.330	L	H	L	L	L	H	H	H
27.035	7	3,359	16.795	3,268	16.340	H	L	H	H	H	H	H	H
27.055	8	3,363	16.815	3,272	16.360	L	L	L	L	L	H	H	H
27.065	9	3,365	16.825	3,274	16.370	L	L	L	H	H	H	H	H
27.075	10	3,367	16.835	3,276	16.380	L	L	H	L	L	L	H	H
27.085	11	3,369	16.845	3,278	16.390	H	H	H	H	H	L	H	H
27.105	12	3,373	16.865	3,282	16.410	H	L	L	L	L	L	H	H
27.115	13	3,375	16.875	3,284	16.420	H	L	L	H	L	L	H	H
27.125	14	3,377	16.885	3,286	16.430	L	H	L	H	H	L	H	H
27.135	15	3,379	16.895	3,288	16.440	L	L	L	H	L	L	H	H
27.155	16	3,383	16.915	3,292	16.460	L	H	L	L	L	L	H	H
27.165	17	3,385	16.925	3,294	16.470	H	L	H	H	H	L	H	H
27.175	18	3,387	16.935	3,296	16.480	L	L	L	L	L	L	H	H
27.185	19	3,389	16.945	3,298	16.490	L	L	L	H	H	L	H	H
27.205	20	3,393	16.965	3,302	16.510	L	L	H	L	L	H	L	H
27.215	21	3,395	16.975	3,304	16.520	H	H	H	H	H	H	L	H
27.225	22	3,397	16.985	3,306	16.530	H	L	L	L	L	H	L	H
27.255	23	3,403	17.015	3,312	16.560	H	L	L	H	L	H	L	H
27.235	24	3,399	16.995	3,308	16.540	L	H	L	H	H	H	L	H
27.245	25	3,401	17.005	3,310	16.550	L	L	L	H	L	H	L	H
27.265	26	3,405	17.025	3,314	16.570	L	H	L	L	L	H	L	H
27.275	27	3,407	17.035	3,316	16.580	H	L	H	H	H	H	L	H
27.285	28	3,409	17.045	3,318	16.590	L	L	L	L	L	H	L	H
27.295	29	3,411	17.055	3,320	16.600	L	L	L	H	H	H	L	H
27.305	30	3,413	17.065	3,322	16.610	L	L	H	L	L	L	L	H
27.315	31	3,415	17.075	3,324	16.620	H	H	H	H	H	L	L	H
27.325	32	3,417	17.085	3,326	16.630	H	L	L	L	L	L	L	H
27.335	33	3,419	17.095	3,328	16.640	H	L	L	H	L	L	L	H
27.345	34	3,421	17.105	3,330	16.650	L	H	L	H	H	L	L	H
27.355	35	3,423	17.115	3,332	16.660	L	L	L	H	L	L	L	H
27.365	36	3,425	17.125	3,334	16.670	L	H	L	L	L	L	L	H
27.575	37	3,427	17.135	3,336	16.680	H	L	H	H	H	L	L	H
27.385	38	3,429	17.145	3,338	16.690	L	L	L	L	L	L	L	H
27.395	39	3,431	17.155	3,340	16.700	L	L	L	H	H	L	L	H
27.405	40	3,433	17.165	3,342	16.710	L	L	H	L	L	L	H	L

AMC(Automatic Modulation Control) CIRCUIT:

The modulation control used in the 77-824B functions as follows: Modulation signals from the mic are amplified by TR18 and IC3 and fed to the Transmitter's final RF Amplifier stage through Modulation Transformer T1.

The level shift diode D20 (a 9-volt Zener diode) "shifts" any voltage that exceeds a predetermined level and this voltage is fed to the base of TR19 through D19 rectifier diode.

(REFER TO THE CIRCUIT DIAGRAM)

When the modulation signal from the mic increases past this predetermined voltage level, D19 applies a voltage to TR19, which cause base current flow. This reduces the equivalent C-E resistance of TR19. Note that R99 and TR19 C-E resistance forms a voltage divider for the audio signal applied to TR18 Mic Amp. Thus this circuitry effectively limits the level of modulation. VR5 sets the predetermined level which causes D19 to conduct.

RF (Radio Frequency) ATTENUATOR CIRCUIT:

This unit incorporates an RF attenuator circuit using P-I-N diodes; The Equivalent RF resistance of a P-I-N diode is controlled by the current which flows into the diode. Thus any receiver audio distortion caused by excess input signal from the antenna or cross modulation caused by RF gain can be prevented by these P-I-N diodes.

(REFER TO THE CIRCUIT DIAGRAM)

Since reverse-AGC is used with this Transceiver, the voltage on the AGC line becomes lower with strong antenna input signals (with no input signal, approximately 1.4 volts appears on the AGC line).

Furthermore, with no input signal, current from the AGC line flows into the base of TR1 which turns TR1 "on", causes collector current I_2 to flow and thus D3 will not conduct; therefore, no current will flow into D1 and D2 P-I-N diodes. As a result, there is no attenuation of the input signal from the antenna.

With a strong input signal, the voltage on the AGC line decreases which turns TR1 "off" and decreases I_2 current, which increases the collector voltage of TR1, current I_1 will flow through D3, and current I_3 will flow into D1 and D2 P-I-N diodes. Thus, the equivalent RF resistance of P-I-N diodes will drop and the excess input from the antenna to TR2 will be bypassed by these diodes.

In addition to the above, the attenuation level is controlled by switching S104(RF Gain)manually, which causes I_4 current to flow, which varies the attenuation level of D1.

ANTENNA WARNING INDICATOR CIRCUIT (REFER TO THE CIRCUIT DIAGRAM)

The 77-824B incorporates an Antenna Warning Indicator circuit which turns an LED on when the Antenna is Mismatched, opened or shorted. When the antenna exhibits such conditions (high SWR), the reflected voltage, V-ref is detected by L8 directional CM coupler and this voltage is fed to the base of TR13 through diode D13. The C-E impedance of TR1 therefore drops causing the base of TR13 to be forward biased, thus, collector Current flows and turns on D201, AWI indicator LED.

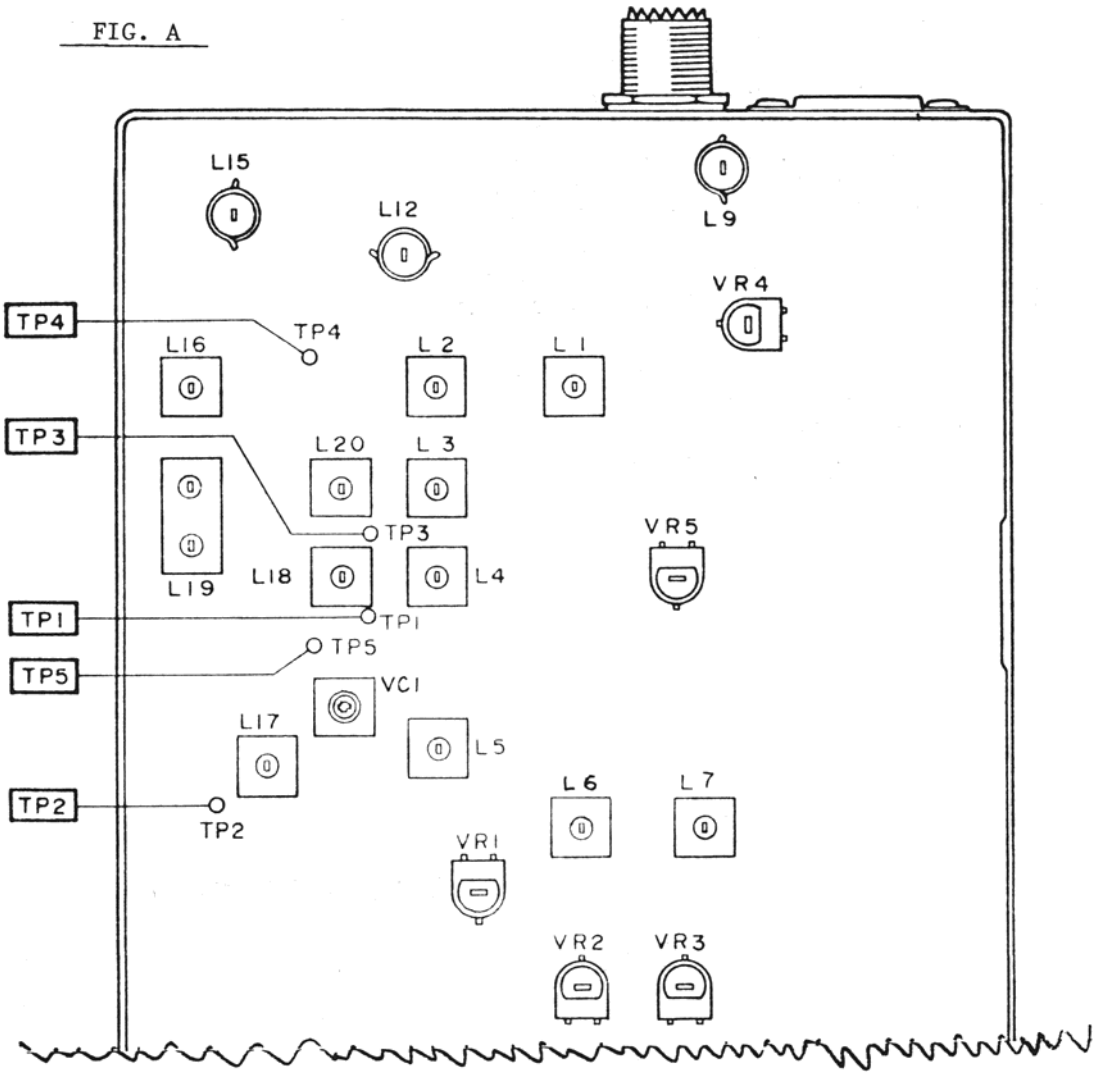
Note: This circuit is designed to activate the AWI LED when SWR is approximately 4 to 6; however, this figure may vary from unit to unit (depending on the method of measurement or equipment used in the SWR measurements).

CHANNEL NUMBER CHARTS

Channel	Frequency	Channel	Frequency
1	26.965 MHz	21	27.215 MHz
2	26.975 MHz	22	27.225 MHz
3	26.985 MHz	23	27.255 MHz
4	27.005 MHz	24	27.235 MHz
5	27.015 MHz	25	27.245 MHz
6	27.025 MHz	26	27.265 MHz
7	27.035 MHz	27	27.275 MHz
8	27.055 MHz	28	27.285 MHz
9	27.065 MHz	29	27.295 MHz
10	27.075 MHz	30	27.305 MHz
11	27.085 MHz	31	27.315 MHz
12	27.105 MHz	32	27.325 MHz
13	27.115 MHz	33	27.335 MHz
14	27.125 MHz	34	27.345 MHz
15	27.135 MHz	35	27.355 MHz
16	27.155 MHz	36	27.365 MHz
17	27.165 MHz	37	27.375 MHz
18	27.175 MHz	38	27.385 MHz
19	27.185 MHz	39	27.395 MHz
20	27.205 MHz	40	27.405 MHz

CHASSIS LAYOUT—ALIGNMENT POINTS:

FIG. A



FRONT CHASSIS SIDE

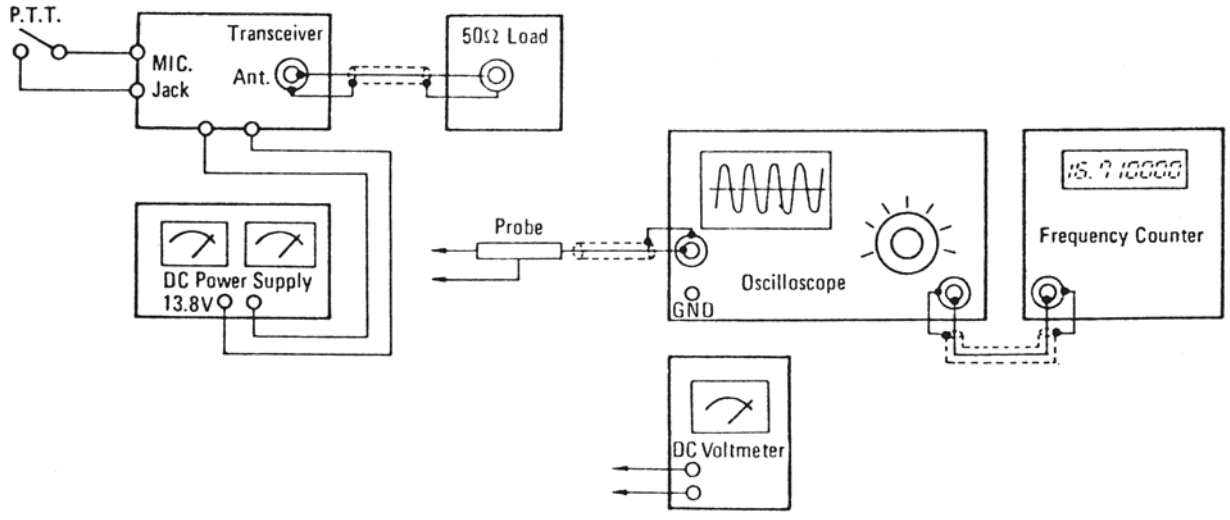
ALIGNMENT OF PLL PORTION: (REFER TO FIG. A)

1. **Test Equipment Required**
   a. Oscilloscope (0 – 50 MHz)
   b. Frequency Counter (0 – 50 MHz)
   c. DC Volt Meter (10 Volts maximum, 100K ohm/Volt)
   d. 50 ohm Load
   e. DC Power Supply (13.8 V/2-Amp)

2. **Alignment Procedure**

Step	Preset to	Connections	Adjustment	Remarks
1	TX mode, Channel 40 No modulation	DC voltmeter to Pin 7 of IC1. (TP2)	L17	Adjust to obtain approx. 3.5V reading on DC voltmeter
2	RX mode, Channel 40	Oscilloscope to secondary of L18. (TP3)	L18	Adjust for the maximum indication on oscilloscope.
3	Same as step 2	Frequency Counter to secondary of L18. (TP3)	VC1	Adjust VC1 for 16.710000 MHz.

PLL TEST EQUIPMENT SETUP



ALIGNMENT OF TRANSMITTER PORTION: (REFER TO FIG. A)

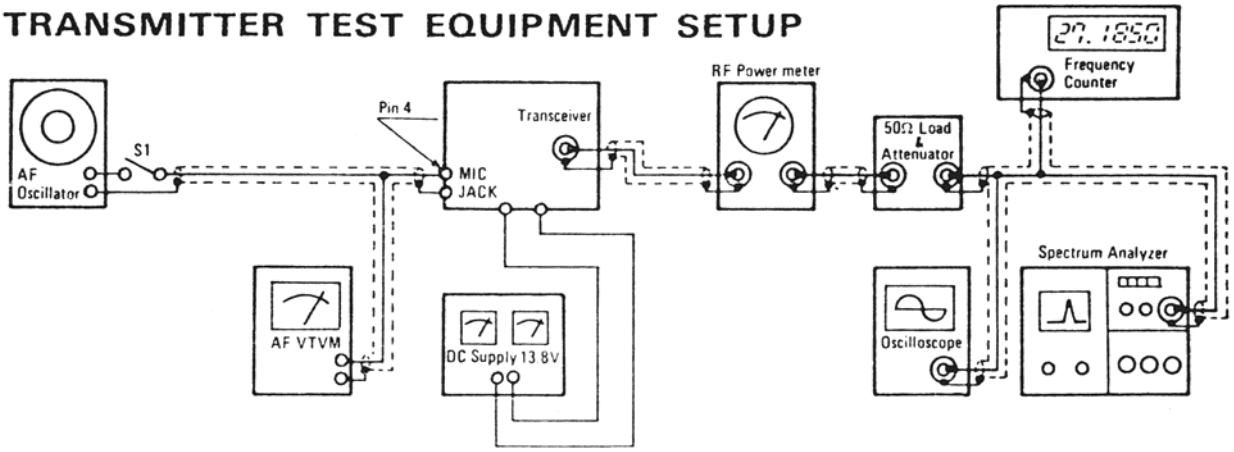
1. Equipment Required

a. VTVM (full scale: 1V DC with RF Probe)
b. RF Output Power Meter
c. Tu nable Field Strength Meter (Wave Meter or Spectrum Analyzer)
d. Frequency Counter (0 – 30 MHz)
e. DC Power Supply (13.8V/2–Amp)
f. 50 ohm Load and Attenuator
g. Oscilloscope (0 – 30 MHz)
h. AF Oscillator

2. Procedure

Step	Preset to	Conditions	Alignment	Remarks
1	TX Mode, No Modulation, Channel 19	RF Output Power Meter to ANT. Jack J202. VTVM to TP4	L19,20	Adjust for a maximum indication on VTVM.
2	Same as step 1	RF Output Power Meter to ANT. Jack J202	L16,15,12	Adjust for a maximum indication on RF Output Power Meter.
3	Same as step 1	Same as step 2	L12	Adjust to obtain Nominal 3.8 W of RF Output Power.
4	Same as step 1	Tunable Field Strength Meter to Ant. Jack (J202) through a suitable load and attenuator (Use Spectrum Analyzer if available)	L9	Adjust for minimum 2nd Harmonic Output.
5	Repeat above adjustments, until no further change can be noted.			
6	TX Mode, Ch19, 1 kHz 40 mV applied to Mic Input for MOD	Audio Generator to Pin 4 of Microphone Jack (J3). Oscilloscope to ANT. Jack (J202) through a suitable load and attenuator	VR5	Adjust for 95% Modulation.
7	Same as step 1	RF Output Power Meter to Ant. Jack J202	VR4	Check that RF Output Power Meter reads 3.8W, then adjust VR4 so that the Transceiver's Meter just approaches the 4 mark.
8	Same as step 1	Frequency Counter to Ant. Jack (J202) through a suitable load and attenuator	VC1	Adjust to obtain 27.185 MHz indication and check frequency of all channels.

TRANSMITTER TEST EQUIPMENT SETUP



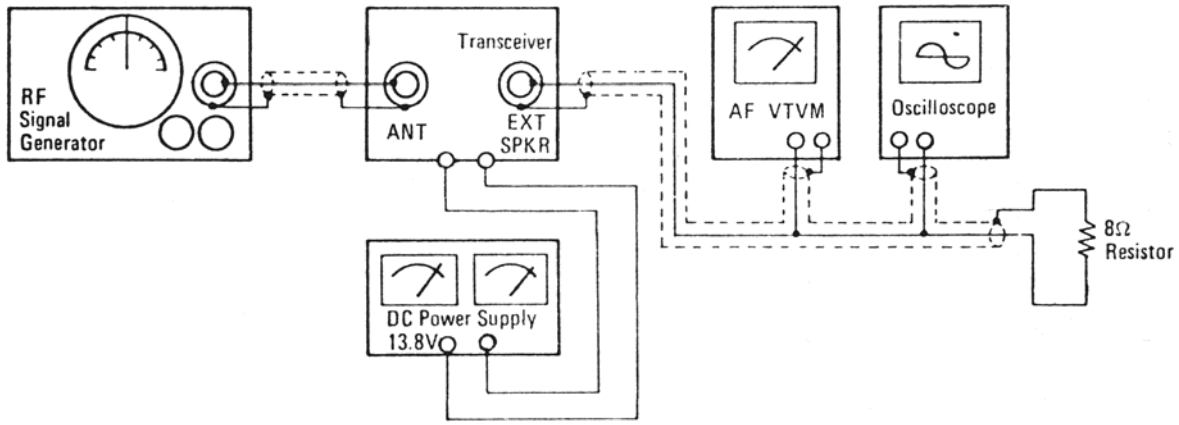
ALIGNMENT OF RECEIVER PORTION: (REFER TO FIG. A)

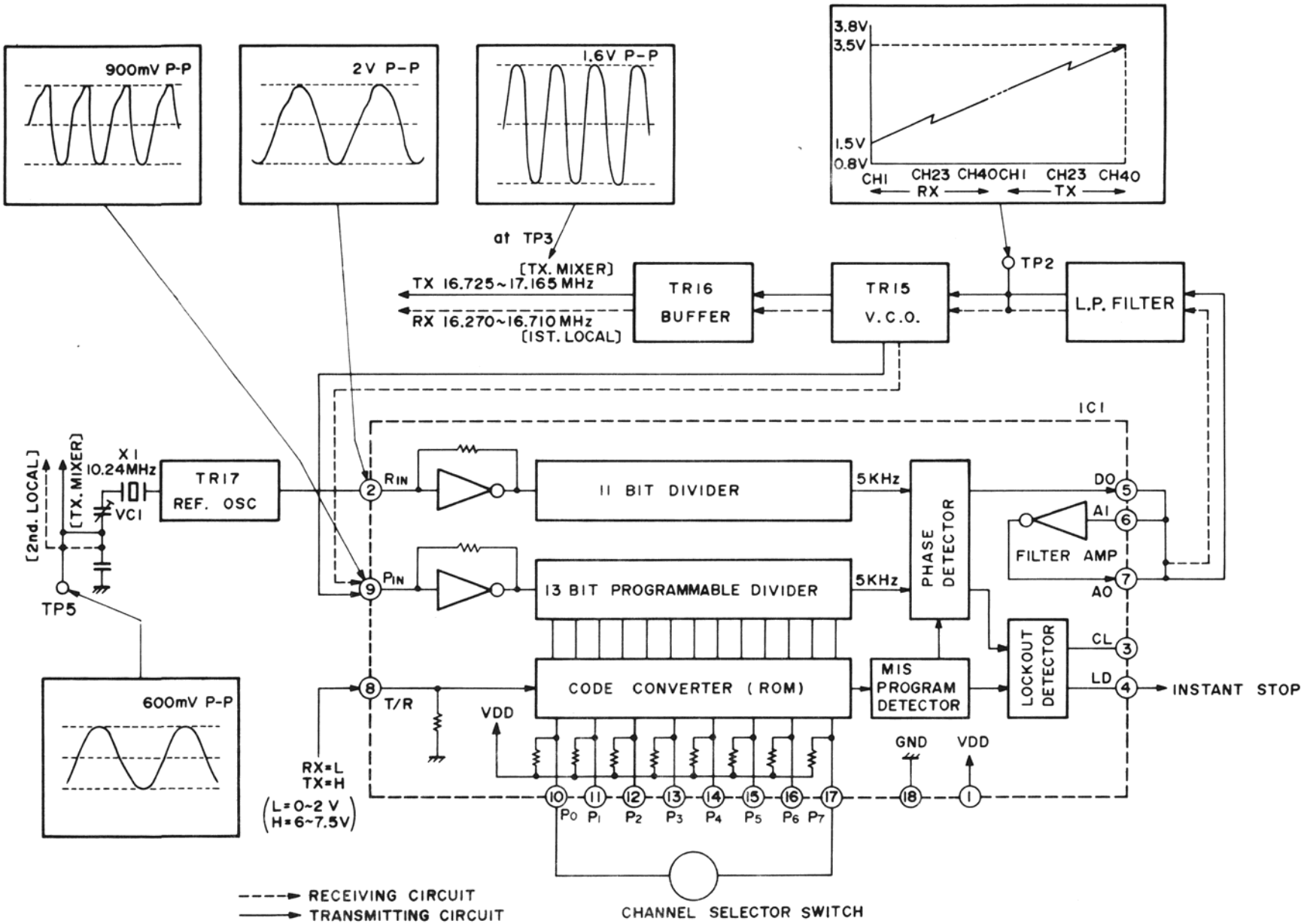
1. **Equipment Required**
   a. Signal Generator (27 MHz Band, 1000 Hz, 30% AM Modulation, Output Impedance = 50 ohm)
   b. Audio VTVM
   c. Oscilloscope
   d. Dummy Load (8 ohms, 5 watts, resistive)
   e. DC Power Suppiy (13.8 V, 2 Amp.)

2. **Procedure**

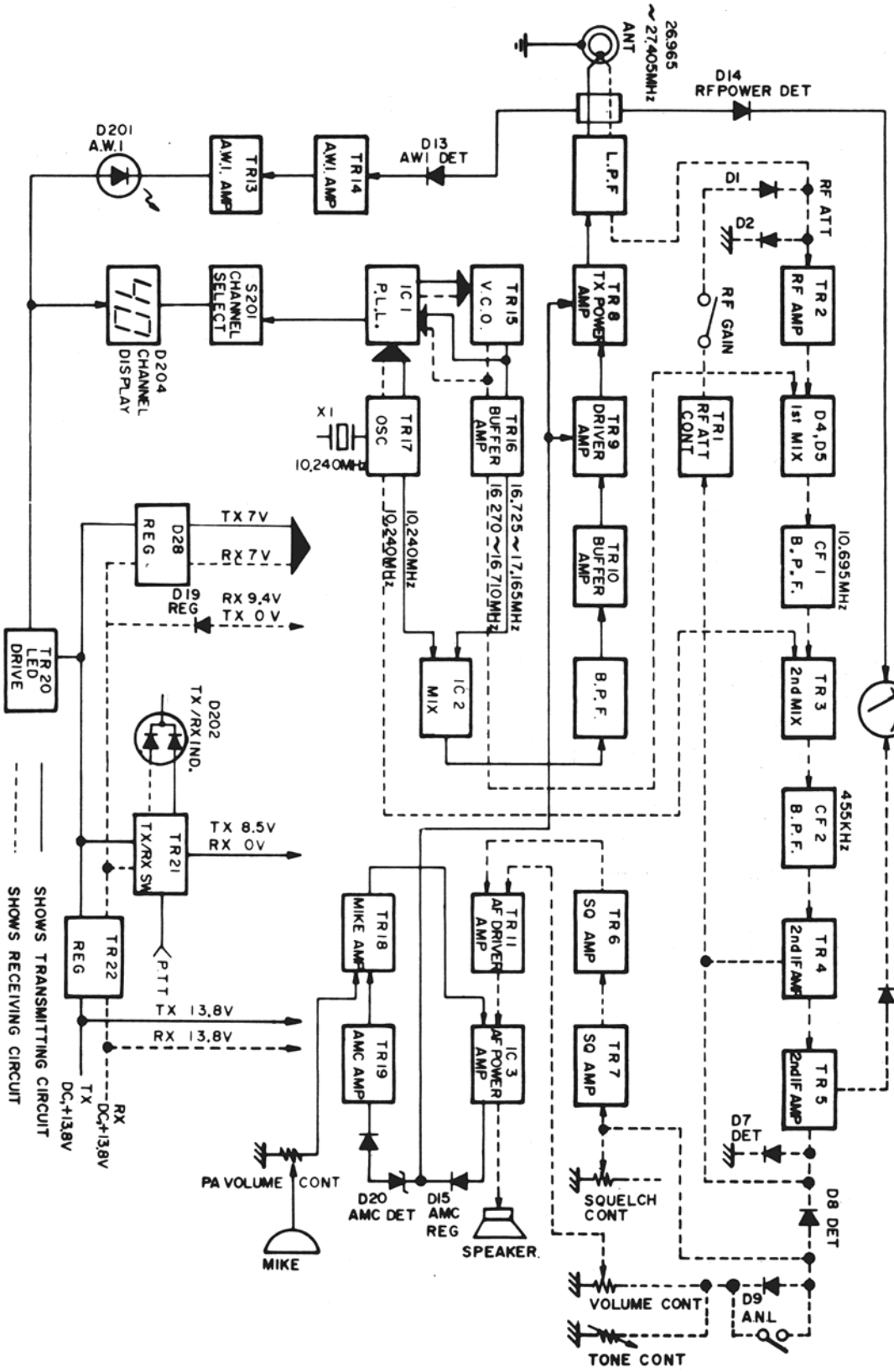
Step	SG Connection: Frequency	Preset to	Audio VTVM	Adjustment	Remarks
1	To Ant. Connector (J202) Freq: 27.185 MHz	Channel 19 Volume: Max. Squelch: Min.	To EXT. SPK. Jack (J2)	L1,2,3,4,5, 6,7	Adjust for a max. Audio Output
2	Same as step 1	Same as step 1	Same as step 1	VR1	Adjust for 2 V output with SG level of 0.3 μV
3	Same as step 1	Volume: Max. Squelch: Max.	Same as step 1	VR2 (Squelch)	Adjust for 2 V output with SG output level of 1000 μV.
4	Same as step 1	Same as step 1	Same as step 1	VR3	Adjust for a reading of S-9 on the Transceiver's S-meter with SG output level of 100 μV.

RECEIVER TEST EQUIPMENT SETUP

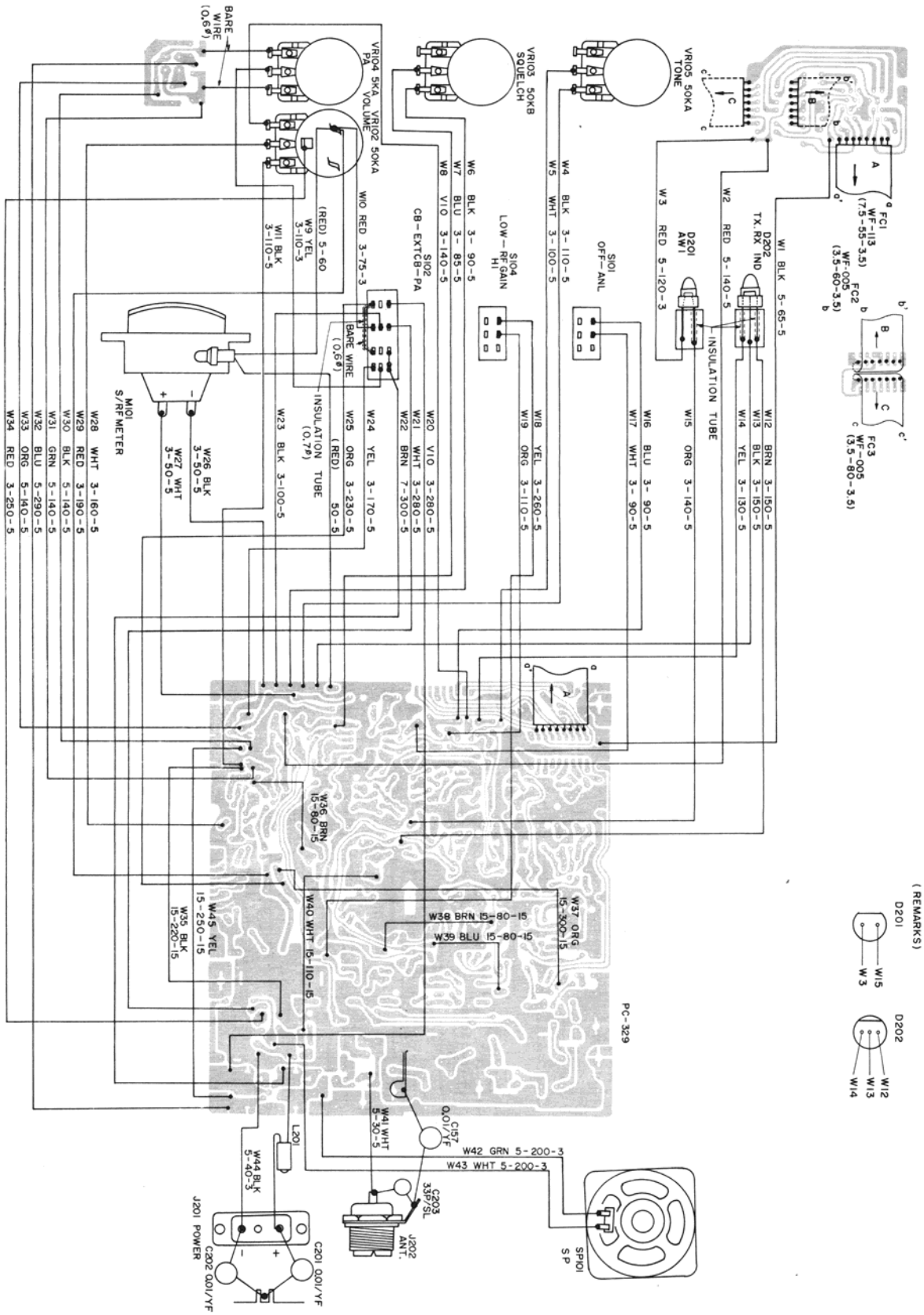



900mV P-P
2V P-P
1.6V P-P
3.8V
3.5V
1.5V
0.8V
CH1 CH23 CH40 CH1 CH23 CH40
RX
TX
at TP3
[TX. MIXER]
TX 16.725~17.165 MHz
RX 16.270~16.710 MHz
[1ST. LOCAL]
TR16 BUFFER
TR15 V.C.O.
TP2
L.P. FILTER
IC1
[2nd. LOCAL]
[TX. MIXER]
X1
10.24MHz
VC1
TR17 REF. OSC
TP5
RIN
PIN
11 BIT DIVIDER
13 BIT PROGRAMMABLE DIVIDER
5KHz
5KHz
PHASE DETECTOR
DO
AI
AO
FILTER AMP
CL
LD
INSTANT STOP
LOCKOUT DETECTOR
MIS PROGRAM DETECTOR
CODE CONVERTER (ROM)
T/R
VDD
GND
VDD
600mV P-P
RX=L
TX=H
(L=0~2 V
H=6~7.5V)
P0 P1 P2 P3 P4 P5 P6 P7
RECEIVING CIRCUIT
TRANSMITTING CIRCUIT
CHANNEL SELECTOR SWITCH

BLOCK DIAGRAM



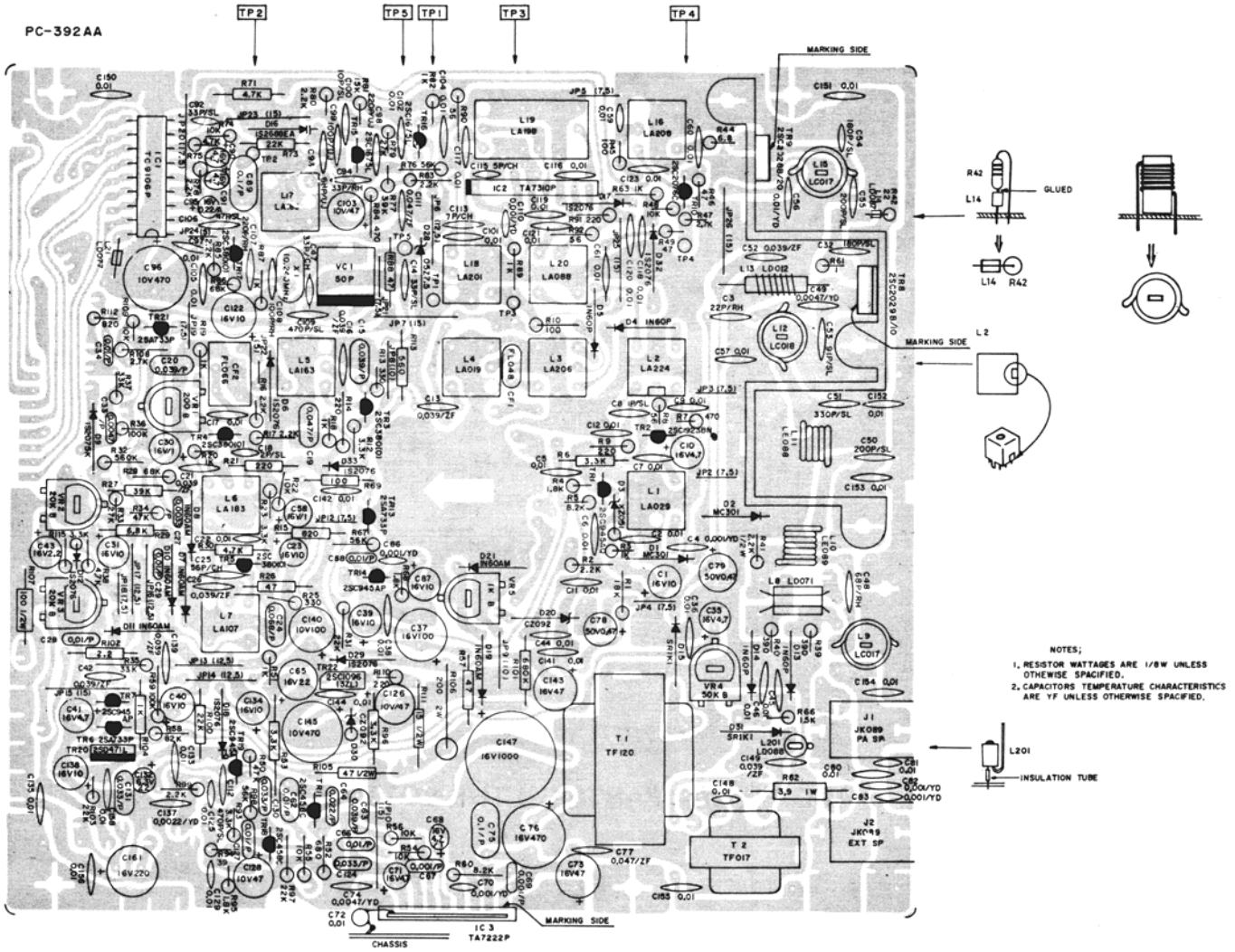
WIRING DIAGRAM



PARTS LAYOUT (TOP VIEW)

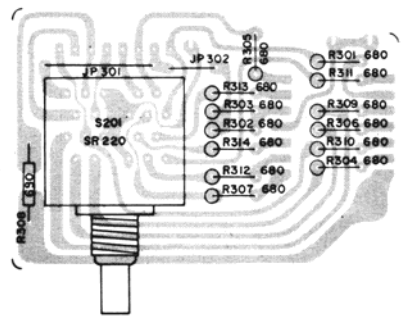
MAIN P.C.B.

PC-392AA



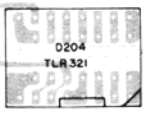
CHANNEL SELECTOR SWITCH P.C.B.

PC-268AA



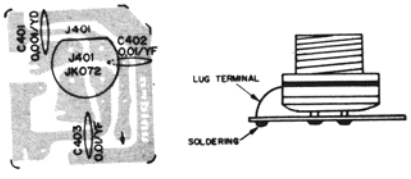
CHANNEL DISPLAY P.C.B.

PC-267AA



MICROPHONE JACK P.C.B.

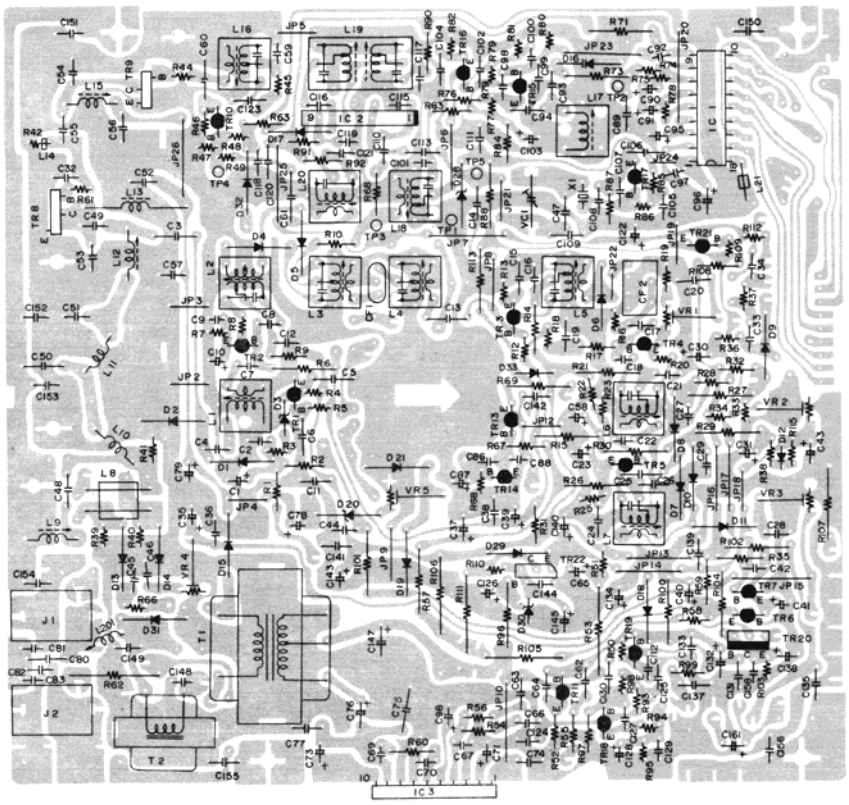
PC-386AA



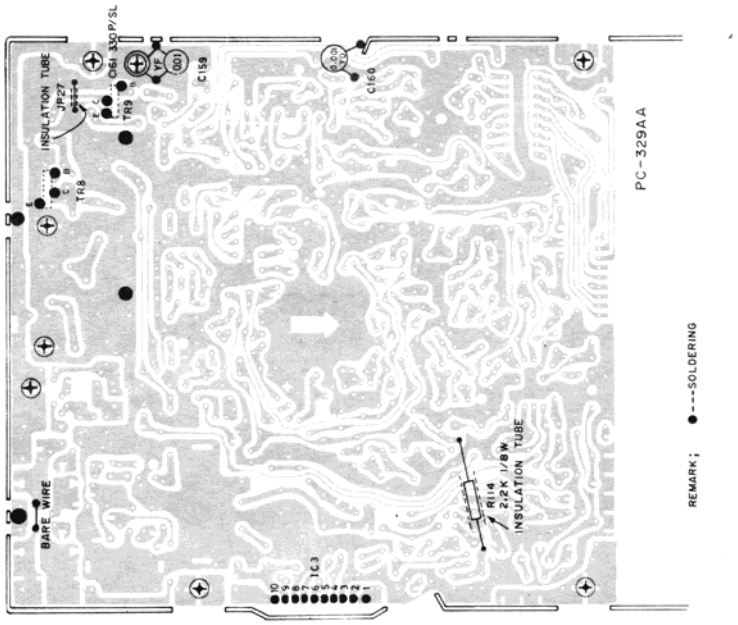
PARTS LAYOUT (BOTTOM VIEW)

MAIN P.C.B.

PC-392AA



ADDITIONAL PARTS ON THE BOTTOM



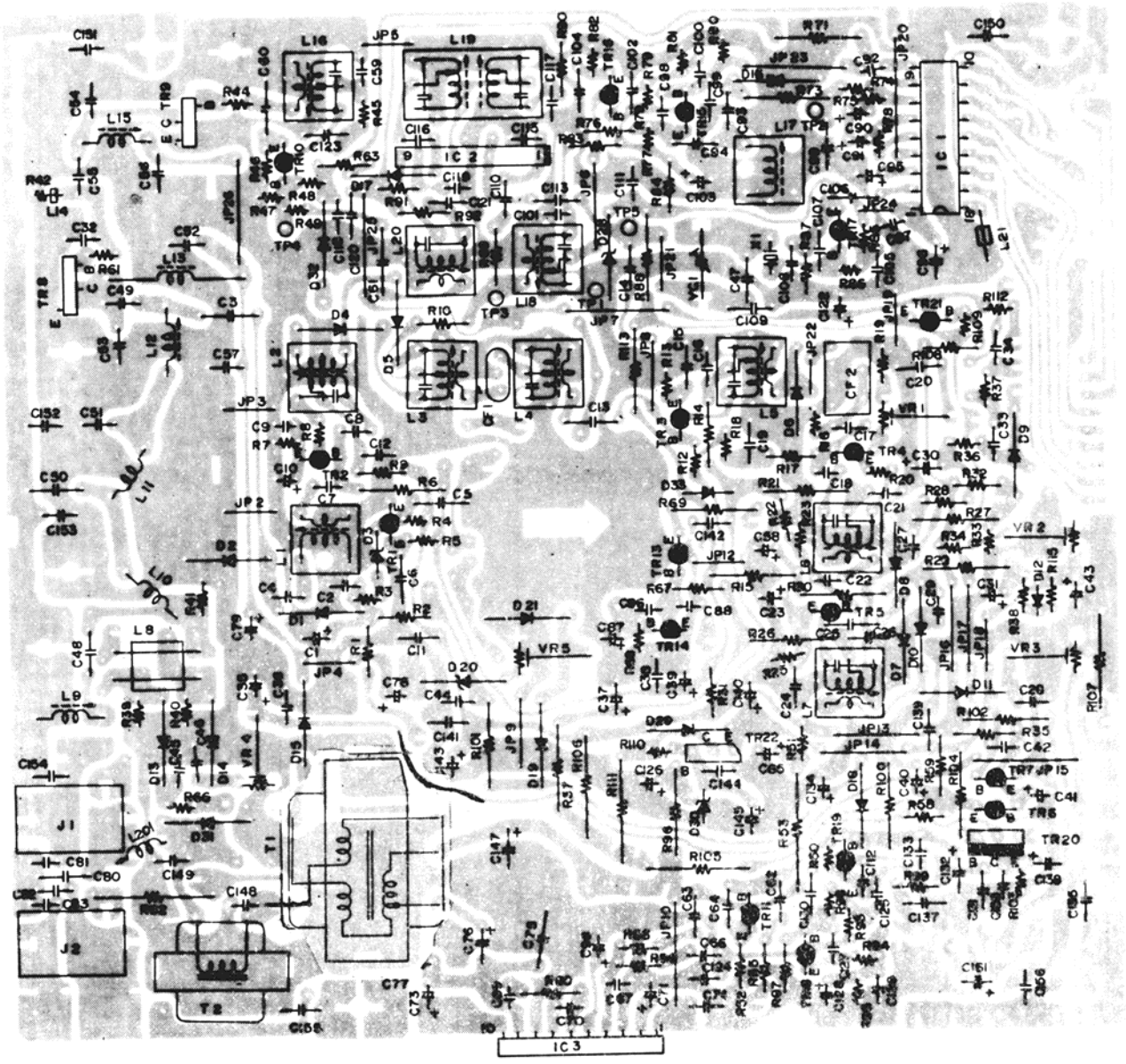
Service manual correction, Model 77-824B, Page #18, Parts Layout Diagram, Main PC Board Drawing

REF.NO:	DESCRIPTION:	OLD PART NO:	NEW PART NO:
T-1	Transformer, Modulation	77-096001	77-096009

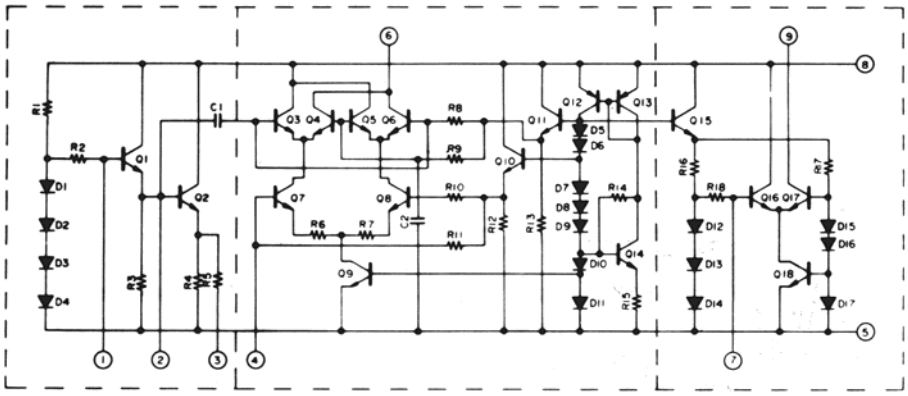
PARTS LAYOUT (BOTTOM VIEW)

MAIN P.C.B.

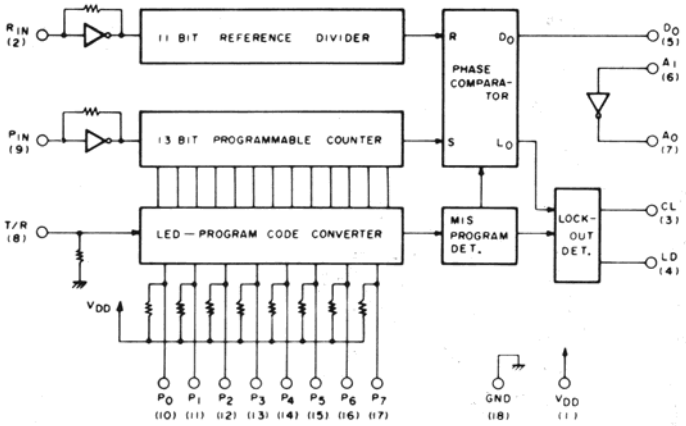
PC-392 AA



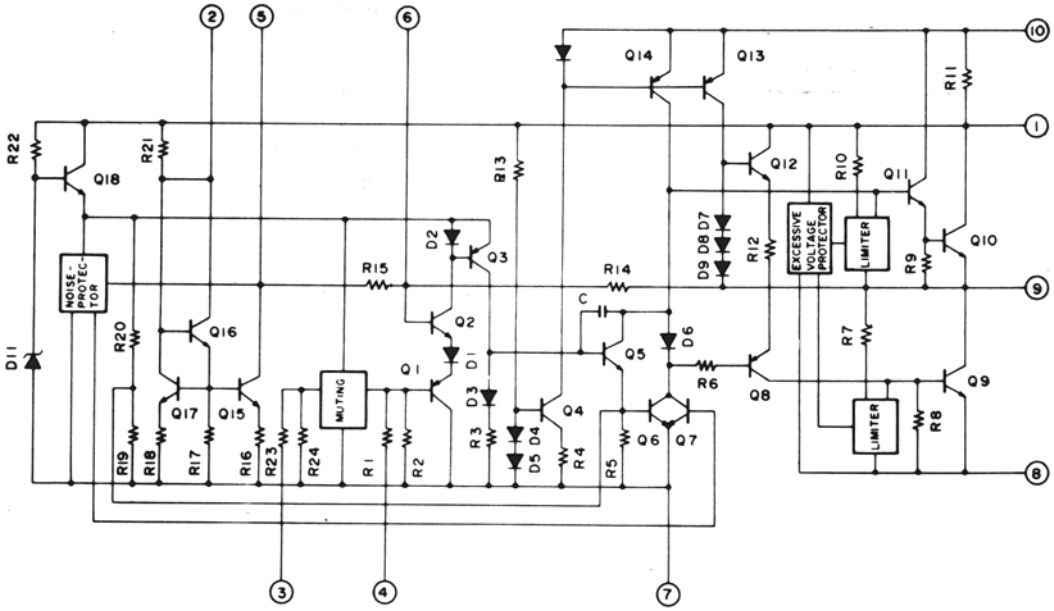
TA7310P

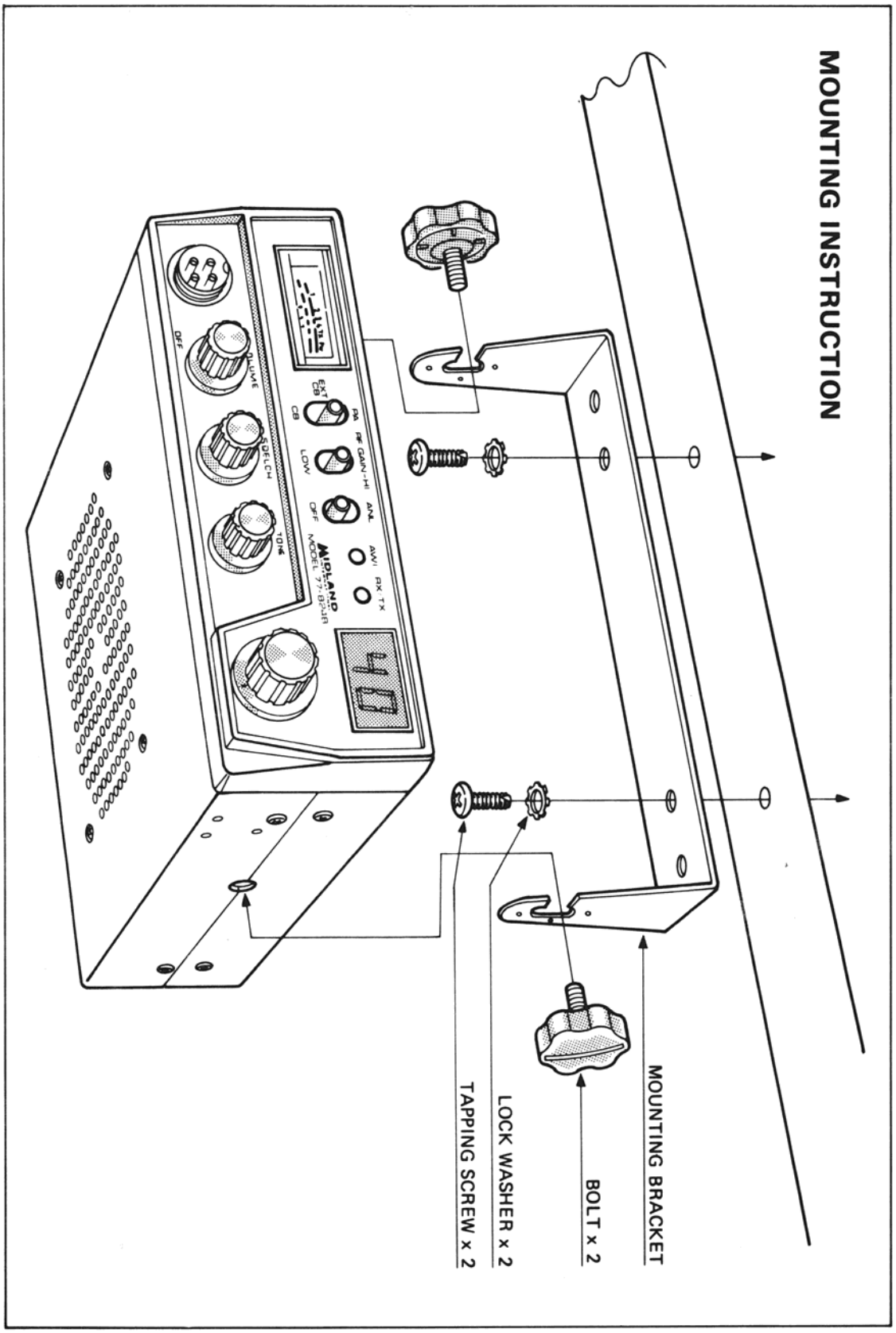


TC9106P

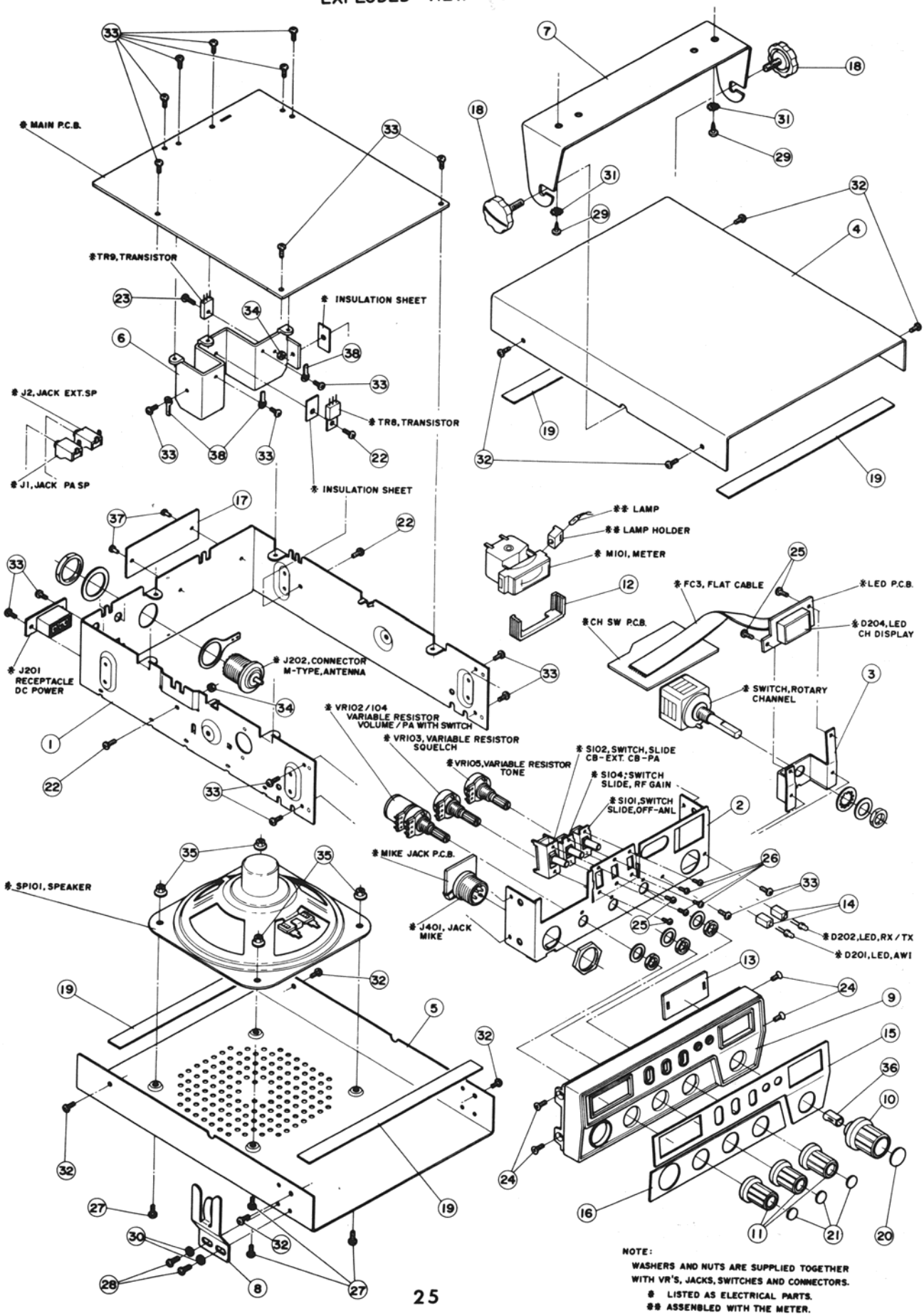


TA7222P




MOUNTING INSTRUCTION
MOUNTING BRACKET
BOLT x 2
LOCK WASHER x 2
TAPPING SCREW x 2
MIDLAND
MODEL 77-628A
OFF
VOLUME
DEFLCH
TONE
EXT CB
CB
PA
RF GAIN-HI
LOW
OFF
ANL
AWI
RX TX
40

EXPLODED VIEW FOR 77-824B



NOTE:
WASHERS AND NUTS ARE SUPPLIED TOGETHER WITH VR'S, JACKS, SWITCHES AND CONNECTORS.
* LISTED AS ELECTRICAL PARTS.
** ASSEMBLED WITH THE METER.

PARTS LIST

MODEL NO. 77-824B PAGE 1

REF. NO.	DESCRIPTION	PART NO.
	CASE MATERIALS (EXPLODED VIEW)	
3	Bracket, Channel Switch	77-158059
4	Case, Top	77-010042
5	Case, Bottom	77-013017
6	Heat Sink	77-089035
7	Bracket, Mount	77-158041
8	Hanger, Microphone	77-158011
9	Case, Front	77-010030
10	Knob, Channel Selector	77-115016
11	Knob, Vol/SQ/Tone	13-110136
12	Bracket, Meter	77-158042
13	Lense, LED Readout	77-020013
14	Holder, LED	77-158060
15	Plate, Front	77-020025
16	Plate, Control	77-020015
17	Plate, FCC	77-023014
18	Screw, Mount Bracket	77-151007
20	Plate, Knob, Channel	77-115017
36	Spring, Knob	77-152002
	MISCELLANEOUS	
SP101	Speaker, 16 Ohm, 4" Square	77-060004
M101	Meter	77-200011
	Microphone	77-038011
F101	Fuse, 2 Amp	13-204014
	Cord, DC Power	77-034003
FC3	Flexible PC Board (8 Conductor)	77-070015
	Flexible PC Board 80 MM (7 Conductor)	77-070016
	Flexible PC Board 60 MM (7 Conductor)	77-070017
	Lamp	79-201001
	Holder, Lamp (Rubber)	77-157031
	CRYSTAL	
X1	Crystal, 10.24 MHz	79-128006
	SWITCHES	
SR220	Switch, Channel Selector	77-180014
S101,104	Switch, ANL/RF Gain	77-183005
S102	Switch, CB/EXT. CB/PA	77-183006
	JACKS	
J1,2	Jack, PA/EXT. SPKR.	77-159026
J201	Jack, DC Power	13-159246
J202	Jack, Antenna	13-159244
J401	Jack, Microphone	77-159025
	COILS & TRANSFORMERS	
L1	Coil, RF, 27 MHz	13-094238
L2	Coil, RF	77-176066
L3	Coil, RF	77-176037
L4	IFT	77-090012
L5	IFT	13-090411
L6	IFT	77-090013
L7	IFT	13-090413
L8	Coil, Trap	77-176039
L9,15	Coil, TX Driver	13-176625
L10	Coil, RF	77-176067
L11	Coil, RF	77-176068
L12	Coil, 27 MHz	77-176042
L13	Coil, Filter	13-176523
L14	Coil, RF	77-176041
L16	Coil, RF	77-176043
L17	Coil, RF	77-176005
L18	Coil, RF, 16 MHz	77-176045
L19	Coil, TX Mixer	77-176047
L20	Coil, Transmit	77-176048
L21	Coil, RF	79-176010
L201	Coil, RF Choke	77-178022
T2	Coil, AF Choke	13-178246
X T1	Transformer, Modulation Output	~~77-096001~~ 77-096009
	TRIMMER CAPACITOR	
VC1	Capacitor, Trimmer, 50 PF, CV-048	77-123015
	CONTROLS	
VR1	Control, Sensitivity 200 Ohm	77-164015
VR2,3	Control, Sensitivity 20K Ohm	77-164009
VR4	Control, Sensitivity 50K Ohm	77-164010
VR5	Control, Sensitivity 1K Ohm	77-164011
VR102,104	Control, Volume W/Squelch	77-160009
VR103	Control, Squelch	13-166056
VR105	Control, Tone	77-163001

REF. NO.	DESCRIPTION	PART NO.
	PC BOARDS (WITH COMPONENTS)	
CH SW PCB	Board, PC, Channel Switch	77-075037
LED PCB	Board, PC, LED	77-075038
MIC JACK PCB	Board, PC, Mic Jack	77-075039
	CERAMIC FILTER	
CF1	Filter, Ceramic, FL048	77-179010
CF2	Filter, Ceramic, FL066	77-179011
	INTEGRATED CIRCUITS	
IC1	TC9106P	02-269106
IC2	TA7310P	02-257310
IC3	TA72222P	02-252222
	TRANSISTORS	
TR1,14	2SC945A	01-030945
TR2	2SC1923BN	01-031923
TR3,4,5,17	2SC380	01-030380
TR6,13,21	2SA733P	01-010733
TR7,19	2SC945A-Q	01-030945
TR8	2SC2029	01-032029
TR9	2SC2028	01-032028
TR10	2SC2076	01-032076
TR11,18	2SC458C	01-030458
TR15,16	2SC1675L	01-031675
TR20	2SD471L	01-040471
TR22	2SC1096	01-031096
	L.E.D.'S	
D201 (AWI)	TLR124	77-202015
D202 (RX,TX)	TLRG101	77-202016
D204(CH DISPLAY)	LED Readout, TLR-321	77-202017
	DIODES	
D1,2	MC301	05-340301
D3	XZ051	05-990051
D4,5,13,14	1N60-P	05-170060
D6,17,18, 29,32,33	1S2076	05-182076
D7,8,10,11, 19,21	1N60-AM	05-170060
D9	1S2075	05-182075
D15,31	SR1K-1	05-750001
D16	1S2688	05-182688
D20	CZ092	05-090092
D28	05Z	05-490005
	RESISTORS	

RESISTORS NOT SHOWN ON THIS PARTS LIST ARE CARBON TYPE, 1/8 WATT. REFER TO SCHEMATIC FOR SPECIFIC VALUES.

	METAL FILM	
R62	3.9 Ohm, 1 Watt	04-010309
R106	220 Ohm, 2 Watt	04-022200

REF. NO.	DESCRIPTION	PART NO.
	CAPACITORS	
CAPACITORS NOT SHOWN ON THIS PARTS LIST ARE CERAMIC DISC TYPE, 50 VOLT. REFER TO SCHEMATIC FOR SPECIFIC VALUES.		
	TANTALUM	
C68,90,91	4.7 uF, 16V	03-003021
	ALUMINUM	
C95	.22 uF, 16V	03-007021
	MYLAR	
C15,20,63	.039 uF, 25V	03-000276
C19	.047 uF, 25V	03-000010
C24	.068 uF, 25V	03-000357
C27	.0038 uF, 25V	03-000274
C28,29,34,62, 68,88,127	.01 uF, 25V	03-000204
C33	.0047 uF, 25V	03-000304
C64	.0022 uF, 25V	03-000244
C67,69	.001 uF, 25V	03-000209
C75,89	.1 uF, 25V	03-000199
C124,130,131	.033 uF, 25V	03-000267
	ELECTROLYTIC	
C1,23,31,122, 134,138	22 uF, 6.3V	00-132293
C10,35,41,71	4.7 uF, 16V	00-132595
C30,58	1 uF, 16V	00-132035
C37	100 uF, 16V	00-132175
C43	2.2 uF, 16V	00-132265
C65	22 uF, 16V	00-132300
C73,143	47 uF, 16V	00-132630
C76	470 uF, 16V	00-132675
C78,79	.47 uF, 50V	00-132575
C103,126,128	47 uF, 10V	00-132625
C96,145	470 uF, 10V	00-132665
C140	100 uF, 10V	00-132165
C147	1000 uF, 16V	00-132210
C162	220 uF, 16V	00-132380

HOW AND WHERE TO ORDER REPLACEMENT PARTS

NOTE: To eliminate error and speed delivery of replacement parts, always include the following information on your order:

1. Complete identification of merchandise for which the part is wanted.

   A. Model Number
   B. Serial Number

2. Best possible identification of the part itself.

   A. Part Number
   B. Schematic Reference Number
   C. Part Description
   D. Quantity Requested
   E. If necessary, return old part as sample.

3. Customer should use address listed below when ordering replacement parts.

MIDLAND INTERNATIONAL
CUSTOMER SERVICE (PARTS DEPT.)
1690 NORTH TOPPING AVENUE
KANSAS CITY, MISSOURI 64120