

MIDLAND
ELECTRONICS COMPANY

INTEGRATED
CIRCUIT

MODEL 13-505

STEREO AM/FM AUTO TUNING BRANDED FRONT CENTER
30 WATT 12 CHANNELS

OWNER'S GUIDE



FEDERAL COMMUNICATIONS COMMISSIONS REQUIREMENTS

Your new Midland 13-505 is a combination receiver-transmitter designed and built for licensed VHF Amateur Band designated by the Federal Communications Commission. You are required to read and understand Part 97 of the F.C.C. rules and regulations prior to operation of this unit.

NOTE: The technical information, diagrams, and charts provided in this manual are supplied for the use of a qualified holder of an Amateur Band license in servicing this transceiver. It is the users responsibility to see that this unit is operating at all times in accordance with the F.C.C. Rules and Regulations.

If you install or service your own transceiver, do not attempt to make any transmitter tuning adjustment. Transmitter adjustments are prohibited by the F.C.C. unless you hold an Amateur Band license or are in the presence of a person holding the license.

MIDLAND COMMUNICATIONS COMPANY HEREBY CERTIFIES THAT THIS UNIT HAS BEEN DESIGNED AND MANUFACTURED IN ACCORDANCE WITH PART 97 OF THE CURRENT F.C.C. RULES AND REGULATIONS AS OF THE DATE OF MANUFACTURE.

OWNER'S GUIDE

Your 13-505 is a versatile, all solid-state, professional quality transceiver providing 12 crystal controlled transmit and receive channels on VHF Amateur Band of 144 to 148 MHz. This transceiver is designed for installation aboard cars or pleasure boats and will provide years of reliable service with ordinary care. The transceiver has many unique features such as separate transmit and receive channel control system, modulation quality monitor system, provision for tone burst signal input, discriminator, S/RF-power/SWR meter, high and low transmitting power switching facility, etc. It also features RF power protection circuitry which protects the expensive RF power transistors from possible damage due to short or open antenna circuit conditions or the use of an improper antenna system which would cause excessive mismatching. This makes the transceiver very easy-to-use and reliable.

We strongly suggest you to read this Owner's Guide carefully before operation so that you may receive full benefit from this transceiver.

OPERATING CONTROLS AND FUNCTIONS

OFF/VOLUME

This turns the set on or off and controls the sound output from the speaker when receiving. The VOLUME control does not affect transmitting output.

SQUELCH

Quiets the receiver when signals are not being received and allows a 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 as settings too far to the right will not allow weaker signals to release the squelch.

"RX/COM" CHANNEL SELECTOR

This controls both transmitter and receiver frequencies simultaneously if the "COM-SEP" switch is placed in the "COM" position, but not controls the transmitter frequency if the "COM-SEP" switch is placed in the "SEP" position. In this case the channel selector can control only the receive frequency.

"TX" CHANNEL SELECTOR

This selects one of 12 transmit channels regardless of "RX/COM" channel selector setting if the "COM-SEP" switch is placed in the "SEP" position. No receive channel can be controlled with this selector switch.

RF-SWR PUSH SWITCH

With this switch in the out position, the transmitting RF power output can be checked on the power meter scale.

To check SWR of your antenna system depress the switch and SWR will be indicated on the lower SWR meter scale. The recommended value of SWR is less than 1.5, even if the value of 2 or less will give satisfiable result in practical transceiver operation.

PRIORITY SWITCH

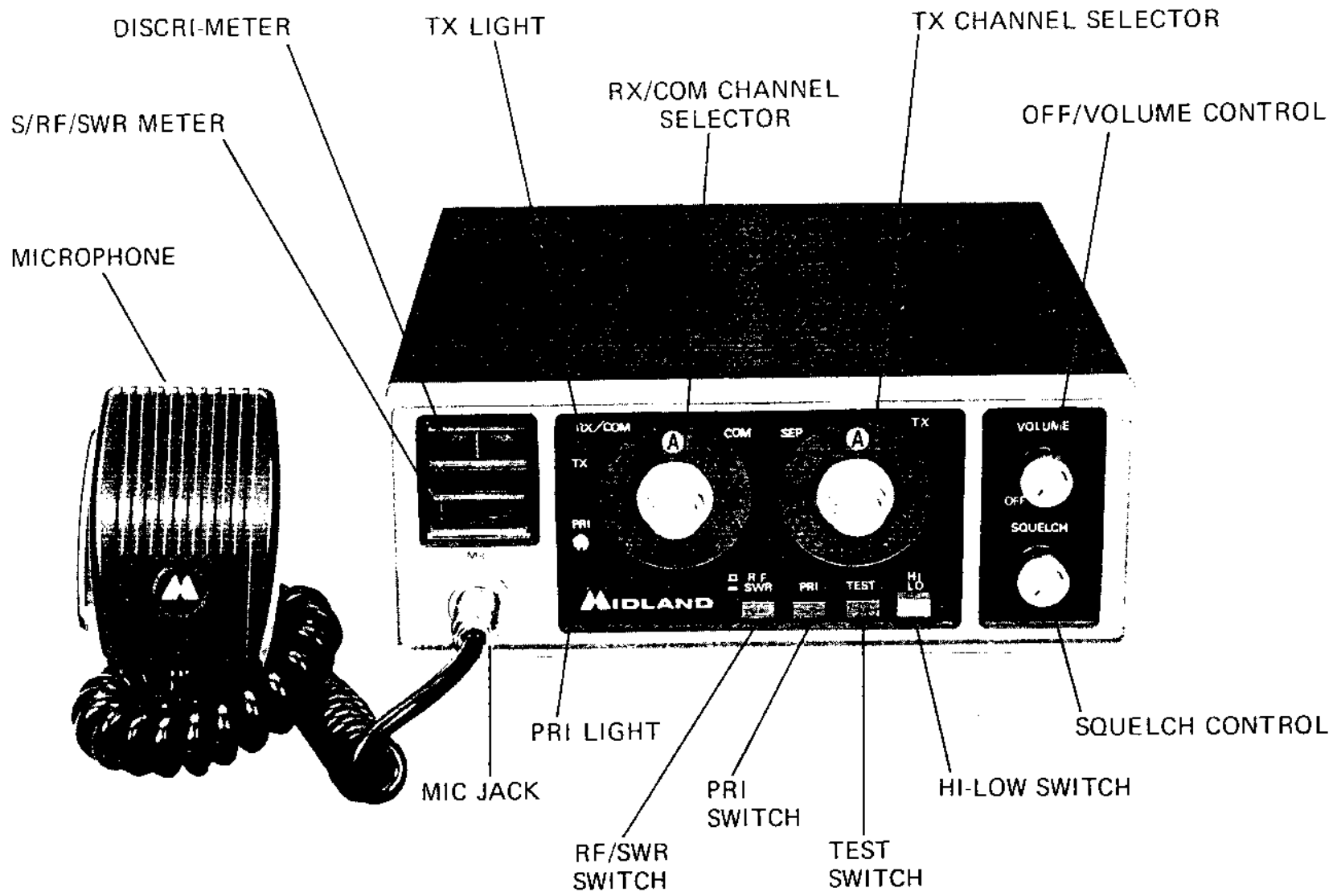
This switch, when depressed, selects both transmit and receive frequencies decided by the crystals inserted in the channel "A" sockets legardless of the channel selector switches. In this model transmitter frequency of 146.34 MHz and receiver frequency of 146.94 MHz will be automatically selected unless you do not change the crystals already inserted in the "A" channel crystal sockets at the factory.

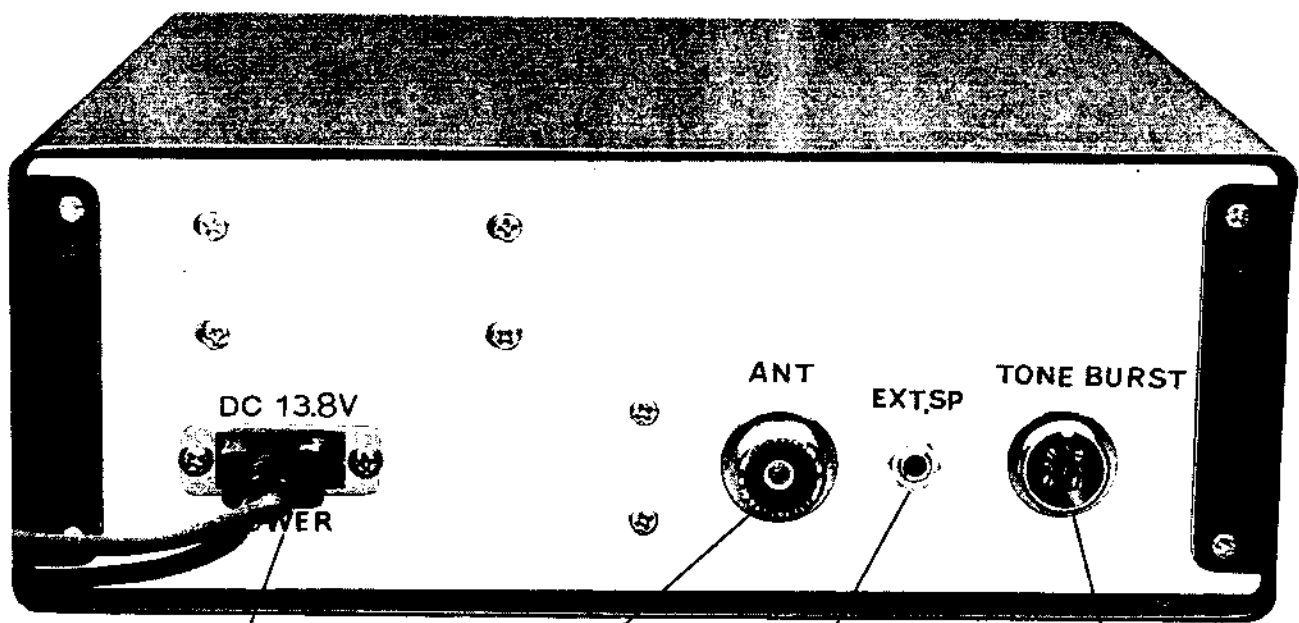
TEST SWITCH

This switch, when depressed, makes the transmitter's final power stage cut off and operate the receiver circuit, even if the push-to-talk switch is depressed. Therefore, if you depress the switch you can receive your own transmitter's sending signal with your transceiver, thus capable of monitoring or checking transmitting characteristics such as modulation, sound quality, tone burst-modulated sound (if tone burst signal is connected to the rear jack, etc.)

To do this proceed as follows:

1. Depress the TEST switch.
2. Place the COM-SEP switch in the SEP position.





DC POWER CONNECTOR

ANTENNA CONNECTOR

EXTERNAL
SPEAKER JACK

TONE BURST CONNECTOR

3. Set both RX/COM and TX channel selector to have the same transmitting and receiving frequency. For example:
Place the RX/COM channel dial (separate receiver channel dial) in the "A" channel (146.94 MHz) position and the TX channel dial (separate transmitter dial) in the "C" channel (146.94 MHz) position.
4. Press the Push-to-Talk switch and speak into the microphone, and the receiver section of the transceiver will receive your transmitter's sending signal (your voice).

HI-LO SWITCH

This switch selects either 30W or 5W transmitting power. With the switch released out position the transceiver produces full rated transmit power for longer communication range. The depressed in position will produce 5W power for local or short range communications.

TX LIGHT

This lights up while the Push-to-Talk switch on the microphone is being depressed.

PRI LIGHT

This lights up when the "PRI" switch is depressed.

CHANNEL DIAL LIGHTS

With the COM-SEP switch placed in COM position, the RX/COM channel dial light will light up and indicate the channel selected. However the channel which has no crystals in the crystal sockets is selected, no dial light will light up.

When the COM-SEP switch is placed in the SEP position, the RX/COM channel dial light will light up in normal brightness but the TX channel dial light will grow dimmely, indicating that the TX channel is ready to be operated. But when the Push-to-Talk switch is depressed the TX channel dial light will grow brightly and the RX/COM channel dial light will be turned off.

DISCRI-METER

This is a center-of-meter and indicates the receiving condition in terms of frequency shift. The pointer at the center position indicates that your receiver is exactly tuned to the signal you received.

This meter can also be used as a simple frequency calibration nullindicator. For example, tune the receiver to the known channel center frequency or reliable station emitting known frequency and observe the meter pointer. If the pointer is shifted from the center position of the meter scale, tune your receiver by adjusting appropriate local oscillator trimmer so that the meter pointer indicates the exact center on the scale. Thus your receiver can be easily calibrated.

The transmitter frequency of your transceiver can also be calibrated in the similar way. In this case proceed as follows:

1. First, calibrate receiver section of the transceiver as just described above.
2. Depress the TEST switch and place the COM-SEP switch in the SEP position.
3. Set the TX channel selector to the channel which has the same frequency as that of receiver channel already calibrated.
4. Press the Push-to-Talk switch and observe the DISCRI-METER pointer.
5. If the pointer is not in the center position, adjust the transmitter oscillator trimmer so that the meter pointer reads the exact center on the meter scale. — end —

S/RF/SWR METER

This meter will be used in three ways.

1. Signal Strength Meter

The upper scale numbered 1, 2 9, 30 will be used as a "S" meter and indicates a relative signal strength of the signals received.

2. RF Power Meter

The middle scale is used for RF transmitting power indicator. The center of left separate scale indicates 5W and that of right separate scale 30W.

3. SWR Meter

The lower scale will be used for checking SWR of your antenna system connected to the transceiver. Refer to the description under "RF-SWR SWITCH".

NOTE: The above three scales are calibrated to give correct indications when 50 ohm resistive antenna is connected to the ANT jack on the rear panel.

MIC JACK

Used for Push-to-Talk microphone connection.

ANT JACK

Used for antenna connection.

EXT. SP JACK

An external speaker may be used by connecting a suitable 4-8 ohm speaker or a standard 1/4" two circuit phone plug. When the plug is inserted in the jack, the built-in speaker is automatically disconnected.

TONE BURST CONNECTOR

For flexible applications of your transceiver, provision for a tone burst signal connection is provided on the rear panel. The details of the 4-pin TONE BURST connector is as follows:

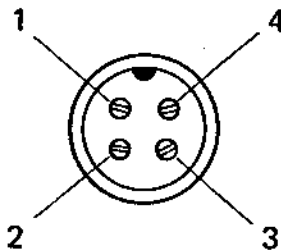


Figure 1. Tone Burst Connector

No. 1 PIN: Tone burst signal will be connected to this PIN. Your transceiver is designed to produce 10 KHz frequency deviation when 100 mV, 2 KHz tone burst signal is applied to the PIN.

No. 2 PIN: The ground lead from a tone burst generator will be connected.

No. 3 PIN: Regulated DC voltage (+10 V, current capacity 30 mA) is supplied to this PIN while the Push-to-talk switch is being depressed but no voltage will be obtained while receiving.

NOTE: Do not short-circuit this voltage line, transceiver's regulated power circuit may be seriously damaged.

No. 4 PIN: NC; not used.

ANTENNA CONNECTION

Connect a VHF antenna to the coaxial antenna connector of the rear panel, using 50 ohm coaxial cable with PL-259 male and female coaxial connectors attached to the cable ends.

There is a great variety of antenna systems, but for maximum efficiency a 50 ohm VHF antenna is recommendable, since this unit is designed to match 50 ohm loads (antenna). For further information on the antenna system that meet your specific needs, please consult your dealer from which you purchased the unit. The antenna should be mounted as high as possible for longer communication range.

IMPORTANT: DO NOT ATTEMPT TO TRANSMIT WITH NO ANTENNA OR AN IMPROPER ANTENNA CONNECTED. A GREAT AMOUNT OF ANTENNA REFLECTION LOSSES WILL BE CAUSED AND THIS MAY GIVE UNDESIRABLE EFFECT ON THE RF POWER TRANSISTORS EVEN THOUGH THEY ARE DESIGNED TO BE AUTOMATICALLY PROTECTED FROM POSSIBLE DAMAGE.

POWER CONNECTION

The 13-505 is designed to be used in a 12 volt DC negative ground system only. If you are unsure of your systems polarity, ask your dealer or local service center.

Simply connect the power cable supplied to the Power Connector on the rear panel. The red wire from the unit is positive and may be connected directly to the positive or + battery terminal or to a fuse block or ignition switch or other convenient point. The black wire is negative or ground and should be connected to a metal part of the car frame or body or - battery terminal. To insure proper operation, care should also be taken in attaching the radiotelephone and mounting bracket to the boat in such a way as to obtain good ground connection at this point.

ADDITION OF NEW CHANNELS

The crystals for three transmit [A-CH: 146.34 MHz, B-CH: 146.16 MHz & C-CH: 146.94 MHz] and two receive [A-CH: 146.94 MHz & B-CH: 146.76 MHz] have already been installed for immediate operation.

Any other new channels may be added by installing two crystals for each channel desired.

When new crystals are installed in the unit, it must be aligned for the exact reception and transmit channel frequencies and this must be performed by an Authorized person, the holder of Amateur Band license or equivalent.

The receive and transmit crystal frequencies can be calculated from the following formulas:

$$\text{Receive Crystal (MHz)} = \frac{\text{Operating Freq. (MHz)} - 10.7 \text{ MHz}}{9}$$

$$\text{Transmit Crystal (MHz)} = \frac{\text{Operating Freq. (MHz)}}{12}$$

NOTE: Use HC-25U type crystals having load capacity of 30 pF at fundamental frequency.

To install new crystals simply remove the sleeve type cover of the unit, removing four screws on the rear cabinet.

The transmit and receive crystal sockets are provided on the front chassis as shown in Figure 2. Each crystal position is marked in relation to the symbols on the channel selector dial [A, B, L]. Insert the new crystals into the proper sockets.

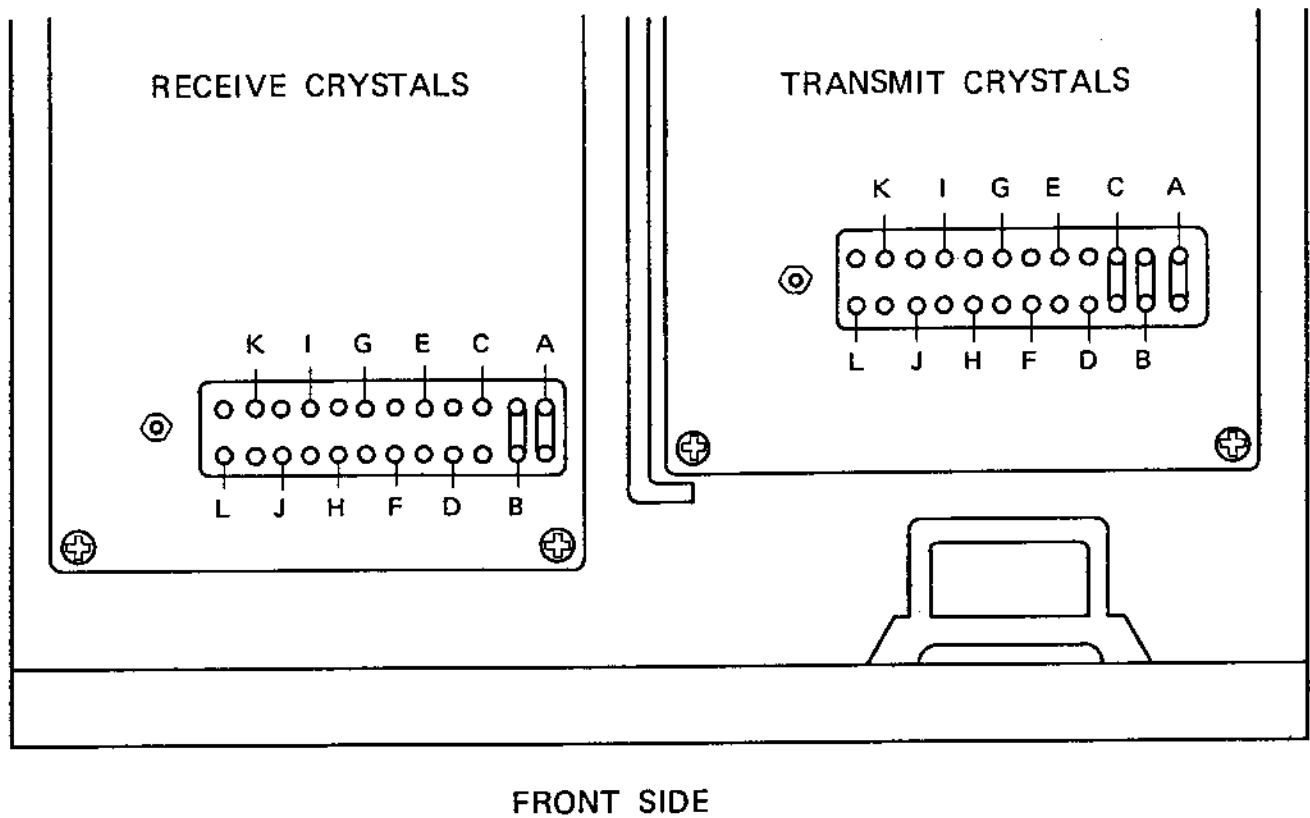


Figure 2. Correlation between Crystal Socket Position

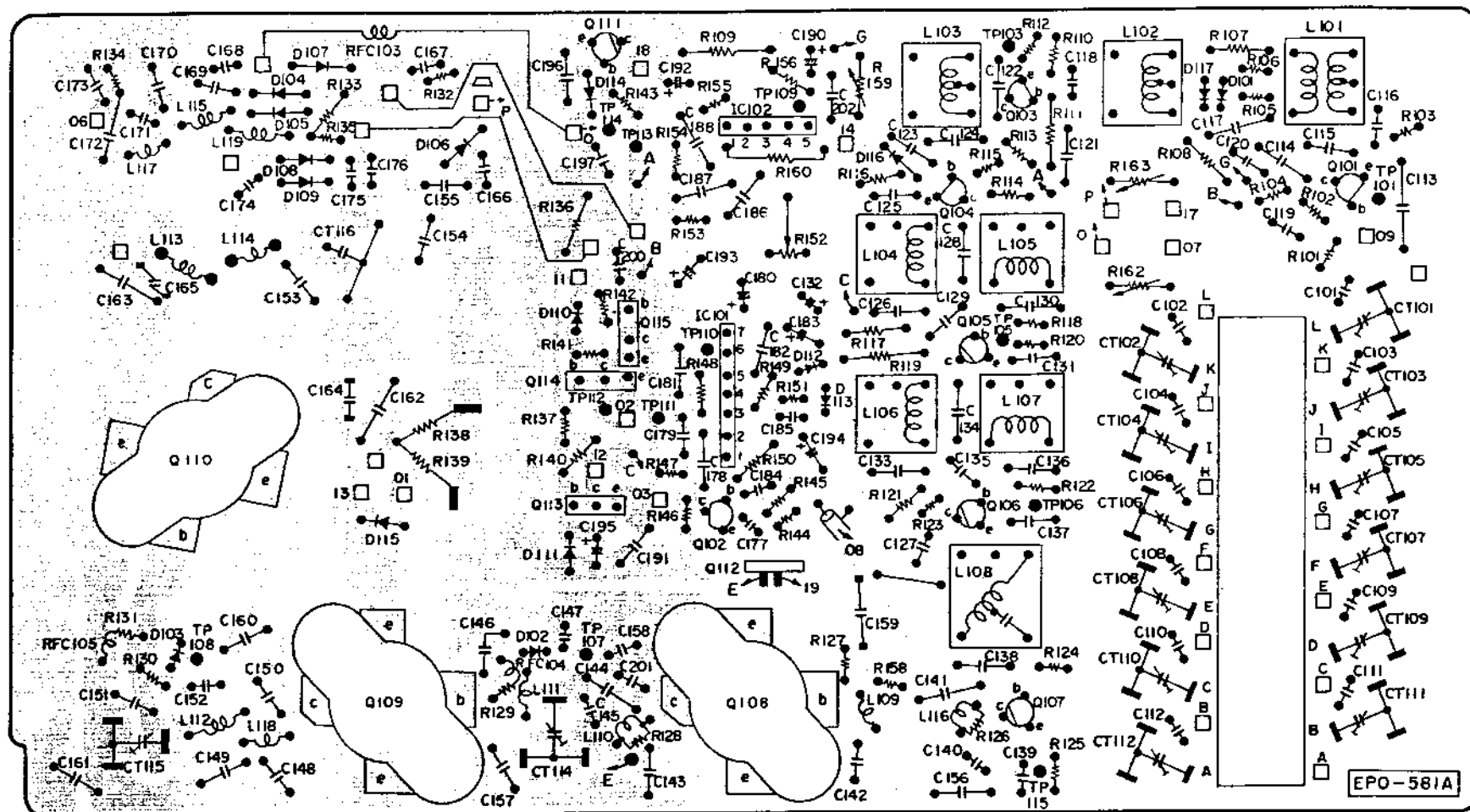
OPERATING INSTRUCTIONS

1. Plug in the Microphone and check to be sure that the antenna and power cables are properly connected.

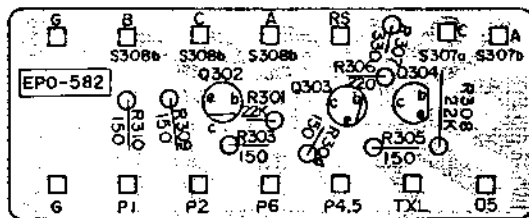
CAUTION: Do not transmit until an antenna or suitable dummy load had been connected to the coax antenna jack.

2. Turn the set on and adjust the volume to the desired level.
3. Place the COM-SEP switch to the desired position.
4. Set the channel selector(s) to the desired channel(s).
5. Adjust the squelch control.
6. To transmit, press and hold the push-to-talk switch on the microphone. Hold the microphone 2 to 3 inches from your mouth and speak in a normal tone of voice. To receive, release the push-to-talk switch.

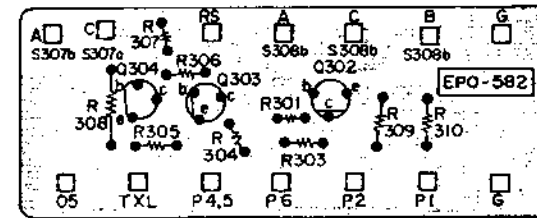
BACK VIEW



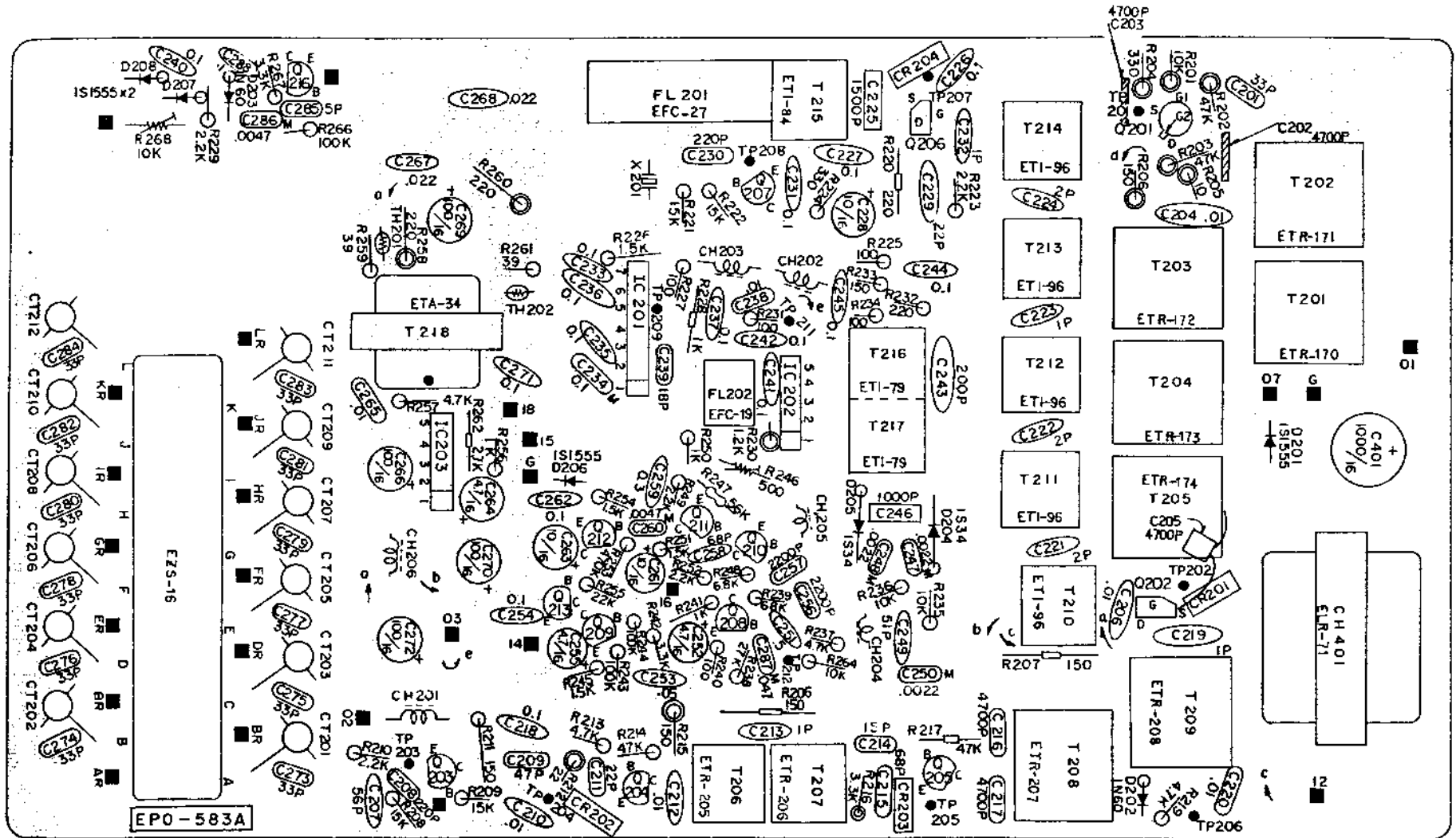
FRONT VIEW



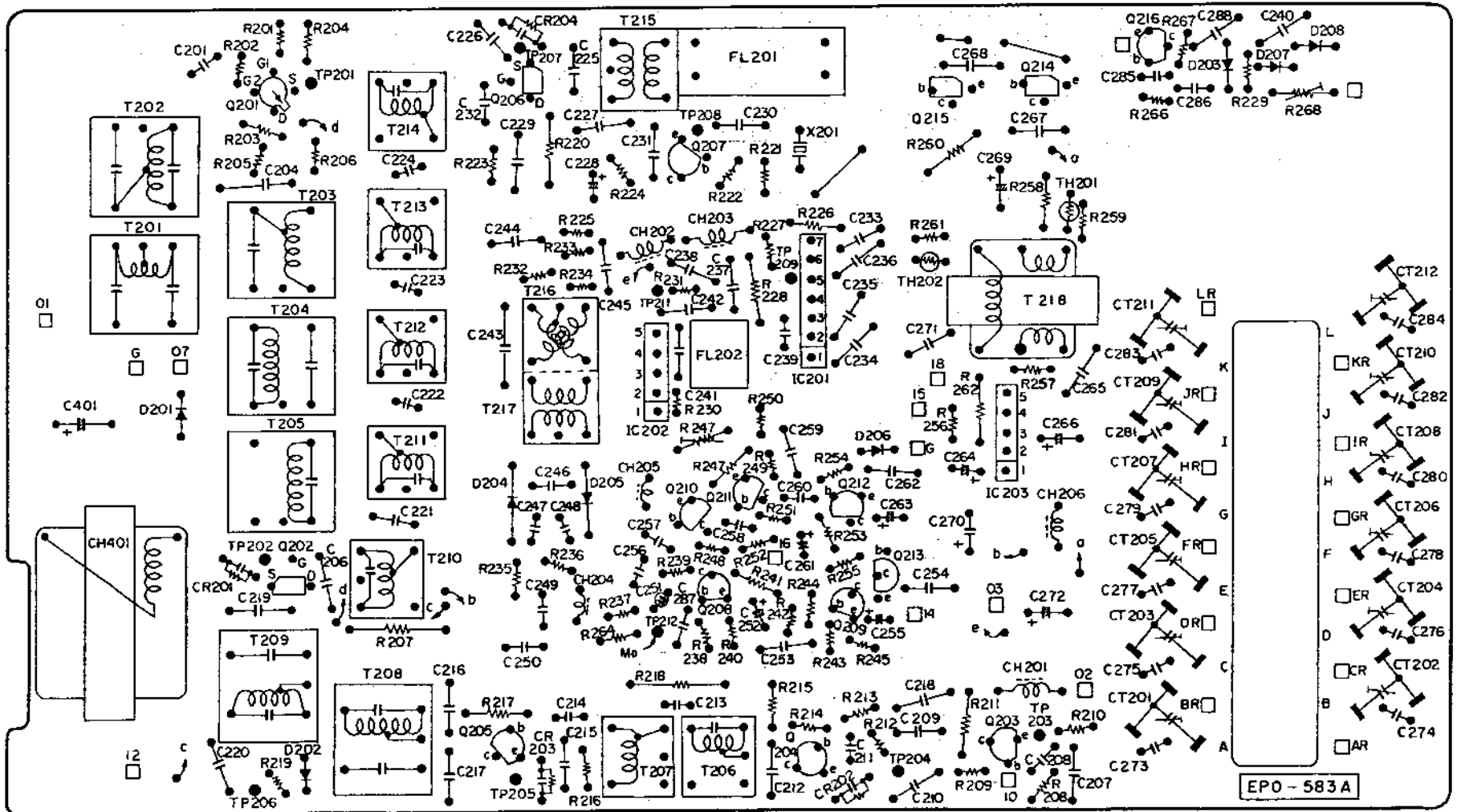
BACK VIEW



FRONT VIEW



BACK VIEW



WARRANTY POLICY

Midland Electronics Company warrants each new Midland product to be free from defects in material and workmanship under normal use and service for a period of 90 days after delivery to the ultimate user and will replace or repair the product at our option, at no charge should it become defective and which our examination shall disclose to be defective and under warranty.

This warranty shall not apply to any Midland product which has been subject to misuse, neglect, accident, incorrect wiring not of our own installation, or to use in violation of instructions furnished by us, nor extended to units which have been repaired or altered outside of our factory.

This warranty does not cover carrying cases, earphones, batteries, antenna, broken or cracked cabinets, or any other accessory used in connection with this product.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

Sales receipt must accompany product to validate the date of purchase.

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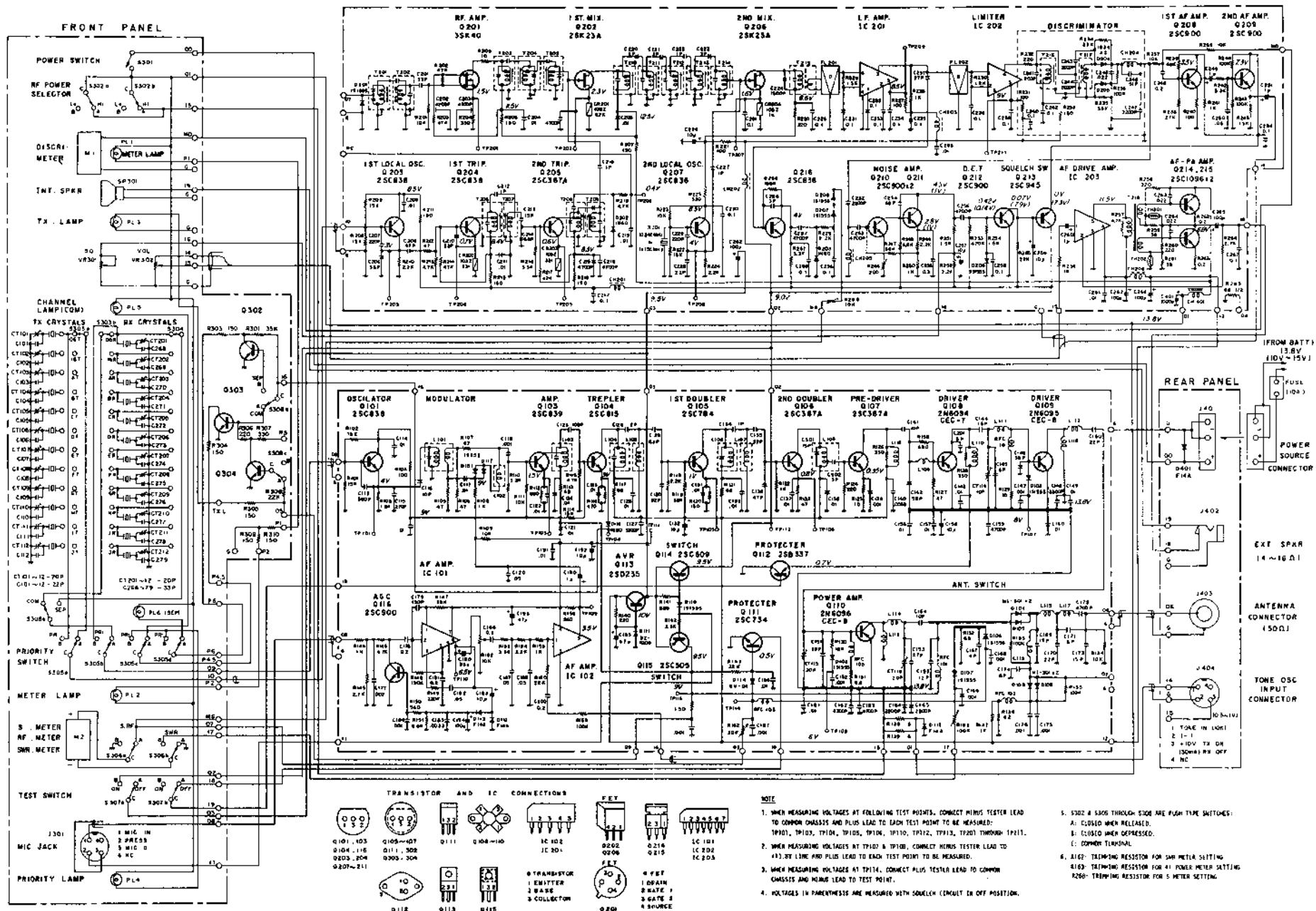
SPECIFICATIONS

RECEIVER SECTION

Frequency Range	144 — 148 MHz
Sensitivity	Better than $0.5\mu\text{V}$ (-20 dB quieting)
Selectivity	60 dB at ± 25 KHz (EIA SINAD)
Frequency Stability	Within $\pm 0.001\%$, from -20°C to $+60^{\circ}\text{C}$
Spurious & Image Rejection	More than 70 dB
Threshold Squelch Sensitivity	Less than 10 dB noise quieting level
Tight Squelch Sensitivity	Less than $2\mu\text{V}$
IF Frequencies	1st IF: 10.7 MHz 2nd IF: 455 KHz
Channels	12
Hum and Noise Level	Better than 50 dB, at 60 dB RF input, Mod. 1000 Hz 2/3 rated system deviation
Audio Output	4 watts to a 4 ohm load, 10 % distortion
Audio Response	300 Hz to 3000 Hz, refered to +1, -8 dB of 6 dB/octave de-emphasis curve
Current Drain	About 0.8A at 13.8V, at maximum power output

TRANSMITTER SECTION

Frequency Range	144 — 148 MHz
Channels	12
Modulation	16F3: ± 10 KHz set, ± 15 KHz adjustable, for 100% at 1000 Hz
RF Power Output (Switchable)	Hi Power: 30W Lo Power: 5W
Frequency Stability	Within $\pm 0.001\%$ from -20°C to $+60^{\circ}\text{C}$
Frequency Multiplication	12 times
Hum and Noise	Better than -45 dB, 2/3 system deviation at 1000 Hz
Antenna Impedance	50 ohms
Spurious & Harmonic Emission	Spurious emission: more than 80 dB below carrier Harmonic emission: more than 60 dB below carrier (Per EIA Spec, RS152B, para. 5)
Microphone	300 ohm to 2000 ohms
Audio Frequency Response	300 to 3000 Hz, referred to +1, -8 dB of 6 dB/octave de-emphasis curve
Audio Distortion	Less than 7% at 1000 Hz, 2/3 system deviation
Current Drain	High power: About 6A (13.8V) Low power: About 2A



13-505 SCHEMATIC DIAGRAM