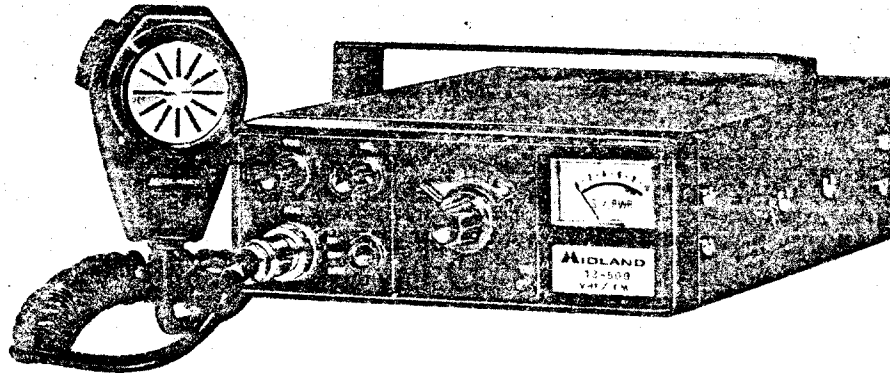


MANUAL NO. 13-220084

DATE: JAN. 5, 1974

PLEASE NOTE: THIS WAS SCANNED FROM A FADED XEROX COPY OF THE ORIGINAL.



SPECIFICATIONS

GENERAL:

Frequency coverage	220.00 to 225.00 MHz
Number of Transistors	Transistors 30 FET 2 IC 1 Diodes 12
Modulation Type	16F3
Power Voltage	DC 13.8V \pm 15% negative ground
Current Drain	Transmit. HI (10W) average 3.1A LOW (1W) average 1.1A Receive, squelched 220mA
Antenna Input	50 ohms
Size	2-1/4" (H) \times 6-3/8" (W) \times 8-7/8" (D)
Weight	4-1/2 lbs.

TRANSMITTER:

RF Power Output	HI 10W LOW 1W
Frequency Control	Crystal (18MHz) multiplied \times 12
Maximum Frequency Deviation	\pm 5 KHz
Audio Input	10K ohms
Modulation System	Variable reactance phase modulation
Microphone	10K ohms - Dynamic microphone with push button switch
Spurious Emission	-60 dB

RECEIVER:

Reception Frequencies	12 channels for 223 MHz band Built-in crystal units for 1 channels
Reception System	Double Superheterodyne
Intermediate Frequencies	1st I.F. : 10.7 MHz 2nd I.F. : 455 KHz
Sensitivity	a. Better than 0.5 μ V 20 dB quieting b. S + N/N at 0.5 μ V input, 12 dB or more
Spurious Response	-60 dB
Squelch Threshold	Less than 0.3 μ V
Band width	\pm 6 KHz/ -6 dB point \pm 12KHz/ -50dB
Audio output power	20W
Audio output impedance	8 ohms
Frequency control	Crystal (53 MHz) multiplied \times 4

ACCESSORIES

Make sure the following accessories for the model 13-500

(1) Microphone (dynamic type) 1	(7) Instruction manual 1
(2) Microphone hanger 1	(8) Warranty card 1
(3) Spare fuse (3A) 2	(9) External speaker plug 1
(4) Mounting bracket 1	(10) 4 prong plug for Tone Burst Generator and Discriminator Meter 1
(5) Gimp nuts 4	
(6) Channel frequency ID card 1	

SECTION II DESCRIPTION

This transceiver is an extremely rugged, completely solid state transceiver. State of the art devices such as ICs, MOS-FETs and Zener diodes are engineered into tight knit straightforward electronic design throughout both transmitter and receiver. Reliability, low current demand, compactness, unexcelled performance and ease of operation are the net result.

The dual conversion receiver with its dual gate MOS-FETs in RF Amplifier and 1st Mixer provides high-Q and highest possible sensitivity for desired signal and lowest possible cross modulation for undesired signal. The multiplication at 1st Local Oscillator is only four times so that the Receiver Spurious Response and Receiver Spurious Radiation are kept minimum.

Audio reproduction is of an unusually high order of distortion free clarity.

The transmitter section will produce a nominal of 10 watts RF output. Again, a zener regulated crystal oscillator is employed for initial frequency stability. Twelve crystal controlled channels are provided for operating convenience and versatility. High-Q and shielded stages provided minimum interstage spurious reaction. An enclosed low pass filter is placed at the output to further insure undesirable frequency products not being emitted. An ingenious final PA transistor protection device (APC), is incorporated in the final output circuitry. A tiny VSWR bridge and two DC amplifiers constantly monitor the output for high VSWR, a shorted or absent antenna load or other difficulty that would cause irreparable final transistor damage. Should these difficulties occur, the APC instantaneously disables the driver and final PA without damage.

Each unit comes complete with built-in speaker, a high-quality dynamic microphone, mobile mounting bracket, microphone hanger, and operating manual.

A modern styled face plate, large S meter, small size and low profile design complete the unit's styling. A welcome addition to any dashboard or fixed station.

SECTION III INSTALLATION

3. 1 Unpacking:

Carefully remove your transceiver from the packing carton and examine it for signs of shipping damage. Should any shipping damage be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. It is recommended you keep the shipping carton. In the event storage, moving, or reshipment becomes necessary, they come in handy. Accessory hardware, microphone, cables, etc., are packed with the transceiver. Make sure you have not overlooked anything.

3. 2 Location:

Where you place the transceiver in your automobile is not critical and should be governed by convenience and accessibility entirely. Since the unit is so compact, many mobile possibilities present themselves. The non-smoker, for instance, will find the removal of the auto ashtray will provide a very handy place in most modern cars. In general, the mobile mounting bracket will provide you with some guide as to placement. Any place where it can be mounted with metal screws, bolts, or pop-rivets will work.

3. 3 Power Requirements:

The transceiver is supplied ready to operate from any regulated 13.8V DC, 3.5 ampere negative ground source. An automobile, 12 volt, negative ground, system is usually more than adequate. Some note must be taken, however, to the condition of the vehicle's electrical system. Item such as low battery, worn generator/alternator, poor voltage regulator, etc., will impair operation of your transceiver as well as the vehicle.

High noise generation or low voltage delivery can be traced to these deficiencies. If an AC power supply is used with your transceiver, make certain it is adequately regulated for both voltage and current. Low voltage while under load will not produce satisfactory results from your transceiver. Receiver gain and transmitter output will be greatly impaired.

CAUTION: Excessive Voltage (above 16VDC) will cause damage to your transceiver. Be sure to check the source voltage before connecting the power cord.

Included with your transceiver is a DC power cable. The red wire is positive (+), and the black wire is negative (-). If your mobile installation permits, it is best to connect these directly to the battery terminals. This arrangement eliminates random noise and transient spikes sometimes found springing from automotive accessory wiring. If such an arrangement is not possible, then any convenient B + lead in the interior of the vehicle and the negative frame can be utilized. Your transceiver provides an internal DC filter that will take out the large amount of transient difficulties anyway. Remember, the unit operates on a negative ground system only-it cannot be used in a positive ground automobile.

3. 4 Antenna:

The most important single item that will influence the performance of any communication system is the antenna. For that reason, a good, high-quality, gain antenna of 50 ohms impedance is recommended.

When adjusting your antenna, whether mobile or fixed, by all means follow the manufacturer's instructions. There are some pitfalls to be aware of. For example, do not attempt to adjust an antenna for lowest VSWR when using a diode VSWR meter not engineered for VHF applications. Such readings will invariably have error of 40% or more. Rather, use an in line watt meter similar to the Drake WV-4 or Bird Model 23 with VHF cartridge. Further, when adjusting a mobile antenna, do so with the motor running preferably above normal idling speed. This will insure proper voltage level to the transceiver.

Do not become alarmed if your transceiver fails to transmit at times during the antenna tune up procedure. Remember, your transceiver has a built-in Automatic Protection Circuit (APC) that will disable the transmitter if excessive VSWR, a short coaxial line or connector, or other antenna deficiency is present.

A quick check on a good 50 ohm dummy load will show the transceiver to be working. The difficulty will lie with the antenna or its transmission line.

The RF coaxial connector on the rear chassis mates with a standard PL-259 connector.

3. 5 Microphone:

A high quality dynamic microphone is supplied with your transceiver. Merely plug it into the proper receptacle on the front panel. Should you wish to use a different microphone, make certain it is of the high impedance type; at least 10K ohms or better. Particular care should be exercised in wiring also, as the internal electronic switching system is dependant upon it. See the schematic for the proper hook up. Under no circumstances use a "gain pre-amp" type microphone. The audio system in your transceiver is more than adequate and additional pre-amplification unnecessary. To use this class of microphone is to invite distortion and possible damage to the transceiver.

3. 6 Crystals:

Your transceiver has twelve channels, both transmit and receive, or a total of 24 crystal positions. The channel selector switch selects one transmit and one receive channel in each of its twelve positions.

Additional crystals are available from Midland dealers. In case you order crystals to a crystal manufacturer, the following correlation data is provided. Remember to specify high activity as prerequisite to your acceptance.

Crystal Data

1) Transmitter crystal

Holder type : HC-25/U
Crystal cut : AT-cut
Resonance : Parallel
Pin to pin capacitance : 7pF Max. 4pF Min.
Load capacitance : 30pF
Series resistance : 20 ohms Max.
Frequency tolerance : $\pm 0.001\%$ at 25°C
Crystal frequency : Desired operating frequency

12

2) Receiver crystal

Holder type : HC-25/U
Crystal cut : AT-cut
Resonance : Series
Pin to pin capacitance : 7pF Max., 4pF Min.
Load capacitance : 20pF
Series resistance : 40 ohms Max.
Frequency tolerance : $\pm 0.001\%$ at 25°C
Crystal frequency : Desired operating frequency — 10.7MHz

4

Trimmers have been placed on the crystal board to assist you in tweeking new crystals on frequency. Consult the trimmer location chart (Fig. 1) for their positions.

The amount of frequency spread between any two receiving or any two transmitting frequencies should not exceed 2 MHz. Since the receiver and transmitter are independent of each other, you may have any practical amount of frequency separation you wish here. Only two or more widely spaced frequencies for the receiver alone or for the transmitter alone need be considered under the 2 MHz limitation.

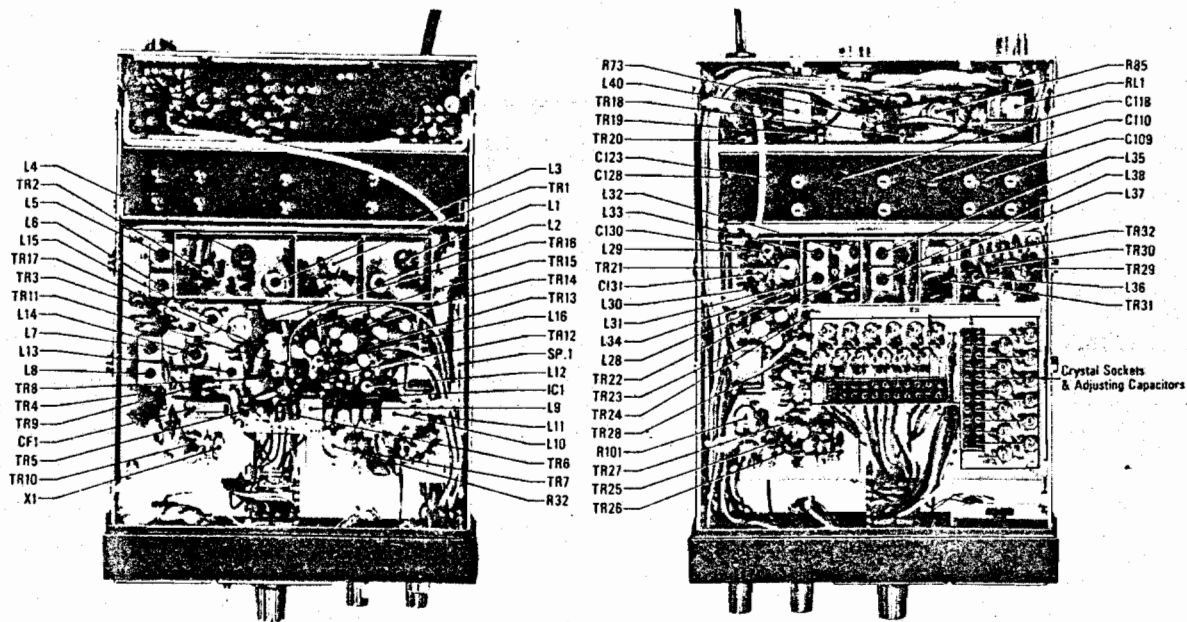


Figure 1

3. 7 External Speaker:

An external speaker jack and plug is supplied with your unit in the event another speaker is desirable. The external speaker impedance should be 8 ohms. The use of external speaker jack will disable the internal speaker. An 8 ohm headset can be utilized as well.

SECTION IV CONTROL FUNCTIONS

4. 1 Front control and jack (Fig 2-A)

- 4. 1. 1 High-Off-Low switch: opens or closes the 13.8 VDC source voltage to the transceiver. In "high" position, output power is 10 watts. In "low" position, output power is 1 watt.
- 4. 1. 2 Volume Control: controls audio output level of the receiver.
- 4. 1. 3 Squelch Control: controls the squelch threshold point of the receiver.
- 4. 1. 4 Microphone Jack: accepts 3 prong mike plug supplied on microphone.
- 4. 1. 5 S/PWR Meter: reads S signal strength in receive mode and relative RF output in transmit mode. The meter face is illuminated with a white lamp when the transceiver is switched on in in-receive condition.
- 4. 1. 6 Channel selector: selects one of twelve pairs of transmit receive crystals.
- 4. 1. 7 TX Lamp: Comes on when microphone PTT button is pressed and transmitter is on the air.

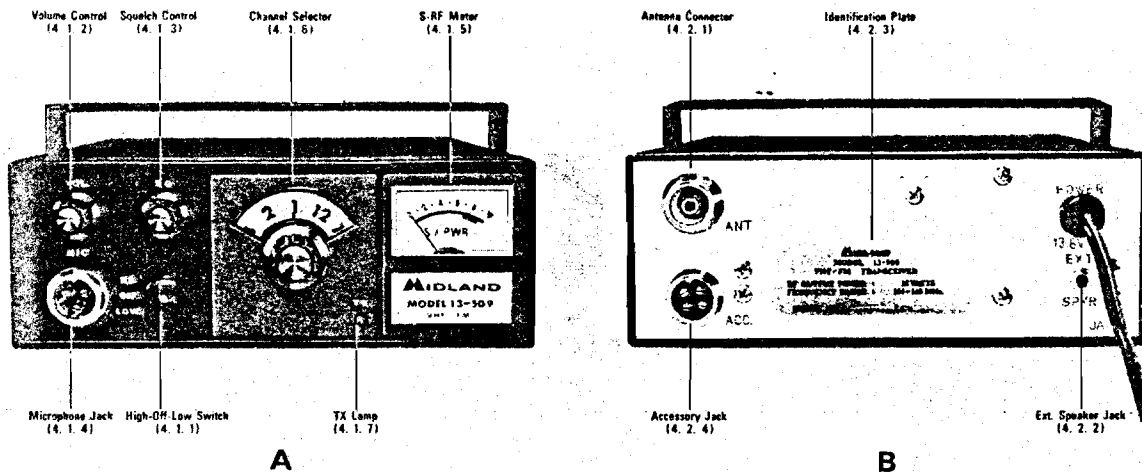


Figure 2

4. 2 Rear Panel (Fig. 2-B)

4. 2. 1 Antenna Connector: Accepts standard PL-259 coaxial connector. Note: Some transceivers may come with a metric threaded connector. If this is the case, a mating metric PL-259 is supplied also. Most PL-259 connectors will mate satisfactorily if care is taken to seat them properly. If you have difficulty, try a different make of PL-259.

4. 2. 2 External Speaker Jack: This jack mates with the accessory Ext. Speaker Plug supplied for external 8 ohm speaker or headset use. The use of this jack mutes the internal speaker.

4. 2. 3 Identification Plate: States model, serial number, RF output power and frequency range. Note: It would be well to make a separate record of the serial number of your unit for insurance purposes.

4. 2. 4 Accessory Jack: Accepts accessory 4 Prong Plug supplied for tone-burst and discriminator meter. It would have as connections:

1. Tone audio input
2. 12 volt negative (ground)
3. Transmit keyed 12 VDC positive
4. Discriminator meter connection

SECTION V OPERATION

5. 1 Initial Preparations:

- a. Connect the microphone to the microphone jack.
- b. Connect the antenna to the antenna coax connector. Make sure the coax line is of the correct impedance (50 ohms) and is neither shorted nor open circuited.
- c. Make sure the function switch is in the off position. The red lead should be connected to the positive side of the power source and the black lead to the negative side. In the event that these leads are improperly connected, the 13-509 will not function. No damage will be incurred since protection is provided in the 13-509 for this purpose.
- d. Turn the volume and squelch controls to the maximum counter clockwise position.

5. 2 Operation:
 - a. When the function switch is set to either the "Hi" or "Low" position, the set is switched on, and the channel indicator window and meter will be illuminated.
 - b. Switch the channel selector to the desired channel.
5. 3 Reception:
 - a. Adjust the volume control to a comfortable listening level of noise, if no signal is present.
 - b. Carefully adjust the squelch control clockwise until the noise just disappears. This is the proper squelch threshold setting and must be done when no signal is present. Your transceiver will now remain silent until an in-coming signal is received which opens the squelch. If the squelch is unstable due to the reception of weak or unstable stations, adjust the squelch control further until the proper threshold is obtained.
 - c. The S meter indicates the signal strength of the in-coming stations and is calibrated in S units, and db over S9, calibrated 5 μ V at S9, across the antenna terminals.
5. 4 Transmitting:
 - a. Push the PTT (push to talk) button on the microphone and the transceiver is set for transmitting. At the same time, the TX Lamp is illuminated and the meter provides an indication of relative power output of the transmitter. The pointer will be on or near the red mark on the meter scale when on high power and adjust a little over one on low power.
 - b. Hold the microphone about one inch from your mouth and speak in a normal voice. Shouting does not increase your communication range, but a good antenna does. The microphone is of the dynamic type and provides good pickup for all levels of the voice.
 - c. To receive again, just release the PTT button. This will also switch off the red illumination of the TX Lamp.
5. 5 Function Switch:
 - a. When the switch is set on "HI", the power output will be 10 watts, and on "LOW" the output will be 1 watt.

SECTION VI THEORY OF OPERATION

6. 1 **Receiver RF Amplifier and 1st Mixer:**
The input signal passed through the pre-selector circuit (C1, C2, C3, C4, L1 and L2) is amplified by TR1 (MOS-FET) and fed into 1st Mixer TR2 (MOS-FET) through Double-tuned Filter (L3 and L4).
6. 2 **Receiver 1st Local Oscillator:**
3rd overtone crystal (53 MHz) is oscillated at 1st Local Oscillator (TR8) with several KHz adjustment by the trimmer capacitor built in series with crystal. The output of the 1st Local Oscillator is multiplied by four times at Multiplier (TR9), and then fed into the 1st Mixer (TR2), giving the 1st I.F. of 10.7MHz.
6. 3 **Receiver 1st IF Amplifier, 2nd Mixer, 2nd Local Oscillator, 2nd IF Amplifier, Limiter, Discriminator and Meter Amplifier:**
The output from the 1st Mixer (10.7MHz) is amplified by TR3 and fed to the 2nd Mixer (base of TR4). Also, the 2nd Local Frequency (10.245MHz) is coupled into the 2nd Mixer through crystal control oscillator (emitter of TR10) to get the output of the 2nd Mixer (455KHz). The 2nd IF signal is amplified and limited by TR5 and TR6, and then is detected by the Discriminator circuit consisted of L10, L11, D2 and D3. The Meter Amplifier (TR7) amplifies a part of output of the 2nd IF Amplifier (TR6) and detect it with D1 to fed into the Meter.
6. 4 **Receiver Audio Amplifier and Squelch Amplifier:**
The audio signal from Discriminator circuit is adjusted by Volume Control (R27) and amplified by Audio Amplifier (TR14, TR15). This output signal is further amplified up to 2 watts by the Complementary Power Amplifier (TR16, TR17) and then fed into Speaker.
The noise signal (with the main element of 40KHz) from Discriminator is controlled by Squelch Control (R50) and fed into the Noise Amplifier (TR11, TR12). The amplified noise signal is detected by D4 and D5 and coupled into DC Switching Amplifier (TR13).
When there is no RF signal, the noise signal from the Discriminator increases and the DC Switching Amplifier (TR13) is set on. In such case, Audio is cut-off since the collector of TR13 and the base of TR14 (Audio Amplifier) become zero level. While, when RF signal comes in, TR13 is set off and TR14 (Audio Amplifier) operates properly.
6. 5 **Power Source Filter:**
The DC Filter (L40 and C206) protects the transceiver from the damages caused by surge and spike voltage, and also from the noises. D11 is also provided to protect the transceiver from the damage caused by miss connection of the power cord.
6. 6 **Transmitter Crystal Oscillator and Phase Modulator:**
TR29 is a fundamental crystal oscillator of 18MHz. The frequency adjustment in the range of several KHz. is made by the trimmer capacitors built in the series with crystals. The output of the Oscillator is coupled into the base of TR30 (Phase Modulator) and receive the Phase Modulation together with the Transmitter Audio Signal coming into the base of TR30.
6. 7 **Transmitter Audio Amplifier:**
The audio signal from microphone is amplified by TR25 and then further amplified and limited by limiter transistor TR26.

The pre-emphasis circuit is formed as feed back type with C154, R95, C153, R90 and R89. The output signal from the AF Amplifier (TR26) is coupled into the Phase Modulator circuit (TR13) through the Integrator Circuit (TR28) and Active Audio Filter (TR27).

6. 8 Transmitter Multiplier:

The output from the Phase Modulator (TR30) is multiplied twelve times to a final frequency of 220MHz through TR31, TR32, TR22 and TR21. These transistors act as, in order, a frequency tripler, buffer amplifier, and frequency doublers.

6. 9 Transmitter Power Amplifier Block:

The output signal from the multiplier is amplified to 10 watts by TR20, TR19 and TR18, and then coupled into the APC. (Automatic Protection Circuit.)

6. 10 APC (Automatic Protection Circuit) and Transmitter Power Monitor Circuit:

A part of 10 watt output from the Power Amplifier Block is coupled by C105 and detected by D10 to be fed into the Meter to indicate as power monitor. The large portion of the RF output is fed into the Antenna Connector through VSWR Bridge and the Relay (RL1).

APC acts as protection to decrease the output of TR22, if the antenna is seriously mismatched. A reflected power is detected by D9. When the antenna is mismatched, this circuit senses a high reflected power and provides a base drive to TR23. TR23 will conduct sufficient base drive to reduce the base drive of TR24. When TR24 begins to turn off, it reduces the Emitter current of TR22. As result, the power output of Power Amplifier Circuit (TR18) is reduced to a safe value. Thus, when the antenna is mismatched, APC protects from the damage.

SECTION VII MAINTENANCE

7. 1 The necessity of completely realigning, the unit is unlikely. The most common cause of breakdown is component failure. It is felt that the average owner would not have the necessary equipment and facilities to accomplish realignment in any case. if it did become necessary. If one did have such facilities and instruments, it is highly likely he would be a FM technician and instructions for alignment would be unnecessary. All of the foregoing is to say that this transceiver is a complicated, and electronically speaking, delicate machine. Great care and precision are employed in its manufacture, and warranty service is provided to ensure at it meets specifications. Adjustments not outlined herein should not be undertaken unless the owner is skilled as a technician.

7. 2 Transmitter Alignment:

- a. Remove the eight self tapping screws on the both sides of the cabinet. Separate the Chassis from the cabinet.
- b. Connect a dummy load (50 ohms) or a wattmeter to coax connector.
- c. Connect the microphone to the microphone jack.

- d. To align the transmitter on a desired frequency, switch the channel control to the desired channel. Slowly adjust the trimmer capacitor for that channel until the desired frequency is achieved. Consult Fig. 1 for the location of the proper trimmer. These trimmers should be adjusted very slowly while the transmit frequency is observed on suitable measuring equipment. Another 13-509 equipped with a discriminator meter can serve well for this purpose. However it must be adapted.

This adaptation can be accomplished by installing a 50 microampere center O meter. Install the meter to accessory plug (4 pin, and ground 2 pin). With the 13-509, meter installed, in the receive mode on the channel desired, adjust the trimmer capacitor for the null point on the meter.

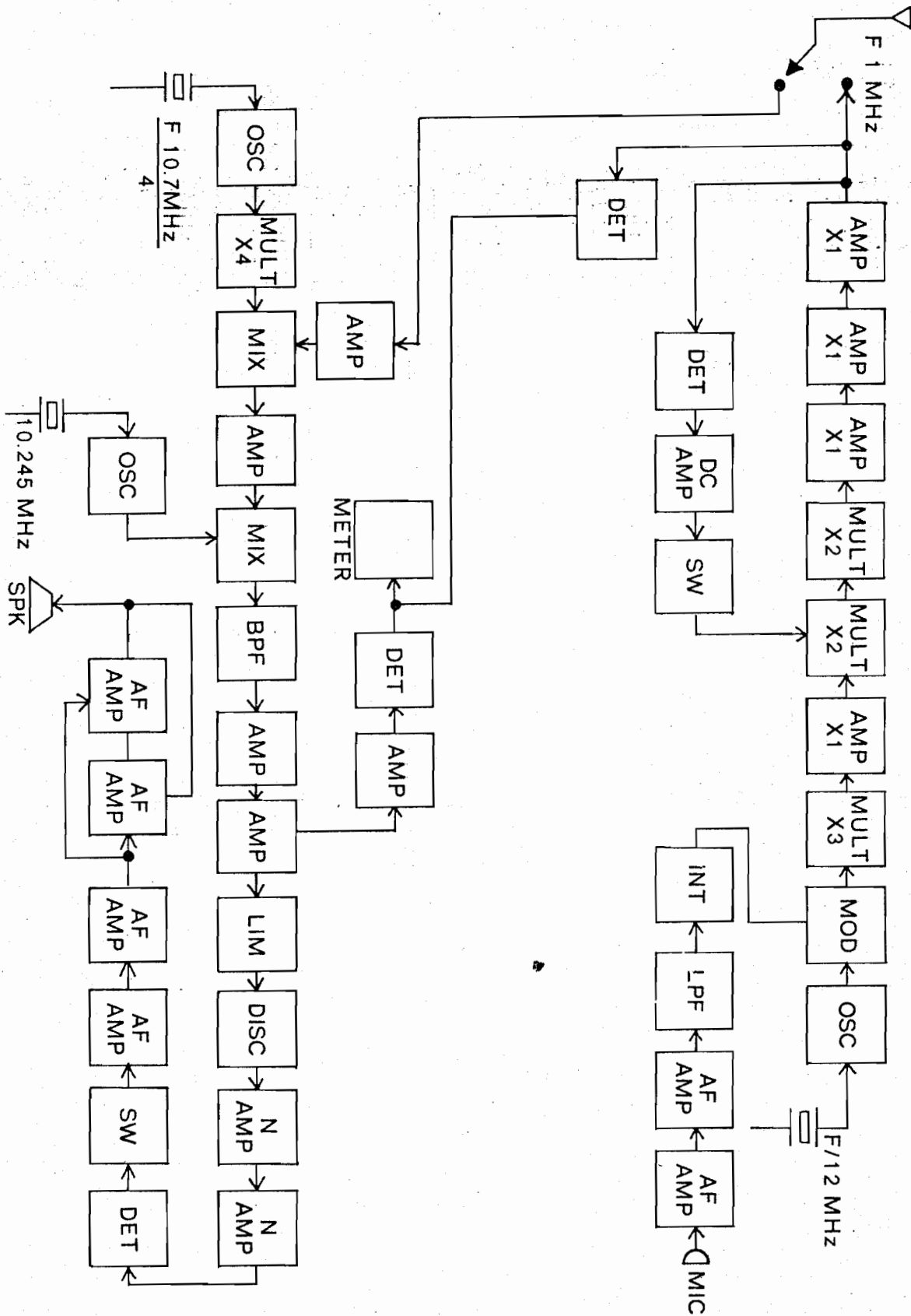
- e. The multipliers, driver and power output stages should be aligned on LOW power first then set the function switch on HIGH power. Align these stages according to the alignment chart provided. (See Alignment Chart).

Be careful not to transmit for more than 5 Second during each alignment step. As damage could be caused to the transistors due to overload during this procedure.

7. 3 Receiver Alignment :

- a. Remove the microphone from the transceiver to prevent accidental transmission during receiver alignment.
- b. Allow the test oscillator or generator to stabilize the output frequency drift.
- c. Connect the test oscillator or generator to the antenna coax connector. Set the test oscillator or generator to the desired frequency. Set the squelch control to the maximum counter clockwise position.
- d. Align the receiver according to the chart provided. (See Alignment Chart).
- e. When setting the receiver to a desired frequency, a discriminator meter should be connected to Accessory plug and the receiver trimmer capacitors adjusted to cause the S meter to read a maximum and the discriminator meter to read zero. Refer to Fig. 1 for the location of the proper trimmer corresponding to the channel to be used. Adjust these trimmers very slowly while observing the discriminator meter. Another 13-509 operating on the desired frequency can be used for this purpose also.

BLOCK DIAGRAM



13-509 BLOCK DIAGRAM

RECEIVER SECTION

I. F. and Frequency Detector Alignment

- STEP-1 Connect center meter (+-50ma) or multi tester to accessory connector (J10). Positive lead to pin No. 4, negative lead to pin No. 2.
- STEP-2 Connect AC Voltmeter or multi meter to external speaker Jack (J2).
- STEP-3 Volume control set at maximum, squelch control minimum and channel selector set at a vacant channel.
- STEP-4 Adjust L9-11 until AC Voltmeter indicates maximum voltage. If output voltage exceeds 1.0V adjust volume control for 1.0V.
- STEP-5 Adjust L11 for center or zero on centering meter.

Local Oscillator

- STEP-1 Set channel selector on channel 1. Connect positive lead of multi tester to emitter of TR9. Adjust L13 until meter indicates highest voltage.
- STEP-2 Adjust L14 and L15 to reduce voltage. (Normally reduced from 0.95V to 0.90V.)
- STEP-3 Adjust L13 to obtain a reading on meter which will indicate 50% of maximum voltage. (Do not exceed 0.3V as lowest level.)

General Alignment

CONNECTIONS: Connect S.S.G. to antenna Jack (J1). Set S.S.G. at 3.3KHz Dev., 1KHz modulation. With an 8 ohm load across external speaker jack (J2) connect V.T.V.M., distortion meter, and oscilloscope.

- STEP-1 Use meter on unit as an indicator. Adjust R32 for an indication of "Level 1" as indicated on unit meter.
- STEP-2 Again, using meter on unit as an indicator. Adjust L1-10, L14 and L15 for a maximum indication on meter. If meter indicates an overload, adjust output level of S.S.G.

COMPONENT LAYOUT

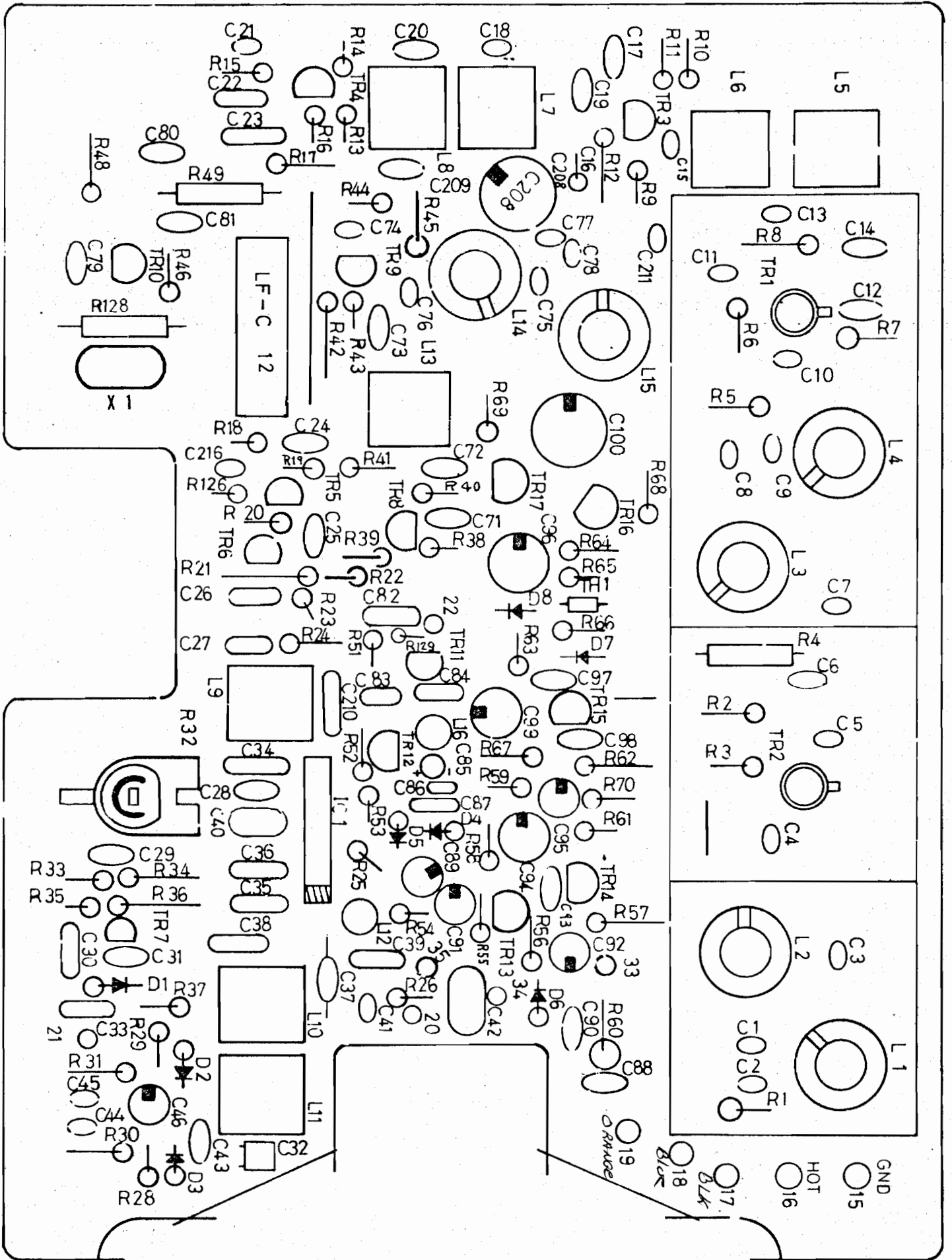


FIG. 1

General Alignment, Cont'd

- STEP-3 Set S.S.G. to 21.4MHz, adjust output level to 70db. Repeat step 2 again.
- STEP-4 Using meter on unit as an indicator. Adjust L4 for a minimum indication on meter.
- STEP-5 Set S.S.G. for a 20db output level at center frequency. Adjust R32 for an "S9" reading on unit meter.

Transmit Section

CONNECTIONS: Connect positive lead of multi tester (set on 3 Volt range) to R120.

- STEP-1 Adjust L37 for the maximum voltage (1.0V).
- STEP-2 Positive lead of tester to R82. Adjust L35 and L38 to obtain a maximum reading on meter. Re-adjust L37 to obtain a maximum voltage (about 2.3V).
- STEP-3 Positive lead of tester to R78. Adjust L33 and L38 to obtain a maximum voltage (about 1.2V).
- STEP-4 Connect V.T.V.M. with 56 ohm load to test point (T.P.2,3). Adjust L33, L34, C130, C131 for a maximum indication on V.T.V.M. (about 4.2VAC).
- STEP-5 Adjust C130, 131, 123 to obtain maximum current drain.
- STEP-6 Connect RF power meter to antenna jack (J1). Adjust C109, 110, 118, 123, L33 and L34 to obtain 15 watts in high power position and 1 watt in low power position.
- STEP-7 Using meter on unit as an indicator, adjust R85 to obtain "Level 8" on indicator. Unit will be set in high power position with no modulation.
- STEP-8 Adjust C164 to obtain a frequency tolerance of within 400Hz.

COMPONENT LAYOUT

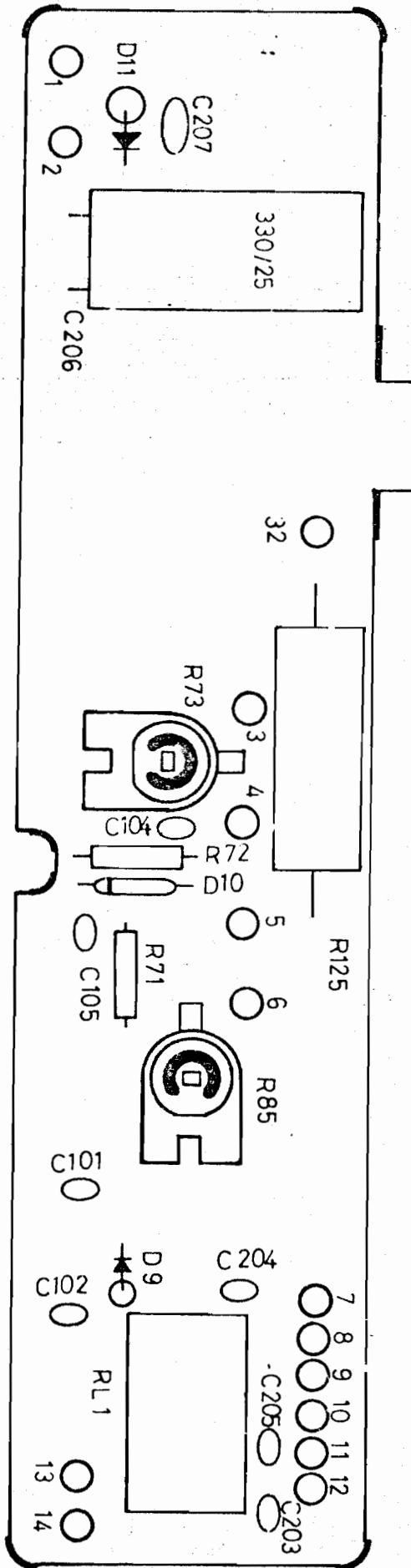
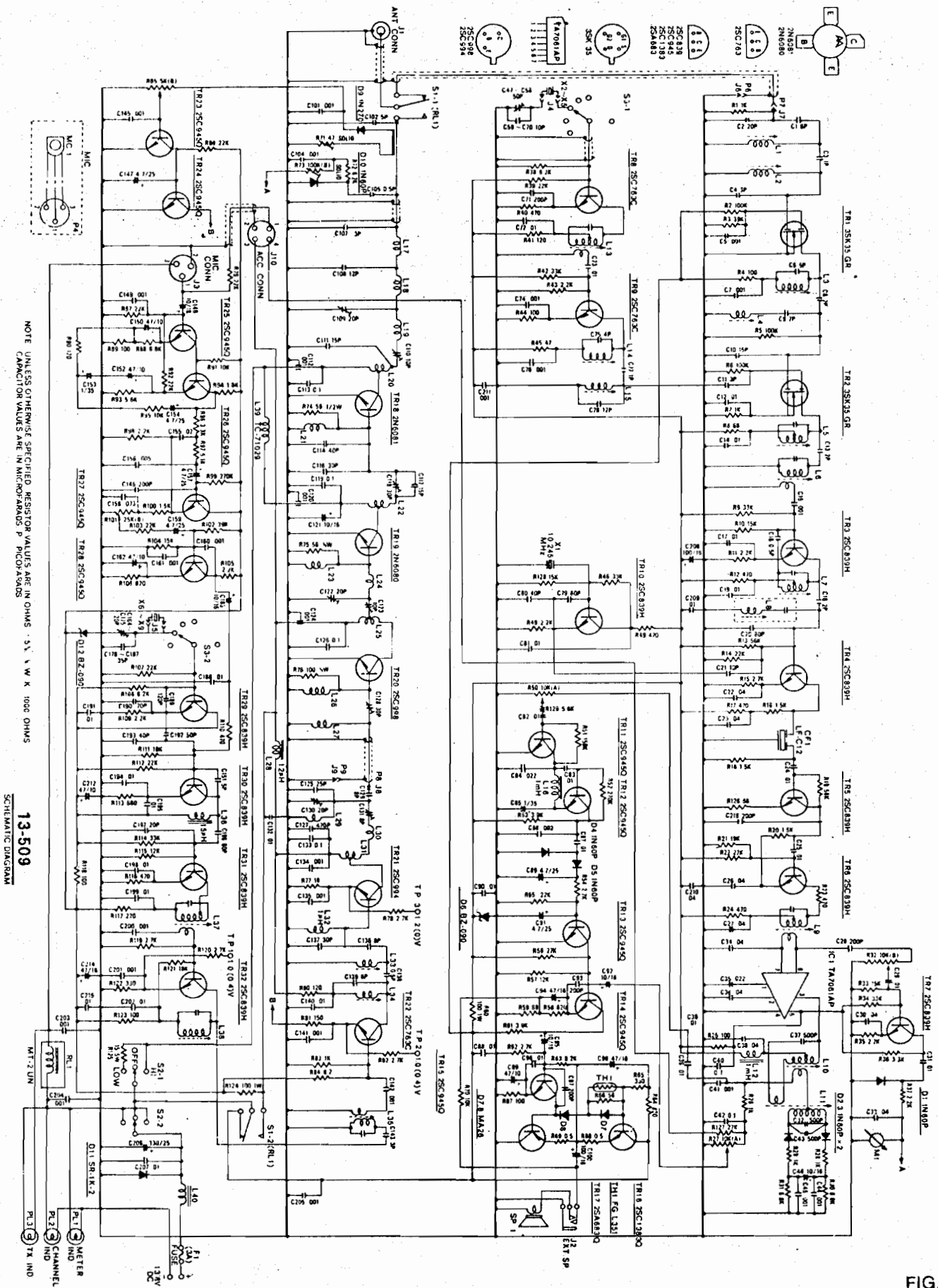


FIG. 3

SCHEMATIC DIAGRAM

(TRANSISTOR VOLTAGE CHART ON PAGE 18, FIG. 5)



CIRCUIT DIAGRAM

FIG. 4

COMPONENT SYMBOL LAYOUT

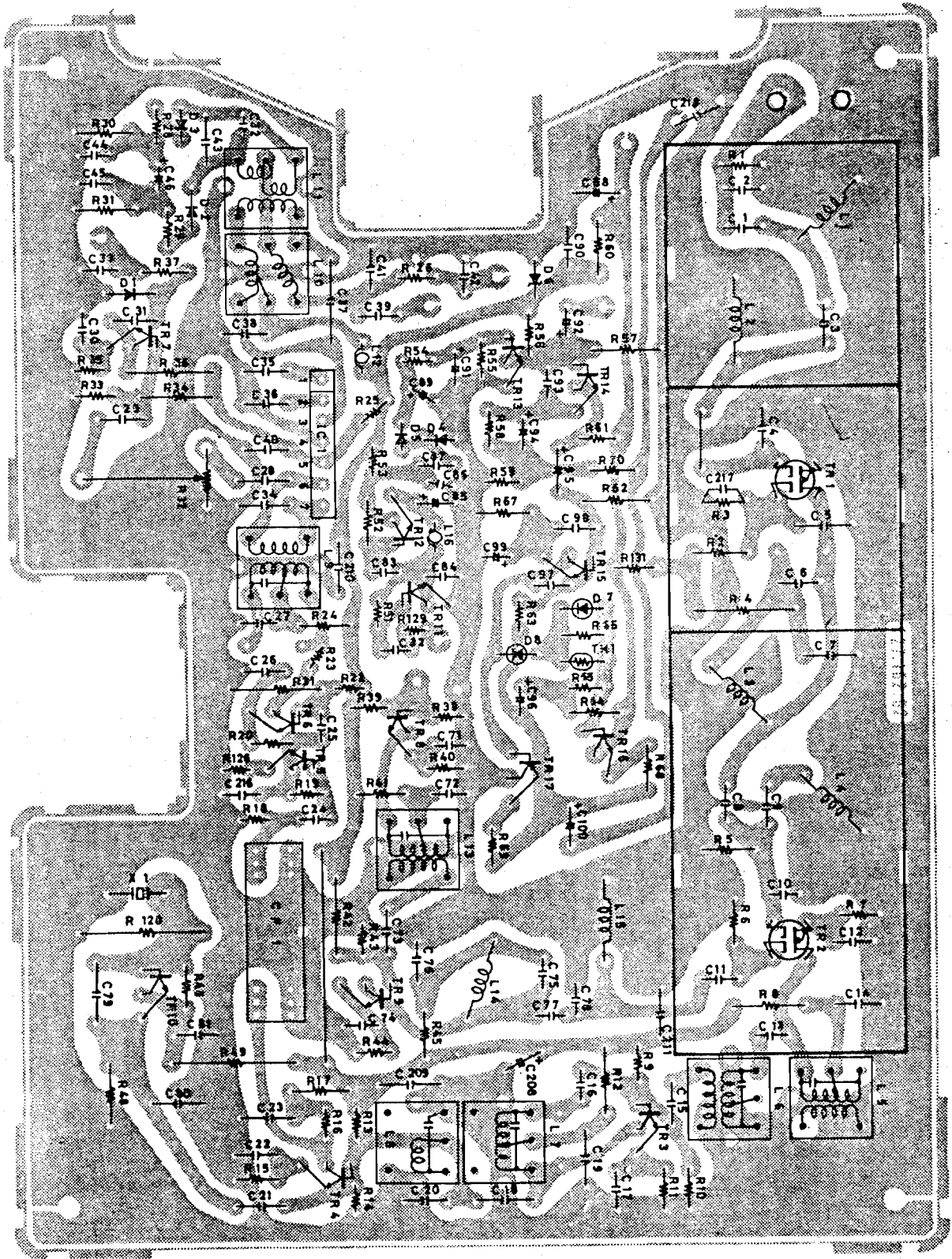


FIG. 6

COMPONENT SYMBOL LAYOUT

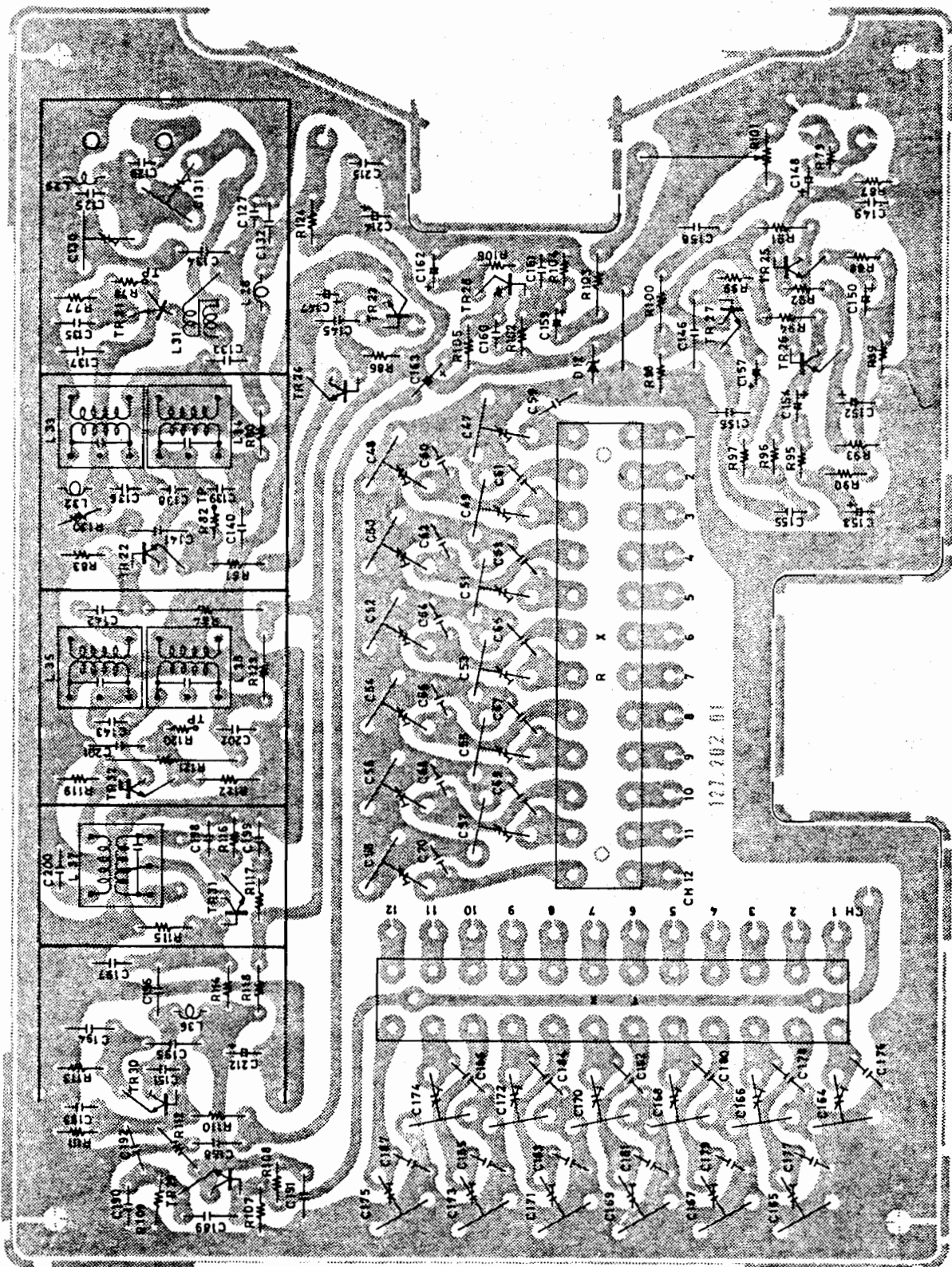


FIG. 7

COMPONENT SYMBOL LAYOUT

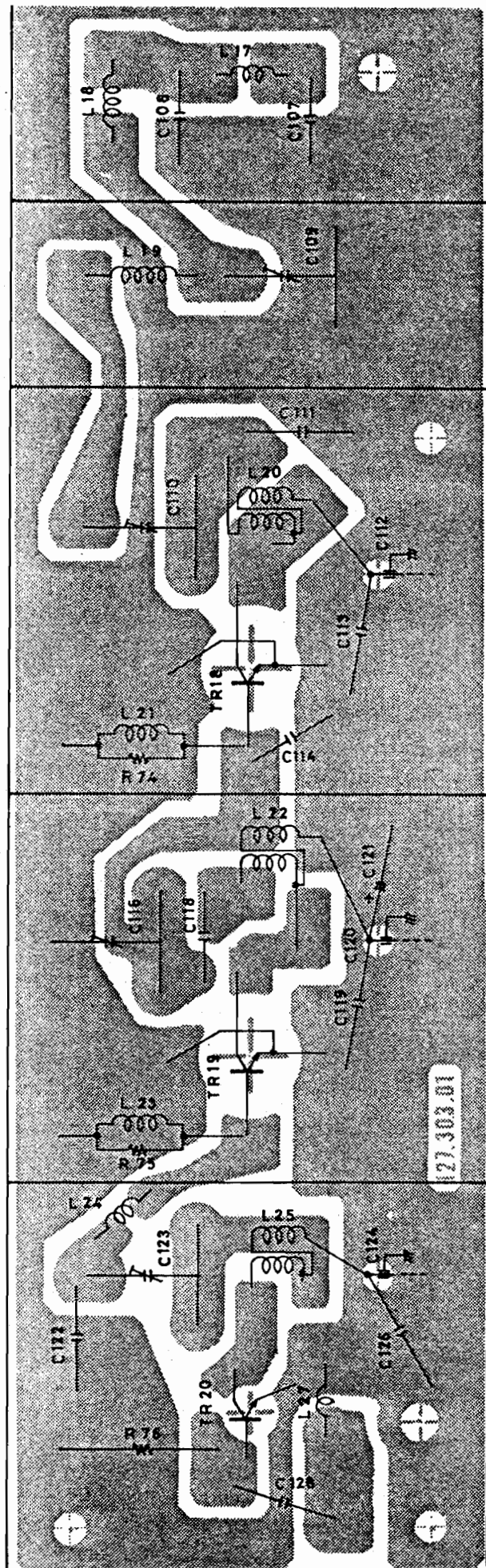
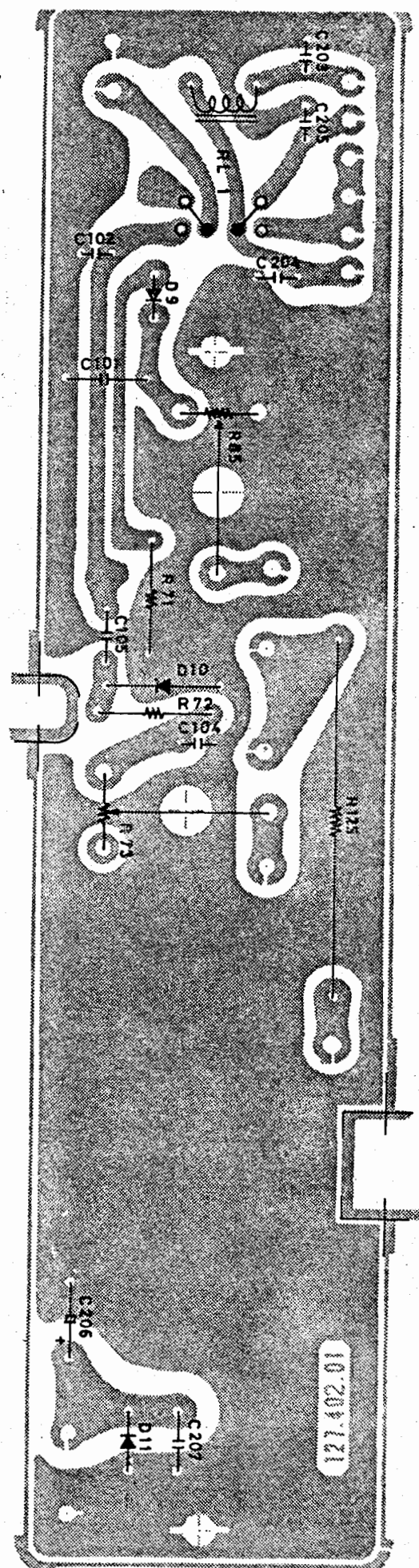


FIG. 8



PARTS LIST
CABINET MATERIAL PARTS LIST

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
	(MODEL NO. 13-509)		
	CABINET MATERIAL		
	Panel, Front	13-010218	\$ 1.66
	Cabinet, Top	13-010219	7.70
	Cabinet, Bottom	13-013099	7.70
	Plate, Name/Model/Feature	13-020532	.46
	Plate, FCC	13-023159	.74
	Knob Vol/Sq.	13-110152	.74
	Lens, TX. Lamp	13-020533	.46
	Lens, Channel Disc.	13-020534	.96
	Plate, Microphone	13-020535	1.66
	Knob, Channel Sel.	13-115092	.46
	Disc, Channel Number	13-115093	1.90
	Mount-Bracket, Auto	13-158299	2.30
	MISCELLANEOUS		
P4	Plug, Microphone	13-159167	3.28
J3	Jack, Microphone	13-159168	2.30
J1	Connector, Antenna	13-159169	1.90
J10	Jack, Accessory	13-159170	2.30
P10	Plug, Accessory	13-159171	3.28
	Plug, External Speaker	13-159172	.46
	Jack, Speaker	13-153111	.46
J4,5	Socket, Crystal	13-159173	1.90
RL1	Relay	13-105020	8.36
	Fuse, 3 Amp.	OBTAIN LOCALLY	
	Meter	13-200050	6.44
	Speaker	13-060092	3.78
	Microphone	13-038054	19.62
PL1	Lamp, Meter/Channel/Tx. Ind. (16V/80MA)	13-201050	1.44
	Cord, DC Power	13-034064	1.66
	Holder, Fuse	13-159174	.46
	SWITCHES AND CONTROLS		
S2	Switch, Transmitt Power	13-183171	5.74
S3	Channel Selector	13-180083	6.22
R27,30	Control, Volume/Squelch (10K ohm)	13-160096	1.44
R32	Sensitivity (10K)	13-164087	.74
R73	Sensitivity (100K)	13-164098	.74
R85	Sensitivity (5K)	13-164091	.74
R101	Sensitivity (25K)	13-164106	.74
	CRYSTALS		

REFER TO PARAGRAPH 3.6 IN YOUR OWNERS GUIDE AND SERVICE MANUAL FOR CRYSTAL DATA.....

PARTS LIST CONTD.

MODEL NO. 13-509

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
TRIMMERS			
C47-58	50PF	13-123046	\$.96
C109,122	20PF	13-123047	.96
C110,123	10PF	13-123048	.96
C118,128	30PF	13-123049	.96
C130,164	20PF	13-123050	.96
-175			
C131	6PF	13-123051	.96
COILS AND TRANSFORMERS			
L1,4, 14	Inductor	13-094083	.96
L2,3 15	Inductor	13-094084	.96
L5,6	Inductor	13-094085	.96
L7	Inductor	13-094086	.96
L8	Inductor	13-094087	.96
L9	Inductor	13-094088	.96
L10	Inductor	13-094089	.96
L11	Inductor	13-094090	.96
L12,16	Inductor	13-094091	.96
L13	Inductor	13-094092	.96
L17,24, 27	Inductor	13-094093	.46
L18	Inductor	13-094094	.46
L19	Inductor	13-094095	.46
L20,22, 25	Inductor	13-094096	.96
L21,23	Inductor	13-094097	.46
L26	Inductor	13-094098	.46
L28	Inductor	13-094099	.46
L29	Inductor	13-094100	.46
L30	Inductor	13-094101	.96
L31	Inductor	13-094102	.96
L32	Inductor	13-094103	.74
L33,34	Inductor	13-094104	.96
L35,38	Inductor	13-094105	.96
L36	Inductor	13-094106	.46
L37	Inductor	13-094107	.96
L39	Inductor	13-176356	.46
L40	Inductor	13-094108	2.30

PARTS LIST CONTD.

MODEL NO. 13-509

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
TRANSISTORS			
TR1,2	3SK35GR	09-305042	\$ 6.82
TR3-7, 10,29- 32	2SC839	09-302124	1.70
TR8,9, 22	2SC763	09-302162	1.70
TR11-15, 23-28	2SC945	09-302125	1.70
TR16	2SC1383	09-302155	2.40
TR17	2SA683	09-300071	2.40
TR18	2N6081	09-304041	29.44
TR19	2N6080	09-304040	22.80
TR20	2SC998	09-302208	8.54
TR21	2SC994	09-302209	5.46

DIODES			
D1-5,10	1N60	09-306019	.60
D6,12	BZ090	09-306180	1.66
D7,8	MA26	09-306223	.74
D9	1N270	09-306317	.74
D11	SR-1K-2	09-306160	.46
TH	Thermistor	13-086029	.74

INTEGRATED CIRCUITS

IC1	TA7061AP	09-308059	3.78
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FILTERS

CF	Ceramic	13-179039	19.62
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RESISTORS

ALL RESISTORS NOT SHOWN ON THIS PARTS LIST ARE CARBON, 1/4 WATT.
FOR SPECIFIC VALUES CONSULT SCHEMATIC DIAGRAM.

R60,124	100 ohm, 1W	77-104101	.40
R74,75	56 ohm, 1/2 W	77-102560	.30
R76	100 ohm, 1/2 W	77-102101	.30
R125	15 ohm, 5 W	77-108150	1.36

SOLID TYPE 1/4 WATT

R49	470 ohm	77-201471	.26
R72	8.2K ohm	77-201822	.26
R128	15K ohm	77-201153	.26
R129	5.6K ohm	77-201562	.26
R130	330 ohm	77-201331	.26

PARTS LIST CONTD.

MODEL NO. 13-509

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
CAPACITORS			
ALL CAPACITORS NOT SHOWN ON THIS PARTS LIST ARE CERAMIC DISC TYPE 50WV. FOR SPECIFIC VALUES CONSULT SCHEMATIC DIAGRAM.			
MYLAR TYPE 50 WV			
C22,23, 26,27,33, 34,30,36, 38	0.04UF	78-651403	\$.38
C35,84, 86	0.002UF	78-651202	.38
C39,82, 83,87	0.01UF	78-651103	.38
C40,42	0.1UF	78-651104	.38
C155	0.02UF	78-651203	.38
C156	0.005UF	78-651502	.38
C158	0.033UF	78-651333	.38
C160	0.001UF	78-651102	.38
ELECTROLYTIC TYPE			
C46,92, 95,121, 148,163	10UF, 16V	77-337106	.96
C85,153	1UF, 35V	77-440105	1.20
C89,91, 147,154, 157,159	4.7UF, 25V	77-339475	1.20
C94,96, 212,214	47UF, 16V	77-337476	.96
C99,150, 152,162	47UF, 10V	77-336476	.74
C112,120 124	Special Type	13-135009	.74
C206	330UF. 25V	77-339337	1.20
C100,208	100UF, 16V	77-337107	.96

MODIFICATION

The following modifications have been made to model 13-509 beginning with serial number 30700501. All units manufactured before this serial number will contain un-modified circuits.

These modifications were made to better transmit frequency tolerance and receive spurious sensitivity.

<u>REF NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
<u>RESISTORS</u>			
(WAS) R102	Carbon, 39K ohm/¼ Watt	77-101393	.26
(NOW) R102	Carbon, 22K ohm/¼ Watt	77-101223	.26
(WAS) R104	Carbon, 15K ohm/¼ Watt	77-101153	.26
(NOW) R104	Carbon, 8.2K ohm/¼ Watt	77-101822	.26
(WAS) R45	Carbon, 47 ohm/¼ Watt	77-101470	.26
(NOW) R45	Carbon, 220 ohm/¼ Watt	77-101221	.26
<u>CAPACITORS</u>			
(WAS) C73	0.01UF/50V	78-151103	.26
C73	0.001UF/50V	78-151102	.26

NOTE: ALL PARTS & PRICES SHOWN ON THIS PARTS LIST ARE SUBJECT TO CHANGE WITHOUT NOTICE.

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. Name Item
 - B. Model Number
 - C. Serial Number
2. Best possible identification of the part itself.
 - A. Part Number
 - B. Part Name
 - C. Quantity
 - D. If necessary, return old part as sample.
3. Customer should use address listed below when ordering replacement parts.

MIDLAND ELECTRONICS COMPANY
Parts Department
110 West 12th Street
North Kansas City, Missouri 64116

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