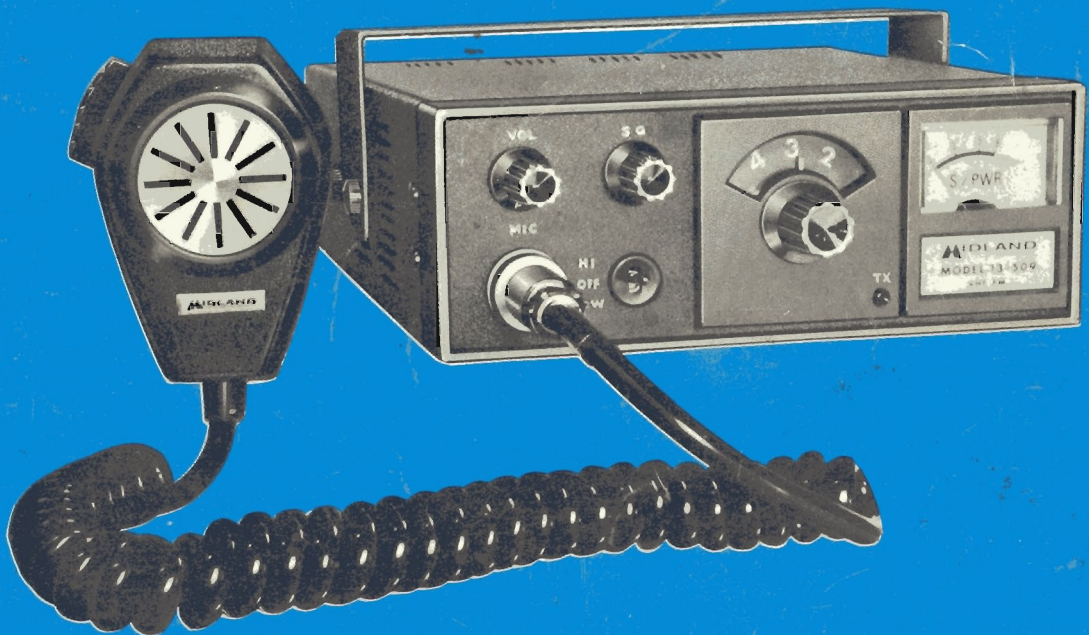


**MIDLAND®**

**VHF-FM 10 WATT 220 MHz  
MOBILE TRANSCEIVER**



**MODEL 13-509**

**OWNER'S GUIDE**



**MODEL 13-509**

For your protection and convenience the space below is provided for you to record the serial number of this product. The model number and serial number are located on the rear of the cabinet. After recording this number, keep this record for your future reference.

**Serial Number** \_\_\_\_\_

It is recommended that this number also be recorded in another safe place.

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**PARTS LIST**

A complete parts list is contained in the 13-509 service manual which can be purchased from the Midland International Service Department, 1690 North Topping Avenue, Kansas City, Missouri 64120, Attention Parts Department.

## SECTION I SPECIFICATIONS

### GENERAL:

Frequency coverage	220.00 to 225.00 MHz	
Number of Semiconductors	Transistors .....	30
	FETs .....	2
	ICs .....	1
	Diodes .....	12
	Modulation Type	16F3
Power Voltage	DC 13.8V ±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) x 6-3/8"(W) x 8-7/8"(D) (57 x 162 x 225 (mm))	
Weight	4-1/2 lbs. (2Kg)	

### TRANSMITTER:

RF Power Output	HI .....	10W
	LOW .....	1W
Frequency Control	Crystal (18 MHz) multiplied x 12	
Maximum Frequency Deviation	±5 KHz	
Audio Input	10K ohms	
Modulation System	Variable reactance phase modulation	
Microphone	10K ohms – Dynamic microphone with Push-To-Talk switch	
Spurious Emission	-60 dB	

### RECEIVER:

Reception Frequencies	12 channels for 223 MHz band	
	Built-in crystal units for 1 channel	
Reception System	Double Superheterodyne	
Intermediate Frequencies	1st I.F.:	10.7 MHz
	2nd I.F.:	455 KHz
Sensitivity	a. Better than 0.5 μV 20 dB quieting	
	b. S + N/N at 0.5 μV input, 12 dB or more	
Spurious Response	-60 dB	
Squelch Threshold	Less than 0.3 μV	
Band width	±6 KHz/-6 dB point	
	±12 KHz/-50 dB	
Audio output power	2.0W	
Audio output impedance	8 ohms	
Frequency control	Crystal (53 MHz) multiplied x 4	

### ACCESSORIES

The following accessories for the model 13-509 are included.

(1) Microphone (dynamic type) .....	1	(7) Owner's Guide .....	1
(2) Microphone hanger .....	1	(8) Registration card .....	1
(3) Spare fuse (3A) .....	2	(9) External speaker plug .....	1
(4) Mounting bracket .....	1	(10) 7 prong plug for Touch Tone Dial, Tone Burst Generator and Discriminator Meter ..	1
(5) Mounting bracket studs .....	4	(11) DC Power Cord .....	1
(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 encased 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. 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. Problems such as low battery, worn generator/alternator, poor voltage regulator, etc., will impair operation for 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 16V DC) 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 an 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 is 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 from 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  
OSC, Mode : Fundamental  
Pin to pin capacitance : 7pF Max., 4pF Min.  
Load capacitance : 30pF  
Series resistance : 20 ohms Max.  
Frequency tolerance :  $\pm 0.001\%$  at  $25^{\circ}\text{C}$   
Crystal frequency : Desired operating frequency/12  
Frequency Stability :  $\pm 0.001\%$  ( $-20^{\circ}\text{C} \sim +50^{\circ}\text{C}$ )

##### 2) Receiver crystal

Holder type : HC-25/U  
OSC, Mode : 3rd Overtone  
Pin to pin capacitance : 7pF Max., 4pF Min.  
Load capacitance : 20pF  
Series resistance : 40 ohms Max.  
Frequency tolerance :  $\pm 0.001\%$  at  $25^{\circ}\text{C}$   
Crystal frequency :  $\frac{\text{Desired operating frequency} - 10.7 \text{ MHz}}{4}$   
Frequency stability :  $\pm 0.001\%$  ( $-20^{\circ}\text{C} \sim +50^{\circ}\text{C}$ )

Trimmers have been placed on the crystal board to assist you in adjusting 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.

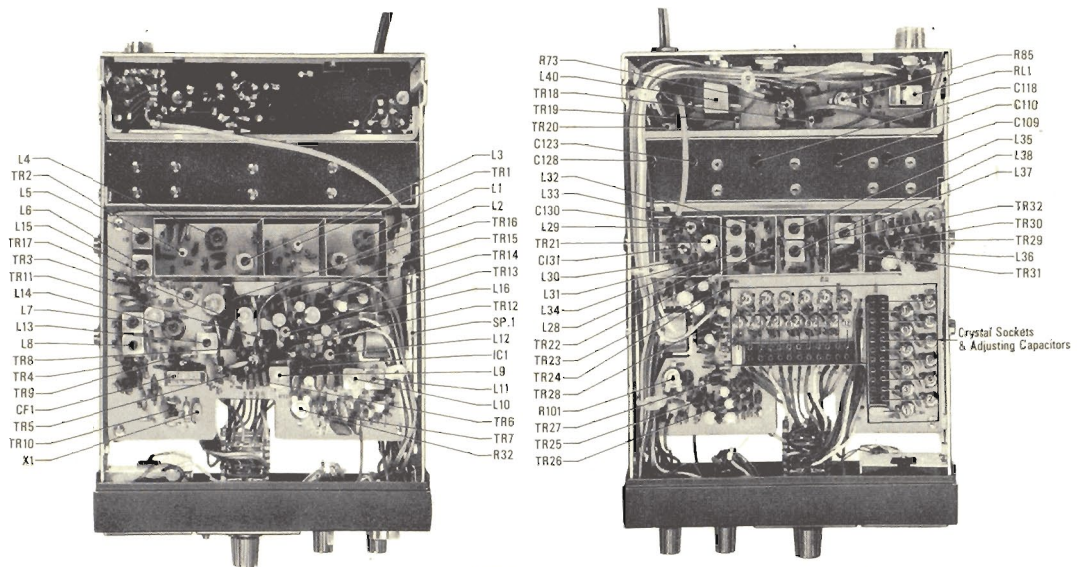


Figure 1

### 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 13.8V DC 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:** Silences background noise in the absence of a received signal when properly adjusted.

NOTE: The 13-509 can be used with Sub-audible Tone Squelch Systems (CTCSS). The transceiver must be modified slightly to accept an encoder/decoder. Modification information is available from the encoder/decoder manufacturer.

**4.1.4 Microphone Jack:** Accepts the 4 prong mike plug supplied on microphone.

NOTE: The microphone jack is supplied 13.8V DC on pin three through a 470 ohm protective resistor. Popular low impedance telephone tone encoding microphones may be used with the 13-509. The mike plug should conform to the following wiring:

PIN	FUNCTION
1	audio input (microphone)
2	ground (shield)
3	13.8V DC
4	Push-to-talk (grounded for transmit)

The level of the telephone dialing tones from the encoding microphone should be adjusted for proper deviation. Tone decoders, do not readily accept tones which have been distorted by the transmitter automatic deviation control circuits. Do not change the deviation in the transmitter. Adjust the tone level from the microphone to the transmitter.

- 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 HI-OFF-LOW switch is placed in the "HI" or "LOW" position.
- 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.

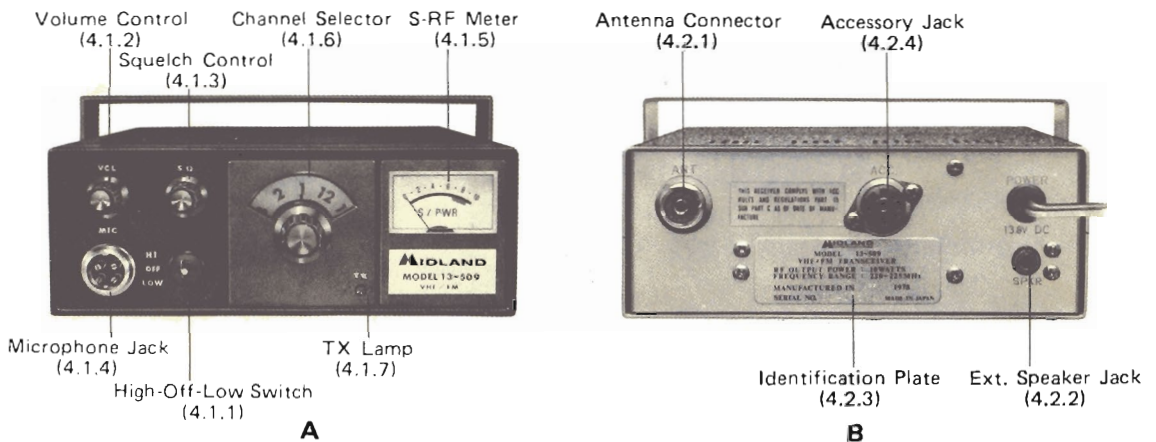


Figure 2

## 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:

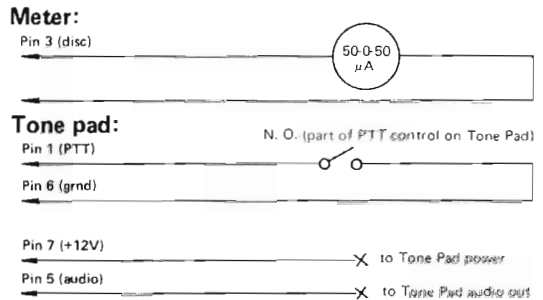
States model, serial number, RF output power and frequency range. Note: It would be well to make a separate record of the serial number of your unit for insurance purposes.

**4.2.4 Accessory jack:** Accepts 7-pin plug Supplied for tone-burst, discriminator meter, and telephone dual tone input.

Connections to the jack are:

1. transmitter PTT
2. 12V DC (during transmit only)
3. discriminator meter connection
4. ground
5. tone audio input (10 mV)
6. ground
7. 12V DC positive

### Typical Accessory Plug Wiring:



## 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 even 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 counterclockwise 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  $5 \mu\text{V}$  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 10.7 MHz.

### **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 (10.7 MHz) is amplified by TR3 and fed to the 2nd Mixer (base of TR4). Also, the 2nd Local Frequency (10.245 MHz) is coupled into the 2nd Mixer through crystal control oscillator (emitter of TR10) to get the output of the 2nd Mixer (455 KHz). 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 40 KHz) 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 misconnection of the power cord.

#### **6.6 Transmitter Crystal Oscillator and Phase Modulator:**

TR29 is a fundamental crystal oscillator of 18 MHz. 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 (TR30) 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 220 MHz 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** This model has been accurately aligned at the factory and will not normally need complete realignment unless it would be necessary to replace IF transformers, etc. In such a case, complete alignment instructions may be obtained by writing to Midland Electronics Co. The user is cautioned that complete realignment is rather complicated and does require precision equipment.

### **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 0 meter. Install the meter to accessory plug (5 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 voltage chart provided. (See Voltage 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 Voltage 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.



ZMB 639 0694

**VOLTAGE CHART**

NO.	NAME	GATE 1	GATE 2	SOURCE	DRAIN	REMARKS
TR 1	3SK45	0	3.6	0	12.8	
2	3SK45	0	0	3.5	8.5	

NO.	NAME	# 1	# 2	# 3	# 4	# 5	# 6	# 7	REMARKS
IC 1	TA7061AP	1.9	1.9	8.6	0	7.8	1.9	1.9	

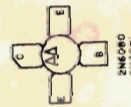
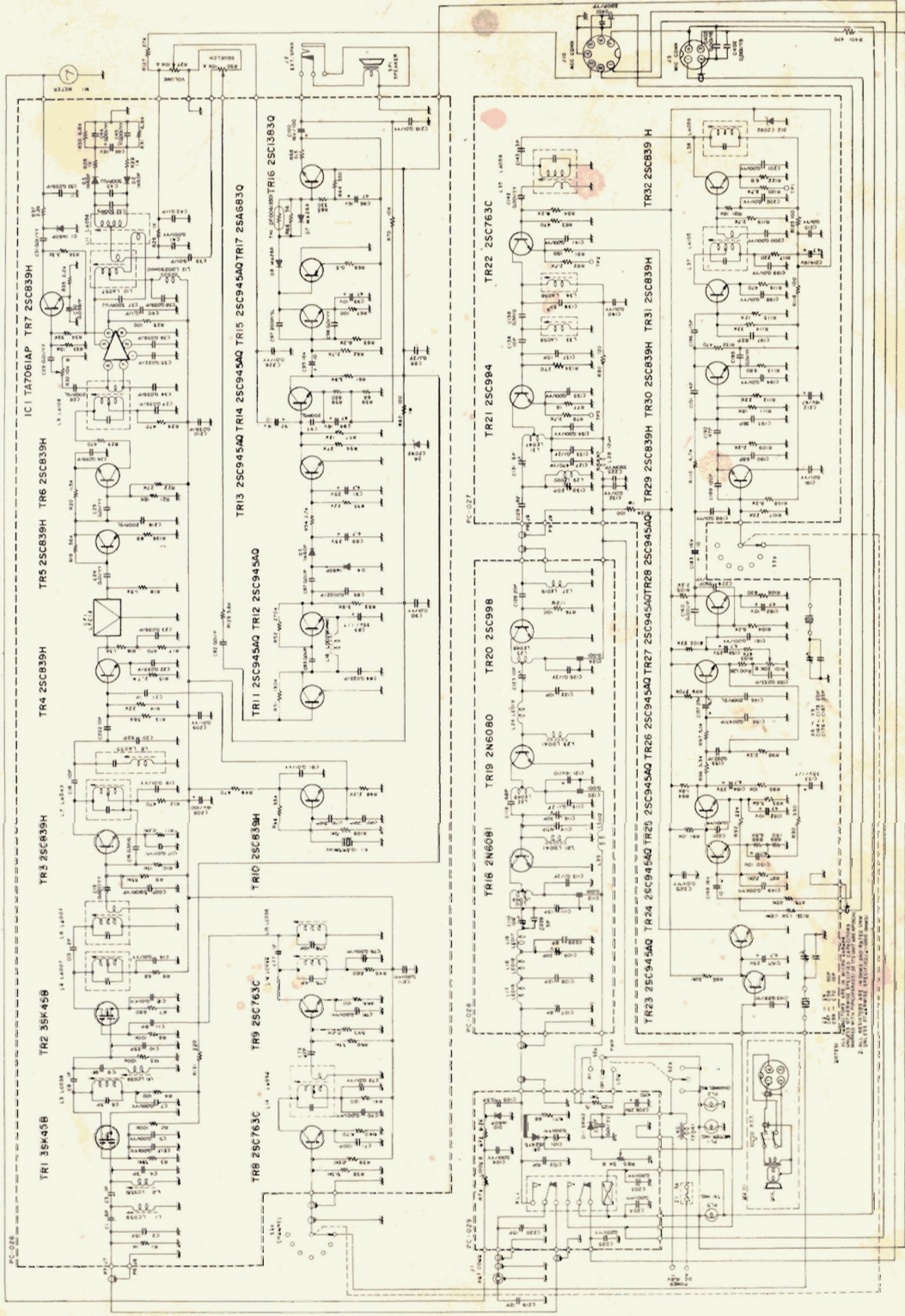
  

NO.	NAME	BASE	EMITTER	COLLECTOR	REMARKS
TR 3	2SC839	2.4	2.0	8.3	
4	2SC839	2.1(2.1)	2.0(1.7)	7.3(7.5)	2nd Local osc. ON(OFF)
5	2SC839	0.75	0.11	1.1	
6	2SC839	3.3	2.8	7.8	
7	2SC839	2.1	1.7	5.3	
8	2SC763	2.5(2.1)	1.6(1.5)	8.4(8.4)	( ) ; Vacant Channel
9	2SC763	0.5(0.5)	0.45(0)	8.6(8.8)	( ) ; Vacant Channel
10	2SC839	2.3(2.3)	3.2(1.8)	7.8(8.2)	2nd Local osc. ON (OFF)
11	2SC945	0.6(0.6)	0	1.9(1.4)	Unsquelched (Squelched)
12	2SC945	1.7(1.3)	1.9(1.4)	4.6(6.0)	Unsquelched (Squelched)
13	2SC945	0(0.6)	0	2.4(0.02)	Unsquelched (Squelched)
14	2SC945	2.4(0.02)	1.9(0)	4.9(13.5)	Unsquelched (Squelched)
15	2SC945	1.6	0.95	6.3	
16	2SC1383	7.4	6.8	13.5	
17	2SA683	6.3	0	6.8	
18	2N6081	0	0	12.5(2.4)	HI Power (Low Power)
19	2N6080	0	0	12.5(2.4)	HI Power (Low Power)
20	2SC998	0	0	12.5(12.5)	HI Power (Low Power)
21	2SC994	0	1.1(0)	12.5(13.0)	( ) ; Vacant Channel
22	2SC763	0.7(0.9)	1.6(0.4)	12.5(13.0)	( ) ; Vacant Channel
23	2SC945	0(0.55)	0	0.6(0.6)	( ) ; Absent Antenna at HI
24	2SC945	0.6(0.6)	0	0.02(1.6)	( ) ; Absent Antenna at HI
25	2SC945	2.4	1.9	5.9	
26	2SC945	5.8	5.3	6.8	
27	2SC945	2.4	1.9	5.8	
28	2SC945	2.1	1.6	4.3	
29	2SC839	5.5(5.6)	5.4(5.0)	7.9(8.0)	( ) ; Vacant Channel
30	2SC839	3.1(3.3)	2.6(2.5)	7.9(8.0)	( ) ; Vacant Channel
31	2SC839	1.5(1.7)	2.0(1.2)	7.6(8.1)	( ) ; Vacant Channel
32	2SC839	0.9(1.0)	1.0(0.4)	8.0(8.5)	( ) ; Vacant Channel

Note: 1. They were measured by DC Volt Meter ; 33.3K $\Omega$ /V,  $\pm$ 3%.

2. Datas. From TR18 to TR32 were measured by DC Volt-Meter (Note 1) with 10K $\Omega$  Resistor of it's probe.

# CIRCUIT DIAGRAM



## LIMITED WARRANTY

Midland International Corporation will repair or replace, at its option, without charge, any Midland Amateur transceiver, which fails due to a defect in material or workmanship within 90 days following the initial consumer purchase.

This warranty does not include any carrying cases or earphones which may be a part of or included with the warranted product, or the cost of labor for removal or reinstallation of the product in a vehicle or other mounting.

Performance of any obligation under this warranty may be obtained by returning the warranted product, freight prepaid, along with proof of the purchase date, to Midland International Corporation, Warranty Service Department, 1690 North Topping, Kansas City, Missouri 64120, or to any "Midland Authorized Amateur Warranty Service Station."

Warranty information and the location of the nearest "Midland Authorized Amateur Warranty Service Station," may be obtained by writing Midland International Corporation, Warranty Service Department.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

**Note:** The above warranty applies only to merchandise purchased in the United States of America or any of its territories or possessions or from a U.S. military exchange. For warranty coverage on merchandise purchased elsewhere, consult the supplemental warranty information included with this product or ask your dealer.



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