

an optional plug-in remote speaker / microphone. The ECOM-40U can be ordered with an optional jack which will accept either an earphone or a remote speaker. Another option available at time of order is a jack which will accommodate an external microphone only.

A self-contained battery pack, consisting of 8 nicad cells, supplies 9.6 VDC to operate the unit. An external charging jack and a diode, which prevents "reversed-polarity" charging, provide for charging the battery pack while installed in the transceiver. A plug-in battery charger is included with each transceiver.

All circuitry employed is the latest state-of-the-art design, using the latest in semiconductor and integrated-circuit technology.

All transceiver components are mounted on a single "double-sided," printed-circuit board.

The transceiver is housed in a rugged Lexan case -- this easily-removed, two-piece, durable plastic cover protects the instrument from dirt and physical damage while maintaining the unit's light weight (less than 2 pounds).

Operating controls for the unit (Volume, Squelch, Charging Jack and Antenna or connector) are mounted on top panel. The Frequency Selector switch is located in the lower, right-hand corner of the front panel. Thus, the controls are easily accessible when needed, yet do not interfere with the portability or operation of the instrument. The push-to-talk switch is mounted on the left-hand side of case for easy one-handed operation.

### 1-3. SPECIFICATIONS

#### GENERAL:

Over-all Dimensions:	8.625" (21.9 cm) High; 2.938" (7.46 cm) Wide; 1.830" (4.65 cm) Deep
Power Supply:	Internal battery pack; 8 nicad cells, 9.6 volts.
Current Drain:	Standby: 25 mA; Receive: 63 mA; Transmit: 700 mA
Battery Operating Time:	1.0 Watt = 6 hrs, based on 5% transmit, 5% receive, and 90% standby duty cycle
Frequency Range:	450 to 512 MHz
Temperature Range:	-30°C to +50°C
Number of Channels:	4, maximum
Weight:	Approx. 1 lb (0.45 kg)

### 1-3. SPECIFICATIONS (Cont'd)

#### RECEIVER:

Sensitivity:	0.5 uV, max. (12 dB SINAD)
Adjacent Channel Rejection:	More than 55 dB at 25 kHz
Squelch Threshold:	0.5 uV, max.
Image Rejection:	Greater than 40 dB
Spurious Rejection:	Greater than 55 dB
Intermodulation:	More than 60 dB
Modulation Acceptance Bandwidth:	<u>+7.5</u> kHz, max.
Frequency Stability:	<u>±</u> .001% from -30°C to +50°C
Frequency Accuracy:	Adjustable within <u>+500</u> Hz
Audio Output Power:	350 mW at less than 10% Distortion
Hum and Noise Level:	More than 35 dB below 0.25 watts
Maximum Channel Separation:	3 MHz with no degradation

#### TRANSMITTER:

Frequency Range:	450 MHz to 512 MHz
Output Power:	1.0 Watt
Output Impedance:	50-ohms, nominal
Frequency Stability:	<u>±</u> .0005% from -30°C to +50°C
Frequency Accuracy:	Adjustable to 100 Hz
Deviation:	<u>+5</u> kHz maximum with <sup>1</sup> kHz modulation
Modulation:	Type 16F3; <u>+5</u> kHz for 100% modulation with 1000 Hz tone
Sub-audible Tone:	Optional
Spurious and Harmonics:	More than 46 dB below 1 watt
Maximum Channel Separation:	5.5 MHz

#### 1-4. EQUIPMENT SUPPLIED

- a) ECOM-40U UHF-FM Transceiver
- b) Helically-loaded, flexible antenna, BNC-mounting (450 to 470 MHz)
- c) 9.6 volt battery pack (8 nicad cells) - PSI-32
- d) Battery charger - PSI-16
- e) Crystal, receiver (1) -- specify frequency
- f) Crystal, Transmitter (1) -- specify frequency

#### 1-5. EQUIPMENT REQUIRED BUT NOT SUPPLIED



#### 1-6. OPTIONAL EQUIPMENT AVAILABLE

- a) Antenna, helically-loaded, rubber-clad, flexible, BNC-mounting (470 to 512 MHz)
- b) SA-44 CTCSS subaudible-tone squelch module
- c) Leather holster for ECOM-40U (GLC-4)
- d) Leather flap for holster (GLC-5)
- e) Speaker/Microphone (G22)

# SECTION II

## INSTALLATION MANUAL

### 2.1 INTRODUCTION

This manual section provides installation and charging data for the nicad battery pack supplied with the UHF-FM handheld transceiver. Information concerning the antenna supplied with the unit is also given.

### 2-2. BATTERY INSTALLATION

The 9.6-volt nicad battery pack is not installed in unit at time of shipment from the factory, but is packaged in shipping container with transceiver. The battery pack must be installed in instrument, and charged for a minimum of 8 hours, prior to using transceiver.

NOTE: Nicad batteries supplied with instrument must be installed in the transceiver in order to charge them with battery charger that is supplied with unit. This charger will NOT overcharge the nicad cells. DO NOT TRANSMIT WITH CHARGER CONNECTED TO TRANSCEIVER.

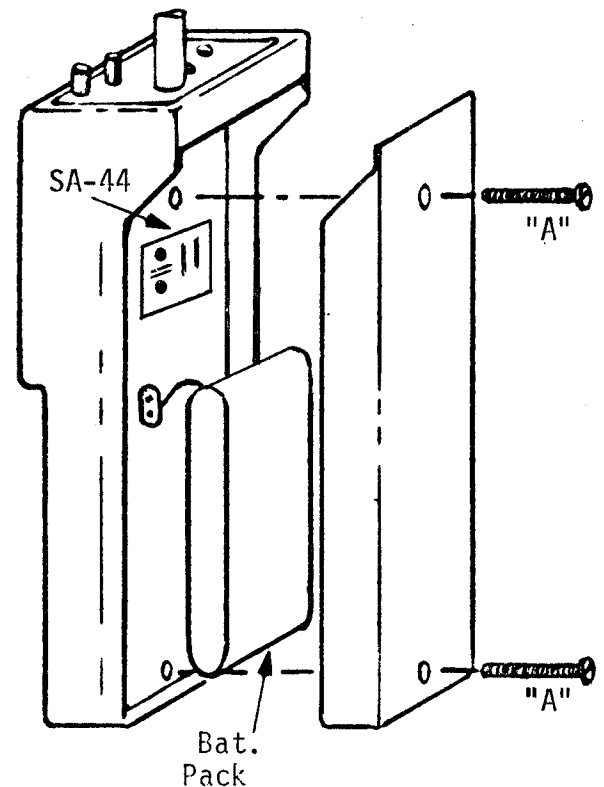


Figure 2-1. Unit Rear View

Remove plastic BACK cover from transceiver in order to install batteries. This cover is easily removed as follows (see Figure 2-1):

1. Carefully lay transceiver on its FRONT on suitable work surface. Be SURE unit is turned OFF.
2. Remove two #4-40 x 1" pan-head machine screws which secure back cover to transceiver (item "A" Fig. 2-1).
3. Lift cover up and off transceiver.
4. Connect battery-pack to mating connector which is attached to ECOM-40 main PC board. Lay battery pack on rear of transceiver main PC board, using foam material supplied to protect PC board.
5. Re-install transceiver rear cover. Be sure cover does not pinch battery wires; then replace two #4-40 x 1" screws removed in step 2 above.
6. Plug cord from battery charger into charging jack on top of unit; then, insert charger into 120 VAC, 50/60 Hz, receptacle.
7. Be SURE volume control is turned fully counterclockwise to its OFF position. Allow batteries to charge for a minimum of 8 hours, and preferably overnight.

NOTE: Disconnect charger from 120V source prior to connecting or disconnecting charger and transceiver.

## 2-3. ANTENNA INFORMATION

The ECOM-40U is designed to operate into a 52-ohm antenna system. The unit is normally supplied with a BNC-mounted flexible, rubber-clad, helically-loaded antenna cut for operation between 450 and 470 MHz; however, an optional antenna designed to operate from 470 to 512 MHz is available.

All UHF communications are basically limited to "line-of-sight" distances; thus, the antenna at the transmitting station and at the receiving station should be mounted as high as practicable.

The operating range of any radio system depends on terrain, power, antenna efficiency and height, and many other factors. The performance obtained will vary, depending upon local conditions, but it is possible to generally predict range under AVERAGE conditions in an urban area. Average ground conductiv-

ity, smooth earth, and normal urban noise conditions are assumed in the following examples:

As a general estimate two handheld, 2-watt UHF transceivers can communicate in a normal urban environment over approximately 1.4 miles.

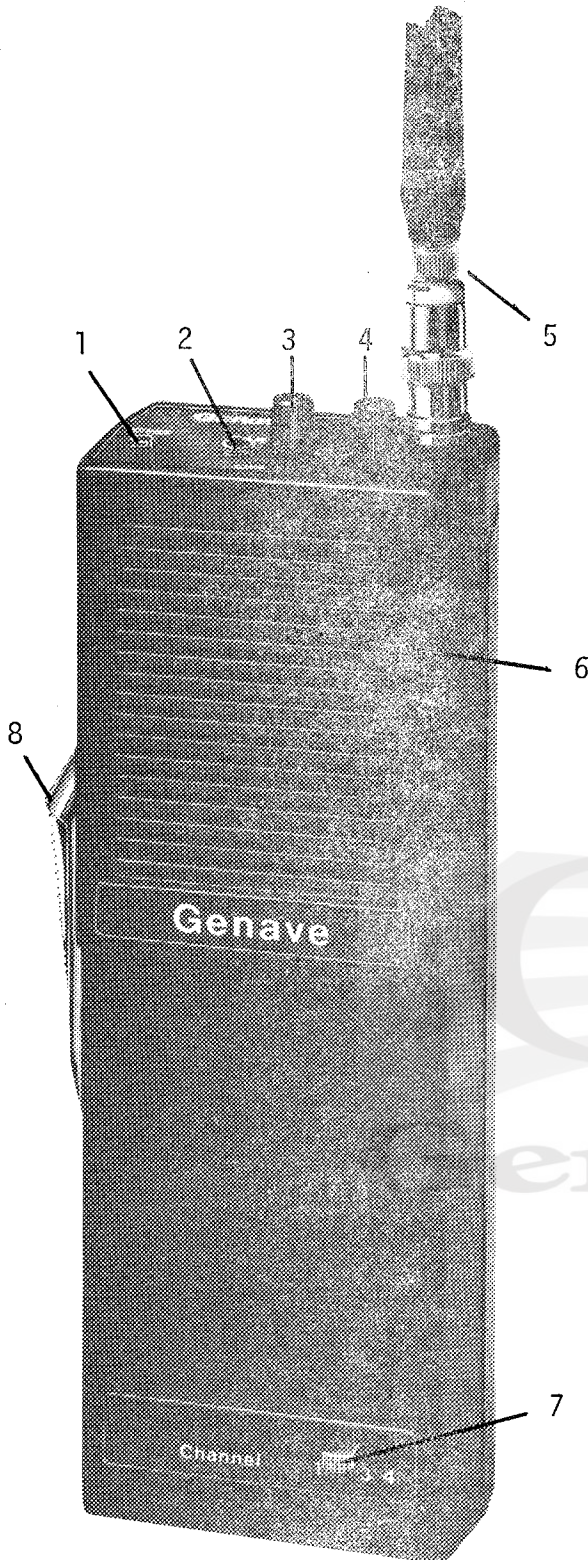
A 2-watt handheld unit communicating directly with a 25-watt mobile unit can transmit approx. 2.7 miles to the mobile, but can receive the mobile for approx. 5.9 miles. A high-gain mobile antenna will increase range in both directions by 0.7 miles.

If a 2-watt handheld is working through a UHF Repeater having a 10-dB gain antenna mounted 100 feet above average terrain, and with a transmitter power of 70-watts, the handheld can expect to raise the repeater over a radius of 11 miles; however, the handheld will receive the repeater for a distance of approximately 22 miles.



# SECTION III

## OPERATING MANUAL



### 3-1. OPERATING CONTROLS

For reliability and operating convenience, only essential operating controls are installed on the unit's external surfaces. The functions of these controls are as follows:

1. Charging jack to permit charging the internal nicad battery pack.
2. Earphone jack.
3. Volume control/On-Off switch.
4. Squelch control/tone-squelch override switch.
5. Flexible antenna, or antenna connector.
6. Built-in Speaker/Microphone.
7. Channel-Selector switch.
8. Push-to-talk switch.

The unit is designed to fit comfortably in the palm of the hand -- permitting easy, one-handed operation.

### 3-2. OPERATING INSTRUCTIONS

1. To operate transceiver, turn unit ON by rotating the Volume control (3) clockwise until switch clicks.
2. Select desired transmit/receive frequency by sliding Channel-Selector switch (7) to desired operating position.
3. Check that helically-loaded, flexible, rubber-clad antenna is properly connected to transceiver.
4. If transceiver is equipped with the SA-44 subaudible-tone option, deactivate tone-squelch by pulling the squelch-control knob (4) OUT to its MONITOR position.
5. Rotate Squelch Control (4) counter-clockwise until noise is heard in speaker (6). Adjust Volume Control for desired audio level; then, re-adjust Squelch Control clockwise until receiver just quiets. DO NOT

## ADJUST SQUELCH WHILE A SIGNAL IS BEING RECEIVED.

6. To activate tone-squelch, PUSH the squelch-control knob (4) IN to its SQUELCH position (Do NOT turn knob from position selected in step 5).
7. To transmit, depress Push-to-Talk switch (8) and speak into microphone (6). Release Push-to-Talk Switch to listen.

NOTE: The carrier-level squelch circuit, which is adjusted by the TOP-PANEL squelch control, quiets the receiver in the absence of an incoming signal on the assigned operating frequency; however, ANY station in your vicinity, operating on this frequency, will be heard.

The SA-44 Subaudible-Tone System is a tone-activated circuit designed to squelch receiver audio until a transmitted signal containing the proper subaudible tone is received. Thus, calls by other licensees who share the channel will not be heard unless transceiver is manually set to its MONITOR position by pulling squelch knob (4) OUT. Note that the channel MUST be monitored prior to initiating a call, to insure that frequency is NOT in use; if channel is clear, PUSH squelch knob (4) IN and proceed to originate call.

8. If an optional, external speaker/microphone is desired, it may be connected to Earphone Jack (2) on unit top panel.
9. To charge internal batteries, plug charger into Charging Jack (1). Now, insert charger into 120 VAC, 60 Hz, receptacle. Be SURE Volume control is turned fully counterclockwise to its OFF position.

NOTE: At time of shipment the nicad battery has NEVER BEEN CHARGED; thus, at least TWO CHARGE CYCLES ARE REQUIRED before battery pack can attain its normal full capacity.

## 3-3. LICENSING INFORMATION

Licensing requirements vary with the service for which this unit will be used; however, all services require the station transmitter to be licensed. Further, all transmitter adjustments or tests during or coincident with the installation, servicing, or maintenance of a radio station, which may affect the proper operation of such station, shall be made by or under the immediate supervision and responsibility of a person holding a first- or second-class commercial radio operator license, either radiotelephone or radiotelegraph, who shall be responsible for the proper functioning of the station equipment. Note, however, that in many services an unlicensed person, after having been authorized to do so by the station licensee, may operate from a control point a mobile, base, or fixed station or from a dispatch point a base or fixed station, during the course of normal rendition of service. The minimum class of operator authorization required for each specific classification of station is set forth in the appropriate F.C.C. rule part.

If this transceiver is to become part of a new radio-communications system, it should be included as a portable or mobile unit on the initial station license application. Information concerning modification of an existing license (that is, adding additional portable or mobile units, or changing transmitter-type of portable or mobile units) can be found in the F.C.C. Rules and Regulations governing the service in which the system is used.

The following technical information is intended to aid ECOM-40U users in completing the application for radio station authorization. Only technical data pertaining to the transceiver are shown below; all other station particulars must be furnished by the licensee.

Type Accepted: Yes  
Type Acceptance/Model No: ECOM-40U  
Type of Unit: Transceiver  
Frequency Range (MHz): 450 to 512  
Frequency Tolerance: .0005%  
Emission: 16F3  
Transmitter Output Power: 1 watt  
Approved under Rule Part Numbers: 22 (21), 74, 90, 95

Form 405-A may be used in applying for license RENEWAL in the Aviation, Public Safety, Industrial, Land Transportation and Disaster radio services when there has been no change, other than mailing address or licensee's name.

For answers to specific licensing questions, contact the Engineer-in-Charge at nearest Federal Communications Commission Field Engineering Office as listed in Section 3-4 -- they will also supply the appropriate form(s), if requested.

For additional information on filling out the appropriate application forms, consult the F.C.C. instruction sheet provided with the form.

The procedures for obtaining necessary licenses are found in the Federal Communications Commission Rules and Regulations. These volumes may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

F.C.C. Form 400 and F.C.C. Form 405-A are normally used to apply for a license for the ECOM-40U. The Form 400 is used to apply for a NEW station authorization in the Public Safety, Industrial, and Land Transportation Radio Services under F.C.C. Rule Part 90.

The services and the corresponding F.C.C. rule part numbers, under which the ECOM-40U transceiver can be used, are as follows:

### 3-3-1. F.C.C. Rule Part Numbers

#### Public Mobile Radio Services

F.C.C. Rules & Regulations, Volume VII, Part 22

Domestic Public Land Mobile Radio Service  
Rural Radio Service

#### Experimental, Auxiliary, and Special Broadcast

F.C.C. Rules & Regulations, Volume III, Part 74

Remote Pickup Broadcast Stations

#### Private Land Mobile Radio Services

F.C.C. Rules & Regulations, Volume V, Part 90

Local government radio service                      Subpart B - Public  
Police radio service    Safety  
Fire radio service  
Highway maintenance radio service  
Forestry-conservation radio service



## Private Land Mobile Radio Services (Cont'd)

Medical services	Subpart C - Special
Rescue organizations	Emergency
Veterinarians	
Disaster relief organizations	
School buses	
Beach patrols	
Paging operations	

Power radio service	Subpart D - Industrial
Petroleum radio service	Radio
Forest products radio service	
Motion picture radio service	
Relay press radio service	
Special industrial radio service	
Business radio service	
Manufacturers radio service	
Telephone maintenance radio service	

Motor carrier radio service	Subpart E - Land
Railroad radio service	Transportation
Taxicab radio service	
Automobile emergency radio service	

## General Mobile Radio Service

F.C.C. Rules & Regulations, Part 95, Subpart A

The logo for Genave, featuring a stylized 'G' with a banner across it, and the word 'Genave' in a bold, sans-serif font with a registered trademark symbol.

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1011 E. Tudor Road, Room 240,  
P.O. Box 2955  
Anchorage, Alaska 99510

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Room 440, Massell Building,  
1365 Peachtree Street, NE,  
Atlanta, Georgia 30309

Baltimore District Office  
1017 Federal Building,  
31 Hopkins Plaza,  
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165 State Street,  
Boston, Massachusetts 02109

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111 West Huron Street,  
Buffalo, New York 14202

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Chicago, Illinois 60604

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U.S. Courthouse, Room 13E7  
1100 Commerce Street,  
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Denver, Colorado 80202

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231 W. LaFayette Street,  
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300 Ala Moana Blvd., Room 730-1,  
P.O. Box 50223  
Honolulu, Hawaii 96860

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515 Rusk Ave., Room #635,  
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8800 East 63rd Street,  
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3711 Long Beach Blvd., Room 501  
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51 S.W. First Ave., Room 919,  
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1007 F. Edward Hebert Federal Bldg.,  
600 South Street,  
New Orleans, Louisiana 70130

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201 Varick Street,  
New York, New York 10014

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Military Circle,  
870 N. Military Highway,  
Norfolk, Virginia 23502

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601 Market Street,  
Philadelphia, Pennsylvania 19106

Pittsburgh Office  
3755 William Penn Highway,  
Monroeville, Pennsylvania 15146

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1220 S.W. Third Avenue,  
Portland, Oregon 97204

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691 Federal Bldg., & U.S. Courthouse,  
316 North Robert Street,  
St. Paul, Minnesota 55101

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La Mesa, California 92041

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585 Battery Street,  
San Francisco, California 94111

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Tampa, Florida 33607

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# SECTION IV MAINTENANCE MANUAL

## 4-1. INTRODUCTION

This Section of the maintenance manual contains theory of operation, alignment data, and schematics. Lists of replacement parts are given in Section 5 of this manual.

The Genave Model ECOM-40U transceiver is a handheld UHF-FM unit designed to transmit and receive 16F3 emissions in the various land-mobile or business-radio services between 450.0 and 512.0 MHz. The instrument supplies a typical RF power output of 1.0 watts on any of four possible channels.

Basically, the receiver is a dual conversion superheterodyne employing a 2-pole monolithic crystal filter at 10.7 MHz and a 4-pole ceramic filter at 455

kHz. A single integrated circuit performs 2nd LO, 2nd mixer, limiter, detection, and squelch functions.

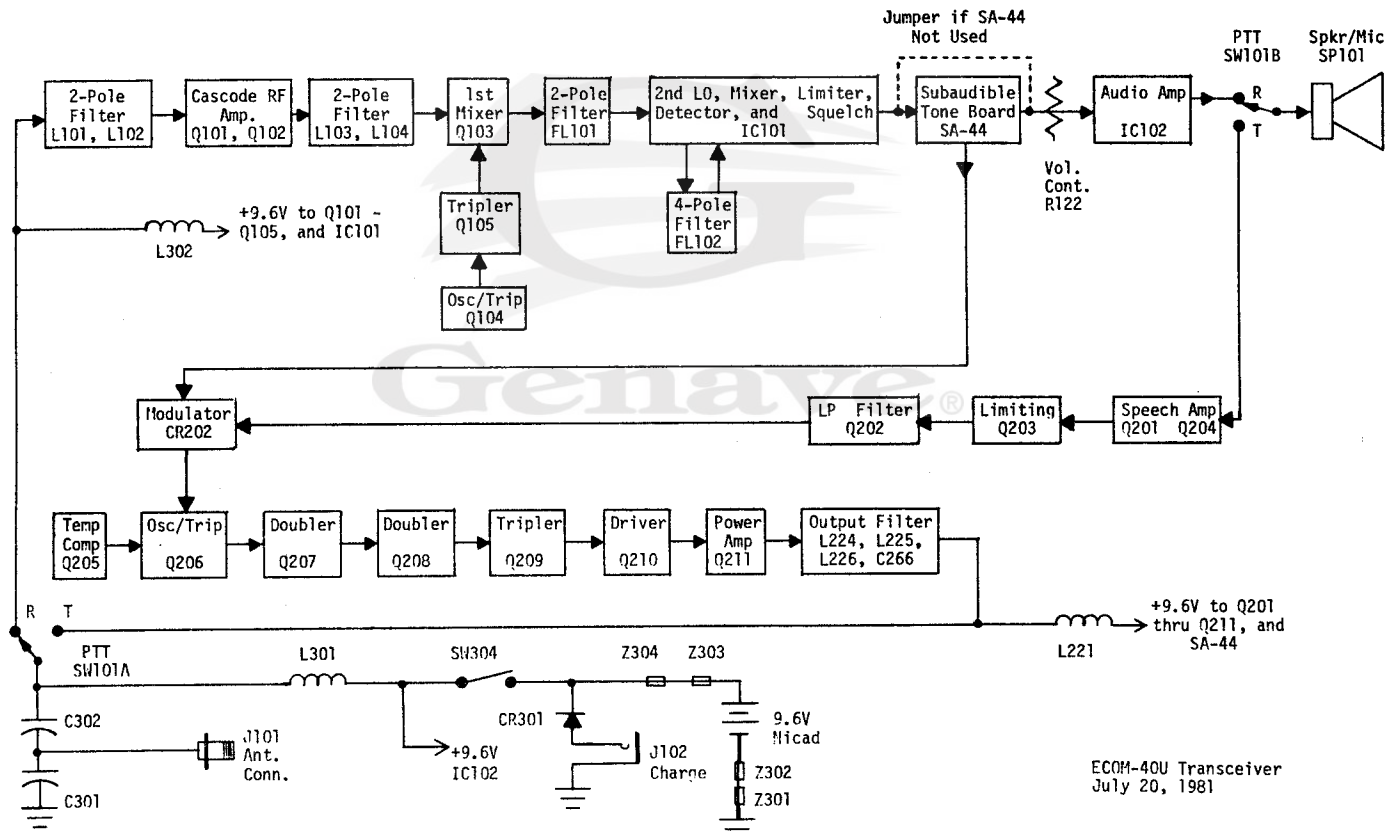
In conjunction with the following circuit description, refer to the block diagram of Figure 4-1, as well as to the transceiver schematic in this manual section.

## 4-2. THEORY OF OPERATION - GENERAL

### 4-2-1. Power Supply

A self-contained battery pack supplies power to operate the instrument. This battery pack supplies 9.6 volts DC, and uses eight (8) Nickel-Cadmium cells.

The battery pack may be charged, while installed in transceiver case, by means



ECOM-40U Transceiver  
July 20, 1981

of CHARGE jack J102, located on the top panel of ECOM-40U case. A series diode, CR301, prevents the "reversed-polarity" charging of nicad battery pack.

The + TRANSMIT and + RECEIVE voltage lines are each supplied with 9.6 volts DC through On-Off switch SW304, Push-to-Talk switch SW101A, and isolating choke L301. L302 supplies DC current to the receiver devices while at the same time resisting flow of RF currents; L221 performs the same functions for the transmitter solid-state devices.

#### 4-2-2. Push-To-Talk Circuitry

On-Off Switch SW304, located on Volume Control R122, applies +9.6-volts to the receiver or transmitter circuitry via Push-To-Talk Switch SW101A. Also P.T.T. SW101A switches antenna between receiver and transmitter circuitry. P.T.T. Switch SW101B connects speaker/microphone SP101 to receiver output when the switch is in its normal resting position, or to transmitter audio input when switch is depressed.

Isolating chokes L301, L302, and L221 allow SW101A to switch DC and RF currents simultaneously. In receive mode, the 9.6-volt supply is applied to Q101, Q102, Q103, Q104, Q105 and IC101 by way of SW304, L301, L302 and SW101A. At the same time, RF signals from the antenna are applied to the 2-pole input filter through C302 and SW101A. Note that L301 and L302 prevent incoming RF signals from entering receiver DC circuits.

In the transmit mode, the 9.6-volt supply is switched to transistors Q201 through Q211 by means of L301, SW101A, and L221. Simultaneously, transmitter RF output from the output filter is routed to the antenna by SW101A and C302. Chokes L221 and L301 prevent the transmitter RF output from appearing across the battery pack or other DC circuitry.

## 4-3. THEORY OF OPERATION - RECEIVER

### 4-3-1. Input Filter and RF Amplifier

Capacitor C302 and SW101A couple the incoming signal to the receiver input filter, comprised of C101, C102, C103, L101, L102, C104 and C105. C101 and C102 form a capacitive tap to match antenna impedance to input of filter. C104 and C105 match filter output to low impedance input of RF amplifier.

Q101 and Q102 are "low-noise" PNP, UHF transistors which form a cascode RF amplifier. The amplifier output appears across a 2-pole filter comprised of C108, C109, L103, C110, L104, C111 and C112. The capacitive tap formed by C111 and C112 matches the filter output to base of 1st mixer.

### 4-3-2. 1st Local Oscillator and Tripler

Q104 and associated components form a modified Colpitts, crystal-controlled, local oscillator. A 4-position, slide switch, SW301A, selects proper crystal in the 48.8 to 55.7 MHz range to produce desired injection frequency. The tuned output circuit of Q104 is tuned to three times the crystal oscillation frequency by L109 and C155.

C156 then couples the LO signal to base of tripler Q105. The output frequency of this stage is tuned to 9 times the crystal frequency by L110 and C157. C160 connects the injection signal to mixer Q103.

NOTE: The first LO injection frequency is 10.7 MHz BELOW desired "receive" frequency.

### 4-3-3. 1st Mixer and 2-Pole Filter

The amplified input signal and the LO injection signal are each applied to the base circuit of mixer Q102. The 10.7 MHz difference signal, produced in the first mixer, is coupled by T101 to a 2-pole monolithic crystal filter, FL101. T102 matches the filter output to input of 2nd mixer in IC101. CR101 is used to limit the signal level at T102.

#### 4-3-4. 2nd LO, Mixer, Limiter, Detector and Squelch

IC101 is a multi-function integrated circuit, which includes the 2nd local oscillator, 2nd mixer, limiting 2nd IF amplifier, quadrature discriminator, active filter and squelch mute switch in a single chip.

Y107, C121, and C122, together with IC101 pins 1, 2, and 4, form an internally biased Colpitts-type oscillator. The collector, base, and emitter connections are at pins 4, 1, and 2 respectively. Low-side injection is used; therefore, the crystal frequency is 10.245 MHz (455 kHz BELOW the 10.7 MHz IF).

The 10.7 MHz IF signal is applied to the 2nd mixer through pin 16 of IC101. The 2nd LO also drives the mixer, which then provides a 455 kHz 2nd IF signal on pin 3 of IC101. Ceramic filter FL102 then couples the IF signal to the input of a five-stage limiter at pin 5 of IC101.

The output of the limiter at pin 7 of IC101 drives a multiplier, both internally directly, and externally through the quadrature coil T103, to detect the FM signal. The recovered audio is filtered and buffered internally in IC101, then applied to pin 9. From pin 9 on IC101, the audio signal is applied to a de-emphasis network consisting of R112 and C130; then the audio is connected to audio volume control R122 --- either directly, or through the SA-44 subaudible tone circuitry.

The detected audio on pin 9 of IC101 is also applied to input of a bandpass active filter (pin 10), consisting of an internal op-amp and external components R114, R116, C127, and C128. The noise output of this filter (pin 11) is applied to an external AM detector, CR103, which detects noise frequencies ABOVE the normal voice band. Absence of an input signal permits considerable noise to be applied to detector CR103

whereas, an incoming signal will tend to "quiet" the receiver and thus greatly reduce this noise level.

An external POSITIVE bias applied to pin 12 of IC101 sets up squelch-trigger circuit such that audio-muting switch (pin 14) is an OPEN circuit, which allows audio output IC102 to develop normal audio. But when IC101 pin 12 is pulled down to 0.7V, either by detected voltage from CR103 or by adjustment of squelch control R118, IC101 pin 14 is internally shorted to ground which then grounds pin 1 of audio output IC102 to mute audio amplifier.

The setting of squelch control R118 determines DC voltage applied to IC101 pin 12, and thus the point at which receiver squelch operates. There is 100 mV of hysteresis at pin 12 to prevent squelch "jitter."

#### 4-3-5. Audio Output

The audio signal, attenuated by volume control R122, is applied to pin 3 of audio output IC102.

R123 and C133 set gain of the amplifier, while C164 is used to prevent high-frequency oscillation of the amplifier.

NOTE: A ground applied to pin 1 of IC102 (by pin 14 of IC101) disables the output stage to mute receiver.

The reactance of speaker SP101 and C132 provide low-frequency roll-off of the audio output.

### 4-4. THEORY OF OPERATION -- TRANSMITTER

#### 4-4-1. Speech Amplifier/Limiter/Filter

In TRANSMIT mode, output of SP101 is applied to a common-base amplifier, Q-201. From Q201, the voice signal is coupled to common-emitter amplifier Q-204. Q201 and Q204 amplify the microphone output, as well as providing pre-emphasis of the voice signal.

It is necessary to limit the peak amplitude of the audio signal applied to the modulator, so that deviation of the FM transmitter will not exceed the preset value. Q203 performs the limiting function in the ECOM-40U transceiver.

The limiting process produces high-order harmonics which, if allowed to pass through to the modulator stage, would create unwanted sidebands. Therefore, an audio low-pass filter, Q202 and associated components, is used at the output of the limiter to provide a -18 dB per octave rolloff above 3 kHz. R201 sets the maximum voice modulation deviation.

#### 4-4-2. Voice/Subaudible-Tone Modulator

C228 couples audio from the speech amplifier to the modulator circuitry, consisting of varactor CR202 and associated components.

If the subaudible-tone option is installed in the transceiver, R219 connects subaudible-tone output from the SA-44 tone board to varactor modulator CR202.

Audio voltages applied to varactor CR202 cause the diode capacitance to vary at an audio rate; therefore, since CR202 is connected between the common crystal line and ground, any change in diode capacitance will result in the crystal frequency changing by a few Hertz. The crystal frequency multiplies 36 times to reach the output frequency; thus the crystal frequency only has to shift approximately 135 Hz for 5 kHz deviation.

#### 4-4-3. Crystal Temperature-Compensation Circuitry

Q205, R218, R220, R222, and thermistor R221 form a temperature-compensation circuit which maintains frequency stability of the unit within  $\pm 0.0005\%$  over the range from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ .

Thermistor R221 senses existing temperature within the instrument. R221 together with R220 form a voltage-divider

across the regulated +6.8 volt supply for the compensation circuitry. When internal temperature drops to approx.  $0^{\circ}\text{C}$ , the resistance of R221 increases to approximately 55K. The resultant voltage drop across R221 is sufficient to turn ON Q205. Collector current for Q205 flows through R218, which develops a reverse-bias voltage across varactor CR202. This reverse bias causes CR202 to change capacity slightly, thus moving crystal frequency to compensate for temperature effects.

#### 4-4-4. Transmit Oscillator

Q206 and associated components form a modified Colpitts, crystal-controlled oscillator. A 4-position, slide switch, SW301B, selects proper crystal in the 12.5 to 14.2 MHz range to produce the desired transmit frequency. A trimmer capacitor in series with each crystal provides the means of adjusting each channel to exact frequency.

A selected-value resistor, R233, R234, R235, or R236, may be installed in series with crystals Y201, Y202, Y203 or Y204, respectively, to obtain approximately the same amount of modulation deviation on each channel. These resistors are ONLY installed if there is marked difference in deviation between channels.

L209, C232, C236, L210, C237 and C238 tune collector circuit of Q206 to three times the crystal oscillation frequency and match collector of Q206 to base of doubler Q207.

#### 4-4-5. 1st Doubler

The doubler consists of a silicon, NPN transistor, Q207, having a slight forward bias supplied by R227 and R228.

L212, C239, C241, L211, C242, and C243 tune output of doubler Q207 to sixth harmonic of crystal frequency (75 - 85.3 MHz), and match output impedance of Q207 to the following stage.

#### 4-4-6. 2nd Doubler

Q208 is a Class C doubler stage, using another silicon, NPN transistor.

L213, C247, C248, L214, C251, and C252 tune output of 2nd doubler to the 150 - 170.6 MHz frequency range (12 times the crystal frequency), and also match collector impedance of Q208 to input of power tripler.

#### 4-4-7. Power Tripler

Q209 is a Class C tripler, with its collector circuit tuned to the 450 - 512 MHz range. C253, L217, C256, C254, L218, C255, C257, and C258 comprise two coupled resonant circuits which match output of Q209 to base of driver Q210.

#### 4-4-8. Driver

Driver Q210 is another silicon, NPN transistor, used as a Class C amplifier over the frequency range 450 - 512 MHz. C259 and L220 form a matching network to couple collector of Q210 to base of power amplifier Q211.

#### 4-4-9. Power Amplifier

Class C power amplifier Q211 amplifies the RF signal to provide a power output of approximately 1.0 watts. L223, C264, and C265 match the collector impedance of Q211 to the 50-ohm antenna impedance. L224, L226, C266 and L225 form an elliptic-function filter which reduces level of all spurious outputs above the operating frequency to at least 46-dB below the carrier level. The filter output is routed to the antenna connector through P.T.T. switch, SW101A.

### 4-5. DISASSEMBLY

Prior to performing any service work on the instrument, the plastic BACK cover must be removed. This will allow battery pack to be replaced, TRANSMIT frequency(ies) to be adjusted, or SA-44 Tone Board to be serviced. Any further work will necessitate removing plastic FRONT cover also.

The transceiver covers are easily removed; refer to Figure 4-2 and proceed as follows: (DO NOT BUMP OR MOVE TRANSMIT CRYSTAL TRIMMERS, on bottom-rear of PC board).

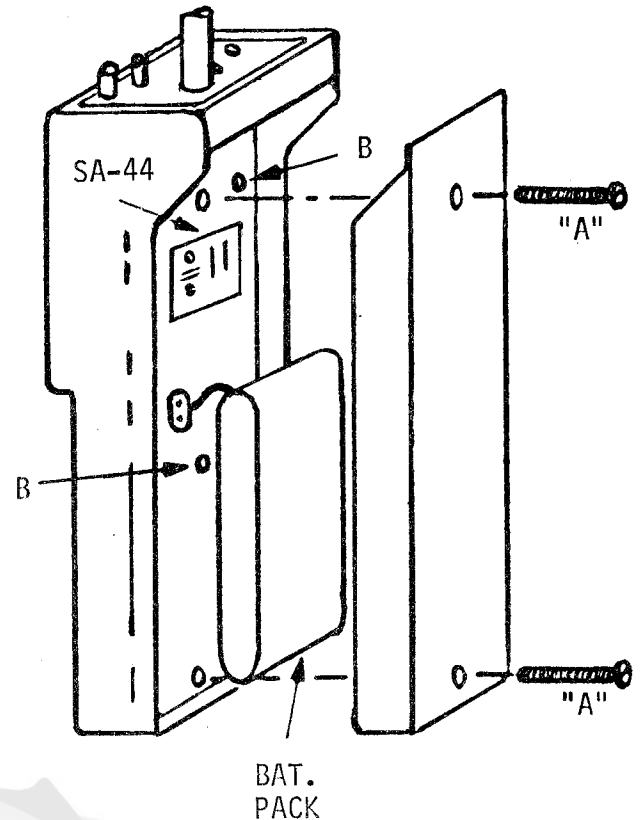


Figure 4-2. Disassembly

#### 4-5-1. BACK Cover Removal

1. Carefully lay ECOM-40U on its FRONT on a suitable work surface. BE SURE unit is turned OFF.
2. Remove two #4-40 x 1" pan-head machine screws which secure back cover to transceiver (Fig. 4-2, item "A").
3. Lift cover up and off transceiver.

#### 4-5-2. FRONT Cover Removal

1. Remove antenna from its mating BNC connector; then, use 0.050" Allen wrench to loosen two setscrews in each control knob. Remove the knobs.

2. Remove BACK cover as given above to gain access to PC-board mounting screws.
3. Disengage battery connector from its mating connector; then, remove battery pack from ECOM-40U Transceiver.
4. Remove two #4-40 pan-head machine screws (Figure 4-2, item "B") which secure PC board to FRONT cover.
5. Place hand across open back-side of transceiver. Carefully grasp unit and turn it over. The PC-board may drop into the palm; but if it does not, push gently on channel-selector switch. Hold PC-board, while sliding FRONT cover off over jacks and control shaves.

CAUTION: The speaker/microphone is simply lying in position on the PC board - DO NOT drop speaker or damage leads.

#### 4-5-3. SA-44 Tone-Board Removal

1. Remove BACK cover from transceiver as outlined in Section 4-5-1 above.
2. Grasp SA-44 tone board by its edges and, with a slight rocking motion, lift tone board away from main PC board until tone board clears the seven (7) connecting pins.
3. If service work, such as component replacement, is to be performed on SA-44, it is necessary to remove phenolic insulator from foil side of tone board. The phenolic insulator is secured to tone board with RTV; thus, the insulator can be easily peeled from tone board and re-used.

#### 4-6. UNIT REASSEMBLY

As a general rule, items are reassembled on the ECOM-40U transceiver by reversing the disassembly procedure. However, a few points require special attention.

#### 4-6-1. FRONT Panel

1. Place the PC board, foil side down, on the palm. Lay speaker/microphone in proper position on the PC board, with its magnet resting on PC board. (Boards have "guide pins" installed to facilitate positioning of speaker magnet on PC board).
2. Rotate speaker so that its two solder terminals face in the general direction of the Charging Jack. Be sure speaker terminals DO NOT short against resistor leads or coils; then, check routing of speaker wires to insure they will not be pinched when mounting screws "B" or "A" (Figure 4-2) are installed.
3. Align holes in top panel with controls and jacks on PC board; then, carefully slide FRONT cover into position. BE SURE Push-to-Talk button is in its normal-resting position (NOT depressed), otherwise the P.T.T. switch may be damaged.

4. Turn transceiver over on its front side and be sure PC board is fully seated in FRONT cover. Now install two 4-40 machine screws (Figure 4-2, item "B").

#### 4-6-2. SA-44 Installation

1. Note that phenolic insulator is in position on foil side of SA-44 Tone Board. This insulator is essential to prevent shorts between the tone board and the main-board circuitry.
2. Align the seven socket pins on tone board with the corresponding male pins on transceiver main board. Push tone board down on pins until the phenolic insulator rests against the main board.
3. Check component side of tone board for a block of foam material designed to press against unit BACK cover and thus hold tone board in place.



#### 4-6-3. Battery Pack Installation

1. Turn Volume Control fully counter-clockwise to the OFF position.
2. Lay nicad battery pack on rear of transceiver main PC board, with the foam material toward PC board. The battery pack SHOULD NOT rest against SA-44 Tone Board.
3. Connect battery-pack to mating connector which is attached to ECOM-40U main PC board. BE SURE BACK COVER WILL NOT PINCH BATTERY WIRES.

#### 4-7. ALIGNMENT PROCEDURE - GENERAL

The unit is properly aligned when shipped from the factory, and realignment should never be necessary during normal life of the unit unless components are replaced within the instrument. In conjunction with the following alignment instructions, refer to the Component Location Diagram in this Section of the manual for location of the adjustment points.

Never attempt to realign circuitry of the unit unless test equipment specified for each section, or its equivalent, is available.

##### 4-7-1. Test Equipment Required

To properly align the ECOM-40U transceiver, the following test equipment, or its equivalent, is required:

- a) FM Sig. Generator, 450 - 600 MHz; Internally modulated with 1000 Hz; Deviation adj. from 0 to  $\pm 5$  kHz; Output level adj. from 0.2  $\mu$ V to 50K  $\mu$ V.
- b) Sweep Generator, 10.7 MHz or 450 - 600 MHz; sweep width approx. 25 kHz; sweep rate adj. to 40 Hz or less.
- c) Audio Generator, to supply 500 Hz, 1700 Hz, and 3,000 Hz.
- d) Sinadder, Helper Instrument Co.

- e) AC VTVM, Any accurate instrument.
- f) DC VTVM, with RF probe. Any accurate instrument.
- g) High-Impedance Detector, (see Fig. 4-3).

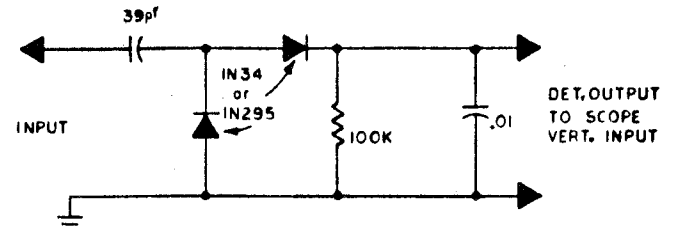


Figure 4-3. High-Impedance Detector

- h) Oscilloscope, DC to 8 MHz; DC coupled; calibrated vert. attenuator.
- i) Power Meter, 5-watts @ 500 MHz; or relative output indicating device (see Figure 4-4).

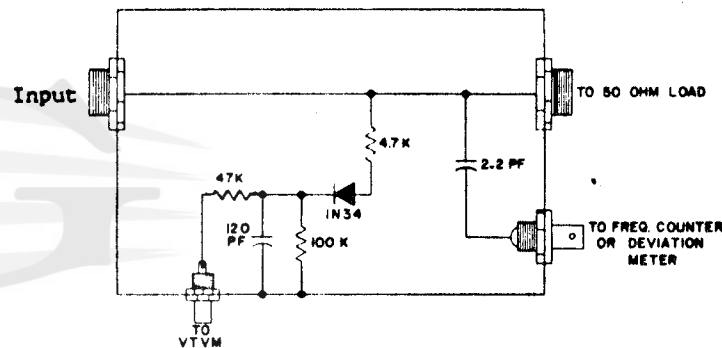


Figure 4-4. Relative Output Indicator

- j) Dummy Load, for item i above; 50-ohm, 5-watts.
- k) Deviation Meter, to read at least  $\pm 5$  kHz.
- l) Frequency Counter, DC to 600 MHz; or other accurate frequency measuring device.
- m) Power Supply, regulated, 9.6 VDC at 1 amp, minimum.

NOTE: An FM Communications Test Set such as a Cushman, Singer, or Wavetek, may be used in lieu of the above items.

ceive crystal to its proper frequency with the appropriate crystal netting inductor. See Figure 4-5.

#### 4-7-2. Preparation for Alignment

1. Remove BACK and FRONT covers as explained in Section 4-5, so that component side of PC board is accessible.
2. Power may be supplied by either a fully charged 9.6V battery pack, or a regulated bench supply capable of 1 Amp at 9.6 volts.

CAUTION: Observe correct polarity when connecting the power supply.

3. To facilitate transceiver test and alignment, the SA-44 tone board (if used) can be temporarily removed and a jumper wire substituted to complete audio circuitry from "Det. Audio" pin to "Audio to Vol. Cont." pin on ECOM-40U PC board. Refer to Component-Location drawing in this Section for pin locations.

NOTE: The SA-44 subaudible tone board (receive "decode" function only) can also be disabled by moving squelch override switch to its MONITOR position; in this event, the transmit "encode" will still be functional. The squelch knob is pulled OUT to MONITOR. This allows carrier-level squelch to operate, if desired, while the tone squelch is disabled.

#### 4-8. ALIGNMENT PROCEDURE - RECEIVER

1. Connect unit to 9.6V supply -- See CAUTION note above in step 2.

NOTE: To prevent accidental keying of transmitter during the receiver tests, temporarily short base of Q-206 to ground.

2. Couple frequency counter to tripler LO coil L110 with a "pick-up" loop. Turn unit ON, and adjust each re-

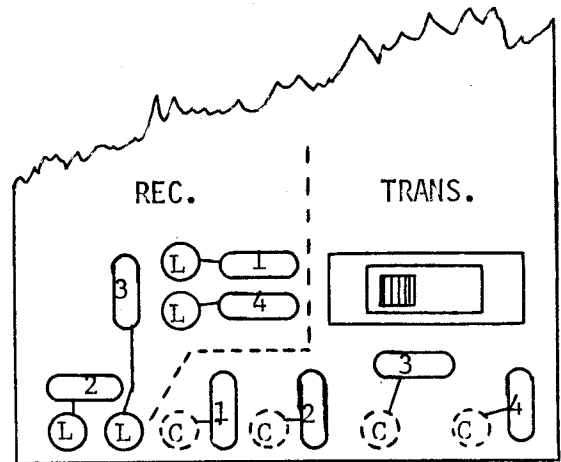


Fig. 4-5. Crystals & Inductors

NOTE: The crystal frequency is calculated as follows:

$$F_c = (\text{Rec. Freq.} - 10.7) \div 9, \pm .001\%$$

3. Turn unit OFF, and remove frequency counter.
4. Place channel-selector switch to ANY working channel position. This will be the test frequency.
5. Connect scope and SINAD-measuring equipment to unit speaker terminals.
6. Connect FM signal generator to antenna-input connector; then, set the generator on desired "receive" frequency, and modulate generator with a 1-kHz tone at  $\pm 5$  kHz deviation.
7. Turn unit ON, adjust squelch fully counterclockwise, adjust rec. volume control and generator RF output level to usable range of the SINAD-measuring equipment.

NOTE: During alignment, the volume control and generator-level control should be adjusted as necessary to avoid over-driving the unit.

8. Adjust L101, L102, L103, L104, L109,

C157, T101, T102, and T103 for best SINAD reading.

9. Repeat step 8 until no further improvement is obtained. Turn unit OFF and disconnect test equipment.

NOTE: An alternate (and preferred) method of adjusting T101 and T102 used with 10.7 MHz crystal filter, FL101, is by using a sweep generator, detector, and oscilloscope as explained below.

10. To sweep T101 and T102, proceed as follows:

- a) Connect detector input (Figure 4-6) to pin 16 of IF chip IC101; connect detector output to scope vertical input. Set scope vert. sensitivity to give a usable pattern with minimum sweep-generator input.

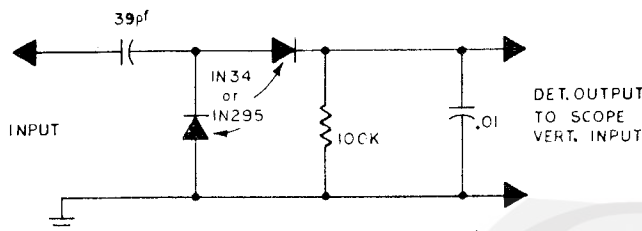


Figure 4-6. High-Impedance Detector

- b) Connection point for sweep-input signal depends upon frequency range of generator being used -- if generator covers 10.7 MHz, the sweep signal can be applied through a 39 pF capacitor to base of mixer Q-103; however, if generator covers the operating frequency, sweep signal can be applied directly to the antenna-input connector.
- c) Set generator sweep width for approximately 25 kHz at a sweep rate of NOT MORE than 40 Hz. During the alignment of T101 and T102, keep generator output low enough to prevent overdriving the detector.
- d) Turn unit ON, and adjust T101 and

T102 for a bandpass response similar to Figure 4-7. Ripple should be NOT MORE than 2 dB, and is generally 1 dB or less.

NOTE: After crystal filters have been properly aligned using a swept signal, do NOT change adjustments of T101 or T102.

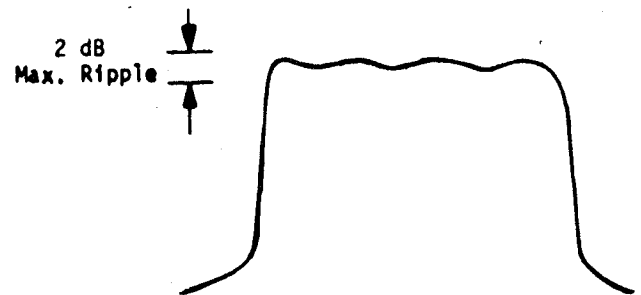


Figure 4-7. IF Response

11. Turn unit OFF, and disconnect test equipment.

#### 4-8-1. RF Input for 20-dB Quieting

1. Connect FM signal generator to unit antenna-input connector, and connect AC voltmeter to speaker terminals.
2. Turn signal generator modulation OFF and set generator RF attenuator for zero output. (Generator must have negligible leakage). Set generator to desired "receive" frequency.
3. Adjust transceiver volume control so that receiver background noise indicates -10 dB on the AC voltmeter.
4. Slowly increase setting of generator RF attenuator, until AC voltmeter indicates -30 dB. Note RF level indicated on signal generator attenuator. This is the RF input required to produce 20 dB receiver quieting. An input of -109 dBm (0.8 uV) will quiet receiver 20 dB.

#### 4-8-2. Squelch Operation

1. Set generator to desired "receive" frequency, and set modulation for a 1 kHz tone with  $\pm 5$  kHz deviation. Set RF attenuator for zero RF output.
2. Turn volume control to full volume; now, rotate squelch control fully ccw (squelch OFF), and then rotate squelch control slowly cw until unit just squelches. The receiver should now be completely silent (no RF signal input).
3. Increase setting of signal-generator RF attenuator until receiver squelch just fully opens. The RF attenuator should read no higher than  $-113$  dBm (0.5  $\mu$ v).
4. With no RF generator input, adjust receiver volume to maximum, and adjust squelch control fully clockwise (full squelch). Increase signal generator output level (modulated with 1 kHz tone at  $\pm 5$  kHz deviation) until squelch just opens. The signal generator attenuator should read no more than 2.0  $\mu$ v.

#### 4-8-3. Audio Output Power

1. Set FM signal generator on desired receive frequency, and set modulation for  $\pm 5$  kHz deviation using 1 kHz audio. Set RF attenuator in the vicinity of 5  $\mu$ v.
2. Turn receiver volume control fully clockwise. The AC voltmeter, connected to speaker terminals, should indicate not less than 1.8 volts.
3. Set signal generator for  $\pm 5$  kHz deviation using 500 Hz audio, and note that AC voltmeter indicates at least 1.8 volts with unit volume control fully clockwise.
4. Set signal generator for  $\pm 5$  kHz deviation using 3 kHz audio. Again the AC voltmeter should indicate at least 1.8 volts at maximum setting of the transceiver volume control.

5. If base of transmit oscillator Q206 was shorted to ground during receiver alignment, remove this short.
6. If SA-44 tone board was removed in step 3 of Section 4-7-2, remove jumper and re-install tone board.

NOTE: If any adjustments are needed for tone board, refer to the SA-44 Maintenance Manual.

#### 4-9. ALIGNMENT PROCEDURE - TRANSMITTER

##### 4-9-1. Preparation for Alignment

1. Refer to Section 4-7-2 in this Section of Maintenance Manual.
2. Attach a 50-ohm power meter, or a relative output indicating device (Figure 4-4), to transceiver antenna connector.
3. Preset deviation potentiometer R201 to its lowest setting, by rotating it fully COUNTERCLOCKWISE, as viewed from component side of ECOM-40U main PC board.

##### 4-9-2. Frequency and Power Alignment

NOTE: The peak voltage measurements in following steps of this Section are made with an RF VTVM. Key the transmitter ONLY when adjustments are being made.

1. Place channel-selector switch to an operative channel.
2. Connect VTVM RF probe to base of Q-207 and key transmitter. Adjust L209 and L210 for a peak voltage indication on the VTVM.
3. Move RF probe to base of Q208. Key transmitter and adjust slugs in L211 and L212 for a peak reading on VTVM.
4. Move RF probe to base of Q209. Key transmitter and adjust L213 and L214 for a peak voltmeter reading.
5. Remove RF probe. Key transmitter and, using the 50-ohm power meter or relative output device, adjust C255,

C256, C259, C264, and C265 for maximum output indication.

6. Touch-up tuning of L209, L210, L211, L212, L213, L214, C255, C256, C259, C264 and C265 for maximum indication on the power or relative-output indicator.

#### 4-9-3. Transmit Crystal Installation & Frequency Netting

1. Refer to Figure 4-5 for crystal and netting-capacitor locations (T).

NOTE: TRANSMIT crystals are mounted on component-side of transceiver PC board, while the netting trimmers are mounted on FOIL side of board.

2. With a crystal installed and channel switch in corresponding position, connect a frequency-indicating device to transceiver --- either by loop coupling to final power stage or, by connecting to jack on relative output device (Figure 4-4).
3. Key transmitter, and adjust appropriate crystal-netting capacitor for correct frequency.
4. Repeat steps 2 and 3 for each crystal installed in transceiver.

#### 4-9-4. Power-Measurement Procedure

1. Key transmitter, and note RF power-output reading. Typically, the power should be approximately 1.0 watt on each channel installed in unit.

#### 4-9-5. Subaudible-Tone Deviation Adjustment (If Used)

1. Connect unit to relative output indicating device (Figure 4-4); then, connect a Deviation Meter to "Freq. Counter/Deviation Meter" output of the relative output indicator.
2. Adjust FREQ potentiometer, R401, on SA-44 board for desired subaudible tone as given in SA-44 Service Man-

3. Key transmitter, and adjust S.A. DEV potentiometer, R405, on SA-44 for a deviation of  $\pm 1$  kHz as shown on Deviation Meter.

#### 4-9-6. Carrier Deviation Adjustment

1. Preset DEVIATION-level pot., R201, by rotating it fully CCW as viewed from component-side of main board, and then backing pot. off approx. 1/4 turn.
2. Key transmitter, and feed a 1700 Hz tone into transceiver microphone. Watching Deviation Meter, increase audio tone (1700 Hz) level until no further increase in deviation is indicated. The modulator stage is now saturated.
3. Key transmitter, and adjust DEVIATION potentiometer, R201, for a  $\pm 5$  kHz reading on Deviation Meter.

NOTE: If ECOM-40U is equipped with SA-44 Tone Board, the  $\pm 5$  kHz deviation consists of the combined 1700 Hz audio and the subaudible tone; whereas, if SA-44 is NOT used the  $\pm 5$  kHz deviation is due ONLY to the 1700 Hz audio tone.

4. Turn transceiver OFF, and disconnect all test equipment. Replace front cover, install battery pack, and replace rear cover.

#### 4-10. FREQUENCY CHANGES

Installation of new frequencies in this transceiver can be easily accomplished by performing the following steps:

NOTE: To aid in obtaining proper crystals for the ECOM-40U, complete crystal specifications are given in Section 4-11 of this manual.

1. Remove BACK and FRONT covers from ECOM-40U, as explained in Sec. 4-5 of this manual.
2. Locate mounting position for the new crystal(s). Refer to Figure 4-5 for

TRANSMIT and RECEIVE crystal locations.

NOTE: When installing new crystals, BE SURE that transmit and receive crystals are properly paired.

3. Insert leads of new crystal through appropriate holes in PC board; then, carefully solder leads to copper pads on back (foil) side of board.

NOTE: Crystal leads MUST BE trimmed close to PC board, to prevent them from cutting into battery pack.

4. To bring the receive crystal(s) "on frequency," perform steps 2 and 3 given in Section 4-8 of this manual.

5. To adjust transmit crystal(s) "on frequency," perform steps 1 through 4 given in Section 4-9-3 of this manual.

NOTE: If new frequencies differ appreciably from original alignment frequencies, it may be necessary to completely re-align transmitter and receiver circuits as detailed in Sections 4-8 and 4-9.



#### 4-10-1. Transmit Crystals

Parallel Mode:	$C_p = 32 \text{ pF}$
Fundamental Cut Tolerance:	$\pm .001\%$ Max. calibration tolerance at $25^\circ\text{C}$ $\pm .0005\%$ Max. drift over temperature range
Temperature Range:	$0^\circ$ to $+50^\circ\text{C}$
Holder:	HC-25/U
Crystal Frequency:	<u>Operating Frequency</u> 36
Series Resistance:	25 ohms, maximum
Drive Level:	1 mW
Genave Part Number:	2300340

#### 4-10-2. Receive Crystals

Parallel Mode:	$C_p = 32 \text{ pF}$
Third Overtone Tolerance:	$\pm .001\%$ calibration tolerance at $25^\circ\text{C} \pm 1^\circ\text{C}$ $\pm .001\%$ Max. drift over temperature range
Temperature Range:	$0^\circ$ to $+50^\circ\text{C}$
Holder:	HC-25/U
Crystal Frequency:	<u>(Operating Frequency - 10.7 MHz)</u> 9
Series Resistance:	40 ohms, maximum
Drive Level:	1 mW
Genave Part Number:	2300341

## 4-11. ECOM-40U DC VOLTAGES

### 4-11-1. Receiver Voltages

- a) Channel-Switch set to channel WITHOUT crystal, or set switch between channels.
- b) No signal input.
- c) P.T.T. switch in "Rec." position.
- d) Unit connected to +9.6V supply.
- e) Volume at "Minimum."
- f) Squelch control fully "Counterclockwise."
- g) Voltages measured with 10 Meg. input VTVM.
- h) Voltages may vary +20%.



Q101	E	7.1V	IC101	1	8.4V
	B	6.4V		2	7.8V
	C	1.9V		3	8.0V
				4	8.5V
				5	1.0V
				6	1.0V
Q102	E	1.9V		7	1.1V
	B	1.2V		8	8.5V
	C	0V		9	3.0V
				10	2.0V
				11	2.3V
				12	1.3V
Q103	E	0V		13	0V
	B	.75V		14	1.3V
	C	4.7V		15	0V
				16	2.1V
Q104	E	3.1V	IC102	1	1.3V
	B	3.9V		2	0V
	C	9.6V		3	0V
				4	0V
				5	4.8V
Q105	E	0V		6	9.6V
	B	.2V		7	4.9V
	C	9.6V		8	1.3V





# ECOM-40U UHF-FM MAINTENANCE MANUAL

**LIMITED**

 **WARRANTY** 

General Aviation Electronics, Inc. (Genave), warrants this product to be free from material defects for a period of 90 days from the date of purchase, provided the warranty registration card properly filled out is returned by the purchaser to Genave within 10 days after purchase. This warranty is limited to the original retail purchaser and is not extended to second owners of the product.

Our obligation under this warranty is limited to replacement of any parts (except periodic maintenance items such as bulbs, fuses, etc.) which, upon our examination, appear to us to be defective in materials or workmanship. The parts will be replaced within 45 days after receipt of the unit, provided the unit is delivered to the Factory (Customer Service Dept., General Aviation Electronics, 4141 Kingman Drive, Indianapolis, Indiana 46226) within 90 days after the date of purchase, shipping prepaid. All shipping costs and labor charges shall be born by the purchaser.

The owner may elect to have the unit repaired at an authorized Genave repair facility in which case Genave, within 45 days after receipt of the unit, will replace only those defective parts returned shipping prepaid to the Factory (Customer Service Dept., General Aviation Electronics, 4141 Kingman Drive, Indianapolis, Indiana 46226). Purchaser shall bear any and all other costs including but not limited to labor, transportation and freight.

This warranty does not apply to defects, malfunction, or breakage due to improper installation or to the servicing thereof by other than an authorized Genave dealer nor to units that have been damaged by lightning or other acts of God, excess current, or any units that have had serial number altered or removed. Abuse, misuse, tampering, submersion in water or willful destruction of the unit will also void this warranty.

This warranty gives you specific legal rights. You also have implied warranty rights. In the event of a problem with warranty service or performance, you may be able to go to a small claims court, a State court, or a Federal District court.

**Genave offers this warranty in lieu of any and all other guarantees or warranties, either EXPRESSED or IMPLIED, including but not limited to warranties of merchantability and/or fitness for a particular purpose. Any implied warranties are specifically and expressly limited to the 90-day period specified herein. Damages for breach of any warranties, either expressed or implied are limited to replacement of any defective parts as specified herein and any other incidental or consequential damages are expressly excluded.**

General Aviation Electronics, 4141 Kingman Drive, Indianapolis, Indiana 46226 -- Area 317-546-1111

## Genave

4141 Kingman Drive, Indianapolis, Indiana 46226

AREA (317) 546-1111

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Printed in U.S.A. Aug. 1981 (Rev. )

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# SECTION I

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## GENERAL INFORMATION

### 1-1. INTRODUCTION

This manual contains all the information normally required to license, implement, and operate the Genave Model ECOM-40U UHF-FM Business-Band, handheld transceiver.

The maintenance manual for the ECOM-40U contains all the above information, as well as unit schematics, alignment data and parts lists.

### 1-2. DESCRIPTION

**NOTE:** The ECOM-40U transceiver has the capability of transmitting and receiving on frequencies assigned by the F.C.C. to the various Business Radio Services, such as: Land Transportation, Industrial Radio, and Public Safety, and thus **MUST BE LICENSED PRIOR TO ACTUAL USE**. While the seller may assist in filing the license application, the responsibility lies solely with the prospective licensee to assure that transmitting equipment is covered by a valid station license.

The Genave ECOM-40U is a portable handheld transceiver, designed to provide reliable, high-quality communications for the various business services authorized under F.C.C. Rules Parts 22, 90, and 95.

The radio was under strict quality control during its fabrication, and was thoroughly checked prior to shipment from the factory. It is sturdily constructed, and will provide many years of satisfactory operation if given reasonable care and handling.

The ECOM-40U UHF-FM transceiver is designed for the transmission and reception of frequency-modulated (16F3) RF signals on any one of four channels within the range from 450 to 512 MHz. A four-position slide switch selects

the desired operating channel; the frequency being dependent upon crystals installed within the instrument. However, the maximum spread between highest and lowest frequencies installed in the unit is 3 MHz for receive frequencies, and 5.5 MHz for transmit frequencies.

The receiver and transmitter circuits each utilize standard quartz crystals with a frequency-netting coil for each rec. crystal, and a netting capacitor for each trans. crystal to allow precise frequency adjustments.

If the transceiver is equipped with the SA-44 sub-audible tone option, a tone-override switch is provided to disable receiver tone squelch for channel monitoring purposes, and to permit communications with other transceivers which are NOT equipped with your sub-audible tone frequency.

The receiver is a crystal-controlled, dual-conversion superheterodyne employing a 2-pole monolithic crystal filter at 10.7 MHz and a 4-pole ceramic filter at 455 kHz. A single integrated-circuit chip performs 2nd L.O., 2nd mixer, and 2nd IF (455 kHz) amplification functions. The 10.7 MHz 1st IF provides good image rejection, while the 455 kHz 2nd IF improves receiver stability. The receiver audio-output power is approx. 350 mW at less than 10% distortion.

The transmitter provides a typical RF output power of 1 watt, minimum, into a standard 52-ohm antenna system over the frequency range from 450.0 MHz to 512.0 MHz. The frequency stability is  $\pm 0.0005\%$  from  $-30$  to  $+50^{\circ}\text{C}$ . A 1-kHz modulating audio signal will give a deviation of  $\pm 5$  kHz maximum.

The transceiver is complete with detachable antenna, 9.6-volt nicad battery pack, and built-in speaker/microphone; however, provisions are made for

#### 4-11-2. Transmitter Voltages

- a) Channel-Switch set to channel WITHOUT crystal, or set switch between channels, except for tests marked \*\*. These tests are made WITH the detector shown below, and with Channel-Switch set to operative channel.
- b) P.T.T. switch in "Transmit" position.
- c) Unit connected to +9.6V supply.
- d) Voltages measured with 10 Meg. input VTVM, except tests marked \*\* use detector ahead of VTVM. Voltages may vary 20%, except voltages taken taken with detector, which may vary as much as 40%.

Q201 E 0V  
 B .6V  
 C 1.9V

Q207 E 0V  
 B 3.0V \*\*  
 C 6.5V \*\*

Q202 E 3.6V  
 B 2.2V  
 C 0V

Q208 E 0V  
 B 3.2V \*\*  
 C 14.0V \*\*

Q203 E 0V  
 B .6V  
 C 2.2V

Q209 E 0V  
 B 4.0V \*\*  
 C 23.0V \*\*

Q204 E 0V  
 B .6V  
 C 2.1V

Q210 E 0V  
 B 6.0V \*\*  
 C 8.5V \*\*

Q205 E 6.7V  
 B 6.2V  
 C 0V

Q211 E 0V  
 B 6.5V \*\*  
 C 13.0V \*\*

Q206 E 1.9V  
 B 1.1V  
 C 9.6V

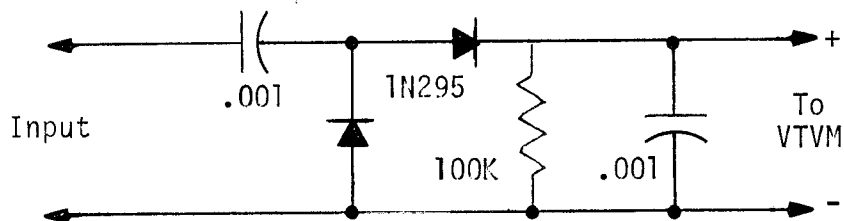


Figure 4-8. Detector

### 4-12. COMPONENT LAYOUT AND SCHEMATICS

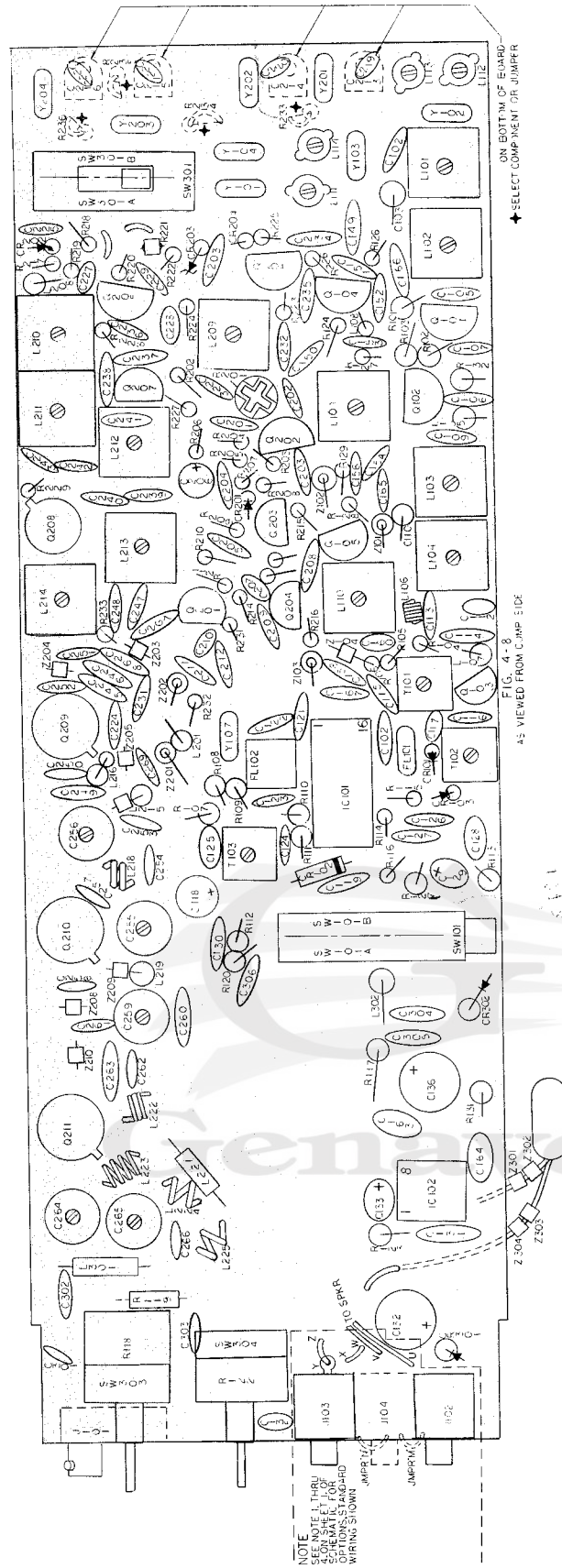
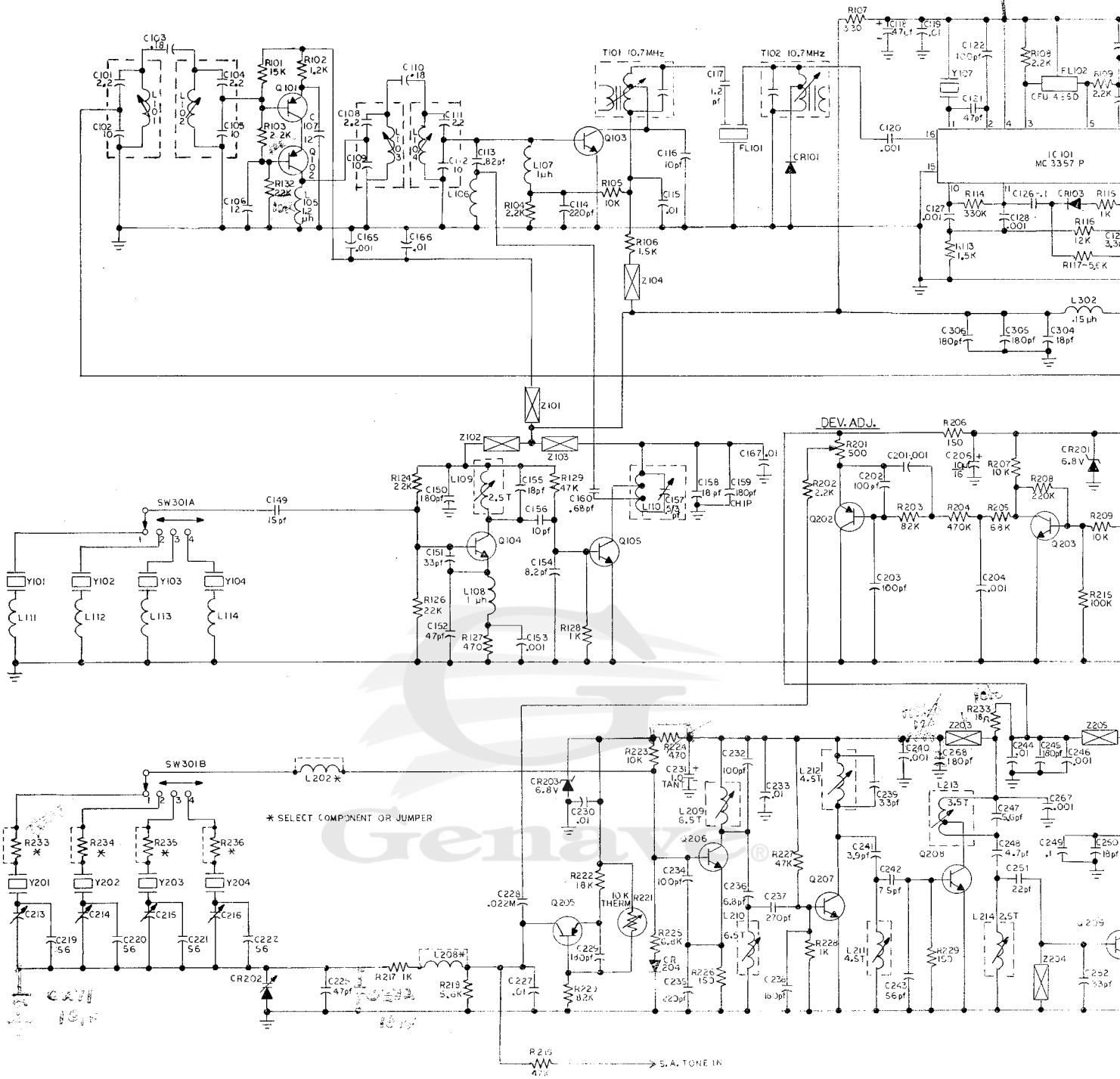
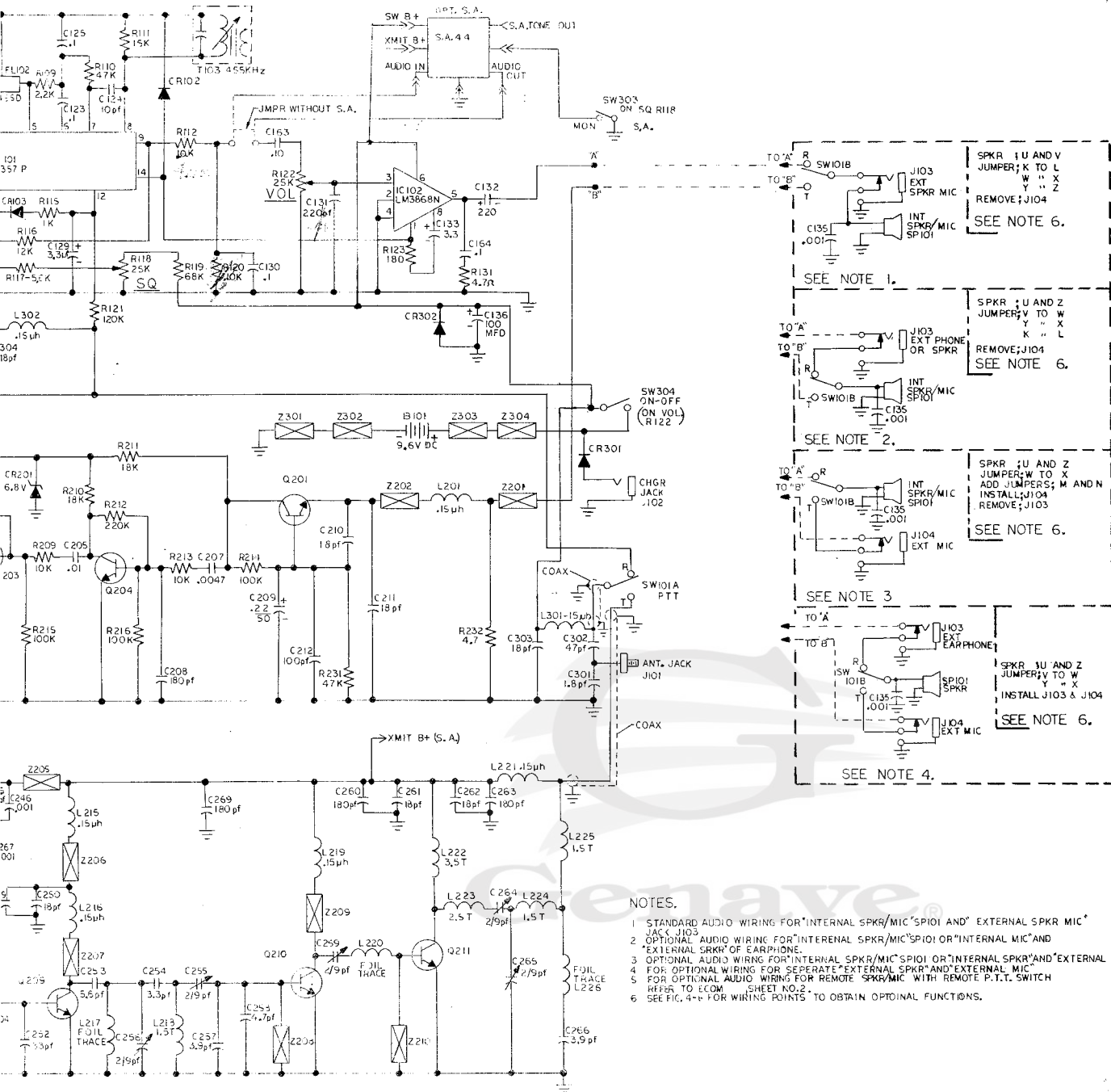


Figure 4-9. ECOM-40U PC Board Component Layout.



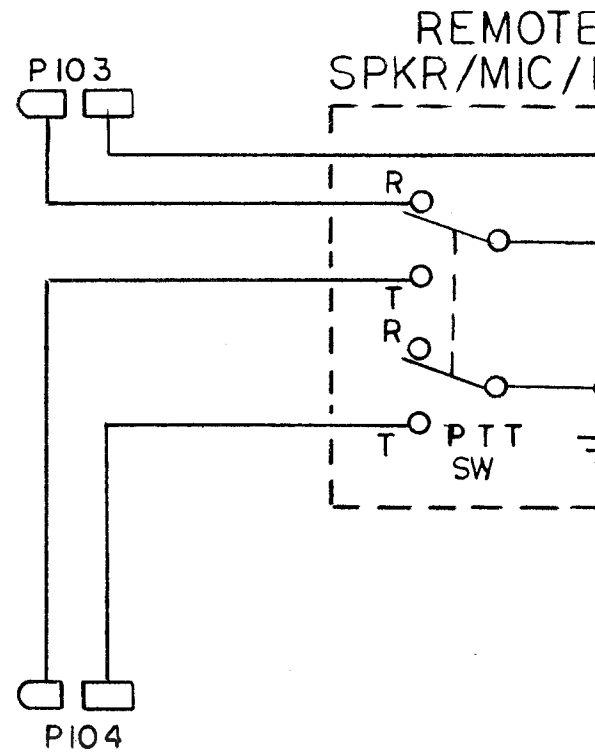
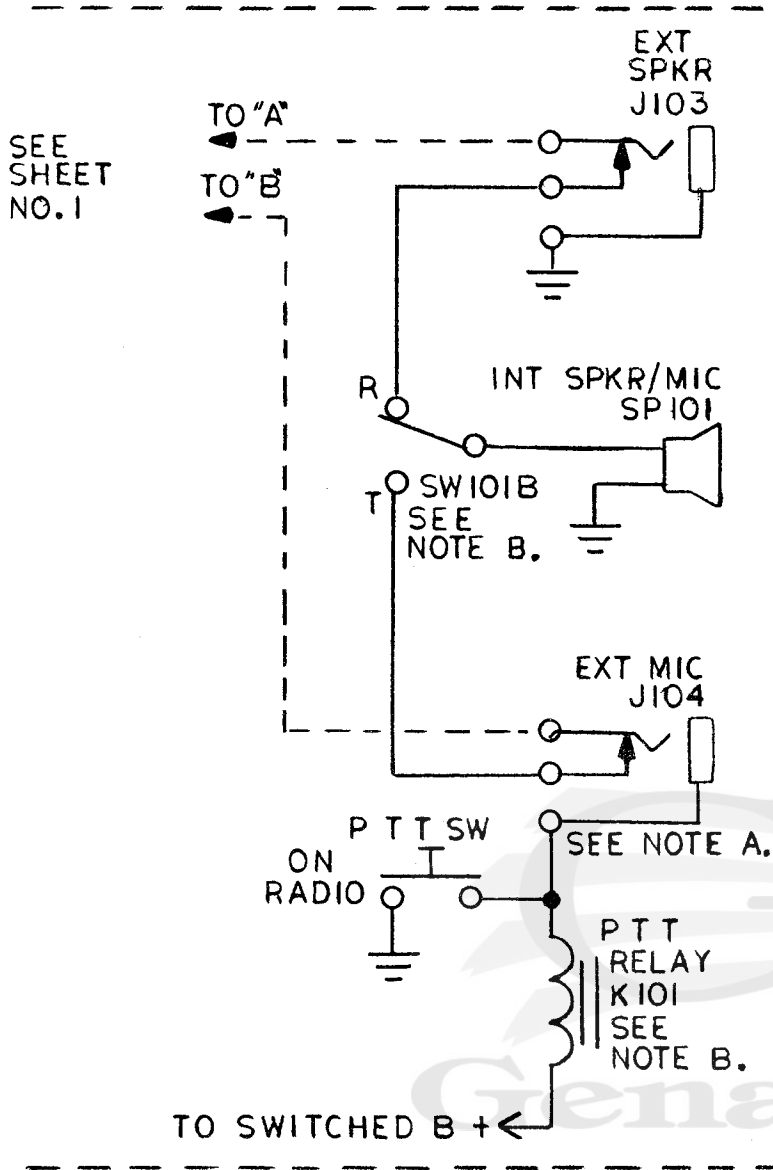


NOTES.

1. STANDARD AUDIO WIRING FOR INTERNAL SPKR/MIC SPIO1 AND EXTERNAL SPKR MIC JACK J103
2. OPTIONAL AUDIO WIRING FOR INTERNAL SPKR/MIC SPIO1 OR INTERNAL MIC AND EXTERNAL SPKR OF EARPHONE.
3. OPTIONAL AUDIO WIRING FOR INTERNAL SPKR/MIC SPIO1 OR INTERNAL SPKR AND EXTERNAL MIC
4. FOR OPTIONAL WIRING FOR SEPERATE EXTERNAL SPKR AND EXTERNAL MIC
5. FOR OPTIONAL AUDIO WIRING FOR REMOTE SPKR/MIC WITH REMOTE P.T.T. SWITCH REFER TO ECOM SHEET NO.2.
6. SEE FIG. 4-6 FOR WIRING POINTS TO OBTAIN OPTIDNAL FUNCTIONS.

Figure 4-10. ECOM-40U Transceiver Schematic

## ECOM AUDIO WIRING



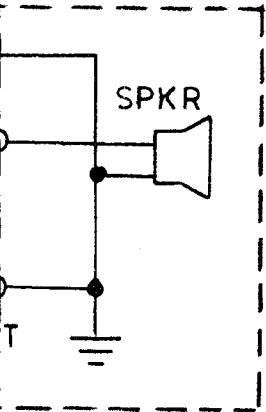
### NOTES:

- A. FOR REMOTE SPKR/MIC WIRING, THE SHELL OF MIC JACK J104 IS USED TO KEY RELAY.
- B. FOR REMOTE KEYING, PTT SW IS REPLACED BY A DPDT.

SHEET 2



NOTE  
MIC/PTT



WITH REMOTE KEYING, THE  
J104 IS NOT GROUNDED, BUT  
RELAY K101.  
PTT SWITCH SW101 (A & B)  
DPDT RELAY K101.



2 OF 2

## 4-13. SPEAKER/MIC. WIRING OPTIONS

### 4-13-1. Optional External Speaker/Mic.

Standard audio wiring for the ECOM-40U utilizes INTERNAL speaker/mic., SP101. Plugging an EXTERNAL speaker/mic. into J103 disables the internal unit. Note 1 on the Schematic (Figure 4-10) depicts these audio connections, while Figure 4-9 shows physical location of jumpers and jacks.

### 4-13-2. Optional Ext. Speaker/Earphone

This option utilizes INTERNAL speaker/mic. SP101, until an EXTERNAL speaker or earphone is plugged into jack J103; then, reception is by means of the external unit, while the internal unit serves as the microphone. Note 2 on the Schematic (Figure 4-10) illustrates the speaker/mic. connections, while Figure 4-9 shows physical location of jumpers and jacks.

### 4-13-3. Optional Ext. Microphone

This wiring option uses the INTERNAL speaker/mic., SP101, until an EXTERNAL microphone is plugged into jack J104. The internal unit then functions as the speaker, while the external unit becomes the microphone. Note 3 on ECOM-40 Schematic (Figure 4-10) gives the audio connections, while Figure 4-9 shows the physical location of jumpers and jacks.

### 4-13-4. External Earphone and/or Mic.

Again, this wiring utilizes INTERNAL speaker/mic. SP101, if earphone jack J-

103 and mic. jack J104 are NOT used. An earphone or speaker may be plugged into J103 for reception, while the internal unit functions as the microphone. If desired, an external microphone can be plugged into J104, while the internal unit functions as the speaker. One of the more practical uses for this option is with a headset having an attached boom microphone; the headset is plugged into J103 and the microphone is plugged into J104.

Note 4 on the Schematic (Figure 4-10) depicts these audio connections, and Figure 4-9 shows physical placement of jumpers and jacks.

### 4-13-5. Optional Ext. Speaker/Mic/PTT

With this option The INTERNAL speaker/mic., SP101, performs the usual receive and transmit functions if headset jack J103 and mic. jack J104 are NOT used. Basically, this option is designed to provide remote speaker, microphone, and push-to-talk operation, with a minimum number of connecting wires, while the transceiver is carried in a belt mounted holster. The speaker or earphone plugs into J103 and the microphone/PTT plugs into mic. jack J104. The normal PTT switch SW101 MUST BE replaced by DPDT relay K101. An auxiliary PTT switch can be added to the ECOM-40U, if desired.

Note 5 on Schematics (Figures 4-10 and 4-11) shows the audio wiring required for this option. Figure 4-9 shows the physical location of jumpers and jacks.

# SECTION V

## PARTS LIST

### 5-1. INTRODUCTION

This section of the Maintenance Manual lists replacement electronic parts, as well as major mechanical components, for use in the Genave ECOM-40U, VHF-FM Business-Band, Handheld Transceiver.

The first column in the Parts List contains component REFERENCE NUMBERS. The three-digit circuit reference on the schematic is represented in the REFERENCE NUMBER column by the last one or two digits. The first digit represents

the assembly, or section, of unit in which the part is located.

The assembly or section number (100, 200, ...) is indicated next to the reference number heading; that is, CAPACITORS C100, or CAPACITORS C200, etc.

In general, 100-series numbers pertain to receiver components, while the 200-series numbers are used for transmitter parts. Genave part numbers for replacement items appear in the PART NUMBER column, while a brief description for each part is shown in the DESCRIPTION column.

<u>Reference Number</u>	<u>Part Number</u>	<u>Description</u>
<u>CAPACITORS C100</u>		
1, 4, 8, 11	1520091	NPO EDPT, 2.2 pF $\pm$ .25 pF, S.T. 3X4
2, 5, 9, 12, 16, 24, 56	1520097	NPO EDPT, 10 pF $\pm$ .25 pF, S.T. 3X4
3, 10	1510002	NPO Gimmick, .18 pF $\pm$ 10%
6, 7	1520098	NPO EDPT, 12 pF $\pm$ .25 pF, S.T. 3X4
13	1520090	P100 EDPT, .82 pF $\pm$ .25 pF, S.T. 3X4
14, 31	1520034	Y5E Disc, 220 pF $\pm$ 10%, 25V
15, 19, 66, 67	1540215	Mylar, .01 uF $\pm$ 10%, 100V
17	1520101	NPO EDPT, 1.2 pF $\pm$ .25 pF, S.T. 3X4
18	1541009	Elect., 47 uF, 16V
20, 27, 28, 35, 53, 65	1520196	Z5U Disc, .001 uF, 25V
21, 52	1520202	N150 Disc, 47 pF $\pm$ 5%
22	1520195	N2200 Disc, 100 pF $\pm$ 10%, 25V
23, 25, 26, 30, 63 64	1520243	Z5U Disc, .1 uF $\pm$ 80 -20%, 25V

<u>Reference Number</u>	<u>Part Number</u>	<u>Description</u>
<u>CAPACITORS C100 (Cont'd)</u>		
29, 33	1550003	Tant., 3.3 uF, 35V
32	1540221	Elect., 220 uF, 25V
36	1540204	Elect., 100 uF, 16V
49	1520009	NPO Disc, 15 pF $\pm 10\%$
50	1520208	N2200 Disc, 180 pF
51	1520191	N750 Disc, 33 pF $\pm 10\%$ , 25V
54	1520088	NPO EDPT, 8.2 pF $\pm .25$ pF, S.T. 3X4
55, 58	1520189	N220 Disc, 18 pF $\pm 10\%$
57	1570017	Trimmer, .5 to 3 pF, R. Triko
59	1520242	Viclan (Chip), 180 pF
60	1520087	P100 EDPT, .68 pF $\pm .25$ pF, S.T. 3X4

CAPACITORS C200

1, 4, 40, 46, 67	1520196	Z5U Disc, .001 uF, 25V
2, 3, 12, 32	1520195	N2200 Disc, 100 pF $\pm 10\%$ , 25V
5, 27, 30, 33, 44	1540215	Mylar, .01 uF $\pm 10\%$ , 100V
6	1540202	Elect., 10 uF, 16V
7	1540216	Mylar, .0047 uF $\pm 10\%$ , 100V
8, 29, 38, 45, 60, 63, 68, 69	1520208	N2200 Disc, 180 pF
9	1550001	Tant., .22 uF, $\pm 20\%$ , 35V
10, 11, 50, 61, 62, 71, 72	1520189	N220 Disc, 18 pF $\pm 10\%$
13, 14, 15, 16	1570014	Trimmer, 2 to 10 pF
19, 20, 21, 22, 43	1520203	N330 Disc, 56 pF $\pm 5\%$ , 25V
25	1520202	N150 Disc, 47 pF $\pm 5\%$

<u>Reference Number</u>	<u>Part Number</u>	<u>Description</u>
<u>CAPACITORS C200 (Cont'd)</u>		
28	1540214	Mylar, .022 uF $\pm 10\%$ , 100V
31	1550002	Tant., 1 uF $\pm 20\%$ , 35V
34	1520244	N330 Disc, 100 pF, S.T.
35	1520245	N750, 220 pF, S.T.
36	1520089	NPO EDPT, 6.8 pF $\pm .25$ pF, S.T. 3X4
37	1520038	N1500 Disc, 270 pF $\pm 10\%$
39, 52	1520191	N750 Disc, 33 pF $\pm 10\%$ , 25V
41, 57, 66	1520096	NPO EDPT, 3.9 pF $\pm .25$ pF, S.T. 3X4
42	1520204	N750 Disc, 75 pF $\pm 5\%$ , 25V
47, 53	1520093	NPO EDPT, 5.6 pF $\pm .25$ pF, S.T. 3X4
48, 58	1520095	NPO EDPT, 4.7 pF $\pm .25$ pF, S.T. 3X4
49	1520243	Z5U Disc, .1 uF $\pm 80 -20\%$ , 25V
51	1520092	NPO EDPT, 22 pF $\pm .25$ pF, S.T. 3X4
54	1520094	NPO EDPT, 3.3 pF $\pm .25$ pF, S.T. 3X4
55, 56, 59, 64, 65	1570015	Trimmer, 2 to 9 pF, Sprague GYA1000

Genave®

CAPACITORS C300

1	1520100	NPO EDPT, 1.8 pF $\pm .25$ pF, S.T. 3X4
2	1520202	N150 Disc, 47 pF $\pm 5\%$
3, 4	1520189	N220 Disc, 18 pF $\pm 10\%$
5, 6	1520208	N2200 Disc, 180 pF

<u>Reference Number</u>	<u>Part Number</u>	<u>Description</u>
<u>DIODES CR100</u>		
1, 2, 3	4810017	Sil., Switching, 1N4148
4	<del>4810017</del> 4810007	<del>Gen. Purpose, 100 PRV, 1A, 1N4001</del> Zener, 6.8V, 1N4736
<u>DIODES CR200</u>		
1, 3	4810007	Zener, 6.8V, 1N4736
2	4810013	Gen. Purpose, 100 PRV, 1A, 1N4001
4	4810017	Sil., Switching, 1N4148
<u>DIODES CR300</u>		
1, 2	4810013	Gen. Purpose, 100 PRV, 1A, 1N4001
<u>FILTERS FL100</u>		
1	2303504	10.7 MHz Monolithic Crystal (1/2 of matched set)
2	2350050	455 kHz, Ceramic, CFU-455E
<u>INTEGRATED CIRCUITS IC100</u>		
1	3130038	FM IF and Discr., MC3357P
2	3130025	Audio Amplifier, LM386
<u>INDUCTORS L100</u>		
1, 2, 3, 4	1800411	Coil, 2-1/2T, Alum. Slug, P. Smith
5	1800359	Coil, 1.2 uH
6	1800267	Coil, 4-1/2T, .062" ID, #26 Wire
7	1800350	Coil, 1 uH
8, 9	---	Not Assigned
10	1800241	Coil, 4T, .234" ID Buss Wire
11, 12, 13, 14	1800308	Coil, 8-1/2T P. Smith 425

<u>Reference Number</u>	<u>Part Number</u>	<u>Description</u>
<u>INDUCTORS L200</u>		
1, 15, 16, 19, 21	1800368	Coil, .15 uH, Wilco #ES-3279
2 thru 8	---	Not Assigned
9, 10	1800306	Coil, 6-1/2T, P. Smith
11, 12	1800322	Coil, 4-1/2T (wide-spacing), P. Smith
13	1800145	Coil, 3-1/2T center-tapped, P. Smith
14	1800320	Coil, 2-1/2T, P. Smith
18, 24, 25	1800238	Coil, 1-1/2T RHH, .1" ID, #20 Buss Wire
22	1800268	Coil, 3-1/2T LHH, .1" ID
23	1800239	Coil, 2-1/2T LHH, .1" ID, #20 Buss Wire

INDUCTORS L300

1, 2	1800368	Coil, .15 uH, Wilco #ES-3279
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JACKS J100

2	2100263	Jack, Charging, SJ465
3	2100095	Jack, Earphone

TRANSISTORS Q100

1, 2	4800078	Sil., PNP, H69
3	4800064	Sil., NPN, Low-Noise Mixer, MPS H20-5
4, 5	4800024	Sil., NPN, RF, 2N3563

<u>Reference Number</u>	<u>Part Number</u>	<u>Description</u>
<u>TRANSISTORS Q200</u>		
1, 3, 4	4800033	Sil., NPN, Gen. Pur., 2N5172
2	4800073	Sil., PNP, Darlington, MPS-A64
5	4800043	Sil., PNP, Audio, 2N5227
6, 7	4800024	Sil., NPN, RF, 2N3563
8	4804427	Sil., NPN, RF, 2N4427
9, 10, 11	4806089	Sil., NPN, RF Power, MRF629 or SD1444

RESISTORS R100

1, 11	4710030	Film, 15K, 5%, 1/4W
2	4710018	Film, 1.2K, 10%, 1/4W
3, 24, 26, 32	4710032	Film, 22K, 5%, 1/4W
4, 8, 9	4710021	Film, 2.2K, 5%, 1/4W
5, 12, 20	4710029	Film, 10K, 5%, 1/4W
6, 13	4710019	Carb., 1.5K, 10%, 1/4W
7	4710012	Film, 330-ohms, 5%, 1/4W
10, 29	4710035	Film, 47K, 5%, 1/4W
14	4710080	Carb., 330K, 10%, 1/4W
15, 28	4710017	Film, 1K, 5%, 1/4W
16	4710050	Film, 12K, 5%, 1/4W
17	4710026	Film, 5.6K, 5%, 1/4W
18	4760081	Pot., 25K (Sq.), w/Push-Pull Sw., PC Lugs
19	4710068	Carb., 68K, 10%, 1/4W
21	4710054	Film, 120K, 5%, 1/4W
22	4760081	Pot., 25K (Vol.) w/On-Off Sw., PC Lugs



<u>Reference Number</u>	<u>Part Number</u>	<u>Description</u>
<u>RESISTORS R100 (Cont'd)</u>		
23	4710010	Film, 180-ohm, 5%, 1/4W
27	4710013	Carb., 470-ohm, 10%, 1/4W
31	4710048	Carb., 4.7-ohm, 10%, 1/4W

RESISTORS R200

1	4760078	Var., 500-ohms, Alps
2	4710021	Film, 2.2K, 5%, 1/4W
3, 20	4710037	Carb., 82K, 10%, 1/4W
4	4710039	Carb., 470K, 10%, 1/4W
5	4710068	Carb., 68K, 10%, 1/4W
6, 26, 29	4710009	Film, 150-ohm, 5%, 1/4W
7, 9, 13, 23	4710029	Film, 10K, 5%, 1/4W
8, 12	4710041	Carb., 220K, 10%, 1/4W
10, 11, 22	4710031	Film, 18K, 5%, 1/4W
14, 15, 16	4710038	Film, 100K, 5%, 1/4W
17, 28	4710017	Film, 1K, 5%, 1/4W
18	4710026	Film, 5.6K, 5%, 1/4W
19, 27, 31	4710035	Film, 47K, 5%, 1/4W
21	4760034	Thermistor, 10K, Fennal JA41J1
24	4710013	Carb., 470-ohms, 10%, 1/4W
25	4710027	Film, 6.8K, 5%, 1/4W
32	4710048	Carb., 4.7-ohms, 10%, 1/4W
33	4710001	Carb., 10-ohms, 10%, 1/4W

<u>Reference Number</u>	<u>Part Number</u>	<u>Description</u>
<u>Switches SW300</u>		
1	5100125	2P4T, Chan. Sel., Alco MSS-2450
2	5100096	4PDT, Push-to-Talk
3	---	Squelch/Mon., Part of R118
4	---	On/Off, Part of R122

TRANSFORMERS T100

1, 2	5600044	Transformer, 10.7 MHz IF
3	5600043	Transformer, 455 kHz

CRYSTALS Y100

1, 2, 3, 4	2300341	Receive Crystal, Specify Freq.
7	2300342	Crystal, 2nd L.O., 10.245 MHz

CRYSTALS Y200

1, 2, 3, 4	2300340	Transmit Crystal, Specify Freq.
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CHOKES Z100

1, 2, 3, 4	1870003	Ferrite Bead, 57-0180 (Each choke uses 2 beads)
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CHOKES Z200

1 thru 10	1870003	Ferrite Bead, 57-0180 (Each choke uses 2 beads)
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CHOKES Z300

1, 2, 3, 4	1870004	Ferrite Bead, 57-1362 (Each choke uses 1 bead)
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<u>Reference Number</u>	<u>Part Number</u>	<u>Description</u>
<u>MISCELLANEOUS</u>		
---	2510571	Shield Can, Aura 10MM
---	2510587	Bracket, Antenna
---	2100249	Connector, Antenna BNC
---	2100299	Pin, Male (for SA-44)
---	2510586	Knob, Volume or Squelch
---	2510550	Insert, Top
---	6070780	Plug, Hole -- 1/4" Heyco #DP-250
---	2510533	Cover, Front
---	2510534	Cover, Rear
---	2509661	Frame, Pushbutton
---	2509681	Pushbutton
---	2509991	Speaker
---	2100298	Connector, Battery (9-volt type)
---	4000010	Battery Pack, 9.6V Nicad
---	4000007	Charger, Battery
---	1200082	Antenna, Helically-Loaded, BNC Mounting

