GMT-240U

UHF-FM TRANSCEIVER

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 merchantibility and/or fitness for a particular purpose. Any implied warranties are specifically and expresly 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

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SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

This manual contains all the information normally required to license, install, and operate the Genave GMT-240U UHF-FM transceiver.

The maintenance manual contains all the above information, in addition to unit schematics, alignment data, and parts lists.

1-2. DESCRIPTION

This GMT-series transceiver is the latest in UHF-FM communications equipment, and is compatible with all other UHF-FM communications systems. The transceiver may be operated as a base station, mobile station, or portable station to provide the versatility necessary to fill any communications need.

The GMT-240U is designed to provide reliable, high-quality communications for various business radio services, such as: Public Safety, Industrial Radio, Land Transportation, and General Mobile Radio Service. The radio was under strict quality control during its fabrication, and was thoroughly checked prior to shipment from the factory. It will provide many years of satisfactory operation, if given reasonable care and handling.

The GMT-240U is a solid-state, UHF-FM transceiver designed for the transmission and reception of frequency modulated (16F3) radio signals on either of two possible channels within the UHF range from 450 to 512 MHz. Either frequency can be selected by means of a front-panel mounted, two-position slide switch.

The unit is complete with an internally mounted speaker and a standard plug-in hand microphone. A plug-in receptacle allows standard Genave hand microphone, desk-style microphone, or telephone-type handset to be used interchangeably. All circuitry employed is the latest state-of-the-art design, using the latest in semiconductor and integrated circuit technology --- including a solid-state T/R switching circuit.

A 15-pin male plug mounted on rear panel of the GMT-240U transceiver is designated as an "Accessory Connector," and mates with a 15-pin female connector to provide a convenient method of connecting power or optional accessories to the unit. Standard wiring of the accessory connector utilizes only five pins, leaving the remainder available for options or customized installation.

The receiver is a crystal-controlled, dual-conversion superheterodyne employing an 8-pole monolithic crystal filter for the selectivity required in a large urban environment. The 10.7 MHz 1st IF provides good image rejection, while the 455 kHz 2nd IF improves receiver stability. A single integrated circuit performs limiting, 2nd mixer, 2nd LO, and detection functions.

The transmitter RF output is typically 15 watts minimum from 450 to 512 MHz. The output impedance is 50-ohms, using a standard UHF-type connector (83-1SP or PL259). An improved heat sink provides increased transmit-power stability.

The GMT-240U transceiver is designed to operate on +13.75 volts DC primary power (negative ground). For mobile operation, the power source may be a battery or the vehicle electrical system. The Genave PSI-10 power supply can be utilized when it is desired to operate the instrument from a 117 volt, 50-60 Hz source.

The internal speaker can be disconnected and replaced by an external speaker via connections to the rear-panel plug.

Provisions are made within each transceiver for the addition of an optional SA-1 Subaudible Tone Encoder-Decoder. This subaudible-tone system keeps the receiver squelched until a signal containing the proper subaudible, continuous tone is received. The SA-1 board generates the subaudible tone used to modulate the transmitter to activate the receivers in the system, and also decodes incoming signals. Note that all operating channels installed in a GMT-240U must utilize the same tone frequency -- there are no provisions for omitting (or changing) subaudible tone on one channel only. A ceramic resonator on the SA-1 printed-circuit board determines the frequency of subaudible tone being used.

NOTE: If subaudible-tone system is used, the carrier is automatically modulated by the subaudible tone during entire time that transmission is taking place. Also, the operating frequency must be monitored to ascertain that it is NOT in use prior to originating a call. This monitoring is accomplished automatically by any of the Genave microphones utilized with the subaudible tone system.

Each transceiver is enclosed in a clad, two-piece, aluminum cover that protects instrument from physical damage.

1-3. ABOUT UHF-FM

Many channels within the UHF range from 450 to 512 MHz are shared by two or more services; for this reason, it is not uncommon to hear other stations operating on the same frequency.

Due to the characteristics of the Ultra High Frequencies at which this radio operates, this system normally is not susceptible to the "skip" phenomenon which is characteristic of the lower-frequency bands. Communications within the UHF-FM band are "line-of-sight;" thus, the higher the antenna is placed, the greater the operating distance. UHF FM, like VHF-FM, is relatively free from static and other forms of noise interference. Noise from the vehicle installation's electrical system can be reduced rather inexpensively by installing noise-suppression equipment -- suppression information and kits can be obtained through an authorized Genave Sales and Service Center.

ANTENNA WARNING

WARNING: Each year a number of persons are electrocuted while installing radio antennas; therefore, use extreme caution when installing antenna/antenna support for this transceiver. Observe following precautions:

a. Do NOT attempt to erect antenna while a thunderstorm is gathering.
b. If installing antenna in vicinity of overhead wires, use a wooden ladder rather than metallic.
c. Do NOT allow antenna, mast or cable to touch electric signs or overhead electric wires --- even if only 120 or 240-volt wiring.
d. If antenna or mast starts to fall toward overhead wires, get completely away. If the antenna comes to rest against electrical wires, do NOT attempt to remove it, but call local power company.
e. REMEMBER - UNDER RIGHT CONDITIONS, ANY CONTACT WITH AN ELECTRICAL CIRCUIT CAN KILL.

1-4. SPECIFICATIONS

GENERAL:

Front-Panel Size:	2.5" (6.35 cm) x 6.5" (16.51 cm)
Over-all Dimensions:	2.5" (6.35 cm) x 6.5" (16.51 cm) x 11.5" (29.21 cm)
Power Requirements:	11 to 15 VDC (13.75 VDC Typ.), negative ground
Frequency Range:	450 to 512 MHz
Number of Channels:	2
Frequency Separation:	1 MHz, maximum
Temperature Range:	-30°C to +50°C
Weight:	Approx. 6 Lbs (2.72 kg)

RECEIVE:

Sensitivity:	0.45 µV for 12-dB SINAD
Selectivity:	±7 kHz minimum at -3 dB
Squelch Threshold:	0.35 µV minimum
"Tight" Squelch Threshold:	2.0 µV maximum
Modulation Acc. Bandwidth:	±5 kHz minimum
Adjacent Chan. Rejection:	70 dB minimum (EIA)
Intermodulation Response:	70 dB minimum (EIA)
Image Response:	80 dB minimum
Spurious Responses:	80 dB minimum
Audio Output Power:	5 watts min., 3.2 ohm load, less than 15% distortion
Hum & Noise Level:	45 dB below rated power output
Frequency Accuracy:	±250 Hz at 25°C
Frequency Stability:	±.0005% over temperature
Circuit Type:	Dual-conversion superheterodyne
S.A. Squelch Thres. Sens.:	0.4 µV max. at ±600 Hz deviation
S.A. Squelch Bandwidth:	±1% of set freq. min. at ±1 kHz deviation
Local Osc. Radiation:	3 dB min. below FCC Part 15 specifications
Current Drain:	0.3 amps maximum, squelched 1 amp max. with 5 watts audio output

TRANSMIT:

Power Output:	15 watts, minimum
Output Impedance:	50-ohms, typical
Frequency Stability:	±.00025% over temperature
Frequency Accuracy:	±250 Hz settable at 25°C
Spurious Output Level:	-(43 +10 log P_o) dB, or -13 dBm maximum
Audio Modulation Dev.:	±5 kHz
S.A. Tone Mod. Deviation:	±1.2 kHz maximum
Current Drain:	7 amps, maximum

CRYSTAL-FREQUENCY FORMULAS:

Receive, 1st L.O.; $F_c = (F_r - 10.7)/9$

Receive, 2nd L.O.; $F_c = 10.7 - .455$ MHz
$= 10.245$ MHz

Transmit; $F_c = F_t/36$

SECTION II

INSTALLATION MANUAL

2-1. INTRODUCTION

This section provides installation data and recommendations for fixed, mobile, or portable operation of the GMT-240U UHF transceiver. For complete technical specifications of the unit, refer to Section 1-4 (Specifications) in this manual.

2-2. EQUIPMENT SUPPLIED

a. GMT-240U Communications Transceiver with hand microphone and hang-up mounting clip.
b. Mounting Bracket with thumbscrew and washers.
c. Mounting Lock.
d. Accessory Connector, 15-pin female

2-3. EQUIPMENT REQUIRED, BUT NOT SUPPLIED

a. Vehicle or Base Antenna, 50-ohm.
b. Antenna Cable, RG-8A/U or RG-58A, as required.
c. Co-axial Connector, PL-259 (83-1SP)
d. Cabling for Power and Audio wiring, as required.

2-4. OPTIONAL EQUIPMENT AVAILABLE

a. SA-1 Subaudible-Tone PC board.
b. Remote Speakers, SP-5 or SP-6
c. PSI-10, AC Power Supply
d. PSI-21 Portable Power Pack
e. Telephone-Style Handset, G-21
f. Desk-Microphone, split bar, G-11

2-5. PRE-INSTALLATION CHECK

Visually inspect the unit for any obvious external damage - such as broken knobs, dents, damaged microphone or radio case. Any damage NOT related to shipping must be reported to General Aviation Electronics, Inc., 4141 Kingman Drive, Indianapolis, Ind., (46226), Telephone (317) 546-1111, as soon as possible.

If the packing case shows damage, make a notation to that effect on the express receipt or freight bill. Report to the transportation company any damage due to shipping, and file a claim promptly.

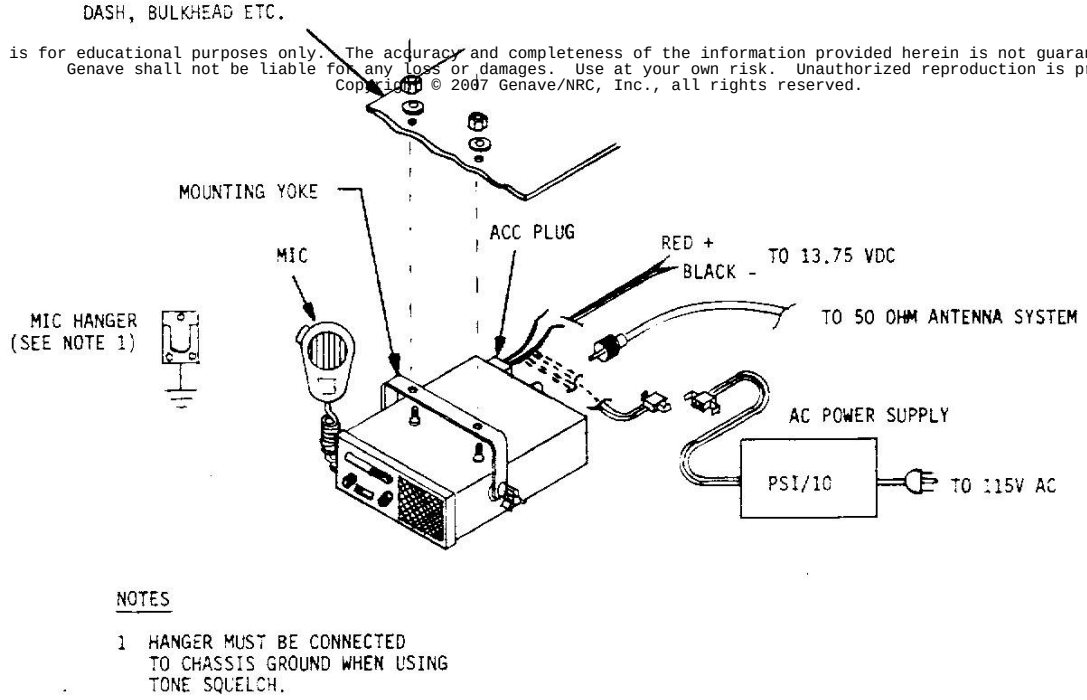
2-6. INSTALLATION PLANNING

The unit has been pre-aligned at the factory on transmit and receive frequencies listed on tag attached to the unit. If it should be necessary to change the transmit or receive frequency, alignment procedures contained in the GMT-240U maintenance manual should be performed by an authorized technician, using proper test equipment; however, if new frequency differs from the factory-alignment frequency by not more than one half of maximum channel separation as listed in the Specifications (normally 1 MHz), it will only be necessary to install and net the new crystals.

If GMT-240U is equipped with optional SA-1 (Subaudible-Tone Squelch System), the subaudible-tone frequency will be listed on tag attached to the unit, and also on a label affixed to the inside of transceiver. If it should be necessary to readjust subaudible-tone frequency from factory-set frequency, refer to "Tone-Frequency Adjustment" procedure in this manual (Section 4-8).

Before starting transceiver installation, determine desired mounting method and location; ascertain that required AC or DC power is available; determine location for antenna installation and routing of co-ax cable to transceiver.

NOTE: F.C.C. Rules require that: "Each transmitter shall be so installed and protected that it is not accessible to or capable of operation by persons other than those duly authorized by licensee," and "The operating position must be under the control and supervision of the licensee."



NOTES

1 HANGER MUST BE CONNECTED TO CHASSIS GROUND WHEN USING TONE SQUELCH.

Figure 2-1. Typical Installation.

2-7. FIXED OR MOBILE INSTALLATION

1. Refer to Figure 2-1. If mounting yoke has been installed on transceiver, remove yoke temporarily. For fixed operation, yoke may be repositioned on bottom side of unit to function as a supporting stand. For either fixed or mobile operation, the yoke may be secured in the desired location (under dash or shelf, on console or desk top, or overhead, etc.) with appropriate screws or bolts through two holes provided in the mounting yoke.

2. Connect color-coded power leads, terminated in the rear-panel 15 pin connector, to a power source. For fixed operation, the source may be a well - regulated, low-ripple AC power supply, such as the Genave Model PSI-10. For mobile operation, the source may be a battery or the vehicle's electrical system. This transceiver is designed to operate ONLY on a supply with neg. ground.

   Be SURE to connect RED power lead to +13.75 volts, and BLACK lead to -13.75 volts (ground). If it is necessary to extend power leads, use #14 or heavier guage insulated copper wire.

   If supply polarity is reversed accidentally, the unit will be inoperative. In this event, check wiring polarity (RED to positive, and BLACK to negative), and check the protective fuse located on transceiver circuit board just below the rear-panel power connector, A blown fuse should be replaced ONLY with a type 3AG 10 amp.

3. The GMT-240U transceiver is equipped with a plug-in microphone receptacle which allows use of either a standard Genave hand microphone or desk-style microphone interchangeably. A Genave telephone-type handset can also be connected to the mic. receptacle; however, if transceiver audio is to be cut-off from speaker during two-way communications, or if SA-1 subaudible-tone option is used, then a handset hanger with internal switching is required. Recommended accessory-

connector and microphone - wiring changes are shown in this section.

NOTE: If standard hand microphone is used with "subaudible-tone option," the microphone-mounting clip should be attached to the desired mounting surface; then, clip MUST be electrically connected to chassis ground in order to provide Hang Up receiver squelching.

4. After any optional or custom wiring has been completed, replace transceiver in mounting yoke, and tighten both thumbscrews, or install the mounting lock.

5. Connect microphone or handset to transceiver, and connect 15-pin receptacle to mating rear-panel plug.

6. Install co-axial connector on antenna cable, and connect cable to rear-panel mounted antenna connector.

NOTE: The transceiver is designed to match standard 50-ohm UHF communications antennas. In the interest of maximum efficiency, the antenna system should exhibit a low VSWR.

2-8. PORTABLE OPERATION

1. The easiest method of portable operation is to utilize a Genave PSI-21 Portable Power Pack. The PSI-21 unit includes a rechargeable battery, and AC-powered charger.

2. Portable operation of the transceiver requires the same basic considerations as fixed or mobile operations, that is, connections to the power source, antenna system, and microphone.

2-9. MOUNTING-LOCK INSTALLATION

If desired, the mounting lock can be used to secure transceiver to mounting bracket (yoke) when unit is attached to a desk-top, bulkhead, overhead, or an under-panel configuration. The lock can be used when transceiver is secured via either the top or bottom mounting holes of bracket; however, the bottom mounting holes will assist in concealing the heads of screws used to secure bracket to the mounting surface. To install the mounting lock, proceed as follows:

1. Remove mounting screw from side of transceiver - mounting bracket to which lock is to be attached.

2. Position mounting lock so that hole in lock and locking tab are aligned with two holes in mounting bracket.

3. Secure mounting lock to unit, using one of the hex-head mounting screws provided. Be sure that screw passes through correct hole in mounting bracket. Refer to Figure 2-2.

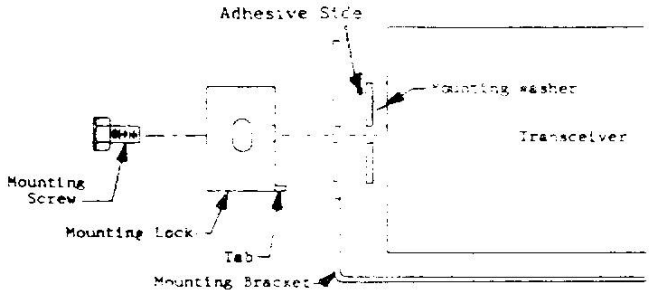


Figure 2-2. Mounting-Lock Installation

4. Attach a padlock through holes in sides of mounting lock, as shown in Figure 2-3; then, latch padlock to prevent removal of unit from mounting bracket.

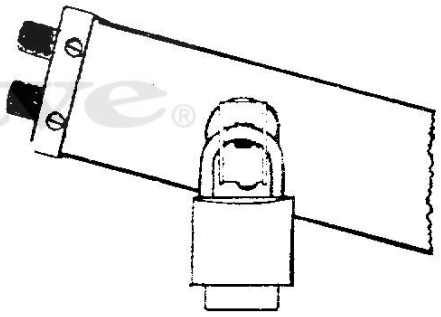


Figure 2-3. Lock Placement

2-10. ANTENNA CONNECTOR ASSEMBLY

For maximum efficiency, the antenna should be fed with low-loss 50-ohm co-axial cable. The loss per 100 feet at 420 MHz is shown in Table 2-1 for several popular types of co-ax cable:

Table 2-1.

Cable Type	Impedance	dB Loss
RG58/A-AU	53-ohms	10.4 dB
RG58 Foam	50-ohms	7.1 dB
RG8/A-AU	52-ohms	4.8 dB
RG8 Foam	50-ohms	3.9 dB

The procedure for installing a PL-259 (83-1SP) antenna connector is dependent upon type co-axial cable used - the PL-259 is installed directly on 0.405" OD cable such as RG8/A, whereas, the plug requires an adapter when used with the 0.195" OD cable such as RG58/A. The procedures for both cable types are given below, and shown in Figure 2-4.

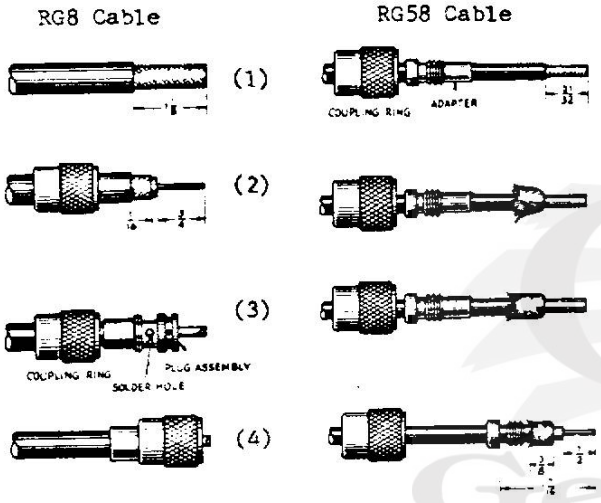


Figure 2-4. Connector Assembly

2-10-1. RG8 Cable Procedure

1. Trim end of cable flush; remove vinyl jacket from 1-1/8" of cable as shown in Figure 2-4 (1). Do NOT nick braid.

2. Bare 3/4" of center conductor. Trim braided shield 1/16" and tin. Slide coupling ring on cable. See 2-4 (2) above.

3. Screw plug assembly on cable; solder plug assembly to braid through solder holes; solder center conductor to plug assembly center pin.

4. Screw coupling ring on assembly.

2-10-2. RG58 Cable Procedure

1. Trim end of cable flush; remove vinyl jacket from 21/32" of cable as shown in Figure 2-4 (1). Do NOT nick braid. Slide coupling ring and adapter on cable.

2. Fan braid slightly and fold back over cable. See Figure 2-4 (2).

3. Compress braid around cable, Figure 2-4 (3), and position adapter to dimension given in Figure 2-4 (4). Press braid over adapter sleeve and trim to dimension shown.

4. Bare 1/2" of center conductor as shown --- do NOT nick conductor. Pre-tin exposed center conductor.

5. Screw plug assembly onto adapter sleeve, and solder the braid to plug assembly through solder holes. Next, solder center conductor to plug assembly center pin.

6. Screw coupling ring on plug assembly.

2-11. ACCESSORY CONNECTOR - P101

The 15-pin male plug mounted on rear panel of the GMT-240U transceiver is designated as an "Accessory Connector," and mates with a 15-pin female connector to provide a convenient method of connecting power or optional accessories to the unit. Standard wiring of the accessory connector utilizes five pins, leaving ten pins available for options or customized installation. Figure 2-5 illustrates standard wiring of the accessory connector, and the recommended connections for use with a handset-hanger switch. The connections

to the accessory connector pins are described below:

PIN 1 - No connection

PIN 2 - High - level audio output from receiver section of the transceiver; this audio is applied either to the internal speaker or to an external 4-ohm speaker, as determined by wiring of the accessory connector. To use the internal speaker, a jumper is connected between pins 2 and 10 of the female connector; to connect an external speaker, the speaker leads are connected between pins 2 and 7 of the 15-pin female connector.

If a telephone-style handset is used with the transceiver, the handset-hanger switch should be connected between pins 2 and 10 of the female connector to disable the internal speaker when the handset is removed from its hanger. The handset has an internal earphone which is wired through the microphone plug; thus, cutting off the internal speaker allows the operator some privacy.

Pin 3 - No connection

Pin 4 - No connection

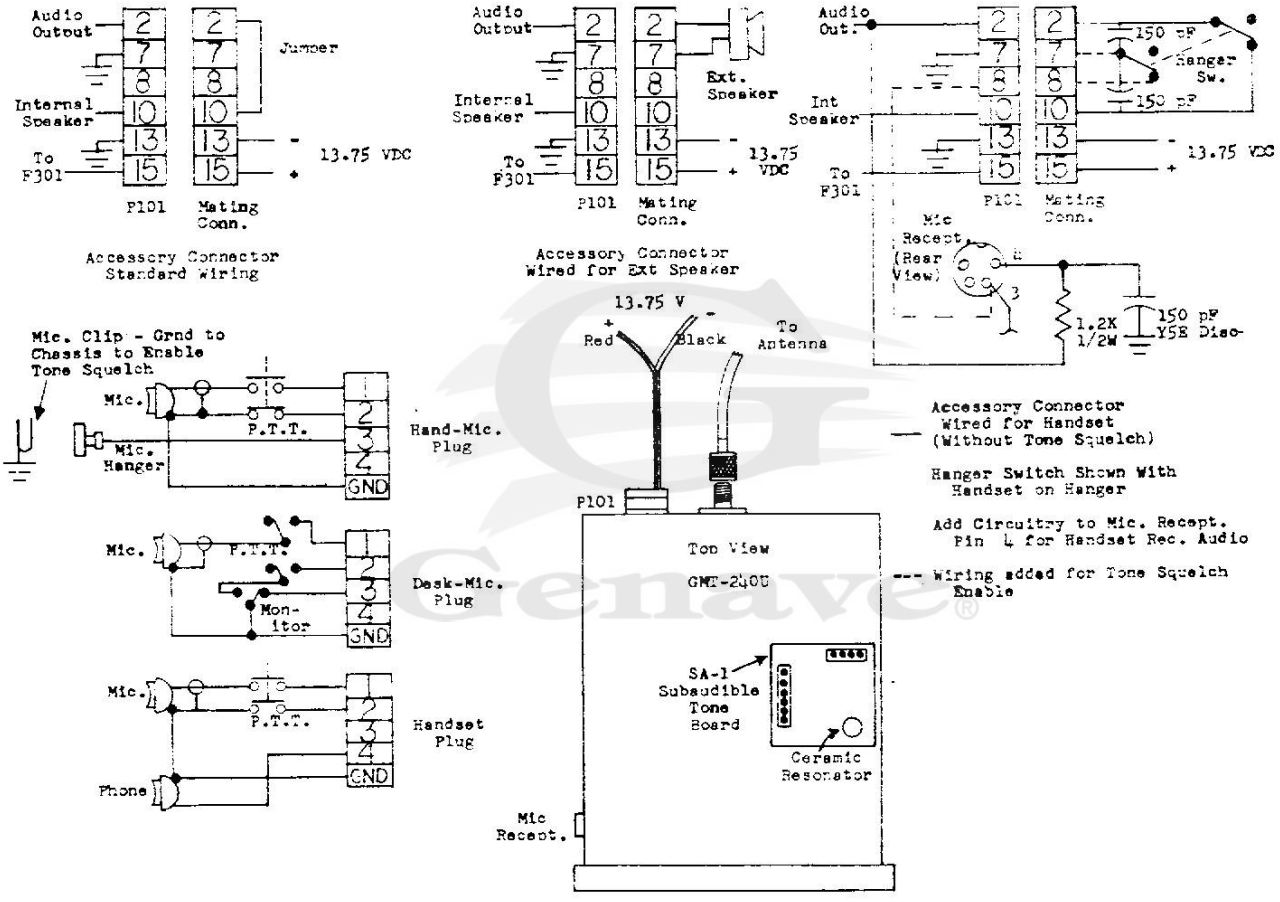


Figure 2-5. Accessory Connector & Mic. Wiring

PIN 5 - No Connection

PIN 6 - No connection

PIN 7 - A chassis ground - particularly intended for audio circuitry such as an external speaker, tone-squelch enable, etc.

PIN 8 - No connection, normally; however, if a handset AND "subaudible tone squelch" are both used with transceiver, pin 8 of the male plug should be connected internally to pin 3 of the microphone receptacle to provide a "tone-squelch enable" wire. The handset hanger "tone-squelch enable" switch is then connected to pins 7 and 8 of the 15-pin female connector as shown in Figure 2-5. Therefore, pin 8 will be held at ground potential when the handset is in place on its hanger. The ground will be removed from pin 8 when handset is lifted from the hanger; thus, tone squelch is disabled to allow monitoring of operating frequency prior to starting transmission.

PIN 9 -No connection

PIN 10 -Input connection to the internal 4-ohm speaker in transceiver. This pin is normally jumpered to pin 2.

PIN 11 -No connection

PIN 12 -No connection

PIN 13 -Chassis ground, and DC-input voltage negative connection. The female connector has a black lead, some four feet in length, attached to this pin for connection to the DC-power source.

PIN 14 -No connection

PIN 15 -DC-input voltage positive connection. The female connector has a red lead, approx. four feet in length, attached to this pin for connection to the DC-power source.

2-12. MICROPHONE RECEPTACLE

The microphone receptacle is a 5 conductor jack (4 pins plus shell) mounted on left-side panel of the GMT-240U. Internal connections are factory-made to this receptacle so that the standard Genave hand microphones, desk-style microphones, or telephone-type handsets can be used interchangeably. However, if a handset is to be used, receiver audio for the handset earphone should be connected to mic. receptacle pin 4 as described below (refer to Figure 2-5). The connections to the microphone receptacle pins are described below:

PIN 1 - Microphone-audio connection to input of transmitter-modulator ciruitry.

PIN 2 - Microphone push-to-talk switch connection. When this switch is closed, a switching transistor is energized which applies power to the transmit circuitry; the antenna switches to trans.

PIN 3 - Tone-squelch enable connection. If transceiver is NOT equipped with SA-1 Subaudible-Tone Option, this pin has no function; however, if tone-squelch option is used, this pin must be connected to ground for the tone-squelch circuitry to squelch the receiver. Removing ground from this pin disables the tone squelch - allowing the frequency to be monitored.

The method of grounding pin 3 is dependent upon type microphone being used: The hand microphone grounds this pin via the mic. hanger and mic. mounting clip; the desk-style microphone grounds pin 3 through contacts on the Monitor Switch; whereas the handset grounds pin

3 by means of switch contacts in the handset hanger. Refer to Figure 2-5.

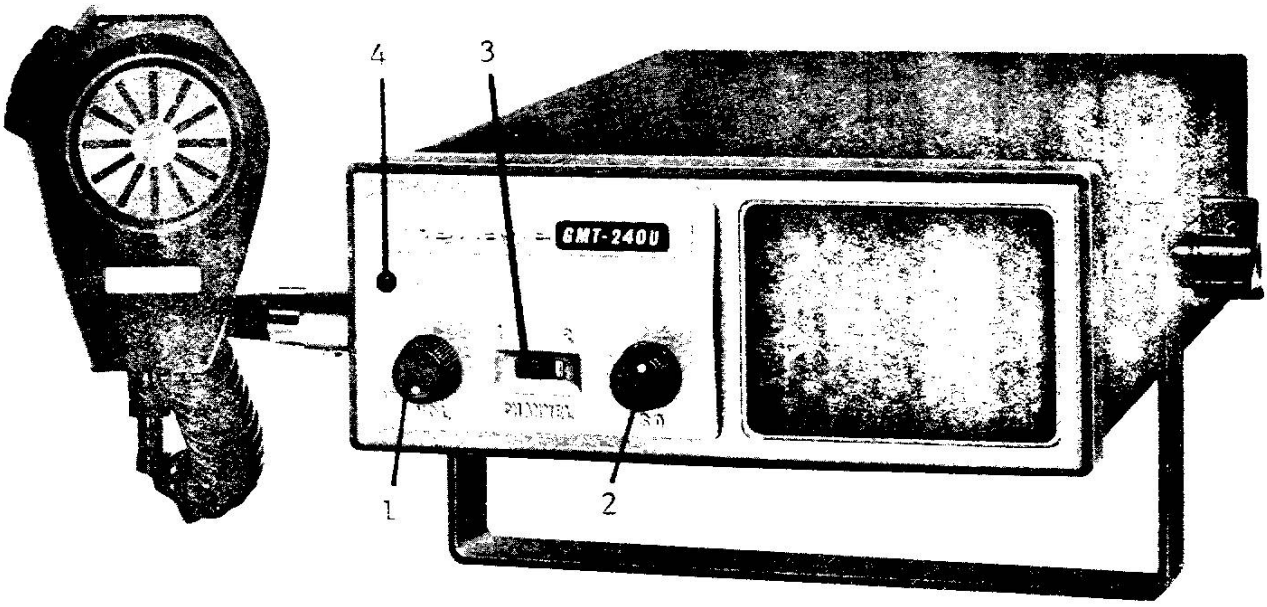
NOTE: If a handset hanger AND tone squelch are to be used with the transceiver, a wire must be connected internally between pin 8 of the rear-panel Accessory Plug and pin 3 of the mic. receptacle as shown in Figure 2-5.

PIN 4 - No connection, normally; however, if a telephone-style handset is used, the receiver audio should be connected to this pin as shown in Figure 2-5. Provisions have been made on the PC board to mount the 1.2K resistor - a copper track on the PC board extends from the resistor mounting pad to the receiver audio output. A wire must be connected from remaining resistor mounting pad to pin 4 on the microphone receptacle, and a 150 pF disc capacitor should be connected from pin 4 to the chassis ground, using short leads.

NOTE: The value of the 1.2K resistor may be increased or decreased as desired to set the maximum earphone volume.

GND - - Provides a chassis-ground connection for microphone audio and push-to-talk circuits.

SECTION III
OPERATING MANUAL



3-1. OPERATING CONTROLS

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

1. Volume control/On-Off switch
2. Squelch control
3. Channel-selector switch
4. Red transmit-indicator lamp

The push-to-talk button on the microphone also functions as an operating control. Unit operation is quite simple, as explained below:

3-2. OPERATING INSTRUCTIONS

1. Turn VOLUME (#1) and SQUELCH (#2) controls fully counterclockwise.

2. Move CHANNEL SELECTOR (#3) to desired operating channel.

3. Rotate VOLUME control clockwise until switch clicks; this turns ON transceiver.

4. If transceiver is equipped with an SA-1 subaudible-tone option, it is necessary to deactivate the tone squelch by removing microphone from its hanger or, by depressing the MONITOR button on desk-style microphone.

5. Now, rotate VOLUME control clockwise to adjust receiver volume to desired level.

6. Turn SQUELCH control clockwise until background noise just disappears. NOTE: Do NOT attempt to adjust SQUELCH control if a signal is being received.

7. To transmit, depress the microphone pushbutton. If unit is equipped with subaudible-tone system, it is important to monitor channel before transmitting to insure that it is clear. The hand microphone circuitry is designed in such manner that rec. tone squelching is deactivated when the microphone is removed from its hanger; while the C-11 desk-style microphone is designed so the TRANSMIT button will not function unless the MONITOR switch has also been depressed.

8. The TRANSMIT-INDICATOR lamp (#4) will illuminate when transmitter is operating; then, hold microphone 3

to 6 inches from your mouth, and talk in a normal voice.

9. Release the TRANSMIT pushbutton to listen.

NOTE: The squelch circuit, which is adjusted by front-panel control, quiets 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. With the tone-squelch system, however, only transmitted signals carrying the proper subaudible tone are heard, as explained previously.

3-3. LICENSING INFORMATION

The following technical information is intended to aid GMT-240U 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:

Transmitter Input Power:	45 watts
Transmitter Output Power:	20 watts
Type of Unit:	Transceiver
Type Acceptance/Model No:	T-7041500
Frequency Range:	450 MHz to 512 MHz
Frequency Tolerance:	.00025%
Emission:	16F3
Approved under Rule Part Numbers	21, 74, 89, 91, 93, and 95

Licensing requirements vary with the service for which this unit will be used; however, all services require that the station transmitter 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 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.

For additional information on filling out the appropriate application forms, consult the F.C.C. instruction sheet provided with that form. Note that some forms may be completed either by printing in ink, or by typing; whereas, typing is mandatory for certain F.C.C. application forms. Two of the more common forms used to apply for a license for the GMT-240U transceiver are F.C.C. Forms 400 or 425, depending upon usage and/or geographic location of proposed station. To determine which form is required, contact nearest F.C.C. Field Engineering Office as listed below --- they will also supply the appropriate forms.

The procedures for obtaining necessary licenses are found in the Federal Communications Commission Rules and Regulations. The services and the corresponding F.C.C. rule part numbers, under which the GMT-240U can be used, are as follows:

Any of these volumes may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

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

Domestic Public Radio Services (Other than Maritime Mobile)
- F.C.C. Rules & Regulations, Volume VII, Part 21
- 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 Stations

Public Safety Radio Services
- F.C.C. Rules & Regulations, Volume V, Part 89
  - Local Government Radio Service
  - Police Radio Service
  - Fire Radio Service
  - Highway Maintenance Radio Service
  - Forestry-Conservation Radio Service
  - Special Emergency Radio Service

Industrial Radio Services
- F.C.C. Rules & Regulations, Volume V, Part 91
  - Power Radio Service
  - Petroleum Radio Service
  - 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

Land Transportation Radio Services
- F.C.C. Rules & Regulations, Volume V, Part 93
  - Motor Carrier Radio Services
  - Railroad Radio Service
  - Taxicab Radio Service
  - Automobile Emergency Radio Service

General Mobile Radio Service
- F.C.C. Rules & Regulations, Subpart A, Part 95

3-3-2. F.C.C. Field Engineering Offices

ALASKA, ANCHORAGE 99510
G-63 U.S.P.O. and Courthouse Bldg.
Box 644, 4th and F. Streets

CALIFORNIA, LONG BEACH
Room 501
3711 Long Beach Blvd.

CALIFORNIA, SAN DIEGO 92101
Fox Theatre Bldg.
1245 7th Ave.

CALIFORNIA, SAN FRANCISCO 94111
323-A Customhouse
555 Battery St.

COLORADO, DENVER 80202
Suite 2925, The Executive Tower
1405 Curtis St.

DISTRICT OF COLUMBIA, WASHINGTON 20554
Room 411
1919 M St. NW.

FLORIDA, MIAMI 33130
Room 919
51 Southwest 1st Ave.

FLORIDA, TAMPA 33602
809 Barnett Office Bldg.
1000 Ashley Dr.

GEORGIA, ATLANTA 30309
440 Massell Bldg.
1365 Peachtreet St. NE.

HAWAII, HONOLULU 96808
502 Federal Bldg.
Box 1021, 355 Merchant St.

ILLINOIS, CHICAGO 60604
3935 New Federal Bldg.
230 South Dearborn St.

LOUISIANNA, NEW ORLEANS 70130
829 F. Edward Hebert Federal Bldg.
600 South St.

MARYLAND, BALTIMORE 21201
819 Federal Bldg.
31 Hopkins Plaza

MASSACHUSETTS, BOSTON 02109
1600 Customhouse
165 State St.

MICHIGAN, DETROIT 48226
1054 Federal Bldg.
231 West LaFayette St.

MINNESOTA, ST. PAUL 55101
691 Federal Bldg. and U.S. Courthouse
316 North Robert St.

MISSOURI, KANSAS CITY 64106
1703 Federal Bldg.
601 East 12th St.

NEW YORK, BUFFALO 14202
1307 Federal Bldg.
111 West Huron St.

NEW YORK, NEW YORK 10014
201 Varick St.

OHIO, CINCINNATI 45231
8620 Winton Road

OREGON, PORTLAND 97204
1782 Federal Office Bldg.
1220 Southwest 3d Ave.

PENNSYLVANIA, PHILADELPHIA 19106
James A. Byrne Federal Courthouse
601 Market St.

PENNSYLVANIA, MONROEVILLE 15146
(Pittsburg Area)
William Penn Highway

PUERTO RICO, HATO REY 00918
747 Federal Bldg.

TEXAS, DALLAS 75242
13E7 Earle Cabell Federal Bldg.
1100 Commerce St.

TEXAS, HOUSTON 77002
5636 New Federal Office Bldg.
515 Rusk Ave.

VIRGINIA, NORFOLK 23502
Military Circle
870 North Military Highway

WASHINGTON, SEATTLE 98174
3256 Federal Bldg.
915 2d Ave.

SECTION IV
MAINTENANCE MANUAL

4-1. INTRODUCTION

This transceiver is designed to transmit and receive 16F3 emissions in the UHF-FM bands from 450 to 512 MHz. The unit provides a minimum power output of 15 watts into a 50-ohm load.

Basically, the receiver is a dual conversion superheterodyne, utilizing the ninth harmonic of the crystal for the 1st L.O. injection. Two 4-pole crystal filters in the 10.7 MHz 1st IF provide good selectivity, while the 455 kHz 2nd IF improves receiver stability. A single integrated circuit performs the limiting and detection functions.

The transmitter employs two triplers and two doublers to multiply the crystal frequency 36 times.

In conjunction with the following circuit description, refer to unit schematics and block diagram of Figure 4-1.

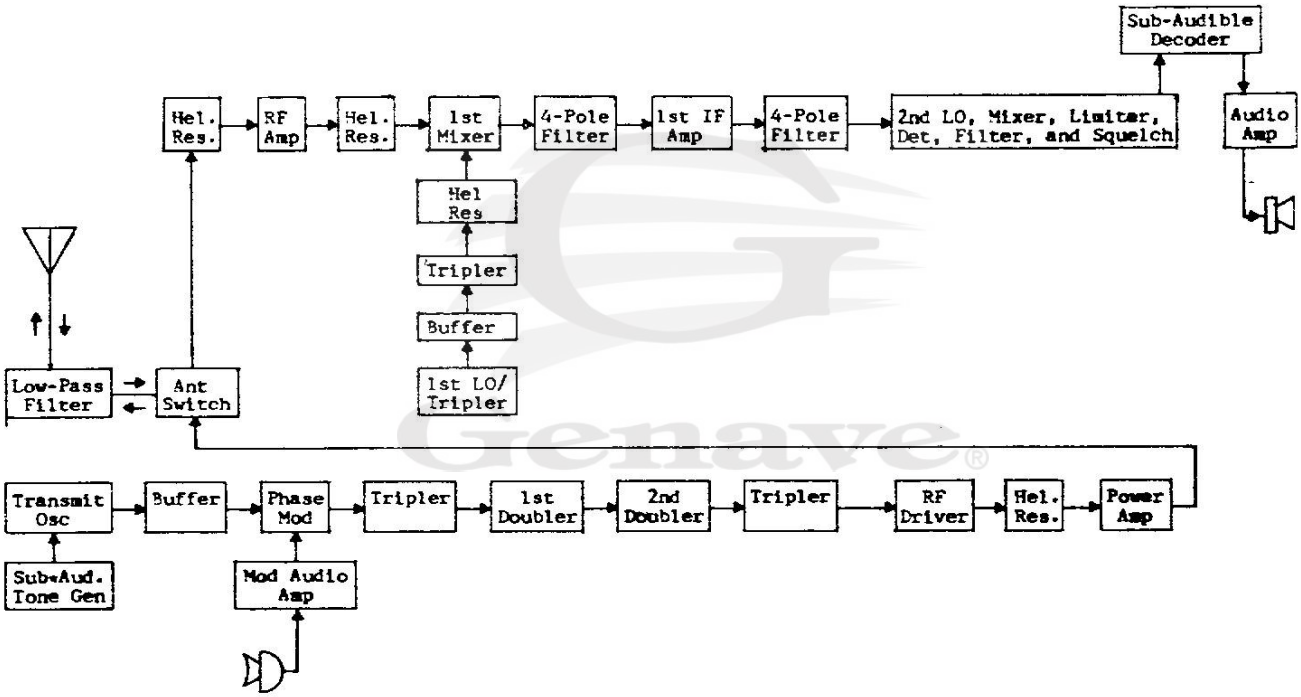


Figure 4-1. Block Diagram

4-2. THEORY OF OPERATION - TRANSMITTER

4-2-1. Microphone Amplifier/Limiter

The voice modulator audio amp. in the unit is built around a single integrated circuit, IC401. This IC is a dual operational amplifier, and is shown on the schematic as IC401A and IC401B. Audio output of the ceramic microphone is amplified by IC401A -- a 6 dB per octave rising characteristic is given to the audio frequencies by loading the 1500 pF microphone capacitance with symmetry potentiometer R402. IC401A also provides the limiting function required by symmetrically clipping amplified audio at essentially supply voltage and ground. Regulated-supply voltage for the modulator is obtained by applying 13.75 V primary power through R201 and across 6.8-volt zener diode CR103.

Output of the limiter is applied to the input of IC401B, which functions as an active Chebyshev 2-pole, low-pass filter with the cutoff frequency set at 3 kHz. R408 and C408 add a third pole to the filter response to ensure an 18 dB per octave roll-off above 3 kHz. R409 sets the deviation by controlling the amount of audio applied to the voltage-variable capacitor CR301. C409 maintains the low end of deviation control R409 at AC ground.

4-2-2. Voice Modulator

Diode CR301 functions as the phase modulator. R410 and C306 shape the audio response to the phase modulator to insure proper pre-emphasis in the transmitted audio. DC bias for the phase modulator diode CR301 is supplied by IC401.

The 12.5 to 14.222 MHz RF output from the transmit oscillator is buffered and then applied to tuned network L304 and CR301. The capacitance of CR301 is varied by the change in audio voltage from the modulator amplifier, causing the resonant frequency of L304 and CR301 to increase and decrease accordingly. This creates a phase change in the oscillator signal. After multiplying this signal 36 times, it becomes the frequency-modulated exciter output to the power amplifier.

4-2-3. Sub-Audible Modulator

Sub-audible modulation is accomplished by applying a small amount of low frequency audio voltage to base circuit of transmit oscillator Q301, through the isolating network C410 and L401. This results in frequency modulation of the oscillator, and is controlled by the level of the low-frequency audio tone applied. The tone frequency and level are controlled by circuitry on the SA-1 Sub-audible Tone Encoder/Decoder board.

4-2-4. Transmit Oscillator

Q301 and associated circuitry form the transmit oscillator, which is a modified crystal-controlled Colpitts circuit. A capacitance/inductance circuit (C301, C302, L301, and L302) in series with the crystal allows adjustment of the frequency. Typical frequency at output of oscillator is 12.5 to 14.222 MHz.

4-2-5. Crystal Heater

Transistors Q309, Q310, and Q311, with their associated resistors, are used to control the temperature of the crystals, both in transmit and receive oscillators, at low temperatures. Thermistor R320 senses the ambient temperature within the case of transceiver; then, if ambient temperature is below 0° Celsius, the voltage division of R326 and R320 turns Q309 OFF, allowing Q310 to conduct, saturating Q311. R324 and R325 are in contact with the crystal case; thus, by raising the temperature of the crystal, the frequency tolerance is maintained even at low ambient temperatures.

4-2-6. Buffer

Q302 is a P-channel JFET which functions as a buffer amplifier to isolate the oscillator stage from the phase-modulator circuitry. Frequency range is

12.5 MHz to 14.222 MHz. The output of the buffer is applied to a tank circuit consisting of L304 and CR301.

4-2-7. First Tripler

The phase-modulated output of Q302 is capacity coupled to the base of tripler Q303. The output circuit is an inductively coupled, double-tuned network, consisting of L305, C309, L306, C312, and C313, covering a frequency range of 37.5 to 42.6667 MHz.

4-2-8. First Doubler

C312 and C313 form a capacitive-tap matching network into base of first doubler Q304. The output circuit is an inductively coupled, double-tuned network, comprised of L307, C314, L308, C317 and C318. The output frequency range is 75 MHz to 85.333 MHz.

4-2-9. Second Doubler

RF from the first doubler is applied to base of second doubler Q305 by a capacitive-tap matching network. The output of Q305 is tuned to the 150 to 170.666 MHz range by variable inductor L309.

4-2-10. Intermediate Power Amplifier

RF from the second doubler is capacitively coupled to base of intermediate power amplifier Q306 by C324. The output circuit of Q306 is a two stage L-network covering the frequency range 150 MHz to 170.666 MHz.

4-2-11. Power Tripler

RF power from the doubler L-network is applied to base of Q307 - a grounded emitter Class-C frequency tripler. A matching network consisting of C333, L314, and L315 transforms the collector impedance of Q307 to the input impedance of the helical resonators.

4-2-12. Helical Bandpass Filter

The three-pole bandpass filter consists of three aperature-coupled helical resonators having a 1-dB bandpass of approximately 7 mHz. The filter is comprised of L316, L317, and L318.

4-2-13. Power Amplifier Assembly

RF power from a tap on L318 is applied to base of Q501 through a matching network consisting of C501, C502, and a length of micro-strip on the PC board. Q501 operates as a Class-C grounded emitter amplifier, having its output tuned and matched to input of Q502 by capacitor C507 and a series micro-strip line.

Q502 is a Class-C grounded emitter amplifier which drives the base of Q503 through matching network C512 and its associated series micro-strip line.

Q503 is the final power amplifier stage of the power amplifier assembly. The output matching network, C516, C517, and a micro-strip line, transforms the collector impedance of Q503 to the 50-ohm input impedance of the antenna switch and low-pass filter.

4-2-14. Antenna Switch

Antenna switching is accomplished electronically by the use of pin diodes CR601 and CR602. In transmit, the push-to-talk line is pulled to ground; thus biasing CR601 and CR602 ON. CR601 connects output of the power amplifier to the low-pass filter. CR602, at the same time, shorts the receiver input to ground. C608 tunes out the inductive reactance of CR602 to make it appear series-resonant at the operating frequency. L603 is approximately a quarter wavelength at the center frequency and, thus, appears as an open circuit at CR601.

4-2-15. Low-Pass Filter

The transmitter RF is coupled through C603 into the 7-pole, low-pass filter to reduce harmonic levels radiated by the antenna. The filter consists of C604, C605, C606, C607, L604, L605, and L606.

4-2-16. Transmit Indicator

C602 couples a small amount of RF from the transmitter output to a detector diode CR603, where it is rectified and applied to base of Q601 through R604. Q601 functions as a switch to turn ON an LED on the front panel when the final amplifier is supplying RF power.

4-2-17. Transmitter Power Supply

Power for the transmit osc., buffer, and tripler is regulated at 8.8 volts DC by CR302, and is switched ON in "transmit" by Q308. In the transmit mode, the push-to-talk line activates Q308 through R318. The first and second doublers, intermediate power amplifier, as well as the final three stages of the power amplifier, are supplied by a filtered line from +13.75 volt DC input voltage. The power tripler operates from a regulated 10-volt supply, consisting of an 8-volt, solid-state regulator IC701 which is configured, with R701 and R702, to regulate this supply at 10 volts.

4-3. THEORY OF OPERATION - RECEIVER

4-3-1. Input Filter and RF Amplifier

In the receive mode, the incoming signal from the antenna is routed through the low-pass filter to the antenna T/R switch. PIN diodes CR601 and CR602 are turned OFF; thus, the signal is applied through C101 to a tap on L101 in the helical input filter.

NOTE: The low-pass filter is utilized to filter both the received and the transmitted signals.

From a tap on L103 in the input filter, the signal is routed to an N-channel, JFET RF amplifier Q101. The amplified output of Q101 is developed across collector tuned circuit L104; thence, it is capacitively coupled by C103 to a tap on L105 in another three-pole helical filter, consisting of L105, L106, and L107.

4-3-2. 1st Local Oscillator/Multipliers

The first local oscillator is a modified Colpitts crystal-controlled circuit, consisting of Q104 and associated circuitry. SW101A selects one of two available crystals in the 48.81 to 55.7 MHz range, while variable inductors L-109 and L110 in series with the crystals allow adjustment of the frequency. L111 tunes collector circuit of Q104 to three times crystal frequency; then, C-151 couples this signal to base of buffer Q105.

L113 tunes collector circuit of buffer stage to the 146 to 167 MHz range, while C155 applies buffer output to the base of tripler Q106.

The collector circuit of Q106 is tuned to the 438 to 501 MHz frequency range. C157, C161, and L116 match the collector impedance of Q106 to the input impedance of the helical resonators, composed of L117, L118, and L119. C107 and the tap on L119 couple the injection signal, which is 10.7 MHz BELOW the desired "receive" frequency, to 1st mixer Q102.

4-3-3. 1st Mixer and 1st IF Amplifier

A tap on L107 applies the incoming RF signal to gate of 1st mixer Q102, while the LO injection signal is applied to source of Q102. The 10.7 MHz difference signal produced in the 1st mixer is coupled by T101 to a 4-pole monolithic crystal filter consisting of FL101 and FL102. T102 tunes output of the crystal filter and applies IF signal to input of 1st IF amplifier IC101.

The amplified 10.7 MHz IF signal is coupled by T103 to another 4-pole monolithic crystal filter consisting of FL-103 and FL104. T104 tunes output of this crystal filter and connects signal to input of 2nd mixer/limiter IC102.

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

IC102 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.

Y103, C120, and C121, together with IC102 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[illegible] kHz BELOW the 10.7 MHz IF, or [illegible] MHz.

The mixer-oscillator [illegible] converts the 10.7 MHz IF signal down to 455 kHz. The internal output to 455 kHz. [illegible] an external bandpass [illegible] the signal is routed to the [illegible] five-stage limiter amplifier and IC101. The output of the limiter at pin 7 drives a multiplier [illegible] directly, and externally [illegible] quadrature coil T101, [illegible] signal.

The recovered audio is filtered and buffered internally in IC102, then applied to pin 9. From pin 9 [illegible] the audio signal is applied to a de-emphasis network consisting of R112 and C128; then the signal is [illegible] to an "audio-shaping circuit, consisting of Q103 and associated [illegible].

The detected audio on pin [illegible] is applied to input (pin 17) [illegible] active filter consisting of [illegible] op-amp and external [illegible] R113, C127, and [illegible]. The noise [illegible] of the filter, on pin 18, is applied to an external AM detector. CR102, which detects noise AND the normal audio (voice) band. The obtained noise output signal permits considerable noise [illegible] the desired audio frequencies [illegible], an incoming signal will greatly reduce noise level. An external squelch [illegible] selected by squelch potentiometer [illegible], is applied to pin 12 to set up squelch trigger circuit such that audio-muting switch (pin 14) is an OPEN circuit, which allows audio from shaping circuit (Q103) to be applied to volume control R121, either directly (without sub-audible tone option) or through SA-1 sub-audible tone encoder/decoder.

When pin 12 of IC102 is pulled down below approximately 0.7 V by rectified noise voltage across CR102, pin 14 is internally shorted to ground; thus, grounding audio input to volume control R121 and squelching receiver. Thus, with no [illegible] signal, a large noise voltage is applied to CR102. The resultant [illegible] DC voltage is applied to [illegible] pin 12 where it combines with the [illegible] voltage supplied by squelch [illegible] R106. With a normal setting of the squelch control, the detected noise [illegible] pin 12 down toward 0 V [illegible] to short to ground and [illegible] receiver. With an incoming [illegible] above the squelch level, a reduced noise voltage is applied to CR102. The detected noise voltage is still applied to IC102 pin 12, but does not have sufficient amplitude to hold pin 12 below 0.7 V; thereby removing the short to ground from pin 14 and allowing audio to be applied to IC103.

4-3-5. Audio Output

The output audio amplifier consists of IC103 and associated circuitry. Audio from volume control R121 is applied to IC103 through C140.

C143, R123, and C142 form a feedback [illegible] to improve amplifier linearity. Audio output from pin 4 of IC103 is applied through C144 either to a speaker (internal or external) or through R125 to pin 4 of the mic. receptacle for use with a handset.

Pin 2 of IC103 is connected through CR[illegible] to the push-to-talk line; thus, the audio output is "shut down" during the time microphone is keyed. In addition to disabling IC103, the push-to-talk line also shuts off 1st LO Q104 through [illegible].

4-3-6. Receiver Power Supply

Power to operate the GMT-240U transceiver is obtained from an external 13.75-volt DC power source via 4-pin DIN connector P101, fuse F201, and ON-OFF switch SW201.

Voltages for receiver oscillator buffer, RF stage, mixer, 1st IF amplifier, and SA-1 tone board (if used) are obtained from a 10-volt regulator consisting of Q201, VR201, and associated components. VR201 adjusts the regulated output to 10 VDC.

CR103 sets ref. voltage for the 10-volt regulator, and also supplies 13 VDC to IC102 and IC401.

4-4. ALIGNMENT PROCEDURE - GENERAL

The transceiver is properly aligned before shipment from the factory. Normally, alignment should not be necessary during normal life of the unit. Also, components within the audio and squelch

NEVER attempt to realign the transceiver circuitry unless the test equipment specified for each section is available.

The receiver alignment procedure is given in Section 4-5, while transmitter alignment is contained in Section 4-7 of this manual.

4-4-1. Disassembly

Prior to performing any service work on the instrument, the aluminum top cover must be removed. The bottom cover need not be removed, unless it is necessary to gain access to the underside of main

PC board. To remove either cover, remove two 4/40 x 3/8" pan head screws securing each side of cover to transceiver chassis; then, slide cover back and lift it off unit.

With unit top cover removed, the component side of main PC board is accessible for alignment or frequency adjustments. If installed, the SA-1 subaudible tone board is accessible for servicing with the unit top cover removed.

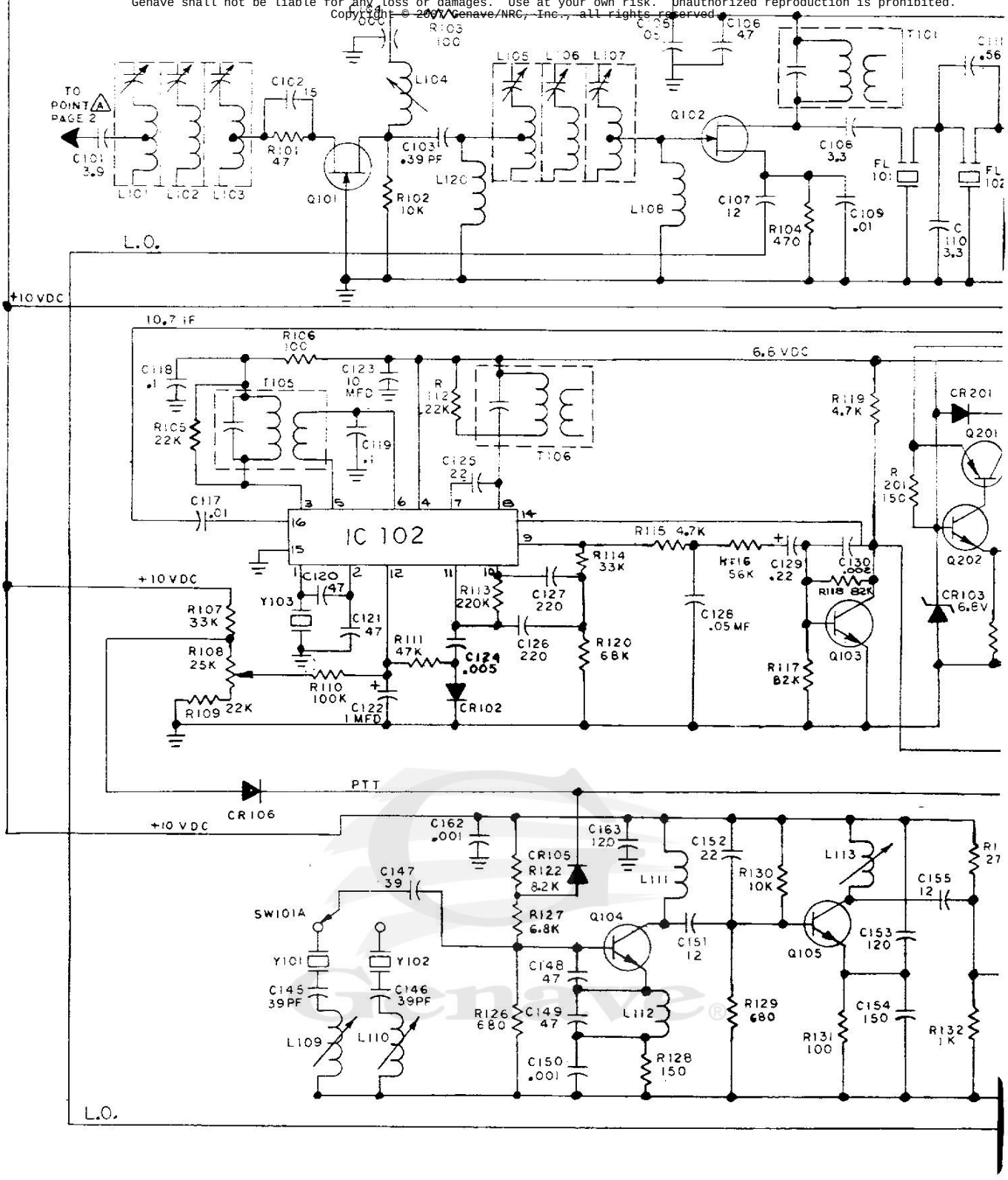
NOTE: If thumbscrews have NOT been removed from sides of transceiver, they must be loosened a few turns before attempting to remove unit covers.

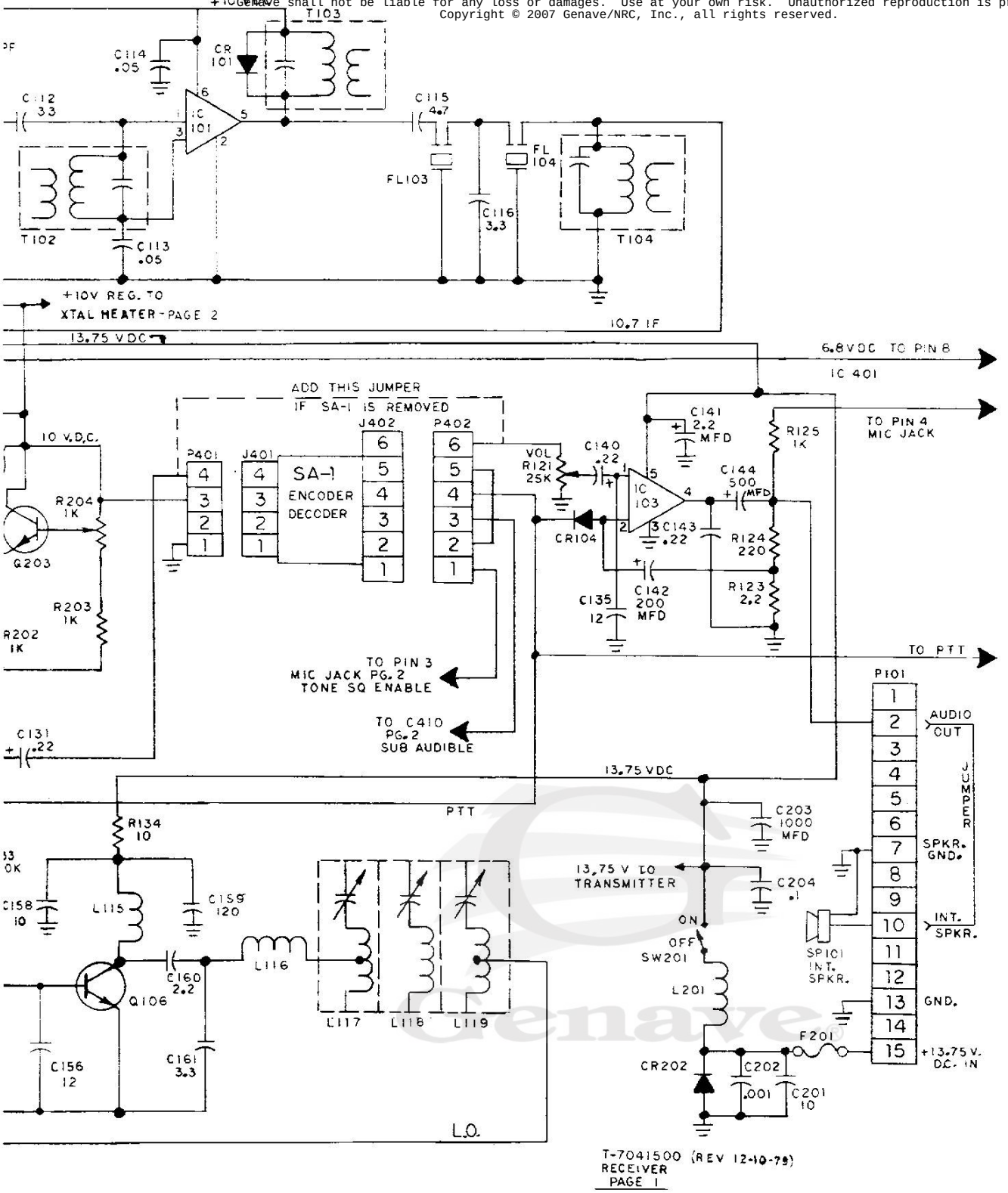
To gain transmitter power-amplifier, both top and bottom covers must be removed as shown above. Then, heatsink, with mating power amplifier PC board, may be removed from the chassis by removing two Phillips-head self-tapping screws which secure each sideplate to the heatsink and, removing one machine screw securing power-amplifier assembly to PC board "L" bracket. Now lift heatsink from rear of chassis, and lay heatsink on its fins so that component side of PC board faces upward. If components are to be replaced, remove shield cover from amplifier assembly.

Re-assemble transceiver by reversing the steps above --- use care NOT to pinch cables when installing heatsink.

4-5. SCHEMATICS & COMPONENT LOCATIONS

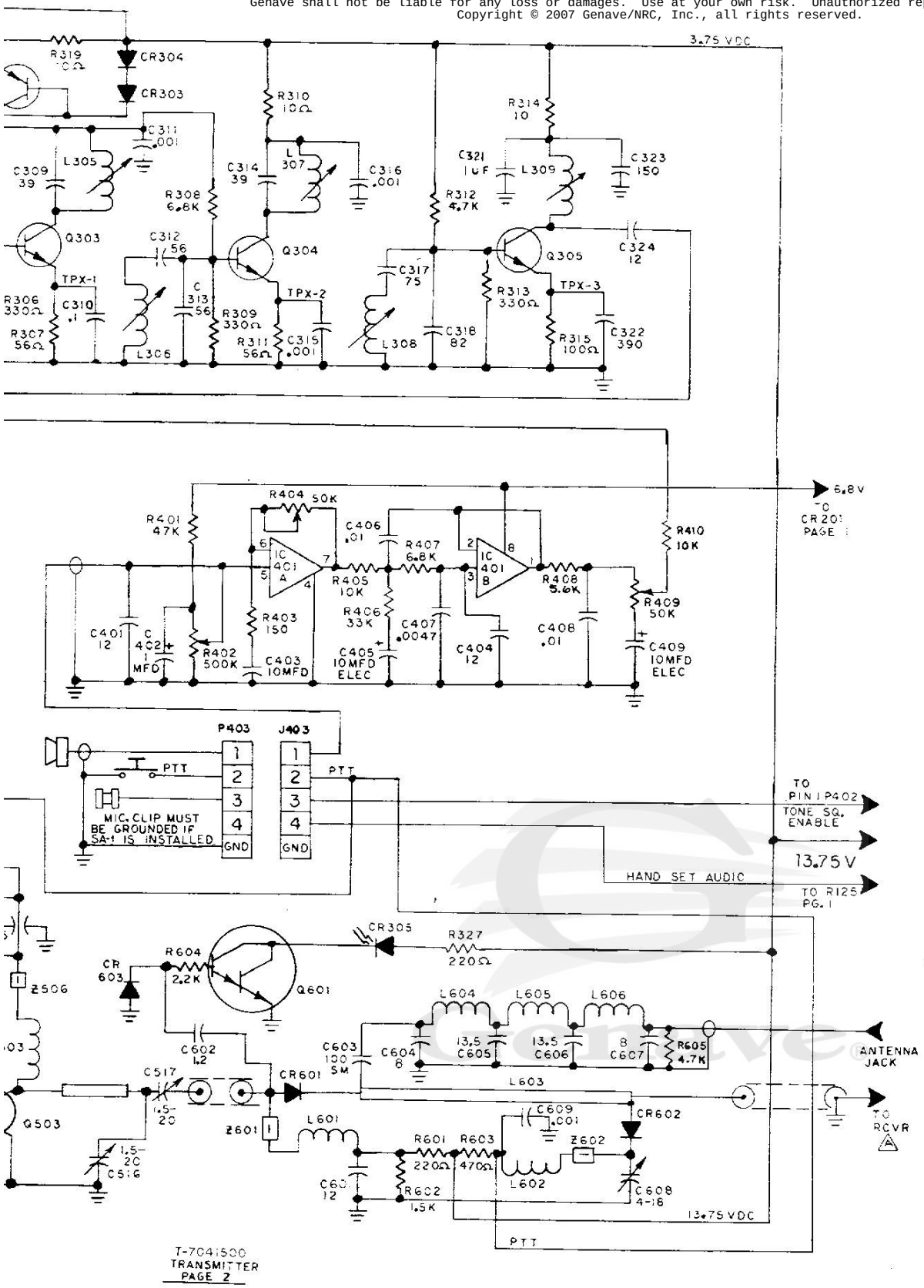
Refer to component location diagrams and schematics in this section for the location of adjustments and test points that are in Sections 4-6 and 4-7.





T-7041500 (REV 12-10-79)
RECEIVER
PAGE 1

Figure 4-2. UHF Transceiver -- Receiver Section
(Rev. 12-12-79)



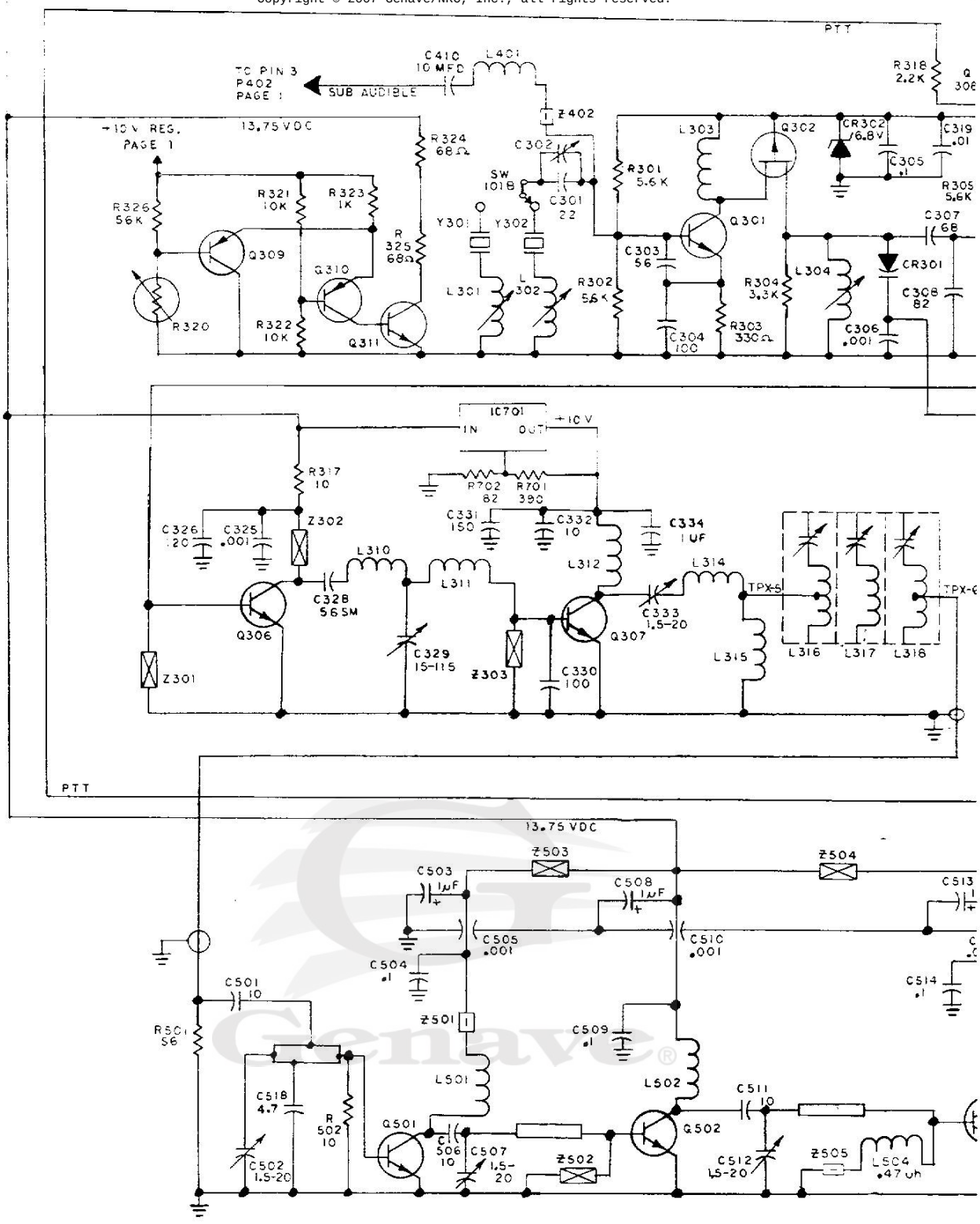


Figure 4-3. UHF Transceiver -- Transmitter Section
(Rev. 12-12-79)

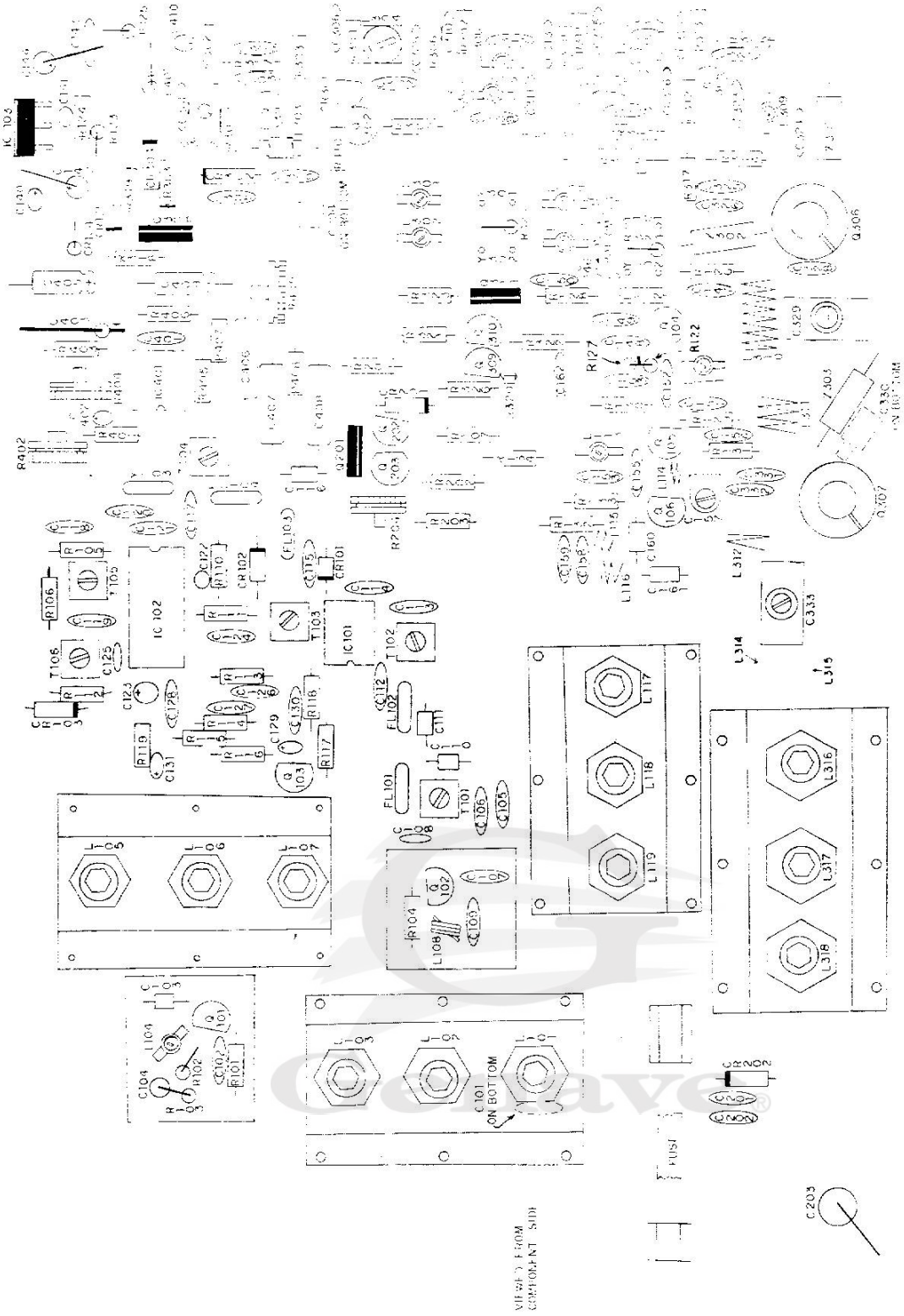


Figure 4-4. Main Board Component Layout (Rev. 12-12-79)
(Top View)

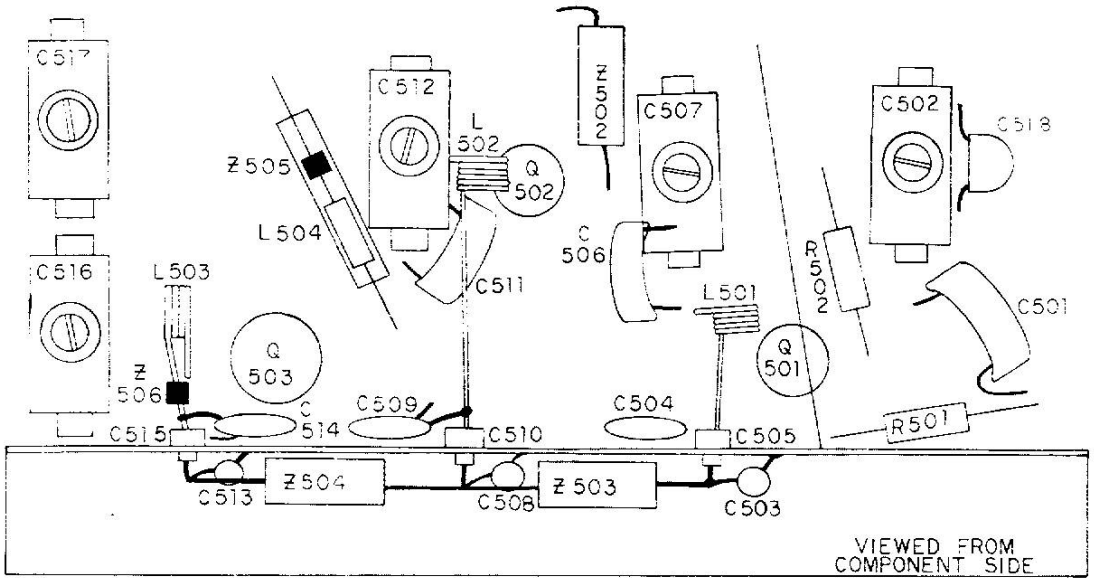


Figure 4-5. Power-Amplifier Assembly
(Rev. 12-12-79)

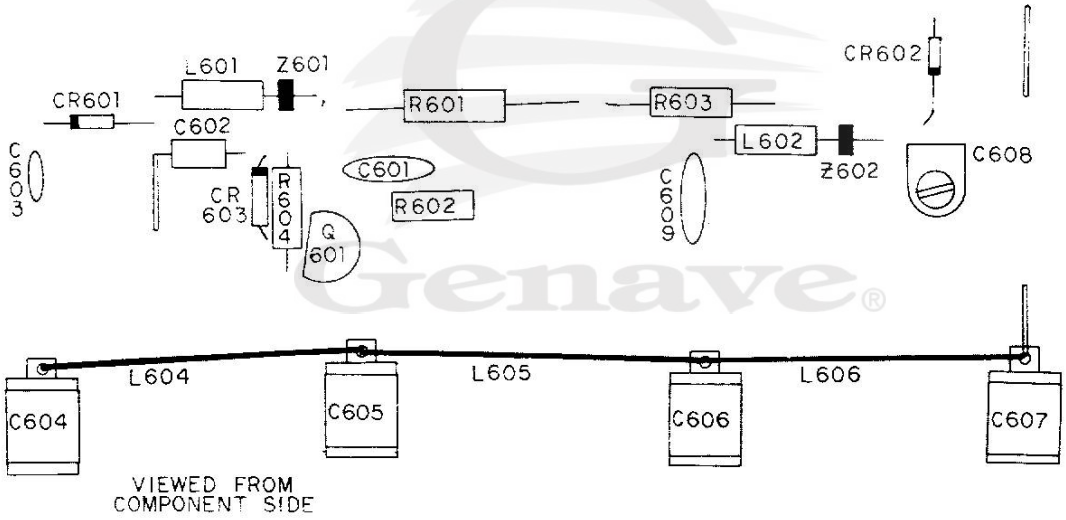


Figure 4-6. RF Switching Board
(Rev. 12-12-79)

4-6. RECEIVER ALIGNMENT

These paragraphs provide proper alignment instructions for the UHF receiver; perform steps listed below in the order given.

NOTE: Refer to schematics and component location diagrams in Section 4-5 of this manual for location of adjustments and test points.

4-6-1. 10-volt Supply Adjustment

1. Connect a DVM to junction of R204, Q201 and Q203. Apply 13.75 volts DC to unit and turn power switch ON.

2. If DVM does not read 10V ±250 mV, adjust potentiometer R204 until DVM reads 10 volts.

3. Turn power switch OFF, and remove DVM.

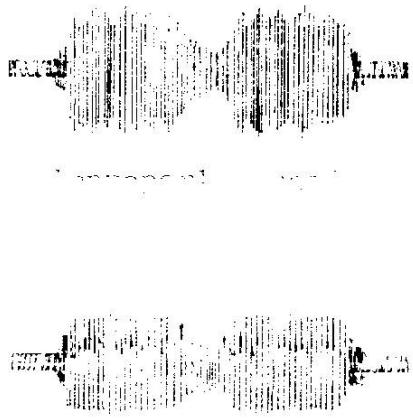
4-6-2. 10.7 MHz & 455 kHz IF Alignment

1. Connect output of an FM signal generator through a 39 pF capacitor to source of 1st mixer Q102. Connect vertical input of oscilloscope to pin 3 of 2nd mixer IC102 through a X10 probe. Connect AC VTVM across speaker leads.

2. Set generator frequency to exactly 10.7 MHz, and modulate generator with a low-frequency audio signal (below 100 Hz). Set generator deviation for approximately ±9 kHz -- the total swing must be somewhat greater than the IF bandwidth.

3. During alignment of the 10.7 MHz and 455 kHz IFs, keep the generator output level low enough to prevent saturating 2nd mixer, as indicated by scope connected to IC102.

4. Turn unit power switch ON: then set scope Internal Sweep, and Vertical Sensitivity, to present a usable scope pattern similar to that shown in Figure 4-7.



Correctly Tuned for Min. Ripple

Figure 4-7. IF Tuning Response

5. Adjust cores in transformers T101, T102, T103, and T104 for MAXIMUM amplitude and MINIMUM ripple in the scope pattern, as shown in Figure 4-7. Repeat this step until no further improvement is obtained.

6. Change FM generator modulation to a 1-kHz signal with ±5 kHz deviation. Set generator output level for max. quieting. Move scope X10 probe to junction of R115, R116, and C128.

7. Adjust core in quadrature transformer T106 for maximum amplitude of the 1000-Hz signal on the scope. If the scope does not indicate a pure sine wave, make a SLIGHT readjustment of T101, T102, T103, or T104 as needed.

8. Remove 10.7 MHz signal from source of mixer Q102. With NO signal input to receiver, adjust core in 455 kHz transformer T105 for maximum noise as shown on AC VTVM.

9. Turn power switch OFF, and disconnect test equipment from the transceiver.

4-6-3. 1st Local Oscillator Alignment

1. Set VTVM function to "DC-," and connect meter lead to base of tripler Q106. Turn transceiver power switch ON, and set frequency-selector to desired channel.

2. Adjust L111 and L113 for most negative reading on VTVM.

3. Move VTVM lead to source of mixer Q-102, and set VTVM function to "DC+." The VTVM may indicate .45 to .5 DCV.

4. Tune helical resonators L118, L119, and L117, in that order, for maximum positive indication on VTVM (an increase of .1 to .15 volts).

5. Carefully tighten locking nuts on helical resonators; BE SURE ADJUSTMENTS DO NOT CHANGE.

6. Turn OFF transceiver power switch, and disconnect VTVM.

NOTE: The receiver crystals will be netted to exact operating frequency in a later step using L109/L110.

4-6-4. Input Filter and RF Alignment

1. Connect output of an FM signal generator to transceiver antenna connector. Set generator to desired frequency, and modulate generator with a 1-kHz tone at ±5 kHz deviation. DISCONNECT MICROPHONE.

2. Connect a Sinadder, or equivalent, across the speaker. If Sinad measuring equipment is not available, substitute an AC VTVM. Back slug in L104 out FLUSH with end of form.

3. Turn ON power switch, and increase generator output until the 1000-Hz tone is heard in speaker.

NOTE: During the following steps, reduce generator output as necessary to prevent overdriving the receiver.

4. Adjust helical resonators L106, L105, and L107, in that order, for best Sinad (or max. quieting).

5. Tune resonators L102, L101, and L-103, in that order, for best Sinad.

6. Repeat steps 4 and 5, until no further improvement is noted.

7. Tune slug in L104 for best Sinad, or best quieting. If L104 does NOT tune through peak, a small change in length of wire from feedthru C-104 to coil L104 will help.

8. Touch up L103 and L105 for best Sinad (or quieting).

9. Tighten locking nuts on cavities -- be careful NOT to change adjustment of resonators.

10. Set GMT-240U to channel 1. Turn FM generator deviation up to point where Sinad starts to drop (keep generator RF level low enough to prevent overdriving receiver). Now tune crystal netting inductance L-109 for best Sinad.

    Due to tolerance accumulation in FL101, 102, 103, 104, and Y103, the actual local osc. freq and the calculated frequency may not be identical for center frequency of channel.

11. Repeat step 10 for the second operating frequency (if used), adjusting L110.

12. Turn generator deviation down to ±5 kHz, and check sensitivity on each operating channel. The generator attenuator should indicate NOT MORE than 0.45 uV for 12 dB Sinad.

4-6-5. Squelch Operation

1. Set FM signal generator to desired "receive" frequency, and modulate generator with a 1 kHz tone at ±5 kHz deviation. Set RF attenuator for minimum RF output.

2. Turn squelch control fully clockwise -- set receiver audio control for maximum volume. Receiver should be completely silent.

3. Set vol. control at midrange, and adjust squelch control fully CCW; then, turn squelch control CW until receiver background noise just disappears.

4. Increase setting of signal generator RF attenuator until the squelch just fully opens. The RF attenuator should show 0.35 uV or better.

4-6-6. Audio-Output Power

1. Set FM signal generator on desired "receive" frequency, and modulate generator with a 1-kHz tone at ±5 kHz deviation. Set RF attenuator in the vicinity of 5 uV.

2. Turn vol. control fully clockwise. The AC VTVM should indicate NOT LESS than 4 volts (5 watts).

3. Modulate generator with 500-Hz tone at ±5 kHz deviation, and note that AC VTVM indicates at least 4 volts with vol. control fully clockwise.

4. Modulate signal generator with a 3-kHz tone at ±5 kHz deviation. Again AC VTVM across speaker should indicate at least 4 volts with trans. volume control fully clockwise.

5. Turn OFF transceiver power switch, and disconnect AC VTVM and Sinadder from transceiver speaker.

4-7. TRANSMITTER ALIGNMENT

4-7-1. Preparation for Alignment

1. With transmit crystals Y301 and/or Y302 installed in proper socket(s), preset the following oscillator components to the approximate center of their range: C302, L301, and L302.

2. Preset mic. amplifier/limiter controls R402 (symmetry) and R404 (mic gain) to approx. midrange position.

3. Preset mic. deviation adjust R409 and subaudible deviation pot., R113 on SA-1 tone board, to their minimum positions.

4. Set channel-selector switch SW101 to the lower-frequency channel.

4-7-2. Oscillator and Multiplier Adjustment

1. Connect 50-ohm, 500-MHz dummy load, capable of dissipating 20 watts, to transceiver antenna jack.

2. Connect unit to a 13.75 VDC power source, and turn transceiver power switch ON. RECONNECT MICROPHONE.

NOTE: Key GMT-240U only when tuning to reduce power amplifier heating.

3. Connect VTVM DC probe to emitter of Q303 (TPX-1), key transmitter, and adjust L304 for maximum reading.

4. Move DC probe to emitter of Q304 (TPX-2). Key transmitter, and adjust L305 and L306 for maximum VTVM reading.

5. Connect DC probe to emitter of Q305 (TPX-3), key transmitter, and adjust L307 and L308 for maximum VTVM reading.

6. Connect detector assembly (Figure 4-8) to junction L314, L315, and L316 (TPX-5); then, adjust C329 and C333 for maximum meter reading.

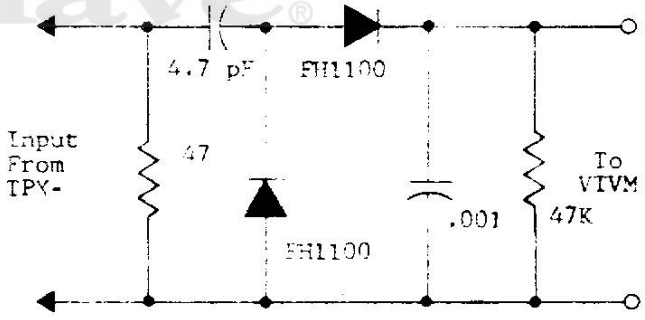


Figure 4-8. Detector Assembly

CAUTION: When adjusting C333 for max. output it is possible to tune to the SECOND HARMONIC, if trimmer C333 is compressed completely. This condition will cause excessive current to flow through Q307.

7. Disconnect coax from L318; then, move detector assembly to output of helical resonator L318 (TPX-6) and adjust the three 1/4 x 28 screws in top of helical-resonator cavity assembly for maximum meter reading.

NOTE: The center adjustment (L317) should be made first; then the order of adjustment for L316 and L318 is not critical.

8. If Y302 is installed, switch SW101 to channel two and check output level at TPX-6. If necessary, adjust resonators L316, L317, and L-318 to equalize output levels between channels 1 and 2. Bandwidth of the helical filter is approx. 7 MHz at the 1-dB points. Remove the detector, and reconnect coax.

9. Connect oscilloscope to junction of IC401 pin 7 and R405; then, check for symmetrical clipping by whistling into microphone. If necessary, adjust R402 for equal clipping at top and bottom of display.

10. Adjust frequency counter to read channel 1 frequency. A pick-up loop adjacent to L315 will give adequate output.

11. Adjust C302 to bring frequency to within 1 kHz of assigned frequency; then adjust L301 to "fine-tune" to correct frequency.

12. Switch unit to channel 2, and adjust L302 to correct frequency.

13. If SA-1 Subaudible Tone Encoder/Decoder is used, adjust subaudible deviation control for ±1 kHz deviation as follows:

    Key transmitter and adjust "Subaudible Dev. Adj." R113 (located on SA-1 subaudible-tone board) to produce an output deviation of ±1 kHz as indicated on a deviation meter.

14. After any adjustment of subaudible deviation, repeat steps 10 through 13, as some interaction may occur.

15. Apply an audio test signal to the microphone, and set deviation to ±3 kHz by adjusting deviation potentiometer R409.

16. With audio signal still applied to microphone, adjust modulation coil L304 for best linearity of modulation by rocking the core in L304 slightly until the + and - deviation levels are brought into balance.

17. Set deviation control R409 to produce NO MORE THAN ±5 kHz total deviation (combined audio mod. and subaudible tone).

4-7-3. Power Amplifier Adjustment

1. Remove power amplifier assembly as given in Section 4-4-1. The shield need NOT be removed unless components are to be replaced. Connect power meter and 50-ohm load to the transceiver antenna jack.

2. Reduce DC voltage applied to unit to 11.8 - 12.0 volts.

NOTE: To ensure that unit will deliver rated power output when connected to a marginal voltage supply, such as might be encountered in a mobile installation, alignment of the power amplifier must be made at the voltage specified above. If the amplifier is adjusted at its normal 13.75 V input, under some conditions the RF output will drop to almost zero if the input voltage drops to 11 - 12 volts.

3. Press mic. button, and adjust C507 and C512 for maximum output indication on the power meter.

4. Adjust C502 for best input match, as indicated by maximum power out-

put. Recheck that C333, L316, and L318 in output of last multiplier are set for maximum power output.

5. Adjust C516 and C517 for maximum power output. Repeat steps 3, 4, and 5.

6. Increase DC voltage applied to unit to 13.75 VDC. The RF power should be NOT LESS than 15 watts, nor more than 20 watts.

NOTE: Power output in excess of 20 watts into a good dummy load may result in destruction of the final transistor when unit is placed into service on an antenna having a high standing wave ratio (shorted or open coax, or a broken antenna).

4-8. TONE-FREQUENCY ADJUSTMENT

If used, the SA-1 tone-squelch PC board is located at right-center of main PC board, as shown in Figure 2-5. The particular ceramic resonator used and the division-ratio selected determine tone frequency; thus, a different resonator is required for each discrete subaudible tone frequency. One division ratio is used for subaudible tones between 67 and 131.8 Hz, whereas a different ratio is used for tone frequencies between 136.5 and 250.3 Hz. The proper ratio is selected by a jumper on bottom of SA-1 board. Refer to SA-1 Manual.

To change tone frequency from factory-set value, preceed as follows:

1. With top cover removed from transceiver, remove SA-1 tone board by lifting board up and off its mating pins.

2. Locate ceramic resonator on subaudible tone PC board (see Figure 4-9). Carefully pull resonator upward from PC board until resonator leads are free from the two pin sockets.

3. Align pins of new resonator with PC-sockets; push resonator into place. Net Y101 to freq. with a small cap.

4. Now, select division ratio by soldering a jumper on bottom side of PC board between IC101 and IC102 as follows: If subaudible tone is below 131.8 Hz, connect pin 8 of IC102 to pin 14 of IC101; but, if frequency is above 136.5 Hz, connect pin 8 of IC102 to pin 6 of IC101.

5. Carefully replace tone board in the transceiver, and connect unit to its power source.

6. If another unit with the correct subaudible-tone frequency is available, it may be used for on-the-air testing; otherwise, set a signal generator to a 10 µV level on the appropriate operating frequency with ±1 kHz deviation at the desired subaudible tone frequency.

7. With test signal applied to receiver, note that receiver unsquelches and operates normally.

8. The transmitter subaudible deviation should also be checked. The deviation should be 1 kHz ±200 Hz. Refer to Section 4-7-2 step 13 in this manual for the measurement and adjustment procedure.

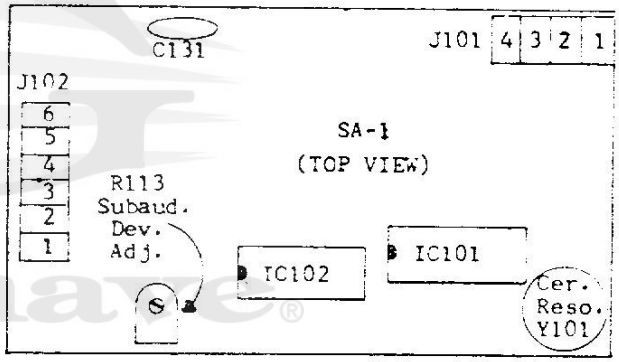


Figure 4-9. SA-1 Tone Board

4-9. FREQUENCY CHANGES

Installation of new frequencies in this unit can be easily accomplished by performing the following steps.

NOTE: To aid in obtaining proper crystals for the GMT-240U, complete crystal specifications are given in Section 4-10 of this manual.

1. Remove top cover from instrument as explained in Section 4-4-1.

2. Install "receive" crystal(s), Y101 - Y102, in appropriate sockets in left front quadrant of main PC board. Refer to Main Board Component Location diagram for crystal locations.

   NOTE: The maximum frequency separation between channels 1 and 2 in a GMT-240U is 1 MHz in receive, and 6 MHz in transmit.

3. Install "transmit" crystal(s), Y301-Y302, in appropriate sockets in left front quadrant of main PC board. Refer to Main Board Component Location diagram for crystal locations.

   Be SURE that transmit and receive crystals are properly paired.

4. To bring the receive crystal(s) "on frequency," perform steps 10 and 11 given in Section 4-6-4 of this manual.

5. To adjust transmit crystal(s) "on frequency," perform steps 10 - 14 given in Section 4-7-2 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 4-6 and 4-7.

4-10. CRYSTAL SPECIFICATIONS

To change a transmit and/or receive operating frequency in a Model GMT-240U transceiver, requires that a new transmit and/or receive crystal be installed in the unit. The transceiver may also require some realignment to insure proper operation of the new frequency.

Crystals for the GMT-series transceivers are available from the factory at nominal cost by calling the factory "Parts Department," and specifying the model number, desired operating frequency, and whether for transmit or receive. Crystals may also be obtained from other sources; therefore, the information necessary for ordering these crystals is given on following page.

4-10-1. Transmit Crystals

Parallel Mode: $C_P = 32$ pF

Fundamental Cut Tolerance:	±.001 % Max. calibration tolerance at 25°C ±.0005% Max. drift over temperature range
Temperature Range:	0° to +50°
Holder:	HC-25/U
Crystal Frequency:	$\frac{\text{Operating Frequency}}{36}$
Series Resistance:	25 ohms, maximum
Drive Level:	1 mW
Genave Part Number:	2300340

4-10-2. Receive Crystals

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

SECTION V

PARTS LIST

This section of the Maintenance Manual lists replacement electronic parts, as well as major mechanical components, for use in the GMT-240U UHF-FM transceiver.

The first column in the Parts List contains component reference numbers as shown on schematics or wiring diagrams.

In general, 100-series through 400-series numbers are located on Main PC Board as follows: 100-series numbers pertain to receiver components; 200-series to power circuits; 300-series to transmitter driver; and 400-series to mic. amplifier circuitry. 500-series numbers are located on Transmitter Board, while 600-series numbers are associated with the RF Switching Board. 700-series numbers are used on 10V Regulator Board.

Reference Number	Part Number	Description
CAPACITORS		
C101	1520003	NPO Disc, 3.9 pF ±10%
2	1520009	NPO Disc, 15 pF ±10%
3	1510006	NPO Gimmick, .39 pF ±10%
4	1520061	CF777 Feedthru, .001 uF, GMV
5	1520054	M25 Disc, .05 uF +80-20%, 25V
6	1520060	N220, Disc, 47 pF ±10%
7	1520008	NPO Disc, 12 pF ±10%
8	1520197	NPO Disc, 3.3 pF ±10%, 25V
9	1520051	Y5U Disc, .01 uF ±20%, 25V
10	1510017	NPO Gimmick, 3.3 pF ±10%
11	1510008	NPO Gimmick, .56 pF ±10%
12	1520013	NPO Disc, 33 pF ±10%
13	1520054	M25 Disc, .05 uF +80-20%, 25V
14	1520054	M25 Disc, .05 uF +80-20%, 25V
15	1520004	NPO Disc, 4.7 pF ±10%
16	1510017	NPO Gimmick, 3.3 pF ±10%
17	1520051	Y5U Disc, .01 uF ±20%, 25V
18	1520055	Magnacap Disc, .1 uF +80-20%, 12V
19	1520055	Magnacap Disc, .1 uF +80-20%, 12V
20	1520060	N220 Disc, 47 pF ±10%
21	1520060	N220 Disc, 47 pF ±10%
22	1550002	Tant, 1 uF ±20%, 35V
23	1550007	Tant, 10 uF ±20%, 35V
24	1500079	Z5U Disc, .005 uF ±20%
25	1520190	NPO Cer, 22 pF ±10%, 25V
26	1520033	Z5F Disc, 220 pF ±10%, 500V
27	1520033	Z5F Disc, 220 pF ±10%, 500V
28	1520054	M25 Disc, .05 uF +80-20%, 25V
29	1550001	Tant, .22 uF ±20%, 35V
30	1520077	Z5P Disc, .002 uF ±10%
31	1550001	Tant, .22 uF ±20%, 35V
32	---	Not Assigned
33	---	Not Assigned
134	---	Not Assigned

Reference Number	Part Number	Description
CAPACITORS (Cont'd)		
C135	1520008	NPO Disc, 12 pF, ±10%
40	1550001	Tant, .22 uF ±20%, 35V
41	1550015	Tant, 2.2 uF ±20%
42	1540212	Elect. 200 uF, 12V
43	1520057	Magnacap Disc, .22 uF +80-20%, 12V
44	1540049	Elect., 500 uF, 12V
45	1520014	NPO Disc, 39 pF ±10%
46	1520014	NPO Disc, 39 pF ±10%
47	1520014	NPO Disc, 39 pF ±10%
48	1520060	N220 Disc, 47 pF, ±10%
49	1520060	N220 Disc, 47 pF, ±10%
50	1520071	JF Disc, .001 uF ±10%, 1000V
51	1520008	NPO Disc, 12 pF ±10%
52	1520011	NPO Disc, 22 pF ±10%
53	1520025	N1500 Disc, 120 pF ±10%
54	1520028	Y5E Disc, 150 pF ±10%, 25V
55	1520008	NPO Disc, 12 pF ±10%
56	1520008	NPO Disc, 12 pF ±10%
57	---	Not Assigned
58	1520007	NPO Disc, 10 pF ±10%
59	1520025	N1500 Disc. 120 pF ±10%
60	1510015	NPO Gimmick, 2.2 pF ±10%
61	1510017	NPO Gimmick, 3.3 pF ±10%
62	1520071	JF Disc, .001 uF ±10%, 1000V
63	1520025	N1500 Disc, 120 pF ±10%
64	---	Not Assigned
165	---	Not Assigned
201	1520007	NPO Disc, 10 pF ±10%
2	1520071	JF Disc, .001 uF ±10%, 1000V
3	1540038	Elect, 1000 uF, 30V
204	1520180	Cer. Chip, .1 uF, 50V, Kemet
301	1520011	NPO Disc, 22 pF ±10%
2	1570009	Cer. Trimmer, 4-18 pF
3	1520018	N220 Disc, 56 pF ±10%
4	1520195	N2200 Disc, 100 pF ±10%, 25V
5	1520055	Magnacap Disc, .1 uF +80-20%, 12V
6	1520071	JF Disc, .001 uF ±10%, 1000V
7	1520019	NPO Disc, 68 pF ±10%
8	1520176	N330 Disc, 82 pF ±10%
9	1520014	NPO Disc, 39 pF ±10%
10	1520055	Magnacap Disc, .1 uF +80-20%, 12V
11	1520071	JF Disc, .001 uF ±10%, 1000V
12	1520018	N220 Disc, 56 pF ±10%
13	1520018	N220 Disc, 56 pF ±10%
14	1520014	NPO Disc, 39 pF ±10%
15	1520071	JF Disc, .001 uF ±10%, 1000V
316	1520071	JF Disc, .001 uF ±10%, 1000V

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Reference Number	Part Number	Description
CAPACITORS (Cont'd)		
C317	1520204	N750 Cer, 75 pF ±5%, 25V
18	1520176	N330 Disc, 82 pF ±10%
19	1520051	Y5U Disc, .01 uF ±20%, 25V
20	---	Not Assigned
21	1550002	Tant, 1 uF ±20%, 35V
22	1520039	Y5E Disc, 390 pF ±10%
23	1520027	N750 Cer, 150 pF ±10%
24	1520008	NPO Disc, 12 pF ±10%
25	1520071	JF Disc, .001 uF ±10%, 1000V
26	1520025	N1500 Disc, 120 pF ±10%
27	---	Not Assigned
28	1530013	Sil. Mica, 56 pF ±5%, 500V
29	1560406	Comp. Trimmer, 15-115pF, Arco 406
30	1530033	UHF Mica, 100 pF, Unelco T-101
31	1520028	Y5E Disc, 150 pF ±10%, 25V
32	1520007	NPO Disc, 10 pF ±10%
33	1570010	Comp. Trimmer, 2-20 pF, PC402
34	1550002	Tant, 1 uF ±20%, 35V
335	---	Not Assigned
401	1520008	NPO Disc. 12 pF ±10%
2	1550002	Tant, 1 uF ±20%, 35V
3	1550007	Tant, 10 uF ±20%, 35V
4	1520008	NPO Disc, 12 pF ±10%
5	1540014	Elec. 10 uF, 25V
6	1500018	Mylar, .01 uF ±10%, 100V, 663UW
7	1500013	Mylar, .0047 uF ±10%, 100V, 600UE
8	1500018	Mylar, .01 uF ±10%, 100V, 663UW
9	1540014	Elect. 10 uF, 25V
10	1550007	Tant, 10 uF ±20%, 35V
11	---	Not Assigned
412	---	Not Assigned
501	1530035	Sil. Mica, 10 pF ±5%
2	1570010	Comp. Trimmer, 2-20 pF, PC402
3	1550002	Tant, 1 uF ±20%, 35V
4	1520055	Magnacap Disc, .1 uF +80-20%, 12V
5	1520061	CF777 Feedthru, .001 uF, GMV
6	1530035	Sil. Mica, 10 pF ±5%
7	1570010	Comp. Trimmer, 2-20 pF, PC402
8	1550002	Tant, 1 uF ±20%, 35V
9	1520055	Magnacap Disc, .1 uF +80-20%, 12V
10	1520061	CF777 Feedthru, .001 uF, GMV
11	1530035	Sil. Mica, 10 pF ±5%
12	1570010	Comp. Trimmer, 2-20 pF, PC402
13	1550002	Tant, 1 uF ±20%, 35V
14	1520055	Magnacap Disc, .1 uF +80-20%, 12V
15	1520061	CF777 Feedthru, .001 uF, GMV
516	1570010	Comp. Trimmer, 2-20 pF, PC402

Reference Number	Part Number	Description
CAPACITORS (Cont'd)		
C517	1570010	Comp. Trimmer, 2-20 pF, PC402
18	1520004	NPO Disc, 4.7 pF, ±10%
19	---	Not Assigned
520	---	Not Assigned
601	1520008	NPO Disc, 12 pF ±10%
2	1510012	NPO Gimmick, 1.2 pF ±10%
3	1530001	Sil. Mica, 100 pF ±5%
4	1530031	UHF Mica, 8 pF, T-101
5	1530032	UHF Mica, 13.5 pF, T-101
6	1530032	UHF MIca, 13.5 pF, T-101
7	1530031	UHF MIca, 8 pF, T-101
8	1570009	Cer. Trimmer, 4-18 pF
9	1520071	JF Disc, .001 uF ±10%, 1000V
10	---	Not Assigned
11	---	Not Assigned
612	---	Not Assigned
DIODES		
CR101	4810017	Sil., Switching, 1N4148
2	4810017	Sil., Switching, 1N4148
3	4810007	Zener, 6.8V ±5%, ZS6.8A
4	4810021	Gen. Purpose, 1N34A
5	4810017	Sil., Switching, 1N4148
6	4810017	Sil., Switching, 1N4148
107	---	Not Assigned
201	4810013	Sil., 100 PRV, 1N4001
2	4810013	Sil., 100 PRV, 1N4001
3	---	Not Assigned
204	---	Not Assigned
301	4812109	Varactor, MV2109
2	4810007	Zener, 6.8V ±5%, ZS6.8A
3	4810017	Sil., Switching, 1N4148
4	4810017	Sil., Switching, 1N4148
305	3900030	Light Emitting Diode, Red, FLV-110
601	4810035	UHF PIN Diode, UM9401
2	4810035	UHF PIN Diode, UM9401
3	4810017	Sil., Switching, 1N4148
4	---	Not Assigned
5	---	Not Assigned

Reference Number	Part Number	Description
CAPACITORS (Cont'd)		
C317	1520204	N750 Cer, 75 pF ±5%, 25V
18	1520176	N330 Disc, 82 pF ±10%
19	1520051	Y5U Disc, .01 uF ±20%, 25V
20	---	Not Assigned
21	1550002	Tant, 1 uF ±20%, 35V
22	1520039	Y5E Disc, 390 pF ±10%
23	1520027	N750 Cer, 150 pF ±10%
24	1520008	NPO Disc, 12 pF ±10%
25	1520071	JF Disc, .001 uF ±10%, 1000V
26	1520025	N1500 Disc, 120 pF ±10%
27	---	Not Assigned
28	1530013	Sil. Mica, 56 pF ±5%, 500V
29	1560406	Comp. Trimmer, 15-115pF, Arco 406
30	1530033	UHF Mica, 100 pF, Unelco T-101
31	1520028	Y5E Disc, 150 pF ±10%, 25V
32	1520007	NPO Disc, 10 pF ±10%
33	1570010	Comp. Trimmer, 2-20 pF, PC402
34	1550002	Tant, 1 uF ±20%, 35V
335	---	Not Assigned
401	1520008	NPO Disc. 12 pF ±10%
2	1550002	Tant, 1 uF ±20%, 35V
3	1550007	Tant, 10 uF ±20%, 35V
4	1520008	NPO Disc, 12 pF ±10%
5	1540014	Elec. 10 uF, 25V
6	1500018	Mylar, .01 uF ±10%, 100V, 663UW
7	1500013	Mylar, .0047 uF ±10%, 100V, 600UE
8	1500018	Mylar, .01 uF ±10%, 100V, 663UW
9	1540014	Elect. 10 uF, 25V
10	1550007	Tant, 10 uF ±20%, 35V
11	---	Not Assigned
412	---	Not Assigned
501	1530035	Sil. Mica, 10 pF ±5%
2	1570010	Comp. Trimmer, 2-20 pF, PC402
3	1550002	Tant, 1 uF ±20%, 35V
4	1520055	Magnacap Disc, .1 uF +80-20%, 12V
5	1520061	CF777 Feedthru, .001 uF, GMV
6	1530035	Sil. Mica, 10 pF ±5%
7	1570010	Comp. Trimmer, 2-20 pF, PC402
8	1550002	Tant, 1 uF ±20%, 35V
9	1520055	Magnacap Disc, .1 uF +80-20%, 12V
10	1520061	CF777 Feedthru, .001 uF, GMV
11	1530035	Sil. Mica, 10 pF ±5%
12	1570010	Comp. Trimmer, 2-20 pF, PC402
13	1550002	Tant, 1 uF ±20%, 35V
14	1520055	Magnacap Disc, .1 uF +80-20%, 12V
15	1520061	CF777 Feedthru, .001 uF, GMV
516	1570010	Comp. Trimmer, 2-20 pF, PC402

Reference Number	Part Number	Description
CAPACITORS (Cont'd)		
C517	1570010	Comp. Trimmer, 2-20 pF, PC402
18	1520004	NPO Disc, 4.7 pF, ±10%
19	---	Not Assigned
520	---	Not Assigned
601	1520008	NPO Disc, 12 pF ±10%
2	1510012	NPO Gimmick, 1.2 pF ±10%
3	1530001	Sil. Mica, 100 pF ±5%
4	1530031	UHF Mica, 8 pF, T-101
5	1530032	UHF Mica, 13.5 pF, T-101
6	1530032	UHF MIca, 13.5 pF, T-101
7	1530031	UHF MIca, 8 pF, T-101
8	1570009	Cer. Trimmer, 4-18 pF
9	1520071	JF Disc, .001 uF ±10%, 1000V
10	---	Not Assigned
11	---	Not Assigned
612	---	Not Assigned
DIODES		
CR101	4810017	Sil., Switching, 1N4148
2	4810017	Sil., Switching, 1N4148
3	4810007	Zener, 6.8V ±5%, ZS6.8A
4	4810021	Gen. Purpose, 1N34A
5	4810017	Sil., Switching, 1N4148
6	4810017	Sil., Switching, 1N4148
107	---	Not Assigned
201	4810013	Sil., 100 PRV, 1N4001
2	4810013	Sil., 100 PRV, 1N4001
3	---	Not Assigned
204	---	Not Assigned
301	4812109	Varactor, MV2109
2	4810007	Zener, 6.8V ±5%, ZS6.8A
3	4810017	Sil., Switching, 1N4148
4	4810017	Sil., Switching, 1N4148
305	3900030	Light Emitting Diode, Red, FLV-110
601	4810035	UHF PIN Diode, UM9401
2	4810035	UHF PIN Diode, UM9401
3	4810017	Sil., Switching, 1N4148
4	---	Not Assigned
5	---	Not Assigned

Reference Number	Part Number	Description
FILTERS		
FL101/FL102	2303504	Crystal, 4-pole Monolithic, 10.7 MHz (Matched)
FL103/FL104	2303504	Crystal, 4-pole Monolithic, 10.7 MHz (Matched)
INTERGRATED CIRCUITS		
IC101	3130366	IF Amplifier, SC74126P
2	3130038	2nd Mixer, Quad Det., MC3357
3	3130367	Audio Amp., LM383
4	---	Not Assigned
105	---	Not Assigned
201	---	Not Assigned
2	---	Not Assigned
301	---	Not Assigned
2	---	Not Assigned
401	3130012	Dual-Op. Amp., MC1458
2	---	Not Assigned
501	---	Not Assigned
601	---	Not Assigned
701	3130021	8V Regulator, MC 7808CT
INDUCTORS		
L101	1800371	Coil, RF, 3-1/2T, Brown Hel.
2	1800371	Coil, RF, 3-1/2T, Brown Hel.
3	1800371	Coil, RF, 3-1/2T, Brown Hel.
4	1800411	Coil, RF, 2-1/2T, Paul Smith (Alum. slug)
5	1800371	Coil, RF, 3-1/2T, Brown Hel.
6	1800371	Coil, RF, 3-1/2T, Brown Hel.
7	1800371	Coil, RF, 3-1/2T, Brown Hel.
8	1800005	Coil, RF, 2-1/2T, #24 DCP
9	1800308	Coil, RF, 8-1/2T, Paul Smith
10	1800308	Coil, RF, 8-1/2T, Paul Smith
11	1800321	Coil, RF, 3-1/2T, Paul Smith
12	1800338	Coil, RF, .47 uH
13	1800322	Coil, RF, 4-1/2T, Paul Smith
14	---	Not Assigned
15	1800234	Coil, RF, 1-1/2T, Tinned
16	1800234	Coil, RF, 1-1/2T, Tinned
17	1800370	Coil, RF, 3-5/8T, White Hel.
18	1800370	Coil, RF, 3-5/8T, White Hel.
19	1800370	Coil, RF, 3-5/8T, White Hel.
20	---	Coil, RF, 2" #24 Tinned Bus
21	---	Not Assigned
22	---	Not Assigned
123	---	Not Assigned

Reference Number	Part Number	Description
INDUCTORS (Cont'd)		
L201	1800247	Choke, .65 mH min. @ 1 kHz & 7 amps DC
2	---	Not Assigned
301	1800312	Coil, RF, 12-1/2T, Paul Smith
2	1800312	Coil, RF, 12-1/2T, Paul Smith
3	1800360	Choke, RF, 220 uH, Wilco ES-3021
4	5600072	Coil, Mod.
5	1800312	Coil, RF, 12-1/2T, Paul Smith
6	1800312	Coil, RF, 12-1/2T, Paul Smith
7	1800304	Coil, RF, 4-1/2T, Paul Smith
8	1800304	Coil, RF, 4-1/2T, Paul Smith
9	1800321	Coil, RF, 3-1/2T, Paul Smith
10	1800237	Coil, RF, 4-1/2T
11	1800201	Coil, RF, 2-1/2T #20, LHH
12	1800233	Coil, RF, 1-1/2T
13	---	Not Assigned
14	---	Etched on PC Board
15	---	Etched on PC Board
16	1800371	Coil, RF, 3-1/2T, Brown Hel.
17	1800371	Coil, RF, 3-1/2T, Brown Hel.
18	1800371	Coil, RF, 3-1/2T, Brown Hel.
401	1800354	Choke, RF, 1 mH, Wilco ES-2735
2	---	Not Assigned
501	1800116	Coil, RF, 4-1/2T #24 DCP
2	1800254	Coil, RF, 5-1/2T #16
3	1800255	Coil, RF, 2-1/2T #16
4	1800338	Choke, RF, .47 uH, Wilco 201-11
505	---	Not Assigned
601	1800350	Choke, RF, 1 uH, Wilco ML10G
2	1800350	Choke, RF, 1 uH, Wilco ML10g
3	---	Etched on board
4	1800403	#22 Tinned Bus Wire, .025" x 1.25"
5	2510375	Beryllium-Copper Wire, .032" x 1.2"
6	1800403	#22 Tinned Bus Wire, .025" 1.25"
7	---	Not Assigned
8	---	Not Assigned
9	---	Not Assigned
610	---	Not Assigned
TRANSISTORS		
Q101	4805484	JFET, N-Channel, 2N5484
2	4805484	JFET, N-Channel, 2N5484
3	4805089	NPN, Sil., General Purpose, 2N5089
4	4800026	NPN, Sil., RF, White, MPS3693
5	4800024	NPN, Sil., RF, Blue, MPS3563
6	4800027	NPN, Sil., RF, MPS6511
107	---	Not Assigned

Reference Number	Part Number	Description
TRANSISTORS (Cont'd)		
Q201	4800023	PNP, Sil., Audio Power, MPSU52
2	4805089	NPN, Sil., General Purpose, 2N5089
3	4805089	NPN, Sil., General Purpose, 2N5089
4	---	Not Assigned
205	---	Not Assigned
301	4800033	NPN, Sil., General Purpose, MPS5172
2	4805461	JFET, P-Channel, 2N5461
3	4800026	NPN, Sil., RF, White, MPS3693
4	4800026	NPN, Sil., RF, White, MPS3693
5	4800024	NPN, Sil., RF, Blue, MPS3563
6	4800069	NPN, Sil., RF Power, MRF237
7	4800063	NPN, Sil., RF Power, MRF227
8	4800023	PNP, Sil., Audio Power, MPSU52
9	4800043	PNP, Sil., Audio Gen. Purpose, 2N5227
10	4800043	PNP, Sil., Audio Gen. Purpose, 2N5227
11	4800018	NPN, Sil., Audio Power, MPSU01
12	---	Not Assigned
401	---	Not Assigned
2	---	Not Assigned
501	4806090	NPN, Sil., 2N5945
2	4806091	NPN, Sil., 2N5946
3	4806092	NPN, Sil., RF Power, 2N6136
4	---	Not Assigned
5	---	Not Assigned
601	4800051	NPN, Sil., Darlington Pair, MPSA13
RESISTORS		
R101	4710005	47-ohm± 5%, 1/4W
2	4710029	10K ±5%, 1/4W
3	4710008	100-ohm ±5%, 1/4W
4	4710013	470-ohm ±10%, 1/4W
5	4710032	22K ±5%, 1/4W
6	4710008	100-ohm ±5%, 1/4W
7	4710033	33K ±5%, 1/4W
8	4760051	25K Potentiometer, Squelch
9	4710032	22K ±5%, 1/4W
10	4710038	100K ±5%, 1/4W
11	4710035	47K ±5%, 1/4W
12	4710032	22K ±5%, 1/4W
13	4710041	220K ±10%, 1/4W
14	4710033	33K ±5%, 1/4W
15	4710025	4.7K ±5%, 1/4W
16	4710036	56K ±5%, 1/4W
17	4710037	82K ±5%, 1/4W

Reference Number	Part Number	Description
RESISTORS (Cont'd)		
R118	4710037	82K ±10%, 1/4W
19	4710025	4.7K ±5%, 1/4W
20	4710068	68K ±10%, 1/4W
21	4760052	25K Potentiometer, Volume w/ON-OFF Sw.
22	4710028	8.2K ±5%, 1/4W
23	4700001	2.2-ohm ±10%, 1/2W
24	4710011	220-ohm ±5%, 1/4W
25	4710017	1K ±5%, 1/4W
26	4710022	2.7K ±5%, 1/4W
27	4710027	6.8K ±5%, 1/4W
28	4710009	150-ohm ±5%, 1/4W
29	4710015	680 ohm ±10%, 1/4W
30	4710029	10K ±5%, 1/4W
31	4710008	100-ohm ±5%, 1/4W
32	4710017	1K ±5%, 1/4W
33	4710043	270K ±5%, 1/4W
34	4710001	10-ohm ±10%, 1/4W
35	---	Not Assigned
136	---	Not Assigned
201	4710009	150-ohm ±5%, 1/4W
2	4710017	1K ±5%, 1/4W
3	4710017	1K ±5%, 1/4W
4	4760015	1K ±20%, Potentiometer
5	---	Not Assigned
301	4710026	5.6K ±5%, 1/4W
2	4710026	5.6K ±5%, 1/4W
3	4710012	330-ohm ±5%, 1/4W
4	4710023	3.3K ±5%, 1/4W
5	4710026	5.6K ±5%, 1/4W
6	4710012	330-ohm ±5%, 1/4W
7	4710006	56-ohm ±10%, 1/4W
8	4710027	6.8K ±5%, 1/4W
9	4710012	330-ohm ±5%, 1/4W
10	4710001	10-ohm ±10%, 1/4W
11	4710006	56-ohm ±10%, 1/4W
12	4710025	4.7K ±5%, 1/4W
13	4710012	330-ohm ±5%, 1/4W
14	4710001	10-ohm ±10%, 1/4W
15	4710008	100-ohm ±5%, 1/4W
16	---	Not Assigned
17	4710001	10-ohm ±10%, 1/4W
18	4710021	2.2K ±5%, 1/4W
19	4710001	10-ohm ±10%, 1/4W
20	4760034	10K Thermistor, JA41J1
21	4710029	10K ±5%, 1/4W
22	4710029	10K ±5%, 1/4W
23	4710017	1K ±5%, 1/4W
24	4700011	68-ohm ±10%, 1/2W
325	4700011	68-ohm ±10%, 1/2W

Reference Number	Part Number	Description
RESISTORS (Cont'd)		
R326	4710036	56K ±5%, 1/4W
27	4710011	220-ohm ±5%, 1/4W
28	---	Not Assigned
29	---	Not Assigned
R401	4710035	47K ±5%, 1/4W
2	4760039	500K ±20%, Var., Minipot
3	4710009	150-ohm ±5%, 1/4W
4	4760021	50K ±20%, Var., Minipot
5	4710029	10K ±5%, 1/4W
6	4710033	33K ±5%, 1/4W
7	4710027	6.8K ±5%, 1/4W
8	4710026	5.6K ±5%, 1/4W
9	4760021	50K ±20%, Var., Minipot
10	4710029	10K ±5%, 1/4W
11	---	Not Assigned
12	---	Not Assigned
13	---	Not Assigned
414	---	Not Assigned
501	4710006	56-ohm ±5%, 1/4W
2	4710001	10-ohm ±5%, 1/4W
3	---	Not Assigned
504	---	Not Assigned
601	4730009	220-ohm ±10%, 1W
2	4710019	1.5K ±5%, 1/4W
3	4700021	470-ohm ±10%, 1/2W
4	4710021	2.2K ±5%, 1/4W
5	4710025	4.7K ±5%, 1/4W
6	---	Not Assigned
607	---	Not Assigned
701	4700020	390 ohm ±10%, 1/2W
2	4700012	82 ohm ±10%, 1/2W
SWITCHES		
SW101	5100039	Switch, Slide - Crystal Selector, SL10
2	---	Not Assigned
201	---	ON-OFF, Part of Vol. Cont. R121
2	---	Not Assigned
203	---	Not Assigned
TRANSFORMERS		
T101	5600044	IF, 10.7 MHz, Green
2	5600044	IF, 10.7 MHz, Green
3	5600044	IF, 10.7 MHz, Green
104	5600044	IF, 10.7 MHz, Green

Reference Number	Part Number	Description
TRANSFORMERS (Cont'd)		
T105	5600043	IF, 455 kHz, Black
6	5600043	IF, 455 kHz, Black
7	---	Not Assigned
108	---	Not Assigned
CRYSTALS		
Y101	2300341	Crystal, Quartz - receive (Specify Freq.)
2	2300341	Crystal, Quartz - receive (Specify Freq.)
3	2300252	Crystal, 2nd L.O., 10.245 MHz
4	---	Not Assigned
105	---	Not Assigned
201	---	Not Assigned
2	---	Not Assigned
301	2300340	Crystal, Quartz - transmit (Specify Freq.)
2	2300340	Crystal, Quartz - transmit (Specify Freq.)
3	---	Not Assigned
304	---	Not Assigned
CHOKES		
Z101	---	Not Assigned
2	---	Not Assigned
201	---	Not Assigned
2	---	Not Assigned
301	1800339	Choke, Wide-Band, VK 200 10/3B
2	1800339	Choke, Wide-Band, VK 200 10/3B
3	1800339	Choke, Wide-Band, VK 200 10/3B
4	---	Not Assigned
305	---	Not Assigned
401	---	Not Assigned
2	1870003	Bead, Ferrite, 57-0180
403	---	Not Assigned
501	1870003	Bead, Ferrite, 57-0180
2	1800339	Choke, Wide-Band, VK 200 10/3B
3	1800339	Choke, Wide-Band, VK 200 10/3B
4	1800339	Choke, Wide-Band, VK 200 10/3B
5	1870003	Bead, Ferrite, 57-0180
6	1870003	Bead, Ferrite, 57-0180
507	---	Not Assigned
601	1870003	Bead, Ferrite, 57-0180
2	1870003	Bead, Ferrite, 57-0180
3	---	Not Assigned
604	---	Not Assigned

Reference Number	Part Number	Description
MISCELLANEOUS		
---	2510111	Panel, Front
---	2510158	Frame, Front
---	2510152	Panel, Sub
---	2510129	Chassis, Sidepanel, Left
---	2510128	Chassis, Sidepanel, Right
---	2510130	Cover, Chassis Top
---	2510131	Cover, Chassis Bottom
---	2510432	Knob, Vol. and Squelch
SP101	1320020	Speaker, 3W, 3-ohm, Quam 72-5276
---	7052400	Microphone, 1325069
---	2510074	Bracket, Mic. Mounting Clip
J403	2100077	Connector, 4-pin, mic.
P403	2100076	Plug, Male - Microphone
---	2100255	Plug, 15-pin Male
---	2100253	Terminal, Male, for above plug
---	2100252	Connector, 15-pin Female
---	2100254	Terminal, Female, for above connector
---	7083001	Cavity, Signal 450 - 470 MHz
---	7083002	Cavity, Loc. Osc. 450 - 470 MHz
---	7083003	Cavity, Transmit 450 - 470 MHz
---	2100256	Receptacle, Antenna (SO239)
---	2510280	Heatsink
---	5300004	Heatsink, #2225C Thermaloy, TO5
---	2400023	Knob, Thumbwheel
---	2508532	Bracket, Locking
---	2508751	Washer, Friction
---	2510162	Bracket, Handle
---	2820010	Washer, Nylon
---	2510486	Shield, frame
---	2510487	Shield, cover
---	2840010	Grommet
---	2510079	Grille, Speaker
---	2510414	Shield, Main Board
---	2510354	Shield, RF Switch PC Board
---	2510355	Shield, Main Board
F201	5140021	Fuse, 3AG 10 amp.
---	7011200	SA-1 Jumper Bd. Assy (If SA-1 option not used)

GMT 240U

DC Voltage Measurements

All voltages shown in this table must be measured with an accurate VTVM. The input voltage to the unit should be set to +13.75 VDC and the receiver 10 volt regulator should be set to +10.00 VDC. A measurement voltage variation of ± 20% may be considered normal. All receiver voltages taken under no signal conditions.

Ref.No	Rx			Tx			Ref. No.	Rx			Tx		
Q	E	B	C	E	B	C	Q	E	B	C	E	B	C
101*	(0)	(0.15	(10)	(0)	(0.37)	(9.7)	308	13.75	13.75	0	13.0	12.0	6.8
102*	(0)	(.68)	(10)	(0)	(0.74)	(10)	309	1.9	1.2	0	1.9	1.2	0
103	0	0.63	1.46	0	0	0	310	1.9	5.5	0.12	1.9	5.5	0.12
104	0.85	1.28	10.0	0	0.17	10.0	311	0	0.12	13.75	0	0.12	13.75
105	0.64	0.59	10.0	0.40	0.64	10.0							
106	0	1.26	13.75	0	0.70	13.75	501	0	-	13.75	0	-	13.75
							502	0	-	13.75	0	-	13.75
201	13.75	13.07	10	13.75	13.07	10	503	0	-	13.75	0	-	13.75
202	6.54	6.8	13.07	6.54	6.8	13.07							
203	6.54	7.17	10.0	6.54	7.17	10.0	601	0	0	13.0	0	1.40	.78
301	0	0	0	3.4	3.4	6.8							
302*	(0)	(0)	(0)	(6.8)	(6.8)	(0)							
303	0	0	0	0.64	0.37	6.8							
304	0	0	13.75	0.67	0.27	13.75							
305	0.22	1.0	13.75	1.85	0.54	13.75							
306	0	0	13.75	0	0	11.0							
307	0	0	10.0	0	0	10.0							

* Denotes F.E.T. voltages in the form: (Gate) (Source) (Drain)