MOTOROLA INC.

HT600™

Handie-Talkie® Portable Radios

Instruction Manual

NOTE

Be sure to use the entire model number when making inquiries about your equipment.

Identifiers have been assigned to chassis and kits. Use these identifiers when requesting information or ordering replacements.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision number is assigned to the chassis or kit affected; -1, -2, -3, etc.

The chassis number complete with revision number, if any, is stamped on the chassis at the time of production. The revision number becomes an integral part of the chassis identifier. Revisions, if any, are listed on the schematic diagram.

INSTRUCTION MANUAL REVISIONS

Changes which occur after a manual is printed are described in the Instruction Manual Revision. These "FMRs" give the reader complete information on the change including pertinent parts listing data.

NATIONAL SERVICE ORGANIZATION

Motorola provides a nationwide service organization. Through its maintenance and installation program, Motorola makes available the finest service to those desiring reliable continuous communications on a contract basis.

For your contract service requirements, please contact your local Motorola representative or write to:

National Service Manager
Motorola Communications & Electronics, Inc.
1301 E. Algonquin Road, Schaumburg, IL 60196

SAFETY INFORMATION

The Federal Communications Commission (FCC) with its action in General Docket 79-144, March 13, 1985 has adopted a safety standard for the human exposure to radio frequency (rf) electromagnetic energy emitted by FCC regulated equipment. Motorola subscribes to the same safety standard for use of its products. Proper operation of this radio will result in user exposure substantially below the FCC recommended limits.

DO NOT hold the radio with the antenna very close to, or touching, exposed parts of the body, especially the face or eyes, while transmitting. The radio will perform best if the microphone is two or three inches away from the lips and the radio is vertical.

DO NOT hold the transmit (PTT) switch on when not actually desiring to transmit.

DO NOT allow children to play with any radio equipment containing a transmitter.

DO NOT operate a transmitter near unshielded electrical blasting caps or in an explosive atmosphere unless it is a type especially qualified for such use.

COMPUTER SOFTWARE COPYRIGHTS

CONTENTS

Instruction Manual
68P81065C75-A

SERVICE INFORMATION

SUPPLEMENTAL SECTIONS (at rear of manual)

RELATED PUBLICATIONS AVAILABLE SEPARATELY

Operating Instructions	68P81057C25
HELP Card	68P81057C40
Single-Unit Battery Chargers	68P81108C83

LIST OF ILLUSTRATIONS

LIST OF TABLES

MODEL CHART

MODEL NUMBER										ITEM NO.	DESCRIPTION
H33SVU7120BN											HT600 "HANDIE-TALKIE" PORTABLE RADIO, VHF, 2-WATT, 2-FREQ.
	H43SVU7120BN										HT600 "HANDIE-TALKIE" PORTABLE RADIO, VHF, 5-WATT, 2-FREQ.
		H33SVU7160BN									HT600 "HANDIE-TALKIE" PORTABLE RADIO, VHF, 2-WATT, 6-FREQ.
			H43SVU7160BN								HT600 "HANDIE-TALKIE" PORTABLE RADIO, VHF, 5-WATT, 6-FREQ.
					H34SVU7120CN						HT600 "HANDIE-TALKIE" PORTABLE RADIO, UHF, 2-WATT, 2-FREQ.
						H44SVU7120CN					HT600 "HANDIE-TALKIE" PORTABLE RADIO, UHF, 4-WATT, 2-FREQ.
							H34SVU7160CN				HT600 "HANDIE-TALKIE" PORTABLE RADIO, UHF, 2-WATT, 6-FREQ.
								H44SVU7160CN			HT600 "HANDIE-TALKIE" PORTABLE RADIO, UHF, 4-WATT, 6-FREQ.
A	A	A	A							NAD6282A	ANTENNA, HELIFLEX, CODED YELLOW (136 - 150.8 MHz)
A	A	A	A							NAD6283A	ANTENNA, HELIFLEX, CODED BLACK (150.8 - 162 MHz)
A	A	A	A							NAD6284A	ANTENNA, HELIFLEX, CODED BLUE (162 - 174 MHz)
					X	X	X	X		NAE6350A	ANTENNA, WHIP (403 - 512 MHz)
X	X	X	X		X	X	X	X		NHN6388A	HOUSING, SHADOW BRONZE
X		X			X		X			NTN4584B	BATTERY, DUAL CHARGE, MEDIUM CAPACITY
X	X	X	X		X	X	X	X		NTN4566A	FRAME
X	X	X	X		X	X	X	X		NTN4568C	CONTROLLER BOARD
X	X	X	X		X	X	X	X		NTN4581A	SHIELD
X	X	X	X		X	X	X	X		NTN4623A	HARDWARE, MISCELLANEOUS
X	X	X	X							NTN4628B	FRONT COVER, VHF
					X	X	X	X		NTN4955B	FRONT COVER, UHF
X	X				X	X				NTN4749A	ESCUTCHEON, 2-FREQ.
		X	X				X	X		NTN4750A	ESCUTCHEON, 6-FREQ.
X	X	X	X		X	X	X	X		NTN4767A	LABEL, FCC
X	X	X	X		X	X	X	X		NTN4904A	FASTENER KIT
X	X	X	X		X	X	X	X		NTN5389B	3" BELT CLIP
	X		X			X		X		NTN5414B	BATTERY, DUAL CHARGE, HIGH CAPACITY
A		A								NUD6771B	TRANSCEIVER CIRCUIT, 5-WATT (136-150.8 MHz)
	A		A							NUD6772B	TRANSCEIVER CIRCUIT, 5-WATT (146 - 162 MHz)
	A		A							NUD6773B	TRANSCEIVER CIRCUIT, 5-WATT (157 - 174 MHz)
A		A								NUD6781B	TRANSCEIVER CIRCUIT, 2-WATT (136 - 150.8 MHz)
A		A								NUD6782B	TRANSCEIVER CIRCUIT, 2-WATT (146 - 162 MHz)
A		A								NUD6783B	TRANSCEIVER CIRCUIT, 2-WATT (157 - 174 MHz)
						A		A		NUE6901C	TRANSCEIVER CIRCUIT, 4-WATT (403-433 MHz)
						A		A		NUE6902D	TRANSCEIVER CIRCUIT, 4-WATT (438 - 470 MHz)
						A		A		NUE6903A	TRANSCEIVER CIRCUIT, 4-WATT (470-500 MHz)
						A		A		NUE6904A	TRANSCEIVER CIRCUIT, 4-WATT (488 - 520 MHz)
					A		A			NUE6911C	TRANSCEIVER CIRCUIT, 2-WATT (403-433 MHz)
					A		A			NUE6912E	TRANSCEIVER CIRCUIT, 2-WATT (438 - 470 MHz)

KEY: **X =** ITEM INCLUDED
A = ALTERNATE ITEM INCLUDED, CHOICE DEPENDS ON CARRIER FREQUENCY AND TRANSMIT POWER

OPTION CHART

MODEL NUMBER	DESCRIPTION
H33SVU7120BN	HT600 "HANDIE-TALKIE" PORTABLE RADIO, VHF, 2-WATT
H43SVU7120BN	HT600 "HANDIE-TALKIE" PORTABLE RADIO, VHF, 5-WATT
H33SVU7160BN	HT600 "HANDIE-TALKIE" PORTABLE RADIO, VHF, 2-WATT
H43SVU7160BN	HT600 "HANDIE-TALKIE" PORTABLE RADIO, VHF, 5-WATT
H34SVU7120CN	HT600 "HANDIE-TALKIE" PORTABLE RADIO, UHF, 2-WATT
H44SVU7120CN	HT600 "HANDIE-TALKIE" PORTABLE RADIO, UHF, 4-WATT
H34SVU7160CN	HT600 "HANDIE-TALKIE" PORTABLE RADIO, UHF, 2-WATT
H44SVU7160CN	HT600 "HANDIE-TALKIE" PORTABLE RADIO, UHF, 4-WATT

OPTION NO.	OMIT	ADD	DESCRIPTION
H112	NAD6282A	-----	OMIT ANTENNA
	NAD6283A	-----	
	NAD6284A	-----	
	NAE6350A	-----	
H124	NAE6350A	NAE6231A	HELIFLEX ANTENNA
		NAE6232A	
		NAE6233A	
H153	-----	*	OMIT ALL ALERT TONES
H226	NTN4563A	NTN5414B	DUAL HIGH CAPACITY BATTERY
	NTN5413A		
H228	-----	*	BATTERY SAVER
H236	NTN4563A	NTN5415B	DUAL HIGH CAPACITY BATTERY (FACTORY MUTUAL)
	NTN5413A		
H297	NTN4628A	NTN4627B	DTMF
H301	NTN5389B	-----	OMIT BELT CLIP
H306	NTN5389B	NTN4814B	CARRY HOLDER
H312	NTN5389B	NTN5460B	CARRY CASE, BELT AND LOOP
H319	NTN5389B	NTN5461B	LEATHER SWIVEL CASE, T-STRAP, AND SWIVEL LOOP (2.5")
H358	-----	*	LED DISABLE
H701	-----	*	INDIVIDUAL CALL ("QUIK-CALL II")
H713	NTN4628A	NTN5215A	DTMF CONTINUOUS TONE
H743	NTN4628A	NTN5405A	DTMF WITH ANI
H753	NTN4563A	NTN4564B	MEDIUM CAPACITY FACTORY MUTUAL BATTERY
	NTN4513A		
H757	-----	-----	FM NON-INCENDIVE RATING
H804	-----	*	PAC-RT® OPERATION
H901	-----	*	TIME-OUT TIMER (60 SECONDS)

X SPECIFIES RADIO MODEL FOR WHICH OPTION IS AVAILABLE

* PROGRAMMING MODIFICATIONS ONLY

SPECIAL TERMS AND ABBREVIATIONS

The construction technology and circuits in the HT600 radio require the use of the following special terms and abbreviations.

Term:	Description:
Alert Tones	Audible annunciators of radio status
Code Plug	That portion of the software that is coded for the individual user
DPL	Digital Private-Line™ (digitally coded squelch)
DTMF	Dual-Tone, Multi-Frequency (phone interconnect signalling)
Logic 1	A voltage level of approximately 5Vdc
Logic 0	A voltage level of approximately 0Vdc
PA	Power Amplifier
PL	Private-Line® (tone coded squelch)
PLL	Phase-Locked Loop
Quik-Call II™	Paging Option
RIB	Radio Interface Box - Converts RS-232 Voltage level signals to 0 and 5 volts
RX	Receive
TX	Transmit
Transceiver Board	The printed circuit board containing the functional components of the receiver and transmitter
VCO	Voltage-Controlled Oscillator

FCC REGULATIONS

State that:

1. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and the local conditions.
2. Frequency and deviation of a transmitter must be checked before it is placed in service and rechecked once each year thereafter.

FCC DESIGNATIONS

H33 Series Models:	AZ489FT3699
H43 Series Models:	AZ489FT3700
H34 Series Models:	AZ489FT4700
H44 Series Models:	AZ489FT4701

GENERAL DESCRIPTION

1. INTRODUCTION

The frequency-synthesized HT600 "Handie-Talkie" Radio is an advanced design, microcomputer-based transceiver that incorporates the latest technology available in two-way radio communications. All channel frequencies and squelch codes are stored in an electrically-erasable programmable read-only memory (EEPROM), with all transmit and receive operations controlled by a microcomputer.

The functions provided by the radio are identified by the model and option numbers as illustrated by the model/option charts at the front of this manual. Model and option numbers will be shown on the radio's information instruction sheet, which is shipped with each new radio.

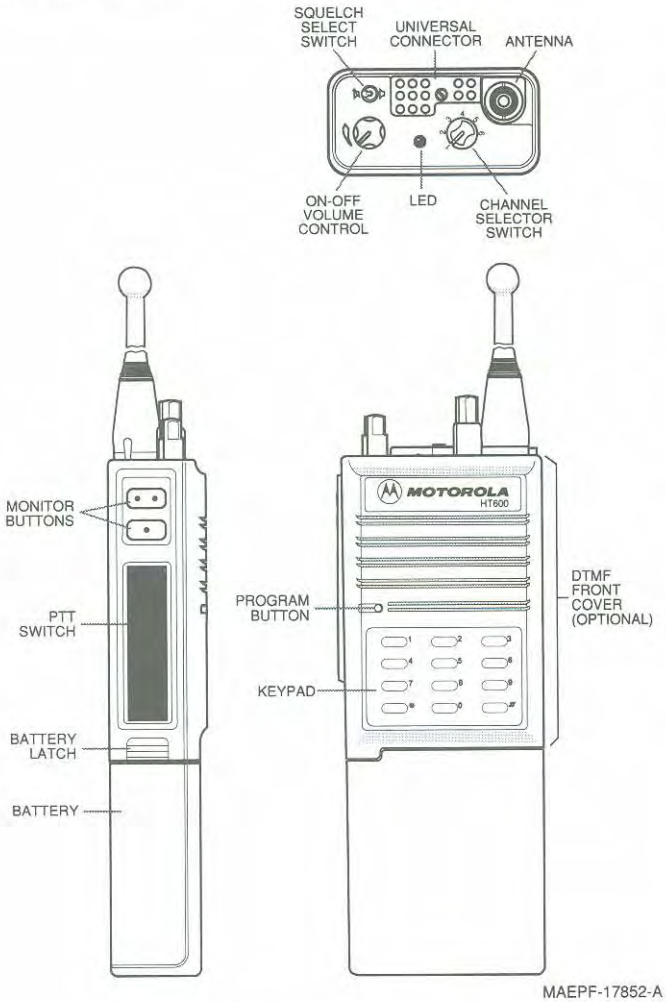

Figure 1. Typical HT600 Series Radio

a. Physical Description

All operating controls, except the push-to-talk (PTT) switch, the monitor buttons, and the keypad (models with DTMF Option), are located on top of the radio. The PTT switch and monitor buttons are located on the left side of the radio (viewed from the front), and the keypad (if so equipped) is an integral part of the front cover.

The HT600 radio is small in size and weight, and constructed of a highly durable, impact resistant, molded polycarbonate housing. O-rings and seals are utilized throughout the radio. All controls, including the PTT switch, the monitor buttons, and the keypad are weather resistant, and the microphone and speaker are covered with a special diaphragm to provide extra resistance against dirt, dust, and water intrusion. This proven rugged construction offers excellent protection against adverse environmental conditions.

The height of the radio varies with the size of the battery. All other dimensions are standard, except for those radios with a keypad option.

b. Electrical Description

Electrically, the radio can be divided into two basic sections; a transceiver board and a controller flexible circuit. The transceiver performs the transmit and receive functions, and the controller controls those functions.

The transceiver board includes an antenna switching circuit, a dual-conversion receiver, and a transmitter. The transmitter carrier and receiver first injection signals are generated by a common phase-locked loop (PLL) consisting of a voltage-controlled oscillator (VCO) and a frequency synthesizer.

The controller flex assembly contains a microcomputer, an EEPROM which stores the channel frequencies and squelch codes, and an audio power amplifier integrated circuit (IC) that includes transmitter and receiver audio amplifiers. The controller flex also includes an audio filter IC which encodes and decodes (in conjunction with a microcomputer) squelch codes, adjusts and limits the audio level for correct transmitter deviation, and pre-emphasizes and de-emphasizes audio signals. Another circuit which is contained on the controller flex is a dc switch, which controls the radio's transmit and receive voltages.

2. STANDARD FEATURES

The HT600 radio has an internal microphone and speaker, but can be operated with an optional external microphone and/or speaker. An external antenna connector and a top-mounted "universal connector" provide easy access for testing, and for attaching a wide variety of audio accessories. Radio models are available with up to six channels of carrier, tone Private-Line (PL), and/or Quik-Call™, and/or Digital Private-Line (DPL) squelch operation. Type of squelch is enabled on a per channel basis with up to three codes available per radio. Two power output levels are offered, medium power (2 watts) or high power (5 watts on VHF models or 4 watts on UHF models).

The battery pack slides on to the bottom of the radio and is held in place by a spring-loaded catch. Batteries are available in two different sizes which correspond to the battery capacity (medium and high). The medium- and high-capacity batteries are available in dual charge rates. The different size batteries affect the operating time between charges as well as the overall height and weight of the radio.

A bicolor LED on the top of the radio serves as user feedback. The LED indicates when the radio is in transmit (continuous red), a low-battery condition (flashing red), or channel busy (flashing green - coded squelch application only).

3. SPECIAL STANDARD FEATURES

a. Radio Cloning

Each HT600 radio has a unique data-stored "personality" with frequencies, squelch code pairs, and other operating characteristics. Using a simple cloning cable, one radio's characteristics can be duplicated into another HT600 radio of the same bandsplit.

b. Field Programming

The HT600 radio utilizes a reprogrammable EEPROM codeplug, which permits operating characteristics to be changed without opening the radio. Programming is accomplished via a programming cable interface to an IBM PC, Laptop PC, or Personal System/2 computers.

c. Multiple Digital Private-Line, Tone Private-Line Coded Squelch and Single Combination of Quik-Call II Codes

Coded squelch allows only those calls with a radio's particular code to be heard, and can be enabled on a per-channel basis. So, an HT600 radio can have carrier squelch on some channels, Digital PL squelch on others, Tone PL squelch on others, and Quik-Call II on even others. You can choose from 80 Digital Private-Line codes and 28 Tone Private-Line codes.

4. PRINTED CIRCUIT BOARDS AND FLEXIBLE CIRCUITS

a. General

Functional circuits in the HT600 radio are contained on: (1) the Transceiver Board and (2) the Controller Flex. Four flexible printed circuits eliminate all discrete wiring, except the switched B+ wire to the transceiver board. Radios with keypad options have functional circuits contained on a board in the front cover.

b. Transceiver Board

The transceiver board is a two-layer printed circuit board (vhf models) or a four-layer printed circuit board (uhf models) containing the rf and i-f portions of the radio. Almost all components are mounted on the top side of this board.

c. Controller Flex

The controller flex is packaged inside a protective flex carrier. It is a two-layer flexible printed circuit with the components surface-mounted on one side. When packaged in the flex carrier it is folded in half, with all components on the outside.

d. Interconnect Flexes

The interconnect flexes are two-layer flexible printed circuits. These include:

- PTT/B+ Flex
- Volume Pot Flex
- Frequency Switch Flex
- I-F Interconnect Flex

e. Keypad Board (Optional)

The keypad option board is a four-layer printed circuit board mounted in the radio's front cover. All components are surface mounted on one side of the board.

5. BATTERIES

The rechargeable nickel-cadmium batteries available for the HT600 radio are listed in Table 1. Battery choice is governed by duty cycle, operating time, and maximum height and weight desired.

Table1. Batteries for the HT600 Radio

KIT NUMBER	BATTERY CAPACITY	CHARGE TIME (IN RAPID CHARGER)	*TYPICAL HOURS OF OPERATION	
			2-WATT RADIOS	4- & 5-WATT RADIOS
NTN4584	MEDIUM	1 HR	8 HRS	5 HRS
NTN4564	MEDIUM (FM)	1 HR	8 HRS	5 HRS
NTN5415	HIGH (FM)	1 HR	**13 HRS	8 HRS
NTN5414	HIGH	1 HR	**13 HRS	8 HRS

* BASED ON A DUTY CYCLE OF 5% TRANSMIT, 5% RECEIVE, AND 90% STANDBY TIME.
** 14 HOURS ON VHF RADIOS
FM = Factory Mutual intrinsically safe approved.

The NTN4590 alkaline battery is available for powering the HT600 radio. Alkaline batteries are not rechargeable.

BATTERY CHARGING

1. CHARGERS AVAILABLE

Available chargers include compact chargers, single-unit desk top chargers, and multiple-unit chargers that may be mounted on a wall or bench. The multiple-unit chargers will charge up to six nickel-cadmium batteries at one time.

The chargers are available in slow charge and rapid charge models. The slow charge models will charge the batteries, with or without the radio (radio must be turned off) attached, in 16 hours. The rapid charge models will charge the dual-charge batteries in approximately one hour.

Refer to the ACCESSORIES page in the Operating Instructions Manual for a list of the available battery chargers and their applications. For further information, contact your Motorola sales representative.

2. BATTERY CONSTRUCTION *(See Figure 2)*

The HT600 dual-charge battery has four charger contacts, two of which receive the charging current. A third contact connects an internal resistor (R_R) to the charger, automatically setting the charging current output to match the capacity of the battery. The fourth contact connects an internal thermistor to the charger. The thermistor senses battery temperature and automatically controls the charger output to permit maximum charger output without overheating the battery.

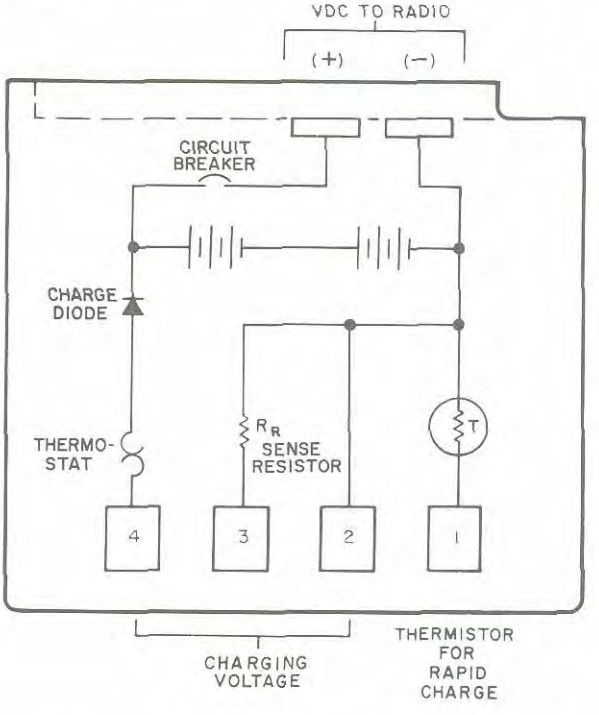

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Figure 2. Typical Dual-Charge Battery Construction, Rear View

All dual-charge batteries contain an internal current-limiting device (breaker) for protection. A diode in the battery prevents damage from an accidental short between the charging contacts.

CAUTION

Sustained shorts across the radio contacts (+, -), excessive current, or excessive heat will destroy the internal thermal fuse, which is not replaceable.

3. BATTERY CHARACTERISTICS

Each nickel-cadmium battery consists of eight cells connected in series to provide a nominal 10Vdc output, which remains approximately constant under load until the battery approaches a discharged condition. At this time, a marked decrease in voltage occurs and the discharge condition (1.0 volt per cell) is reached abruptly.

A general characteristic of all rechargeable batteries in storage is self-discharge. If the battery is to be used after an unknown period of storage, it is recommended that it be charged at the full charging rate using an approved battery charger.

4. MAINTENANCE

The battery cells will never require additional electrolyte. The only maintenance required is recharging the battery and keeping the contacts clean. Use only a Motorola-approved charger. The use of other chargers, unless approved, will void the battery warranty and may result in permanent damage to the battery.

5. STORAGE

The battery may be stored at room temperature in any state of charge without damage. As previously stated, however, the battery is subject to self-discharge and should be recharged after extended storage.

6. DETERMINING BATTERY CAPACITY

Battery capacity is determined by measuring the time that a fully-charged battery requires to discharge to eight volts through a specified load, as described in the following procedure.

NOTE

This procedure requires using a 20-ohm, 1%, 10-watt load resistor to discharge medium-capacity batteries, and an 11-ohm, 1%, 15-watt load resistor to discharge high-capacity batteries.

a. Obtain a Radio Housing Adapter (Motorola part number 1580368B62) from your nearest Area Parts Office.

b. Connect the appropriate 20-ohm or 11-ohm load resistor (see preceeding Note) between the gold (+) terminal and a solder lug (-) screw and nut of the housing adapter.

c. Connect a voltmeter across the load resistor and slide a fully charged battery onto the housing adapter.

d. Monitor the voltmeter as the battery discharges through the load resistor, until the voltage is eight volts. This will erase the memory effect.

e. Disconnect battery from the housing adapter (resistor load) when the cell pack reaches 8.0 volts.

CAUTION

Discharging the battery down to 4.0 volts can cause permanent cell pack damage.

f. Recharge the battery to a complete charge. This will require a 1-hour rapid charge followed by a 16-hour standard charge.

g. Re-attach the battery to the housing adapter (resistor load) and measure the elapsed time until the cell pack reaches 8.0 volts. Disconnect the battery.

h. A good battery will require 48 minutes or longer to discharge, indicating greater than 80% of rated capacity. A weak battery will drop below 8.0 volts in less than 48 minutes.

THEORY OF OPERATION

1. INTRODUCTION

This section of the manual provides a functional description of the HT600 radio. First, overall basic functions are discussed in general terms, with each circuit and its relationship to other parts of the radio described. Then, detailed circuit descriptions are given for each board, circuit, and module used in the radio.

2. BASIC FUNCTIONAL DESCRIPTION

a. DC Voltage Distribution *(See Figure 3)*

Operating power for the radio is derived from a 10-volt battery. This 10 volts (BATT B+), via the PTT/B+ flex, the frequency switch flex, and the volume pot flex, is applied to the ON/OFF switch. When the radio is turned on, the voltage sources required to operate the various stages of the radio are distributed as shown in Figure 3. In the transmit mode (PTT actuated) a logic low on the R/T line enables the DC switch to provide the required 5 Vdc and 10 Vdc to the transmitter circuits.

b. Frequency Generation and Distribution Circuits *(See Figure 4)*

The frequency generation and distribution circuits in the HT600 radio are common to both transmitter and receiver. They consist of two phase-locked loops (PLLs). One PLL provides the carrier frequency for the transmitter and the injection signal for the receiver first mixer stage. The other PLL generates the second local oscillator (LO) signal. Audio is modulated on the carrier in two different places (two-spot modulation); the VCO's frequency response allows it to modulate audio above 60 Hz, and the reference modulator modulates audio below 60 Hz.

The frequency generation circuits include a reference oscillator (U106), a synthesizer (U202), and a VCO (U201). The reference oscillator generates a 16.8 MHz reference signal for the synthesizer. An external adjustment is provided to set the frequency at the output of the reference oscillator.

The following is a functional description of the transmitter first injection PLL. Initially, the VCO becomes active and generates a signal, part of which is coupled back to the synthesizer as a feedback signal. The synthesizer divides this signal and compares it to a reference frequency. If the frequencies differ, the synthesizer generates a control (error) voltage which causes the VCO to change frequency. When the VCO reaches the correct frequency, the synthesizer generates a constant control voltage signal, locking the VCO on frequency. In the transmit mode, voice audio is applied to a varactor on the VCO. The capacitance of the varactor changes in proportion to the instantaneous audio voltage, which results in a shift in carrier frequency at an audio rate. Audio below 60 Hz is modulated onto the synthesizer reference signal, which in turn causes a similar shift in the carrier frequency.

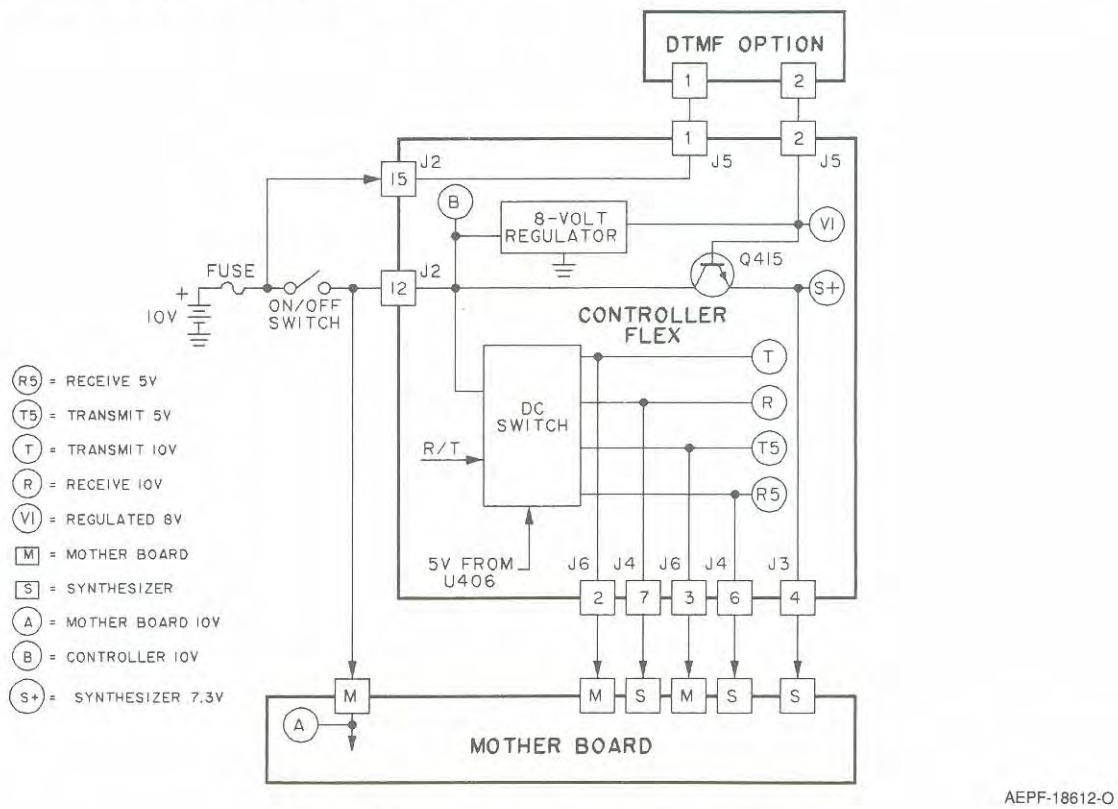

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Figure 3. DC Voltage Distribution Block Diagram

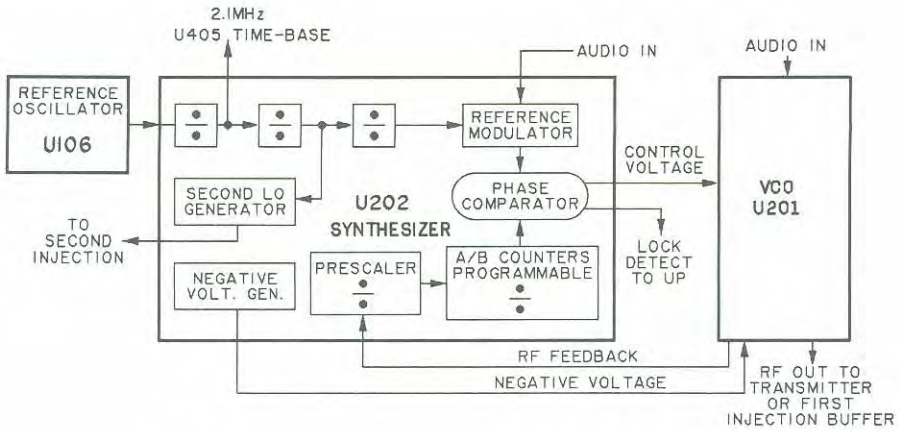

Figure 4. Frequency Generation Circuits

c. Basic Controller Functions

Module U401 is a single-chip microcomputer and is the heart of the HT600 controller. It works in conjunction with the code plug (U402), which stores radio information data. The controller's functions are as follows:

- Read the PTT and channel selector switches, and program the synthesizer for the desired operating frequency using the information stored in the code plug.
- Set the audio output levels for the VCO and synthesizer.
- Control the dc switch.
- Unsquelch the receiver's audio PA when a carrier is present, a correct PL/DPL/Quik-Call tone(s) is (are) decoded, or when an alert tone is generated or the monitor button is pressed.
- Monitor the internal and external PTT.
- Control the receive/transmit LED.
- Monitor battery voltage.
- Perform a self test during power-up.

d. Antenna Switch

The antenna switch consists of modules U103 and U104 on vhf models and U105 on uhf models. Through the use of pin diodes, the antenna switch directs incoming rf from either the standard or remote antenna to the receiver circuitry and outgoing rf from the transmitter to the remote or standard antenna.

e. Basic Receiver Operation *(See Figure 5)*

The HT600 uses double-conversion superheterodyne receiver circuits to provide greater image-signal suppression and improved adjacent channel selectivity. The receiver consists of three main sections:

- radio frequency (rf) circuits
- intermediate frequency (i-f) circuits
- audio frequency (af) circuits

(1) RF Signal Path

The rf signal is received by the antenna and coupled to a two-pole bandpass filter through the antenna switch. The output of the two-pole filter is amplified by an rf amplifier (Q1). The output of the amplifier is then coupled through a three-pole bandpass filter, and applied to the rf input of the first mixer stage (Q2). An injection signal (FIRST LO) is applied to the second input of the mixer, resulting in an output difference frequency of 53.55 MHz, which is the first i-f frequency.

(2) I-F Signal Path

The first i-f signal is passed through highly selective crystal filters (FL1 and FL2) to circuit module U1, where it is mixed with a second oscillator injection signal (SECOND LO) to produce the second i-f frequency of 450 kHz. The low conversion signal is then filtered via highly selective ceramic filters (FL3 and FL4), amplified, and demodulated. The resultant signal (RECOVERED AUDIO) is sent to the audio filter (U405) on the controller flex. Module U1 also contains a squelch detect circuit.

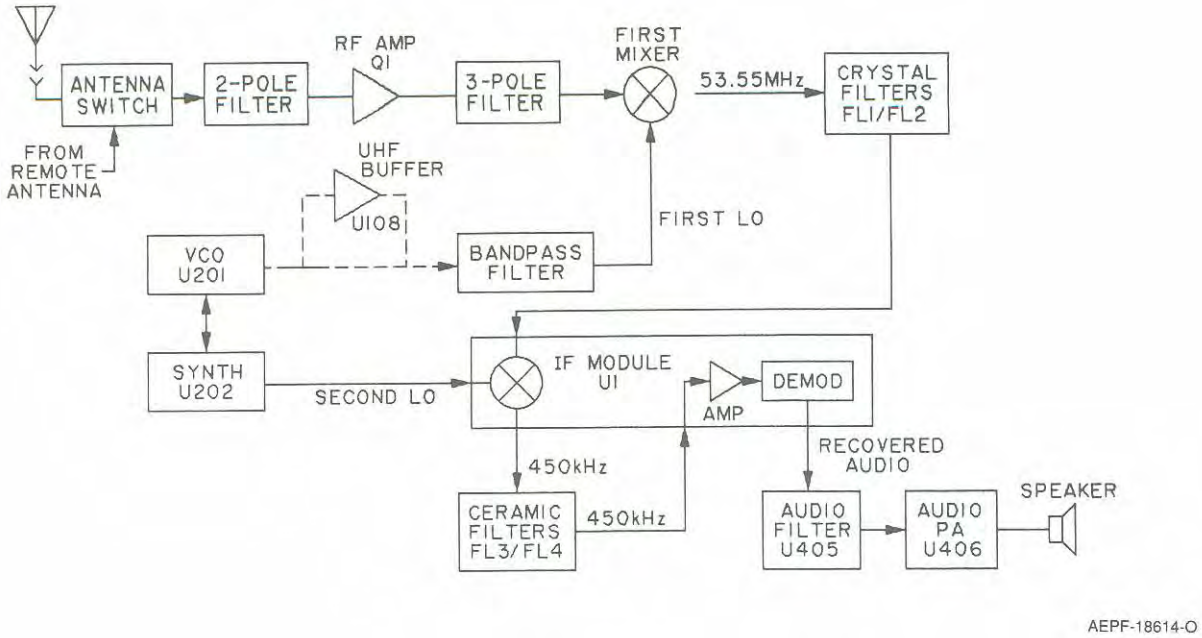

Figure 5. Receiver Block Diagram

(3) Audio Signal Path

Recovered audio from U1 is received by the audio filter IC (U405). The audio filter performs basically two functions in the receive mode. It filters, de-emphasizes, and attenuates the voice audio, and routes the signal to the volume control. Secondly, if the radio is receiving a coded signal, U405 low-pass filters the audio and separates the subaudible PL/DPL tones. The tones are filtered, sampled, and then sent to the microcomputer for decoding.

After passing through the volume control, the audio is sent to the audio PA IC (U406). Integrated circuit U406 amplifies the audio and drives the speaker. The audio amplifier consists of three separate amplifiers: an internal speaker/amplifier, an external speaker/amplifier, and a common amplifier. If the internal speaker is selected, it is differentially driven by the internal and common amplifiers. If the external speaker is selected, it is driven by the external and common amplifiers.

Squelch circuitry resides in the i-f module (U1). Discriminator noise from U1 is sent to U405, where the noise is passed through a programmable attenuator (squelch control) and sent back to U1. The squelch circuits in U1 detect demodulator signal-to-noise ratio and produce a dc logic output (5 volts when carrier is present). This output is read by the microcomputer, which in turn programs the audio filter (U405) to enable the audio power amplifiers on U406.

f. Basic Transmitter Operation *(See Figure 6)*

The transmitter (excluding the frequency generation and distribution circuits described in earlier paragraphs) comprises two main circuits:

- Audio circuitry
- RF power amplifiers

(1) Audio Signal Path

When the PTT switch is pressed, audio from the microphone is fed to the input of the mic amplifier in U406. The amplified audio is then sent to an audio filter IC (U405). Integrated circuit U405 pre-emphasizes, limits, and low-pass filters the audio. IC U405 also generates squelch codes, which are summed with the voice audio. The audio is then passed through programmable attenuators and sent to the reference modulator and VCO to be modulated.

(2) UHF Medium-Power Modulated RF Signal Path

The modulated rf carrier from the VCO/synthesizer is applied through a transmit buffer stage to three consecutive stages of amplification: pre-driver, driver, and rf power amplifier. Medium-power uhf radios output 2 watts of rf power.

(3) UHF High-Power Modulated RF Signal Path

High-power uhf radios output 4 watts of rf power. This is accomplished through four consecutive stages of amplification: pre-driver, driver, intermediate power amplifier (IPA), and final rf power amplifier.

(4) VHF Modulated RF Signal Path

VHF radios are available in medium and high power models. In both models, the modulated rf carrier is applied directly from the VCO/synthesizer to three consecutive stages of amplification: pre-driver, driver, and final rf power amplifier. The difference in power output between medium- and high-power radios is achieved using different final rf power transistors.

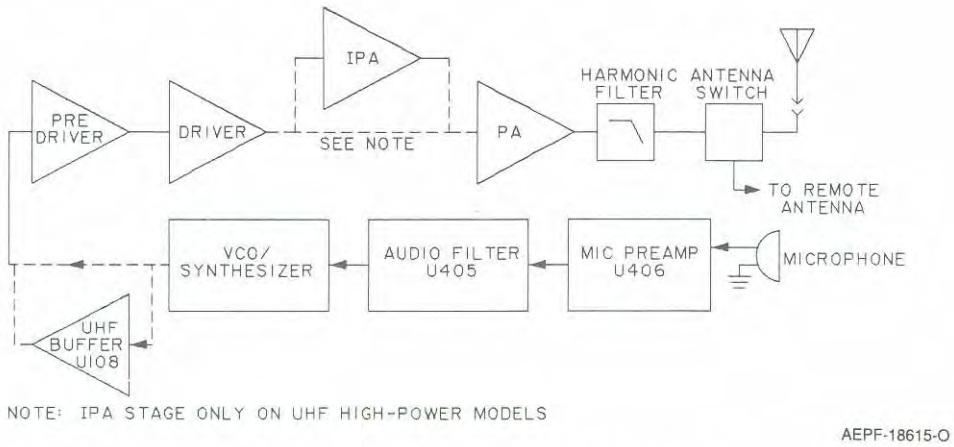

Figure 6. Transmitter Block Diagram

3. DETAILED CIRCUIT DESCRIPTION

The circuit descriptions contained in the following paragraphs are supplemented with simplified schematic diagrams to help the service technician understand the signal processing in various parts of the radio. They are not intended for troubleshooting or servicing. Refer to the complete schematic diagram in this manual when repairing a radio. **When signal tracing on the schematic diagram, pay particular attention to the circles and squares around the module's pin numbers. Circles denote connections to the controller flex; squares denote connections to the main circuit board.**

a. DC Switch

The dc switch controls voltages being applied to the receiver and transmitter circuits. These voltages are R (10V) and R5 (5V) for receive, and T (10V) and T5 (5V) for transmit. The dc switch consists of module U403, transistors Q403 thru Q407, Q412, Q413, Q416, resistors R421 thru R424, R427, R428, and diodes CR403 through CR407. Transistors Q403 and Q405 drive the T voltage line while transistors Q404 and Q406 drive the R voltage line. R5 and T5 voltages are provided via transistors Q407 and Q412 respectively. The DC switch receives its supplies from fused 10V, B, and the five-volt regulator (Q400 collector). Module U403 responds to the R/T line from U405 pin 40, which is controlled by the microcomputer. In transmit the R/T line is low (0 volts) and in receive the R/T line is high (5 volts).

The microcomputer monitors the $\overline{\text{LOCK DETECT}}$ line from the synthesizer (U202 pin 7). When the $\overline{\text{LOCK DETECT}}$ line is low, indicating a frequency lock condition, the microcomputer signals U405, via the microprocessor interface, to switch the output at U405 pin 39 low. This low is applied to diode CR405, which supplies a ground path for the emitters of transistors Q405 and Q406. These emitters must have this ground path so that the R/T line can forward bias Q405 or Q406, activating the T or the R line, respectively.

In transmit (synthesizer locked), the R/T line is at 0 volts. The R/T low is fed to the input of an inverter on U403. The output of the inverter turns on transistors Q416, Q405, and Q403 to activate the T voltage line (Q403 collector). The R/T low is also fed to the base of transistor Q412, which turns on Q412 and activates the T5 voltage line (Q412 collector).

In receive (synthesizer locked, battery-saver off, U202 pin 3 high), the R/T line is at 5 volts. The R/T high is fed to the input of U403 where it is NANDed with the high on the BATTERY SAVER line (U403 pins 8 and 7 respectively). The resulting low at the NAND gate output forward biases transistor Q407, which activates the R5 voltage line (Q407 collector). Also, the low output from the NAND gate is inverted and the high output at U403 pin 14 turns on Q406 and Q404 to activate the R voltage line (Q404 collector). When theR voltage line is activated, Q413 is forward biased, which supplies drive voltage for the green LED (CR301A).

If the battery-saver option is programmed into the radio, the microcomputer programs the synthesizer to strobe the R and R5 lines via the BATTERY SAVER line. The battery-saver signal is a square wave which is NANDed with the 5 volts on the R/T line. The strobing of the receive voltages reduces current drain when the radio is in the stand-by condition.

Another part of the dc switch circuit is an 8-volt regulator. The 8-volt regulator consists of module U407, transistor Q410, and resistors R447, R448, and R446. Module U407 is a five-volt regulator which is offset to 8 volts by R447 and R448. Transistor Q410 is a pass transistor which increases the regulator's current sourcing ability. The 8 volts is applied to the audio PA (U406 pin 9) and also applied to the base of Q415, which supplies approximately 6.6V S+ to the synthesizer at U202 pin 4.

b. Frequency Generation and Distribution
(See Figures 7 and 8)

(1) The VCO (VHF Radios - Figure 7)

The VCO (U201), in conjunction with the synthesizer (U202) and the reference oscillator (U106), generates rf in both modes of operation (receive and transmit). The VCO RF OUT signal is produced at U201 pin 7. A sample of the rf signal is routed from U201 pin 3 as a buffered feedback to a prescaler circuit in the synthesizer (U202). After frequency comparison in the synthesizer, a resultant control voltage from U202 pin 14 is received at U201 pin 12. This voltage is between 0 and 5 volts when the PLL is locked on frequency. At the same time, a negative voltage from the synthesizer is applied to U201 pin 11. This negative voltage is either -2, -4, -6, or -8 volts. The negative voltage and control voltage are applied at opposing ends of a varactor diode, which tunes the VCO to the correct frequency. The frequencies for respective -VEE's are shown in Table 2.

Five volts at U201 pin 8 places the VCO in the receive mode. During the receive condition, the VCO produces the first LO injection signal at U201 pin 7. The signal is routed to the first mixer (Q2), via a transistor buffer stage (Q3).

During the transmit condition, PTT depressed, the five volts at U201 pin 8 is removed and five volts is applied to U201 pin 2. This places the VCO in the

Table 2.
Negative Voltage Vs. User Rx and Tx Frequencies

BANDSPLIT	-VEE	Rx (MHz)	Tx (MHz)
(VHF)			
136.0-151.0(MHz)	-2	136.00000-139.45000	136.00000-139.00000
	-4	139.45001-144.45000	139.00001-145.00000
	-6	144.45001-148.45000	145.00001-149.00000
	-8	148.45001-151.00000	149.00001-151.00000
146.0-162.0(MHz)	-2	146.00000-150.95000	146.00000-150.20000
	-4	150.95001-155.35000	150.20001-155.20000
	-6	155.35001-159.85000	155.20001-160.70000
	-8	159.85001-162.00000	160.70001-162.00000
157.0-174.0(MHz)	-2	157.00000-161.15000	157.00000-158.70000
	-4	161.15001-165.95000	158.70001-165.20000
	-6	165.95001-171.45000	165.20001-171.70000
	-8	171.45001-174.00000	171.70001-174.00000
(UHF)			
403.0-433.0(MHz)	-2	402.55000-410.75000	403.00000-409.60000
	-4	410.75001-418.75000	409.60001-417.20000
	-6	418.75001-427.35000	417.20001-426.00000
	-8	427.35001-433.55000	426.00001-433.00000
438.0-470.0(MHz)	-2	437.55000-444.55000	438.00000-446.00000
	-4	444.55001-454.55000	446.00000-456.00000
	-6	454.55001-462.55000	456.00001-465.00000
	-8	462.55001-470.55000	465.00001-470.00000
470.0-500.0(MHz)	-2	469.55000-477.55000	470.00000-477.00000
	-4	477.55001-486.05000	477.00001-485.20000
	-6	486.05001-494.05000	485.20001-494.50000
	-8	494.05001-500.55000	494.50001-500.00000
488.0-520.0(MHz)	-2	487.55000-495.55000	488.00000-496.50000
	-4	495.55001-504.25000	496.50001-504.80000
	-6	504.25001-513.25000	504.80001-514.40000
	-8	513.25001-520.55000	514.40001-520.00000

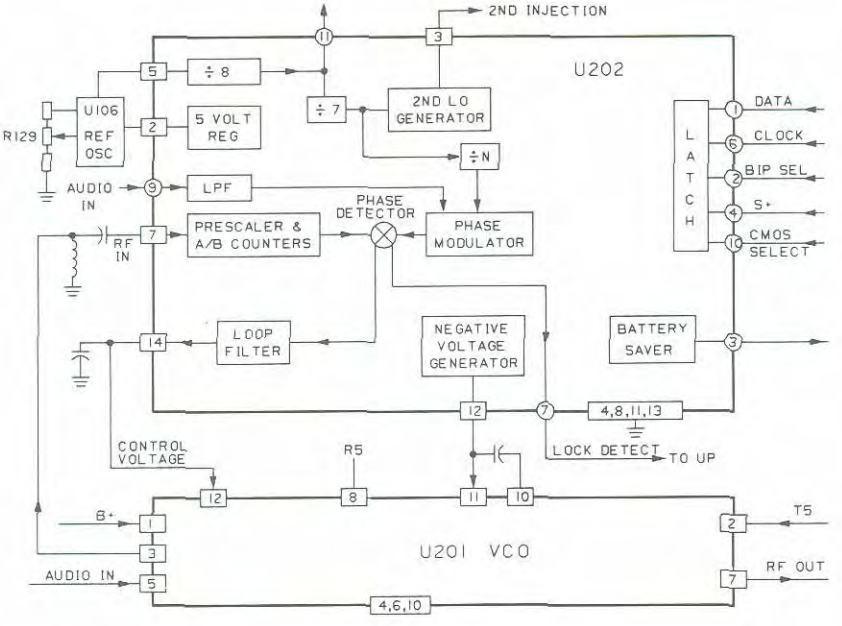

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Figure 7. VCO / Synthesizer Block Diagram, VHF

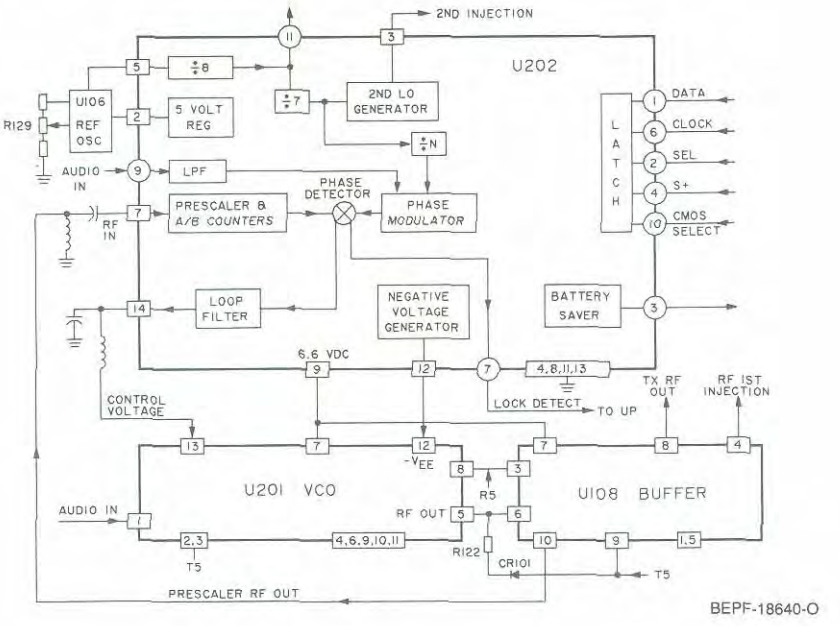

Figure 8. VCO/Synthesizer Block Diagram, UHF

transmit mode. During the transmit condition, the VCO generates the carrier signal, and routes it from U201 pin 7 to the pre-driver (Q102), via a transistor buffer stage (Q101). Also in the transmit mode, the audio signal to be modulated onto the carrier is received by a varactor in the VCO module at U201 pin 5.

(2) The VCO (UHF Radios - Figure 8)

The VCO (U201), in conjunction with the synthesizer (U202) and the reference oscillator (U106), generates rf in both modes of operation (receive and transmit). The VCO rf output, produced at U201 pin 5, is routed to the VCO buffer (U108). A sample of the rf signal is routed from U108 pin 10 (PRE-SCALER RF OUT) as a buffered feedback to a prescaler circuit in the synthesizer (U202). After frequency comparison in the synthesizer, a resultant control voltage from U202 pin 14 is received at U201 pin 13. This voltage is between 0 and 5 volts when the PLL is locked on frequency. At the same time, a negative voltage from the synthesizer is applied to U201 pin 12. This negative voltage is either -2, -4, -6, or -8 volts. The negative voltage and control voltage are applied at opposing ends of a varactor diode, which tunes the VCO to the correct frequency. The frequencies for respective negative voltages are shown in Table 2.

In the receive mode, five volts (R5) is applied to U201 pin 8 and U108 pin 3, which places the VCO in the receive mode and enables a receive injection buffer in U108. The rf signal (first LO injection) at U201 pin 5 is received at U108 pin 6 (VCO IN). The buffer stage in U108 routes this signal (RF INJECTION OUT), via U108 pin 4, to the first mixer (Q2).

During the transmit condition (PTT depressed), the five volts at U201 pin 8 and U108 pin 3 is removed. Five volts is applied to U201 pin 3 and U108 pin 9, which places the VCO in the transmit mode and enables a transmit buffer in U108. During the transmit condition, the VCO generates the carrier signal, and routes it from U201 pin 5 to U108 pin 6 (VCO IN). The buffer stage in U108 routes this signal (TX RF OUT), via U108 pin 8, coil L101, capacitor C105, and coil L116, to the pre-driver Q102. Also in the transmit mode, the audio signal to be modulated onto the carrier is received by a varactor in the VCO module at U201 pin 1.

(3) The Synthesizer

The microcomputer (U401) reads the code plug (U402) and sends set-up signals, which are received by the synthesizer (U202) latch circuit. These set-up signals determine the correct negative voltage and the A/B counter divide ratios needed to generate the proper rf frequencies. The reference frequency for the synthesizer/VCO phase-locked loop is provided by a 16.8 MHz crystal oscillator (U106), which is fine-tuned by resistor R129. The 16.8 MHz crystal oscillator frequency is divided, first to 2.1 MHz and then to 300 kHz. The 300 kHz signal is used for two different applications in the synthesizer.

First, the 300 kHz reference frequency is applied to an internal phase-locked loop circuit (within the synthesizer), which generates the receiver's second LO injection signal. The second LO injection frequency of 53.1 MHz (for low-side injection) or 54.0 MHz (for high-side injection) is routed from U202 pin 3 to the second mixer stage in i-f module U1.

Secondly, the 300 kHz frequency is further divided to produce a VCO/synthesizer PLL reference frequency of 5.0 or 6.25 kHz, which is applied to a phase modulator. In the transmit mode, the phase

modulator modulates audio below 60 Hz (PL/DPL tones, U202 pin 9) onto this reference signal. The reference signal is then fed, as one of two inputs, to a phase detector. The second input signal to the phase detector comes from the VCO (U201 pin 3, vhf radios) or from the VCO buffer (U108 pin 10, uhf radios). This second signal (RF IN) is received by the synthesizer at U202 pin 7, divided by a prescaler circuit, divided again by an A/B counter circuit, and then applied to the phase detector. The phase detector circuit compares the two input signals. If the frequencies are not the same, a CONTROL VOLTAGE (error voltage) is generated and sent to the VCO, ultimately pulling the PLL on frequency. When the two frequencies are the same, the phase detector outputs a low on the lock detect line. This lock detect low is routed to the microcomputer, which in turn sets up radio transmit and receive voltages. Refer to the "DC SWITCH" section for a more detailed explanation.

c. Controller *(See Figure 9)*

Module U401 is a single-chip, microcomputer which performs control and processing functions. It works in conjunction with the code plug which stores the radio personality in its non-volatile memory. The microcomputer controls three data buses; the code plug bus, the synthesizer module/audio filter IC bus, and the radio programming bus.

The code plug data bus is bi-directional, meaning that data can be sent to or received from the code plug. When the microcomputer wants to access the code plug it will pull CODE PLUG POWER (U401, pin 39) low, turning on the supply to the code plug through Q402. The microcomputer will then transmit the address of the data to the code plug on the data bus by toggling CODE PLUG CLOCK (U401, pin 34). The data will be available on CODE PLUG DATA (U401, pin 35). During a read instruction, data is input to the microcomputer from the code plug. During a write instruction, data is output from the microcomputer to the code plug.

The synthesizer module/audio filter IC programming bus is uni-directional, meaning that data is sent from the microcomputer to the synthesizer module (U202)/audio filter IC (U405). The bus is synchronous and the flow of data is controlled by SPI CLOCK (U401, pin 14). The data appears on SPI DATA (U401, pins 10 and 11). The synthesizer module has two separate programming latch circuits which are controlled by BIPOLAR SEL (U401, pin 8) and CMOS SEL (U401, pin 7). When programming the synthesizer module, the microcomputer first pulls BIPOLAR SEL low and sends data using SPI CLOCK and SPI DATA. BIPOLAR SEL is then pulled high and CMOS SEL is pulled low. The microcomputer again sends data using SPI CLOCK and SPI DATA.

When the data transfer is complete, CMOS SEL is pulled high. The synthesizer module is now programmed for the new operating frequency. To program the audio filter IC, AF SELECT (U401, pin 9) is pulled low. The data is transferred using SPI CLOCK and SPI DATA. When the data transfer is complete AF SELECT goes high.

The radio programming bus is bi-directional, meaning that data can be sent to or received from the microcomputer. The bus is asynchronous and data is sent or received on SCI DATA (U401, pins 10 and 11). The flow of data is controlled by BUSY (U401, pin 6). A low on the BUSY line indicates that a message exists on the DATA line.

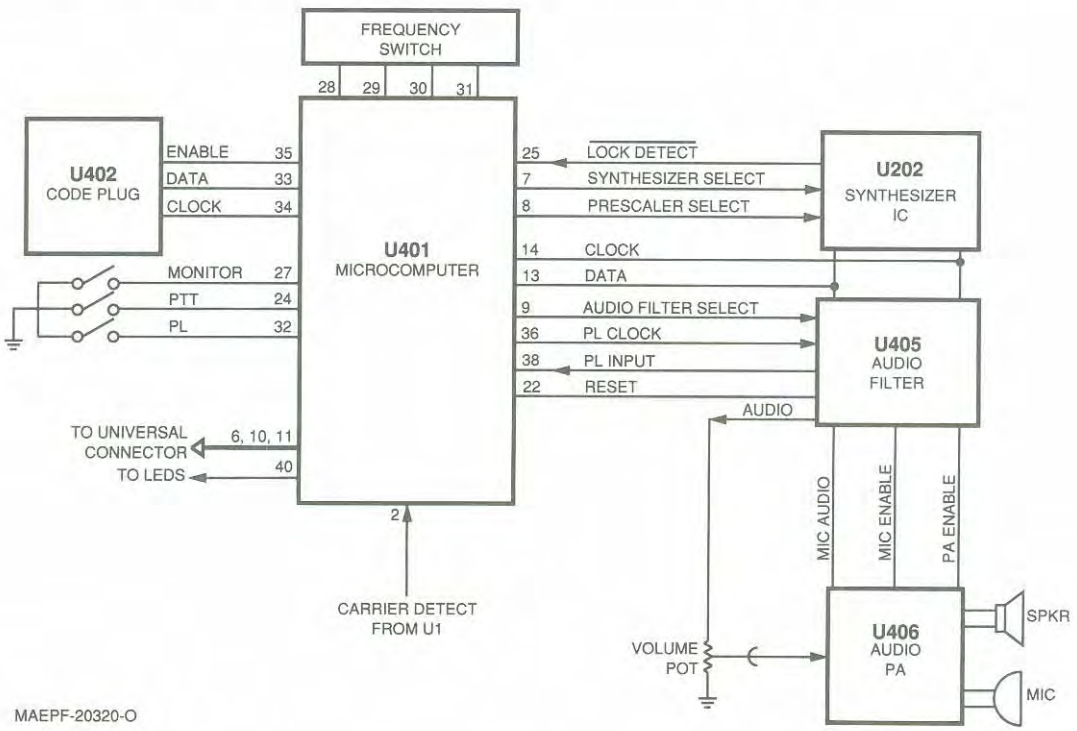

Figure 9. Microcomputer Interface

(1) Microcomputer (U401) functions

- Read the PTT and channel selector status, and program the synthesizer module (U202) for the desired operating frequency using the data stored in the code plug.
- Program the audio filter IC (U405) to set the audio output levels to the speaker and VCO module (U201) and synthesizer module (U202).
- Control the dc switch circuits which supply B+ and other voltages to the receiver and transmitter at various times. It does this by signalling the audio filter IC (U405) to set the R/T line (U405, pin 40) and the dc switch enable line at U405, pin 39.
- Program the audio filter IC (U405) to unsquelch the radio when a carrier is detected, when a squelch code is detected, when an alert tone is to be generated, or when the monitor button is pressed.
- Control the flashing of the LED by turning transistor Q401 on and off.

(2) Microcomputer (U401) input/output pin functions

- **Vss** (pin 1) - Ground for the microcomputer.
- **CARRIER DETECT** (pin 2) - This input to the microcomputer goes high when a carrier is present.
- **NC** (pin 3) - This pin is not used.
- **CLOCK SHIFT** (pin 4) - This output from the microcomputer is low (0V) to shift the microcomputer oscillator frequency. A high output (5V) leaves the oscillator unshifted. The oscillator frequency is shifted depending on the receive frequency for each channel.
- **SELECTIVE CALL DECODE** (pin 5) - This input to the microcomputer is a filtered and limited signal from the demodulator used by the microcomputer to decode a selective call.
- **$\overline{\text{BUSY}}$** (pin 6) - This line is bi-directional and is used to indicate the presence of data on the programming bus.
- **$\overline{\text{CMOS SEL}}$** (pin 7) - This output from the microcomputer is used when programming the synthesizer module (U202).
- **$\overline{\text{BIPOLAR SEL}}$** (pin 8) - This output from the microcomputer is used when programming the synthesizer module (U202).
- **$\overline{\text{AF SELECT}}$** (pin 9) - This output from the microcomputer is used when programming the audio filter IC (U405). It is also used to reset a watchdog timer in the audio filter IC (U405), ensuring that the microcomputer is operating properly. When the microcomputer is operating properly this line will be pulsed at a periodic rate.
- **SCI DATA** (pins 10,11) - These lines are the asynchronous, bi-directional lines used for communicating with the microcomputer.
- **SPI DATA** (pins 12,13) - These lines are the synchronous uni-directional lines used for communicating with the synthesizer module (U202) and the audio filter IC (U405).
- **SPI CLOCK** (pin 14) - This output from the microcomputer is the clock line used when programming the synthesizer module (U202) or audio filter IC (U405).
- **SLAVE SELECT** (pin 15) - This input to the microcomputer enables the SPI CLOCK and SPI DATA lines.
- **ADAPT** (pin 16) - This output from the microcomputer will go high whenever the channel changes and when going from transmit to receive mode. It will cause the squelch circuitry to go into a fast mode of operation.
- **$\overline{\text{LOW BATTERY}}$** (pin 17) - This input to the microcomputer goes low when the radio battery voltage drops below approximately 8.5 volts. The microcomputer responds by flashing the red LED when in the transmit mode.
- **NC** (pin 18) - This pin is not used.
- **OSC1, OSC2** (pins 19,20) - These two lines are connected to the 3.6864 MHz crystal that provides the reference clock frequency for the microcomputer.
- **Vcc** (pin 21) - 5-volt dc power for the microcomputer.
- **$\overline{\text{RESET}}$** (pin 22) - A low on this line will reset the microcomputer. The microcomputer is reset by the watch dog timer on the audio filter IC (U404).
- **$\overline{\text{IRQ}}$** (pin 23) - This pin is not used and is pulled to 5 volts through a resistor.
- **$\overline{\text{PTT}}$** (pin 24) - This input to the microcomputer goes low when the PTT switch is pressed, and signals the microcomputer to enable the transmitter circuitry.
- **$\overline{\text{LOCK DETECT}}$** (pin 25) - This input to the microcomputer goes low when the synthesizer is locked on frequency.
- **PA6** (pin 26) - This pin is not used, and is pulled high (to 5V) through a resistor.
- **MONITOR** (pin 27) - This input to the microcomputer goes high when the monitor button is pressed. The microcomputer will respond by turning on the audio.
- **CHANNEL SELECT** (pins 28,29,30,31) - Channel selection is made via the frequency switch.
- **PL SWITCH** (pin 32) - This input to the microcomputer goes high when the mode select switch is in the PL mode. The microcomputer will respond by turning on the PL CLOCK (pin 36), when carrier is detected.
- **CODE PLUG DATA** (pin 33) - This input/output from the microcomputer receives data from or sends data to the code plug.

- **CODE PLUG CLOCK** (pin 34) - This output from the microcomputer is used to clock data in and out of the code plug(s).
- **CHIP SELECT** (pin 35) - This output is toggled when reading from or writing to the code plug.
- **PL CLOCK** (pin 36) - This output from the microcomputer is the reference clock used when encoding/decoding PL.
- **CODE PLUG POWER** (pin 37) - This output from the microcomputer is used to power-up the code plug.
- **PL DECODE** (pin 38) - This input to the microcomputer receives filtered and limited squelch code signal from the audio filter IC (U405).
- **NC** (pin 39)) - This pin is not used.
- **LED CONTROL** (pin 40) - This output from the microcomputer turns on the LEDs through Q401.

d. Antenna Switch and Filters

(1) VHF Radios

The antenna switching circuitry consists of two modules, U103 and U104. Module U103 is the receiver/transmitter signal select switch. Module U104 is the remote/standard antenna select switch. Applying 10V through L116 to U103 pin 1 puts U103 in transmit mode, and creates a low-impedance path between pin 1 and pin 2. Removing 10 volts from L116 causes U103 to revert back to receive mode and a low-impedance path exists between pin 2 and pin 4.

Grounding pin 3 of U104 selects the remote antenna while an open circuit at pin 3 selects the standard antenna. Ten volts is present at the anode of CR101 during the transmit mode to increase the bias and reduce insertion loss. Coils L115, L119, L120 and capacitors C123, C145, C148, C149, C151, and C152 provide additional filtering and matching to the antennas.

(2) UHF Radios

In transmit, 10 volts T is supplied to the antenna switch (U105 pin 4), via L114. When T is removed the antenna switch reverts back to receive mode. Grounding the REMOTE ANTENNA SELECT line (pin 7) selects the remote antenna while an open circuit will select the standard antenna. In transmit, with the remote antenna selected, a low-impedance path exists between pin 4 and pin 5. When the standard antenna is selected a low-impedance path exists between pin 4 and pin 6. In receive, with the remote antenna selected, a low-impedance path exists between pin 5 and pin 1. When the standard antenna is selected a low-impedance path exists between pin 6 and pin 1. Coils L115 and L122 and capacitors C143 and C154 match the output of U108 to the standard antenna. Capacitors C151 and C185 match the remote port of U108 to the universal connector. When the remote antenna is selected, current flows via R128 and L119 to turn on the remote port. Also, when transmitting with a remote antenna, additional current is provided to the antenna switch via CR103 and R123.

e. Receiver Selectivity and RF Amplifier

The received signal at the antenna is routed through the antenna switch and antenna matching networks, and applied to the receiver rf front end for filtering and amplification.

(1) VHF Radios

There are 5 poles of filtering for rf front end selectivity. Coils L1, L2, and capacitors C1 thru C5 form a two-pole tuned butterworth filter with a bandwidth of greater than 16 MHz. Capacitor C8 thru C14 together with coils L3, L4, and L5 form a 3-pole Chebychev filter with a bandwidth of 16 MHz. The rf amplifier (Q1) is a low noise rf transistor, configured in the common-base mode for good intermodulation performance. Transistor Q1 is biased when the R5 voltage is applied to the resistor divider of R1 and R2. Capacitor C21 provides a good rf ground to the base of Q1. The weak rf signal from the two-pole filter is fed to the emitter of Q1, and the amplified signal is available at the collector.

(2) UHF Radios

Tunable preselectors L1 and L2 form a two-pole tunable butterworth filter with a bandwidth of greater than 8 MHz. Capacitors C1, C2, C3, resistor R1, and coil L3 match the output of the preselectors to the input of the rf amp (Q1). Capacitors C41 and C49 improve the preselector's performance. Transistor Q1 is configured in the common-emitter mode. The amplified rf signal is available at the collector and is matched to the 3-pole fixed-tuned preselector (L5, L6, and L7) by L4, C6, and C7. Capacitors C35, C36, and C37 improve preselector performance. In some bandsplits C7, C35, C36, C37, and C41 are replaced by 0-ohm resistors. The 3-pole filter has a bandwidth of greater than 30 MHz. Capacitor C8 and coils L8 and L16 match the output of the 3-pole filter to the input of the mixer (Q2).

f. Receiver First Mixer, Crystal Filter, and Injection Buffer

(1) VHF Radios

Transistor Q2, a dual-gate MOSFET, is used as the first mixer stage. The rf signal from the three-pole filter is fed to the source of Q2. The first injection signal from the VCO, via buffer transistor Q3, is introduced at gate 1. The output of Q2 is taken from the drain. The difference signal of 53.55 MHz is the desired i-f output.

The first or high i-f is fed to filter FL1/FL2, which is a four-pole quartz crystal filter resonant at 53.55 MHz. The filter provides about 28 dB of adjacent channel protection. Components C20, C19, L12, C37, C24, L7, L8, C25, C26, and C27 provide matching for the crystal filters. The i-f signal is then passed to the i-f module (U1) for further signal processing.

Transistor Q3 is in cascade with an open-collector transistor located within the VCO module (U201). Biasing of Q3 (common base) occurs when theR5 voltage is applied to the voltage divider of R13 and R14. Capacitor C36 insures a good rf ground at the base. Transistor Q3, together with coils L9, L10 and capacitors C30, C32, and C35, provide buffering and rejection of unwanted harmonics on the injection string.

(2) UHF Radios

Transistor Q2, a dual-gate MOSFET, is used as the first mixer stage. The rf signal from the three-pole filter is fed to gate 1 of Q2. The first injection signal is developed by the VCO (U201) and sent to an injection buffer contained on the VCO buffer module, U108. The buffered signal is routed through a bandpass filter network consisting of C21, C22, L12, L13, C25, C31 and C30, and applied to gate 2 of the mixer. The output of Q2 is taken from the drain. The difference signal of 53.55 MHz is the desired i-f output.

The first or high i-f is fed to filter FL1/FL2, which is a four-pole quartz crystal filter resonant at 53.55 MHz. The filter provides about 28 dB of adjacent channel protection. Components L9, L10, L11, L14, C14, C15, C43, C29, C16, and C18 match the output of the mixer to the input of the i-f module, U1.

g. Receiver Second I-F and Signal Processing
(See Figure 10)

Module U1 contains the second mixer, i-f amplifier, PLL demodulator, noise amplifiers and filters, and squelch circuitry. The first i-f signal (53.55 MHz) is received at U1 pin 7. The second LO injection signal from the synthesizer (U202 pin 3) is received by the mixer at U1 pin 9. The desired output frequency from the mixer is 450 KHz. Therefore, the oscillator injection frequency must be 450 KHz above or below the first i-f of 53.55 MHz. The second oscillator frequency is 54 MHz (high-side injection) or 53.1 MHz (low-side injection). The resulting 450 KHz second i-f signal is filtered by the ceramic filter FL3 and FL4 to reject unwanted mixing products. The second i-f signal is then amplified and can be monitored at M1 (U1 pin 4 or 12). The signal is then demodulated and the resultant audio can be monitored at U1 pin 1. The audio is then passed to the audio filter IC (U405).

The squelch controller circuit contained in module U1 is a noise detection circuit. The noise output from the squelch controller at U1 pin 5 is routed to U405 to be attenuated by a programmable squelch attenuator, and is then fed back to pin U1 pin 7 to the carrier detect circuitry. When the noise level exceeds the threshold level set by the squelch pot on U405, U1 pin 9 (CARRIER DETECT line) goes low, indicating the absence of a carrier signal. The microcomputer reads this CARRIER DETECT low and programs the audio filter (U405) to turn off the power amplifiers on U406 by pulling the PA EN line (U405 pin 3) low. If the noise is less than the threshold level set by the attenuator on U405, U1 pin 9 (CARRIER DETECT line) goes high, indicating the presence of a carrier signal. The microcomputer reads this CARRIER DETECT high and programs the audio filter (U405) to turn on the power amplifiers (U406) by outputting a high PA EN signal (U405 pin 3).

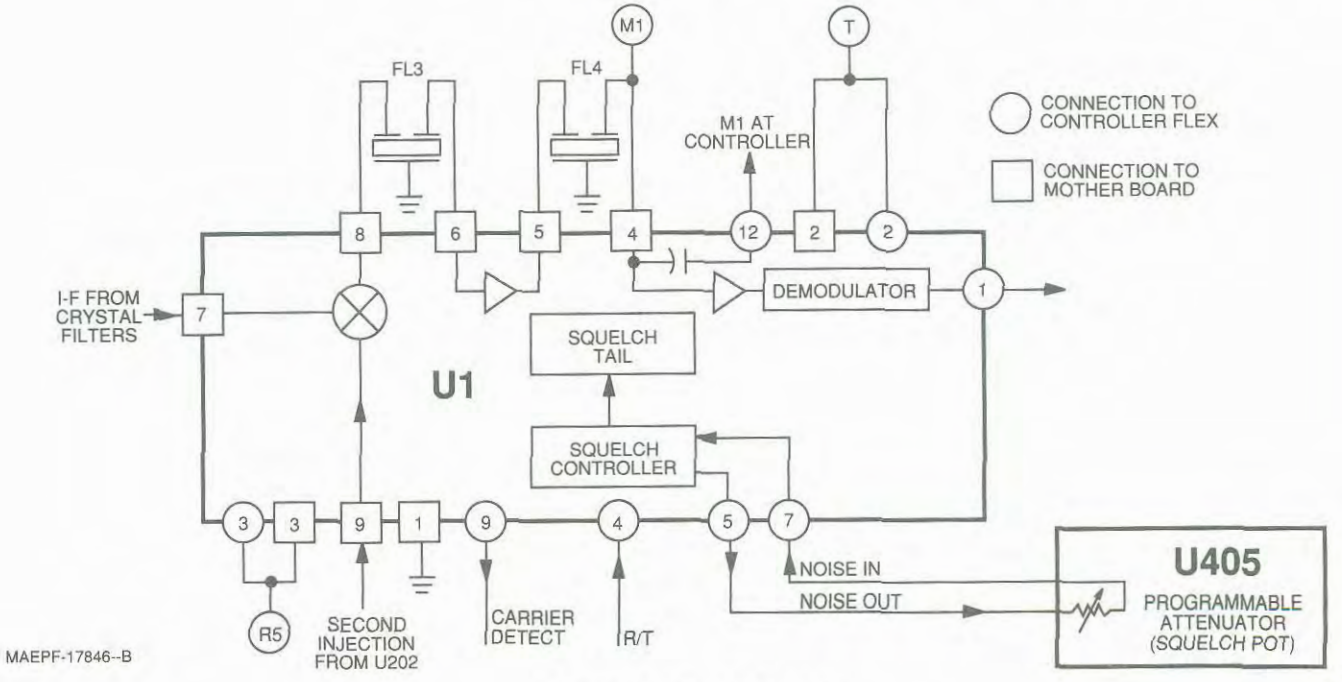

Figure 10. U1, I-F Module

h. Receiver Audio Circuitry *(See Figure 11)*

The recovered audio from U1 is routed to the audio filter IC (U405 pins 7 and 8). The audio is low-pass filtered to separate squelch codes and high-pass filtered to separate voice. Squelch codes are filtered, sampled, and sent to the microcomputer (U401 pin 38). If the radio is in the PL/DPL squelch mode, the microcomputer turns on its decoding circuitry. When the squelch codes are decoded, the microcomputer sends program signals to a microprocessor interface circuit in the audio filter module (U405). The audio filter IC, via the PA EN line, turns on the audio PA IC (U406).

After high-pass filtering, voice audio is de-emphasized, filtered, sent through a programmable attenuator (volume control), and then passed from the audio filter to the volume pot (U405 pin 23 to R140). Audio is routed from the volume pot to the audio PA IC (U406 pin 10) and applied to three audio power amplifiers: internal PA, external PA, and common PA. The common PA is active for both internal and external speaker applications. Without an external speaker connected, a high input on the EXTERNAL SPEAKER SELECT line (U406 pin 24) biases the internal PA, and audio from the internal and common power amplifiers is 180 degrees out of phase, which drives the internal speaker (LS1) differentially. Audio from the common power amplifier and external power amplifier is in phase.

If an external speaker is attached to the radio's universal connector, the EXTERNAL SPEAKER SELECT line (U406 pin 24) is pulled low. This low biases the external PA and shifts the audio output of the common amplifier 180 degrees. This phase shift does two things. First, it puts the audio output from the common amplifier 180 degrees out of phase with the audio output from the external amplifier, and the external speaker is driven differentially. Second, audio from the common power amplifier and internal power amplifier is in phase, which results in no audio drive for the internal speaker.

i. Transmitter Audio Circuitry *(See Figure 12)*

Audio from the microphone is routed to the audio power amplifier (U406), which contains two microphone amplifiers (internal and external). Pressing the PTT switch (internal or external) pulls U401 pin 24 low. The microcomputer reacts by programming the microprocessor interface on U405 to output a low on the R/T line (U405 pin 39). This low is inverted by U403 and applied to U406 pin 18, which enables the microphone circuits. If the internal PTT switch is pressed, a high is present at U406 pin 20, enabling the internal amplifier. If the external PTT switch is pressed, U406 pin 20 is pulled low, and the external microphone amplifier is enabled. Module U406 amplifies and high-pass filters the audio. The audio signal is then routed from U406 pin 19 to the audio filter (U405 pin 10), where it is pre-emphasized, limited, and sent through a splatter filter. In PL/DPL applications, the audio is summed with the squelch codes, which are generated in U405. The audio is then attenuated by two programmable attenuators and the resultant audio signal is routed from U405 pin 20 to the VCO modulation port (U201 pin 5), and from U405 pin 19 to the reference modulator input at U202 pin 9.

j. Transmitter

(1) VHF Radios

Transmit rf is originated in the VCO/synthesizer modules as discussed in earlier paragraphs of this manual. The rf output of the VCO (U201 pin 7) is applied to the buffer stage (Q101 and associated circuitry). Transistor Q101 is base biased by the T5

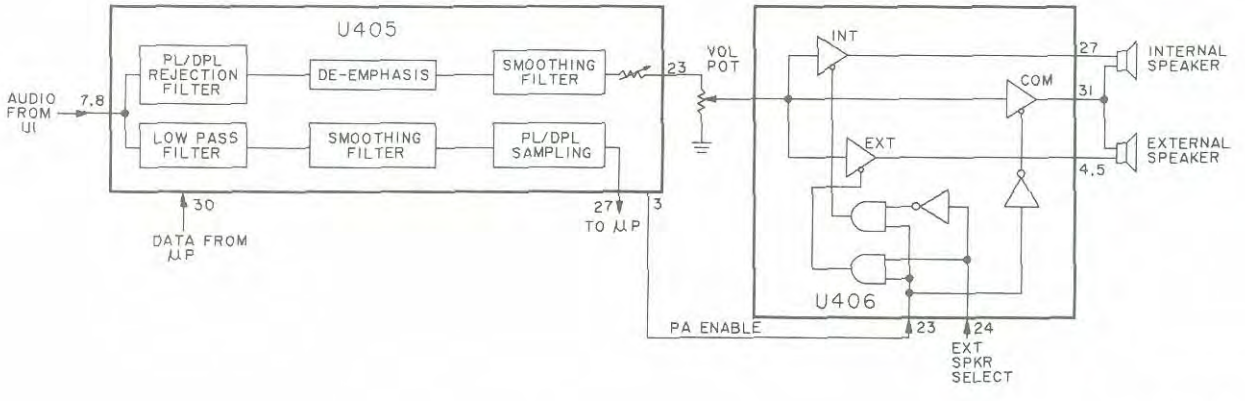

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Figure 11. Receiver Audio Circuitry

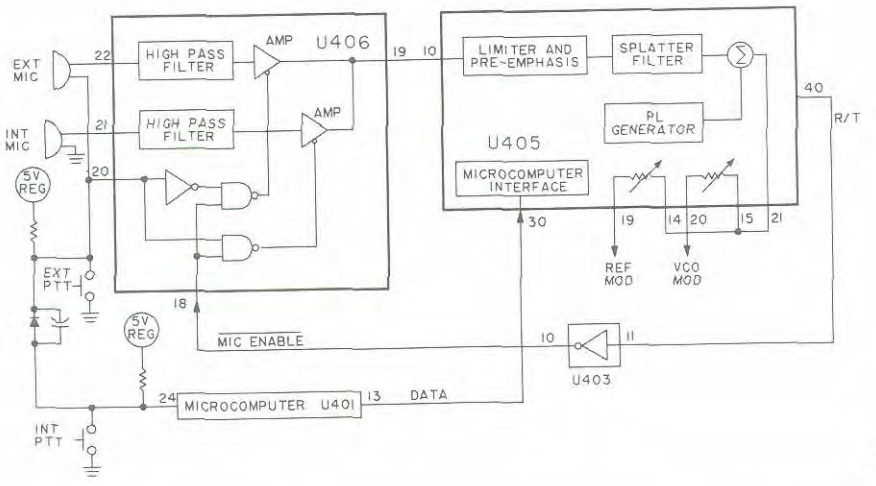

Figure 12. Transmitter Audio Circuitry

voltage via R100, and collector biased by the A voltage line via R102. The rf signal is coupled to the predriver stage (Q102) through C100 and the matching network of C101, L102, and C102. The predriver (Q102), operated class AB, is biased from the T voltage line. Base bias for Q102 is supplied through resistors R105, R104, and R103. Collector bias for Q102 is provided through coil L103. The predriver (Q102) is matched to the driver (Q103) by coils L104, L105, and capacitors C140, C107, C108 and C109. Transistor Q103 operates class C and is supplied from the A voltage line. Collector bias for Q103 is provided through L107. Coil L106 and resistor R108 establish a dc ground return for the base. RF from the collector of Q103 is coupled through C111 and matched to the final PA (Q104) by capacitors C142, C112, and coil L108. Resistor R112 provides stage stability. Transistor Q104 operates class C and is supplied from the A voltage line. Collector bias for Q104 is provided through coil L110. Resistor R109 and coil L109 provide a dc ground return for the base. The PA (Q104) is matched to the antenna switch (U103) by capacitors C143, C117, C118 , C120, and coils L111 and L112. A five-element low-pass filter is used to reject unwanted harmonics of the carrier signal. This network consists of C119, C121, C122, L113, and L114. The trimmer cap (C120) is used for adjusting output power. The vhf transmitter is available in 2-watt and 5-watt versions. The main difference is the device used for the final PA (Q104).

(2) UHF Low-Power Radios

Transmit rf is originated in the VCO/synthesizer/ VCO buffer stages as discussed in earlier paragraphs of this manual. RF output of the VCO buffer (U108 pin 8) is applied to the predriver stage (Q102). Impedance matching between the VCO buffer (U108) and the predriver (Q102) is accomplished by L101, C105, C102, and L116. Transistor Q102 operates in the class AB mode. Transistor Q106 and associated circuitry is use to supply operating voltage to the predriver. The T voltage line forward biases Q106 and supplies drive to the base of Q102 through resistors R107, R103, and R102. The collector of Q102 is biased via L104. Both the buffer and predriver have a 30 MHz bandwidth. The output of the predriver (Q102) is matched to the input of the driver (Q103) by L105, C110, C158 and L106. Capacitor C152 and resistor R121 provide stage stability. Both the driver and final PA (U102) operate in class C mode. The driver (Q103) is collector biased from the A voltage line through coil L108. A dc ground return for the base is provided by L107 and R113. Resistor R127 and capacitor C155 provide stage stability. RF output from the driver (Q103) is matched to the input of the PA module (U102) by C116, L112, and C117. The trimmer cap on U102 adjusts the power output. The nominal power output for the uhf low-power radio is 2 watts.

(3) UHF High-Power Radios

The transmitter in high-power radios is very similar to the transmitter in low-power radios. The differences are:

- In the high-power model Q106 is eliminated and the predriver is powered directly from the T voltage line.
- The high-power model has an additional stage of amplification (the IPA stage). Impedance matching the output of the driver (Q103) to the input of the IPA (Q104) is accomplished by L118, C167, C111, L109, and C112. Transistor Q104 operates in the

Collector bias is provided through L111, and a dc ground return for the base is provided through L110 and R115. The nominal output power of the uhf transmitter is 4 watts.

k. Dual-Tone Multiple Frequency (DTMF) Circuits (Optional)

(1) Timed Tone Option

The DTMF circuit receives its power from unswitched battery B+ and an 8-volt regulator (U407) on the controller flex, via connector plug P701. When the radio is turned on, the regulated 8 volts supplied to the DTMF board is routed through a low-pass filter network (R729 and C725). The 8 volts is applied to audio amplifier U702 pin 6, and to the 5-volt regulator (U706). The regulated 5 volts is used throughout the circuit. Module U701, the heart of the DTMF circuit, receives its supply voltage (5V) through steering diode CR702. When the radio is turned off, the 5 volts is removed and U701 is supplied with memory retention voltage from the radio's unswitched B+ through resistor R701 and steering diode CR701. Resistor R706 and capacitor C701 act as a low-pass filter to keep noise off the IC's supply line. Capacitor C701 is also a memory retention cap. When the radio's battery is removed C701 will hold memory retention voltage for 2 minutes. **If the battery is not replaced within two minutes, memory will be lost.** All of the 47 pf caps are used for rf bypassing.

Transistor Q701, and resistors R722 and R716 lock and unlock the keypad. When the radio is on, Q701 is saturated, U701 pin 22 is pulled low, and the keypad is unlocked. When the radio is turned off, Q701 is off, U701 pin 22 is pulled high through resistor R716, and the keypad is locked-up.

Integrated circuit U701 is a CMOS tone generator. Components Y701, R726, C722, and C723 form the oscillator circuit for the tone generator. When a key is pressed, U701 goes into the encode mode and outputs the appropriate tone on pin 21. Module U701 also sends a low (MUTE output) from pin 23 to NOR gate U703D pin 3. The tone (DTMF OUT) is routed through the deviation adjusting network of R720 and potentiometer R709, and applied to pin 6 of isolation switch U704B. If the control "C" input at U704B pin 4 is high, the switch closure is made and the DTMF tone output at U704B at pin 7 is applied to the radio's INT MIC IN line via connector plug P701 pin 3.

The purpose of the isolation gate (NOR gate U703D) is to prevent the transmission of beep tones. Therefore, the switch (U704B) will only close when a DTMF tone is to be transmitted, which is determined by a high output of NOR gate U703D at pin 4. This high output is achieved when both inputs are low. One input (pin 3) goes low everytime a DTMF tone is generated. The other input (pin 2) goes low whenever the radio is in transmit, via the saturation of transistor Q703.

The function of FET transistor Q702 is to mute the microphone during tone transmission. If the microphone was not muted, noise could get mixed with the DTMF tones and prevent successful decoding. Transistor Q702 is controlled by the MUTE output (U701 pin 23). When no tone is present, the mute line is pulled high by resistor R728, transistor Q702 is on, and the microphone has a low-impedance path to ground. When a DTMF tone is generated the mute line goes low, Q702 is turned off, and the microphone is no longer grounded. Therefore, the microphone is muted. It is also necessary to mute the microphone when beep tones are generated. When a beep tone is present, switch U704C closes and transistor Q702 turns off. The time that Q702 stays off is controlled by the RC network of C724 and R719.

The combination of U703B, U703C, U704A, R707, R708, C705,C703, and R723 is the beep-tone oscillator circuit. When a "*" or a "#" command key is pressed, or when any key is pressed during the program mode, module U701 generates a pacifier tone. This tone, which lasts for approximately 30 milliseconds, is applied to beep tone gate U704A, which responds with a low output at pin 9. The low at U704A pin 9 is applied to the beep-tone oscillator (U703B pin 10), which responds by generating a 2000 Hz beep tone. The beep tone continues until U703B

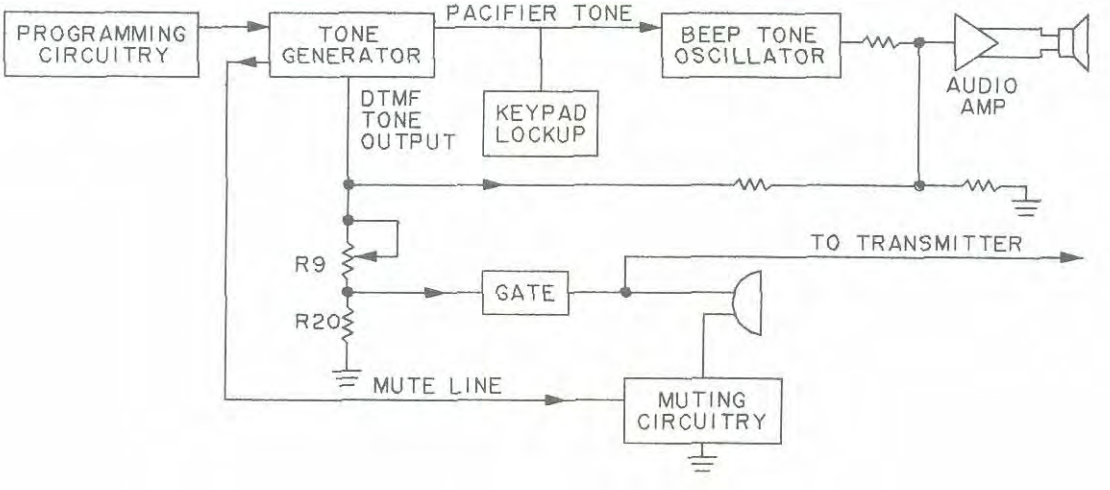

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Figure 13. DTMF Option Diagram

pin 10 goes high, which is determined by the RC network of C703 and R723 (approximately 57 milliseconds).

DTMF and beep tones are routed to the sidetone/ beep-tone amplifier U702. This IC amplifies the tones and sends them to the speaker. Amplifier U702 is enabled when pin 1 is pulled low through CR704A or CR704B, which occurs when module U701 is in the program mode or when the radio is in transmit. Resistor R702 and capacitor C702 control the duration of the DTMF tones and the rate at which the tones are generated during automatic dialing. Tone duration is set at 150 ms.

Program switching is done by U704D, U703A, U705, R703, R704, R705, and CR703. Pressing the program button puts the DTMF circuit in the program mode by grounding the control line of U704D, which in turn causes pin 39 of U701 to be pulled high through resistor R705. With module U701 in the program mode (U701 pin 39 high), numbers can be stored in the memory registers. When the program button is not pressed, the control line of U704D is pulled high through R727, the switch (U704D) is closed, pin 39 of U701 is grounded, and U701 is in tone mode.

R731 is removed in radios with the ANI version DTMF circuit to prevent programming DTMF functions. In order to put module U701 into the program mode (a high at U701 pin 39), both inputs (pins 6 and 8) of U703A must be low. This can be accomplished only by using the ANI programming fixture to push the program button.

(2) Continuous Tone Option

Integrated circuit U701 is a DTMF tone generator, which accepts inputs from the keypad. The option is supplied from the radio's 8-volt line. During tone generation, the IC outputs a high on its MUTE line (U701 pin 8). This output mutes the microphone by saturating Q704 which turns off Q702, resulting in a high-impedance path to ground for the microphone. The MUTE line also turns on Q701, which supplies a path to ground for the resistor divider network of R704 and R705.

The tone generator outputs a tone on pin 16 of U701. This tone level is reduced by R704 and R705, and is applied to the radio's MIC line to be transmitted. The tones are also divided by R706 and R707, and routed to the side-tone amplifier (U702). The amplified tones are then sent to the radio's speaker for user feedback.

The amplifier is enabled by the radio's MIC line. In the transmit mode, the MIC line is at 5 volts. This turns on Q703 and pulls pin 1 of U702 low, enabling the amplifier.

MAINTENANCE

1. INTRODUCTION

This section of the manual describes the disassembly and reassembly procedures, recommended repair procedures, special precautions regarding maintenance, and recommended test equipment. Each of these topics provides information vital to the successful operation and maintenance of the HT600 radio.

2. PREVENTIVE MAINTENANCE

The HT600 radio does not require a scheduled preventive maintenance program; however, periodic visual inspection and cleaning is recommended.

a. Inspection

Check that the external surfaces of the radio are clean, and that all external controls and switches are functional. A detailed inspection of the interior electronic circuitry is not needed or desired.

b. Cleaning

The following procedures describe the recommended cleaning agents and the methods to be used when cleaning the external and internal surfaces of the radio. External surfaces include the front cover, housing assembly, and battery case. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime. Internal surfaces should be cleaned only when the radio is disassembled for servicing or repair.

The only recommended agent for cleaning the external radio surfaces is a 0.5% solution of a mild dishwashing detergent, such as JOY®, in water. The only factory recommended liquid for cleaning the printed circuit boards and their components is ISOPROPYL alcohol (70% by volume).

CAUTION

The effects of certain chemicals and their vapors can have harmful results on certain plastics. Aerosal sprays, tuner cleaners and other chemicals should be avoided.

(1) Cleaning External Surfaces

(a) Polycarbonate Surfaces

The detergent-water solution should be applied sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the radio. A soft, absorbent, lintless cloth or tissue should be used to remove the solution and dry the radio. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

(b) Silverized Surfaces

A non-metallic, soft-bristled brush should be used to apply the detergent-water solution to silverized surfaces, and a second non-metallic soft-bristled brush (free of detergent or rinsed in clean water) should be used to remove the detergent-water solution.

Upon completion of the cleaning process, a soft, absorbent, lintless cloth or tissue should be used (with a blotting action) to dry the frame and covers. The blotting action will prevent damage to the silverized conductive coating.

(2) Cleaning Internal Circuit Boards and Components

Isopropyl alcohol may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the radio.

Alcohol is a high-wetting liquid and can carry contamination into unwanted places if an excessive quantity is used. Make sure that controls or tunable components are not soaked with the liquid. Do not use high-pressure air to hasten the drying process, since this could cause the liquid to puddle and collect in unwanted places.

Upon completion of the cleaning process, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the frame, front cover, or housing.

NOTE

Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material (from previous usage).

3. DETAILED DISASSEMBLY PROCEDURE

(Refer to the exploded view in the back of this manual.)

Disassembly of the radio involves removal of the major components listed below, one at a time, in the sequence described in the following paragraphs.

NOTE

1. Several special tools are required to completely disassemble the radio. Refer to the "TEST EQUIPMENT AND SERVICE AIDS" paragraphs in this section of the manual. Also refer to the "TORQUE AND TOOL SPECIFICATIONS CHART."
2. Before proceeding, make sure that the radio is turned off.

JOY® is a registered trademark of Proctor and Gamble. The use of other dishwashing solutions could cause damage to the plastic parts.

a. Battery Removal

To remove the battery from the radio, proceed as follows:

Step 1. Hold the radio with the front of the radio facing up.

Step 2. Disengage the battery latch from the battery by pushing and holding the latch towards the top of the radio.

Step 3. With the battery latch disengaged, slide the battery from left to right to remove it from the baseplate on the bottom of the radio housing.

b. Gaining Access to Internal Components

CAUTION

The HT600 radio contains complementary metal-oxide semiconductor (CMOS) devices, which are highly susceptible to damage in handling due to static discharge. The entire printed circuit board should be treated as static sensitive. Damage can be latent, resulting in failures occurring weeks or months later.

DO NOT attempt to disassemble the radio without first referring to the "SAFE HANDLING OF CMOS DEVICES" paragraph in this section of the manual.

Step 1. Remove the battery as described in paragraph **a**.

Step 2. Remove the two screws from the back of the radio.

Step 3. Remove the two screws on the bottom of the radio (baseplate corners).

Step 4. Lift the front cover from the radio housing, being careful not to pull against the speaker/microphone wires.

Step 5. Disconnect the speaker/microphone connector from the controller flex by grasping the speaker wires (near the plug) and pulling the plug straight out and away from the circuit board.

Step 6. Loosen the two captive screws on the bottom of the radio. Do not completely remove the captive screws from the baseplate.

Step 7. With a thumb and forefinger, grasp the antenna at its base and pull lightly to remove the frame assembly from the radio housing. Do not press the PTT or monitor switches during removal.

Step 8. Remove the antenna by unscrewing it counterclockwise.

Step 9. Remove the screw that secures the front shield to the controller carrier.

Step 10. Remove the front shield by pulling it straight out and away from the radio.

Step 11. Remove the four screws that secure the main back shield to the frame.

Step 12. Remove the main back shield by pulling it straight out and away from the radio.

c. Removing the Controller Assembly

Step 1. Perform steps 1 through 10 of paragraph **b**.

Step 2. Remove the plastic retainer clip that holds the two connectors at the top of the controller in place.

Step 3. Remove the four screws (two on each side) that secure the controller carrier to the frame.

NOTE

Be careful to pull each connector straight out and away from the mating socket so as not to bend or break the connector pins.

Step 4. Disconnect the two bottom flex connectors by carefully sliding them away from the synthesizer.

Step 5. Lift the controller circuit (nearest the bottom of the radio) away from the radio just enough to gain access to the connector under the controller.

Step 6. Disconnect the connector under the controller.

Step 7. Disconnect the two connectors at the top of the controller.

Step 8. Lift the controller assembly totally away from the radio.

d. Gaining Access to the Controller Flexible Circuit

Step 1. Perform steps 1 through 7 of paragraph **c**.

Step 2. Remove the screws that secure the bottom shield to the top flex carrier.

Step 3. Along the top edge of the controller assembly (edge nearest speaker clearance indentation), gently pry the bottom shield away from the top flex carrier.

Step 4. Pull the bottom shield completely away from the top flex carrier and remove the controller flexible circuit.

Step 5. Remove the flex from the top (flex carrier). Remove the small plastic spacer from the carrier (spacer is near J5).

e. Removing the Transceiver Board from the Frame

Step 1. Perform steps 1 through 7 of paragraph **c**.

Step 2. Remove the four screws that secure the main back shield, and remove the shield. On vhf radios, remove the small back shield.

Step 3. Unsolder four contacts (two pins and one frame ground connection) located next to the screw (back, top-center of transceiver board), and the antenna ferrule located on the back, top-left corner of the transceiver board.

Step 4. Remove one screw (back, top-center of transceiver board) that secures the transceiver board to the frame.

Step 5. Unsolder and remove the red B+ wire (controller side of radio) from the On-Off/ volume switch pot.

CAUTION

Always place the On-Off/Volume switch pot in the "On" position before soldering to this switch, and return to the "Off" position when finished soldering.

Step 6. Gently pull the transceiver circuit board straight out and away from the frame.

f. Removing the Control-Top Panel Components

Step 1. Perform steps 1 through 5 of paragraph **e**.

NOTE

All control-top panel components, except the antenna jack, are connected on two flexible circuits, which are connected together and should be removed as one unit.

Step 2. Remove both control knobs by pulling straight out and away from the control-top panel.

Step 3. The escutcheon is stuck to the top surface of the control-top panel with adhesive. Gently pry one corner of the escutcheon away from the control-top panel and then peel the escutcheon completely away. Notice that two washers are stuck on the back side of the escutcheon.

Step 4. Using a 5/16" nut driver, remove the hex nuts and washers from the frequency switch and volume potentiometer.

Step 5. Using a spanner wrench, remove the spanner nut and washer from the PL switch.

Step 6. Unsolder and remove the black wire from the volume pot flex.

Step 7. Unsolder the (nine) solder joints between the flex and the universal connector pins, then remove the flex.

Step 8. Unsolder the three legs of the LED and pull the flex away from the LED's legs.

Step 9. Unsolder the (nine) solder joints between the PC board and the universal connector pins. Remove the PCB.

NOTE

Be careful not to apply too much heat to the pins.

Step 10. The frequency switch flex connects to the PTT/B+ flex with five solder tabs located along the side of the frame near the monitor popple switches.

NOTE

A capacitor is placed across the last two tabs.

Unsolder the five contact tabs, and with "solder wick," remove the solder and separate the two flexes.

Step 11. Push the switch shaft(s) until clear of the mounting holes, and remove the flex circuits and control-top panel components away from the frame.

g. Removing the Control-Top Panel and LED

Step 1. Perform steps 1 through 8 of paragraph **f**.

Step 2. Unsolder the ground pin of the universal connector contacting the frame (near the antenna bushing).

Step 3. Remove the screw and washer located near the antenna receptacle.

Step 4. Gently pull the control-top panel away from the frame.

Step 5. Push the LED and rubber boot out of the control-top panel.

Step 6. Pull the LED out of the rubber boot.

h. Removing the Battery Latch

Step 1. Perform steps 1 through 7 of paragraph **b**.

Step 2. Remove the ground contact screw that holds the negative battery contact. Be careful not to lose the lockwasher, contact, and rubber pad (under the contact).

Step 3. While holding the latch slide, carefully pull the baseplate assembly away from the housing.

Step 4. Carefully slide the latch out of the housing.

Step 5. Remove the exposed latch springs.

i. Removing the PTT / B+ Flex

Step 1. Perform steps 1 through 7 of paragraph **b**.

Step 2. Two corners of the PTT/B+ flex are soldered to the frame. Remove the solder, using "solder wick."

Step 3. The PTT/B+ flex connects to the frequency switch flex with five solder tabs located along the top side of the frame near the PL switch. Unsolder the five contact tabs, and with "solderwick," remove the solder and separate the two flexes.

NOTE

A capacitor is placed across the last two tabs.

Step 4. The PTT/B+ flex is stuck to the frame with adhesive. Carefully peel the PTT/B+ flex away from the frame.

4. REASSEMBLY *(Refer to the exploded view in the back of this manual.)*

CAUTION

1. DO NOT attempt to reassemble the radio without first referring to the "SAFE HANDLING OF CMOS DEVICES" paragraph in this section of the manual.
2. DO NOT attempt to reassemble the radio without first referring to the appropriate vhf or uhf service manual "TORQUE AND TOOL SPECIFICATIONS CHART."
3. Inspect all O-rings and replace if obvious damage exists.

a. Reinstalling the Battery Latch and Base Plate

Step 1. Insert the two springs into their proper holes, and replace the slide latch.

Step 2. Position the base plate and hold it firmly to compress the springs.

Step 3. Holding the base plate in place, install the negative battery contact, being sure that the rubber pad is in place in the cup of the contact.

Step 4. Reinstall the screw and lockwasher in the negative battery contact. Tighten the screw per the "TORQUE AND TOOL SPECIFICATIONS CHART."

b. Reinstalling the PTT/B+ Flex

Step 1. Position the PTT/B+ flex to the frame such that the five contact tabs line up with the corresponding tabs on the frequency switch flex. Note that a little oval hole in the corner of the flex (near the solder tabs) mates with a round dot on the frame.

Step 2. Press the flex to the frame. Note that two more places, holes in the flex correspond with dots on the frame.

Step 3. Resolder the five solder tabs connecting the PTT/B+ flex to the frequency switch flex.

NOTE

A capacitor is placed across the last two tabs. Also, ensure that a solder spot connection is made near and connecting the first two tabs (making the two switches common).

Step 4. Resolder the two corners of the flex to the frame.

c. Reinstalling the LED and Control-Top Panel

Step 1. Insert the LED into the rubber boot such that the flat edge of the LED's base mates with the flat edge inside the boot.

Step 2. Insert the LED and boot into the control-top panel.

Step 3. Place the control-top panel on the frame.

Step 4. Reinstall the screw and washer located near the antenna receptacle, and tighten the screw per the "TORQUE AND TOOL SPECIFICATIONS CHART."

Step 5. Resolder the ground pin of the universal connector to the frame.

d. Reinstalling the Control-Top Panel Components

Step 1. Insert the switch shafts into the proper holes.

Step 2. Slide the universal connector PC board over the interconnect pins and solder the board to the (nine) pins.

Step 3. Resolder the three LED legs to the frequency switch flex.

Step 4. Solder the volume pot flex to the (nine) universal connector pins.

Step 5. Resolder the black ground wire to the volume pot flex (center pin).

Step 6. Resolder the five solder tabs of the frequency switch flex to the corresponding tabs of the PTT/B+ flex.

Step 7. Reinstall the PL switch washer and spanner nut, and tighten per the "TORQUE AND TOOL SPECIFICATIONS CHART."

Step 8. Reinstall the frequency switch and volume pot washers and hex nuts, and tighten each screw per the "TORQUE AND TOOL SPECIFICATIONS CHART."

Step 9. Reinstall the escutcheon.

Step 10. Reinstall the switch knobs.

e. Reinstalling the Transceiver Board

Step 1. With the frame's backside lying down, and viewing the transceiver board from the solder side with the assembly upright, slightly spread the sides of the frame and slide the transceiver into the frame.

Step 2. Turn the unit over and resolder the loose end of the red B+ wire to the On-Off/Volume switch pot.

> **CAUTION**
> Always place the On-Off/Volume switch pot in the "On" position before soldering to this switch, and return to the "Off" position when finished soldering.

Step 3. Reinstall one screw (back, top-center of transceiver board) that secures the transceiver board to the frame, and tighten securely.

Step 4. Resolder four contacts (two pins and one frame ground connection) located next to the screw (back, top-center of transceiver board), and the antenna ferrule contact (back top-left corner of board). Reinsert small back shield.

Step 5. Press the main back shield (edges over the frame) flush to the transceiver board.

Step 6. Reinstall the four screws that secure the main back shield to the frame, and tighten each screw per the "TORQUE AND TOOL SPECIFICATIONS CHART."

f. Reassembling the Controller Assembly

> **CAUTION**
> Make sure that the flex insulator is installed around the controller flex before placing the controller flex into the carrier.

Step 1. With the outside surface of the carrier lying down, and the controller flex folded over (shield-to-shield), align the holes in the flex with corresponding holes in the carrier, and place the flex into the carrier. Make sure that the P1 and P2 jack's grooves slide into the tabs of the carrier. Also, make sure that the J5 jack is seated properly in the carrier.

Step 2. Replace the small clear plastic spacer adjacent to J5.

Step 3. Align the controller bottom shield to the controller flex and carrier. In the J5 jack area, slide the tab of the shield under the slot in the carrier, and press the bottom shield into place (sides of the bottom shield fit inside the sides of the carrier).

Step 4. Reinstall the screws that secure the bottom shield to the controller carrier, and tighten each screw per the "TORQUE AND TOOL SPECIFICATIONS CHART".

g. Reinstalling the Controller Assembly

> **CAUTION**
> Be careful to push each connector straight into the mating socket so as not to bend or break the connector pins.

Step 1. Reconnect the two top flex connectors, firmly seating both plug/jack connections.

Step 2. Reconnect the connector under the controller, firmly seating the plug/jack connection.

Step 3. Press the controller into place (inside of frame sides).

Step 4. Reconnect the two bottom flex connectors, firmly seating both plug/jack connections.

Step 5. Reinstall the four screws (two on each side) that secure the controller carrier to the frame, and tighten each screw per the "TORQUE AND TOOL SPECIFICATIONS CHART."

Step 6. Insert the plastic retainer that holds the top two connectors in place.

Step 7. Reinstall front shield (shield edges fit inside the frame).

Step 8. Reinstall the screw that secures the front shield to the controller carrier, and tighten the screw per the "TORQUE AND TOOL SPECIFICATIONS CHART."

h. Final Reassembly

Step 1. Insert the internal radio unit into its housing, and tighten the two screws on the baseplate per the "TORQUE AND TOOL SPECIFICATIONS CHART."

Step 2. Reconnect the speaker/microphone connector, being careful to push the connector straight into the mating socket so as not to bend or break the connector pins.

Step 3. Reinstall the front cover.

Step 4. Reinstall the two screws on the bottom of the radio (baseplate corners), and tighten the screws per the "TORQUE AND TOOL SPECIFICATIONS CHART."

Step 5. Reinstall the two screws that secure the front cover to the housing, and tighten each screws per the "TORQUE AND TOOL SPECIFICATIONS CHART."

Step 6. Reinstall the antenna.

Step 7. Reinstall the battery.

5. SAFE HANDLING OF CMOS DEVICES

Complementary metal-oxide semiconductor (CMOS) devices are used in the HT600 radio. While the attributes of CMOS are many, their characteristics make them susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair. The following handling precautions are mandatory for CMOS circuits, and are especially important in low humidity conditions.

a. All CMOS devices must be stored or transported in conductive material so that all exposed leads are shorted together. CMOS devices must not be inserted into conventional plastic "snow" or plastic trays of the type that are used for storage or transportation of other semiconductor devices.

b. All CMOS devices must be placed on a grounded bench surface and the technicians must ground themselves prior to handling the devices. This is done most effectively by having the technician wear a conductive wrist strap in series with a 100k-ohm resistor to ground.

c. Do not wear nylon clothing while handling CMOS circuits.

d. Do not insert or remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices, and be certain that there are no voltage transients present.

e. When straightening CMOS device leads, provide ground straps for the apparatus used.

f. When standing, use a grounded soldering iron.

g. All power must be turned off in a system before printed circuit boards containing CMOS devices are inserted, removed, or soldered.

6. REPAIR PROCEDURES AND TECHNIQUES

CAUTION

Leadless component technology requires the use of specialized equipment and procedures for repair and servicing of the HT600 radio. If you are not totally familiar with leadless component repair techniques, it is strongly recommended that you either defer maintenance to qualified service personnel and service shops or take the recommended video taped leadless component repair training program, MAV-PACK 3 (VID-952) (see paragraph 7b, **Service Aids and Recommended Tools**, in this section). This is of paramount importance as irreparable damage to the radio can result from service by unauthorized persons. Unauthorized attempts to remove or repair parts may void any existing warranties or extended performance agreements with the manufacturer.

a. Parts Replacement and Substitution

Special care should be taken to be as certain as possible that a suspected component is actually the one at fault. This special care will eliminate unnecessary unsoldering and removal of parts, which could damage or weaken other components or the printed circuit board itself.

When damaged parts are replaced, identical parts should be used. If the identical replacement component is not locally available, check the parts list for the proper Motorola part number and order the component from the nearest Motorola Communications Parts office listed in the "Replacement Parts Ordering" section of this manual.

b. Rigid Circuit Boards

The HT600 radio uses bonded multi-layer printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The printed through holes may interconnect multiple layers of the printed circuit. Therefore, care should be exercised to avoid pulling the plated circuit out of the hole.

When soldering near the module socket pins, use care to avoid accidentally getting solder in the socket. Also, be careful not to form solder bridges between the module socket pins. Closely examine your work for shorts due to solder bridges. When removing modules with metal enclosures, be sure to desolder the enclosure ground tabs as well as the module pins.

c. Flexible Circuits

The flexible circuits are made from a different material than the rigid boards, and different techniques must be used when soldering. Excessive prolonged heat on the flexible circuit can damage the material. Avoid excessive heat and excessive bending. For parts replacement, use the ST-1087 Temperature-Controlled Solder Station with a 600 or 700 degree tip, and use small diameter solder such as ST-633. The smaller size solder will melt faster and require less heat being applied to the circuit.

To replace a component on a flexible circuit, grasp the edge of the flexible circuit with seizers near the part to be removed, and pull gently. Apply the tip of the soldering iron to the component connections while pulling with the seizers. Do not attempt to puddle out components. Prolonged application of heat may damage the flexible circuit.

7. TEST EQUIPMENT AND SERVICE AIDS

The following paragraphs describe the test equipment and service aids required for maintaining the HT600 radio. Your Motorola sales representative will assist in analyzing your specific requirements and help you select the latest available equipment to suit your individual needs. In addition, your sales representative can advise you of the availability of new test equipment and service aids that become available after the printing of this manual.

Refer to Figure 14 for an illustration of trouble-shooting, test equipment, and programming set-up.

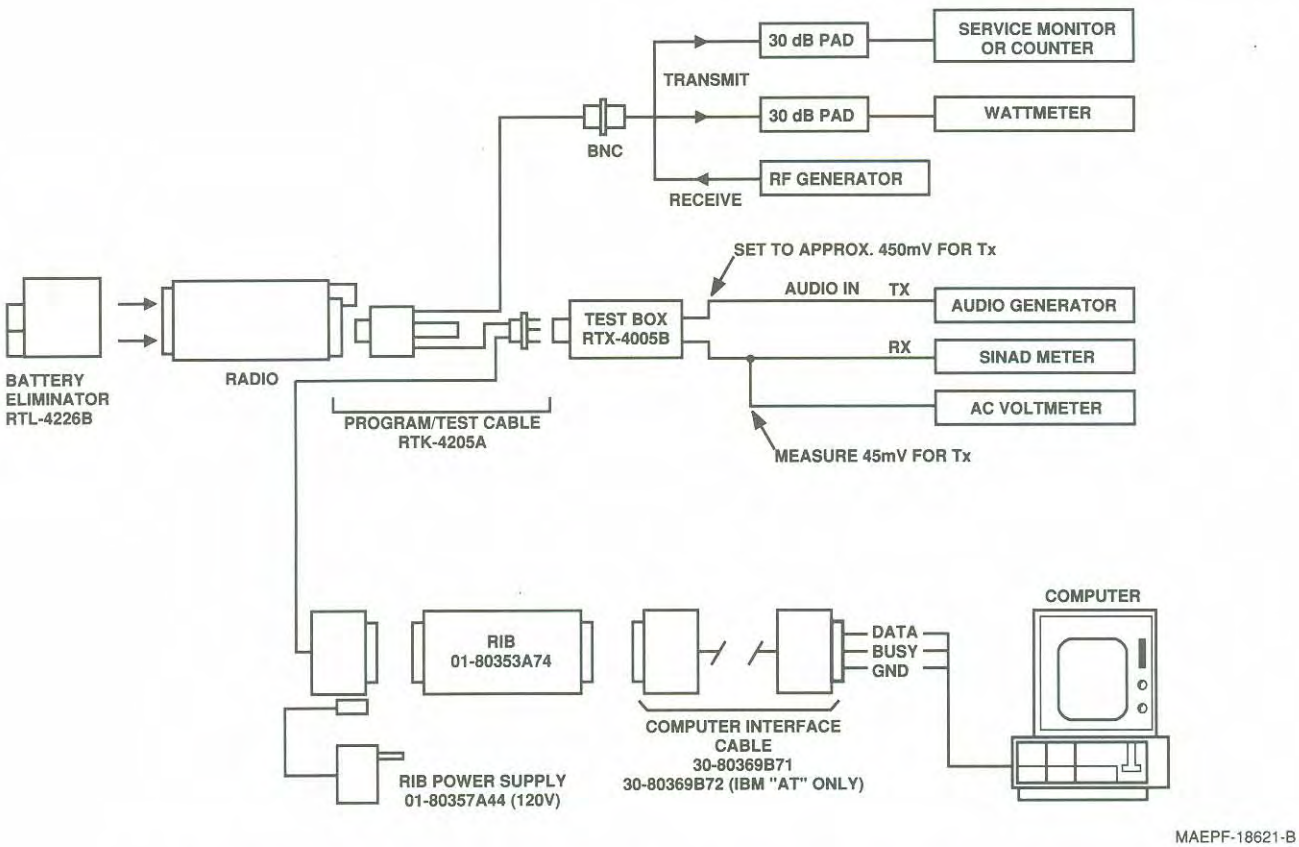


Figure 14. Troubleshooting, Test Equipment, and Programming Set-Up Detail

a. Recommended Test Equipment

The list of equipment contained in Table 3 includes all of the standard test equipment required for servicing two-way portable radios, as well as several unique items designed specifically for servicing the HT600 radio. Battery-operated test equipment is recommended when available. The "CHARACTERISTICS" column is included so that equivalent equipment may be substituted; however, when no information is provided in this column, the specific Motorola model listed is either a unique item or no substitution is recommended.

Table 3. Test Equipment

MOTOROLA MODEL NUMBER	DESCRIPTION	CHARACTERISTICS	APPLICATION
R2200, R2400, or R2001D with trunking option	Service Monitor	This monitor will substitute for items with an asterisk (*)	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
*R1049A	Digital Multimeter		Two meters recommended for ac/dc voltage and current measurements
*S1100A	Audio Oscillator	67 to 161.4Hz tones	Used with service monitor for injection of PL tones
*S1053D *SKN6009A *SKN6001A	AC Voltmeter Power Cable for Meter Test Leads for Meter	1mV to 300V, 10-Megohm input impedance	Audio voltage measurements
R1053	Dual-Trace Oscilloscope	20MHz bandwidth 5mV/cm - 20V/cm	Waveform measurements
*S1350C *ST1215B (VHF) *ST1223B (UHF) *T1013A	Watt Meter Plug-in Element RF Dummy Load	50-ohm, ±5% accuracy 10 Watts, maximum 0-1000MHz, 300W	Transmitter power output measurements
S1339A	RF Millivolt Meter	100µV to 3V rf 10kHz to 1.2GHz	RF level measurements
*R1013A	SINAD Meter		Receiver sensitivity measurements
S1347D or S1348D (programmable)	DC Power Supply	0-20Vdc, 0-5 Amps current limited	Bench supply for 10Vdc

* R2200, R2400, or R2001D will substitute for items with an asterisk (*)

b. Service Aids and Recommended Tools

Refer to the "SERVICE AIDS" and "RECOMMENDED TOOLS LIST" for a listing and description of the service aids and tools designed specifically for servicing the HT600 radio, as well as the more common tools required to disassemble and properly maintain the radio. These kits and/or parts are available from the Motorola Communications Parts office listed in the "Replacement Parts Ordering" section of this manual.

MAV-PACK 3 (VID-952)

The VID-952 Motorola Video Visual Package (MAV-PACK) is a video tape training program on leadless component repair techniques. This VHS format video cassette and supplemental literature describe the removal and replacement of leadless components using the following specialized equipment:

- RRX-4033 Laurier Hot Gas Bonder
- RPX-4234A Regulator and Hardware Kit
- 0180386A62 Heated Tweezers
- RSX-1002 Desoldering Station
- RSX-1008 Weller Soldering Station

This MAV-PACK is strongly recommended for technicians who intend to service this and other Motorola radios using leadless components. This VHS videotape is in standard half-inch format. This MAV-PACK, as well as others, is available from:

Motorola C&E, Inc.
National Service Training Center
1300 N. Plum Grove Road
Schaumburg, Illinois 60195

8. FIELD PROGRAMMING

The HT600 radio can be field programmed. Field programming requires specific equipment and accompanying instructions. Refer to the HT600 "Radio Service Software User's Manual" for complete field programming information.

TROUBLESHOOTING

1. INTRODUCTION

Servicing the HT600 Series radio requires the localization of the malfunctioning circuit before the defective component can be isolated and replaced. Since localizing and isolating a defective component constitutes the most time consuming part of troubleshooting, a thorough understanding of the circuits involved will aid the technician in performing efficient servicing. The technician must know how one function affects another; he must be familiar with the overall operation of the radio and the procedures necessary to place it back in operation in the shortest possible time.

The radio functional block diagrams, schematic diagrams, and troubleshooting charts provide valuable information for troubleshooting purposes. The functional diagrams provide signal flow information in a simplified format, while the schematic diagrams provide the detailed circuitry and the biasing voltages required for isolating malfunctioning components. By using the diagrams, troubleshooting charts, and deductive processes, the suspected circuit may be readily found.

To determine if analyzation of the radio is required, perform checks such as 20dB quieting, 12dB SINAD, noise and PL squelch sensitivity, for the receiver, and current drain for the transmitter. These should give the technician a general indication of where the problem is located.

NOTE

See Figure 14 - Troubleshooting, Test Equipment, and Programming Set-Up Detail.

After the general problem area of the radio has been identified, careful use of a dc voltmeter, rf millivoltmeter, and an oscilloscope should isolate the problem to an individual component.

2. TROUBLESHOOTING PROCEDURE

Each time that the radio is turned on, a microcomputer self-test occurs. A 1600Hz alert tone is generated for approximately 500 milliseconds to indicate that the microcomputer is functioning properly. If the alert tone is not heard (and the alert tones have not been disabled via the Radio Service Software), there is a problem with the radio.

Following the microcomputer self-test, a synthesizer self-test occurs. A continuous 1600Hz alert tone is generated if the synthesizer test is **not** successful. If this condition occurs (continuous alert tone) refer to the VCO/synthesizer troubleshooting chart.

When a radio performs unsatisfactorily, the following procedures should help localize the fault.

a. Check Batteries

The first step in localizing a problem is to check the battery voltage under load. With the transmitter turned on (keyed), check the battery voltage. A convenient way to do this is to remove the front cover and monitor the B+ line with a voltmeter (with respect to ground). The measured load voltage should not be less than eight volts. Even though the transmitter may operate at a lower voltage, operation would be marginal and for only a short period of time. Low-voltage transmit operation is indicated by the flashing LED on top of the radio. If the measured voltage is zero volts, check the battery and fuse. The recommended procedure is to replace, or recharge, the battery if the voltage is below eight volts under load.

b. Alignment

Strict adherence to the published procedures is a prerequisite to accurate alignment and proper evaluation of the performance of the radio. The selection of test equipment is critical. The use of equipment other than that recommended should be cleared through your Motorola Area Representative to ensure that it is of equivalent quality.

The service technician must observe good servicing techniques. The use of interconnecting cables that are too long, poorly positioned (dressed), or improperly terminated will result in erratic meter readings. As a result, it will not be possible to tune the radio to the desired specifications.

Use the recommended test equipment setup and proper connections for alignment and adjustments. Refer to the detailed procedures supplied in the applicable service manual.

c. Check Overall Transmitter Operation

If the battery voltage is sufficient, check the overall performance of the transmitter. A good overall check of the transmitter is the rf power output measurement. This check indicates the proper operation of the transmitter amplifier stages. A properly tuned and operating transmitter will produce the rated rf output into a 50-ohm load with a dc input of 10 volts (refer to "Transmitter Alignment Procedure," located in the service section of this manual, for specific rf output). If the power is less than rated rf output, refer to the applicable transmitter troubleshooting chart.

d. Check Overall Receiver Operation

(1) 20dB Quieting Sensitivity Test

A good overall check of receiver operation is the 20dB quieting sensitivity measurement. This check will indicate that the receiver has sufficient gain and

that all of the included circuitry is working properly. The quieting signal is that rf signal input necessary to reduce the audio output at the speaker by 20dB. This measurement should be made with no modulation. It will be necessary to hold the monitor button during this test, or the radio's squelch circuitry will remove the noise from the speaker.

Make the actual measurement (using an ac voltmeter) by setting the noise voltage across the test box speaker load (with no rf signal received at the antenna) to one-fourth (1/4) of the rated audio power output (2.24Vrms). Sufficient carrier signal from a generator is then introduced via the universal connector (remote antenna port) to reduce the noise output voltage to one-tenth (1/10) of the previous reading. If all of the circuitry is operating correctly, this reading should be 0.35μV or less on vhf models and 0.5μV on uhf models. If the radio does not meet this specification, try to retune the receiver using the procedure indicated in the service manual. If this does not solve the problem, refer to the receiver troubleshooting chart.

(2) 12dB SINAD

This procedure is a standard method for evaluating the performance of an fm receiver, since it provides a check of the rf, i-f, and audio stages. The method consists of finding the lowest modulated signal necessary to produce 50% of the radio's rated audio output with a 12dB or better ratio of signal + noise + distortion/noise + distortion. This is termed "usable sensitivity."

To perform this measurement, connect the leads from a SINAD meter to the audio output of the test box. Set the Motorola service monitor or rf signal generator to output a 1-millivolt signal. Modulate the rf signal with a 1kHz tone at 3kHz deviation. Introduce the signal to the radio at the exact channel frequency through the universal connector. Set the volume control for rated audio output (4.47Vrms). Decrease the rf signal level until the SINAD meter reads 12dB. The signal generator output (12dB SINAD measurement) should be less than 0.25μV on vhf receivers or less than 0.35μV on uhf receivers. If the radio does not meet this specification, try to retune the receiver using the procedure indicated in the service manual. If this does not solve the problem, refer to the receiver troubleshooting chart.

3. VOLTAGE MEASUREMENT AND SIGNAL TRACING

To aid in troubleshooting, ac and dc voltage readings are provided (in red) on the transceiver schematic diagram in the service manual. When making these voltage checks, pay particular attention to any notes that may accompany the voltage reading of a particular stage.

If receiver sensitivity is high or if the rf power output is lower than normal for a fully tuned transceiver, the dc voltages on the printed circuit board should be checked. These voltages should be referenced to ground.

CAUTION

When checking a transistor or module, either in or out of the circuit, do not use an ohmmeter having more than 1.5 volts dc appearing across the test leads or an ohms scale of less than x 100.

It is recommended not to replace a transistor or module before a thorough check is made. Read the voltages around the suspected stage. If these voltages are not reasonably close to those specified, the associated components should be checked.

A low-impedance meter should not be used for measurement. If all dc voltages are correct, the signal should be traced through the circuit to show any possibility of breaks in the signal path.

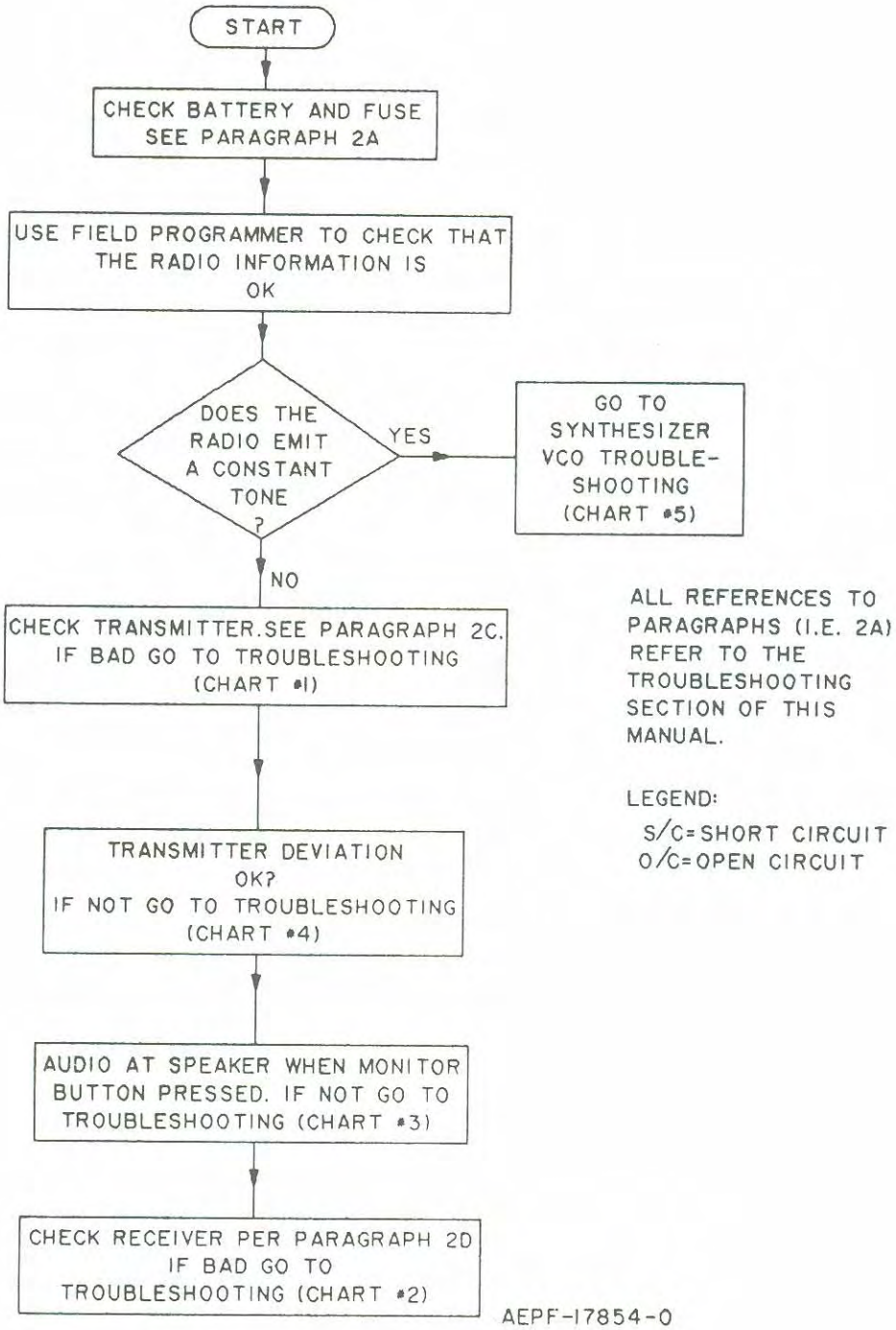
CAUTION

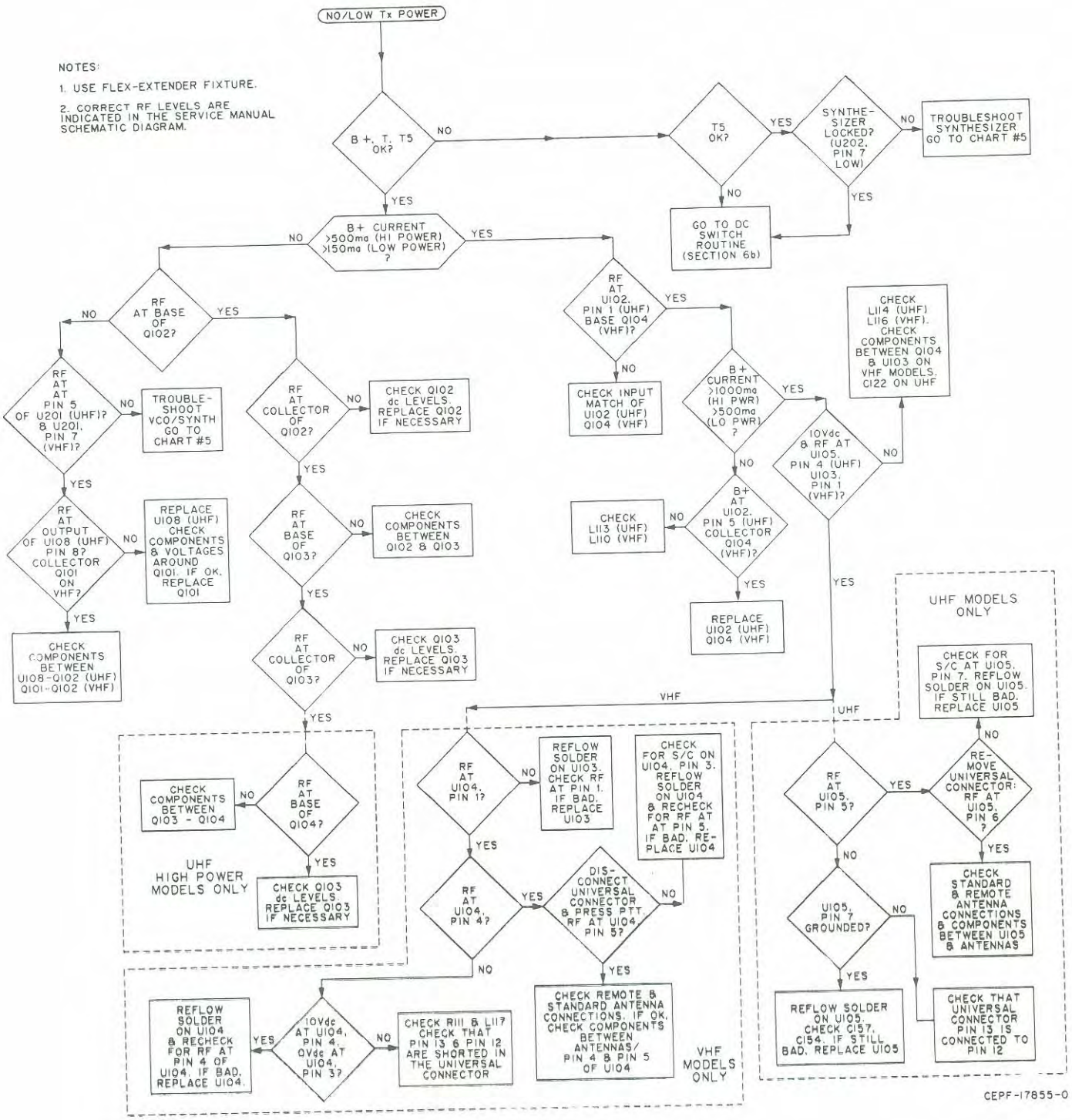
The microcomputer is a static sensitive device contained on the controller flex assembly. DO NOT attempt to troubleshoot or disassemble the microcomputer/controller flex assembly without first referring to the "SAFE HANDLING OF CMOS DEVICES" paragraph in the **MAINTENANCE** section of the manual.

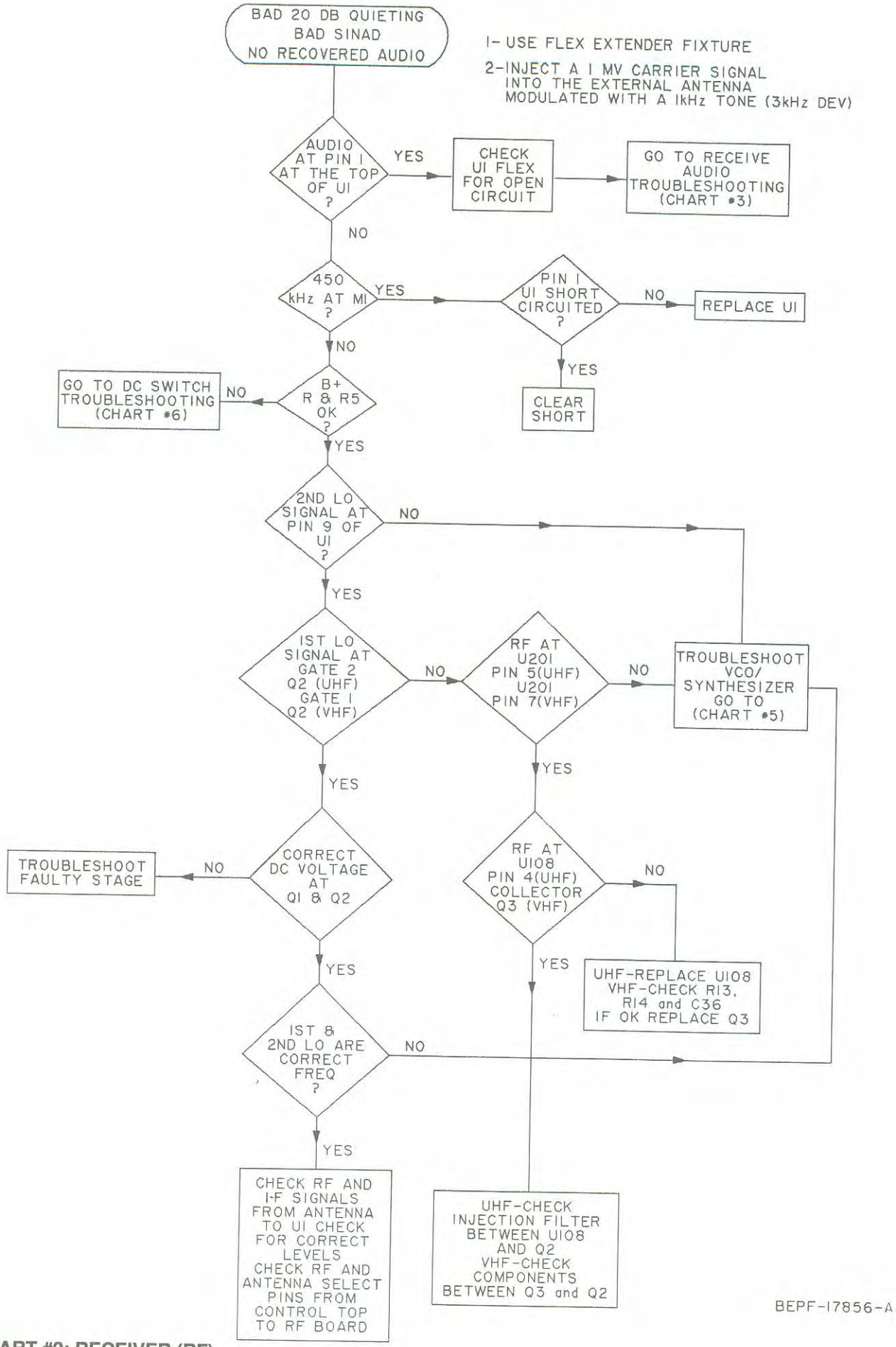
When troubleshooting the microcomputer controller flex circuits, it will be necessary to disconnect the flex from the radio main circuit board and reconnect it via a flex extender fixture. Also, many of the measurements referred to in the microcomputer troubleshooting charts that follow are short in duration. So, it will be necessary to use an oscilloscope set for 1V/division and 5ms/division.

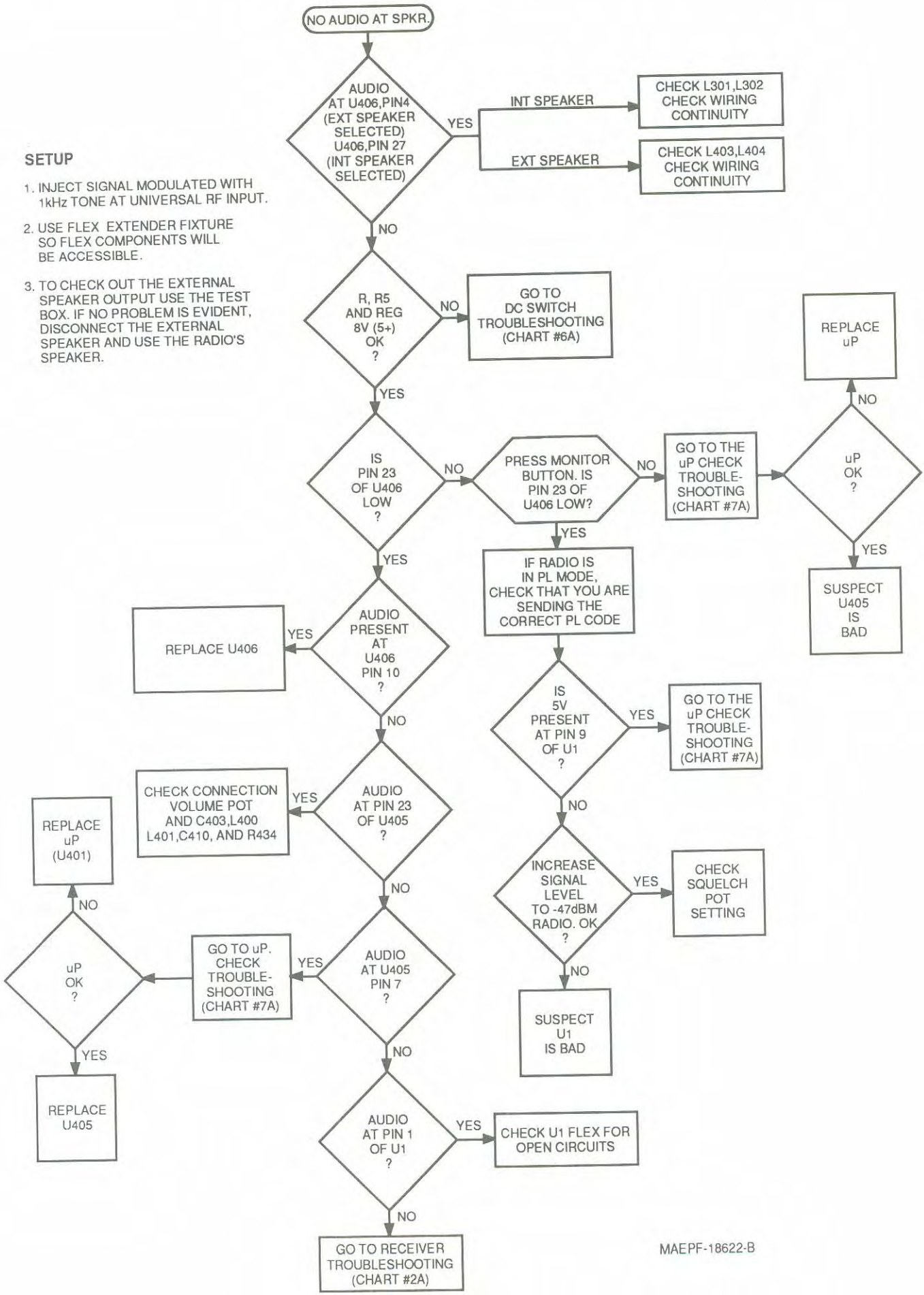
4. TROUBLESHOOTING CHARTS

The troubleshooting charts on the following pages will help isolate troubles in the different sections of the radio. Start at the top of the appropriate chart and make the checks as indicated. Most usual malfunctions will respond to the systematic approach to troubleshooting. Also, a flowchart is provided to aid in choosing the proper troubleshooting chart.


START
CHECK BATTERY AND FUSE SEE PARAGRAPH 2A
USE FIELD PROGRAMMER TO CHECK THAT THE RADIO INFORMATION IS OK
DOES THE RADIO EMIT A CONSTANT TONE ?
YES
GO TO SYNTHESIZER VCO TROUBLE-SHOOTING (CHART #5)
NO
CHECK TRANSMITTER.SEE PARAGRAPH 2C. IF BAD GO TO TROUBLESHOOTING (CHART #1)
TRANSMITTER DEVIATION OK? IF NOT GO TO TROUBLESHOOTING (CHART #4)
AUDIO AT SPEAKER WHEN MONITOR BUTTON PRESSED. IF NOT GO TO TROUBLESHOOTING (CHART #3)
CHECK RECEIVER PER PARAGRAPH 2D IF BAD GO TO TROUBLESHOOTING (CHART #2)
ALL REFERENCES TO PARAGRAPHS (I.E. 2A) REFER TO THE TROUBLESHOOTING SECTION OF THIS MANUAL.
LEGEND:
S/C=SHORT CIRCUIT
O/C=OPEN CIRCUIT
AEPF-17854-0

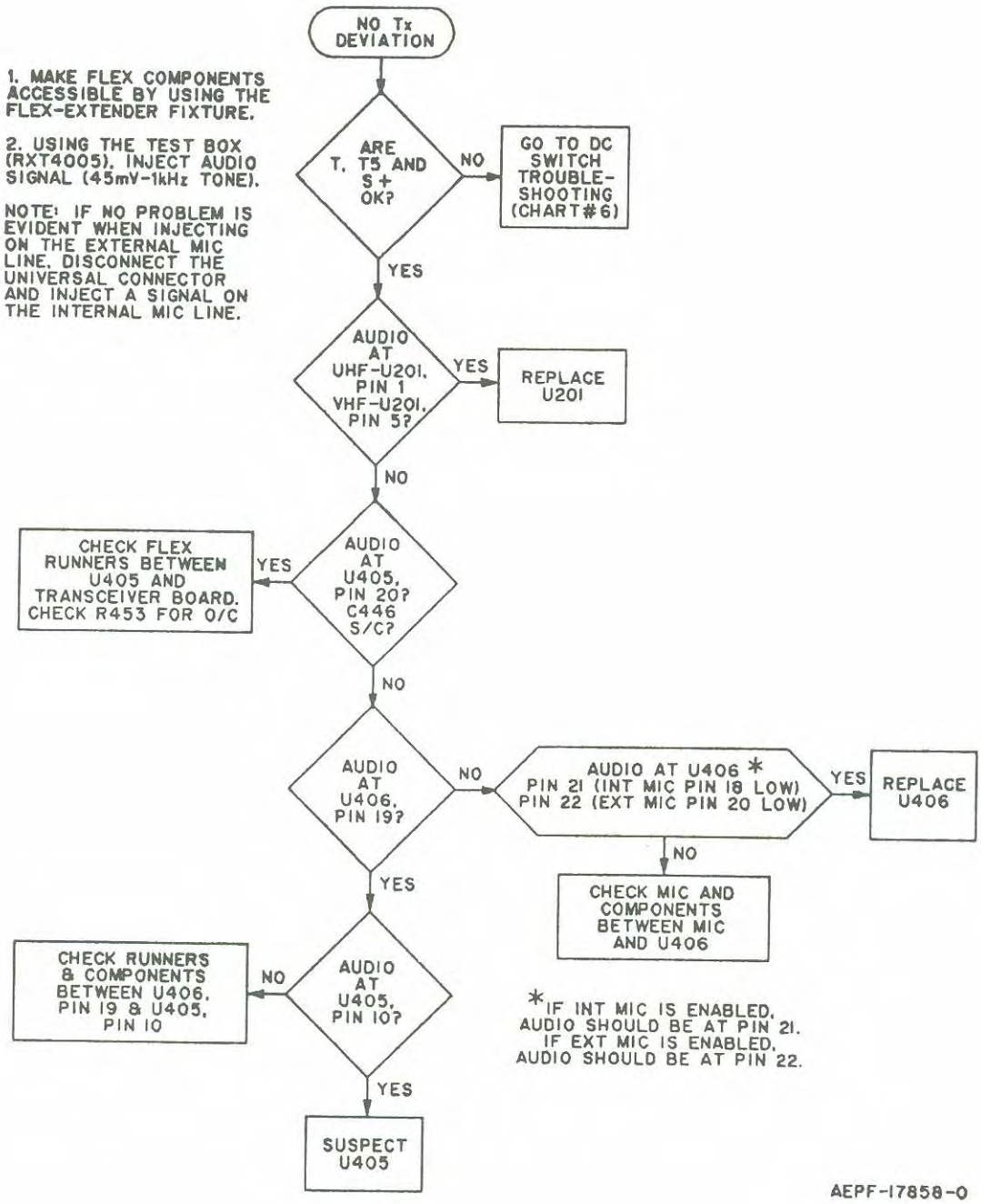

NO/LOW Tx POWER
NOTES:
1. USE FLEX-EXTENDER FIXTURE.
2. CORRECT RF LEVELS ARE INDICATED IN THE SERVICE MANUAL SCHEMATIC DIAGRAM.
B +, T, T5 OK?
NO
YES
T5 OK?
YES
NO
SYNTHE-SIZER LOCKED? (U202, PIN 7 LOW)
NO
YES
TROUBLESHOOT SYNTHESIZER GO TO CHART #5
GO TO DC SWITCH ROUTINE (SECTION 6b)
B+ CURRENT >500ma (HI POWER) >150ma (LOW POWER) ?
NO
YES
RF AT BASE OF Q102?
NO
YES
RF AT AT PIN 5 OF U201 (UHF)? & U201, PIN 7 (VHF)?
NO
YES
TROUBLE-SHOOT VCO/SYNTH GO TO CHART #5
RF AT OUTPUT OF U108 (UHF) PIN 8? COLLECTOR Q101 ON VHF?
NO
YES
REPLACE U108 (UHF) CHECK COMPONENTS & VOLTAGES AROUND Q101. IF OK, REPLACE Q101
CHECK COMPONENTS BETWEEN U108-Q102 (UHF) Q101-Q102 (VHF)
RF AT COLLECTOR OF Q102?
NO
YES
CHECK Q102 dc LEVELS. REPLACE Q102 IF NECESSARY
RF AT BASE OF Q103?
NO
YES
CHECK COMPONENTS BETWEEN Q102 & Q103
RF AT COLLECTOR OF Q103?
NO
YES
CHECK Q103 dc LEVELS. REPLACE Q103 IF NECESSARY
RF AT U102, PIN 1 (UHF) BASE Q104 (VHF)?
NO
YES
CHECK INPUT MATCH OF U102 (UHF) Q104 (VHF)
B+ CURRENT >1000ma (HI PWR) >500ma (LO PWR) ?
NO
YES
B+ AT U102, PIN 5 (UHF) COLLECTOR Q104 (VHF)?
NO
YES
CHECK L113 (UHF) L110 (VHF)
REPLACE U102 (UHF) Q104 (VHF)
10Vdc & RF AT U105, PIN 4 (UHF) U103, PIN 1 (VHF)?
NO
YES
CHECK L114 (UHF) L116 (VHF). CHECK COMPONENTS BETWEEN Q104 & U103 ON VHF MODELS. C122 ON UHF
VHF
UHF
UHF MODELS ONLY
CHECK FOR S/C AT U105, PIN 7. REFLOW SOLDER ON U105. IF STILL BAD, REPLACE U105
RF AT U105, PIN 5?
NO
YES
RE-MOVE UNIVERSAL CONNECTOR: RF AT U105, PIN 6 ?
NO
YES
U105, PIN 7 GROUNDED?
NO
YES
CHECK STANDARD & REMOTE ANTENNA CONNECTIONS & COMPONENTS BETWEEN U105 & ANTENNAS
REFLOW SOLDER ON U105. CHECK C157, C154. IF STILL BAD, REPLACE U105
CHECK THAT UNIVERSAL CONNECTOR PIN 13 IS CONNECTED TO PIN 12
RF AT U104, PIN 1?
NO
YES
REFLOW SOLDER ON U103. CHECK RF AT PIN 1. IF BAD, REPLACE U103
CHECK FOR S/C ON U104, PIN 3. REFLOW SOLDER ON U104 & RECHECK FOR RF AT PIN 5. IF BAD, RE-PLACE U104
RF AT U104, PIN 4?
NO
YES
DIS-CONNECT UNIVERSAL CONNECTOR & PRESS PTT. RF AT U104, PIN 5?
NO
YES
CHECK REMOTE & STANDARD ANTENNA CONNECTIONS. IF OK, CHECK COMPONENTS BETWEEN ANTENNAS/ PIN 4 & PIN 5 OF U104
10Vdc AT U104, PIN 4. 0Vdc AT U104, PIN 3?
YES
NO
REFLOW SOLDER ON U104 & RECHECK FOR RF AT PIN 4 OF U104. IF BAD, REPLACE U104.
CHECK R111 & L117 CHECK THAT PIN 13 & PIN 12 ARE SHORTED IN THE UNIVERSAL CONNECTOR
VHF MODELS ONLY
CHECK COMPONENTS BETWEEN Q103 - Q104
NO
RF AT BASE OF Q104?
YES
UHF HIGH POWER MODELS ONLY
CHECK Q103 dc LEVELS. REPLACE Q103 IF NECESSARY
CEPF-17855-0

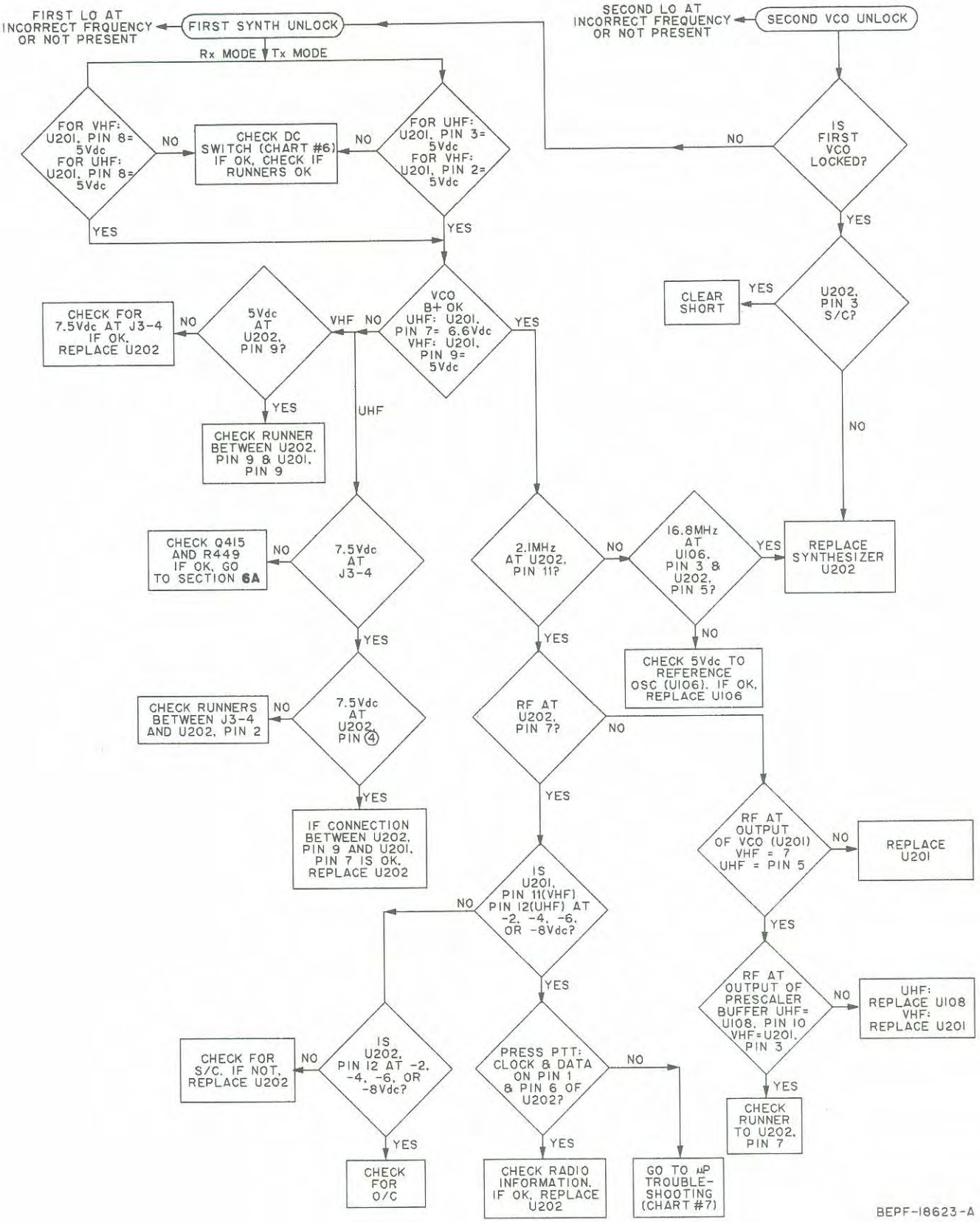

BAD 20 DB QUIETING
BAD SINAD
NO RECOVERED AUDIO
1- USE FLEX EXTENDER FIXTURE
2-INJECT A 1 MV CARRIER SIGNAL INTO THE EXTERNAL ANTENNA MODULATED WITH A 1kHz TONE (3kHz DEV)
AUDIO AT PIN 1 AT THE TOP OF U1 ?
YES
CHECK U1 FLEX FOR OPEN CIRCUIT
GO TO RECEIVE AUDIO TROUBLESHOOTING (CHART #3)
NO
450 kHz AT M1 ?
YES
PIN 1 U1 SHORT CIRCUITED ?
NO
REPLACE U1
YES
CLEAR SHORT
NO
B+ R 8 R5 OK ?
NO
GO TO DC SWITCH TROUBLESHOOTING (CHART #6)
YES
2ND LO SIGNAL AT PIN 9 OF U1 ?
NO
YES
1ST LO SIGNAL AT GATE 2 Q2 (UHF) GATE 1 Q2 (VHF)
NO
RF AT U201 PIN 5(UHF) U201 PIN 7(VHF)
NO
TROUBLESHOOT VCO/ SYNTHESIZER GO TO (CHART #5)
YES
YES
CORRECT DC VOLTAGE AT Q1 & Q2
NO
TROUBLESHOOT FAULTY STAGE
RF AT U108 PIN 4(UHF) COLLECTOR Q3 (VHF)
NO
YES
YES
UHF-REPLACE U108 VHF-CHECK R13, R14 and C36 IF OK REPLACE Q3
1ST & 2ND LO ARE CORRECT FREQ ?
NO
YES
CHECK RF AND I-F SIGNALS FROM ANTENNA TO U1 CHECK FOR CORRECT LEVELS CHECK RF AND ANTENNA SELECT PINS FROM CONTROL TOP TO RF BOARD
UHF-CHECK INJECTION FILTER BETWEEN U108 AND Q2 VHF-CHECK COMPONENTS BETWEEN Q3 and Q2
BEPF-17856-A

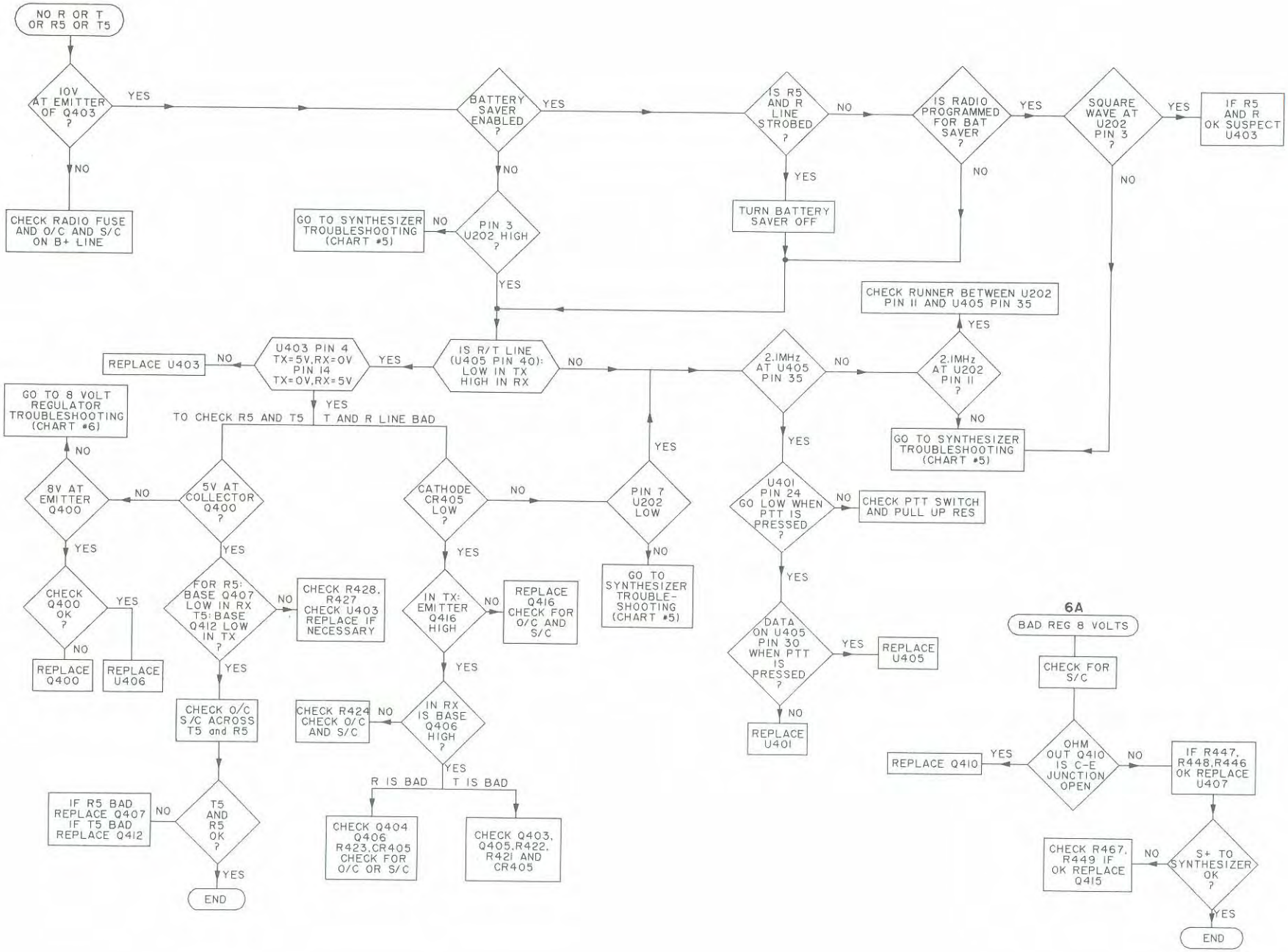


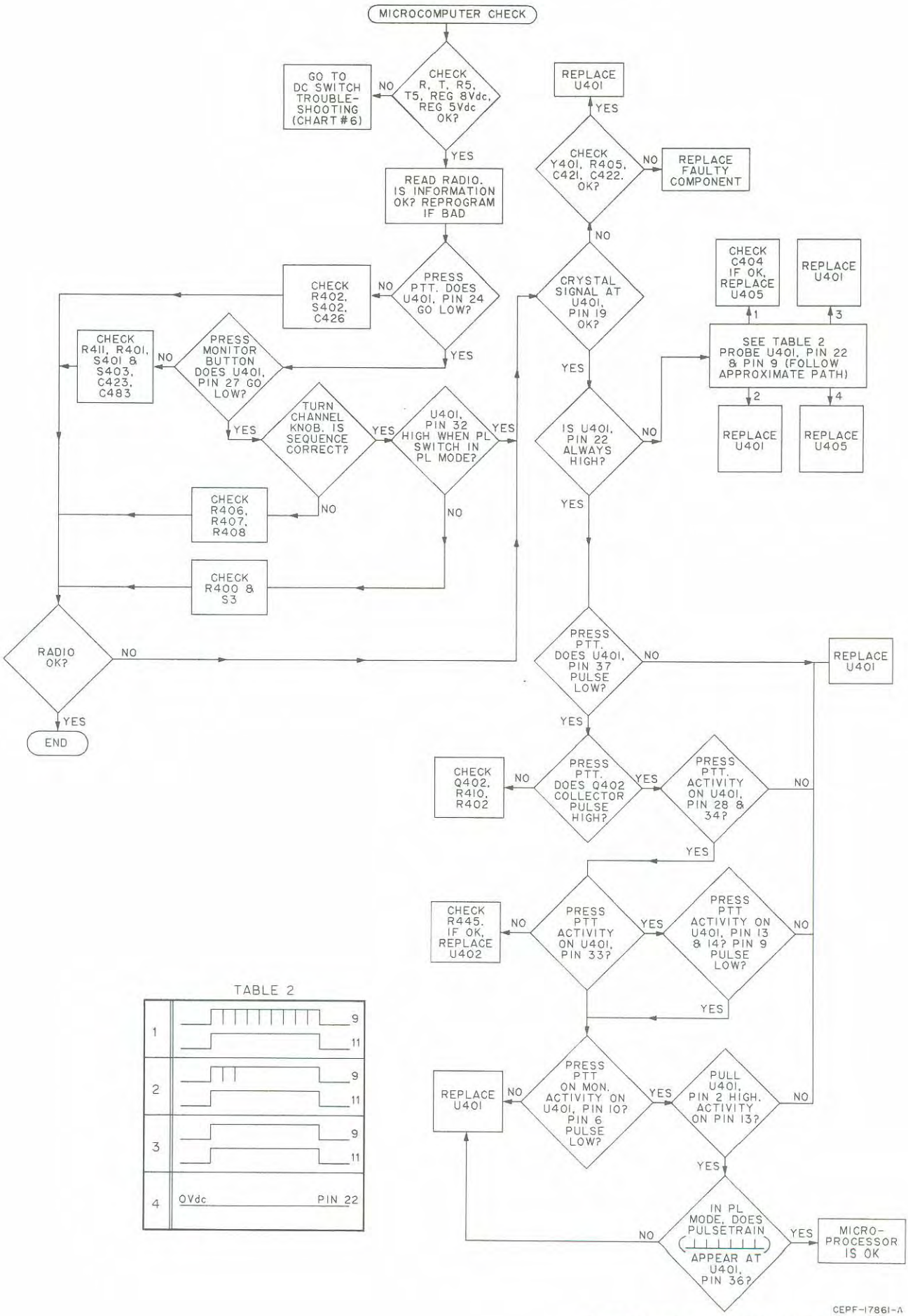
SETUP

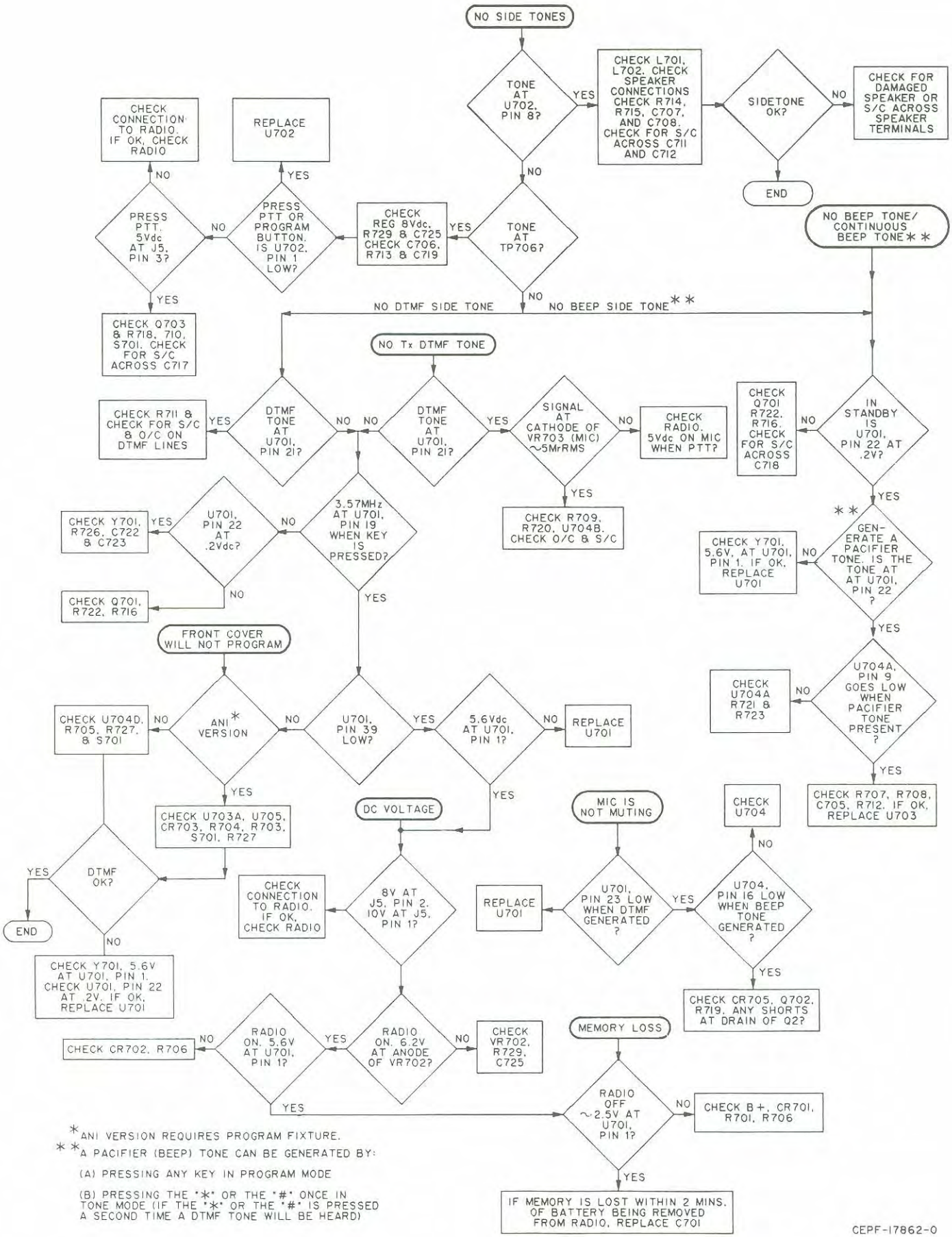
1. INJECT SIGNAL MODULATED WITH 1kHz TONE AT UNIVERSAL RF INPUT.
2. USE FLEX EXTENDER FIXTURE SO FLEX COMPONENTS WILL BE ACCESSIBLE.
3. TO CHECK OUT THE EXTERNAL SPEAKER OUTPUT USE THE TEST BOX. IF NO PROBLEM IS EVIDENT, DISCONNECT THE EXTERNAL SPEAKER AND USE THE RADIO'S SPEAKER.


NO Tx DEVIATION
1. MAKE FLEX COMPONENTS ACCESSIBLE BY USING THE FLEX-EXTENDER FIXTURE.
2. USING THE TEST BOX (RXT4005), INJECT AUDIO SIGNAL (45mV-1kHz TONE).
NOTE: IF NO PROBLEM IS EVIDENT WHEN INJECTING ON THE EXTERNAL MIC LINE, DISCONNECT THE UNIVERSAL CONNECTOR AND INJECT A SIGNAL ON THE INTERNAL MIC LINE.
ARE T, T5 AND S+ OK?
NO
GO TO DC SWITCH TROUBLE-SHOOTING (CHART #6)
YES
AUDIO AT UHF-U201, PIN 1 VHF-U201, PIN 5?
YES
REPLACE U201
NO
AUDIO AT U405, PIN 20? C446 S/C?
YES
CHECK FLEX RUNNERS BETWEEN U405 AND TRANSCEIVER BOARD. CHECK R453 FOR O/C
NO
AUDIO AT U406, PIN 19?
NO
AUDIO AT U406 * PIN 21 (INT MIC PIN 18 LOW) PIN 22 (EXT MIC PIN 20 LOW)
YES
REPLACE U406
NO
CHECK MIC AND COMPONENTS BETWEEN MIC AND U406
YES
AUDIO AT U405, PIN 10?
NO
CHECK RUNNERS & COMPONENTS BETWEEN U406, PIN 19 & U405, PIN 10
YES
SUSPECT U405
* IF INT MIC IS ENABLED, AUDIO SHOULD BE AT PIN 21. IF EXT MIC IS ENABLED, AUDIO SHOULD BE AT PIN 22.
AEPF-17858-O


FIRST LO AT INCORRECT FRQUENCY OR NOT PRESENT
FIRST SYNTH UNLOCK
SECOND LO AT INCORRECT FREQUENCY OR NOT PRESENT
SECOND VCO UNLOCK
Rx MODE
Tx MODE
FOR VHF: U201, PIN 8= 5Vdc FOR UHF: U201, PIN 8= 5Vdc
NO
CHECK DC SWITCH (CHART #6) IF OK, CHECK IF RUNNERS OK
NO
FOR UHF: U201, PIN 3= 5Vdc FOR VHF: U201, PIN 2= 5Vdc
NO
IS FIRST VCO LOCKED?
YES
YES
YES
CLEAR SHORT
YES
U202, PIN 3 S/C?
NO
CHECK FOR 7.5Vdc AT J3-4 IF OK, REPLACE U202
NO
5Vdc AT U202, PIN 9?
VHF
NO
VCO B+ OK UHF: U201, PIN 7= 6.6Vdc VHF: U201, PIN 9= 5Vdc
YES
YES
CHECK RUNNER BETWEEN U202, PIN 9 & U201, PIN 9
UHF
CHECK Q415 AND R449 IF OK, GO TO SECTION 6A
NO
7.5Vdc AT J3-4
2.1MHz AT U202, PIN 11?
NO
16.8MHz AT U106, PIN 3 & U202, PIN 5?
YES
REPLACE SYNTHESIZER U202
YES
YES
NO
CHECK 5Vdc TO REFERENCE OSC (U106). IF OK, REPLACE U106
CHECK RUNNERS BETWEEN J3-4 AND U202, PIN 2
NO
7.5Vdc AT U202, PIN 4
RF AT U202, PIN 7?
NO
YES
YES
IF CONNECTION BETWEEN U202, PIN 9 AND U201, PIN 7 IS OK, REPLACE U202
RF AT OUTPUT OF VCO (U201) VHF = 7 UHF = PIN 5
NO
REPLACE U201
IS U201, PIN 11(VHF) PIN 12(UHF) AT -2, -4, -6, OR -8Vdc?
NO
YES
YES
CHECK FOR S/C. IF NOT, REPLACE U202
NO
IS U202, PIN 12 AT -2, -4, -6, OR -8Vdc?
PRESS PTT: CLOCK & DATA ON PIN 1 & PIN 6 OF U202?
NO
RF AT OUTPUT OF PRESCALER BUFFER UHF= U108, PIN 10 VHF=U201, PIN 3
NO
UHF: REPLACE U108 VHF: REPLACE U201
YES
YES
YES
YES
CHECK FOR O/C
CHECK RADIO INFORMATION. IF OK, REPLACE U202
GO TO µP TROUBLE-SHOOTING (CHART #7)
CHECK RUNNER TO U202, PIN 7
BEPF-18623-A


NO R OR T OR R5 OR T5
10V AT EMITTER OF Q403 ?
YES
NO
CHECK RADIO FUSE AND O/C AND S/C ON B+ LINE
BATTERY SAVER ENABLED ?
YES
NO
PIN 3 U202 HIGH ?
NO
GO TO SYNTHESIZER TROUBLESHOOTING (CHART #5)
YES
IS R5 AND R LINE STROBED ?
NO
YES
TURN BATTERY SAVER OFF
IS RADIO PROGRAMMED FOR BAT SAVER ?
YES
NO
SQUARE WAVE AT U202 PIN 3 ?
YES
IF R5 AND R OK SUSPECT U403
NO
CHECK RUNNER BETWEEN U202 PIN 11 AND U405 PIN 35
YES
2.1MHz AT U202 PIN 11 ?
NO
GO TO SYNTHESIZER TROUBLESHOOTING (CHART #5)
IS R/T LINE (U405 PIN 40): LOW IN TX HIGH IN RX
NO
YES
2.1MHz AT U405 PIN 35
NO
YES
U403 PIN 4 TX=5V,RX=0V PIN 14 TX=0V,RX=5V
YES
NO
REPLACE U403
TO CHECK R5 AND T5
YES
T AND R LINE BAD
GO TO 8 VOLT REGULATOR TROUBLESHOOTING (CHART #6)
NO
8V AT EMITTER Q400
NO
YES
CHECK Q400 OK ?
YES
NO
REPLACE Q400
REPLACE U406
5V AT COLLECTOR Q400 ?
YES
FOR R5: BASE Q407 LOW IN RX T5: BASE Q412 LOW IN TX ?
NO
CHECK R428, R427 CHECK U403 REPLACE IF NECESSARY
YES
CHECK O/C S/C ACROSS T5 and R5
IF R5 BAD REPLACE Q407 IF T5 BAD REPLACE Q412
NO
T5 AND R5 OK ?
YES
END
CATHODE CR405 LOW ?
NO
YES
PIN 7 U202 LOW
NO
GO TO SYNTHESIZER TROUBLE-SHOOTING (CHART #5)
YES
IN TX: EMITTER Q416 HIGH
NO
REPLACE Q416 CHECK FOR O/C AND S/C
YES
IN RX IS BASE Q406 HIGH ?
NO
CHECK R424 CHECK O/C AND S/C
YES
R IS BAD
T IS BAD
CHECK Q404 Q406 R423,CR405 CHECK FOR O/C OR S/C
CHECK Q403, Q405,R422, R421 AND CR405
U401 PIN 24 GO LOW WHEN PTT IS PRESSED ?
NO
CHECK PTT SWITCH AND PULL UP RES
YES
DATA ON U405 PIN 30 WHEN PTT IS PRESSED ?
YES
REPLACE U405
NO
REPLACE U401
6A
BAD REG 8 VOLTS
CHECK FOR S/C
OHM OUT Q410 IS C-E JUNCTION OPEN
YES
REPLACE Q410
NO
IF R447, R448,R446 OK REPLACE U407
S+ TO SYNTHESIZER OK ?
NO
CHECK R467, R449 IF OK REPLACE Q415
YES
END
CEPF-18624-A


MICROCOMPUTER CHECK
CHECK R, T, R5, T5, REG 8Vdc, REG 5Vdc OK?
NO
GO TO DC SWITCH TROUBLE-SHOOTING (CHART #6)
YES
READ RADIO. IS INFORMATION OK? REPROGRAM IF BAD
PRESS PTT. DOES U401, PIN 24 GO LOW?
NO
CHECK R402, S402, C426
YES
PRESS MONITOR BUTTON DOES U401, PIN 27 GO LOW?
NO
CHECK R411, R401, S401 & S403, C423, C483
YES
TURN CHANNEL KNOB. IS SEQUENCE CORRECT?
YES
U401, PIN 32 HIGH WHEN PL SWITCH IN PL MODE?
YES
NO
CHECK R406, R407, R408
NO
CHECK R400 & S3
RADIO OK?
NO
YES
END
REPLACE U401
YES
CHECK Y401, R405, C421, C422. OK?
NO
REPLACE FAULTY COMPONENT
NO
CRYSTAL SIGNAL AT U401, PIN 19 OK?
YES
CHECK C404 IF OK, REPLACE U405
REPLACE U401
1
3
SEE TABLE 2 PROBE U401, PIN 22 & PIN 9 (FOLLOW APPROXIMATE PATH)
2
4
REPLACE U401
REPLACE U405
IS U401, PIN 22 ALWAYS HIGH?
NO
YES
PRESS PTT, DOES U401, PIN 37 PULSE LOW?
NO
REPLACE U401
YES
CHECK Q402, R410, R402
NO
PRESS PTT, DOES Q402 COLLECTOR PULSE HIGH?
YES
PRESS PTT, ACTIVITY ON U401, PIN 28 & 34?
NO
YES
CHECK R445, IF OK, REPLACE U402
NO
PRESS PTT ACTIVITY ON U401, PIN 33?
YES
PRESS PTT ACTIVITY ON U401, PIN 13 & 14? PIN 9 PULSE LOW?
NO
YES
REPLACE U401
NO
PRESS PTT ON MON. ACTIVITY ON U401, PIN 10? PIN 6 PULSE LOW?
YES
PULL U401, PIN 2 HIGH. ACTIVITY ON PIN 13?
NO
YES
NO
IN PL MODE, DOES PULSETRAIN APPEAR AT U401, PIN 36?
YES
MICRO-PROCESSOR IS OK
TABLE 2
1
9
11
2
9
11
3
9
11
4
0Vdc
PIN 22
CEPF-17861-A



*ANI VERSION REQUIRES PROGRAM FIXTURE.

**A PACIFIER (BEEP) TONE CAN BE GENERATED BY:

(A) PRESSING ANY KEY IN PROGRAM MODE

(B) PRESSING THE '*' OR THE '#' ONCE IN TONE MODE (IF THE '*' OR THE '#' IS PRESSED A SECOND TIME A DTMF TONE WILL BE HEARD)

CEPF-17862-0

VHF SPECIFICATIONS

GENERAL

FREQUENCY RANGE: 136-174MHz

POWER SUPPLY: Nickel-cadmium battery

BATTERY DRAIN-

at10Vdc	H33	H43
Standby:	*43mA	*43mA
Receive:	*163mA	*163mA
Transmit:	**875mA	**1600mA

*Add 8mA with Remote Antenna
**Add 25mA with Remote Antenna

DIMENSIONS:

WIDTH:	2.63"	(66.8mm)
DEPTH:	1.39"	(35.3mm)
HEIGHT:		
Radio Only	3.90"	(99.0mm)
Radio with Battery		
Medium Capacity	6.35"	(161.3mm)
High Capacity	7.26"	(184.4mm)

WEIGHT:

Radio Only	13.5 oz	(383g)
Radio with Battery (Nickel-Cadmium)		
Medium Capacity	21.6 oz	(612g)
High Capacity	24.2 oz	(686g)

TRANSMITTER

RF OUTPUT-	H33	H43
Nickel-cadmium battery:	2.0W at 10Vdc	5.0W at 10Vdc

MODULATION: Type 20K0F3E, ±5kHz for 100% modulation at 1000Hz (±4.0kHz min.) including PL modulation for PL models

PL MODULATION:
±1kHz max. ±500Hz min.

AUDIO DISTORTION: Less than 5% at 1000Hz, 3kHz deviation

MAX. PERMISSIBLE CHANNEL SEPARATION: 6MHz (no degradation)

FREQUENCY STABILITY:
±.0005% from -30°C to +60°C (+25°C ref.)

SPURIOUS & HARMONIC FREQUENCIES:
More than 60dB below carrier

FM NOISE:
At least 45dB below ±3.0kHz deviation at 1000Hz

AUDIO RESPONSE:
+1, -3dB from 6dB/octave pre-emphasis characteristic from 300-3000Hz

RECEIVER

AUDIO OUTPUT: 500mW at less than 5% distortion

SECOND I-F FREQUENCY: 450kHz ± 1.5kHz measured at M1

SENSITIVITY: 0.25µV max. (12dB SINAD), 0.35µV max. (20dB quieting)

NOISE SQUELCH SENSITIVITY: Noise compensated type, Programmable

MAX. PERMISSIBLE CHANNEL SEPARATION: 6MHz (no degradation)

FREQUENCY STABILITY:
± .0005% from -30°C to +60°C (+25°C ref.)

USEABLE BANDWIDTH: ±5kHz

SPURIOUS FREQUENCY REJECTION:
More than 70dB below carrier

IMAGE REJECTION:
More than 65dB below carrier

SELECTIVITY:
More than 70dB at ± 30kHz (12dB SINAD)

INTERMODULATION:
More than 70dB at adjacent channel

CHANNEL SPACING: 30kHz

Specifications Subject To Change Without Notice

NOTE:

- ALL BATTERIES MUST BE CHARGED PRIOR TO USE
- USE OF CHEMICALS (DETERGENTS, ALCOHOL, AEROSOL SPRAY, PETROLEUM PRODUCTS) MAY BE HARMFUL AND DAMAGE THE RADIO HOUSING. WE RECOMMEND A MILD DISHWASHING SOAP FOR CLEANING THE EXTERIOR OF THE PRODUCT.
- O-RING SEALS MUST BE PROPERLY LUBRICATED AND ASSEMBLED TO INSURE CONFORMANCE TO MIL-810D SPECIFICATIONS FOR WATER INTRUSION.

UHF SPECIFICATIONS

GENERAL

FREQUENCY RANGE: 403-433MHz
438-520MHz

POWER SUPPLY: Nickel-cadmium battery

BATTERY DRAIN-

at10Vdc	H34	H44
Standby:	*48mA	*48mA
Receive:	*166mA	*166mA
Transmit:	**875mA	**1600mA

*Add 8mA with Remote Antenna
**Add 15mA with Remote Antenna

DIMENSIONS:

WIDTH:	2.63"	(66.8mm)
DEPTH:	1.39"	(35.3mm)
HEIGHT:		
Radio Only	3.90"	(99.0mm)
Radio with Battery		
Medium Capacity	6.35"	(161.3mm)
High Capacity	7.26"	(184.4mm)

WEIGHT:

Radio Only	13.5 oz	(383g)
Radio with Battery (Nickel-Cadmium)		
Medium Capacity	21.6 oz	(612g)
High Capacity	24.2 oz	(686g)

TRANSMITTER

RF OUTPUT-	**H34**	**H44**
Nickel-cadmium battery:	2.0W at 10Vdc	4.0W at 10Vdc

MODULATION: Type 20K0F3E, ±5kHz for 100% modulation at 1000Hz (±4.0kHz min.) including PL modulation for PL models

PL MODULATION:
±1kHz max. ±500Hz min.

AUDIO DISTORTION: Less than 5% at 1000Hz, 3kHz deviation

MAX. PERMISSIBLE CHANNEL SEPARATION: 8MHz (no degradation)

FREQUENCY STABILITY:
±.0005% from -30°C to +60°C (+25°C ref.)

SPURIOUS & HARMONIC FREQUENCIES:
More than 53dB below carrier

FM NOISE:
At least 45dB below ±3.0kHz deviation at 1000Hz

AUDIO RESPONSE:
+1, -3dB from 6dB/octave pre-emphasis characteristic from 300-3000Hz

RECEIVER

AUDIO OUTPUT: 500mW at less than 5% distortion

SECOND I-F FREQUENCY: 450kHz ± 1.5kHz measured at M1

SENSITIVITY: 0.35µV max. (12dB SINAD), 0.50µV max. (20dB quieting)

NOISE SQUELCH SENSITIVITY: Noise compensated type, Programmable

MAX. PERMISSIBLE CHANNEL SEPARATION: 8MHz (no degradation)

FREQUENCY STABILITY:
± .0005% from -30°C to +60°C (+25°C ref.)

USEABLE BANDWIDTH: ±5kHz

SPURIOUS FREQUENCY REJECTION:
More than 70dB below carrier

IMAGE REJECTION:
More than 65dB below carrier

SELECTIVITY:
More than 70dB at ± 25kHz (12dB SINAD)

INTERMODULATION:
More than 68dB at adjacent channel

CHANNEL SPACING: 25kHz

Specifications Subject To Change Without Notice

NOTE:

- ALL BATTERIES MUST BE CHARGED PRIOR TO USE
- USE OF CHEMICALS (DETERGENTS, ALCOHOL, AEROSOL SPRAY, PETROLEUM PRODUCTS) MAY BE HARMFUL AND DAMAGE THE RADIO HOUSING. WE RECOMMEND A MILD DISHWASHING SOAP FOR CLEANING THE EXTERIOR OF THE PRODUCT.
- O-RING SEALS MUST BE PROPERLY LUBRICATED AND ASSEMBLED TO INSURE CONFORMANCE TO MIL-810D SPECIFICATIONS FOR WATER INTRUSION.

SERVICE AIDS

The following table lists tools and service aids recommended for working on the HT-600. While all of these items are available from Motorola, most are standard shop equipment items, and any equivalent item capable of the same performance may be substituted for the item listed.

MOTOROLA PART NO.	DESCRIPTION	APPLICATION
RTK-4205A	RIB/Radio/test set cable	Connects radio to RTX-4005B Test Box and RIB.
RTL-4226B	Battery Eliminator	Interconnects radio to power supply.
1580368B62	Battery Adapter	Connects radio to battery eliminator without main housing.
REN-4000A	Controller Flex Extender Fixture	Eases in troubleshooting of controller flex and RF board.
0180370B92	Controller Flex Hold Down Fixture	Provides secure mount for controller flex during servicing.
RTX-4005B or both RTX-4005A and RPX-4665A field modification kit	Portable Test Set	Enables connection to the universal connector. Allows switching for radio testing.
0180353A74	Radio Interface Box	Enables communications between the radio and the computer's serial communications adapter.
0180357A57	Wall-mounted Power Supply	Used to supply power to the RIB.
3080369B71 or 3080369B72	Computer Interface Cable	Use B72 for the IBM PC AT. All other IBM models use B71. Connects the computer's serial communications adapter to the RIB.
NKN6376A	Cloning Cable	Allows an HT600 radio to be duplicated from a master radio by transferring programmed data from one radio to another.
RVN4005	Radio Service Software	Software on 5-1/4 in. floppy disc.
RVN4006	Radio Service Software	Software on 3-1/2 in. floppy disc.
F.A.S.T. #9	"Using the RSX-4057A Desoldering Station"	How to use the RSX-4057A to successfully remove and replace surface mount devices.
0180358A59	ANI Programming Tool	Used on DTMF ANI Options to program ANI codes.

RECOMMENDED TOOLS LIST

The following table lists the tools recommended for working on the HT-600; these also are available from Motorola. Note that the RSX-4057A workstation requires the use of a specific "heat focus head" for each of the components on which this item is used. **Each of these heat focus heads must be ordered separately.** The individual heat focus heads (and the components on which they are used) are listed at the end of the table.

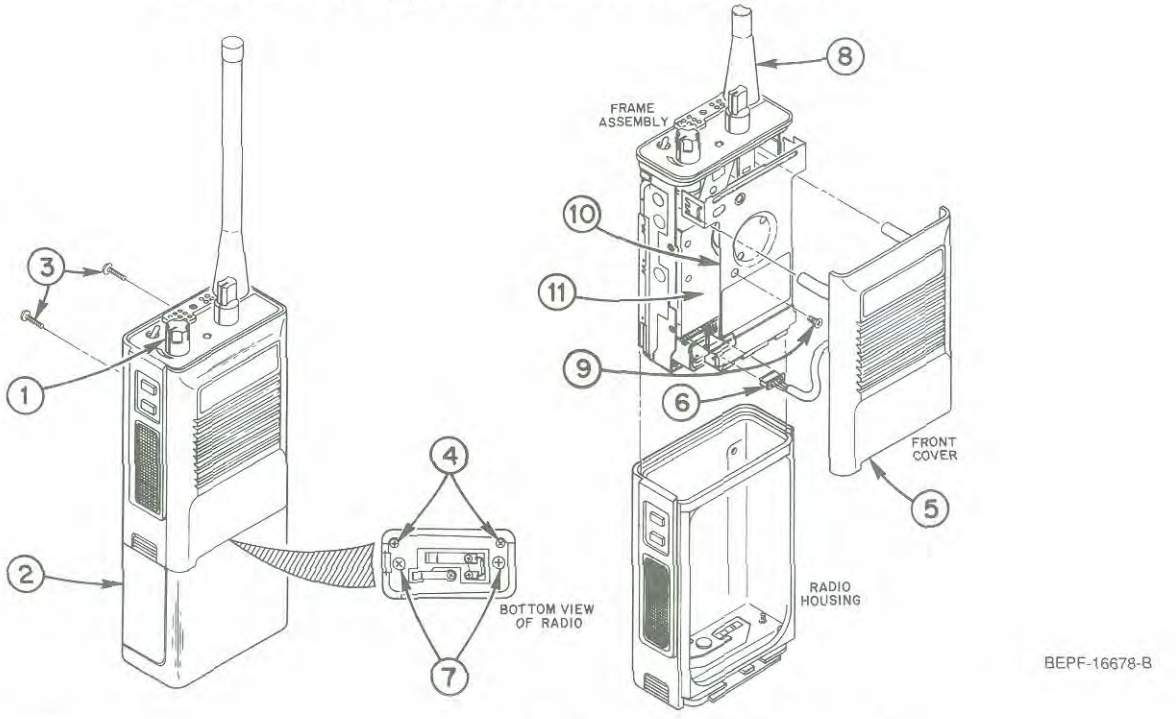
MOTOROLA PART NO.	DESCRIPTION	APPLICATION
RSX-4043A	Torque screwdriver	Handle for bits listed below
6680321B86	Phillips bit (0)	Radio screws
6680321B79	Phillips bit (1)	Radio screws
6680371B03	Hex socket bit	Volume and rotary switch nuts
6680370B90	Spanner bit	Antenna bushing spanner nut
6680370B95	Spanner bit	Toggle switch spanner nut
6605106N01	Tuning tool	Tunable coils and potentiometers
6680387A59	Extractor, 2 contact	Removal of discrete surface-mounted devices
6680387A64	Heat controller with safety stand, or	
6680387A65	Safety stand only	
0180382A31	Portable desoldering unit	
6680375A74	0.025 replacement tip, 5/pk	For 0180382A31 portable desoldering unit
0180386A81	Miniature digital readout soldering station (incl. 1/64" micropoint tip)	
0180386A78	Illuminated magnifying glass *with lens attachment*	
0180386A82	Anti-static grounding kit	Used during all radio assembly and disassembly procedures
6684253C72	Straight prober	
6680384A98	Brush	
1010041A86	Solder (RMA type), 63/37, 0.020" diameter-1 lb. spool	
1080370B43	RMA liquid flux	
RSX-4057A	Surface-mounted component-*IC removal/rework station* (order all heat focus heads separately)	Removal of surface-mounted integrated circuits
HEAT FOCUS HEADS	**INSIDE DIMENSION OF HEADS**	
6680334B48	0.318" X 0.318" For U402, *U403*, and *U801*	
6680334B49	0.410" X 0.410" for U406	
6680334B51	0.492" X 0.492" for U401 and U405	

TORQUE AND TOOL SPECIFICATIONS CHART

DESCRIPTION	SIZE	PART NUMBER	QTY.	RETIGHTEN WITH RSX-4043A TORQUE SCREWDRIVER AND	TORQUE (IN./LB.)	EXP. VIEW NUMBER
Control Top Antenna Bushing Spanner		0205765L02	1	6680370B90	12	21
Volume Pot Nut	0.75X8X1.6	0205629L01	1	6680371B03	5	25
Freq. Switch Nut	0.75X8X1.6	0205629L01	1	6680371B03	5	25
Toggle Switch Spanner		0205163Q01	1	6680370B95	4	19
Control Top Screw	4-40X3/16	0300136785	1	6680321B79	5	23
Housing Battery Contact Screws	2-56X5/32	0300139982	2	6680321B86	3	50
Bottom Front Cover Screws	2-56X1/4	0300140041	2	6680321B86	3	34
Baseplate to Frame Screws	4-40 (captive)	0305941K01	2	6680321B79	5	54
Front Cover Post Screws	4-40X5/16	0305137Q01	2	6680321B79	5	61
Controller Front Shield Screw	2-56X1/8	0300140369	1	6680321B86	2	101
Bottom Screw	2-56X5/16	0300138620	2	6680321B86	3	79
Controller to Frame Screws	2-56X1/8	0300140369	4	6680321B86	2	39
RF Board Back Shield Screws	2-56X5/16	0300136772	4	6680321B86	3	75
RF Board Screw	2-56X5/16	0300136772	1	6680321B86	3	not shown
PA Heatsink to PCB (VHF-LP)	2-56X3/16	0300136771	2	6680321B86	3	115
PA Heatsink to PCB (VHF-HP)	2-56X3/16	0300136771	1	6680321B86	3	115
PA to Heatsink (VHF-LP)	2-56X5/32	0300139675	1	6680321B86	3	70
PA to Heatsink Nut (VHF-HP)	1/4		1		5	not shown
PA Heatsink to PCB (UHF)	2-56X3/16	0300136771	2	6680321B86	4	115
Synthesizer Casting Screw	2-56X3/16	0300136771	2	6680321B86	4	115
Front Cover Speaker/Mic Tab Screws	2-56X5/32	0300139982	4	6680321B86	3	50

TUNING AND ALIGNMENT DISASSEMBLY PROCEDURE

Disassembly Typical (VHF Radio Shown)



1. Turn off the radio.
2. Remove the battery:
   While pushing the spring-loaded battery latch towards the top of the radio, slide the battery away from the latch, removing it from the baseplate on the bottom of the radio.
3. Remove the two screws from the back of the radio.
4. Remove the two screws on the bottom of the radio (baseplate corners).
5. Lift the front cover from the radio housing being careful not to pull against the speaker/microphone wires.
6. Disconnect the speaker/microphone connector from the controller flex by grasping the sleeved wires (near the plug) and pulling the plug straight out and away from the circuit board.
7. Loosen the two captive screws on the bottom of the radio (middle of each end of baseplate). Do not completely remove the captive screws from the baseplate.
8. With a thumb and forefinger, grasp the antenna at its base and pull lightly to remove the frame assembly from the radio housing. Do not press the PTT switch during removal.

CAUTION
REFER TO "CMOS" PRECAUTIONS, "SAFETY INFORMATION" SECTION.

9. Remove the screw that secures the front shield.
10. Remove the front shield by pulling it straight out and away from the radio.
11. Remove the controller circuit.

a. Remove the four screws (two on each side) that secure the controller to the frame.

b. Remove the retainer clip that secures the top two connectors.

CAUTION
Be careful to pull each connector straight out and away from the mating socket so as not to bend or break the connector pins.

c. Disconnect the two bottom flex connectors by carefully sliding them away from the bottom of the radio.

d. Lift the controller circuit (nearest the bottom of the radio) away from the radio just enough to gain access to the connector under the controller.

e. Disconnect the connector under the controller.

f. Disconnect the two connectors at the top of the controller.

g. Lift the controller totally away from the radio.

NOTE
Refer to the Exploded View Diagram if further disassembly is necessary.

12. Assemble the radio in the reverse order of disassembly, making certain:

- to avoid damage to the flex circuits, connectors, and connector pins when reinserting the controller.
- not to depress the PTT switch when sliding the circuit board back into the housing.

CAUTION
Inspect the frame O-ring and control head O-ring. Replace if obvious damage exists.

GENERAL

THIS RADIO HAS BEEN FACTORY ALIGNED AND DOES NOT REQUIRE ANY ADJUSTMENTS.

Realignment may be required if components are replaced or have aged, or if any transmitter/receiver frequencies are changed. If it is necessary to realign the radio, perform the following procedures:

1. When using the RTX-4005 test box, place the **MT PL** switch in the **OFF** position.
2. Remove the battery and front cover as described in the "TUNING AND ALIGNMENT DISASSEMBLY PROCEDURE."
3. Refer to the "Figure 14. Trouleshooting, Test Equipment, and Programming Set-Up Detail," and connect the test equipment and programmer to the radio as illustrated.
4. Connect a dc power supply to the battery eliminator and attach the battery eliminator to the radio.
5. Adjust the power supply for 10.0Vdc. Set current limit to 2.0A.
6. Turn the radio off, then on, to reinitialize the radio.
7. **Frequency Adjust (Synthesizer) -** Terminate the program/test cable (RTK-4205A), RF lines (pins 10 and 12), through a 30dB pad to a frequency counter or service monitor. Set the radio's frequency switch to any channel. Key the radio using the external PTT switch. Compare the frequency reading on the counter (or service monitor) to the customer frequency assigned to that channel. The frequency difference should be less than ±750Hz (vhf) or 1.25kHz (uhf). Adjust R129 (vhf) or R120 (uhf) if the frequency difference is more than ±750Hz (vhf) or 1.25kHz (uhf).
8. Perform either the "RECEIVER ALIGNMENT" procedure or "TRANSMITTER ALIGNMENT" procedure or both procedures as required.

TRANSMITTER ALIGNMENT

Review "GENERAL" information section before performing TRANSMITTER ALIGNMENT

Preliminary Adjustments:

1. Terminate the program/test cable, rf lines (pins 10 and 12), to a power meter through a 30dB pad.
2. Make all measurements at the universal interface connector (pins 10 and 12), with radio keyed, through the external PTT switch.

STEP	ADJUST	FOR	USING	NOTE
1	Check power output on all channels. **NOTE:** You must dekey before changing channels for the synthesizer to change frequencies. Set the frequency switch to the channel with the lowest output power.			
2A VHF	C120 Trimmer Capacitor	* Rated power output with least current drain	RF Wattmeter and Ammeter	Reading should be greater than rated rf power output, with current drain less than 800mA (2-watt models) or less than 1625mA (5-watt models). **NOTE:** Two possible peaks; choose peak with least current drain. Adjust from component side.
2B UHF	P.A. Trimmer Capacitor (on U102)	* Rated power output with least current drain	RF Wattmeter and Ammeter	Reading should be greater than rated RF power output, with current drain less than 890mA (2-Watt Models) or less than 1615mA (4-Watt Models). **NOTE:** Two possible peaks, choose peak with least current drain. Adjust from component side.
3.	Check remaining channels	Same power and current readings obtained in STEP 2	RF Wattmeter and Ammeter	
4	Repeat steps 1 through 3 if necessary.			

* For radios using an alkaline battery, adjust power supply for 12.0Vdc.

Deviation Check:

1. Terminate the program/test cable through a 30dB pad to a service monitor or deviation meter.
2. Connect the program/test cable to the radio interface box (RIB).
3. Place the **METER SELECTOR** switch on the RTX test box to the **MIC** position. Insert a 1kHz tone at the **AUDIO INPUT** port of the test box. Use an ac voltmeter to monitor the voltage at the **AC/DC METER** port of the test box. Using the PTT switch on the RTX box to key the radio, adjust the level of the 1kHz tone until 45 millivolts rms is present at the **AC/DC METER** port. Dekey the radio.
4. If the radio requires a change in frequency or options, make the appropriate changes to the personality file, and program the radio.

NOTE

The RTK-4005 test box has a resistive divider between the **AUDIO IN** port and the **AC/DC METER** port. To accurately set deviation, 45mV muist be present at the **AC/DC METER** port. This means that approximately 450mVrms must be applied to the **AUDIO IN** port.

5. Set the radio's PL switch to the PL position.
6. With the 1kHz tone applied, key the radio externally and check the total transmit deviation. It should be greater than 4.0kHz, but less than 5.0kHz. If outside this window, perform the **"Deviation Adjustment"** procedure.
7. For channels with Transmit PL, remove the 1kHz tone from the **AUDIO IN** port of the RTX. Check the deviation of the PL signal; it should be greater than 500Hz, but less than 1000Hz. If outside this window, perform the **"Deviation Adjustment"** procedure.

Deviation Adjustment:

DO NOT PERFORM DEVIATION ADJUSTMENT UNTIL THE "DEVIATION CHECK" HAS BEEN PERFORMED

NOTE

This transmit deviation procedure is for Radio Service Software R01-00-02. If updated software is used, refer to help files or the accompanying field programming manual for any changes to this procedure.

1. Use the radio service software to read the radio.
2. Enter the Service Alignment portion of the radio service software.
3. Set the frequency switch on the radio's control top for the channel to be adjusted.
4. Press the **F7** key on the programmer to move the cursor to the **CHANNEL SELECTOR** position.
5. Press the up/down arrow keys to select the channel to be adjusted; this must be the same as the channel selected in step 3.
6. Proceed to the Service/Chan Dev. Alignment position in the Tuner menu.
7. Press the PTT switch on the RTX-4005 to the constant position to continuously key the radio.
8. Press the up/down arrow keys until 4.6 to 4.8kHz of peak deviation is obtained.
9. Release the PTT switch on the RTX-4005 to dekey the radio.
10. Proceed to the **REFERENCE DEV** position in the Tuner menu.
11. Disconnect the 1kHz tone from the **AUDIO IN** port of the RTX-4005.
12. Press the PTT switch on the RTX-4005 to the constant position to continuously key the radio.
13. Press the up/down arrow keys to adjust the peak deviation of the 30Hz tone for 0.67 to 0.73kHz.
14. Release the PTT switch on the RTX-4005 to dekey the radio.
15. Reconnect the 1kHz tone to the **AUDIO IN** port of the RTX-4005.
16. Repeat steps 3 through 15 for all channels to be adjusted.
17. Exit from the Service/Chan Dev. Alignment menu and program the radio.
18. With the 1kHz tone applied, check the total transmit deviation. It should be greater than 4.0kHz but less than 5.0kHz. Repeat the above procedure, if necessary.
19. For channels with transmit PL, remove the 1kHz tone from the **AUDIO IN** port of the RTX-4005. Check the deviation of the PL signal; it should be greater than 500Hz but less than 1kHz. Repeat the above procedure, if necessary.

NOTE

While in the Service/Chan Dev. Alignment menu, changes to the deviation settings (using the up/down arrows) are made in the radio's RAM. If the radio is dekeyed during the deviation adjustment, the radio's original information will be returned to the RAM. It will be necessary to toggle the appropriate key to replace the programmer settings in the radio's RAM. The deviation settings should be toggled by pressing the up/down arrows when in the transmit mode. Refer to the radio service software manual for more details.

Deviation Adjustment for DTMF Radios:

1. Follow the deviation procedure detailed above, but in step 8, adjust for 4.7 to 4.9kHz deviation.
2. Press the number **1** key on the DTMF pad and continuously key the radio using the radio's PTT switch. Adjust R709 for 3.0 to 3.2kHz deviation.

NOTE

DTMF memory is volatile. If the battery is left off for more than 2 minutes the memory will be erased.

RECEIVER ALIGNMENT (VHF Radios)

Review "GENERAL" information section before performing RECEIVER ALIGNMENT

Preliminary Adjustments:

1. The receiver is factory tuned to operate over the entire bandsplit and should not need retuning. Perform the "Receiver Check" to determine if "RECEIVER ALIGNMENT" (tuning any portion of the receiver) is necessary.
2. Connect the program/test cable (RTK-4205A) to the radio interface box (RIB). Use the radio service software to read the radio.
3. When using the RTX-4005 test box, place the **AUDIO OUT** switch in the **B** position to set for proper speaker loading. Place the meter selector in the **AUDIO PA** position for receiver tests.
4. Connect the rf cable of the test cable to an rf generator or service monitor.

Receiver Check:

1. Use the radio service software to program for new customer frequencies, if necessary.
2. Set the rf generator (or service monitor) for the appropriate frequency at a 1mV level with a 1kHz tone modulated at 3kHz deviation.
3. Connect the **AC/DC METER** port of the RTX-4005 to an ac voltmeter. Adjust the volume potentiometer (R140) for an ac voltmeter reading of 4.47Vrms.
4. Connect a SINAD meter to the **AC/DC METER** port of the RTX-4005.
5. Reduce the rf level until 12dB of SINAD is obtained; record the rf level reading. Depress the monitor button while taking this measurement to ensure that the radio is not squelched. Also temporarily disconnect the test cable from the RIB to ensure that computer noise does not affect the measurement.
6. Perform SINAD measurements on all channels.
7. If the rf level required to produce 12dB SINAD is 0.25μV or less, *DO NOT REALIGN THE RECEIVER;* instead, proceed directly to "Squelch Sensitivity/Check Adjustment." If the rf level required to produce 12dB SINAD is greater than 0.25μV, perform the "Receiver Alignment".

Receiver Alignment (Back End):

DO NOT PERFORM RECEIVER ALIGNMENT UNTIL THE "RECEIVER CHECK" HAS BEEN PERFORMED.

NOTE

The receiver back end coils L6, L7, and L8, and the receiver front end coils L1, L3, L4, and L5 are factory tuned to cover the entire bandsplit and should not need retuning. Should the rf amp, mixer, crystal filters, i-f module, or accompanying parts need replacing, it may be necessary to perform the following tuning procedure.

1. Remove the radio from its housing as described in the "DISASSEMBLY PROCEDURE", then remove the backplane shield (exploded view item #74).
2. Attach the battery adapter to the radio frame, then attach the battery eliminator to the battery adapter.
3. Selecting any one of the customer frequencies, adjust the rf generator or service monitor for the appropriate frequency. Then, place the radio front side down so that the solder side (side 2) of the PC board is facing up.
4. Tune coils L6, L7, and L8 flush with the solder side of the PC board.
5. With an ac voltmeter, monitor M1 on the solder side of the PC board.
6. Peak coils L6, L7, and L8 (in that order) for maximum ac voltage at M1.
7. Perform the "Receiver Check" procedure, then repeat steps 4 through 6 of the "Back End" procedure, if necessary.

Receiver Alignment (Front End):

NOTE

Perform the following procedure only if the radio fails the receiver check and the receiver back end alignment has been performed. The radio should already be removed from the housing.

Narrow bandwidth (6MHz or less)

8. Tune coils L1, and L3 through L8 flush with the solder side (side 2) of the PC board.
9. Set the radio to the highest customer receive frequency, then adjust the rf generator or service monitor for the appropriate frequency.
10. With an ac voltmeter, monitor M1 on the controller flex. Set the ac voltmeter to the - 40dB scale and adjust the rf level so that the ac voltage can be read at M1. During the following procedure, adjust the rf level to keep the ac voltage at M1 within the -40dB scale.
11. Adjust L3, then L5 for the maximum ac voltage level at M1.
12. Set the radio to the lowest customer receive frequency, then adjust the rf generator or service monitor to the appropriate frequency and level.
13. Adjust L4, then L1 for the maximum ac voltage level at M1.
14. Perform the "Receiver Alignment (Back End)" procedure and then the "Receiver Check".

Wide Bandwidth (Greater than 6MHz)

15. Tune coils L1, and L3 through L8 flush with the solder side (side 2) of the PC board.
16. Use the radio service software to program the receiver frequency for 147.125 ±0.1MHz for low-split radios (136-150.8MHz), or 158.125 ±0.1MHz for mid-split radios (146-162MHz), or 170.125 ±0.1MHz for high-split radios (157-174MHz). If interference is present, program for a receive frequency as close to the desired frequency as possible.
17. Adjust L3, then L5 for the maximum ac voltage level at M1. Select the peak where the slugs of the coils are closest to the solder side of the PC board.
18. Use the radio service software to program the receiver frequency for 150.775 ±0.1MHz for low-split radios (136-150.8MHz), or 161.975 ±0.1MHz for mid-split radios (146-162MHz), or 173.975 ±0.1MHz for high-split radios (157-174MHz).
19. Adjust L4 for the maximum ac voltage level at M1. Select the peak where the slug of the coil is closest to the solder side of the PC board.
20. Use the radio service software to program the receiver frequency for 136.125 ±0.1MHz for low-split radios (136-150.8MHz), or 146.125 ±0.1MHz for mid-split radios (146-162MHz), or 157.125 ±0.1MHz for high-split radios (157-174MHz).
21. Adjust L1 for the maximum ac voltage level at M1. Select the second peak where the slug of the coil is farthest from the solder side of the PC board.
22. Program the radio back to the original customer receiver frequencies.
23. Perform the "Receiver Alignment (Back End)" procedure and then the "Receiver Check".

Squelch Sensitivity Check/Adjustment:

1. Use the radio service software to read the radio, then proceed to the Service/SQ-VOL. Alignment menu.
2. Set the frequency switch for the channel determined to have the poorest sensitivity on the "Receiver Check." Place the PL switch in the carrier squelch position.
3. Connect an ac voltmeter to the **AC/DC METER** port of the RTX-4005.
4. Set the rf generator or service monitor for the appropriate frequency and no modulation. Reduce the rf level to a minimum, then turn the rf off.
5. Depress the monitor button on the side of the radio and adjust the noise level for 2.2Vrms. Make a note of the level on the dB scale; this will be the reference level for quieting measurements.
6. Turn the rf of the generator or monitor on at the minimum possible level. Increase the rf level until squelch break occurs. Note the quieting level at squelch break. If squelch break occurs between 7 and 16dB of quieting, proceed directly to step 9. If the quieting level is not within the 7 to 16dB range, continue on with step 7.
7. Press the up/down arrow keys to adjust the **carrier squelch** setting to 0. Adjust the rf level for 8dB of quieting.
8. Holding the rf level constant, press the up arrow key to increment the carrier squelch setting one step at a time until the radio squelches. This will be the carrier squelch setting.
9. Proceed to the **tone squelch** setting in the tuner menu.
10. Adjust the tone squelch setting to be the same value used in the carrier squelch setting.
11. Exit from the Service/SQ-VOL. Alignment menu.
12. If the squelch settings required modification, program the radio.

RECEIVER ALIGNMENT (UHF Radios)

Review "GENERAL" information section before performing RECEIVER ALIGNMENT

Preliminary Adjustments:

1. Coils L9 through L13 are tuned at the factory for a 30MHz bandwidth and should never need retuning. Coils L1 and L2 adjust an 8MHz window anywhere across the 30MHz bandwidth. Perform the "Receiver Check" to determine if "Receiver Alignment" (tuning any portion of the receiver) is necessary.
2. Connect the program/test cable (RTK-4205A) to the radio interface box (RIB). Use the radio service software to read the radio.
3. When using the RTX-4005 test box, place the **AUDIO OUT** switch in the **B** position to set for proper speaker loading. Place the meter selector in the **AUDIO PA** position for receiver tests.
4. Connect the rf cable of the test cable to an rf generator or service monitor.

Receiver Check:

1. Use the radio service software to program for new customer frequencies, if necessary.
2. Set the rf generator (or service monitor) for the appropriate frequency at a 1mV level with a 1kHz tone modulated at 3kHz deviation.
3. Connect the **AC/DC METER** port of the RTX-4005 to an ac voltmeter. Adjust the volume potentiometer (R140) for an ac voltmeter reading of 4.47Vrms.
4. Connect a SINAD meter to the **AC/DC METER** port of the RTX-4005.
5. Reduce the rf level until 12dB of SINAD is obtained; record the rf level reading. Depress the monitor button while taking this measurement to ensure that the radio is not squelched. Also temporarily disconnect the test cable from the RIB to ensure the computer noise does not affect the measurement.
6. Perform SINAD measurements on all channels.
7. If the rf level required to produce 12dB SINAD is 0.35µV or less, *DO NOT REALIGN THE RECEIVER;* instead, proceed directly to "Squelch Sensitivity/Check Adjustment." If the rf level required to produce 12dB SINAD is greater than 0.35µV, perform the "Receiver Alignment."

Receiver Alignment (Front End):

NOTE

The receiver front end tuning procedure can be accomplished with the radio in its housing. Coils L1 and L2 are tuned through the flex carrier while M1 is monitored on the controller flex.

Narrow bandwidth (less than 4MHz)

1. Select the customer frequency that is at the center of the specified customer frequencies. For two-frequency radios, or radios without an obvious center frequency, select the lower frequency. Set the channel switch for the appropriate frequency.
2. Tune coils L1 and L2 to the top of the coil form. This will be the position where the coils are nearest to the flex carrier.
3. With an ac voltmeter, monitor M1 on the controller flex. Set the ac voltmeter to the -40dB scale. Set the service monitor to the appropriate frequency and adjust the rf level so that the ac voltage can be read at M1. During the following procedure, adjust the rf level to keep the ac voltage at M1 within the -40dB scale.
4. Peak coil L1 for maximum ac voltage at M1. Select the peak where the coil's slug is closest to the flex carrier assembly.
5. Peak coil L2 for maximum ac voltage at M1. Select the peak where the coil's slug is closest to the flex carrier assembly.
6. Perform steps 2 through 7 of the "Receiver Check" procedure, then repeat the "Narrow Bandwidth" procedure, if necessary.

Wide Bandwidth (4-8MHz)

7. For wide bandwidth tuning, coils L1 and L2 must be peaked at a frequency that is centered between the highest and lowest customer frequency. If no such frequency is specified, it will be necessary to program a temporary tune frequency. Program the radio for this frequency (if necessary).
8. Tune coils L1, and L2 to the top of the coil form. This will be the position where the coils are nearest to the flex carrier.
9. With an ac voltmeter, monitor M1 on the controller flex. Set the ac voltmeter to the -40dB scale. Set the service monitor to the appropriate frequency and adjust the rf level so that the ac voltage can be read at M1. During the following procedure, adjust the rf level to keep the ac voltage at M1 within the -40dB scale.

10. Peak coil L1 for maximum ac voltage at M1. Select the peak where the coil's slug is closest to the flex carrier assembly.
11. Peak coil L2 for maximum ac voltage at M1. Select the peak where the coil's slug is closest to the flex carrier assembly.
12. Program the radio back to the specified customer frequencies.
13. Peak coil L1 for maximum ac voltage at M1, with radio set at highest customer frequency.
14. Peak coil L2 for maximum ac voltage at M1, with radio set at lowest customer frequency.
15. Perform steps 2 through 7 of the "Receiver Check" procedure, then repeat the "Wide Bandwidth" procedure, if necessary.

Receiver Alignment (Back End/Injection Filter):

NOTE

The receiver back end coils L9, L10, and L11, and the injection filter coils L12 and L13 are factory tuned for 30MHz and should not need retuning. Should the mixer, crystal filter, i-f modules, or accompanying back end parts need replacing, it will be necessary to perform the back end procedure.

Back End

16. Remove the radio from its housing as described in the "DISASSEMBLY PROCEDURE", then remove the backplane shield (exploded view item #74).
17. Attach the battery adapter to the radio frame, then attach the battery eliminator to the battery adapter.
18. Selecting any one of the customer frequencies, adjust the rf generator or monitor for the appropriate frequency. Then place the radio front side down so that the solder side (side 2) of the PC board is facing up.
19. Tune coils L9, L10, and L11 flush with the solder side of the board.
20. With an ac voltmeter, monitor M1 on the solder side of the PC board. Set the ac voltmeter to the -40dB scale, and adjust the rf level so that the voltage can be monitored at M1. During the following procedure, adjust the rf level to keep the ac voltage at M1 within the -40dB scale.
21. Peak coils L9, L10, and L11 (in that order) for maximum ac voltage at M1.
22. Perform the "Receiver Check" procedure, then repeat steps 17-19 of the "Back End" procedure, if necessary.

Injection Filter:

NOTE

Perform the following procedure only if the radio fails the receiver check and both receiver front end and back end alignments have been performed. The radio should already be removed from the housing.

23. Tune coils L12 and L13 to be flush with the solder side of the PC board.
24. Monitor M2 with a dc voltmeter.
25. Peak L12, then L13 for maximum dc voltage at M2.
26. Perform the "Receiver Check" procedure, then repeat steps 23-25 if necessary.

Squelch Sensitivity Check/Adjustment:

1. Use the radio service software to read the radio, then proceed to the Service menu.
2. Set the frequency switch for the channel determined to have the poorest sensitivity on the "Receiver Check." Place the PL switch in the carrier squelch position.
3. Connect an ac voltmeter to the **AC/DC METER** port of the RTX-4005.
4. Set the rf generator or service monitor for the appropriate frequency and no modulation. Reduce the rf level to a minimum, then turn the rf off.
5. Depress the monitor button on the side of the radio and adjust the noise level for 2.2Vrms. Make a note of the level on the dB scale; this will be the reference level for quieting measurements.
6. Turn the rf of the generator or monitor on at the minimum possible level. Increase the rf level until squelch break occurs. Note the quieting level at squelch break. If squelch break occurs between 7 and 16 dB of quieting, proceed directly to step 9. If the quieting level is not within the 7 to 16dB range, continue on with step 7.

7. Press the up/down arrow keys to adjust the **carrier squelch** setting to 0. Adjust the rf level for 12dB of quieting.
8. Holding the rf level constant, press the up arrow key to increment the carrier squelch setting one step at a time until the radio squelches. This value will be used for the carrier squelch setting.
9. Proceed to the **Tone Squelch** position in the tuner menu.
10. Adjust the tone squelch setting to the same value used for the carrier squelch setting.
11. Exit from the Service/SQ-VOL. Alignment menu.
12. If the squelch settings required modification, program the radio.

CLONING PROCEDURE:

(The content of Radio 1 is to be duplicated into Radio 2)

General Information

- Full cloning duplicates the content of radio 1 into radio 2.
- Partial cloning duplicates the content of radio 1 into radio 2 except for the deviation and squelch settings. Partial cloning is recommended.

General Information

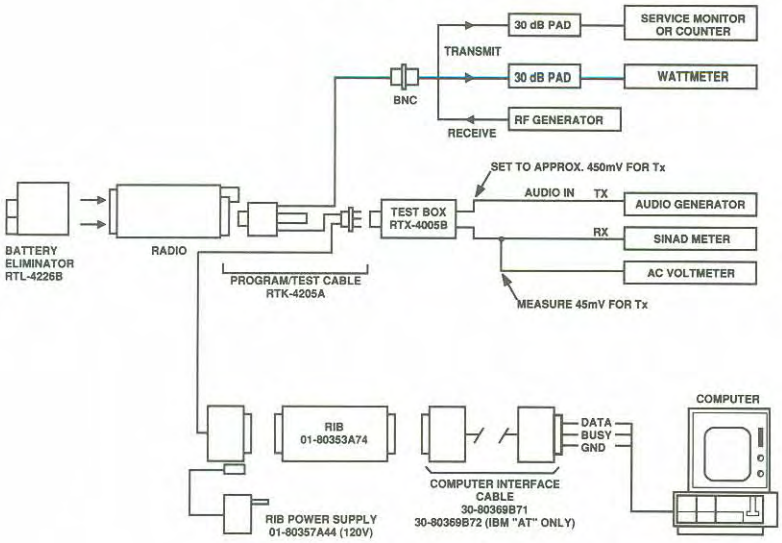
1. Turn off radio 1 and turn on radio 2.
2. Connect the cloning cable (NKN6376A) to the universal connector of both radio 1 and radio 2.
3. As applicable, place the PL switch on radio 1 to the carrier squelch position ( ) for full cloning, or to the PL position ( ) for partial cloning.
4. Simultaneously depress the PTT and monitor button on radio 1 and hold.
5. Turn on radio 1. The green LED on radio will flash, indicating that cloning is in progress.
6. Cloning is complete when the green LED turns off. Release both the PTT and the monitor button on radio 1. Turn radio 1 off and on to reset.
7. Disconnect the cloning cable and turn on both radios to resume normal operation.

NOTE

Any unsuccessful cloning attempt (depending on the operating condition of the radio) results in one of the following alerts:

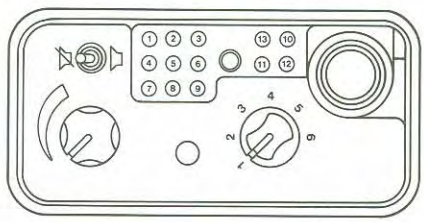
1. in receive (rotary radio) - a 1600Hz continuous tone
2. in transmit - a 1600Hz beeping alert tone

TEST SET-UP DETAIL



MAEPF-18621-B

RADIO (TOP VIEW) UNIVERSAL CONNECTOR DETAIL AND PIN NUMBER ASSIGNMENT

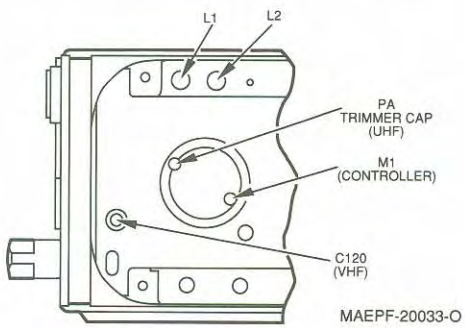


AEPF-16679-A

1. EXTERNAL MICROPHONE
2. EXTERNAL SPEAKER
3. NOT USED
4. EXTERNAL PTT
5. GROUND (to Controller Board)
6. DATA
7. EXTERNAL SPEAKER SELECT
8. SPEAKER COMMON
9. BUSY
10. REMOTE ANTENNA
11. NOT USED
12. RF GROUND (to Mother Board)
13. SENSE

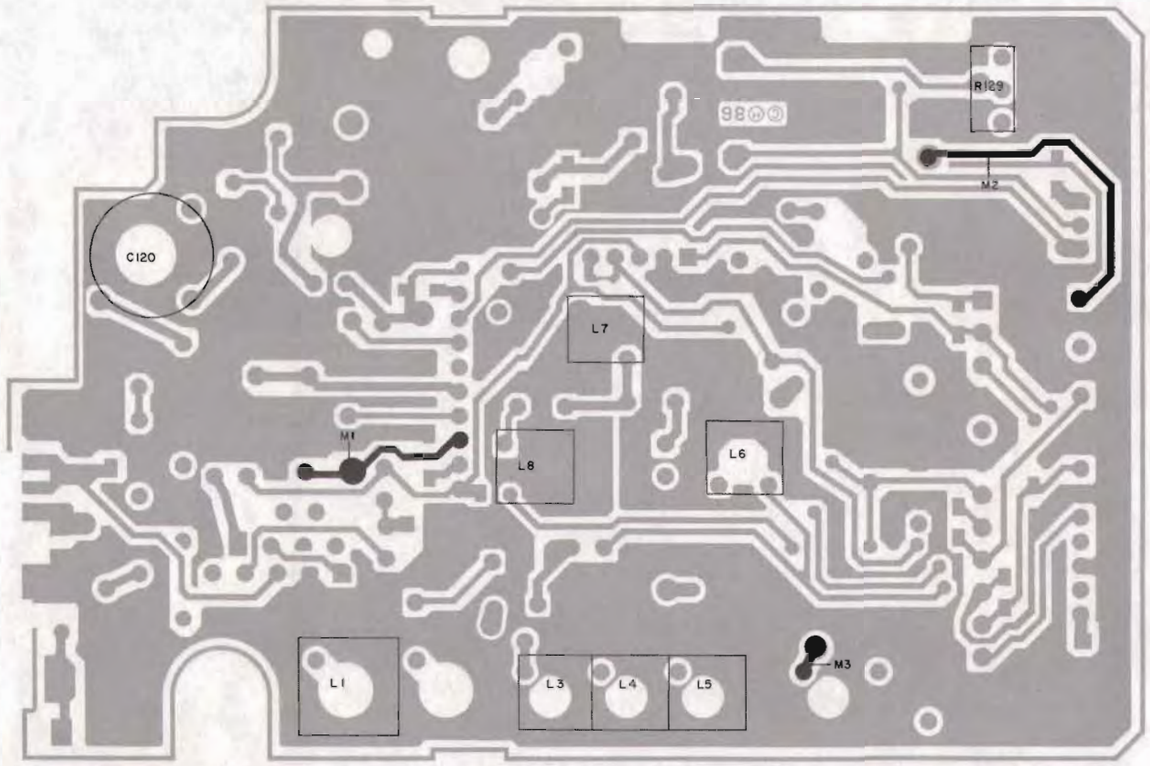
TEPF-17333-A

M1 METERING POINT LOCATION (CONTROLLER)



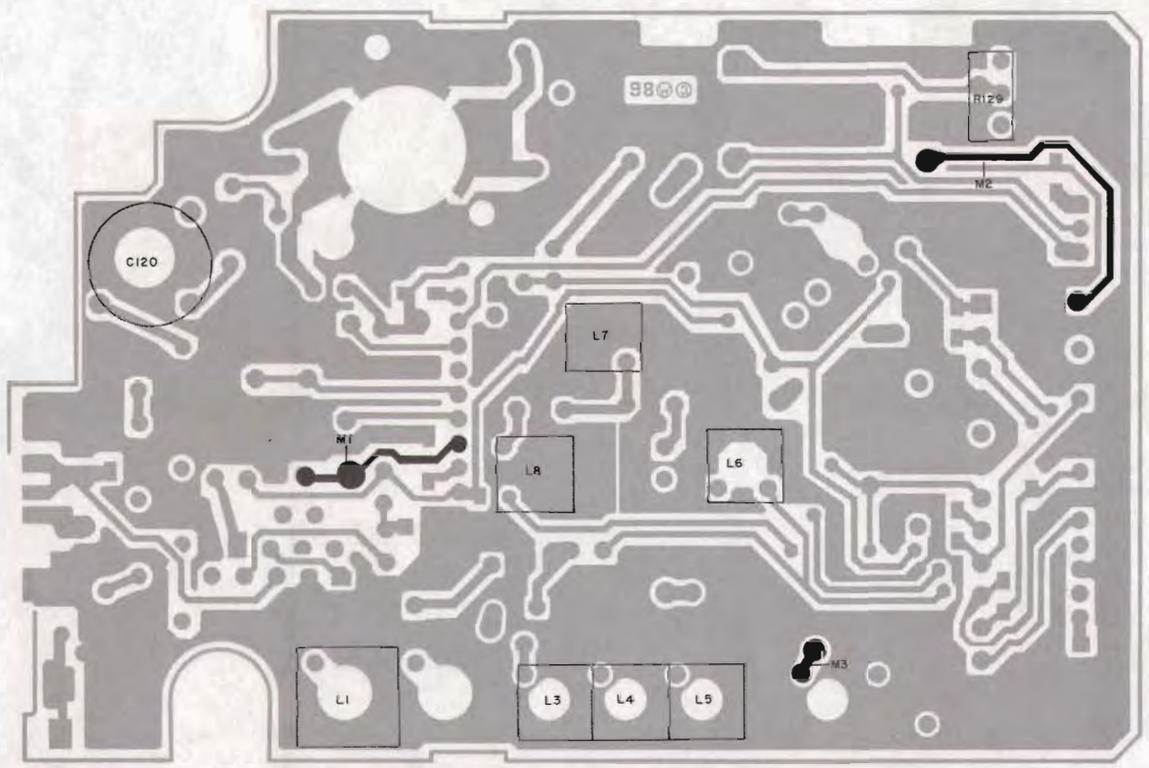
MAEPF-20033-O

ALIGNMENT ADJUSTMENT LOCATIONS
VHF 2-WATT RADIOS



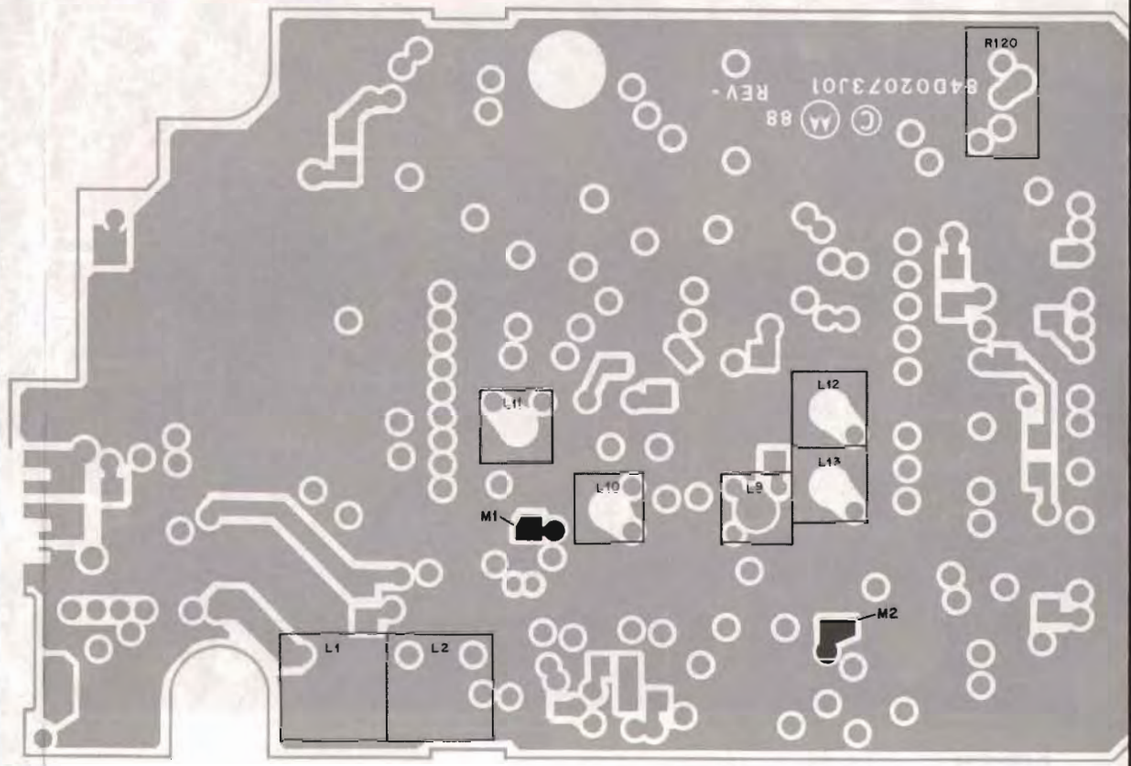
L2-CEPF-16863-A
OL-CEPF-16682-C

VHF 5-WATT RADIOS



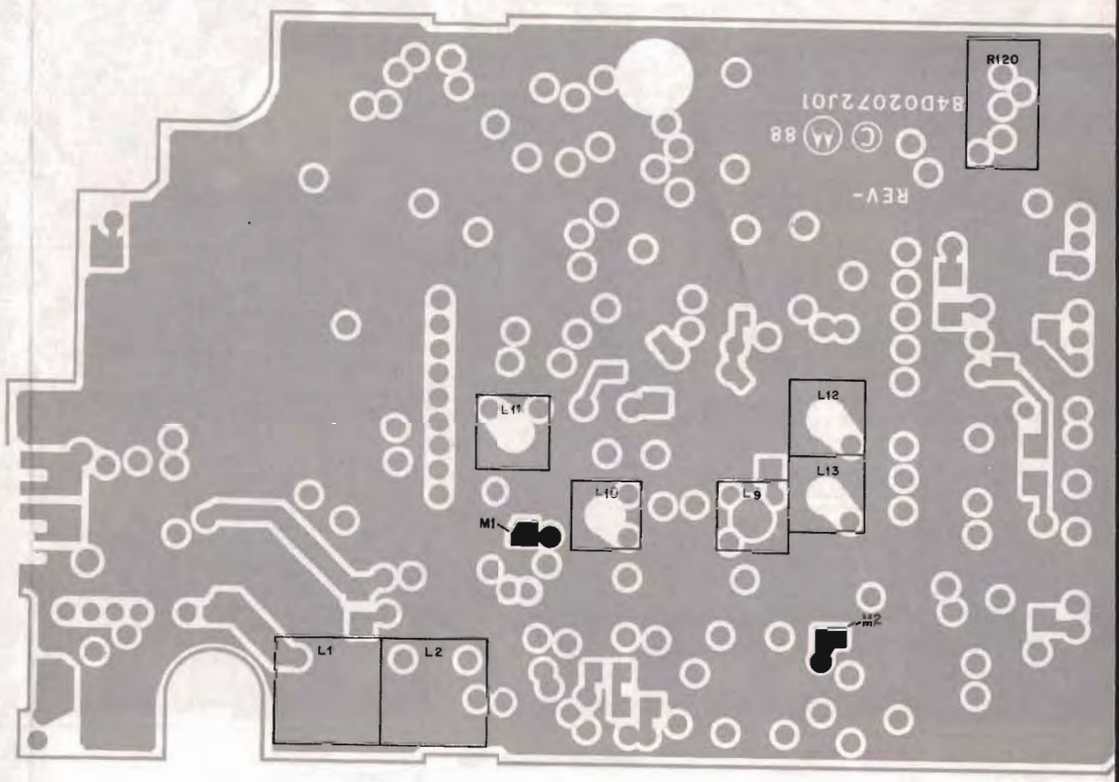
L2-CEPF-16940-A
OL-CEPF-16681-B

ALIGNMENT ADJUSTMENT LOCATIONS
UHF 2-WATT RADIOS



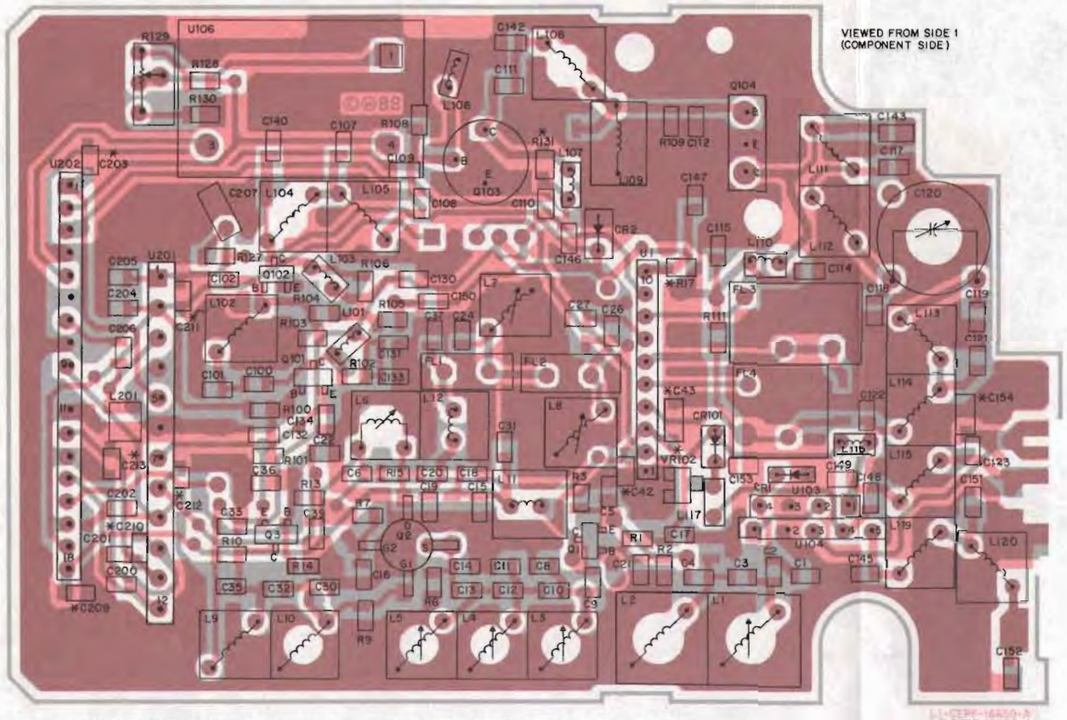
L4-CEPF-20114-0
OL-CEPF-20280-0

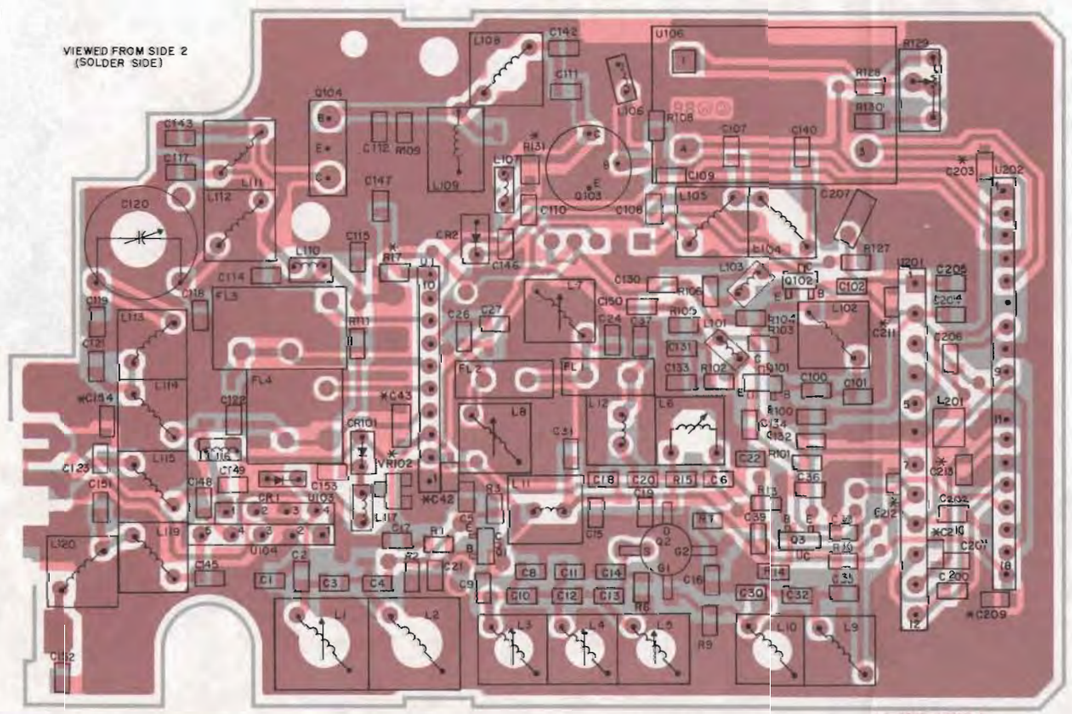
UHF 4-WATT RADIOS



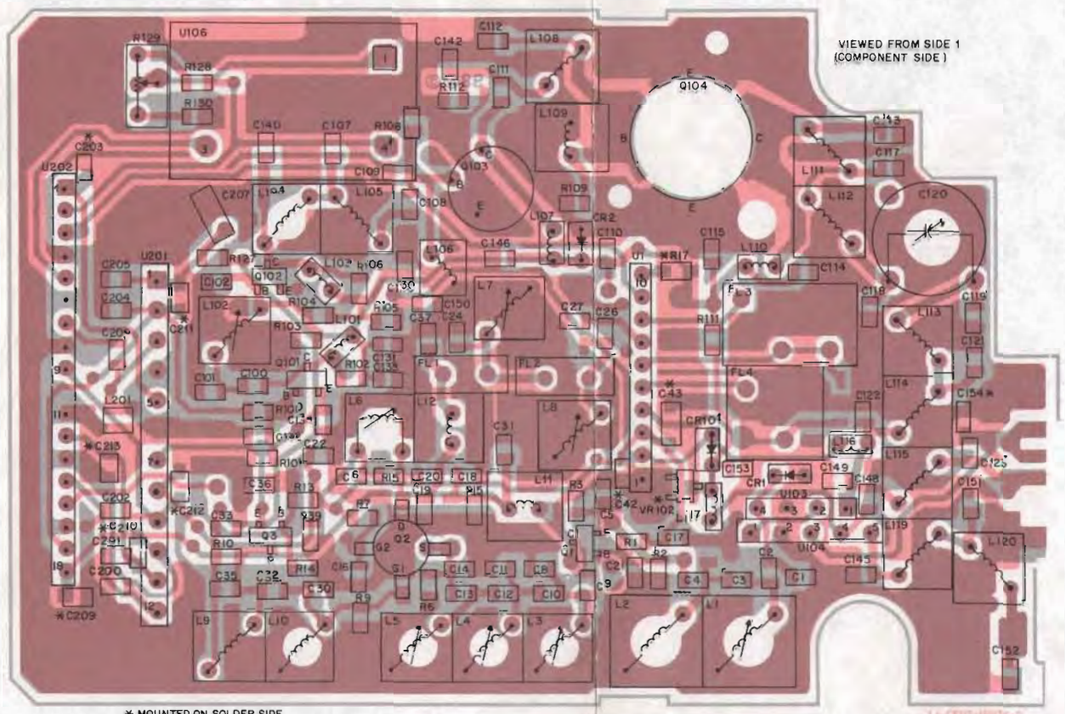
L4-CEPF-19400-0
OL-CEPF-20279-0

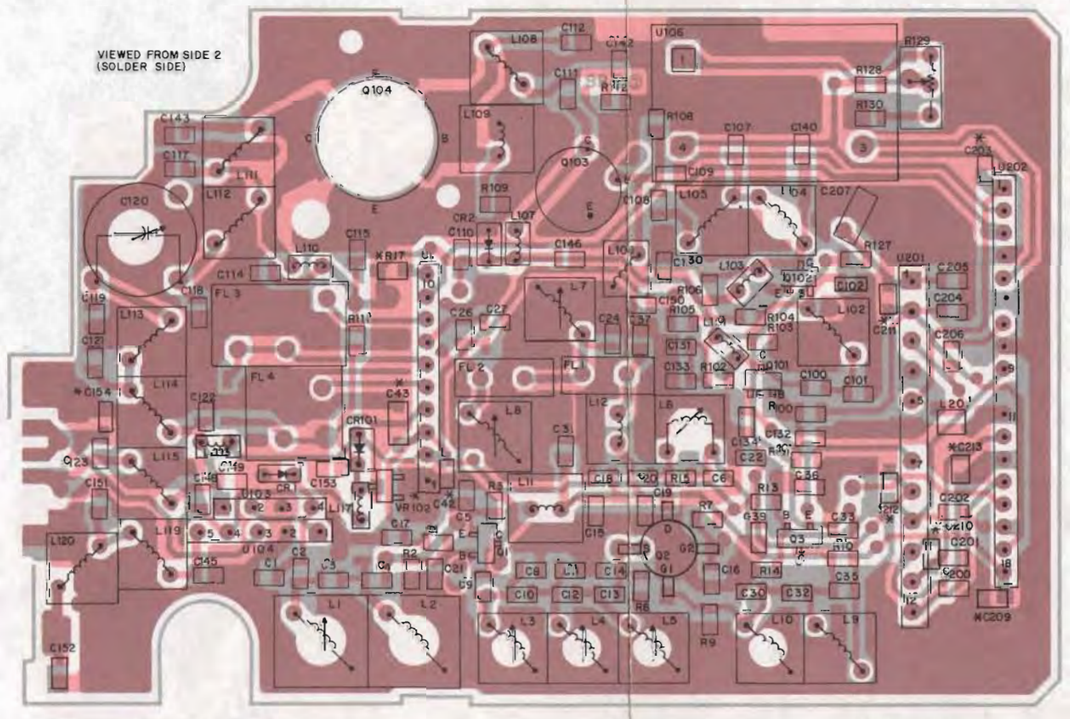
VHF 2-WATT RADIOS

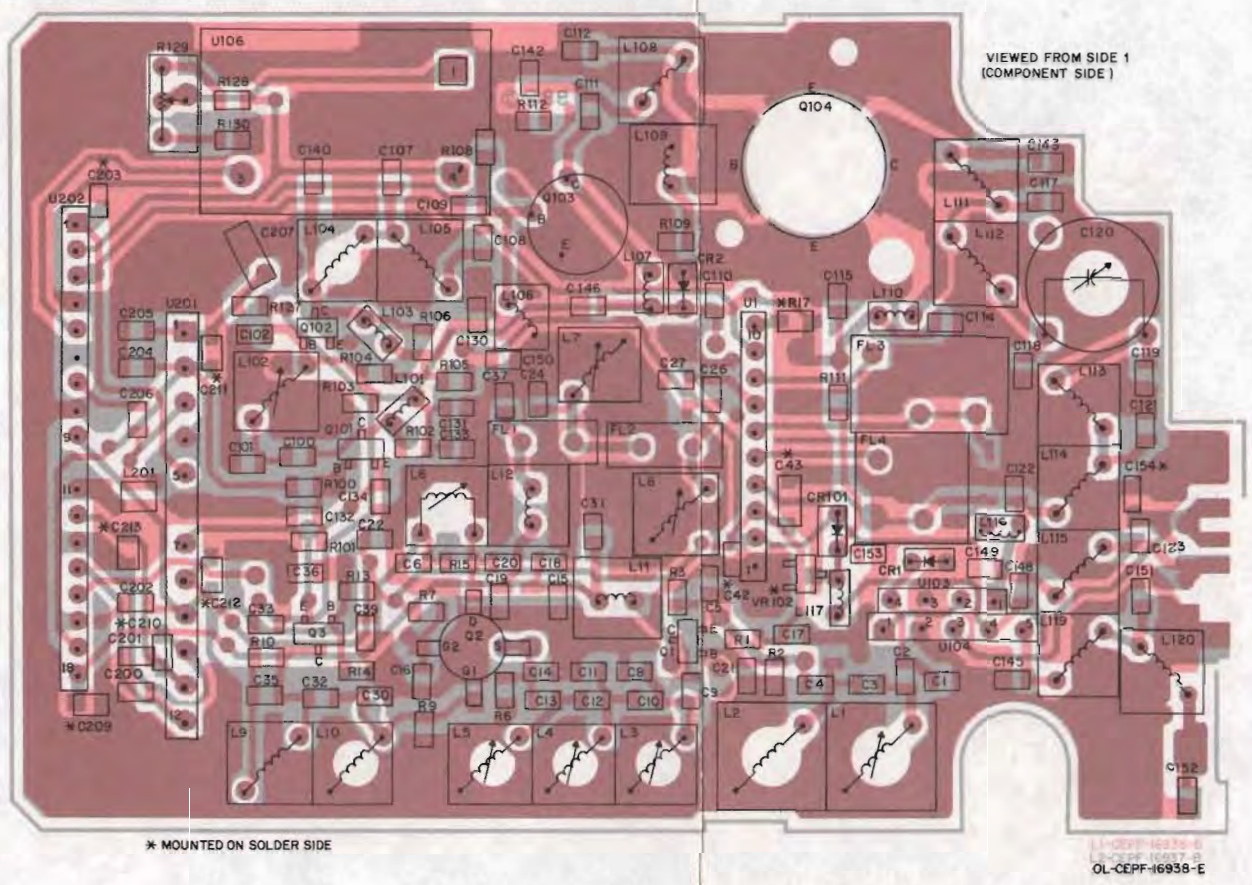


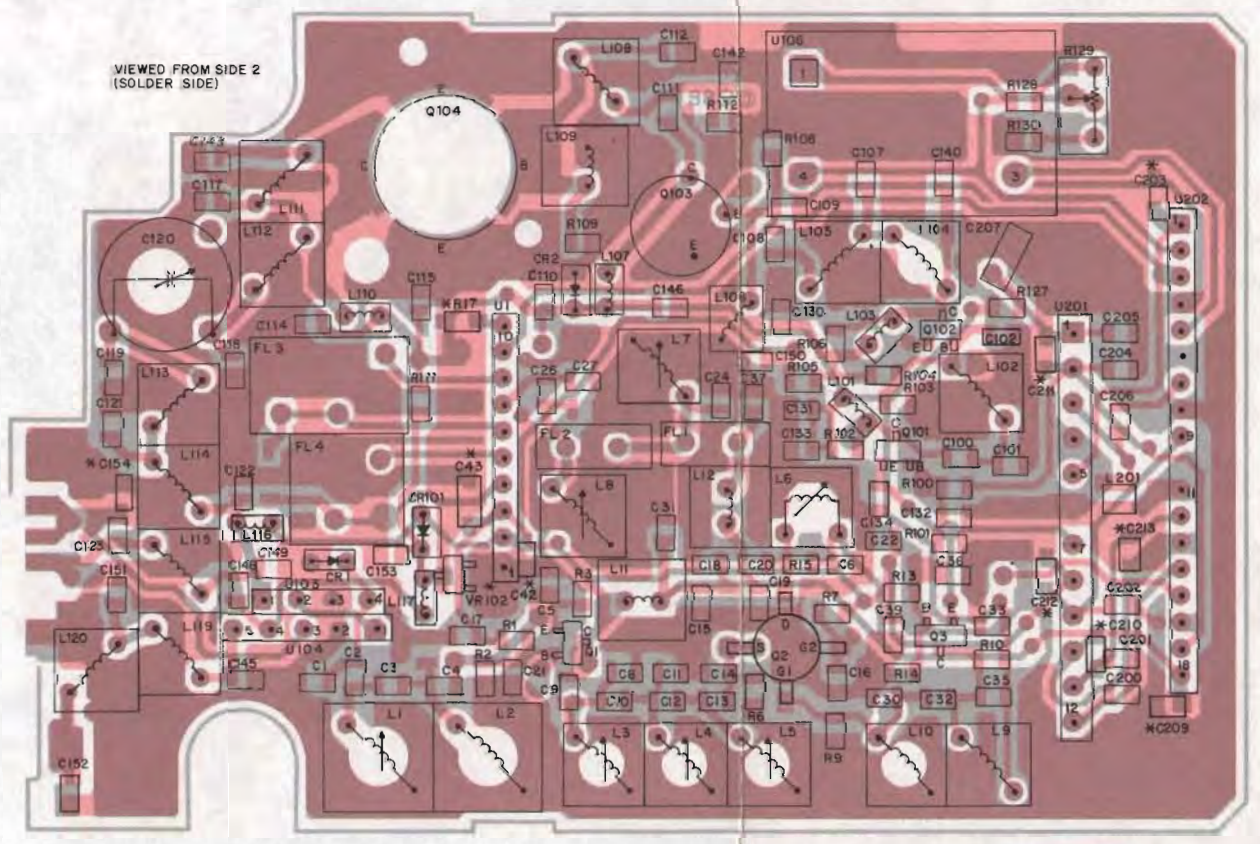


VHF 5-WATT RADIOS









SCHEMATIC AND CIRCUIT BOARD NOTES

1. UNLESS OTHERWISE STATED, RESISTANCES ARE IN OHMS (k=1000), CAPACITANCES LESS THAT ARE LESS THAN 1 ARE IN MICROFARADS, AND CAPACITANCES 1 OR GREATER ARE IN PICOFARADS.

2. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND USING MOTOROLA DC MULTIMETER OR EQUIVALENT. TRANSMITTER MEASUREMENTS SHOULD BE MADE WITH A 1.2µH RF CHOKE IN SERIES WITH VOLTAGE PROBE TO PREVENT CIRCUIT LOADING.

3. REFERENCE DESIGNATIONS ARE ASSIGNED IN THE FOLLOWING MANNER:

UNIT SERIES	=	RECEIVER
100 SERIES	=	TRANSMITTER
200 SERIES	=	VCO & SYNTHESIZER
300 SERIES	=	MISCELLANEOUS
400 SERIES	=	CONTROLLER FLEX
500 SERIES	=	DISPLAY BOARD
800 SERIES	=	SIGNALLING (CONTROLLER FLEX)

4. INTERCONNECT TIE POINT LEGEND:

- (A) B+ TO MOTHER BOARD
- (B) CONTROLLER FLEX B+
- (5V REG.) REGULATED 5V
- [D] TO DTMF CIRCUIT
- (M1) METERING POINTS M1, M2, M3
- (M) TO MOTHER BOARD
- (R) RECEIVER 10V
- (R5) RECEIVER 5V
- [S] TO SYNTHESIZER BOARD
- (T) TRANSMIT 10V
- (T5) TRANSMIT 5V
- [T] TO CONTROLLER FLEX
- [U] TO UNIVERSAL CONNECTOR
- [*] TO FRONT COVER
- (V1) REGULATED 8V

TEPF-16684-B

VOLTAGE OVERLAY AND WAVEFORM NOTES

1. 7mV SIGNAL GENERATOR LEVEL. PLACE A 47-OHM RESISTOR ACROSS L10 TO REDUCE 1ST L.O. INJECTION FEED THROUGH.

2. BASE OF Q102 SHORTED TO GROUND.

3. INJECT (AT SELECTED ANTENNA) AN ON-CHANNEL SIGNAL AT 1mV, 1kHz MODULATION AT 3kHz DEVIATION.

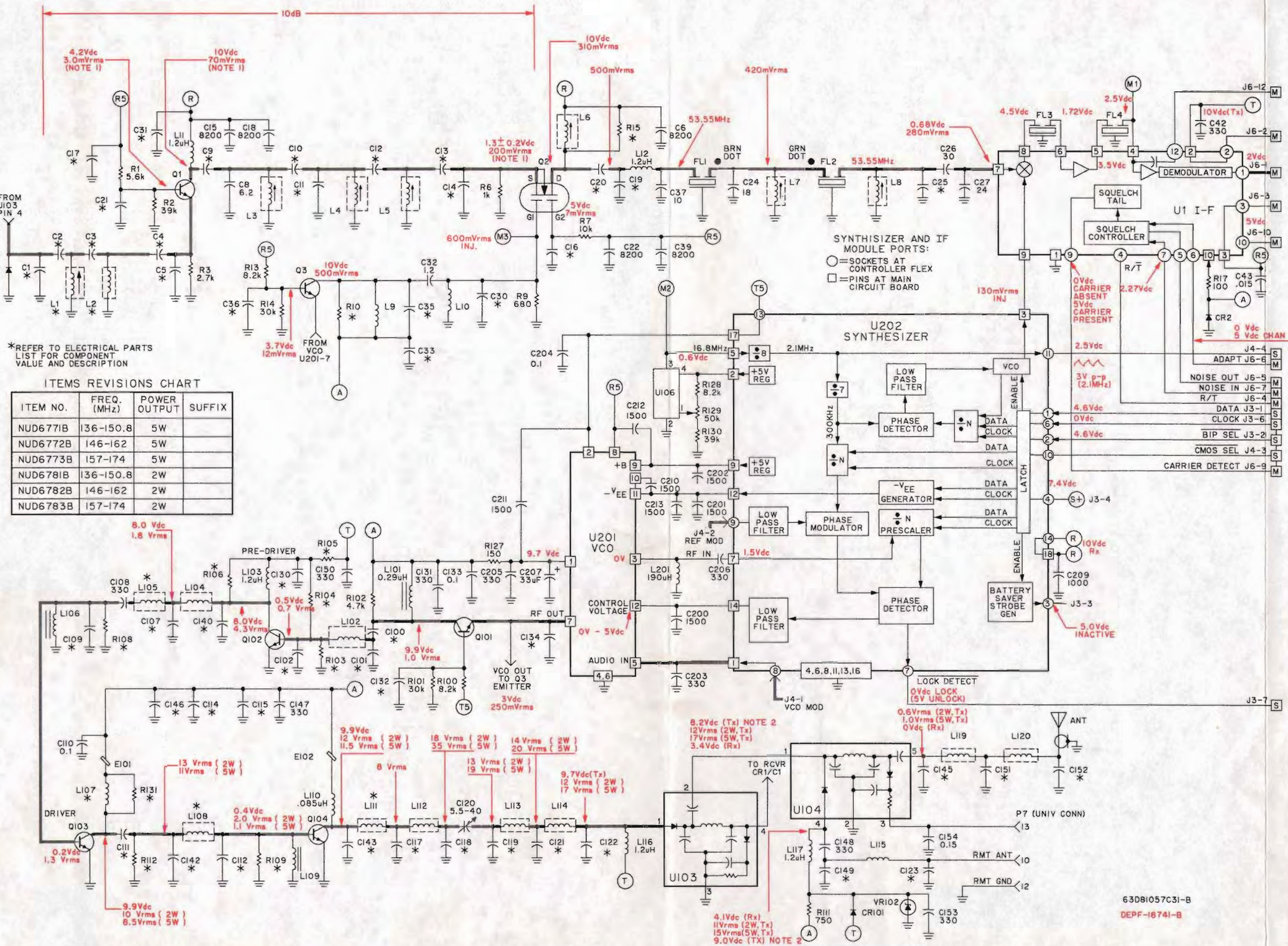
4. VERIFY USING PROGRAMMER.

5. EXTERNAL SIGNAL FROM AUDIO SIGNAL GENERATOR AT MIC. INPUT.

TEPF-18833-O

2-LAYER CIRCUIT BOARD COPPER DETAIL VIEWING COPPER STEPS AT EDGE OF BOARD IN PROPER LAYER SEQUENCE.

MAEPF-16805-O



ITEMS REVISIONS CHART

ITEM NO.	FREQ. (MHz)	POWER OUTPUT	SUFFIX
NUD6771B	136-150.8	5W	
NUD6772B	146-162	5W	
NUD6773B	157-174	5W	
NUD6781B	136-150.8	2W	
NUD6782B	146-162	2W	
NUD6783B	157-174	2W	

VHF Electrical Parts List, Transceiver Board

L = 136-150.8MHz
M = 146-162MHz
H = 157-174MHz

TPLF-3631-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: pF ±5%;50V unless stated
C1	2160520S09	22 ± 0.25pF (L, M)
	or 2113740A23	6.2 ± 0.25pF (H)
C2	2113740A32	13 (L)
	or 2160520S09	22 ± 0.25pF (M)
	or 2113740A21	5.6 ± 0.25 pF (H)
C3	2113740A15	3.3 ±0.25pF (L)
	or 2113740A19	4.7 ± 0.25pF (M)
	or 2113740A11	2.2 ± 0.25pF (H)
C4	2113740A34	16 (L)
	or 2113740A35	18 (M)
	or 2113740A32	13 (H)
C5	2113740A36	20 (L)
	or 2113740A33	15 (M)
	or 2113740A34	16 (H)
C6	2113741A43	8200
C8	2113740A23	6.2 ± 0.25pF
C9	2113740A75	680 (L, M)
	or 2113741A17	680 ± 10% (H)
C10	2113740A04	1.1 ± 0.25pF (L)
	or 2113740A03	1.0 ± 0.25pF (M, H)
C11	2113740A25	7.5 ± 0.25 pF (L)
	or 2113740A23	6.2 ± 0.25pF (M)
	or 2113740A24	6.8 ± 0.25pF (H)
C12	2113740A04	1.1 ± 0.25 pF (L)
	or 2113740A03	1.0 ± 0.25pF (M, H)
C13	2113740A32	13 (L, H)
	or 2113740A31	12 (M)
C14	2113740A32	13 (L)
	or 2113740A29	10 (M)
	or 2160520S02	11 ± 0.25pF (H)
C15	2113741A43	8200
C16, 17	2113740A75	680 (L, M)
	or 2113741A17	680 ± 10% (H)
C18	2113741A43	8200
C19	2113740A43	39 (L, M)
	or 2160520S16	43 ± 0.25pF (H)
C20	2113740A19	4.7 ± 0.25pF (L, M)
	or 2113740A23	6.2 ± 0.25pF (H)
C21	2113740A75	680 (L, M)
	or 2113741A17	680 ± 10% (H)
C22	2113741A43	8200
C24	2113740A35	18
C26	2113740A40	30
C27	2113740A38	24
C30	2113740A18	4.3 ± 0.25 pF (L)
	or 2113740A21	5.6 ± 0.25pF (M)
	or 2113740A27	8.2 ± 0.25pF (H)
C31	2113740A75	680 (L, M)
	or 2113741A17	680 ± 10% (H)
C32	2113740A05	1.2 ± 0.25pF
C33	2113740A75	680 (L, M)
	or 2113741A13	470 ± 10% (H)
C35	2113740A21	5.6 ± 0.25 pF (L)
	or 2113740A23	6.2 ± 0.25pF (M)
	or 2113740A27	8.2 ± 0.25pF (H)
C36	2113740A75	680 (L, M)
	or 2113741A17	680 ± 10% (H)
C37	2160520S01	10 ± 0.25pF
C39	2113741A43	8200
C42	2113740A67	330
C43	2113741B49	.015µF; 25V
C100	2113740A11	2.2 ± 0.25 pF (L, 5W)
	or 2113740A10	2 ± 0.25pF (M), (H, 2W)
	or 2113740A08	1.6 ± 0.25pF (H, 5W)
C101	2113740A36	20 (L), (M, 2W)
	or 2113740A33	15 (M, 5W), (H, 5W)
	or 2113740A32	13 (H, 2W)
C102	2113740A41	33 (L, 2W)
	or 2113740A38	24 (L, 5W)
	or 2113740A40	30 (M, 2W), (H, 5W)
	or 2113740A35	18 (M, 5W)
	or 2113740A37	22 (H, 2W)
C107	2113740A46	47 (L, 2W), (H, 5W)
	or 2113740A52	75 (L, 5W)
	or 2113740A48	61 (M, 2W)
	or 2113740A51	68 (M, 5W)
	or 2113740A46	47 (H, 2W)
C108	2113740A67	330
C109	2113740A43	39 (L, 2W)
	or 2113740A42	36 (M, 2W)
	or 2113740A40	30 (L, 5W), (M, 5W)
	or 2113740A36	20 (H)
C110	2160521G37	0.1µF +80 - 20%
C111	2113740A46	47 (L, 2W), (M, 2W)
	or 2113740A48	51 (L, 5W)
	or 2113740A44	43 (M, 5W)
	or 2113740A42	36 (H)
C112	2113740A54	91 (5W Models only)
C114	2113740A67	330 (L), (M), (H, 2W)
	or 2160521G37	0.1µF + 80 - 20% (H, 5W)
C115	2160521G37	0.1µF + 80 - 20% (L), (M), (H, 2W)
	or 2113740A67	330 (H, 5W)
C117	2113740A51	68 (L, 2W)
	or 2113740A55	100 (L, 5W)
	or 2113740A49	56 (M, 2W)
	or 2113740A53	82 (M, 5W)
	or 2113740A48	47 (H, 2W)
	or 2113740A52	75 (H, 5W)
C118	2113740A37	22 (L, 2W)
	or 2113740A35	18 (L, 5W)
	or 2113740A36	20 (M, 2W)
	or 2113740A31	12 (M, 5W)
	or 2113740A32	13 (H, 5W)
	or 2113740A33	15 (H, 2W)
C119	2113740A38	24 (L, 2W)
	or 2113740A33	15 (L, 5W)
	or 2113740A37	22 (M, 2W)
	or 2113740A31	12 (M, 5W)
	or 2113740A36	20 (H, 2W)
	or 2113740A27	8.2 ± 0.25 pF (H, 5W)
C120	2005568P03	Trimmer, 5.5-40
C121	2113740A43	39 (L), (M)
	or 2113740A42	36 (H)
C122	2113740A38	24 (L, 2W)
	or 2113740A36	20 (L, 5W)
	or 2113740A35	18 (M, 2W)
	or 2113740A33	15 (M, 5W), (H, 5W)
	or 2113740A32	13 (H, 2W)
C123	2113740A36	20 (L, 2W), (M)
	or 2113740A35	18 (L, 5W), (H)
C130	2113740A67	330 (L, 2W), (M, 2W), (H)
	or 2113741A33	3300 (L, 5W), (M, 5W)
C131	2113740A67	330
C132	2113740A67	330 (L, 2W), (M, 2W), (H)
	or 2113740A75	680 (L, 5W), (M, 5W)
C133	2160521G37	0.1µF + 80 - 20%
C134	2113740A18	4.3 ± 0.25pF (H, 5W Models only)
C140	2113740A18	4.3 ± 0.25pF (L, 2W)
	or 2113740A19	4.7 ± 0.25pF (L, 5W), (M, 5W)
	or 2113740A14	3 ± 0.25pF (M, 2W)
	or 2113740A15	3.3 ± 0.25pF (H)
C142	2113740A42	36 (L, 2W)
	or 2113740A49	56 (L, 5W)
	or Not Used	(M, 2W)
	or 2113740A43	39 (M, 5W)
	or 2113740A36	20 (H, 2W)
	or 2113740A39	27 (H, 5W)
C143	2113740A33	15 (L, 2W), (M, 5W)
	or 2113740A37	22 (L, 5W)
	or 2113740A31	12 (M, 2W)
	or 2113740A34	16 (H, 5W)
	or 2113740A29	10 (H, 2W)
C145	2113740A36	20 (L)
	or 2113740A37	22 (M)
	or 2113740A32	13 (H)
C146	2113740A67	330 (2W Models), (H, 5W)
	or 2160521G37	0.1µF + 80 - 20% (L, 5W), (M, 5W)
C147	2113740A67	330 (2W)
C148	2113740A67	330
C149	2113740A37	22 (L, 5W)
	or 2113740A35	18 (L, 2W), (M)
	or 2113740A32	13 (H, 2W)
	or 2113740A33	15 (H, 5W)
C150	2113740A67	330
C151	2113740A50	62 (L)
	or 2113740A44	43 (M)
	or 2113740A46	47 (H)
C152	2113740A39	27 (L, 2W)
	or 2113740A37	22 (L, 5W)
	or 2113740A35	18 (M)
	or 2113740A33	15 (H)
C153	2113741B49	330
C154	2113741B49	.015µF ± 10%
C200 thru 202	2113741A25	1500
C203	2113740A67	330
C204	2160521G37	0.1µF + 80 - 20%
C205, 206	2113740A67	330
C207	2305458G12	33µF; 16V
C209	2113741A21	1000
C210 thru C213	2113741A25	1500
C301 thru 304	2113740A53	82
C305, 306	2113740A49	56
	or 2113740A53	82
C308	2113740A53	82
C310	2113740A67	330
		DIODE: See Note
CR1	4883654H06	Silicon (L)
	or 4883654H08	Silicon (M, H)
CR2	4805490G02	Silicon
CR101	4883654H01	Silicon
CR301A, 301B	4805729G24	LED, Bicolor
		CORE:
E101	7683960B04	Ferrite Bead
E102	7683960B01	Ferrite Bead
		FUSE:
F1	6505214E02	Axial, 5-Amp.
		FILTER:
FL1, 2	4805245J20	Crystal, 53.55MHz
FL3	9105725Q02	Ceramic, 450kHz
FL4	9105726Q01	Ceramic, 450kHz
		COIL, RF: unless stated
L1	2405669G13	5-1/2 turns, spacewound (L, H)
	or 2405669G12	4-1/2 turns, spacewound (M)
L2	2405669G31	5-1/2 turns, spacewound (L, H)
	or 2404669G30	4-1/2 turns, spacewound (M)
L3, 4, 5	2405523P29	9-1/2 turns, closewound; with core (L)
	or 2405523P18	8-1/2 turns, closewound; with core (M, H)
L6	2405063H13	Tunable, 1.2µH Choke
L7, 8	2405063H05	Tunable, 0.4µH Choke
L9	2405523P28	6-1/2 turns, spacewound (L)
	or 2405523P10	5-1/2 turns, spacewound (M)
	or 2405523P09	4-1/2 turns, spacewound (H)
L10	2405523P10	5-1/2 turns, spacewound (L)
	or 2405523P09	4-1/2 turns, spacewound (M)
	or 2405523P08	3-1/2 turns, spacewound (H)
L11	2482723H38	1.2µH Choke
L12	2505129Q02	1.2µH Choke, precision
L101	0105951P49	Assy., 0.29µH Choke and bead (L, 5W), (M, 5W)
	or 2482723H28	0.29µH Choke (2W), (H, 5W)
L102	2405523P28	6-1/2 turns, spacewound
L103	2482723H38	1.2µH Choke
L104	2405523P32	9-1/2 turns, closewound
L105	2405523P07	2-1/2 turns, spacewound
L106	2405913C01	3-turn ferrite bead
L107	0105951P49	Assy., 0.29µH Choke and bead (2W)
	or 0105951P48	Assy., .085µH Choke and bead (5W)
L108	2405523P07	2-1/2 turns, spacewound (2W Models)
	or 2405559P09	1-1/2 turns, airwound (5W Models)
L109	2405913C01	3-turn ferrite bead
L110	0105951P48	Assy., 0.85µH Choke and bead
L111	2405559P07	2-1/2 turns, airwound (2W Models)
	or 2405559P08	1-1/2 turns, airwound (5W Models)
L112	2405559P11	4-1/2 turns, airwound (L, M), (H, 2W)
	or 2405559P21	4-1/2 turns, airwound (H, 5W)
L113, 114	2405559P01	6-1/2 turns, airwound (L)
	or 2405559P02	5-1/2 turns, airwound (M, H)
L115	2405559P01	6-1/2 turns, airwound (L, M)
	or 2405559P02	5-1/2 turns, airwound (H)
L116, 117	2482723H38	1.2µH Choke
L119, 120	2405559P01	6-1/2 turns, airwound (L)
	or 2405559P02	5-1/2 turns, airwound (M, H)
L201	2405452C70	190µH Choke
LS1	5005155Q03	**TRANSDUCER**
MK1	0105956M62	**MICROPHONE ASSEMBLY**
		PLUG:
P1	2805572P01	Connector, Flex To P, 13-pin
P2	2805572P01	Connector, Flex To P, 13-pin
P3, 4	2805144Q01	Connector, Synthesizer, 7-pin
P5	2805250Q01	Connector, Front Cover

P6	2805247Q01	Connector, I-F
P7	- - - -	Not field replaceable, order Top Control Panel Assembly 0105951N41
		TRANSISTOR: See Note
Q1	4805218N08	NPN
Q2	4805452G08	Dual Gate MOSFET; Type M52G08
Q3	4805218N09	NPN
Q101, 102	4805218N09	NPN
Q103	4805474G37	NPN; Type M74G37
Q104	4805452G06	NPN; Type M52G06 (2W Models)
	or 4805474G33	NPN; Type M74G33 (5W Models)
		RESISTOR, Fixed: Ω ± **5%; 1/10W** unless stated
R1	0660076A67	5.6k
R2	0660076A87	39k
R3	0660076A59	2.7k
R6	0660076A49	1k
R7	0660076A73	10k
R9	0660076A45	680
R10	0660076A55	2k (L), (M), (H, 2W)
	or 0660076A56	2.2k (H, 5W)
R13	0660076A71	8.2k
R14	0660076A84	30k
R15	0660076A71	8.2k (L)
	or 0660076A77	15k (M, H)
R17	0660076A25	100
R100	0660076A71	8.2k
R101	0660076A84	30k
R102	0660076A65	4.7k (L), (M), (H, 2W)
	or 0660076A59	2.7k (H, 5W)
R103	0660076A69	6.8k (L), (M, 5W), (H, 5W)
	or 0660076A68	6.2k (M,2W), (H, 2W)
R104	0660076A82	24k (5W)
	or 0660076A80	20k (L, 2W)
	or 0660076A84	30k (M, 2W)
	or 0660076A79	18k (H, 2W)
R105	0660076A25	100 (L), (M, 2W), (H)
	or 0660076A32	200 (M, 5W)
R106	0660076A75	12k (L)
	or 0660076A67	5.6k (M, 2W), (H, 2W)
	or 0660076A65	4.7k (M, 5W), (H 5W)
R108	0660076A17	47 (2W Models)
	or 0660076A25	100 (L, 5W)
	or 0660076A23	82 (M, 5W), (H, 5W)
R109	0660076A17	47 (M, 2W)
	or 0660076A07	18 (L, 5W)
	or 0660076A09	22 (M, 5W)
	or 0660076A18	51 (L, 2W), (H)
R111	0660076A46	750
R112	0660076A29	150 (5W Models)
R127	0660076A29	150
R128	0660076A71	8.2k
R129	1805559S02	Pot., 50k
R130	0660076A87	39k
R131	0660076A29	150 (L, 2W Models only)
R140	1805100Q03	Pot., 25k
		SWITCH:
S1	- - - -	On/Off, Part of R140
S2	4005148Q05	6-position, BCD
S3	4005101Q01	Toggle, PL Disable
S301	3905834K04	Snap Dome, Monitor
S302	3905834K04	Snap Dome, PTT
S303	3905834K04	Snap Dome, Monitor
		CIRCUIT MODULE: See Note
U1	5102001J12	I-F
U103	5105822P51	Antenna Switch
U104	5105822P64	Antenna Selector (2W)
	or 5105729E93	Antenna Selector (5W)
U106	5105729E52	Ref. Oscillator
U201	5105822P61	VCO (L)
	or 5105822P60	VCO (M)
	or 5105822P59	VCO (H)
U202	5102001J03	Synthesizer
		DIODE: See Note
VR102	4805129M61	Zener, 18V
VR301	4883461E32	Zener, 8.2V

NONREFERENCED ITEMS		
	0105953P30	I-F SHIELD, for U1
	0200007007	NUT, Hex; 8-32 X 1/4" X 3/32" (for Q104, 5W Models)
	0311995A08	SCREW, Phillips; 2-56 X 3/16" (for Q104 heatsink)
	0705196A04	BOOT, for FL1, FL2
	0705766R01	SUPPORT, Rubber
	1400861196	INSULATOR, for Q103
	1405238Q01	INSULATOR, for U106
	1405496B01	INSULATOR (I-F)
	2605524P01	CAN, for L11, L12
	2605524P03	CAN, for L111, L112, L115, and L108 (5W Models)
	2605532P02	HEAT SINK, for Q104 (5W Models)
	2605578P01	HEAT SINK, for Q104 (2W Models)
	2605820D07	CAN, for L1, L2
	2683379H01	HEAT SINK, for Q103
	3905130N01	CONTACT STRIP
	3905509R02	CONTACT
	7505295B07	PAD, for FL1, FL2
	7505695R01	CUSHION, for U106

NOTE:
For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.

UHF Electrical Parts List, Transceiver Board
B1 = 403-433MHz 2- and 4-Watt Radios
B3 = 438-470MHz 2- and 4-Watt Radios
B4 = 470-500MHz 4-Watt Radios Only
B5 = 488-520MHz 4-Watt Radios Only TPLF-3841-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: pF±5%; 50V unless stated
C1	2113740A33	15 (B1)
	or 2113740A23	6.2 ±0.25pF (B3)
	or 2113740A39	27 (B4)
	or 2113740A40	30 (B5)
C2	2113740A19	4.7 ±0.25pF (B1)
	or 2113740A12	2.4 ±0.25pF (B3)
	or 2113740A27	8.2 ±0.25pF (B4)
	or 2113740A21	5.6 ±0.25pF (B5)
C3	2113740A21	5.6 ±0.25pF (B1)
	or 2113740A29	10 ±0.25pF (B3)
	or Not Used	(B4 and B5)
C4	2113740A53	82 (B1, B3, B4)
	or 2113740A43	39 (B5)
C5	2113741A21	1000
C6	2113740A17	3.9 ±0.25pF (B1)
	or 2113740A13	2.7 ±0.25pF (B3 2W, B4)
	or 2113740A14	3.0 ±0.25pF (B3 4W, B5)
C7	2113740A07	1.5 ±0.25pF (B1)
	or 2113740A19	4.7 ±0.25pF (B3 2W)
	or 2113740A23	6.2 ±0.25pF (B3 4W)
	or 2113740A03	1.0 ±0.25pF (B4)
	or Not Used	(B5)
C8	2113740A53	82
C11	2113741A33	3300; 25V (B1, B3, B4)
	or 2113741A25	1500 (B5)
C12	2113740A53	82 (B1, B3, B4)
	or 2113741A25	1500 (B5)
C13	2113741A45	.01uF; 25V (B1)
	or 2113741A21	1000 (B3)
	or 2113741A43	8200 (B4)
	or 2160521G37	0.1uF (B5)
C14	2113740A29	10
C15	2113740A28	9.1 (B1, B3, B4)
	or 2113740A29	10 (B5)
C16	2113740A27	8.2 ±0.25pF
C17	2113740A32	13 (B5 only)
C18	2113740A36	20
C19	2113740A43	39 (B1Only)
	or 2113740A40	30 (B3 4W Only)
C21	2113740A19	4.7 ±0.25pF (B1)
	or 2113740A29	10 ±0.25pF (B3 2W)
	or 2113740A28	9.1 ±0.25pF (B3 4W)
	or 2113740A27	8.2 ±0.25pF (B4)
	or 2113740A30	11 (B5)
C22	2113740A10	2.0 ±0.25pF (B1)
	or 2113740A14	3.0 ±0.25pF (B3)
	or 2113740A05	1.2 ±0.25pF (B4)
	or 2113740A16	3.6 ±0.25pF (B5)
C23	2113740A17	3.9 ±0.25pF
C25	2113740A21	5.6 ±0.25pF (B1)
	or 2113740A10	2.0 ±0.25pF (B3)
	or 2113740A09	1.8 ±0.25pF (B4, B5)
C29	2113740A18	4.3 ±0.25pF (B1, B3)
	or 2113740A16	3.6 ±0.25pF (B4, B5)
C30	2113741A21	1000
C31	2113740A16	3.6 ±0.25pF (B1)
	or 2113740A13	2.7 ±0.25pF (B3 2W)
	or 2113740A17	3.9 ±0.25pF (B3 4W)
	or 2113740A15	3.3 ±0.25pF (B4)
	or 2113740A19	4.7 ±0.25pF (B5)
C35	2113740A31	12 (B1)
	or 2113740A43	39 (B3)
	or 2113740A28	9.1 ±0.25pF (B4)
	or 2113740A33	15 (B5)
C38	2113741A53	82 (B1 2W Only)
	or 2113741A21	1000 (B3 2W Only)
C39	2360562A13	1.0uF; 16V (B1, B3 Only)
C41	2113740A53	82 (B4, B5)
	or - - - - -	See R4 for B1, B3 application
C42	2360562A16	1.5uF;10V
C43	2113740A43	39
C47	2113741A33	3300; 25V
C48	2113740A53	82
C49	Not Used	(B1)
	or 2113740B34	24 (B3 2W, B4, B5)
	or - - - - -	See R11 for B3 4W application
C50	2113741B73	1000
C51	2113741A53	82 (B1 2W Only, B3 2W Only)
C52	2113741B69	0.1uV (B1 2W, B3 2W)
	or 2111032B13	0.1uF (B1 4W, B3 4W, B4, B5)
C56	2113740A03	1.0 ±0.25pF (B1, B3 2W, B5)
	or 2113740A10	2.0 ±0.25pF (B3 4W)
	or 2113740A07	1.5 ±0.25pF (B4)
C60	2113740B01	1.0 ±0.25pF (B1, B3)
	or 2113740B07	1.8 ±0.25pF (B4)
	or Not Used	(B5)
C100	2113740A09	1.8 ±0.25pF (B3 2W Only)
C102	2113740A33	15 (B1 2W)
	or 2113740A32	13 (B1 4W)
	or 2113740A19	4.7 ±0.25pF (B4)
	or 2113740A27	8.2 ±0.25pF (B5)
C105	2113740A53	82 (B1 2W, B4, B5)
	or 2113740A38	24 (B1 4W)
	or 2113740A27	8.2 (B3 2W)
	or 2113740A35	18 (B3 4W)
C107	2113740A53	82
C108	2113740A24	6.8 ±0.25pF (B1 4W Only)
	or 2113740A36	20 (B3 4W Only)
	or 2113740A33	15 (B4)
	or 2113740A28	9.1 (B5)
C110	2113740A18	4.3 ±0.25pF (B1 2W)
	or 2113740A53	82 (B1 4W)
	or 2113740A33	15 (B3 2W)
	or 2113740A37	22 (B3 4W)
	or 2113740A39	27 (B4)
	or 2113740A48	51 (B5)
C111	2113740A42	36 (B1 4W Only)
	or 2113740A29	10 (B3 4W Only)
	or 2113740A24	6.8 ±0.25pF (B4)
	or 2113740A53	82 (B5)
C112	2113740A36	20 (B1 4W, B3 4W, B4)
	or 2113740A31	12 (B5)
	or Not Used	B1 2W, B3 2W
C113	2113740A53	82 (4W Only)
C114	2105454G02	11 (B5 Only)
C115	2113740A53	82
C116	2113740A32	13 (B1)
	or 2113740A43	39 (B3 2W)
	or 2113740A28	9.1 ±0.25pF (B3 4W)
	or 2113740A30	11(B4)
	or 2113740A17	3.9 ±0.25pF (B5)
C117	2113740B47	82 (B1 2W, B3 2W)
	or 2113740A53	82 (B1 4W, B3 4W, B4, B5)
C119	2113740A53	82
C120	2113740A13	2.7 ±0.25 pF (B3, 4W Only)
	or 2113740A15	3.3 ±0.25pF (B4 Only)
C121	2111031A62	4.7 ±0.25pF (B4 Only)
	or 2113740A21	5.6 ±0.25pF (B5 Only)
C122	2113740A53	82
C123	2113740A53	82 (2W)
	or 2160521G37	0.1uF (4W)
C127	2360562A24	3.3uF; 16V
C130	2113740A12	2.4 ±0.25pF (B1, 4W Only)
	or 2113740A16	3.6 ±0.25pF (B3 4W Only, B4 Only)
C143	2113740A23	6.2 ±0.25pF (B1 2W)
	or 2113740A16	3.8 ±0.25pF (B1 4W)
	or 2113740A20	5.1pF ±0.25pF (B3)
	or 2113740A24	6.8 ±0.25pF (B4)
	or 2113740A15	3.3 ±0.25pF (B5)
C145	Not Used	(B1 2W)
	or 2113740A53	82 (B1 4W, B3, B4, B5)
C149	2160521G37	0.1uF+80-20% (B1 2W, B3 2W, B4)
	or 2113740A53	82 (B1 4W, B3 4W, B5)
C151	2113740A53	82 (B1, B3, B4)
	or 2113740A42	36 (B5)
C152	2160521G37	0.1uF+80-20%
C154	2113740A19	4.7 ±0.25pF (B1 4W)
	or 2113740A03	1.0 ±0.25pF (B1 2W, B3)
	or Not used	(B4, B5)
C155	2160521G37	0.1uF+80-20%
C157	2113740A27	8.2 ±0.25pF (B1 2W)
	or 2113740A17	3.9 ±0.25pF (B1 4W)
	or Not Used	(B3 2W)
	or 2113740A12	2.4 ±0.25pF (B3 4W)
	or 2113740A03	1.0 ±0.25 (B4 B5)
C158	2113740A21	5.6 ±0.25pF (B1 2W Only)
	or 2113740A31	12 (B3 2W Only)
C159,160	2113740A53	82 (B1 2W, B3 2W, B4, B5)
	or Not Used	(B1 4W, B3 4W)
C162	2113740A53	82
C164	2113740A53	82
C166	2360562A24	3.3uF ±20%; 16V
C167	2113740A32	13 ±0.25pF (B1 4W Only)
	or 2113740A29	10 ±0.25pF (B3 4W Only, B4)
	or 2113740A12	2.4 ±0.25pF (B5)
C168	2113740A53	82 (B1 2W Only, B3 2W Only)
C169	2160521G37	0.1uF+80-20%(B1 2W Only)
	or 2113740A53	82 (B3 2W Only)
C170	2113740A53	82
C171	2360562A24	3.3uF
C177	2113740A29	10 ±0.25pF (B3 2W)
	or 2113740A03	1.0 ±0.25pF (B3 4W, B4)
	or 2113740A12	2.4 ±0.25pF (B5)
C179	2160521G37	0.1uF+80-20%
C182	2113741A37	4700 ±10%;25V (B1, B3)
	or 2113741A21	1000 (B5)
C183	2113740A24	6.8 ±0.25pF (B1 2W)
	or 2113740A28	9.1 ±0.25pF (B1 4W)
	or 2113740A16	3.6 ±0.25pF (B3)
	or 2113740A04	1.1 ±0.25pF (B4)
	or Not used	(B5)
C185	2113740A17	3.9 ±0.25pF (B1 2W)
	or 2113740A20	5.1 ±0.25pF (B1 4W)
	or 2113740A15	3.3 ±0.25pF (B3 2W)
	or 2113740A13	2.7 ±0.25pF (B3 4W)
	or 2113740A03	1.0 ±0.25pF (B4)
	or 2113740A07	1.5 ±0.25pF (B5)
C186	2113740A53	82
C187	2160521G37	0.1uF ±20%;35V (B1 2W Only, B3 2W Only)
C190	2305499G13	1uF±20%; 25V
C191	2113740A53	82
C193	2113740A03	1.0 ±0.25pF (B3 2W Only)
C195	2113740A53	82
C196	2113740A27	8.2 ±0.25pF (B1 2W Only)
	or 2113740A16	3.6 ±0.25pF (B3 2W Only)
C197	2113741A21	1000 (B1 4W Only, B3 4W Only, B4, B5)
C198	2113740A03	1.0 (B1 2W Only)
	or 2113740A21	5.6 (B3 2W Only)
C199	2113740B47	82 (B1, B3 4W, B4, B5)
	or 2113740B44	62pF (B3 2W)
C300 thru 304	2113740A53	82
C305, 306	2113740A49	56
C307, 308	2113740A53	82
C309	2105454G38	33
C310	2113740A67	330
		DIODE: See Note
CR1	4883654H08	Silicon
CR101	4805494Q04	Silicon
CR102	4805490G02	Silicon
CR103	4883654H01	Silicon (B1 2W)
	or 4883654H08	Silicon (B1 4W, B3)
	or 4805129M24	Silicon (B4, B5)
CR105	4805119G14	Silicon (4W Only)
CR301A/B	4805729G24	Led, Bicolor
		FUSE:
F1	6505214E02	5-Amp.
		FILTER:
FL1, FL2	4805245J20	Crystal, 53.55 MHz
FL3	9105725Q02	Ceramic, 450 KHz
FL4	9105726Q01	Ceramic, 450 KHz
		COILS:
L1, 2	0105951P30	ASSEMBLY, Preselector; 2-pole (B1)
	or 0105957M23	ASSEMBLY, Preselector; 2-pole (B3)
	or 0102702J62	ASSEMBLY, Preselector, 2-Pole (B4)
	or 0102702J63	ASSEMBLY, Preselector, 2-Pole (B5)
L3	2405559P18	3-1/2 turns, airwound (B1)
	or 2484238H02	1-1/2 turns (B3)
	or 2405027E38	3-1/2 turns, airwound (B4, B5)
L4	2405559P03	1-1/2 turns, airwound (B1, B3)
	or 2405027E38	3-1/2 turns, airwound (B4, B5)
L5	2405732J22	11 -3/4 turns, Preselector (B1)
	or 2405732J21	10 -3/4 turns, Preselector (B3)
	or 2405732J08	10 turns, Preselector (B4, B5)
L6	2405732J10	12 turns, Preselector (B1)
	or 2405732J01	11 turns, Preselector (B3)
	or 2405732J06	10-1/2 turns, Preselector (B4)
	or 2405732J23	10-1/4 turns, Preselector (B5)
L7	2405732J22	11-3/4 turns, Preselector (B1)
	or 2405732J01	11 turns, Preselector (B3)
	or 2405732J23	10-1/4 turns, Preselector (B4)
	or 2405732J08	10 turns, Preselector (B5)
L8	2405559P22	4 - 1/2 turns, airwound (B1)
	or 2405559P12	4 - 1/2 turns, airwound (B3 2W)
	or 2405559P13	5 - 1/2 turns, airwound (B3 4W, B4, B5)
L9	2405063H24	13 turns, space wound
L10	2405063H13	1.2 uH , tunable
L11	2405063H05	0.4 uH , tunable
L12,13	2405523P39	2 -1/2 turns, spacewound; with core (B1)
	or 2405523P48	1 -1/2 turns, spacewound; with core (B3, B4, B5)
L14	2505129Q02	1.2 uH Choke
L16	2405027E19	Coil, RF (B1)
	or 2405559P19	4-1/2 turns, airwound (B4)
	or 2405559P18	3-1/2 turns, airwound (B4)
	or 2405027E38	3-1/2 turns, airwound (B5)
L17,18	2462575A01	0.39uH Choke
L101	2405559P07	2 -1/2 turns, airwound (B1)
	or 2405559P14	3 -1/2 turns, spacewound (B3 2W)
	or 2484238H02	1 -1/2 turns, fixed (B3 4W)
	or 2405523P06	1-1/2 turns, spacewound (B4, B5)
L104	0105951N35	Assembly, .085 uH Choke, with bead (B1, B3 4W, B4, B5)
	or 0105950L78	Assembly, 1.2 uH Choke, with bead (B3 2W)
L105	2405523P08	3 -1/2 turns, spacewound (B1 2W)
	or 2484238H02	2-1/2 turns, spacewound (B1 4W, B3 4W)
	or 2405559P07	2-1/2 turns, spacewound (B3 2W)
	or 2405523P07	1-1/2 turns, fixed (B4, B5)
L106	2405559P18	3 -1/2 turns, airwound (B1 2W)
	or 2405027E38	3 -1/2 turns (B1 4W, B3 4W, B4)
	or 2405027E21	2 -1/2 turns (B3 2W, B5)
L107	0105950L75	Assembly,1.2uH Choke with bead (B1, B4, B5)
	or 0105951N35	Assembly, .085 uH Choke, with bead (B3)
L108	0105951N35	Assembly, .085uH Choke, with bead
L109	2405027E38	3 -1/2 turns (B1 4W Only, B3 4W Only, B4)
	or 2405027E21	2-1/2 turns, airwound (B5)
L110	0105951N34	Assembly,0.29 uH Choke, with bead (B1 4W Only, B3 4W Only, B5)
	or 0105950L78	Assembly, 1.2uh, with bead (B4)
L111	0105951N35	Assembly, .085 uH Choke, with bead (B1 4W Only, B3 4W Only, B4, B5)
L112	2405027E19	Coil, RF (B1 2W)
	or 2405027E38	3 -1/2 turns (B1 4W)
	or 2405059P19	4 -1/2 turns airwound (B3 2W)
	or 2405027E21	2 -1/2 turns airwound (B3 4W, B4, B5)
L113	0105955N19	Assembly, 0.2 uH Choke, with bead (B1 2W, B3 2W)
	or 0105952N08	Assembly, 0.15uH Choke, with bead (B1 4W, B3 4W)
	or 0102702J40	Assembly, 0.085uH, with Bead (B5)
L114	0105951N34	Assembly, 0.29uH Choke, with bead (B1, B3 4W, B4, B5)
	or 0105951N35	Assembly, .085uH Choke, with bead (B3 2W)
L115	2405559P18	3 -1/2 turns, air wound (B1 2W)
	or 2405207E38	3 -1/2 turns, fixed (B1 4W)
	or 2405559P19	4 -1/2 turns, air wound (B3, B4, B5)
L116	2484238H02	1 -1/2 turns (B1 2W, B3)
	or 2405559P03	1-1/2 turns, airwound (B1 4W)
	or 2405559P09	1-1/2 turns, airwound (B4)
	or 2405027E38	3-1/2 turns, airwound (B5)
L117	0105951N34	Assembly, 0.29 uH, with bead (B1, B3, B5)
	or 0105951N35	Assembly, .085 uH, with bead (B3 2W)
L118	2405027E38	3 -1/2 turns airwound (4W Only)
L119	2405452C08	275 nH choke
L120	2405452C08	275 nH chip (B1, 4W Only, B4, B5)
L121	2405452C09	50 nH choke (B3, 4W Only)
	or 2405452C06	21 nH choke (B4 Only, B5 Only)
L122	2405559P19	4 1/2 turns, airwound (B1 2W)
	or 2405559P18	3 -1/2 turns, airwound (B1 4W,B3 2W)
	or 2405027E21	2 - 1/2 turns airwound (B3 4W, B4)
	or 2405559P14	3 -1/2 turns, airwound (B5)
L123	2405559P18	3 -1/2 turns (B1 2W, B5)
	or 2405027E38	3 -1/2 turns (B1 4W, B3 2W, B4)
	or 2405559P14	3 -1/2 turns airwound (B3 4W)
L124	2482723H28	0.29 uH Choke
L126,127	2462575A01	0.39 uH Choke
L128	2462575A01	0.39 uH (B1 2W, B3 2W, B4, B5)
	or 2462575A03	0.82 uH Choke (B1 4W)
	or 2462575A04	1 uH Choke (B3 4W)

L129	2462575A03	0.82 uH Choke (B1)
	or 2462575A01	0.39 uH Choke (B3 2W, B4, B5)
	or 2462575A04	Choke (B3, 4W)
L131	2405027E38	3-1/2 turns airwound (B1 2W, B3, B4)
	or 2405027E21	2-1/2 turns airwound (B1 4W, B5)
L132	2405452C06	21 nH Choke (B1 and B3 only)
L303, 304	2462575A01	0.39 uH Choke
LS1	5005155Q03	**TRANSDUCER:**
MK1	0105956M62	**MICROPHONE ASSEMBLY:**
		PLUG:
P1, P2	2805572P01	Connector, Flex Top;13-pin
P3, 4	2805144Q01	Connector, Synthesizer; 7-pin
P5	2805250Q01	Connector, Front Cover
P6	2805247Q01	Connector, I-F
P7	------	Not field repairable, order Top Control Panel Assembly 0105951N41
		TRANSISTOR: See Note
Q1	4880182D39	NPN
Q2	4805452G13	Dual Gate MOSFET
Q102	4802245J06	NPN
Q103	4805474G48	NPN (2W)
	or 4805474G38	NPN (4W)
Q104	4800869887	NPN (B1 4W Only, B3 4W Only)
	or 4880225C09	NPN (B4, B5)
Q106	4805128M09	NPN (2W Only)
		RESISTOR, Fixed: Ω±5%;1/10W unless specified
R1	0660076A71	8.2k (B1, B4, B5)
	or 0660076A69	6.8k (B3)
R2	0660076A89	47k
R3	0660076A59	2.7k (B1, B4, B5)
	or 0660076A57	2.2k (B3)
R4	0660076M01	0 (B1 2W Only , B3 2W Only)
	or -----	Refer to C41 for 4W application
R5	0660076A45	680
R6	0660076A35	270 (B1)
	or 0660076A39	390 (B3, B4)
	or 0660076A34	240 (B5)
R7	0660076M01	0
R8	0660076A54	1.6k (B1, B3)
	or 0660076A71	8.2k (B4)
	or 0660076A56	2k (B5)
R9	0660076A56	2k (B1)
	or 0660076A57	2.2k (B3)
	or 0660076A49	1k (B4 Only)
R11	0660076M01	0 (B3 4W Only)
	or -----	Refer to C49 for other applications
R12	0611024A85	33k (B1, B3)
	or 0660076A85	33k (B4, B5)
R102	0660076A46	750 (2W Only)
R103	0660076A65	4.7k (B1 2W)
	or 0660076A64	4.3k (B3, B1 4W)
	or 0660076A73	10k (B4)
	or 0660076A59	2.7k (B5)
R104	0660076A46	750 (B1 4W, B3 4W)
R107	0660076A17	47 (B1 2W, B3 2W)
	or 0660076A29	150 (B1 4W, B3 4W, B4)
	or 0660076A31	180 (B5)
R113	0660076A22	75 (B1 2W)
	or 0660076A25	100 (B3 2W)
	or 0660076M01	0 (B1 4W, B3 4W, B4)
	or 0660076A18	51 (B5)
R115	0660076A22	75 (B1 4W Only, B5)
	or 0660076A25	100 (B3 4W Only)
	or 0660076A21	68 (B4)
R118	0660076A72	9.1k
R119	0660076A87	39k
R120	1805559S02	Pot., 50k
R121	0660076A49	1k (B1 2W, B3 2W)
	or 0660076A31	390 (B1 4W ,B3 4W)
	or 0660076A41	470 (B4, B5)
R122	0660076A79	18k (B1)
	or 0660076A67	5.6k (B3 2W)
	or 0660076A63	3.9k (B3 4W)
	or 0660076A64	4.3k (B4, B5)
R123	0660076A48	910 (B1, B4, B5)
	or 0660076A49	1k (B3)
R127	0660076A41	470
R128	0660076A52	1.3k (B1, B4, B5)
	or 0660076A51	1.2k (B3)
R129	0660076A42	510
R133	0660076A45	680

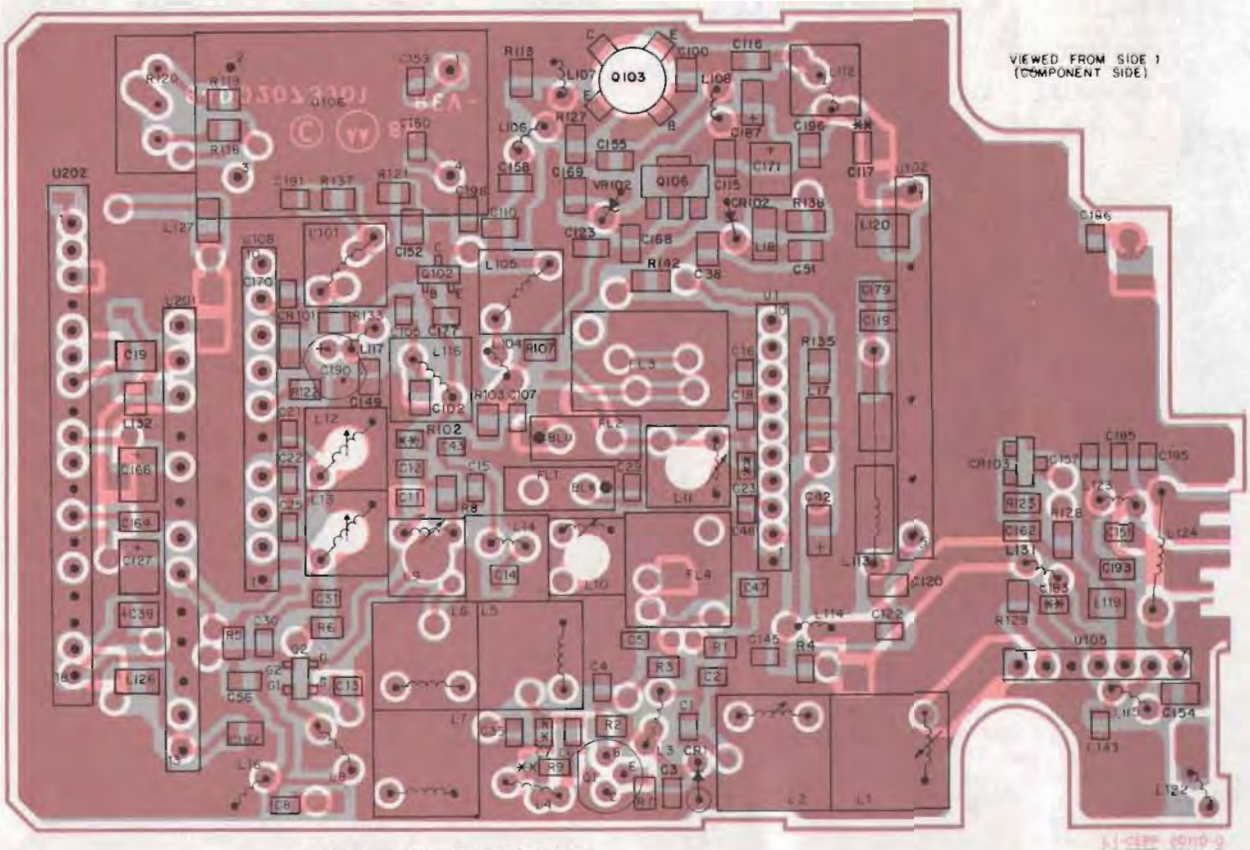
R135	0660075C45	680; 1/4W ; Carbon Film (2W Only)
R137	0660076A18	51
R138	0660076A15	39
R140	1805100Q03	Pot., 25k
R141	0660076M01	0 (B1 4W Only)
	or 0660076L18	5.1 (B4, B5)
R142	0660076A18	51
		SWITCH:
S1	-----	On/Off, Part of R140
S2	4005265Q05	6-position, BCD
S3	4005101Q01	Toggle, PL Disable
S301	3905834K06	Snap Dome, Monitor
S302	3905834K06	Snap Dome, PTT
S303	3905834K06	Snap Dome, Light / Scan
		CIRCUIT MODULE: See Note
U1	5102001J08	I-F
U102	5105729E79	2-Watt PA (B1 2W)
	or 5105729E81	4-Watt PA (B1 4W)
	or 5105729E80	2-Watt PA (B3 2W)
	or 5105729E82	4-Watt PA (B3 4W)
	or 5105822P68	4-Watt PA (B4)
	or 5105822P69	4-Watt PA (B5)
U105	5105822P85	Antenna Switch (B1 2W)
	or 5105729E75	Antenna Switch (B1 4W)
	or 5105822P63	Antenna Switch (B3 2W)
	or 5102001J19	Antenna Switch (B3 4W)
	or 5105729E77	Antenna Switch (B4)
	or 5105729E78	Antenna Switch (B5)
U106	5105729E52	Ref. Oscillator, 5-PPM
U108	5102001J05	Buffer (B1)
	or 5102001J02	Buffer (B3)
	or 5105822P90	Buffer (B4)
	or 5105822P91	Buffer (B5)
U201	5105822P54	VCO (B1)
	or 5102001J45	VCO (B3)
	or 5105822P57	VCO (B4)
	or 5105822P58	VCO (B5)
U202	5105822P84	Synthesizer (B1)
	or 5105822P75	Synthesizer (B3, B4, B5)
		DIODE: See Note
VR102	4805189E05	Zener, 7.5V (2W Only)

NON-REFERENCED ITEMS

		ASSEMBLY, Preselector Can; for L5, L6, L7
	0102706J47	(B1, B3)
	or 0102702J38	(B4)
	or 0102702J39	(B5)
	0705196A04	BOOT, for FL1, FL2
	1400861196	INSULATOR, for Q104
	2605524P01	CAN, for L14, L112, L116
	2605524P03	CAN, for L105 (M 2W)
	2605567S01	HEAT SINK, for Q104
	7505695R01	PAD, for U106
	7505295 B07	PAD, for FL1, FL2

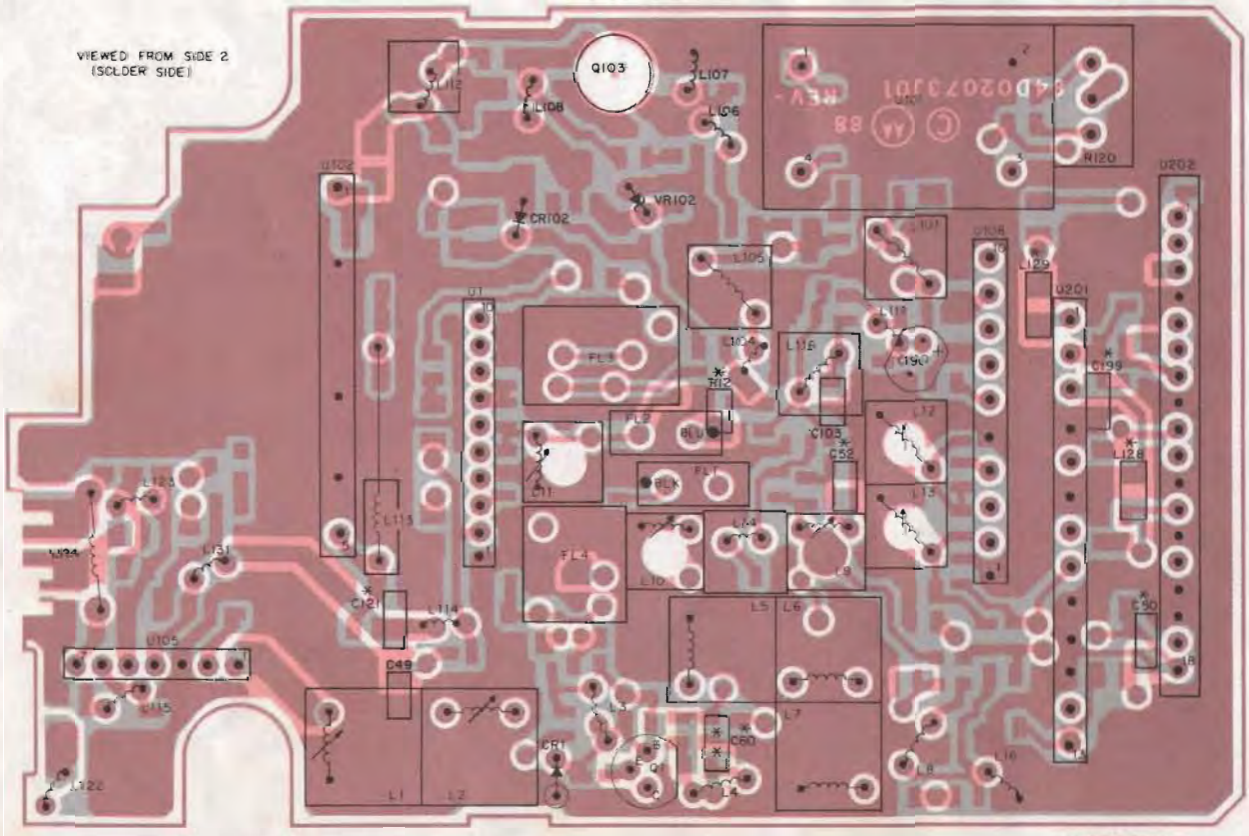
NOTE: For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.

UHF 2-WATT RADIOS



** REFER TO ELECTRICAL PARTS LIST FOR USAGE

OL-CEPF-20112-B



* BACK OF THE BOARD
** REFER TO ELECTRICAL PARTS LIST FOR USAGE

OL-CEPF-20115-A

SCHEMATIC AND CIRCUIT BOARD NOTES

1. UNLESS OTHERWISE STATED, RESISTANCES ARE IN OHMS (k=1000), CAPACITANCES LESS THAT ARE LESS THAN 1 ARE IN MICROFARADS, AND CAPACITANCES 1 OR GREATER ARE IN PICOFARADS.

2. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND USING MOTOROLA DC MULTIMETER OR EQUIVALENT. TRANSMITTER MEASUREMENTS SHOULD BE MADE WITH A 1.2µH RF CHOKE IN SERIES WITH VOLTAGE PROBE TO PREVENT CIRCUIT LOADING.

3. REFERENCE DESIGNATIONS ARE ASSIGNED IN THE FOLLOWING MANNER:

UNIT SERIES	=	RECEIVER
100 SERIES	=	TRANSMITTER
200 SERIES	=	VCO & SYNTHESIZER
300 SERIES	=	MISCELLANEOUS
400 SERIES	=	CONTROLLER FLEX
500 SERIES	=	DISPLAY BOARD
800 SERIES	=	SIGNALLING (CONTROLLER FLEX)

4. INTERCONNECT TIE POINT LEGEND:

- (A) B+ TO MOTHER BOARD
- (B) CONTROLLER FLEX B+
- (5V REG) REGULATED 5V
- (M1) METERING POINTS M1, M2, M3
- (M) TO MOTHER BOARD
- (R) RECEIVER 10V
- (R5) RECEIVER 5V
- [S] TO SYNTHESIZER BOARD
- (T) TRANSMIT 10V
- (T5) TRANSMIT 5V
- [T] TO CONTROL TOP FLEX
- [U] TO UNIVERSAL CONNECTOR
- [*] TO FRONT COVER
- (V1) REGULATED 8V

TEPF-18834-O

VOLTAGE OVERLAY AND WAVEFORM NOTES

1. AC VOLTAGE READINGS IN dBm ARE MADE VIA A 1pF CAPACITOR INTO THE 50 OHM ADAPTER OF AN RF mV METER. RX READINGS ARE MADE WITH -20dBm CARRIER SIGNAL INTO REMOTE RF PORT. TX READINGS MADE WITH REMOTE RF PORT INTO 50 OHMS.

2. AC VOLTAGE READINGS IN mV ARE MADE VIA A HIGH IMPEDANCE RF mV METER.

3. INJECT (AT SELECTED ANTENNA) AN ON-CHANNEL SIGNAL AT 1mV, 1kHz MODULATION AT 3kHz DEVIATION.

4. VERIFY USING PROGRAMMER.

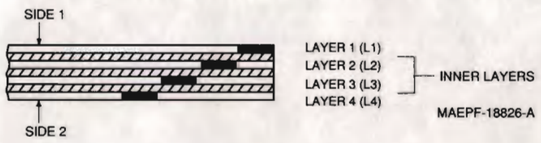
5. EXTERNAL SIGNAL FROM AUDIO SIGNAL GENERATOR AT MIC. INPUT.

6. THIS READING IS OBTAINED BY SHORTING BASE OF Q102 TO GROUND. (Q102-B ON ALIGNMENT/ ADJUSTMENT LOCATIONS DIAGRAM.

7. THIS READING IS OBTAINED BY SOLDERING A 47-OHM RESISTOR ACROSS L13 TO REDUCE 1ST L.O INJECTION FEED THROUGH. (REFER TO ALIGNMENT/ ADJUSTMENT LOCATIONS DIAGRAM).

TEPF-18835-O

4-LAYER CIRCUIT BOARD DETAIL VIEWING
COPPER STEPS IN PROPER LAYER SEQUENCE.

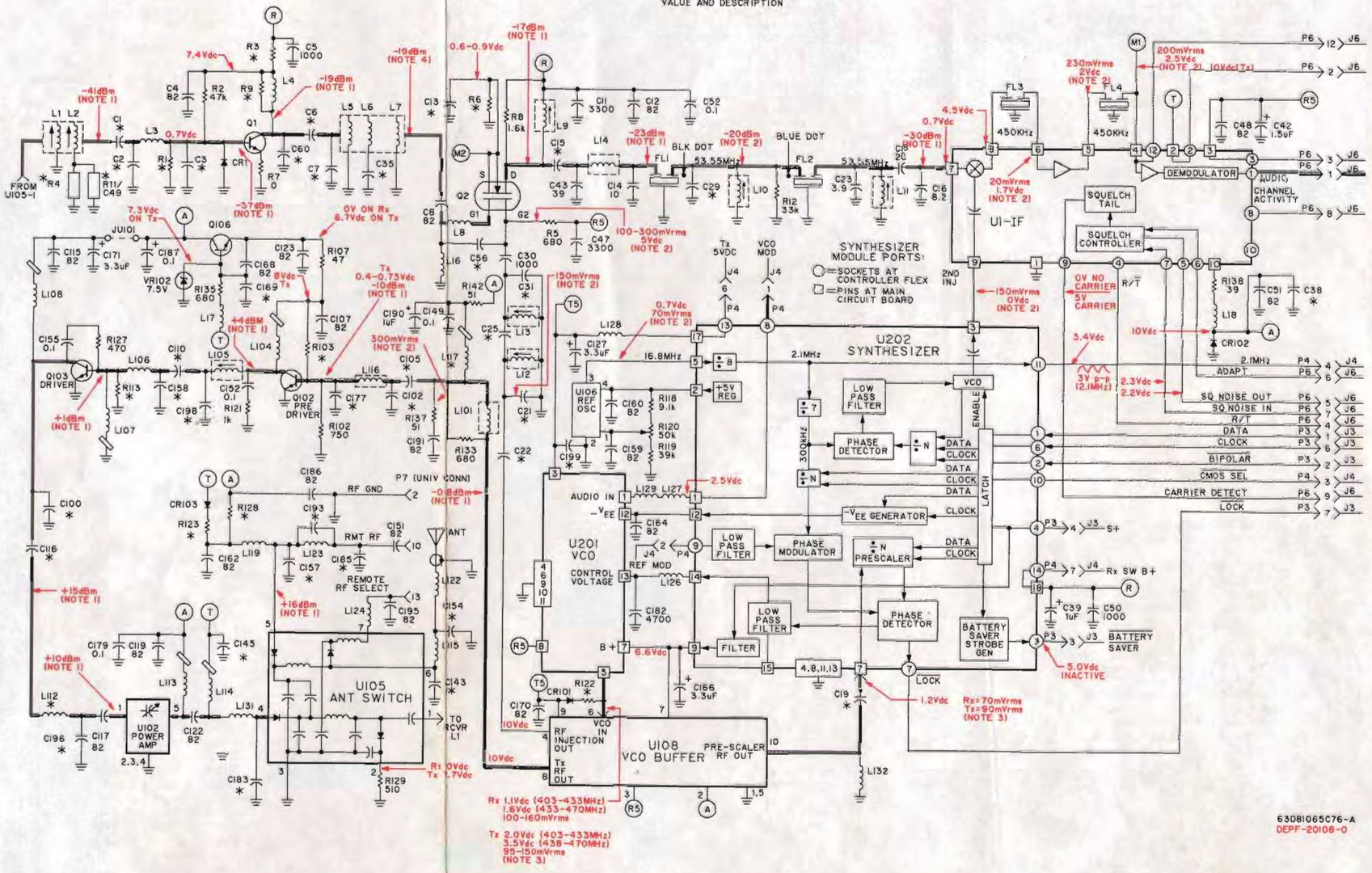


MAEPF-18826-A

ITEM REVISIONS CHART

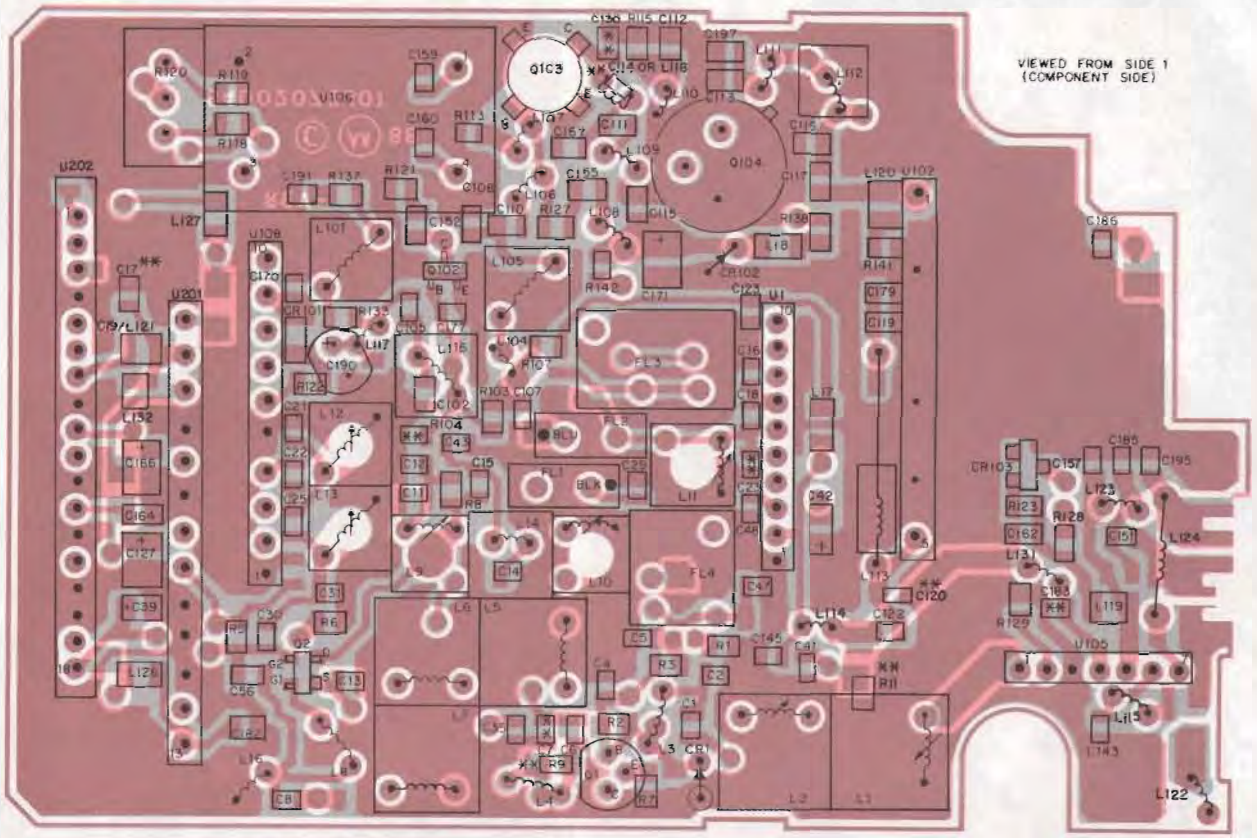
ITEM NO.	FREQ. (MHz)	POWER OUTPUT	SUFFIX
NUE6911C	403-433	2W	
NUE6912E	438-470	2W	

* REFER TO ELECTRICAL PARTS LIST FOR VALUE AND DESCRIPTION



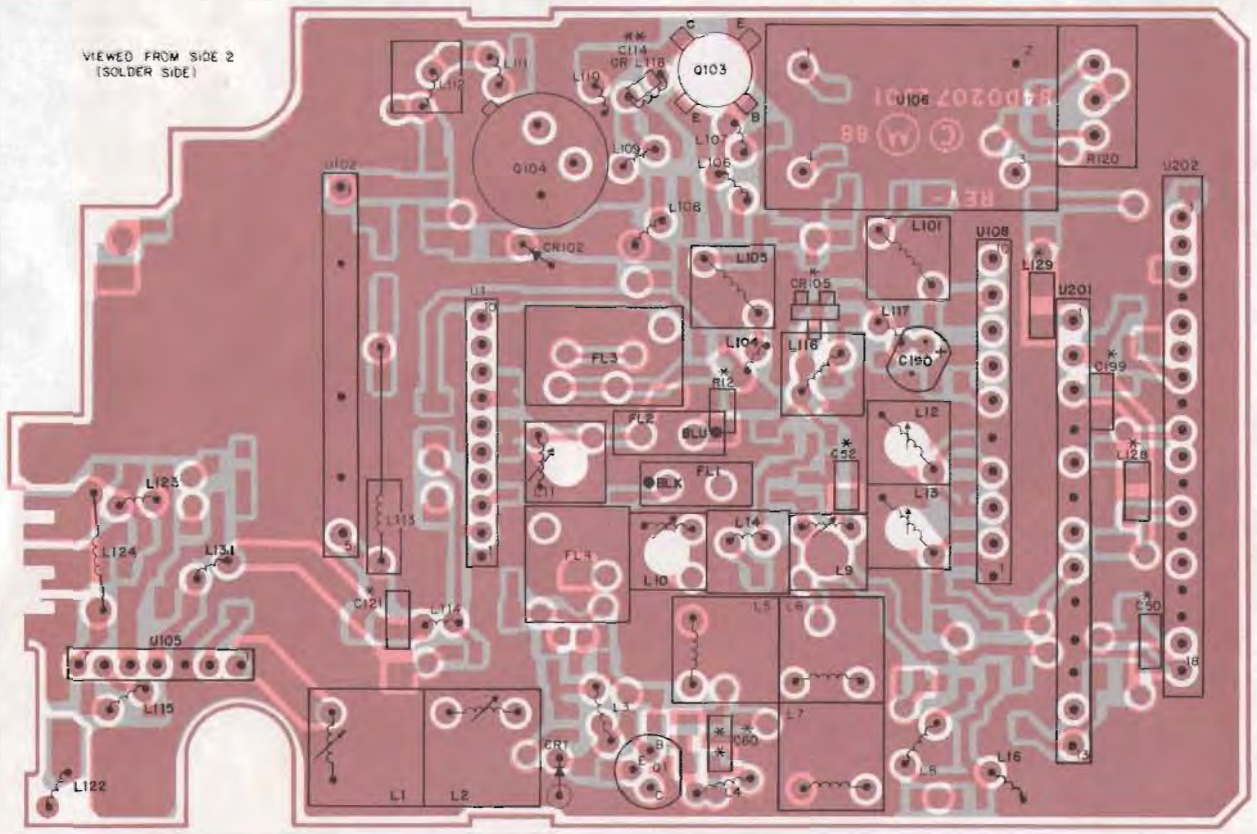
63D81065C76-A
DEPF-20108-O

UHF TRANSCEIVER SCHEMATIC DIAGRAM AND MAIN CIRCUIT BOARD COMPONENT LOCATION DIAGRAMS (2-W RADIOS)



** REFER TO ELECTRICAL PARTS LIST FOR USAGE

OL-CEPF-20106-A



* BACK OF THE BOARD
** REFER TO ELECTRICAL PARTS LIST FOR USAGE

OL-CEPF-20107-A

SCHEMATIC AND CIRCUIT BOARD NOTES

1. UNLESS OTHERWISE STATED, RESISTANCES ARE IN OHMS (k=1000), CAPACITANCES LESS THAT ARE LESS THAN 1 ARE IN MICROFARADS, AND CAPACITANCES 1 OR GREATER ARE IN PICOFARADS.

2. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND USING MOTOROLA DC MULTIMETER OR EQUIVALENT. TRANSMITTER MEASUREMENTS SHOULD BE MADE WITH A 1.2µH RF CHOKE IN SERIES WITH VOLTAGE PROBE TO PREVENT CIRCUIT LOADING.

3. REFERENCE DESIGNATIONS ARE ASSIGNED IN THE FOLLOWING MANNER:

UNIT SERIES	=	RECEIVER
100 SERIES	=	TRANSMITTER
200 SERIES	=	VCO & SYNTHESIZER
300 SERIES	=	MISCELLANEOUS
400 SERIES	=	CONTROLLER FLEX
500 SERIES	=	DISPLAY BOARD
800 SERIES	=	SIGNALLING (CONTROLLER FLEX)

4. INTERCONNECT TIE POINT LEGEND:

- (A) B+ TO MOTHER BOARD
- (B) CONTROLLER FLEX B+
- (5V REG) REGULATED 5V
- (M1) METERING POINTS M1, M2, M3
- (M) TO MOTHER BOARD
- (R) RECEIVER 10V
- (R5) RECEIVER 5V
- [S] TO SYNTHESIZER BOARD
- (T) TRANSMIT 10V
- (T5) TRANSMIT 5V
- [T] TO CONTROL TOP FLEX
- [U] TO UNIVERSAL CONNECTOR
- [*] TO FRONT COVER
- (V1) REGULATED 8V

TEPF-18834-O

VOLTAGE OVERLAY AND WAVEFORM NOTES

1. AC VOLTAGE READINGS IN dBm ARE MADE VIA A 1pF CAPACITOR INTO THE 50 OHM ADAPTER OF AN RF mV METER. RX READINGS ARE MADE WITH -20dBm CARRIER SIGNAL INTO REMOTE RF PORT. TX READINGS MADE WITH REMOTE RF PORT INTO 50 OHMS.

2. AC VOLTAGE READINGS IN mV ARE MADE VIA A HIGH IMPEDANCE RF mV METER.

3. INJECT (AT SELECTED ANTENNA) AN ON-CHANNEL SIGNAL AT 1mV, 1kHz MODULATION AT 3kHz DEVIATION.

4. VERIFY USING PROGRAMMER.

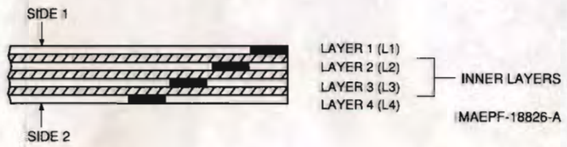
5. EXTERNAL SIGNAL FROM AUDIO SIGNAL GENERATOR AT MIC. INPUT.

6. THIS READING IS OBTAINED BY SHORTING BASE OF Q102 TO GROUND. (Q102-B ON ALIGNMENT/ ADJUSTMENT LOCATIONS DIAGRAM.

7. THIS READING IS OBTAINED BY SOLDERING A 47-OHM RESISTOR ACROSS L13 TO REDUCE 1ST L.O INJECTION FEED THROUGH. (REFER TO ALIGNMENT/ ADJUSTMENT LOCATIONS DIAGRAM).

TEPF-18835-O

4-LAYER CIRCUIT BOARD DETAIL VIEWING COPPER STEPS IN PROPER LAYER SEQUENCE.

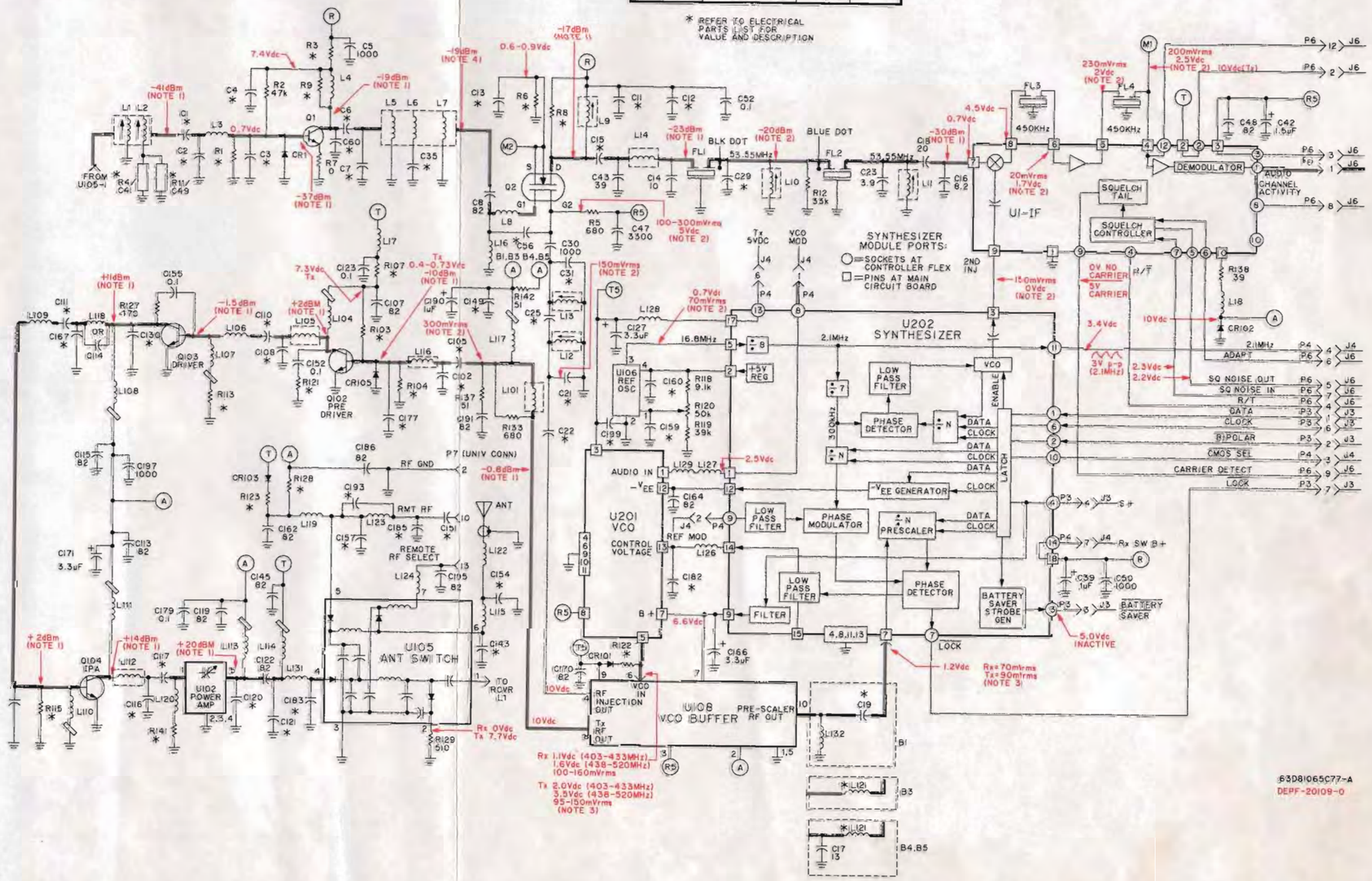


MAEPF-18826-A

ITEM REVISIONS CHART

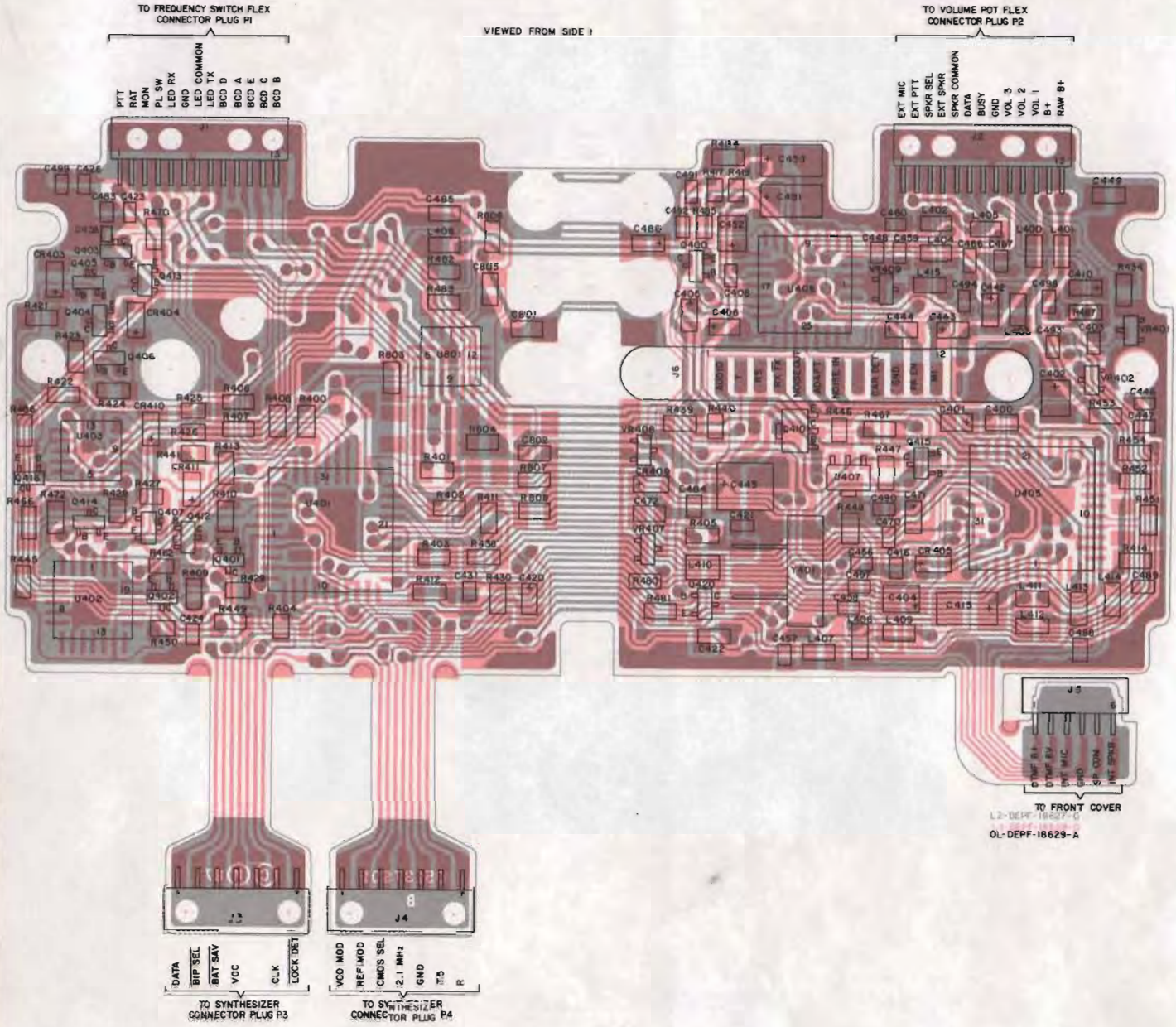
ITEM NO.	FREQ. (MHz)	(BAND)	POWER OUTPUT	SUFFIX
NUE6901C	403-433	(B1)	4W	
NUE6902D	438-470	(B3)	4W	
NUE6903A	470-500	(B4)	4W	
NUE6904A	488-520	(B5)	4W	

* REFER TO ELECTRICAL PARTS LIST FOR VALUE AND DESCRIPTION



63D81065C77-A
DEPF-20109-O

CONTROLLER FLEX



CONTROLLER FLEX SCHEMATIC DIAGRAM AND COMPONENT LOCATION DIAGRAM

U801
SIGNALLING OPTION
PART OF
CONTROLLER FLEX

ITEM REVISION CHART	
ITEM NO.	SUFFIX
NTN4568B	

U405 AUDIO FILTER

U406 AUDIO PA

U401 MICROCOMPUTER

U402 EEPROM

U403

U801

LIMITER
LOW PASS FILTER
REF MOD CONTROL
VCO MOD CONTROL
AUDIO FILTER
VOLUME CONTROL
PL/DPL FILTER
Rx/Tx SWITCH
PL/DPL GEN
DEADMAN TIMER
MICROPROCESSOR INTERFACE

EXT MIC IN
INT MIC IN
EXT MIC SEL
INT AMP
COM AMP
EXT AMP
EXT SPKR SEL

MK1 ASSEMBLY
LS1 INT SPKR
VOL POT FLEX
UNIVERSAL INTERCONNECT BOARD
UNIVERSAL CONNECTOR
EXT SPK
EXT MIC
EXT PTT
BUSY
DATA

MAX. SETTING VCO MOD (NOTE 4)
MAX. SETTING REF MOD (NOTE 4)
MAX. VOL. SETTING (NOTES 3,4)
4.47Vrms RATED OUTPUT MEASURED ACROSS 40Ω (NOTE 3)
(INT.SPKR SELECTED)
(EXT.SPKR SELECTED)
1KHz, 5mVrms TEST SIGNAL INT. MIC SELECTED (NOTE 5)
1KHz, 5mVrms TEST SIGNAL EXT. MIC SELECTED (NOTE 5)
PL ONLY
TX SYNTH LOCK 0V SYNTH UNLOCK 5Vdc
0Vdc DISABLED 5Vdc ENABLED
0Vdc SQ 5Vdc UNSQ
0Vdc Tx 5Vdc Rx
NO BATTERY SAVER, 5Vdc
LOW BATT
PL DECODE FROM U405-27
3.686MHz 2.5Vdc 5V p-p
10Vdc Rx
10Vdc Tx
5Vdc Rx
5Vdc Tx
Rx SW B+
Tx SW B+

S1 ON/OFF
S2 BCD FREQ SW
S3 PL DISABLE PTT
S301 MON
S302 INT PTT
S303 MON

63D81065C78-A
OL-DEPF-20445-O

NTN4568C Controller Flex

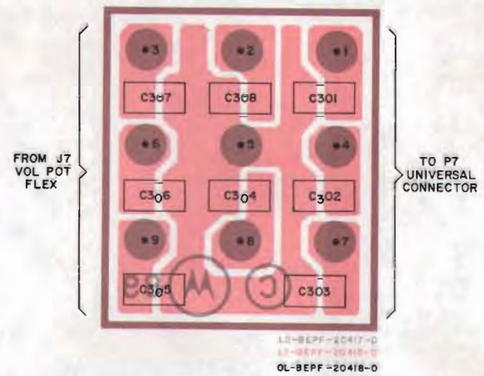
TPLF-3602-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: µF ±5%; 50V, unless stated
C400	2113741B33	3300pF±10%
C401	2360562A07	0.47±20%; 25V
C402	2360562A13	1.0; 16V
C403	2160521G37	0.1+80-20%; 25V
C404	2360562A28	4.7; 10V
C405, 406	2111032B13	0.1 +80 -20%
C408	2113741A37	.0047±10%
C410	2111032B13	0.1 +80 -20%
C415	2360562A43	10; 16V
C416	2160521G37	0.1+80-20%; 25V
C420	2360562A13	1; 16V
C421	2113740A29	10pF
C422	2113740B29	15pF
C423	2113740A55	100pF
C424	2160521G37	0.1+80-20%; 25V
C426	2113740A55	100pF
C431	2160521G37	0.1+80-20%; 25V
C438	2113740A67	330
C442, 443, 444	2360562A13	1; 16V
C445	2369562A35	10; 25V
C446	2113741A39	5600pF
C447	2113741A31	2700pF
C448	2113741A45	.01
C449	2111032B13	0.1+80-20%
C452	2360562A28	4.7; 10V
C453	2360562A43	10; 16V
C456 thru C460	2113740A59	150pF
C466, 467	2113740A53	82pF
C470	2113741A45	.01
C471	2360562A13	1; 16V
C472	2113740B47	82pF
C481	2360562A43	10; 16V
C483, 484	2113741A21	1000pF
C485	2113740B47	82pF
C486	2360562A13	1; 16V
C488, 489	2160521G37	0.1+80-20%; 25V
C490	2113741A45	.01
C491	2113741A39	5600pF
C492	2113741A53	.022
C493, 494	2160521G37	0.1+80-20%; 25V
C497	2113741A53	.022
C498	2113741A37	.0047±10%
C499	2113741A45	.01
C801	2113741B33	3300pF
C802	2111032B13	0.1+80-20%
C805	2113741B45	0.1
		DIODE: See Note
CR403, 404, 405	4805494Q04	Silicon
CR409, 410, 411	4805494Q04	Silicon
		JACK:
J1	0905573P02	Connector, Controller Flex Top; 13-pin
J2	0905573P02	Connector, Controller Flex Top; 13-pin
J3	0905577P01	Connector, Synthesizer; 7-pin
J4	0905577P01	Connector, Synthesizer; 7-pin
J5	0905249Q01	Connector, 6-pin
J6	0105959M27	Assembly, Connector; I-F
J7	----------	Not field replaceable, order Volume Pot Flex Assembly 0105956M66
		COIL, RF:
L400 thru L409	2462575A01	0.39µH
L410	2460590A02	150µH
L411thru L415	2462575A01	0.39µH
		TRANSISTOR: See Note
Q400	4805128M94	PNP
Q401	4805128M12	NPN
Q402 thru Q404	4805128M94	PNP
Q405, 406	4805128M12	NPN
Q407	4805128M94	PNP
Q410	4805128M10	PNP
Q412	4805128M94	PNP
Q413	4805128M12	NPN
Q414,	4805128M94	PNP
Q415, 416	4805128M12	NPN
Q420	4805128M12	NPN
		RESISTOR, Fixed: Ω±5%; 1/8W unless stated
R400	0611077B23	100k
R401, 402	0611077A98	10k
R403	0611077A92	5.6k
R404	0611076A73	10k
R405	0660076K49	10 Meg±10%
R406, 407, 408	0611077B23	100k
R409	0611077A72	820
R410	0611077A84	2.7k
R411, 412, 413	0611077B23	100k
R414	0611077B16	51k
R417	0660076A56	2k; 1/10W
R419	0660076A56	2k; 1/10W
R421	0611077A66	470
R422	0611077A76	1.2k
R423	0611077B09	27k
R424	0611077A78	1.5k
R425	0660076F01	100k±1%
R426	0660076E84	30k±1%
R427	0660076A94	75k; 1/10W
R428	0660076B05	150k
R429	0660076B01	100k
R430	0611077A98	10k
R434	0611077A66	470
R438	0611077B23	100k
R439	0611077A98	10k
R440	0660076A73	10k; 1/10W
R441	0660076B25	1 Meg; 1/10W
R445	0611077A98	10k
R446	0660076A25	100; 1/10W
R447	0611024J08	158k±1%
R448	0611024H84	90.9k±1%
R449	0611077A26	10
R450	0611076A73	10k; 1/10W
R451	0611077B15	47k
R452	0611077A79	1.6k
R453, 454	0611077A74	1k
R462	0660076A73	10k; 1/10W
R466	0611077A98	10k
R467	0611077A84	2.7k
R470	0611077A50	100
R472	0611077A50	100
R480	0611077B23	100k
R481	0611077A98	10k
R482	0611024J09	175k±1%
R483	0611024H88	100k±1%
R484	0611024H09	15k±1%
R485	0611024E90	51k±1%
R486, 487	0611077A82	2.2k
R803	0611024J16	182k±1%
R804	0611024H88	100k±1%
R806, 807	0611077A97	9.1k
R808	0611076B23	1 Meg
		CIRCUIT MODULE: See Note
U401	0105955Q46	Microcomputer
U402	0105957N84	EEPROM
U403	0105957N87	Hex Gate
U405	0105951Q59	Audio Filter
U406	0105958P03	Audio PA
U407	5160880B01	5V Regulator, CMOS
U801	0105957N83	Quad Op Amp
		DIODE: See Note
VR401, 402	4880140L09	Zener, 6.2V
VR407,408, 409	4880140L09	Zener, 6.2V
		CRYSTAL:
Y401	4805664G33	3.6864 MHz

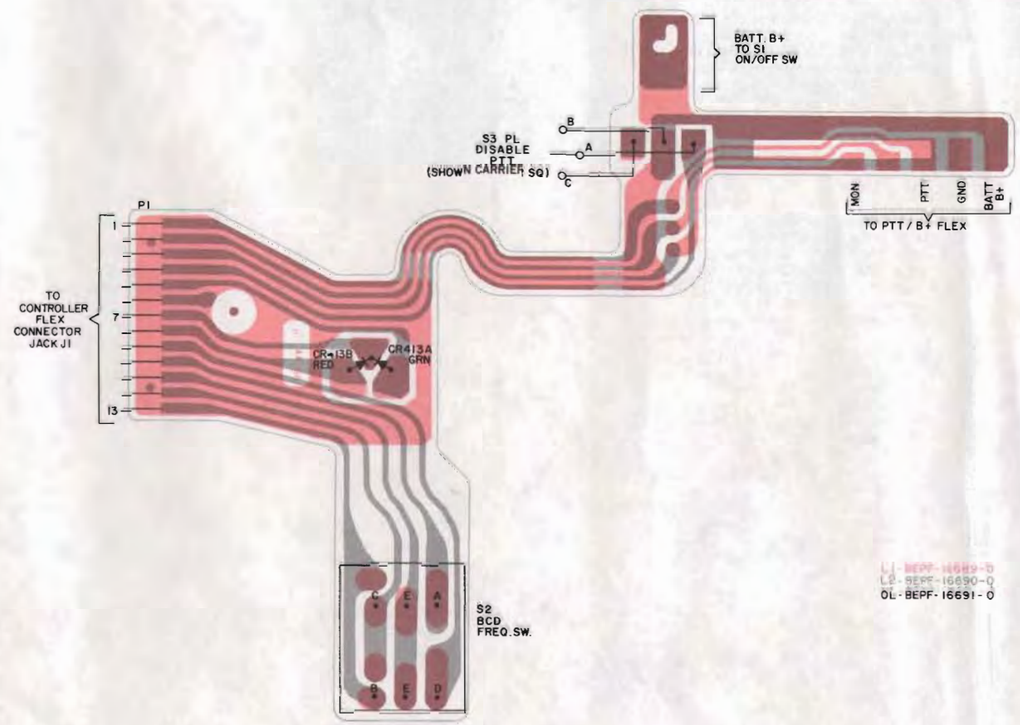
NOTES:

1. For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.

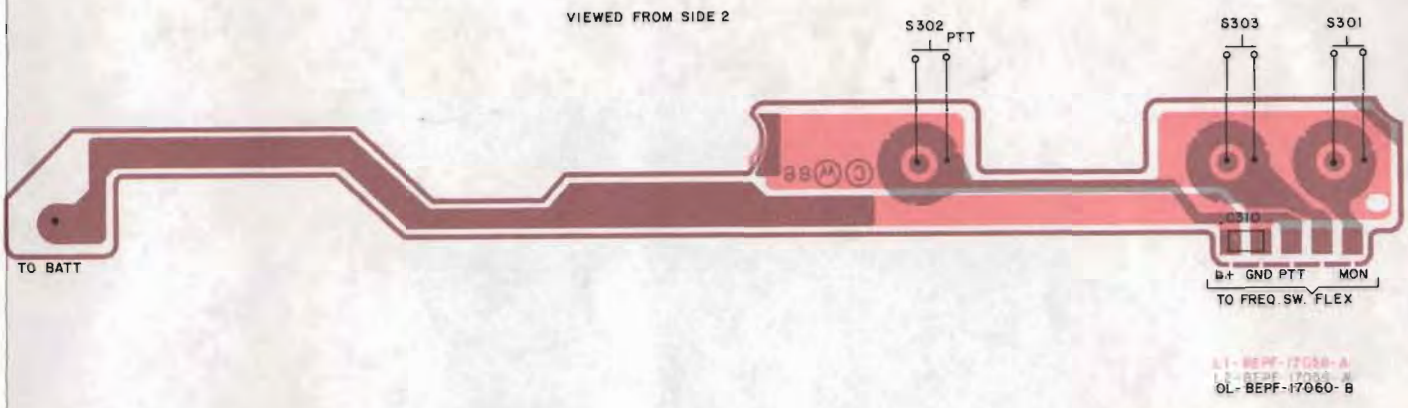
UNIVERSAL INTERCONNECT BOARD



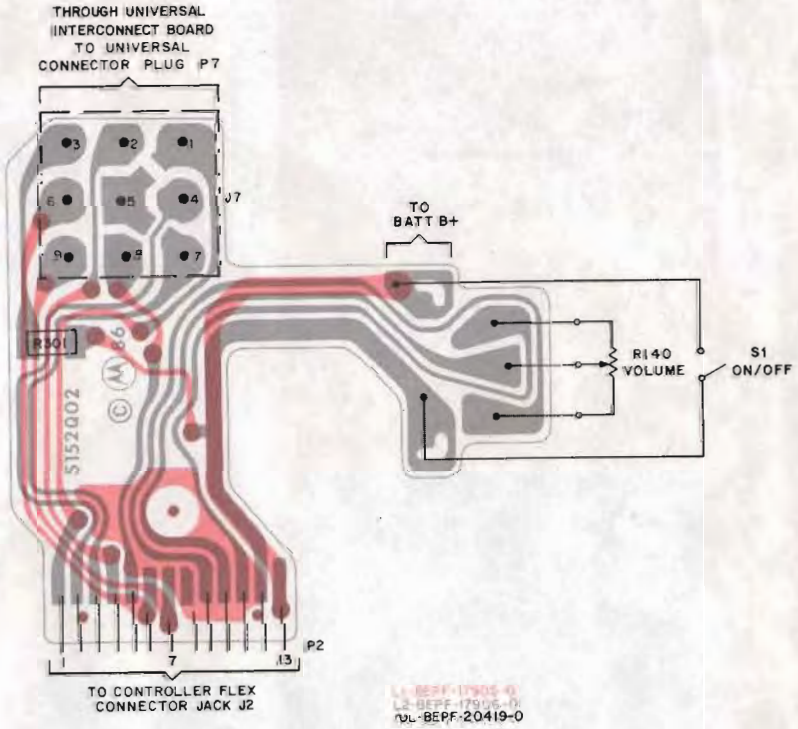
FREQUENCY SWITCH FLEX



PTT/B+ FLEX



VOLUME POT FLEX



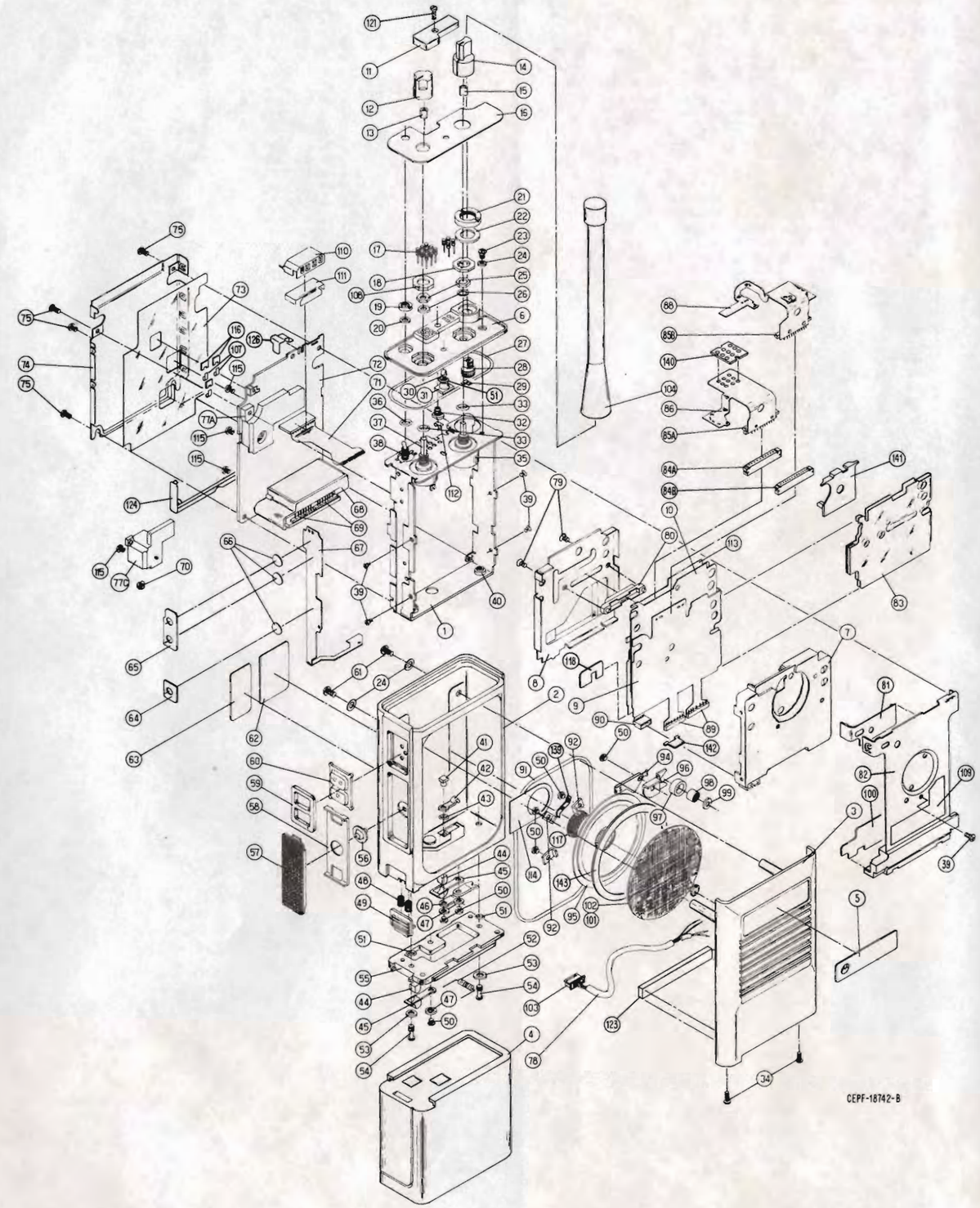
HT600 Exploded View Parts List

TPLF-3632-B

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	0105956M63	ASSEMBLY, Frame; includes: * ITEM 1 Frame * ITEM 40
2	0105955N18	ASSEMBLY, Housing; includes: * ITEM 2 Housing * ITEMS 56, 58, 59 and 60
3	1505527P01	COVER, Front
4	----	BATTERY (See Model Chart in Theory/Maintenance Manual)
5	3305543P01	NAMEPLATE, Front
6	0105951N41	ASSEMBLY, Top Control Panel; includes: * ITEM 6 Panel * ITEMS 17, 28, 29, and 32
7	1505182S01	CARRIER, Flex Top
8	2605184Q01	SHIELD, Bottom
9	0105956M73	ASSEMBLY, Controller Flex; includes: * ITEM 9 Controller Flex * ITEMS 10, 80, 84, 89, 90, and 118 (The Controller Flex Assembly also includes electrical parts. See Note)
10	----	* SHIELD, Center; part of item 9
11	0102706J99	ASSEMBLY, Dust Cover
12	0105951N79	ASSEMBLY, Knob; includes: * ITEM 12 Knob * ITEM 13
13	----	* CLIP, Push; part of item 12
14	0105950N92	* ASSEMBLY, Knob; includes: * ITEM 14 Knob * ITEM 15
15	----	* Clip, Push; part of item 14
16	1305676R01	ESCUTCHEON (2-Freq. Radios)
or	1305676R02	ESCUTCHEON (6-Freq. Radios)
17	See Note	* PIN, Contact (P7); part of item 6
18	0405218Q01	WASHER
19	0205163Q01	NUT, Spanner
20	0405162Q01	WASHER, Flat
21	0205765L02	NUT, Spanner
22	0405216L04	WASHER, Flat
23	0300136785	SCREW, Phillips Hd., 4-40 X 3/16"
24	0484345A06	WASHER, Seal
25	0205629L01	NUT, Hex; 2 req'd
26	0405162Q02	WASHER, Flat; 2 req'd
27	3205141Q02	GASKET, O-Ring
28	----	* BUSHING, Antenna; part of item 6
29	----	LUG, Antenna; part of item 6
30	See Note	LED, Bicolor (CR413A/CR413B)
31	3205131S01	SEAL, LED
32	----	* STUD, Insert; part of item 6
33	3205082E01	GASKET, O-Ring
34	0300140041	SCREW, Phillips; 2-56 X 1/4"
35	See Note	SWITCH, Frequency (S2)
36	3205141Q03	GASKET, O-Ring
37	See Note	SWITCH/POT, On-Off/Volume (S1/R140)
38	See Note	SWITCH, PL (S3)
39	0300140369	SCREW, Flat Hd.; 2-56 X 1/8"
40	----	* INSERT, Frame; part of item 1
41	4605945K05	CONTACT STUD, Battery
42	3905127Q01	CONTACT, B +
43	3205082E24	GASKET, O-ring
44	0705830C02	SUPPORT, Contact
45	3905421C13	CONTACT, Battery
46	2905124Q01	LUG
47	3205082E03	O-Ring
48	4105944K01	SPRING, Battery Latch
49	5505536P01	LATCH
50	0300139982	SCREW, Phillips Hd.; 2-56 X 5/32"
51	3205082E03	GASKET, O-Ring
52	See Note	FUSE (F-1)
53	0400009761	LOCKWASHER, Split #4
54	0305941K01	SCREW
55	6405531P02	PLATE, Base
56	----	* ACTUATOR, PTT; part of item 2
57	4505535P01	LEVER, PTT
58	----	* RETAINER, PTT; part of item 2
59	----	* PLATE, Actuator Button; part of item 2
60	----	* BUTTON, Actuator; part of item 2
61	0305137Q01	SCREW, Phillips; 4-40 X 5/16"
62	----	LABEL, FCC
63	----	LABEL
64	----	* SEAL, Dome (PTT); part of item 67
65	----	* SEAL, Dome (Mon); part of item 67
66	----	* CONTACT, Snap Dome; part of item 67
67	0105951N40	ASSEMBLY, B +/PTT Flex; includes: * ITEM 67/Flex * ITEMS 64, 65, and 66
68	1505533P01	HOUSING, VCO
69	See Note	PLUG (P3, P4)
70	0300139675	SCREW, Flat Hd.; 2-56 X 5/32"
71	8405149Q01	FLEX, Connector
72	----	Typical Circuit Board
73	1405511R02	INSULATOR, Back Shield
74	2605775R02	SHIELD, Main Back
75	0300136772	SCREW, Phillips Hd.; 2-56 X 5/16"
76	----	Not Used
77A	2605532P01	HEATSINK (High Power Models)
77B	----	Not Used
77C	2605578P01	HEATSINK (Low Power Models)
78	----	* TUBING, Heat Shrink; part of item 98
79	0300138620	SCREW, Phillips; 2-56 X 5/16"
80	----	* HEADER, part of item 9
81	1405753R01	INSULATOR, Front Shield
82	0105951P28	* ASSEMBLY, Front Shield; includes item 109
83	1405264Q01	INSULATOR, Flex
84A	See Note	* JACK (J2), part of item 9
84B	See Note	* JACK (J1), part of item 9
85A	See Note	* JACK (P2), part of item 86
85B	See Note	* JACK (P1), part of item 88
86	0102708J42	ASSEMBLY, Volume Pot Flex; includes: * ITEM 86 Volume Pot Flex * ITEMS 85A and 140
87	----	Not Used
88	0105956M68	ASSEMBLY, Frequency Switch Flex; includes: * ITEM 88 Frequency Switch Flex * ITEM 85B
89A	See Note	* JACK (J3), part of item 9
89B	See Note	* JACK (J4), part of item 9
90	See Note	* JACK (J5), part of item 9
91	3205141Q01	GASKET, O-Ring
92	4205140Q01	CLAMP, Speaker
93	----	Not Used
94	----	* FLEX, Microphone; part of item 98
95	See Note	SPEAKER (LS1)
96	4205136S01	RETAINER, Microphone
97	----	* BOOT, Microphone; part of item 98
98	0105956M62	ASSEMBLY, Microphone; includes: * ITEM 98 Microphone * ITEMS 78, 94, 97, 98 and 103
99	7505564S01	PAD, Microphone Boot
100	1405754S01	INSULATOR
101	1105298Q01	ADHESIVE
102	3505152J01	FELT, Speaker
103	See Note	* PLUG (P5), part of item 98
104	----	ANTENNA (See Model Chart in Theory/Maintenance Manual
105	----	Not Used
106	----	Not Used
107	3905509R02	CONTACT, 3 req'd
108	0405534R01	WASHER, Flat
109	5402446J01	LABEL, Warning
110	2605494R01	SHIELD, I-F
111	1405496R01	INSULATOR, I-F Shield
112	3905130N01	CONTACT STRIP
113	2605186S01	SHIELD
114	1405299Q01	INSULATOR, Speaker
115	0300136771	SCREW, Phillips; 2-56 X 3/16"
116	0705766R01	SUPPORT, Rubber
117	7505501R02	PAD, Speaker
118	2605762R01	SHIELD, Controller Flex, part of item 9
119, 120	----	Not Used
121	----	SCREW, Captive #4.40, part of item 11
122	----	Not Used
123	7505501R03	PAD, Front Cover
124	2605123S01	SHIELD, Back
125	5405158S01	LABEL, Instruction
126	2605696R01	SHIELD, Antenna Switch
127 thru 138	----	Not Used
139	3905178S01	CONTACT, Front Cover
140	0102708J41	ASSEMBLY, Universal Interconnect Board
141	4205153S01	RETAINER, Flex Connector
142	0705168S01	SPACER, Clear Plastic; 6-pin
143	4302210J01	SPACER, Speaker

NOTES:

1. For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.

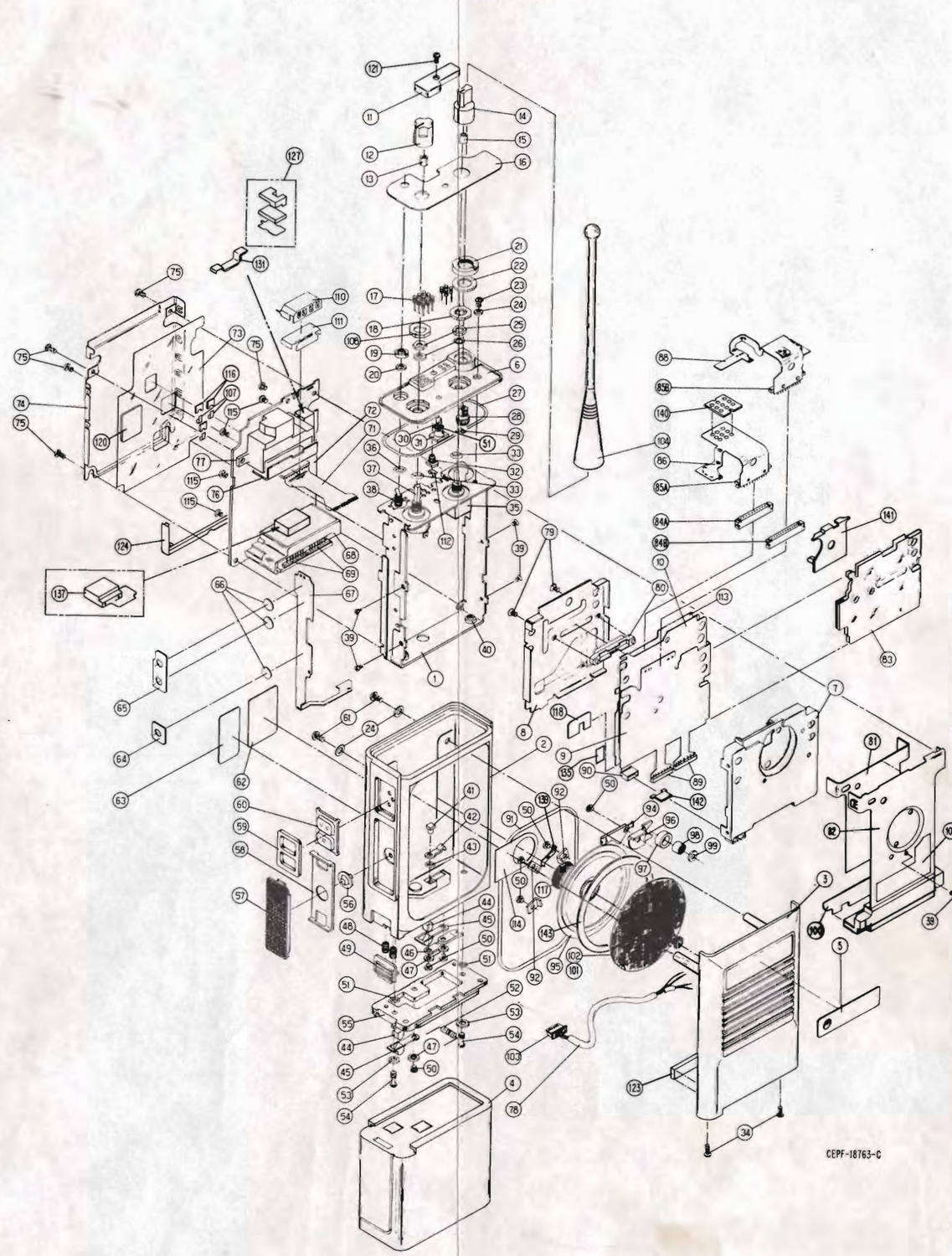


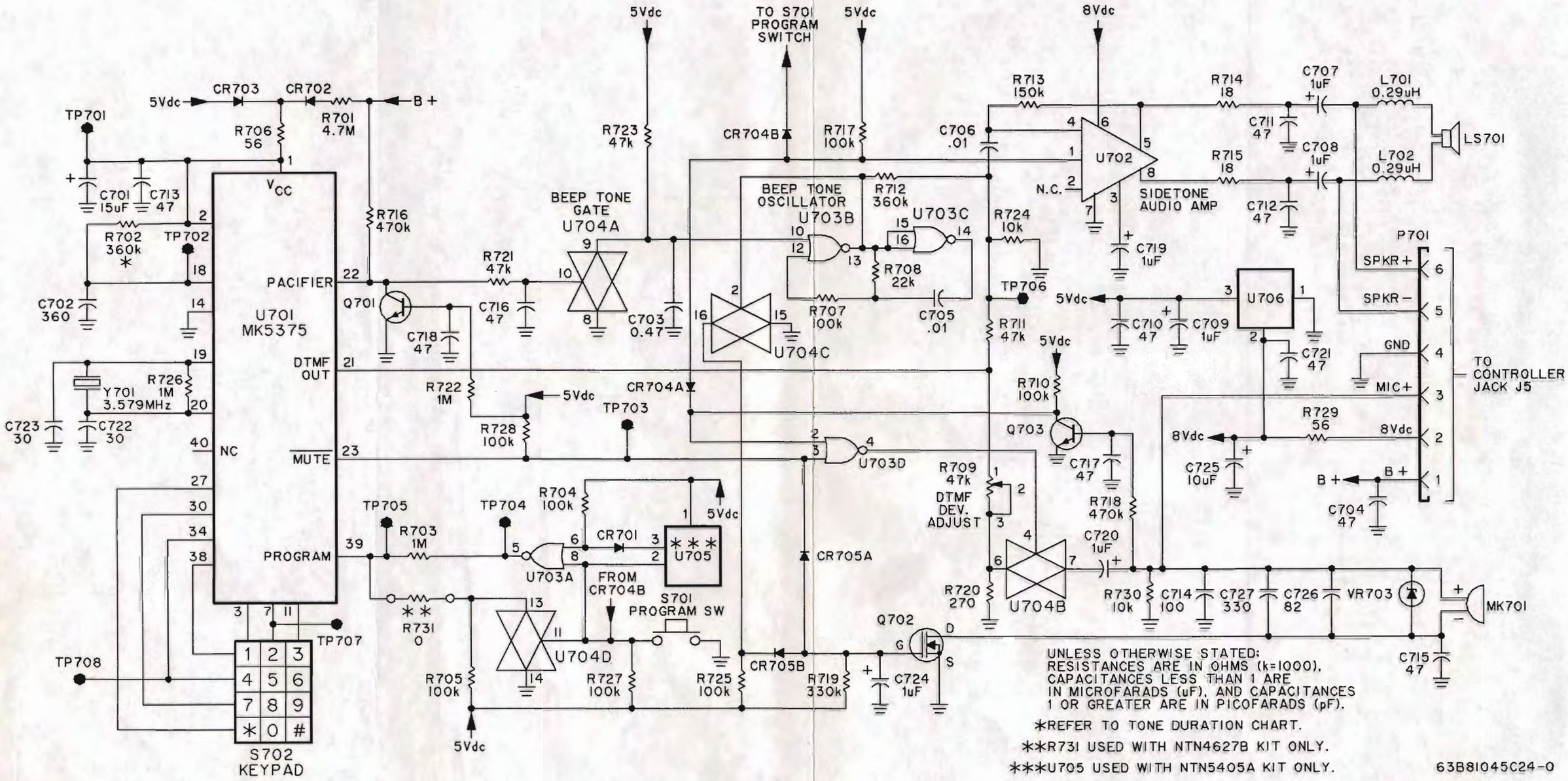
HT600 Exploded View Parts List

TPLF-3645-B

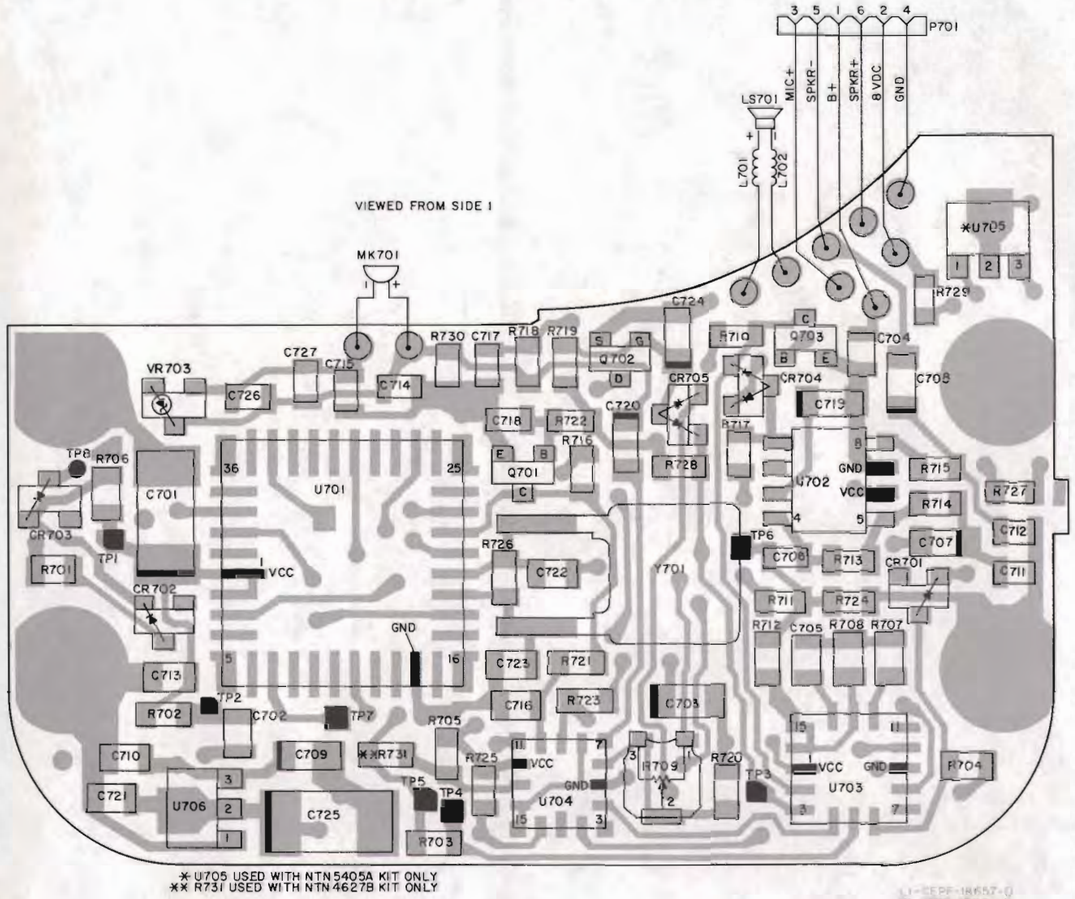
ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	0105956M63	ASSEMBLY, Frame; includes: * ITEM 1 Frame * ITEM 40
2	0105955N18	ASSEMBLY, Housing; includes: * ITEM 2 Housing * ITEMS 56, 58, 59 and 60
3	1505527P01	COVER, Front
4	----	BATTERY (See Model Chart in Theory/Maintenance Manual)
5	3305543P01	NAMEPLATE, Front
6	0105951N41	ASSEMBLY, Top Control Panel; includes: * ITEM 6 Panel * ITEMS 17, 28, 29, and 32
7	1505182S01	CARRIER, Flex Top
8	2605184Q01	SHIELD, Bottom
9	0105956M73	ASSEMBLY, Controller Flex; includes: * ITEM 9 Controller Flex * ITEMS 10, 80, 84, 89, 90, and 118 (The Controller Flex Assembly also includes electrical parts. See Note)
10	----	* SHIELD, Center; part of item 9
11	0102706J99	COVER, Dust
12	0105951N79	ASSEMBLY, Knob; includes: * ITEM 12 Knob * ITEM 13
13	----	* CLIP, Push; part of item 12
14	0105950N92	* ASSEMBLY, Knob; includes: * ITEM 14 Knob * ITEM 15
15	----	* Clip, Push; part of item 14
16	1305676R01	ESCUTCHEON (2-Freq. Radios)
	or 1305676R02	ESCUTCHEON (6-Freq. Radios)
17	See Note	* PIN, Contact (P7); part of item 6
18	0405218Q01	WASHER
19	0205163Q01	NUT, Spanner
20	0405162Q01	WASHER, Flat
21	0205765L02	NUT, Spanner
22	0405216L04	WASHER, Flat
23	0300136785	SCREW, Phillips Hd., 4-40 X 3/16"
24	0484345A06	WASHER, Seal
25	0205629L01	NUT, Hex; 2 req'd
26	0405162Q02	WASHER, Flat; 2 req'd
27	3205141Q02	GASKET, O-Ring
28	----	* BUSHING, Antenna; part of item 6
29	----	LUG, Antenna; part of item 6
30	See Note	LED, Bicolor (CR413A/CR413B)
31	3205131S01	SEAL, LED
32	----	* STUD, Insert; part of item 6
33	3205082E01	GASKET, O-Ring
34	0300140041	SCREW, Phillips; 2-56 X 1/4"
35	See Note	SWITCH, Frequency (S2)
36	3205141Q03	GASKET, O-Ring
37	See Note	SWITCH/POT, On-Off/Volume (S1/R140)
38	See Note	SWITCH, PL (S3)
39	0300140369	SCREW, Flat Hd.; 2-56 X 1/8"
40	----	* INSERT, Frame; part of item 1
41	4605945K05	CONTACT STUD, Battery
42	3905127Q01	CONTACT, B +
43	3205082E24	GASKET, O-ring
44	0705830C02	SUPPORT, Contact
45	3905421C07	CONTACT, Battery
46	2905124Q01	LUG
47	3205082E03	O-Ring
48	4105944K01	SPRING, Battery Latch
49	5505536P01	LATCH
50	0300139982	SCREW, Phillips Hd.; 2-56 X 5/32"
51	3205082E03	GASKET, O-Ring
52	See Note	FUSE (F-1)
53	0400009761	LOCKWASHER, Split #4
54	0305941K01	SCREW
55	6405531P02	PLATE, Base
56	----	* ACTUATOR, PTT; part of item 2
57	4505535P01	LEVER, PTT
58	----	* RETAINER, PTT; part of item 2
59	----	* PLATE, Actuator Button; part of item 2
60	----	* BUTTON, Actuator; part of item 2
61	0305137Q01	SCREW, Phillips; 4-40 X 5/16"
62	----	LABEL, FCC
63	----	LABEL
64	----	* SEAL, Dome (PTT); part of item 67
65	----	* SEAL, Dome (Mon); part of item 67
66	----	* CONTACT, Snap Dome; part of item 67
67	0105951N40	ASSEMBLY, B +/PTT Flex; includes: * ITEM 67/Flex * ITEMS 64, 65, and 66
68	1505533P01	HOUSING, VCO
69	See Note	PLUG (P3, P4)
70	----	Not Used
71	8405149Q01	FLEX, Connector
72	----	Typical Circuit Board
73	1405510R02	INSULATOR, Back Shield
74	2605775R02	SHIELD, Main Back
75	0300136772	SCREW, Phillips Hd.; 2-56 X 5/16"
76	2605161Q01	SHIELD, Heatsink
77	2605570P01	HEATSINK
78	----	* TUBING, Heat Shrink; part of item 98
79	0300138620	SCREW, Phillips; 2-56 X 5/16"
80	----	* HEADER, part of item 9
81	1405581S01	INSULATOR, Front Shield; part of item 82
82	0105951P28	* ASSEMBLY, Front Shield; includes items 82 and 109
83	1405264Q01	INSULATOR, Flex
84A	See Note	* JACK (J2), part of item 9
84B	See Note	* JACK (J1), part of item 9
85A	See Note	* JACK (P2), part of item 86
85B	See Note	* JACK (P1), part of item 88
86	0102708J42	ASSEMBLY, Volume Pot Flex; includes: * ITEM 86 Volume Pot Flex * ITEMS 85A, and 140
87	----	Not Used
88	0105956M68	ASSEMBLY, Frequency Switch Flex; includes: * ITEM 88 Frequency Switch Flex * ITEM 85B
89A	See Note	* JACK (J3), part of item 9
89B	See Note	* JACK (J4), part of item 9
90	See Note	* JACK (J5), part of item 9
91	3205141Q01	GASKET, O-Ring
92	4205140Q01	CLAMP, Speaker
93	----	Not Used
94	----	* FLEX, Microphone; part of item 98
95	See Note	SPEAKER (LS1)
96	4205136S01	RETAINER, Microphone
97	----	* BOOT, Microphone; part of item 98
98	0105956M62	ASSEMBLY, Microphone; includes: * ITEM 98 Microphone * ITEMS 78, 94, 97, 98 and 103
99	7505564S01	PAD, Microphone Boot
100	1405754R01	INSULATOR
101	1105298Q01	ADHESIVE
102	3505152J01	FELT, Speaker
103	See Note	* PLUG (P5), part of item 98
104	----	ANTENNA (See Model Chart in Theory/Maintenance Manual
105, 106	----	Not Used
107	3905509R02	CONTACT, 3 req'd
108	0405534R01	WASHER, Flat
109	----	LABEL, Instruction, part of item 82
110	2605494R02	SHIELD, I-F
111	1405496R01	INSULATOR, I-F Shield
112	3905130N01	CONTACT STRIP
113	2605186S01	SHIELD
114	1405299Q01	INSULATOR, Speaker
115	0300136771	SCREW, Phillips; 2-56 X 3/16"
116	0705766R01	SUPPORT, Rubber
117	7505501R02	PAD, Speaker
118	2605762R01	SHIELD, Controller Flex, part of item 9
119	----	Not Used
120	7505761R01	PAD, Back Plane Shield
121	----	Part of item 11
122	----	Not Used
123	7505501R03	PAD, Front Cover
124	2605123S01	SHIELD, Back
125	----	Not Used
126	2605696R01	SHIELD, Antenna Switch
127	See Note	ASSEMBLY, Antenna Switch
131	0105953P30	ASSEMBLY, I-F/PA Shield
133	----	Not Used
135	0705168S01	SPACER, Connector
137	0105953P91	ASSEMBLY, Buffer Shield
138	----	Not Used
139	3905178S01	CONTACT, Front Cover
140	0102708J41	ASSEMBLY, Universal Connector Board
141	4205153S01	RETAINER, Flex Connector
142	0705168S01	SPACER, Clear Plastic; 6-pin
143	4302210J01	SPACER, Speaker

NOTE: Refer to Electrical Parts List for part number and description.
* Not field replaceable, order parent ASSEMBLY.




5Vdc
CR703
CR702
B +
TP701
R706 56
R701 4.7M
C701 15uF
C713 47
R702 360k *
TP702
C702 360
R716 470k
R723 47k
TO S701 PROGRAM SWITCH
CR704B
R717 100k
5Vdc
BEEP TONE GATE U704A
R721 47k
C716 47
C703 0.47
BEEP TONE OSCILLATOR
U703B
U703C
R712 360k
R708 22k
C705 .01
R707 100k
U704C
C706 .01
R713 150k
8Vdc
U702
N.C.
SIDETONE AUDIO AMP
R714 18
R715 18
C707 1uF
C708 1uF
C711 47
C712 47
L701 0.29uH
L702 0.29uH
LS701
C719 1uF
R724 10k
TP706
R711 47k
R710 100k
P701
SPKR +
SPKR −
GND
MIC+
TO CONTROLLER JACK J5
U706
C710 47
C709 1uF
C721 47
R729 56
8Vdc
C725 10uF
B +
C704 47
C717 47
Q703
R718 470k
C720 1uF
R730 10k
C714 100
C727 330
C726 82
VR703
MK701
C715 47
PACIFIER
22
Q701
C718 47
U701 MK5375
DTMF OUT
21
R722 1M
R728 100k
CR704A
TP703
Y701 3.579MHz
R726 1M
C723 30
C722 30
NC
40
MUTE
23
U703D
R709 47k
DTMF DEV. ADJUST
27
30
34
38
PROGRAM
39
TP705
TP704
R703 1M
R704 100k
CR701
U705 ***
U703A
FROM CR704B
S701 PROGRAM SW
CR705A
R731 **
0
U704D
R705 100k
R727 100k
R725 100k
CR705B
R719 330k
C724 1uF
Q702
R720 270
U704B
TP707
TP708
S702 KEYPAD
1 2 3
4 5 6
7 8 9
* 0 #
5Vdc
UNLESS OTHERWISE STATED:
RESISTANCES ARE IN OHMS (k=1000).
CAPACITANCES LESS THAN 1 ARE
IN MICROFARADS (uF), AND CAPACITANCES
1 OR GREATER ARE IN PICOFARADS (pF).
*REFER TO TONE DURATION CHART.
**R731 USED WITH NTN4627B KIT ONLY.
***U705 USED WITH NTN5405A KIT ONLY.
63B81045C24-0

NTN4627B & NTN5405A CIRCUIT BOARDS
COMPONENT LOCATION DETAIL



TONE DURATION CHART

R702 USER-SELECTABLE VALUES			
MOTOROLA PART NUMBER	VALUE OHMS±5%	TONE DURATION RANGE (ms)	TONE DURATION NOMINAL Tn (ms)
0660076B10	240k	94- 108	101
0660076B12	300k	117- 135	126
0660076B14	360k	141- 162	150
0660076B16	430k	168- 193	180
0660076B17	470k	184- 211	197
0660076B18	510k	199- 229	214
0660076B19	560k	219- 252	235
0660076B20	620k	242- 279	260
0660076B21	680k	266- 306	285
0660076B22	750k	293- 337	315
0660076B23	820k	320- 368	344
0660076B24	910k	355- 409	382

TEPF-18743-O

NTN4627B DTMF Front Cover
NTN5405A DTMF with ANI Front Cover
Electrical Parts List

TPLF-3608-O

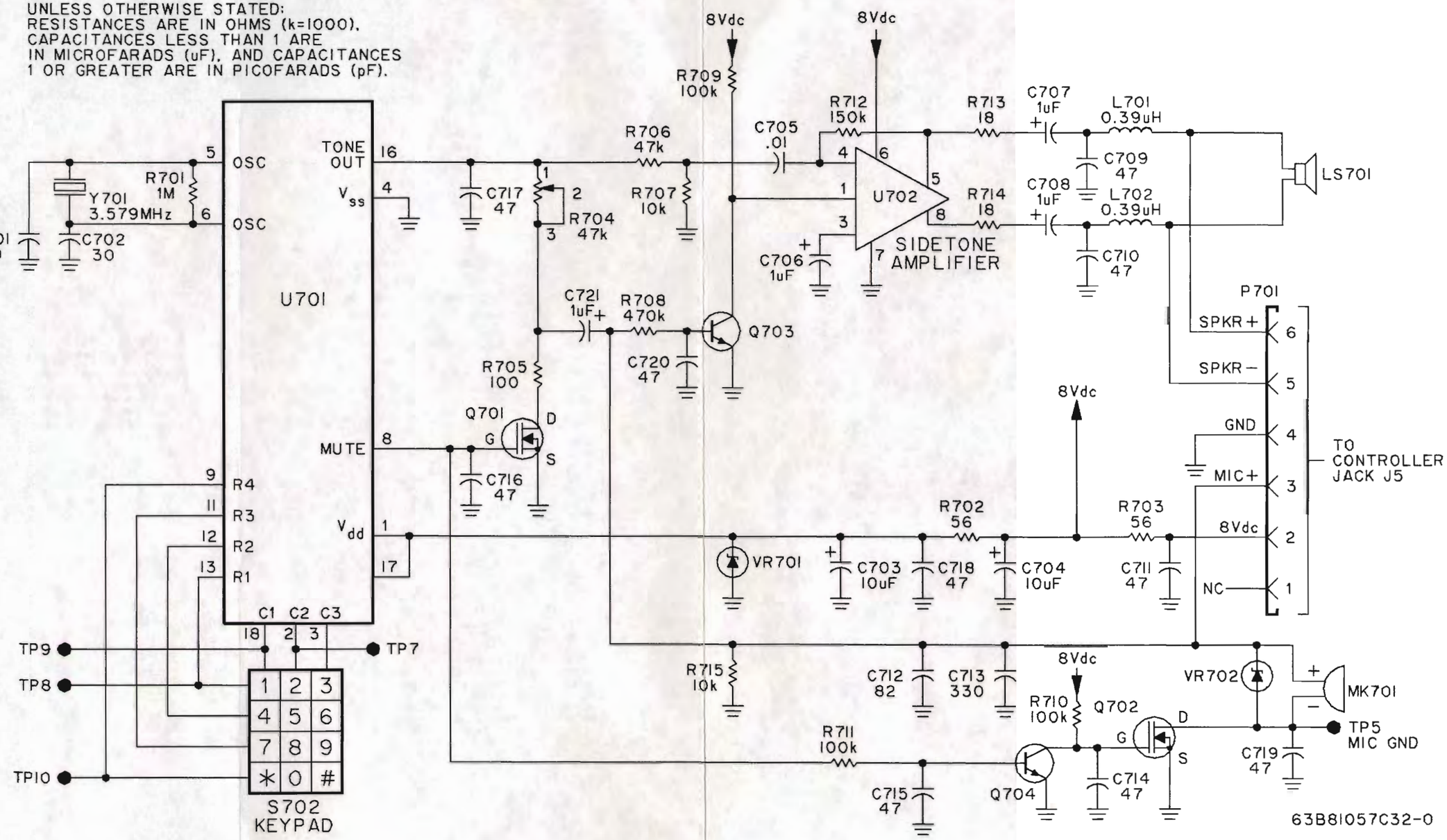
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: µF±10%; 16V unless stated
C701	2362998C24	15; 10V; Tant.
C702	2160520C14	360pF±2%; 25V
C703	2362998C05	0.47; 35V
C704	2160520B17	47pF±5%; 50V
C705, 706	2160521C25	.01; 25V
C707–709	2362998C09	1
C710–713	2160520B17	47pF±5%; 50V
C714	2160520C01	100
C715–718	2160520B17	47pF±5%; 50V
C719, 720	2362998C09	1
C721	2160520B17	47pF±5%; 50V
C722, 723	2160520B12	30pF±5%; 50V
C724	2362998C09	1
C725	2362998B73	10±20%
C726	2160520B23	82pF±5%; 50V
C727	2160520C13	330pF±5%; 50V
		DIODE: See Note I
CR701–705	4805129M24	Switching
L701, 702	2482723H04	**COIL:** 0.29µH Choke
LS701	5005155Q03	**TRANSDUCER**
MK701	5005227J01	**MICROPHONE**
		PLUG:
P701	2805250Q02	Socket, 6-Pin
		TRANSISTOR: See Note I
Q701	4805128M11	SOT
Q702	4805218N11	D-MOS
Q703	4805128M11	SOT
		RESISTOR, Fixed: Ω±5%; 1/10W unless stated
R701	0660076H41	4.7Meg
R702	0660076B14	360k: See Note III
R703	0660076B25	1Meg
R704, 705	0660076B01	100k
R706	0660076A19	56; 1/8W
R707	0660076B01	100k
R708	0660076A81	22k
R709	1860502A17	Pot., 47k
R710	0660076B01	100k
R711	0660076A89	47k
R712	0660076B14	360k
R713	0660076B05	150k
R714, 715	0660076A07	18
R716	0660076B17	470k
R717	0660076B01	100k
R718	0660076B17	470k
R719	0660076B13	330k
R720	0660076A35	270
R721	0660076A89	47k
R722	0660076B25	1Meg
R723	0660076A89	47k
R724	0660076A73	10k
R725	0660076B01	100k
R726	0660076B25	1Meg
R727, 728	0660076B01	100k
R729	0660076A19	56; 1/8W
R730	0660076A73	10k
R731	0660076M01	0 (NTN4627B only)
		SWITCH:
S701	-----	Program, Single-Pole (Not replaceable, order DTMF Front Cover Kit)
S702	-----	Keypad (Not replaceable, order DTMF Front Cover Kit)
		CIRCUIT MODULE: See Note I
U701	0105953P31	Tone Generator
U702	5105469E51	Audio Amplifier
U703	0105953P32	Quad NOR Gate
U704	0105954P13	Analog Switch
U705	5105469E52	Hall Effect Digital Switch (NTN5405A only)
U706	5160880B01	Regulator; 5Vdc
		DIODE: See Note I
VR703	4805129M42	Zener, 5.6V
		CRYSTAL: See Note II
Y701	4805719G04	3.579MHz Resonator

NOTES:

I. For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.

II. DTMF radios transmit timed DTMF tones. These tones are preset at the factory for 150ms. duration. To accommodate equipment with timing requirements other than 150ms., the tone duration can be changed by changing resistor R702, which is located between pins 2 and 8 of U701. Refer to the TONE DURATION CHART for specific values.

UNLESS OTHERWISE STATED:
RESISTANCES ARE IN OHMS (k=1000).
CAPACITANCES LESS THAN 1 ARE
IN MICROFARADS (uF), AND CAPACITANCES
1 OR GREATER ARE IN PICOFARADS (pF).



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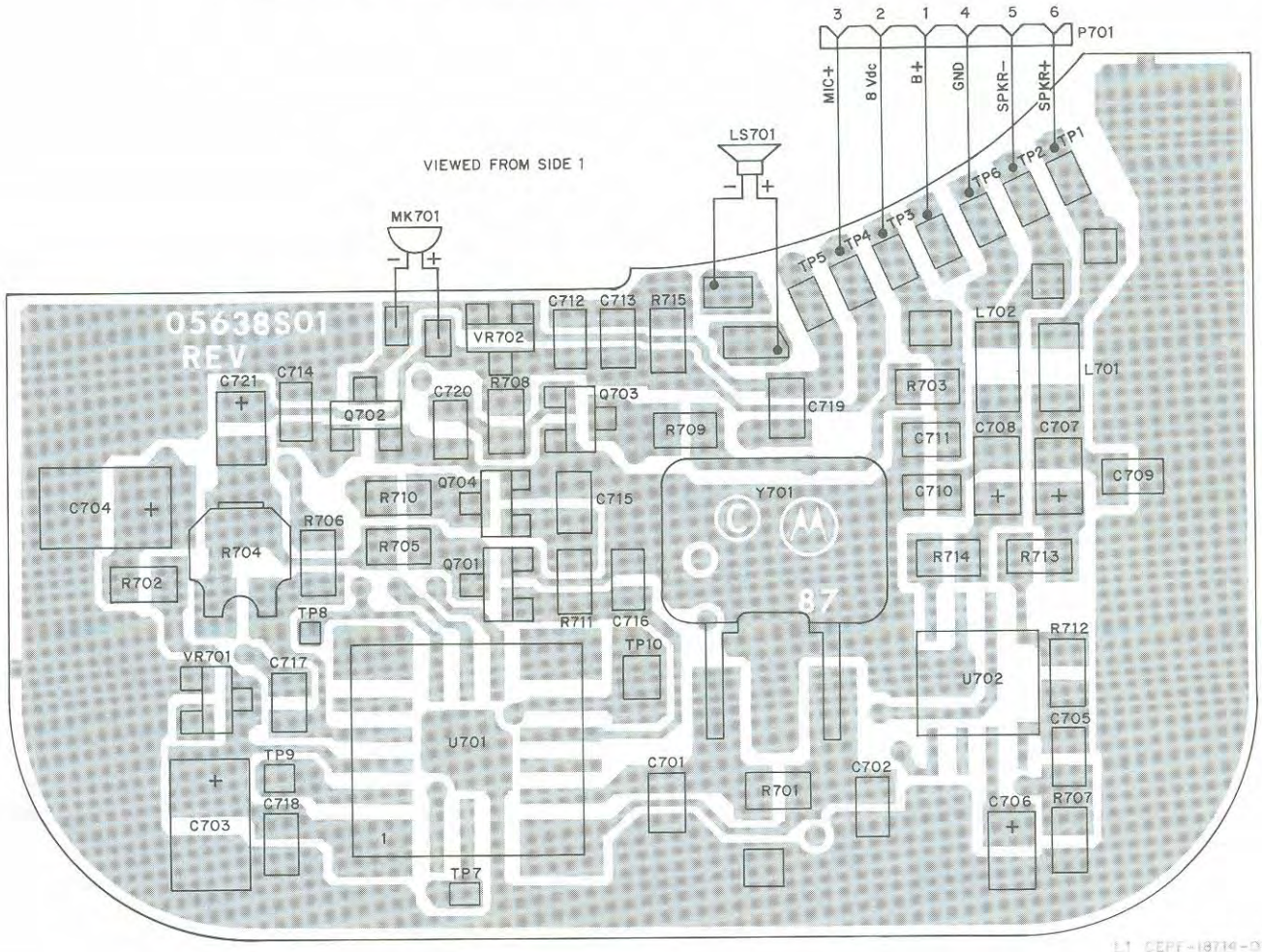
NTN5215A CIRCUIT BOARD COMPONENT LOCATION DETAIL



NTN5215A DTMF Front Cover (Continuous Tone) Electrical Parts List

TPLF-3633-A

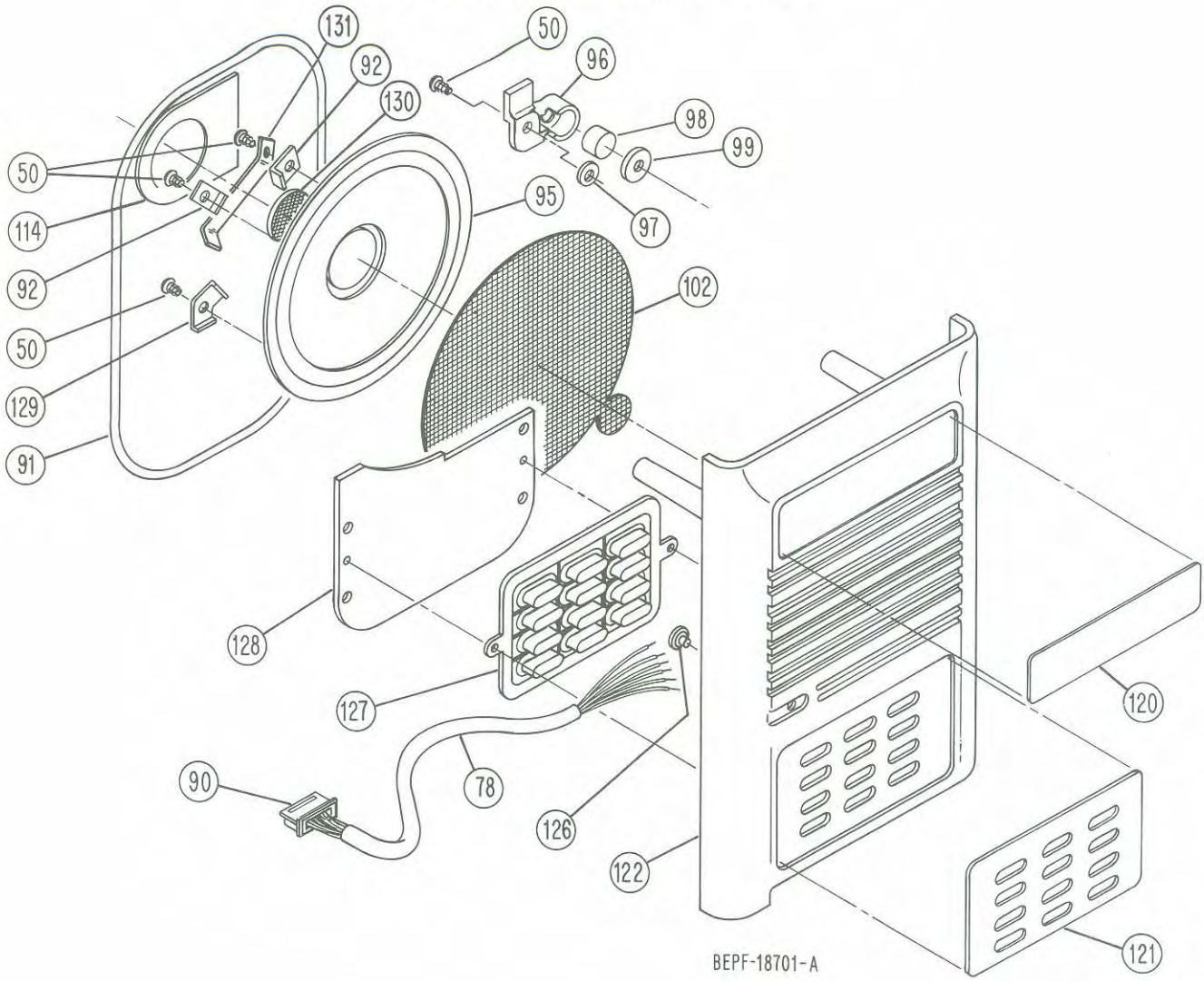
ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: pF ± 5%; 50V unless stated
C701, 702	2160520B12	30
C703, 704	2262998B73	10µF ± 20%; 16V
C705	2160521C25	.01µF ± 20%; 25V
C706, 707, 708	2362998C09	1µF ± 10%; 16V
C709, 710, 711	2160520B17	47
C712	2160520B23	82
C713	2160520C13	330
C714 thru 720	2160520B17	47
C721	2362998C09	1µF ± 10%; 16V
		COIL, RF:
L701, 702	2462575A01	0.39µH
LS701	5005155Q03	**TRANSDUCER**
MK701	5005227J01	**MICROPHONE**
P701	2805250Q02	Socket, 6-Pin
		TRANSISTOR: See Note I
Q701, 702	4805218N11	D-MOS FET
Q703, 704	4805128M11	NPN
		RESISTOR, Fixed: Ω ± 5%; 1/10W unless stated
R701	0660076B25	1M
R702, 703	0660076A19	56
R704	1860502A17	47k Pot.
R705	0660076A25	100
R706	0660076A89	47k
R707	0660076A73	10k
R708	0660076B17	470k
R709, 710, 711	0660076B01	100k
R712	0660076B05	150k
R713, 714	0660076A07	18
R715	0660076A73	10k
		SWITCH:
S701	- - - -	Program, Non-Functional (Not replaceable, order DTMF Front Cover Kit)
S702	- - - -	Keypad (Not replaceable, order DTMF Front Cover Kit)
		CIRCUIT MODULE: See Note I
U701	0105951Q08	Tone Generator
U702	5105469E51	Audio Amplifier
		DIODE: See Note I
VR701	4805129M49	Zener
VR702	4805129M42	Zener, 5.6V
		CRYSTAL: See Note II
Y701	4805719G04	Resonator; 3.6864MHz

NOTES:

I. For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.

II. When ordering crystal units, specify crystal frequency, crystal type number, and Motorola part number.

NTN4627B, NTN5405A, AND NTN5215A
DTMF FRONT COVER EXPLODED VIEW



Exploded View Parts List

TPLF-3634-A

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
50	0300139982	SCREW, #2-56x5/32"
78	3700132526	TUBE, Heat-Shrink
90	2805250Q02	CONNECTOR, 6-pin (P5)
91	3205141Q01	O-RING, Front Cover
92	4205140Q01	CLAMP, Speaker
95	5005155Q01	SPEAKER
96	4202036J02	RETAINER, Microphone
97	0405179S01	WASHER, Flat
98	5005227J01	MICROPHONE
99	7505564S01	PAD, Microphone
102	3505152J01	FELT, Speaker
102	1105298Q01	ADHESIVE, Speaker Felt
114	1405299Q01	INSULATOR, Speaker
120	3305543P01	NAMEPLATE, Front
121	1305728R01	ESCUTCHEON
122	-----	* FRONT COVER
126	-----	* SWITCH, Actuator
127	-----	* SWITCH, Keypad
128	-----	* CIRCUIT BOARD
129	0705456R01	BRACKET, Speaker/PCB
130	7505501R02	PAD, Speaker
131	3905178S01	CONTACT, Front Cover

* Not field replaceable.
Order applicable DTMF Front Cover Kit: NTN4627B, NTN5405A, or NTN5215A.

MOTOROLA INC.

REMOTE SPEAKER MICROPHONES

MODELS: NMN6145A, NMN6145B, NMN6155A, NMN6156A, NMN6156B

1. INTRODUCTION

This instruction manual covers "A" models and corresponding "B" models listed. The new B model is exactly the same as the corresponding A model, except that the cable and connector assembly (item 6 in the exploded view) part number has been changed. The new part number for item 6 in the exploded view parts list applies to both A and B models. Although everything in text applies to both A and B models, text, parts lists, and drawings will reference only the current model.

2. DESCRIPTION

Remote Speaker Microphones NMN6145B, NMN6155A, and NMN6156B, all include a speaker, a microphone, a push-to-talk (PTT) switch, and associated circuitry. Each of the speaker microphones also includes a cable and connector assembly, terminated with a special plug, for attaching to the universal connector on the portable radio. The NMN6145B and NMN6156B Speaker microphones use a belt clip for attaching the unit to a user. The NMN6155A Speaker Microphone uses a Velcro® patch for attaching the unit to a user, and requires a corresponding Velcro Patch kit NLN8410A, which is available separately.

Also, the NMN6145B Speaker Microphone includes a 2.5mm earphone jack, which is attached to and located on the special plug.

When the remote speaker microphone is attached to the radio, the speaker in the radio is disabled, and receiver audio is connected to the accessory speaker. Similarly, the accessory microphone is connected to the transmitter, and the accessory PTT switch can now control the PTT function in the radio. The radio microphone and PTT switch are still operational, but you can listen to the radio only through the accessory speaker.

When a secondary receiver audio accessory is plugged into the earphone jack (NMN6145B), audio to the remote speaker microphone is disconnected and rerouted to the secondary audio accessory.

NOTE

Observe safety information in the radio operating instructions.

3. OPERATION

a. Attach the microphone's accessory connector to the universal connector on top of the radio.

b. Firmly tighten the captive screw of the accessory connector into the threaded hole (middle of universal connector). The maximum recommended torque is 4 in. lbs.

c. While listening to the accessory speaker, turn the radio on and operate it as explained in the operating instructions supplied with the radio.

d. The microphone will perform best if it is worn as shown in Figure 1.

MAEPF-17335-O

Figure 1.

4. HANDLING PRECAUTIONS

To avoid damage to circuits, observe the following handling, shipping, and servicing precautions.

a. Prior to and while servicing a remote speaker microphone, particularly after moving within the service area, momentarily place both hands on a bare metal, earth-grounded surface. This will discharge any static charge which may have accumulated on the person doing the service.

CAUTION

Wearing a conductive wrist strap (Motorola No. RSX-4015A) will minimize static buildup during servicing.

Instruction Manual

68P81107C27-C

WARNING

When wearing a conductive wrist strap, be careful near high voltage sources. The good ground provided by the wrist strap will also increase the danger of lethal shock from accidentally touching high voltage sources.

b. Whenever possible, avoid touching any electrically conductive part of the unit with your hands.

c. When servicing a unit, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static buildup.

d. All electrically powered test equipment should be grounded. Apply the ground lead from the test equipment to the unit before connecting the test probe. Similarly, disconnect the test probe prior to removing the ground lead.

e. If the microphone cartridge is removed from the unit, place it on a conductive surface, such as a sheet of aluminum foil which is connected to ground through 100k ohms of resistance.

WARNING

If the aluminum foil is connected directly to ground, be cautious of possible electrical shock from contacting the foil at the same time as other electrical circuits.

f. When soldering, be sure the soldering iron is grounded.

g. Prior to replacing circuit components or touching the microphone cartridge, be sure to discharge any static buildup. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch the microphone cartridge and associated wiring.

h. Replacement microphone cartridges should be kept in conductive packaging until they are placed in the unit.

5. MAINTENANCE

Refer to the schematic diagram, the exploded view, and the parts lists. Every part in the microphone is identified and illustrated for assistance in removal and replacement.

If necessary, the external surfaces of the remote speaker microphone may be cleaned with a 0.5% solution of mild dishwashing detergent in water (one teaspoon of detergent in a gallon of water).

6. OPTION

An optional thumbscrew is available that replaces the captive screw, exploded view item 7. The Motorola part number for the replacement thumbscrew is:

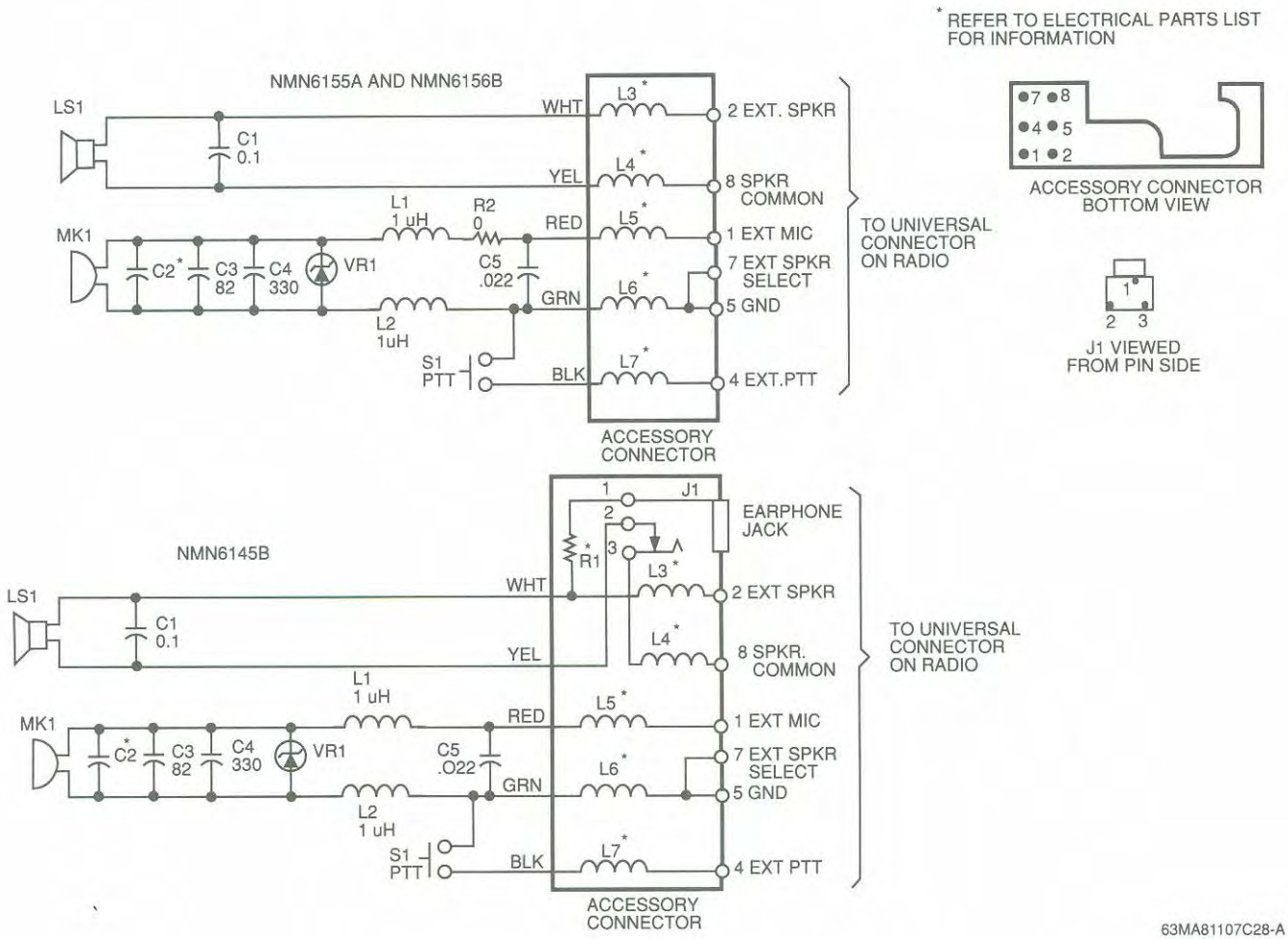
- 0305202T02 (NMN6145B)
- 0305202T03 (NMN6155A and NMN6156B)

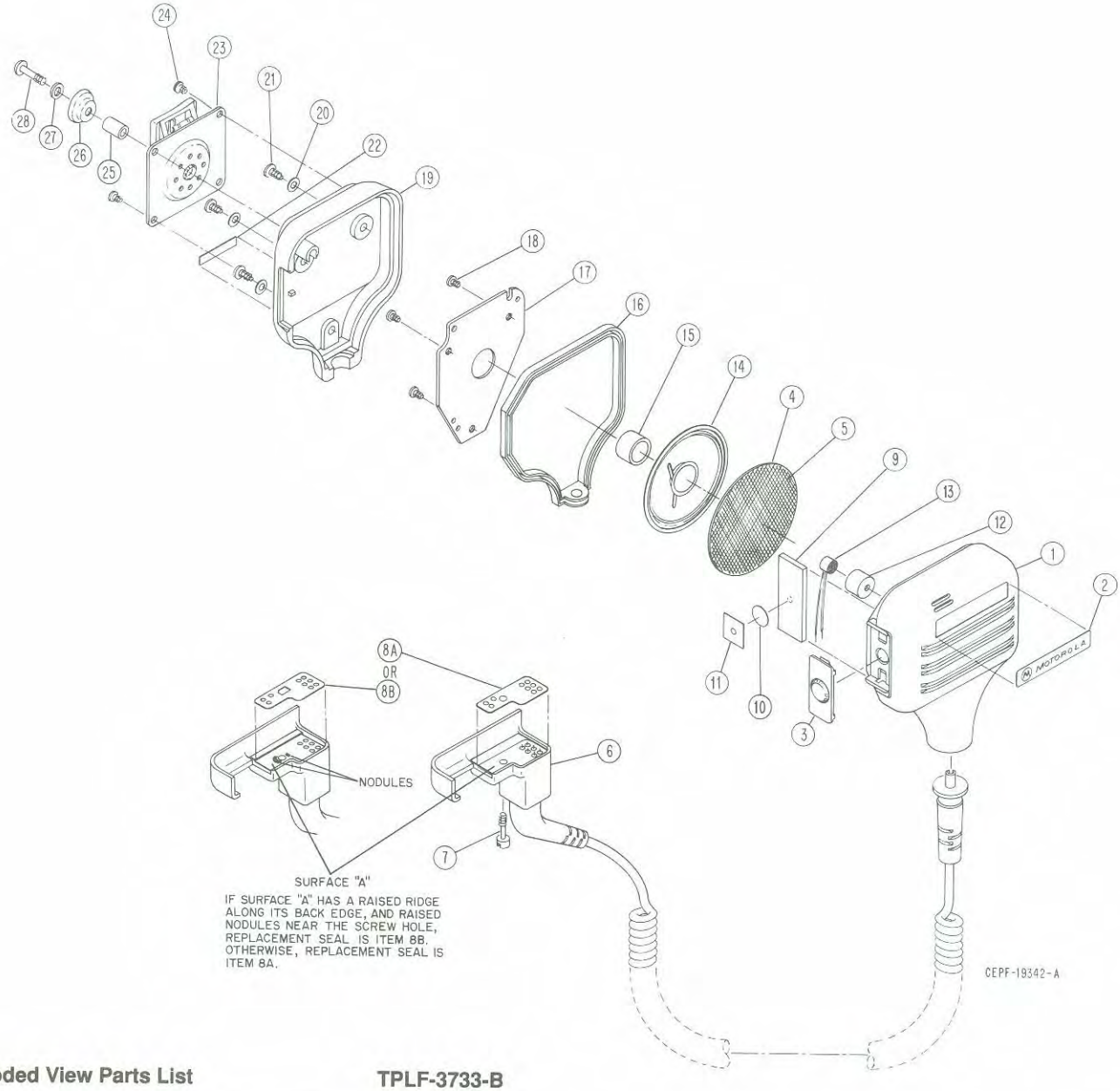
Electrical Parts List

TPLF-3732-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR: Fixed: pF±5% unless otherwise stated
C1	2160521D37	0.1µF
C2	- - - - -	Not field repairable, order Microphone Assembly (MK1)
C3	2160520B23	82
C4	2160520C13	330
C5	2160521A29	.022µF
J1	0902126J02	**JACK, Earphone;** 2.5mm mono (NMN6145B only)
		COIL, RF: unless otherwise stated
L1, 2 L3 thru 7	2462575A04	Choke, 1µH
	- - - - -	Not field repairable, order Cable and Connector Assembly (Exp. View Item 6)
LS1	5005910P03	**SPEAKER:** 1 3/4"; 28Ω
MK1	0105953N48	**ASSEMBLY, MICROPHONE:** Electret, includes capacitor C2
		RESISTOR, Fixed:
R1	- - - - -	Not field repairable (NMN6145B only), order Cable and Connector Assembly, Exp. View item no. 6.
R2	0660076M01	0Ω NMN6155A and NMN6156B only)
S1	3905834K04	**SWITCH:** Dome, PTT
VR1	4880140L14	**DIODE, Zener:** 9.1V

NOTE: For optimum performance, order replacement diodes and circuit modules by Motorola part number only.





Exploded View Parts List TPLF-3733-B

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	0102701J97	ASSEMBLY, Front Housing; includes items 1 thru 5
2	3305259Q01	NAMEPLATE, Motorola
3	0102701J96	LEVER, PTT
4	3505152J01	GRILLE CLOTH
5	1105461R01	ADHESIVE
6		ASSEMBLY, Cable and Connector; includes items 6, 7, and 8
	0105959R75	(NMN6145B)
	or 0105959R73	(NMN6155A and NMN6156B)
7		SCREW, Captive (See text, paragraph 5)
	0305425R02	(NMN6145B)
	or 0305425R03	(NMN6155A and NMN6156B)
8A	3205378T01	SEAL
8B	or 3205884T01	SEAL
9	0105953N46	ASSEMBLY, PC Board; includes electrical components
10	See Note	SWITCH, Snap Dome Contact (S1)
11	3205231Q01	SEAL, Dome
12	1405219Q01	BOOT, Microphone
13	See Note	ASSEMBLY, Microphone (MK1); includes items 11 and 12
14	See Note	SPEAKER (LS1)
15	7505283Q02	PAD, Speaker
16	3205690R01	GASKET
17	6405689R01	PLATE, Housing Mounting
18	0300139982	SCREW, Phillips Hd.; 2-56 x 5/32" (3 req'd)
19	1505172Q01	HOUSING, Back
20	0484345A06	WASHER, Seal (3 req'd)
21	0305137Q02	SCREW, Phillips Hd. (3 req'd)
22		LABEL, Kit Number
	5405258Q09	(NMN6145B)
	or 5405258Q10	(NMN6156B)
	or 5405258Q11	(NMN6155A)
23		ASSEMBLY, Attachment
	0105959N54	BELT CLIP (NMN6145B and NMN6156B); shown on Exp. View
	or 7505385P01	VELCRO (NMN6155A)
24		SCREW, Phillips Hd.; 4 req'd
	0300139982	2-56 x 5/32" (NMN6145B and NMN6156B)
	or 0300139939	2-56 x 3/16" (NMN6155A)
25	4382377B71	SPACER
26	0905518D02	SNAP SOCKET
27	0482650D06	WASHER
28	0382210E01	SCREW

NOTE: Refer to Electrical Parts List for part number and description.

MOTOROLA INC.

ADAPTERS

Models: NTN4812B
NTN5075B
NTN5368A
NTN5598A

DESCRIPTION

The following adapters provide a convenient method of connecting remote accessories to many Motorola Handie-Talkie® portable radios. Each adapter has a connector or connector jack for connecting to the remote accessory, and spring loaded pins, which make positive contact with corresponding mating pins of the universal connector on the radio.

Attaching any of the four adapters to the radio does not disable or alter the radio's operation in any way. But, when the adapter is attached to the radio and terminated at the other end with a remote accessory, the radio's corresponding function of that remote accessory is disabled. For example, if the NTN5368A RF Adapter is attached to the radio and connected to a remote antenna, the radio's antenna becomes nonfunctional.

- The NTN4812B Adapter provides an earphone jack that connects the radio to audio accessories using a 3.5mm phone plug. A 3.5mm to 2.5mm jack (part number 5880378B84) can be used with this adapter to connect the radio to audio accessories using a 2.5mm phone plug.
- The NTN5368A Adapter provides an rf port that connects the radio to a remote antenna. This adapter requires an NKN6408A Cable Kit.

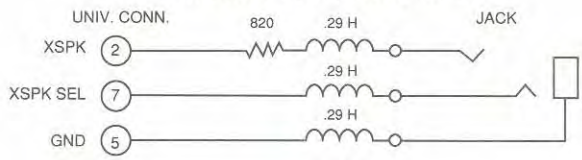
WARNING
DO NOT plug an audio accessory into the NTN5368A RF Adapter and transmit.

The NTN4812B Earphone Adapter and the NTN5368A RF Adapter look alike. The NTN5368A RF Adapter is marked with an antenna symbol on the top surface of the housing near the antenna jack. Be careful not to mistake one adapter for the other.

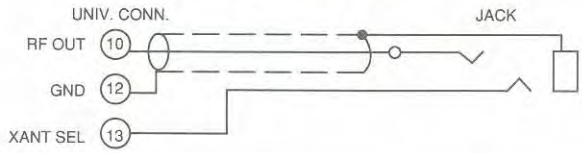
- The NTN5075B Adapter provides a six-pin jack to connect the radio to two-piece and three-piece audio accessories.
- The NTN5598A Adapter provides a six-pin jack (like the NTN5075B) to connect the radio to two-piece and three-piece audio accessories.This adapter applies to radios with B+ at the universal connector pin 3. When connected to the radio, the adapter routes battery voltage (B+) to the six-pin jack at pin 2.

The NTN5075B and NTN5598A Adapters are similar and look alike. Both units have a six-pin jack, but differ at the universal connector end. The NTN5075B Adapter has five pins and the NTN5598A Adapter has six pins.

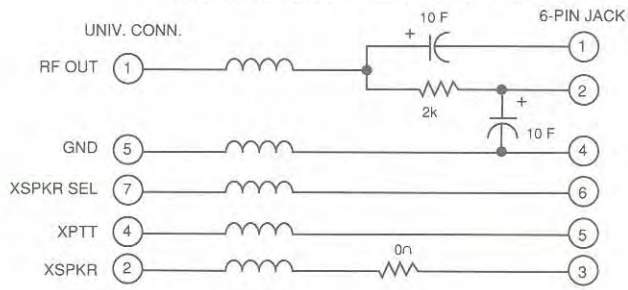
NTN4812B EARPHONE JACK ADAPTER



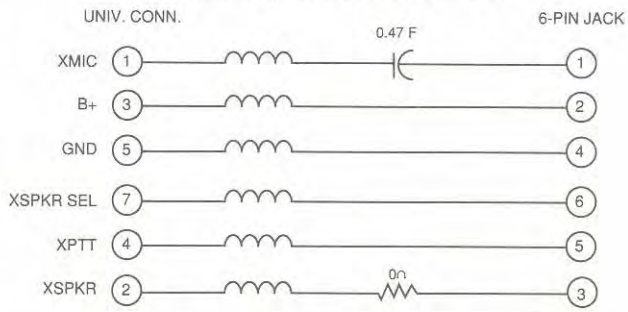
NTN5368A RF ADAPTER



NTN5075B UNIVERSAL CONNECTOR ADAPTER



NTN5598A UNIVERSAL ADAPTER WITH B+



MAEPF-19344-A

Instruction Manual

68P81107C30-C

MOTOROLA INC.

PUBLIC SAFETY MICROPHONES

MODELS NTN5050A, NTN5493A, NTN5881A, & ZLN6416A (for UHF Models Only)

1. DESCRIPTION

Public Safety Microphones (PSM's) NTN5050A, NTN5493A, NTN5881A, and ZLN6416A include a microphone, a push-to-talk (PTT) switch, a high/low volume switch, and associated circuitry. Each of the public safety microphones also includes a cable and connector assembly, terminated with a special plug, for attaching to the universal connector on the portable radio. The NTN5050A PSM uses a Velcro® patch for attaching the unit to a user, and requires a corresponding Velcro® Patch Kit NLN8410A, which is available separately. The NTN5493A PSM uses a belt clip for attaching the unit to a user. The NTN5881A and ZLN6416A PSMs have a lower profile accessory connector, which allows for easier access to the volume and frequency knobs. The NTN5881A and ZLN6416A PSMs also include an earphone jack in the accessory connector. In order for the PSM to operate properly, a removable antenna, designed for the desired frequency band, must be ordered separately and installed on the PSM.

When the PSM's accessory connector is connected to the radio's universal connector, the speaker and antenna in the radio are disabled, and the speaker and antenna in the PSM are enabled. The radio's PTT switch and internal microphone still operate normally. If the PSM's PTT switch is used to activate the radio's transmitter, the PSM's microphone must also be used; if the radio's PTT switch is used, the radio's microphone must be used as well. In either case, the radio can be listened to only through the remote speaker.

A high/low volume switch, S2, allows the user to monitor the audio at a low volume level, then to immediately switch to a high volume level without resetting the volume control on the radio. This feature is especially useful when the radio is worn on the belt and the speaker microphone is on the lapel or shoulder, as shown in Figure 1.

NOTE

Observe safety information in the radio operating instructions.

2. OPERATION

a. Attach the microphone's accessory connector to the universal connector on top of the radio.

b. Firmly tighten the captive screw of the accessory connector into the threaded hole (middle of universal connector). The maximum recommended torque is 4 in. lbs. (A knurled thrumbscrew is provided as an alternate replacement to the standard slotted screw.)

MAEPF-17414-O

Figure 1.

c. Turn the radio on and operate it as explained in the operating instructions supplied with the radio. Listen to the radio through the PSM's speaker.

d. Set the "high-low" switch on the speaker microphone to the "low" position to monitor audio at a low volume; for a high volume level, set the switch to the "high" position.

e. The microphone will perform best if it is worn with the antenna above the shoulder as shown in Figure 1.

f. A radio antenna bushing boot (Motorola part number 3205782P01) is provided to cover the radio antenna bushing.

3. HANDLING PRECAUTIONS

To avoid damage to circuits, observe the following handling, shipping, and servicing precautions:

a. Prior to and while servicing a public safety speaker microphone, particularly after moving within the service area, momentarily place both hands on a bare metal, earth-grounded surface. This will discharge any static charge which your body may have accumulated.

CAUTION

Wearing a conductive wrist strap (Motorola No. RSX-4015A) will minimize static buildup during servicing.

Instruction Manual

68P81108C06-E

WARNING
When wearing a conductive wrist strap, be careful near high-voltage sources. The good ground provided by the wrist strap will also increase the danger of lethal shock from accidentally touching high-voltage sources.

b. Whenever possible, avoid touching any electrically conductive part of the unit with your hands.

c. Because they contribute to static buildup, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) when servicing a unit.

d. All electrically-powered test equipment should be grounded. Connect the ground lead from the test equipment to the unit before connecting the test probe. Similarly, disconnect the test probe prior to removing the ground lead.

e. If the microphone cartridge is removed from the unit, place it on a conductive surface, such as a sheet of aluminum foil, which is connected to ground through 100k ohms of resistance.

WARNING
If the aluminum foil is connected directly to ground, be cautious of possible electrical shock from contacting the foil and other electrical circuits at the same time.

f. When soldering, be sure the soldering iron is grounded.

g. Prior to replacing circuit components or touching the microphone cartridge, be sure to discharge any static buildup. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch the microphone cartridge and associated wiring.

h. Replacement microphone cartridges should be kept in conductive packaging until they are placed in the unit.

4. MAINTENANCE

Refer to the schematic diagram, the exploded view, and the parts lists. Every part in the speaker microphone is identified and illustrated for assistance in removal and replacement.

If disassembly of the public safety microphone is required, do not reassemble it without doing the following (numbers in parentheses refer to item numbers in the exploded view):

- Remove the O-ring (22) from the cover assembly (16).
- Inspect the seal areas around the housing (1) and the cover (16) for foreign material which might prevent the O-ring from sealing properly.
- Inspect O-ring (22) and both cover screw O-rings (18). If any of these are split, cracked, or damaged in any way, discard and replace them.
- If the main printed circuit board (14) is removed, remove the speaker spacer (27) and inspect the membrane of the seal pad (28) for tears or holes. If the membrane is damaged, remove it, being careful to remove all old adhesive, and replace it with a new seal pad.

NOTE
When replacing the seal pad (28), it is critical that the small seal pad opening be aligned with the microphone port in the housing.

- Tighten all hardware loosened or removed during disassembly per the values listed in the Torque Specifications table. Use the recommended torque driver (Sturtevant PM-5 Rototorq Tool or equivalent).

TORQUE SPECIFICATIONS

APPLICATION	TORQUE (IN.LBS.)	TORQUE (N-m)	TORQUE BIT NO.
Cover Screws	6	.68	6680321B78
PC Board Screws	4	.45	6680321B78
Velcro Pad Screws	4	.45	6680321B78
Toggle Switch Boot	3	.34	6680370B99
RF Connector Nut	20	2.27	6680371B01
Accessory Connector Captive Screw	4	.45	- - - - -

If necessary, the external surfaces of the speaker microphone may be cleaned with a 0.5% solution of mild dishwashing detergent in water (one teaspoon of detergent in a gallon of water.

ELECTRICAL PARTS LIST

TPLF-3552-B

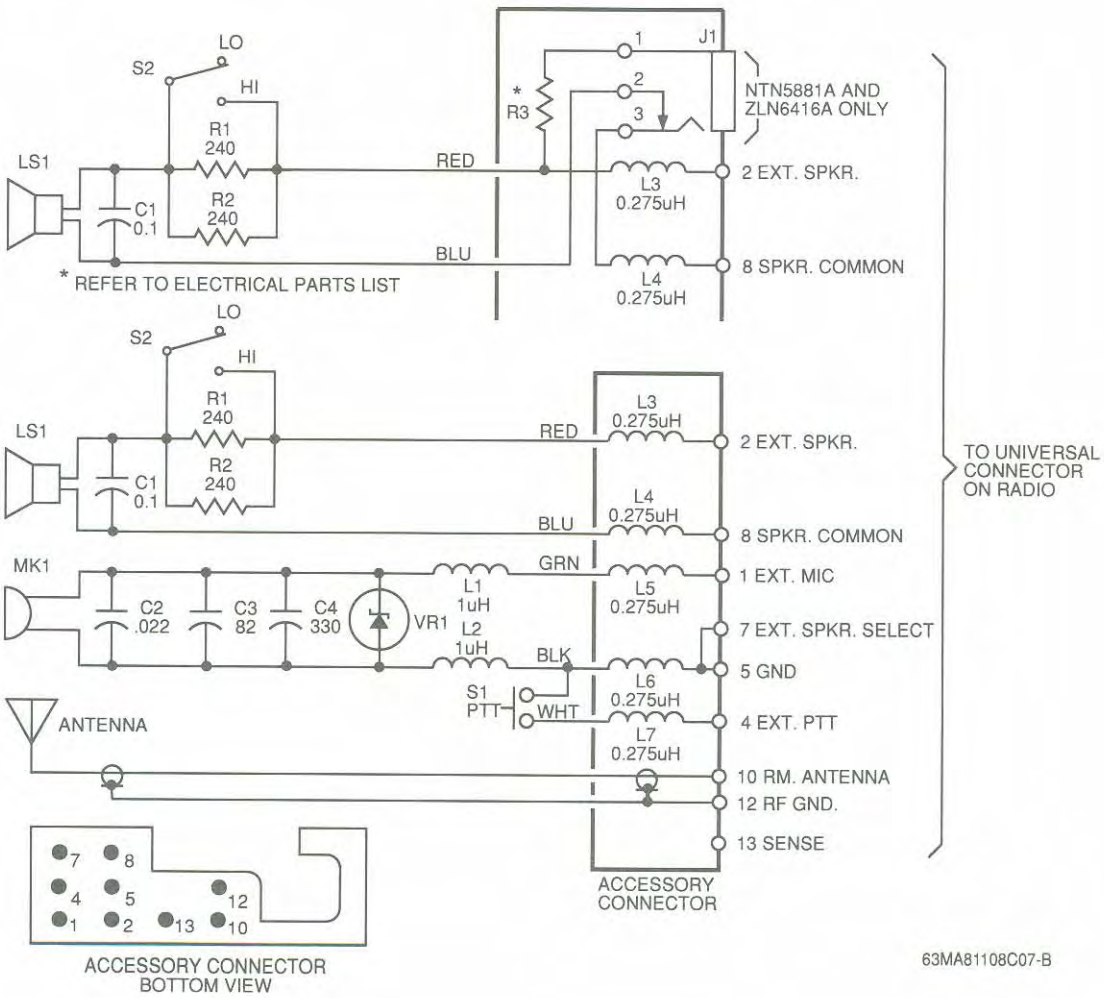
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR: Fixed: pF ±5%; unless otherwise stated
C1	2160521D37	0.1µF
C2	2184008H08	.022µF
C3	2160520B23	82
C4	2160520C13	330
J1	0905101S02	**JACK**, Earphone (NTN5881A and ZLN6416A)
		COIL, RF: unless otherwise stated
L1, 2	2462575A04	Choke, 1µH
L3 thru 7	2405452C08	Choke, 0.275µH
		SPEAKER:
LS1	5005910P03	1-3/4"
		MICROPHONE:
MK1	5005227J02	Electret
		RESISTOR, Fixed:
R1, 2	0611024A34	240Ω±5%; 1/4W
R3	- - - - - - - - -	Not Field Replaceable, order NTN5881A or ZLN6416A as applicable
		SWITCH:
S1	3905834K05	Dome, PTT
S2	4005680K04	Toggle
VR1	4880140L14	**DIODE, Zener:** 9.1V

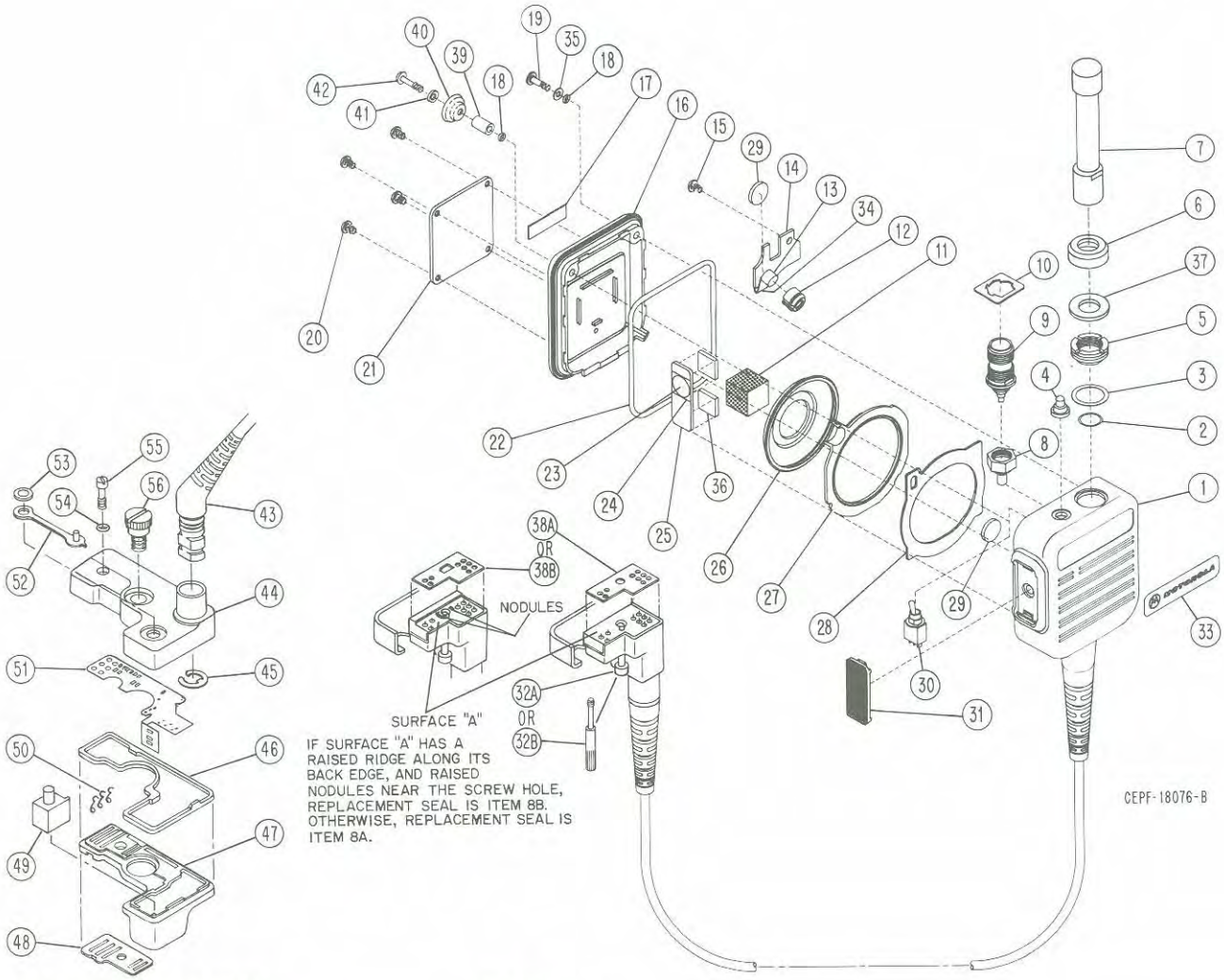
NONREFERENCED ITEMS		
	NAE6131A	ANTENNA, Helical (400-440MHz) (See Note II)
	or NAE6132A	ANTENNA, Helical (440-470MHz) (See Note II)
	or NAE6133A	ANTENNA, Helical (470-512MHz) (See Note II)
	0905261B01	CONNECTOR, RF

NOTES:

I. For optimum performance, order replacement diodes by Motorola part number only.

II. The antenna is not part of the Public Safety Microphone Kit; it must be ordered separately.





Exploded View Parts List

TPLF-3553--D

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	0105954P63	ASSEMBLY, Housing, Cable, and Accessory Connector. Includes items 28, 29, 31, and 32.
2	3205082E69	GASKET, O-Ring
3	0405465C02	WASHER, Plastic
4	0205791P01	NUT, Toggle Seal
5	0205326S01	NUT, Antenna
6	3205325S01	SEAL, Washer
7	See Note	ANTENNA (must be ordered separately)
8	0205541C01	NUT, Special
9	See Note	CONNECTOR, RF
10	0405327S01	WASHER, Bearing
11	7582154D33	PAD, Speaker
12	1405490Q01	BOOT, Microphone
13	See Note	MICROPHONE (MK1)
14	See Note	PRINTED CIRCUIT BOARD, Main
15	0300139047	SCREW, Cutting
16	0105955P12	ASSEMBLY, Cover
17	5405152S01	LABEL, Kit Number (NTN5050A)
	or 5405152S17	LABEL, Kit Number (NTN5881A)
	or 5405152S02	LABEL, Kit Number (ZLN6416A)
18	3205082E03	GASKET, O-Ring (2 req'd.)
19	0382210E19	SCREW, Cover-Captive; #4-40 (2 req'd.)
20	0300139939	SCREW, Pad Retainer (4 req'd.)
21	7505385P01	PAD, Hook (NTN5050A)
	or 0105957Q44	ASSEMBLY, Belt Clip (NTN5493A)
22	3205082E63	GASKET, O-Ring
23	See Note	DOME, PTT (S1)
24	3205264L06	SEAL, PTT
25	See Note	PRINTED CIRCUIT BOARD, PTT
26	See Note	SPEAKER (LS1)
27	4305407R01	SPACER, Speaker
28	3205190R01	PAD, Seal
29	7505136L03	PAD, Silicon Sponge (2 req'd.)
30	See Note	SWITCH, Toggle (S2)
31	4505211R01	LEVER, PTT
32A	0305425R02	SCREW, Captive
32B	0305202T02	THUMBSCREW
33	3305269R01	LABEL, Nameplate
34	See Note	PRINTED CIRCUIT, Flexible
35	0405465C01	WASHER, Plastic (2 req'd.)
36	1405424D04	INSULATOR (2 req'd.)
37	0405910D01	WASHER, Insulator
38A	3205378T01	SEAL
38B	3205884T01	SEAL
39	4382377B71	SPACER
40	0905518D02	SNAP SOCKET
41	0482650D06	WASHER
42	0382210E01	SCREW, Captive; # 4-40
43	----------	STRAIN RELIEF; Not field replaceable, order NTN5881A
44	----------	HOUSING, Top; Not field replaceable, order NTN5881A
45	----------	CLIP; Not field replaceable, order NTN5881A
46	3202475J01	SEAL, Housing
47	1502469J01	HOUSING, Bottom
48	3202472J01	SEAL
49	See Note	JACK, Earphone
50	3902474J01	CONTACT
51	8402467J01	PC FLEX
52	3205557S01	SEAL, Earphone Jack
53	0205163Q01	NUT, Spanner
54	0405179S02	WASHER, Seal
55	0302473J01	SCREW, Mounting
56	4302471J01	ADAPTER, Antenna

NOTE: Refer to Electrical Parts List for part number and description.

MOTOROLA INC.

NTN5438A

12VDC CONTROL UNIT/VEHICULAR CHARGER
With PAC•RT® Operation

1. DESCRIPTION

The NTN5438A 12VDC Control Unit/Vehicular Charger performs two basic functions. It automatically activates or deactivates the PAC•RT Vehicular Repeater to and from its standby condition, and it trickle charges the portable radio nickel-cadmium battery while the portable radio is in the unit. The unit may also be used as a stand alone charger in which case, all the references to PAC•RT operation will not be applicable.

Two switches control the unit: an on/off switch and an enable/disable switch. The on/off switch applies dc power to the PAC•RT repeater and to the charging circuitry when the mobile radio is on. The enable/disable switch duplicates the automatic functions of the pocket switch, which switches the repeater to and from its standby condition.

Two lamps indicate the condition of the repeater; the green lamp indicates that power is applied to the repeater and to the charging circuits of the charging unit, and the blue lamp indicates that the portable radio is properly seated in the pocket and its nickel-cadmium battery is being charged.

The control unit/vehicular charger is housed in a metal cabinet approximately 3 inches high by 7 1/4 inches wide by 5 inches deep (less mounting hardware). The operating switches and indicators are conveniently located on the front panel. Power and control connections are made through a receptacle on the rear panel to the PAC•RT vehicular charger/holder cable. In the stand-alone charger mode of operation, the power connection is made via a power cable (NKN6428A).

2. INSTALLATION

Mounting hardware supplied includes a bracket for mounting the unit below the vehicle dashboard. The bracket enables the charger to be pivoted to a position which offers the best security to the portable radio during rough traveling conditions. Install the unit as described in the following steps:

a. Use the trunnion bracket as a template and drill three 0.265-inch holes in a convenient place on the underside of the dashboard.
b. Refer to the installation detail, and mount the bracket to the dash using three 1/4-20 bolts, lockwashers, and nuts provided.
c. Mount the unit to the bracket using four 1/4-20 bolts and lockwashers, and two flat washers as shown in the figure. The flat washers **must** be placed between the lockwasher and the bracket to ensure proper locking action of the lockwasher. Do not tighten the four bolts yet.
d. Rotate the unit to a position that provides about a 45-degree mounting angle. This angle provides operational convenience for the operator and physical security for the portable radio under rough traveling conditions. Tighten the four mounting bolts holding the charger to the bracket.
e. Attach the PAC•RT cable to the unit. Refer to the PAC•RT manual for more information. If used as a stand alone charger, make the power connection per installation instructions supplied with the NKN6428A Cable Kit.

CAUTION

The NKN6428A Cable is the only power cable compatible with vehicular charger NTN5438A. Do not use cable kits NKN6149, NKN6150, or NKN6151.

3. OPERATION

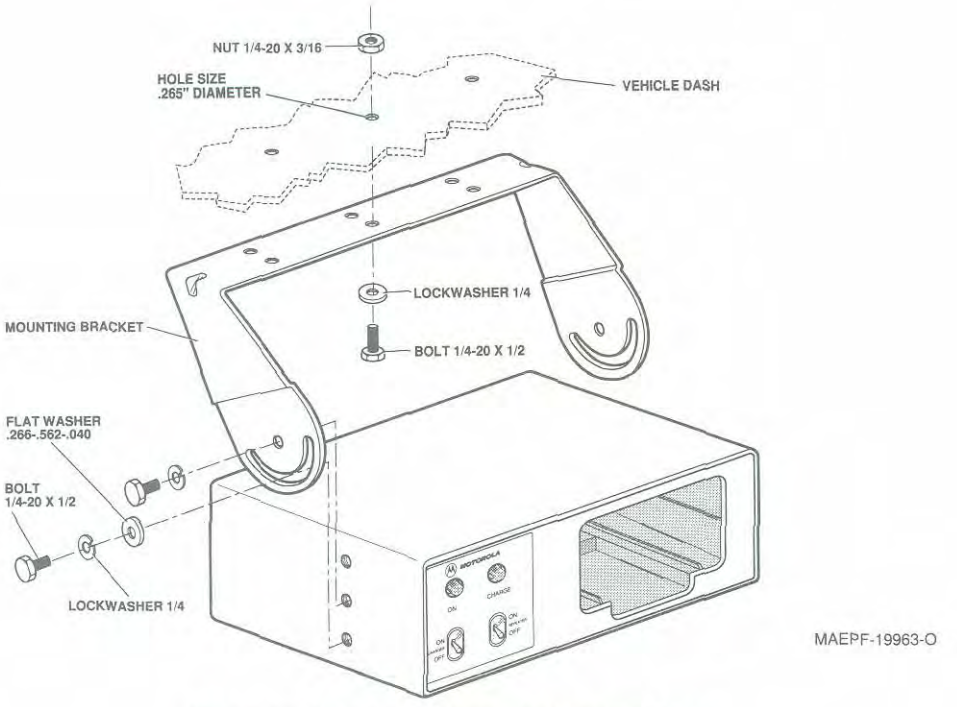
When used with a mobile/PAC•RT system, turn the mobile radio on.

Place the vehicular charger on/off switch in the ON position. The green lamp above the on/off switch should glow. This switch applies unregulated B+ to both the charging circuitry and the PAC•RT repeater (if applicable).

Place the portable radio in the pocket of the unit. The blue lamp should glow indicating that the

Instruction Manual

68P81108C50-A



Vehicular Charger or Holder Installation Detail

portable radio nickel-cadmium battery is being charged. If a battery other than a nickel-cadmium battery is used, the blue lamp will not glow.

NOTE

For best charging results, turn the portable radio off while it's in the charging unit. The approximate charge time is 16 hours.

When used with a mobile/PAC•RT system, the enable/disable switch and the pocket switch have similar functions. With the enable/disable switch in the enable position, the pocket switch enables the repeater (switches from standby to its on condition) when the portable radio is out of the pocket. When the radio is in the pocket, the pocket switch disables (switches back to standby) the repeater. The automatic function of the pocket switch is manually disabled by setting the enable/disable switch in the disable position. This disables the repeater even if the portable radio is removed from the pocket. For more details, refer to the PAC•RT instruction manual.

NOTE

All of the switching functions are operative even if the lamps are burned out.

CAUTION

If the unit is directly connected to the vehicle's battery, place the on/off switch in the OFF position when the vehicle is not running.

4. THEORY OF OPERATION

When the on/off switch is turned on, and a portable radio is in the pocket, the blue lamp (DS2) will glow and the portable radio nickel-cadmium battery will begin to charge. Source voltage is applied through fuse F1 to on/off switch S1. Components L1 and C6 form a filter for noise elimination. Integrated circuit IC1 consists of six inverters which form an oscillator stage (IC1-A and IC1-F) and amplifiers IC1-B, IC1-C, IC1-D, and IC1-E. The ac signal from the integrated circuit is fed to voltage drivers Q1 and Q2, which drive the voltage doublers Q3 and Q4. Components CR4 and C4 filter the voltage doubler output.

Current regulation is provided by transistor Q5 and its associated components. Current through the charging contacts biases current sensor Q7 into conduction and activates lamp driver Q6. Lamp driver Q6 applies a ground to lamp DS2 to causes it to glow, indicating that the battery is being charged. Diode CR5 prevents the radio battery from discharging when power is turned off with a radio in the charger pocket.

5. MAINTENANCE

A. Lamp Replacement

Unscrew the green or blue lamp jewel with your fingers. Remove the miniature flange lamp bulb from the jewel and replace it with a new bulb. Place the jewel and replacement bulb back into the unit.

B. Fuse Replacement

The fuse can be replaced by unscrewing the fuseholder at the back of the chassis.

C. Charging Current

Connect a milliamp meter (0 -100mA range) between the charging contacts. With an input voltage of 13.8 volts dc, the charging current should be approximately 85mA.

NTN5438A
Control Unit/Vehicular Charger

TPLF-3809-A

REFERENCE SYMBOL	MOTOROLA PART NUMBER	DESCRIPTION
		CAPACITOR, Fixed:
C1	2183162H22	470pF±5%; 50V
C2	2184511B01	100pF±10%; N750
C3, 4	2384669A23	60uF-10+150%; 50V
C5	2382256J06	2.2uF-10+50%; 63V
C6	2383441B19	10uF±20%; 20V
CR2 thru 7	4883654H01	**DIODE:** Silicon, See Note
DS1, 2	6500868908	**LAMP:** #327
F1	6500804908	**FUSE:** 2-Amp; 32V
IC1	5182822F02	**INTEGRATED CIRCUIT**: Hex Inverter
L1	2482549D13	**CHOKE:** 68uH
		TRANSISTOR: See Note
Q1, 2	4800869570	NPN, Type M9570
Q3	4800869677	PNP, Type M9677
Q4	4800869676	NPN, Type M9676
Q5	4800869677	PNP, Type M9677
Q6	4800869570	NPN, Type M9570
Q7	4800869571	PNP, Type M9571
		RESISTOR, Fixed: Ω ± 10%; 1/4W unless stated
R1	0600124C79	18k
R2	0600124D04	180k
R3	0600124A75	12k ±5%
R4	0600124C73	10k
R5, 6	0600124C79	18k
R7	0600124C49	1k
R8	0600124C57	2.2k
R9	0600124C47	820
R10	0611009D26	8.2 ±5%
R12	0600124C59	2.7k
R13	0600124C37	330
R14	0600124C95	82k
R16	0600124C67	5.6k
R17	0600124C97	100k
		SWITCH:
S1, 2	4000482097	Toggle, SPST
S3	4183052A01	Spring part of switch
	3905590D01	Contact part of switch
		DIODE: See Note
VR1	4882256C18	Zener, 9.1V
VR2	4805746G24	Zener, 15V
NONREFERENCED ITEMS		
	0105954Q54	ASSEMBLY, Pocket
	0105954Q53	ASSEMBLY, Contact
	0105953C60	ASSEMBLY, PC Board Chassis with Terminal Strip
	0180792A30	ASSEMBLY, Mounting Hardware
	0982083C01	HOLDER, Fuse
	0982684G02	SOCKET and JEWEL, Grn (for DS1
	0982684G03	SOCKET and JEWEL, Blue (for DS2
	0984509H01	RECEPTACLE, 6-contact
	1305622T01	ESCUTCHEON

NOTE: For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.

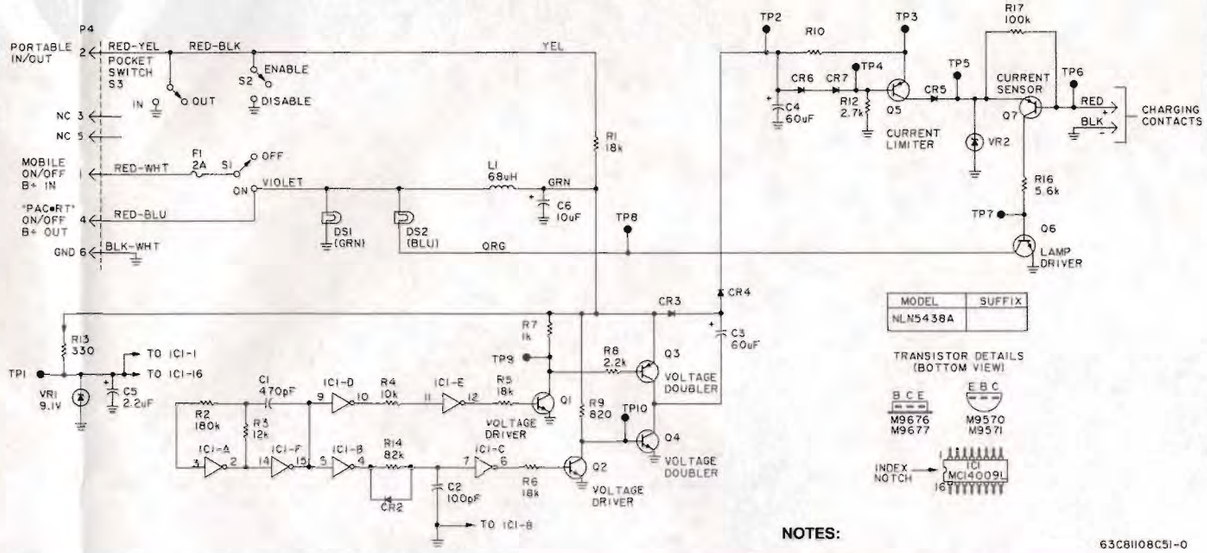
NOMINAL DC VOLTAGE MEASUREMENTS

* TEST POINT	BATTERY CHARGING CONTACTS OPEN (VDC)	BATTERY CHARGING CONTACTS SHORTED WITH 100-OHM 2-WATT RESISTOR (VDC)
1	9.1	9.1
2	22.0	22.0
3	21.3	21.3
4	20.4	20.4
5	16.0	9.7
6	15.9	8.6
7	0	0.77
8	13.8	.04
9	5.5	5.5
10	0.24	0.24

* REFERENCE VOLTAGES ARE TAKEN WITH 13.8 VDC FROM AN EXTERNAL POWER SUPPLY.

TEPF-19910-O

SCHEMATIC DIAGRAM

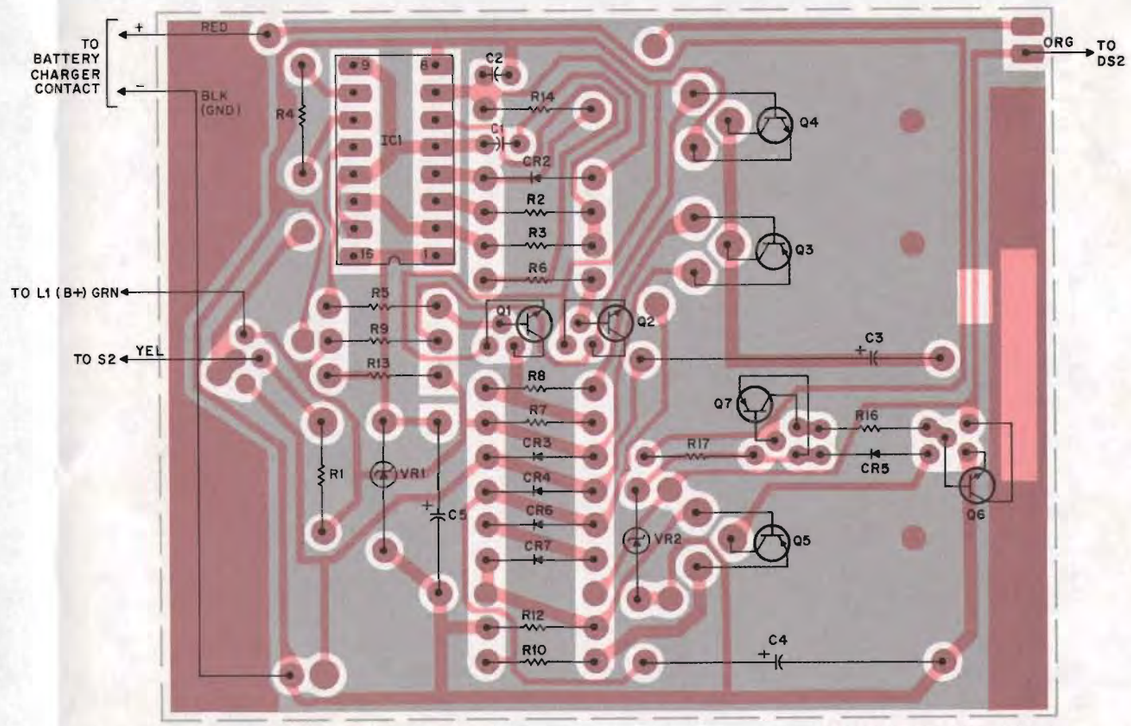


NOTES:

1. UNLESS OTHERWISE STATED: RESISTOR VALUES ARE IN OHMS, k = 1000; AND ALL CAPACITOR VALUES ARE SHOWN.
2. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND USING MOTOROLA DC MULTIMETER OR EQUIVALENT.

TEPF-19909-O

63C81108C51-O



CIRCUIT BOARD VIEWED FROM COMPONENT SIDE

● SOLDER SIDE CEPF-19917-O
● COMP SIDE CEPF-19918-O
OL-CEPF-19919-O

INSTRUCTION MANUAL QUESTIONNAIRE

We believe that reports from users provide valuable information for producing quality manuals. By taking a few moments to answer the following questions as they relate to this specific manual, **you** can take an active role in the continuing effort to ensure that our manuals contain the most accurate and complete information of benefit to you. Thank you for your cooperation.

In reference to Manual Number: **68P81065C75-A**

HT600™ Handie-Talkie® Portable Radios

1. Please check all the appropriate boxes:

	Complete	Incomplete	Correct	Incorrect	Clear	Confusing	Size Adequate	Size Too Small	Not Covered in This Manual
Model/Option Charts									
General Description (Features/Options)									
Detailed Circuit Description									
Test Equipment & Service Aids									
Troubleshooting Procedures/Charts									
Repair Procedures									
Illustrations/Photos/Tables									
Disassembly Procedures									
Alignment Procedures									
Exploded Views									
Schematic Diagrams									
Circuit Board Details									
Electrical Parts List									
Exploded View Parts List									

2. How would you rate the overall organization of this manual?
   ❒ excellent ❒ very good ❒ good ❒ fair ❒ poor

3. Is the information in this manual **essential** to servicing and maintaining the specific equipment?
   ❒ very much so ❒ generally yes ❒ to some extent ❒ no

4. How do you rate this particular manual?
   ❒ excellent ❒ very good ❒ good ❒ fair ❒ poor

5. We would appreciate any corrections or recommendations for improving this manual. Please include the specific page number(s) of the diagram, illustration, photo, chart, parts list, or procedure in question.

   a. Model/Option Charts: (Page No. _____)

   b. General Descriptions (Features/Options): (Page No. _____)

   c. Detailed Circuit Descriptions: (Page No. _____)

   d. Test Equipment & Service Aids: (Page No. _____)

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(Continued)

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g. Illustrations/Photos/Tables: (Page No. _____)
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i. Alignment Procedures: (Page No. _____)
j. Exploded Views: (Page No. _____)
k. Schematic Diagrams: (Page No. _____)
l. Circuit Board Details: (Page No. _____)
m. Electrical Parts Lists: (Page No. _____)
n. Exploded View Parts Lists: (Page No. _____)

6. General comments/suggestions: _____

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When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

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