


Regency®

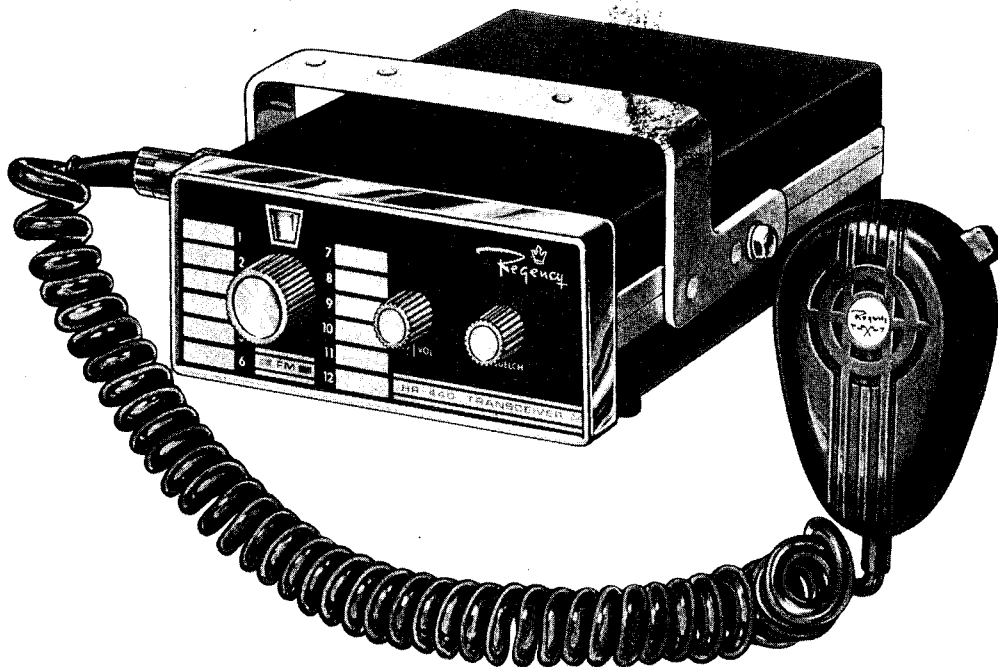
ELECTRONICS INC.

Don
W3ITM

SN

171-400438

OWNER'S MANUAL



MODEL HR-440

440MHz

AMATEUR FM TRANSCEIVER

7707 RECORDS STREET
INDIANAPOLIS, INDIANA 46226

PRINTED IN U.S.A.
3-75

PRICE \$5.00
7001-1057-900

Power Output 10 Watts (min.) @ 13.6 VDC

Power Bandwidth (factory range) 10 Watts from 444-450 MHz

Power Module Protection SWR Bridge Limiting Circuit

Harmonic and Spurious Emissions 54 DB, or more,
below carrier

Modulation Phase Modulation with
automatic deviation limiting

Deviation Factory adjusted to 5 KHz; internal
adjustment of 0-10 KHz deviation

Mike Pre -Amp FET Input with internal level control

Microphone Plug-in, hand held, high-Z ceramic

Channels 12; Crystal Controlled with individual
trimmer capacitors for Frequency netting

Crystal Multiplication 36

Crystal Installed 446.00 MHz in Channel 1

POWER

Voltage Requirements 11.5 VDC (min) - 14.5 VDC (max)

Current Requirements @ 13.6 Volts

 Receive (Squelched) 180 MA.

 Receive (Max. Audio Output) 800 MA.

 Transmit 4.0 Amps (max.)

Fuse Size 5 Amp. 3AG

SEMICONDUCTORS

UHF Power Module 1

Integrated Circuits 2

SPECIFICATIONS

RECEIVER

Antenna Impedance	50 Ohms
Frequency Range	420-450 MHz
Factory Tuned Segment.....	444-450 MHz
Sensitivity.....	0.5 μ v (nom.), 20 DB Quieting
Sensitivity Bandwidth	approx. 3.5 MHz @ 3 DB approx. 6.5 MHz @ 6 DB
Selectivity.....	6 DB Down \pm 7 KHz 50 DB Down \pm 20 KHz
Spurious Rejections (excluding Image).....	60 DB
Modulation Acceptance	\pm 7.5 KHz
I.F. Frequencies.....	10.7 MHz & 455 KHz
Audio Output (3-4 Ω Speaker).....	3 Watts @ 10%, or less, Distortion; 5 Watts Maximum
Squelch System.....	"Noise" Operated
AFC Range	\pm 6 KHz (approx.)
Channels	12; Crystal Controlled
Crystal Installed	446.00 MHz in Channel 1
FCC Certified	Part 15, Subpart C

TRANSMITTER

Antenna Impedance	50 Ohms
Frequency Range	420-450 MHz
Factory Tuned Segment	444-450MHz

The HR -440 utilizes silicon transistors (23) throughout for dependability. The use of two Integrated Circuits provides for compactness and circuit reliability. In addition, a ceramic filter employed in the receiver's second I.F. ensures optimum performance in areas of the country where channels are closely grouped together .

The transmitter employs a UHF Power Module (thin-film construction) for high RF power output (10 Watts). A large, copper heat sink plus a SWR Bridge Limiting Circuit ensures maximum protection even under long periods of "key down" operation and open or shorted antenna conditions. Also, there is very little power drop off during lengthy transmissions. In addition, the attenuation of spurious emissions from the transmitter exceed the FCC limits as would be required for Type Acceptance. The receiver section is Certified under Part 15, Subpart C of the FCC Rules and Regulations.

Some EXTRA features include:

1. Provision for connection of an external or remote speaker (such as Regency's MA -8).
2. A Mobile Mounting Bracket for easy installation in most any vehicle.
3. A Security Bracket, which will help minimize the possibility of theft. See installation illustration on page 6
4. A plug-in, high-impedance microphone.
5. Reverse-polarity protection on Power connector.

UNPACKING

- 1 - Transceiver Unit
- 1 - Microphone Assembly
- 1 - DC Power Cord with Fuse Holder
- 1 - Mobile Mounting Bracket
- 1 - Security Bracket (See page 6 for Installation)
- 1 - Instruction Manual
- 1 - Warranty Card; To be filled out and returned to:

Regency Electronics, Inc.
7707 Records Street
Indianapolis, Indiana 46226

T
4
1
449.15 444.15
2 448.35 443.35
3 447.5 442.5
9 446.25 441.25
4 445.4 440.4
1 444.55 439.55

For engines
Send to
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Chickasha, Oklahoma 73016
1-800-651-1111

MAINTENANCE

To help facilitate tuning the HR -440 to a different 6 MHz segment of the band, simplified alignment procedures for the receiver's RF section and the transmitter are given, starting on page 10. In addition, procedures for properly aligning the IF and AFC (Automatic Frequency Control) are included; see page 15.

A voltage data chart, parts overlay diagrams (of all four PC boards) and a fully itemized parts list provide the necessary information for troubleshooting, repair and replacement purposes.

DESCRIPTION

The Regency HR -440 is a 12-channel, all-transistor narrowband FM transceiver designed for use in the 420-450 MHz Amateur Band. Its receiver section is a double-conversion, super-heterodyne type with plug-in, crystal-controlled (with AFC) frequency selection.

The transmitter section is also crystal-controlled on each channel. The transmitter employs phase modulation, using varactor diodes. Internal controls are provided for adjusting the deviation from 0 to 10 KHz. This control is factory adjusted for approximately 5 KHz deviation.

The transmitter and receiver sections both employ band-pass circuitry so that effective transmitter power and receiver sensitivity are maintained across any 6 MHz segment of the band. Based upon a recently published Band Plan, the receiver is factory tuned to cover 442 to 448 MHz, while the transmitter is factory tuned to cover 444 to 450 MHz. Crystals for the proposed National Simplex Frequency, 446.0 MHz, are factory installed in Channel 1.

Silicon Transistors (Total)	23
Field Effect Transistors	2
Diodes (Total)	10
Zener Diodes	2
Varactor Diodes	3
Signal Diodes	4
Rectifier Diodes	1

ACCESSORIES

<u>DESCRIPTION</u>	<u>REGENCY PART NO.</u>
AC Power Supply - Regulated, 4 Amp.	P109
or - Regulated, 5 Amp.	P110
Remote Speaker with Mounting Bracket	MA -8
DC Power Cord with Cigarette Lighter Plug	MA -10
70 DB Filter Kit (455 KHz)	MA -46
Handset (Telephone type) Microphone	MA -79
(See page 7 for installation)	

INSTALLATION

Mobile (12 VDC) Installation:

The HR -440 transceiver may be used in any car, truck, boat, etc. that has a 12 VDC negative ground system. The RED lead with the fuse holder must be connected to the positive terminal side of the battery. The BLACK lead should be connected to the chassis or negative terminal of the battery.

To reduce the possibility of theft, the Security Bracket should be installed (as shown on page 6). The padlock used should be of substantial construction and can be either a key or combination operated type.

For a quick and easier mobile installation, an accessory 12 VDC power cord with a cigarette lighter plug (Regency MA -10) can be used. In this case, the unit can be operated from on the front seat of the vehicle.

The "mobile" antenna used should be adjusted as closely as possible to present a 50 Ω load to the transceiver. The adjustments recommended by the antenna's manufacturer should be carefully followed to insure that the lowest

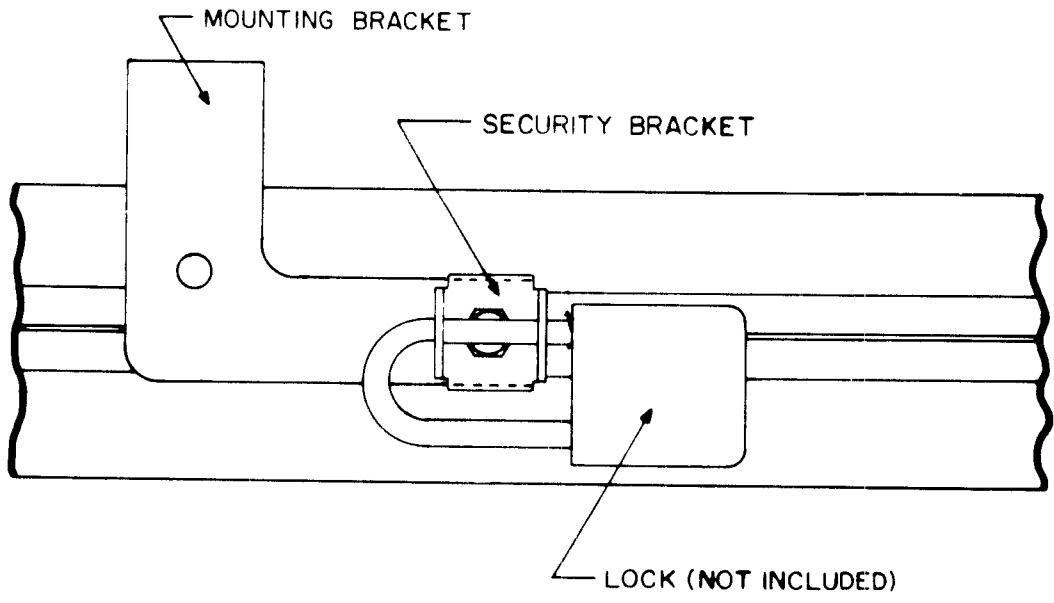
possible SWR is achieved. It is recommended that any final adjustment to the antenna be made with a reliable SWR indicator in the feedline and with the HR -440 operating. If the SWR is too high, the built-in SWR Bridge Limiting Circuit of the HR -440 will reduce the RF power out, or may even shut-off the transmitter entirely.

Base Station (117 VAC) Installation:

The HR -440 may be used with any regulated or well filtered DC power supply that can supply at least 4 amperes at 12 to 14.5 VDC. The regulation of the power supply should be such that its output voltage does not get over 14.5 VDC when the transceiver is in the receive mode and is squelched off. Damage to various components may occur if the unit's input voltage exceeds 15 volts for any length of time.

The power supply and/or the power connection to the HR -440 should be properly fused. In addition, the ripple on the supply's output voltage should be less than 1%. It is recommended that Regency's regulated power supply, the P109 or P110, be utilized for base station operation of the HR -440.

The antenna impedance should be adjusted or matched as closely as possible for use with 50 ohm coaxial cable. Use of RG-58/U should be considered only if the length of coax needed is 15 feet or less. For longer runs of feedline, it is recommended that a lower-loss cable, such as RG-8/U (especially of the "foam" type) should be used.



SIDE VIEW SHOWING SECURITY BRACKET INSTALLATION

OPERATION

Volume Control/Off-On Switch:

This control varies the audio output level for the internal speaker. It also varies the level of audio present at the external speaker connection. Clockwise rotation of this control turns the receiver on and increases the volume.

Squelch Control:

This control eliminates background noise in the absence of a signal. Full clockwise rotation removes all squelch action. Turning this control counter-clockwise until the noise disappears permits the receiver to be "quiet" until an actual signal is received. Even if the squelch control is set fully counter-clockwise, the receiver will still operate properly and not be locked-out or prevented from receiving a signal.

Channel Selector:

This is a twelve-position rotary switch which enables the operator to select any one of twelve crystal-controlled transmit-receive channels. Each switch position pairs up a specific transmit crystal with its respective receive crystal. For example, position 1 connects transmit crystal No. 1 and receive crystal No. 1 to their respective oscillator circuits.

Microphone:

A high-impedance, ceramic microphone is supplied with the unit. To install the microphone, insert the 5-pin connector plug into its socket with the indexing tab toward the bottom of the unit. The connector is then locked into place by rotating the locking ring 1/4 turn clockwise.

To use Regency's telephone type microphone (Handset Accessory, MA-79), a resistor and wire will have to be installed. Solder a 680 ohm resistor, either a 1/4 or 1/2 watt, between lug No. 1 and lug No. 3 on the rear panel's terminal board. Then, using a length (approximately 8 3/4 inches) of insulated wire, connect lug No. 3 of the terminal board to solder lug No. 1 of the 5-pin microphone connector socket. Install the wire close to the chassis, following the speaker wires dress. The schematic already shows the proper connections for this modification.

Transmit:

To transmit, it is only necessary to press the PTT (push-to-talk) button on the microphone and speak into the microphone. Best results are usually obtained by holding the microphone about one inch from the lips, inclined at

approximately a 30 degree angle away from the face. Speak clearly in a **normal tone** of voice across the face of the microphone. Release the PTT button to end the transmission and enable the receiver section.

CRYSTAL INFORMATION

Crystal Specifications:

Due to the numerous frequencies or channels involved, only one pair of crystals is installed by the factory. Miniature, plug-in crystals are simply installed by inserting them in the receptacles on the circuit board. Because of the accuracy required, Shepherd Industries' crystals are recommended. They are usually available at the source from which the radio was purchased. Specify exact frequency.

If desired, the crystals may be purchased from other manufacturers. The following information must be included in the order:

Receive Crystal:

1. Crystal frequency, determined as follows:

$$\text{Crystal frequency} = \frac{\text{receive frequency (MHz)} - 10.7 \text{ MHz}}{9}$$

Example:

$$\text{Crystal frequency} = \frac{446.00 \text{ MHz} - 10.7 \text{ MHz}}{9} = 48.366667$$

2. 3rd Overtone
3. Load Capacitance: 18 PF
4. Maximum Equivalent Series Resistance: 35 Ohms
5. Drive level: 2 MW (Max.)
6. Holder: HC-25/U
7. Frequency Calibration: $\pm .001\%$ @ 25°C
8. Frequency Tolerance: $\pm .0015\%$ from -10°C to $+60^{\circ}\text{C}$

Transmit Crystal:

1. Crystal frequency, determined as follows:

$$\text{Crystal frequency} = \frac{\text{transmit frequency (MHz)}}{36}$$

Example:

$$\text{Crystal frequency} = \frac{446.00 \text{ MHz}}{36} = 12.388888 \text{ MHz}$$

2. Fundamental mode
3. Load Capacitance . 32 PF
4. Static Capacitance: 6 PF $\pm 10\%$
5. Maximum Equivalent Series Resistance: 25 Ohms
6. Drive level: 2 MW (Max.)
7. Holder: HC -25/U
8. Frequency Calibration: $\pm .001\%$ @ 25⁰C
9. Frequency Tolerance: $\pm .001$ from -10⁰C to +60⁰C
10. Aging: $\pm .0005\%$ First Year
 $\pm .001\%$ Maximum

Crystal Installation:

Prior to installing a crystal, the transceiver's cover should be removed. To remove the cover, unscrew the two large bolts located at the sides of the unit. The cover may then be slipped off by sliding it toward the rear of the unit.

Next, the speaker should be removed. Unscrew the two small metal screws (one located on each side) holding the speaker brackets in place. Then carefully place the speaker assembly along side of the unit.

The unit is shipped from the factory with the transmit and receive crystals for 446.00 MHz installed in Channel 1.

Insert the crystal, or crystals, in the proper socket pins as indicated on the crystal location drawing. (See page 25). The number by each pair of sockets matches the dial and channel block designation. For each transmit crystal, there is a variable capacitor that can be used for adjusting (netting) each transmit crystal to the exact frequency. This adjustment should be made with a frequency counter or by utilizing a receiver which is known to be "on frequency". See the section on Alignment Procedures for specific details on Netting.

Reinstall the speaker; position the speaker assembly so that the cut-off corner is adjacent to the relay lugs. Carefully reinstall the cover.

The channel, or frequency, blocks on the front panel will accept 1/4" wide embossing tape with up to 5 digits, letters, or other characters. These blocks are to be used for identifying the channel frequencies installed in the unit.

Crystal Jumpering:

Due to the possible excessive "pulling" of the crystal's frequency, jumpering of the RECEIVE crystals is NOT recommended. If jumpering is attempted, the crystal's frequency should be checked with a highly accurate counter to help insure that proper "on channel" operation is possible.

NOTE: Adding a jumper will slightly lower the TRANSMIT crystal's frequency. Adjust the associated trimmer on the transmitter board for correction.

ALIGNMENT PROCEDURES

The HR -440, as sent from the factory, covers 442 to 448 MHz (receiver) and 444 to 450 MHz (transmitter). In order to retune the transmitter and/or the receiver's RF (front-end) section to a different 6 MHz segment of the band follow the procedures detailed below. If possible, utilize crystals that would represent the center frequency and the high and low ends of the desired 6 MHz segment. This will help ensure proper bandspread alignment. If end limit crystals are not available, adequate results can usually be obtained by aligning on a crystal when frequency is near the center of the new segment.

When aligning the transmitter or the receiver's RF section, it is highly recommended that the unit be placed on a metal sheet (or on its cabinet). This will simulate the cabinet's effect when the unit is installed.

The diagram on page 27 indicates the location of the trimmer capacitors and coil that are referred to in the receiver's RF alignment procedure. The diagrams on pages 26 and 24 locate the necessary coils, trimmer capacitors and voltage test points used in aligning the transmitter section.

For possible future repairs or maintenance, the alignment procedures for the receiver's IF and AFC (automatic frequency control) sections are also given. The diagram on page 28 shows the pertinent coils and integrated circuit.

Equipment Required - Receiver (RF):

- a. 13.6 VDC Power Supply (P109, P110 or equivalent).
- b. AC VTVM
- c. DC VTVM
- d. Signal Generator - 420 to 450 MHz.

Alignment Procedure - Receiver (RF):

1. Connect an AC voltmeter to unit's audio output (lug No. 1 on rear panel terminal strip).
2. Adjust Volume Control for a reading of 1 volt (of noise).
3. Connect a Signal Generator (FM or AM) to the unit. With NO modulation, set the generator as accurately as possible to the receive frequency ("center" crystal).

NOTE: To aid in putting the generator "on frequency", monitor the AFC voltage, using a DC VTVM. Connect the VTVM to the top exposed lead of the 10K resistor (R312) that is mounted just in front of the small trimmer resistor (R308); both are located on the AFC board which is vertically mounted on the left side of the chassis. With no signal in, a normal voltage reading will be 2 to 4 volts and slightly fluctuating. Adjust the generator's frequency and output until this voltage is approximately 3 volts and steady.

4. Adjust generator's output until the AC voltmeter reads approximately 0.2 volts.
5. Adjust trimmer capacitors C220, C203 and C201 (in that order) for MAXIMUM quieting (minimum meter reading). Readjust generator's output to maintain a voltmeter reading between 0.1 and 0.2 volts. Repeat these adjustments until no further improvement in quieting can be made.

NOTE: Use a NON-METALLIC tuning tool for adjusting the trimmer capacitors.

6. Adjust L203 for MAXIMUM quieting (minimum meter reading). Re-adjust generator's output to maintain a reading between 0.1 and 0.2 volts.
7. Readjust C220, C203 and C201 for MAXIMUM quieting. Do NOT re-adjust L203 after the final adjustment of C220.
8. Using the end or limit crystals, check bandwidth sensitivity. If necessary, repeat Steps No. 5, 6 and 7 until the desired bandwidth (6 MHz maximum) is obtained.

Equipment Required - Transmitter:

- a. 13.6 VDC Power Supply with at least 4 amp. capability; P109, P110 or equivalent.
- b. DC VTVM (preferably with a 1.5 V range).
- c. RF Wattmeter or a suitable 50 Ω dummy load and a relative power output indicator.
- d. 25 MHz Frequency Counter (see Crystal Netting instructions).
- e. Oscilloscope
- f. FM Deviation Meter
- g. Audio Generator (optional)

Alignment Procedure - Transmitter:

The encircled numbers on the Test Points Diagram (See page 26) correspond to the following procedural steps:

1. Install the crystals; maximum frequency separation should be no greater than 6 MHz. If possible, use a crystal whose frequency is near the center of the new 6 MHz segment for the initial alignment.
2. Connect the VTVM across R422. When the oscillator stage (Q406) is operating, the normal reading will be 0.8 to 0.9 volts (0.6 to 0.7 with no crystal).
3. Connect the VTVM across R413. Adjust both cores (top and bottom) of T403 for MAXIMUM voltage indication. Readjust these cores until the same reading (approximately) is obtained when using the lowest and highest frequency crystals. Normal voltage reading at this point is 0.9 to 1.1 volts. Now adjust the BOTTOM core (core nearest PC board) of T402 for a MINIMUM reading.

NOTE: Tuning T403 slightly affects the TX crystal's frequency, therefore do not net the TX crystals until the transmitter alignment is completed.

4. Connect the VTVM across R410. Adjust the TOP core of T402 for MAXIMUM voltage, normally 0.9 to 1.3 volts. Again using the high and low frequency crystals, adjust both cores for approximately the same voltage. Then adjust the BOTTOM core of T401 for a MINIMUM voltage indication.
5. Connect the VTVM across R406. Adjust the TOP core of T401 for MAXIMUM voltage. Adjust trimmer capacitor C412 for MAXIMUM voltage. Readjust the TOP core of T401 again for MAXIMUM reading, usually 0.6 to 0.9 volts.

6. Connect the VTVM across R402. The following adjustments are interacting and may require repeating the three steps several times.
 - a. Using a non-metallic tool, adjust C405 (piston trimmer) for MAXIMUM RF power output and MAXIMUM voltage (normally 0.5 to 0.9 volts).
 - b. Adjust C408 for MAXIMUM voltage reading.
 - c. Using the limit crystals (highest and lowest frequency), readjust C412 and BOTH cores of T401 for MAXIMUM, and approximately the same RF power output. Repeat Steps a, b and c until no further improvement can be made. If nearly equal output at the limit frequencies can not be obtained, carefully repeat Steps 3 through 6.

Normal RF power output will be in the order of 15 to 18 watts when the module's heat sink is cold or at normal room temperature. When the heat sink is hot or very warm, normal power out will usually be 10 or 11 watts. Total current to the HR -440 will be 3.5 to 4 amperes when the supply voltage is 13.6 volts and the RF power output is greater than 10 watts.

Crystal Netting Procedure:

The highest reading frequency counter that can be readily obtained should be utilized for netting the transmit crystals. However, adequate and proper results can be realized even with a counter that can accurately measure frequencies up to 25 MHz.

See the Crystal Location and Adjustment Diagram (page 25) for netting capacitors location.

1. Use the following procedure if a 450 MHz frequency counter is available:
 - a. Connect the unit to a suitable dummy load.
 - b. Place an RF pick-up loop near L402 or L404 (see the Transmitter Board Parts Overlay Diagram for their location).
 - c. Key the transmitter.
 - d. Read the frequency direct (no multiplication required).
 - e. Adjust the appropriate netting capacitor until the frequency being read is within at least 200 hertz of the required frequency.
2. Use the following procedure if a 225 MHz counter is available:
 - a. Connect the unit to a suitable dummy load.

- b. Place an RF pick-up loop (3 or 4 turns) near the top of coil T401 (blue).
 - c. Key the transmitter .
 - d. Multiply the frequency read on the counter by two (2) to find the ultimate frequency being transmitted.
EXAMPLE: Frequency read = 223.000 000 MHz
 Ultimate Frequency = 2 x 223.000 = 446.000 MHz
 - e. Adjust the appropriate netting capacitor until the frequency being read is within at least 100 hertz of the required one-half (1/2) frequency.
3. Use the following procedure if a 75 MHz counter is available:
 - a. Connect the unit to a suitable dummy load.
 - b. Place an RF pick-up loop (consisting of 3 or 4 turns) near the top of coil T402 (brown).
 - c. Key the transmitter .
 - d. Multiply the frequency read on the counter by six (6) to find the ultimate frequency being transmitted.
EXAMPLE: Frequency read = 74.333 333 MHz
 Ultimate Frequency = 6 x 74.333 333 = 445.999 998 MHz
 - e. Adjust the appropriate netting capacitor until the frequency being read is within at least 30 hertz of the required one-sixth (1/6) frequency.
 4. Use the following procedure if only a 25 MHz counter is available:
 - a. Connect the unit to a suitable dummy load.
 - b. Place an RF pick-up loop (3 or 4 turns) near the top of coil T403 (red).

 NOTE: Due to a possible slight "pulling" of the crystal's frequency, couple the pick-up loop as lightly as possible to T403. Use the maximum sensitivity available at the counter's input .
 - d. Multiply the frequency read on the counter by eighteen (18) to find the ultimate frequency being transmitted.
EXAMPLE: Frequency read = 24.777 778 MHz
 Ultimate Frequency = 18 x 24.777 778 = 446.000 004 MHz
 - e. Adjust the appropriate netting capacitor until the frequency being read is within at least 10 hertz of the required one-eighteenth (1/18) frequency.

Mike Gain And Deviation Adjustments:

NOTE: These adjustments are not required every time the transmitter is realigned.

1. Use the following procedure for proper adjustment of the Microphone Gain Control (R220); see Crystal Location and Adjustment Diagram for location.
 - a. Connect the unit to a dummy load.
 - b. Connect the scope to the junction of CR204 and R227. See Bottom View of PC board 500-113 for location.
 - c. Key the transmitter and talk into the microphone with a normal voice level. Repeatedly say the word "four".
 - d. Adjust R220 (mike gain) until approximately 10% of the voice peaks are clipped, as observed on the scope.

2. Use the following procedure for proper adjustment of the Deviation Control (R231); See Crystal Location and Adjustment Diagram for location.
 - a. Connect the unit to a dummy load.
 - b. Couple an FM Deviation Meter to the transmitter's output.
 - c. Connect an audio generator to the mike input terminals. Set the audio level to approximately 0.5 VRMS, using 1000 Hz as the test signal. If an audio generator is not available, speak into the microphone with a normal voice level and repeatedly say the word "four".
 - d. Key the transmitter.
 - e. Adjust R231 (Deviation Control) until the maximum deviation is no greater than 7 KHz (or whatever lesser value is desired).

Equipment Required - IF And AFC:

- a. 13.6 VDC Power Supply (P109, P110 or equivalent).
- b. AC VTVM
- c. DC VTVM
- d. FM Signal Generator - 420 to 450 MHz
- e. Oscilloscope (optional)
- f. 10.7 MHz or 455 KHz generator (optional)

Alignment Procedure - IF

1. Connect an AC voltmeter to unit's audio output (lug No. 1 on rear panel terminal strip).
2. Adjust Volume Control for approximately a 0.5 volt reading; no signal in, just "noise" output.
3. Peak the bottom core and then the top core of T102 for maximum noise output (highest meter reading). Each core will have two peak settings; the proper peak is when the core is adjusted away from the center of the coil form. See Receiver (IF) Alignment Diagram on page 28 for location of coils.
4. Adjust L103 (Quadrature Detector Coil) for maximum noise output. Pin 1 of IC102 should have a voltage on it of 3.8 to 4.2 VDC.
5. Preset AFC by adjusting R308 until a 3 to 3.5 VDC reading is obtained on the exposed lead of R312. See Receiver (RF) Alignment Diagram for the location of R308 and R312.
6. Adjust Volume Control for a 1 volt reading on AC voltmeter.
7. Connect the FM Signal Generator to the antenna jack. Set the generator as accurately as possible to the receive frequency (no modulation).
8. Adjust the generator's output until the AC voltmeter reads approximately 0.2 volts.
9. Adjust T101 and then T201 (see Receiver RF Alignment Diagram) for lowest meter reading (MAXIMUM quieting). If necessary, re-adjust the generator's output to maintain a reading between 0.1 and 0.2 volts during this step.

NOTE: Each coil will have two peaks. Adjust the core of T101 to the peak away from the center of the coil form. Adjust T201's core to the peak toward the center of the coil form.

10. Set the FM generator to a frequency 910 KHz BELOW the receive frequency (this is the Secondary Image frequency).
11. Adjust the generator's output until the AC voltmeter reads approximately 0.2 volts.
12. Adjust the bottom core and then the top core of T102, and the single core of T101 and T201 for the highest meter reading (maximum quieting degradation). Readjust the generator's output to maintain a 0.1 to 0.2 volt reading during this step.

13. Perform the following steps only if an oscilloscope is available:
 - a. Connect oscilloscope to audio output.
 - b. Set Volume Control for a 2 or 3 volts P-P trace.
 - c. Set the FM generator as accurately as possible to the receive frequency (see the "NOTE" on page 11). Set the modulation for 2 or 3 KHz deviation.
 - d. Adjust generator's output until the audio signal is visibly "noise" free.
 - e. Adjust L103 for maximum audio and best symmetry.

Alignment Procedure - AFC

1. Measure the voltage on Pin 1 of IC102. It should read between 3.8 and 4.2 VDC. If it does NOT, perform the IF Alignment first.
2. Remove any signal (either from an RF generator or antenna) from the antenna connector and squelch the unit.
3. Adjust R308 for a 3.5 VDC reading on the exposed lead of R312. There will be some fluctuation on this reading (with no signal in).
4. To check for proper AFC operation, perform the following steps:
 - a. Connect the signal generator (FM or AM) to the unit. Do NOT apply any modulation. Set the generator as accurately as possible to the receive frequency.
 - b. Adjust the generator's frequency and output level until the AFC voltage (as measured on the exposed lead of R312) is reading approximately 3.5 volts, with no fluctuation. Increase the generator's output level until the voltage reading is steady.
 - c. Slowly turn the generator's vernier or incremental tuning control first in one direction and then the other; observe the AFC voltage changes.
 - d. The AFC voltage will RISE to approximately 7.0 volts as the generator's frequency is INCREASED by 5 to 7 KHz.
 - e. The AFC voltage will FALL to approximately 0.9 volts as the generator's frequency is DECREASED by 5 to 7 KHz.

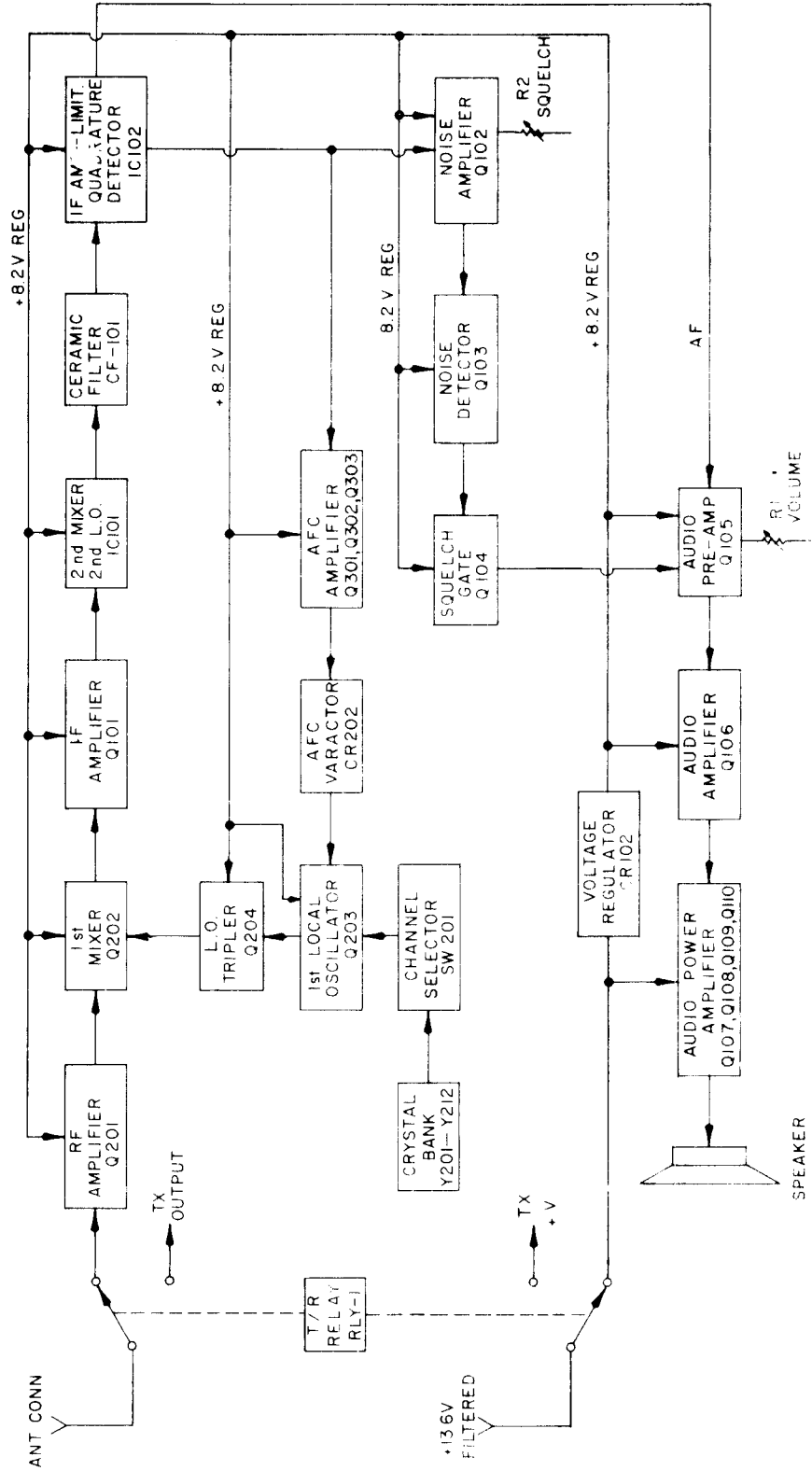
MAINTENANCE INFORMATION

In order to provide the owner with the basic information needed to make most repairs and to maintain his unit in top operating condition, this section contains a voltage data table, parts overlay diagrams and a detailed parts list. Thus, in conjunction with the section on Alignment, complete servicing of the unit is possible by any competent electronic technician.

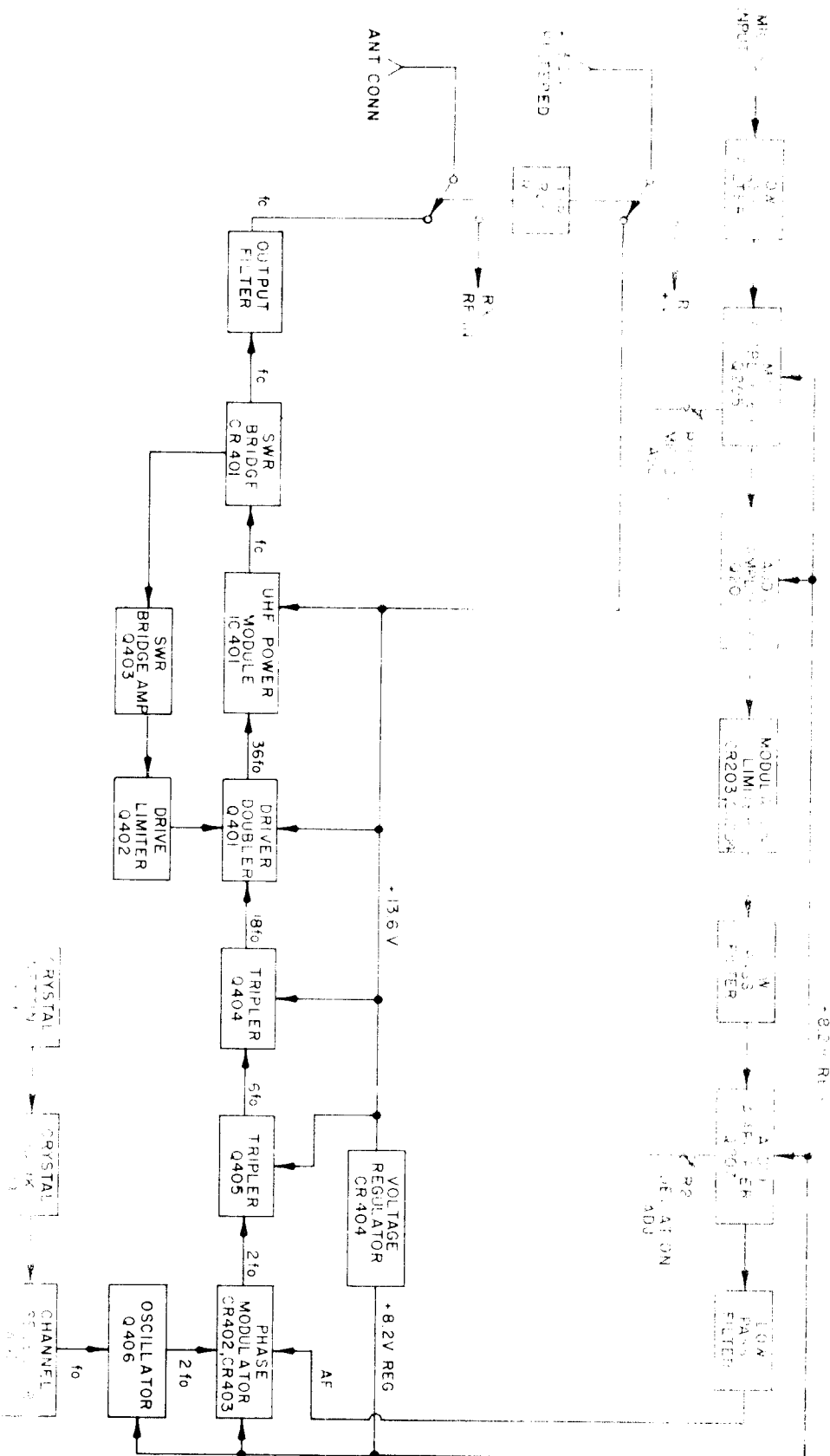
When ordering replacement parts from our Parts Department, please include the following information:

- a. Model Number (HR -440)
- b. Item Number (or schematic designation)
- c. Description (see Parts List)
- d. Part Number (see Parts List)

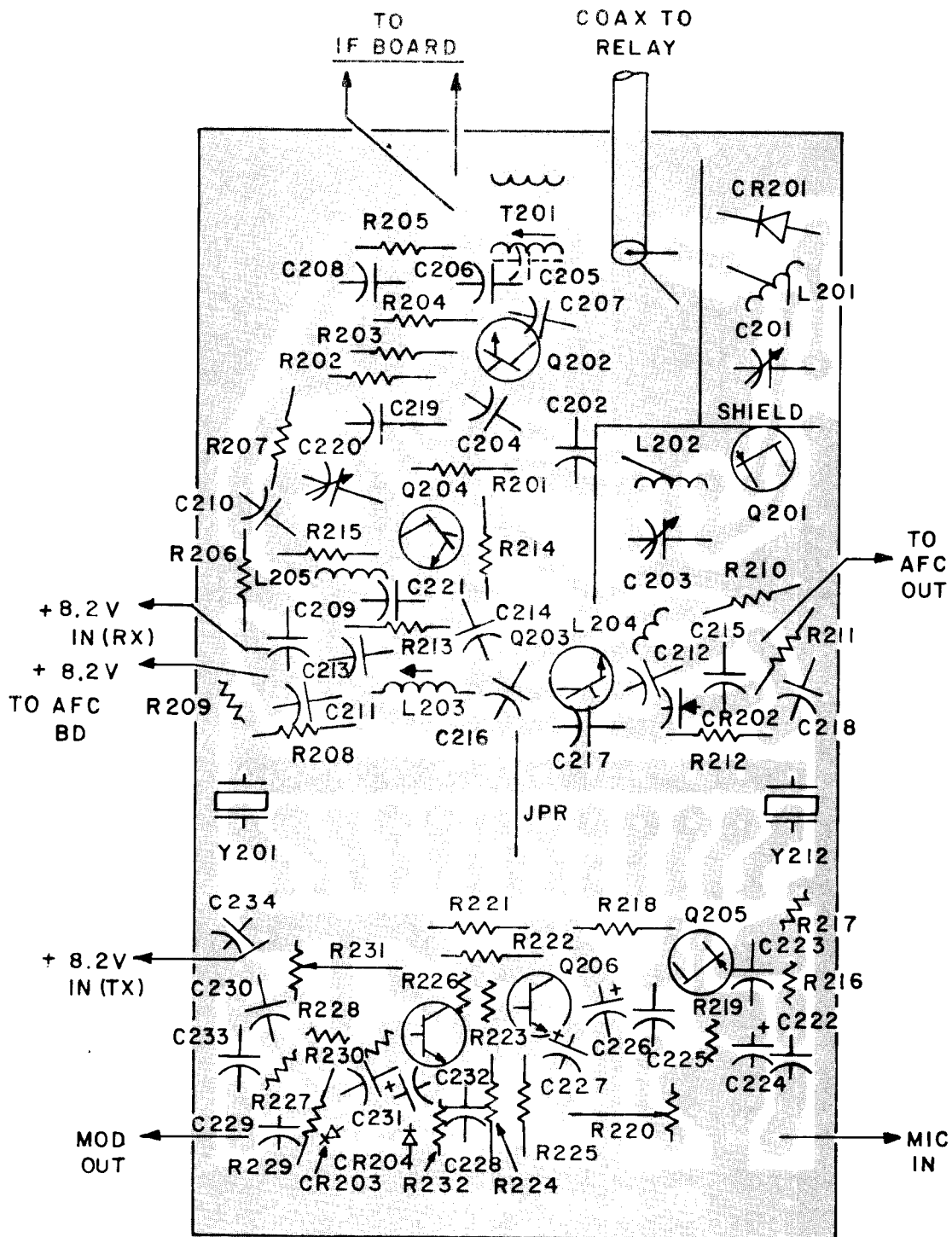
HR-440 RECEIVER BLOCK DIAGRAM



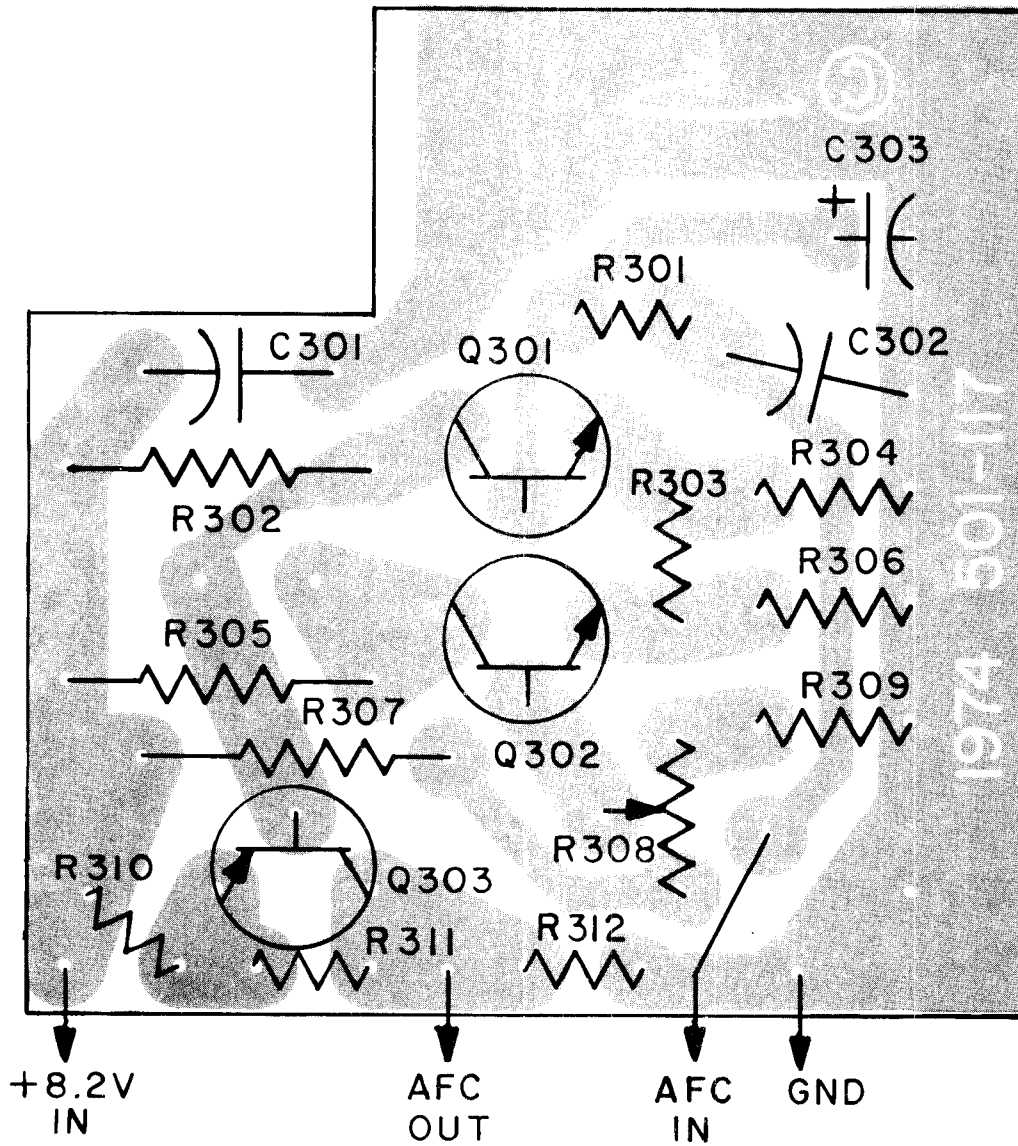
HR-440 TRANSMITTER BLOCK DIAGRAM



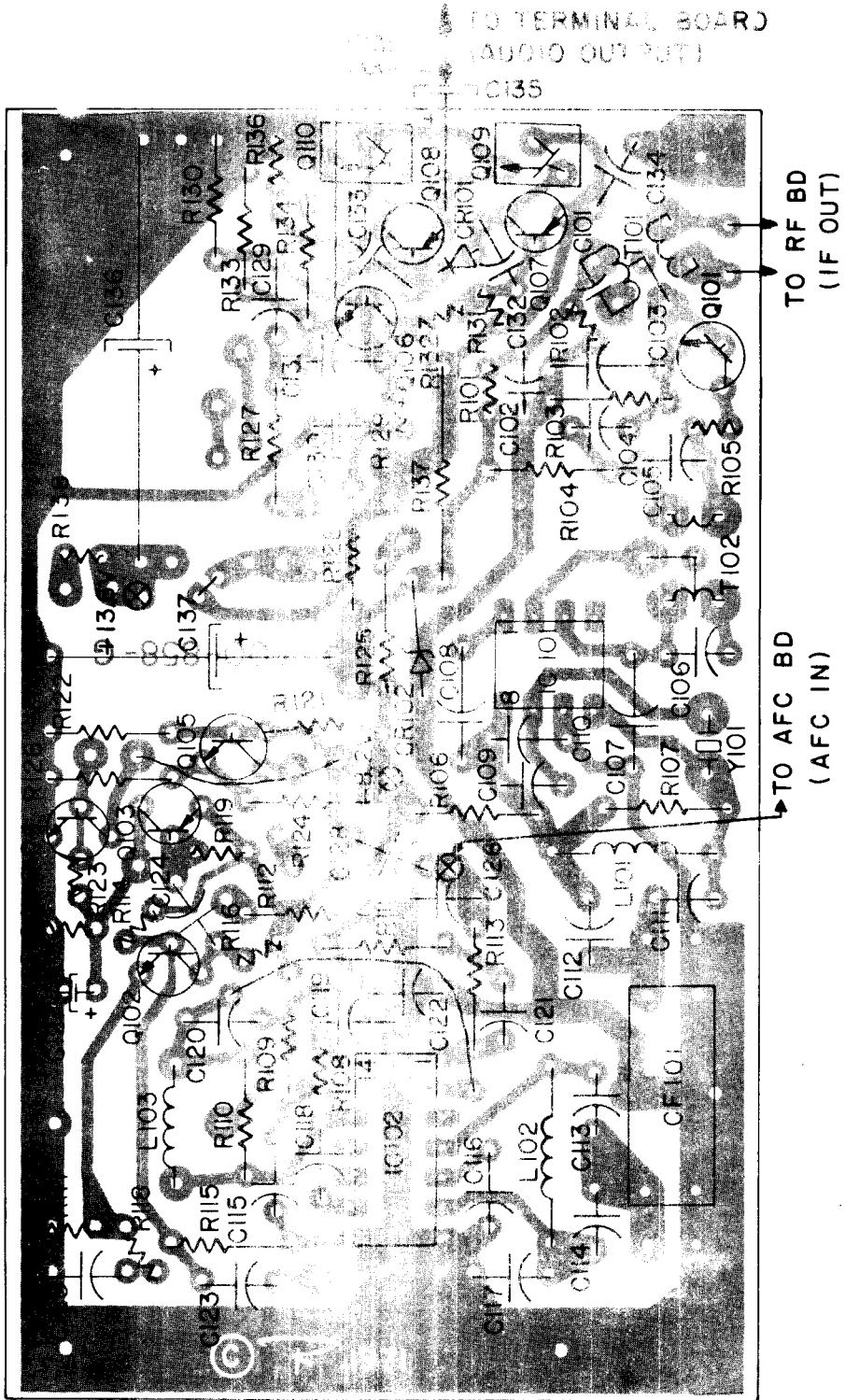
RF/MOD BOARD 501-113



AFC BOARD 501 - 117

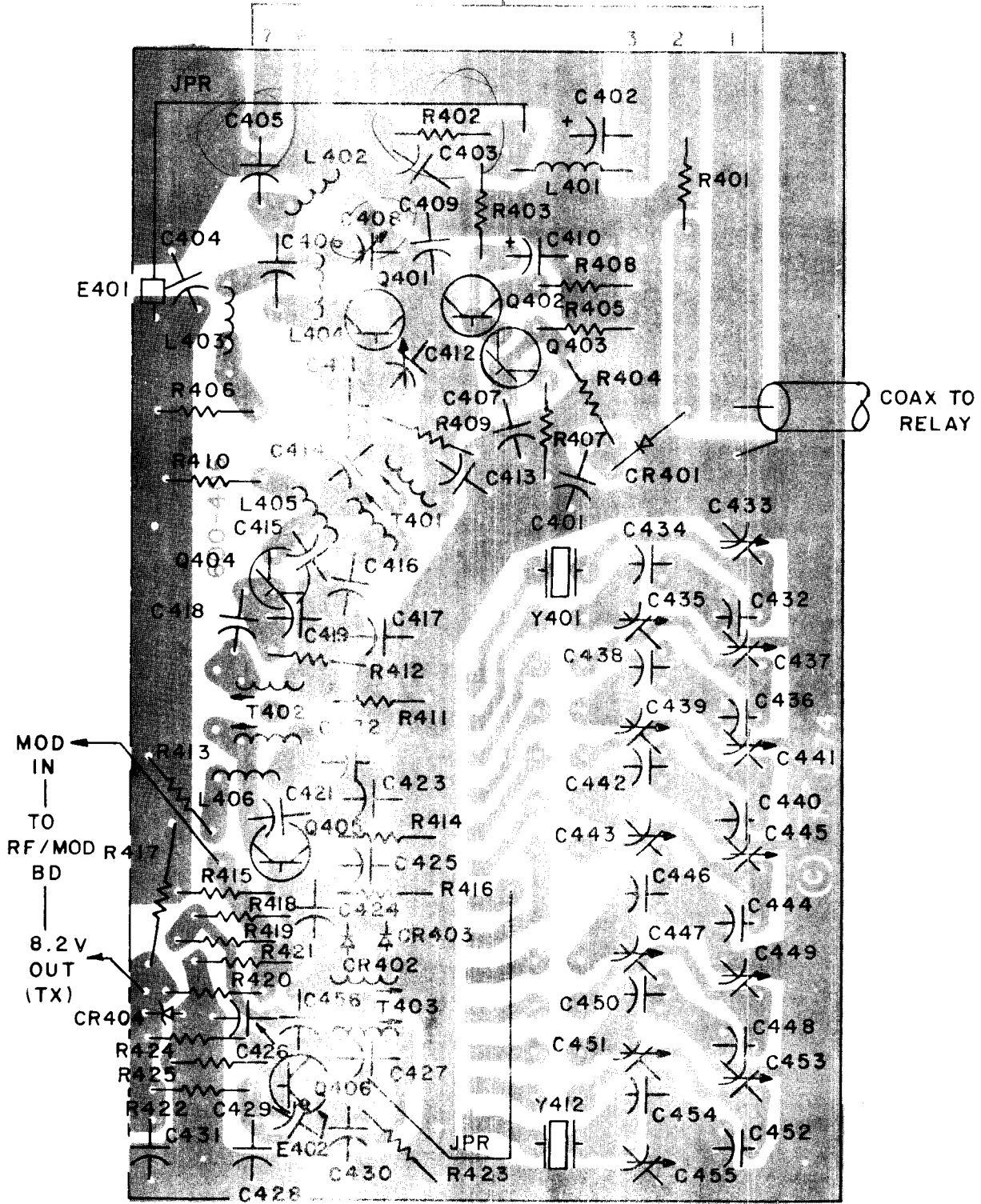


IF/AUDIO BOARD 500-858

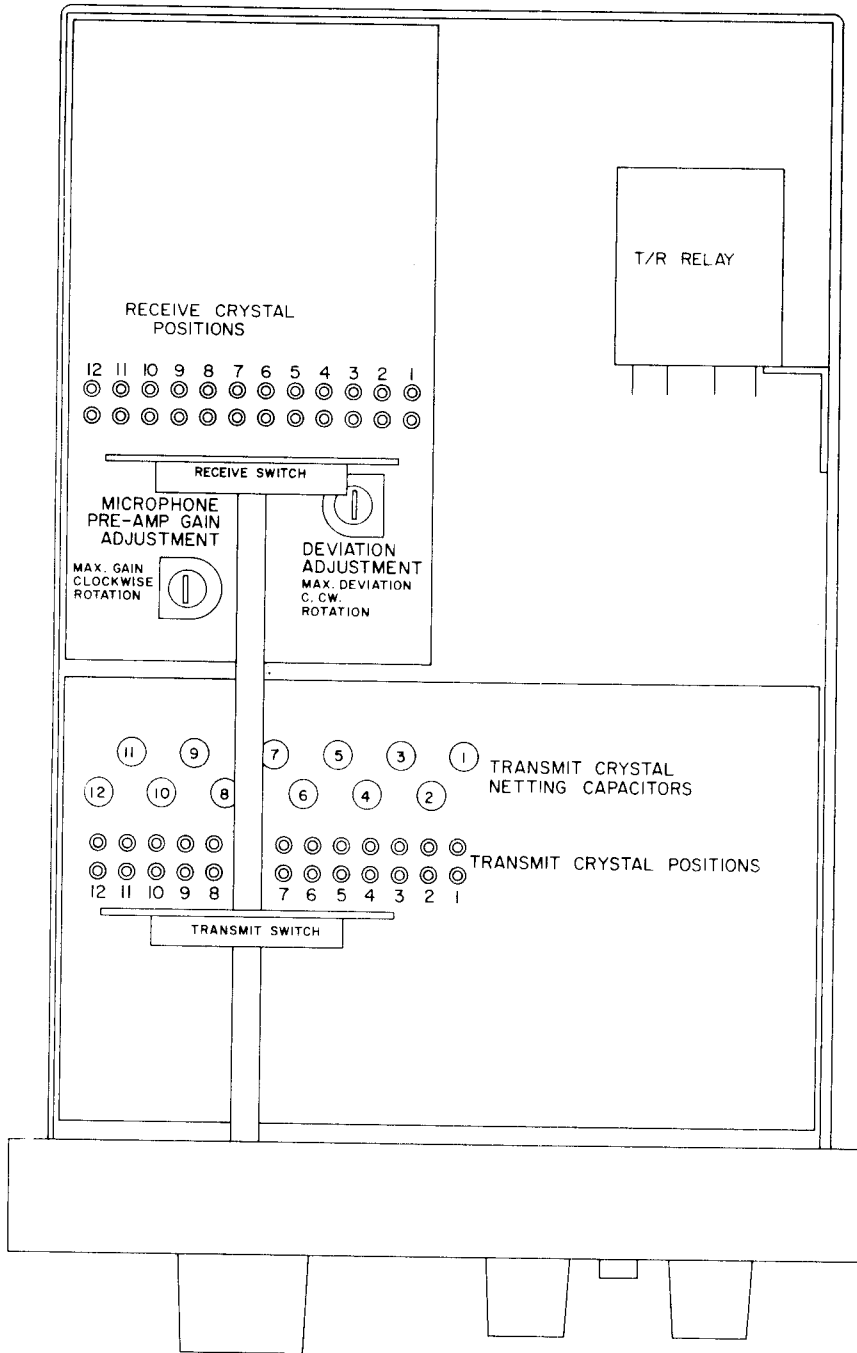


TRANSMITTER BOARD 600-406

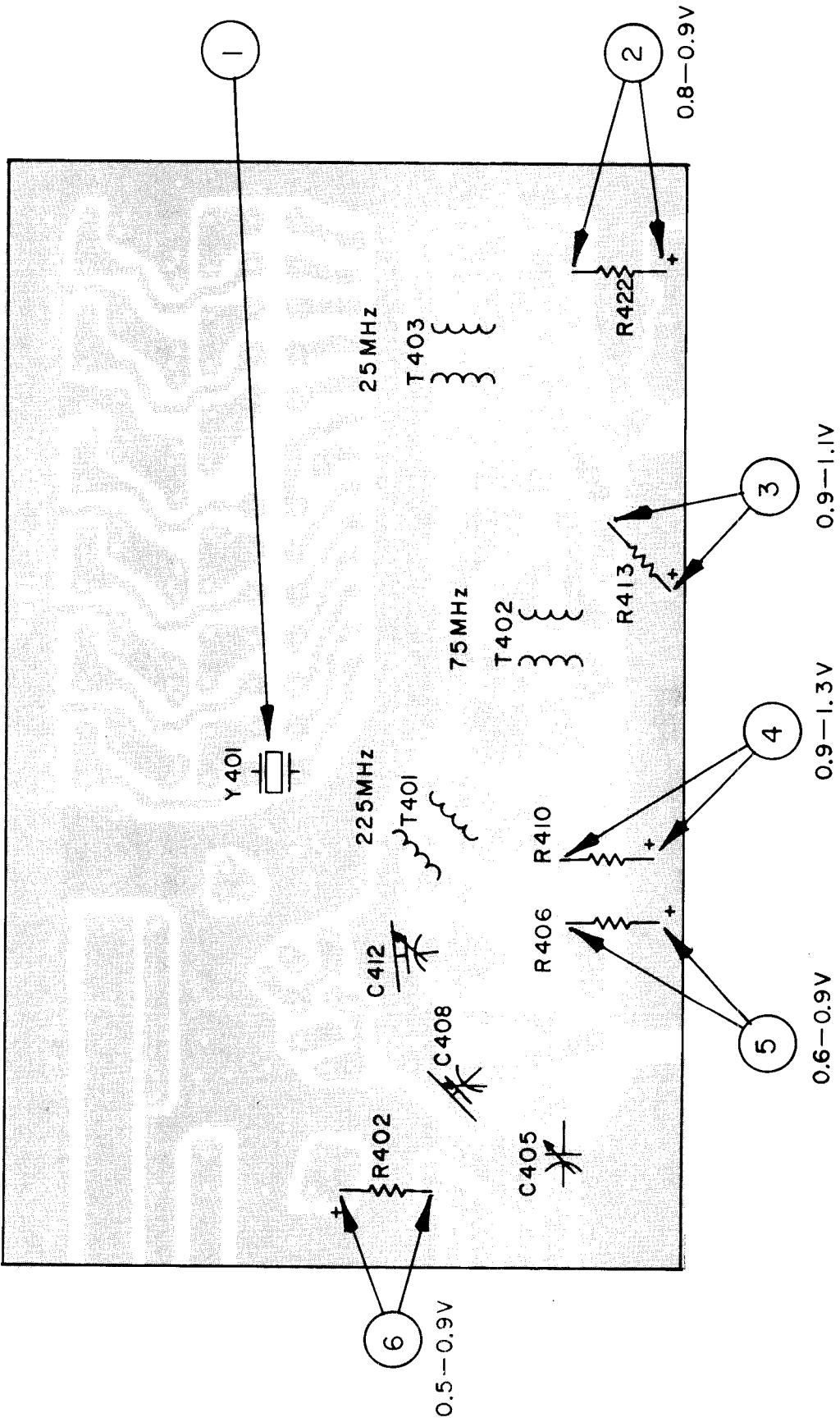
TO IC 401



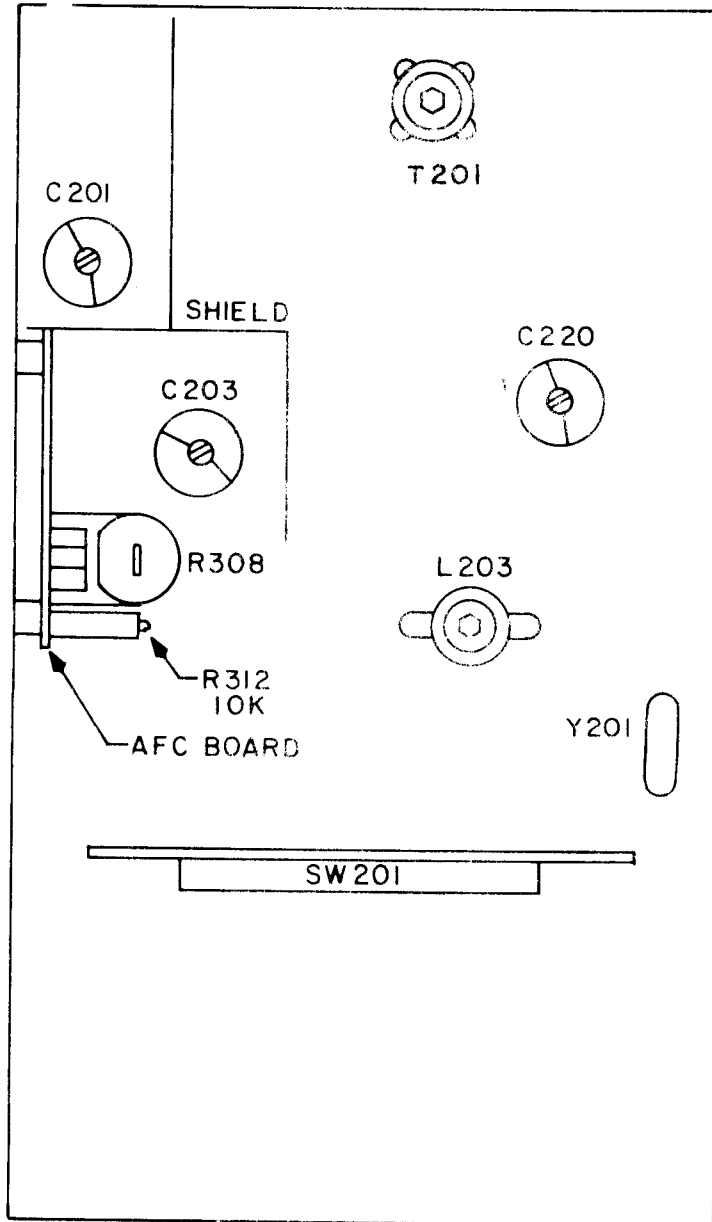
CRYSTAL LOCATION AND ADJUSTMENT DIAGRAM



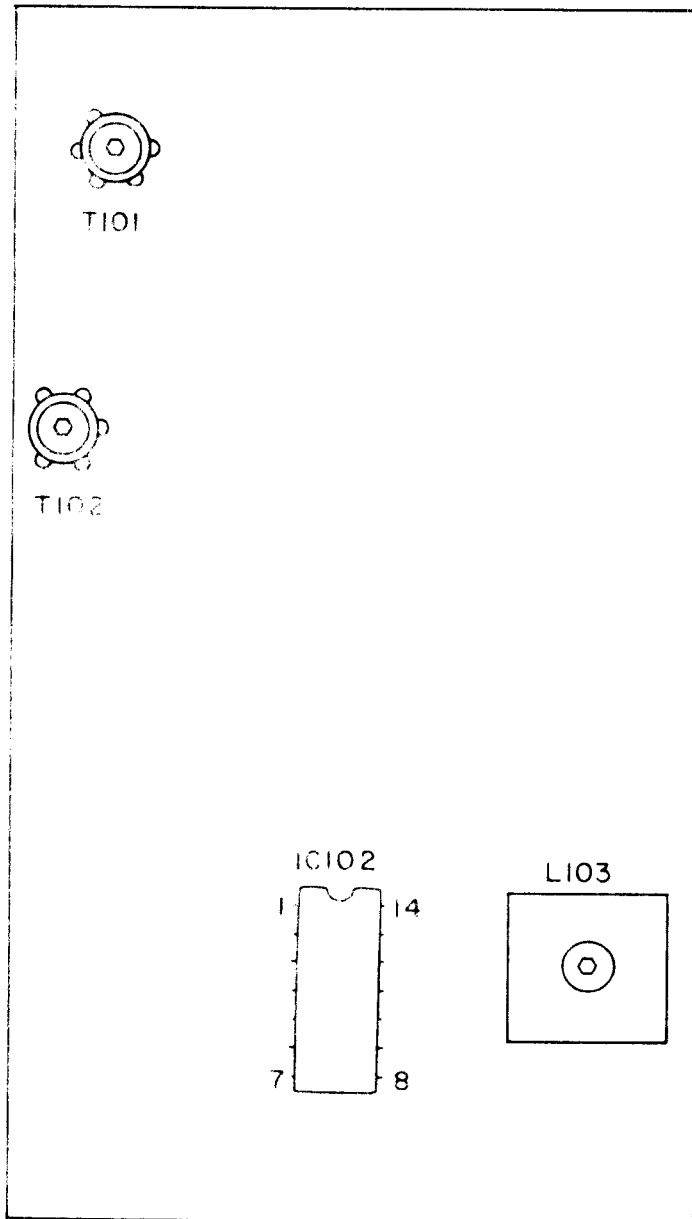
TRANSMITTER ALIGNMENT TEST POINTS



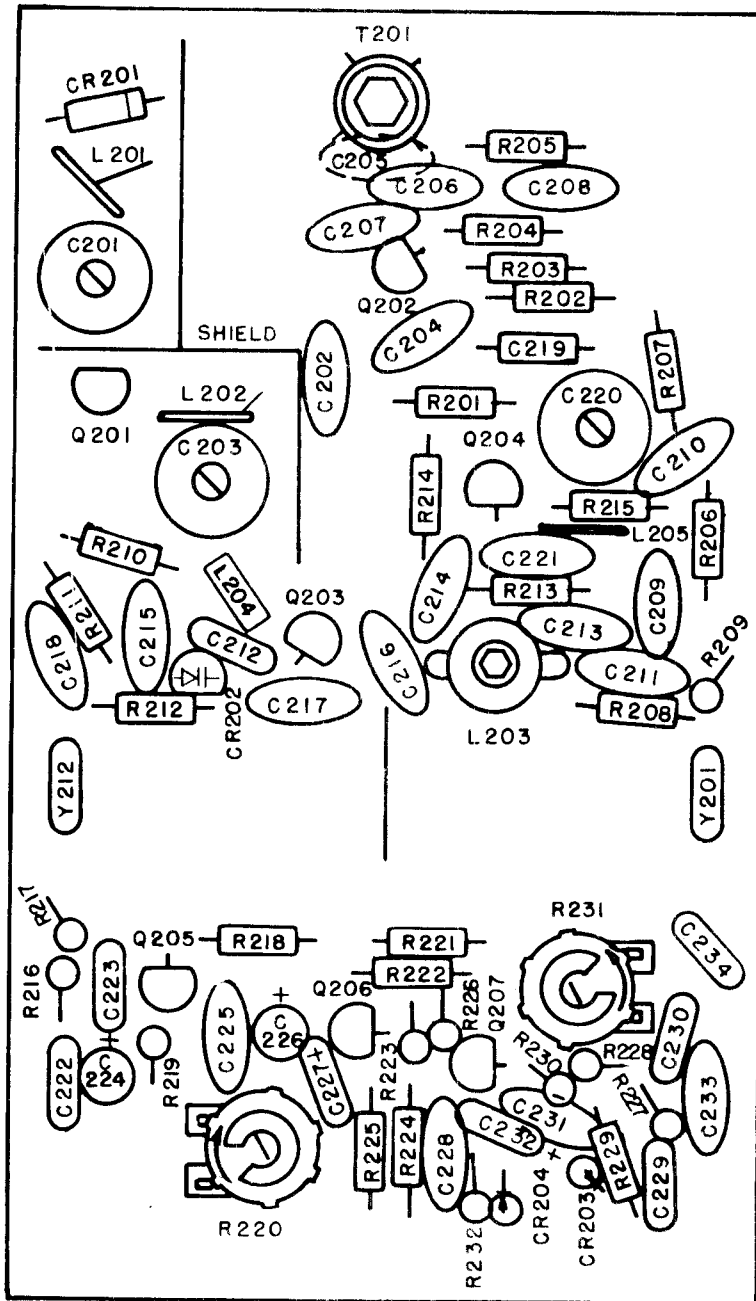
RECEIVER (RF) ALIGNMENT DIAGRAM



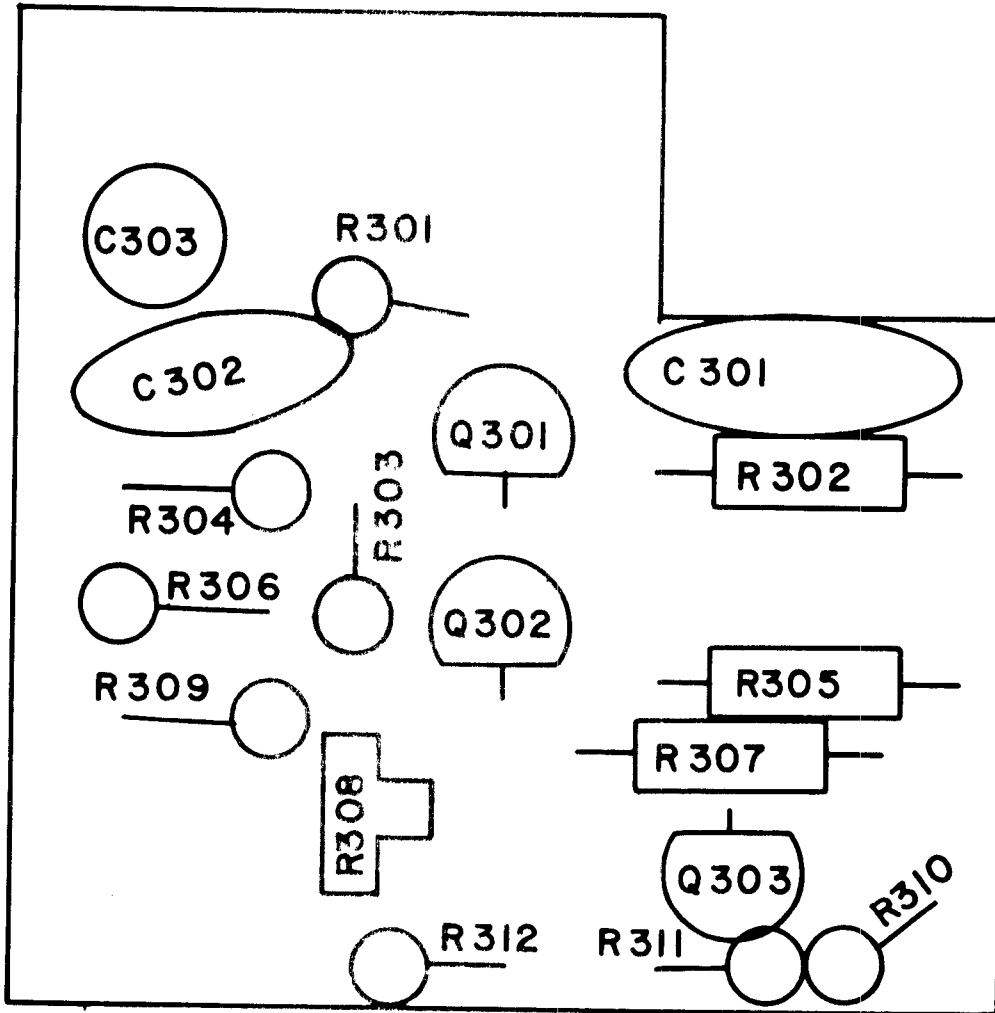
RECEIVER (F) ALIGNMENT DIAGRAM



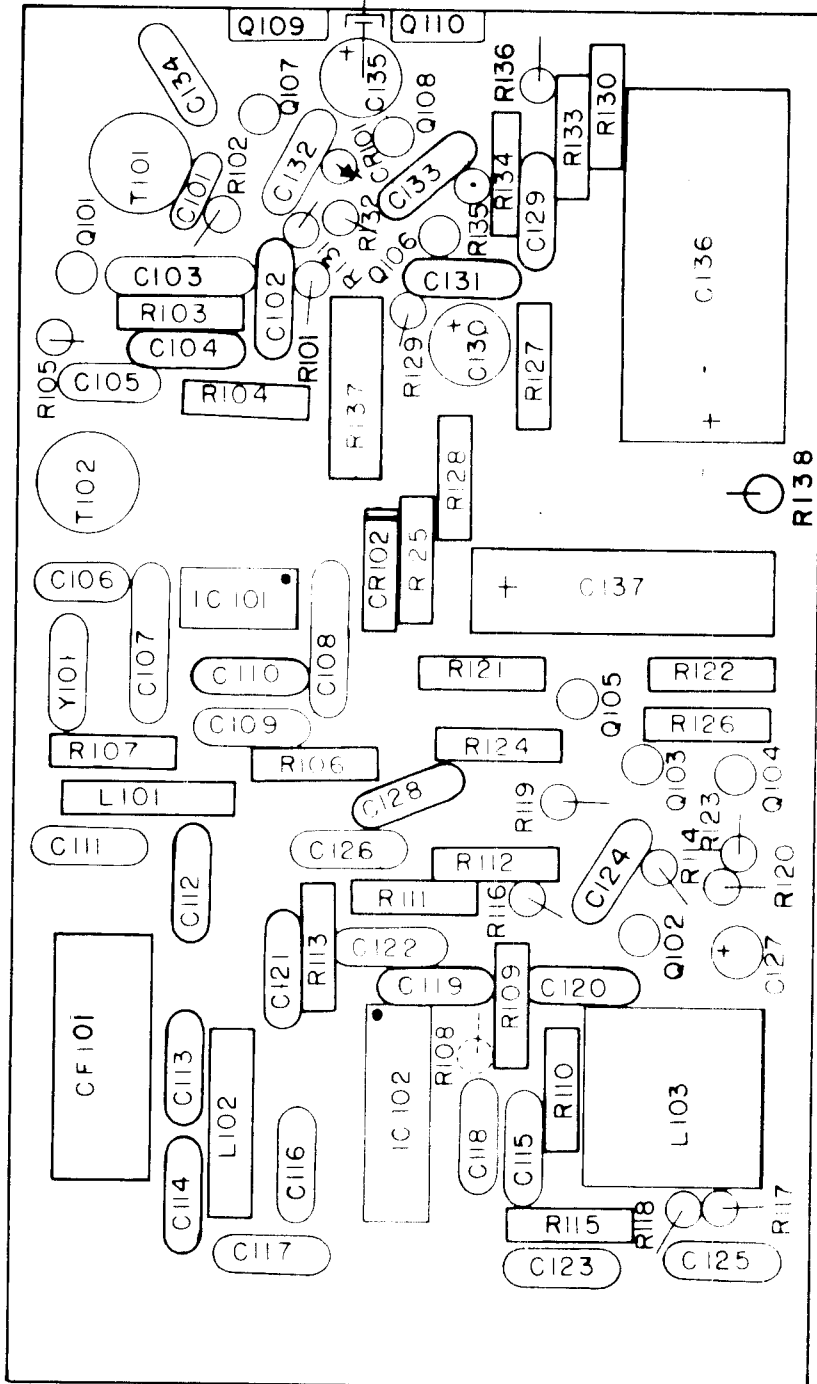
RF/MOD BOARD 501-113



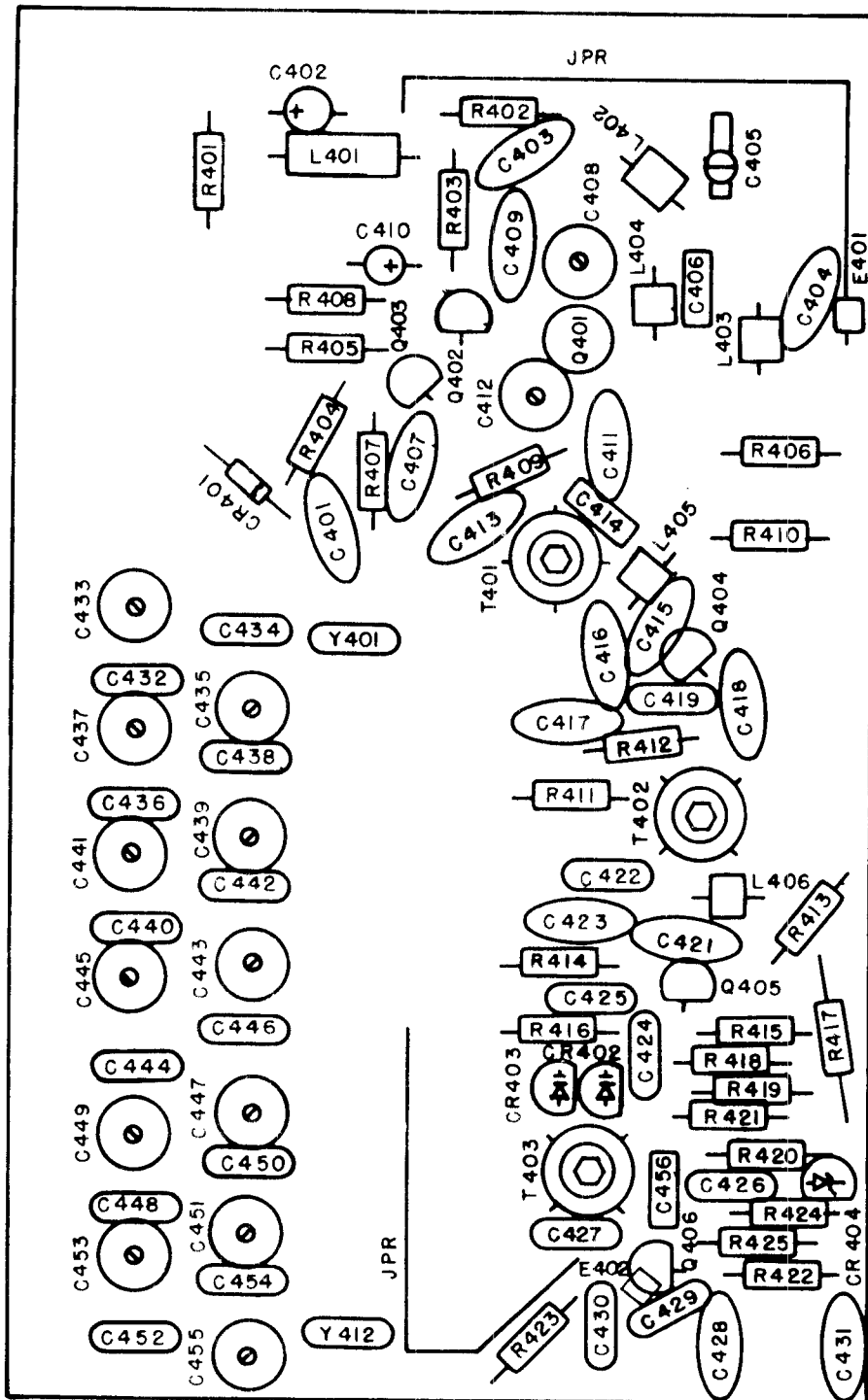
AFC BOARD 501-117



IF/ AUDIO BOARD 500-858



TRANSMITTER BOARD 600-406



VOLTAGE DATA CHART

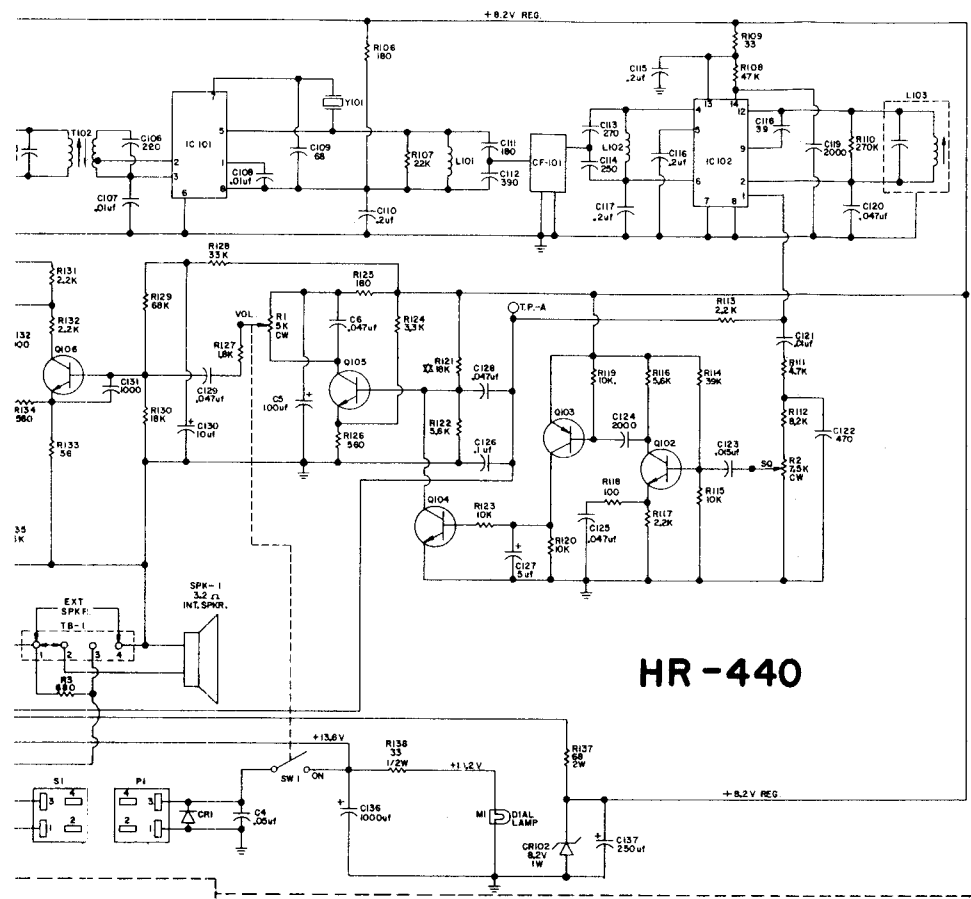
NOTE: All DC voltages are nominal and are measured with a VTVM.
Supply voltage at pin 3 of the power connector is 13.6VDC

VOLTAGE DATA – TRANSISTORS

	<u>Transistor</u>	<u>Emitter (Source)</u>	<u>Base (Gate)</u>	<u>Collector (Drain)</u>
RF Board No.501-113	Q201 (FET)	0	0	5.7 (RF AMP)
	Q202	1.6	2.3	7.0 (Mixer)
	Q203	3.0	3.4	7.1 (Oscillator; 3x)
	Q204	0	0.2	7.2 (Multiplier; 3x)
	Q205 (FET)	0.8	0	5.0 (Mike Pre-Amp)
	Q206	0.2	0.8	4.6 (Mod AMP)
	Q207	.15 - .3	.65 - .9	4-6 (Varies with setting of R231)
	CR202 (Diode)			2-4 (cathode voltage)
AFC Board No.501-117	Q301	3.2	3.8	7.3 (Diff. AMP)
	Q302	3.2	3.8	7.3 (Diff. AMP)
	Q303 (PNP)	7.9	7.3	2-4 (AFC AMP)
IF Board No. 500-858	Q101	2.3	3.0	7.3 (IF AMP)
	Q102	1.0	1.7	4.8 (Noise AMP)
	Q103	8.2	8.2	0 (unscelched)
		8.2	8.2	1.5 (min., tight squelch)
	Q104	0	0	1.9 (unscelched)
		0	0.8	0.1 (tight squelch)
	Q105	1.4	1.9	5.0 (unscelched)
		1.1	0.1	8.2 (tight squelch)
	Q106	0.7	1.3	12.4 (Audio AMP)
	Q107 (PNP)	13.6	13.1	7.2 (Driver)
	Q108 (PNP)	6.9	6.6	0.1 (Driver)
Q109	6.9	7.2	13.6 (Final)	
Q110	0	0.1	6.9 (Final)	
TX Board 600 - 406	Q401	0.9	0.3	12.5 (Driver; 2x)
	Q402	0.4	1.1	0.9 (Drive Limiter)
	Q403	0.1	0.2	1.1 (Bridge AMP)
	Q404	1.0	0.7	12.2 (Multiplier; 3x)
	Q405	2.0	1.0	12.2 (Multiplier; 3x)
	Q406	1.7	1.6	7.2 (Oscillator; 2x)
		1.4	2.0	7.4 (Non-oscillator)

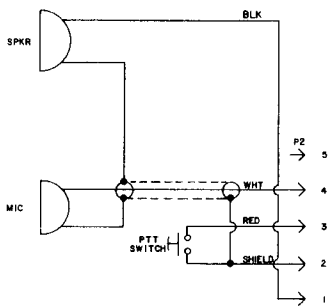
VOLTAGE DATA – INTEGRATED CIRCUITS

<u>IC No.</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>
IC 101	4.2	0.7	0.7	4.2	7.8	0	4.2	7.8						
IC 102	4.0	3.5	0	1.3	1.3	1.3	0	0	0.2	1.4	2.9	3.5	7.6	5.0
IC 401	RF Out	0	13.5	0	12.8	0	RF In							

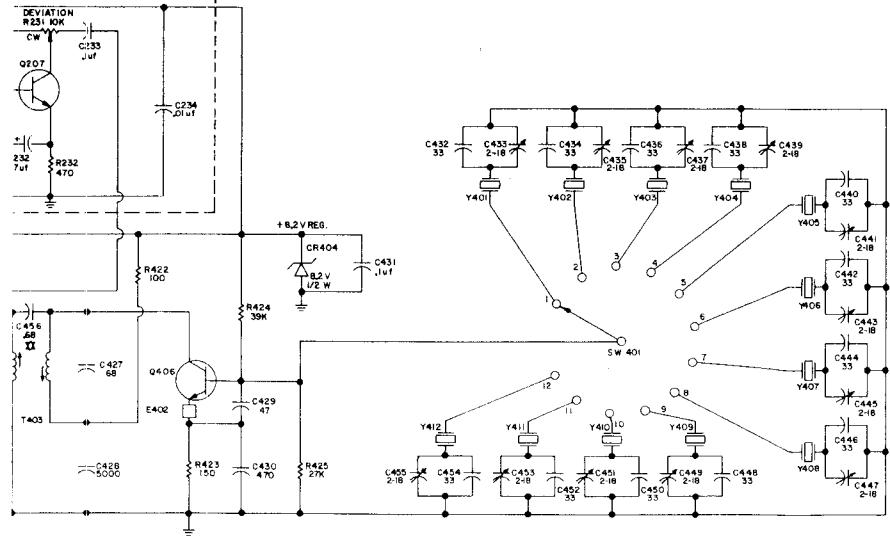


HR-440

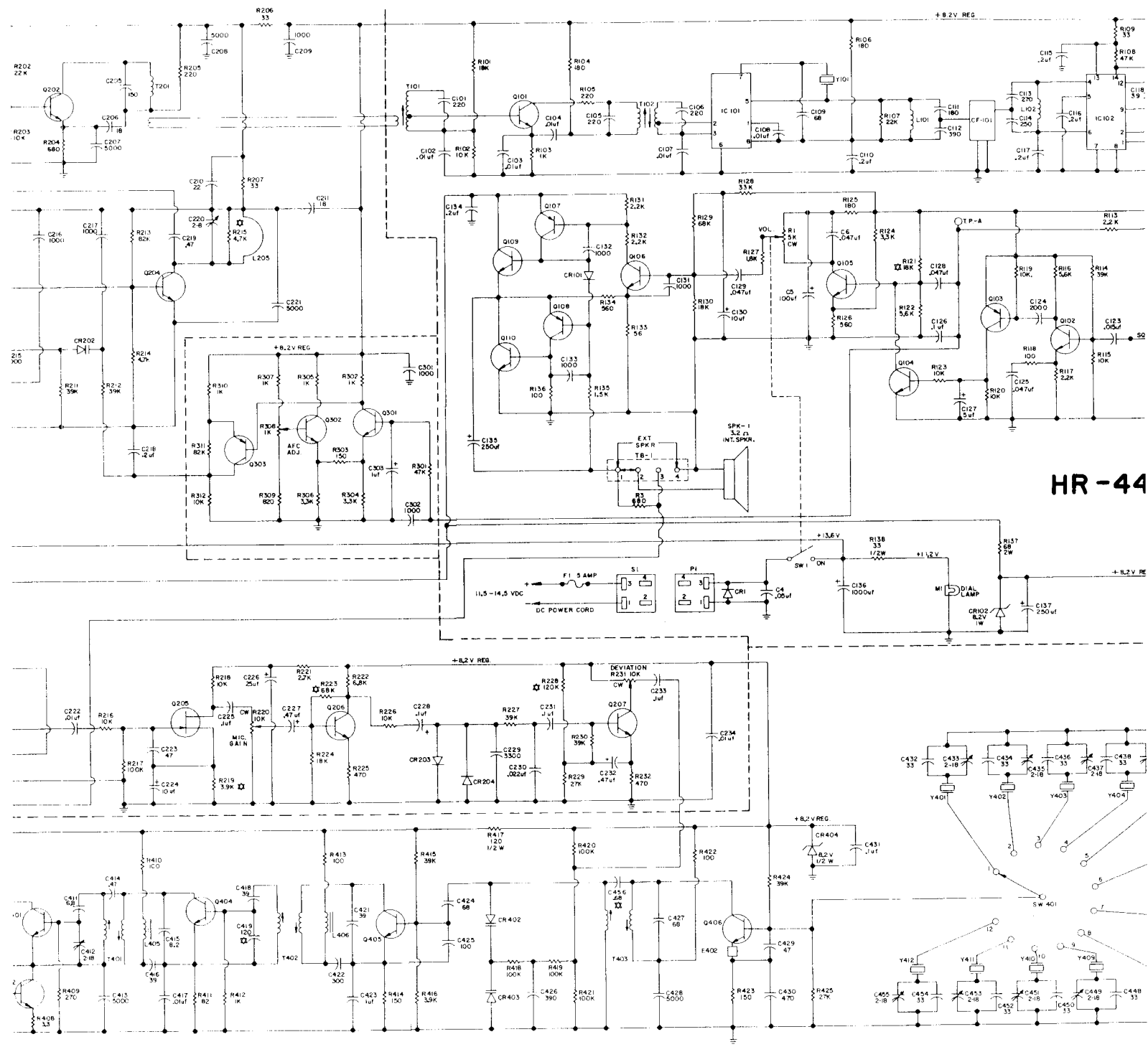
TELEPHONE HANDSET (MA-79) WIRING DIAGRAM



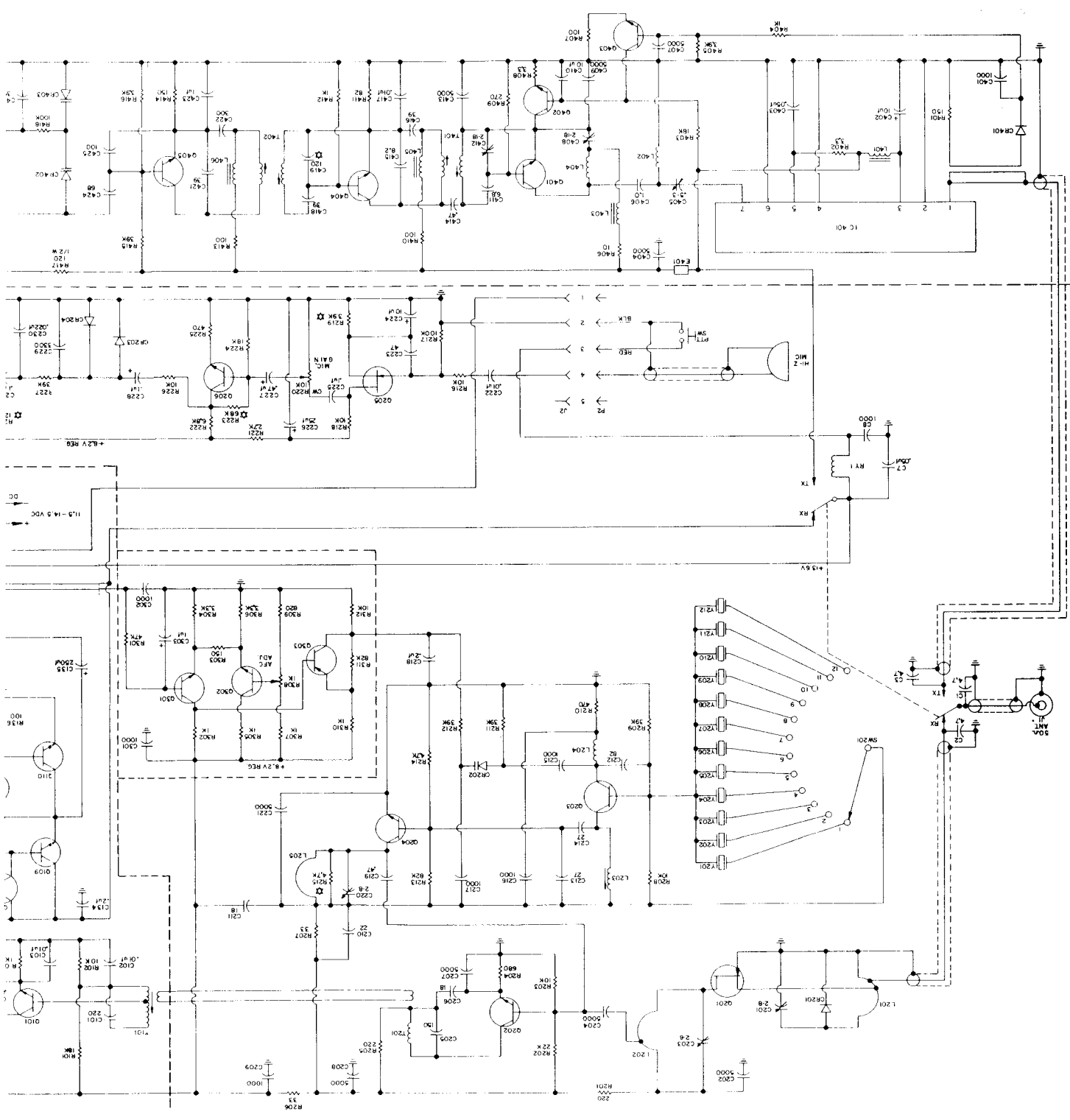
- NOTES:**
1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICO-FARAD.
 - ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS.
 - ALL RESISTORS NOT SPECIFIED OTHERWISE ARE 1/4 WATT.
 2. *NOTED VALUES ARE FACTORY SELECTED, NOMINAL VALUES SHOWN.
 3. -C DENOTES A FERRITE BEAD PLACED ON THE COMPONENT LEAD.
 4. R3 IS NOT FACTORY INSTALLED, NEEDED ONLY IF MA-79 (TELEPHONE HANDSET) IS USED.



SCHEMATIC



HR-44



AFC Board 501-117

Item No.	Description	Part No.
RESISTORS		
R301	47K 10% ¼W	4701-0473-042
R302	1K 10% ¼W	4701-0102-042
R303	150 ohm 10% ¼W	4701-0151-042
R304	3.3K 10% ¼W	4701-0332-042
R305	1K 10% ¼W	4701-0102-042
R306	3.3K 10% ¼W	4701-0332-042
R307	1K 10% ¼W	4701-0102-042
R308	1K Trimmer (vertical)	4751-0102-008
R309	820 ohm 10% ¼W	4701-0821-042
R310	1K 10% ¼W	4701-0102-042
R311	82K 10% ¼W	4701-0823-042
R312	10K 10% ¼W	4701-0103-042
CAPACITORS		
C301	.001mfd +80 -20% 50v (Disc)	1503-0102-003
C302	.001mfd +80 -20% 50v (Disc)	1503-0102-003
C303	1mfd 50v 85°C (Electrolytic)	1513-0010-004
TRANSISTORS		
Q301	Silicon NPN SPS 952	4801-0000-010
Q302	Silicon NPN SPS 952	4801-0000-010
Q303	Silicon PNP SPS 1539 (White Top)	4801-0000-060

RF-Modulator Board 501-113

Item No.	Description	Part No.	Item No.	Description	Part No.
RESISTORS			COILS		
R201	220 ohm 10% 1/4W	4701-0221-042	L201	Input rf AMP	1800-3160-001
R202	22K 10% 1/4W	4701-0223-042	L202	Output rf AMP	1800-3160-002
R203	10K 10% 1/4W	4701-0103-042	L203	Oscillator, Collector (White)	1800-3152-900
R204	680 ohm 10% 1/4W	4701-0681-042	L204	Oscillator, Emitter	1801-1236-900
R205	220 ohm 10% 1/4W	4701-0221-042	L205	Tripler, Collector	1800-3160-003
R206	33 ohm 10% 1/4W	4701-0330-042	T201	Mixer, Collector (Red)	1800-3161-900
R207	33 ohm 10% 1/4W	4701-0330-042	DIODES		
R208	10K 10% 1/4W	4701-0103-042	CR201	Silicon, Signal	4805-1241-200
R209	39K 10% 1/4W	4701-0393-042	CR202	Varactor, SMV1172	4809-0000-001
R210	470 ohm 10% 1/4W	4701-0471-042	CR203	Silicon, Signal	4805-1241-200
R211	39K 10% 1/4W	4701-0393-042	CR204	Silicon, signal	4805-1241-200
R212	39K 10% 1/4W	4701-0393-042	TRANSISTORS		
R213	82K 10% 1/4W	4701-0823-042	Q201	Field Effect, junction	4811-0000-015
R214	4.7K 10% 1/4W	4701-0472-042	Q202	Silicon, NPN, SPS1473 (Red Top)	4801-0000-035
R216	10K 10% 1/4W	4701-0103-042	Q203	Silicon, NPN, SM-4306-5	4801-0000-100
R217	100K 10% 1/4W	4701-0104-042	Q204	Silicon, NPN, SPS 1473 (Red Top)	4801-0000-035
R218	10K 10% 1/4W	4701-0103-042	Q205	Field Effect, junction	4811-0000-010
R219	3.9K 10% 1/4W	4701-0392-042	Q206	Silicon, NPN SPS 952	4801-0000-010
R220	10K Trimmer (Lay down)	4751-0103-001	Q207	Silicon NPN	4801-0000-005
R221	2.7K 10% 1/4W	4701-0272-042			
R222	6.8K 10% 1/4W	4701-0682-042			
R223	68K 10% 1/4W	4701-0683-042			
R224	18K 10% 1/4W	4701-0183-042			
R225	470 ohm 10% 1/4W	4701-0471-042			
R226	10K 10% 1/4W	4701-0103-042			
R227	39K 10% 1/4W	4701-0393-042			
R228	120K 10% 1/4W	4701-0124-042			
R229	27K 10% 1/4W	4701-0273-042			
R230	39K 10% 1/4W	4701-0393-042			
R231	10K Trimmer (Lay down)	4751-0103-001			
R232	470 ohm 10% 1/4W	4701-0471-042			
CAPACITORS					
C201	2-8pf NPO Trimmer	1517-0000-010			
C202	.005 mfd +80 -20% 50v (Disc)	1503-0502-005			
C203	2-8pf NPO Trimmer	1517-0000-010			
C204	.005 mfd +80 -20% 50v (Disc)	1503-0502-005			
C205	150pf 5% 50v (Mica)	1506-0151-550			
C206	18pf 10% NPO 500v (Disc)	1500-0180-605			
C207	.005 mfd +80 -20% 50v (Disc)	1503-0502-005			
C208	.005 mfd +80 -20% 50v (Disc)	1503-0502-005			
C209	.001 mfd +80 -20% 50v (Disc)	1503-0102-003			
C210	22pf 10% NPO 500v (Disc)	1500-0220-605			
C211	18pf 10% NPO 500v (Disc)	1500-0180-605			
C212	82pf 5% NPO 50v (Disc)	1524-0820-002			
C213	27pf 10% NPO 500v (Disc)	1500-0270-605			
C214	27pf 10% NPO 500v (Disc)	1500-0270-605			
C215	.001 mfd +80 -20% 50v (Disc)	1503-0102-003			
C216	.001 mfd +80 -20% 50v (Disc)	1503-0102-003			
C217	.001 mfd +80 -20% 50v (Disc)	1503-0102-003			
C218	.2 mfd 20% 12v (Disc)	1502-0204-006			
C219	.47pf 10% (Composition)	1510-0478-900			
C220	2-8pf NPO Trimmer	1517-0000-010			
C221	.005 mfd +80 -20% 50v (Disc)	1503-0502-005			
C222	.01 mfd 10% 100v (Disc)	1508-0103-610			
C223	47pf 10% NPO 50v (Disc)	1524-0470-002			
C224	10 mfd 10v 85°C (Electrolytic)	1513-0100-001			
C225	.1 mfd 20% 12v (Disc)	1502-0104-005			
C226	25 mfd 10v 85°C (Electrolytic)	1513-0250-001			
C227	.47 mfd 20% 10v (Electrolytic)	1526-0474-001			
C228	.1 mfd 20% 12v (Disc)	1502-0104-005			
C229	.0033 mfd 10% 100v (Mylar Film)	1508-0332-610			
C230	.022 mfd 10% 100v (Mylar Film)	1508-0223-610			
C231	.1 mfd 20% 12v (Disc)	1502-0104-005			
C232	.47 mfd 20% 10v (Electrolytic)	1526-0474-001			
C233	.1 mfd 20% 12v (Disc)	1502-0104-005			
C234	.01 mfd 10% 100v (Mylar Film)	1508-0103-610			

IF - Audio Board 500-858

Item No.	Description	Part No.
RESISTORS		
R101	18K 10% ¼W	4701-0183-042
R102	10K 10% ¼W	4701-0103-042
R103	1K 10% ¼W	4701-0102-042
R104	180 ohm 10% ¼W	4701-0181-042
R105	220 ohm 10% ¼W	4701-0221-042
R106	180 ohm 10% ¼W	4701-0181-042
R107	22K 10% ¼W	4701-0223-042
R108	47K 10% ¼W	4701-0473-042
R109	33 ohm 10% ¼W	4701-0330-042
R110	270K 10% ¼W	4701-0274-042
R111	4.7K 10% ¼W	4701-0472-042
R112	8.2K 10% ¼W	4701-0822-042
R113	2.2K 10% ¼W	4701-0222-042
R114	39K 10% ¼W	4701-0393-042
R115	10K 10% ¼W	4701-0103-042
R116	5.6K 10% ¼W	4701-0562-042
R117	2.2K 10% ¼W	4701-0222-042
R118	100 ohm 10% ¼W	4701-0101-042
R119	10K 10% ¼W	4701-0103-042
R120	10K 10% ¼W	4701-0103-042
R121	18K 10% ¼W	4701-0183-042
R122	5.6K 10% ¼W	4701-0562-042
R123	10K 10% ¼W	4701-0103-042
R124	3.3K 10% ¼W	4701-0332-042
R125	180 ohm 10% ¼W	4701-0181-042
R126	560 ohm 10% ¼W	4701-0561-042
R127	1.8K 10% ¼W	4701-0182-042
R128	33K 10% ¼W	4701-0333-042
R129	68K 10% ¼W	4701-0683-042
R130	18K 10% ¼W	4701-0183-042
R131	2.2K 10% ¼W	4701-0222-042
R132	2.2K 10% ¼W	4701-0222-042
R133	56 ohm 10% ¼W	4701-0560-042
R134	560 ohm 10% ¼W	4701-0561-042
R135	1.5K 10% ¼W	4701-0152-042
R136	100 ohm 10% ¼W	4701-0101-042
R137	68 ohm 10% 2W (wire wound)	4710-0680-041
R138	33 ohm 10% ¼W	4701-0330-044

Item No.	Description	Part No.
CAPACITORS		
C101	220pf 5% 50v (Mica)	1506-0221-550
C102	.01 mfd 10% 100v (Mylar Film)	1508-0223-610
C103	.01 mfd +80 -20% 500v (Disc)	1503-0103-001
C104	.01mfd 10% 100v (Mylar Film)	1508-0103-610
C105	220pf 5% 50v (Mica)	1506-0221-550
C106	220pf 5% 50v (Mica)	1506-0221-550
C107	.01mfd +80 -20% 500v (Disc)	1503-0103-001
C108	.01mfd +80 -20% 500v (Disc)	1503-0103-001
C109	68pf 5% 50v (Mica)	1506-0680-550
C110	.2mfd +80 -20% 12v (Disc)	1502-0204-006
C111	180pf 5% 50v (Mica)	1506-0181-550
C112	390pf 5% 50v (Mica)	1506-0391-550
C113	270pf 5% 50v (Mica)	1506-0271-550
C114	250pf 5% 50v (Mica)	1506-0251-550
C115	.2 mfd +80 -20% 12v (Disc)	1502-0204-006
C116	.2mfd +80 -20% 12v (Disc)	1502-0204-006
C117	.2mfd +80 -20% 12v (Disc)	1502-0204-006
C118	39pf 10% NPO 500v (Disc)	1500-0390-605
C119	.002mfd 20% 500v (Disc)	1523-0202-001
C120	.047mfd 10% 100v (Mylar Film)	1508-0473-610
C121	.01mfd 10% 100v (Mylar Film)	1508-0103-610
C122	470pf 20% 500v (Disc)	1523-0471-001
C123	.015mfd 10% 100v (Mylar Film)	1508-0153-610
C124	.002mfd 20% 500v (Disc)	1523-0202-001
C125	.047mfd 10% 100v (Mylar Film)	1508-0473-610
C126	.1mfd 20% 12v (Disc)	1502-0104-005
C127	5mfd 50v 85°C (Electrolytic)	1513-0050-004

Item No.	Description	Part No.
CAPACITORS		
C128	.047mfd 10% 100v (Mylar Film)	1508-0473-610
C129	.047mfd 10% 100v (Mylar Film)	1508-0473-610
C130	10mfd 25v 85°C (Electrolytic)	1513-0100-003
C131	.001mfd +80 -20% 500v (Disc)	1503-0102-001
C132	.001mfd +80 -20% 500v (Disc)	1503-0102-001
C133	.001mfd +80 -20% 500v (Disc)	1503-0102-001
C134	.2mfd +80 -20% 12v (Disc)	1502-0204-006
C135	250mfd 16v 85°C (Electrolytic)	1511-0251-002
C136	1000mfd 16v 85°C (Electrolytic)	1511-0102-002
C137	250mfd 10v 85°C (Electrolytic)	1511-0251-001
C138	.001mfd +80 -20% 50v (Disc)	1503-0000-008

Item No.	Description	Part No.
COILS		
L101	Choke 820 uhy 10%	1803-3238-600
L102	Choke 820 uhy 10%	1803-3238-600
L103	Quadrature Detector	1800-3151-700
T101	Input 10.7MHz IF AMP	1800-1250-700
T102	Output 10.7MHz IF AMP	1800-3168-300

Item No.	Description	Part No.
DIODES		
CR101	Silicon signal	4805-1241-200
CR102	Zener 8.2v 5% 1W	4808-0000-009

Item No.	Description	Part No.
TRANSISTORS		
Q101	Silicon NPN SPS 952	4801-0000-010
Q102	Silicon NPN SPS 952	4801-0000-010
Q103	Silicon PNP SPS 1539 (White Top)	4801-0000-060
Q104	Silicon NPN SPS 952	4801-0000-010
Q105	Silicon NPN SPS 952	4801-0000-010
Q106	Silicon NPN SPS 952	4801-0000-010
Q107	Silicon PNP AF Driver	4801-0000-135
Q108	Silicon PNP AF Driver	4801-0000-135
Q109	Silicon NPN AF Output	4802-0000-002
Q110	Silicon NPN AF Output	4802-0000-002

Item No.	Description	Part No.
INTEGRATED CIRCUITS		
IC101	IF Amplifier	3130-3167-901
IC102	IF Limiter/Detector	3130-3157-603

Item No.	Description	Part No.
CRYSTAL		
Y101	10.245 MHz	2301-3151-601

Item No.	Description	Part No.
FILTER		
CF101	Ceramic 455 KHz	2700-0000-007

Transmitter Board 600-406

Item No.	Description	Part No.
RESISTORS		
R401	82 ohm 10% ¼W	4701-0820-042
R402	3.3 ohm 10% ¼W	4701-0339-042
R403	18K 10% ¼W	4701-0183-042
R404	1K 10% ¼W	4701-0102-042
R405	3.9K 10% ¼W	4701-0392-042
R406	10 ohm 10% ¼W	4701-0100-042
R407	100 ohm 10% ¼W	4701-0101-042
R408	3.3 ohm 10% ¼W	4701-0339-042
R409	270 ohm 10% ¼W	4701-0271-042
R410	100 ohm 10% ¼W	4701-0101-042
R411	82 ohm 10% ¼W	4701-0820-042
R412	1K 10% ¼W	4701-0102-042
R413	100 ohm 10% ¼W	4701-0101-042
R414	150 ohm 10% ¼W	4701-0151-042
R415	39K 10% ¼W	4701-0393-042
R416	3.9K 10% ¼W	4701-0392-042
R417	120 ohm 10% ½W	4701-0121-044
R418	100K 10% ¼W	4701-0104-042
R419	100K 10% ¼W	4701-0104-042
R420	100K 10% ¼W	4701-0104-042
R421	100K 10% ¼W	4701-0104-042
R422	100 ohm 10% ¼W	4701-0101-042
R423	150 ohm 10% ¼W	4701-0151-042
R424	39K 10% ¼W	4701-0393-042
R425	27K 10% ¼W	4701-0273-042
CAPACITORS		
C401	.001mfd +80 -20% 50v (Disc)	1503-0102-003
C402	10mfd 20% 25v (Tantalum)	1515-0100-005
C403	.05mfd +80 -20% 16v (Disc)	1502-0503-003
C404	.005mfd +80 -20% 50v (Disc)	1503-0502-005
C405	.5 -3pf Trimmer (Piston)	1517-0000-017
C406	1pf 10% (Composition)	1510-0010-900
C407	.005mfd +80-20% 50v (Disc)	1503-0502-005
C408	2-18pf Trimmer	1517-0000-001
C409	.005mfd +80 -20% 50v (Disc)	1503-0502-005
C410	10mfd 20% 50v (Tantalum)	1515-0100-005
C411	6.8pf 10% NPO 500v (Disc)	1500-0689-905
C412	2-18pf Trimmer	1517-0000-001
C413	.005mfd +80 -20% 50v (Disc)	1503-0502-005
C414	.47pf 10% (Composition)	1510-0478-900
C415	8.2pf 10% NPO 500v (Disc)	1500-0829-905
C416	39pf 10% NPO 50v (Disc)	1500-0390-650
C417	.01mfd +80 -20% 50v (Disc)	1503-0103-007
C418	39pf 10% NPO 50v (Disc)	1500-0390-650
C419	120pf 5% 50v (Mica)	1506-0121-550
C421	39pf 10% NPO 50v (Disc)	1500-0390-650
C422	300pf 5% 50v (Mica)	1506-0301-550
C423	.1mfd 20% 12v (Disc)	1502-0104-005
C424	68pf 5% NPO 50v (Disc)	1524-0680-002
C425	100pf 5% 50v (Mica)	1506-0101-550
C426	390pf 5% 50v (Mica)	1506-0391-550
C427	68pf 5% NPO 50v (Disc)	1524-0680-002
C428	.005mfd +80 -20% 50v (Disc)	1503-0502-005
C429	47pf 5% NPO 50v (Disc)	1524-0470-002
C430	470pf 5% 50v (Mica)	1506-0471-550
C431	.1mfd 20% 12v (Disc)	1502-0104-005
C432	33pf 5% 50v (Mica)	1507-0330-001
C433	2-18pf Trimmer	1517-0000-001
C434	33pf 5% 50v (Mica)	1507-0330-001
C435	2-18pf Trimmer	1517-0000-001
C436	33pf 5% 50v (Mica)	1507-0330-001
C437	2-18pf Trimmer	1517-0000-001
C438	33pf 5% 50v (Mica)	1507-0330-001
C439	2-18pf Trimmer	1517-0000-001
C440	33pf 5% 50v (Mica)	1507-0330-001
C441	2-18pf Trimmer	1517-0000-001

Item No.	Description	Part No.
CAPACITORS		
C442	33pf 5% 50v (Mica)	1507-0330-001
C443	2-18pf Trimmer	1517-0000-001
C444	33pf 5% 50v (Mica)	1507-0330-001
C445	2-18pf Trimmer	1517-0000-001
C446	33pf 5% 50v (Mica)	1507-0330-001
C447	2-18pf Trimmer	1517-0000-000
C448	33pf 5% 50v (Mica)	1507-0330-001
C449	2-18pf Trimmer	1517-0000-001
C450	33pf 5% 50v (Mica)	1507-0330-001
C451	2-18pf Trimmer	1517-0000-001
C452	33pf 5% 50v (Mica)	1507-0330-001
C453	2-18pf Trimmer	1517-0000-001
C454	33pf 5% 50v (Mica)	1507-0330-001
C455	2-18pf Trimmer	1517-0000-001
C456	.68pf 10% (Composition)	1510-0688-900
COILS		
E401	Bead Ferrite	2502-0000-001
E402	Bead Ferrite	2502-0000-001
L401	Choke Ferroxcube	2502-0000-002
L402	Driver Output (5 turns)	1801-1296-701
L403	Choke RF	1803-1245-900
L404	Driver Collector (4 turns)	1801-1296-702
L405	Choke RF	1803-1245-900
L406	Choke RF	1803-1245-900
T401	Tripler 225MHz (Blue)	1800-3240-100
T402	Tripler 75MHz (Brown)	1800-3240-200
T403	Modulator 25MHz (red)	1800-3240-300

DIODES		
CR401	Silicon signal	4805-1241-200
CR402	Varactor	4809-0000-003
CR403	Varactor	4809-0000-003
CR404	Zener 8.2v 5% ½W	4808-0000-013

TRANSISTORS		
Q401	Silicon NPN Driver	4804-3169-605
Q402	Silicon NPN Drive Limiter	4801-0000-005
Q403	Silicon NPN SPS 952	4801-0000-011
Q404	Silicon NPN Tripler	4801-0000-011
Q405	Silicon NPN Tripler (Blue Top)	4801-0000-003
Q406	Silicon NPN Oscillator	4801-0000-001

INTEGRATED CIRCUITS		
IC401	Module UHF Power	3132-5112-501

Chassis Assembly

Item No.	Description	Part No.
Electrical		
R1	5K Volume Control ON-OFF sw	4750-3211-201
R2	7.5K Squelch Control	4750-3211-202
C1	4.7pf 10% NPO 500v (Disc)	1500-0479-905
C2	4.7pf 10% NPO 500v (Disc)	1500-0479-905
C3	4.7pf 10% NPO 500v (Disc)	1500-0479-905
C4	.05mfd +80 -20% 25 Disc	1501-0503-004
C5	100mfd 10v 85°C (Electrolytic)	1511-0101-001
C6	.047mfd 10% 100v (Mylar Film)	1508-0473-610
C7	.05mfd +80 -20% 25v (Disc)	1501-0503-003
C8	.001mfd +80 -20% 500v (Disc)	1501-0102-005
CR1	Diode Silicon Rectifier	4806-0000-004
F1	Fuse 5 AMP 3 AG	5106-0000-008
J1	Connector Antenna (Chassis)	2105-0000-020
J2	Connector Microphone (Chassis)	2105-0000-023
M1	Lamp Incandescent 14.4v	3901-0000-002
P1	Connector Power (Chassis)	2104-0000-004
P2	Connector, Microphone (Cable)	2104-0000-009
RY-1	Relay 3PDT 12VDC (T/R)	4500-0000-004
S1	Connector Power (Cable)	2108-0000-001
SPK-1	Speaker Assembly (w/brackets)	7011-1069-700
SW201	Switch PCMount (receive)	7011-1069-300
SW401	Switch PCMount (transmit)	7011-1069-300
TB-1	Terminal Band 4-lug	2103-3007-914
Y200	Crystal Receive (Specify frequency)	2304-0000-000
Y400	Crystal Transmit (Spec. frequency)	2321-0000-000
	Socket Pins Crystal	2830-0000-004
	Microphone (no connector)	1300-5080-902
	Microphone (with connector)	7011-1070-900
	DC Power Cord Assembly (w/fuse)	7011-1037-902
Mechanical		
	Bracket Relay Mounting	1400-3211-100
	Detent 12-position (rotary)	5105-3239-501
	Heat Sink Power Module	5400-3235-200
	Bonding strap Power Module	2110-3239-800
	Grounding Contact, Speaker	2107-3237-800
	Mica Washer Audio Transistor Mtg.	3103-1288-800
	Bezel Chrome	1405-5081-301
	Faceplate	2403-5111-400
	Knob Channel Selector	2402-3178-801
	Knob Volume and Squelch	2402-1276-201
	Dial Assembly (with bushing)	7011-1069-900
	Cabinet (wrap) Assembly	1408-6033-301
	Foot Rubber	1402-3231-902
	Bracket Mobile Mounting	1400-3143-100
	Bracket Security (less lock)	1400-1241-500
	Hanger Microphone	2830-0000-003
	Hardware Kit, Mounting (bolts, washers, security bracket, mic hanger)	7011-1070-000
	Manual, Owner's	7001-1057-900

