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**VHF/UHF
FM TRANSCEIVER**
Model HW-24HT
SERVICE 595-4475

STANDARD C500 SAME RADIO

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**VHF/UHF
FM TRANSCEIVER
Model HW-24HT**

SERVICE

595-4475

**HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022**

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Table of Contents

<p>SPECIFICATIONS 3</p> <p style="padding-left: 20px;">General 3</p> <p style="padding-left: 20px;">Receiver 3</p> <p style="padding-left: 20px;">Transmitter 3</p> <p>CONTROLS AND CONNECTIONS 4</p> <p>MAINTENANCE 6</p> <p style="padding-left: 20px;">Disassembly 6</p> <p style="padding-left: 20px;">Test Set Up 7</p> <p style="padding-left: 20px;">Alignment Reference Points 8</p> <p style="padding-left: 20px;">Power Supply Alignment 8</p> <p style="padding-left: 20px;">Microprocessor Alignment 8</p> <p style="padding-left: 20px;">PLL Synthesizer Alignment 8</p> <p style="padding-left: 20px;">Receiver Alignment 9</p> <p style="padding-left: 20px;">Transmitter Alignment 9</p> <p style="padding-left: 20px;">Tone Squelch Board Alignment 10</p> <p style="padding-left: 20px;">Touch Tone Board Alignment 12</p>	<p>THEORY OF OPERATION 13</p> <p style="padding-left: 20px;">PLL Synthesizer 13</p> <p style="padding-left: 20px;">Receiver 14</p> <p style="padding-left: 20px;">Transmitter 16</p> <p style="padding-left: 20px;">Controls 17</p> <p style="padding-left: 20px;">Power Supply 17</p> <p style="padding-left: 20px;">Tone Squelch Board 17</p> <p style="padding-left: 20px;">Touch Tone Board 18</p> <p style="padding-left: 20px;">Terminal Descriptions 19</p> <p>EXPLODED VIEW AND PARTS LIST 21</p> <p>HW-24HT BLOCK DIAGRAM 33</p> <p>HW-24HT SCHEMATIC Fold-in</p> <p>HW-24HT INTERCONNECTIONS AND COMPONENT LOCATIONS Fold-in</p>
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SPECIFICATIONS

GENERAL

Frequency Range	
VHF Receive	130.00 to 169.995 MHz.
UHF Receive	418.00 to 469.995 MHz (in 5 kHz steps).
VHF Transmit	144.000 to 147.995 MHz.
UHF Transmit	438.00 to 449.995 MHz (in 5 kHz steps).
	MARS/CAP transmit modification available*.
Modulation Type	F3.
Microphone Input Impedance	.600 ohms.
Speaker Impedance	.8 ohms.
Antenna Impedance	.50 ohms.
Power Requirements	.9 volts, nominal. Requires six AA (nickel-cadmium or alkaline) batteries.
External Input Voltage	5.5 to 16 volts DC.
Size (excluding knobs and antenna)	.6-3/8" H x 2-3/8" D (17 x 60 x 34mm).
Weight (including antenna and batteries)	.17 oz. (490 g).

RECEIVER

Receiver Type	Double-conversion superheterodyne.
First Intermediate Frequency	.55.05 MHz. VHF: Upper heterodyne. UHF: Lower heterodyne.
Second Intermediate Frequency	.455 kHz.
Sensitivity	.0.15 μ V for 12 dB SINAD**.

* May be modified for out-of-band operation for MARS, CAP, and embassy operators. Contact Heath Customer Service for information on how to do this. Proof of participation in these activities will be required.

** $SINAD = \frac{Signal + Noise + Distortion}{Signal + Distortion}$

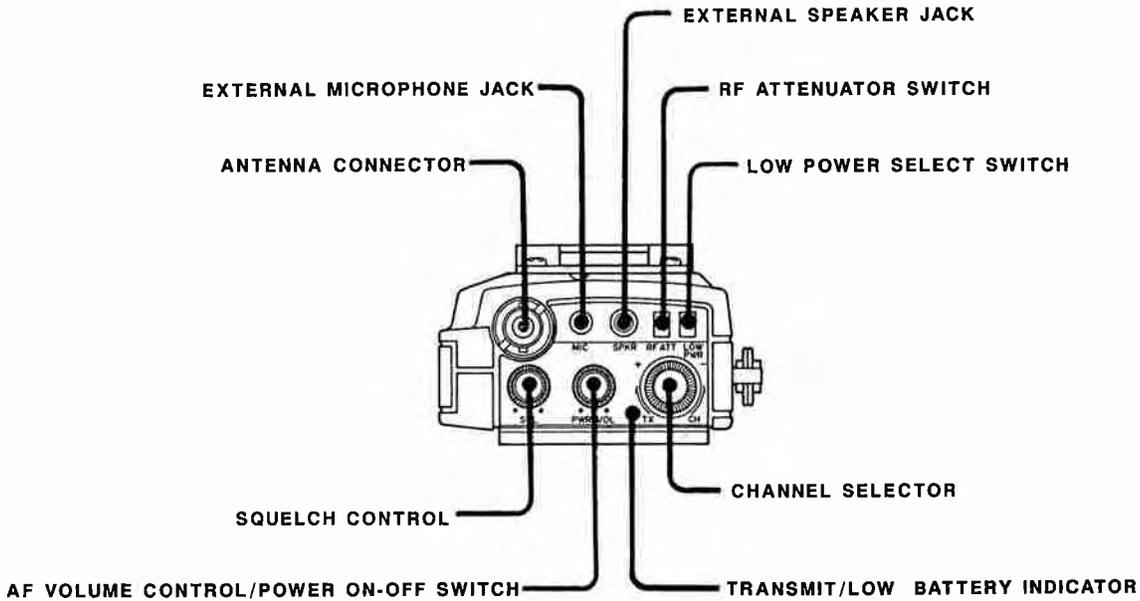
Signal-to-Noise input ratio @ 1 μ V input	.30 dB or better.
Acceptable Modulation Bandwidth	. \pm 7 kHz (-6 dB).
Selectivity	-.60 dB.
Squelch Sensitivity	-.14 dB.
Audio Output	.400 mW into 8 Ω (10% distortion).
Power Consumption (approximate)	.150 mA unsquelched. VHF: 35 mA squelched (no signal). UHF: 40 mA squelched (no signal).
Battery Save (3:1)	VHF: 10 mA. UHF: 12 mA.

TRANSMITTER

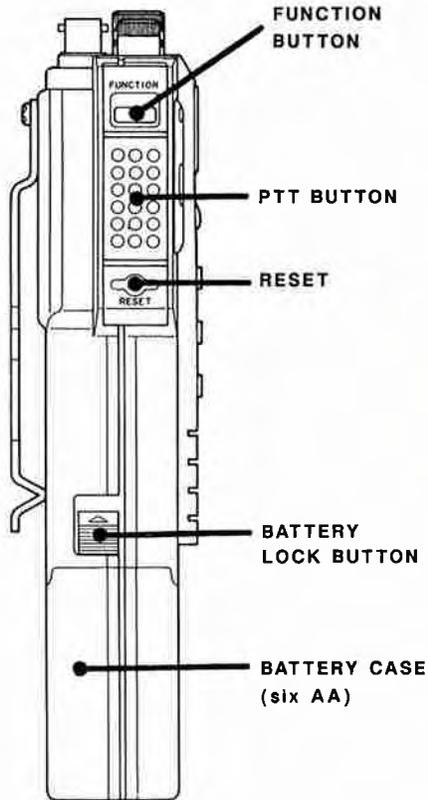
RF Output Power	
VHF	.3.5 watts with HWA-110, 5.0 watts or more with HWA-120.
UHF	.3.0 watts with HWA-110, 5.0 watts or more with HWA-120.
Low	.400 mW.
Spurious and Harmonic Attenuation	.Better than -60 dB.
Maximum Frequency Deviation	. \pm 5 kHz.
Modulation System	.Reactance modulation.
Power Consumption (approximate)	
VHF High	.750 mA at 2.5 watts RF output, 1000 mA at 5.0 watts RF output.
VHF Low	.350 mA.
UHF High	.900 mA at 2.5 watts RF output, 1300 mA at 5.0 watts RF output.
UHF Low	.400 mA.

Heath Company reserves the right to discontinue products and change specifications at any time without incurring any obligation to incorporate new features into products previously sold.

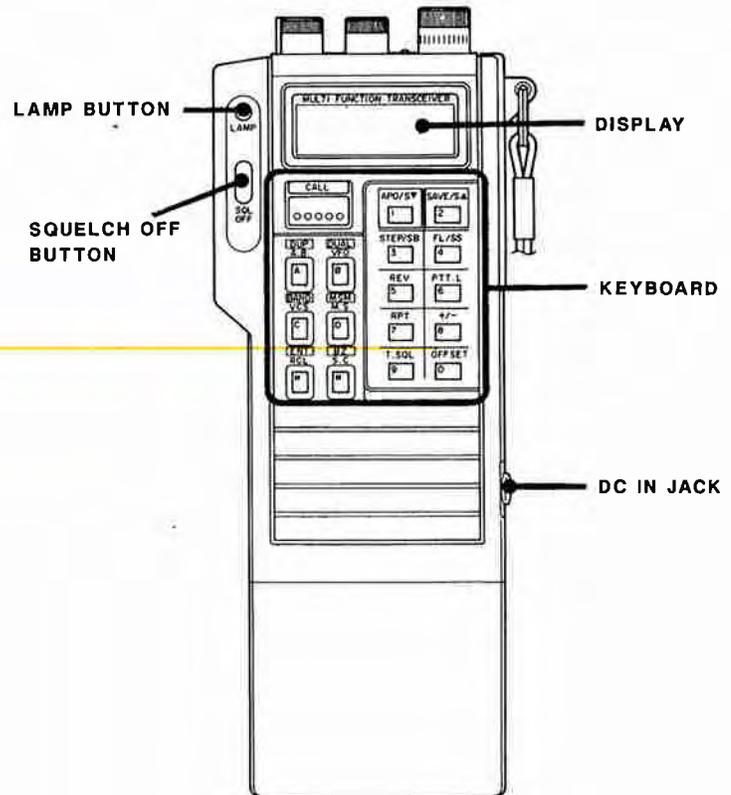
CONTROLS AND CONNECTIONS



Top View



Side View



Front View

The button functions of the transceiver are described below. Refer to your operation manual for more details. Proper operation of a button is indicated by a long beep, while improper operation is indicated by a short beep.

Button	Normal Function	With FUNCTION button pressed
CALL	Recalls call channel.	—
A/ [DUP] A. B	Switches A and B VFOs.	Turns duplex operation on and off.
B/ [DUAL] VFO	Selects the dial frequency mode.	Turns dual watch operation on and off.
C/ [BAND] VCS	Turns VCS operation on and off.	Switches VFO frequency range (146 MHz and 446 MHz).
D/ [MSM] M. S.	Turns memory scan operation on and off.	Sets MSM for programmed channel; sets MSM scan.
*/ [ENT] RCL	Recalls programmed channel.	Sets program channel.
#/ [BZ] S. C.	Starts and stops the scan.	Turns beeper on and off.
1/APO/S▼	Enters 1 (changes frequency downwards during scanning, except for memory scan).	Turns auto-power-off on and off.
2/SAVE/S▲	Enters 2 (changes frequency upwards during scanning, except for memory scan).	Turns saver feature on and off.
3/STEP/SB	Enters 3 (changes Pause and Busy scan during scanning).	Changes frequency step.
4/FL/SS	Enters 4 (switches 1 MHz scan and all scan or program scan during VFO scan; switches A or B memory scan and all memory scan).	Turns frequency lock on and off.
5/REV	Enters 5.	Reverses transmit and receive frequency during repeater operation.
6/PPT. L	Enters 6.	Turns transmission inhibit on and off.
7/RPT	Enters 7.	Turns repeater operation on and off.
8/+/-	Enters 8.	Shifts the offset frequency to upper or lower during repeater operation.
9/T. SQL	Enters 9.	Sets tone frequency and tone squelch operation.
0/OFFSET	Enters 0.	Sets frequency offset.

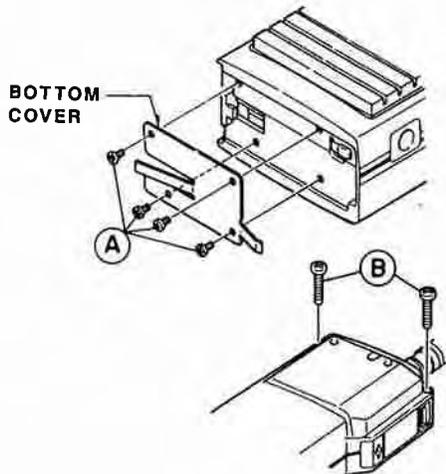
MAINTENANCE

DISASSEMBLY

Turn the power switch off and remove the battery and antenna before disassembly.

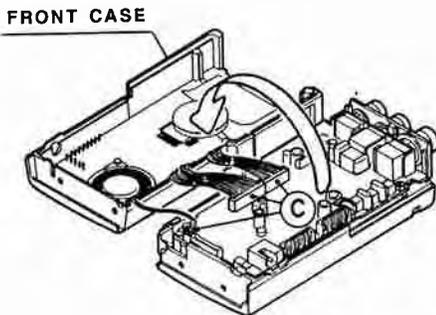
Bottom Cover

Remove four screws labeled A at the bottom and two screws labeled B on the rear case.



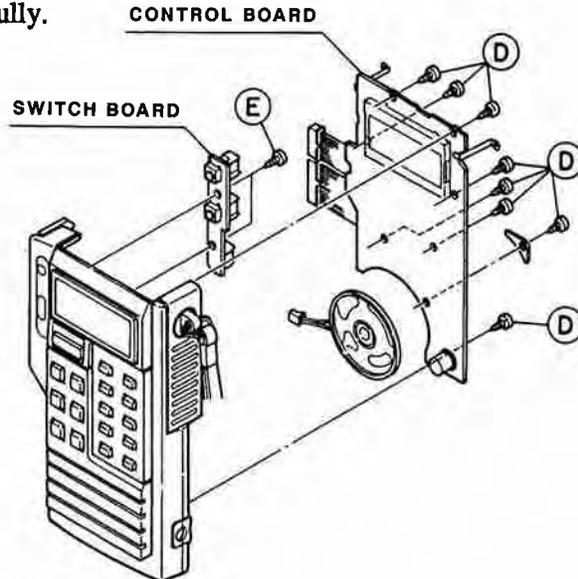
Front Case

Open the front case carefully as shown below. Remove the connectors labeled C on the board.



Microprocessor and Switch Board

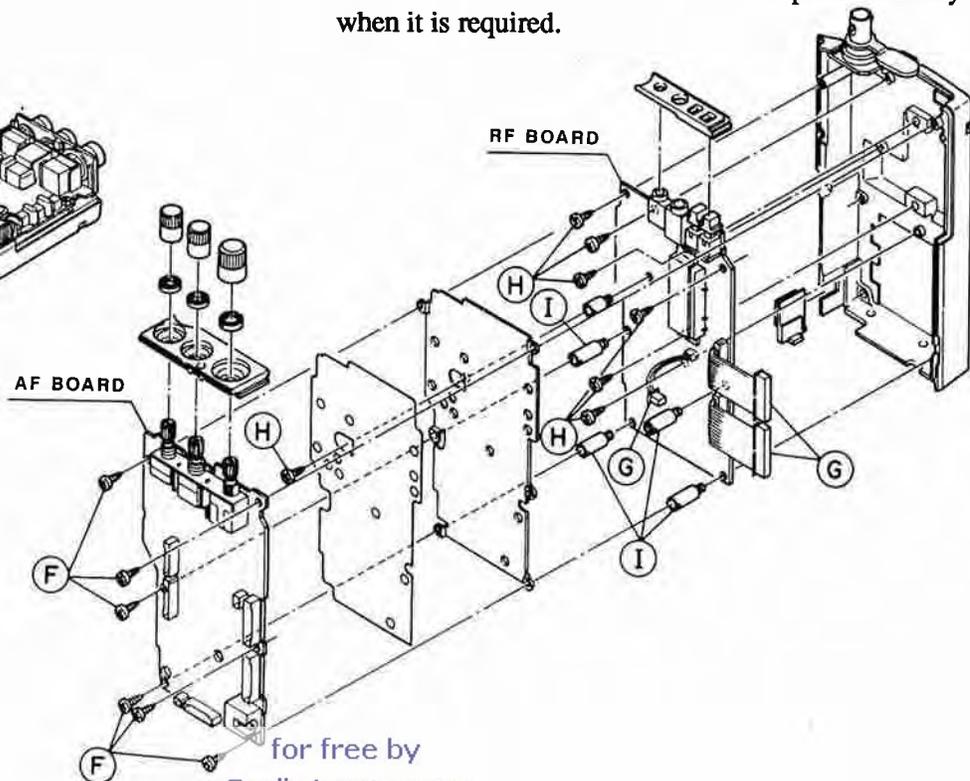
Remove the eight screws labeled D and two screws labeled E on the boards. Remove each board carefully.



AF and RF Board

Remove the six screws labeled F on the AF board, the connectors labeled G, eight screws labeled H, and four spacers labeled I on the RF board. Remove each board carefully.

NOTE: Unsolder the lead wires and parts carefully when it is required.



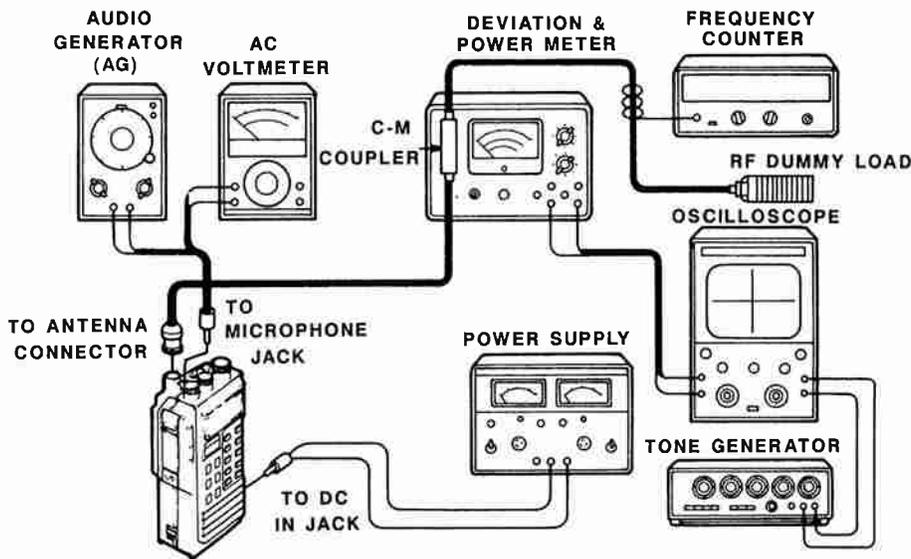
TEST SET UP

Be sure to use correctly adjusted instruments. Warm up the instruments for at least 30 minutes before use.

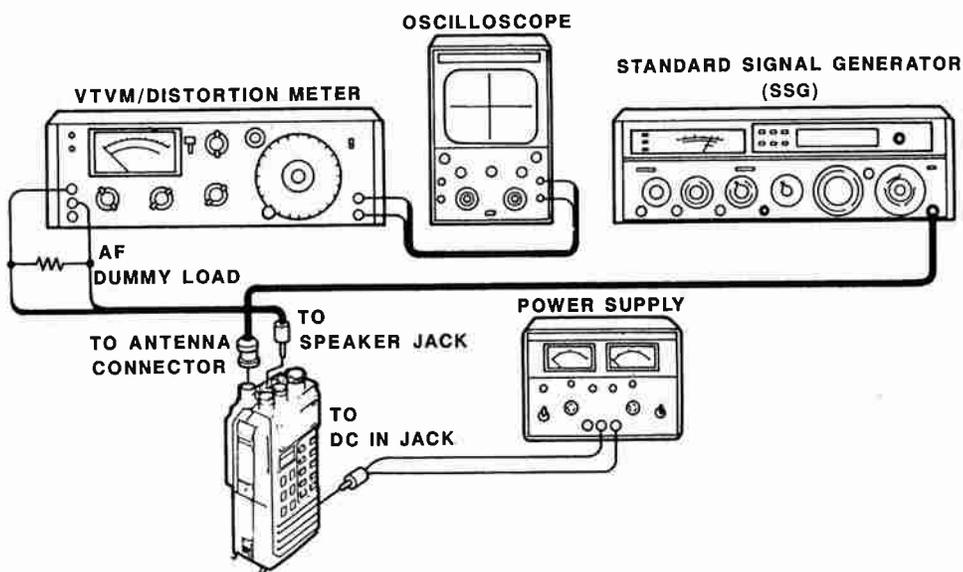
NOTE: Do not attempt the alignment procedure unless you are experienced with test procedures and have properly calibrated equipment.

General Conditions

- Supply voltage..... 9.0 V DC.
- Audio output..... 75 mW.
- AF dummy load..... 8 Ω .
- Standard modulation..... ± 3.5 kHz at 1 kHz.
- RF dummy load..... 50 Ω .
- Alignment frequency
 - Receiver..... VHF 146.00 MHz,
UHF 444.00 MHz.
 - Transmitter..... VHF 146.00 MHz,
UHF 444.00 MHz.

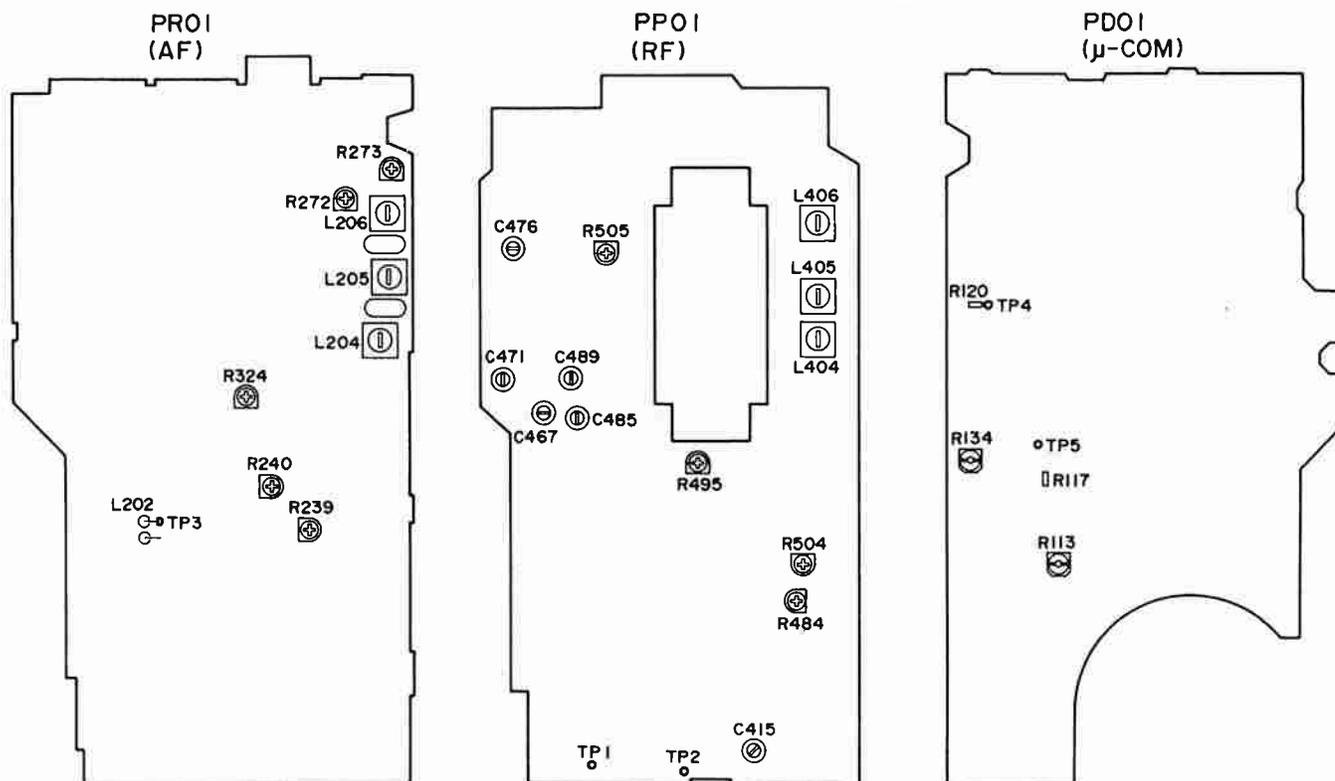


Transmitter Test Set Up



Receiver Test Set Up

ALIGNMENT REFERENCE POINTS



POWER SUPPLY ALIGNMENT

Five-Volt Regulator

1. Apply 9 V to the transceiver and turn the power switch on.
2. Monitor TP3 with the voltmeter. Adjust R324 for a voltmeter reading of 5.1 V. Current drain at VHF is approximately 30 mA in Standby mode.

MICROPROCESSOR ALIGNMENT

Clock

Monitor TP4 with the frequency counter. Confirm that the clock frequency at TP4 is within the range of 160 kHz to 220 kHz.

20 Hz Oscillator

Monitor TP5 with the frequency counter. Adjust R113 for a frequency counter reading of 20 Hz.

PLL SYNTHESIZER ALIGNMENT

VCO

1. Set the channel frequency to 146.00 MHz.
2. Monitor TP2 with the voltmeter. Confirm that the voltage at TP2 is within the range of 1.05 V DC to 1.35 V DC.
3. Key the transmitter and confirm that the voltage at TP2 is within the range of 1.75 V DC to 2.05 V DC.
4. Set the channel frequency to 444.00 MHz.

5. Monitor TP1 with the voltmeter. Confirm that the voltage at TP1 is within the range of 1.55 V DC to 1.85 V DC.
6. Key the transmitter and confirm that the voltage at TP1 is within the range of 2.05 V DC to 2.35 V DC.

Local Frequency

Monitor the output passed through the C-M coupler with the frequency counter. Key the transmitter and adjust C415 for a frequency counter reading of 444.00000 MHz.

RECEIVER ALIGNMENT

Sensitivity

1. Set the frequency of the transceiver and the Standard Signal Generator (SSG) to 444.00 MHz. Modulate the SSG output signal by ± 3.5 kHz with a 1 kHz tone. Monitor the output of the external speaker jack with the oscilloscope. Adjust C476, C471, C467, and L206 for a maximum of 12 dB SINAD.
2. Adjust L205 within two inward turns from the top of the coil case to obtain the maximum 12 dB SINAD. If the maximum 12 dB SINAD is not found, set the core to the top of the coil case.
3. Confirm that the SINAD variation is at its minimum while varying the SSG frequency.
4. Set the frequency of the transceiver and the SSG to 146.00 MHz. Modulate the SSG output by ± 3.5 kHz with a 1 kHz tone. Monitor the 12 dB SINAD with the oscilloscope. Adjust L406, L405, and L404 for the maximum 12 dB SINAD.
5. Adjust L204 so that the signal level meter of the transceiver reads its maximum.

6. Confirm that the SINAD variation is at its minimum while varying the SSG frequency.

RF Attenuator

1. Set the frequency of the transceiver and the SSG to 146.00 MHz. Modulate the SSG output by ± 3.5 kHz with a 1 kHz tone. Confirm that the 12 dB SINAD varies within the range of 15 dB to 20 dB by turning the RF attenuator switch on and off.
2. Set the frequency of the transceiver and the SSG to 444.00 MHz. Modulate the SSG output by ± 3.5 kHz with a 1 kHz tone. Confirm that the 12 dB SINAD varies within the range of 15 dB to 25 dB by turning the RF attenuator switch on and off.

Signal Meter Level

1. Set the frequency of the transceiver and the SSG to 444.00 MHz. Set the SSG output level to 20 dB μ . Monitor the display of the transceiver. Adjust R272 so that the signal level meter lights up to level 7.
2. Set the frequency of the transceiver and the SSG to 146.00 MHz. Set the SSG output level to 20 dB μ . Monitor the display of the transceiver. Adjust R273 so that the signal level meter lights up to level 7.

TRANSMITTER ALIGNMENT

RF Output: High Power

1. Set the supply voltage to 13.8 V DC. Verify that the low power select switch is turned off.
2. Connect the power meter to the antenna connector. Set the channel frequency to 146.00 MHz. Key the transmitter and adjust R484 for the output power of 5.2 W.

- Set the channel frequency to 444.00 MHz. Key the transmitter and adjust R495 for an output power of 5.2 W.

RF Output: Low Power

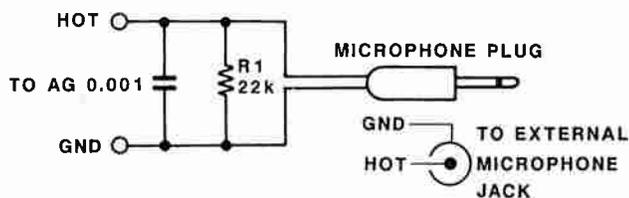
- Set the supply voltage to 9 V DC. Turn the low power select switch on.
- Set the channel frequency to 146.00 MHz. Key the transmitter and adjust R504 for an output power of 0.35 W.
- Set the channel frequency to 444.00 MHz. Key the transmitter and adjust R505 for an output power of 0.35 W.

Transmit Indicator Level

- Turn the low power select switch on. Monitor the display of the transceiver. Key the transmitter and confirm that the signal level meter lights up to level 3 to 5.
- Turn the low power select switch off. Monitor the display of the transceiver. Key the transmitter and confirm that the signal level meter lights up to level "+".

Modulation

- Set the channel frequency to 146.00 MHz. Plug the microphone plug shown below into the external microphone jack. Inject a sine wave signal of 1 kHz, 60 mV to the microphone plug. Adjust R240 for a maximum deviation of ± 5 kHz.



Disconnect the plug from the microphone jack or disconnect R1 after adjustment. (When R1 is removed from the microphone plug, receive mode is activated.)

- Decrease the AG output for ± 3.5 kHz deviation. Confirm that the open circuit voltage of the AG output is within the range of 3 mV to 9 mV, indicating the microphone's sensitivity.
- Set the channel frequency to 444.00 MHz. Inject a sine wave signal of 1 kHz, 60 mV to the microphone plug. Adjust R239 for a maximum deviation of ± 5 kHz.
- Decrease the AG output for ± 3.5 kHz deviation. Confirm that the open circuit voltage of the AG output is within the range of 3 mV to 9 mV, indicating the microphone's sensitivity.

Tone Modulation: Built-in 100 Hz Tone Signal

- Set the channel frequency to 444.00 MHz. With the Function button pressed, press the OFF SET button. Set the off-set frequency to 0.00 MHz, using the buttons or the channel selector, and press the RPT button.
- Key the transmitter. Adjust R134 for a tone deviation of ± 0.65 kHz and confirm that the detecting tone frequency is within the range of 99.5 Hz to 100.5 Hz.

TONE SQUELCH BOARD ALIGNMENT

Setting Tone Squelch Mode

- Press the 9/T.SQL button with the FUNCTION button. "T.SQL" should be indicated on the display.
- Press it again to release tone squelch mode. "T.SQL" should disappear.

Setting the Tone Frequency

1. Press the */ENT.RCL button. "M" is indicated on the display.
2. Press the 9/T.SQL button with the FUNCTION button. The initial tone frequency (100 Hz) is displayed.
3. Select the desired tone frequency from the tone frequency list below. Set the frequency with the channel selector.
4. Press the #/BZ.SC button to return to the previous mode.

Tone Frequencies (Hz)			
67.0	100.0	141.3	203.5
71.9	103.5	146.2	210.7
74.4	107.2	151.4	218.1
77.0	110.9	156.7	225.7
79.7	114.8	162.2	233.6
82.5	118.8	167.9	241.8
85.4	123.0	173.8	250.3
88.5	127.3	179.9	
91.5	131.8	186.2	
94.8	136.5	192.8	

Encoder

NOTE: Enter transmit mode by installing the microphone plug described earlier.

1. Set the channel frequency to 444.00 MHz and the tone frequency to 67 Hz.
2. Set the transceiver to the tone squelch mode. Adjust R801 for a deviation of ± 0.6 kHz in the transmit mode.
3. Set the tone frequency to 250.3 Hz. Monitor the output of the linear detector or Tone Out of the tone board with the frequency counter.
4. Confirm that the tone frequency is 250.3 Hz \pm 1.25 Hz in the transmit mode. Check all tone frequencies.

NOTE: Tone frequency tolerance is $\pm 0.5\%$ or less.

Decoder

NOTE: Set the transceiver to the tone squelch mode.

1. Set the channel frequency and the SSG to 146.00 MHz. Modulate the SSG output by ± 0.5 kHz with each tone frequency.
2. Set the SSG output level to 15 dB QS. Confirm that the squelch is open for all tone squelch frequencies.
3. Set the channel frequency and the SSG to 444.00 MHz. Modulate the SSG output by ± 0.5 kHz with one of the tone frequencies.
4. Set the SSG output level to 15 dB QS. Confirm that the squelch is open for all tone squelch frequencies.

TOUCH TONE BOARD ALIGNMENT

NOTE: Enter transmit mode by installing the microphone plug described earlier.

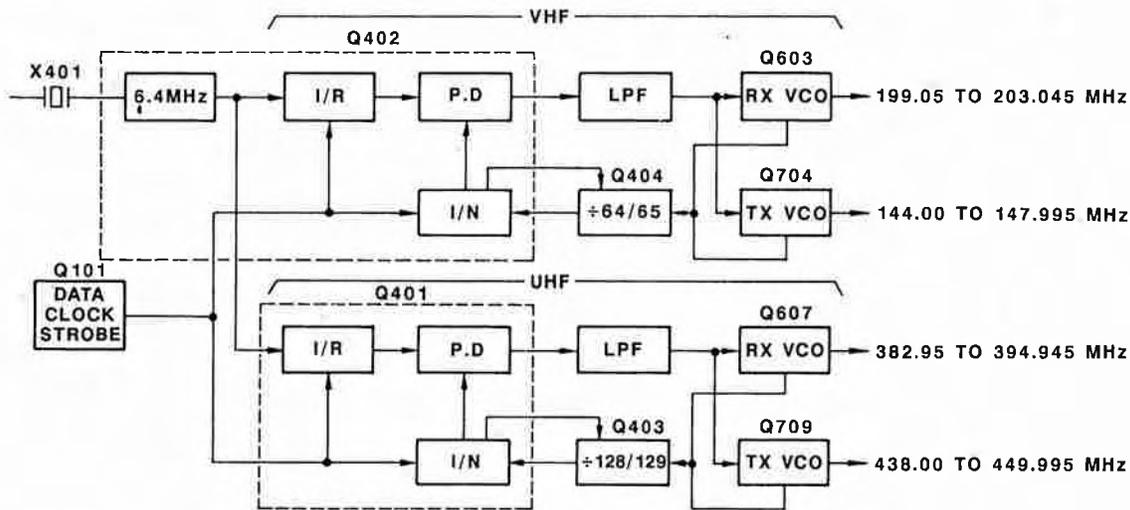
1. Set the channel frequency to 444.00 MHz in the transmit mode.
2. Press the "8" button (dual tone). Adjust R901 for a deviation of ± 3.2 kHz.
3. Monitor the output of the linear detector or DTMF on the tone board with a frequency counter. Install the microphone plug in the external microphone jack for the transmit mode.
4. Press the "0" and "8" buttons (single tone) simultaneously. Confirm that the single tone frequency is within a range of 1325.3 Hz to 1338.7 Hz.
5. Confirm that the single tone frequency is available with every combination.

SINGLE TONE FREQUENCY	
Combination	Frequency (Hz)
1 and 2	697
5 and 6	770
7 and 8	852
* and #	941
1 and 4	1209
0 and 8	1336
3 and 6	1477
C and D	1633

DUAL TONE MULTI-FREQUENCY (Hz)				
High \ Low	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

THEORY OF OPERATION

PLL SYNTHESIZER



PLL Block Diagram

NOTE: You may want to refer to the schematic while reading this section.

A block diagram of the PLL synthesizer is shown above. It consists of a crystal-controlled oscillator, a programmable reference divider and a voltage-controlled oscillator (VCO). The VCO output frequency is divided by programmable dividers and applied to a phase detector that compares the resultant signals from the dividers and develops a correction voltage for the VCO.

VHF

The reference oscillator with X401 generates a 6.4 MHz signal which is divided by the programmable reference divider in Q402 to produce a reference frequency of either 5 kHz, when the channel step is 25 kHz, or 6.25 kHz, when the channel step is 12.5 kHz.

The PLL local frequency generated by VCO Q603 operates in the receive frequency range and is applied to the receiver section. When in the transmit mode,

VCO Q704 generates the PLL local frequency, part of which is applied to the transmitter section. The remaining PLL local frequencies are applied to dual modulus pre-scaler Q404 and a programmable divider passing through switching diode Q413. The output frequency of the VCO is divided down to 5 kHz when the channel step is 25 kHz and to 6.25 kHz when the channel step is 12.5 kHz. The phase detector in Q402 compares the phase of two 5 kHz signals and outputs the phase difference from Q402 pin 5. The PLL loop filter, a low-pass filter, develops a voltage proportional to the phase-difference between two 5 kHz signals. This voltage is applied to the vari-cap diode of the VCO in such a manner as to cause a frequency change in the direction that will reduce the phase difference.

The VCO is a circuit with Q601, Q602, Q701, Q702, and Q703 providing the variable capacitance to control the frequency. Q601 and Q602 are selected for the transmit frequency and Q701 and Q702 for the receive frequency. The modulation signal from the microphone amplifier is applied to Q703.

PLL IC Q402 Pins

Pin No.	SYM	Description
1	OSCI _n	Crystal
2	OSCO _u t	
4	V _{dd}	Power Supply
5	PD _o ut	Charge pump output
6	V _{ss}	Ground
7	LD	Phase detector output High: Lock Negative pulse: Unlock
8	fin	Clock input
9	Clock	Clock input
10	Data	Serial data input
11	LE	Load enable
12	MC	Dual modulus pre-scaler control output

Dual Modulus Pre-Scaler Q403

Pin No./SYM	Pin No./SYM	Divide-by-number
3/SW	6/M	Pin 4 output
L	H	1/128
L	L	1/129

Dual Modulus Pre-Scaler Q404

Pin No./SYM	Pin No./SYM	Divide-by-number
3/SW	6/M	Pin 4 output
L	H	1/64
L	L	1/65

UHF

The PLL local frequency generated by VCO Q607 operates in the receive frequency range and is applied to the receiver section. When in the transmit mode, VCO Q709 generates the PLL local frequency, part of which is applied to the transmitter section. The remaining PLL local frequencies are applied to dual modulus pre-scaler Q403 and a programmable divider in Q401. The output frequency of the VCO is divided down to 5 kHz when the channel step is 25 kHz and to 6.25 kHz when the channel step is 12.5 kHz. The phase detector in Q401 compares the phase of two 5 kHz signals and outputs the phase difference from Q401 pin 5. The PLL loop filter, a low-pass filter, develops a voltage proportional to the phase difference between two 5 kHz signals. This voltage is applied to the vari-cap diode of VCO in such a manner as to cause a frequency change in the direction that will reduce the phase difference.

The VCO is a circuit with Q605, Q606, Q707, Q708, and Q706 providing the variable capacitance to control the frequency. Q605 and Q606 are selected for the transmit frequency and Q707 and Q708 for the receive frequency. The modulation signal from the microphone amplifier is applied to Q706.

RECEIVER

The receiver is a double-conversion superheterodyne with a 55.05 MHz first intermediate frequency (IF) and 455 kHz second IF, designed to operate in the FM VHF and UHF frequency range.

Front End

The receive signal is picked up by the antenna and applied to a duplexer. The duplexer consists of a low-pass filter for VHF and a high-pass filter for UHF and divides the receive signal according to the frequency range.

VHF—The receive signal is applied to RF coil L406 and passes through an antenna circuit and RF attenuator circuit. When forward-biased, the RF attenuator switch turns on and diode Q418 allows both direct current and RF current to be passed to the RF attenuator circuit. The receive signal is attenuated approximately 20 dB.

The receive signal in L406 is amplified by RF amplifier FET Q417. The amplified receive signal is applied to the gate of first mixer FET Q415, then passing through the two-stage band-pass filter consisting of L405 and L404.

UHF—The receive signal is applied to RF coil L413 and passes through an antenna switching circuit and RF attenuator circuit. When forward-biased by turning on the RF attenuator switch, diode Q429 allows both direct current and RF current to be passed to the RF attenuator circuit. The receive signal is attenuated by approximately 20 dB.

The receive signal in L413 is amplified by RF amplifier Q426. The amplified receive signal is then applied to the base of first mixer transistor Q424.

First Mixer/IF

The first IF is applied to a matched pair of 55.05 MHz crystal filter circuits consisting of L204, F201, L205, F202, and L206, and passes through forward-biased Q414 or Q423 and a switching diode. The signal is then filtered in the crystal filter circuit, obtaining excellent cross modulation.

VHF—The filtered signal from MOS FET Q417 is applied to the gate of MOS FET Q415, the first mixer, while the receiver's PLL local signal (199.05 MHz to 203.04 MHz) is simultaneously injected at the source of Q415. The two signals are heterodyned against each other, producing a first IF of 55.05 MHz on the drain of Q415.

UHF—The filtered signal from transistor Q426 is applied to the base of transistor Q424, the first mixer, while the receiver's PLL local signal (382.95 MHz to 394.94 MHz) is simultaneously injected at the base of Q424. The two signals are heterodyned against each other, producing a first IF of 55.05 MHz on the collector of Q424. After filtering, the first IF signal is amplified by first IF amplifier Q236 and applied to IC Q201 pin 20.

Second IF and Discriminator

Q201 is a multifunction IC consisting of the following circuits: second local oscillator, second mixer, second IF amplifier, detector, and squelch switching circuit.

The amplified 55.05 MHz first IF is applied to the second mixer section of Q236, which in turn heterodynes it against the second local oscillator frequency.

A second local oscillator frequency is generated at 54.595 MHz crystal X202, using low side-injection. The second IF, 455 kHz at Q201 pin 4, is applied to ceramic filter F203, with bandwidth characteristics. After filtering, the second IF is fed to a limiter, quadrature detector, and amplifier in the IC. The frequency-modulated second IF signal is demodulated into an audio signal in the quadrature detector.

Audio Circuit

Audio signals from the pin 11 of Q201 are applied to the de-emphasis circuit consisting of R291, C263, R292, and C264, which limits audio frequency response to below 3 kHz, and to muting circuit Q248. After filtering, the audio is applied to volume control R295. The volume control determines the audio level to audio power amplifier Q203. Q203 develops the required level of audio drive to the speaker.

Squelch Circuitry

Capacitor C262 and resistor R290 are configured as a low-pass filter circuit which removes the 455 kHz applied to squelch control R287. The squelch control determines the noise sent to noise amplifier Q201 pin 12.

After filtering, the audio signal is applied to the high-pass filter consisting of C251, R278, and C250, selecting noise components. The output of Q201 pin 14 is rectified by diodes Q239 and Q238 to obtain DC voltage. This DC voltage is applied to the squelch switch circuit in Q201 at pin 15.

The squelch signal output of Q201, pin 16, is applied to the audio muting control circuit (Q240, Q241, and Q248) and the switching circuit (Q247, Q246, Q244, Q245, Q243, and Q242) for audio mute of audio power amplifier Q203.

When the output of Q201 pin 16 is high, Q248 turns on, the audio mute switching circuit turns on, and the squelch action is turned off, as well as the audio muting and switching circuits, muting audio power amplifier Q203. When the output of Q201 pin 16 is low, it is turned off. When the Squelch Off button is pressed, the squelch action is turned off, reducing the gate voltage of Q248.

When the DC voltage at pin 15 of Q201 is 0.7 V or more, pin 16 will be low, which sets pin 17 at high impedance. When the voltage is less than 0.7 V, pin 16 will be high, setting pin 17 to ground. The signal from pin 17 is applied to microprocessor Q101 to control various features of the transceiver.

Signal Meter

A part of the output from Q201 pin 6 passes through band-pass filter F203 and is controlled by variable resistor R272 and amplified by Q234 and Q233. The input of Q234 is adjusted by R273 and Q235 during VHF operation to make the VHF and UHF sensitivity equivalent.

The amplified signal is rectified by diodes Q232 and Q231 and converted into a DC voltage. The DC voltage varies according to the received signal level and is applied to comparator Q103 (1/2). The reference voltage of Q103 (1/2) is controlled by the microprocessor and the high or low level of the output signal at pin 1 is used by the signal meter. The reference voltage is determined by the relation between R121 through R125 and microprocessor pin 51 through pin 54.

TRANSMITTER

The transmitter produces up to 5 watts of output power in the VHF and UHF bands.

Microphone Amplifier

The audio signal from the microphone element is coupled to pin 5 of Q204. Microphone amplifier Q204 has a pre-emphasis circuit and consists of an operational amplifier (1/2) and associated circuitry. Q204 (1/2) pre-emphasizes the audio levels between 300 Hz and 3000 Hz at 6 dB/octave and amplifies the audio level.

The amplified audio signal is then fed to a deviation and limiter circuit, where the audio is maintained at levels that will not exceed ± 5 kHz frequency deviation. After limiting, the audio signal is applied to a low-pass filter where audio frequencies above 3000 Hz and below 300 Hz are de-emphasized at 18 dB/octave.

The converted modulation signal is adjusted by variable resistor R239. The deviation level is fed to the modulation circuit in VCO. The 100 Hz tone modulation signal is adjusted by variable resistor R134. The tone deviation level is applied to pin 3 of Q204 and passes through an active low-pass filter.

Power Amplifier

Unwanted noise is not radiated during reception and in the PLL unlock mode. Instead, a transmission muting circuit consisting of transistor Q226 and diodes Q225 and Q227 cuts bias voltages TU and TV to the younger stage and final power module. In the transmit mode, a part of the output power passes through diode Q252 and is applied to comparator Q103 (1/2) to be indicated on the signal meter. The reference voltage of Q103 (1/2) is for operation as well as the signal meter.

VHF — The transmit signal received from the J-FET Q704 in the VCO is applied to buffer amplifier Q705 and Q434, driver Q435, and final power module Q405. The transmit signal is then applied to a low-pass filter, antenna switching circuit, and duplexer. The low-pass filter in the duplexer attenuates the second and third harmonic of the transmit signal by a minimum of 60 dB. Power output is varied by an adjustable variable resistor (R484), which varies the voltage collector current supply to driver Q435. At low power, output power is varied by R504, which varies the emitter current to Q435.

UHF — The transmit signal received from transistor Q709 in the VCO is applied to buffer amplifier Q710, Q711, and Q436, driver Q437, and final power module Q406. The amplified transmit signal is then applied to a low-pass filter, antenna switching circuit, and duplexer. The low-pass filter in the duplexer attenuates the second and third harmonic of the transmit signal by a minimum of 60 dB. Power output is varied by an adjustable variable resistor (R495), which varies the collector current to driver Q437.

CONTROLS

Microprocessor Q101 controls the transceiver. Oscillator Q103 generates a timer frequency of 20 Hz for the microprocessor. Diodes Q104 and Q107 determine the initial setting of the transceiver. When the PTT button is pressed, switching transistor Q115 turns on. The logic high at the collector of Q115 is

supplied to pin 80 of Q101. The 100 Hz output of Q101 pin 56 is distributed by diode Q109 and digital transistor Q110 for tone frequency and the beeper.

POWER SUPPLY

A 5-volt regulator circuit consists of transistors Q255 and Q256 and zener diode Q254. Supply voltage passes through the power switch (SW+B) and is applied to the RF power modules (Q405 for VHF and Q406 for UHF), the 5-volt regulator circuit, and the AF power amplifier (Q203). The output of the 5-volt regulator circuit is adjusted by variable resistor R324 to 5.1 V. Serial data from Q101 pin 66 is applied to shift register Q202 pin 1 and controls voltages TU, TV, RU, VU, VV, SV, R5, and T5 in accordance with the transceiver (see "Terminal Descriptions").

TONE SQUELCH BOARD

The serial data from Q101 is applied to shift register Q802 on the tone squelch board and determines the tone frequency. The parallel outputs of Q802 are connected to pins 3 through 8 of Q801. Q801 develops a tone frequency proportional to the parallel outputs of pins 13, 14, and 4 through 7 at Q802. The tone frequency varies with a change in the serial data applied to Q801, causing a corresponding control of Q101. When pin 12 of Q801 is low, the squelch action turns on. Reference oscillator X801 in Q801 generates 4.194304 MHz, which is divided by the divider in Q801.

Decoder

A part of the second IF from Q201 passes through the squelch control and is applied to pin 29 of Q801 on the tone board. If the detected tone signal agrees with the desired tone signal, pin 23 of Q801 becomes high, turning on transistors Q804 and Q805, and the squelch turns off. If the tones do not match, pin 23 is low and the squelch remains on.

Encoder

During transmission, TXG is low and pin 12 is high. Pin 26 of Q801 outputs a tone signal. The tone signal is amplified by Q803 and tone deviation is adjusted by R801.

TOUCH TONE BOARD

DTMF consists of low and high groups of tone frequencies. When you press one button on the keyboard, both the row and column inputs associated with that button are low. Tone dialer Q901 generates

the dual tone frequency combined with the column and row. If you press two buttons, Q901 generates a single tone.

The dual tone output of Q901 pin 17 is adjusted by R901 for ± 3.2 kHz deviation. The modulated tone signal is then applied to microphone amplifier Q204 and passes through the terminal DTMF. DTMF BZ monitors the dual tone frequency. When the dual tone frequency is emitted from pin 17 of Q901, pin 11 is high. DTMF muting switch Q108 then turns on, and the audio signal from the microphone is grounded. Transmit supply voltage T5 is supplied to pins 1 and 2 of Q901. Reference oscillator X901 generates 3.579545 MHz for Q901.

TERMINAL DESCRIPTIONS

Transceiver Board

Terminal	Function
LOW	Hi/Lo power detect line (high: open, low: ground).
SPA	AF power AMP OUT.
MIC	Microphone line.
SPK	Speaker line.
TV	4.3 V during transmission at VHF.
+B	Line through power switch.
TU	4.3 V during transmission at UHF.
RU	4.3 V during reception at UHF.
RX	—
RV	4.3 V during reception at VHF.
G	Ground.
IF	55.05 MHz IF signal output.
IFG	55.05 MHz IF signal ground.
ULR	Unlock signal output line from PLL (low when unlocked).
VU	4.3 V during transmission at UHF.
MOD	VCO modulation line.
VV	4.3 V during transmission at VHF.
SV	5 V with VHF operation.
SU	5 V with UHF operation.
PV	PLL IF data strobe signal for VHF.
PU	PLL IF data strobe signal for UHF.
SO	PLL IC data signal, signal for 5-volt power supply shift resistor (compatible when tone data is used).
CK	PLL IC data clock signal (compatible when tone data is used).
5V	5-volt regulator.

Terminal	Function
XT	—
SQL OFF	Squelch is on with high level and off with low level.
LAS	Ground by pressing lamp switch.
LAMP	Lamp line.
DAC	Analog data line for signal meter and TX power meter.
SQL	Low level when Q201 is detected and high level when Q201 is not detected.
ULM	Unlock signal line (5 V when unlocked).
EU	Encoder UP signal.
ED	Encoder DOWN signal.
G	Ground.
CK	PLL IC data clock signal (compatible when tone data is used).
SO	PLL IC data signal, signal for 5-volt power supply shift resistor (compatible when tone data is used).
IOE	Data strobe signal for 5-volt power supply shift resistor.
PU	PLL IC data strobe signal for UHF.
TE	Data strobe signal for tone squelch.
PV	PLL IC data strobe signal for VHF.
BZ	Buzzer signal line.
BST	100 Hz tone signal output line.
MIC	Microphone line.
5V	5-volt regulator.
T5	5 V during transmission.
SPK	Speaker line.
G	Ground.

Tone Squelch Board

Terminal	Function
AFI	IF detect signal input line for RX tone squelch.
TONE	TX tone signal output.
SQT	RX tone squelch detect output (5 V when squelch is on).
TXG	Tone squelch IC TX/RX switch signal (high-to-low during transmission).
5V	5-volt regulator.
CK	Tone data clock signal.
SO	Tone data signal.
TE	Tone data strobe signal.
XO	Ground.
G	Ground.

Touch Tone Board

Terminal	Function
R4 R1 R2 R3	Row lines.
DTMF BZ	Touch tone monitor line.
DTMF	Touch tone signal output.
MUTE	Low-to-high when touch tone is output.
G	Ground.
C4 C3 C2 C1	Column lines.
T5	5 V during transmission.

NOTE: This parts list is for your reference. These parts are not available from Heath Company. Contact your nearest Heath-recommended service center for service assistance.

<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
001B	1	FRONT CASE	057B	7	FOR P.C.BOARD
002B	1	REAR CASE	059B	2	SUPPORT FOR AF P.C.BOARD
003B	2	FOR U'COM P.C.BOARD	060B	1	(+) TERMINAL
004B	1	LABEL	062B	1	INSULATOR FOR AF P.C.BOARD
005B	4	FOR SPRING	065B	1	SHIELD FOR AF P.C.BOARD
006B	1	CAP FOR DC JACK	068B	1	BUFFER FOR SHIELD
007B	2	SCREW FOR REAR CASE	076B	2	BUTTON FOR PUSH SWITCH
008B	1	LEAF SPRING FOR CASE	079B	1	ESCUTCHEON FOR RF P.C.BOARD
009B	1	BATTERY LOCK BUTTON	082B	1	SUPPORT FOR RF P.C.BOARD
010B	1	FUNCTION BUTTON	085B	4	SUPPORT FOR RF P.C.BOARD
011B	1	PTT BUTTON	088B	2	SHIELD FOR RF P.C.BOARD
012B	1	LAMP/SQL BUTTON	089B	1	SHIELD FOR POWER IC
013B	1	BUFFER FOR LAMP/SQL BUTTON	090B	1	RETAINER FOR POWER IC
014B	9	SCREW FOR P.C.BOARD	091B	2	FOR P.C.BOARD
018B	1	LCD PANEL	092B	1	CAP FOR ESCUTCHEON
019B	1	LCD COVER	093B	4	FOR RF P.C.BOARD
020B	1	SHEET FOR LCD	095B	1	ANTENNA BRACKET
025B	1	RUBBER BUTTON	098B	1	NUT FOR ANTENNA
030B	1	NET FOR SPEAKER	101B	1	BATTERY CASE (FRONT)
031B	1	CLAMPER FOR SPEAKER	102B	1	BATTERY CASE (REAR)
032B	1	SCREW FOR SPEAKER	105B	1	CONTACTOR FOR BATTERY CASE(+)
033B	13	PIN FOR U'COM P.C.BOARD	106B	1	CONTACTOR FOR BATTERY CASE(-)
036B	1	SHEET FOR LITHIUM BATTERY	107B	2	CONTACTOR FOR BATTERY CASE(+)
039B	1	SHEET FOR U'COM P.C.BOARD	108B	2	CONTACTOR FOR BATTERY CASE (+,-)
046B	2	VOLUME CONTROL KNOB	109B	1	CONTACTOR FOR BATTERY CASE (+)
049B	1	CHANNEL KNOB	110B	1	CONTACTOR FOR BATT. CASE (-)
050B	3	NUT FOR VOLUME CONTROL	113B	1	SPACER FOR CONTACTOR
052B	1	ESCUTCHEON FOR AF P.C.BOARD	002V	1	STRAP
056B	1	FOR VOLUME (BRACKET)			

<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
C281	1	0.001 UF	C474	1	15 PF CH
E201	1	INTERNAL SPEAKER	C475	1	0.001 UF
J401	1	CONNECTOR FOR BNC ANTENNA	C476	1	6 PF TRIMMING CAPACITOR
J402	1	MIC JACK 2.5 M/M	C477	1	3 PF CJ
J403	1	SPEKERK JACK	C478	1	3 PF CJ
K001	1	AF/RF TACT SWITCH P.C.BOARD	C479	1	5 PF CH
K002	2	TX/RX VCO P.C.BOARD	C480	1	0.001 UF
N101	1	INTERNAL MICROPHONE	C481	1	1 PF CK
PD01	1	U'COM P.C.BOARD	C482	1	0.001 UF
PP01	1	RF P.C.BOARD	C483	1	100 PF UJ
PR01	1	AF P.C.BOARD	C484	1	6 PF CH
PS01	1	TACT SWITCH P.C.BOARD	C485	1	6 PF TRIMMING CAPACITOR
S101	1	TACT SWITCH RESET	C486	1	7 PF CH
S102	1	TACT SWITCH SQL OFF	C487	1	1 PF CK
S103	1	TACT SWITCH FUNCTION	C488	1	7 PF CH
S104	1	TACT SWITCH PIT	C489	1	6 PF TRIMMING CAPACITOR
S105	1	TACT SWITCH LAMP	C490	1	0.001 UF
S106	1	TACT SWITCH CALL	C491	1	15 PF CH
W103	1	ZEBRA CONNECTOR FOR LCD	C492	1	27 PF CH
X101	1	CRYSTAL 31.4685 KHZ	C493	1	0.001 UF
001P	1	EXTERNAL SPEAKER PLUG 3.5M/M	C494	1	8 PF CH
002P	1	EXTERNAL MICROPHONE PLUG 2.5M/M	C495	1	5 PF CH
011V	1	FLEXIBLE ANTENNA	C556	1	1.5 PF CK
C437	1	6 PF CH	L404	1	COIL
C438	1	47 PF CH	L405	1	COIL
C439	1	0.001 UF	L406	1	COIL
C440	1	0.001 UF	L407	1	COIL 1.5T
C441	1	8 PF CH	L411	1	PRESS COIL-A
C442	1	1.5 PF CK	L412	1	PRESS COIL-B
C443	1	8 PF CH	L413	1	PRESS COIL-A
C444	1	0.001 UF	L414	1	PRESS COIL-A
C445	1	0.001 UF	L415	1	PRESS COIL-B
C446	1	5 PF CH	L416	1	PRESS COIL-A
C447	1	150 PF UJ	L421	1	COIL 4.7 UH
C448	1	47 PF CH	L422	1	COIL 4.7 UH
C449	1	0.001 UF	Q414	1	DIODE 1SS265
C450	1	100 PF UJ	Q415	1	2SK302(Y1)
C451	1	22 PF CH	Q416	1	DIGITAL TRANSISTOR RN1404
C452	1	27 PF CH	Q417	1	2SK302(Y2)
C453	1	15 PF CH	Q418	1	DIODE 1SS265
C463	1	0.001 UF	Q419	1	DIODE 1SS265
C464	1	1 PF CK	Q420	1	DIGITAL TRANSISTOR RN1401
C465	1	100 PF UJ	Q421	1	DIODE 1SS265
C466	1	3 PF CJ	Q423	1	DIODE 1SS265
C467	1	6 PF TRIMMING CAPACITOR	Q424	1	2SC3099
C468	1	3 PF CJ	Q425	1	2SC3120
C469	1	1 PF CK	Q426	1	2SC3429
C470	1	3 PF CJ	Q427	1	2SC3429
C472	1	6 PF TRIMMING CAPACITOR	Q428	1	DIODE 1SS268
C472	1	0.001UF	Q429	1	DIODE 1SS268
C473	1	5 PF CH	Q431	1	DIGITAL TRANSISTOR RN1401
			R441	1	100 OHM 1/10W

<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
R442	1	2.7 KOHM 1/10W	C128	1	0.001 UF
R443	1	47 KOHM 1/10W	C129	1	0.001 UF
R444	1	100 OHM 1/10W	C130	1	0.001 UF
R445	1	100 OHM 1/10W	C131	1	10 PF CH
R446	1	10 KOHM 1/10W	C132	1	10 PF CH
R447	1	2.2 KOHM 1/10W	C133	1	10 PF CH
R448	1	180 OHM 1/10W	Q101	1	U'COM
R451	1	100 OHM 1/10W	Q102	1	LCD DISPLAY
R452	1	330 OHM 1/10W	Q103	1	IC NJM2903M
R453	1	10 KOHM 1/10W	Q104	1	DIODE 1SS190
R454	1	33 KOHM 1/10W	Q105	1	DIODE 1SS187
R455	1	47 OHM 1/10W	Q107	1	DIODE 1SS187
R456	1	10 KOHM 1/10W	Q108	1	DIGITAL TRANSISTOR RN1404
R457	1	330 OHM 1/10W	Q109	1	DIODE 1SS184
R458	1	2.2 KOHM 1/10W	Q110	1	DIGITAL TRANSISTOR RN1404
R459	1	4.7 KOHM 1/10W	Q111	1	DIGITAL TRANSISTOR RN1404
R460	1	10 KOHM 1/10W	Q112	1	DIODE 1SS184
R462	1	330 OHM 1/10W	Q113	1	DIODE 1SS184
R463	1	10 KOHM 1/10W	Q114	1	DIODE 1SS184
R464	1	33 KOHM 1/10W	Q115	1	2SA1162(GR)
R465	1	10 KOHM 1/10W	R101	1	1 KOHM 1/10W
R466	1	47 OHM 1/10W	R102	1	47 KOHM 1/10W
R467	1	10 KOHM 1/10W	R103	1	22 KOHM 1/10W
R468	1	330 OHM 1/10W	R104	1	22 KOHM 1/10W
R469	1	2.2 KOHM 1/10W	R105	1	22 KOHM 1/10W
R470	1	4.7 KOHM 1/10W	R106	1	22 KOHM 1/10W
R471	1	10 KOHM 1/10W	R107	1	27 KOHM 1/10W
R472	1	4.7 KOHM 1/10W	R108	1	27 KOHM 1/10W
S401	1	ATTENUATER SWITCH	R109	1	27 KOHM 1/10W
W402	1	12P CONNECTOR TO J206	R110	1	27 KOHM 1/10W
C101	1	0.047 UF	R111	1	100 KOHM 1/10W
C102	1	33 PF CH	R112	1	680 KOHM 1/10W
C103	1	0.001 UF	R113	1	200 KOHM
C104	1	10 UF/6.3 V ELECT CAP	R114	1	100 KOHM 1/10W
C105	1	0.001 UF	R115	1	100 KOHM 1/10W
C106	1	0.047 UF	R116	1	33 KOHM 1/10W
C107	1	0.001 UF	R117	1	10 KOHM 1/10W
C109	1	0.022 UF	R118	1	10 KOHM 1/10W
C110	1	0.022 UF	R119	1	3.3 KOHM 1/10W
C111	1	0.47 UF/50 V ELECT CAP	R120	1	6.8 KOHM 1/10W
C112	1	47 UF/6.3 V ELECT CAP	R121	1	6.8 KOHM 1/10W
C113	1	0.01 UF	R122	1	33 KOHM 1/10W
C114	1	0.001 UF	R123	1	68 KOHM 1/10W
C115	1	0.022 UF	R124	1	130 KOHM 1/10W
C116	1	0.022 UF	R125	1	270 KOHM 1/10W
C117	1	0.022 UF	R126	1	2.2 KOHM 1/10W
C118	1	22 PF CH	R127	1	470 OHM 1/10W
C119	1	33 PF CH	R128	1	100 KOHM 1/10W
C121	1	0.001 UF	R129	1	1 MOHM 1/10W
C122	1	10 UF/6.3 V ELECT CAP	R130	1	2.2 KOHM 1/10W
C123	1	0.001 UF	R131	1	47 KOHM 1/10W
C124	1	0.001 UF	R132	1	100 KOHM 1/10W
C125	1	0.047 UF	R133	1	100 KOHM 1/10W
C126	1	0.001 UF	R134	1	200 KOHM VARIABLE RESISTOR
C127	1	0.001 UF	R135	1	2.2 KOHM 1/10W
			R136	1	2.2 KOHM 1/10W

<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
R137	1	2.2 KOHM 1/10W	C408	1	22 UF/6.3 V TANTAL CAP
R138	1	1 KOHM 1/10W	C409	1	0.001 UF
R139	1	10 KOHM 1/10W	C410	1	22 UF/6.3 V ELECT CAP
R140	1	1 KOHM 1/10W	C411	1	0.001 UF
R141	1	1 KOHM 1/10W	C412	1	0.047 UF W5R
R142	1	10 KOHM 1/10W	C413	1	0.001 UF W5R
R143	1	2.2 KOHM 1/10W	C415	1	6 PF TRIMMING CAPACITOR
R144	1	2.2 KOHM 1/10W	C416	1	0.001 0UF
R145	1	2.2 KOHM 1/10W	C417	1	26 PF CH
R146	1	2.2 KOHM 1/10W	C418	1	27 PF UJ
R147	1	33 KOHM 1/10W	C419	1	0.001 UF
R148	1	100 KOHM 1/10W	C420	1	0.047 UF W5R
R149	1	10 KOHM 1/10W	C421	1	0.001 UF
R150	1	10 KOHM 1/10W	C422	1	100 PF UJ
R151	1	10 KOHM 1/10W	C423	1	100 PF UJ
R152	1	10 KOHM 1/10W	C424	1	0.047 UF
R153	1	47 KOHM 1/10W	C425	1	68 UF/6.3 V TANTAL CAP
R154	1	10 KOHM 1/10W	C426	1	0.022 UF W5R
R155	1	10 KOHM 1/10W	C427	1	0.001 UF
R156	1	10 KOHM 1/10W	C428	1	100 PF
R157	1	1 KOHM 1/10W	C429	1	100 PF
R158	1	1 KOHM 1/10W	C430	1	0.001 UF
R159	1	220 OHM 1/10W	C431	1	0.001 UF
R160	1	2.2 KOHM 1/10W	C432	1	0.001 UF
R161	1	10 KOHM 1/10W	C433	1	0.001 UF
R162	1	10 KOHM 1/10W	C434	1	0.001 UF
R163	1	10 KOHM 1/10W	C435	1	0.001 UF
R164	1	220 KOHM 1/10W	C436	1	0.001 UF
R165	1	10 KOHM 1/10W	C461	1	0.001 UF
R166	1	47 KOHM 1/10W	C462	1	5 PF CH
R167	1	47 KOHM 1/10W	C505	1	5 PF CH
R168	1	10 KOHM 1/10W	C506	1	22 PF CH
R169	1	12 KOHM 1/10W	C507	1	10 PF CH
R170	1	47 KOHM 1/10W	C508	1	100 PF
R171	1	47 KOHM 1/10W	C509	1	0.001 UF
R172	1	47 KOHM 1/10W	C552	1	0.0047 UF W5R
R173	1	47 KOHM 1/10W	C553	1	0.0047 UF W5R
R174	1	470 OHM 1/10W	C554	1	0.001 UF W5R
R175	1	100 KOHM 1/10W	C557	1	100 PF UJ
R176	1	10 KOHM 1/10W	L401	1	COIL 1UH
R177	1	2.2 KOHM 1/10W	L402	1	COIL 10 UH
R179	1	33 KOHM 1/10W	L403	1	COIL 10 UH
R180	1	10 KOHM 1/10W	L423	1	COIL 2.2 UH
V101	1	LCD LAMP	L424	1	COIL 2.2 UH
W101	1	9PIN CONNECTOR TO J202	L425	1	COIL 100 UH
W102	1	12PIN CONNECTOR TO J203	Q401	1	IC MB87087PF-GH-BND
Z101	1	LITHIUM BATTERY	Q402	1	IC MB87006A
C401	1	0.22 UF	Q403	1	IC WB501L
C402	1	0.001 UF	Q404	1	IC MB504L
C403	1	0.001 UF	Q407	1	DIODE 1SS272
C404	1	12 PF CH	Q408	1	DIGITAL TRANSISTOR RN1411
C405	1	0.047 UF	Q410	1	DIGITAL TRANSISTOR RN1411
C406	1	47 UF/6.3 V TANTAL CAP	Q411	1	DIODE 1SS181
C407	1	0.047 UF	Q412	1	DIODE 1SS97

<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
Q413	1	DIODE 1SS268	C609	1	100 PF UJ
Q433	1	DIODE 1SS268	C610	1	2 PF
R401	1	10 KOHM 1/10W	C611	1	12 PF UJ
R402	1	10 KOHM 1/10W	C612	1	7 PF UJ
R403	1	100 KOHM 1/10W	C613	1	0.001 UF
R404	1	2.2 KOHM 1/10W	C614	1	0.001 UF
R405	1	2.2 KOHM 1/10W	C615	1	1 PF CK
R406	1	2.2 KOHM 1/10W	C616	1	1 PF CK
R407	1	150 OHM 1/10W	C617	1	0.001 UF
R408	1	3.3 KOHM 1/10W	L601	1	COIL 3.5T
R409	1	2.2 KOHM 1/10W	L602	1	COIL 2.2 UH
R410	1	2.2 KOHM 1/10W	L603	1	COIL 0.22 UH
R411	1	10 KOHM 1/10W	L604	1	COIL 3.5T
R412	1	120 OHM 1/10W	L605	1	COIL 1 UH
R413	1	10 KOHM 1/10W	L606	1	COIL 2.5T
R414	1	3.3 KOHM 1/10W	PV01	1	RX VCO P.C.BOARD
R415	1	3.3 KOHM 1/10W	Q601	1	VARI-CAP DIODE 1SV153
R416	1	2.2 KOHM 1/10W	Q602	1	VARI-CAP DIODE 1SV153
R417	1	2.2 KOHM 1/10W	Q603	1	2SK210(Y)
R418	1	47 KOHM 1/10W	Q604	1	2SC3120
R419	1	270 KOHM 1/10W	Q605	1	VARI-CAP DIODE 1SV153
R420	1	47 KOHM 1/10W	Q606	1	VARI-CAP DIODE 1SV153
R421	1	2.2 KOHM 1/10W	Q607	1	2SC3356
R422	1	2.2 KOHM 1/10W	Q608	1	2SC3120
R424	1	2.2 KOHM 1/10W	R601	1	100 OHM 1/6W
R426	1	10 KOHM 1/10W	R602	1	2.2 KOHM 1/6W
R427	1	47 KOHM 1/10W	R603	1	10 KOHM 1/10W
R428	1	1 KOHM 1/10W	R604	1	100 OHM 1/10W
R429	1	1 KOHM 1/10W	R605	1	100 OHM 1/6W
R430	1	22 KOHM 1/10W	R606	1	680 OHM 1/10W
R431	1	4.7 KOHM 1/10W	R607	1	12 KOHM 1/10W
R432	1	3.3 KOHM 1/10W	R608	1	4.7 KOHM 1/10W
R433	1	10 KOHM 1/10W	R609	1	2.2 KOHM 1/6W
R434	1	1 KOHM 1/10W	R610	1	47 KOHM 1/10W
R435	1	1 KOHM 1/10W	R611	1	820 OHM 1/10W
R436	1	100 KOHM 1/10W	R612	1	150 OHM 1/10W
R437	1	15 KOHM 1/10W	R613	1	10 KOHM 1/10W
R438	1	47 OHM 1/10W	R614	1	6.8 KOHM 1/10W
R439	1	10 KOHM 1/10W	R615	1	47 OHM 1/10W
R440	1	47 OHM 1/10W	R616	1	680 OHM 1/6W
R461	1	1 KOHM 1/10W	R617	1	12 KOHM 1/10W
R478	1	47 OHM 1/10W	R618	1	4.7 KOHM 1/10W
R479	1	47 OHM 1/10W	C701	1	0.022 UF W5R
R480	1	22 KOHM 1/10W	C702	1	1 PF CJ
W401	1	12PIN CONNECTOR TO J205	C703	1	12 PF UJ
X401	1	CRYSTAL 6.4 MHZ	C704	1	4 PF UJ
C601	1	0.022 UF W5R	C705	1	0.001 UF
C602	1	6 PF UJ	C706	1	1 PF
C603	1	5 PF UJ	C707	1	0.001 UF
C604	1	1 PF CK	C708	1	0.001 UF
C605	1	1 PF CK	C709	1	1 PF
C606	1	0.001 UF W5R	C710	1	0.001 UF
C607	1	0.001 UF W5R	C711	1	120 PF UJ
C608	1	0.001 UF W5R	C712	1	2 PF UJ
			C713	1	12 PF CH

<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
C256	1	0.022 UF	L202	1	COIL 10 UH
C257	1	0.022 UF	L203	1	COIL 10 UH
C258	1	100 PF UJ	L204	1	COIL
C259	1	0.022 UF	L205	1	COIL
C260	1	22 UF/6.3 V TANTAL CAP	L206	1	COIL
C261	1	0.0022 UF	L207	1	COIL 0.82 UH
C262	1	0.01 UF	L208	1	COIL 0.56 UH
C263	1	0.1 UF/50 V ELECT CAP	L209	1	FERRITE CORE
C264	1	0.22 UF/50 V ELECT CAP	L210	1	COIL 1 UH
C265	1	0.047 UF	PR02	1	VOL CONTROL&POWER SW P.C.BOARD
C266	1	0.022 UF	PR03	1	SQL P.C.BOARD
C267	1	0.1 UF/50 V ELECT CAP	PR04	1	CHANNEL SWITCH P.C.BOARD
C268	1	4.7 UF/50 V ELECT CAP	Q201	1	IC TK10420L
C269	1	100 PF UJ	Q202	1	IC TC4094BF
C270	1	0.01 UF	Q203	1	IC BA546
C271	1	0.022 UF	Q204	1	IC NJM4558M
C272	1	0.001 UF	Q205	1	DIGITAL TRANSISTOR RN2411
C273	1	100 UF/16 V ELECT CAP	Q206	1	ZENER DIODE 02CZ7.5Y
C274	1	100 UF/16 V ELECT CAP	Q207	1	2SA1162(GR)
C275	1	0.0022 UF	Q208	1	2SA1162(GR)
C276	1	4.7 UF/25 V ELECT CAP	Q210	1	2SK208(Y)
C277	1	10 UF/16 V ELECT CAP	Q211	1	DIODE 1SS181
C278	1	33 UF/10 V ELECT CAP	Q212	1	DIGITAL TRANSISTOR FMA4
C279	1	470 PF	Q213	1	DIGITAL TRANSISTOR RN2411
C280	1	0.01 UF	Q214	1	DIGITAL TRANSISTOR RN1404
C282	1	0.001 UF	Q215	1	2SA1162(GR)
C283	1	0.001 UF	Q216	1	2SA1162(GR)
C284	1	0.001 UF	Q217	1	DIGITAL TRANSISTOR RN2411
C285	1	0.001 UF	Q218	1	2SC2712(GR)
C286	1	100 UF/16 V ELECT CAP	Q219	1	DIGITAL TRANSISTOR FMA4
C287	1	0.001 UF	Q220	1	DIODE 1SS181
C288	1	0.001 UF	Q221	1	DIGITAL TRANSISTOR FMA4
C289	1	0.001 UF	Q222	1	2SD1225M(Q)
C290	1	0.001 UF	Q223	1	2SD1225M(Q)
C291	1	470 PF	Q224	1	DIGITAL TRANSISTOR FMA4
C292	1	22 UF/16 V ELECT CAP	Q225	1	DIODE 1SS184
C293	1	0.001 UF	Q226	1	DIGITAL TRANSISTOR RN1404
C294	1	0.001 UF	Q227	1	DIODE 1SS184
C295	1	100 UF/16 V ELECT CAP	Q228	1	ZENER DIODE 02CZ2.4X
C296	1	0.001 UF	Q229	1	TX LED
C297	1	0.001 UF	Q230	1	DIGITAL TRANSISTOR RN1404
C298	1	0.001 UF	Q231	1	DIODE 1SS294
C299	1	0.001 UF	Q232	1	DIODE 1SS294
C301	1	0.001 UF W5R	Q233	1	2SC2712(GR)
C302	1	0.001 UF W5R	Q234	1	2SC2712(GR)
C303	1	0.001 UF W5R	Q235	1	DIGITAL TRANSISTOR RN1404
C305	1	2 PF CK	Q236	1	2SK302(Y2)
C306	1	0.001 UF W5R	Q237	1	DIODE 1SS242
F201	2	CRYSTAL FILTTER 55M15BU (F202)	Q238	1	DIODE 1SS294
F203	1	CFU455E2	Q239	1	DIODE 1SS294
J201	1	EXTERNAL DC JACK	Q240	1	DIGITAL TRANSISTOR RN1404
J202	1	9PIN JACK	Q241	1	DIGITAL TRANSISTOR RN1404
J203	1	15PIN JACK	Q242	1	DIGITAL TRANSISTOR RN1411
J204	1	2PIN JACK FOR INTERNAL SPEAKER	Q243	1	DIODE 1SS184
J205	1	15PIN JACK	Q244	1	DIGITAL TRANSISTOR FMA2
J206	1	2PIN JACK	Q245	1	DIGITAL TRANSISTOR RN1404
J207	1	11PIN JACK	Q246	1	2SC2712(GR)
J208	1	10PIN JACK FOR CTCSS	Q247	1	2SB909M(Q)
L201	1	COIL 10 UH	Q248	1	2SJ106(GR)

<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
C714	1	9 PF UJ
C715	1	0.001 UF W5R
C716	1	0.001 UF
C717	1	2 PF UJ
C718	1	0.001 UF
C719	1	2 PF
C720	1	1 PF CK
C721	1	0.001 UF
L701	1	COIL 4.5T
L702	1	COIL 2.2 UH
L703	1	COIL 0.22 UH
L704	1	COIL 1UH
L705	1	COIL 2.5T
L706	1	COIL 2.5T
L707	1	COIL 2.5T
PV02	1	TX VCO P.C.BOARD
Q701	1	VARI-CAP DIODE 1SV161
Q702	1	VARI-CAP DIODE 1SV161
Q703	1	VARI-CAP DIODE 1SV153
Q704	1	2SK210(Y)
Q705	1	2SC3120
Q706	1	VARI-CAP DIODE 1SV153
Q707	1	VARI-CAP DIODE 1SV153
Q708	1	VARI-CAP DIODE 1SV153
Q709	1	2SC3356
Q710	1	2SC3099
Q711	1	2SC3099
R701	1	100 OHM 1/6W
R702	1	2.2 KOHM 1/6W
R703	1	10 KOHM 1/10W
R704	1	100 OHM 1/10W
R705	1	12 KOHM 1/10W
R706	1	4.7 KOHM 1/10W
R707	1	100 OHM 1/10W
R708	1	330 OHM 1/6W
R709	1	4.7 KOHM 1/6W
R710	1	10 KOHM 1/10W
R711	1	2.2 KOHM 1/6W
R712	1	47 KOHM 1/10W
R713	1	470 OHM 1/10W
R714	1	100 OHM 1/10W
R715	1	10 KOHM 1/10W
R716	1	6.8 KOHM 1/10W
R717	1	47 OHM 1/6W
R718	1	220 OHM 1/10W
R719	1	12 KOHM 1/10W
R720	1	4.7 KOHM 1/10W
R721	1	220 OHM 1/10W
R722	1	4.7 KOHM 1/10W
R723	1	10 KOHM 1/10W
C201	1	0.001 UF
C202	1	0.001 UF

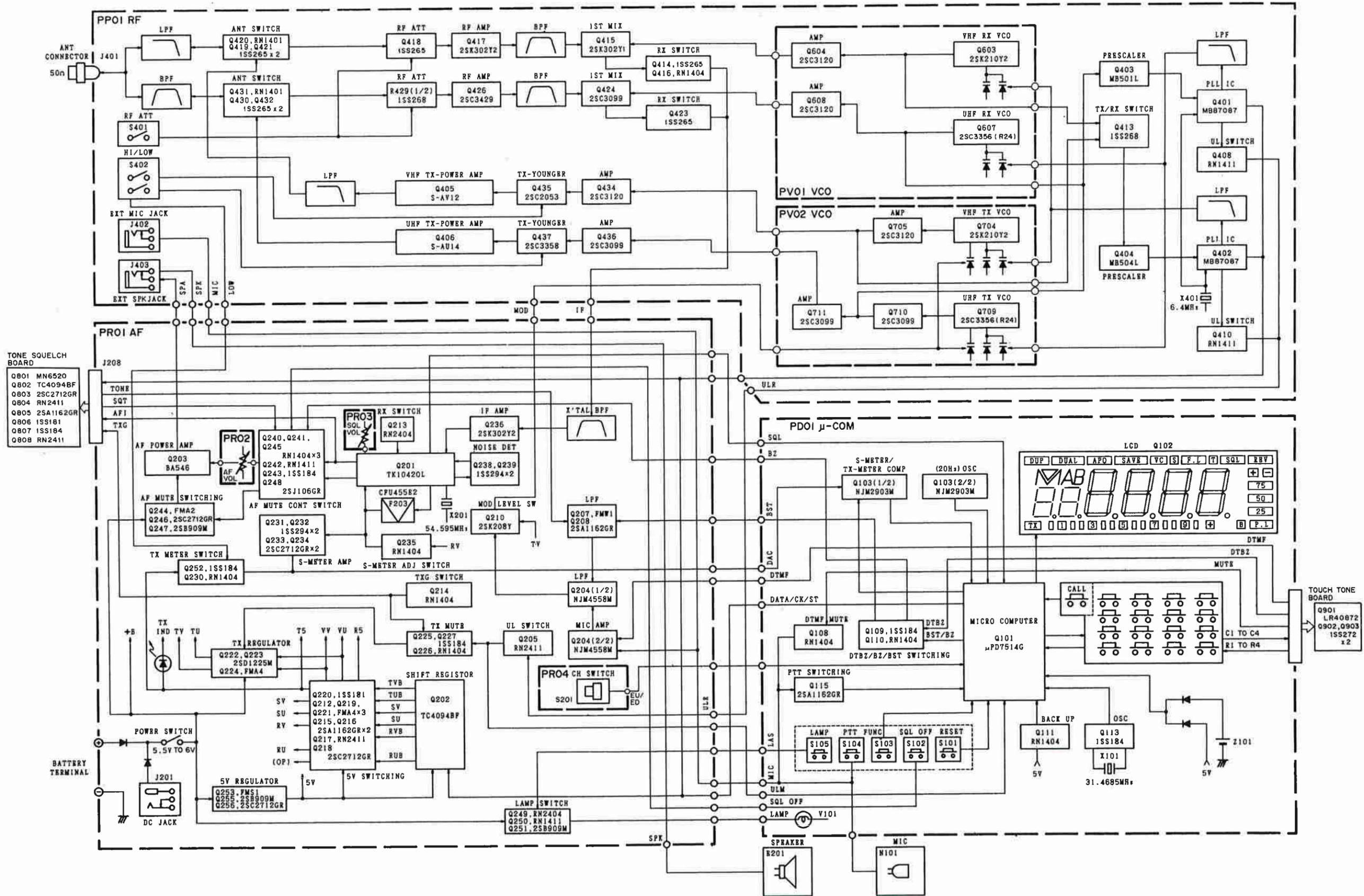
<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
C203	1	0.001 UF
C204	1	0.01 UF W5R
C205	1	0.068 UF W5R
C206	1	0.0033 UF
C207	1	0.0082 UF
C208	1	0.022 UF
C209	1	0.47 UF/50 V ELECT CAP
C210	1	0.1 UF
C211	1	0.001 UF
C212	1	0.01 UF
C213	1	0.01 UF
C214	1	4.7 UF/25 V ELECT CAP
C215	1	22 PF
C216	1	0.082 UF
C217	1	22 UF/6.3 V TANTAL CAP
C218	1	0.001 UF
C219	1	0.0039 UF
C220	1	390 PF
C221	1	4.7 UF/25 V ELECT CAP
C222	1	0.001 UF
C223	1	0.001 UF
C224	1	0.33 UF/50 V ELECT CAP
C225	1	0.022 UF
C226	1	22 UF/6.3 V ELECT CAP
C227	1	0.001 UF
C228	1	0.001 UF
C229	1	47 UF/6.3 V ELECT CAP
C230	1	0.01 UF
C231	1	0.001 UF
C232	1	0.47 UF/50 V ELECT CAP
C233	1	5 PF CH
C234	1	0.01 UF
C235	1	2 PF CK
C236	1	4 PF CH
C237	1	0.01 UF
C238	1	0.01 UF
C239	1	0.001 UF
C240	1	0.001 UF
C241	1	0.01 UF W5R
C242	1	0.022 UF
C243	1	0.022 UF
C244	1	0.001 UF
C245	1	33 PF CH
C246	1	0.001 UF
C247	1	0.47 UF/50 V ELECT CAP
C248	1	0.47 UF/50 V ELECT CAP
C249	1	0.022 UF
C250	1	0.001 UF
C251	1	0.0022 UF
C252	1	22 PF CH
C253	1	27 PF CH
C254	1	0.001 UF
C255	1	0.001 UF

<u>REF.</u> <u>DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>	<u>REF.</u> <u>DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
Q249	1	DIGITAL TRANSISTOR RN2404	R246	1	10 KOHM 1/10W
Q250	1	DIGITAL TRANSISTOR RN1411	R247	1	10 KOHM 1/10W
Q251	1	2SB909M(Q)	R248	1	10 KOHM 1/10W
Q252	1	DIODE 1SS184	R249	1	10 KOHM 1/10W
Q253	1	DIGITAL TRANSISTOR FMS1	R250	1	10 KOHM 1/10W
Q254	1	ZENER DIODE 02CZ5.1X	R251	1	10 KOHM 1/10W
Q255	1	2SB909M(Q)	R252	1	220 OHM 1/10W
Q256	1	2SC2712(GR)	R253	1	4.7 KOHM 1/10W
Q257	1	DIODE 21DQ03	R254	1	10 KOHM 1/10W
Q258	1	DIODE 21DQ03	R255	1	220 OHM 1/10W
R202	1	22 KOHM 1/10W	R256	1	220 OHM 1/10W
R203	1	22 KOHM 1/10W	R257	1	4.7 KOHM 1/10W
R204	1	47 KOHM 1/10W	R258	1	390 OHM 1/10W
R205	1	82 KOHM 1/10W	R259	1	100 OHM 1/10W
R206	1	82 KOHM 1/10W	R260	1	100 OHM 1/10W
R207	1	820 KOHM 1/10W	R261	1	180 OHM 1/10W
R208	1	10 KOHM 1/10W	R262	1	2.2 KOHM 1/10W
R209	1	47 KOHM 1/10W	R263	1	1 KOHM 1/10W
R210	1	47 KOHM 1/10W	R264	1	180 KOHM 1/10W
R211	1	47 KOHM 1/10W	R265	1	220 KOHM 1/10W
R212	1	2.2 KOHM 1/10W	R266	1	1 KOHM 1/10W
R213	1	100 KOHM 1/10W	R267	1	3.3 KOHM 1/10W
R214	1	0 OHM 1/10W	R268	1	470 OHM 1/10W
R215	1	68 KOHM 1/10W	R269	1	680 KOHM 1/10W
R216	1	10 KOHM 1/10W	R270	1	3.3 KOHM 1/10W
R217	1	33 KOHM 1/10W	R271	1	680 KOHM 1/10W
R218	1	2.2 KOHM 1/10W	R272	1	47 KOHM VARIABLE RESISTOR
R219	1	47 KOHM 1/10W	R273	1	47 KOHM VARIABLE RESISTOR
R220	1	1.5 KOHM 1/10W	R274	1	10 KOHM 1/10W
R221	1	560 KOHM 1/10W	R275	1	100 OHM 1/10W
R222	1	330 OHM 1/10W	R276	1	2.2 KOHM 1/10W
R223	1	39 KOHM 1/10W	R277	1	470 KOHM 1/10W
R224	1	120 KOHM 1/10W	R278	1	3.3 KOHM 1/10W
R225	1	15 KOHM 1/10W	R279	1	47 OHM 1/10W
R226	1	39 KOHM 1/10W	R280	1	22 KOHM 1/10W
R227	1	39 KOHM 1/10W	R281	1	4.7 KOHM 1/10W
R228	1	47 KOHM 1/10W	R282	1	1.5 KOHM 1/10W
R229	1	43 KOHM	R283	1	4.7 KOHM 1/10W
R230	1	33 KOHM	R284	1	2.2 KOHM 1/10W
R231	1	4.7 KOHM 1/10W	R285	1	47 KOHM 1/10W
R232	1	150 KOHM 1/10W	R286	1	1.5 KOHM 1/10W
R233	1	47 KOHM 1/10W	R287	1	10 KOHM SQL CONTROL
R234	1	10 KOHM 1/10W	R288	1	1 KOHM 1/10W
R235	1	10 KOHM 1/10W	R289	1	10 KOHM 1/10W
R236	1	220 KOHM 1/10W	R290	1	330 OHM 1/10W
R237	1	1 MOHM 1/10W	R291	1	2.7 KOHM 1/10W
R238	1	1 MOHM 1/10W	R292	1	2.7 KOHM 1/10W
R239	1	47 KOHM VARIABLE RESISTOR	R293	1	47 KOHM 1/10W
R240	1	10 KOHM VARIABLE RESISTOR	R294	1	4.7 KOHM 1/10W
R241	1	47 KOHM 1/10W	R295	1	10 KOHM VOL CONTROL&POWER SW
R242	1	100 OHM 1/10W	R296	1	150 OHM 1/10W
R243	1	10 KOHM 1/10W	R297	1	470 KOHM 1/10W
R244	1	1 KOHM 1/10W	R298	1	1 KOHM 1/10W
R245	1	10 KOHM 1/10W	R299	1	68 OHM 1/10W
			R301	1	10 KOHM 1/10W

<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
R302	1	22 KOHM 1/10W	C501	1	7 PF CH
R303	1	5.6 KOHM 1/10W	C502	1	4 PF CH
R304	1	22 KOHM 1/10W	C503	1	470 PF
R305	1	2.2 KOHM 1/10W	C504	1	0.001 UF
R306	1	22 KOHM 1/10W	C510	1	0.001 UF
R307	1	470 KOHM 1/10W	C511	1	15 PF CH
R308	1	0 OHM 1/10W	C512	1	15 PF CH
R309	1	1 KOHM 1/10W	C513	1	0.001 UF
R310	1	1 KOHM 1/10W	C514	1	4.7 UF/25 V ELECT CAP
R311	1	1 KOHM 1/10W	C515	1	0.001 UF
R312	1	2.2 OHM 1/10W	C516	1	22 PF CH
R313	1	22 KOHM 1/10W	C517	1	47 PF CH
R314	1	10 KOHM 1/10W	C518	1	0.001 UF
R315	1	47 KOHM 1/10W	C519	1	0.001 UF
R316	1	33 OHM 1/2W	C520	1	22 UF/6.3 V ELECT CAP
R317	1	1 KOHM 1/10W	C521	1	0.001 UF
R318	1	820 OHM 1/10W	C522	1	12 PF CH
R319	1	100 KOHM 1/10W	C523	1	0.001 UF
R320	1	10 KOHM 1/10W	C524	1	0.001 UF
R321	1	10 KOHM 1/10W	C525	1	0.001 UF
R322	1	100 KOHM 1/10W	C526	1	10 PF CH
R323	1	22 KOHM 1/10W	C527	1	0.001 UF
R324	1	10 KOHM VARIABLE RESISTOR	C528	1	3 PF CJ
R325	1	33 KOHM 1/10W	C529	1	0.001 UF
R326	1	47 KOHM 1/10W	C530	1	0.001 UF
R327	1	4.7 KOHM 1/10W	C531	1	0.001 UF
R328	1	4.7 KOHM 1/10W	C532	1	0.001 UF
R329	1	1 KOHM 1/10W	C533	1	10 PF CH
R330	1	2.2 OHM 1/10W	C534	1	10 PF CH
R331	1	10 KOHM 1/10W	C535	1	0.001 UF
R332	1	0 OHM 1/10W	C536	1	0.001 UF
S201	1	ROTARY CHANNEL SWITCH	C537	1	0.001 UF
W201	1	2PIN CONNECTOR FOR INT. SPEAKER	C538	1	0.001 UF
X201	1	CRYSTAL 54.595MHZ	C539	1	0.001 UF
X202	1	CERAMIC DISCRI CDB455C7	C540	1	22 UF/6.3 V ELECT CAP
C454	1	2 PF CK	C541	1	2 PF CK
C455	1	33 PF CH	C542	1	0.001 UF
C456	1	6 PF CH	C543	1	0.001 UF
C457	1	0.001 UF	C544	1	0.001 UF
C458	1	27 PF CH	C545	1	0.001 UF
C459	1	7 PF CH	C546	1	100 UF/16 V ELECT CAP
C460	1	0.5 PF CK	C547	1	0.001 UF
C496	1	47 PF CH	C548	1	0.001 UF
C497	1	24 PF CH	C549	1	0.001 UF
C498	1	13 PF CH	C550	1	0.001 UF
C499	1	10 PF CH	C551	1	0.001 UF
			C555	1	10 PF CH

<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>	<u>QTY</u>	<u>DESCRIPTION</u>
C558	1	0.0033 UF W5R	R450	1	4.7 KOHM 1/10W
L408	1	COIL 3.5T	R473	1	4.7 KOHM 1/10W
L409	1	COIL 3.5T	R474	1	100 OHM 1/10W
L410	1	COIL 2.5T	R475	1	4.7 KOHM 1/10W
L417	1	COIL 1.5T	R476	1	2.2 KOHM 1/10W
L418	1	COIL 1.5T	R477	1	0 OHM 1/6W
L419	1	COIL 1.5T	R481	1	4.7 KOHM 1/10W
L420	1	COIL 1.5T	R482	1	6.8 KOHM 1/10W
L426	1	COIL 4.5T	R483	1	470 OHM 1/10W
L427	1	COIL 3.5T	R484	1	1 KOHM VARIABLE RESISTOR
L428	1	COIL 4.7 UH	R485	1	47 OHM 1/10W
L429	1	COIL 4.7 UH	R486	1	470 OHM 1/10W
L430	1	COIL 4.5T	R487	1	120 OHM 1/10W
L431	1	COIL 2.2 UH	R488	1	100 OHM 1/10W
L432	1	COIL 3.5T	R489	1	18 OHM 1/10W
L433	1	COIL 1.5T	R490	1	100 OHM 1/10W
L434	1	COIL 1.5T	R491	1	10 KOHM 1/10W
L435	1	COIL 4.7 UH	R492	1	4.7 KOHM 1/10W
L436	1	COIL 4.7 UH	R493	1	10 KOHM 1/10W
L437	1	FERRITE CORE	R494	1	470 OHM 1/10W
L438	1	FERRITE CORE	R495	1	1 KOHM VARIABLE RESISTOR
L439	1	COIL 1UH	R496	1	33 OHM 1/10W
PP02	1	HIGH/LOW&ATT. SWITCTH P.C. BOARD	R497	1	470 OHM 1/10W
Q405	1	VHF RF POWER AMP S-AV12	R498	1	1 KOHM 1/10W
Q406	1	UHF RF POWER AMP S-AU14	R499	1	470 OHM 1/10W
Q422	1	DIODE 1SS184	R501	1	5.6 OHM 1/10W
Q430	1	DIODE 1SS265	R502	1	470 OHM 1/10W
Q432	1	DIODE 1SS265	R503	1	100 OHM 1/10W
Q434	1	2SC3120	R504	1	47 OHM VARIABLE RESISTOR
Q435	1	2SC2053	R505	1	47 OHM VARIABLE RESISTOR
Q436	1	2SC3099	R506	1	470 OHM 1/10W
Q437	1	2SC3358	R507	1	4.7 KOHM 1/10W
R449	1	4.7 KOHM 1/10W	S402	1	HIGH/LOW SWITCH
			W403	1	11P CONNECTOR TO J207

HW-24HT BLOCK DIAGRAM



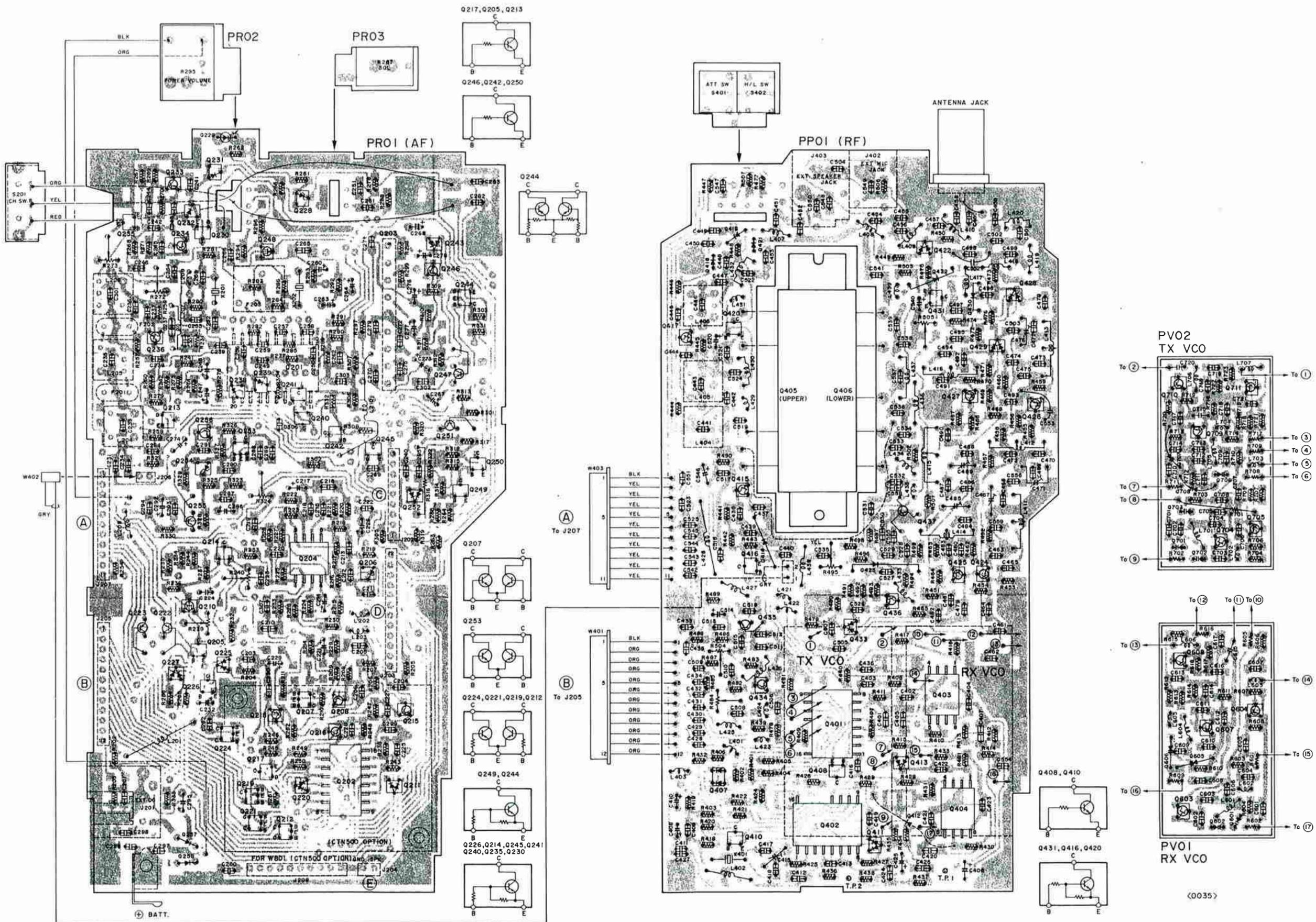
TONE SQUELCH BOARD

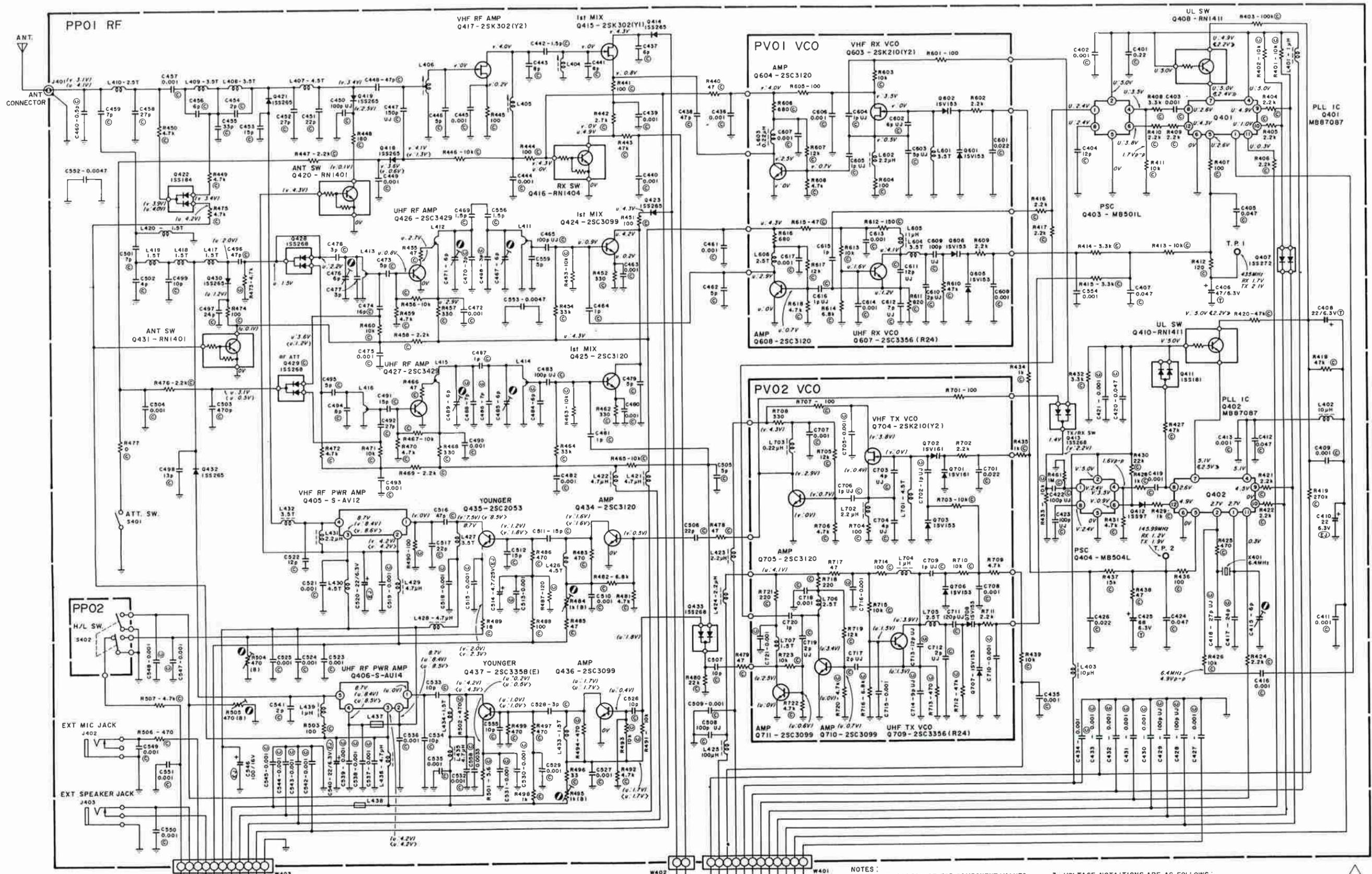
Q801	MN6520
Q802	TC4094BF
Q803	2SC2712GR
Q804	RN2411
Q805	2SA1162GR
Q806	1SS181
Q807	1SS184
Q808	RN2411

TOUCH TONE BOARD

Q901	LR40872
Q902, Q903	1SS272 x2

HW-24HT INT COMPO





PPO1 RF

VHF RF AMP
Q417 - 2SK302(Y2)

1st MIX
Q415 - 2SK302(Y1), 2416

PVO1 VCO

VHF RX VCO
Q603 - 2SK210(Y2)

UL SW
Q400 - RN1411

PLL IC
Q401
MB87087

ANT SW
Q420 - RN1401

UHF RF AMP
Q426 - 2SC3429

1st MIX
Q424 - 2SC3099

AMP
Q608 - 2SC3120

UHF RX VCO
Q607 - 2SC3356 (R24)

UL SW
Q410 - RN1411

PLL IC
Q402
MB87087

ANT SW
Q431 - RN1401

VHF RF PWR AMP
Q405 - S-AV12

YOUNGER
Q435 - 2SC2053

AMP
Q434 - 2SC3120

PVO2 VCO

VHF TX VCO
Q704 - 2SK210(Y2)

PSC
Q404 - MB504L

PP02

UHF RF PWR AMP
Q406 - S-AU14

YOUNGER
Q437 - 2SC3358 (E)

AMP
Q436 - 2SC3099

AMP
Q705 - 2SC3120

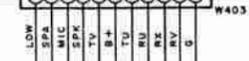
AMP
Q711 - 2SC3099

AMP
Q710 - 2SC3099

UHF TX VCO
Q709 - 2SC3356 (R24)

EXT MIC JACK
J402

EXT SPEAKER JACK
J403



NOTES:
1. REFER TO PARTS LIST FOR COMPONENT VALUES.
2. UNLESS OTHERWISE NOTED RESISTOR VALUES ARE IN OHMS, AND CAPACITOR VALUES ARE IN MICROFARADS.

3. VOLTAGE NOTATIONS ARE AS FOLLOWS:
V: - VHF TX/RX
U: - UHF TX/RX
v: - VHF RX
u: - VHF TX
RX: - RX
NOMARKING: VHF RX SOL OFF
(): ATT ON

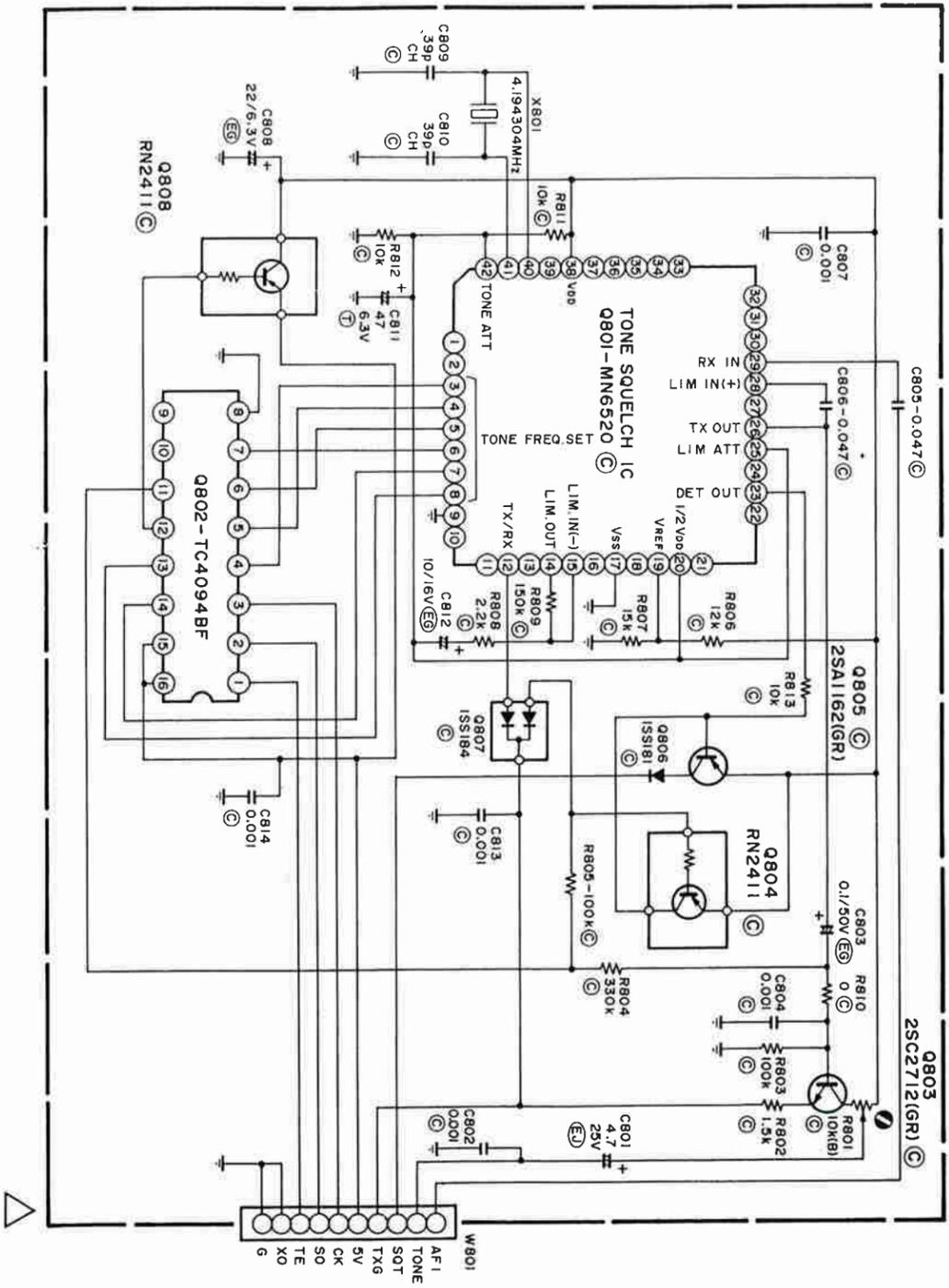
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HW-24HT SCHEMATIC

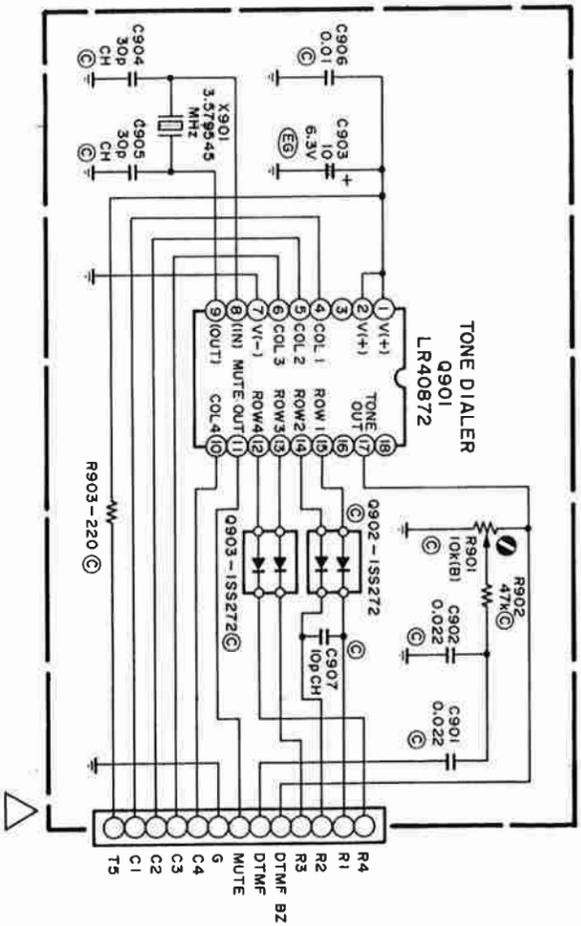
Sheet 2 of 2

Part of 595-4475

STONE SQUELCH BOARD



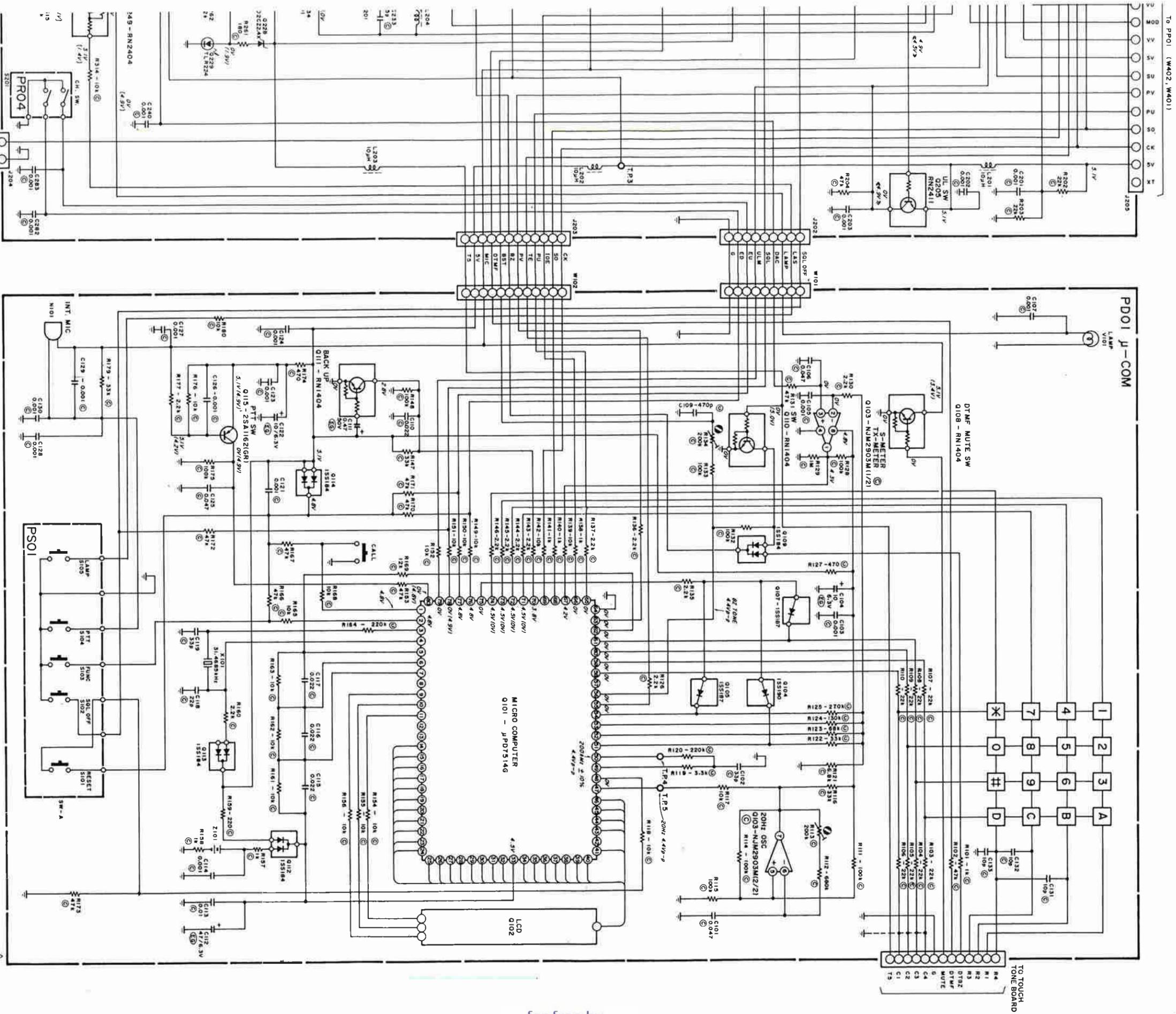
TOUCH TONE BOARD



SCHEMATIC

Sheet 1 of 2

Part of 595-4475



- NOTES:
1. REFER TO PARTS LIST FOR COMPONENT VALUES.
 2. UNLESS OTHERWISE NOTED RESISTOR VALUES ARE IN OHMS, AND CAPACITOR VALUES ARE IN MICROFARADS.
 3. VOLTAGE NOTATIONS ARE AS FOLLOWS:
() : TX (HI POWER) NO MARKING : RX VHF SOL OFF
() : TX (LOW POWER) RU : :
() : SOL (TIGHT) RU : :
() : UNLOCK RX : :
() : LAMP ON RX : :
() : ATTEN SU : :
() : SU : :
() : SU : :
() : SU : :

Heath Company
Benton Harbor, Michigan