

uniden®

ARH 351
148-174 MHz
35 WATTS REPEATER



uniden®

UNIDEN AMERICA CORPORATION
Commercial Communications Division
4700 Amon Carter Blvd.
Fort Worth, TX 76155
(817) 858-3300

**SERVICE
MANUAL**

CC SM 7

SAFETY INFORMATION

Through the provisions of the Occupational Safety and Health Act (OSHA) of 1970, the United States Department of Labor has established an electromagnetic safety standard which applies to the use of two-way radio equipment. The proper use of this transceiver will result in exposure below the OSHA limit.

The following precautions shall be observed.:

WARNING

DO NOT operate the transmitter of any radio equipment with the antenna touching, or close to the eyes, face, or exposed body parts.

DO NOT operate the transmitter of any radio equipment unless all the Radio Frequency (RF) connectors are secure and any open connectors are properly terminated.

DO NOT operate the transmitter of any radio equipment near electrical blasting caps or in an explosive atmosphere.

DO NOT let children operate any transmitter-equipped radio equipment.

Have your radio equipment installed and serviced by a qualified technician.

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SPECIFICATIONS

This Equipment Meets or Exceeds the Following Specifications

GENERAL

Channels	1
Frequency Range	148 - 174 MHz
Size	14 ⁷ / ₈ "W × 5 ³ / ₈ "H × 12 ³ / ₄ "D
Weight	25 lbs.
Input Power	
Standard	117 VAC, 60 Hz
Optional	117/220 VAC, 50/60 Hz
Current Drain	
Transmit	1.0 AMP @ 117 VAC/ 8 AMP @ 13.6 VDC
Receive	0.5 AMP @ 117 VAC/ 0.5 AMP @ 13.6 VDC
Operating Temperature Range	-30° C to +60° C
Channel Spacing	30 kHz
Tone Module (optional)	1 Tone Encode/Decode
Community Repeater Panel (optional)	Holds 7 Additional Tones
FCC Type Acceptance & Certification	Parts 21, 90, 15

TRANSMITTER

RF Power Output	35 Watts (EIA DUTY CYCLE) 15 Watts Continuous
Modulation Distortion	3%
Modulation	16F3
FM Hum and Noise	60 dB
Spurious and Harmonic Suppression	60 dB
Frequency Stability	± 0.0005% (-30° C +60° C)

RECEIVER

Sensitivity	
12 dB S INAD	0.35 uV
20 dB Quieting	0.50 uV
Selectivity	70 dB
Intermodulation Rejection	70 dB
Spurious Rejection	70 dB
Image Rejection	70 dB
Modulation Acceptance	7 kHz
Audio Output (@ 10% THD)	2.5 W
Frequency Stability	± 0.0005%

Specifications subject to change without notice.

INTRODUCTION

Scope of Manual

This service manual is intended for use by experienced technicians familiar with similar types of equipment. The manual contains all service information required for the equipment described and is current as of the printing date. Changes that occur after the printing date are incorporated by Service Manual Revisions. The revisions are added to the manual as engineering changes are incorporated into the equipment.

Description

The ARH 351 repeater is a solid state FM repeater that is capable of 35 watts of RF power. The ARH 351 normally operates from a 117 volt (60 Hz) AC source. You can also order it to operate from a switchable 117/220 volt (50/60 Hz) AC source. The ARH 351 is designed so that a 12 volt battery source can take over if AC power fails. However, the ARH 351 is not designed to recharge the battery during normal operation.

You can access the standard repeater by using a carrier only or by using a single CTCSS tone. You can add an ARX 200 Community Repeater Panel to upgrade the tone accessed system to an eight user community repeater. The ARH 351 has a time-out timer that you can adjust to between 2 and 8 minutes. It also has a warning beep to alert the operator when the AC power source fails and the repeater is operating on the 12 volt battery source.

Duplexer

Since a wide variety of transmit and receive spacings are used in the VHF band, the ARH 351 does not come with a duplexer.

When you select a duplexer to use with the ARH 351, choose one that has a receive to transmit isolation of at least 80 dB. Higher receive to transmit isolation causes less receiver desensitization. The insertion loss of the duplexer should be kept to a minimum.

Licensing

Before using your transceiver, it must be properly licensed by the Federal Communications Commission (FCC) and properly installed. Your Uniden Dealer will be able to help you with any or all of these requirements and will be there to help you with all your future communications needs.

Technical Support

Technical Assistance and information is available from the Technical Support Group during normal work days between the hours of 8:00 A.M. and 5:00 P.M. Central Time. You may reach the Technical Support Group by writing to:

UNIDEN AMERICA CORPORATION
Commercial Communications Division
Technical Support
4700 Amon Carter Boulevard
Fort Worth, Texas 76155

Or by telephone:
1-800-231-2868 (outside Texas)
1-800-621-8527 (Texas only)

Replacement Parts

Replacement parts are available through the Parts Department located in Fort Worth, Texas. When ordering replacement parts, please use the complete identification number of the part. If the identification number is not known, the order should contain the Part Symbol Number, the Unit Model Number, and a description of the part so that the part may be properly identified. Parts orders may be placed by writing to:

UNIDEN AMERICA CORPORATION
Commercial Communications Division
Parts Department
4700 Amon Carter Boulevard
Fort Worth, Texas 76155

or by telephone: 1-817-858-3600
or by FAX: 1-817-858-3523

Ordering Additional Manuals

To order additional copies of this Service Manual, send order for CC SM 58 to:

UNIDEN AMERICA CORPORATION
Commercial Communications Division
Repair/Parts Department
4700 Amon Carter Boulevard
Fort Worth, Texas 76155

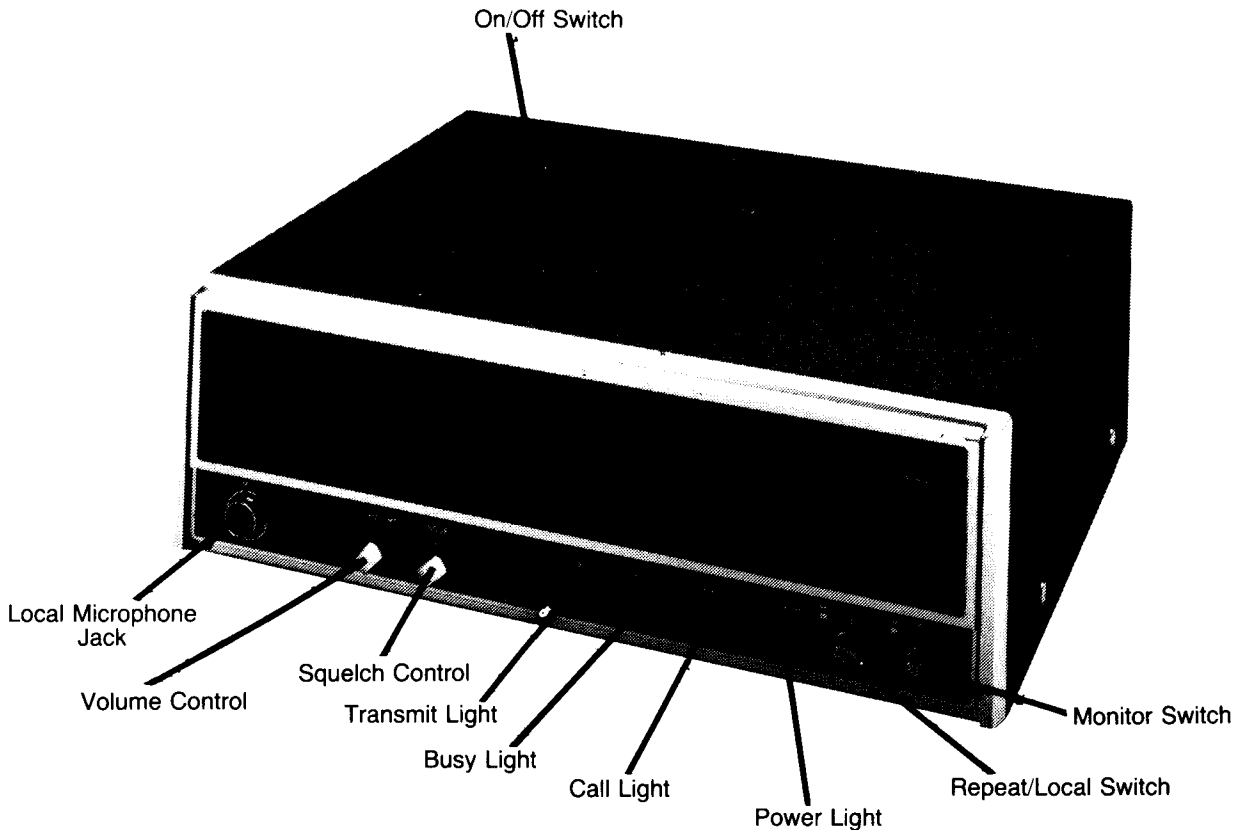
or by telephone: 1-817-858-3638

In Canada, write to:

UNIDEN CANADA, INCORPORATED
11 Plateau Street
Pointe Claire, (Montreal) Quebec
Canada H9R 9Z7

or by telephone: 1-514-697-6920
or by FAX: 1-514-697-7700

OPERATING INSTRUCTIONS



CONGRATULATIONS

You now own the best value in land mobile radio . . . a Uniden/Force Communications Radio from Uniden. You'll find that it gives you consistently outstanding performance in virtually all conditions and situations.

Before using, your radio must be properly licensed by the Federal Communications Commission (FCC) and be properly installed. Your Uniden Dealer will be able to help you with any or all these requirements. He will be there to help you with all your future communication needs.

LOCAL CONTROL REPEATER/BASE STATION OPERATION

1. After initial power-up, allow a 5 minute warm-up period to ensure that the transmitter is within FCC frequency specifications.
2. Rotate the squelch control fully counterclockwise.
3. Adjust the volume control for a comfortable listening level.
4. Turn the squelch control clockwise until all background noise disappears.
5. Place the REPEAT/LOCAL switch in the "LOCAL" (OUT) position.
6. The monitor switch is used as follows:
 - 6.1 Switch In: Lets you receive all calls broadcast on the channel.
 - 6.2 Switch Out: Lets you hear only those calls meant for your group, if the unit is equipped with

CTCSS, and if the microphone is hung-up in a properly grounded hang-up bracket. When a call is received, the CALL light will come on and remain on until you pick up the microphone or reset the light by momentarily depressing and releasing the monitor "MON" switch. The CALL light will alert you that a call was received while you were away from your station.

7. Before transmitting, monitor your channel to ensure that it is not busy. The BUSY light will be on if the channel is busy.
8. To transmit, depress the Push-To-Talk switch on the side of the microphone and hold it in while you transmit your message. Release the switch when your message is finished. For better voice quality in your transmissions, hold the microphone vertically in front of your face with the top of the microphone approximately level with your lips and about 2 inches away from your mouth.
9. When your call is finished, and a reply has been made, it is a good practice to hang-up the microphone.

REPEATER OPERATION

1. After initial power-up, allow a 5 minute warm-up period to ensure that the transmitter is within FCC frequency specifications.
2. Place the Repeat/Local switch in the Repeat (IN) position.
3. That's it! The ARH 351 is now a repeater.

OPERATING CONTROLS AND THEIR FUNCTIONS

- On/Off Switch:** Located on the rear panel. When activated, the switch applies power to the unit.
- Power Light:** This green LED will glow steady during AC power operation, and flash during battery operation.
- Transmit Light:** This red LED indicates the presence of the transmitter RF carrier.
- Busy Light:** This yellow LED indicates the presence of a carrier on the receive frequency, and shows the user that the channel is busy.
- Monitor Switch:** By placing this switch in the monitor position, the user can monitor or receive all calls broadcast on the channel. When the switch is in the "TONE SQ" position, the user will only hear the calls intended for his group, if the unit is equipped with the CTCSS option.
- Call Light:** This yellow LED indicator is provided for use when the ARH 351 is utilized as a local control repeater/base station. It will come on and remain on when the correct CTCSS tone has been received, provided the unit is equipped with CTCSS, and the microphone is in a properly grounded hang-up bracket and the "MON" switch is in the "TONE SQ" position. Resetting the call light can be accomplished by simply removing the microphone from the hang-up bracket or momentarily depressing and releasing the "MON" switch.
- Repeat/Local Switch:** When this switch is in the "Repeat" (IN) position, the repeater action is automatic and can be accessed by another station as well as the local microphone. In the "Local" (OUT) position, keying of the transmitter can only be accomplished by the local microphone.
- Squelch Control:** This control adjusts the Local audio amplifier opening sensitivity and should be adjusted in the following manner. **Note: This control has no effect on repeater operation.**
1. Rotate the squelch control fully counterclockwise.
 2. Then rotate the control clockwise until the noise just disappears. For the best results, leave the control in this position. Turning the control further will result in diminished sensitivity.
- Volume Control:** This control adjusts the local speaker audio output level.

THEORY OF OPERATION

To better understand the theory of operation of the ARH 351, refer to the block diagram located on page 12 and the schematic diagrams located on page 24-32.

TRANSMITTER OSCILLATOR

The transmitter frequency is controlled by a crystal oscillator, composed of a third overtone series resonant crystal X001, transistors Q001, and Q009, varactor diode D003, and tuning capacitor CV001. This circuit oscillates at a frequency between 16.4 to 19.3 MHz as determined by the crystal that is installed. The oscillator is modulated by the frequency modulator D003. Thermistor TH001, diode D002 and varactor D003 make up the temperature compensation network for the transmit oscillator. All components used in the oscillator and compensation network were chosen to have a minimal effect on the frequency as the operating temperature changes.

SPEECH AMPLIFIER

In the local mode, the output of the dynamic microphone is amplified by the speech amplifier Q011. IC001 (1/2) acts as an amplifier and limiter. The output from the limiter is fed into an active low-pass filter, IC001 (2/2), which provides a very sharp attenuation of frequencies above 3000 Hz to prevent radiation outside the permissible bandwidth.

FREQUENCY MODULATOR

The output of the speech amplifier is fed to the frequency modulator, D003 through D001 and VR001, Modulation Limit Control, where it then modulates the transmit oscillator at the transmit crystal. The CTCSS encoded tone is applied to the modulator, D003 through VR002, Tone Limit Control.

FREQUENCY MULTIPLIER

The modulated RF signal from the transmit oscillator is fed to the frequency multiplier, where the signal is tripled by Q008, and Q006 for a total multiplication of 9. Transistor Q007 serves as a buffer amplifier. Transistor Q005, Q004, Q003, and Q002 amplifies the signal to about 300 mW to provide sufficient drive level for the final amplifier. The output of Q002 is then passed through a tuned network to suppress harmonics and other spurious emission before being applied to the power amplifier.

RF POWER AMPLIFIER

The signal, at the proper transmit frequency and containing modulation, is fed to the power amplifier consisting of Q302, and Q301. This RF power amplifier increases the output power to 35 watts. The signal then

passes through a tuned output circuit to transform the collector impedance of Q301 to 50 ohms; followed by a fixed tuned low-pass filter to suppress harmonics of the transmitter.

POWER CONTROLS

The ALC, Automatic Level Control, circuit consists of D303, VR302, Q006 and Q007. The ALC monitors the forward power and controls the collector voltage on Q002 to maintain 35 watts of output power under varying conditions.

The APC, Automatic Power Control, circuit consists of D301, VR301, Q303, Q006, and Q007. The APC monitors the reflected power and aids in protecting the Power Amplifier by decreasing the collector voltage to Q002 under mismatched load conditions.

RECEIVER RF SECTION

The received signal passes through a dual-tuned bandpass filter, L101 and L102, to the RF amplifier Q101. The diodes D101 and D102 provide overload protection for the first RF amplifier. The output of Q101 is passed through a triple-tuned bandpass filter L103, L104, and L105 to the first mixer Q102. This signal is then mixed with the signal from the receive oscillator to produce the first I.F. of 21.4 MHz.

RECEIVER OSCILLATOR

The receive crystal X102 is connected to the oscillator Q107 by switching transistor Q109. The oscillator oscillates at a frequency of 42.2 to 50.9 MHz. This signal is tripled by Q106, L114, and L113. The tripler output is then buffered by Q105 and filtered by L112 and L111 before it is applied to the mixer Q102. The output level of Q105 is stabilized by the ALC circuit consisting of D104, D105, and Q110.

FIRST and SECOND I.F.

The output of the first mixer, at L106, is passed through a 21.4 MHz crystal filter FT101 to obtain the desired selectivity. The I.F. signal is then amplified by the I.F. amplifier Q103. This amplified I.F. signal is then applied to pin 16 of the integrated circuit IC101. This integrated circuit contains the second mixer and the second local oscillator. A 20.945 MHz crystal is connected to pins 1 and 2 of IC101 to complete the second local oscillator. The output of the second mixer, pin 3 of IC101, is passed through a 455 kHz ceramic filter FT102 and is applied to the amplifiers, limiters, and quadrature detector contained in IC101. The recovered audio is available at pin 9 of IC101 and is applied to the squelch gate, audio amplifier and CTCSS decoder if the unit is so equipped.

SQUELCH GATE

The noise signal from IC101 is fed to the squelch control VR502 via the limit control VR101. This signal is then amplified by the noise amplifier Q104 and fed to the active filter of IC101, pin 10. The output of the filter, pin 11, is then rectified by D103 and used to drive the squelch trigger circuit in IC101, pin 12. The output of the trigger, pin 13 of IC101, drives the base of Q113 high in the squelched mode, thus pulling the gate of Q112 low muting the audio noise in the speaker with no carrier present.

RECEIVER AUDIO

The audio signal from IC101 is fed through an active high pass filter FT103 to the audio preamplifier Q111. The output of this amplifier passes through the squelch gate, Q112, to the volume control VR501, then to the audio power amplifier IC102, which amplifies the recovered audio to a level sufficient to drive the speaker.

TX AND BUSY LEDS

The TX LED is activated by detecting a portion of the transmitted RF signal by D304 which turns Q305 on, pulling the cathode of D500 near ground potential. The anode of D500 is connected to the 8V line.

The BUSY LED is activated when a received signal causes pin 14, of IC101 to go high, turning on Q407, pulling the cathode of D501 near ground potential. The anode of D501 is connected to the 8V receive line.

CALL MEMORY

The CTCSS includes a call memory feature. On reception of a proper CTCSS signal Q406 is turned on, which also turns on Q402 and Q403, which turns on D502, the yellow call LED. Transistors Q402 and Q403 remain latched on until reset by the monitor switch or by removing the microphone from the hang-up clip.

CRYSTAL TEMPERATURE CONTROL

A resistor is clipped to the receive crystal which is used to heat the crystal when the ambient temperature is about -10°C or lower.

As the temperature decreases, the resistance of thermistor TH505 increases, allowing Q501 and Q502 to turn on. Q502 supplies power to resistor TH501 and TH502.

POWER SUPPLY

The output voltage is regulated by a 317-T adjustable voltage regulator IC1. This regulator controls the output voltage by maintaining a reference voltage between the output and adjustment pins. This reference voltage is applied across R712 resulting in a current flow of $(1.25\text{V}/R712)$, which also flows through the series combination of R713 and VR701. The current flowing through R712 and VR701 will produce a voltage of $(1.25\text{V}/R712) \times (R713 + VR701)$. The output voltage is the result of the addition of this voltage to the reference voltage.

The high output current capability is provided by the pass transistor Q705 and driver Q703. As the load current increases, the output voltage tends to decrease, which forces the reference voltage lower. Since the reference voltage must be maintained, IC1 draws more current from Q702. The increased current flowing through R703, supplies more base current to Q703, increasing its collector current and the base drive to Q705, thus allowing a higher load current at a set output voltage.

As the load current increases, the base emitter junction voltage of Q701 increases due to the current sensing resistor R716. As this voltage approaches 0.7 volts Q701 begins to conduct reverse biasing, Q702, forcing it into cutoff. With Q702 no longer fully conducting, the input to IC1 will be decreased below the necessary mini-

mum, thus causing the output voltage to decrease. As Q702 is driven into cutoff, the emitter - collector current of Q702 will decrease, thus decreasing the base current to Q703. As the base current of Q703 is decreased, the collector current must also decrease, thus decreasing the drive to Q705 and the output load current.

As the load attempts to draw, increasing amounts of current from the power supply, Q701 is driven further into conduction, thus driving Q702 further into cutoff. As this happens, the output voltage is decreased, thus decreasing the output current. This condition is known as current fold-back.

When the output becomes shorted, the base of Q705 is pulled close to ground, thus driving Q705 into cutoff, severely limiting the output current. Also, the emitter of Q704 is pulled low turning on Q704 and unbalancing the resistor network of R705, R704, R701 and R716 turning on Q701 and folding back the current as above.

When the output voltage reaches a danger point, about 16.5 volts, the zener diode D703 breaks over and applies a voltage to the gate of the SCR, IC2. This gate voltage causes the SCR to fire, shorting the output of the power supply, thus protecting the equipment that is connected to it. The SCR will remain fired until the supply voltage has been removed.

REPEATER CONTROL BOARD

In the repeat mode, the audio signal from IC101 (push pin P22), is fed to the control PCB. On the control PCB the audio path is split; one path will cause the transmitter to key, the other path is the repeat audio to the transmitter.

REPEAT AUDIO

In repeat mode, the CTCSS tone is stripped from the recovered audio signal by the high pass filter IC606, before it is de-emphasized by IC600-4. This audio signal is then passed through the audio transmission gate IC604 to the speech amplifier, via the gain control VR604. The audio signal is then processed by the speech amplifier in the same way as the signal from the local microphone.

In the repeat mode, one input of IC602-3 is held high by switch SW500, the other input is allowed to follow the C.O.S. line. When the C.O.S. goes high, the output of IC602-3 goes low and is inverted by IC602-4, thus opening the speech transmission gate. In the local mode the speech transmission gate is held closed by grounding one input of IC602-3.

REPEATER SQUELCH GATE

The recovered audio is also fed to the repeater squelch circuit, and the CTCSS tone decoder, if the unit is equipped with CTCSS. Op amp IC600-1 buffers the audio so as not to load down the receiver output. IC600-2 is a Hi-Pass filter which allows the high frequency "rush" noise to pass. This noise is rectified by D601 and used to charge capacitor C615. In the absence of carrier, C615 will remain charged, thus keeping the output of IC600-3 low. When an RF carrier is present, the "rush" noise is reduced, thus allowing C615 to discharge through R610, causing the output of IC600-3 to go high. The output of IC600-3 is wired OR'ed to the output of a second squelch

gate IC611-1, and is connected to the input of IC611-2. This second squelch gate is composed of D612, IC611-1, C621 and R653 which parallels the operation of IC600-3, but with a shorter time constant. The output of IC611-2 is connected to one input of NAND gate IC602-4. When the output of IC600-3 or IC611-2 goes high it turns Q600 on, lighting up the yellow LED D609, showing that a carrier has been detected.

A portion of the recovered audio is fed to the tone decoder through P1-1. When the decoder sees the correct CTCSS tone it will output a high on P1-7. This high is fed to the second input of IC602-1 through S1, to the base of Q601 turning on the green LED D610, indicating that a CTCSS tone has been detected, and to the call memory circuit of the receiver, causing it to latch if the microphone is hung-up in a grounded bracket. When both inputs of NAND gate IC602-1 are high the output is low this is inverted by IC602-2 and fed to the speech and tone transmission gate, and to the transmitter Push-To-Talk line.

The repeater can be operated as a carrier access unit by placing switch S1 in the carrier squelch mode. When placed in this mode the red LED D611 is turned on as an indication that the unit is in carrier only operation, and a logic high is placed on the tone input of IC602-1.

REPEATER PTT and DROP OUT TIMER

When the C.O.S. goes high, it turns on Q603, thus charging C617 and turning off IC603-1. When the output of IC603-1 goes low, the output of IC603-2 goes high, turning on Q602, pulling the collector near ground potential keying the transmitter. When the C.O.S. goes low, C617 will discharge through R624 and VR601, thus keeping the transmitter up until the input of IC603-1 is low enough for it to turn on. This dropout time can be set from 1 to 10 seconds. When the local microphone is keyed in the repeat mode, diode D605 is forward biased and will conduct keying the transmitter.

CTCSS TONE ENCODER

The CTCSS tone encoder is composed of IC605 and the resistor network R638, R639, R640 and VR605. Jumpers J7 and J8 control the frequency range of the encoder and VR605 controls the tone frequency. The output tone is taken from pin 3 of IC605 and fed to the tone transmission gate IC604-4 to P2-5 (tone input to the Phase Modulator VR202). When the C.O.S. line is high, the tone transmission gate is opened. In local mode the tone transmission gate is opened by pressing the Push-To-Talk key, causing the output of IC603-3 to go high. Diodes D606 and D607 are used as isolation diodes.

TIME-OUT-TIMER

When the C.O.S. line goes high it will reset the T.O.T. pin 11 of IC601 via IC603-1, and start the T.O.T. oscillator IC603-4 via IC603-2. The output of the oscillator is fed to the counter IC601 pin 10. The counter is programmed to count 8192 cycles of the oscillator before sending pin 3 high. The high on pin 3 of IC601 starts the beep tone oscillator, sending 2 to 3 seconds of alert tone before C618 charging through R626 turns off IC603-2 un-keying the transmitter.

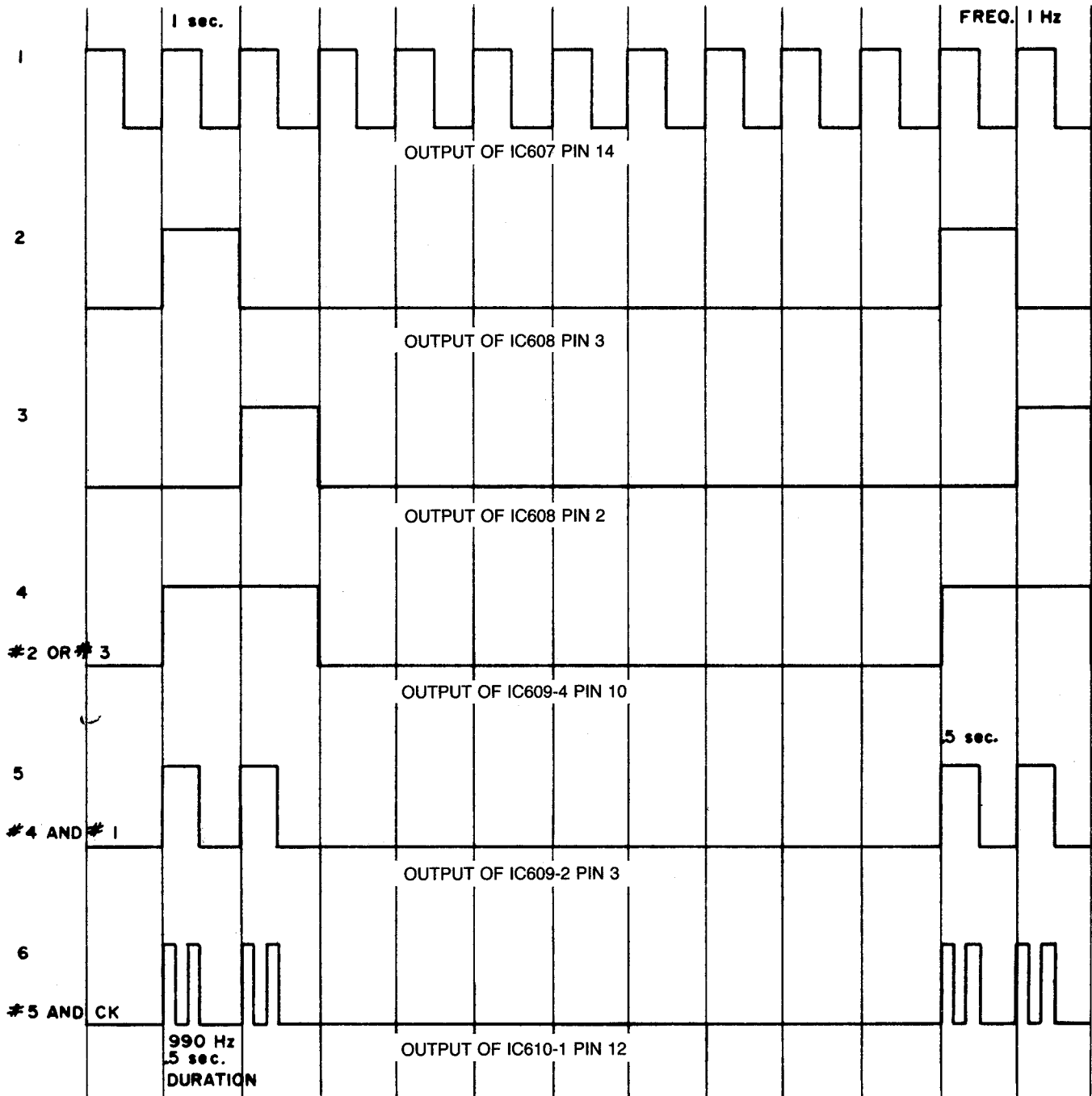
BATTERY OPERATION WARNING

When the internal AC power supply fails, and the external battery takes over the operation of the repeater, the system warns the operator by flashing the green power LED, and transmitting an alert tone, consisting of two half-second tone burst every ten seconds.

To better understand the operation of the warning system, refer to the timing chart below. The warning system is enabled by removing the bias to the input of IC610-4, thus starting the clock, which is divided by IC607, to produce a frequency of about 1 Hz. The output

of IC607, pin 14 is used to flash the green power LED and is divided again by IC608 to produce two signals of 1 second on and 9 seconds off with one offset by 1 second. These two outputs are OR'ed together in IC610-3, IC610-2 and IC609-4 to produce an output signal of 2 seconds on and 8 seconds off. This signal is NAND'ed in IC609-1 with the 1 Hz signal to produce two half-second pulses every 10 seconds. The signal is then inverted by IC609-2 and NAND'ed with the clock signal in IC609-3. The output is inverted by IC610-1 and applied to the modulator via VR606.

TIMING CHART A

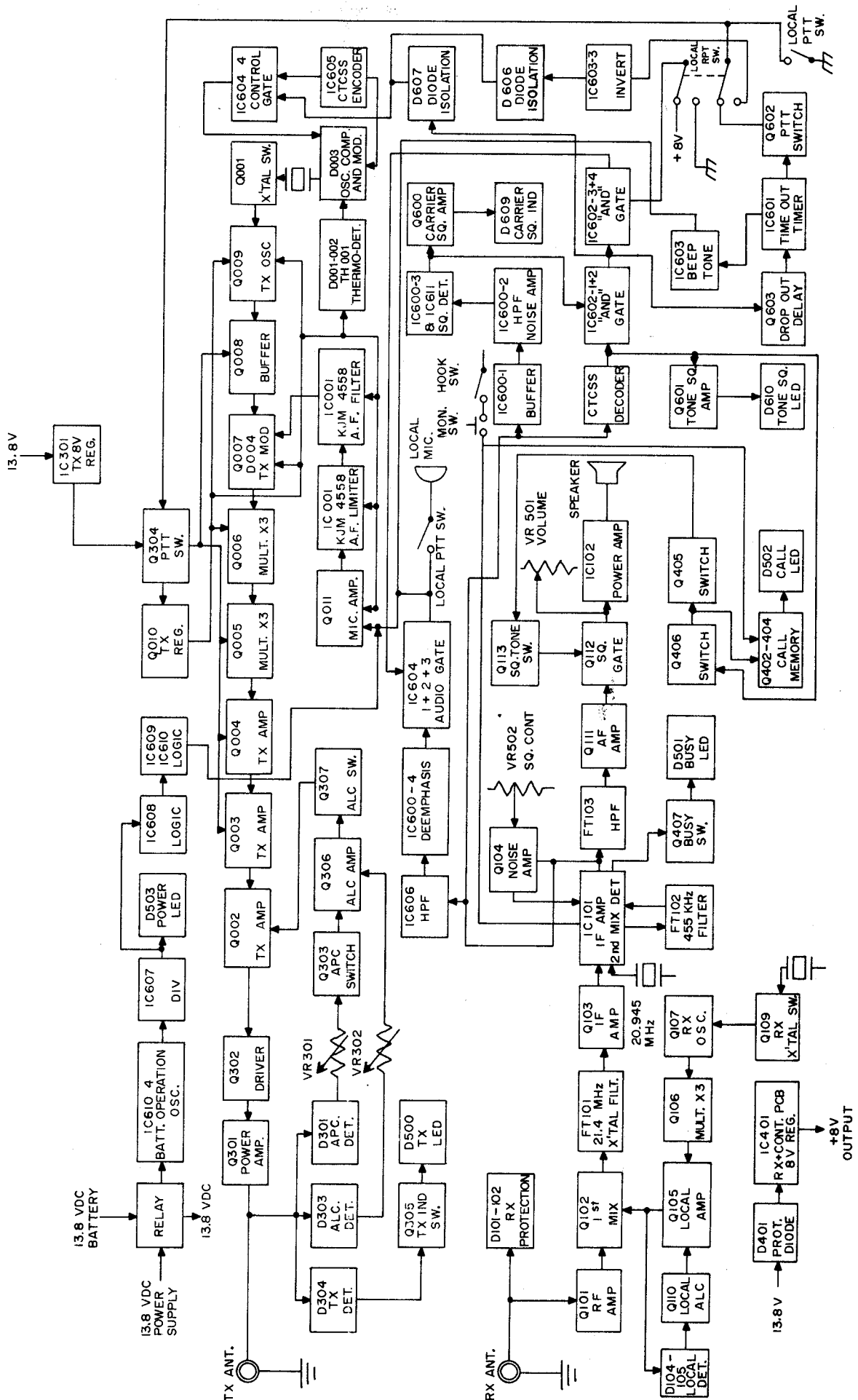


SUGGESTED TEST EQUIPMENT

The following is a list of suggested test equipment that will be needed to repair this unit. Many of the individual items can be replaced by a service monitor. However, to completely test this unit you **must** be able to generate an RF signal while monitoring the transmitter.

TEST INSTRUMENT	REQUIRED SPECIFICATIONS	SUGGESTED TYPE
DC Power Supply	Voltage: 13.8 VDC Current: 10 Amps Cont.	Ratelco PS-9 12VDC Battery
RF Wattmeter	Frequency: 148 - 174 MHz Power: 0 - 50 Watts	Bird Model 43 & 50 C Element
RF Dummy Load	Impedance: 50 Ohms Power: 50 Watts	Bird Model 8085 Bird Model 8135
DC Voltmeter	Range: 0 - 10 V DC Resistance: 10 Meg Ohm	Simpson 260 Fluke D802 or D804
AC Voltmeter	Range: 3 mV - 10 V	Leader LMV 181 A
Audio Generator	Frequency: 10 - 10 kHz Level: 0-1 V	Leader LGA 120 A
Deviation Meter	Range: 0 - 5 kHz	Marconi TF 2304
Distortion Meter or	Range: 30 - 10 kHz Level: 1 mV - 300 V	Leader LDM 170
Sinadder	Input Level: 1 - 5 VAC	Helpers Sinadder 3
RF Frequency Counter	Range: 148 - 174 MHz Accuracy: ± 2 ppm/yr.	HP - 5383 A Data Precision 500/TB8
Oscilloscope	Bandwidth: 50 - 100 MHz Triggered Sweep	Tektronics 2213 or 456 Hameg HM705
RF Signal Generator	Range: 148 - 174 MHz Level: 0.1 - 1000 μ V Modulation: Int/Ext Deviation: 0 - 5 kHz	Wavetek 3005
Attenuator	Attenuation: 20 dB Power: 50 Watts Min.	Bird 8341-200 Bird 8343-200
Service Monitor		Motorola RS2001 IFR 500, 1000S, 1200 or 1500 Wavetek 3000 or 3000B Cushman CE-4000 or CE-50

ARH 351 BLOCK DIAGRAM



POWER SUPPLY ALIGNMENT PROCEDURE

STP	PRESET TO	ADJUSTMENT	REMARKS
1	Connect unit to 117 VAC Source. Power switch: ON	VR701 (On Power Supply PCB)	Connect a DC Voltmeter to the emitter of Q705. Adjust VR701 to obtain a 13.8 VDC reading on the Voltmeter.

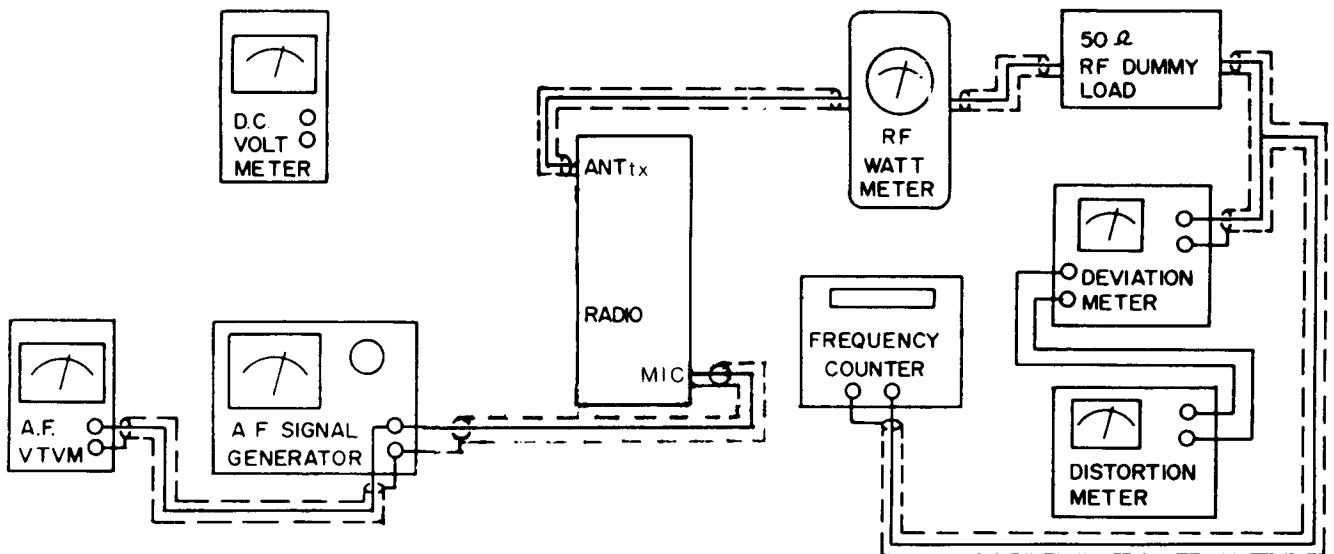
TRANSMITTER ALIGNMENT PROCEDURE

STP	PRESET TO	ADJUSTMENT	REMARKS
1.	Volume: Min (CCW) Squelch: Max (CW) Mode: Local	VR301, VR302	Preset VR301 and VR302 fully counter clockwise. Preset VR604 (on control board) to Mid-Range point. Connect wattmeter, frequency counter and FM modulation meter to the TX antenna connector.
2	Same as Above	L019	Connect DC Voltmeter (+) to CM001 Pin 5, (-) to Ground. Adjust L019 for maximum DC Voltage.
3	Same as Above	L015, L016 L017	Connect DC Voltmeter (+) to CM001 Pin 3, (-) to Ground. Adjust L015, L016, and L017 for maximum DC Voltage.
4	Same as Above	L015, L016 L017, L018	Connect DC Voltmeter (+) to CM001 Pin 3, (-) to Ground. Repeat step three several times, then adjust L018 for maximum DC Voltage.
5	Same as Above	L013, L014	Connect DC Voltmeter (+) to CM001 Pin 2, and (-) to Ground. Adjust L013 and L014 for maximum DC Voltage.
6	Same as Above	L012	Connect DC Voltmeter (+) to CM001 Pin 1, (-) to Ground. Adjust L012 for maximum DC Voltage.
7	Same as Above EXCEPT: VR302: Fully CCW	CV002, CT301	Adjust CV002 and CT301 for maximum RF power output.
8	Same as Above	VR302	Adjust VR302 for the desired RF output power level. 35 watts Intermittent Duty. 15 watts Continuous Duty.

TRANSMITTER ALIGNMENT PROCEDURE cont'd

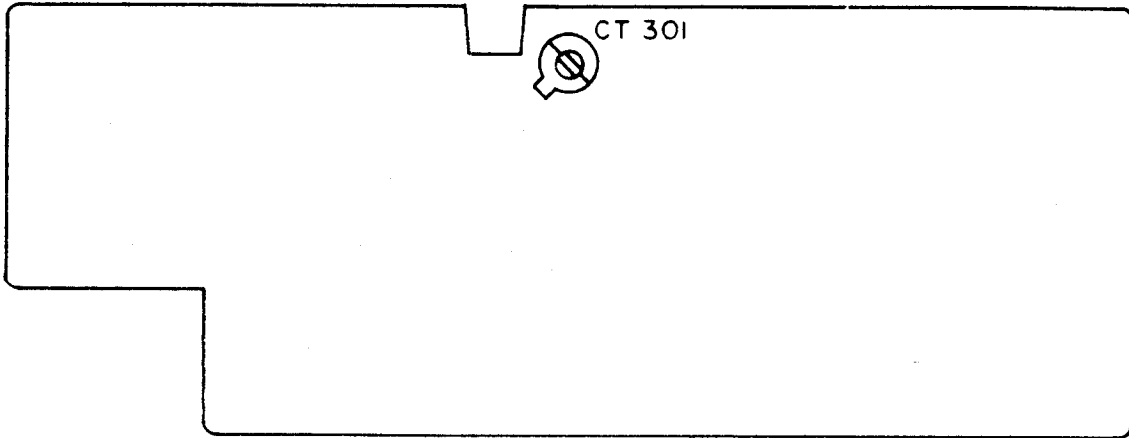
STP	PRESET TO	ADJUSTMENT	REMARKS
9	Same as Above	CV001	Adjust CV001 to obtain the correct transmit frequency as shown on the frequency counter.
CTCSS ALIGNMENT STEP 10			
10	Same as Above	VR003	Adjust VR003 to obtain 550 to 750 Hz CTCSS deviation.
11	Same as Above EXCEPT: AF SG: FREQ: 1kHz LEVEL: 30 mV	VR002	Apply output of AF generator to local microphone input. Adjust VR002 for 4.7 kHz total system deviation.
12	Same as Step 10 EXCEPT: No RF Load	VR301	Adjust for 3 watts of reflected RF power with the RF load removed.

TRANSMITTER TEST EQUIPMENT SETUP

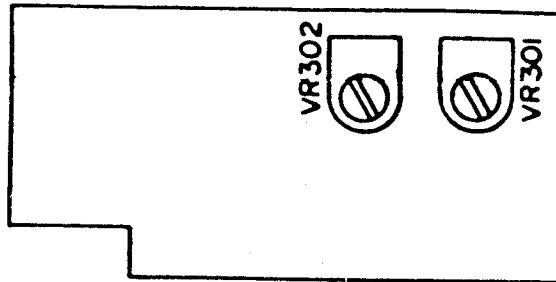


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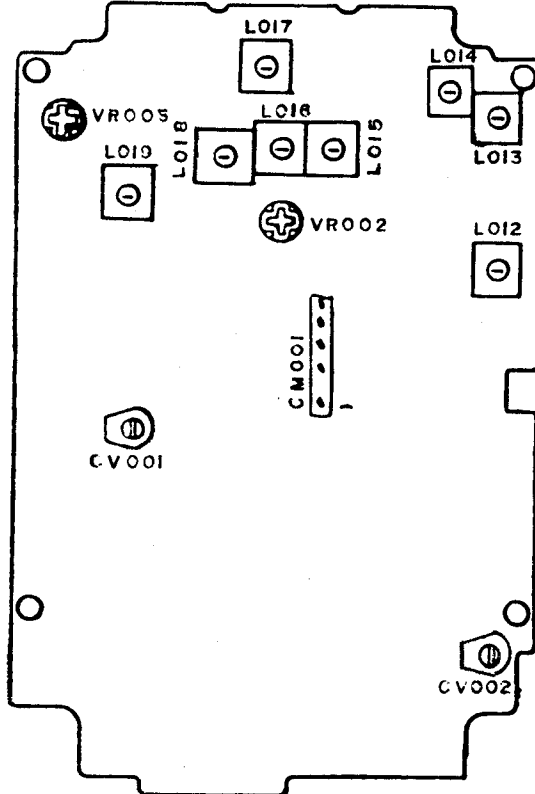
POWER AMPLIFIER



EXCITER INTERFACE
3500-0147



EXCITER
PD-012AE

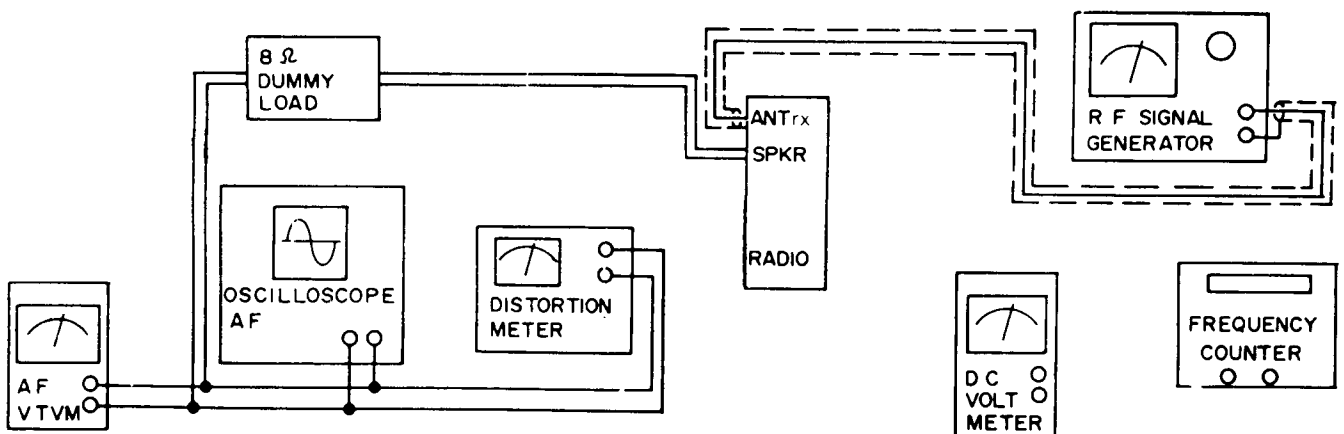


ALIGNMENT LOCATION CHART

RECEIVER ALIGNMENT PROCEDURE

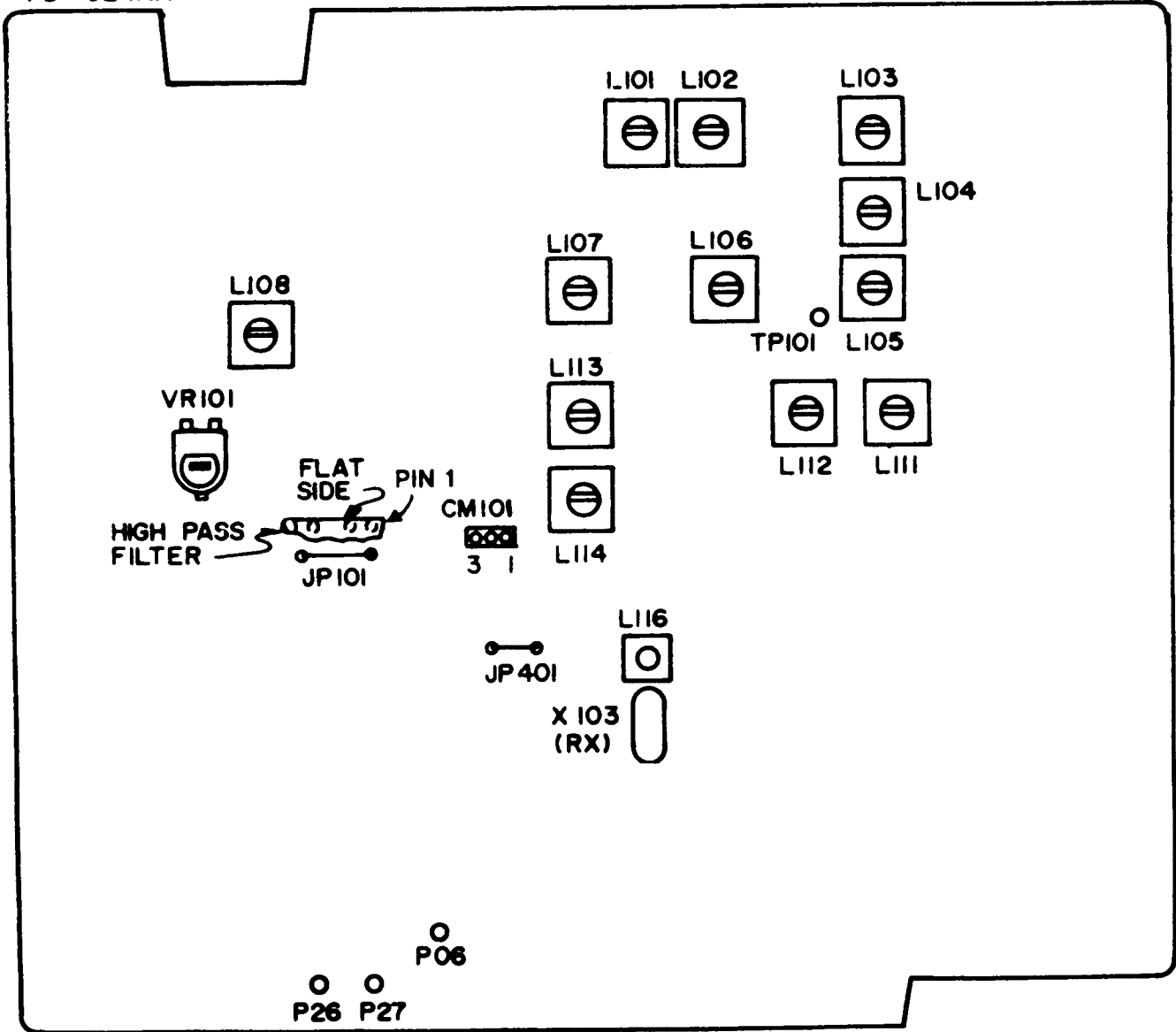
STP	PRESET TO	ADJUSTMENT	REMARKS
1	Volume: Max (CW) Squelch: Min (CCW) Mode: Local	L111, L112 L113, L114	Connect DC Voltmeter (+) to CM101 pin 1, (-) to Ground. Adjust L111, L112, L113, and L114 for maximum DC Voltage.
2	Same as Above	L116	Connect RF counter to TP101. Adjust L116 to obtain a frequency of RX frequency - 21.4 MHz on the RF counter.
3	Same as Above	L108	Connect DC Voltmeter (+) to CM101 pin 3, and (-) to Ground. Adjust L108 to obtain a 4V + 0.2V reading on the DC Voltmeter.
4	Same as Above EXCEPT: Mod. Freq. 1 kHz Dev: 3 kHz	L101, L102 L103, L104 L105	Connect RF SG to the RX antenna jack Adjust L101, L102, L103, L104, and L105 for best SINAD. Decrease the level of the RF SG and repeat to obtain sensitivity.
5	Same as Above EXCEPT: RF SG Level: 1 mV	L106, L107	Adjust L106 and L107 to obtain minimum audio distortion indication on the distortion meter.
6	Same as Above EXCEPT: Squelch: Max (CW) RF SG Level: 1 uV	VR101	Adjust VR101 so that the squelch will open at 1 uV.
With CTCSS; the Brown wire from FT4 must be connected to Push Pin P06. Without CTCSS; the Brown wire from FT4 must be connected to Push Pin P27.			

RECEIVER TEST EQUIPMENT SETUP



PD-024AA

RECEIVER P.C. BOARD



ALIGNMENT LOCATION CHART

CONTROL BOARD ALIGNMENT PROCEDURE

STP	PRESET TO	ADJUSTMENT	REMARKS
1	Volume: Max (CW) Squelch: Min (CCW) Mode: Local RF SG: Freq 1kHz Dev: 3 kHz Level 0.25 uV	VR600, VR601 VR602, VR603 VR604, VR605 VR606	Preset controls to mid-range.
2	Same as Above Rptr Squelch Adj.	VR600	Adjust VR600 until the yellow L.E.D. (D609) just comes on. (Repeater squelch is opening.)
CTCSS ALIGNMENT STEPS 3, 4, 5, & 6 With CTCSS; the Brown wire FT4 must be connected to Push Pin P06. Without CTCSS; the Brown wire FT4 must be connected to Push Pin P27.			
3	Same as Above	JP1, JP2 (On Decoder) (ARX 500)	Cut jumpers JP1 and JP2 on the Tone decoder Board for the desired decode tone range. Refer to TABLE 1 below.
4	Same as Above	VR1 (On Decoder) (ARX 500)	Connect a frequency counter to test point 1 on the decoder board. Make sure J4 on control board is connected. Adjust VR1 on the decoder to obtain the desired decode frequency. Cut J4 on the control board.
5	Same as Above	J7, J8 (On Control Board)	Cut jumpers J7 and J8 for the desired encode tone range. Refer to TABLE 2.
6	Same as Above	VR605* (On Control Board)	Connect frequency counter to TP3. Adjust VR605 to obtain the desired encode CTCSS frequency.
7	Same as Above Rptr Audio Level EXCEPT: Mode: Repeat RF SG: Level 1 mV SW600: Carrier Sq.	VR604	Adjust VR604 to obtain 4.7 kHz deviation of the transmitter, with signal generator deviation set to 3 kHz. TX should key

* **NOTE:** When changing CTCSS Frequency it may be necessary to readjust the transmitter deviation. Refer to the transmitter alignment procedure, Steps 10 and 11.

CONTROL BOARD ALIGNMENT PROCEDURE cont'd

STP	PRESET TO	ADJUSTMENT	REMARKS
8	Same as Above Rptr T.O.T. Adj.	VR602	Connect frequency counter to TP2. Adjust VR602 to obtain the desired Time-Out time using the formula: $FR = 8192 / (\text{Time} - 2)$ Time is in seconds
9	Same as Above Drop-out Time Adj	VR601	Apply a carrier to the receiver. Transmitter should key-up. Remove carrier. Adjust VR601 for the desired dropout delay.
10	Same as Above TOT Warning Level	VR603	Cut Jumper J6. Apply a carrier to the receiver. Allow the transmitter to time out. Adjust VR603 for the desired modulation level of the beep tone. (Approx. 3 kHz) Connect Jumper J6.
11	Same as Above Batt Warning Level EXCEPT: AC Power Removed 13.8V Applied to battery back-up terminals.	VR606	In Repeat Mode. Adjust VR606 for the desired modulation level of warning tone. (Approx. 1 kHz)

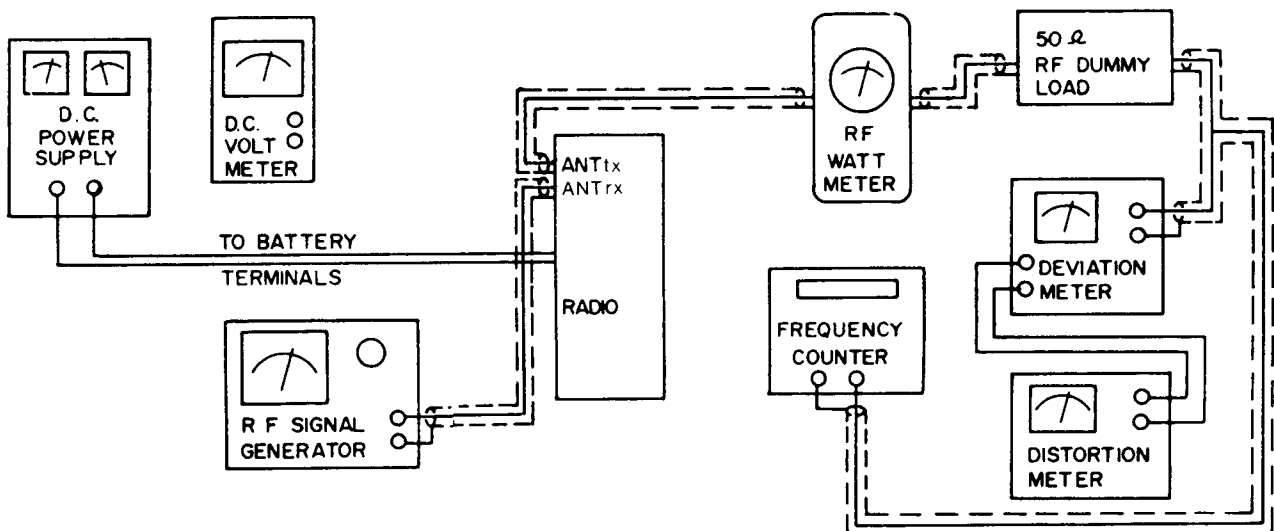
**TABLE 1
DECODER CTCSS FREQUENCY CHART**

FREQUENCY	JP1	JP2
160 — 300	IN	IN
125 — 165	CUT	IN
60 — 135	CUT	CUT

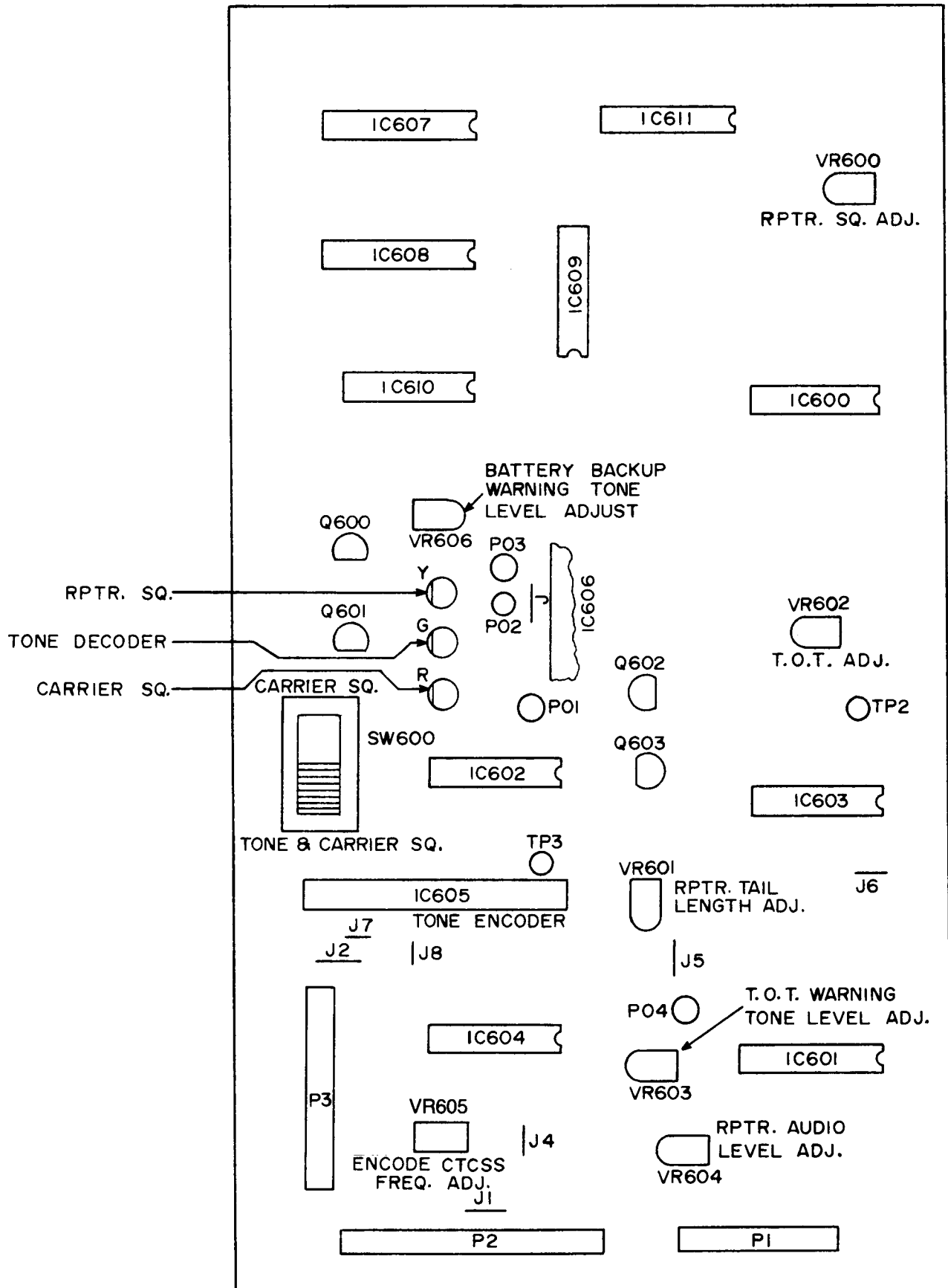
**TABLE 2
ENCODER CTCSS FREQUENCY CHART**

FREQUENCY	J7	J8
180 — 340	IN	IN
140 — 190	CUT	IN
60 — 150	CUT	CUT

CONTROL BOARD TEST EQUIPMENT SETUP



3500-0117A CONTROL P.C. BOARD



NEW CONTROL BOARD ALIGNMENT LOCATION CHART

VOLTAGE CHART

EXCITER VOLTAGE CHART

PART NO.	PART NAME	EMITTER SOURCE	BASE GATE	COLLECTOR DRAIN	REMARKS
Q001	2SC2668	2.34	3.10	2.33	TX
Q002	2SC2221	0.00	0.00	7.42	TX
Q003	2SC2407K	0.63	1.11	7.59	TX
Q004	2SC2026L	0.59	1.01	7.20	TX
Q005	2SC2026L	0.59	1.10	7.20	TX
Q006	2SC2026L	1.18	1.20	7.28	TX
Q007	2SC1675L	0.31	1.03	1.20	TX
Q008	2SC1675L	1.64	1.80	4.96	TX
Q009	2SC1675L	2.34	1.80	4.96	TX

PART NO.	PART NAME	EMITTER SOURCE	BASE GATE	COLLECTOR DRAIN	REMARKS
Q010	2SC2458LY	4.99	5.72	7.59	TX
Q011	2SC2458LY	0.97	0.40	2.32	TX
Q303	2SC945A-Q	0.00	0.00	7.47	TX
Q304	2SA733	7.90	7.06	7.59	TX
Q305	2SC945A-Q	0.00	0.71	0.09	TX
		0.00	0.00	6.89	RX
Q306	2SC945A-Q	0.00	0.56	11.61	TX
Q307	2SB772-R	13.77	13.00	10.60	TX
		13.80	13.34	13.80	RX

PART NO.	PART NAME	1	2	3	4	5	6	7	8
IC001	NJM4558D	2.78	2.98	2.82	0.00	2.78	2.86	2.86	5.00
IC301	MC7808CT	INPUT	COM	OUTPUT					
		13.80	0.00	7.90					

NOTES:

All voltage readings were taken reference to ground using a D.V.M. with a 10 Meg Ohm DC input resistance. Power supply voltage was set to 13.8 VDC.

POWER AMPLIFIER VOLTAGE CHART

PART NO.	PART NAME	EMITTER SOURCE	BASE GATE	COLLECTOR DRAIN	REMARKS
Q301	2SC1446A	0.00	0.00	13.65	TX
Q302	2SC2237-22	0.00	0.00	13.65	TX

NOTES:

All voltage readings were taken reference to ground using a D.V.M. with a 10 Meg Ohm DC input resistance. Power supply voltage was set to 13.8 VDC.

RECEIVER VOLTAGE CHART

PART NO.	PART NAME	EMITTER SOURCE	BASE GATE	COLLECTOR DRAIN	REMARKS
Q101	2SK168E	0.43	0.00	12.90	RX
Q102	J310	0.00	2.15	13.34	RX
Q103	2SC1675L	0.95	1.64	5.75	RX
Q104	2SC945AP	0.00	0.62	1.71	RX
Q105	MPSH(10)	3.06	3.81	7.70	RX
Q106	MPSH(10)	2.32	2.91	8.33	RX
Q107	2SC1675-L	2.90	3.48	5.46	RX
Q109	2SC1675-L	3.88	3.24	4.54	RX

RECEIVER VOLTAGE CHART, cont.

PART NO.	PART NAME	EMITTER SOURCE	BASE GATE	COLLECTOR DRAIN	REMARKS
Q110	2SC945A-Q	0.00	0.69	0.13	RX
Q111	2SC945A-Q	4.32	4.95	8.09	RX
Q112	2SK117-GR	0.00	4.32	0.81	RX, SQ ON
		4.04	4.32	4.32	RX, SQ OFF
Q113	2SC945A-Q	0.00	0.64	0.00	RX, SQ ON
		0.00	0.01	4.03	RX, SQ OFF
Q401	2SC945A-P	13.00	14.00	13.80	RX
Q402	2SC945A-P	7.87	7.29	6.98	RX
Q403	2SA733P	6.98	6.98	7.29	RX
Q404	2SC945A-Q	0.00	0.41	0.00	RX
Q405	2SC945A-P	0.00	0.61	0.03	RX
Q406	2SC945A-P	0.00	3.97	8.38	RX
Q407	2SC945A-P	0.00	0.69	0.10	RX, SQ OFF
		0.00	0.00	6.99	RX, SQ ON
Q501	2SA945A-Q	0.29	0.44	13.51	RX
Q502	2SB722-B	13.80	13.51	0.00	RX

PART NO.	PART NAME	1	2	3	4	5	6	7	8
IC101	MC3357-P	8.34	7.79	7.81	8.37	1.06	1.06	1.06	8.37
		8.34	7.79	7.81	8.37	1.06	1.06	1.06	8.37
PIN NO.	9	10	11	12	13	14	15	16	REMARKS
	4.02	1.97	1.99	0.98	0.00	4.54	0.00	2.02	RX, SQ OFF
	4.02	1.97	1.99	0.30	7.48	0.00	0.00	2.02	RX, SQ ON
PART NO.	PART NAME	1	2	3	4	5	6	7	8
IC102	MB3713	7.00	12.00	13.20	0.00	NC	0.00	0.55	0.58
IC401	MB3756	8.20	13.80	8.20	0.00	13.70	8.20	NC	NC

NOTES:

All voltage readings were taken reference to ground using a D.V.M. with a 10 Meg Ohm DC input resistance. Power supply voltage was set to 13.8 VDC.

CONTROL BOARD VOLTAGE CHART

PART NO.	PART NAME	EMITTER SOURCE	BASE GATE	COLLECTOR DRAIN	REMARKS
Q600	2SC945A-Q	0.00 0.00	0.20 0.71	6.80 0.07	NO SIGNAL SIGNAL
Q601	2SC945A-Q	0.00 0.00	0.00 0.70	6.70 0.13	NO SIGNAL SIGNAL
Q602	2SC945A-Q	0.00 0.00	0.12 0.70	7.50 0.03	NO SIGNAL SIGNAL
Q603	2SC945A-Q	0.00 7.55	0.00 8.14	8.20 8.20	NO SIGNAL SIGNAL

PART NO.	PART NAME	1	2	3	4	5	6	7	8	REMARKS
IC600	LM324	4.10 4.17	4.10 4.26	4.10 4.10	8.20 8.26	3.90 3.95	3.90 3.95	3.80 3.80	0.60 6.92	
PIN NO.	9 4.20 3.68	10 4.00 4.18	11 0.00 0.00	12 4.10 4.10	13 4.10 4.12	14 4.10 4.10				NO SIGNAL SIGNAL
IC601	MC14020BCP	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 8.18	0.00 4.06 0.00	0.00 4.29 0.00	0.00 3.82 0.00	0.00 4.00 0.00	0.00 0.00 0.00	
PIN NO.	9 0.00 4.12 0.00	10 7.90 4.13 8.14	11 8.20 0.00 0.40	12 0.00 8.25 8.25	13 0.00 7.78 8.25	14 0.00 8.24 0.00	15 0.00 0.00 0.00	16 8.20 8.25 8.26		NO SIGNAL SIGNAL TIMED OUT
IC602	MC14011BCP	8.20 8.26 8.26	0.00 8.25 8.26	8.20 0.00 0.00	0.00 8.25 8.26	8.20 0.00 0.00	8.20 0.00 0.00	0.00 0.00 0.00	0.60 6.92 6.91	
PIN NO.	9 0.00 6.86 6.87	10 8.20 0.00 0.00	11 0.00 8.25 8.25	12 8.20 0.00 0.00	13 8.20 0.00 0.00	14 8.20 8.26 8.26				NO SIGNAL SIGNAL TIMED OUT
IC603	MM74C14	8.20 0.00 6.35	0.16 8.04 0.00	0.74 4.13 0.59	0.00 4.13 8.15	0.00 7.75 0.00	8.20 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	
PIN NO.	9 0.22 0.00 0.72	10 0.00 0.00 0.50	11 8.20 8.25 8.25	12 8.20 8.20 4.11	13 0.53 0.53 4.11	14 8.20 8.25 8.26				NO SIGNAL SIGNAL TIMED OUT
IC604	MC14066BCP	3.60 3.67	0.50 3.67	0.00 3.63	0.00 3.70	0.00 8.21	0.00 8.21	0.00 0.00	3.80 3.81	
PIN NO.	9 0.10 3.71	10 0.10 3.70	11 0.10 3.71	12 0.00 8.21	13 0.10 8.07	14 8.20 8.25				NO SIGNAL SIGNAL
IC605	DE-390	0.00	3.63	3.67	3.67	0.00	0.00	2.75	0.00	
PIN NO.	9 2.37	10 8.26								SIGNAL
IC606	DE-334	8.60 8.25	3.97 3.97	0.00 0.00	4.43 4.80					SIGNAL NO SIGNAL
IC607	MC14020BCP	0.06 14.20	0.06 14.20	0.06 0.00	0.06 7.15	0.02 7.15	0.01 7.37	0.00 7.14	0.00 0.00	
PIN NO.	9 0.00 7.14	10 0.37 7.11	11 8.40 0.00	12 0.54 7.02	13 0.06 7.13	14 1.51 PULSE	15 0.06 PULSE	16 13.80 14.20		AC BATTERY
IC608	MC14017	0.00 PULSE	0.00 PULSE	0.00 PULSE	0.00 PULSE	0.00 PULSE	0.00 PULSE	0.00 PULSE	13.80 0.00	0.00 0.00
PIN NO.	9 0.00 PULSE	10 0.00 PULSE	11 13.80 PULSE	12 0.00 PULSE	13 0.00 0.00	14 1.58 PULSE	15 0.00 0.00	16 13.80 13.40		AC BATTERY
IC609	MC14011BCP	13.80 PULSE	13.80 PULSE	0.00 PULSE	13.80 PULSE	1.58 PULSE	0.00 PULSE	0.00 0.00	13.80 PULSE	

CONTROL BOARD VOLTAGE CHART, cont.

PIN NO.	9 13.80 PULSE	10 0.00 PULSE	11 13.80 PULSE	12 0.39 SQ.	13 0.00 PULSE	14 13.80 14.20			REMARKS AC BATTERY	
PART NO. IC610	PART NAME MM74C14		1 0.19 0.00	2 13.80 14.10	3 0.00 PULSE	4 13.80 PULSE	5 0.00 PULSE	6 13.80 PULSE	7 0.00 0.00	8 0.39 SQ.
PIN NO.	9 8.30 TRI.	10 0.00 0.00	11 0.18 0.00	12 0.00 PULSE	13 13.80 PULSE	14 13.80 14.20			REMARKS AC BATTERY	

NOTES:

All voltage readings were taken reference to ground using a D.V.M. with a 10 Meg Ohm DC input resistance.
 Power supply voltage set to 13.8 VDC.
 SQ: A Square wave form. PULSE: A pulsed wave form.
 TRI: A triangular wave form.

POWER SUPPLY VOLTAGE CHART

PART NO.	PART NAME	EMITTER SOURCE	BASE GATE	COLLECTOR DRAIN	REMARKS
Q701	MPSA55	24.00	23.90	22.70	RX
Q702	MPSA55	23.40	22.70	23.40	RX
Q703	TIP32	24.00	23.40	14.40	RX
Q704	MPSA05	0.90	1.30	24.00	RX
Q705	2N3771	13.80	14.40	24.00	RX
		INPUT	ADJ.	OUTPUT	
IC701	LM317T	23.30	12.60	13.80	
		CATH	GATE	ANODE	
IC702	2N6504	0.00	0.00	13.80	

NOTES:

All voltage readings were taken reference to ground using a D.V.M. with a 10 Meg Ohm DC input resistance.
 Power supply voltage was set to 13.8 VDC.

FEED THRU VOLTAGE CHART

FT1	FT2	FT3	FT4	FT5	FT6	FT7	FT8	REMARKS		
0.00	0.00	0.00	7.87	6.97	0.00	0.00	0.00	RX, SQ. OFF		
FT9	FT10	FT11	FT12	FT13	FT14	FT15	FT16	REMARKS		
0.00	0.00	0.00	0.10	0.00	8.37	2.04	13.80	RX, SQ OFF		
FT17	FT18	FT19	FT20	FT21	FT22	FT23	FT24	FT25	FT26	REMARKS
6.87	0.00	0.00	0.00	8.23	0.00	0.01	0.87	0.00	14.03	RX
6.29	0.00	0.00	0.00	0.00	0.00	2.99	-2.97	0.02	13.79	TX

NOTE:

All voltage readings were taken reference to ground using a D.V.M. with a 10 Meg Ohm input resistance.
 Power supply voltage set to 13.8 VDC.

Photo 1

Pin 1 of P2
 Recovered Audio
 RFSG to Rx Ant.
 Level: 1000 uV
 Dev: 3 kHz
 Mod. Freq: 1 kHz
 Scale
 H: 1 ms/Div
 V: 0.5V/Div
 DCV: 4.8V

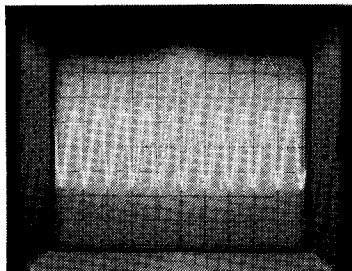


Photo 3

Test Point 3
 Input to tone
 transmission gate.
 Tx Keyed.
 Scale
 H: 5ms/Div
 V: 0.5V/Div
 DCV: 3.6V

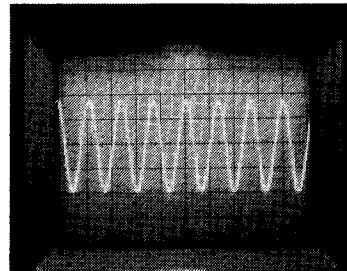


Photo 2

Pin 1 of P1
 Tone decoder input
 RFSG to Rx Ant.
 Level: 1000 uV
 Dev: 500 Hz
 Mod Freq: 150 Hz
 Scale
 H: 5ms/Div
 V: 50mV/Div
 DCV: 1V

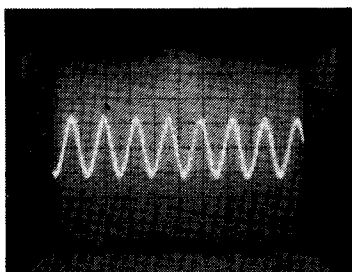
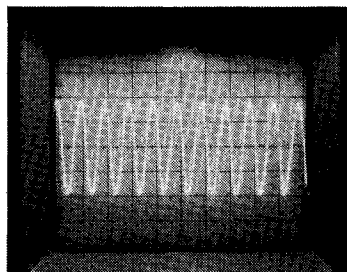
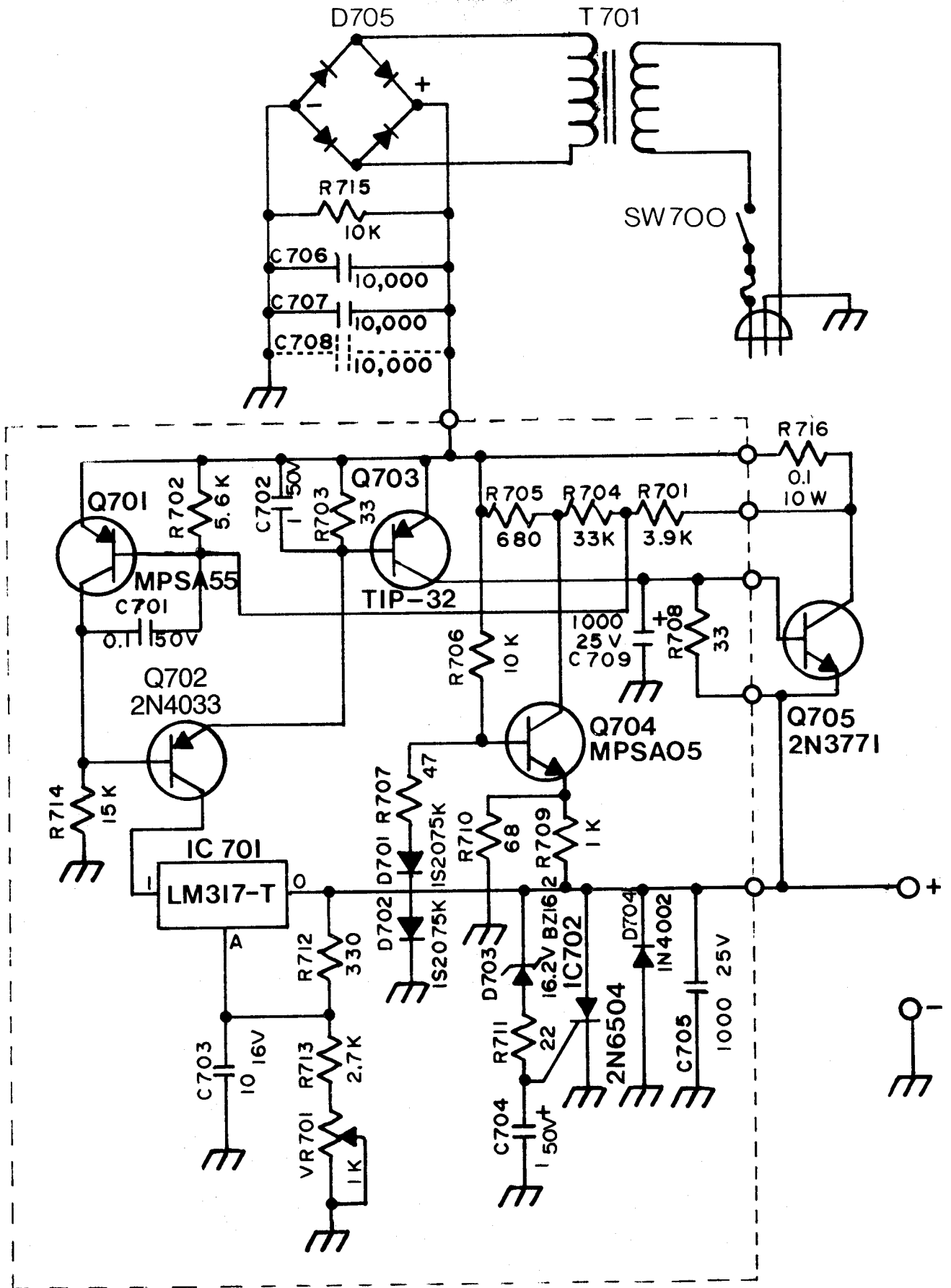


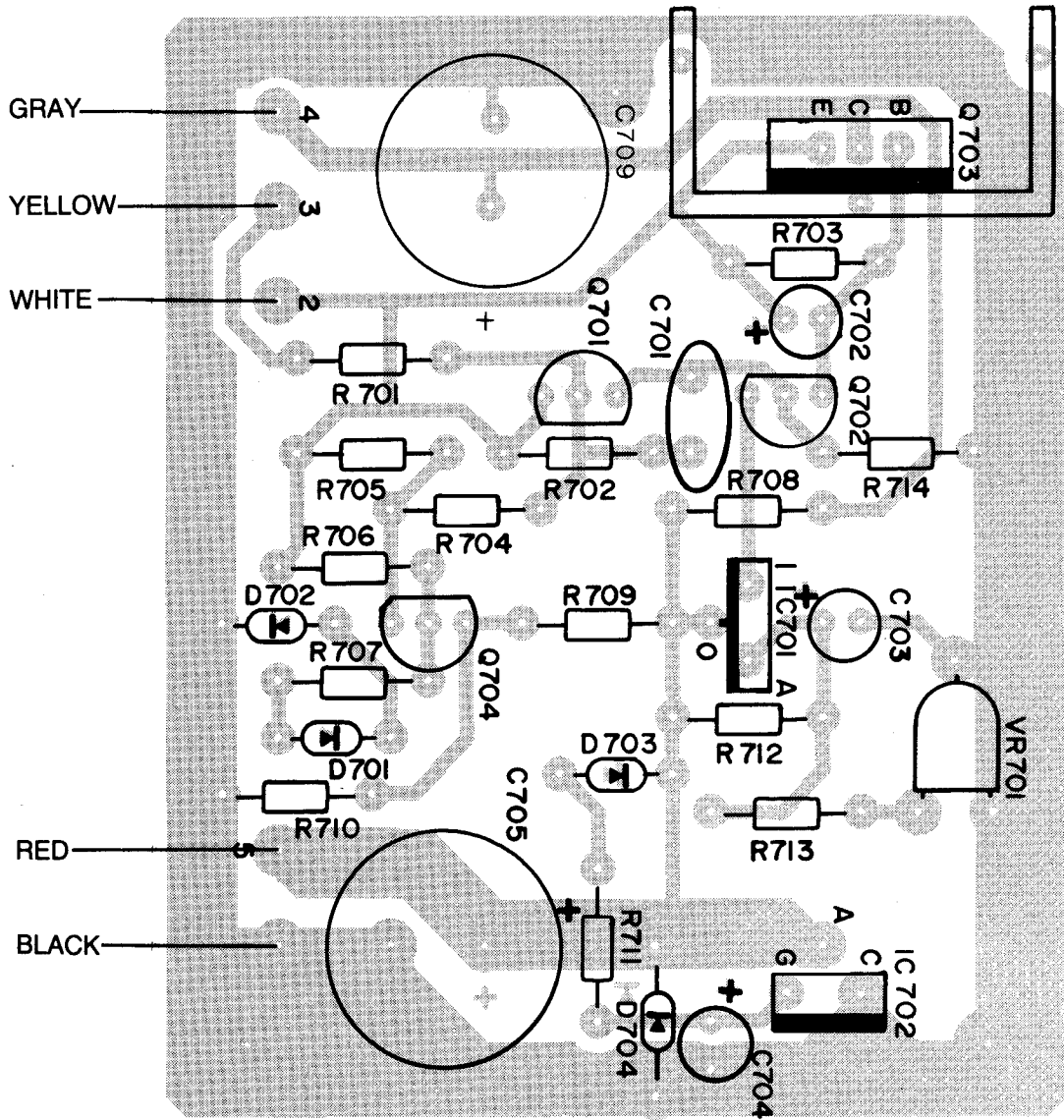
Photo 4

Pin 8 of IC604
 Input of audio
 transmission gate.
 Carrier Sq. Operation.
 RFSG to Rx Ant.
 Level: 1000uV
 Dev: 3 Hz
 Mod. Freq: 1 kHz
 Scale
 H: 1ms/Div
 V: 0.2V/Div
 DCV: 3.8V

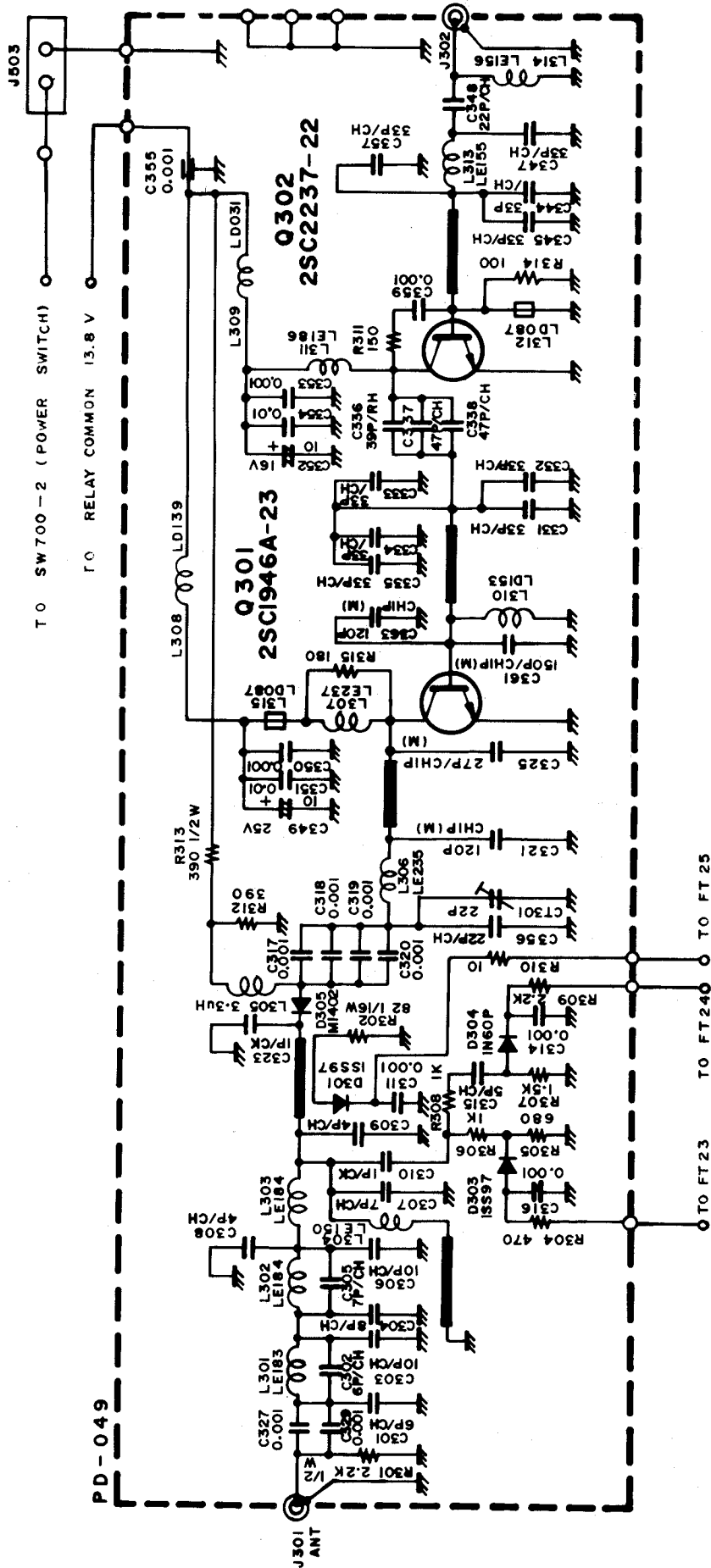




**POWER SUPPLY
SCHEMATIC**



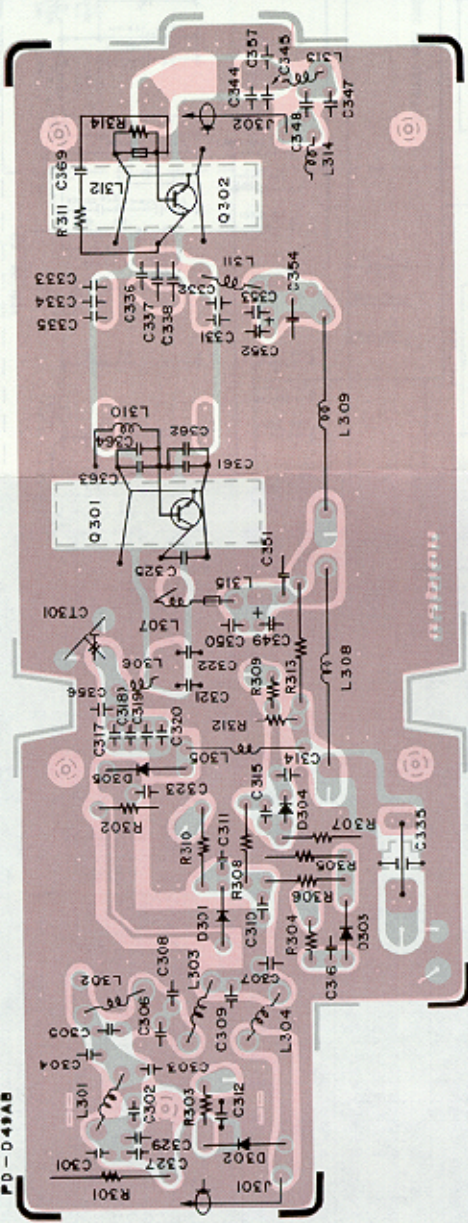
**POWER SUPPLY
X-RAY VIEW**



POWER AMPLIFIER SCHEMATIC

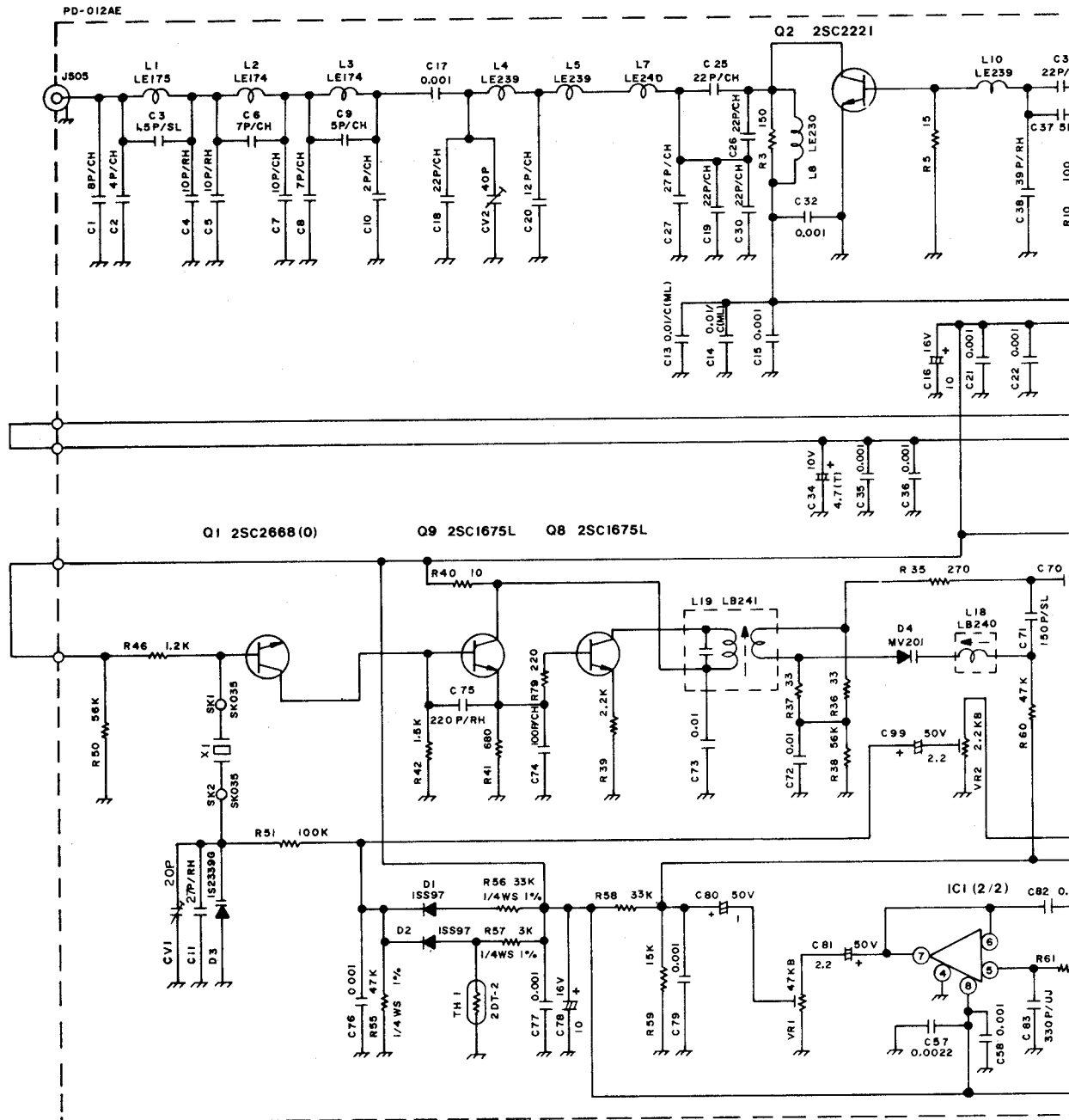
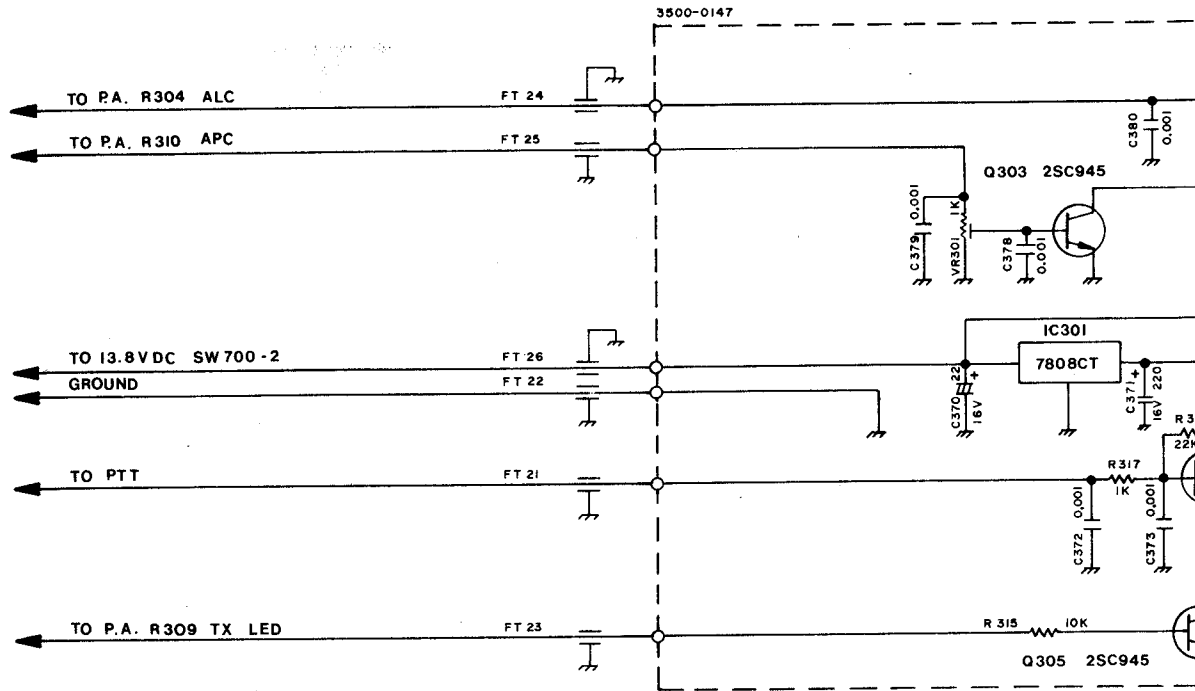
- NOTES**
1. RESISTANCE VALUES ARE SHOWN IN OHMS UNLESS OTHERWISE NOTED.
(K = KILO OHM, M = MEG OHM)
 2. RESISTOR WATTAGES ARE 1/4W UNLESS OTHERWISE NOTED.
 3. CAPACITANCE VALUES ARE INDICATED IN MICROFARADS UNLESS OTHERWISE NOTED. (P = MICRO - MICRO FARAD)
 4. ALL CAPACITORS TEMPERATURE CHARACTERISTICS ARE YD UNLESS OTHERWISE NOTED.

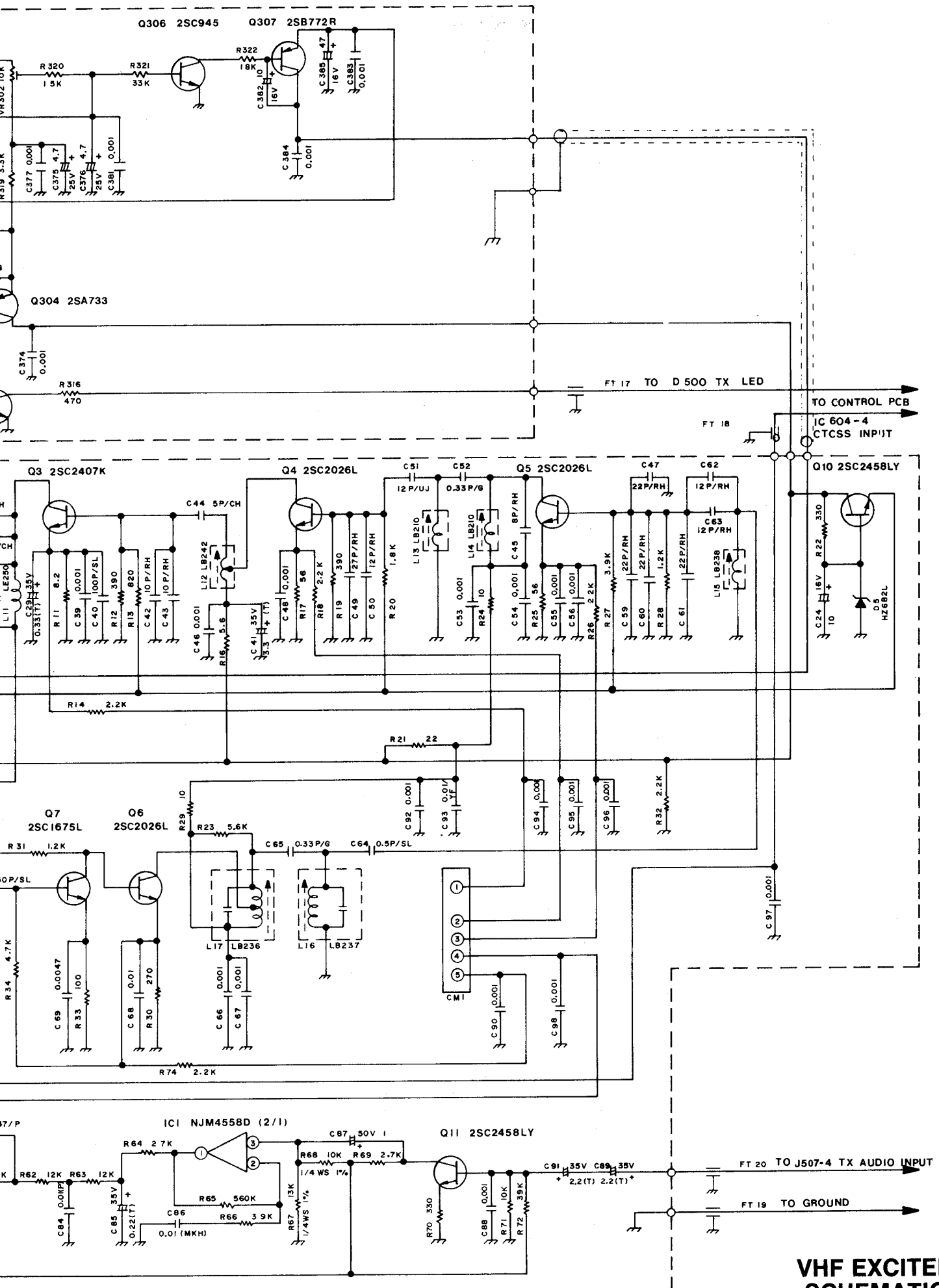
FD-049AB



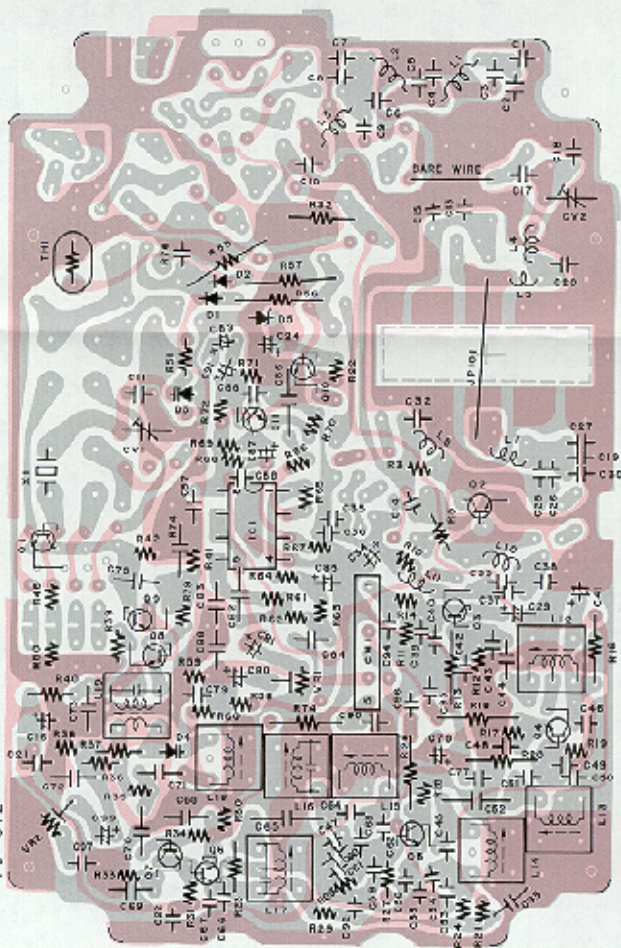
VIEWED FROM COMPONENT SIDE

POWER AMPLIFIER
VIEWED FROM COMPONENT SIDE

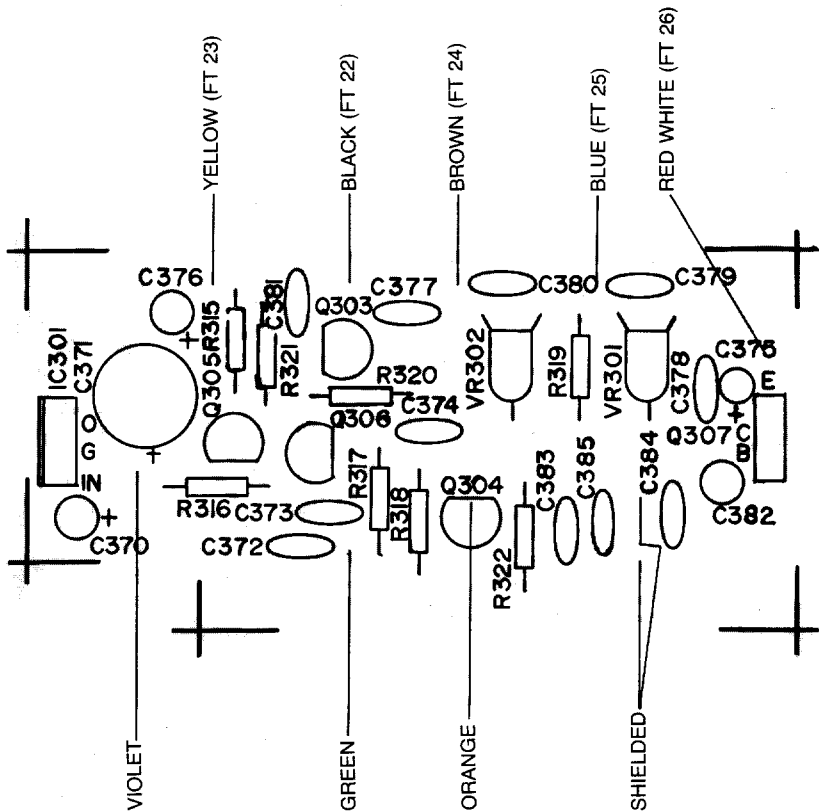




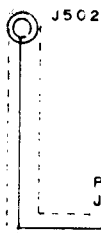
**VHF EXCITER
SCHEMATIC**



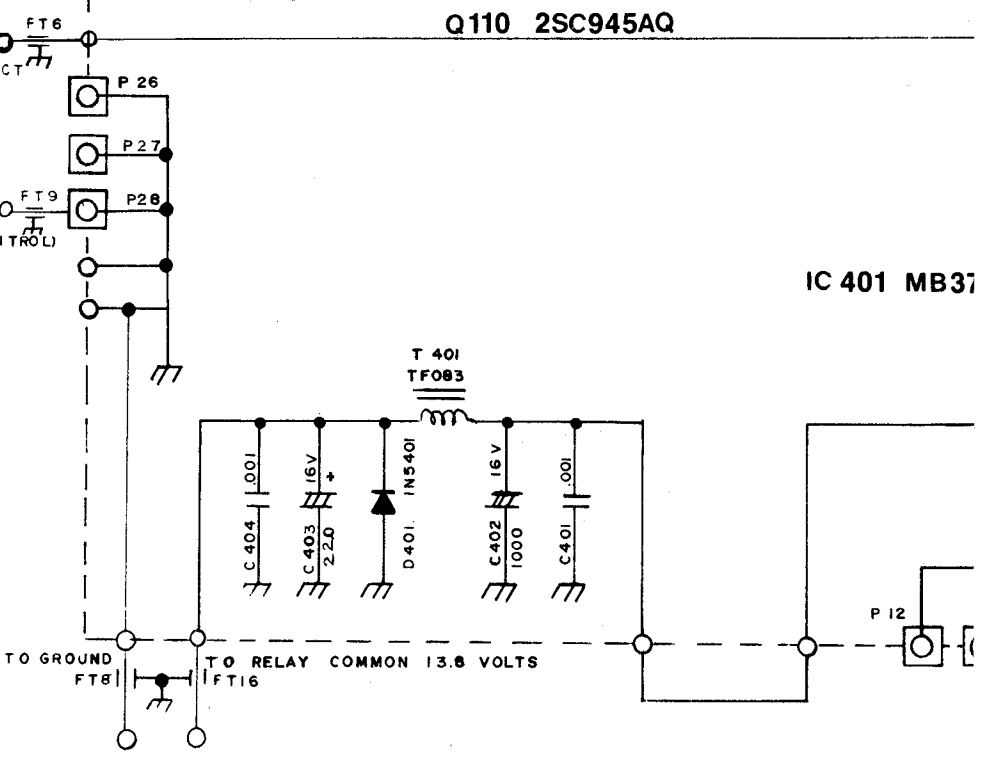
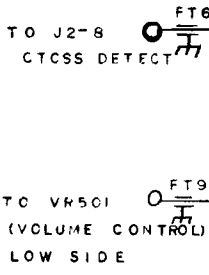
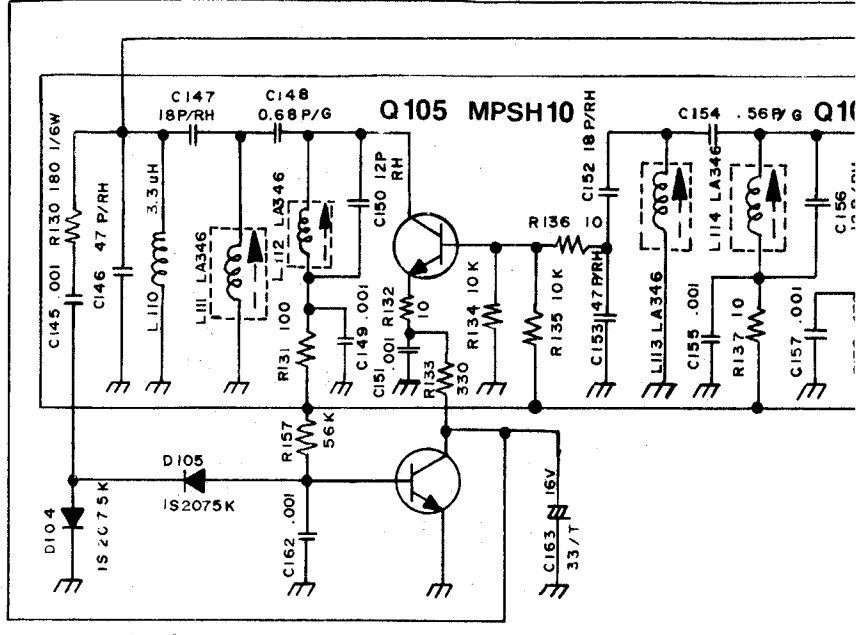
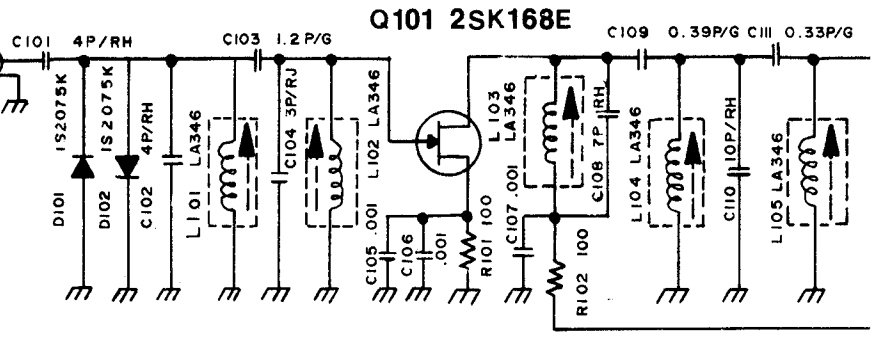
EXCITOR P.C. BOARD
X-RAY VIEW
SOLDER SIDE



EXCITOR INTERFACE
P.C. BOARD
X-RAY VIEW
COMPONENT SIDE



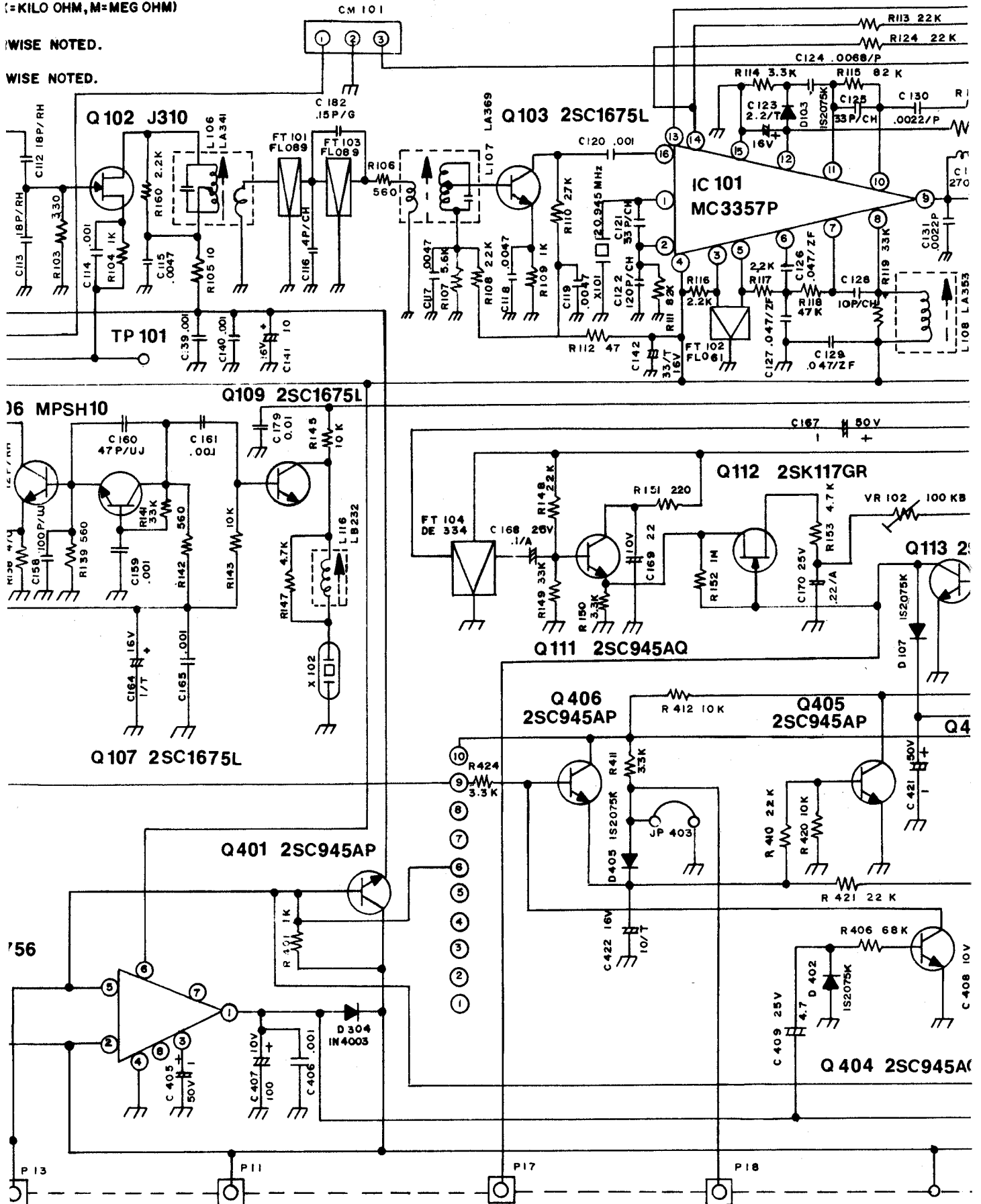
- NOTES**
1. RESISTANCE VALUES ARE SHOWN IN OHMS UNLESS OTHERWISE NOTED. (K = THOUSANDS)
 2. RESISTOR WATTAGES ARE 1/4 W UNLESS OTHERWISE NOTED.
 3. CAPACITANCE VALUES ARE INDICATED IN MICROFARADS UNLESS OTHERWISE NOTED. (P = MICRO - MICRO FARAD)
 4. ALL CAPACITORS TEMPERATURE CHARACTERISTICS ARE YD UNLESS OTHERWISE NOTED.

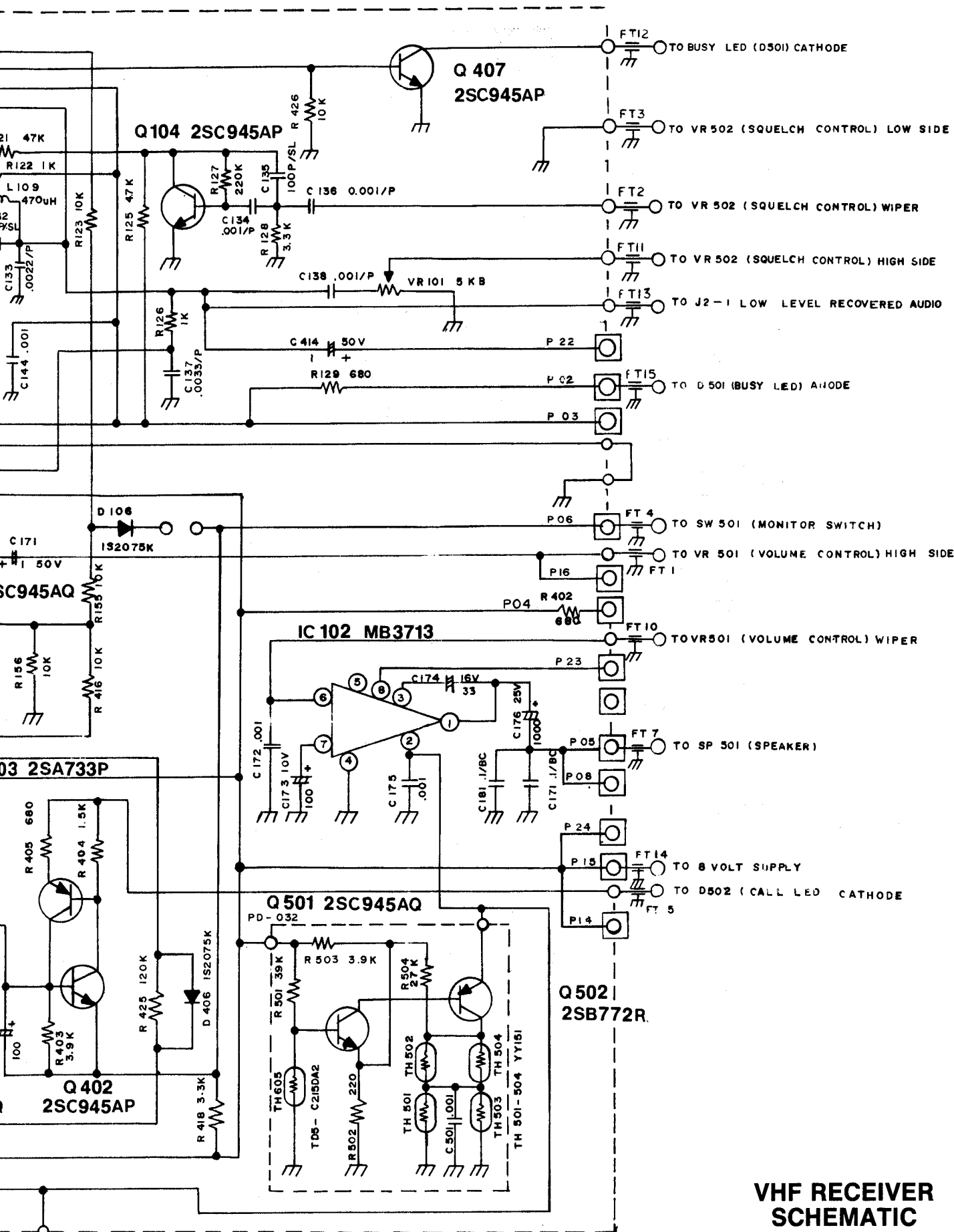


(=KILO OHM, M=MEG OHM)

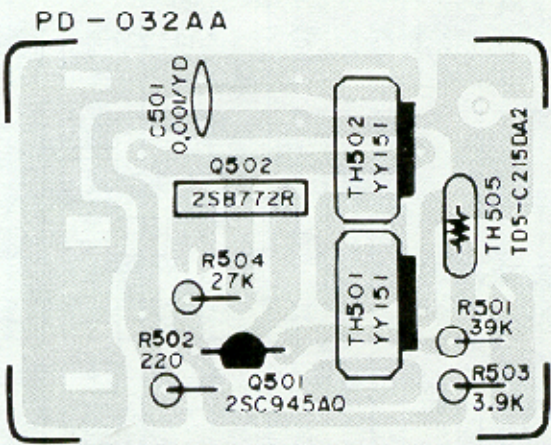
WISE NOTED.

WISE NOTED.

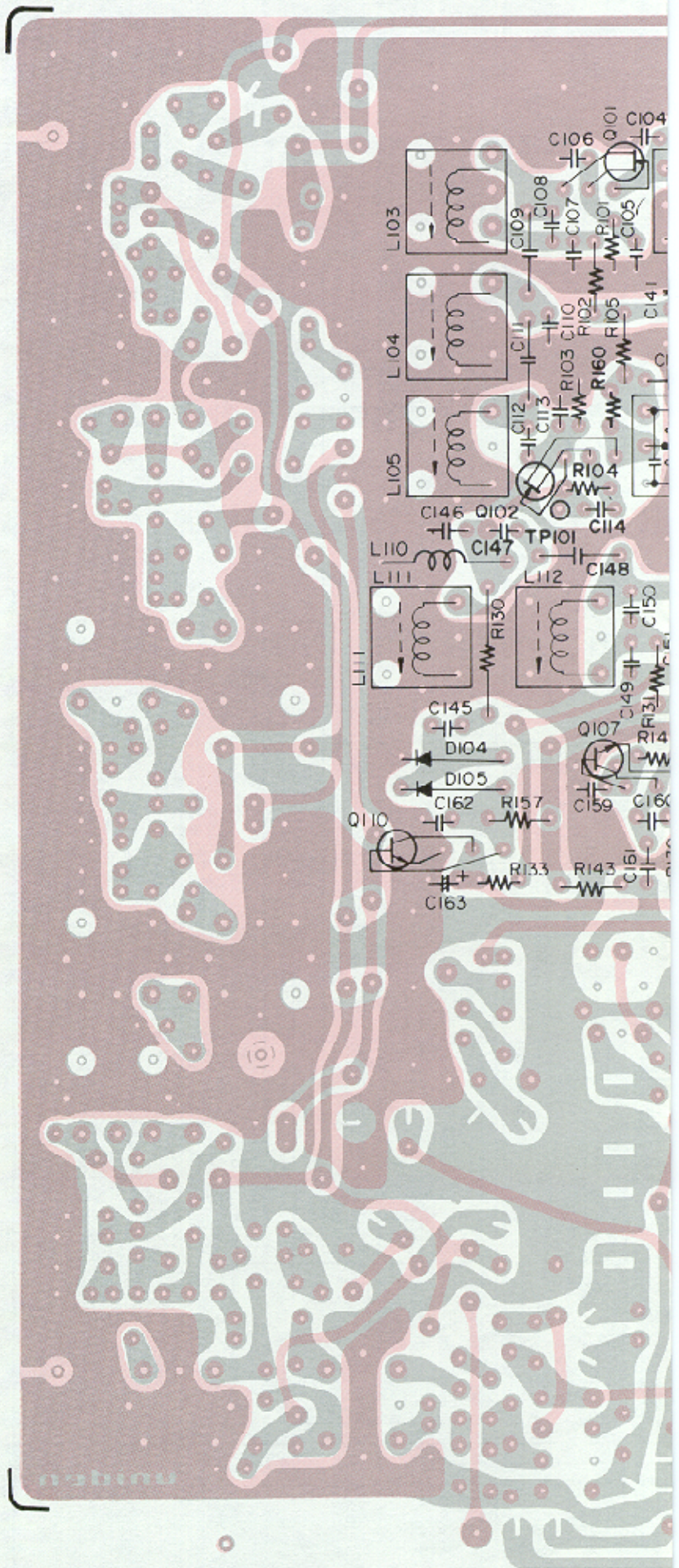


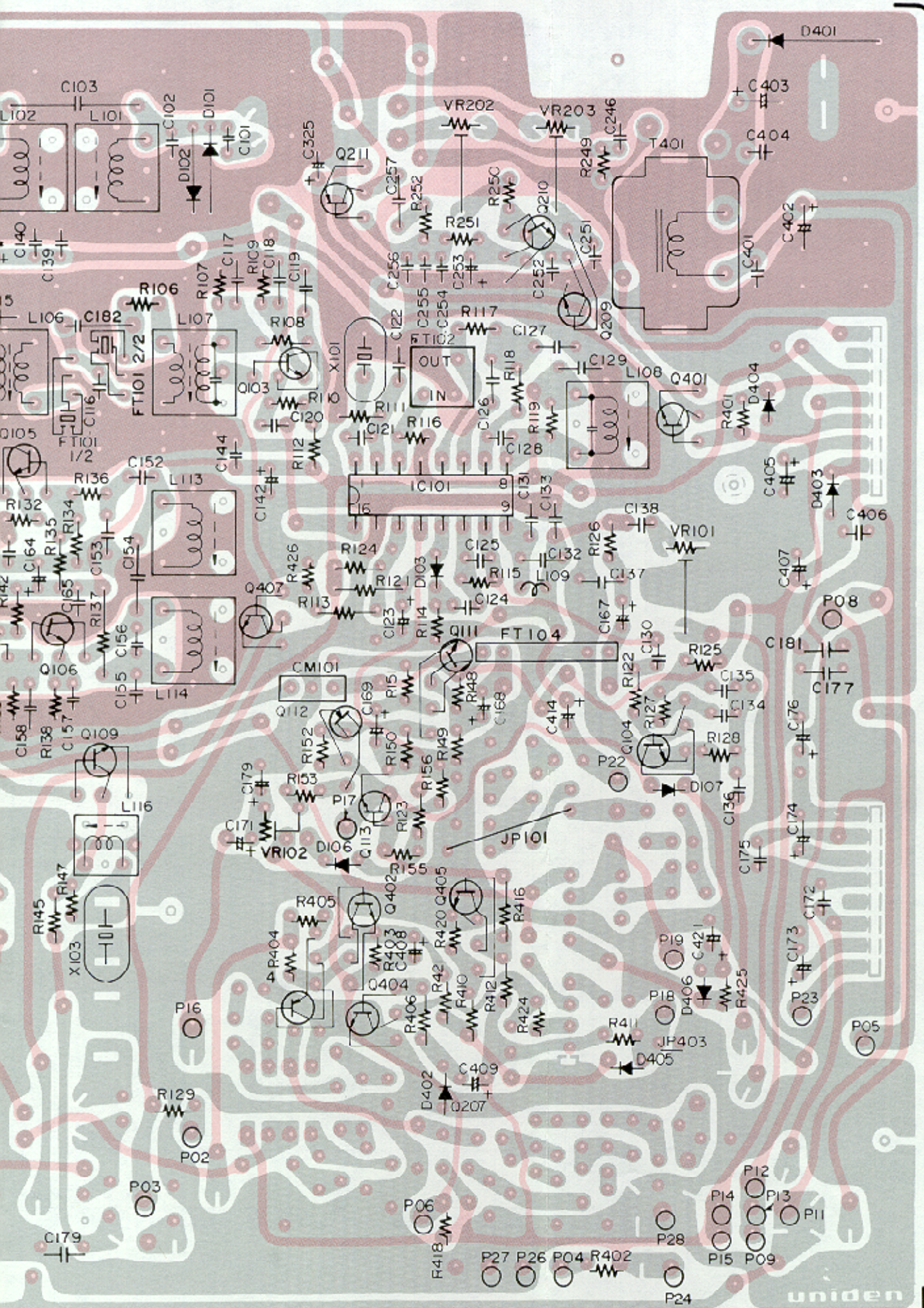


VHF RECEIVER SCHEMATIC

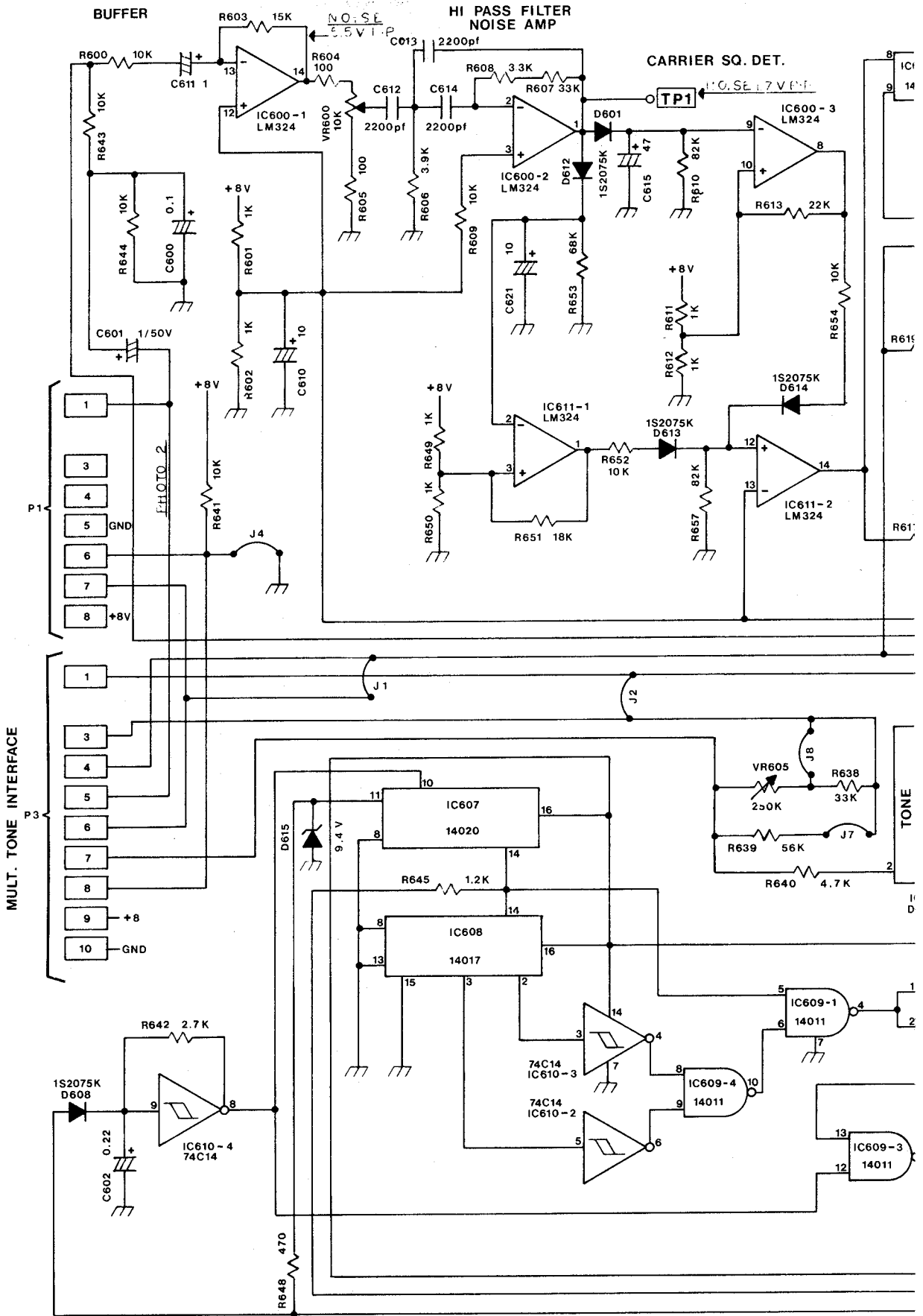


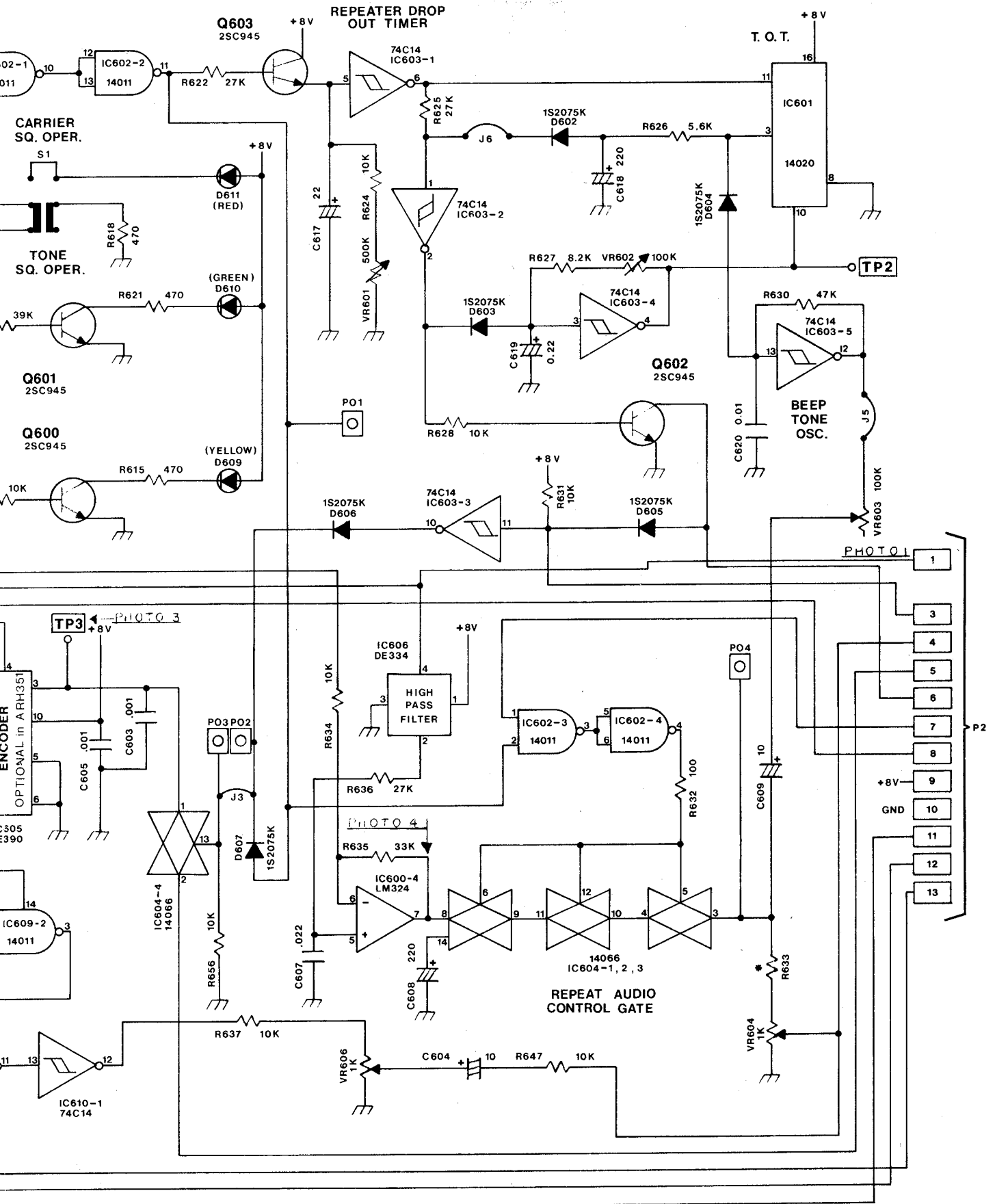
POSISTOR P.C. BOARD
SHOWN FROM COMPONENT SIDE



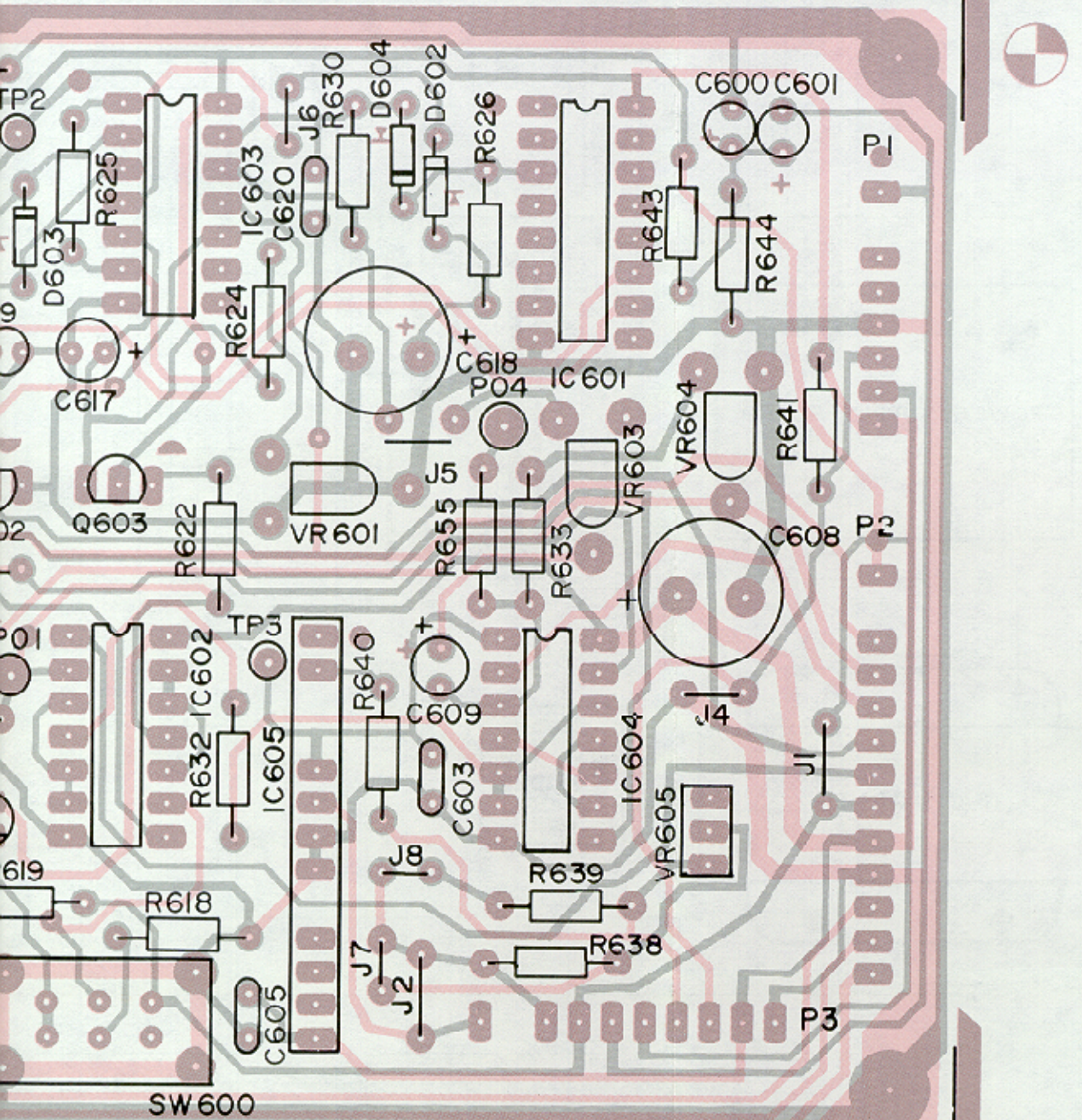


**VHF RECEIVER P.C. BOARD
SHOWN FROM SOLDER SIDE**

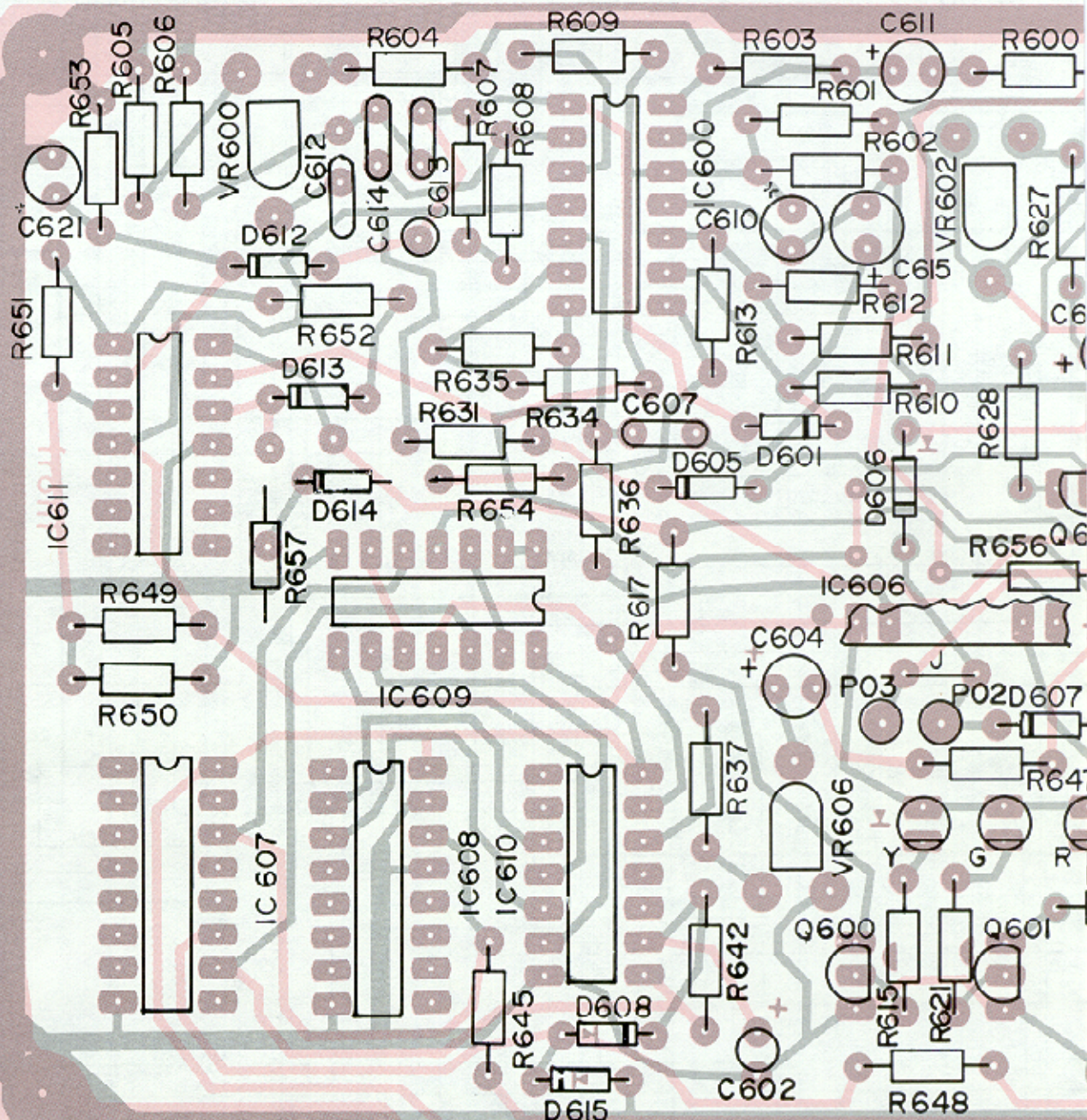




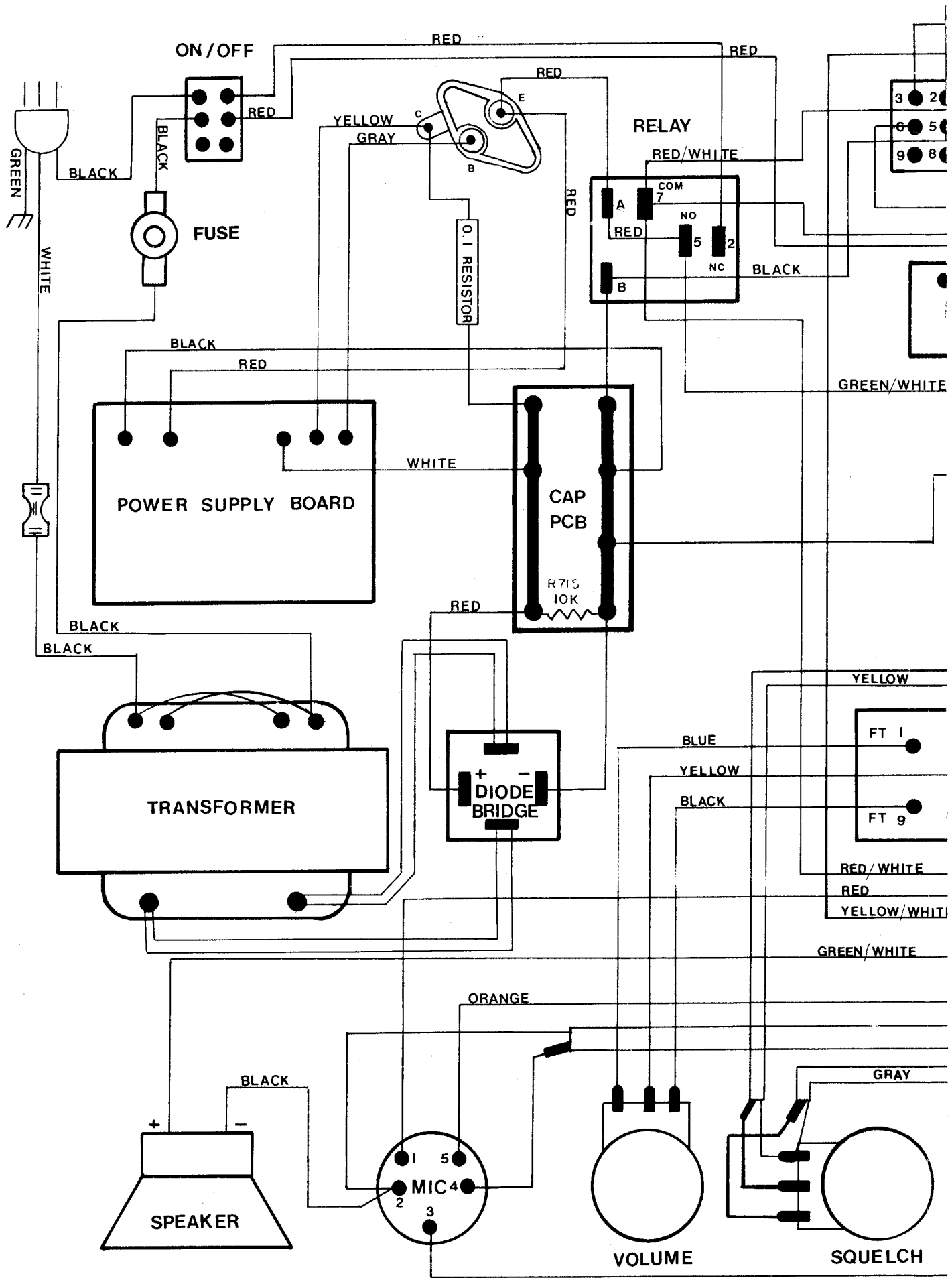
REPEATER CONTROL BOARD



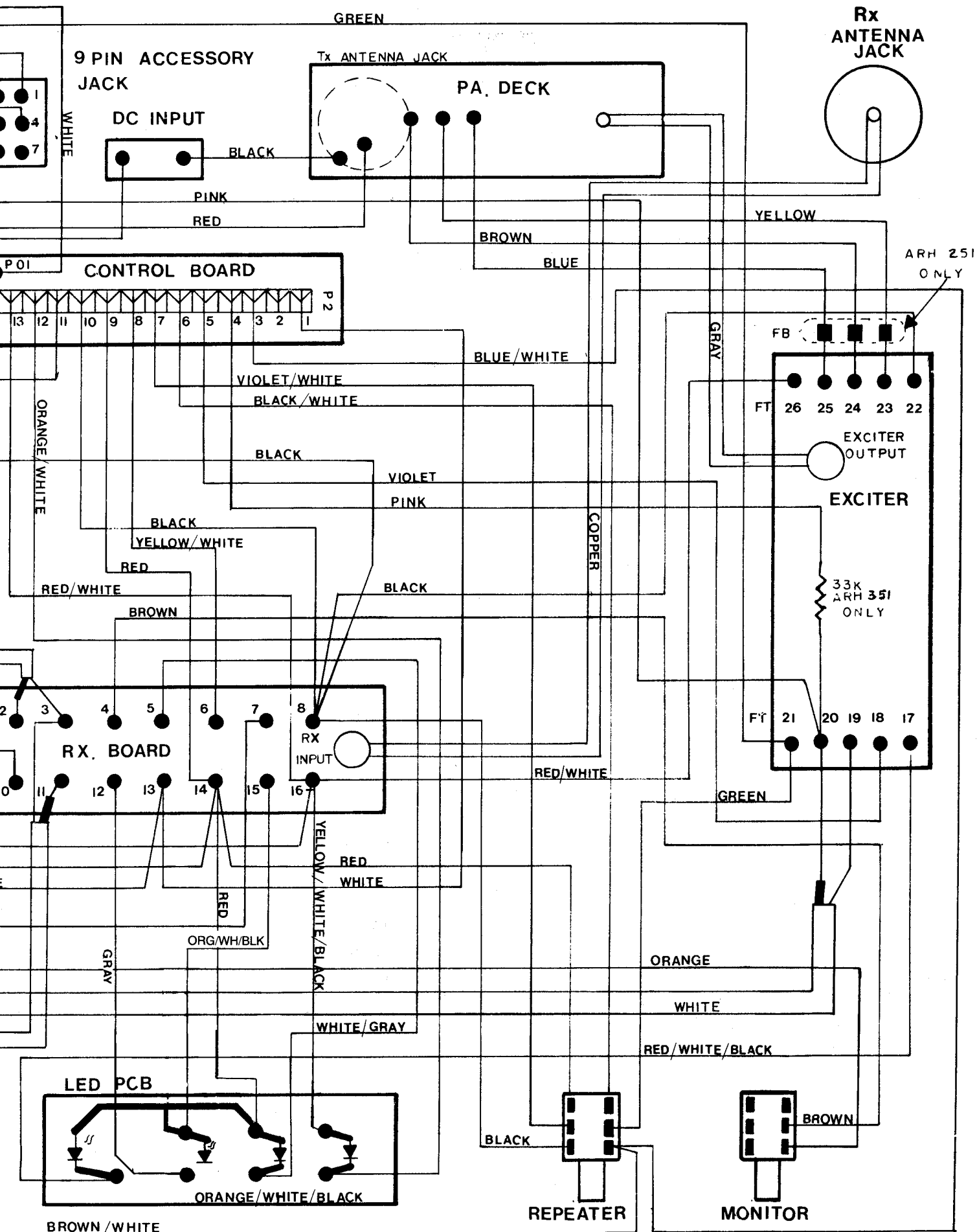
RD
 ENT SIDE

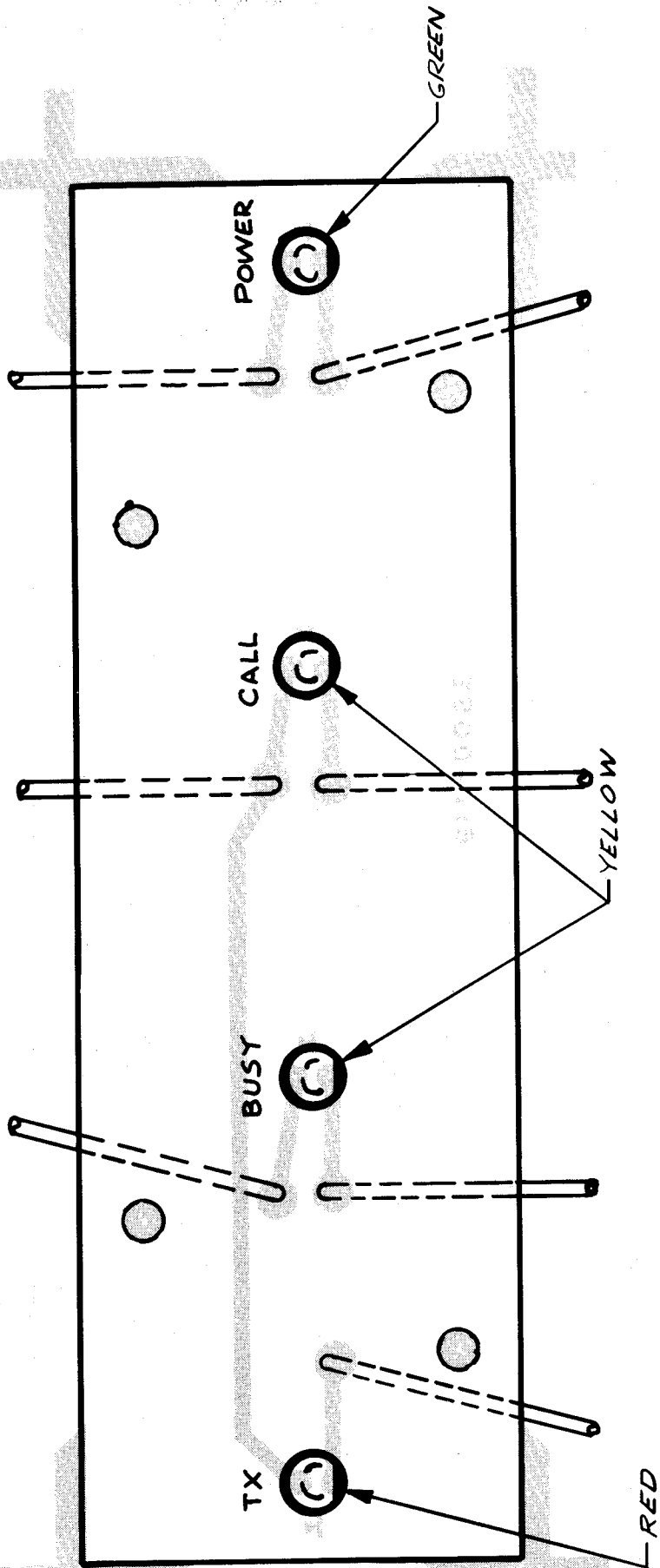


CONTROL P.C. BOARD
SHOWN FROM COMPONENT SIDE



REPEATER WIRING DIAGRAM

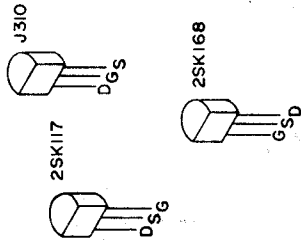




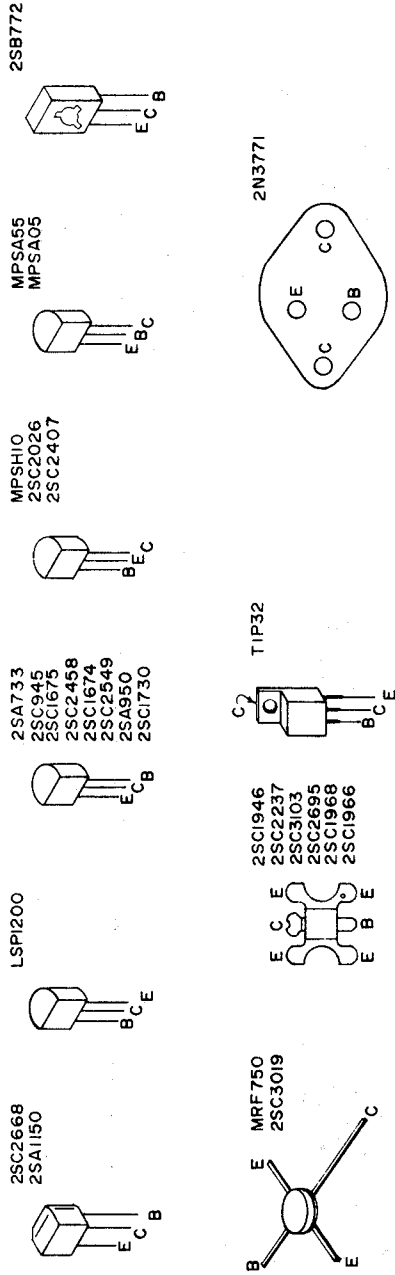
LED P.C. BOARD
SHOWN FROM COMPONENT SIDE

Semiconductor Pin Connections

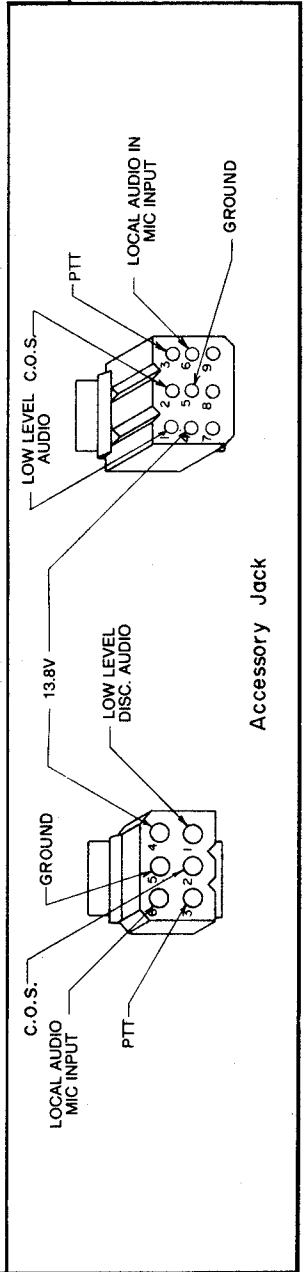
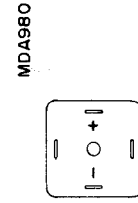
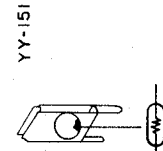
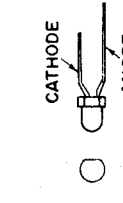
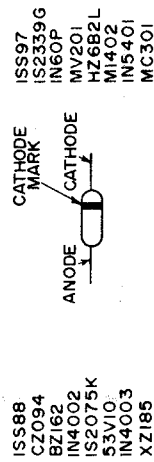
FET



Transistors



Diodes



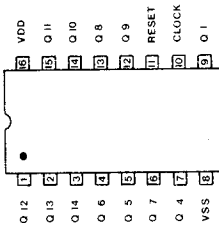
INTEGRATED CIRCUITS

MC14020B

TRUTH TABLE

CLOCK	RESET	OUTPUT STATE
0	0	No Change
0	1	Advance to All Inputs are 1
1	0	Advance to All Inputs are 1
1	1	Advance to All Inputs are 1

X = Don't Care

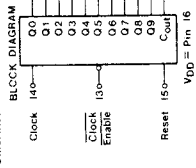


MC14017B

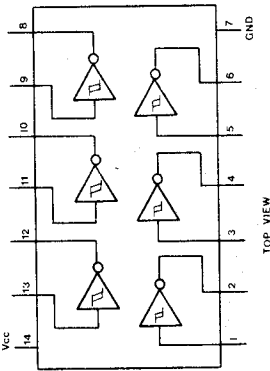
FUNCTIONAL TRUTH TABLE

CLOCK	ENABLE	RESET	OUTPUT
0	X	0	0
0	X	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

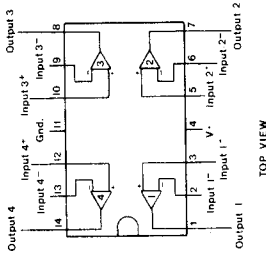
X = Don't Care If n < 5, Carry = 1
Otherwise = 0



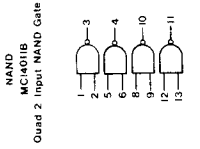
MM74C14



LM324

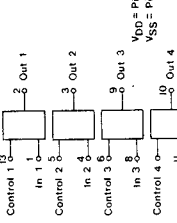


MC14011

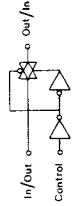


MC14066B

BLOCK DIAGRAM



LOGIC DIAGRAM AND TRUTH TABLE
1/4 OF DEVICE SHOWN



Control Switch Logic Diagram Restrictions

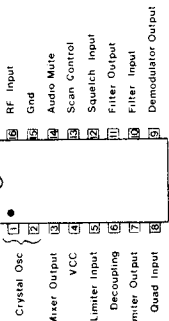
Control Switch	Logic Diagram Restrictions
0	VSS ≤ Vin ≤ VDD
1	VDD ≤ Vout ≤ VDD
ON	
OFF	

Max Input to Vout Resistance
VSS 3 × 10³ Ohms Typ
VDD 3 × 10² Ohms Typ

NJM4558D

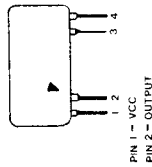


MC3357P



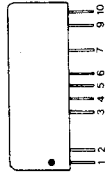
HI PASS FILTER (DE 334)

PART NO. 2200-331



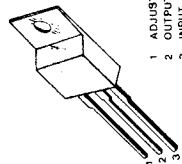
CTCSS HYBRID IC (DE 390)

PART NO. 2000-1001

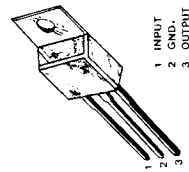


PIN 1 - SIGNAL IN
PIN 2 - RESISTOR
PIN 3 - ENCODE OUT
PIN 4 - EXT. RESISTOR
PIN 5 - GND
PIN 6 - ENCODE SW
PIN 7 - EXT. CAPACITOR
PIN 8 - DECODE OUT
PIN 9 - DECODE OUT
PIN 10 - VCC

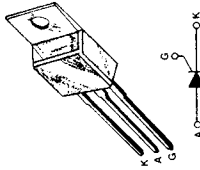
LM317



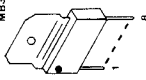
MC 7808CT



2N6504



MB3756



MB3713



MECHANICAL PARTS LIST

ARH 351

QUANTITY	DESCRIPTION	VENDOR PART NUMBER	UNIDEN PART NUMBER
1	INSULATION PLATE	RZEB480438Z	*
1	TERMINAL:ANT	HTML480822Z	*
1	HOLDER:IC	HHDE480101A	*
1	INSULATION PLATE X'TAL	RTLA480052A	*
1	WASHER:ANT	HWSR480823Z	*
2	SPACER	HCLR480102Z	*
1	SHIELD PLATE	HSDP480437Z	*
13	TIE WRAP: 4"	PLT1M-MO	1100-0843
1	PCB:POWER SUPPLY		3500-0118
1	PCB:LED BOARD		3500-0119
1	PCB:CAPACITOR REPEATER		3500-0124
1	PCB:EXCITER INTERFACE VHF		3500-0147
2	SCREW:M FLAT HD M2.6x6 NI	SSCW132606N	1100-1702
8	SCREW:M BIND HD M3x5 NI	SSCW193005N	1100-0728
6	SCREW:M FLAT HD M3x6 NI	SSCW133006N	1100-0703
6	SCREW:M FLAT HD M3x6 BLACK	SSCW143006K	1100-0788
43	SCREW:T BIND HD M3x6 NI	SSCW343006N	1100-0725
3	SCREW:M BIND HD M3x6 NI	SSCW193006N	1100-0704
4	SCREW:M PAN HD M3x8 NI	SSCW103008N	1100-0785
8	SCREW:M BIND HD M3x8 BLACK	SSCW193008B	1100-0705
19	SCREW:M BIND HD M3x8 NI	SSCW193008N	1100-0723
4	SCREW:T BIND HD M3x14 NI	SSCW343014N	1100-0733
4	SCREW:M BIND HD M5x10 NI	SSCW195010N	1100-0748
4	SCREW:M PHIL HD #4-40x14		1100-1713
23	SCREW:M PAN HD #4-40x1/4		1100-1734
12	SCREW:T PAN HD #4-40x1/4		1100-0715
4	SCREW:T PAN HD 4-40x3/8		1100-1708
10	SCREW:T PAN HD #6-32x1/4		1100-0713
2	SCREW:M PAN HD #6-32x1/4		1100-0799
2	SCREW:M PAN HD 6-32x3/4		1100-1704
1	SCREW:M ROUND HD 6-32x1		1100-1706
4	SCREW:M PAN HD 8-32x1/2		1100-0795
4	SCREW:T PAN HD #8-32x1/2		1100-0796
1	SCREW:T PAN HD 8-32x3/4		1100-1703
3	HEX NUT M3 NI	SSCW430030N	1100-0735
7	HEX NUT #4-40		1100-0717
4	HEX NUT #6-32		1100-0714
4	HEX NUT #8-32		1100-0797
4	STAR WASHER #8 EXT TOOTH		1100-0798
1	STUD	MSTD410426Z	1100-0786
3	THREADED STUD 4-40-5	FH-440-5	1100-0722
6	BANC-LOCK: M3 `2T	TSTD0263020	1100-0326
15	STANDOFF - PEM NUT	SO-440-6CI	1100-0911
4	STANDOFF - PEN NUT	SO-440-8CI	1100-0912

QUANTITY	DESCRIPTION	VENDOR PART NUMBER	UNIDEN PART NUMBER
1	BUTT SPLICE	34070	1100-0076
5	SOLDERLESS TERMINALS	61974-2	1100-0077
3	LOCKING TERMINAL LUG	1415-6	1100-0784
2	INSULATED TAB RECEPTACLE	640934-1	1100-0090
1	FUSE HOLDER	341001	1100-0852
1	SOCKET:TRANSISTOR TO-3	8080-1G3	1400-0009
1	STRAIN RELIEF	SR-5N-4	1100-0824
2	GROMMET	2817	1100-0825
1	CAPACITOR MOUNTING CLAMP	1780-11	1100-0844
1	TERMINAL STRIP KEY	15-04-9209	1100-0087
4	LED SPACER	LHDL411326Z	3400-0019
1	INSULATOR:WASHER MICA	BYDY0003002	3400-0226
1	INSULATOR:MICA WASHER	BYDY0003003	3400-0233
1	TRANSISTOR HEAT SINK	5630B	3000-0318
1	FRONT PANEL	GCMF180751A	3300-0574
1	FRONT PANEL SLIDE PIECE	GCMZ414434Z	3400-0756
2	NYLON EDGING	TSTD0191110	4000-0062
2	KNOB (REPEATER)	GNBY408150Z	1300-0093
2	PUSH BUTTON KNOB REPEATER	GNBP480760Z	1300-0094
4	RUBBER FEET 20x16 (ABS)	TSDT0100004	1100-0745
3	DP-562 BLACK HOLE PLUGS	2653	1100-0842
3	PLASTIC STANDOFF	1919N	1100-0336
3	FRONT INSERT CLAMP	3400-0024	1100-0838
1	FCC LABEL ARH351		1700-0414
1	REPEATER FUNCTION LABEL		1700-0611
1	REPEATER REAR PANEL LABEL		1700-0615
1	REPEATER FRONT INSERT		3300-0014
1	MOBILE NAMEPLATE (UNIDEN)	JDPA480523A	3400-0163
1	CHASSIS:REAR MOBILE	FCSR280096B	3300-0010
1	CHASSIS:FRONT	HCSF280753Z	3300-0012
1	CHASSIS:MAIN (STATION)	HCSY180752Z	3300-0013
1	CHASSIS:REAR (STATION)	HCSR280754Z	3300-0015
1	BRACKET:XFORMER SUPPORT		3300-0018
1	COVER:TOP (STATION)	HCMT204085Z	3300-0125
1	HEAT SINK:POWER SUPPLY		3300-0317
1	HOLDER:RIGHT	HHDF404083Z	3300-0805
1	HOLDER:LEFT	HHDF404084Z	3300-0806
1	COVER:BOTTOM (STATION)	HCMB204566Z	3300-0810
1	SHIELD BOX:RX		4000-0500
1	SHIELD BOX:TX		4000-0501
1	SHIELD COVER:TX		4000-0502
1	SHIELD COVER:RX		4000-0503

SYMBOL NUMBER	DESCRIPTION	VENDOR PART NUMBER	UNIDEN PART NUMBER
SK001	SK-035 SOCKET:CRYSTAL	BSKY0035001	1400-0010
SK002	SK-035 SOCKET:CRYSTAL	BSKY0035001	1400-0010
SK101	SK-036 SOCKET:CRYSTAL	BSKY0036001	1400-0002*
RELAY	RELAY: 12VDC SPDT	1515-1C-12VDC	2400-0008
T401	TF-083 CHOKE:AF	BTFY0083001	2300-0001
T701	TRANSFORMER:POWER	16167-P	2600-0030
SP501	SP-014 SPEAKER	BSPY0014001	3100-0004
F701	FUSE SLOW-BLOW: 2 AMP	313002	2800-0013
P01	TP-043 PUSH PIN MALE	BTPY0043001	1100-0108
P02	TP-043 PUSH PIN MALE	BTPY0043001	1100-0108
P03	TP-043 PUSH PIN MALE	BTPY0043001	1100-0108

SYMBOL NUMBER	DESCRIPTION	VENDOR PART NUMBER	UNIDEN PART NUMBER
P04	TP-043 PUSH PIN MALE	BTPY0043001	1100-0108
P1-28	TP-043 PUSH PIN MALE	BTPY0043001	1100-0108
TP1	TP-019	BTPY0019001	1100-0102
TP2	TP-019	BTPY0019001	1100-0102
TP3	TP-019	BTPY0019001	1100-0102
TP101	TP-019	BTPY0019001	1100-0102
1	PUSH PIN FEMALE	60790-1	1100-0107
1	AC POWER CORD	17236	2700-0203
(OPT)	UU-015 TONE BOARD	UU015	ARX 500
(IC605)	DE-390 CTCSS IC	BDEY0390001	2000-1001
#	VALUE CHANGED ON LATTER PRODUCTIONS RUNS.		

APPENDIX A

PIN CONNECTIONS FOR CONTROL PCB

<p>P1 CTCSS DECODER (ARX 500)</p> <p>1 FILTERED TONE AUDIO 3 N.C. 4 N.C. 5 GROUND 6 TEST ENABLE HIGH NORMAL OPERATION, LOW TEST MODE 7 DECODE LINE 8 +8 V DC</p>	<p>P2 INTERFACE CONNECTOR</p> <p>1 DISCRIMINATOR AUDIO 3 LOCAL PTT 4 REPEATER VOICE MODULATION 5 REPEATER TONE ENCODE MODULATION 6 REPEATER PTT 7 REPEATER MODULATION DISABLE CONTROLLED BY LOCAL REPEAT SWITCH 8 TONE DECODE CONTROL FOR CALL LIGHT ON FRONT PANEL 9 +8 V DC 10 GROUND 11 +13.5 POWER SUPPLY SENSE FOR BATTERY BACKUP RELAY 12 FRONT PANEL POWER LED - INTERNAL POWER SUPPLY LED LIGHTS SOLID, BATTERY BACKUP LED FLASHES 13 +13.5 V DC</p>
<p>P3 COMMUNITY PANEL INTERFACE</p> <p>1 ENCODE FREQUENCY SELECT LINE 2 N.C. 3 ENCODE FREQUENCY SELECT LINE TONE #1 4 TONE DECODE LINE FROM ARX 200 ALL TONES 5 FILTERED TONE AUDIO 6 TONE #1 DECODE LINE TO ARX 200 7 ENCODE FREQUENCY SELECT LINE HIGH SIDE 8 TONE #1 TEST ENABLE LINE 9 +8 V DC 10 GROUND</p>	

CONTROL BOARD JUMPER SELECTIONS

- J1 MUST BE CUT ONLY WHEN ARX 200 USED
- J2 MUST BE CUT ONLY WHEN ARX 200 USED
- J3 IF CUT ENCODE TONE WILL PASS TO EXCITER ONLY IF P02 AND P03 ARE SHORTED
- J4 TONE #1 TEST MODE WHEN IN NORMAL OPERATION THIS JUMPER SHOULD BE CUT, IF ARX 200 IS USED.
- J5 TOT-WARNING TONE CUT TO DISABLE TONE
- J6 TOT-CUT TO DISABLE TOT

CONTROL BOARD PUSH PIN IDENTIFICATION

- P01 COS LINE-(CMOS LEVEL) TONE 7 CARRIER CONTROLLED DEPENDING ON SI SETTING.
- P02 ENCODE ENABLE OR DISABLE--IF J3 IS CUT , THESE PINS MUST BE SHORTED TO ENABLE TONE ENCODE AUDIO.
- P03 ENCODE ENABLE OR DISABLE--IF J3 IS CUT , THESE PINS MUST BE SHORTED TO ENABLE TONE ENCODE AUDIO.
- P04 REPEAT AUDIO

FEED THRU

RECEIVER

FT 1 TO VR501 (VOLUME CONTROL) HIGH SIDE
 FT 2 TO VR502 (SQ. CONTROL) WIPER
 FT 3 TO VR502 (SQ. CONTROL) LOW SIDE
 FT 4 TO SW501 (MONITOR SWITCH)
 FT 5 TO D502 (CALL LED CATHODE)
 FT 6 TO J2-8 CTCSS DETECT
 FT 7 TO SPEAKER SP501
 FT 9 TO VR501 (VOLUME CONTROL) LOW SIDE
 FT10 TO VR501 (VOLUME CONTROL) WIPER
 FT11 TO VR 502 (SQ. CONTROL) HIGH SIDE
 FT12 TO D501 (BUSY LED CATHODE)
 FT13 TO J2-1 LOW LEVEL RECOVERED AUDIO
 FT14 +8 VOLT
 FT15 TO D501 (BUSY LED) ANODE
 FT16 TO RELAY COMMON +13.8V DC

EXCITER

FT17 TO D500 TX LED
 FT18 TO CONTROL PCB IC604-4
 FT19 GROUND
 FT20 TX AUDIO INPUT (J507-4)
 FT21 PTT
 FT22 GROUND
 FT23 TO P.A. R309 TX LED
 FT24 TO P.A. R304 ALC
 FT25 TO P.A. R310 APL
 FT26 TO 13.8V SW 700-2

J504 ACCESSORY JACK

1 LOW LEVEL AUDIO (YELLOW)
 2 C.O.S. (WHITE)
 3 PTT (GREEN)
 4 +13.8 V DC (RED)
 5 GROUND (BLACK)
 6 LOCAL MIC INPUT (PINK)
 7 AUDIO AMP OUTPUT (VIOLET)
 8 HIGH SIDE OF SPEAKER (GRAY)
 9 OPTION

NOTE: JUMPER PLUG MUST BE INSTALLED TO ENABLE THE LOCAL SPEAKER

J507 MICROPHONE JACK

1 +8 V DC
 2 GROUND
 3 LOCAL PTT
 4 MIC INPUT (AUDIO)
 5 MONITOR

PUSH PINS ON RECEIVER BOARD

P02 TO D501 (BUSY LED) ANODE P03 +8 V DC RX P04 +8 V DC P05 TO SP 501 (SPEAKER) P06 TO SW501(MONITOR SWITCH) P08 HIGH LEVEL AUDIO 9SPEAKER) P11 +13.8 V DC P14 +8 V DC P15 +8 V DC	P16 TO VR501 (VOLUME CONTROL) HIGH SIDE P17 SQUELCH MUTING P18 CALL LATCH CONTROL P22 RECOVERED AUDIO P23 ALERT TUNE INPUT P24 +8 V DC P26 GROUND P27 GROUND P28 GROUND
--	---

ARX 400 19 INCH RACK MOUNT BRACKETS

The ARU 251 UHF repeater and the ARH 351 VHF repeater may be mounted in a 19 inch rack using the ARX 400 brackets. There are two (2) brackets in the kit, one left side bracket, and one right side bracket.

INSTALLATION INSTRUCTIONS

1. Remove the four (4) rubber feet from the bottom of the repeater.
2. Remove the screws from the feet and insert them in through the holes in the bracket to the bottom plate.
3. Tighten Securely.

The brackets are made so that the screws securing the top cover can be removed without removing the ARX 400 brackets.

ARX 500

CONTINUOUS TONE — CONTROLLED SQUELCH

GENERAL

The ARX 500 is a TUNABLE SINGLE TONE DECODER for use with the Uniden/Force repeaters.

THEORY OF OPERATION

The tone selection is determined by the resistor network composed of R1, R2, and VR1. The jumpers JP1 and JP2 are used to select the correct CTCSS frequency range. Refer to the CTCSS frequency chart below for the correct jumper arrangement. The received signal is applied to pin 1 of DE-390. When a proper decode tone is received, pin 9 of the DE-390, goes high opening the squelch circuit.

INSTALLATION

1. Plug the ARX 500 into the seven pin header strip (P1) on the control board, or P802 to P808 on the community repeater panel. Pin 2 of the ARX 500 is plugged to prevent installing the decoder in backwards.

ARH 351 ONLY: STEPS 2 THROUGH 6

2. Remove the four (4) screws securing the control board to the receiver box cover, disconnect the cable at P2, and remove the control board from the unit.
3. Install IC605 (DE-390) in the control board, solder and trim leads to prevent any possible shorts.
4. Remove the four (4) screws securing the receiver box cover, and remove the cover.
5. Move the Brown wire from push pin P27 or P26 to push pin P06.
6. Reassemble the receiver box cover and the control board.

ALIGNMENT PROCEDURE

1. Cut jumpers JP1 and JP2 (located on the ARX 500) for desired frequency range.
2. **Key the transmitter** and adjust VR1 (located on the ARX 500) to obtain the correct tone frequency.
3. Adjust the CTCSS deviation to about 700 Hz. See service manual.
4. Adjust total system deviation to 4.7 kHz. See service manual.

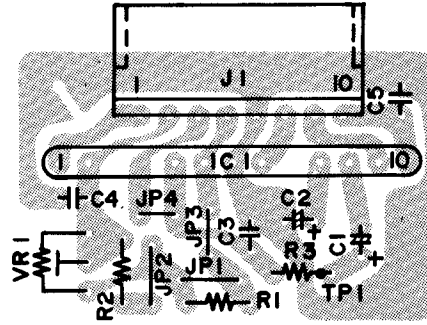
CTCSS FREQUENCY CHART

FREQUENCY	JP1	JP2
60 - 135 Hz	CUT	CUT
125 - 165 Hz	CUT	IN
160 - 300 Hz	IN	IN

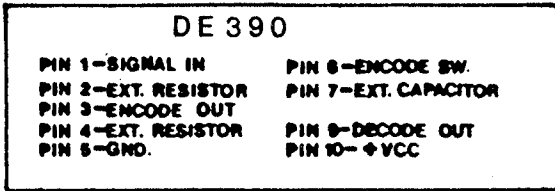
ELECTRICAL PARTS LIST

SYMBOL NUMBER	DESCRIPTION	UNIDEN PART NUMBER	I
C2	TT 0.47UF 16V	1800-0611	
C3	CD 0.001UF 50V M YD	1800-0117	
C4	CD 0.001UF 50V M YD	1800-0117	
C5	CD 0.001UF 50V M YD	1800-0117	
IC1	DE-390 CTCSS IC	2000-1001	
R1	MF 33K ohm 1/4W F	19-2014-3331	
R2	MF 56K ohm 1/4W F	19-2014-5631	
R3	CF 1 ohm 1/4W J	19-0014-1085	
VR1	250 K ohm		
J1	JK-075 3024-8AH	1100-0061	

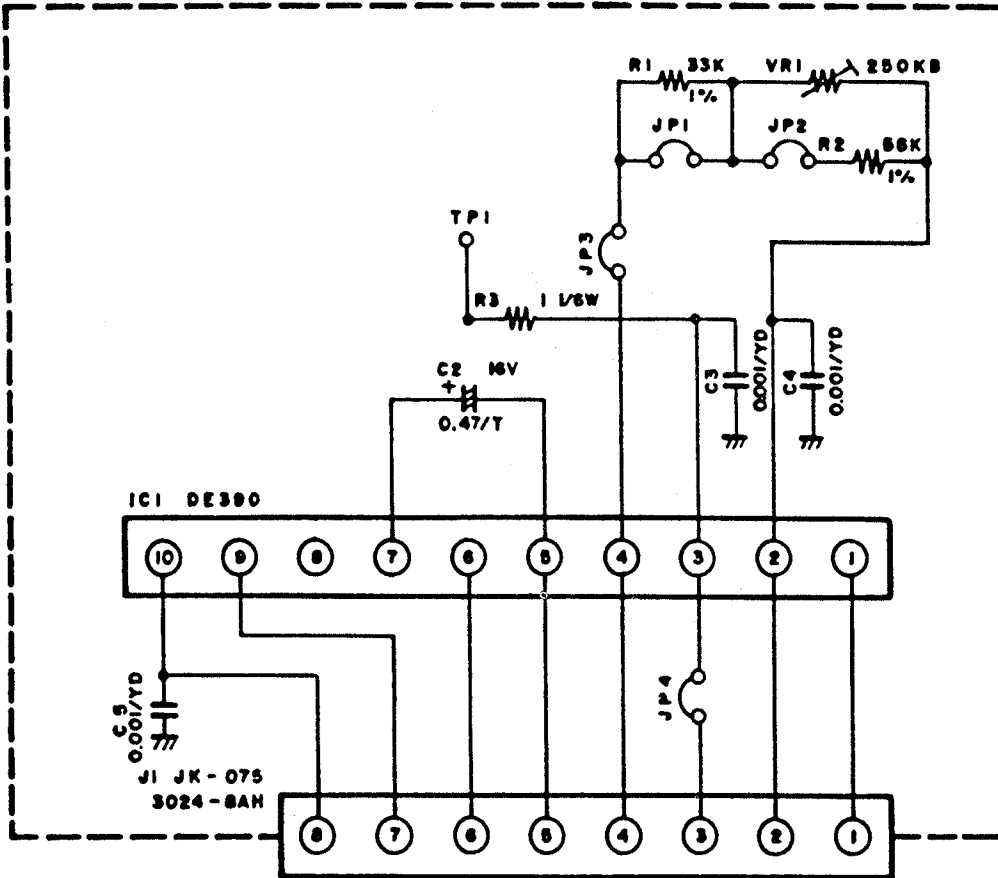
PD-085AA



COMPONENT LOCATION DIAGRAM



PD-085



SCHEMATIC DIAGRAM



UNIDEN AMERICA CORPORATION
Support Engineering Group
Commercial Communications Division
4700 Amon Carter Boulevard
Fort Worth, Texas 76155

REVISION

MODEL: ARH 351

EFFECTIVE DATE: DECEMBER 1, 1989

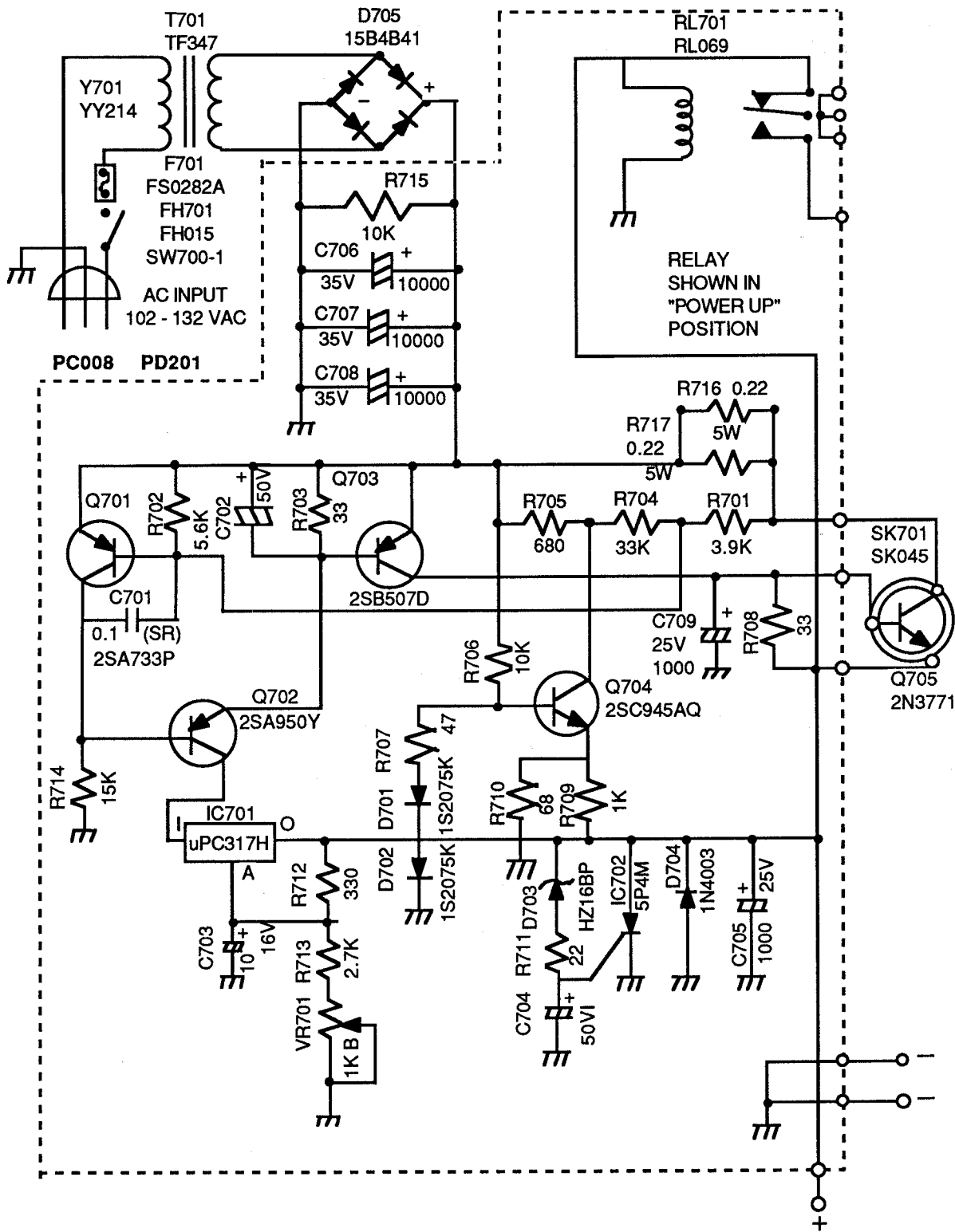
DATE OF NOTICE: NOVEMBER 13, 1989

DESCRIPTION OF CHANGE:

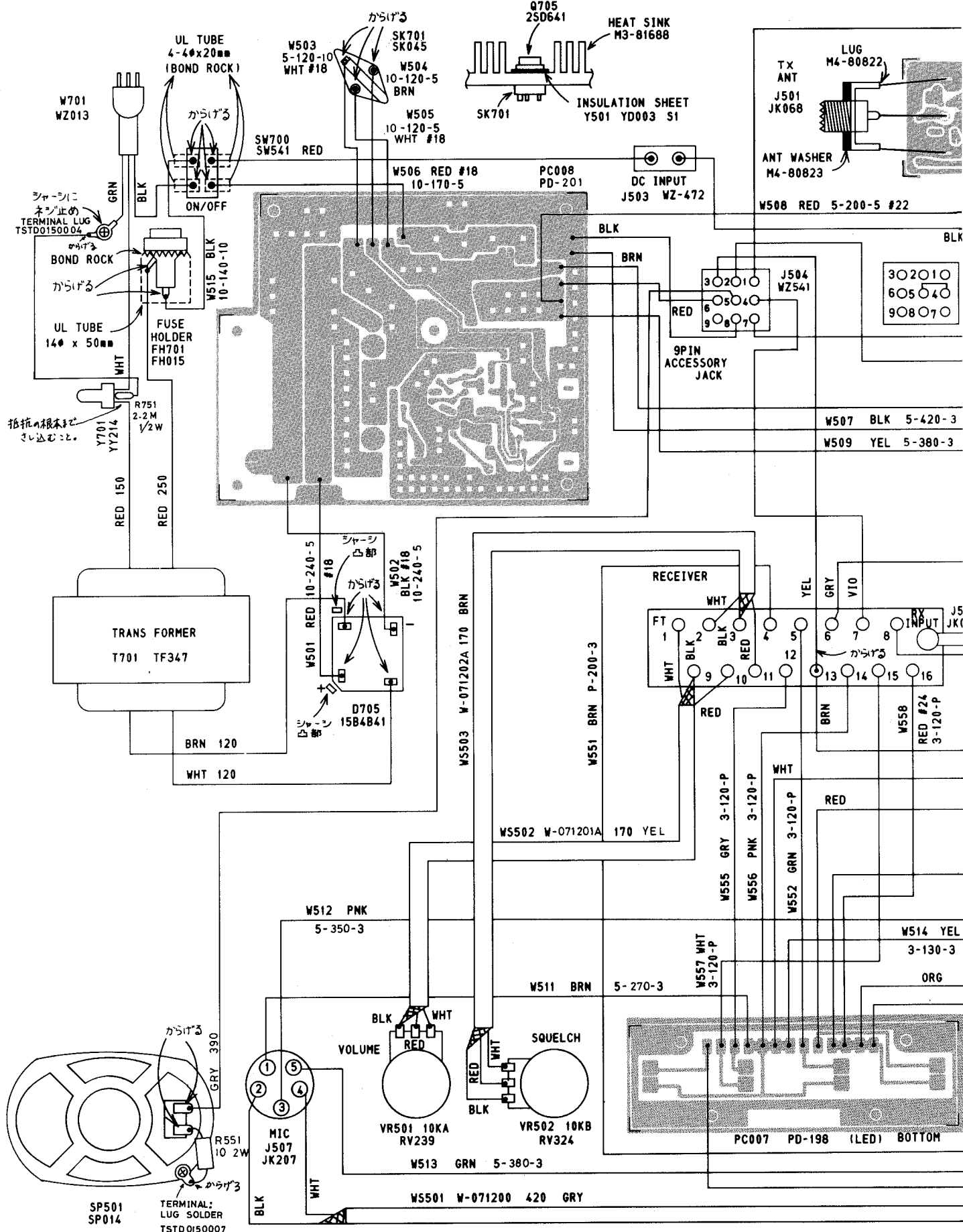
Effective December 1, 1989, significant changes will be made to the Power Supply section of all ARH 351 Repeaters.

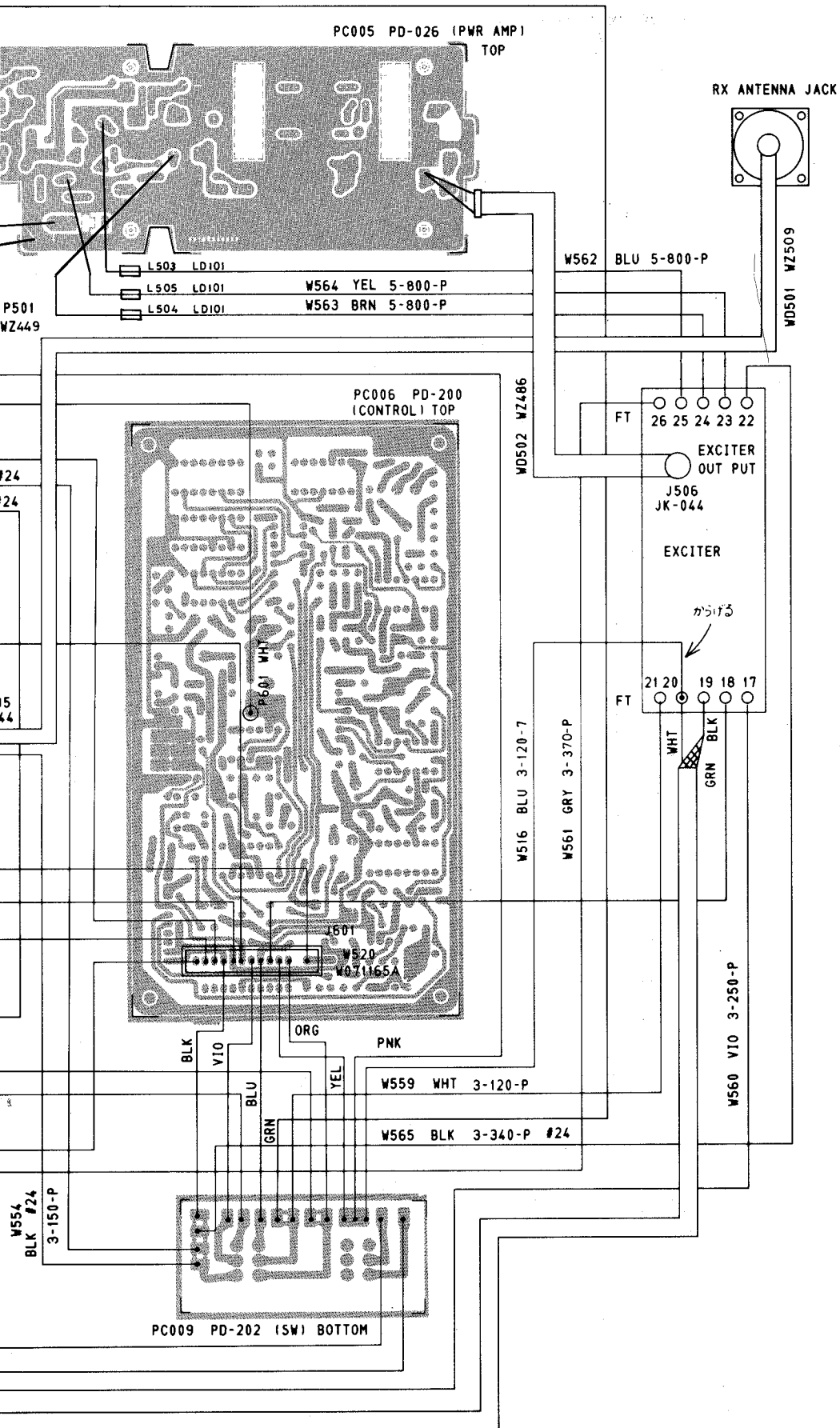
The Regulator PCB assembly, Filter PCB assembly, Bridge Rectifier, and Relay will be replaced. The new PCB assembly (PD201AA) combines the Regulator, Filter, and Relay onto one circuit board.

The Repeater Control PCB (PD200AA) will be replaced with an updated version (PD200AB)

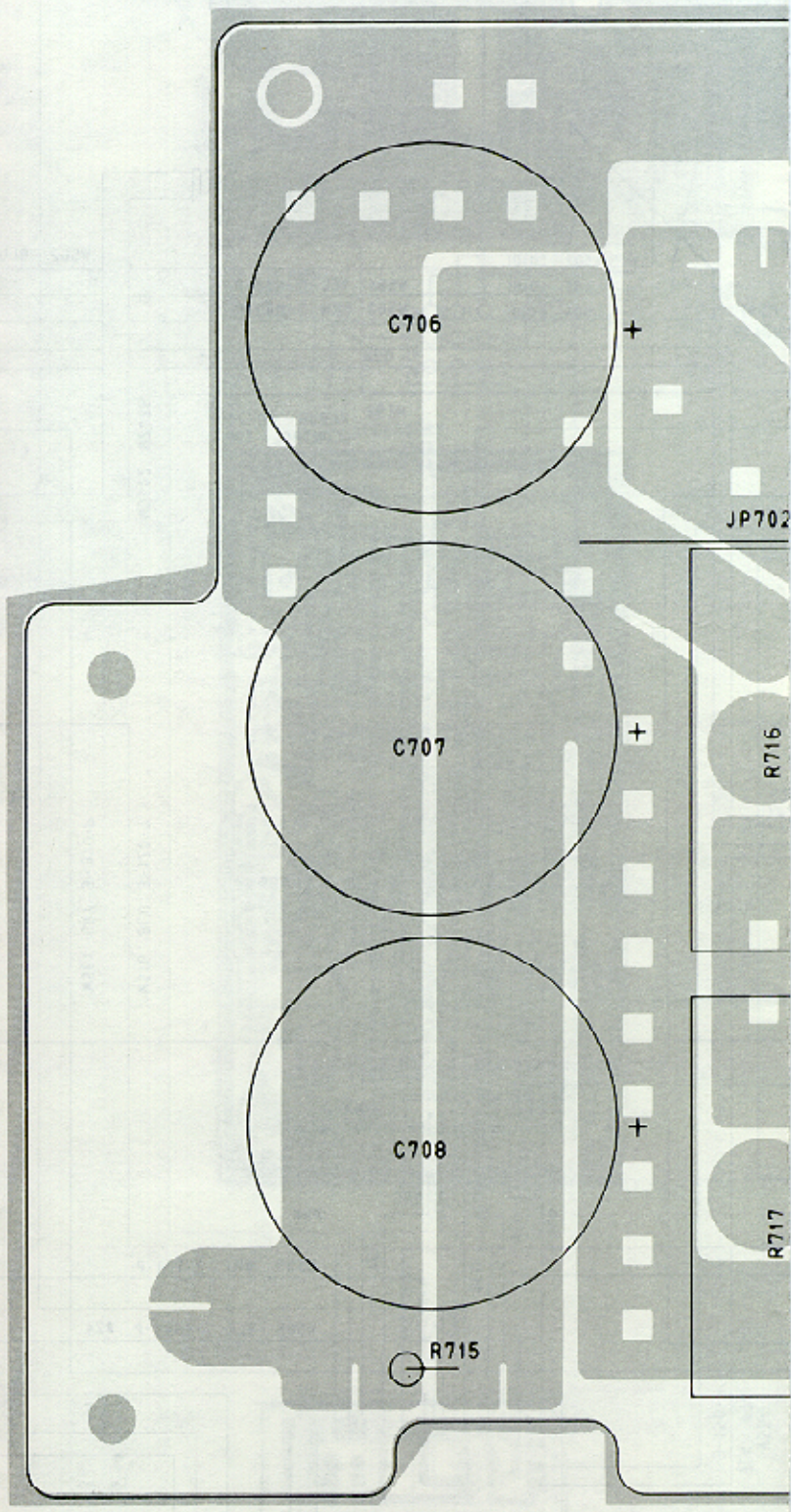


ARH 351 POWER SUPPLY SCHEMATIC DIAGRAM

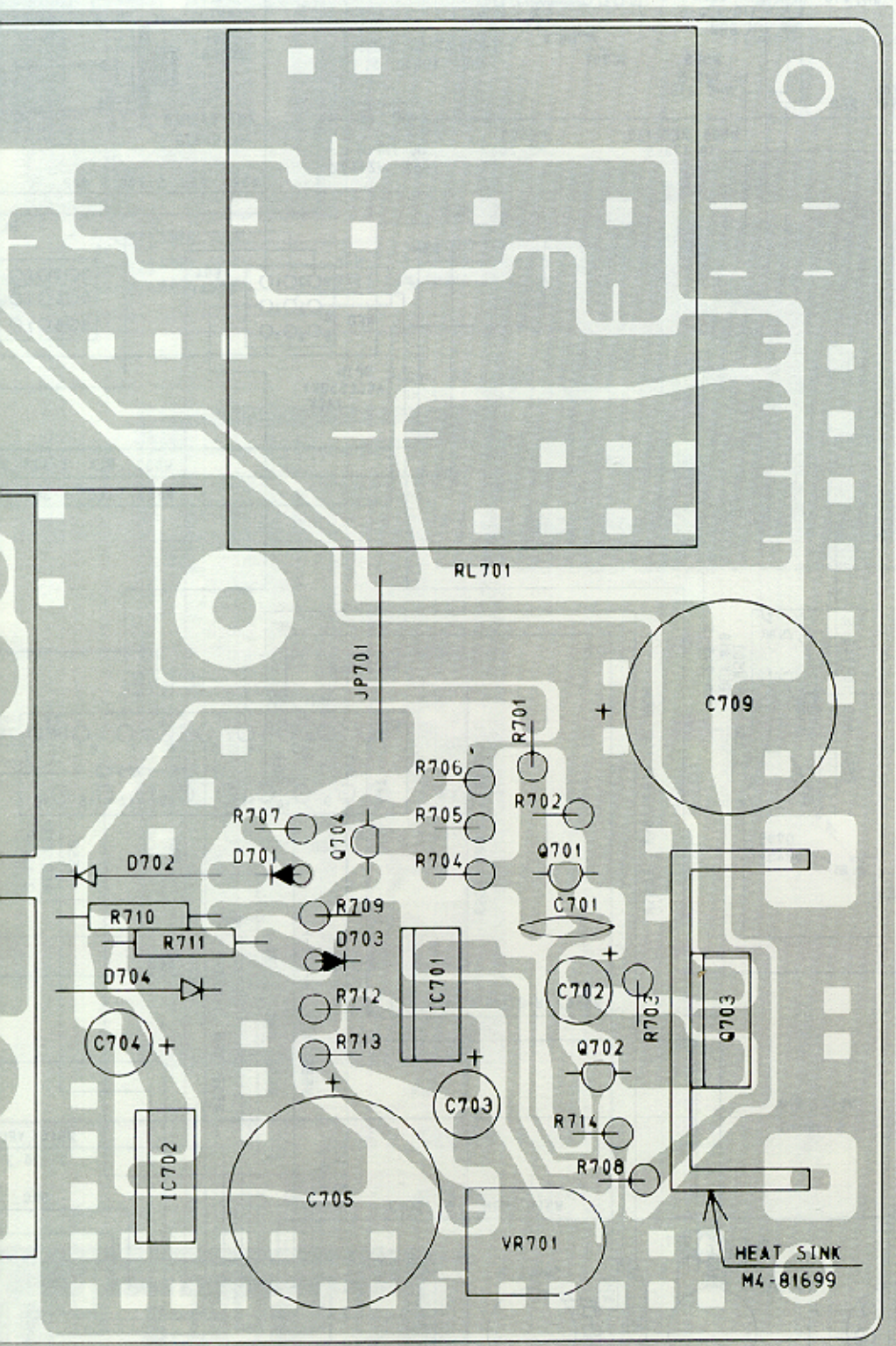


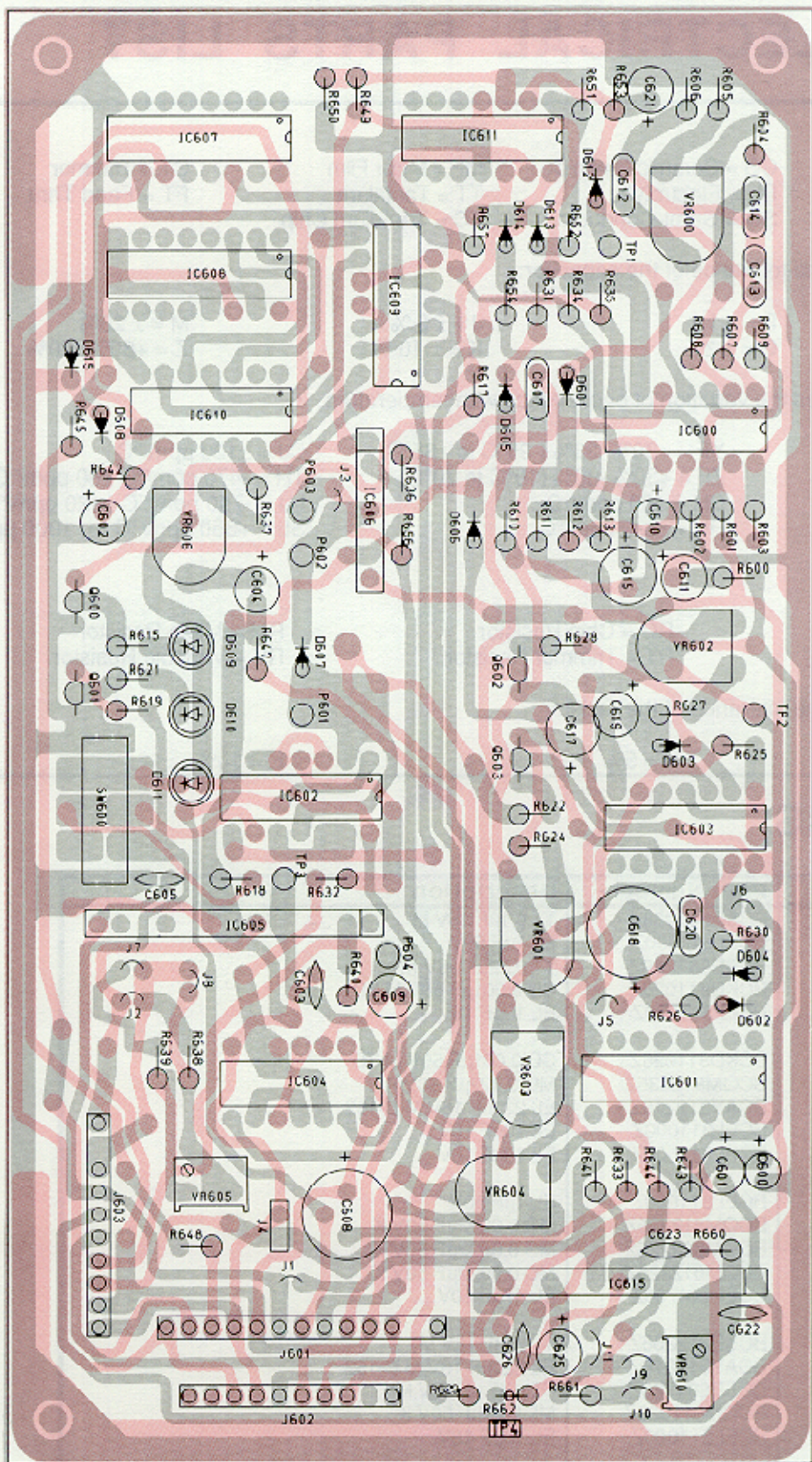


ARH 351 WIRING DIAGRAM



**ARH 351
POWER SUPPLY PCB (PD 201 AA)
BOARD VIEW
COMPONENT SIDE**





**ARH 351
REPEATER CONTROL PCB
BOARD VIEW
COMPONENT SIDE**

ELECTRICAL PARTS LIST

Capacitors

AS = Al Solid CG = Ceramic Gimmick MF = Mylar Film CT = Trimmer
 CC = Chip Capacitor EL = Electrolytic TT = Tantalum FT = Feed Thru
 CD = Ceramic Disk SD = Semi-Conductor TC = Tantalum Chip

The first code indicates the tolerance of the capacitor:

C = ± 0.25 PF F = ± 1 J = ± 5 % M = ± 20 %
 D = ± 0.5 PF G = ± 2 % K = ± 10 % Z = $+80\%$ -20%

The second code Indicates the variation of capacitance with temperature:

YA = ± 5 % YF = $+30\%$ -38% (-25°C to +85°C) CJ = ± 120 ppm/°C
 YB = ± 10 % ZF = $+30\%$ -80% (10°C to 70°C) TH = -470 ppm/°C ± 60 ppm/°C
 YD = $+20\%$ -30% CH = ± 60 ppm/°C UJ = -750 ppm/°C ± 120 ppm/°C
 YE = $+20\%$ -50% RH = -220 ppm/°C SL = $+350$ ppm/°C to -1000 ppm/°C

Resistors

CF = Carbon Film RC = Chip Resistor RM = Micro Resistor
 MF = Metal Film RT = Trimmer Resistor RV = Variable Resistor

The last code Indicates the tolerance of the resistor:

F = 1% J = 5% K = 10%

CAPACITORS

Symbol	Part Number	Description
C600	BCSE661086Z	TT 0.1 μ F 35V M
C601	BCEL811090Z	EL 1 μ F 50V
C602	BCSE662286Z	TT 0.22 μ F 35V M
C603	BCKD811026Z	CD 0.001 μ F 50V M YD
C604	BCEL311000Z	EL 10 μ F 16V
C605	BCKD811026Z	CD 0.001 μ F 50V M YD
C607	BCQM812235Z	MC 0.022 μ F 50V K
C608	BCAY312216Z	EL 220 μ F 16V M C-152
C609	BCEL311000Z	EL 10 μ F 16V
C610	BCEL311000Z	EL 10 μ F 16V
C611	BCEL811090Z	EL 1 μ F 50V
C612	BCQM812225Z	MC 0.0022 μ F 50V K
C613	BCQM812225Z	MC 0.0022 μ F 50V K
C614	BCQM812225Z	MC 0.0022 μ F 50V K
C615	BCEL114700Z	EL 47 μ F 10V
C617	BCSE212206Z	TT 22 μ F 16V M
C618	BCAY312216Z	EL 220 μ F 16V M C-152
C619	BCSE664786Z	TT 0.47 μ F 35V M
C620	BCQM811035Z	MF 0.01 μ F 50V K
C621	BCEL311000Z	EL 10 μ F 16V
C622	BCKD811026Z	CD 0.001 μ F 50V M YD
C623	BCKD811026Z	CD 0.001 μ F 50V M YD
C625	BCEL811026Z	EL 0.47 μ F 50V
C626	BCKD811026Z	CD 0.001 μ F 50V M YD
C701	BCGC511045Z	SD 0.1 μ F 25V K

Symbol	Part Number	Description
C702	BCEL811090Z	EL 1 μ F 50V
C703	BCEL311000Z	EL 10 μ F 16V
C704	BCEL811090Z	EL 1 μ F 50V
C705	BCAY511026Z	EL 1000 μ F 25V M C-152
C706	BCAR661036Z	EL 10,000 μ F 35V M C-132
C707	BCAR661036Z	EL 10,000 μ F 35V M C-132
C708	BCAR661036Z	EL 10,000 μ F 35V M C-132
C709	BCAY511026Z	EL 1000 μ F 25V M C-132

DIODES

Symbol	Part Number	Description
D601	BDAY0063001	1S2075K
D602	BDAY0063001	1S2075K
D603	BDAY0063001	1S2075K
D604	BDAY0063001	1S2075K
D605	BDAY0063001	1S2075K
D606	BDAY0063001	1S2075K
D607	BDAY0063001	1S2075K
D608	BDAY0063001	1S2075K
D609	BDAY0122001	TLY124 Yellow LED
D610	BDAY0116001	TLG-124A Green LED
D611	BDAY0100001	TLR-124 Red LED
D612	BDAY0063001	1S2075K
D613	BDAY0063001	1S2075K
D614	BDAY0063001	1S2075K
D615	BDAY0272004	HZ9.1BP Zener
D701	BDAY0063001	1S2075K
D701#	BDAY0181001	1S1555
D702	BDAY0063001	1S2075K
D702#	BDAY0181001	1S1555
D703	BDAY0272005	HZ16BP Zener
D704	BDAY0133001	1N400D
D705	BDAY0309001	15B4B41

INTEGRATED CIRCUITS

Symbol	Part Number	Description
IC600	BDEY0356001	LM324N OP-AMP
IC601	BDEY0774001	TC4020BP
IC602	BDEY0129001	TC4011BP
IC603	BDEY0529001	TC4584BP
IC604	BDEY0411001	TC4066BP
IC605	BDEY0390001	DE-390 CTCSS IC
IC606	BDEY0334001	DE-334 Hi-Pass Filter
IC607	BDEY0774001	TC4020BP
IC608	BDEY0188001	TC4017BP
IC609	BDEY0129001	TC4011BP
IC610	BDEY0529001	TC4584BP
IC611	BDEY0356001	LM324N OP-AMP
IC615	BDEY0390001	DE-390 CTCSS IC
IC701	BDEY0773001	UPC317HC
IC702	BDFY0038001	DF-038 5P4M Thyristor

TRANSISTORS

Symbol	Part Number	Description
Q600	BDBC0945507	2SC945A-Q DB-224
Q601	BDBC0945507	2SC945A-Q DB-224
Q602	BDBC0945507	2SC945A-Q DB-224
Q603	BDBC0945507	2SC945A-Q DB-224
Q701	BDBA0733115	2SA7330 DB-003
Q702	BDBA0950124	2SA950-Y DB-010
Q703	BDBB0507104	2SB507-D DB-120
Q704	BDBC0945507	2SC945A-Q DB-224
Q705	2000-0434	2N3771

RESISTORS

Symbol	Part Number	Description
R600	BRUB181034Z	CF 10K Ω 1/4W J (V)
R601	BRUB181024Z	CF 1000 Ω 1/4W J (V)
R602	BRUB181024Z	CF 1000 Ω 1/4W J (V)
R603	BRUB181534Z	CF 15K Ω 1/4W J (V)
R604	BRUB181014Z	CF 100 Ω 1/4W J(V)
R605	BRUB181014Z	CF 100 Ω 1/4W J(V)
R606	BRSS443923Z	MF 3900 Ω 1/4W F(A)
R607	BRUB183334Z	CF 33K Ω 1/4W J (V)
R608	BRUB183324Z	CF 3300 Ω 1/4W J (V)
R609	BRUB181034Z	CF 10K Ω 1/4W J (V)
R610	BRUB188234Z	CF 82K Ω 1/4W J(V)
R611	BRUB181024Z	CF 1000 Ω 1/4W J (V)
R612	BRUB181024Z	CF 1000 Ω 1/4W J (V)
R613	BRUB182234Z	CF 22K Ω 1/4W J(V)
R615	BRUB184714Z	CF 470 Ω 1/4W J(V)
R617	BRUB181034Z	CF 10K Ω 1/4W J (V)
R618	BRUB184714Z	CF 470 Ω 1/4W J(V)
R619	BRUB183934Z	CF 39K Ω 1/4W J (V)
R621	BRUB184714Z	CF 470 Ω 1/4W J(V)
R622	BRUB182734Z	CF 27K Ω 1/4W J (V)
R624	BRUB181034Z	CF 10K Ω 1/4W J (V)
R625	BRUB182734Z	CF 27K Ω 1/4W J (V)
R626	BRUB185624Z	CF 5600 Ω 1/4W J (V)
R627	BRUB184724Z	CF 4700 Ω 1/4W J (V)
R628	BRUB181034Z	CF 10K Ω 1/4W J (V)
R629	BRUB183334Z	CF 33K Ω 1/4W J (V)
R630	BRUB188234Z	CF 82K Ω 1/4W J(V)
R631	BRUB181034Z	CF 10K Ω 1/4W J (V)
R632	BRUB181014Z	CF 100 Ω 1/4W J(V)
R633	BRUB181034Z	CF 10K Ω 1/4W J (V)
R634	BRUB181034Z	CF 10K Ω 1/4W J (V)
R635	BRUB183334Z	CF 33K Ω 1/4W J (V)
R636	BRUB182734Z	CF 27K Ω 1/4W J (V)
R637	BRUB185634Z	CF 56K Ω 1/4W J (V)
R638	BRSS443333Z	MF 33K Ω 1/4W F (A)
R639	BRSS445633Z	MF 56K Ω 1/4W F (A)
R640	BRSS444723Z	MF 4700 Ω 1/4W SF (A)
R641	BRUB181034Z	CF 10K Ω 1/4W J (V)
R642	BRUB182724Z	CF 2700 Ω 1/4W J (V)
R643	BRUB181034Z	CF 10K Ω 1/4W J (V)

Symbol	Part Number	Description
R644	BRUB181034Z	CF 10K Ω 1/4W J (V)
R645	BRUB181224Z	CF 1200 Ω 1/4W J (V)
R647	BRUB181034Z	CF 10K Ω 1/4W J (V)
R648	BRUB184714Z	CF 470 Ω 1/4W J(V)
R649	BRUB181024Z	CF 1000 Ω 1/4W J (V)
R650	BRUB181024Z	CF 1000 Ω 1/4W J (V)
R651	BRUB181834Z	CF 18K Ω 1/4W J (V)
R652	BRUB181034Z	CF 10K Ω 1/4W J (V)
R653	BRUB186834Z	CF 68K Ω 1/4W J (V)
R654	BRUB181034Z	CF 10K Ω 1/4W J (V)
R656	BRUB181034Z	CF 10K Ω 1/4W J (V)
R657	BRUB188234Z	CF 82K Ω 1/4W J(V)
R660	BRSS445633Z	MF 56K Ω 1/4W F (A)
R661	BRSS443333Z	MF 33K Ω 1/4W F (A)
R662	BRPB181094Z	CF 1 Ω 1/4W J (A)
R701	BRUB183924Z	CF 3900 Ω 1/4W J (V)
R702	BRUB185624Z	CF 5600 Ω 1/4W J (V)
R703	BRUB183304Z	CF 33 Ω 1/4W J (V)
R704	BRUB183334Z	CF 33K Ω 1/4W J (V)
R705	BRUB186814Z	CF 680 Ω 1/4W J (V)
R706	BRUB181034Z	CF 10K Ω 1/4 W J (V)
R707	BRUB184704Z	CF 47 Ω 1/4W J (V)
R708	BRUB183304Z	CF 33 Ω 1/4W J (V)
R709	BRUB181024Z	CF 1000 Ω 1/4W J (V)
R710	BRPB186804Z	CF 68 Ω 1/4W J (A)
R711	BRPB182204Z	CF 22 Ω 1/4W J (A)
R712	BRUB183314Z	CF 330 Ω 1/4W J (V)
R713	BRUB182724Z	CF 2700 Ω 1/4W J (V)
R714	BRUB181534Z	CF 15K Ω 1/4W J (V)
R715	BRUB181034Z	CF 10K Ω 1/4W J (V)
R716	BRXM502284Z	CERMET 0.22 Ω 5W J
R717	BRXM502284Z	CERMET 0.22 Ω 5W J

VARIABLE RESISTORS

Symbol	Part Number	Description
VR600	BRTY0526103	RT-526 10KB Ω
VR601	BRTY0526504	RT-526 500KB Ω
VR602	BRTY0526104	RT-526 100KB Ω
VR603	BRTY0526104	RT-526 100KB Ω
VR604	BRTY0526102	RT-526 1KB Ω
VR605	BRTY0494254	RT-494 250KB Ω
VR606	BRTY0526102	RT-526 1KB Ω
VR610	BRTY0494254	RT-494 250KB Ω
VR701	BRTY0526102	RT-526 1KB Ω

CONNECTORS

Symbol	Part Number	Description
J4	BJKY0321002	JK-321 68908-002 2 pin Jack
J601	BJKY0032012	JK-032 5048-12A Jack
J602	BJKY0032009	JK-032 5048-09A Jack
J603	BJKY0032009	JK-032 5048-09A Jack
P601	BTPY0043001	TP-043 Male Push Pin
P602	BTPY0043001	TP-043 Male Push Pin
P603	BTPY0043001	TP-043 Male Push Pin
P604	BTPY0043001	TP-043 Male Push Pin
TP1	BTPY0019001	TP-019 Test Point
TP2	BTPY0019001	TP-019 Test Point
TP3	BTPY0019001	TP-019 Test Point

MISCELLANEOUS

Symbol	Part Number	Description
SW600	BSWY0315001	SW-315 SSFU-22-07 Switch
T701	BTFY0347001	TF-347 Power Transformer