Pace Scan 308 216 208a 108 Service Manual

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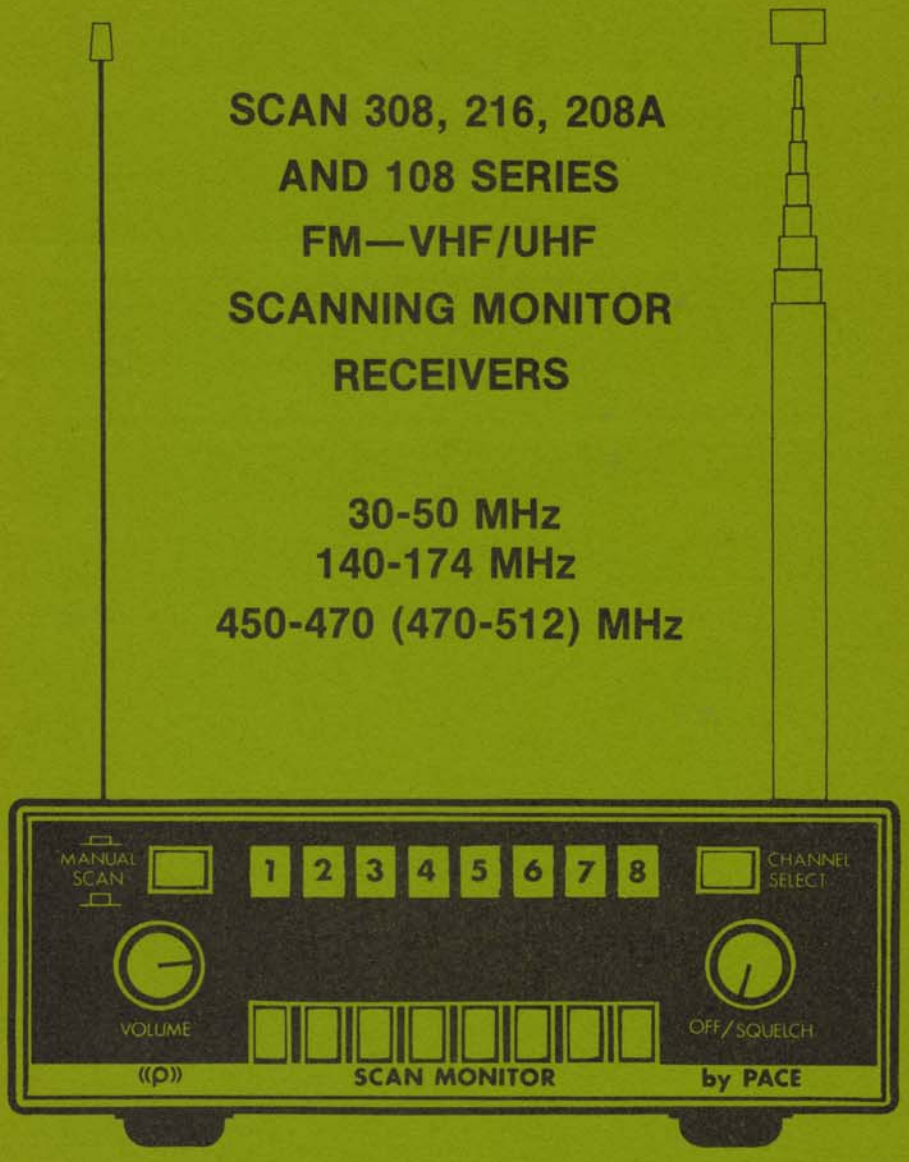
PRICE $2.50

SERVICE MANUAL

SCAN 308, 216, 208A AND 108 SERIES FM—VHF/UHF SCANNING MONITOR RECEIVERS

30-50 MHz
140-174 MHz
450-470 (470-512) MHz



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SECTION I
GENERAL INFORMATION

1.1 GENERAL

This manual contains the necessary information to perform a detailed troubleshooting analysis and complete alignment of the PACE SCAN Models 308, 216, 208A, 108H, 108L, and 108U.

The SCAN 308 is a 3-band simultaneous scanning monitor receiver. It allows simultaneous monitoring of all three Public Safety Radio bands. The receiver automatically scans 16 crystal sockets (eight UHF plus eight VHF High or Low) and gives instant readout of any desired combination of eight channels. Three-position band switches on the rear panel give immediate control of 16 frequencies without the need of opening the case or changing wires.

The SCAN 216 monitors two bands of frequencies at one time. This receiver has the capability of monitoring 16 channels. Two-position band switches on the rear panel provide for a total of eight channel readout at any one time. There may be a total of eight UHF channels installed plus eight VHF High channels.

The SCAN 208A also monitors two bands of frequencies, VHF High and VHF Low. Two-position band switches on the rear panel provide for a total of eight channel readout at any one time. Unlike the SCAN 308 and 216 models, a total of eight channels may be installed.

SCAN Models 108H, 108L, and 108U can each monitor a single band of frequencies in the VHF High, VHF Low, and UHF bands, respectively. There may be from one up to a total of eight crystal channels installed and scanning at any one time.

All SCAN models contain lockout switches on the front panel for the eight channels being scanned. This provides additional control of each scanned channel. Table 1-1 lists receiver band capabilities for all models.

Table 1-1
Scanner Bands

Band	Frequency in MHz	Model Used in					
		108L	108H	108U	208A	216	308
VHF - Low	30-50	X			X		X
VHF - High	140-174		X		X	X	X
UHF	450-470			X		X	X

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Table 1-2
Technical Specifications

FCC Certification	Part 15C
Frequency Range:	
Low Band	VHF 30-50 MHz Any 10 MHz bandwidth, tuned for 37-47 MHz unless specified
High Band	VHF 140-174 MHz Any 12 MHz bandwidth, tuned for 151-163 MHz unless specified
UHF Band	450-470 MHz Any 12 MHz bandwidth, tuned for 454-466 MHz unless specified (Also available for 470-512 MHz)
Crystals:	
Low Band	L-532 (specify frequency)
High Band	H-542 (specify frequency)
UHF Band	U-603 (specify frequency)
Power Supply	117 V AC and 12 V DC negative
Selectivity	50 dB @ 20 kHz separation or better (all bands)
Sensitivity	0.5 µV for 20 dB quieting (all bands)
Squelch Sensitivity (Threshold)	0.4 µV (all bands)
AFC Range (UHF)	± 6 kHz
Audio/Speaker	2 W, 3.2 Ω
Channels	8 continuous scan with individual lockouts
Power Consumption	7 W
Antenna	All models (except 108U) are supplied with VHF telescopic antennas. In applicable models a separate antenna is supplied for UHF. Additional jacks are provided in all models for remotely mounted antennas.
Size	2-1/2" high X 6" wide X 8" deep

1.2 SPECIFICATIONS

Technical specifications for all SCAN models are shown in Table 1-2.

1.3 CRYSTAL INFORMATION

Some crystal manufacturers are still utilizing an obsolete crystal-can with solid metal grounded base. When ordering scan crystals from other than PACE, be sure to specify the glass filled or insulated base.

The old style metal base, if used, must be insulated from the metal crystal sockets in the radio for proper operation. This can be accomplished by inserting the crystal pins through a small piece of tape before inserting the crystal in the socket.

The PACE SCAN Models use a 10.7 MHz IF. The IF crystal is either a 10.245 MHz to mix on the low side, or 11.155 MHz to mix on the high side, depending on unwanted transmitter frequency interference problems in the area. Regardless of high or low side mixing, any crystal specified for other 10.7 MHz IF scan receivers will work in the PACE Scan Monitors.

The reliability of the crystal manufacturer to actually supply crystals cut to proper frequency, to meet other crystal parameters, is most important to obtain the maximum design performance of the PACE Scan Monitor.

The Scan Monitor may be retuned to compensate for minor variations within the crystal specification. This peaking is done at the factory on a no charge basis when crystals are ordered to be factory installed.

1.3.1 Crystal Specifications

Precise PACE crystals may be obtained from the factory. When ordering crystals from other than the PACE Factory, be sure to specify crystal formulas listed in Table 1-3.

1.4 OTHER PERTINENT INFORMATION

All Scanning Monitor Receivers are designed to comply with the necessary government requirements for receiver radiation. They are FCC Certified in compliance with Part 15C. Each country and state has varying regulations concerning the application and use of monitor receivers in the Public Safety Service, or other services. The user is required to be cognizant of these regulations for his country of operation.

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Table 1-3
Crystal Specifications

LOW BAND CRYSTALS (30–50 MHz)

Crystal Frequency	= Channel frequency + 10.7 MHz
Frequency Tolerance	± .001% @ 25 °C ± .005% @ −55 °C to +105 °C
Mode	Series resonnance − 450 Hz, 3rd overtone
Impedance	35 Ω maximum
Holder	HC-25/U

HIGH BAND CRYSTALS (140-174 MHz)

Crystal Frequency	$\frac{\text{Channel frequency} - 10.7\ \text{MHz}}{3}$

Other specifications the same as above.

UHF BAND CRYSTALS (450-470 MHz)

Crystal Frequency	$\frac{\text{Channel frequency} - 10.7\ \text{MHz}}{9}$
Frequency Tolerance	± .001% @ 25 °C ± .005% @ −55 °C to +105 °C
Mode	Parallel 3rd overtone
Load Capacity	18 pF
Drive Level	2 mW
Impedance	35 Ω maximum
Holder	HC-25/U

SECTION II
INSTALLATION PROCEDURES

2.1 GENERAL

To avoid improper performance, a thorough study of this manual is recommended. In particular, the following precautionary notes should be strictly observed.

DO NOT install crystals without inspecting first. If PACE Brand crystals are not available, make sure that the base of the crystal is insulated from the metal crystal sockets.

DO NOT attempt retuning without the proper FM test and service instruments.

DO NOT attempt to connect the power cord with the power on. The monitor is wired for 12 volt negative ground and 117 volt AC operation. Both power cords are supplied and plug into the same 4-pin socket.

DO NOT connect the antennas with the power on. If signals are weak and hard to pick up, an external antenna with more height may be installed. However, the furnished antenna must first be disconnected for proper match with the external antenna systems. It may be necessary to retune the monitor to favor sensitivity on the specific weak or distant channel.

2.2 ANTENNAS

Two antennas are provided with the SCAN 308 and SCAN 216.

1. Telescopic antenna with the threaded base fits into the antenna opening in the top case and is adjusted for best reception of both low and high VHF signals. Turn gently clockwise after inserting in the case and locating over the threaded stud mounted on the printed circuit (PC) board. There is also a rear jack for connecting a VHF High/Low external antenna (we recommend PACE PS5611, or similar, for picking up weaker signals in the VHF high or low band). The telescopic antenna must be removed when using an external antenna.

2. The short antenna with the pin plug is for UHF reception. This antenna plugs into the receptacle on the rear panel marked UHF ANT. For receiving weak or distant UHF signals, an external UHF antenna is recommended. External antennas should always be installed at the highest possible elevation for greatest reception range.

Only one antenna for the appropriate band (VHF or UHF) is provided with all other models.

2.3 INSTALLATION FOR AC OPERATION

1. Plug the 4-pin receptacle into the pronged pins in the rear panel, and plug in the AC power cord into any 117 volt AC 60 cycle socket.

2. Insert the telescopic antennas as referred to in the ANTENNA section above.

3. If a remote speaker is required, plug into the auxiliary speaker position in the back of the set.

4. If using the receiver in a building containing heavy electrical machinery or many fluorescent lights, it is recommended to run a grounding wire from the case or rear panel to a metal pipe or structure to minimize interference from electrical power line noises.

2.4 INSTALLATION FOR MOBILE OPERATION

The Scan Monitor may be operated in any truck or car with the use of mobile antennas. The red power lead is connected directly to the positive terminal of the battery and plugged into the 4-pin socket on the rear panel. Grounding is obtained through the antenna mounting, however, if grounding is not sufficient a separate ground wire may be connected from the case or the rear panel to the nearest negative ground point.

Two mobile monitor antennas are recommended. Separate antenna with RCA pin-type plug utilized for UHF reception and a combination High/Low VHF Base Loaded Mobile antenna with a Motorola pin-plug type connector on the end of the coaxial cable can be utilized for VHF reception.

Locate two holes to match the locking mobile mounting bracket. This bracket may be bent to slide around the side, rather than slide back and forth across the cover, to prevent scratching. This mounting bracket is provided with a locking latch that will accept a small padlock and discourage theft.

2.5 CRYSTAL INSTALLATION

2.5.1 SCAN 308

Up to 16 crystals may be installed in the SCAN Model 308 at one time. Eight crystals may be UHF and eight crystals may be any combination of high or low VHF. Care must be taken to install the UHF crystals in the proper bank marked UHF. The VHF High or Low must be installed in the bank marked VHF (behind transformer). See Figure 2-1(A).

The 3-position program switch on the rear panel will select the particular band to be monitored in the crystal position which that switch controls. For instance:

if in the two crystal sockets which are available for Channel 1 position, there is

(a) a 456.5 MHz crystal in the UHF #1 socket, and

(b) a 156.5 MHz crystal in the VHF High/Low #1 socket,

the operator would have the option of:

(a) listening to 456.5 MHz in the #1 light position by putting the back panel switch marked #1 to the UHF (full up), or

(b) listening to 156.5 MHz on the #1 light position by putting the back panel switch marked #1 to the High (middle) position.

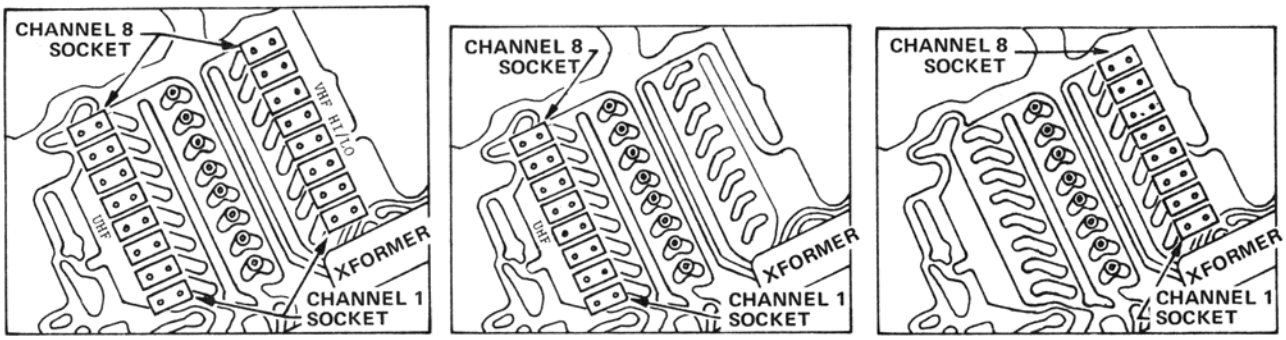

Figure 2-1. Crystal Socket Locations for (A) Models 308 and 216, (B) Models 208A, 108H and 108L and (C) Model 108U

With the back panel #1 switch in the Low (full down) position nothing will be heard unless the crystal in the VHF bank in position #1 were changed from the present 156.5 MHz to a frequency in the 30-50 MHz range.

2.5.2 SCAN 216

Crystal installation procedures for the SCAN 216 are the same as described in Section 2.5.1, except that only high band VHF crystals may be used, and there is only a 2-position program switch on the rear panel.

2.5.3 SCAN 208A

The SCAN 208A operates in the High and Low VHF bands only. Up to eight crystals may be installed in any combination of VHF High or Low channels. See Figure 2-1(B). This model also utilizes a 2-position program switch on the rear panel.

2.5.4 SCAN 108 Series

Each model in this series operates on a single band as described in Section 1.1. Therefore, all crystals used must be for the appropriate band. See Figure 2-1(B) and (C). No program switch is required for these units.

NOTES

SECTION III
PRINCIPLES OF OPERATION

3.1 GENERAL

This section provides a general description of the operating principles of the SCAN Models 308, 216, 208A, and the 108 Series scanning monitor receivers. Major circuits and system operation are described.

The SCAN 308 is the basic model of the group. It is capable of monitoring channels in three bands; UHF, VHF High and VHF Low. All other models in the group have scanning capabilities in only one or two of these bands as described in Section 1.1.

Each of the scanners has a separate oscillator for UHF or the VHF bands as applicable, with the VHF oscillator common to both the high and low bands. RF circuitry used for all three bands are similar, and all other circuits are identical with minor variations. Therefore, only the VHF low band circuit of the SCAN 308 will be described. Refer to the simplified block diagram in Figure 3-1 and schematics in Section VI.

3.2 RECEIVER DESCRIPTION

The receiver is a double conversion superheterodyne using crystal controlled oscillators. The first mixer (Q304) uses low side injection from oscillator Q309. This results in a first IF frequency of 10.7 MHz which is coupled to the second mixer (IC101) via L306 and L101. The second mixer receives high side injection from the 10.245 MHz oscillator Q101 which results in the second IF frequency of 455 kHz. The output of IC101 passes through ceramic filter FL101 to the FM IF amplifier/limiter/detector IC102.

Audio output from the limiter is coupled to pre-amplifier Q401 via C125. The output from Q401 is coupled to phase inverter Q402 via volume control (R1) and C404; and on to the complementary amplifier consisting of Q403 through Q406 and associated circuitry. Finally, output from the audio power amplifier is fed to the speaker via C406.

3.2.1 Squelch Circuit

A second output from terminal 1 of detector IC102 passes through a high-pass filter (R107, R108, and C120), and on to the base of noise amplifier Q102 via squelch control R2 and C123. The noise is rectified by C412 and R417 and coupled to squelch detector Q103. With increased squelch, switch Q407 is turned on resulting in decreased gain of the audio pre-amplifier.

3.2.2 Scanning Logic

With no signal present Q408 is cut off. This permits scan trigger oscillator (Q409/Q410) to oscillate and supply clock pulses to the decade counter (IC401). Pulses from the counter are decoded in IC402 which produces a series of negative pulses. The negative pulses are sequentially applied to each of the crystals in both the VHF and UHF oscillators. These negative pulses are simultaneously applied to the bases of DC switches Q302 and Q308, which turn on the appropriate oscillator and RF amplifier as determined by the S5 switch settings. Scanning continues until a signal is received on one of the channels.

When a signal is present, Q408 goes into full conduction which shunts the emitter of Q409 to ground. This turns off the scan trigger oscillator and the scanner locks in on that channel.

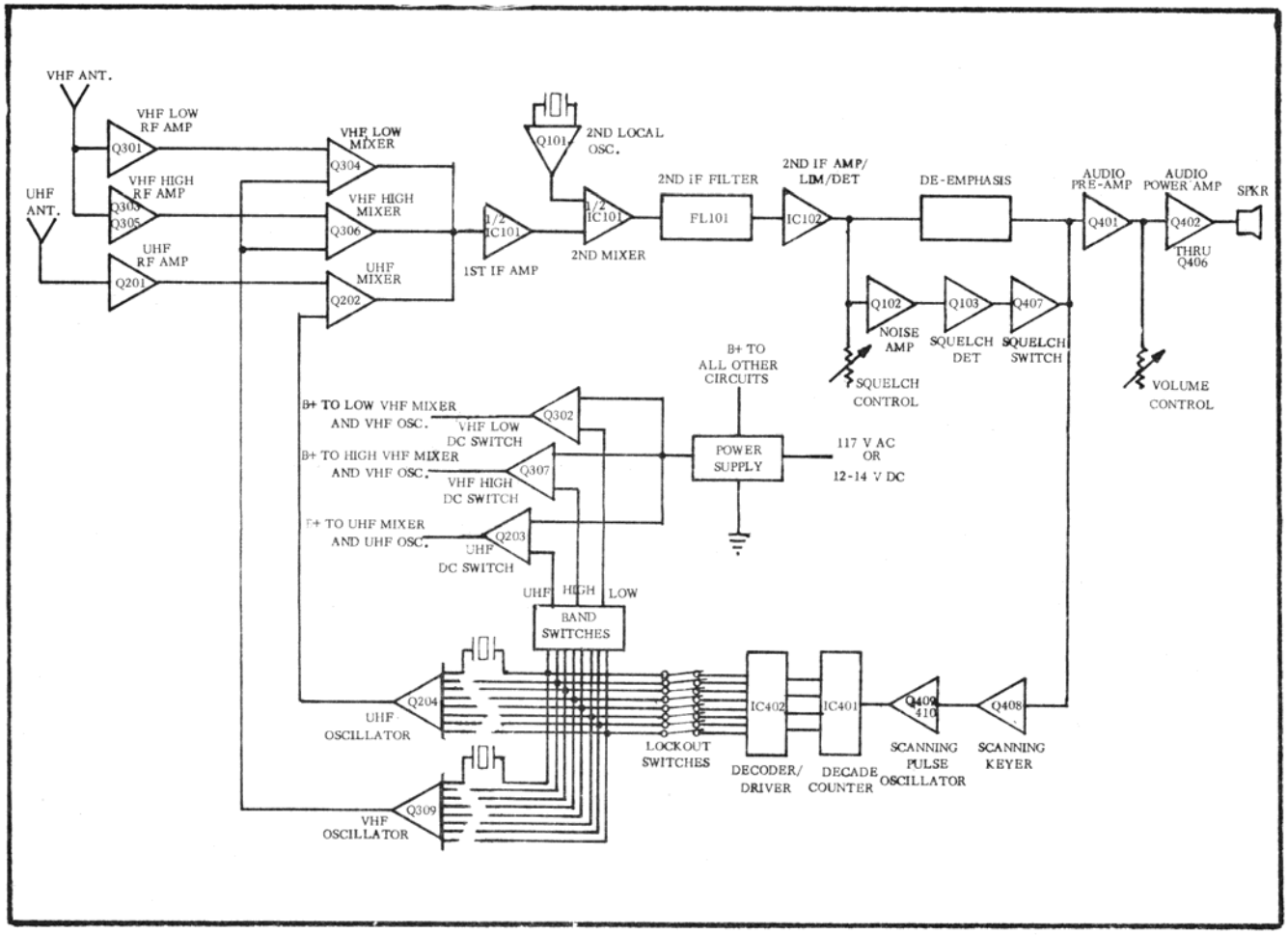

Figure 3-1. SCAN 308 Block Diagram

SECTION IV
MAINTENANCE PROCEDURES

4.1 GENERAL

This section contains maintenance instructions for all scan models in the series. The procedures given in this section assume a general knowledge of communications FM type receivers and a familiarization with transistors and integrated circuits (IC's).

4.1.1 Tools and Techniques

A list of recommended tools and test equipment required for maintenance operations is presented in Table 4-1. Aside from the items listed, hand tools and equipment commonly used in the maintenance of electronic equipment are sufficient for maintenance operations.

It is recommended that maintenance adjustments and repairs be performed only by experienced personnel familiar with the equipment. In some cases, minor changes in voltage levels may be corrected by adjusting trim potentiometers located in the affected circuits. Standard practices in the electronic industry should be observed in checking and/or replacing system components.

Table 4-1
Recommended Tools and Test Equipment

Item	Model or Description
VOM	Simpson 260 or equivalent
AC VTVM	Simpson 715 or equivalent
RF VOLTMETER	Boonton 91H or equivalent
SIGNAL GENERATOR	Singer-Gertsch FM-10 or equivalent

4.1.2 Parts Identification

For printed circuit (PC) board component location, refer to illustrations and schematics in Section VI.

4.2 PREVENTIVE MAINTENANCE

The receiver requires minimal maintenance due to the nonmechanical nature of the equipment. However, a preventive maintenance program consisting of electrical checks is recommended as an aid in obtaining maximum operating efficiency from the system. A schedule of recommended maintenance operations is shown in Table 4-2. Procedures describing the operations listed in the table are presented in subsequent paragraphs.

Table 4-2
Preventive Maintenance Schedule

Time Interval		Maintenance Operation
Semi-Annual	Annual	
X	X	Voltage Check, DC Power Supply
X	X	Visual Inspection
X	X	Clean Chassis Components
X	X	Blow Out Dust

4.2.1 Semi-Annual Voltage Check

The semi-annual voltage check consists of checking all DC power supply output voltages to verify that voltages are within specified limits. Output voltage levels should be as noted in Table 4-3. These voltages are based upon a nominal input of 117 volts AC ± 10%. See Figure 4-1 for test point locations.

Table 4-3
DC Voltage Chart

Test Point	DC Voltage
A - (+) Side of C414	14 V ± 0.5 V
B - (+) Side of C415	10 V ± 0.5 V
C - (+) Side of C416	5 V ± 0.5 V

4.2.2 Semi-Annual Maintenance Check

The purpose of this maintenance check is to verify the general operational status of the receiver. In addition to including the DC power supply voltage check described in Section 4.2.1, it includes a visual inspection of the unit and a general cleaning of all potentiometers, switches, plugs, and jacks. To conduct the semi-annual maintenance check, proceed as follows:

1. Visually inspect each PC board for evidence of overheated components, excessive dirt, or foreign material, or other physical damage. Inspect all connectors for dust corrosion or foreign material.

NOTE

Replacement or repair of the PC board is recommended if any of the components show evidence of overheating, thus preventing possible failure during system operation.

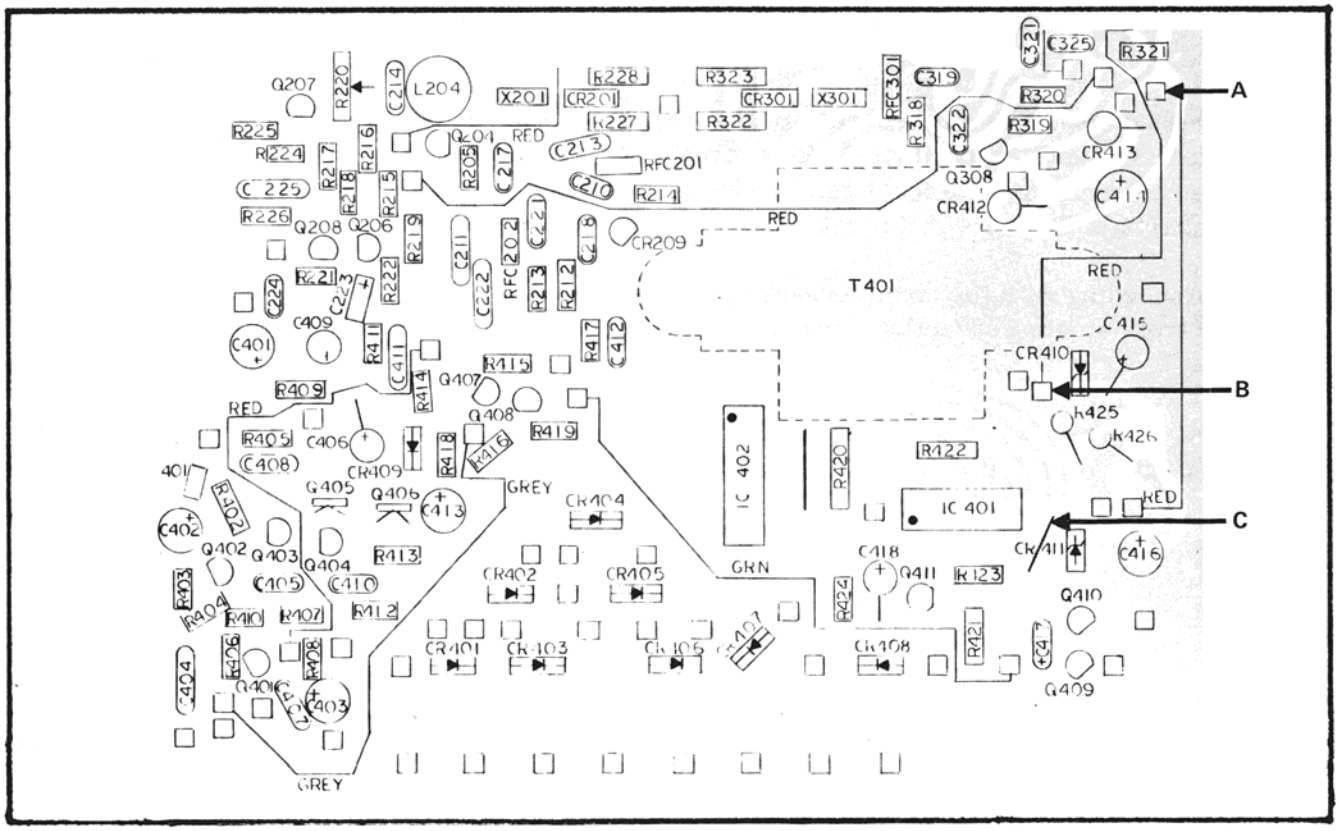

Figure 4-1 DC Voltage Test Point Location

2. Blow out all dust from chassis and PC board components.

3. Clean and lubricate all potentiometer switches, plugs, and jacks.

4. Upon completion of the visual inspection and cleaning procedure, energize the unit and check power supply output voltage levels as described in Section 4.2.1.

4.3 CORRECTIVE MAINTENANCE

Corrective maintenance operations entail receiver checks and adjustments which are not part of preventive maintenance procedures. Operational malfunctions which require corrective maintenance may usually be corrected by an adjustment or PC board replacement. If necessary to make repairs at the component level, such repairs should be made by maintenance technicians who are familiar with the equipment and electronic repair techniques. Refer to Section V for alignment and adjustment procedures.

4.4 TROUBLESHOOTING

It is recommended that a functional analysis approach be used to locate the cause of the receiver malfunction. Troubleshooting can be simplified by reference to the schematic diagrams in Section VI.

Standard troubleshooting procedures, such as signal injection and signal tracing, should be used in locating faulty circuits. Once the trouble has been isolated to a particular circuit, the defective component can be localized by voltage and resistance measurements. Refer to voltage charts in Tables 4-4 through 4-8.

Before proceeding with the troubleshooting procedures, the entire installation should be checked for defective antenna connections and loose or broken supply cables and plugs.

Voltages were measured with an ohmmeter having a 20,000 ohm/volt sensitivity, with 13.8 volt ± 10% DC input and no crystals installed. Measurements were made in manual mode unless otherwise indicated. All voltages are positive and have a tolerance of ± 10%.

Table 4-4
IF, Squelch Amplifier Board Voltage Chart

Transistors			
Reference Number	DC Voltage		
	E	B	C
Q101	4.2	3.6	8.6
Q102	3.8	4.4	5.8
Q103	10.0	10.0	SQ 9.5 UNSQ 0.0

Integrated Circuits					
Pin No.	DC Voltage		Pin No.	DC Voltage	
	IC 101	IC 102		IC 101	IC 102
1	0.7	3.8	8	4.4	0.0
2	0.0	3.6	9	8.6	-
3	0.0	-	10	3.6	1.5
4	0.7	1.5	11	-	-
5	0.0	1.5	12	-	-
6	8.6	1.5	13	-	9.6
7	0.0	0.0	14	-	4.2

Table 4-5
UHF RF Section* Voltage Chart

Transistors			
Reference No.	DC Voltage		
	E	B	C
Q202	0.8	1.5	9.0
Q203**	10.0	9.4	10.0
Q204	3.4	4.2	9.2
Q205	0.0	0.4	9.6
Q206	9.4	9.2	3.5
Q207	2.4	3.0	9.2
Q208	2.4	3.2	9.2
	D	S	G
Q201	9.0	0.0	0.0

* Switches in UHF positions (Models 308 and 216 only).
** Not used in Model 108U.

Table 4-6
VHF RF Section* Voltage Chart

Transistors				
Reference No.		DC Voltage		
		E	B	C
Q302	High	10.0	9.4	0.0
	Low	10.0	9.0	10.0
Q304	High	0.4	0.0	9.6
	Low	0.4	1.0	9.6
Q306	High	0.4	1.0	9.6
	Low	0.4	0.0	9.6
Q307	High	10.0	9.0	10.0
	Low	10.0	9.4	0.0
Q308	High	10.0	9.8	9.0
	Low	10.0	9.8	9.0
Q309	High	2.7	3.5	9.5
	Low	2.7	3.5	9.5
		D	S	G
Q301		9.6	0.5	0.0
Q303		8.4	0.0	0.0
Q305		9.8	1.6	0.0

* Switches in VHF High or Low positions as indicated (Models 308 and 208A only).

Table 4-7
Audio/Squelch Circuit* Voltage Chart

Transistors				
Reference No.	Condition	DC Voltage		
		E	B	C
Q401	SQ	1.2	0.0	10.0
	UNSQ	2.0	2.5	4.5
Q402		6.0	6.6	12.8
Q403		13.8	12.8	7.8
Q404		7.2	7.8	0.6
Q405		7.2	7.8	13.8
Q406		0.0	0.6	7.2
Q407	SQ	0.0	0.8	0.0
	UNSQ	0.0	0.0	6.0
Q408	SQ	0.0	0.0	2.0
	UNSQ	0.0	0.5	0.0

* Signals squelched or unsquelched as indicated. Where not indicated, either condition prevails.

Table 4-8
SCAN Logic* Voltage Chart

Transistors				
Reference No.	Condition	DC Voltage		
		E	B	C
Q409	SQ/SCAN	1.8	2.5	0.6
	SQ/MAN	0.5	0.0	0.6
	UNSQ	0.0	same as above	0.6
Q410	SQ/SCAN	0.0	0.6	2.5
	SQ/MAN	0.0	0.6	0.0
	UNSQ	0.0	0.6	same as above
Q411		0.0	0.6	0.2

* Signals squelched in SCAN or MAN position as indicated. Where not indicated, either condition or SCAN switch position prevails.

Table 4-8 (continued)

Integrated Circuits									
Reference No.	Pin No.	CHANNEL							
		1	2	3	4	5	6	7	8
IC401	1	0.0	2.8	0.0	2.8	0.0	2.8	0.0	2.8
	2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	5	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	8	0.0	0.0	0.0	0.0	3.4	3.4	3.4	3.4
	9	3.4	3.4	3.4	3.4	0.0	0.0	0.0	0.0
	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	0.0	2.8	0.0	2.8	0.0	2.8	0.0	2.8
	14	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
IC402	1	1.0	13.8	13.8	13.8	13.8	13.8	13.8	13.8
	2	13.8	1.0	13.8	13.8	13.8	13.8	13.8	13.8
	3	13.8	13.8	1.0	13.8	13.8	13.8	13.8	13.8
	4	13.8	13.8	13.8	1.0	13.8	13.8	13.8	13.8
	5	13.8	13.8	13.8	13.8	1.0	13.8	13.8	13.8
	6	13.8	13.8	13.8	13.8	13.8	1.0	13.8	13.8
	7	13.8	13.8	13.8	13.8	13.8	13.8	1.0	13.8
	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	9	13.8	13.8	13.8	13.8	13.8	13.8	13.8	1.0
	10	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	13	0.0	0.0	0.0	0.0	3.4	3.4	3.4	3.4
	14	3.4	3.4	3.4	3.4	0.0	0.0	0.0	0.0
	15	0.0	2.8	0.0	2.8	0.0	2.8	0.0	2.8
	16	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1

4.5 SENSITIVITY PROBLEM

Apparent poor sensitivity on one or more channels in a properly aligned receiver may be due to a faulty band switch on the rear panel. The following procedures may be used for checkout of these switches.

NOTE

These tests only apply to appropriate models containing the designated band-switch positions.

1. Rotate the squelch control clockwise for maximum squelch.

2. Set the MAN/SCAN switch to its SCAN position (out).

3. Set all band switches to UHF (upper positions).

4. Make DC measurements as shown in Table 4-9. Refer to Figure 4-2 for test point locations.

Table 4-9
UHF Position Switch Test

Test Point	DC Voltage		
	Switch OK	Switch OPEN	Switch SHORTED
A. Collector of Q203	10 V	Pulsating	-
B. Collector of Q307	0 V	Pulsating	10 V
C. Collector of Q302	0 V	Pulsating	10 V

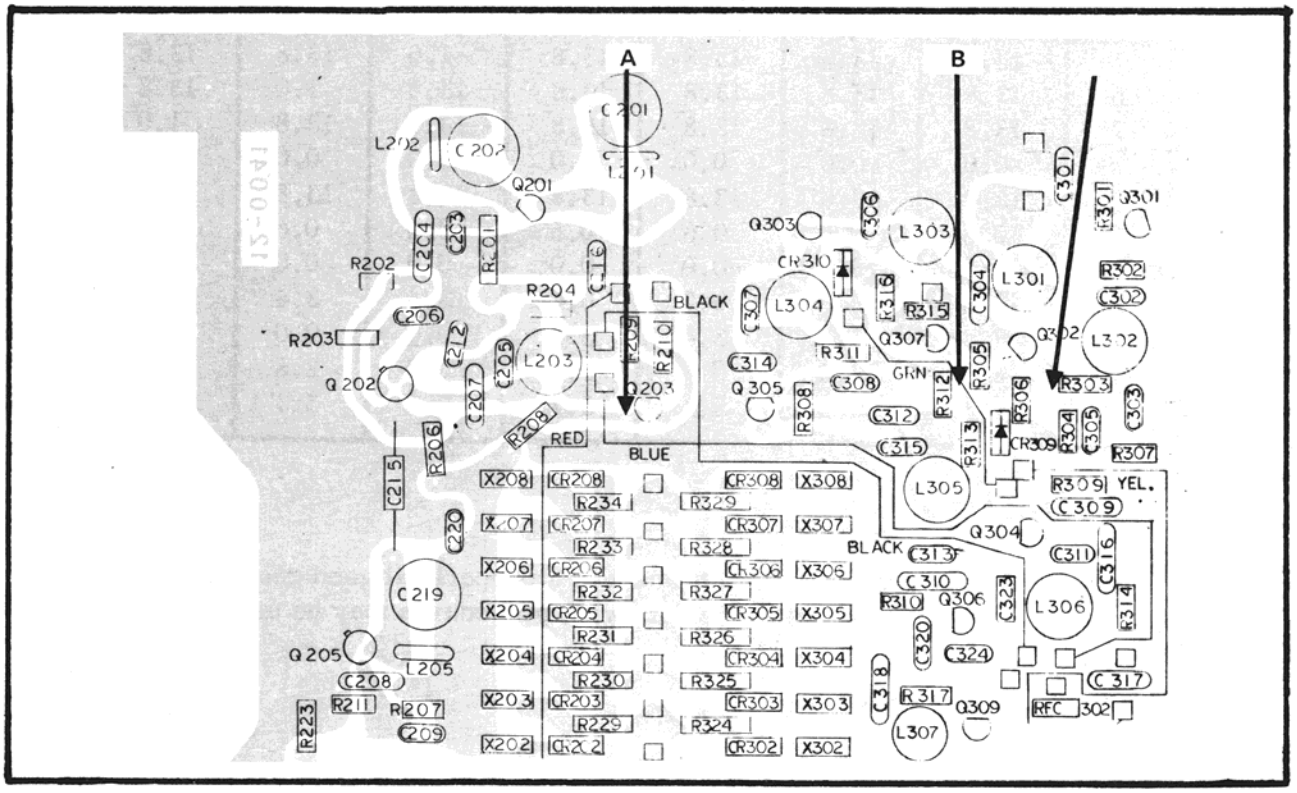

Figure 4-2. Switch Test Point Locations (Partial of Main PC Board Component Side)

5. Set all band switches to VHF High band (mid positions) and make DC measurements as indicated in Table 4-10.

6. Set all band switches to VHF Low band (lower positions) and make measurements as indicated in Table 4-11.

Table 4-10
VHF High Band Switch Test

Test Point	DC Voltage		
	Switch OK	Switch OPEN	Switch SHORTED
A. Collector of Q203	0 V	Pulsating	10 V
B. Collector of Q307	10 V	Pulsating	-
C. Collector of Q302	0 V	Pulsating	10 V

Table 4-11
VHF Low Band Switch Test

Test Point	DC Voltage		
	Switch OK	Switch OPEN	Switch SHORTED
A. Collector of Q203	0 V	Pulsating	10 V
B. Collector of Q307	0 V	Pulsating	10 V
C. Collector of Q302	10 V	Pulsating	-

4.6 DISASSEMBLY

CHASSIS REMOVAL: Remove the four screws, two from each side of the scanner, and remove the top cover. Four additional hidden screws hold the bottom cover. If more than crystal installation and/or repeaking is required, the bottom cover should also be removed.

SPEAKER REMOVAL: It may be more convenient to perform service work with the speaker removed. The speaker can then temporarily be plugged into the EXT SPKR (external speaker) jack.

NOTES

SECTION V
ADJUSTMENT AND ALIGNMENT

5.1 GENERAL

Every effort has been made to keep the required instruments necessary to align and service as simple as possible. It must be realized that the degree of accuracy attained in measurement is directly related to the quality of instruments used. Where a lower quality instrument than the one suggested is used, allowance must be made for possible error in readings. Refer to Table 4-1 for a list of recommended test equipment.

5.2 ALIGNMENT PROCEDURE

The main PC board is capable of accommodating three separate receiver front ends.

1. **UHF** Section can be tuned to cover 450-470 MHz. If it is necessary to retune to cover up to 512 MHz, certain component values must be changed. Unless specified otherwise, the UHF section is peak tuned at the factory to 460 MHz with broad band tuning to adequately receive signals from 454 MHz through 466 MHz.

2. **HIGH VHF** Section can be tuned to cover 140-174 MHz without component changes. Unless specified otherwise, the High VHF section is peak tuned at the factory to 156.5 MHz with broad band tuning to adequately receive signals from 151 MHz through 163 MHz.

3. **LOW VHF** Section can be tuned to cover 30-50 MHz without component changes. Unless specified otherwise, the Low VHF section is peak tuned to 42 MHz with broad band tuning to adequately receive signals from 37 MHz through 47 MHz.

Whenever it becomes necessary to change the factory tuning to a different frequency, try to tune at the center of the new frequency and then check the sensitivity of the extreme frequencies for adequate reception. (For each of the "center frequency" crystals, select the crystal frequency nearest the desired center band for your peak tuning procedure.)

Alignment procedures are referenced to the SCAN 308, because that model embodies all three receiver sections mentioned above. The SCAN 216 utilizes the UHF and High VHF sections. SCAN 208A utilizes the High VHF and Low VHF sections. Receivers in the 108 Series utilize only one section for each designation; L for Low VHF, H for High VHF, and U for UHF. Some component values change, and circuit jumpers are used, when omitting a receiver section from the main board. However, all component designations and alignment procedures are the same for all models.

5.2.1 IF/Discriminator Alignment (All Models)

1. Disconnect twisted pair leads from IF/SQ board (Figure 5-1) to main board at the main board end. Connect these leads to the signal generator grounding one lead to the chassis (either lead may be grounded).

2. Set the SQUELCH control to its maximum counterclockwise position.

3. Set signal generator to 10.7 MHz with 500 μV output and 1 kHz modulation frequency with 3.3 kHz deviation.

4. Connect RF voltmeter to pin 4 of IC102 and ground. Tune L101 for maximum indication on voltmeter. Voltmeter reading should be typically 0.25 to 0.35 volts.

5. Connect AC VTVM across the speaker terminals and adjust the volume control for a reading of approximately 0.3 volts. Adjust T101 for maximum indication on AC VTVM.

6. Reconnect twisted pair leads to main board.

7. Adjust L203 (Figure 5-2) and L306 (Figure 5-3) for maximum indication on AC VTVM.

5.2.2 UHF Alignment (Models 308, 216, and 108U)

1. Install desired channel crystal in Channel 1 position (see Figure 5-2) and set Channel 1 band switch (on rear panel) to UHF position.

2. Connect signal generator to UHF antenna jack.

3. Set AFC trimmer (R220) to middle of range.

4. Turn on power and be sure that the Channel 1 light is on.

5. Connect RF voltmeter to pin 4 of IC102 and ground on IF/SQ board. See Figure 5-1.

6. Set signal generator output level to approximately 1000 μV and tune for maximum indication on RF voltmeter. Adjustment of L204 and C219 (Figure 5-2) may be necessary to obtain an indication on the RF voltmeter. Reduce the signal generator output level as required to maintain an RF voltmeter reading of approximately 0.3 volts.

7. Tune C201, C202, L204, and C219 (Figure 5-2) for maximum indication on RF voltmeter. Reduce signal level to maintain approximately 0.3 volts on RF voltmeter.

8. Reduce signal generator output level to zero and remove UHF crystal from socket.

9. Connect VTVM to AFC test point (junction of R214 and R219, as shown in Figure 5-2) and ground. Set AFC control for a reading of 2.0 to 4.0 volts.

10. Reinstall crystal and measure sensitivity. Sensitivity should be 0.5 to 1.0 mV for 20 dB quieting. Some retuning may be necessary for maximum sensitivity.

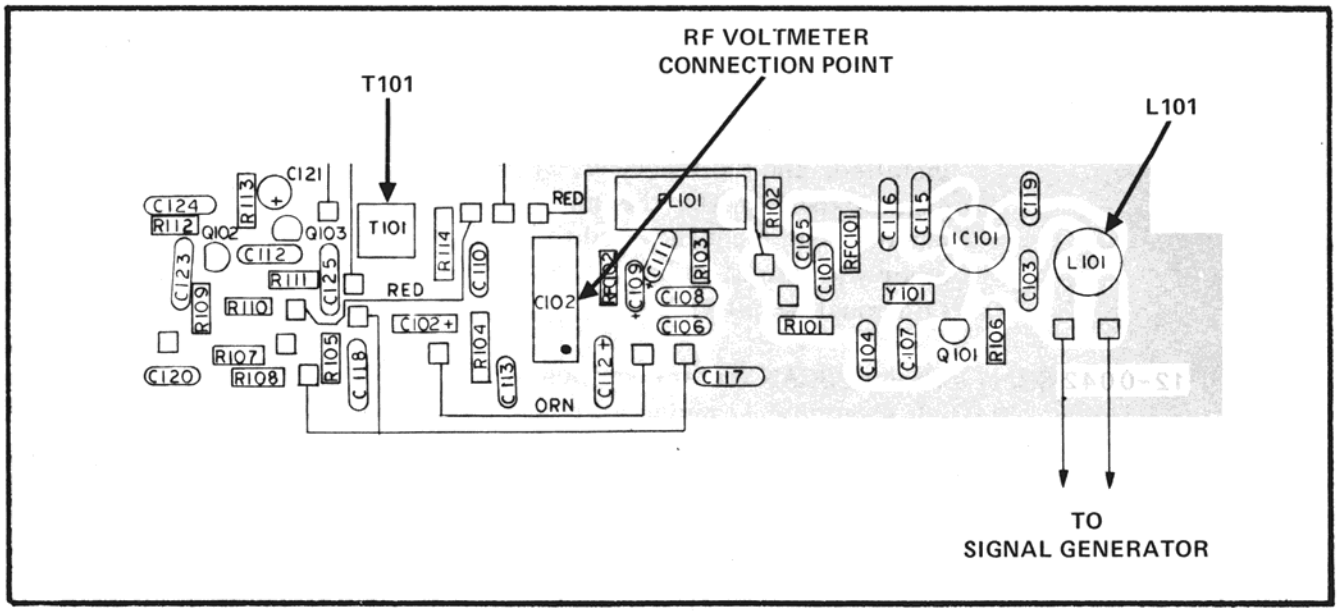

Figure 5-1. IF/Squelch Amplifier Tuning and Connecting Points

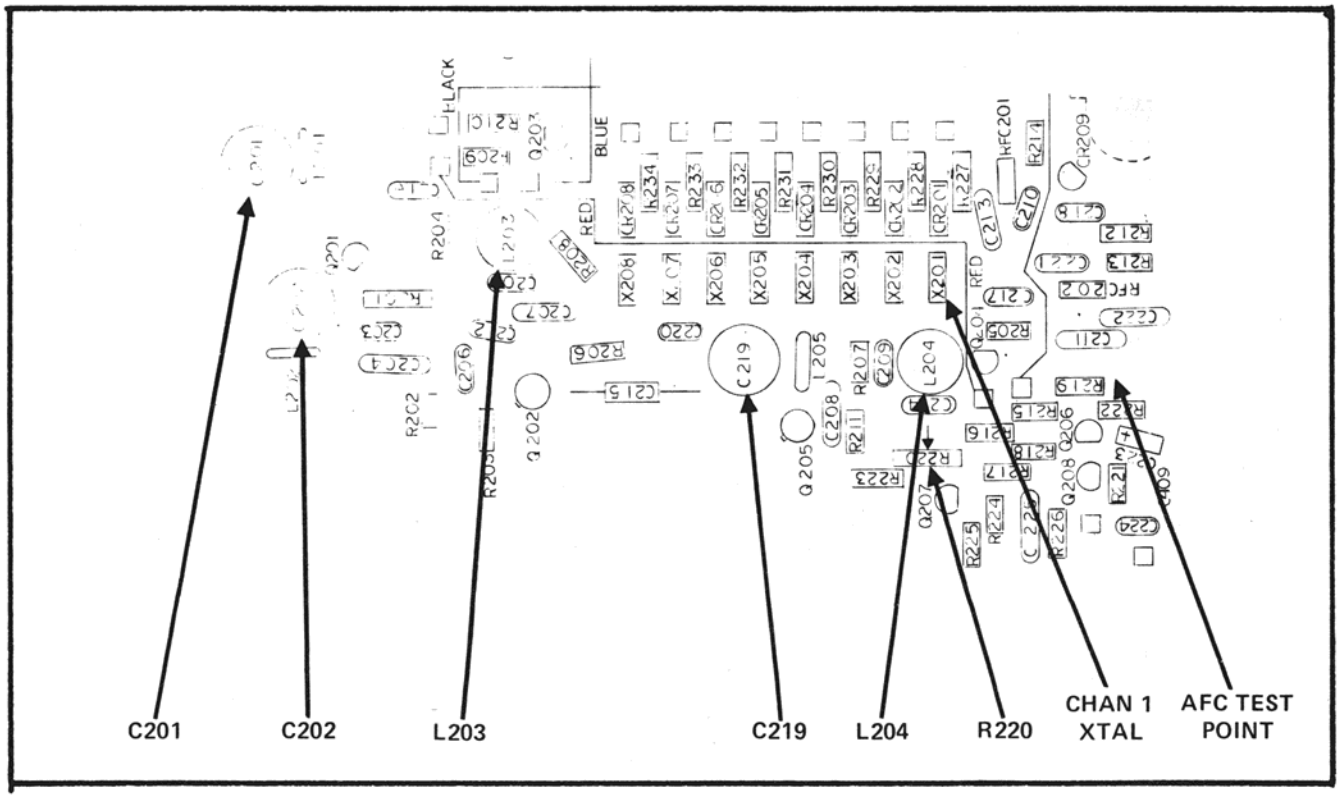

Figure 5-2. Main Board Tuning and Connecting Points for UHF Alignment

NOTE

When more than one crystal is being installed, and the frequency spread is greater than 3 MHz, the unit should be tuned on one frequency and then the other with slight adjustment to maintain equal sensitivities.

11. Set MAN/SCAN switch to SCAN (outer) position and rotate SQUELCH control fully clockwise. The unit should be scanning all channels.

12. Increase signal generator output level until scanning stops on Channel 1. Signal generator output level should be less than 5.0 μV.

5.2.3 High VHF Band Alignment (Models 308, 216, 208A, and 108H)

1. Install desired channel crystal in Channel 1 position (Figure 5-3) and set Channel 1 band switch (on rear panel) to HIGH position.

2. Connect signal generator to High-Low antenna jack.

3. Turn on power and be sure that the Channel 1 light is on.

4. Connect RF voltmeter to pin 4 of IC102 (Figure 5-1) and ground on IF/SQ board.

5. Set signal generator output level to approximately 1000 μV and tune for maximum indication on RF voltmeter.

6. Tune L307, L305, L304, and L303 (Figure 5-3) for maximum indication on RF voltmeter. Reduce signal generator level as required to maintain approximately 0.3 volts on RF voltmeter during tuning.

7. Measure sensitivity (0.5-0.7 μV) for 20 dB quieting.

NOTE

When more than one crystal is being installed, and the frequency spread is greater than 1 MHz, the unit should be tuned on one frequency and then the other with slight readjustment to maintain equal sensitivities.

8. Reduce signal generator output to zero. Set MAN/SCAN switch to SCAN (outer) position and rotate SQUELCH control fully clockwise. Unit should be scanning all channels.

9. Increase signal generator output level until scanning stops on Channel 1. Signal generator output level should be less than 5.0 μV.

5.2.4 Low VHF Band Alignment (Models 308, 208A, and 108L)

1. Install desired channel crystal in Channel 1 position (Figure 5-3) and set Channel 1 band switch (on rear panel) to LOW position.

2. Connect signal generator to High-Low antenna jack.

3. Turn on power and be sure that the channel light is on.

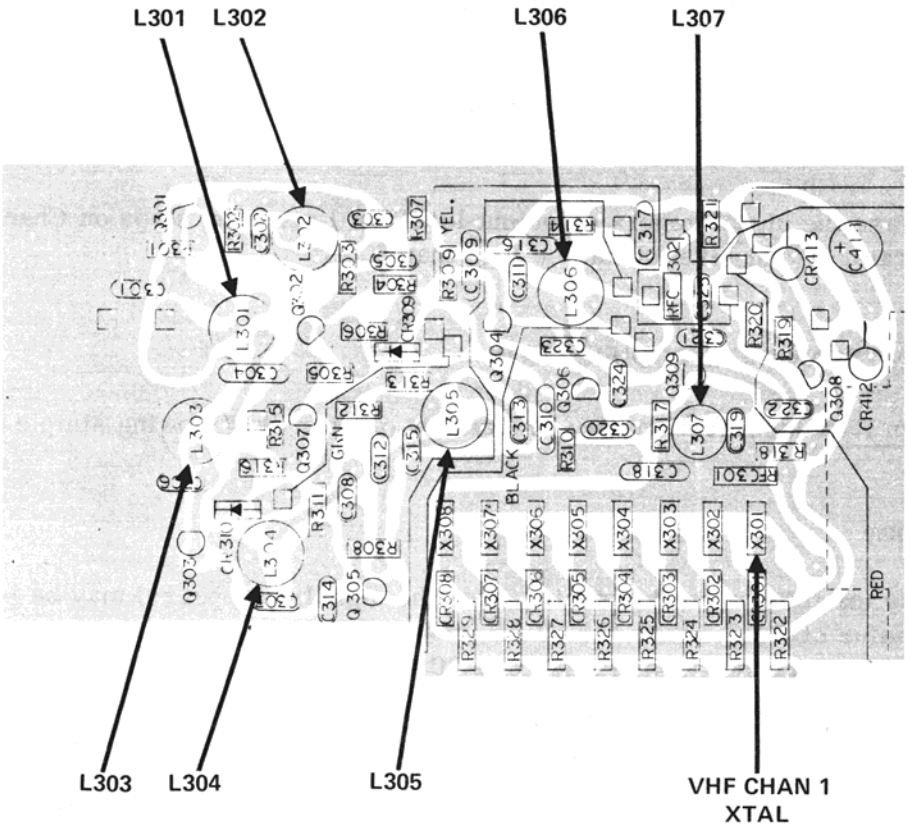

Figure 5-3. Main Board Tuning and Connecting Points for High and Low VHF Band Alignment

4. Connect RF voltmeter to pin 4 of IC102 (Figure 5-1) and ground in IF/SQ board.

5. Set signal generator output level to approximately 1000 μV and tune for maximum indication on RF voltmeter.

6. Tune L301 and L302 (Figure 5-3) for maximum indication on RF voltmeter. Reduce signal generator output level as required to maintain approximately 0.3 volts on RF voltmeter during tuning.

7. Measure sensitivity (0.5-0.7 μV) for 20 dB quieting.

NOTE

When more than one crystal is being installed and the frequency spread is greater than 5 MHz, the unit should be tuned on one frequency and then the other with slight readjustment to maintain approximately equal sensitivities.

8. Reduce signal generator output to zero. Set MAN/SCAN switch to SCAN (outer) position and rotate SQUELCH control fully clockwise. Unit should be scanning all channels.

9. Increase the signal generator output level until scanning stops on Channel 1. Signal generator output level should be less than 5.0 μV.

5.3 DELAY AND SCAN RATE MODIFICATION

Delay and Scan Rate Modification may be made by making the following simple component changes.

5.3.1 Scan Delay

The scan delay (or time to start scanning after the signal disappears) may be increased by changing the value of C413. With the 10 μF/15 V installed at the factory, this time delay is approximately 0.3 seconds. Installation of a 30 μF/15 V capacitor increases the delay to approximately one second.

5.3.2 Scan Rate

The scan rate (or number of channels scanned per second) may be reduced by changing the value of R421. The factory installed value of 220 k ohm provides a scan rate of 15-20 channels per second. Installation of 330 k ohm resistor will provide a scan rate of approximately 5-10 channels per second.

For location of C413 and R421, refer to Figure 5-4.

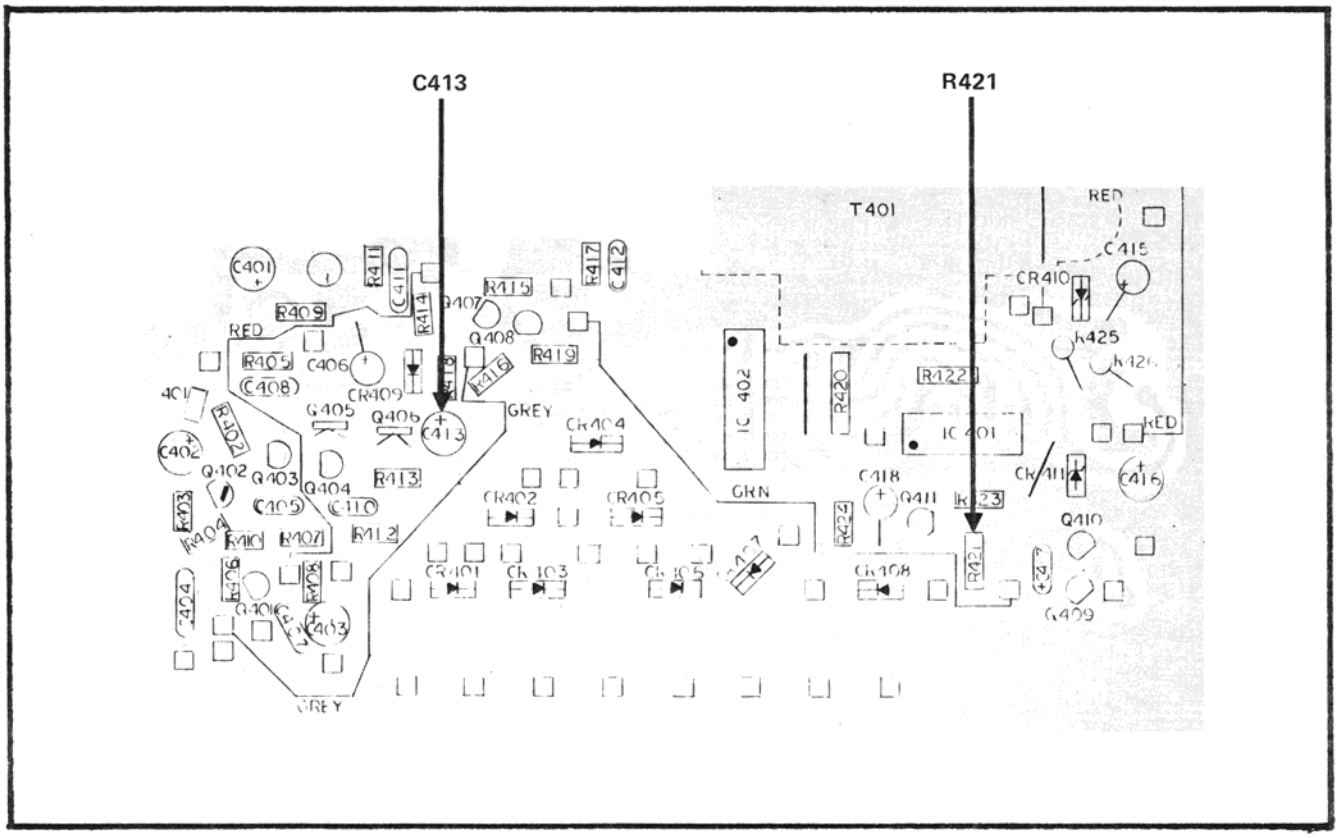

Figure 5-4. Main Board Component Location for SCAN Delay and SCAN Rate Modifications

NOTES

SECTION VI
ILLUSTRATIONS AND PARTS LIST

6.1 GENERAL

The schematics, parts locators, and parts list in this section are for the PACE SCAN Models 308, 216, 208A, 108H, 108L, and 108U. Part numbers and descriptions are keyed to schematic reference numbers and are listed for these components.

Figure 6-1 is the parts locator for the IF/Squelch Amplifier Board and applies to all models. The parts locator for the SCAN 308 Main Board is shown in Figure 6-2. This drawing may be used for all models keeping in mind that various sections are not used in the other models as previously described.

Figures 6-3 through 6-6 are schematics of IF, Squelch, Audio, and Logic Circuits for Models 308, 216, 208A, and the 108 Series, respectively. Schematics of the VHF RF sections for Models 308, 216, 208A, 108H, and 108L are shown in Figure 6-7 through 6-11, respectively. UHF RF section schematics are shown in Figure 6-12 for Models 308 and 216, and in Figure 6-13 for Model 108U.

The applicable parts list for all models are given in Table 6-1.

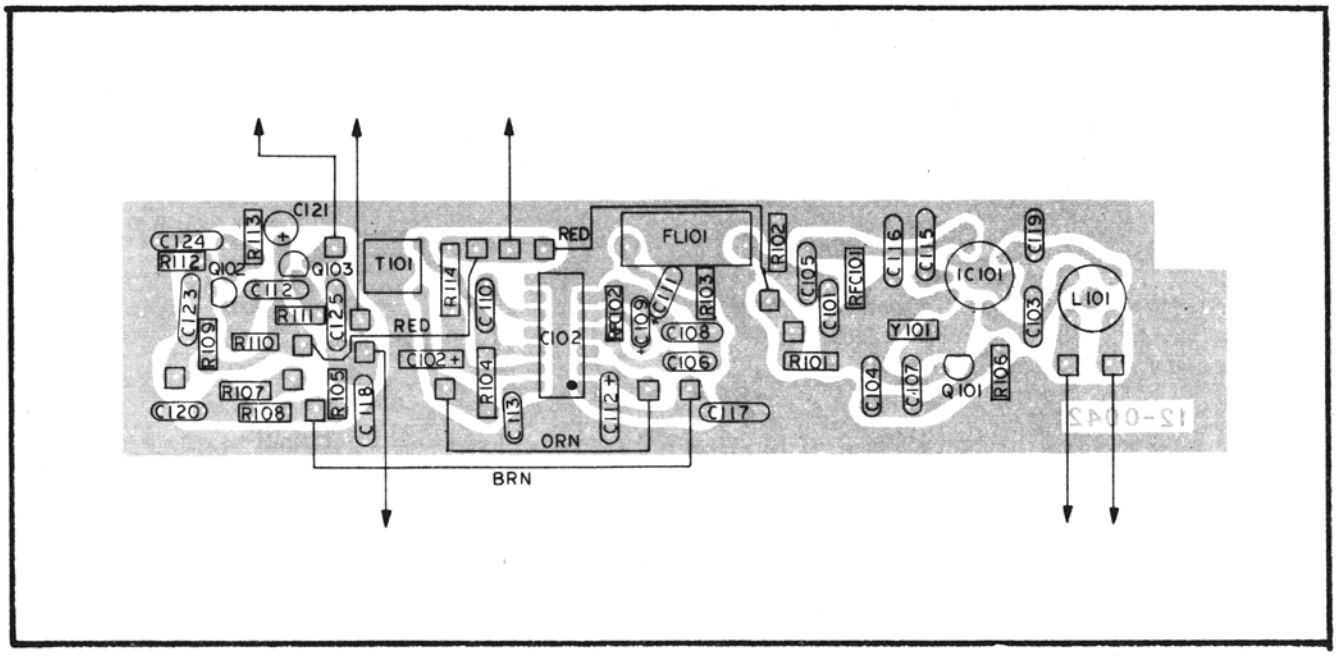

Figure 6-1. IF/Squelch Amplifier Board Component Locator (Component Side)

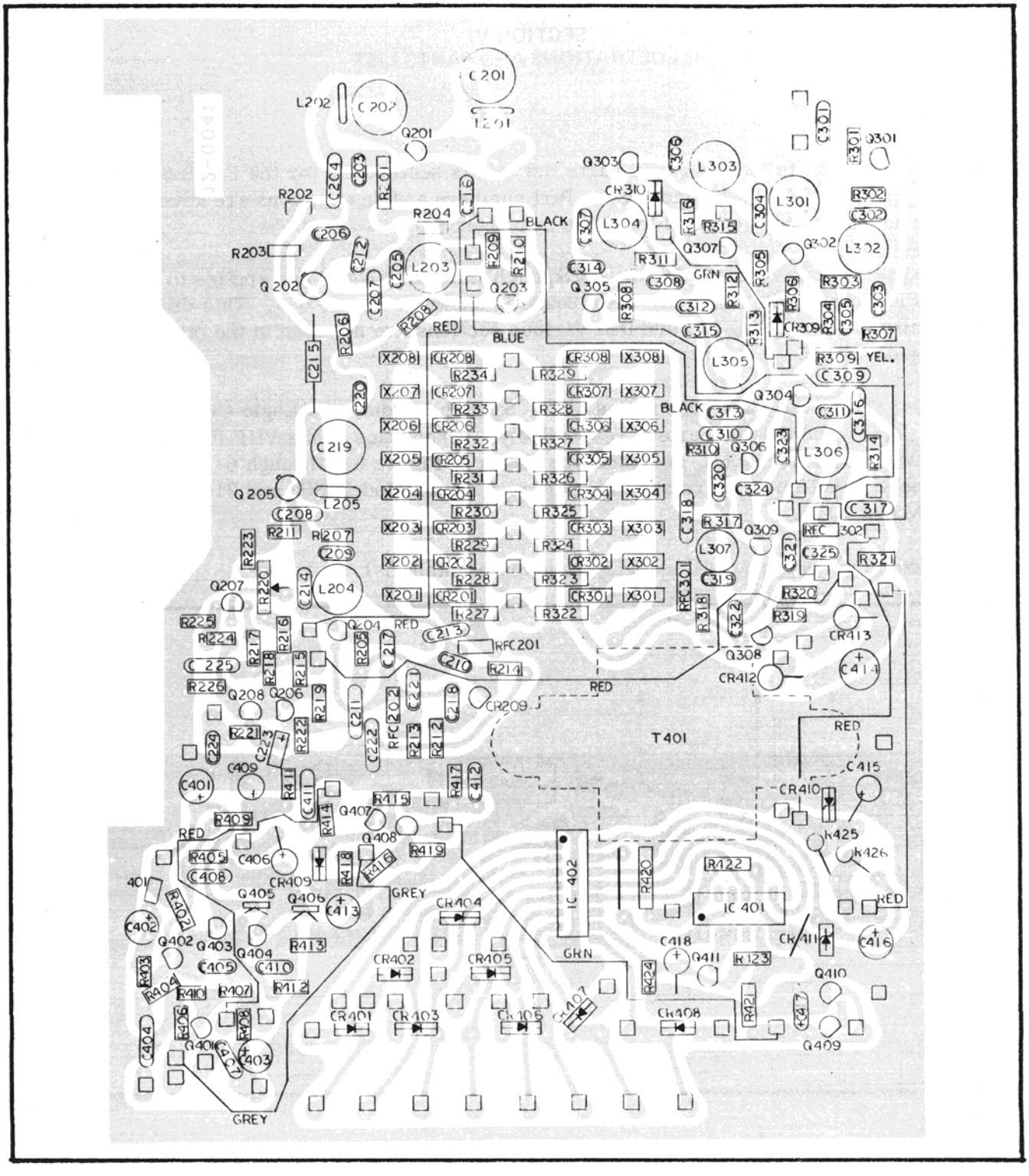

Figure 6-2. Main Board Parts Locator (Component Side)

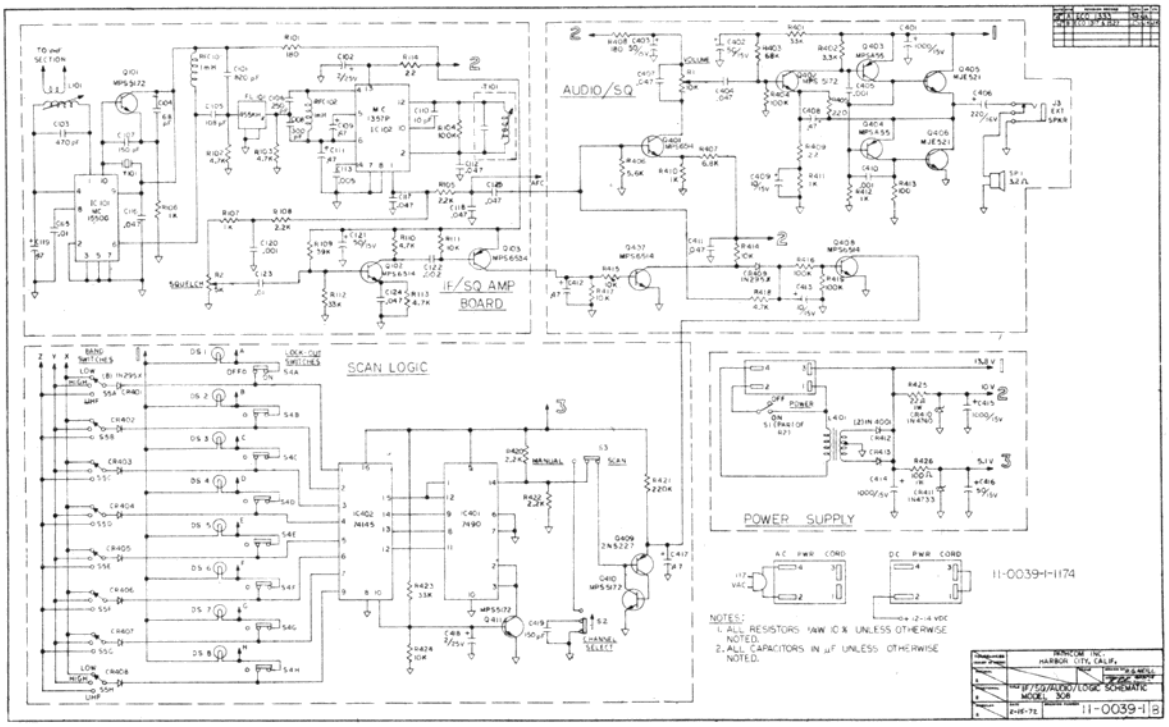

Figure 6-3. IF, Squelch, Audio and Logic Circuits for SCAN 308

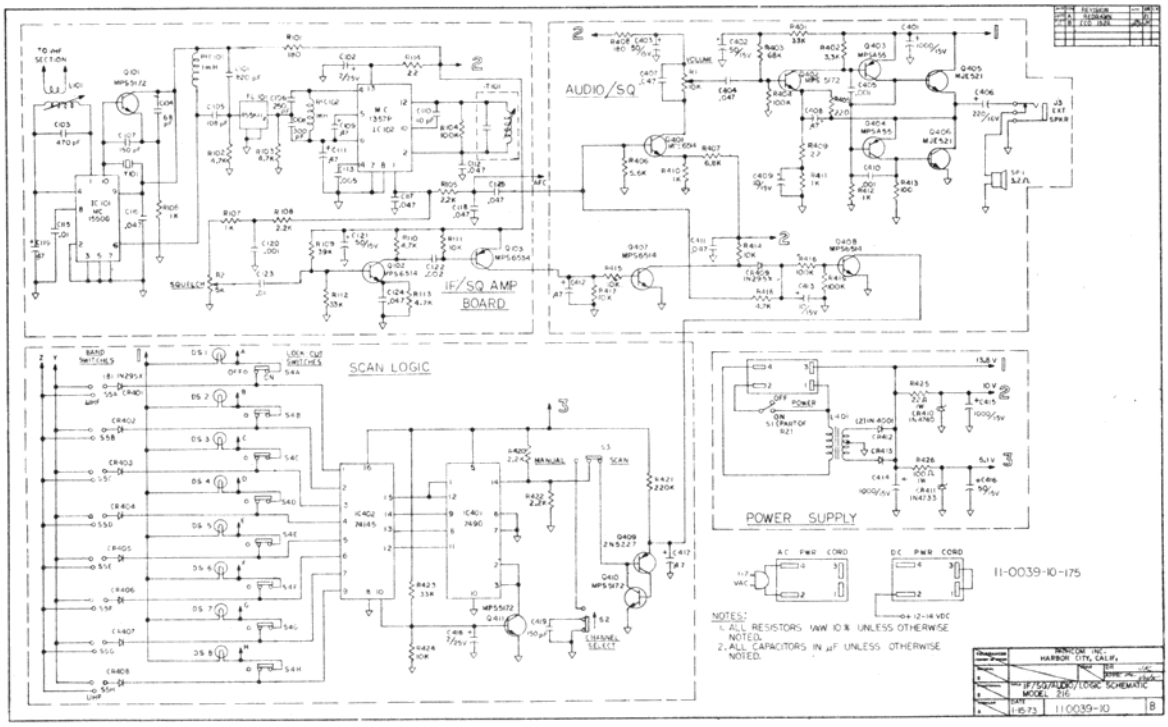

Figure 6-4. IF, Squelch, Audio and Logic Circuits for SCAN 216

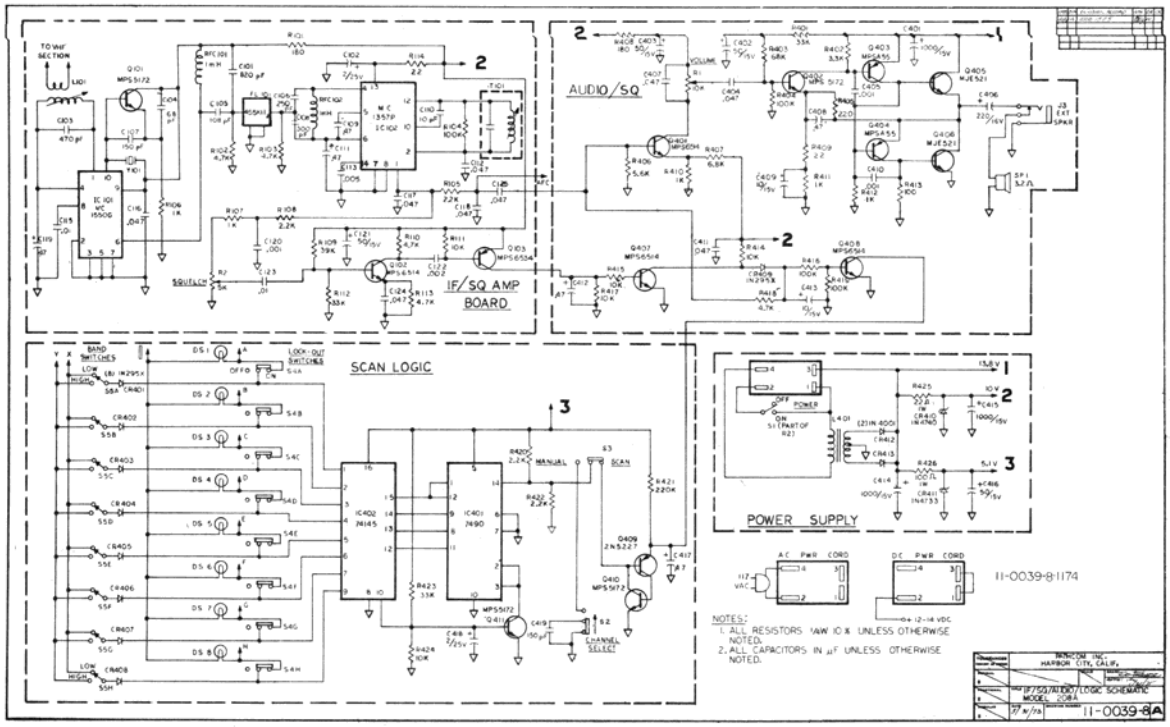

Figure 6-5. IF, Squelch, Audio and Logic Circuits for SCAN 208A

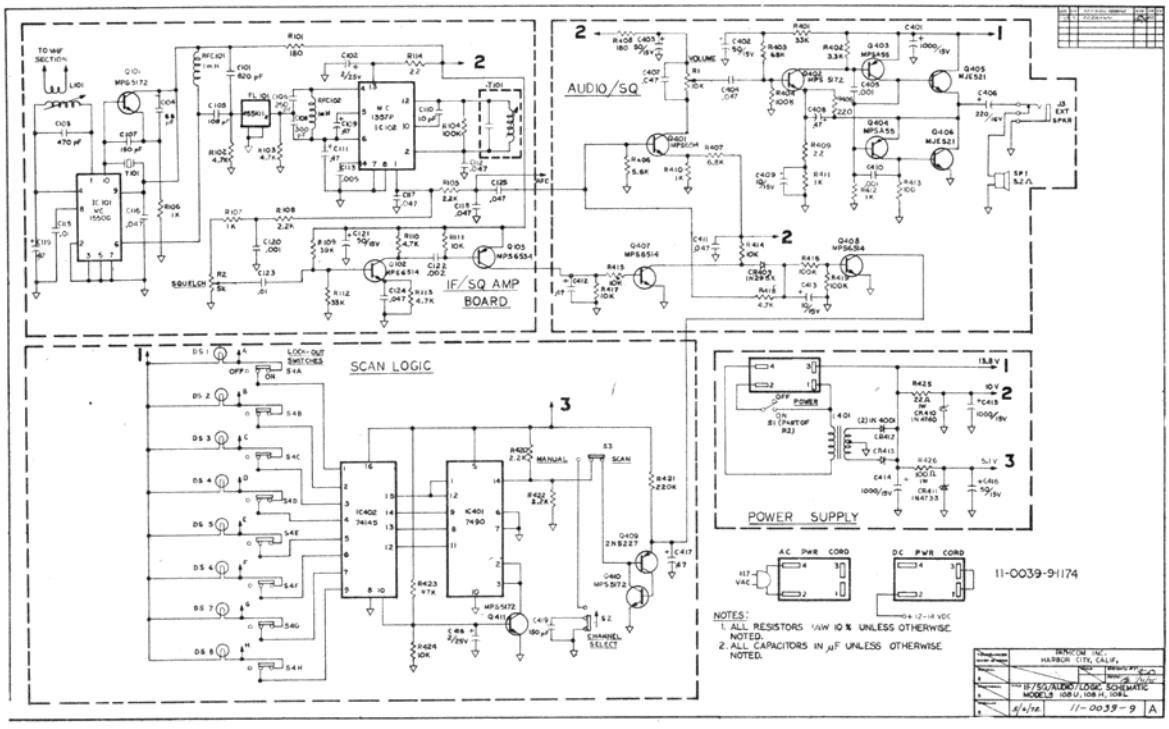

Figure 6-6. IF, Squelch, Audio and Logic Circuits for SCAN 108 Series

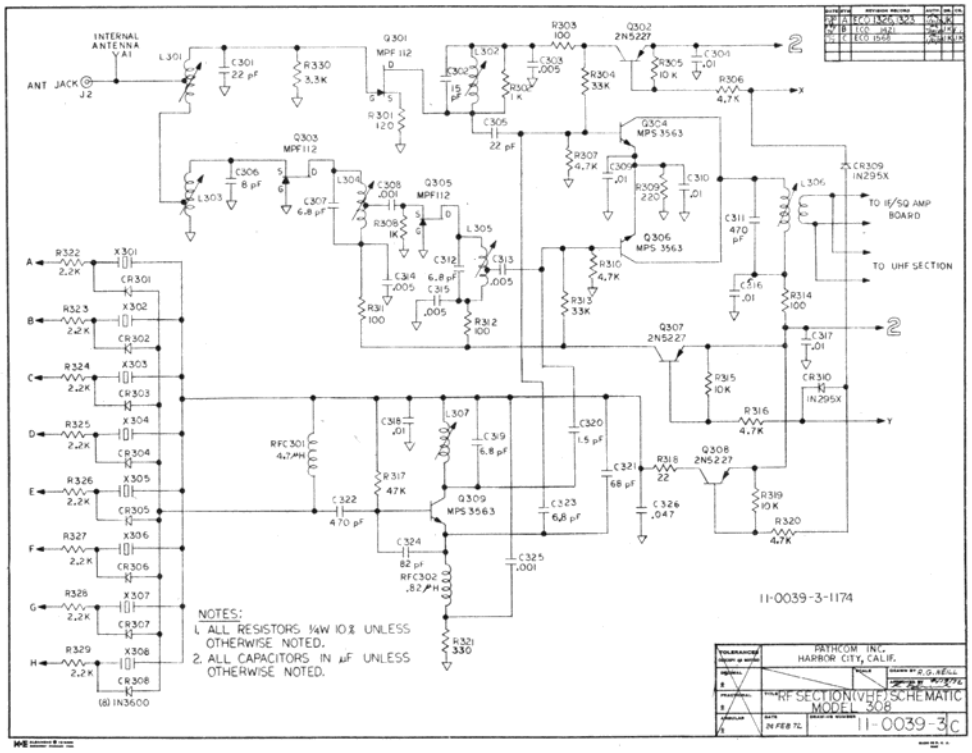

Figure 6-7. VHF/RF Circuit for SCAN 308

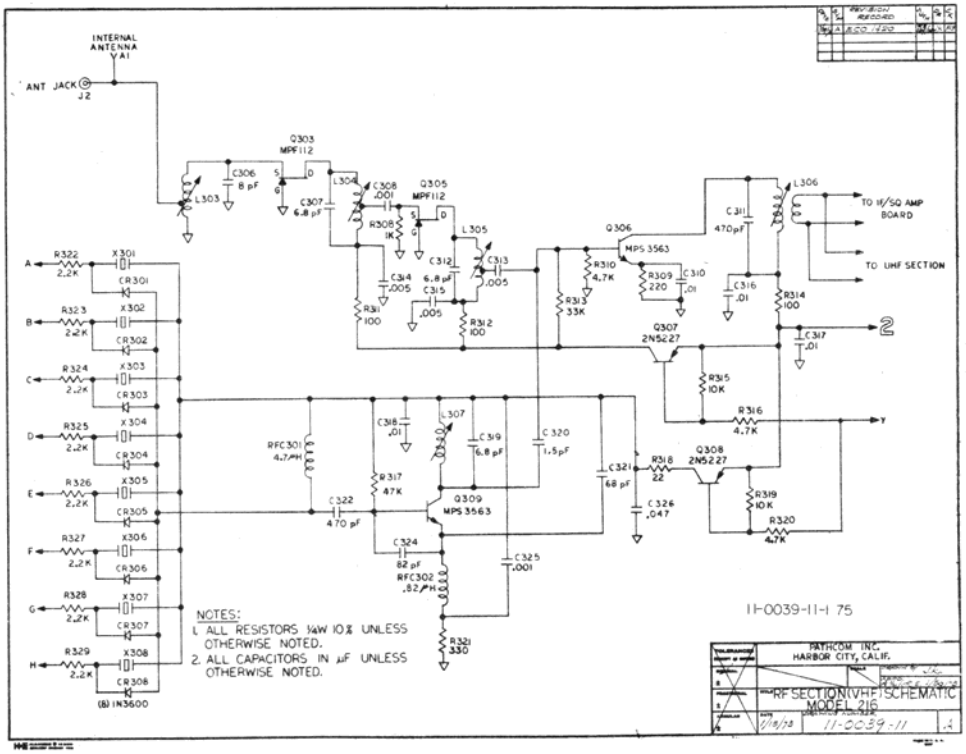

Figure 6-8. VHF/RF Circuit for SCAN 216

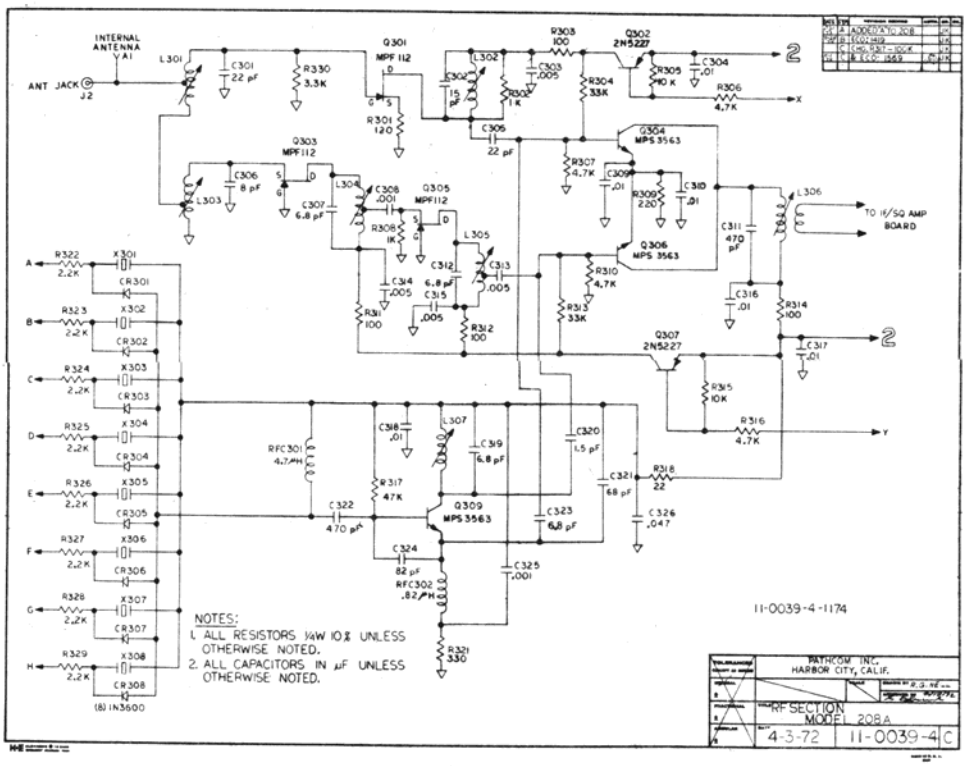

Figure 6-9. VHF/RF Circuit for SCAN 208A

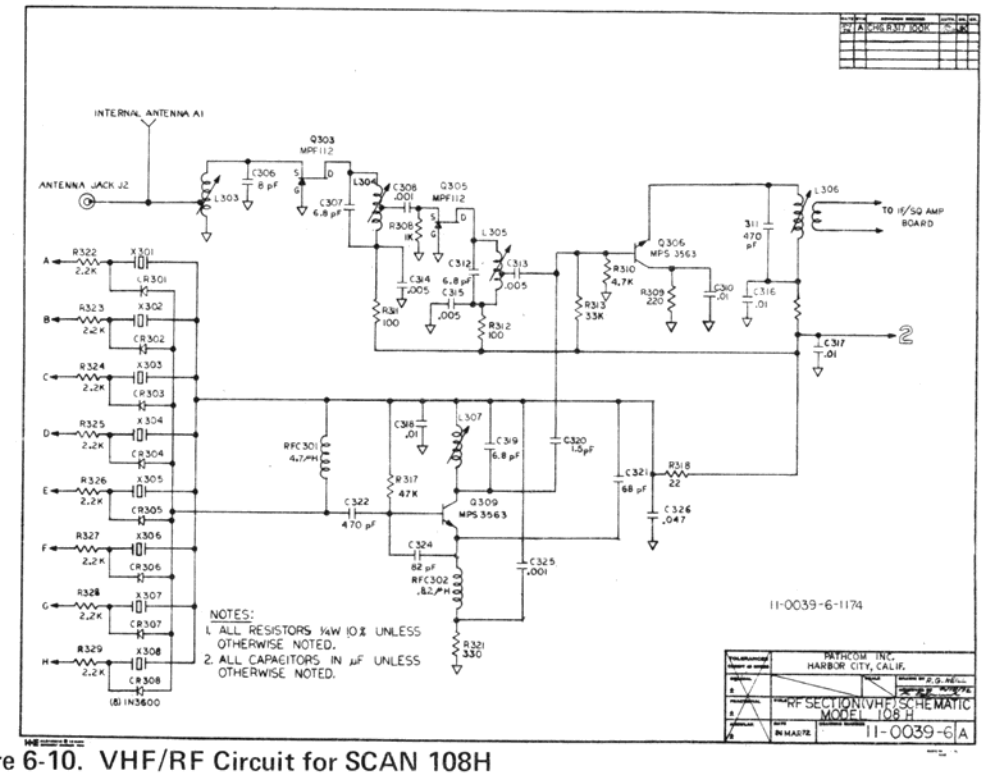

Figure 6-10. VHF/RF Circuit for SCAN 108H

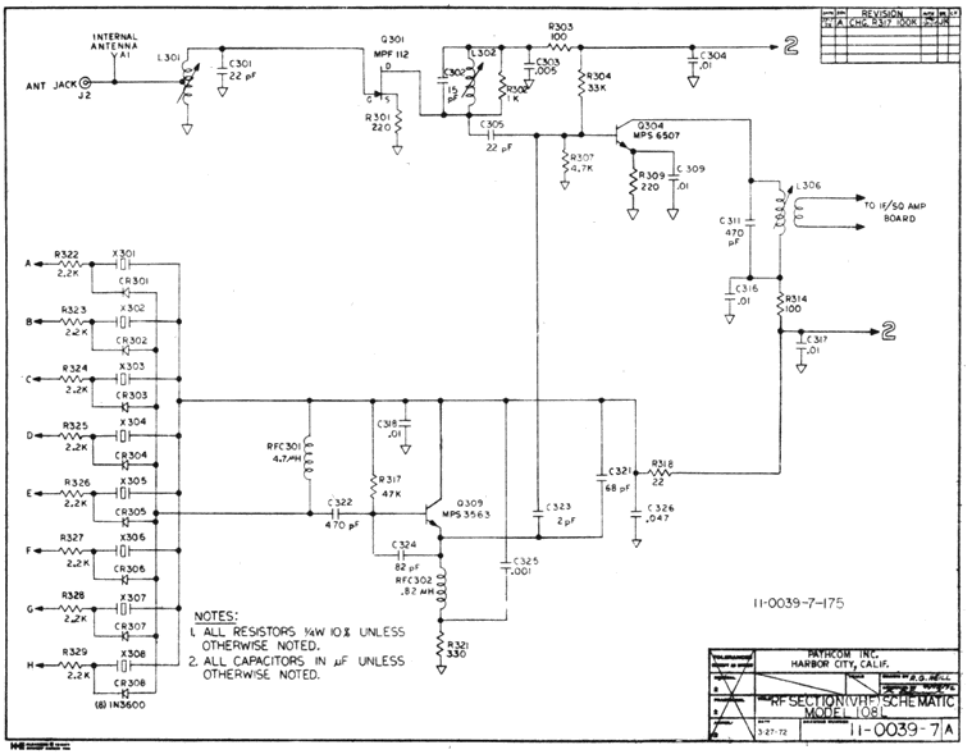

Figure 6-11. VHF/RF Circuit for SCAN 108L

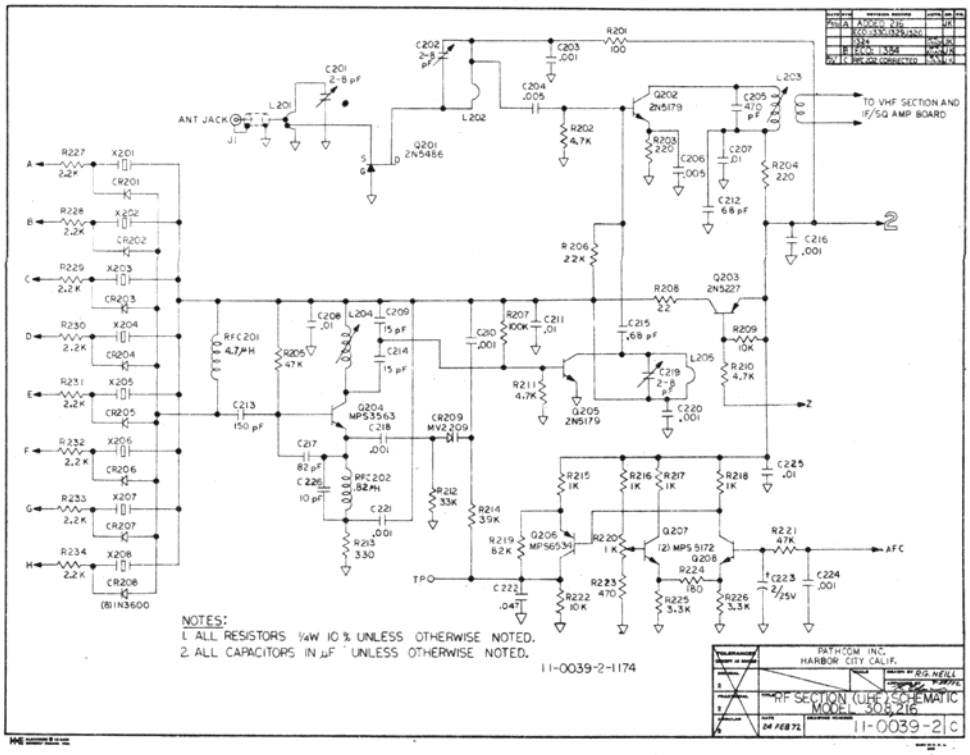

Figure 6-12. UHF/RF Circuit for SCAN 308 and 216

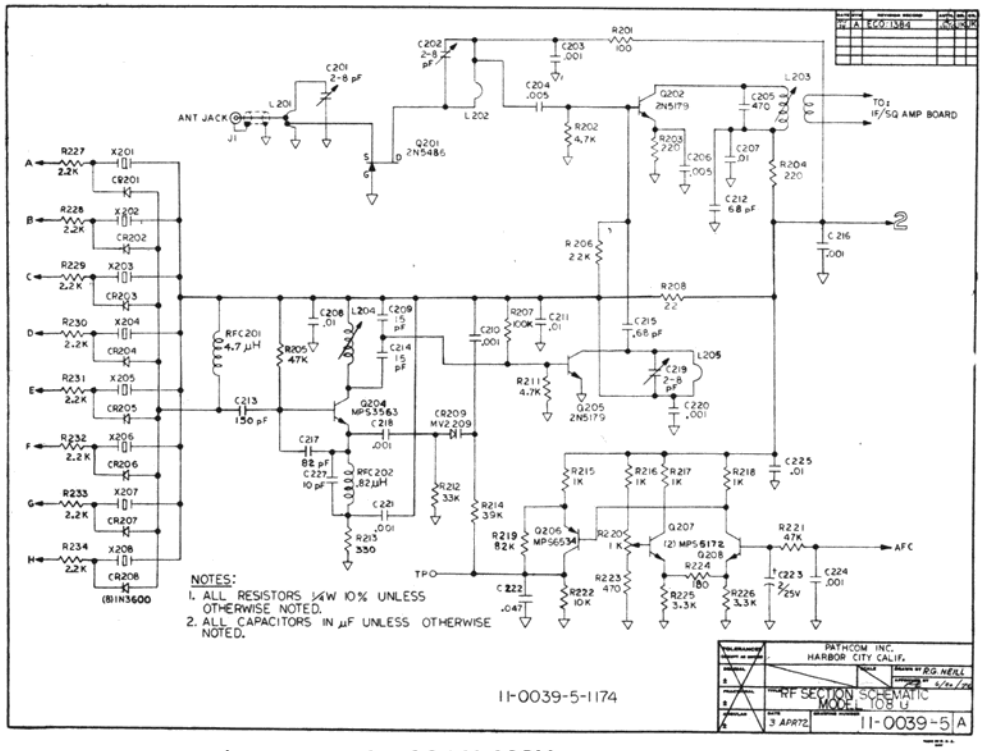

Figure 6-13. UHF/RF Circuit for SCAN 108U

Table 6-1
Electrical Parts List

Reference Number	Description	Part Number
CAPACITORS*		
C102, 223, 418	Electrolytic, 2 µF 25 V	19-0049
C109, 111, 119, 408, 412, 417	Tantalum, 0.47 µF 35 V	19-0116
C112, 116 thru 118, 124, 125, 222, 326, 404, 407, 411 . . .	Mylar, 0.047 µF	19-0043
C121, 402, 403, 416	Electrolytic, 50 µF 15 V	19-0129
C201, 202, 219	Trimmer, 2-8 pF	19-0136
C401, 414, 415	Electrolytic, 1000 µF 15 V	19-0052
C406	Electrolytic, 220 µF 16 V	19-0132
C409, 413	Electrolytic, 10 µF 15 V	19-0127
RESISTORS*		
R1.	Potentiometer, VOLUME	15-0066
R2.	Potentiometer w/SW, SQUELCH . .	15-0067
R220	Trimmer, 1 k Ω	14-0007-2

Table 6-1 (continued)

DIODES, INTEGRATED CIRCUITS, AND TRANSISTORS

CR201 thru 208, 301 thru 308	Diode, 1N3600	13-0003
CR209	Diode, Volt. Variable, MV2209	13-0105
CR309, 310, 401 thru 409	Diode, 1N295	13-0004
CR410	Diode, 1N4740	13-0002
CR411	Diode, 1N4733	13-0100
CR412, 413	Diode, 1N4001	13-0050
IC101	Integrated Circuit, MC1550G	13-0091
IC102	Integrated Circuit, MC1357P	13-0089
IC401	Integrated Circuit, MC7490P	13-0103
IC402	Integrated Circuit, MC74145P	13-0104
Q101, 207, 208, 402, 410, 411	Transistor, MPS5172	13-0092
Q102, 401, 407, 408	Transistor, MPS6514	13-0022
Q103, 206	Transistor, MPS6534	13-0061
Q201	Transistor, 2N5486	13-0101
Q202, 205	Transistor, 2N5179	13-0095
Q203, 302, 307, 308, 409	Transistor, 2N5227	13-0084
Q204, 304, 306, 309	Transistor, MPS3563	13-0082
Q301, 303, 305	Transistor, MPF112	13-0102
Q403, 404	Transistor, MPSA55	13-0093
Q405, 406	Transistor, MJE521	13-0094

CHOKES, INDUCTORS, AND TRANSFORMERS

L101, 203, 306	Coil	17-0028
L201, 202	Coil	17-0063
L204, L307	Coil, Oscillator	17-0057
L205	Coil, Multiplier	17-0064
L301, 302	Coil	17-0025
L303, 304	Coil, RF	17-0050
L305	Coil	17-0053
L401	Transformer, Power	16-0003
RFC101, 102	Choke, 1.0 mH	17-0060
RFC201, 301	Choke, 4.7 μH	17-0041
RFC202, 302	Choke, 0.82 μH	17-0062
T101	Transformer, IF	16-0003