AD-A032 088 ARMY ELECTRONICS COMMAND FORT MONMOUTH N J F/G 17/2.1

REDESIGN OF SQUELCH MODULES IN THE AN/VRC-12 SERIES RADIOS.(U)

OCT 76 L V BOKKE

UNCLASSIFIED ECOM-4448 NL

1 OF 1
ADA032088

END
DATE
FILMED
1 - 77

Research and Development Technical Report

ECOM-4448

REDESIGN OF SQUELCH MODULES IN THE AN/VRC-12 SERIES RADIOS

Lee van der Bokke

Communications/Automatic Data Processing Laboratory

October 1976

DISTRIBUTION STATEMENT

Approved for public release; distribution unlimited.

ECOM

US ARMY ELECTRONICS COMMAND FORT MONMOUTH, NEW JERSEY 07703

NOTICES

Disclaimers

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

The citation of trade names and names of manufacturers in this report is not to be construed as official Government indorsement or approval of commercial products or services referenced herein.

Disposition

Destroy this report when it is no longer needed. Do not return it to the originator.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: ECOM-4448 (14)	2. GOVT ACCESSION NO.
	3. RECIPIENT'S CATALOG NUMBER
(9) Research and development rept.	
4. TITLE (and Subtitle): Redesign of Squelch Modules in the AN/VRC-12 Series Radios (6)	5. TYPE OF REPORT & PERIOD COVERED: technical rept.
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Lee van der Bokke (10)	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Communications/ADP Laboratory (DRSEL-NL-RN-1) US Army Electronics Command Fort Monmouth, NJ 07703	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 697348.PI.361.35.01
11. CONTROLLING OFFICE NAME AND ADDRESS: US Army Electronics Command DRSEL-NL-RN-1 Fort Monmouth, NJ 07703	12. REPORT DATE: (11) OCTO[redacted]R [redacted]76 (12) 31p.
	13. NUMBER OF PAGES: 28
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

R-552/VRC, RT-246/VRC, RT-524/VRC, tone squelch, new squelch, noise squelch, integrated circuit, silicon semiconductors, germanium semiconductors, future component availability.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The squelch modules (A5200 and A5300) of the AN/VRC-12 series radios were redesigned. Difficult to obtain germanium and early generation silicon transistors were replaced by an integrated circuit and modern silicon transistors. Modifications were made for response deficiencies in the old design. The new design is cost effective over the old.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

037620

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

1B

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX A

1. INTRODUCTION:

The AN/VRC-12 Series Radios (R-442/VRC, RT-246/VRC, RT-524/VRC) provide short range, two-way, radiotelephone communication in the 30.00 to 75.95 MHz range, using frequency-modulated (fm) transmission and reception. The radio sets are used in such vehicles as jeeps, trucks, tanks, and armored personnel carriers. They are also used in light planes and helicopters, in some communication shelters and vans as an auxiliary radio for communication in the fm band, and in small marine craft.

The squelch in the AN/VRC-12 can operate in two modes; it can detect a 150 Hz tone or it can detect the absence of 7.3kHz noise in the receive mode. The audio squelch preamplifier output is applied to the squelch alternating-current (ac) amplifier. The squelch filter provides selectable tuned circuits for the squelch ac amplifier. These tune the squelch ac amplifier so that it amplifies either 150 Hz tone or 7.3 kHz noise signals. The amplified ac signal is rectified and amplified in the squelch dc amplifier. The squelch dc amplifier operates the squelch relay. When the squelch relay is energized, 16-volt dc power supply voltage is switched into the monitor and audio amplifier stages, allowing them to operate. When the front panel SQUELCH switches are at OFF, the squelch dc amplifier and the squelch relay are bypassed.

The squelch modules are also utilized during transmission. The 150 Hz squelch ac amplifier becomes the 150 Hz squelch tone oscillator. The squelch tone oscillator functions only during transmission, when the front panel SQUELCH switch is at any position except OLD ON.

The output of the 150 Hz squelch oscillator is applied to the transmitter speech amplifier to frequency modulate the transmitter. When voice frequency signals are applied to the transmitter speech amplifier, both the voice frequency signal and the 150 Hz tone from the 150 Hz squelch tone oscillator will modulate the transmitter. The 150 Hz tone is used to activate the squelch circuit in the distant receiver.

In the past few years, it has become increasingly more difficult to obtain germanium and early generation silicon transistors. When these devices are available there has been a trend of tremendous cost increases. A quote of $1.80 each was received for 2N328A (Silicon) transistors in 5,000 piece quantities. Three of these devices are presently required in the squelch amplifier module A5200 of the AN/VRC-12 series radios.

In addition to the price and availability problems of the transistors used in the squelch, there are inherent problems in both the squelch amplifier module A5200 and the squelch filter module A5300. These problems include intolerably long recovery time, changing bandwidth, and oscillations.

In order to provide an alternative, a version of these modules using an integrated circuit was developed and tested by the Comm/ADP Laboratory.

2. ASSUMPTIONS AND CONSTRAINTS:

a. The currently used germanium (Ge) or early generation silicon (Si) transistors can be replaced either with more common Si transistors or with integrated circuits (IC's). In the latter case the following considerations are mandatory:

. There must be at least two independent sources of manufacture of the IC.

. The IC must be available in reliability grades at least equivalent to JAN, preferably MIL-STD 883, Class C.

. The cost should not be increased due to the use of IC's.

b. In all cost comparisons, those costs common to all versions as for example, printed circuit (PC) boards, and hardware were omitted.

c. Assembly times for various components were assumed as follows:

resistor	14 seconds
capacitor	14 seconds
diode	14 seconds
transistor	17 seconds
IC	51 seconds

d. Assembly costs were computed at $7 per hour. Using the above assembly times, the assembly costs of the various components were computed as follows:

resistor	2.7¢
capacitor	2.7¢
diode	2.7¢
transistor	3.3¢
IC	10.0¢

3. SHORT FALLS OF THE PRESENT DESIGN:

a. The availability of germanium and early silicon transistors has been dwindling and the prices of these components have risen dramatically.

b. By adjusting the squelch threshold level, the transmit-to-receive recovery time can be extended almost indefinitely.

c. By adjusting the tone squelch frequency, the gain and bandwidth change drastically until it is possible for the squelch amplifier to oscillate.

d. Since adjusting the squelch frequency also affects the gain, the squelch threshold must also be readjusted.

4. DISCUSSION OF MODIFICATIONS

The present design could be readily modified to utilize common transistors, but after reviewing the deficiencies of the present design, a new approach was developed.

a. Squelch Amplifier A5200A (A detailed discussion is presented in Section 5.) The squelch amplifier was redesigned using an integrated circuit MC1558 and four transistors 2N2222. The IC is available in MIL-STD-883, Class C performance from three independent sources. The transistors are standard NPN switching transistors: Q5202A was added to reduce the transmit-to-receive recovery time and transistors Q5203A and Q5204A are used to disable the noise and tone squelch decision circuits respectively. As can be seen in Table 3, the A5200A module costs $2.72 less than the A5200 module. (Omitted from the comparison were the trimpots, PC board, base assembly and case.)

The schematic diagram, PC board layout, PC Mask, parts list and pin designations of module A5200A are shown in Figures 1, 2, 3, 4, and 5 respectively.

b. A5300A - Squelch Filter (A detailed discussion is presented in Section 5.) For the reasons outlined previously the circuit was redesigned, and made compatible with the A5200A module. These modules (A5200A and A5300A) are interchangeable with modules A5200 and A5300 as a pair only. Its schematic diagram, PC mask, parts list, and wiring assembly are shown in Figures 6, 7, 8, and 9.

The only part cost difference between the A5300 module and the A5300A module is the addition of one resistor costing less than 10¢ total for the component and assembly time.

Comparative test data between the old design and the new design can be found in Table 1. These data show that the response times of the new design are significantly better than those of the old (as much as 1:7). The new design also has considerably narrower bandwidth (a factor of about 1:2), which increases the gain and sensitivity at the squelch frequencies. The new design can no longer self-oscillate (from frequency adjustment in the squelch filter) due to a modification in the squelch filter. Temperature drift and supply current data are located in Table 2. A step by step squelch adjustment procedure is given in Appendix A. The new design utilizes only the 16 VDC regulated supply and is therefore completely unaffected by changes in the battery line(specified from 21 to 30 VDC). The attendant disadvantage is that the transmitted tone amplitude at TP5008 is limited by the 16 VDC supply.

Since the 150 Hz oscillator amplitude is limited by the 16 VDC supply, clipping would occur if the gain margin were the same as in the original design (2:1). If this would occur, harmonics of the 150 Hz tone would be audible at the receiver. In addition, if the gain margin was 2:1, spurious 150 Hz noise spikes would trigger the squelch when in receive. For these reasons a gain margin of 1.4:1 was chosen. If a tolerance analysis should show this value to be insufficient for reliable operation over the temperature range, a lower value of R5201A could be used to increase this gain margin.

5. DETAILED CIRCUIT DISCUSSION (Squelch Assembly Figure 15)

a. Squelch Filter Assembly A5300A - Detailed Discussion.

The signal fed to squelch amplifier assembly A5200 is amplified in the squelch ac amplifier. The amplifier is stabilized by ac feedback. The amount and frequency of the feedback is determined by selecting components in squelch filter A5300. The squelch filter attenuates 150 Hz tone or noise components around 7.3 kHz, depending on which components are selected by the SQUELCH switch. Since all other frequencies are fed back in a degenerative network, their gain is greatly reduced. The desired frequency is not attenuated in the amplifier and thus receives maximum gain. The result is an amplifier with a very narrow frequency response. When the SQUELCH switch is at NEW ON (fig 10), resistors R5301A, R5302A, R5303A, R5304A, and R5305A; and capacitors C5301A, C5302A, and C5303A are connected in a parallel twin-T circuit that attenuates 150 Hz tone. Potentiometer R5303A is adjusted to tune the filter to provide maximum attenuation to 150 Hz squelch tone signals. With the resistors R5301A, R5302A, R5303A R5304A, and R5305A; and capacitors C5301A, C5302A, C5303A, C5304A, C5305A, and C5306 are connected in a parallel twin-T circuit that attenuates 7.3 kHz noise components. When transmitting, the squelch amplifier oscillates because of the action of resistive feedback components in the transmitter speech amplifier module. At this time, the 150 Hz feedback circuit tunes the oscillator to 150 Hz.

b. Squelch Amplifier Assembly A5200A (Figures 1 and 15). Detailed Discussion.

(1) AC Amplifier ICA. Figure 12 is a simplified schematic diagram of the ac amplifier and block diagram of the degenerative feedback circuits. Figures 10 and 11 are simplified schematic diagrams of the 150 Hz tone-filters (NEW squelch) and noise filters (OLD squelch) degenerative feedback circuits, respectively.

(a) Depending on the setting of the front panel SQUELCH switch, the output of the audio and squelch preamplifier or the 150 Hz tone feedback network of the speech amplifier is applied through voltage divider R5201A and R5202A and coupling capacitor C5201A to the non-inverting input of ICA (Pin 3). Voltage divider R5302A and R5304A determine the bias voltage of the non-inverting input of ICA (Pin 3). The amplified output (Pin 1) is applied to:

- Squelch dc amplifiers ((2) below)
- Tone modulator in the transmitter (transmit operation)

(b) The degenerative feedback path is from the output of ICA (Pin 1) to the inverting input of ICA (Pin 2). The gain resistor R5201A provides the proper voltage gain for degenerative feedback. With the SQUELCH switch on OLD ON, the squelch filter passes all frequencies except 7.3 kHz. The ac amplifier is completely degenerative for all frequencies except 7.3 kHz. Therefore, it provides maximum gain at 7.3 kHz. With the SQUELCH switch on NEW ON, the squelch filter will feedback all frequencies except 150 Hz. The ac amplifier is completely degenerative for all frequencies except 150 Hz. The amplifier provides maximum gain at 150 Hz.

(2) Squelch DC Amplifier, Noise and Tone Decision Circuits (Figure 13). The amplified output from the squelch ac amplifier feeds one of two decision circuits and the dc amplifier. These circuits control the smoothing filter, squelch transistor Q5204A and the squelch relay K5002 which, in turn, control the 16 volts dc fed to the monitor and audio amplifiers.

(a) When the front panel SQUELCH switch is at OLD ON, noise components centered around the 7.3 kHz control squelch relay K5002. The noise components are coupled through capacitor C5203A. A diode comparator consisting of potentiometer R5208A **and** diode D5202A is combined with a rectifier D5303A and capacitor C5204A. This voltage passes through limiting resistor R5211A and decision diode D5205A. Resistor R5214A provides a low voltage potential to the inverting input of ICB (Pin 6) when no noise is present. Since the non-inverting input (Pin 5) of ICB is biased at 5.6 volts by diode D5201A and resistor R5209A, the operational amplifier ICB amplifies the voltage difference. If noise is present, D5205A would conduct and the non-inverting input (Pin 6) of ICB would be at a higher potential than the non-inverting input (Pin 5) at ICB, then the output of ICB (Pin 7) will be zero.

(b) When the front panel SQUELCH switch is at NEW ON, 150 Hz tone signals control squelch relay K5002. Capacitor C5202A and series resistor R5206A couple 150 Hz tone signals from the squelch ac amplifier to the tone decision circuit consisting of dc biasing potentiometers R5207A and resistor R5205A, and diode D5204A. When no 150 Hz tone is present, and when potentiometer R5207A is adjusted such that the potential of the inverting input (Pin 6) of ICB is higher than the 5.6 volts dc of the non-inverting input, the output of ICB (Pin 7) will be low (near zero potential) when a 150 Hz tone is applied, diode D5204A will not conduct during the negative half cycle. Resistor R5214A will create a lower potential at the inverting input (Pin 6) than the potential at the non-inverting input (Pin 5). Therefore, ICB will amplify the voltage difference. Since the amplifier is operating without feedback, the output voltage peaks at the maximum allowable by the voltage supply (16 V). Since this occurs only every half cycle, a smoothing filter is necessary to prevent the squelch relay from pulsing.

(c) Resistor R5215A is included to keep the inverting and non-inverting inputs of ICB at close (not equal potential).

(d) OLD-NEW SQUELCH switching (Figure 13). In the previous design, there were two dc amplifiers and it was possible to switch from OLD to NEW at the squelch (Q5207) transistor. On this same line there was a voltage induced during the transition from transmit to receive operation (see section d); because of these factors, switching transistors are employed in the redesign. To disable the new squelch during OLD ON operation, current is applied to the base of transistor Q5201A through R5212A and R5216A from Zener Diode D5201A. This creates a voltage potential of .2 V between the collector and the emitter of Q5201A. Therefore, diode D5204A is reverse biased and will not conduct. At this time, transistor Q5202A is in the cut-off region and the 7.3 kHz signal passes to the dc amplifier unimpeded. Analagous to the above, when the squelch selector is turned on NEW ON, R5213A saturates transistor Q5201A which reverse biases D5205A. At this time, Q5201A is in the cut-off region and the 150 Hz signal passes unimpeded. The voltage applied to the series base resistors R5212A and R5213A comes from the 5.6 volt Zener Diode D5201A through R5216A.

(3) Squelch Smoothing Filter and Squelch Transistor (Figure 14). The output of the dc squelch amplifier pulses at 150 Hz when on NEW SQUELCH. A smoothing filter R5219A, C5205A, R5221A and R5222A alleviates this problem. Resistors R5221A and R5222A are used as biasing resistors for the base of squelch transistor Q5204A. Transistor Q5204A energizes squelch relay K5002. Diode D5206A is a reverse transient suppressor to protect transistor Q5204A.

(4) Anti-Pinball Circuit (see squelch assembly Figure 15). During retransmission utilizing two receiver-transmitters, it was possible for an oscillation to occur between the two sets. RT #1 receives a message and it keys RT #2 into transmit mode. The message ends, RT #1 squelch is de-energized, but the squelch transmit to receive recovery time of RT #2 takes longer. RT #2 believes momentarily that a signal is received, it then keys RT #1 to transmit. The same action occurs as before, similar to pinball lights. In the old design of the squelch, this action was prevented through the use of differential voltage pulse from resistor R2101, capacitor C2101, diode CR2101 on the voltage regulator board A2100, was applied to the base of squelch transistor Q5207 and put the transistor into cut-off, and de-energized the squelch relay K5002. This pulse was imposed on the same line as one section of the front panel SQUELCH switch.

In the new design, the additional old, new squelch disable transistors Q5201A and Q5202A were added because of this pulse. (If the pulse were applied to the inverting input of ICB, which would be the case if we did the switching similar to the old design, squelch response times were intollerably long, on the order of seconds.) To utilize this pulse to reduce the squelch disable time, the pulse would saturate transistor Q5203A (only when the voltage is greater than 9.1 volts) through biasing resistors R5218A and R5217A to discharge capacitor C5205A, squelch transistors W5204A is then cut-off which de-energizes squelch relay K5002. Since Zener diode D5207A is a 9.1 volt Zener diode, it conducts only when the applied voltage is greater than 9.1 volts. The only time more than 9.1 volts are applied is when the 16 volt differential pulse is applied. To dissipate this pulse and to recut-off Q5203A, resistor R5216A and Zener diode D5201A are used (this brings the voltage down to 5.6 V). R5216A and D5201A are also used to saturate the old, new squelch disable transistors Q5201A and Q5202A (paragraph 5b(2)(d)).

(5) When the front panel SQUELCH switch is at OLD OFF or NEW OFF, the squelch amplifier control circuits are bypassed. Regulated 16 volt dc power is mechanically connected by the SQUELCH switch directly to the 16 volt dc switched supply line which feeds the monitor and audio stages.

TABLE 1

SQUELCH RESPONSE COMPARISON DATA

The following tests utilize RT-524 SN230

	New Design	Old Design
A. Center Frequency		
Tone	150.1 Hz	150.0 Hz
Noise	7.3 kHz	7.3 kHz
B. Squelch Threshold (rf)		
Tone	.30 μV	.28 μV
Noise	.26 μV	.38 μV
C. 150 Hz Transmit Tone		
(TP 5008)	4.69 vac	5.65 vac
D. Oscillator Margin		
(Gain above Unity)	3 dB	6 dB
E. Bandwidth (from nominal)		
3 dB Tone	±3.6 Hz	±6.3 Hz
6 dB Noise	−.8 kHz, +.6 kHz	-1.6kHz, +1.3kHz

F. RESPONSE TIME (ms)	New Design Threshold	New Design Above Threshold	Old Design Threshold	Old Design Above Threshold
1. Attack				
Tone	110	60	300	100
Noise	50	25	90	25
2. Release				
Tone	30	30	120	250
Noise	15	15	16	50
3. Transmit to Receive				
Tone	120	70	900	200
Noise	110	25	300	130

TABLE 2

TEMPERATURE RESPONSE AND SUPPLY CURRENT DATA

A. Temperature Response of Center Frequency (reference to room temperature).

	-40°	$+75^{\circ}$
TONE	-0.9 Hz	+1.1 Hz
NOISE	-0.0 kHz	+0.0 kHz

B. Maximum supply current to squelch amplifier A5200 @ 16 VDC was 13 mA.

TABLE 3

COMPONENT AND LABOR COSTS - A5200, A5200A

COMPONENT	NUMBER RQRD	UNIT COST	COST/ MODULE	ASSY TIME RQRD	ASSY COST	TOTAL COST
A5200						
Resistor	13	.05	.65	182	.35	1.00
Capacitor 15 μf	2	.35	.70			
4700 pf	3	.22	.66			
.47 μf	1	.20	.20	140	.27	3.13
1.5 μf	1	.25	.25			
6.8 μf	2	.35	.70			
56 μf	1	.35	.35			
Diodes	3	.13	.39	4.2	.08	.47
Transistor 2N270	2	.37	.74			
2N335	2	.35	.70	119	.23	4.07
2N328A	3	.80*	2.40			
Thermistors	2	.75**	1.50	28	.06	1.56
TOTALS	35		9.24	511	.99	10.23
A5200A						
Resistor	20	.05	1.00	280	.55	1.55
Capacitor .001 μf	1	.14	.14			
4700 pf	1	.22	.22	70	.14	1.57
.1 μf	2	.36	.72			
10 μf	1	.35	.35			
Transistor 2N2222	4	.14	.56	68	.13	.69
IC MC 1558	1	2.50	2.50	51	.10	2.60
Diodes	7	.13	.91	98	.19	1.10
TOTALS	38		6.40	567	1.11	7.51

*Quote from another manufacturer was $1.80 each/5k lot.
** Estimated.

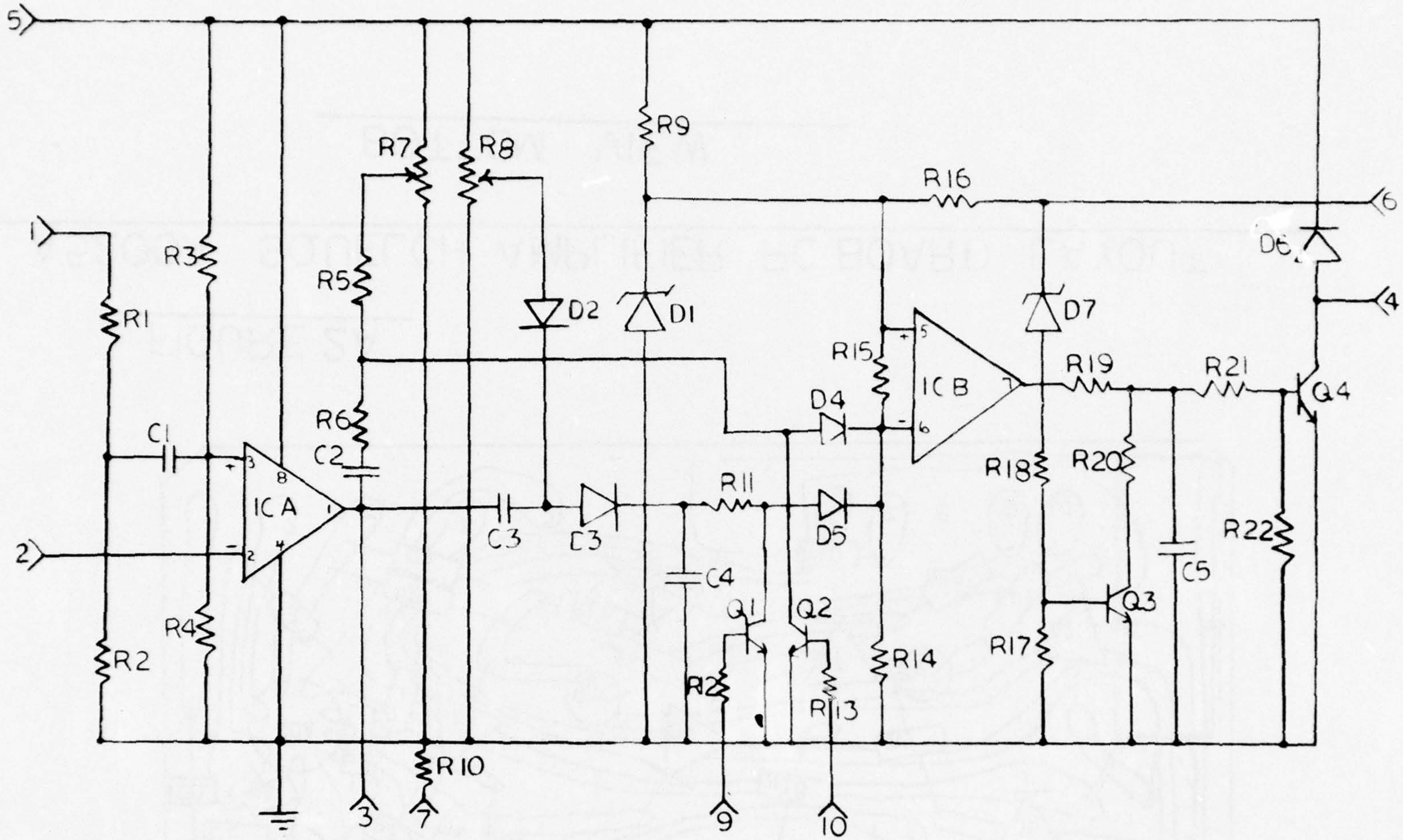

FIGURE 1

A5200A SQUELCH AMPLIFIER SCHEMATIC

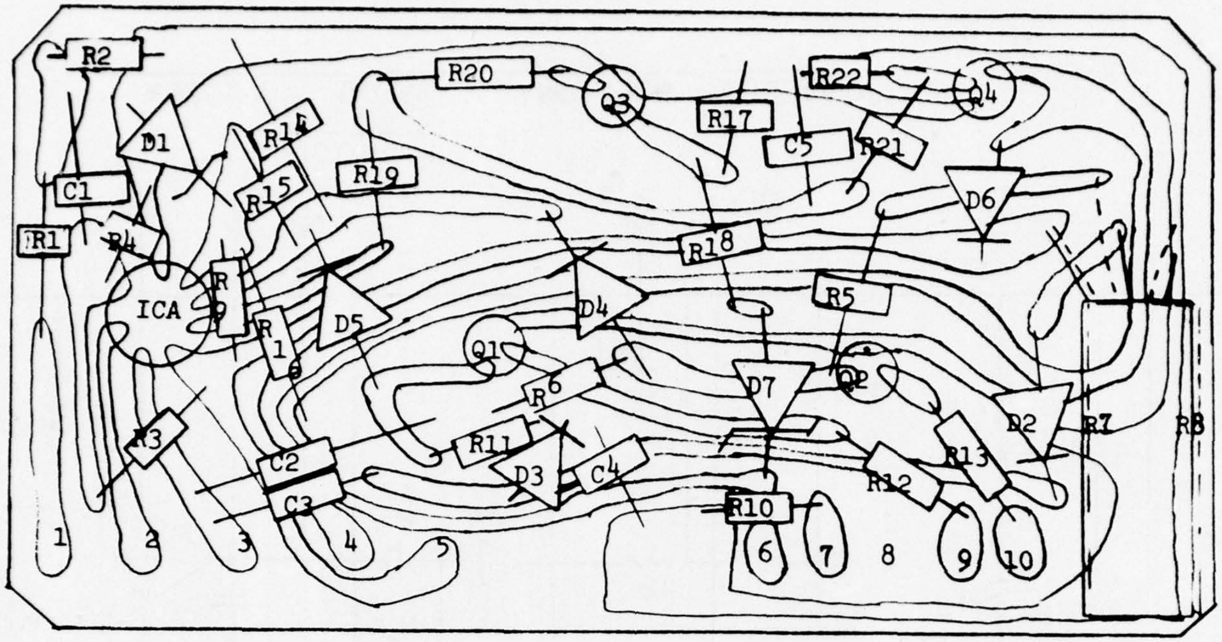

FIGURE 2A

A5200A SQUELCH AMPLIFIER PC BOARD LAYOUT

BOTTOM VIEW

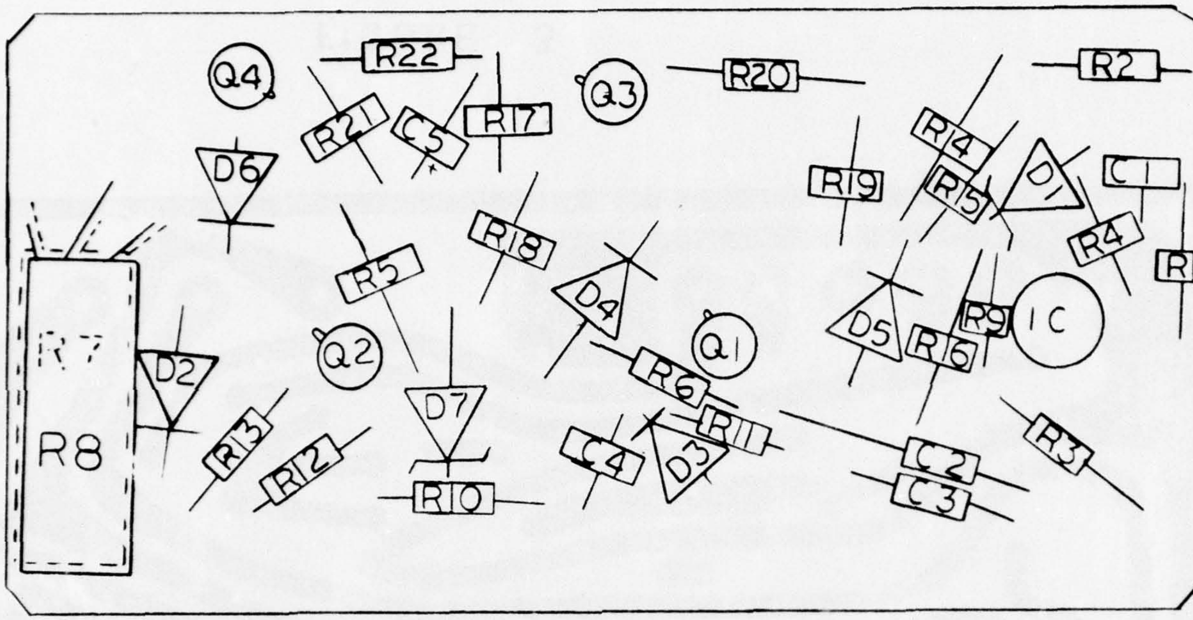

FIGURE 2b

A5200A SQUELCH AMPLIFIER PC BOARD

LAYOUT, TOP VIEW

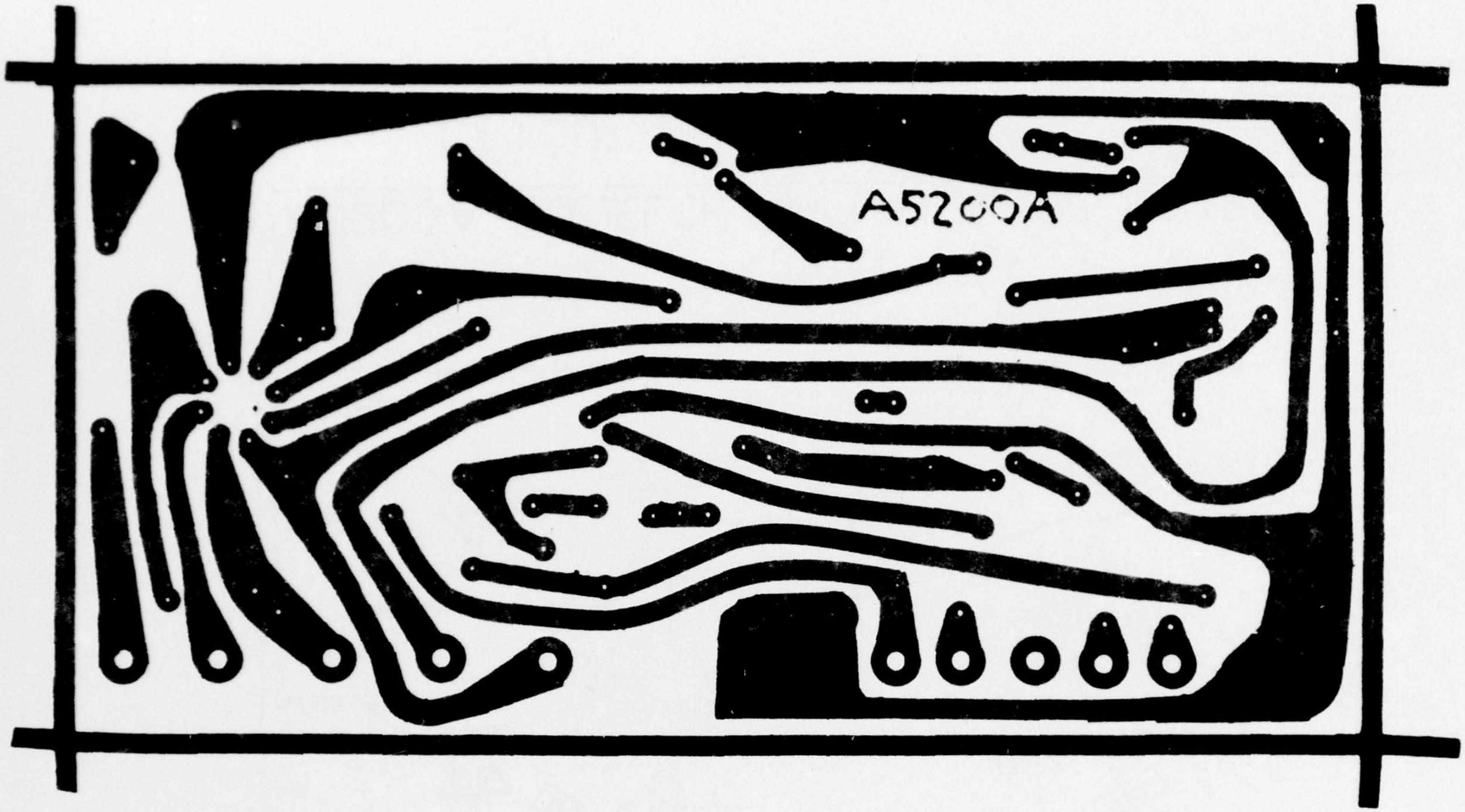

FIGURE 3

A5200A SQUELCH AMPLIFIER PC MASK
(NOT DRAWN TO SCALE)

FIGURE 4

PARTS LIST FOR MODULE A5200A

R5201A	1.5k	RCR07G152JM	MIL-R-39008/1
R5202A	300	RCR07G301JM	MIL-R-39008/1
R5203A	100k	RCR07G104JM	MIL-R-39008/1
R5204A	120k	RCR07G124JM	MIL-R-39008/1
R5205A,R5211A,R5215A	27k	RCR07G273JM	MIL-R-39008/1
R5206A,R5212A,R5213A	47k	RCR07G473JM	MIL-R-39008/1
R5207A,R5208A	20k	SM-C-374830-4*	
R5209A	1k	RCR07G102JM	MIL-R-39008/1
R5210A	180	RNR55C1800F	MIL-R-10509/7
R5214A	1M	RCR07G105JM	MIL-R-39008/1
R5216A	390	RCR07G391JM	MIL-R-39008/1
R5217A,R5218A	10k	RCR07G103JM	MIL-R-39008/1
R5219A,R5221A	5.6k	RCR07G562JM	MIL-R-39008/1
R5220A	27k	RCR07G270JM	MIL-R-39008/1
R5222A	3.3k	RCR07G332JM	MIL-R-39008/1

All capacitance values in microfarads

C5201A,C5202A	.1	CK05BX104K	MIL-C-11015
C5203A	.047	CK05BX473K	MIL-C-11015
C5204A	.001	CK05BX102K	MIL-C-11015
C5205A	10	CSR13E106KP	MIL-C-39003/1
D5201A		JAN1N752A	MIL-S-19500
D5202A,D5203A,D5204A D5205A,D5206A		JAN1N645	MIL-S-19500
D5207A		JAN1N758A	MIL-S-19500
Q5201A,Q5202A, Q5203A,Q5204A		JAN2222	MIL-S-19500
IC		Motorola MC1558 or equal	

With the exception of the new printed circuit board pattern and new components, all dimensions and assembly drawings and hardware are identical to the existing A5200 module. The new module is designated A5200A and should be so marked on the cover. In addition, it should be marked "USE ONLY WITH A5200A".

*(Bourns 220W-1-204 or equal) Resistor R5207A is the tone squelch sensitivity adjustment. Resistor R5208A is the noise squelch sensitivity adjustment.

FIGURE 5

PIN DESIGNATIONS FOR SQUELCH AMPLIFIER ASSEMBLY A5200A

PIN NUMBER	FUNCTIONAL DESCRIPTION
1 (TP5012)	Input from Audio and Squelch Preamplifier Assembly A4300
2	Feedback from Squelch Filter Assembly A5300A
3 (TP5008)	Output from Squelch AC Amplifier
4	Squelch Relay K5002 Control
5	DC Power Supply, +16 VDC Regulated
6	Anti-Pinball Input
7	Series Load Resistors
8	NC
9	Noise Squelch Disable
10	Tone Squelch Disable

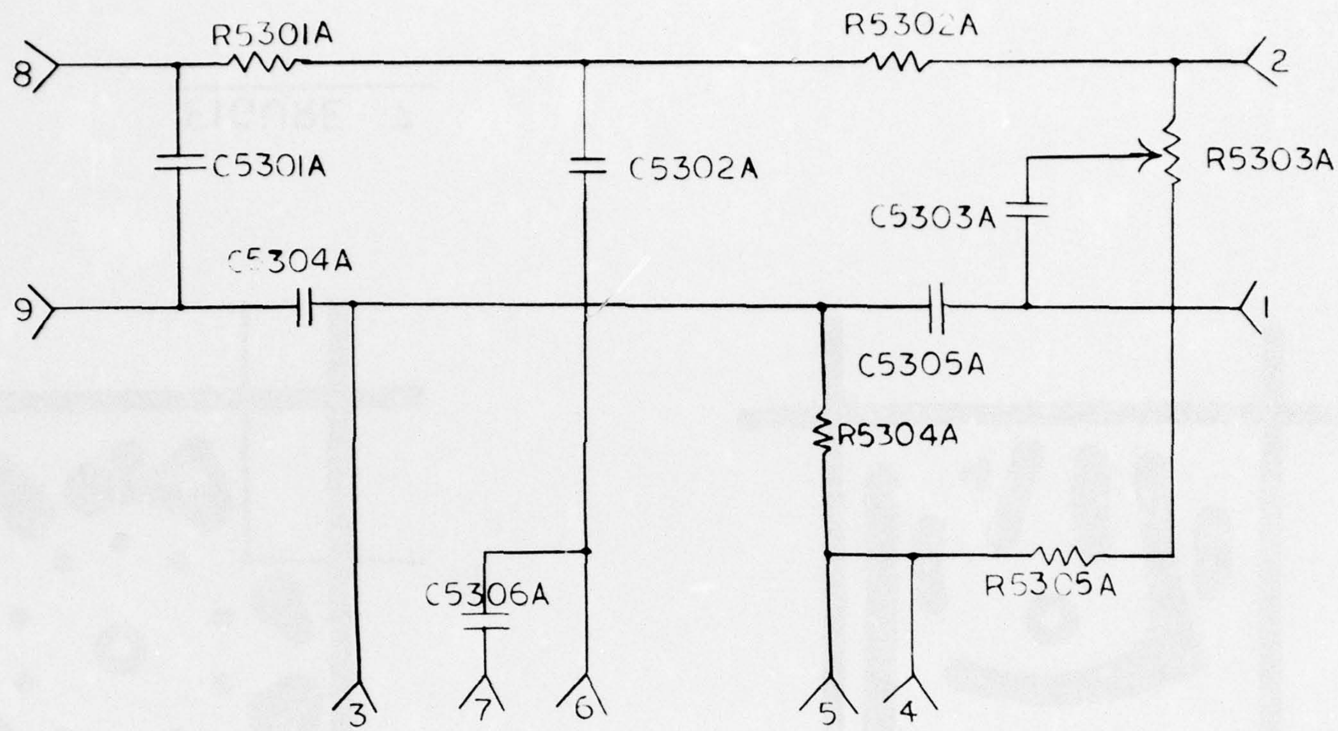

FIGURE 6

A5300A SQUELCH FILTER SCHEMATIC

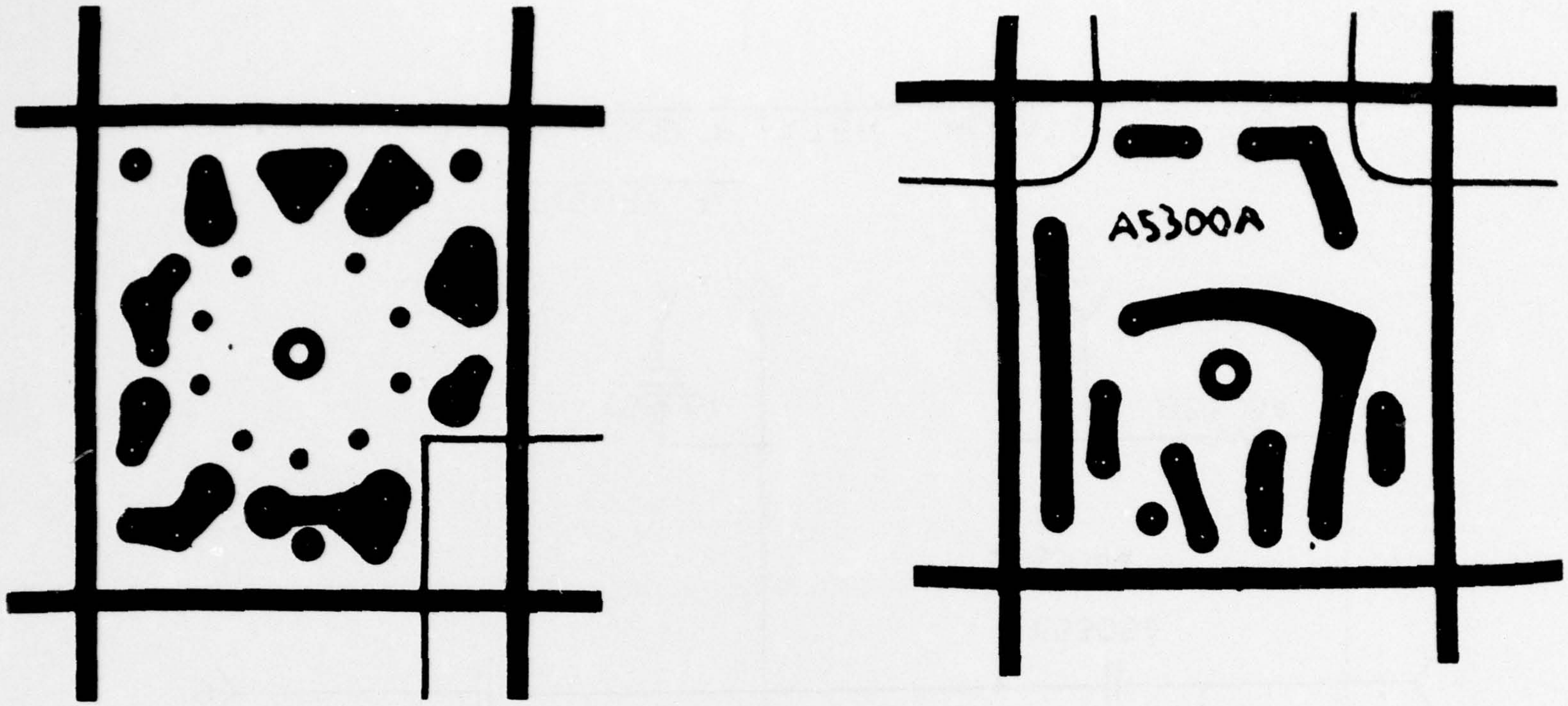

FIGURE 7

A5300A SQUELCH FILTER PC MASK

(NOT DRAWN TO SCALE)

FIGURE 8

A5300A SQUELCH FILTER ASSEMBLY PARTS LIST

R5301A, R5302A	154k	RNR55C1543F	MIL-R-10509/7
R5303A	5k	SM-C-374830-5* (Bourns 220W-1-502)	
R5304A	38.3k	RNR55C3832F	MIL-R-10509/7
R5305A	18k	RNR55C1082F	MIL-R-10509/7
C5301, C5302, C5303	200 pf	MEPCO/ELECTRA* 2222-527-42001	
C5304, C5305, C5306	.01μf	MEPCO/ELECTRA* 2222-427-41003	

*or equivalent.

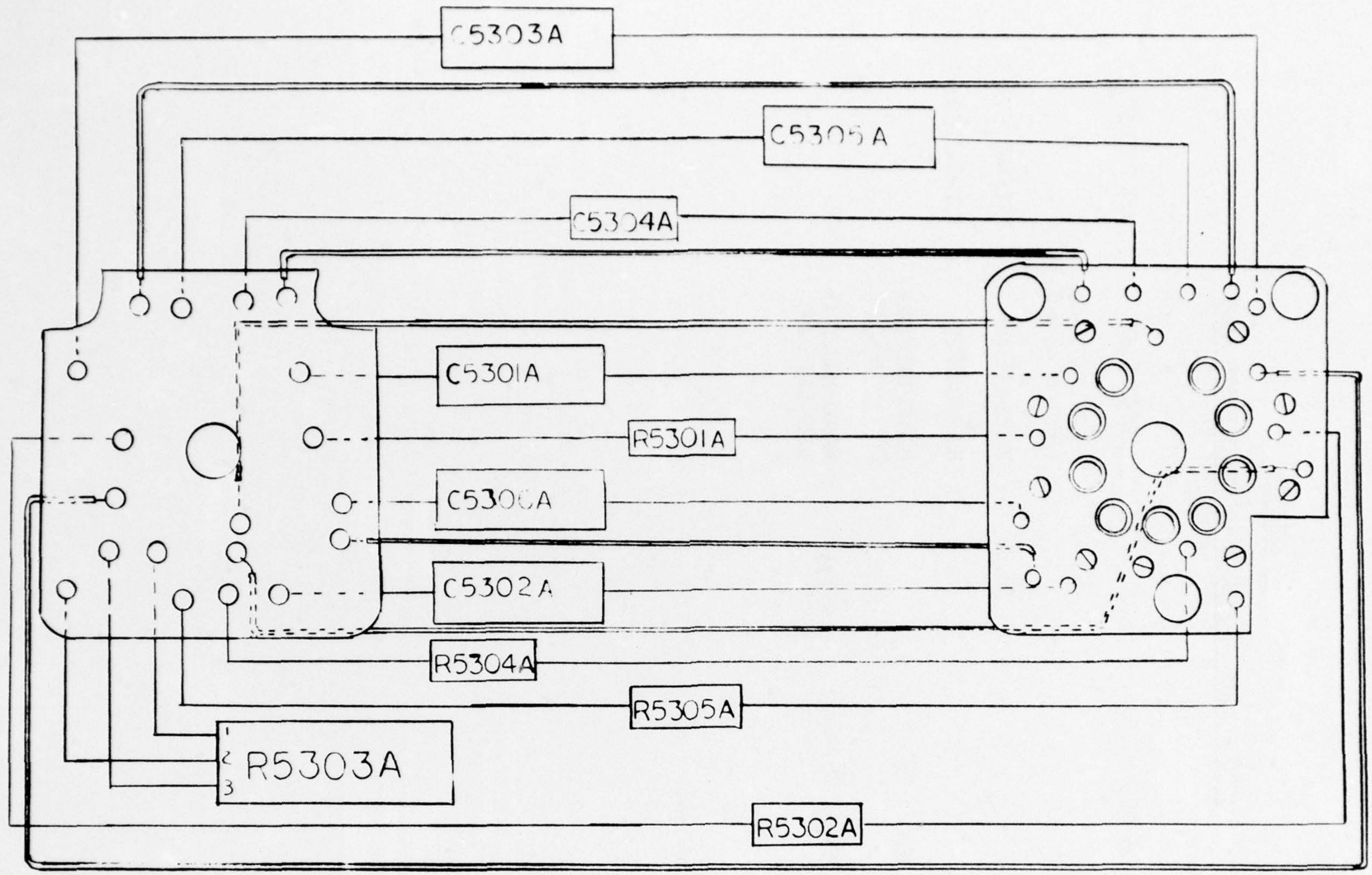

FIGURE 9- A5300A WIRING ASSEMBLY

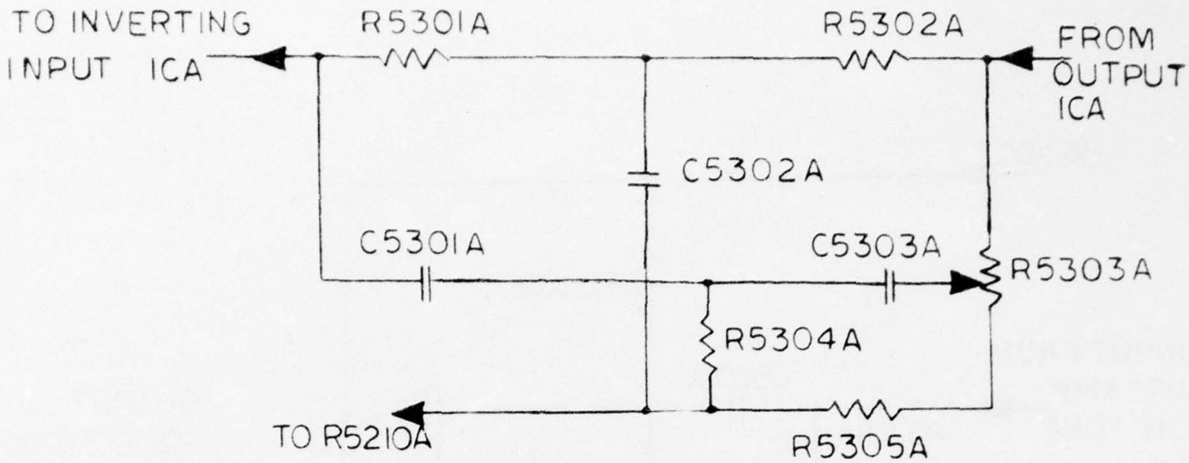

FIGURE 10

NEW (150-CPS TONE) AC FEEDBACK CIRCUIT, SIMPLIFIED SCHEMATIC

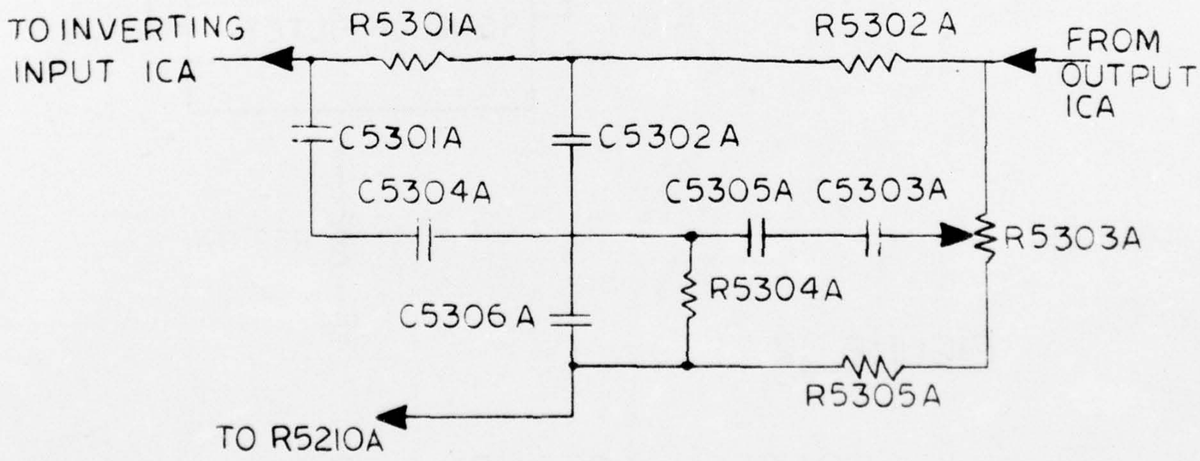

FIGURE 11

OLD (NOISE) AC FEEDBACK CIRCUIT

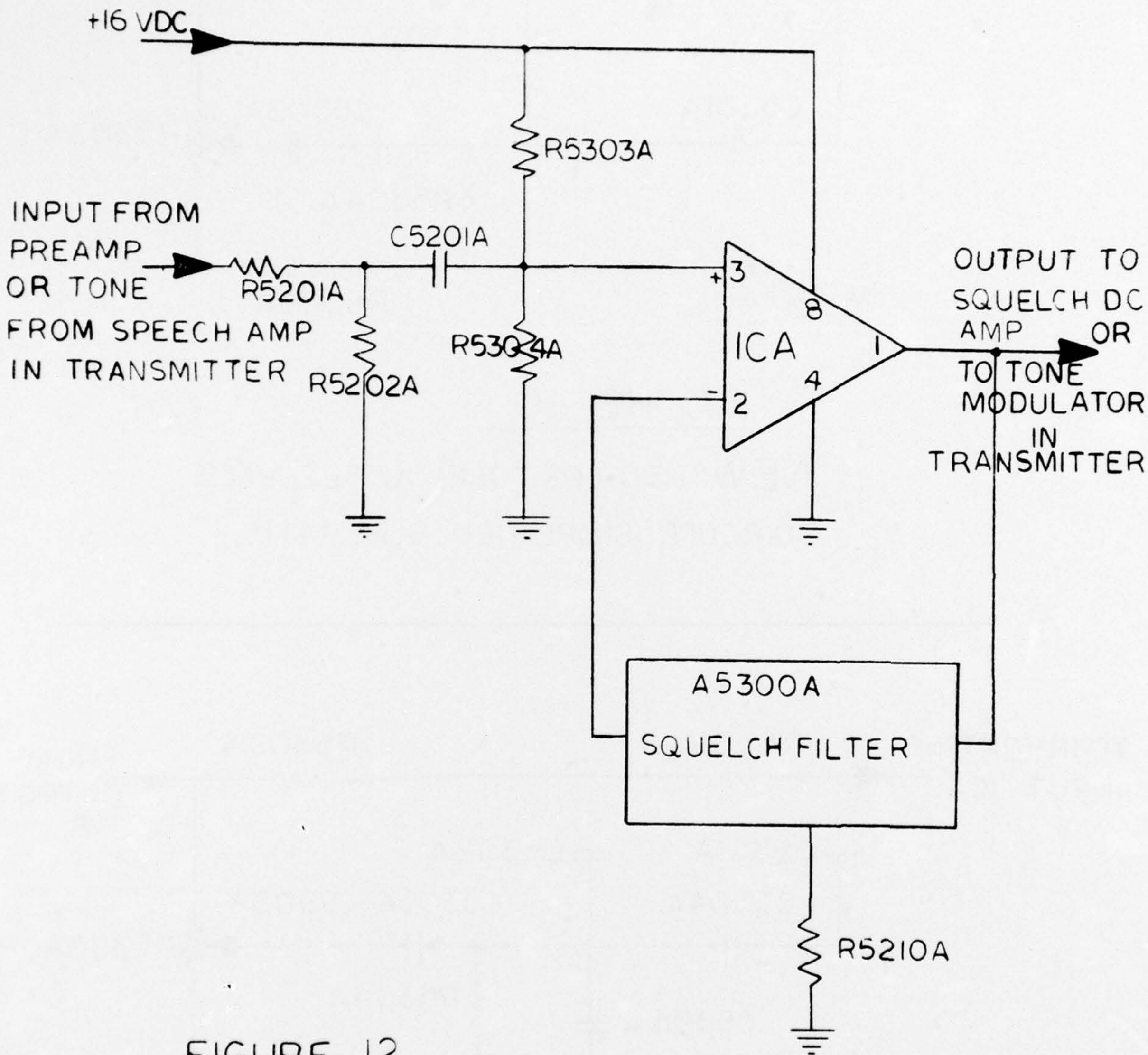

FIGURE 12

SQUELCH AC AMPLIFIER

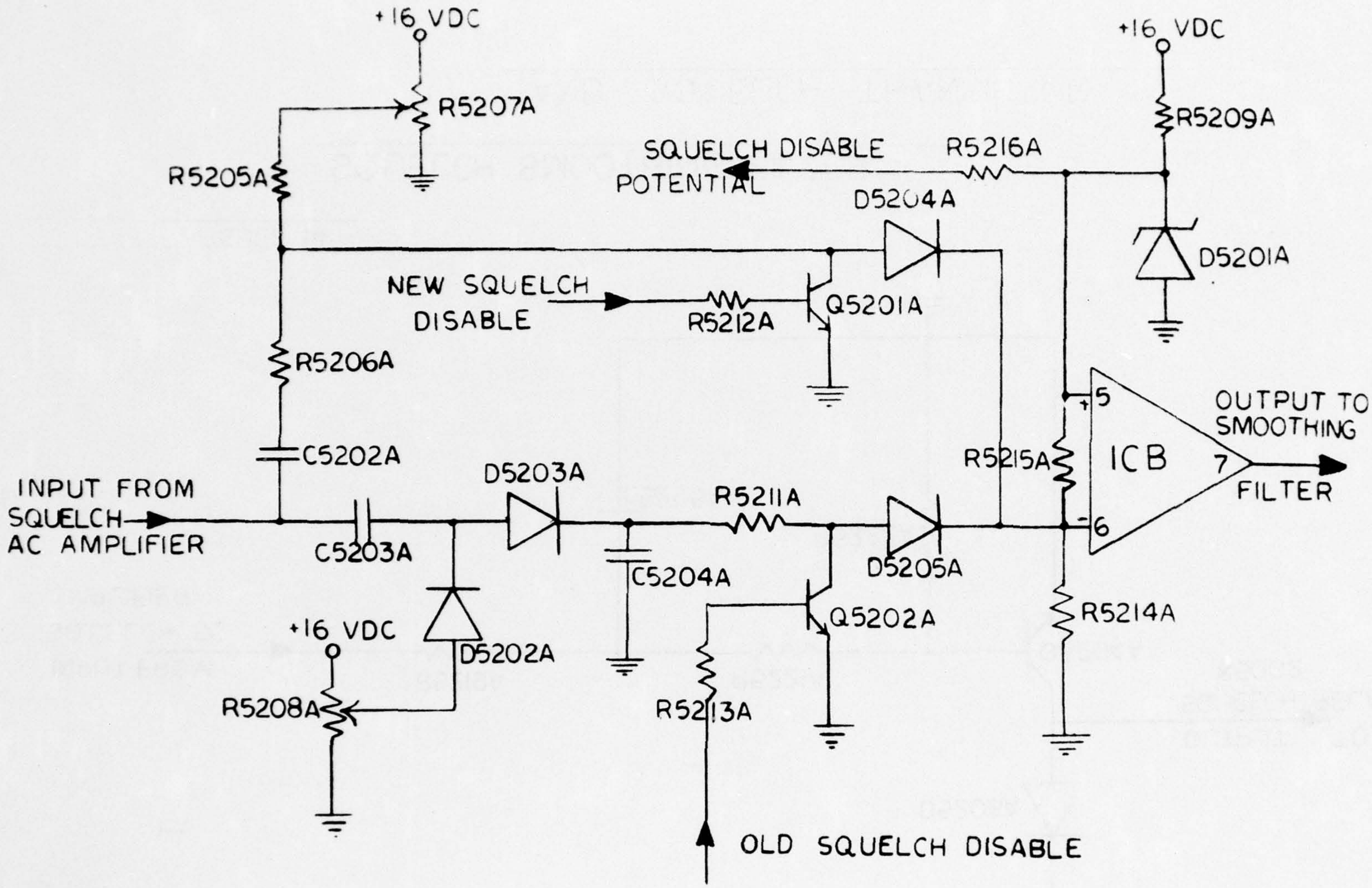

FIGURE 13 SQUELCH DC AMPLIFIER AND DECISION CIRCUITS

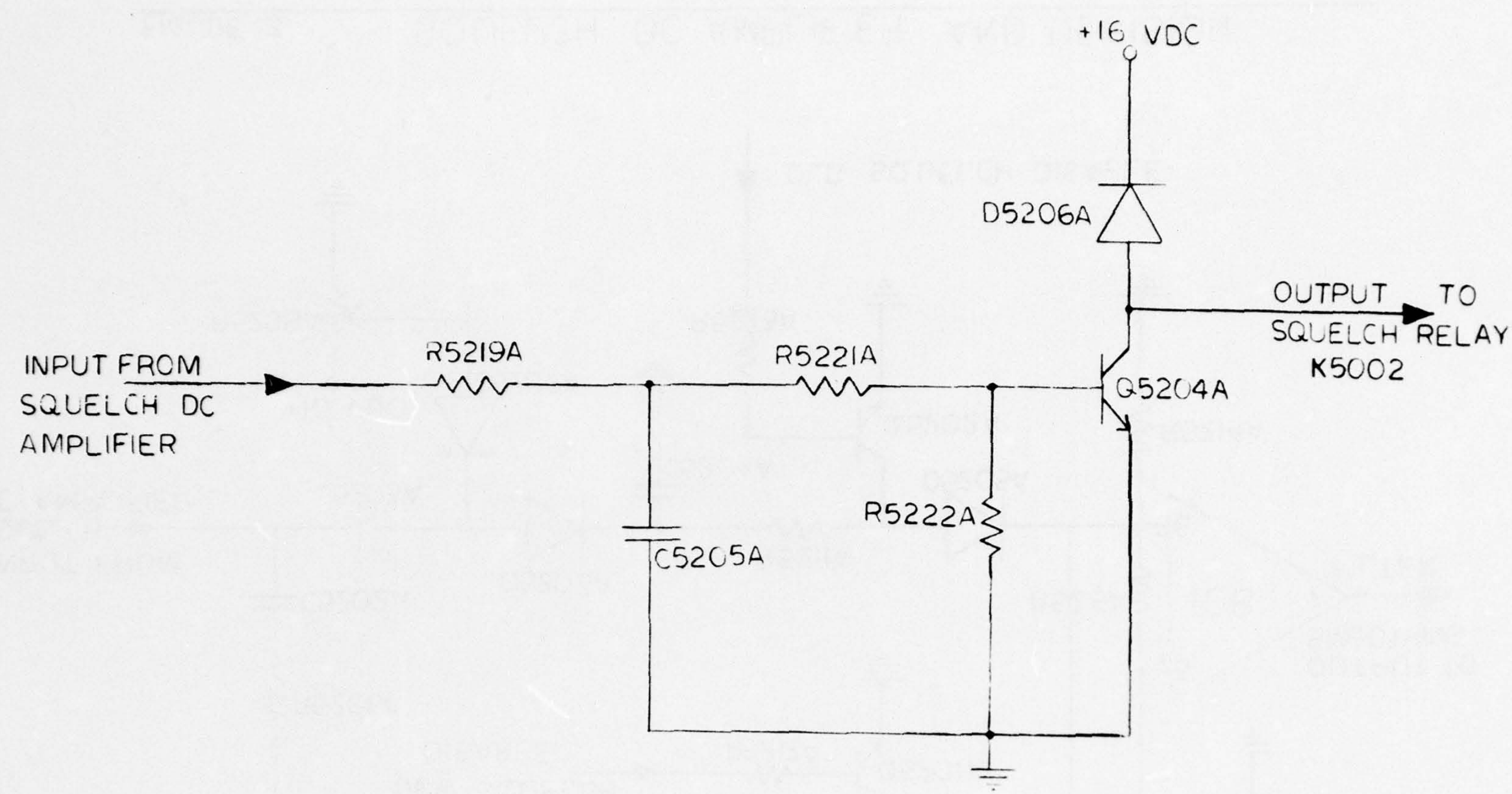

FIGURE 14

SQUELCH SMOOTHING FILTER

AND SQLELCH TRANSISTOR

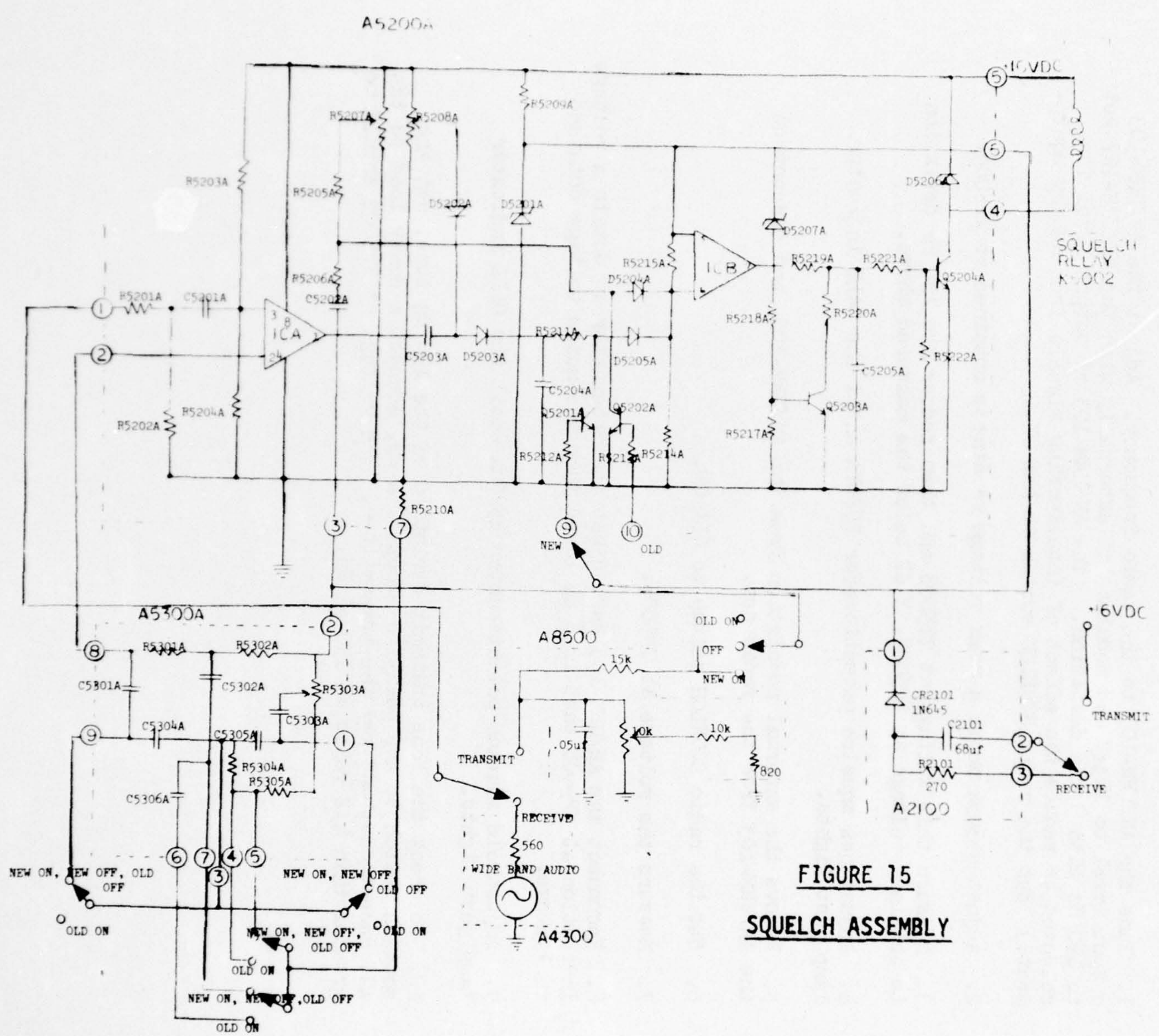

FIGURE 15

SQUELCH ASSEMBLY

APPENDIX A

ADJUSTMENT PROCEDURE FOR MODULES A5200A, A5300A

1. Tune the AN/URM-103 to the radio frequency. Adjust the AN/URM-103 output level to 1kμV and modulate it externally with the AN/URM-127 set to 150 Hz with 3 kHz deviation. (The AN/URM-103 rf output level is selected to reduce the effect of interferring signals from nearby equipment.) Set the radio SQUELCH switch to NEW ON.

2. Adjust R5303A until a peak voltage reading is obtained at TP5008.

3. Measure this voltage at TP5008 and then reduce the 150 Hz deviation to obtain a voltage at TP5008, 3 dB below the measured above.

4. Adjust new squelch potentiometer R5207A until the CALL indicator lamp just lights.

5. Remove the external modulation from the AN/URM-103, and disconnect the AN/URM-103 from the radio set.

6. Set the radio SQUELCH switch to OLD ON.

7. Measure the voltage at TP5008.

8. Reconnect the AN/URM-103 and adjust its attenuator to obtain a voltage indication at TP5008 that is 6 dB lower than the noise voltage obtained in 7 above.

9. Adjust old squelch potentiometer R5208A until the CALL indicator lamp just lights.

10. To check the tone transmit deviation of the 150 Hz tone, set the squelch switch to any position except OLD ON, connect a dummy load to the ANT receptacle, and key the transmitter. The voltage at TP5008 should be greater than 4.2 volts at 150 $\pm$1 Hz.

ACKNOWLEDGEMENT

It is with a great deal of pleasure that I wish to thank Arthur R. Sills, for all the support and assistance he provided throughout this project.