WJ-861X RECEIVER

APPENDIX H

TYPE 798069-1, NOISE RIDING THRESHOLD, (NRT)

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GAITHERSBURG, MARYLAND 20878-1794

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WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

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TYPE 798069-1, NOISE RIDING THRESHOLD, (NRT)

H.1 GENERAL

The Noise Riding Threshold (NRT) option measures the ratio of a signal carrier level to the IF background noise and activates the audio and COR (carrier operated relay) outputs when the operator selected threshold is exceeded. The circuitry has a threshold adjustment range of 0-to-20 dB that is set using the NRT/COR UP/DOWN pushbuttons on the receiver front panel or by using the COR command to set NRT remotely. The NRT LEVEL display provides a number from 00 to 20 that represents the NRT threshold in decibels. The NRT module board is inserted in option slot 6. The DAV option is excluded when the NRT option is selected.

H.2 INSTALLATION

NRT is installed by plugging Type 798069-1 Noise Riding Threshold module into option slot 6. Refer to the decal on the receiver top dust cover for the location of option slot 6. Ensure that the Audio/Video/COR (A3A15) module installed in the receiver is Type 796233-1. Set switch S2 Portion #3 on the Synthesizer Interface (A5A2) board to the closed position to enable the NRT option (1 is open; 0 is closed).

H.3 OPERATION

Refer to Table H-1 for a list of the controls and indicators used by the Noise Riding Threshold option. The NRT option is selected by first pressing the FUNCTION (F↑) key to illuminate the LED on this key. With the FUNCTION key LED illuminated, the receiver front panel is placed in the uppercase operating mode. In the uppercase mode, press the NRT key to illuminate the LED on this key. The Noise Riding Threshold operating mode is now enabled. The NRT level is visible in the display below the NRT LEVEL label on the front panel display. The NRT increment (↑) and NRT decrement (↓) keys are used to vary the level visible in the NRT display. This value is selectable between 00 to 20. A NRT setting of 00 has a noise riding threshold level of zero dB. Using the NRT increment key (↑) a level of up to 20 may be selected. A NRT value of 02 requires a 2 dB carrier-to-noise level (C+N/N) before the NRT output is forced to a TTL level High, indicating that the set NRT level has been exceeded. Exceeding the set NRT level causes the LED on the decrement key (↓) to illuminate.

NRT can only be selected when the 10 kHz, 20 kHz, 50 kHz or 100 kHz IF bandwidths are selected. If an IF bandwidth other than these four bandwidths is selected, NRT is not able to be selected. NRT may be disabled by pressing the NRT key to extinguish the LED below the NRT label on the front panel. With NRT disabled, the receiver returns to the COR operating mode.

During remote operation, the COR "n" command is used to set the NRT level (where "n" is a value between 00 and 20) when NRT is enabled. The COR? query is used to determine the NRT set level, when the NRT mode is enabled. IF NRT is not enabled, the COR mnemonics affect the COR operation.

Table H-1. NRT Controls and Indicators

Control/Indicator	Function
F↑	Must be pressed before NRT can be turned on or off.
NRT	Initiates NRT function. If NRT is already selected, NRT disables NRT and selects COR.
NRT/COR	Increases or decreases NRT threshold when NRT is selected.
NRT LEVEL	Displays NRT threshold, 1 increment per 1 dB of carrier-to-noise ratio.
COR "n"	Sets the NRT level when NRT is enabled (n = 00 -20)
COR?	Requests the NRT level when NRT is enabled.
NRT	Enables NRT
NRT/	Disables NRT

H.4 CIRCUIT DESCRIPTIONS

The following paragraphs provide circuit descriptions for the subassemblies required for NRT.

H.4.1 TYPE 798069-1 NOISE RIDING THRESHOLD (A5NRT)

Refer to **Figure H-8** for the Type 798069-1 Noise Riding Threshold schematic diagram. The NRT board is installed in option slot 6 of the Digital Motherboard.

The FM signal is input from the FM discriminator to U10 and U12 and their associated circuitry which function as an active high-pass filter with selectable cutoff frequencies which correspond to the selected IF bandwidths. The bandwidth select lines, input pins 4 and 6, digitally determine the cutoff frequency of the filter. Feedback resistors R2 through R17 in conjunction with C1 and C2, and C5 and C6 create the time constants to filter the signal. The cutoff frequency is slightly greater than one-half of the selected IF bandwidth, this provides immunity from modulation and allows good noise sensitivity. The filtered output of U12 is applied to noise amplifier and detector U7. Associated with U7 is a feedback network consisting of CR1, CR4, R20, R52, and R54. For a positive input to U7 the gain is very low, for a negative input there is high gain. The noise amplifier and detector is a non-linear device, whose

gain output depends on the level of the input signal. A detected noise voltage is at the output of U7.

Monostable multivibrators U1 and U2 provide timing for the circuit. The bandwidth select lines are input through logic gates U3 to the inverting inputs of flip-flops U1A, U1B, U2A, and U2B. The Q output of U2A acts as a clock for U4B and the Q* (Low) output of U2A sets U1A, U1B, and U2B. Logic gates U8A through U8D receive inputs from the microprocessor at connector pins 14 and 41. When the receiver is in the Scan or Step mode, U8 resets U1A, U1B, and U2B after each step or scan increment. This recycles the integration process and continues the scan or step sequence.

The output of U7 through R21 is a dc voltage proportional to the noise level; with no RF signal present, the noise input at connector pin 49 is maximum. U7 applies its maximum positive voltage. This detected noise voltage is applied to U6 along with the bandwidth select lines. Variable resistors R22 through R29, resistors R30 through R33, capacitor C13, and amplifier U11B make up an integrator. The resistors that are to be included are determined by the bandwidth select lines. The charging of C13 is determined by the sum of the detected noise voltage at R21 and the current at S1 of U6. If the current at R21 is higher than S1, C13 produces a sawtooth wave with a maximum amplitude of -15V; if the U6 S1 current is higher than the current through R21, C13 charges toward +15V. The duration of the charging is 5 or 12 msec, depending on whether the output of U1A, U1B, U2B is selected by the bandwidth select lines. At the end of the 5 or 12 msec period Q2, is made to conduct by a .5 msec pulse from U2A, this discharges C13 and resets the integrator. The output of U11B is input to comparator U5. The programmed COR level, from 0 to 5V, is input to U11C and applied to U5. The output of U5 is +5V if the output of U11C exceeds that of U11B, or 0V if the output of U11B exceeds the output of U11C. The TTL output of U5 is applied to flip-flop U4B. The Q output of U4B is applied to connector pin 47, and Q* (Low) output is applied through inverter U9B and then applied to connector pin 11 to update the microprocessor on the COR status.

H.5 MAINTENANCE

Performance tests and alignment procedures are provided for the subassemblies required for NRT.

H.5.1 PERFORMANCE TESTS

H.5.1.1 Audio/Video/COR Performance Tests

H.5.1.1.1 Video Output

1. Connect the test equipment as illustrated in **Figure H-1**, and remove the FM Demodulators from their slots on the RF/IF Motherboard.

2. Set the receiver to AM detection and select the 10 kHz bandwidth.

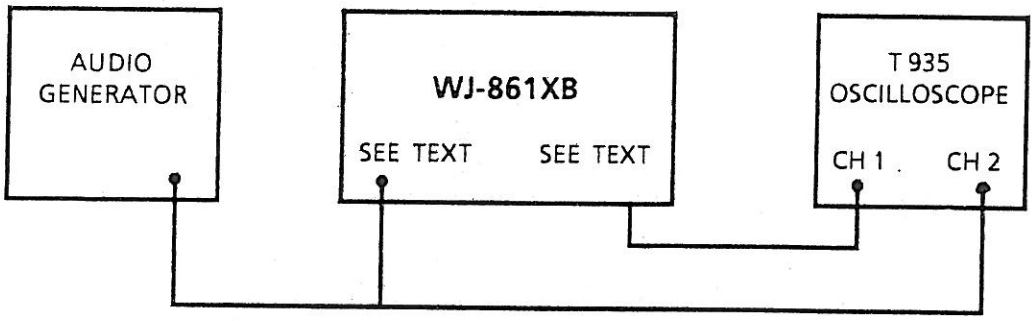

Figure H-1. Audio/Video/COR Performance Test, Equipment Connections

3. Connect the audio signal generator and the channel B input of the oscilloscope to pin 3 of connector XA15. Adjust the generator to produce a 1 kHz signal at 2 V peak-to-peak amplitude, as observed on channel B of the oscilloscope. Remove the oscilloscope probe.

4. Connect the channel A input of the oscilloscope, and 93 Ω termination to J2 (FM MON) on the receiver rear panel. Observe that the signal at J2 is 2 V peak-to-peak.

5. Move the channel A input of the oscilloscope and the 93 Ω termination to J4 (Switched Video) on the receiver rear panel. Observe no AM video is present.

6. Move the input signal from the signal generator to pin 1 of XA15. Observe a 2 V peak-to-peak signal displayed on the A trace of the oscilloscope.

7. Connect the channel B input of the oscilloscope and 600 Ω termination to the J3 (Audio) output on the receiver.

8. Rotate the LINE AUDIO fully CW and observe the output reaches an amplitude of at least 7 V peak-to-peak with no clipping present.

9. Select the 20 kHz bandwidth and repeat steps 3 through 8. Connect the signal generator to pin 5 of XA15 in step 3 and to pin 7 of XA15 in step 6.

10. Select the 50 kHz bandwidth and repeat steps 3 through 8. Connect the signal generator to pin 9 of XA15 in step 3 and to pin 11 in step 6.

11. Select the 100 kHz bandwidth and repeat steps 3 through 8. Connect the signal generator to pin 13 of XA15 in step 3 and to pin 15 in step 6.

H.5.1.1.2 COR Operation

1. Connect the test equipment as illustrated in **Figure H-2.**

2. Adjust the signal generator for a 255.5550 MHz CW signal, with the output level set to minimum. Set the HP-6216A power supply output for 24 V and adjust the current limit for 100 mA maximum.

3 Set the receiver to the standard test set-up described in **Table 4-3** with the NRT LEVEL set to 00 and observe that the NRT LED is illuminated. Observe the milliammeter on the power supply reads 100 mA.

4. Depress the NRT UP pushbutton and increase the NRT level until the NRT LED extinguishes. This level is typically 05 or less. Observe the milliammeter on the power supply reads near 0 mA.

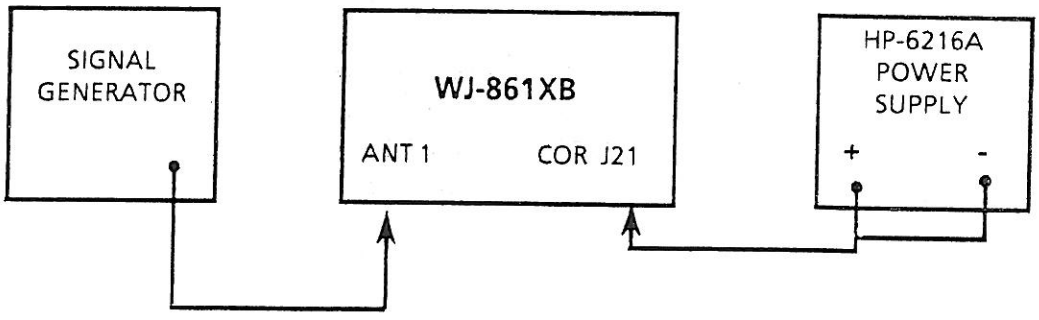

Figure H-2. COR Circuit Test, Equipment Connections

H.5.1.2 **Noise Riding Threshold (NRT), Performance Test**

1. Tune the receiver to the standard test setting listed in **Table 4-3**, except set NRT to 05 and AGC OFF.

H.5.1.2.1 **NRT Threshold Range**

1. Set the receiver to a 10 kHz bandwidth and NRT to 05. Set the signal generator to -145 dBm.

2. Connect the test equipment as shown in **Figure H-3.**

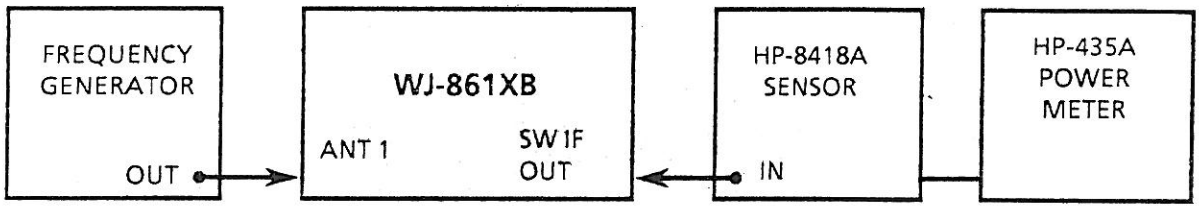

Figure H-3. NRT Threshold Test Configuration

3. Terminate the receiver with 50 ohms. Measure the noise level of the receiver at IF OUT with the RF power meter.

4. Increase the signal generator amplitude until a 3 dB rise in the noise level is noted at IF OUT. Use this as a reference.

5. Increase the signal generator until the NRT LED illuminates. The NRT LED should illuminate at 5, ±1 dB above the reference level established in **step 4.**

6. Set NRT to 20. Increase the signal generator amplitude until the NRT LED illuminates. The NRT LED should illuminate at 20, ±1 dB above the reference level established in **step 4.**

H.5.2 **ALIGNMENT PROCEDURES**

H.5.2.1 **Audio/Video/COR (A3A15), Alignment**

1. The following test requires that the IF bandwidth slot (A3A9) contain an IF Amplifier with a 10 kHz bandwidth. A matching FM Demodulator must be installed in slot A3A17.

2. Connect the test equipment as illustrated in **Figure H-4.**

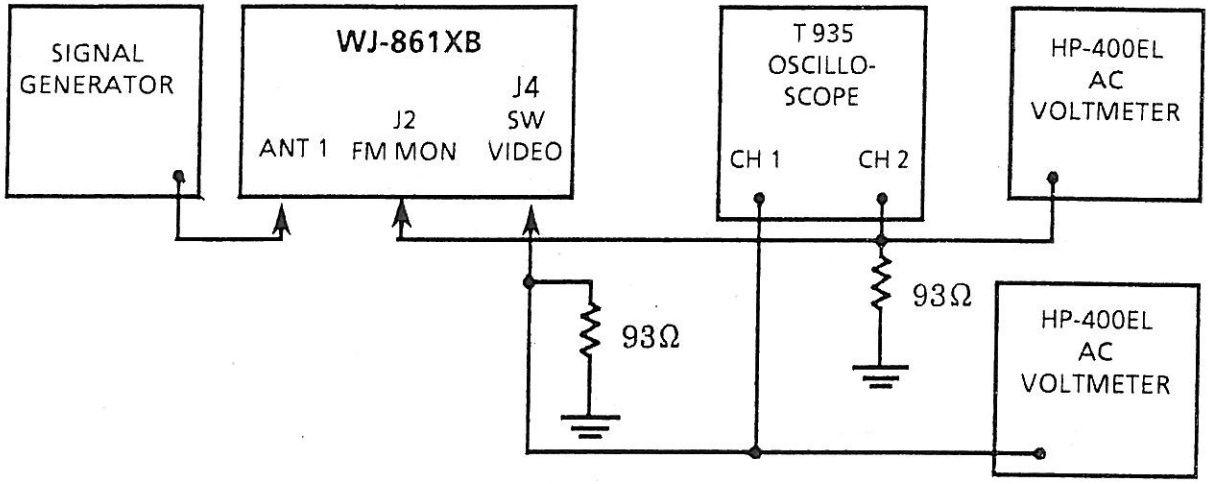

Figure H-4. Audio/Video/COR Alignment, Equipment Connections

3. Tune the receiver to 20.0000 MHz and select AGC on, 10 kHz Bandwidth, FM Detection and Antenna 1.

4. Set the signal generator to produce a 20.000 MHz signal, modulated at a 400 Hz rate. Set the peak deviation to 30%. Adjust the output level of the generator to 104 dBm as listed.

5. Set R4, R12, and R47 to midrange.

6. Adjust R4 for a 2.5 V peak-to-peak signal on channel 2 of the oscilloscope (approximately .884 Vrms) on the voltmeter.

7. Observe the switched video output level on the AC voltmeter, connected to Channel 1 of the oscilloscope and adjust R47, to decrease this level by 8 dB. Note the level indicated on the AC voltmeter (approximately .350 Vrms).

8. Select AM modulation on the signal generator and set the modulation for 50% at a 400 Hz rate. Select AM Detection on the receiver.

9. Adjust R12 for the same AC voltmeter level noted in **step 7.**

10. Adjust the signal generator output level to the level set in **step 4.**

11. Adjust the rear panel Line Audio control for 2.45 Vrms (6.93 V peak-to-peak).

H.5.2.2 **Noise Riding Threshold (NRT), Alignment**

1. Connect the test equipment as illustrated in **Figure H-5.**

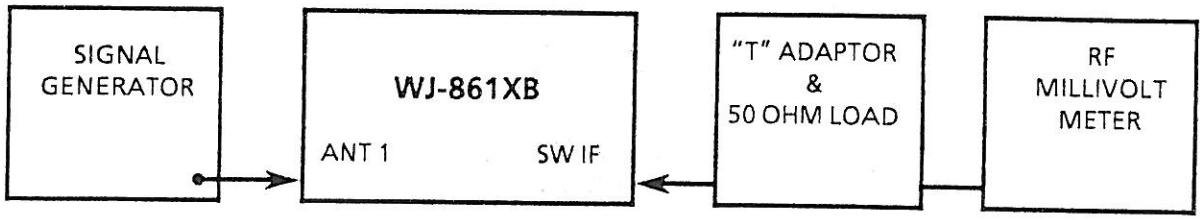

Figure H-5. NRT Alignment, Equipment Connection

2. Set the HP-8640B Signal Generator to produce a 255.5550 MHz CW signal. Set the output level to minimum.

3. Tune the receiver to 255.5550 MHz. Select 10 kHz Bandwidth, FM, AGC off. Rotate RF/IF Gain control fully CW. Set NRT LEVEL to 05.

4. With the HP-8640B Signal Generator output set to minimum, note the level present at the switched IF Output connector (J1). Slowly increase the signal generator output level until a 3 dB increase is noted. The level indicated on the signal generator is the noise floor of the selected bandwidth.

5. Increase the generator output level by 5 dB and adjust R22 until the NRT LED just illuminates.

6. Increase the NRT Level to obtain a display reading of 20. Increase the generator output level 15 dB (20 dB above the noise floor obtained in **step 4**).

7. Adjust R26 until the NRT LED just illuminates.

8. Repeat **steps 4** through **7** to minimize interaction between adjustments. The adjustment in **step 5** should cause the NRT LED to illuminate at exactly 5 dB above the noise floor and the adjustment in **step 6** should cause the NRT LED to illuminate at exactly 20 dB above the noise floor.

9. Select 20 kHz bandwidth and determine the noise floor using the procedure described in **step 4.**

10. Repeat **steps 5** through **8,** except, adjust R23 in **step 5** and R27 in **step 7.**

11. Select bandwidth #3 and determine the noise floor using the procedure described in **step 4.**

12. Repeat **steps 5** through **8,** adjust R24 in **step 5** and R28 in **step 6.**

13. Select bandwidth #4 and determine the noise floor **as described** in **step 4.**

14. Repeat **steps 5** through **8,** adjusting **R25** in **step 5** and **R29** in **step 7.**

H.6 REPLACEMENT PARTS LIST

The following list of manufacturers, parts list, and schematic diagrams supplement the Receiver Instruction Manual, and are to be used in conjunction with applicable sections of that manual.

Mfr. Code	Name and Address
04099	Capco, Incorporated P.O. Box 2164 Grand Junction, CO
88245	Litton Industries USECO Division 81501 Van Nuys, CA 91409

H.6.1 TYPE 798069-1 NOISE RIDING THRESHOLD

REF DESIG PREFIX A5

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision F				
C1	Capacitor, Mica, Dipped: 330 pF, 20%, 500 V	4	CM05FD331G03	81349	
C2	Same as C1				
C3	Capacitor, Electrolytic, Tantalum: 1 µF, 20%, 35 V	4	196D105X0035HE3	56289	
C4	Same as C3				
C5	Same as C1				
C6	Same as C1				
C7	Same as C3				
C8	Same as C3				
C9	Capacitor, Polycarbonate: .47 µF, 2%, 50 V	2	MPCW-474-.5-2	04099	
C10	Same as C9				
C11	Capacitor, Polycarbonate: .1 µF, 2%, 50 V	1	MPCW-105-.5-2	04099	
C12	Capacitor, Polycarbonate: .1 µF, 2%, 100 V	1	MPCW-104-1-2	04099	
C13	Capacitor, Polycarbonate: .01 µF, 2%, 100 V	1	MPCW-103-1-2	04099	
C14	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 15 V	3	196D226X0015KE3	56289	
C15	Same as C14				
C16	Same as C14				
C17	Capacitor, Ceramic Disc: .1 µF, 20%, 50 V	3	34475-1	14632	
C18	Same as C17				
C19	Same as C17				
C20	Capacitor, Ceramic Disc: .1 µF, 10%, 100 V	1	CK06BX104K	81349	
CR1	Diode	4	1N4444	80131	
CR2 Thru CR4	Same as CR1				
Q1	Transistor	1	2N2907/JAN	81350	
Q2	Transistor	1	U1899E	15818	
R1	Resistor, Fixed, Film: 10 kΩ, 5%, 1/4 W	6	CF1/4-10K/J	09021	
R2	Resistor, Fixed, Film: 15 kΩ, 1%, 1/10 W	3	RN55C1502F	81349	
R3	Resistor, Fixed, Film: 7.5 kΩ, 1%, 1/10 W	2	RN55C7501F	81349	
R4	Resistor, Fixed, Film: 3.01 kΩ, 1%, 1/10 W	2	RN55C3011F	81349	
R5	Resistor, Fixed, Film: 1.5 kΩ, 1%, 1/10 W	2	RN55C1501F	81349	
R6	Resistor, Fixed, Film: 100 kΩ, 1%, 1/10 W	3	RN55C1003F	81349	
R7	Resistor, Fixed, Film: 49.9 kΩ, 1%, 1/10 W	2	RN55C4992F	81349	
R8	Resistor, Fixed, Film: 20 kΩ, 1%, 1/10 W	2	RN55C2002F	81349	
R9	Resistor, Fixed, Film: 10 kΩ, 1%, 1/10 W	5	RN55C1002F	81349	
R10	Same as R2				
R11	Same as R3				
R12	Same as R4				
R13	Same as R5				
R14	Same as R6				
R15	Same as R7				
R16	Same as R8				
R17	Same as R9				

REF DESIG PREFIX A5

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R18	Resistor, Fixed, Film: 1 kΩ, 1%, 1/10 W	1	RN55C1001F	81349	
R19	Same as R1				
R20	Resistor, Fixed, Film: 750 kΩ, 1%, 1/4 W	1	MF4C/750KF	80031	
R21	Resistor, Fixed, Film: 4.75 kΩ, 1%, 1/10 W	1	RN55C4751F	81349	
R22	Resistor, Variable, Film: 20 kΩ, 10%, 1/2 W	2	62PAR20K	73138	
R23	Resistor, Variable, Film: 10 kΩ, 10%, 1/2 W	2	62PAR10K	73138	
R24	Same as R23				
R25	Same as R22				
R26	Resistor, Variable, Film: 50 kΩ, 10%, 1/2 W	4	62PAR50K	73138	
R27 Thru R29	Same as R26				
R30	Resistor, Fixed, Film: 301 kΩ, 1%, 1/10 W	1	RN55C3013F	81349	
R31	Resistor, Fixed, Film: 121 kΩ, 1%, 1/4 W	1	MF4C/121K/F	80031	
R32	Same as R6				
R33	Resistor, Fixed, Composition: 147 kΩ, 1%, 1/10 W	1	RN55C1473F	81349	
R34	Same as R9				
R35	Same as R9				
R36	Resistor, Fixed, Film: 12.1 kΩ, 1%, 1/10 W	1	RN55C1212F	81349	
R37	Resistor, Fixed, Film: 4.75 kΩ, 1%, 1/10 W	2	RN55C4751F	81349	
R38	Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/4 W	1	RCR07G472JS	81349	
R39	Resistor, Fixed, Composition: 1 MΩ, 5%, 1/4W	1	RCR07G105JS	81349	
R40	Resistor, Fixed, Composition: 3.3 kΩ, 5%, 1/4 W	1	RCR07G332JS	81349	
R41	Same as R1				
R42	Resistor, Fixed, Film: 6.19 k,Ω 1%, 1/10 W	2	RN55C6191F	81349	
R43	Resistor, Fixed, Film: 56.2 kΩ, 1%, 1/10 W	1	RN55C5622F	81349	
R44	Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W	1	RCR07G104JS	81349	
R45	Same as R1				
R46	Same as R1				
R47	Same as R42				
R48	Same as R2				
R49	Resistor, Fixed, Film: 4.32 kΩ, 1%, 1/10 W	1	RN55C4321F	81349	
R50	Same as R9				
R51	Resistor, Fixed, Composition: 1 kΩ, 5%, 1/4 W	1	RCR07G102JS	81349	
R52	Resistor, Fixed, Film: 3.92 kΩ, 1%, 1/10 W	1	RN55C3921F	81349	
R53	Same as R37				
R54	Resistor, Fixed, Film: 634 kΩ, 1%, 1/10 W	1	RN55C6340F	81349	
R55	Same as R1				
R56	Resistor, Fixed, Composition: 8.2 kΩ, 5%, 1/4 W	1	RCR07G822JS	81349	
R57	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	1	CF1/8-1.0K/J	09021	
U1	Integrated Circuit	2	MM74C221N	27014	
U2	Same as U1				
U3	Integrated Circuit	1	MM74C32N	27014	

REF DESIG PREFIX **A5**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
U4	Integrated Circuit	1	MM74C74N	27014	
U5	Integrated Circuit	1	734DC	07263	
U6	Integrated Circuit	3	DG509CJ	17856	
U7	Integrated Circuit	1	LM318N	27014	
U8	Integrated Circuit	1	SN74LS00N	01295	
U9	Integrated Circuit	1	MM80C98N	27014	
U10	Same as U6				
U11	Integrated Circuit	1	HA1-4741-5	37371	
U12	Same as U6				

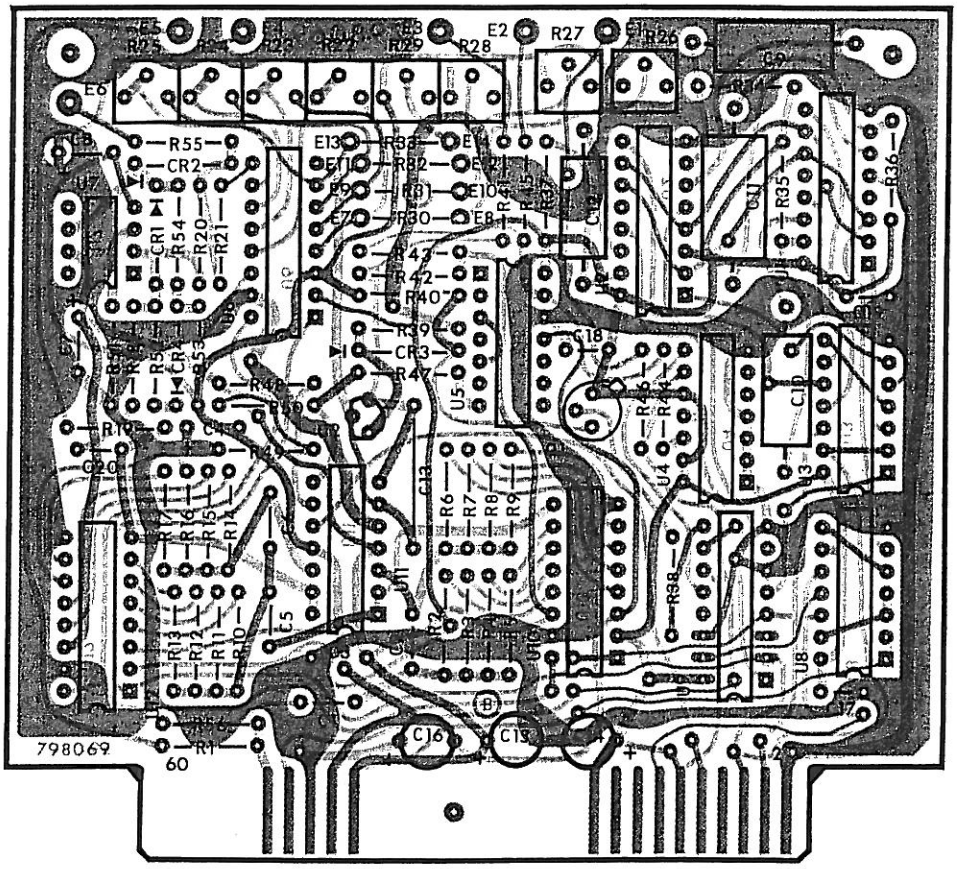

Figure H-6. Type 798069-1 Noise Riding Threshold, (Option H-NRT), Location of Components