MAINTENANCE MANUAL

AUDIO BOARD 19D901870G1

FOR MCS

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DESCRIPTION

Audio Board 19D901870G1 (A3) interfaces through the Logic Board (A1) to provide all audio and tone processing for the receiver and transmitter, except the receiver volume control and 5 watt audio PA. The board also contains the receiver squelch circuit which is internally adjustable. The Audio Board obtains all control signals from the Logic Board. Refer to Figure 1 for an overall block diagram of the Audio Board.

The Audio Board is located under the top cover of the radio and is mounted above the Logic Board. The board plugs into the Logic Board by an 18 pin connector. Refer to the combination manual for a complete mechanical layout and interconnection diagram.

The Audio Board contains 4 main paths: a receiver squelch path, a receiver audio path, a tone path, and a transmitter audio path. Refer to Figure 2 for a block diagram of the Receiver Squelch Path and Receiver Audio Path. Figure 3 provides a block diagram of the Tone Path and Transmitter Audio Path.

CIRCUIT ANALYSIS

RECEIVER SQUELCH PATH

The squelch circuit monitors the level of high frequency noise on the receiver output to determine if a carrier is quieting the receiver. A squelch adjustment sets the noise threshold level required to operate the squelch circuit (nor-

mally at 8dB SINAD). When the noise falls below the threshold level, the carrier activity sensor (CAS) output switches to 5 volts. This CAS signal feeds the microprocessor on the Logic Board. The squelch path consists of a high pass filter, a noise rectifier/amplifier, and a comparator.

VOL-SQ HI (J703-7) is the unfiltered receiver audio input from the RF Board. A 6 kHz high pass filter removes all voice signals from the VOL-SQ HI input. The 3 pole filter consists of the circuitry around U601-A. The filter provides a gain of 2 (6dB) at 8-10 kHz and drops 3dB in gain at the 6 kHz cut-off frequency.

Noise in the 6-8 kHz range is coupled to the Squelch Adjust R602, which varies the level of noise to the noise rectifier/amplifier U601-B. U601-B is biased at ground, amplifying only the positive peaks of the noise by about 9dB.

The rectified noise is filtered by R605, C605, and C606 to provide an average DC level proportional to the noise level. This DC level is applied to the inverting (-) input of comparator U602-A. The non-inverting (+) input of U602-A is referenced to 100 mVdc.

When the DC noise level falls below 100 mVdc, the comparator output switches the CAS line to +5 Vdc to tell the Logic Board's microprocessor the channel is busy with a carrier. The comparator output will remain at a logic high until the DC noise level exceeds 140 mVdc. This difference in voltage between the CAS turn-on and turn-off points provides sufficient hysteresis to eliminate "bubbling" or chattering noise in the speaker. The "bubbling" would normally be caused by transitional changes in the DC level around the reference point. The hysteresis is provided by R610.

The RF Board VOL-SQ HI level varies slightly over temperature which would normally cause the squelch threshold to vary. The diodes in D601 slightly vary the 100 mVdc reference voltage to stabilize the squelch threshold over a wide temperature range.

Transistor Q601 is always turned on by +5V on the FAST SQ line, placing C605 in the DC noise averaging circuit. C605 provides a conventional slow (60 msec) squelch operation to prevent chopping the audio with rapid squelch closings in weak signal areas.

RECEIVER AUDIO PATH

Unfiltered receiver audio from the RF Board (VOL-SQ HI) is high pass filtered, muted, de-emphasized, and amplified by the receiver audio path on the Audio Board. The processed receiver audio is routed through the Logic Board and J701 to feed the 5 watt audio PA in the Control Head.

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VOL-SQ HI feeds a 300 Hz high pass Channel Guard tone filter (U601-C and D). The filter prevents the low frequency Channel Guard tones (below 210 Hz) from passing to the speaker. The output of the first section of the filter (U601-C pin 8) cuts off sharply at 300 Hz and provides a deep notch at 200 Hz. The second section (U601-D) provides additional rejection of CG tones. The entire filter has a gain of 1 (0 dB) at 1 kHz. C611 provides a high frequency roll-off above 3 kHz.

The high pass filtered audio feeds three FET switches. The LP filter bypass switch Q605 is unused and turned off by a logic low on the gate. The Voice Mute switch Q602 allows muting the receiver audio only. This switched audio is summed with the signalling tone audio and feeds the RX Mute switch Q603. The signalling tones are generated by the 5-bit Digital to Analog Converter (DAC) on the Logic Board for alert tones. Q603 allows muting both signalling tones and receiver audio. Each FET requires a logical high from the Logic Board microprocessor to turn on the audio switches. Note that Q603 feeds the inverting (-) input port of U603-B which is a "virtual" ground. Little or no audio signal will be measured on Q603 when Q603 is on.

U603-B provides the -6 dB/octave de-emphasized receiver response. AT 1 kHz, the amplifier has a gain of 7 (17 dB) between Q602 and the RX AUDIO output. C617 and R619 determine the de-emphasis. R620 prevents U603-B from oscillating when driving capacitive loads. RX AUDIO feeds the volume control and 5 Watt audio PA in the Control Head.

TONE PATH

The tone path removes voice and noise signals from the unfiltered receiver audio (VOL-SQ HI) to provide the Logic Board microprocessor with limited tones and data. Transmitted Channel Guard tones and data, generated on the Logic Board, are low pass filtered to provide low distortion signals to the transmitter audio path.

Receiving Tones:

VOL-SQ HI feeds FET switch Q604. In the receive mode, DPTT is at a logical high which turns on Q604. Unfiltered receiver audio passes to summing amp U604-A. The summing amp provides a gain of 1 (0 dB) for the receiver audio. FET switch Q606 is unused and turned off by a logic low on the CHANNEL CHANGE PULSE line.

Receiver audio from the summing amp feeds the 200 Hz low pass filter U605-A, B, C, and D to remove all voice signals and pass only the Channel Guard tones and data. U604-B buffers the high impedance output of the filter and provides 13 dB of gain. FET switch Q605 is unused and turned off by a logic low on the LP FILTER BYPASS line.

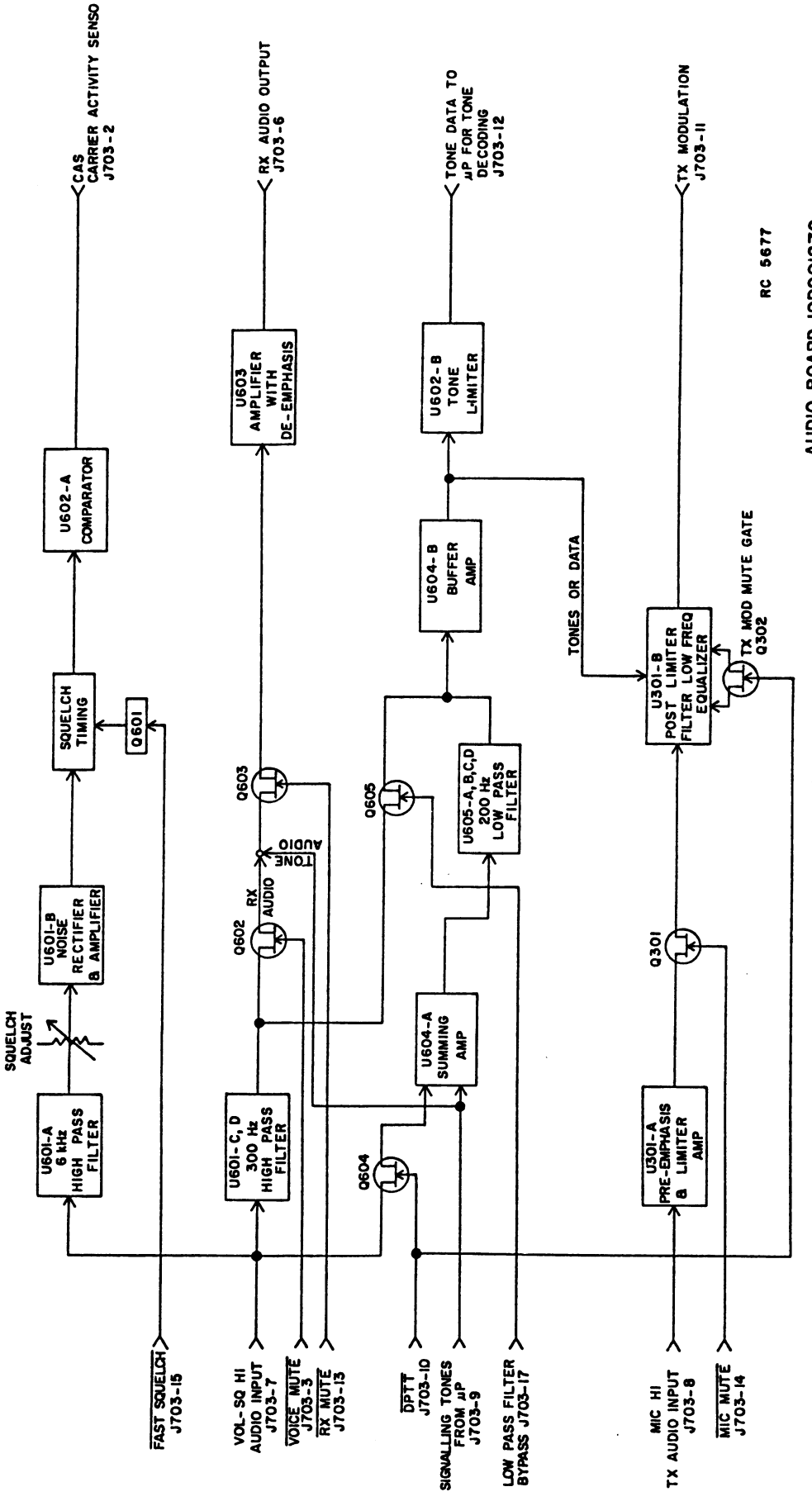

FIGURE 1 - OVERALL BLOCK DIAGRAM

The output of U604-B feeds the tone limiter U602-B. The tone limiter is a comparator with a 5 Vdc reference on the inverting (-) input provided by U604-B. R625-I and C627 remove the tone signals from the reference voltage. The non-inverting (+) input of U602-B receives the tone signals with the identical 5 Vdc reference voltage. The tone limiter provides a 5 Vp-p square wave to the TONE DATA line. This signal is routed to the Logic Board microprocessor where the software decodes the tone.

Transmitting Tones:

In transmit mode, $\overline{\text{DPTT}}$ is low which turns off Q604 to mute the receiver audio to the tone path. Channel Guard tones and data are digitally generated by the DAC on the Logic Board and feed the SIG TONE input line J703-9. Summing amp U604-A provides a gain of 0.1 (-20 dB) for the signalling tone input to reduce the 5 Vp-p Channel Guard signal to 0.5 V p-p.

The 200 Hz low pass filter (U605-A, B, C, and D) removes the high frequency harmonics from the digitally generated tones and data. U604-B provides 13 dB of gain for the filtered tones. The Channel Guard is summed into the transmitter audio path through R310. R310 fixes the Channel Guard level relative to the limited mic audio level.

TRANSMITTER AUDIO PATH

The Audio Board provides all transmitter audio processing. The MIC HI input signal is amplified, pre-emphasized, limited, and low pass filtered. Processed mic audio and Channel Guard tones leave the Audio Board to feed the deviation adjust pot and the synthesizer VCO on the RF Board.

The microphone feeds the MIC HI input to the Audio Board. Series resistors R301 and R312 provide the supply voltage for the microphone amplifier inside the Control Head. Varying the resistor values will vary the microphone audio gain. A resistance of 180 ohms (obtained by shorting R312) will reduce the mic gain 8 dB. The MIC HI input level is nominally 30 mVrms at 1 kHz to produce 3 kHz deviation.

U301-A provides the 6 dB/octave pre-emphasis and amplitude limiting. C301, C304, and R302-A thru D provide the audio pre-emphasis. C303 controls the cut-off point for the high frequency pre-emphasis above 3 kHz. Voltage divider R302-G, H, I, and J provides the 4 volt operating reference bias for U301-A and the limiter reference voltages for D301-A and B. C302 filters audio and noise from the 4 volt bias. When the MIC input signal is at a level such that the output of U301-A does not exceed 4 Vp-p, the gain at 1 kHz is 30 dB at U301-A pin 1. When the audio level tries to exceed 4 Vp-p, diodes D301-A and B conduct on the negative and positive half cycles providing 100% negative feedback to reduce the gain of U301-A to 0.

The output of U301-A is fed through voltage divider R302-E and F. The divider and C307 provide one pole of RC filtering to FET switch Q301. This muting FET is controlled by the $\overline{\text{MIC MUTE}}$ line from the microprocessor. Here a logical high turns the gate on and a logical low mutes the mic audio. This gate allows muting the mic audio in the receive mode and when only tones are to be transmitted.

The switched mic audio feeds amplifier U301-B which performs several functions. C309, C311, R304, R305, and R306 form 2 additional poles for the post limiter filter, providing a total of 18 dB/octave filtering to the limited mic audio. U301-B also sums the Channel Guard tones and data into the transmit audio from the tone path. R310 determines the modulation level of the Channel Guard relative to the mic audio level. FET switch Q302 allows additional muting when in the receive mode and is controlled directly by the $\overline{\text{DPTT}}$ line from the processor. In receive mode, this line is high, turning on Q302 which provides 100% negative feedback to reduce U301-B gain to 0. C310, C312, R307, R308, and R309 comprise a low frequency equalizer circuit for digital data transmission. The equalizer increases the gain 6 dB/octave below 15 Hz to help compensate for the low frequency roll-off normally experienced when modulating the VCO in RF synthesizers.

The output of U301-B is DC coupled to the TX MOD output. R311 prevents U301-B from oscillating when driving capacitive loads. TX MOD feeds the deviation pot and the synthesizer VCO on the RF Board.

SUPPLY REGULATORS

The Audio Board receives 13 volts from the switched A+ filtered line on the Logic Board. This voltage feeds 8 volt regulator U606 and op amp U603. The regulator supplies 8 volts to all ICs except U603. U603-A supplies a low noise 5 volt bias to the audio circuits.

SERVICE NOTES

Refer to the Block Diagrams, Figures 2 and 3, for proper signal levels and gains for the various audio paths.

Note the state of the FET switches for muting. These switches are controlled by the Logic Board. If a mute line is high (+5 V) you may ground that pin and monitor the results. However, if a mute line is low, the line may not be pulled high unless the line is disconnected from the Logic Board.

All bias points (+5 V) shown on the Audio Board schematic diagram are generated by U603-A. None of the operational amplifier circuits will operate properly without this voltage.

When measuring signal levels, remember that the inverting (-) input ports are "virtual grounds". No AC voltages will be present at these ports.

GE Mobile Communications

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Lynchburg, Virginia 24502

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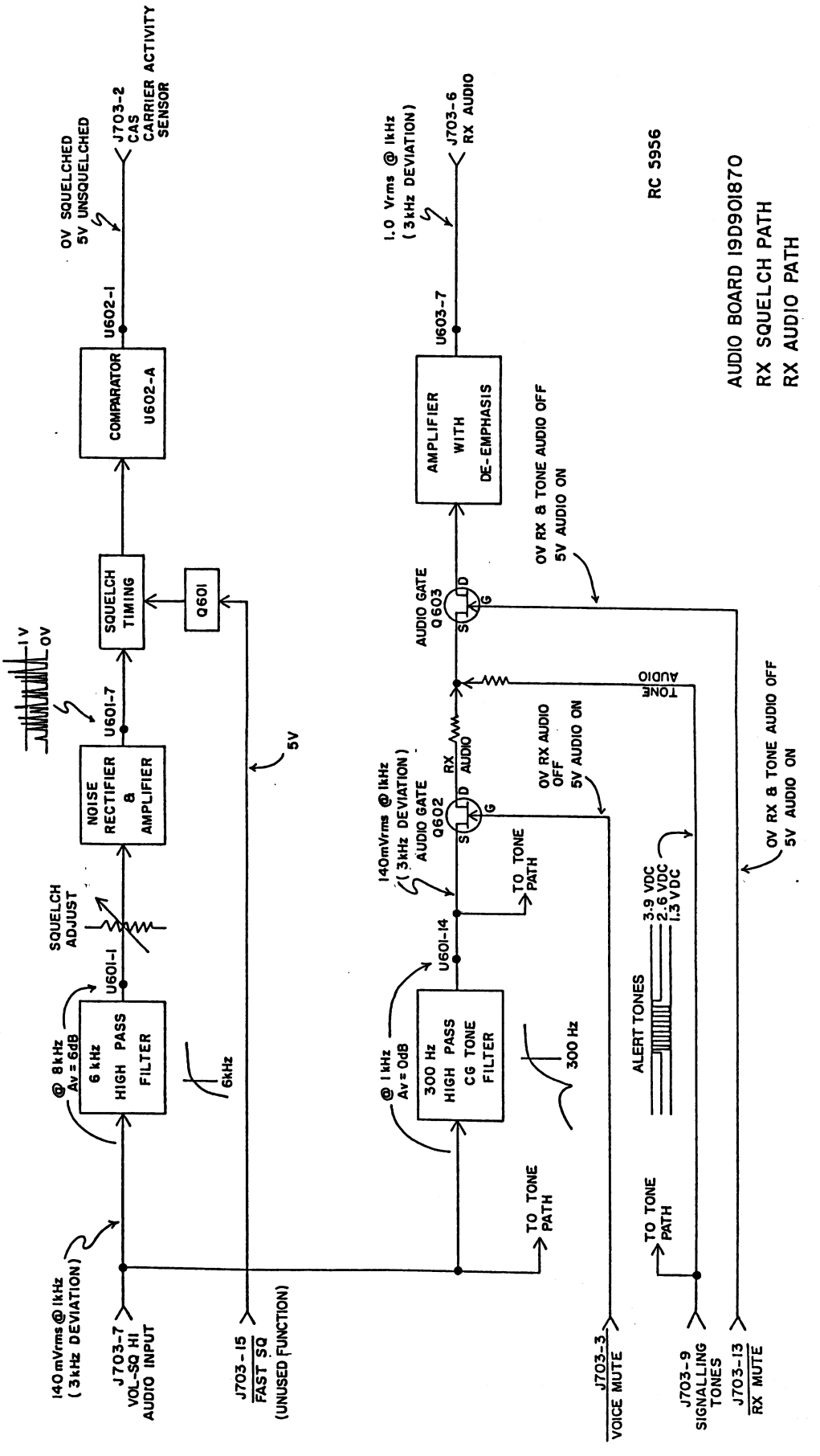
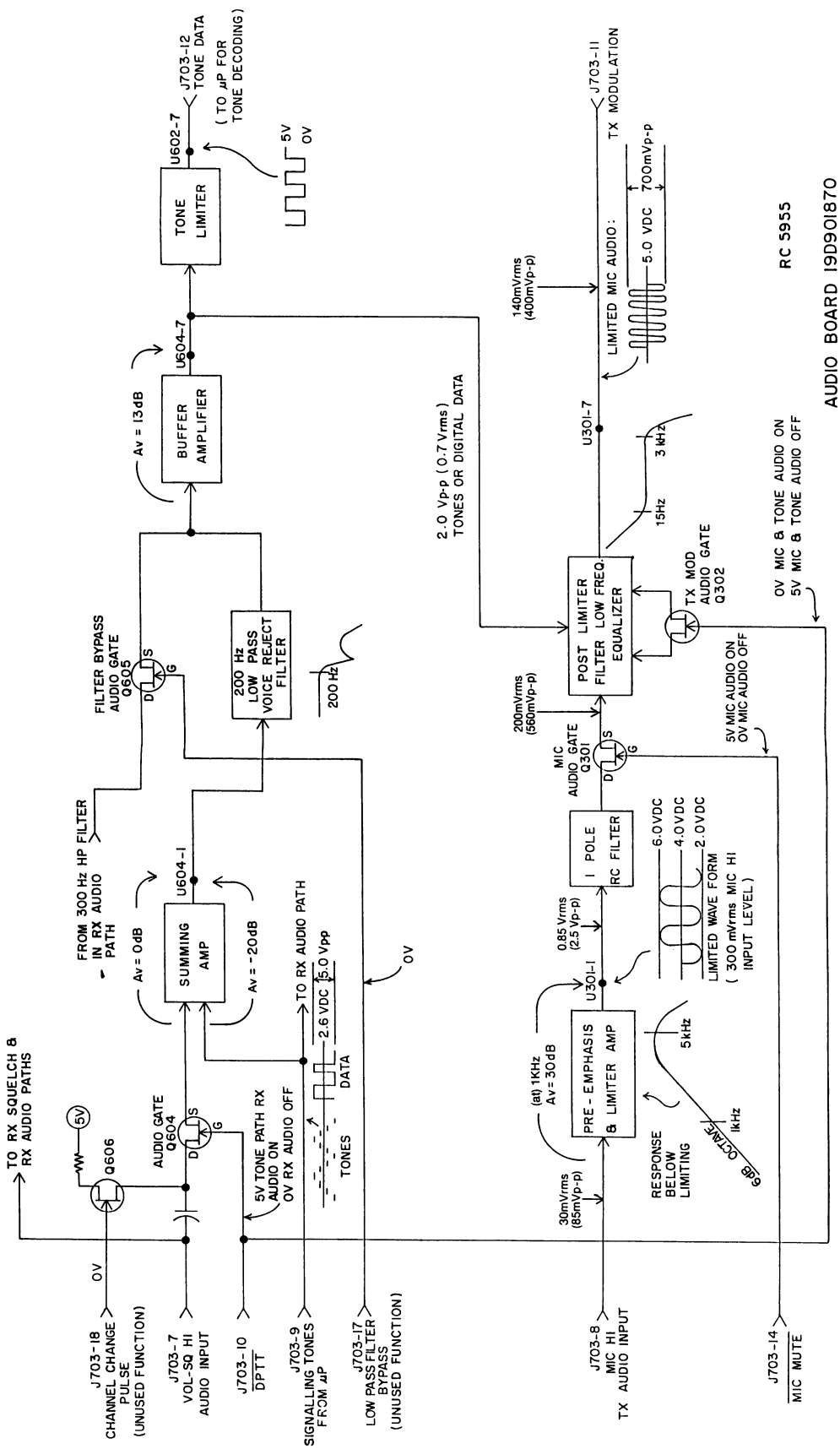
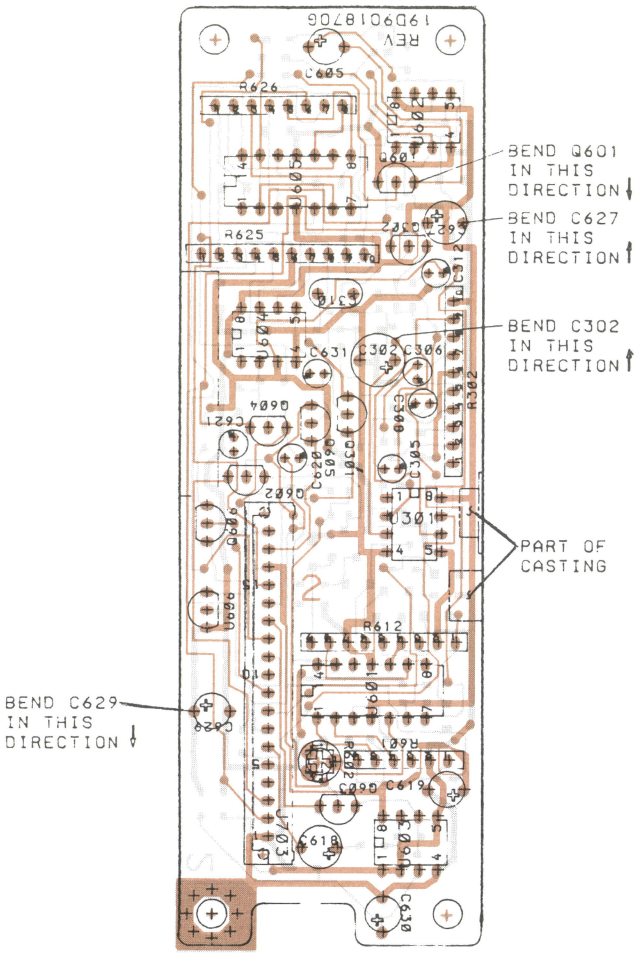

AUDIO BOARD 19D901870
RX SQUELCH PATH
RX AUDIO PATH
RC 5956
140 mVrms @ 1kHz (3kHz DEVIATION)
J703-7 VOL-SQ HI AUDIO INPUT
J703-15 FAST SQ (UNUSED FUNCTION)
@ 8kHz Av = 6dB
6 kHz HIGH PASS FILTER
U601-1
SQUELCH ADJUST
NOISE RECTIFIER & AMPLIFIER
U601-7
1V
0V
SQUELCH TIMING
Q601
6kHz
5V
COMPARATOR U602-A
U602-1
0V SQUELCHED
5V UNSQUELCHED
J703-2 CAS CARRIER ACTIVITY SENSOR
140mVrms @ 1kHz (3kHz DEVIATION)
AUDIO GATE Q602
RX AUDIO
S D G
0V RX AUDIO OFF
5V AUDIO ON
@ 1kHz Av = 0dB
300 Hz HIGH PASS CG TONE FILTER
U601-14
TO TONE PATH
300 Hz
ALERT TONES
3.9 VDC
2.6 VDC
1.3 VDC
TONE AUDIO
AUDIO GATE Q603
0V RX & TONE AUDIO OFF
5V AUDIO ON
AMPLIFIER WITH DE-EMPHASIS
U603-7
1.0 Vrms @ 1kHz (3kHz DEVIATION)
J703-6 RX AUDIO
J703-3 VOICE MUTE
J703-9 SIGNALLING TONES
J703-13 RX MUTE


AUDIO BOARD 19D901870
TONE PATH
TX AUDIO PATH
RC 5955
TONE LIMITER
U602-7
J703-12 TONE DATA
(TO μP FOR TONE DECODING)
5V
0V
BUFFER AMPLIFIER
U604-7
Av = 13dB
FILTER BYPASS AUDIO GATE Q605
200 Hz LOW PASS VOICE REJECT FILTER
200 Hz
FROM 300 Hz HP FILTER IN RX AUDIO PATH
Av = 0dB
SUMMING AMP
U604-1
Av = -20dB
TO RX AUDIO PATH
2.6 VDC
5.0 Vpp
TONES
DATA
0V
TO RX SQUELCH & RX AUDIO PATHS
Q606
AUDIO GATE Q604
5V TONE PATH RX AUDIO ON
0V RX AUDIO OFF
J703-18 CHANNEL CHANGE PULSE (UNUSED FUNCTION)
J703-7 VOL-SQ HI AUDIO INPUT
J703-10 DPTT
J703-9 SIGNALLING TONES FROM μP
J703-17 LOW PASS FILTER BYPASS (UNUSED FUNCTION)
2.0 Vp-p (0.7 Vrms) TONES OR DIGITAL DATA
140mVrms (400mVp-p)
J703-11 TX MODULATION
LIMITED MIC AUDIO :
5.0 VDC
700mVp-p
U301-7
POST LIMITER FILTER LOW FREQ. EQUALIZER
15Hz
3 kHz
TX MOD AUDIO GATE Q302
0V MIC & TONE AUDIO ON
5V MIC & TONE AUDIO OFF
200mVrms (560mVp-p)
MIC AUDIO GATE Q301
5V MIC AUDIO ON
0V MIC AUDIO OFF
1 POLE RC FILTER
6.0VDC
4.0VDC
2.0VDC
LIMITED WAVE FORM
(300 mVrms MIC HI INPUT LEVEL)
0.85 Vrms (2.5 Vp-p)
U301-1
(at) 1KHz Av = 30dB
PRE-EMPHASIS & LIMITER AMP
5kHz
1kHz
OCTAVE
6dB
RESPONSE BELOW LIMITING
30mVrms (85mVp-p)
J703-8 MIC HI TX AUDIO INPUT
J703-14 MIC MUTE

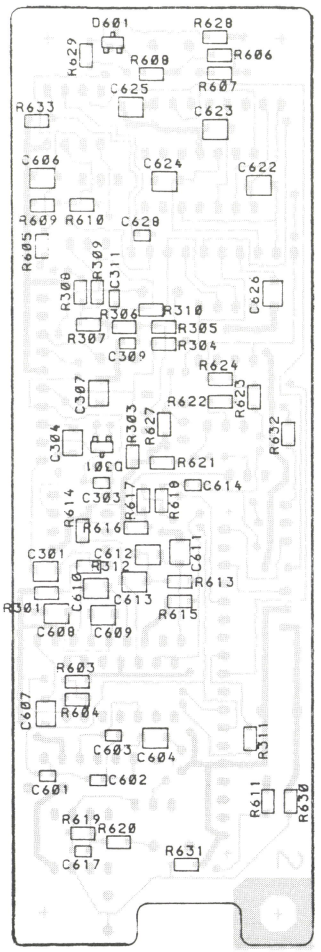
AUDIO

COMPONENT SIDE

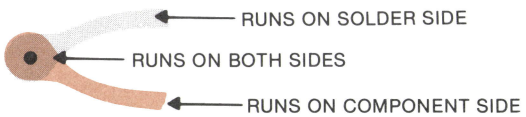


(19D901870, Rev. 2)
(19A705131, Sh. 1, Rev. 2)
(19A705131, Sh. 2, Rev.2)

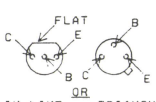
SOLDER SIDE



(19D901870, Rev. 2)
(19A705131, Sh. 2, Rev.2)



LEAD IDENTIFICATION FOR Q601



IN-LINE OR TRIANGULAR
TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR Q602-Q606, Q301 & Q302

IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR U606

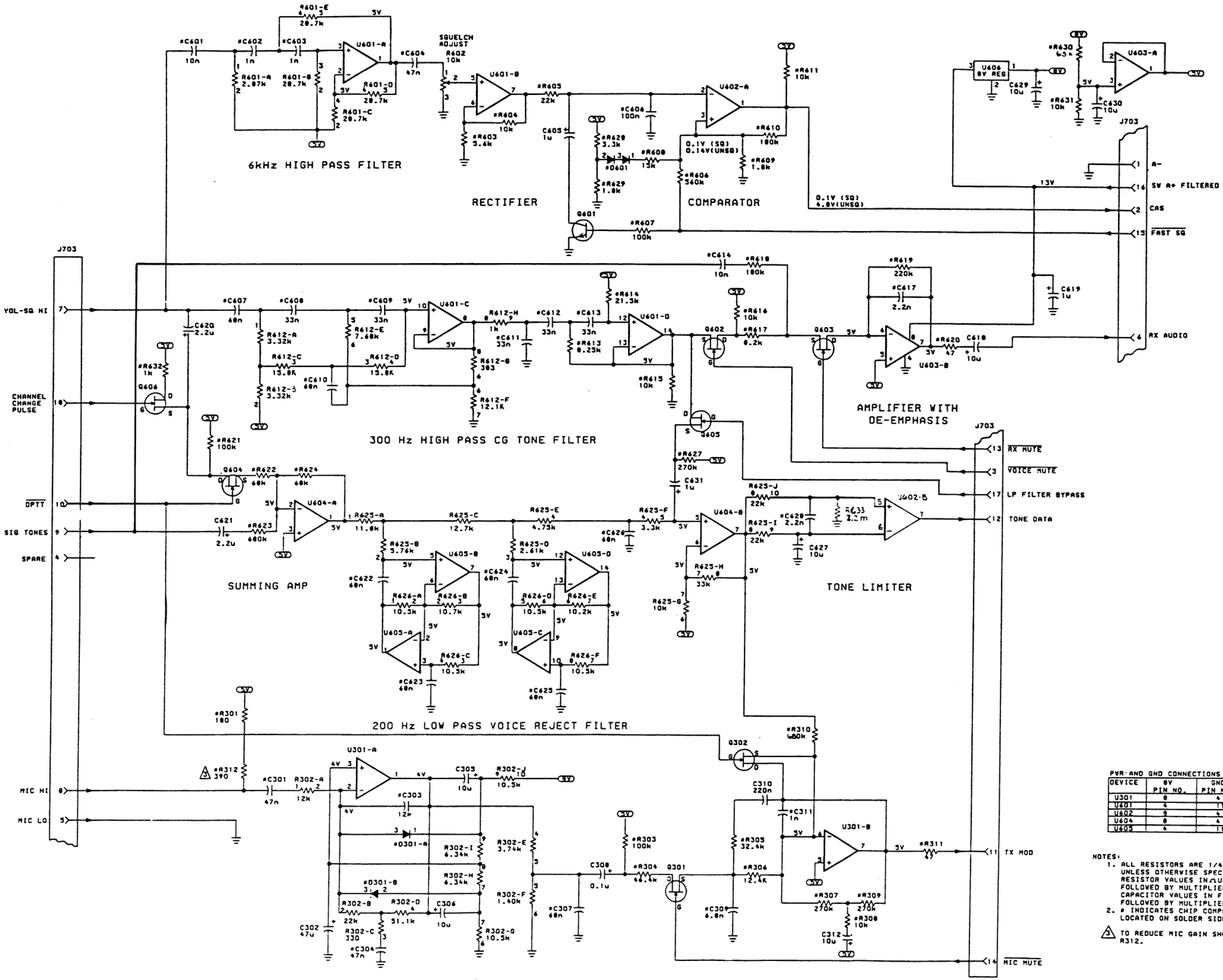
IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR D301 AND D601

BACK SIDE OF BOARD

Audio Board
19D901870G1



PWR AND GND CONNECTIONS		
DEVICE	8V PIN NO.	GND PIN NO.
U301	8	4
U401	4	11
U402	8	4
U404	8	4
U405	4	11

MODEL NO.	REV. LETTER
19D901870G1	C

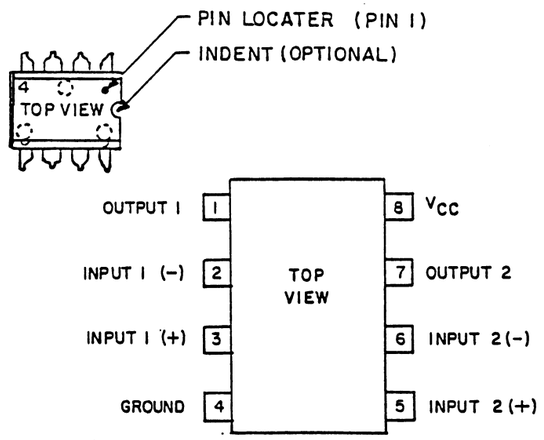
NOTES:
1. ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED. RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M. CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER U, N, OR P.
2. # INDICATES CHIP COMPONENT LOCATED ON SOLDER SIDE OF PWB.

⚠3 TO REDUCE MIC GAIN SHORT ACROSS R312.

(19D901970, Rev. 4)

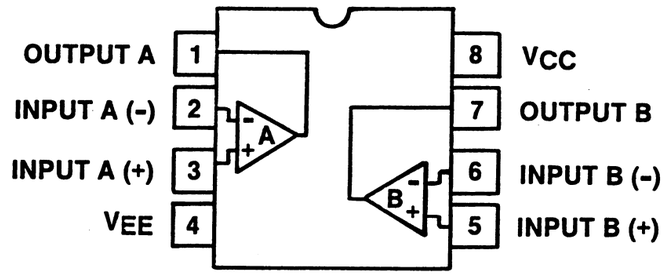
Audio Board
19D901870G1

LINEAR VOLTAGE COMPARTOR
(U602)
19A134764P2



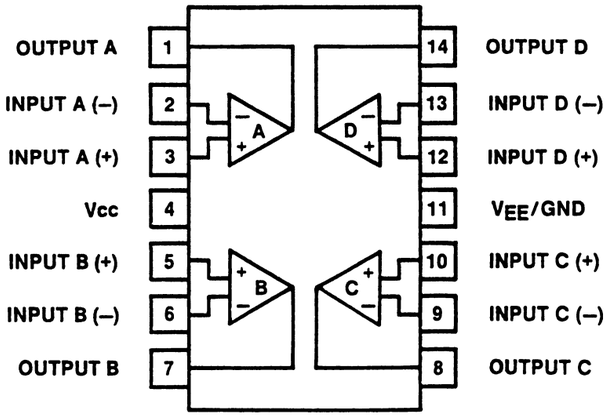
RC-5285

OPERATIONAL AMPLIFIER
U301, U603, & U604
19A700086P4



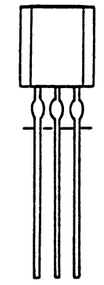
RC-5758

OPERATIONAL AMPLIFIER
U601 & U605
19A701789P1



RC-5750

VOLTAGE REGULATORS
(U606)
19A704073P2



BOTTOM VIEW

PIN 1 - OUTPUT
PIN 2 - GROUND
PIN 3 - INPUT

PARTS LIST

AUDIO BOARD
19D901870G1

ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C301	19A702052P122	Ceramic: 0.047 uF ±5%, 50 VDCW.
C302	19A701534P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C303	19A702061P17	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM/°C.
C304	19A702052P122	Ceramic: 0.047 uF ±5%, 50 VDCW.
C305 and C306	19A704879P5	Electrolytic: 10 uF ±20%, 16 VDCW.
C307	19A702052P124	Ceramic: 0.068 uF ±5%, 50 VDCW.
C308	19A704879P13	Electrolytic: 0.1uF ±20%, 50 VDCW.
C309	19A702052P112	Ceramic: 6800 pF ±5%, 50 VDCW.
C310	162B3688P422K	Ceramic: 0.22 uF ±10%, 50 VDCW; sim to Erie 8131-M050-W5R-224K.
C311	19A702052P105	Ceramic: 1000 pF ±5%, 50 VDCW.
C312	19A704879P5	Electrolytic: 10 uF ±20%, 16 VDCW.
C601	19A702052P114	Ceramic: 0.01 uF ±5%, 50 VDCW.
C602 and C603	19A702052P105	Ceramic: 1000 pF ±5%, 50 VDCW.
C604	19A702052P22	Ceramic: 0.047 uF ±10%, 50 VDCW.
C605	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C606	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C607	19A702052P124	Ceramic: 0.068 uF ±5%, 50 VDCW.
C608 and C609	19A702052P120	Ceramic: 0.033 uF ±5%, 50 VDCW.
C610	19A702052P124	Ceramic: 0.068 uF ±5%, 50 VDCW.
C611 thru C613	19A702052P120	Ceramic: 0.033 uF ±5%, 50 VDCW.
C614	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.
C617	19A702052P7	Ceramic: 2200 pF ±10%, 50 VDCW.
C618	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C619	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C620 and C621	19A704879P8	Electrolytic: 2.2uF ±20%, 50 VDCW.
C622 thru C626	19A702052P124	Ceramic: 0.068 uF ±5%, 50 VDCW.
C627	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C628	19A702052P7	Ceramic: 2200 pF ±10%, 50 VDCW.
C629 and C630	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C631	19A704879P9	ELectrolytic: 1 uF ±20%, 50 VDCW.
		- - - - - - - - - - DIODES - - - - - - - - - -
D301	19A700053P2	Silicon: Fast Recovery: (2 diodes in series).
D601	19A700053P2	Silicon: Fast Recovery: (2 diodes in series).
		- - - - - - - - - - JACKS - - - - - - - - - -
J703	19A704874P1	Connector: sim to Elco 00-9021-18-12-00-339.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q301 * and Q302	19A134137P7	N-type: FET.
Q601	19A700023P2	Silicon, NPN: sim to 2N3904.
Q602 thru Q606	19A134137P7	N-type: FET.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R301 *	19B800607P181	Metal film: 180 ohms ±5%, 200 VDCW, 1/8 w.
R302	19A704885P6	Resistor Network, Custom: 10 Pins, 1/8 w.
R303	19B800607P104	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 w.
R304 *	19A702931P365	Metal film: 46.4K ohms ±1%, 200 VDCW, 1/8 w.
R305	19A702931P350	Metal film: 32.4K ohms ±1%, 200 VDCW, 1/8 w.
R306	19A702931P310	Metal film: 12.4K ohms ±1%, 200 VDCW, 1/8 w.
R307	19B800607P274	Metal film: 270K ohms ±5%, 200 VDCW, 1/8 w.
R308	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R309	19B800607P274	Metal film: 270K ohms ±5%, 200 VDCW, 1/8 w.
R310 *	19B800607P684	Metal film: 680K ohms ±5%, 200 VDCW, 1/8 w.
R311	19B800607P470	Metal film: 47 ohms ±5%, 200 VDCW, 1/8 w.
R312	19B800607P391	Metal film: 390 ohms ±5%, 200 VDCW, 1/8 w.
R601	19A704885P7	Resistor Network, Custom: 6 pins, 1/8 w.
R602	19B800779P10	Variable: 10K ohms ±25%, 100 VDCW, .3 watt.
R603	19B800607P562	Metal film: 5.6K ohms ±5%, 200 VDCW, 1/8 w.
R604	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R605	19B800607P223	Metal film: 22K ohms ±5%, 200 VDCW, 1/8 w.
R606	19B800607P564	Metal film: 560K ohms ±5%, 200 VDCW, 1/8 w.
R607	19B800607P104	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 w.
R608	19B800607P153	Metal film: 15K ohms ±5%, 200 VDCW, 1/8 w.
R609	19B800607P182	Metal film: 1.8K ohms ±5%, 200 VDCW, 1/8 w.
R610	19B800607P184	Metal film: 180K ohms ±5%, 200 VDCW, 1/8 w.
R611	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R612	19A704885P8	Resistor Network, Custom: 9 pins, 1/8 w.
R613	19A702931P289	Metal film: 8250 ohms ±1%, 200 VDCW, 1/8 w.
R614	19A702931P333	Metal film: 21.5K ohms ±1%, 200 VDCW, 1/8 w.
R615 and R616	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R617	19B800607P822	Metal film: 8.2K ohms ±5%, 200 VDCW, 1/8 w.
R618	19B800607P184	Metal film: 180K ohms ±5%, 200 VDCW, 1/8 w.
R619	19B800607P224	Metal film: 220K ohms ±5%, 200 VDCW, 1/8 w.
R620	19B800607P470	Metal film: 47 ohms ±5%, 200 VDCW, 1/8 w.
R621	19B800607P104	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 w.
R622	19B800607P683	Metal film: 68K ohms ±5%, 200 VDCW, 1/8 w.
R623	19B800607P684	Metal film: 680K ohms ±5%, 200 VDCW, 1/8 w.
R624	19B800607P683	Metal film: 68K ohms ±5%, 200 VDCW, 1/8 w.
R625	19A704885P9	Resistor Network, Custom: 10 pins, 1/8 w.
R626	19A704885P10	Resistor Network, Custom: 8 pins, 1/8 w.
R627	19B800607P274	Metal film: 270K ohms ±5%, 200 VDCW, 1/8 w.
R628	19B800607P332	Metal film: 3.3K ohms ±5%, 200 VDCW, 1/8 w.
R629	19B800607P182	Metal film: 1.8K ohms ±5%, 200 VDCW, 1/8 w.
R630 *	19B800607P682	Metal film: 6.8K ohms ±5%, 200 VDCW, 1/8 w.
R631	19B800607P103	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 w.
R632	19B800607P102	Metal film: 1K ohms ±5%, 200 VDCW, 1/8 w.
R633 *	19B800607P225	Metal film: 2.2M ohms ±5%, 200 VDCW, 1/8 w.
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - - - - -
U301	19A700086P4	Linear: Dual Op Amp; sim to 4558.
U601	19A701789P1	Linear: Low Power Op Amp; sim to LM324N.
U602	19A134764P2	Linear: Voltage Comparator; sim to LM393N.
U603 and U604	19A700086P4	Linear: Dual Op Amp; sim to 4558
U605	19A701789P1	Linear: Low Power Op Amp; sim to LM324N.
U606	19A704073P2	Linear: 8 Volt Regulator.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for the descriptions of parts affected by these revisions.

REV. A - AUDIO BOARD 19D901870G1
To improve the Channel Guard deviation by 1.6db, changed R310 near Q302 from 820K to 680K ohms. Resistor R310 was: 19B800607P824 Metal film: 820K ohms ±5%, 200 VDCW, 1/8 w.

REV. B - AUDIO BOARD 19D901870G1
To improve transmitter audio distortion and deviation specifications, changed R630 at U603-A pin 3 from 5.6K to 6.8K ohms. Resistor R630 was: 19B800607P562 Metal film: 5.6K ohms ±5%, 200 VDCW, 1/8 w.

REV. C - AUDIO BOARD 19D901870G1
To improve operation by reducing Tone Limiter sensitivity, added R633 at U602-B pin 5.
To improve operation by reducing transmitter alternator whine at low supply voltages, changed R301 supply connection from the +8 volt source to the +5 volt source.
To reduce transmitter audio distortion, changed Q301 and R304 connections.