



**Wulfsberg** Electronics Division  
*A Chelton Group Company*

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# **RT-138 TRANSCEIVER NARROW-BAND CONVERSION**

## **Maintenance Manual Addendum**

**Manual Number 150-040699**

**Revision A**

**April 27, 2000**

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**Wulfsberg** Electronics Division  
*A Chelton Group Company*

## **RT-138 NARROW-BAND CONVERSION MAINTENANCE MANUAL ADDENDUM**

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## **RT-138 NARROW BAND CONVERSION MAINTENANCE MANUAL ADDENDUM**

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### **Section 1      Introduction**

#### **1.1              Overview**

This addendum contains information pertaining to the RT-138 narrow band conversion.

#### **1.2              Audience**

This manual is intended for qualified aircraft avionics technicians in authorized maintenance and repair facilities.

#### **1.3              References**

Wulfsberg Electronics RT-138 Maintenance Manual, P/N 150-0101-000.



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### **Section 2 Theory of Operation**

#### **2.1 General**

The standard RT-138 and narrow banded RT-138 are identical except for the following items:

- A daughter board has been added to the Audio board for gain switching purposes.
- One wire that is normally tied back (mem discrete #2) is now soldered to 'T' on the Audio board connector A3J3.
- IF filters FL1 and FL2 (20 Mhz filters) were changed to provide a steeper roll-off and narrower bandwidth. The Guard receiver will have its 16.9 Mhz IF filters changed to steeper roll-off and narrower bandwidth characteristics as well.

The theory of operation in this document covers only those parts of the Audio board that have been affected by the narrow band modification. The remaining operations are covered in the original Theory of Operation in the RT-138 Maintenance Manual.

#### **2.2 Operational Block Diagram**

Figure 2-1 is a block diagram illustrating the operation of the '-000' Audio board used in the RT-138 with the narrow band Daughter board installed.

#### **2.3 Narrow Banded Audio Board Circuit Theory**

A3U1A, the Main Receiver inverting buffer no longer drives the main squelch circuitry in the narrow banded Audio board. The signal for the main squelch circuitry is now taken directly from pins A3P3-21/Y and input to the isolated leg of C4. The reason for this change is because the gain of A3U1A is now switchable to double the amplitude of the incoming audio when in the narrow band mode. Since the gain is doubled in the narrow band mode, the noise is also doubled. The squelch circuitry therefore would sense the extra noise and squelch accordingly. This would create one squelch point for narrow and a different point for wide band depending on which is selected on the C-1000 control head. By picking off the signal before it gets to A3U1A, the squelch remains consistent regardless of the gain selected for the buffer and independent of whether the incoming signal is narrow or wide band.

The Guard Audio Buffers' gain is also switchable for the purpose of doubling the amplitude of an incoming narrow band signal. The squelch circuitry however, is contained in the Guard so the signal received by the Audio Board from the Guard has already been screened for squelch.

A3U9B, the Modulation Summing Buffer, also has switchable gain. Its gain however, is cut in half by the gain switch in the narrow band mode in order to keep the modulation within narrow band specs during transmit.



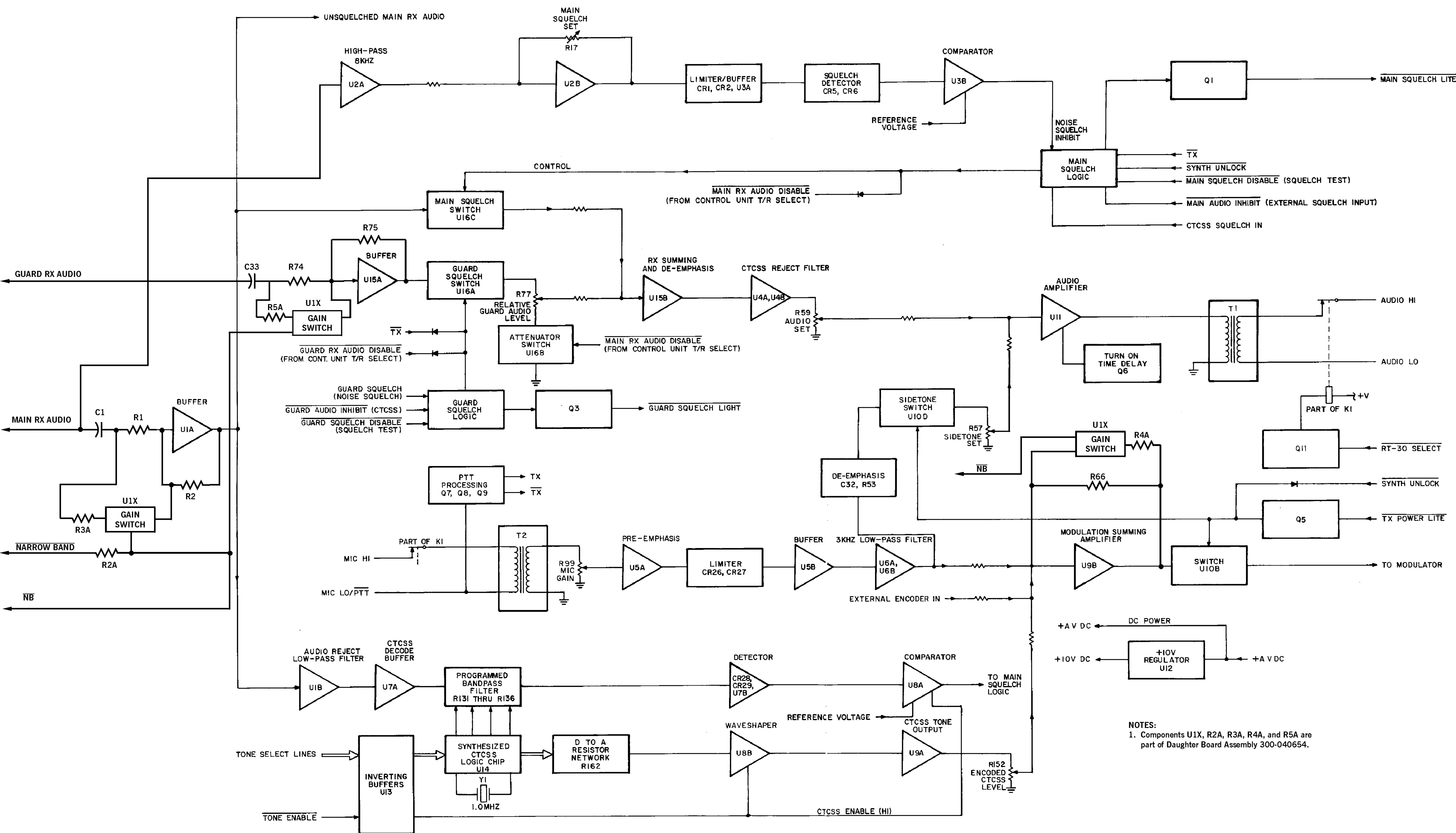


Figure 2-1. RT-138 Narrow Band Audio Board Block Diagram



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### **2.3.1      Narrow Band Gain Boost**

When the radio incorporates a narrow band system, the received audio is reduced by a factor of two due to the reduced modulation deviation. To compensate for this reduction, a times-two audio boost circuit is supplied for the Main and Guard receive audio paths and is controlled by the Narrow Band control signal.

The Main Receiver audio is buffered by amplifier A3U1A. The gain of this stage will be 1.18 with a high signal (+10 Vdc) applied to U1X pin 5. A low signal applied to this pin will double the gain to 2.36.

The Guard Receiver audio is buffered by amplifier A3U15A. This is a switchable gain stage that is unity when a high signal (+10 Vdc) is applied to U1X pin 9. A low signal applied to this pin gives it a gain of two.

### **2.3.2      Narrow Band Gain Reduction**

Another aspect of a radio that incorporates a narrow band system is that when transmitting in narrow band, the modulated audio and CTCSS tone deviation are reduced by a factor of two. This reduction is created by making the Modulation Summing Buffer a switchable gain stage controlled by the narrow band control signal.

The Modulation Summing Buffer A3U9B is a switchable gain stage that is unity when a high signal (+10 Vdc) is applied to U1X pin 8. A low signal applied to this pin cuts the gain in half reducing the deviation by a factor of two when in narrow band.



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### **Section 3        Maintenance**

#### **3.1                Disassembly**

See the RT-138 Maintenance Manual, Section 4.1.

#### **3.2                Test Equipment**

See the RT-138 Maintenance Manual, Section 4.2.

#### **3.3                RT-138 Overall Performance Tests**

See the RT-138 Maintenance Manual for wide band tests. All narrow band tests are performed with a C-1000 control head that has been modified for narrow band operation. The following tests apply to a narrow banded RT-138 and are done in the narrow band mode.

##### **3.3.1            Transmitter Deviation Capability**

In the narrow band mode, with an input of .25 Vrms at 1000 Hz, the transmitter shall produce a deviation greater than 1.5 Khz.

##### **3.3.2            Transmitter Deviation Limiter**

A 2.5 Vrms audio input signal shall produce no greater than 2.5 Khz deviation.

##### **3.3.3            Transmitter CTCSS**

Selection of a tone from either a test set or a control unit shall produce a tone deviation between 350 and 475 Hz (375 Hz nominal). This test needs to be performed at only one channel.

#### **3.4                Troubleshooting**

##### **3.4.1            Audio Board Troubleshooting Procedure**

There are seventeen supporting inputs called out in section 4.5.4 in the RT-138 Maintenance Manual. There is an additional input on the narrow banded Audio board called Narrow Band and the narrow banded C-1000 control unit is its source of input.



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Narrow Band , when pulled low, will double the gain of A3U1A and A3U15A by applying the signal to the active low inputs 5 and 9 respectively of Analog Switch U1X. U1X and its associated components are on the Daughter Board Assembly 300-040654. With the analog switch enabled, resistors R74 and R5A are effectively paralleled thus doubling the gain of Guard Audio buffer U15A. Also, R1 and R3A are paralleled causing the gain of the Main Audio buffer U1A to double. A high level on these pins would disable U1X and take R5A and R3A electrically out of the circuit. A high on the Narrow Band line should be approximately 10v but anything over 2.4v would be taken as a high by the device and a low is anything less than .8V.

The Modulation Summing buffer U9B is also affected by the Narrow Band control line. Its gain is effectively halved by paralleling resistors R4A and R66 when U1X pin 8 is low. When U1X pin 8 is high, R4A is electrically removed from the circuit and the buffer is at unity gain.

### **3.5 Alignment Procedures**

Refer to the RT-138 Maintenance Manual for the alignment procedures.



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### **Section 4      Schematic Diagrams**

#### **4.1      Assembly and Component Numbers**

The Audio board schematic showing the Daughter Board installed is included in this addendum (see Figure 4-1). The Audio Board assembly number is A3. Parts are numbered according to component assembly numbers within the RT-138. For example, C1 on the Power Supply Board is referred to as A2C1 while C1 on the Audio Board is referred to as A3C1. The Daughter Board has a different component numbering scheme to differentiate it from the rest of the Audio board components. Its components have a suffix of 'A' except U1 which has a suffix of 'X'. Example: U1X, R1A, C1A etc.

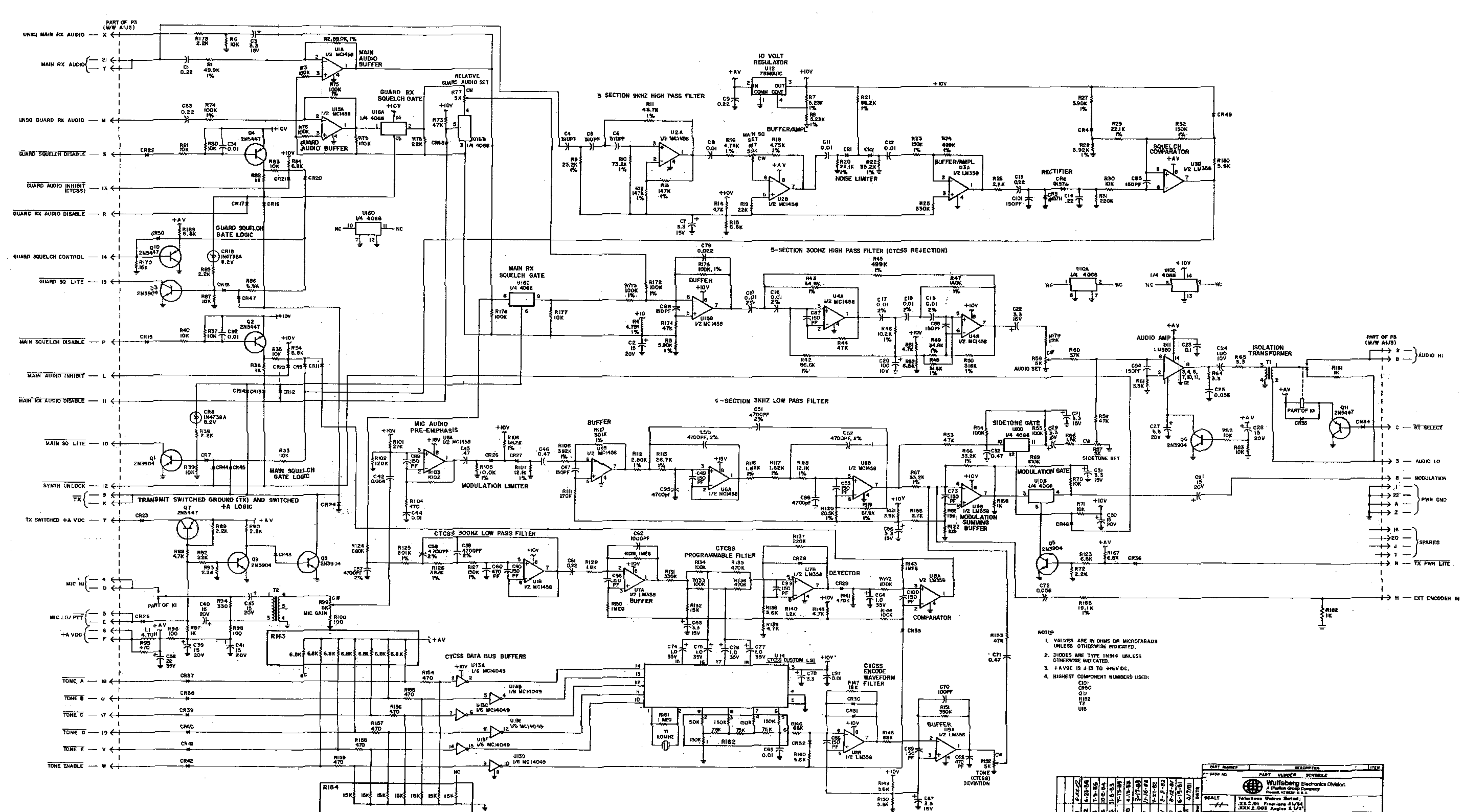


Figure 4-1. RT-138 Narrow Band Audio Board Schematic Diagram



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**Section 5      Parts List**

**5.1            General**

Since the complete '-000' Audio board Parts List is in the RT-138 Maintenance Manual, it will not be included in this addendum. The Audio board components will remain the same except for the addition of the Daughter Board and its associated components. Therefore, just the Daughter Board parts list will be listed here.

**Parts List, Daughter Board, RT-138 Audio Board, Narrow Bandwidth**

<b>Item</b>	<b>Qty</b>	<b>Part Number</b>	<b>Description</b>	<b>Reference</b>
1	2	106-04104-0047	Cap, .1uf, 50v, Chip, 1206	C1A-C2A
2	1	106-714803-02	IC DG201A Quad SPST Analog Sw	U1X
3	2	139-01002-0000	RES 10K Ohm 1% 1/8w Chip	R1-2
4	1	139-01003-0000	RES 100K Ohm 1% 1/8w Chip	R5
5	1	139-03322-0000	RES 33.2K Ohm 1% 1/8w Chip	R4
6	1	139-04992-0000	RES 49.9K Ohm 1% 1/8w Chip	R3
7	A/R	600-0021-000	Protective Coating	
8	1	300-040654	Daughter Board	