The Noise Remover

A simple, effective way to get rid of the static.

by Gerald F. Gronson K8MKB

There have been a number of remarks as to how a really narrowband CW filter becomes useless when a lot of "static" noise is on the band. The source doesn't matter; the result is the same. The filter becomes a tone generator and the signal you are trying to copy is lost.

One solution is the noise circuit described in this article. It is adjustable from "no effect" to "no signal out," requires no special parts, and can be made small enough to be installed in an existing add-on CW or SSB filter. It can also be used in one of the new simple receivers, such as the Sudden (see the October '91 issue, p. 8), to give the receiver a bit more performance.

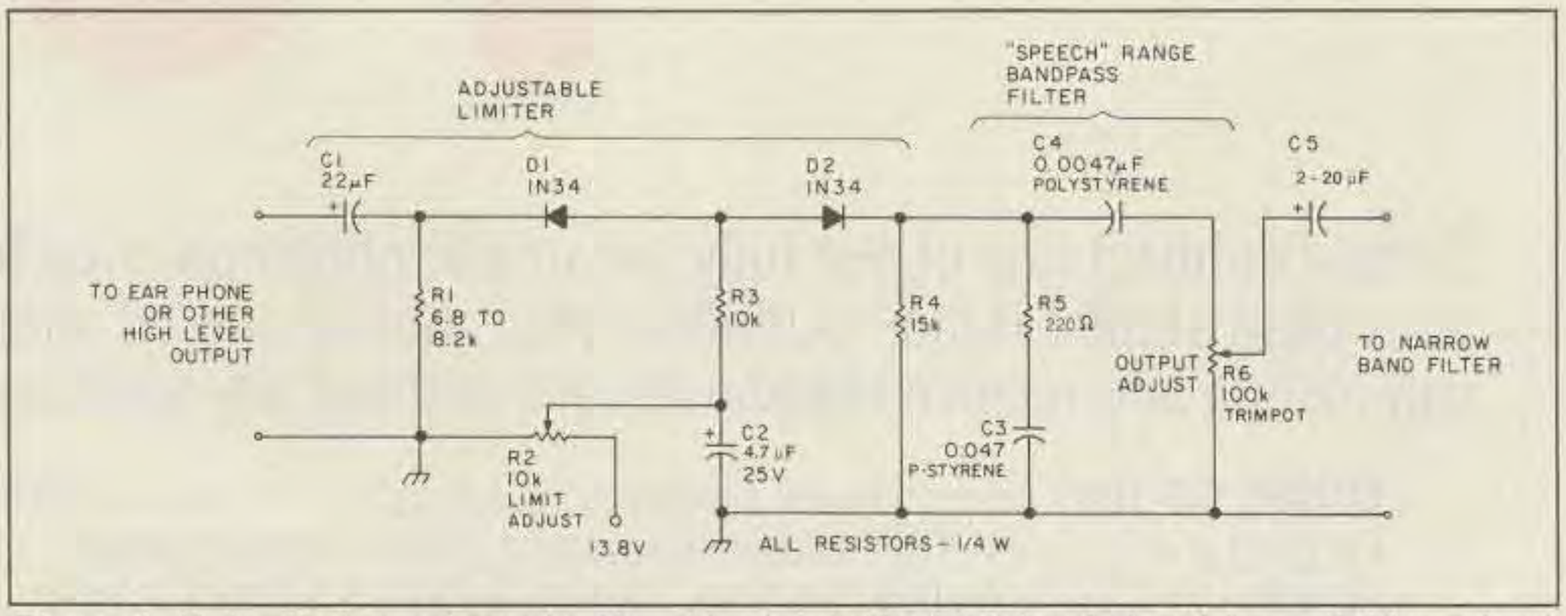

Figure 1. Noise-limiter schematic. Use this circuit if a high level signal is available and you have an "add-on" narrowband filter.

The Noise-Limiter Circuit

The circuit that does the job is shown in Figure 1. Most noise-limiter circuits are of the shunt type. This one is a series limiter. The bias on the diodes is adjusted by the 10k limit adjust pot. The resistor marked 6.8 to 8.2k (a 10k/25 turn pot can be used here) is used to adjust symmetry. The capacitor is a bias filter; the 15k resistor is the output load. The 220 ohm, 0.047 µF, and 0.0047 µF capacitors form a speech range filter. The 100k output adjust potentiometer can be a trimmer or a standard audio taper "volume control."

Putting the noise limiter in the receiver ahead of any filter makes copying a signal easier. It's like closing the window a bit on the radio signals being received, but unlike a volume control, small signals get full amplification and big signals get clipped.

Three circuits are shown. With so many different situations out there it's a hard call to make as to which circuit to recommend, but it is best to place the noise limiter ahead of any filter. In the Sudden receiver, place the noise limiter ahead of the LM386. In fact, in a simple receiver, use the circuit in Figure 3. The circuit between the X's could be omitted for first-time builders. All it does is give steeper

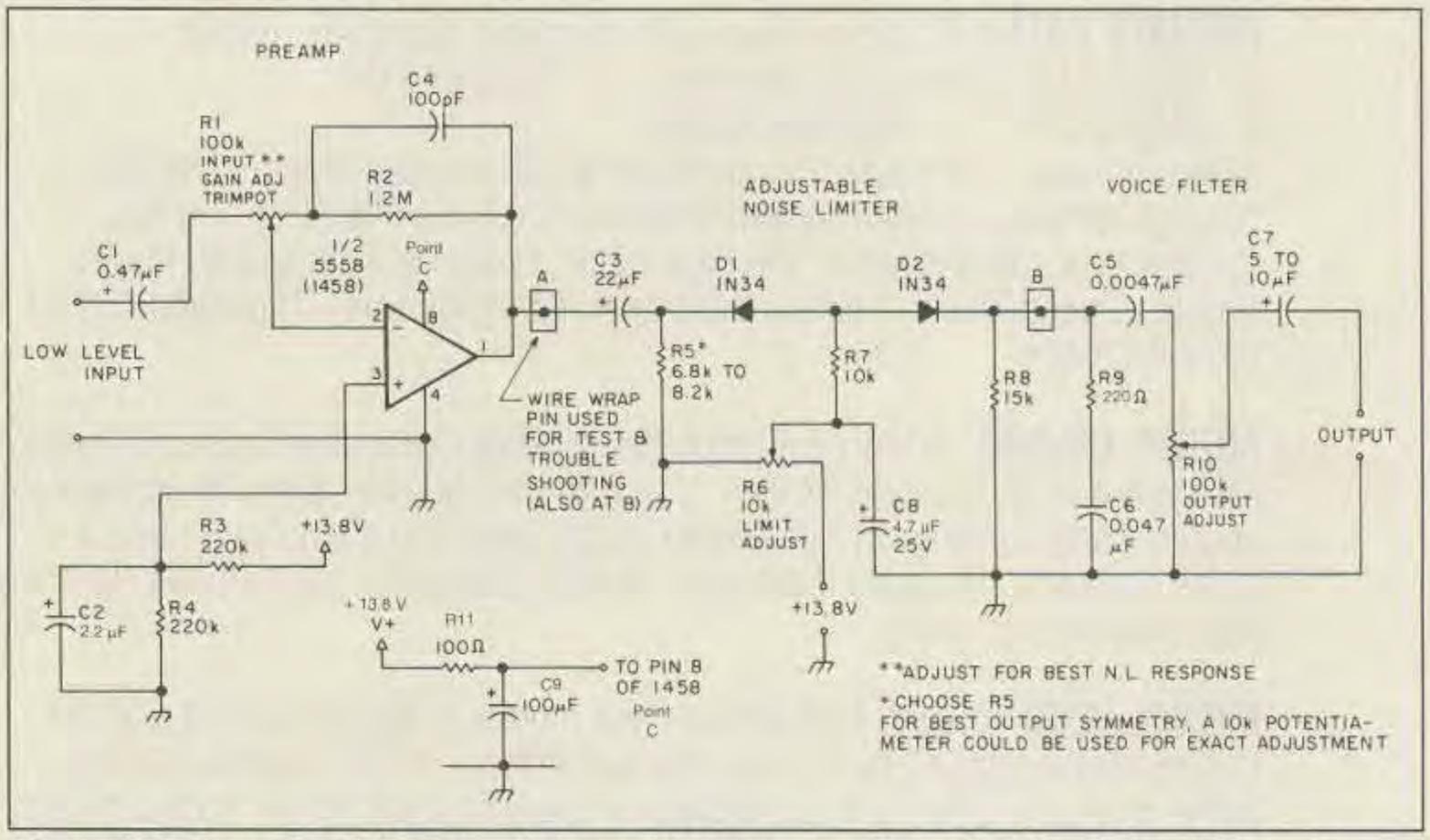

Figure 2. Schematic of the noise-limiter with a pre-amp. For a low level signal if you have an "add-on" filter such as an MFJ CW type.

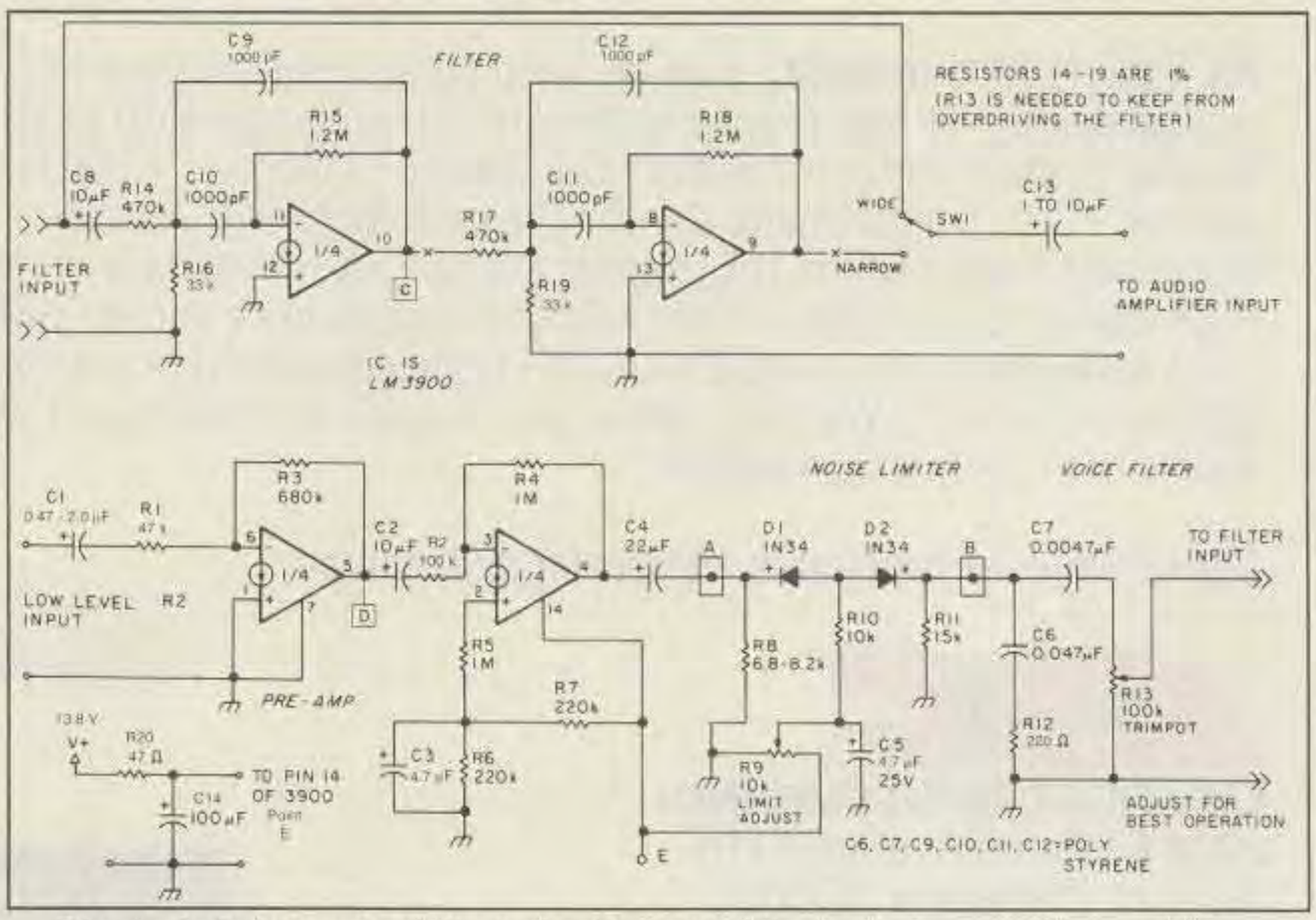

Figure 3. Schematic of the noise-limiter with a built-in amplifier and filter.

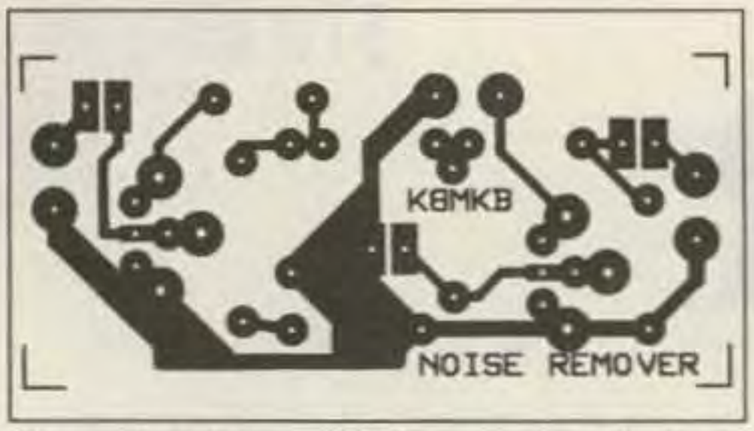

Figure 4. PC board foil pattern for the basic noise-limiter (refer to Figure 1).

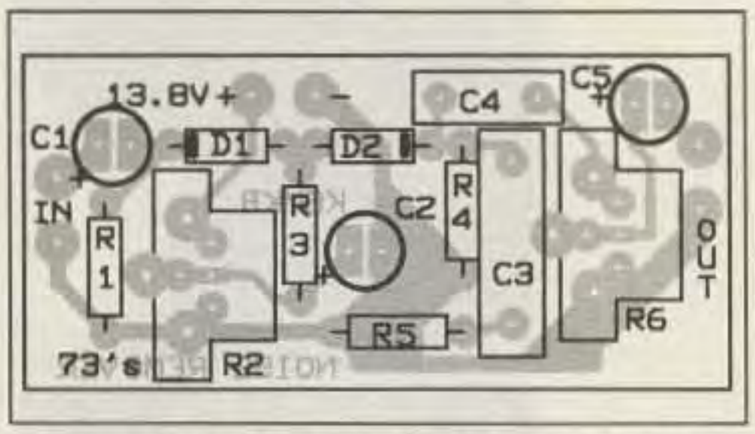

Figure 5. Parts placement for the basic noise-limiter.

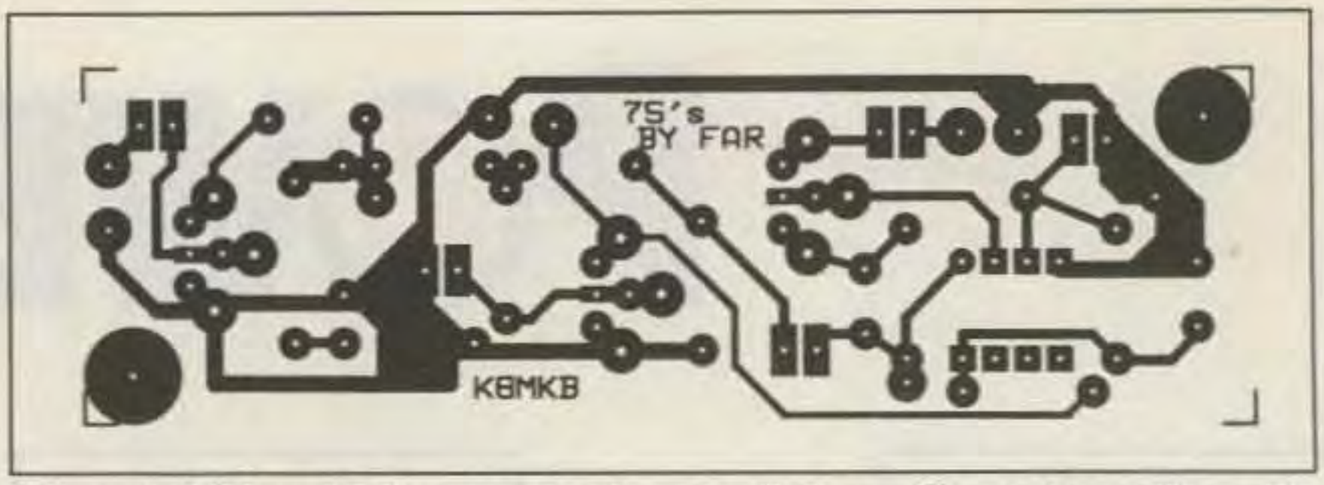

Figure 6. PC board foil pattern for the noise-limiter + filter (refer to Figure 2).

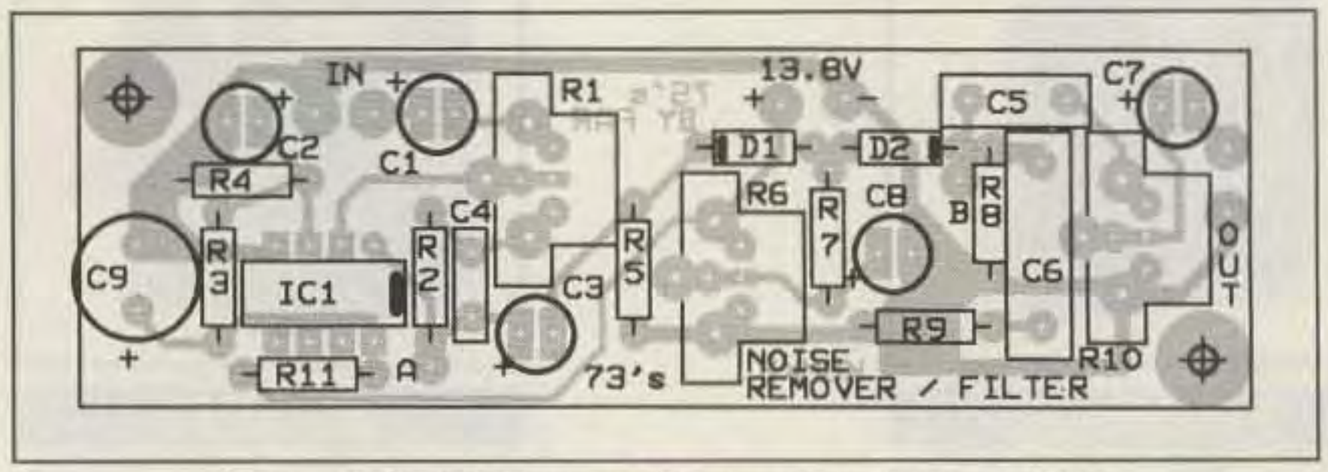

Figure 7. Parts placement for the noise-limiter + filter.

skirts to the bandpass response. It is a definite improvement, but not really necessary. The output trimpot is adjusted, in any case, to keep from overdriving the filter. Using fixed resistors that are about 35% lower in value will allow operation of the limiter on 9 volts. It could then be built into one of the existing add-on filters, such as one of the MFJ models.

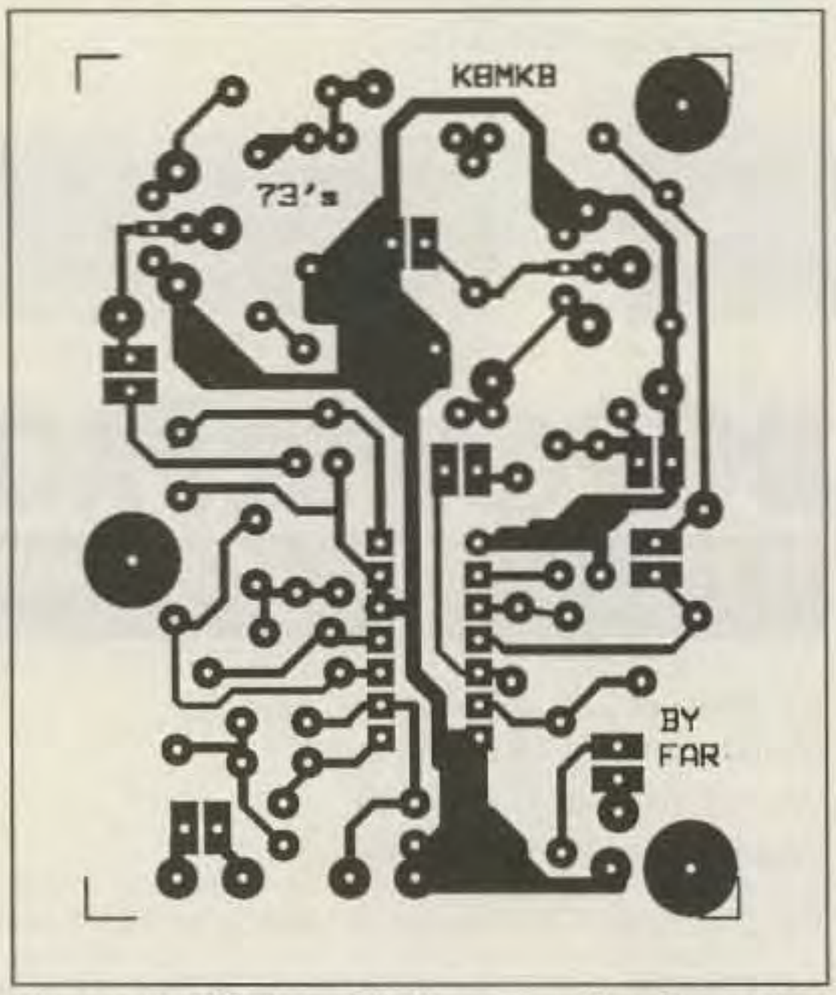

Figure 8. PC board foil pattern for the noise-limiter + filter + preamp (refer to Figure 3).

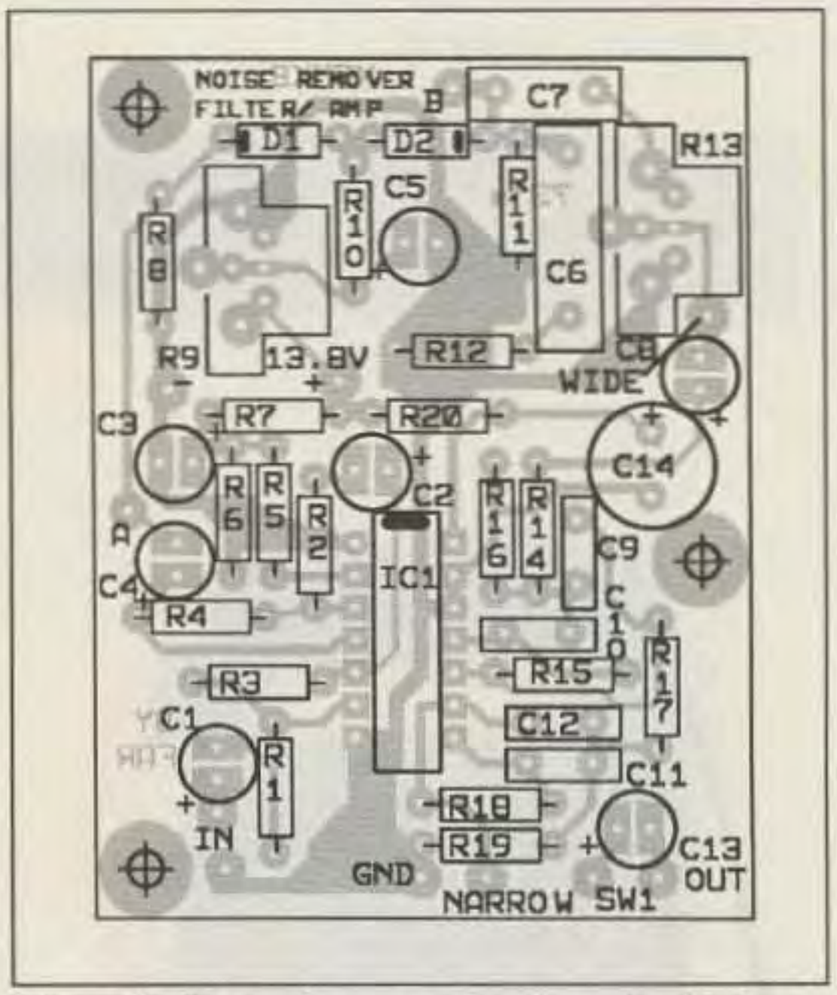

Figure 9. Parts placement for the noise-limiter + filter + preamp.

Assembly

The noise limiter can be assembled on perf board. PC boards are also available (see the parts list on page 16). Glass epoxy is preferred to paper phenolic. Use a low-watt soldering pencil, and *heat-sink the diodes*. Quarter-watt resistors are used throughout. *Poly-styrene* capacitors are used in the filter circuits, as are 1% resistors (you can get by with 5%). The squares with dots are wire wrap pins. Wire wrap pins are handy for making connections to pots, power connections, and input-output connections.

Adjustments

I used a panel mount pot for the *limit adjust* pot (R2 in Figure 1, R6 in Figure 2 and R9 in Figure 3) so I could easily adjust the noise reducer. Hook up a 10k pot in place of the resistor marked 6.8 to 8.2k (R1 in Figure 1, R5 in Figure 2 and R8 in Figure 3) for initial adjustments (you can leave the pot in place when done or measure its final value and replace it with a fixed value).

"I believe that this circuit can improve copying a CW signal in a high QRN situation by between 60-80%. Try it; you'll like it."

Tune in a signal with your receiver and set resistor R1 (marked R5 in Figure 2 and R8 in Figure 3) to 2/3 of its maximum resistance. Next, set the *limit adjust* pot (R2 in Figure 1, R6 in Figure 2 and R9 in Figure 3) to maximum. Then adjust the output pot (R6 in Figure 1, R10 in Figure 2 and R13 in Figure 3) for the optimal output level. Adjust the *limit adjust* control (R2 in Figure 1) counterclockwise until clipping occurs (listen for a definite change in the quality of the sound). Rock R1 back and forth until you hear a clean sound. From this point on you only need to adjust the *limit control* for noise reduction.

I believe that this circuit can improve copying a CW signal in a high QRN situation by between 60-80%. Try it; you'll like it. 73

See the parts list on page 16.

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Parts List.

Basic Noise-Limiter (see Figure 1).

C1	22 µF electrolytic
C2	4.7 µF/25V electrolytic
C3,C4	0.047 µF polystyrene
C4	0.0047 µF polystyrene
C5	2 to 20 µF electrolytic
R1	6.8 to 8.2k
R2	10k potentiometer
R3	10k
R4	15k
R5	220 ohm
R6	100k trim pot

Noise-Limiter with Preamp (see Figure 2).

C1	0.47 µF tantalum
C2	2.2 µF electrolytic
C3	22 µF electrolytic
C4	100 pF
C5	0.0047 µF polystyrene
C6	0.047 µF polystyrene
C7	4.7 to 10 µF electrolytic
C8	4.7 µF/25V electrolytic
C9	100 µF electrolytic
R1	100k trim potentiometer
R2	1.2 MEG
R3,R4	220k
R5	6.8k to 8.2k (choose for best symmetry or use 10k pot)
R6	10k potentiometer
R7	10k
R8	15k
R9	220 ohm
R11	100 ohm
R10	100k potentiometer
D1,D2	1N34 diodes
U1	1458 op-amp IC

Noise-limiter + Amplifier and Filter (see Figure 3).

C1	0.47 to 2.0 µF electrolytic
C2	10 µF electrolytic
C3	4.7 µF electrolytic
C4	22 µF electrolytic
C5	4.7 µF electrolytic
C6	0.047 polystyrene
C7	0.0047 polystyrene
C8	10 µF electrolytic
C9,C10,C11,C12	1000 pF polystyrene
C13	1 to 10 µF electrolytic
C14	100 µF electrolytic
R1	47k (or 100k potentiometer)
R2	100k
R3	680k
R4	1 MEG
R5	1 MEG
R6,R7	220k
R8	6.8 to 8.2k
R9	10k potentiometer
R10	10k
R11	15k
R12	220 ohm
R13	100k trim potentiometer
R14	470k, 1% tolerance
R15,R18	1.2 MEG, 1%
R16,R19	33k, 1%
R17	470k, 1%
R20	47 ohm
D1,D2	1N34 diodes
U1	LM3900 IC

Note: Etched and drilled PC boards are available for each version of the Noise Limiter from FAR Circuits, 18N640 Field Court, Dundee IL 60118. The basic Noise-Limiter PC board is $3.00, the Noise Limitier + Filter is $3.75 and the Noise Limiter + Filter + Preamp is $4.00. Please add $1.50 per order for shipping/handling.