Improved VOX Mobile Extender

Give your handheld the power of a mobile.

by John Neeley K6YDW

This article improves upon my original "Mobile Extender Using VOX Control" project, which first appeared in the December 1987 issue of *73* (pages 44-45). While the original project worked OK—it had a few drawbacks. For one thing, it utilized parts which are difficult to impossible to find today. This new and improved version solves that problem and goes a step further. It uses commonly available parts but also works quite a bit better. This version also eliminates the intermittent reception problem which cropped up in the original, thereby improving communications.

Why Build the Extender?

This project can be invaluable at parades, public events, and especially in search and rescue work. When the extender is operating, you can leave your vehicle and still be in contact with others on the repeater channel via the extender. This is important if you can't access the local repeater via your handie-talkie in your portable location. Using the extender allows you to use the higher power mobile radio in your vehicle to access the repeater. You will also have the advantage of a gain mobile antenna over a rubber duckie.

Circuit Description

In the original circuit, the speaker output of the receiver went to an audio transformer, with a diode in series on the secondary, which produced a DC voltage to drive the input of an LM3900 Norton op amp IC. This arrangement was satisfactory, but at times would become intermittent due to voltage changes on the input to the LM3900. The improved version, shown in Figure 1, is not as dependent on varying input voltages, thereby making the circuit more reliable. Voice modulation is no longer required to activate the circuit. Instead, it will activate upon hearing the receiver noise, when the squelch is opened.

Two identical circuits, using a single LM386 400 mW audio amplifier IC in each channel, instead of a single LM-3900 IC, are built to make the extender. The 1RF511 power MOSFET is available from Radio Shack and other suppliers. If a relay output is desired, the 1RF511 can be replaced by an NPN transistor. The 1RF511 has very low on-state resistance, combined with high transconductance, and the capability of sinking 3 amperes.

When the gate of the MOSFET is driven high, the drain goes low, which will key the T/R relay in the transceiver. The only voltage on the drain is supplied by the relay of the radio. Parallel to the drain output of the MOSFET is an over-voltage protection circuit consisting of a zener diode (Z1, Z2), and a 0.01 µF disc capacitor (C7, C16) to prevent voltage spikes from destroying the MOSFET.

Diodes (D1, D2) rectify the output voltage of the LM386 IC from AC to DC, to operate the MOSFET keying transistor (or NPN/re-

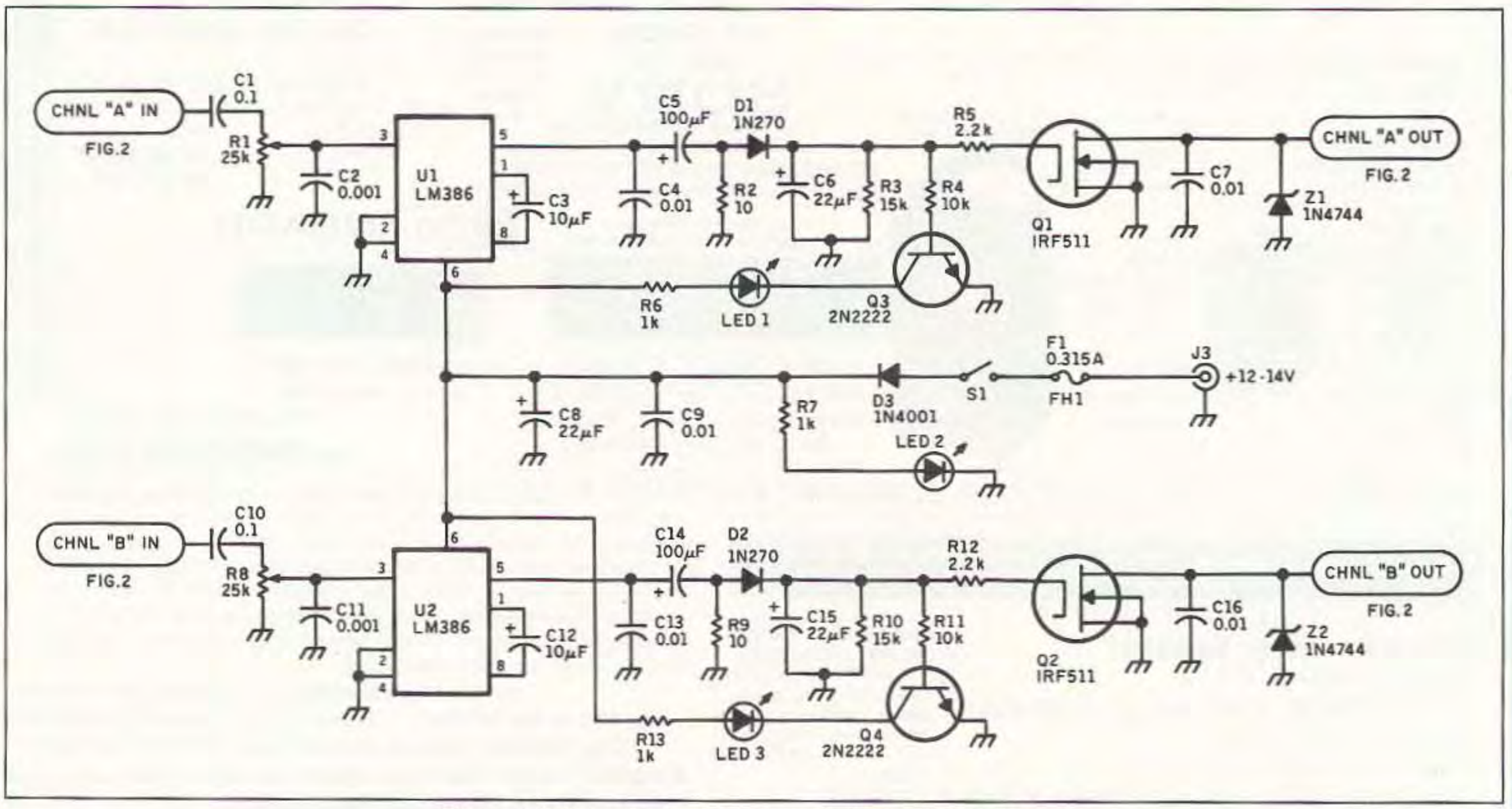

Figure 1. Schematic for the improved VOX Mobile Extender.

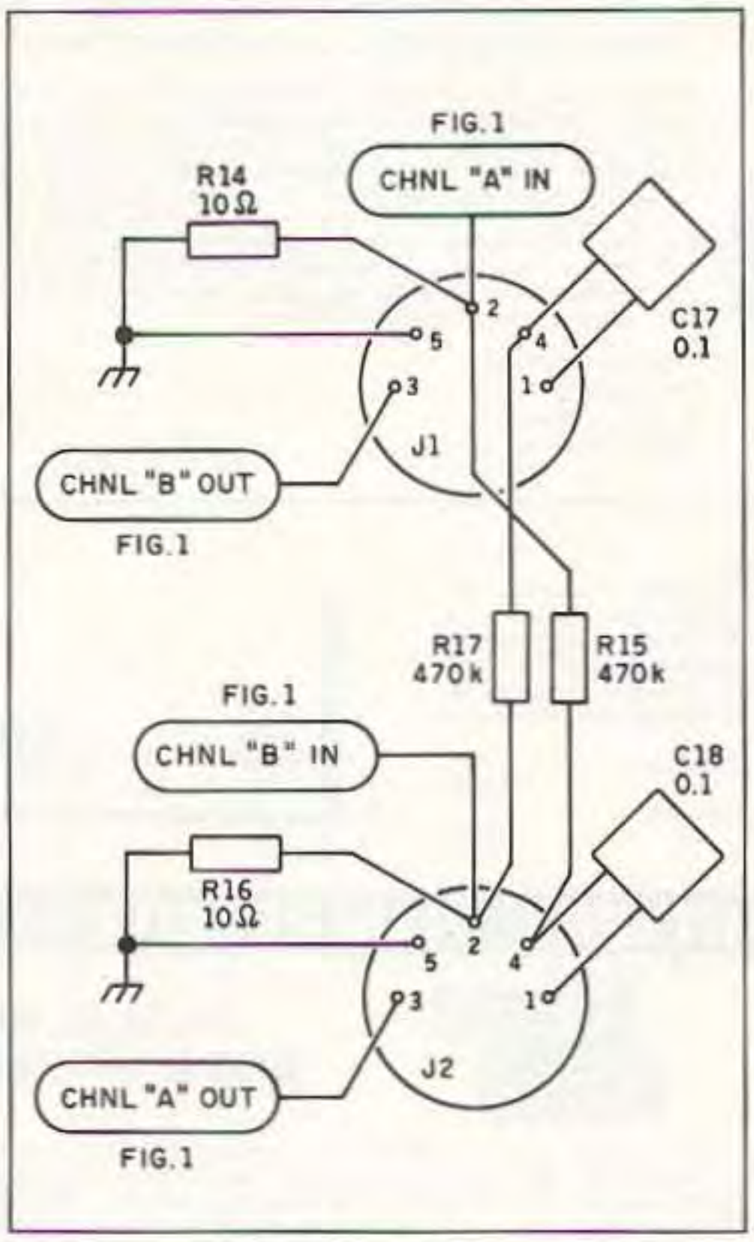

Figure 2. The 5-pin DIN jack wiring.

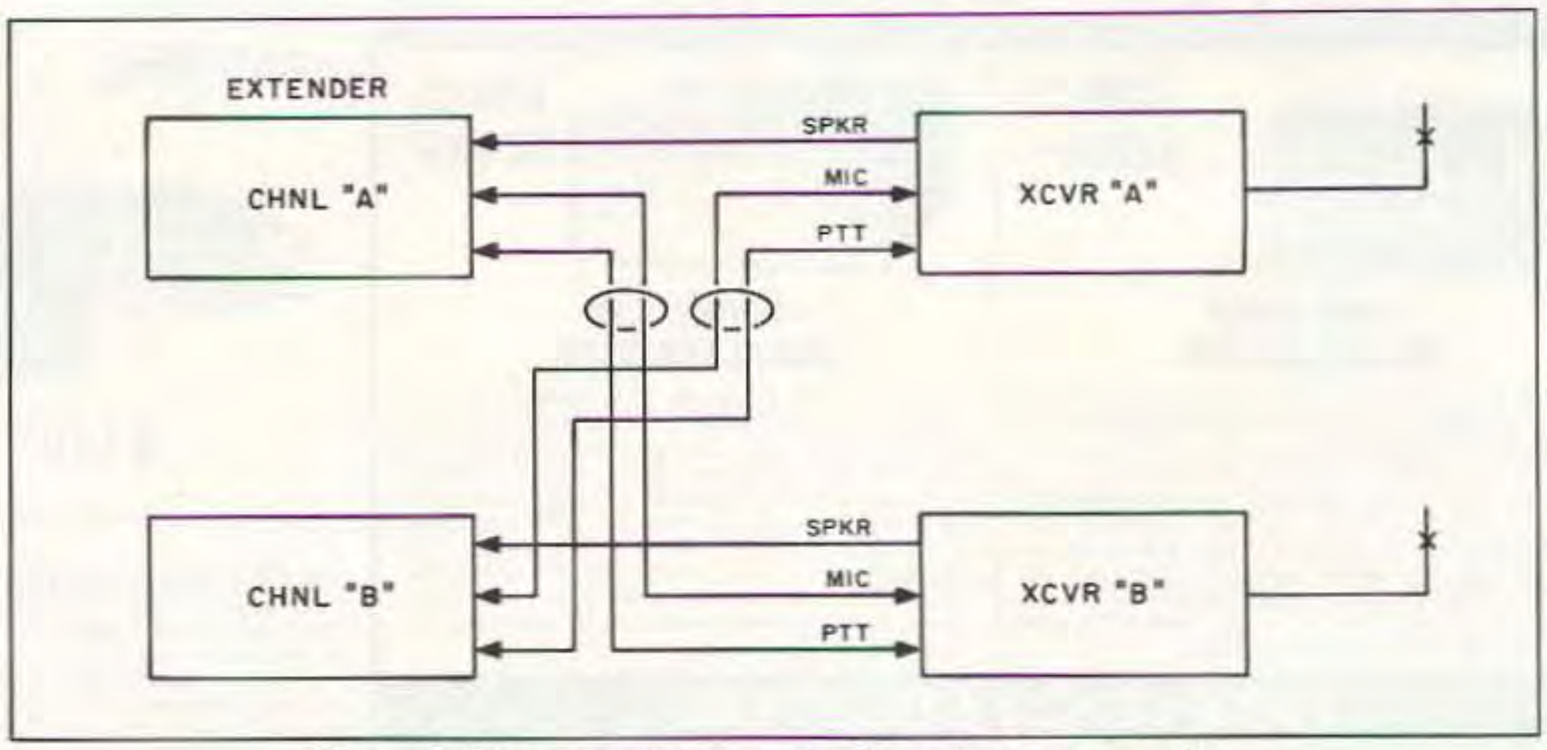

Figure 3. It's easy to hook up the Extender to your radios.

lay configuration). The LED indicators are optional, but they do give a visual indication as to which channel is active. I use a red LED for "CHNL A," green for "CHNL B," and yellow for POWER ON.

Transmit Audio Circuit

The transmit audio section is identical to the original article. The speaker output of one receiver goes through a 470k ohm resistor (R15, R17), to a 0.1 µF capacitor (C17, C18), then terminates at the microphone input of the other transmitter. The values of the resistor/capacitor network may vary, depending on your radio, but the device has been found to work with several different types. It is suggested that the network be placed directly at the I/O jacks (J1, J2), instead of on the PC board. See Figure 2.

Wiring It Up

Figure 3, the wiring diagram, shows how simple it is to hook it up to your radios. XCVR "A" speaker output goes to CHNL "A" input; CHNL "A" output (MIC/PTT) goes to XCVR "B" microphone/PTT jack (reverse for the other channel). XCVR "A" should be on your 2 meter repeater channel, or can be on simplex. XCVR "B" can be on your 2 meter repeater channel, or can be on simplex. XCVR "B" can be on any simplex channel, preferably on either 220 or 440 MHz, to prevent desense.

Operation

To use the unit, plug in the appropriate cables to the transceivers. The input/output jacks (J1, J2) of the extender are wired the same, so all you need to make up are the cable connectors going to your transceivers. Refer to your radio's manual for correct wiring and types of connectors required.

Select XCVR "A" to an active repeater channel; set the volume control on the receiver to about halfway on each radio for initial tests. Monitor on another receiver; set to XCVR "B" transmit frequency, and adjust the 25k pot (R1) to where the circuit keys XCVR "B."

Now adjust the receiver volume to where the audio has good quality. Again, these values may need to be changed to fit your radio, but they should be correct for most units. Now you can do XCVR "B," which is the same procedure. The 5-pin DIN jack wiring is shown in Figure 2.

Construction

The circuit can be constructed on a printed circuit board from FAR Circuits (see note at the end of the Parts List). Place the board, along with the associated switches, LEDs and jacks, in a metal box of your choice and mount it in a suitable location near

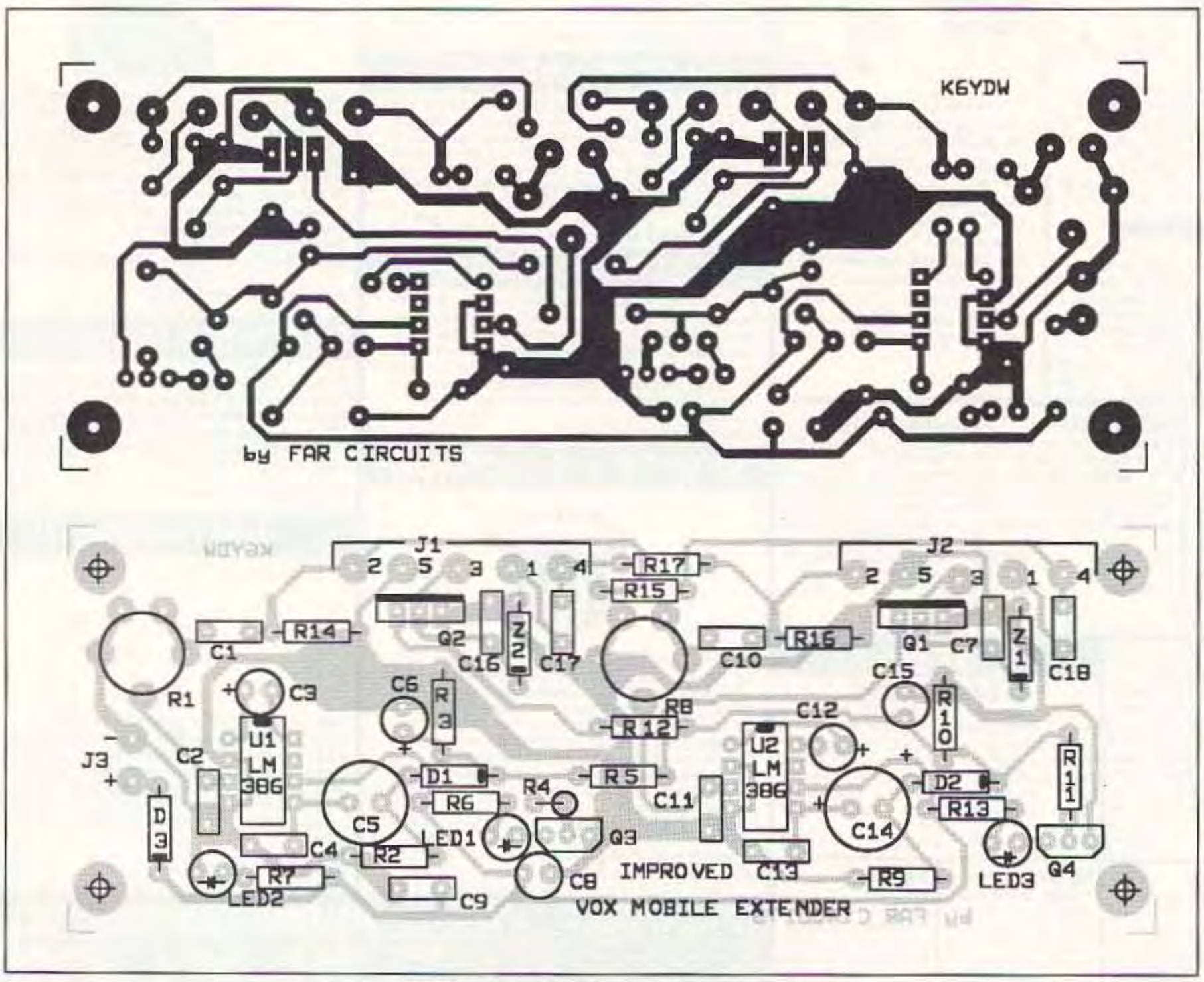

Figure 4. PC board pattern and parts placement.

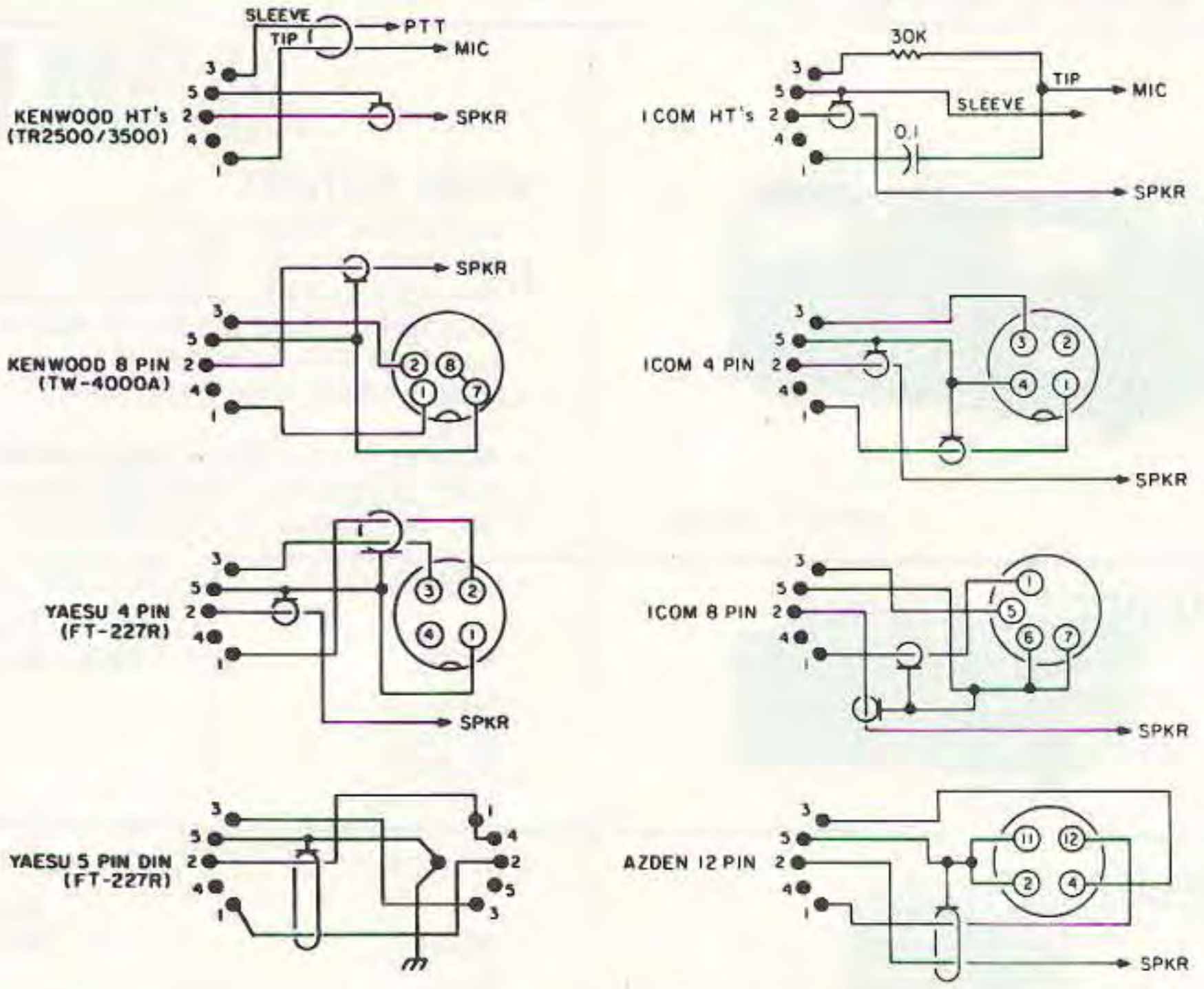

Figure 5. 5-pin DIN plug output to various radios.

the transceivers. The fuse F1 and the switch S1 are mounted off the PC board on the enclosure box. The cost of this project is less than $50 if all the parts are purchased new; less, of course, if you have a good junk box. Pinouts for various radios can be found in Figure 5 in this article.

Reminders

Remember to wait for the repeater squelch-tail to drop before transmitting through the extender. *Be advised: You have just created a remote base, which you must ID as such, per FCC rules.*

Parts List

Integrated Circuit		
U1,2	LM386 audio amp	RS 276-1731
Transistor		
Q1,2	1RF511 Power MOSFET	RS 276-2072
Q3,4	2N2222 NPN	RS 276-2009
Diodes		
D1,2	1N270 (or 1N914/1N4148)	RS 276-1122
D3	1N4001 50V/1A	RS 276-1101
Z1,2	1N4744 Zener, 15V/1W	
LED1	Red T-1 3/4	RS 276-041
LED2	Yellow T-1 3/4	RS 276-021
LED3	Green T-1 3/4	RS 276-022
Resistors		
R1,8	25k ohm PC mount pot	
R2,9,14,16	10 ohm, 1/2W	RS 271-001
R3,10	15k ohm, 1/4W	RS 271-1337
R4,11	10k ohm, 1/4W	RS 271-1335
R5,12	2.2k ohm, 1/4W	RS 271-1325
R6,7,13	1k ohm, 1/4W	RS 271-1321
R15,17	470k ohm, 1/2W	RS 271-053
Capacitors		
C1,10,17,18	0.1 µF/50V Mylar	RS 272-1069
C2,11	0.001 µF/50V disc	RS 272-126
C3,12	10 µF/16V tantalum	RS 272-1436
C4,7,9,13,16	0.01 µF/50V disc	RS 272-131
C5,14	100 µF/35V electrolytic	RS 272-1028
C6,8,15	22 µF/16V tantalum	RS 272-1437
Jacks		
J1,2	5-pin DIN	RS 274-005
J3	5mm/2.1mm power	RS 274-1565
Plugs		
P1,2	5-pin DIN	RS 274-003
P3	5mm/2.1mm power	RS 274-1567
Switch		
S1	SPST sub-mini	RS 275-612
Fuse		
F1	.315A/5x20mm	RS 270-1249
FH1	Fuseholder, 5x20mm	RS 270-362
Other		
Cabinet	Metal	RS 270-253
PC Board	Universal Board	RS 276-168

A drilled and etched PC board for this project is available for $7.50 plus $1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.