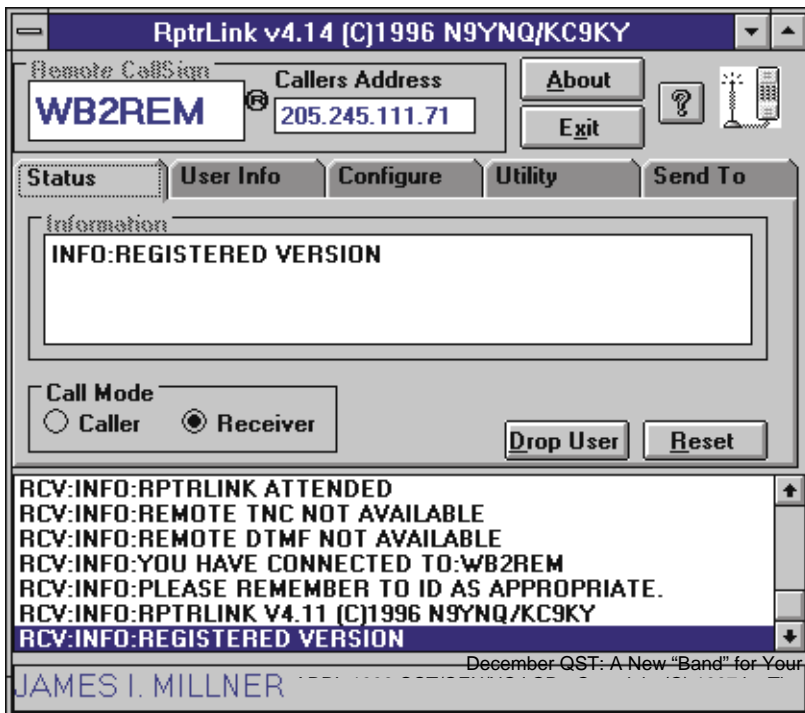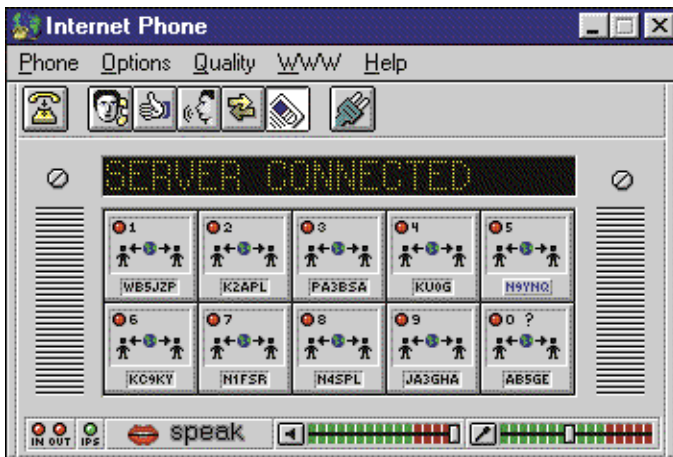# A New "Band" for Your Radio

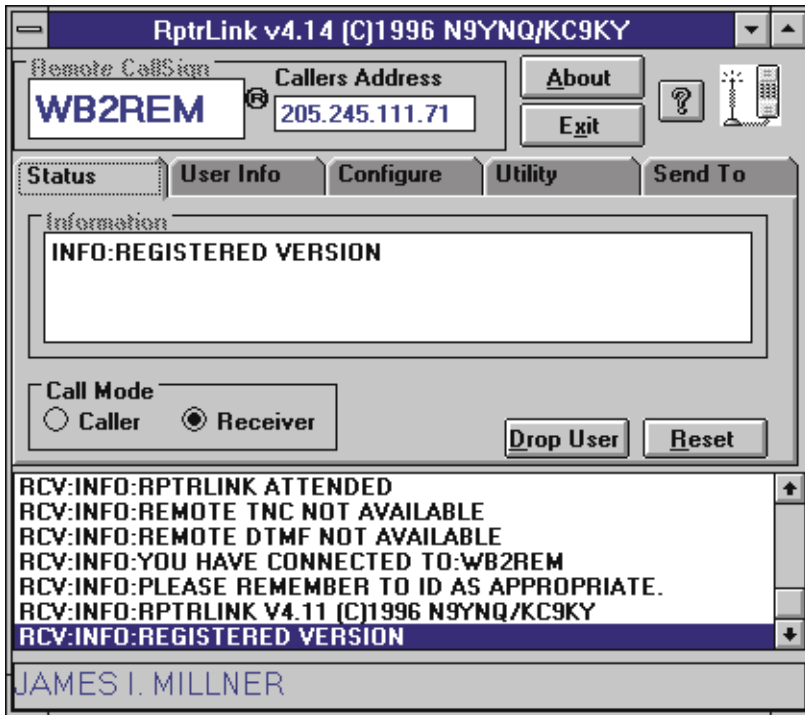## Amateur Radio and the Web combine to deliver another way of having fun!

By James Millner, WB2REM

Can you recall talking with a ham in Thailand for 30 minutes without other hams pouncing on you? Have you chatted with a ham in South Africa without a peep of QRM? How'd you like to use your new Technician class license to have a QSO with a ham in Taiwan? Imagine being in your car and talking through a repeater in another country, or running a net between two clubs on each coast of the US. An innovative piece of software, some classic ham ingenuity, less than $50, and some easy time with a soldering iron make this—and more—a reality, so jump in and join the fun!

Internet Phone

Until recently, communication via the Internet was confined to e-mail or keyboard chats. Approximately two years ago, software developers at VocalTec Ltd introduced *Internet Phone*, an application that permits you to use a personal computer equipped with a Sound Blaster-compatible sound card and a microphone to receive and transmit audio via the Internet. [1] This enables Internet-connected people worldwide to conduct real-time voice communication almost as easily as talking on a telephone! *Internet Phone's* appeal was immediate and captured the imagination and enthusiasm of Internet users. Two years and several versions later, *Internet Phone* has evolved to allow near-perfect conversation with excellent audio quality.

The RptrLink v4.14 screen showing the Status tab with INFO:REGISTERED VERSION, Remote CallSign WB2REM, Callers Address 205.245.111.71.

Internet Phone permits properly equipped personal computer users to receive and transmit audio via the Internet. Repeater Link provides the software interface between Internet Phone and your radio.

Why Not Internet Radio?

Jack Leverich, KC9KY, and Mark Brown, N9YNQ, two early users of *Internet Phone,* realized that a connection between *Internet Phone* and their repeater system would extend the repeater string to unimaginable distances! Such a connection would make it possible for a ham checking into the local repeater to have a QSO with another ham literally anywhere in the world, as if the other ham were on the local repeater! KC9KY and N9YNQ created a new outlook on how your computer can be used as an integral part of your repeater or home station. *Repeater Link*, shareware written by N9YNQ, provides the software portion of the interface between *Internet Phone* and your radio. [2] Currently, *Repeater Link* runs only in a Microsoft *Windows* environment (*Windows* 3.1 or higher). KC9KY designed an easy-to-duplicate hardware interface.

Getting Started First, Internet Phone

Before using *Repeater Link,* download and configure *Internet Phone,* carefully setting the audio and microphone levels: They're critical for a good match between the radio and the computer. Once you've finished the user-information configuration, go on line to the *Internet Phone* server and give it a try with a microphone and speaker connected to your computer's sound card. On *Internet Phone,* I use my Amateur Radio call sign as my nickname so other hams can identify me as a ham. Conversations with hams on *Internet Phone* are similar to on-the-air QSOs. In fact, many people I've contacted via *Internet Phone* use call signs. We've even exchanged QSL cards—unfortunately, they aren't acceptable for DXCC!

The Repeater Link Hardware Addition

To allow *Internet Phone* and *Repeater Link* (*RptrLink*) software users to access your radio, a simple hardware interface is needed. This consists of a couple of inexpensive boxes: a VOX unit and a relay box. The $35 Radio Shack 43-263 voice-activated telephone recording control (VOX) is easy to modify for our use. (You can use a less-expensive Ramsey Electronics VS-1 or similar device.) [3] A block diagram of the hardware interface is shown in **Figure 1**. Refer to **Figures 1** through **3** during the following discussion.
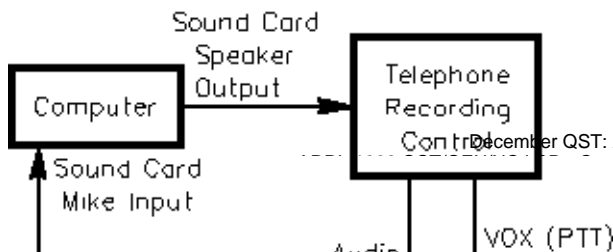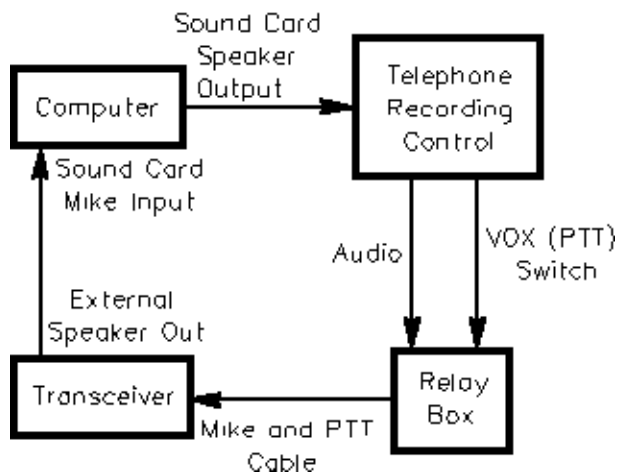
Figure 1—Block diagram of the system.

VOX Unit Modification

Caution: Remove the VOX-unit batteries prior to making modifications. Failure to do so could damage the unit.

Two cables exit the VOX unit (see **Figure 2**). The PHONE LINE input cable is a four-foot cord terminated in a modular telephone connector. The output cable (RECORDER) terminates in a pair of two-circuit mini-plugs: a 2.5-mm and a $1/8$-inch plug. In normal use, the $1/8$-inch plug carries the telephone-line audio; the 2.5-mm plug is the VOX switch that activates the attached tape recorder.

At the end of the VOX-unit INPUT cable, clip off the modular telephone plug. [4] Attach the cable's red wire to the tip of a $1/8$-inch, three-circuit (stereo) plug. Connect the green wire to the plug's ground terminal. Insert this plug into your sound card's SPEAKER OUT jack. This allows the incoming *Internet Phone* audio to activate the VOX unit.

Making a minor modification inside the VOX unit decreases the PTT-line hang time (the period after audio from *Internet Phone* or the sound card ceases) from six to two seconds. Turn the VOX unit upside down and remove the four screws. Solder a 1-MΩ, $1/4$-W resistor in parallel with R6 (3.3 MΩ)—R6's ID is labeled on the PC board. (Alternatively, you can install a pot to provide variable-delay capabilities.) Reassemble the VOX unit.

Figure 2—The VOX unit and the interface box. The VOX unit's PHONE LINE cable connector is rigged to terminate in a three-circuit phone jack. The two miniplugs are from the VOX unit RECORDER output. The DIN plug at the right of the relay box routes mike audio, ground and two PTT-line wires to the rig's mike connector.

The Relay Box

I use a plastic enclosure to contain a low-voltage SPDT relay powered by a 9-V battery. A relay, K1, isolates the radio's PTT line

from the VOX unit. If you use a relay with different voltage and current requirements, you'll need an appropriate power supply to energize it. I mounted the relay on the experimenter's board supplied with the enclosure (see **Figure 3** caption).

Mount J1, a two-circuit, 2.5-mm jack at one end of the box to accept the VOX-switch plug from the VOX unit. Mount a two-circuit, $1/8$-inch jack, J2, next to J1; J2 receives the VOX unit's audio plug. At the opposite end of the box, drill a hole large enough to accept a shielded multiconductor cable (or install a 5-circuit DIN jack) for the output lines (see **Figures 3** and **4**) to your radio. Connect the PTT line from K1's common contact, the mike ground, and the audio-output line to the output cable. At the other end of this cable, attach a mike connector that mates with your rig. [5, 6]
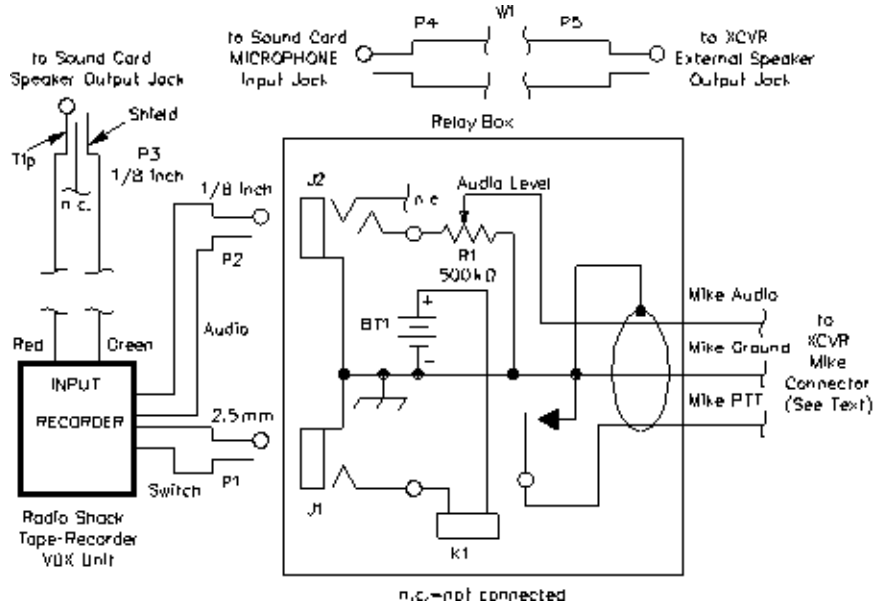

Figure 3—Diagram of the RptrLink interface. Equivalent parts can be substituted. RS part numbers in parentheses are Radio Shack.

BT1—9-V battery

J1—3/32-inch (2.5-mm) two-circuit jack (RS 274-247)

J2—1/8-inch three-circuit jack (RS 274-249), one circuit unused

K1—SPDT PC-mount relay 7 to 9-V dc coil (RS 275-005)

P1—Existing VOX unit 2.5-mm plug

P2—Existing VOX unit 1/8-inch plug

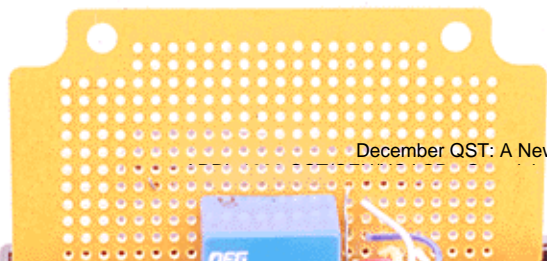**P3—1/8-inch, 3-circuit (stereo) plug (RS 274-284)**

P4, P5—1/8-inch 2-circuit plug (RS 274-286/287)

R1—500-kΩ PC-mount trimmer potentiometer

W1—6-foot shielded cable equipped with 1/8-inch plugs (RS 42-2420)

Misc: VOX unit (RS 43-263); enclosure with perf board (RS 270-283); battery clip; 5-circuit DIN jack (RS-274-005); 5-circuit DIN plug (RS 274-003)
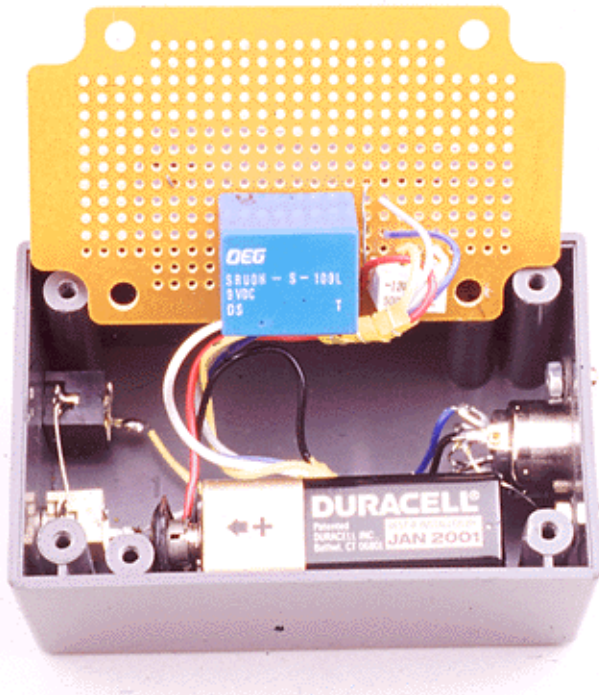
Figure 4—A view of the relay box. K1 and R1 are mounted upside-down and on one side of the enclosure's mating experimenter's board. This allows room on the opposite side of the box for mounting the 9-V battery, which is secured to the wall by double-stick tape. The 1/8-inch and 2.5-mm jacks are mounted on the left end of the box. The cable to the rig connects to the box via a DIN connector at the right. R1 is adjusted via the access hole in the box side.

Initial Check-Out

Connect the EXTERNAL SPEAKER output of your transceiver to the sound card's MICROPHONE input to send your radio's audio to *Internet Phone.* Next, set up the sound card to work properly with *Internet Phone.* First, make sure that the mike audio from the sound card is muted to avoid feedback. Once the hardware is attached, the receiver audio from your radio can be controlled by your radio's volume control. Adjust your radio's mike gain to avoid overmodulation. Audio output from *Internet Phone* to your radio can be adjusted three ways: by the volume control in *Internet Phone,* the sound card's output-level control, and R1, the AUDIO LEVEL pot (see **Figure 3**) in the mike line. Adjust each audio source to avoid distortion and ensure quick triggering of the VOX.

The VOX unit has three SENSITIVITY levels (A, B and C). I find that setting B works best. Adjust the VOX unit's PLAYBACK/RECORD switch and SELECT A/B switch so that the VOX switch (RECORDER output) is normally in an open state, and shows continuity when the unit is triggered.

Check continuity between the tip and shield of the VOX unit's 2.5-mm plug when an audio signal is present on *Internet Phone* and from the sound card. Continuity should show for approximately two seconds after audio ceases (if you made the resistor modification in the VOX unit). Connect this plug to J1 of **Figure 3**.

RptrLink Software

Download the *RptrLink* software (see Notes 1 and 2) from the *Internet Phone* Repeater Link site and install it. *RptrLink's* installation program creates a RPTRLINK directory on your hard drive and makes a group in your *Internet Phone* program named HAM RADIO RptrLink. Start *Internet Phone* first. Once you have connected to the server, activate the *RptrLink* program. If you start the *RptrLink* program prior to connecting to *Internet Phone's* server, you'll receive an error message.

To properly setup the *RptrLink* program, click the Configure tab and click the CallSign tab. Enter your call sign. Next, determine whether you're a *caller* or a *receiver.* A caller is one who's looking to bring up a repeater, or initiate a call to another *RptrLink* ham. A receiver is a person on the repeater or simplex-repeater station that accepts calls from anyone running *RptrLink.* To run the *RptrLink* system, click *Internet Phone's* Phone tab followed by the Call tab and enter the HAM RADIO RptrLink topic/group. Here you'll find a

number of stations with -Repeater or -Simplex repeater after their calls. Choose a station you want to call and click on the call sign.

Testing and Calibration

With the software configured and hardware ready, you can test and calibrate your radio link. First, trigger the test audio program in *Internet Phone* and confirm that it triggers the VOX and activates your radio's PTT. Observe how long the PTT hangs after the audio is gone. (It shouldn't be longer than two to three seconds.) Adjust the audio output of *Internet Phone* through adjustments of the sound card or the volume control slide switch of *Internet Phone.* Listen on an auxiliary radio to test the transmitted-audio quality and make adjustments as necessary. Next, tune in a station using your receiver. Adjust the receiver's volume so that it triggers the *Internet Phone* VOX and the amplitude doesn't exceed two-thirds of the audio bar graph. Once both conditions are working well, try to make a contact.

"Caller ID"

Before allowing a connection from the Internet to a ham repeater or station, *RptrLink* intercepts the request for a connection and looks up the caller's call sign for authentication. When a caller attempts to connect to a receiver, the caller's call sign is checked against the USER.INI database in the RPTRLINK directory of your PC. If there is no match in the database, a call-sign look-up is sent through the Internet to a user-selectable call-sign lookup site. On authentication, *Internet Phone* is answered and the *Internet Phone* caller can access the repeater or *RptrLink* user. Call signs of hams in foreign countries who are not listed in the database can be manually added to the USER.INI file. After authentication, the caller is connected to a radio (repeater or simplex). Subsequent transmissions are fed through *Internet Phone* to the linked radio. *You're on the air!* Remember, since you're now transmitting on a ham band, call-sign identification is mandatory. If someone is listening to the radio-link frequency, they can answer you.

Station Identification

RptrLink can use a WAV file to generate an audio ID. WAV files can be set up (under WI [wave ID] in the Configure tab) to ID your station and announce a person entering or leaving the system. This function is extremely important if you are running a simplex repeater that doesn't have an on-board IDer. The WAV files can be created by several programs (such as the one provided with the Sound Blaster card). Place the files in the RPTRLINK directory. Because *Internet Phone* can handle only one WAV file at a time, the ID is inactive during an active connection. However, the ID will be announced when *Internet Phone* is in an idle state during a conversation, or before and after a connection. Therefore, an interval of five to ten minutes between announcements of the WAV ID generally works well. The intervals can be set in the WI tab. The most recent version of *RptrLink* offers an optional CW identifier that will not experience conflicts with *Internet Phone* audio during an active connection. [7]

Connecting to TNCs

RptrLink can access a remote station's TNC. The TNC can be connected to HF or VHF packet, AMTOR, or another mode. For example, G3 stations have connected through the KC9KY and N9YNQ repeater link in St Louis, Missouri, to check a DX cluster, and to enter a packet wormhole and talk to friends in California. To access a remote TNC, first push the Send To tab, then the TNC tab and check Remote. In the blank screen, type in normal packet commands (ie, MH for Mheard and C (call sign) to connect. When you enter the TNC mode, the remote station's call sign is replaced by your call sign and appears as an on-the-air station at the remote location. Other *RptrLink* features include Chat and PopUp Chat capabilities as well as the ability to send DTMF encoded tones. There are many more features of *RptrLink* that are well documented in the program's Help files.

Summary

The combination of *Internet Phone, RptrLink* and hardware provides a fantastic integration of ham radio and the Internet. It expands normal UHF/VHF activity by allowing worldwide access to hams on your repeater or home station. Just think of the fun you can have as a mobile station talking to Hong Kong as if it were around the block, or commuting to work and talking to other hams thousands of miles away doing the same! For a few dollars and a little effort, you can bring your repeater into the computer age and expand the horizons of your club or personal station.

I want to acknowledge the effort and contribution that Mark, N9YNQ, and Jack, KC9KY, have made to the creation and development of the *RptrLink* system and their assistance in writing this article.

Notes

[1]*Internet Phone* is available for Windows and Macintosh operating environments: **http://www.vocaltec.com/**. VocalTec, 35 Industrial Pkwy, Northvale, NJ 07647, tel 201-768-9400, fax 201-768-8893, e-mail **info@vocaltec.com.** VocalTec allows download of a free, limited-time version of *InternetPhone.* If you don't register the software, it ceases to work 30 days after installation.

[2]The most-recent release of *RptrLink* can be found at **http://www.onramp.net/swta/rptrlink**. Registered users (the fee is $25) receive free upgrades as they become available. Send a check or money order to Mark Brown, 163 Eighth St, Wood River, IL 62095. The program is updated regularly (revision number as of this article is version 4.32) and can be upgraded through *RptrLink* itself without leaving the program, if you are a registered user. This is done by placing your SMTP server name in the RPTRLINK.INI file found in the **files** tab (my system required a name instead of a number, ie, *mail.yournet.com*). Next, click the *RptrLink* icon (phone and antenna) at the top right of the screen, and provide the information requested. This is a good area to provide feedback to the *RptrLink* developer. Lastly, on the bottom, you can update your **User Info** or *RPTRLINK.EXE* by clicking the desired action.

[3]Ramsey Electronics VS-1 voice-activated switch, 793 Canning Pkwy, Victor, NY 14564, tel 800-446-2295, 716-924-4560, fax 716-924-4555. Price: $6.95 plus shipping charges and tax, where applicable.

[4]Another approach is to clip off the modular connector, attach a phono jack to the wires and use an interconnecting cable with dual male plugs between the added jack and the sound card. If you want to retain the modular plug, you can use an in-line adapter and a short piece of telephone cable to add the plug, or use a surface-mount modular connector and make the plug attachment to the wires at the back of it.

[5]Consult your radio's manual to determine the PTT circuit used and control signal required. Some radios may require a voltage to trigger the PTT line and modifications to the circuit shown here may be needed.

[6]Some sound cards have only a LINE OUT port. If that's the case, and the audio level from the VOX unit mike output is too low to be useful, take the audio directly from the phone jack's red wire within the VOX unit. Attach the center conductor of a shielded cable (RG-174 coax will do) to the phone jack's red wire in the VOX unit (the wire's readily identifiable). Solder the cable shield to the ground (black) wire of the VOX-unit's battery case and the green telephone wire. Route the cable to the relay box via J2.

[7]Check the *RptrLink* and VocalTec home pages on the Internet to determine the current system configuration capable of running *Internet Phone* and *RptrLink,* as these programs are constantly being revised.

Jim Millner, WB2REM, comes from a family of six Amateur Radio operators, and has been a ham since he was 11 years old. He currently holds an Amateur Extra class license, and is the President of the Delaware Valley Radio Association. Jim is active in many aspects of ham radio including satellite operations, HF, VHF, UHF and ATV. He enjoys participating in new and unique modes of communication such as the Internet Phone/RptrLink *connection. Jim can be contacted at 7 Winnipeg Ln, Lawrenceville, NJ 08648. e-mail wb2rem@amsat.org.*

Sidebar: Being in Control

Is this method of operation legal? Yes, if regulations pertaining to third-party agreements and proper station operation are adhered to. Any station offering a gateway—repeater or otherwise—must have a control operator present at the control point. The gateway station's control operator must authorize any transmission from incoming Internet parties. Any radio remote control must be accomplished on frequencies above 222.15 MHz.

If you need ideas on how to build a DTMF decoder and control latches, read *The WB2"REMote Link.*"(James Millner, WB2REM, "The WB2 'REMote Link,'" *QST,* Jan 1995, pp 29-34.) As on the ham bands, there is no foolproof way to determine if the person you are talking to is the person to whom the call sign belongs. The same is true on *Internet Phone/RptrLink.* But, *RptrLink* logs and date/time-stamps all incoming and outgoing calls by their Internet IP address and call sign.—*James Millner, WB2REM*