Remote operation

The recent Lifetime Licence paves the way for operating your station remotely.

THE NEW LICENCE. If you have read your new lifetime licence from cover to cover, you may have noticed Clause 10, Unattended and remote control operation. Subject to various conditions, this allows a UK amateur to "conduct Unattended Operation of Radio Equipment" and "Remote Control Operation of Radio Equipment". In this first of two parts I'll look at the system overview and what you need; next month we'll put it all together.

There are at least two ways that remote operation could be very useful. One is to make your home station remoteable so that you can use it when away on business or holiday, and the other is to set up an entirely independent remote station.

A remote station is an attractive proposition for those of us who live in urban environments and are battling against ever-increasing levels of man-made noise, space and planning restrictions, TVI etc. How wonderful it would be if one were able to sit at home and operate from a nice quiet location with some good aerials? Such a station is sometimes referred to as an IRB or Internet Remote Base.

Of course, the first requirement for establishing a remote station is to have a suitable location available to you, but if you have a weekend cottage or an auntie in the country, you're off to a good start. I have been operating such a station for the last year or so with no major problems (apart from mice!) and it has made a huge difference to my operating pleasure.

There are many ways of configuring a remote station and I offer the following description as one tried and tested option. At the end of the article next month are a few more sources of information.

BUILDING BLOCKS. At your remote-capable station you will need:

- A broadband internet connection with firewall router.
- A reliable and economical PC with serial and parallel ports if possible.
- Specialist software (it's all free!).
- An emergency shut down and reboot facility.
- A transceiver, audio interface and power supply.
- Aerials and tuners.

Internet connection. The internet is by far the easiest way to connect a remote station. With a suitable Wi-Fi equipped laptop you will be able to operate your station from hotels, cafes and anywhere else that offers a connection, as well as from the comfort of your home shack.

The connection at the remote site won't get a lot of traffic (unless teenagers live there!) so a cheap broadband package will be enough. Mine allows for 15GB of data transfer each month, which I have found to be sufficient. (If there is no phone line at the remote site you may be able to use one of the increasingly popular broadband 'dongles' that are available, but check the data allowance: some are much more generous than others. You'll also need a good firewall program on your PC.)

Many people worry about interference from the ADSL data on the telephone line spoiling their quiet receiving site but I have experienced no such problems with mine. The problem I have had has been in the reverse direction with a tendency for the ADSL router to drop the connection when I transmitted on Top Band. I have since fitted filters in the line between the micro-filter and the router, which has cured the problem – see **Photo 2**.

The internet can be a dangerous place and you need to keep your station secure from hackers. The easiest way to do this is to set up a "Virtual Private Network" or VPN. Some ADSL routers have VPN facilities built in, so if you are starting from scratch and only want to control the remote from one place it might be worth getting two identical routers that will have no trouble talking to each other. You may have to ask your ISP for a "static IP address" if you want to use the router's own VPN facility but it is not required for software solutions like Hamachi (see later).

The remote computer. The PC at the remote station needn't be fast; a 1GHz machine is fine. I use an old Dell 850MHz laptop that

PHOTO 1: The system as described. It lives in a wooden box in the utility room. The sweet tin next to the laptop contains the audio transformers.

FIGURE 1: Basic system diagram of the remote station described.

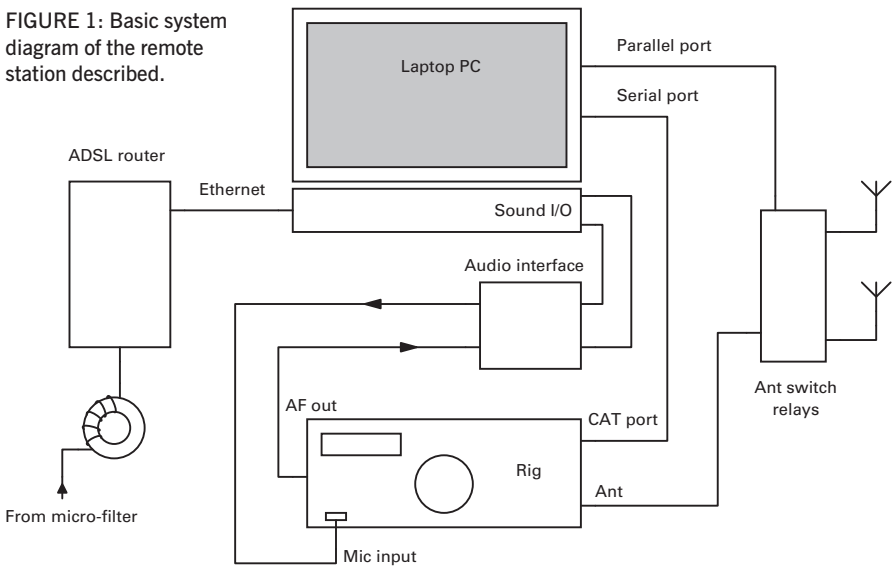
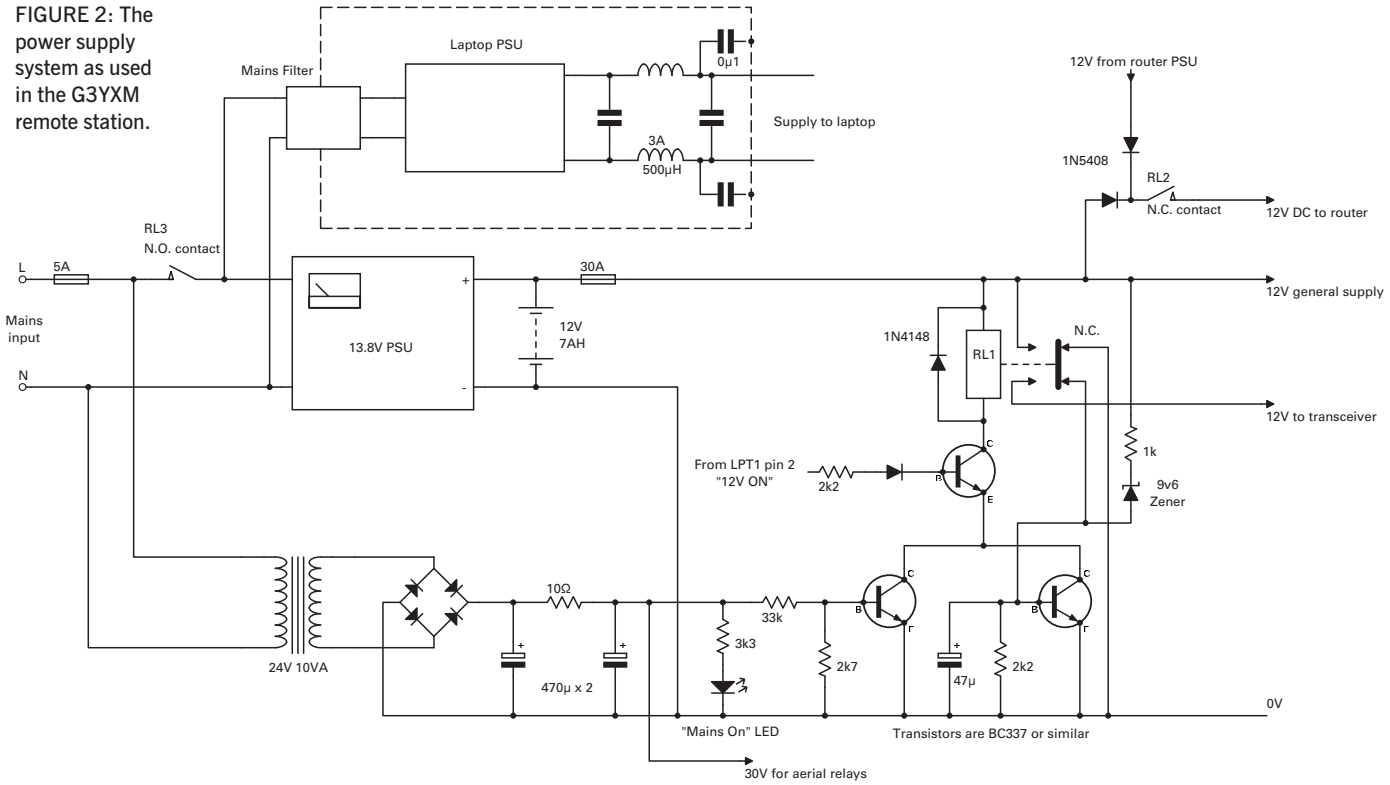


FIGURE 2: The power supply system as used in the G3YXM remote station.



has serial and parallel ports (more on those later) and, being a laptop, it is compact, economical to run and has its own built-in backup battery! Search the rallies and auction sites for a suitable machine for £100 or less.

To be able to recover from the inevitable PC crashes, a remote restart facility needs to be added to the PC. On a laptop this can be a bit fiddly but the following method has proved successful: remove the trim at the rear of the keyboard to reveal the power button (note that this is NOT equivalent to the mains power switch on a desktop PC: leave that *well alone*). Measure the voltage at both sides of the switch with it open and with it pressed. This way you can work out whether it pulls the control line up to 5V or down to ground when pressed. Remove the laptop's battery and make a connection to the switching line as shown in **Photo 3**. The remote re-start should accept a 5V signal from the control logic.

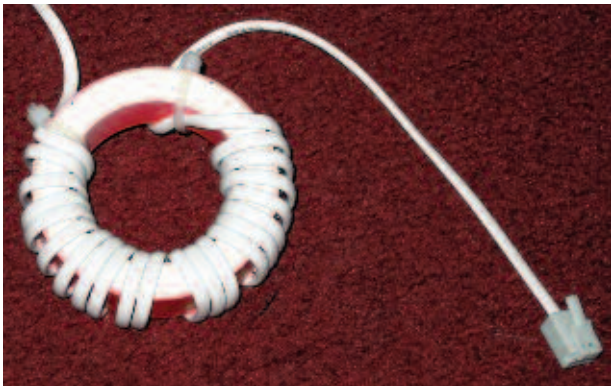


PHOTO 2: Many turns on a 58mm ferrite toroid are needed to keep top band out of the ADSL router.

At your nice quiet location you don't want interference from the laptop's power supply. I mounted mine in a diecast box with a mains filter on the input and a choke/capacitor filter in the DC output line (cut the output lead close to the PSU). It's probably a good idea to drill some holes in the metal box to allow air flow.

Software. Most of the software I use requires a 32 bit Windows operating system so Windows 98 or Me are no use. I run Windows 2000 on my remote machine because it is stable, not too bloated and it runs all the software required. It's also happy with 256MB of RAM. You can still get a genuine disk from eBay or computer fairs for about £30. *Win 2K* doesn't have a firewall, but XP's built-in one seems to create more problems than it solves. In any case, the remote PC will be protected by the hardware firewall in the router.

The amateur licence stipulates that the remote control link must be "adequately secure" to prevent unauthorised use. An easy way to achieve this is by setting up a password-protected virtual private network (VPN). Although some routers can provide this functionality it won't help you if you want to operate your remote station whilst sitting in a cafe in Paris or a pub in Preston. A simple solution (and one that's free for non-commercial purposes) is to download a program called Hamachi from www.Logmein.com and run a copy at each end of the link. This software sets up a private, pass-worded 'tunnel' through the internet, wherever you may log in, and allows you to treat your remote PC as if it were part of your home network.

In my system I use the following programs:

Hamachi (www.logmein.com) to provide the VPN.

Ham Radio Deluxe (www.ham-radio-deluxe.com) to allow remote control of your radio.

IP Sound by SM5VXC (www.wireless.org.uk/software.htm) to provide a good quality two-way audio link.

Lalim parallel port control software to switch aerials etc.

A VNC client such as *Real VNC* or *Tight VNC* for housekeeping of the remote PC.

Emergency shutdown system. One absolute essential at any remote station is a way of shutting it down if something goes wrong. If you lose the link or the PC crashes whilst you are on the air the transceiver might be left in transmit mode. Many radios have a pre-settable timeout that will prevent continuous transmission and this is worth setting up to suit your operating style, but if the computer crashes you don't want to have to travel miles to reset it. This is where the modification to the power button comes in.

In the system described, the power to the transceiver is supplied via a power relay operated from the PC's parallel port. This allows switching of the rig remotely but it

PHOTO 3: Look carefully and you can see a green wire connected to the switch.

PHOTO 4: The DTMF decoder board at the front and the 20A relay is at the back. As this was the prototype there are a few more bits than we actually need.

also means that if the PC is off, the relay drops out and the rig is de-powered. I have also incorporated a backup battery (a surplus 7AH UPS gel type) to keep the system alive in the event of a power cut. The relay driver circuit features a low voltage trip that will protect it from too deep a discharge.

An old mobile phone with a pay as you go SIM card makes a good independent emergency channel. If it is configured to auto-answer you can dial into it from anywhere, listen to the receiver and send it DTMF tones that can be decoded and used to perform various tasks. In my system the mobile phone's audio jack is wired to a DTMF decoder card. One of the outputs is used to 'press' the laptop's power button, and another to momentarily interrupt the router's power supply in order to reset it. I used a kit from CPC (80-2100 board) based on the MT8870 chip. It's a bit of a lash-up but it's shown in **Photo 4**.

A PC will shut down if the power button is pressed for about 5 seconds, even it has completely crashed. Once it has turned off, a short 'press' of the button will start it up again. The DTMF controller card will output 5V to 'press' the re-start switch for as long as you are sending the appropriate DTMF tone.

The phone must be on charge all the time so do check that the charger doesn't cause interference to the remote receiver. If it does you may be able to use a similar filtering system as on the laptop PSU, or maybe use a car type charger fed from the 12V rail but be aware that most of these are switch-mode too!

Remember to make a call on the emergency phone every once in a while: most mobile phone companies will deactivate a number if no calls are made for a few months.

Transceiver and PSU. This is largely up to you. Most modern transceivers can be CAT controlled but some are better than others. I started out with an old Icom 735 that worked quite well but needed a hardware PTT system as there is no CI-V command for TX/RX changeover. The cheapest new option is the Yaesu FT857 that can be made to do almost everything via CAT control except, for some bizarre reason, switching the attenuator/preamp or adjusting the squelch or RF gain. I use its big sister, the FT897, and got round the preamp problem by setting up one VFO with the preamp in, and one with it out.

The Kenwood TS2000, TS480 and TS570D work extremely well remotely and have two HF aerial sockets that may save an external aerial switch. The newer Icom radios are pretty good too. You pays your money and takes your choice! Do check that your chosen radio will come back on after the 12V supply is interrupted: some (like the Kenwoods) can be powered on and off with a CAT command.

You will need a lead to connect the transceiver to the PC serial port (if it doesn't have a serial port, a USB to serial converter will also be needed). These leads are easy to find on eBay or from other suppliers such as G4ZLP.

All I have to say about the 12V power supply is to recommend you choose a good one and be especially careful if you are considering using a switched-mode type as these will always produce a sprog just where you don't want it! The internal circuitry of the power supply I use seems quite happy to have the UPS backup battery wired straight across it. I set it to 14.2V, which keeps the battery topped up (recharge current being regulated by the PSU's current limit). The battery keeps all the internal systems powered including the router – I might as well enjoy the reduced noise level during a local power cut!

Aerial and tuner. Again a matter of choice, but as the station may be unattended for long periods, the aerial should probably be built for longevity rather than for ultimate performance. The safety of other users of the remote site is obviously paramount so don't be tempted to erect any over-ambitious arrays that might come down in a gale. Ensure that all 'hot' parts of the aerial are out of reach. I use a large horizontal loop, an excellent receiving aerial on all bands, and a doublet.

My wire aerials are switched via a vacuum relay onto an auto-tuner housed in a box as near to the feed points as I can get it (**Photo 5**). Coax and power leads run underground from the tuner to the radio. Many rigs these days have built-in tuners but unless you have a trap-dipole or a similar multi-band aerial, you will find that these tuners are not usually capable of matching a non-resonant aerial on all bands. It's preferable to use an outboard tuner with a wider matching range mounted as near to the aerial as possible.

As the FT897 has VHF and UHF I have also erected a dual-band collinear. Most multiband transceivers have a separate socket for the VHF/UHF aerial so no extra switching is required.

Next month we will look at how to configure the hardware and software to get the system up and running.

PHOTO 5: The ATU in its tree-mounted box with the lid removed. The aerial relay is inside the pepper carton.