

Contesting

The technology underpinning remote operation has advanced rapidly in recent years.

Many homes now have high-speed fibre broadband, fast 4G data services are widespread across the UK and Starlink provides satellite connectivity even in very remote locations.

Modern radios are increasingly ethernet-ready and can connect directly to a network router. For radios without native network capability, interface units are available that handle audio, PTT, CW and CAT control over the internet.

Licensing

In the UK it is perfectly legal to operate a remotely controlled amateur radio station, subject to several conditions defined in the amateur licence.

Internet makes the possibility of controlling an overseas station a reality – we've seen many DX operations do it in recent years. However, the rules of the country where the transmission is made always apply. The operator must hold an appropriate licence for that country and must comply with its regulations.

It is also important to note that CEPT Recommendation T/R 61-01 [1] does not permit remote operation of a station located in one participating country by an operator situated in another country, even if a locally licensed operator is present at the station.

Some countries do not permit remote operation at all so regulations must always be checked carefully.

Remote operation in contest rules

Most major contests now allow remote operation, although the details vary. Examples include: CQ contests permit remote operation within defined parameters; RSGB HF contests allow remote operation without specific restrictions; RSGB VHF/UHF contests allow remote operation of a 'home station' from anywhere whereas stations established away from the main station address may only be operated from within the same DXCC entity; UK/EI DX Contest rules allow remote operation but state that only a single station may be used during the contest – the same as any other category; the RSGB Commonwealth Contest allows remote operation in all categories and RSGB IOTA Contest permits remote operation of a 'World Station' only if the operator is located within 100km and within the same DXCC entity. An 'Island Station' may only be remotely operated from within the same DXCC entity and within 100km and the operator must be located within the same island group. This is to comply with the rules of the IOTA award programme.

At the Control Site (**Photo 1**), the operator typically controls the radio using one or more of the following methods.

Dedicated control head

Examples include: Elecraft K3/O Mini remote head for the K3, FlexRadio Maestro and Remote head for the Icom IC-7100, IC-7760 or Kenwood TS-2000 etc.

These provide a physical front panel to the remote radio.

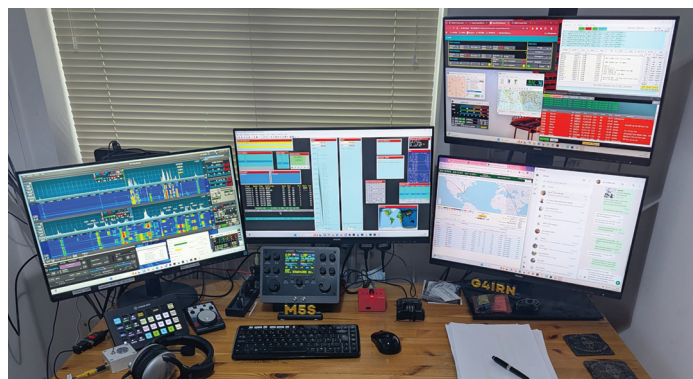


PHOTO 1: The Control Site at G4IRN's QTH. The screens show SmartSDR to control the Flex Radio; Sonobus audio; DXLog contest software; antenna and power controls via Node-RED; cluster feeds; amplifier control; rotator control. On the desk is a StreamDeck, 'TeensyMaestro', Flex Control Knob and Morconi CW unit with a paddle.

Software control panel

Examples include: Icom RS-BA1, Yaesu SCU-LAN10, Win4IcomSuite/Win4YaesuSuite / Win4K4Suite, SmartSDR for Flex radios and Thetis for SDR radios.

Remote desktop

A PC located at the Radio Site runs the radio control software and the operator connects using a remote desktop application such as AnyDesk, TeamViewer or VNC.

In contest situations operators prefer responsive controls and minimal hand movement. Software panels often require mouse interaction, which many testers try to avoid. Hardware control heads therefore remain popular because they provide the look and feel of a traditional radio.

However, software panels usually provide much larger panadapter displays, which can be a significant advantage when visualising band activity. A useful compromise is to use a physical tuning knob for VFO control while leaving other functions accessible via the keyboard and logging software.

Contesting at remote station G4IRN

I have built a remote Radio Site that can be operated from almost anywhere with connectivity. In practice, however, it performs best when operated from my home location because there is space for the multiple screens and accessories that make contesting easier. The network path between home and the Radio Site also has a dedicated VPN.

The station is built around a flex radio with a software front-end (SmartSDR) with a multi-function Flex USB 'Control Knob' and an Elgato StreamDeck [2] interfacing with Node-RED [3] (**Photo 2**).

A network PING from home to the Radio Site typically shows a round-trip time of around 80ms, although it varies between 65ms and over 200ms. This variation is known as 'network jitter' and is common with 4G connections.

I have also discovered that different network providers can perform very differently at the same location.

This presents a challenge for real-time audio. If packets arrive late,

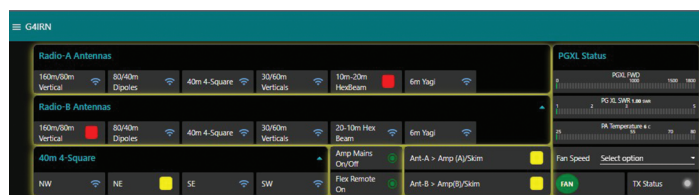


PHOTO 2: Node RED provides a framework for station automation. It is used at G4IRN's station to switch antennas and monitor equipment.

pops, distortion and dropouts are experienced. Listening to audio through SmartSDR can sometimes produce these symptoms, therefore I use a more forgiving audio transport solution called SonoBus [4]. SonoBus dynamically buffers incoming audio (**Photo 3**); I typically observe buffer delays of around 130ms. Another popular product that performs a similar function is Mumble.

Impacts of latency and jitter

Latency also affects transmitter control. The PTT signal from my footswitch is routed through a COM port on my PC. When the switch is pressed, there is a noticeable delay before the transmitter switches to transmit mode and the Tx indicator illuminates in the control software. I estimate this delay to be around 200ms, consisting of network latency plus Windows processing time.

In a search-and-pounce situation:

- Perceived audio arrives with about 130ms delay
- Pressing PTT introduces around 200ms delay
- Transmitted audio may experience another 130ms delay

When the CQ station stops transmitting, my call therefore arrives with them at least half a second later once reaction time is included. This delay can sometimes make it harder to break pile-ups and occasionally results in doubling with another station. Remote operators simply need to adapt their operating technique accordingly.

Operating technique adjustments

Operating a remote station successfully in contests often requires small adjustments in technique. For example, when calling a CQ station during search and pounce, it is beneficial to anticipate the end of the CQ slightly earlier than one would when operating locally. Similarly, when running stations, leaving a slightly longer pause between overs can help to avoid doubling caused by network delays.

After some operating experience, these adjustments become instinctive.

CW operation

CW operation presents additional challenges. If CW is generated from macros or the keyboard within contest software, the simplest approach is to run the logging software at the Radio Site and access it via remote desktop. This avoids timing issues but prevents hand-keyed CW and introduces delayed sidetone.

Generating CW locally at the Control Site is more complex, though several solutions are available:

RemoteRig systems: RemoteRig [5] systems are widely regarded as the gold standard for remote CW operation. They also provide reliable CAT control and audio transfer for many radios.

Software solutions: There are two types: some Windows programs convert CW elements to ASCII characters and send them to the remote station for transmission, although these programs can be difficult to use.

The Remote CW Keyer program by DL4YHF [6] 'times' the CW elements and sends the timing information to the Radio Site, in theory transmitting CW exactly as it was keyed.

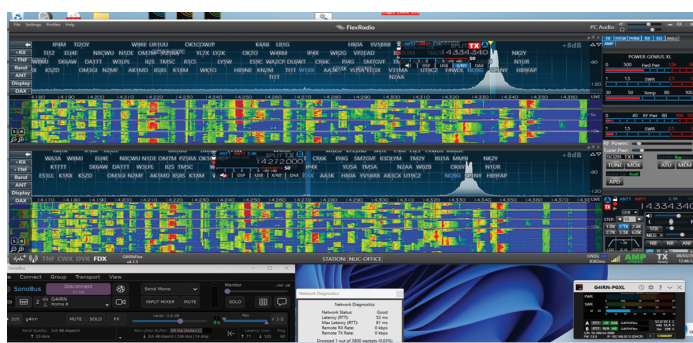


PHOTO 3: The remote radio's 'soft panel' in SO2V mode as presented at the Control Site with Sonobus audio, network monitoring and amplifier control.

Morconi interfaces

Morconi [7] devices are based on a small microprocessor board rather than Windows and use a similar technique as above, timing each CW element and sending that information to the Radio Site. Versions exist both for Flex radios and for general-purpose use with other rigs.

Contest software

In addition to radio control, contest stations typically run logging software and digital mode decoders. These can run either locally at the Control Site or at the Radio Site, accessed via remote desktop.

Running logging software locally provides the most responsive keyboard operation, which is particularly important during contests. When sending CW locally, a local sidetone can also be used.

For audio-based digital modes such as MMTTY or MMVARI, the situation is different. Running decoders locally requires transferring the audio across the network; digital codecs, compression and buffering sometimes can affect the received digital data.

In these cases, it may be preferable to run the decoding software at the Radio Site and access it remotely.

As with many aspects of remote operation, it becomes a matter of choosing the least compromised solution for the available network conditions.

Conclusion

Remote station operation has become increasingly practical thanks to modern radios and improved internet connectivity. For contesters it offers exciting possibilities, including access to better antenna locations and the ability to operate from almost anywhere in the world.

However, remote operation introduces new challenges, particularly relating to network latency, jitter and station reliability. With careful planning, appropriate equipment and some adaptation of operating technique, these challenges can be overcome.

For many contesters, remote operation is no longer a novelty but simply another tool for enjoying the hobby and competing effectively from locations that would otherwise be unavailable.

References

- [1] docdb.cept.org/download/2ae38a89-e58a/TR6101.pdf
- [2] Elgato StreamDeck: elgato.com/us/en
- [3] NodeRed: nodered.org
- [4] Sonobus IP Audio App : sonobus.net
- [5] Remote Rig: remoterig.com/wp
- [6] qsl.net/dl4yhf/Remote_CW_Keyer/Remote_CW_Keyer.htm
- [7] Morconi: morconi.com

John Warburton, G4IRN
g4irn@dxdx.co.uk