Building A Successful Remotely Operated Station

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Building A Successful Remotely Operated Station

- Why a remote amateur station ?
- UK licence conditions
- Technology review
- Demonstration – hopefully!
- A few results
- The future

Wouldn't It Be Nice If ?

- We could all have large arrays at home
- There was no noise limiting receiving
- There were no EMC issues on transmit

A Nice Dream

- But not often realistic!
- Sometimes dashed!

What Happens When We Get Old?

- No longer capable of erecting or maintaining antennas
- Difficulty in manipulating a modern complex transceiver
- Living in sheltered accommodation or even a home
- But still capable of SSB,CW & digital operation
- It should be possible to have a simple interface from a tablet PC to a remote club station.
- Perhaps this is just a dream?
- Now on the RSGB Board's agenda

What If You Can't Put Up An Antenna

- A large percentage of the population in the UK cannot put up an external amateur antenna
  - Should they be excluded from operating an amateur station?
  - This includes many new licensees
  - And those that have to move for many reasons

If you did not need to put up an antenna to be active on the amateur bands it might possibly attract more people to the hobby

If You Only Want To Listen!
SDR-Radio
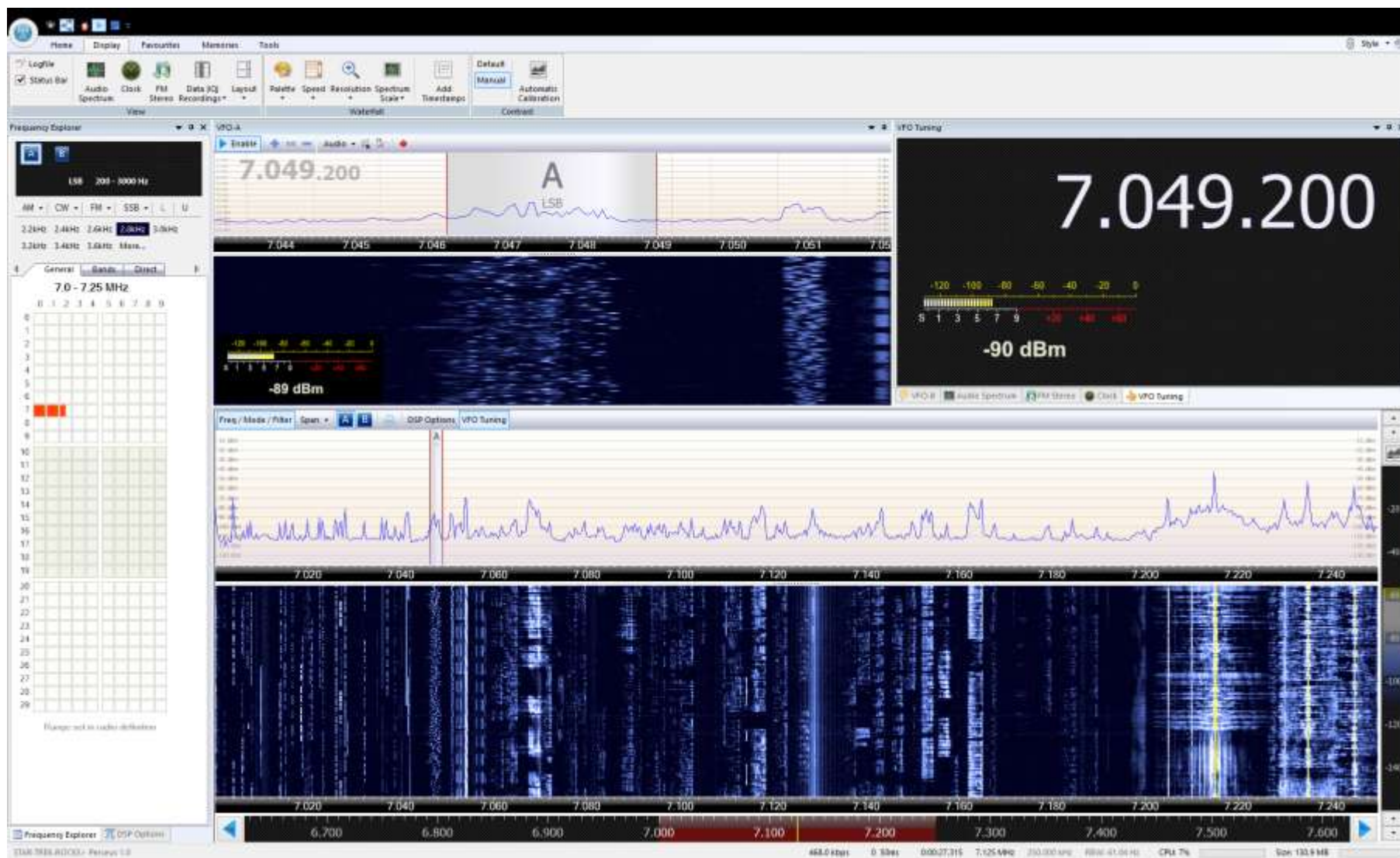
What Does The Licence Say? 1

- 10(2) Subject to Clause 10(3), the Licensee may also conduct Remote Control Operation of Radio Equipment (including, for the avoidance of doubt, Beacons) provided that any such operation is consistent with the terms of this Licence.

- 10(3) This Clause 10 does not permit the Licensee to install Radio Equipment capable of Remote Control Operation for general unsupervised use by other Amateurs.

What Does The Licence Say? 2

- 10(4) Any communication links used to control the Radio Equipment or to carry Messages to or from the Radio Equipment in accordance with Clause 10(2) must be adequately secure so as to ensure compliance with Clause 3 of this Licence. Any security measures must be consistent with Clause 11(2) of this Licence.

- 10(5) The use of any such communication links referred to in Clause 10(4) must be failsafe such that any failure will not result in unintended transmissions or any transmissions of a type not permitted by this Licence.

What Does This Really Mean?

- **Can you exercise <u>complete</u> control over the station?**
  - Have you taken reasonable measures to stop others gaining access to the transmitter?
  - In all circumstances?
  - Is it you or a Windows PC that really has control ?
  - Is it 'fail-safe' ?
  - How do you shut the station down if electronic communications fail ?

Is It Really You In Control ?

- Remote control of a station by remotely logging onto a Widows PC controlling a transceiver is questionable !

- The state of the transmitter is ultimately controlled by the PC not you !
  - What happens when it loses the network ?
  - What happens when it crashes ?
  - What happens when it is hacked ?
  - How do you push 'CTRL-ALT-DEL' ?

- Can you really exercise <u>complete</u> control over the station ?

Proceed – with due caution!

- You must be sure that you can reassure Ofcom, if asked, that you have complete control.

- It is important that you always have a method of station shutdown.

Simple Block Diagram

Speaker

Mic   CW-Paddle

Internet

MIC

AF

CON

RRC-1258MkII

RS-232   RS-232

COM-1

COM-2

PA
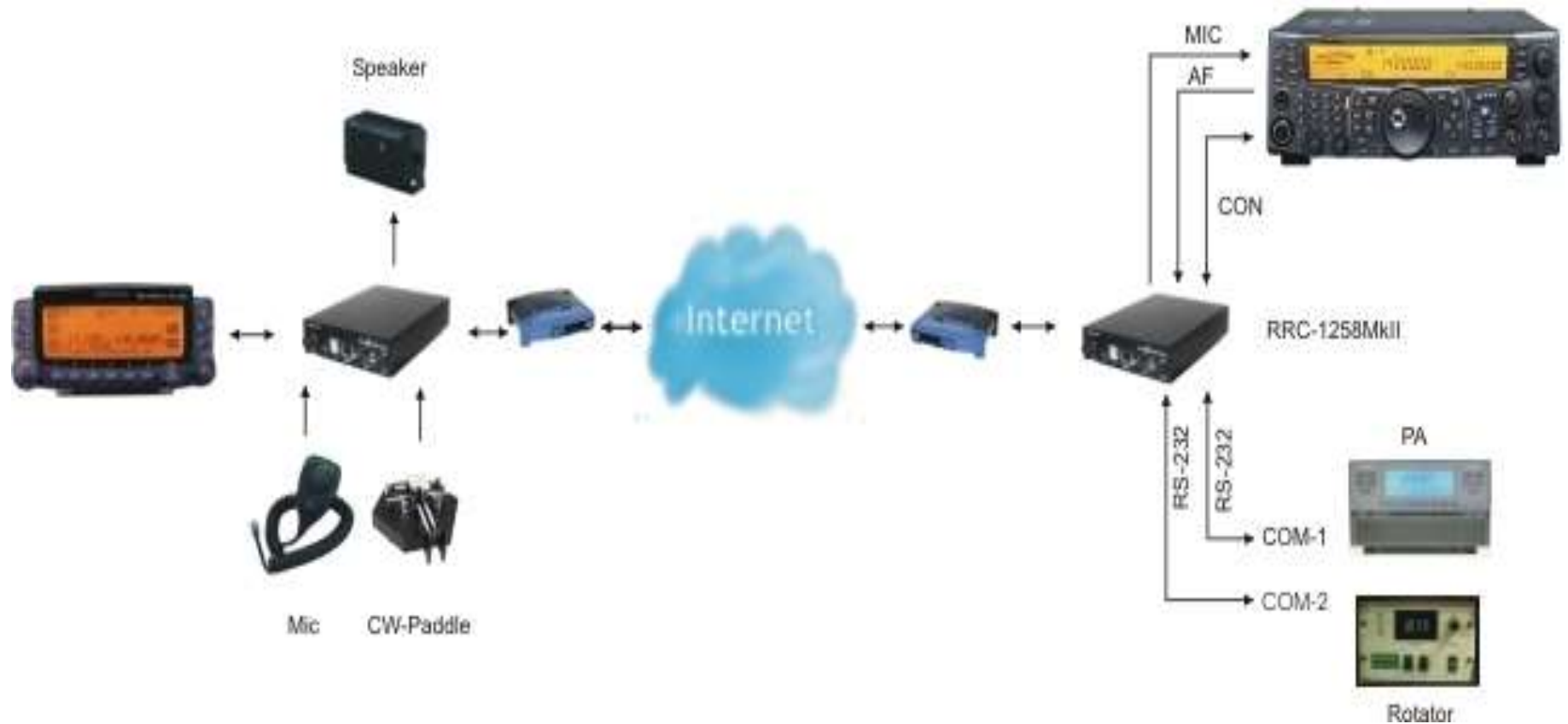
Rotator

Remote Control End   **Radio Station End**

Technology Review

- Radios & modems
  - RemoteRig RRC-1258
- Switching things
  - Webswitch 1216H + others
- Rotators
- Linears
- Not 'Rocket Science' or writing software
- It is all 'off the shelf'
- 'Local' testing saves a lot of time.

RemoteRig RRC-1258

- Custom made modem for remote amateur operation over the Internet

- Supports audio on RX and TX, rig control, keyer + additional RS232 linking

- Many modern rigs supported

- Configured from a web browser

- Firmware regularly updated with new features
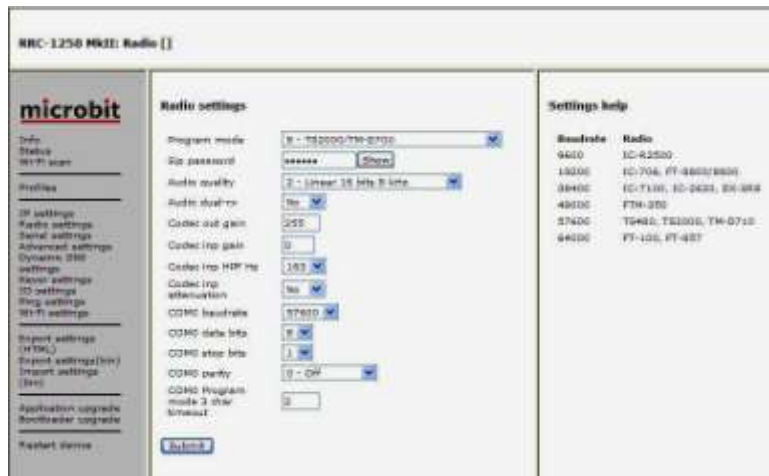
Ensuring Fail-Safe Control

- RemoteRig RRC-1258 powers-up the radio 'cold'
- Lose the data connection and the radio is switched off in <2mins
- Time Out Timer is also enabled in TS-2000
  - 5mins max transmission time
- Add the ability to turn the mains off via another unit
  - Even from a 'smart phone'

Switching Things On & Off
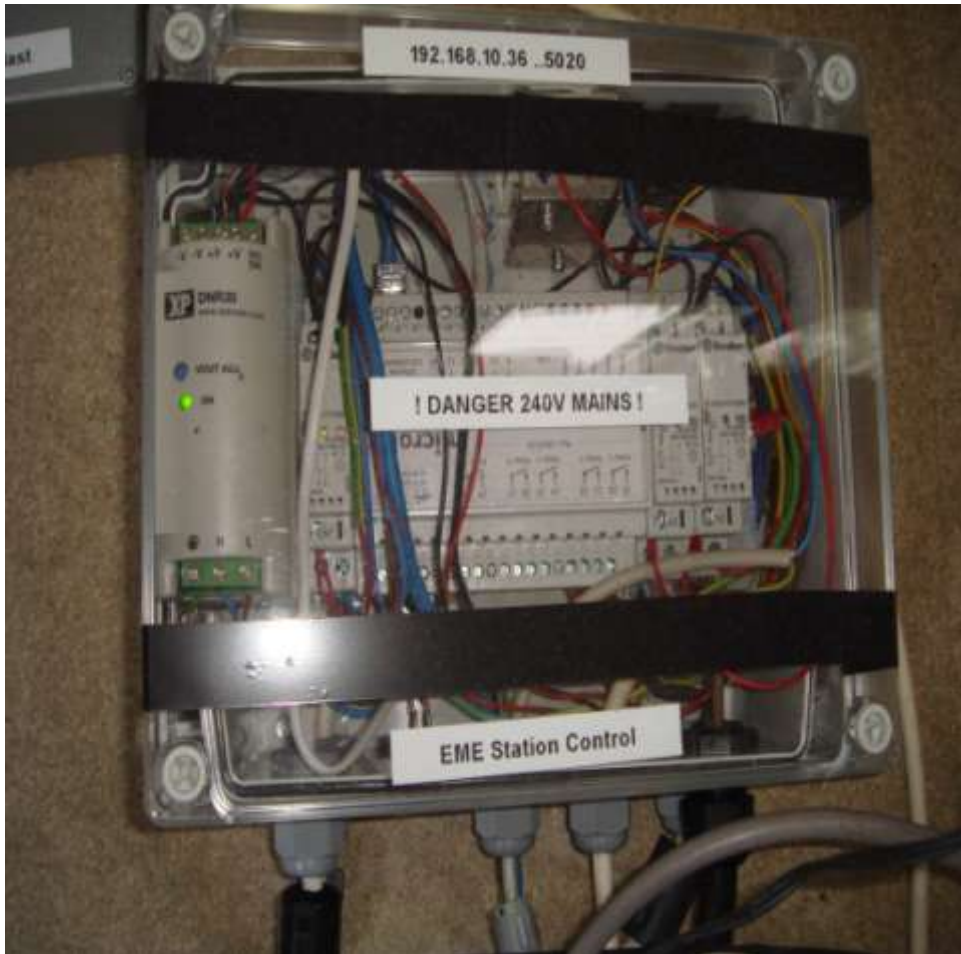
- **Mains control for the rest of the station**
- **Microbit Webswitch 1216H**
- **Powers-up 'cold'**
- **Interlock the linear with the rig PSU**
- **Provides some temperature monitoring**
- **Can support some rotators with web control**
- **Smart phone 'App'**

Remote Rotator Control

- **Rotators with RS232 interfaces are relatively easy to remote.**

- **Add a Wiznet RS232-Ethernet card**

- **Configure control PC with Virtual Serial Port software**

Converting An Old Rotator

- **Yaesu G1000**
- **Easy-Rotor card**
- **Wiznet 110 RS232-Ethernet card**
- **RJ45 at the bottom connects to switch/router**
- **Total cost about £100**

Linear Amplifier Control

We Use Internet Protocol - Gromit !

- An understanding of the basics of IP networking and firewalls is needed to set things up.
  - Cheap ISP routers are often harder to configure!
- A standard ADSL connection at the remote end is usually OK
  - Only 448kbps upstream – you require 130-200kbps
  - ADSL2+ and fibre connections are much better
  - Using the same ISP both ends is generally better
  - However other protocols and users can steal all of the available bandwidth
  - Webcams are particularly bad!
- Wi-Fi can make things much harder !

Building Your Own Network

- 10(4) Any communication links used to control the Radio Equipment or to carry Messages to or from the Radio Equipment in accordance with Clause 10(2) must be adequately secure so as to ensure compliance with Clause 3 of this Licence. Any security measures must be consistent with Clause 11(2) of this Licence.

- 11(2) The Licensee shall only address Messages to other Amateurs or to the stations of those Amateurs and shall not encrypt these Messages for the purpose of rendering the Message unintelligible to other radio spectrum users.

WiFi but not as you know it
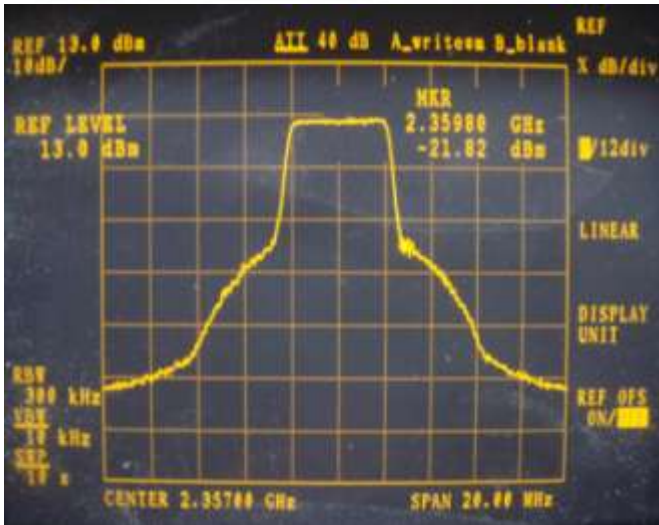
- **The firmware in Ubiquiti WLAN transceivers can be re-flashed down to 2.3-2.4GHz**

- **The bandwidth can be reduced to ~4MHz by using a relatively unused configuration of IEEE802.11b**

- **This avoids accidental reception by Wi-Fi scanners and hackers as encryption is NOT permitted**

- **Reliable >6Mbps links over 10+Km near-optical paths**

My 'Shack'- No Radio !

The Other 'Shack' With The Radio

Digital Modes – No Problem

It was a Genuine QSO!

GB2EME Cambridge 2012

RSGB Centenary Lecture at Ofcom 2013
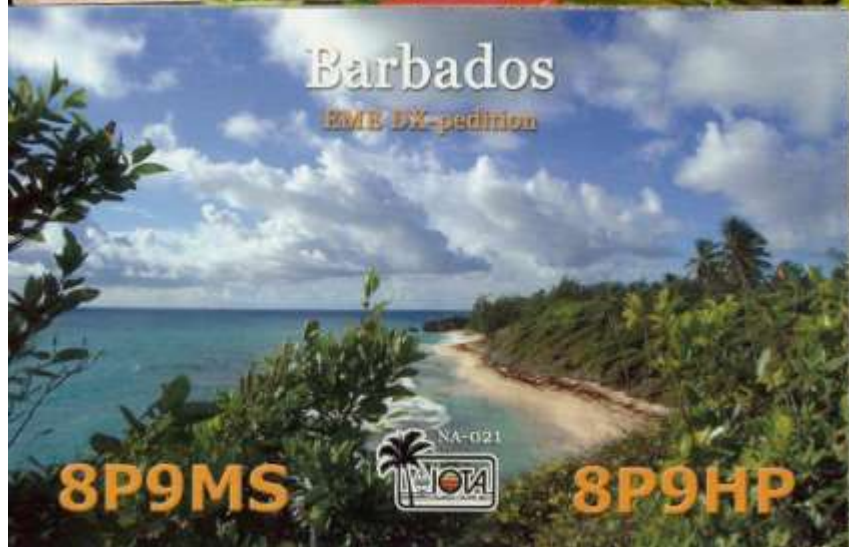
The Deluxe Version

A Radio At Each END !

The Proof of the Pudding !

A Few Others…….

It Works As Well As Being In Front Of The Rig – Well Almost!

- Ergonomics are still an issue
  - Minimal with the Elecraft K3
- Mean Time To Failure = getting into the car
  - Initially 4 hours !
  - Now >3 months
- A few lowlights
  - Insects causing HT flash-overs
  - Solid-state relay failures
  - Rats chewing through control cables
  - Oxidation of transceiver copper 12V PSU leads

Eliminating Additional QRN

- Use of FTP or STP for **all** Ethernet leads at the station is essential
  - UTP Ethernet cables radiate noise & 'birdies' from 15m to 70cms
- On LF you might need an ADSL filter
- Use linear PSUs wherever possible
  - Network equipment usually uses SMPS
  - Older Netgear switches are screened with linear PSUs
  - Note: many Stontronics Ltd PSUs sold as 'linear' use switching regulators!
- Webcams can radiate a lot of RF noise

A Few Other Important Considerations

- Safety
  - Electrical safety
  - Fire risk
- Security
  - Locks and windows
  - CCTV with a DVR
- Insurance
  - Can you afford not to have it?

Commercial Remote Stations ?

- Remote Ham Radio {dot} com
    - "On the air from anywhere"!
- No transmitters within the UK ………
- 1(1) The Licensee shall ensure that the Radio Equipment is only used:
    - (b) as a leisure activity and not for commercial purposes of any kind.
- 10(3) This Clause 10 does not permit the Licensee to install Radio Equipment capable of Remote Control Operation for general unsupervised use by other Amateurs.

Next - The Homebrew Version

RaspberryPI

- **Similar to the RemoteRig boxes but homebrew**
  - It does require software skills
  - Possibly a large collaborative effort
- **New capabilities**
  - A web interface for controlling any linear
  - Multi-user audio feeds
  - User log-in and audit
  - Supervised control interface

RaspberryPI Soundcard

RaspberryPI Server

A Future New Role For The Local Radio Club?

- **RSGB has asked Ofcom to clarify Licence Condition10(3) with respect to remote operation of club stations**
  - 10(3) This Clause 10 does not permit the Licensee to install Radio Equipment capable of Remote Control Operation for general unsupervised use by other Amateurs.

- **Remote Operation Club Stations**
  - Stations set-up and maintained by club members
  - Remote access to station for older and disabled members
  - Remote novice operation under supervision?
  - RSGB Board sponsored project

Thank You To My Support Team

- Bob G4BAH
- Graham G4FSG
- John G8ONH
- Jason G7OCD
- Geoff G4AKW

KEEP CALM AND PHONE A FRIEND

Thank You
&
Any Questions?

G4SWX

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