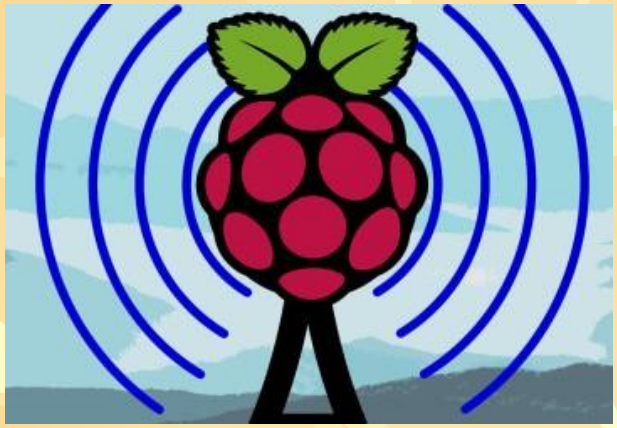
WSPR

and the

Raspberry Pi



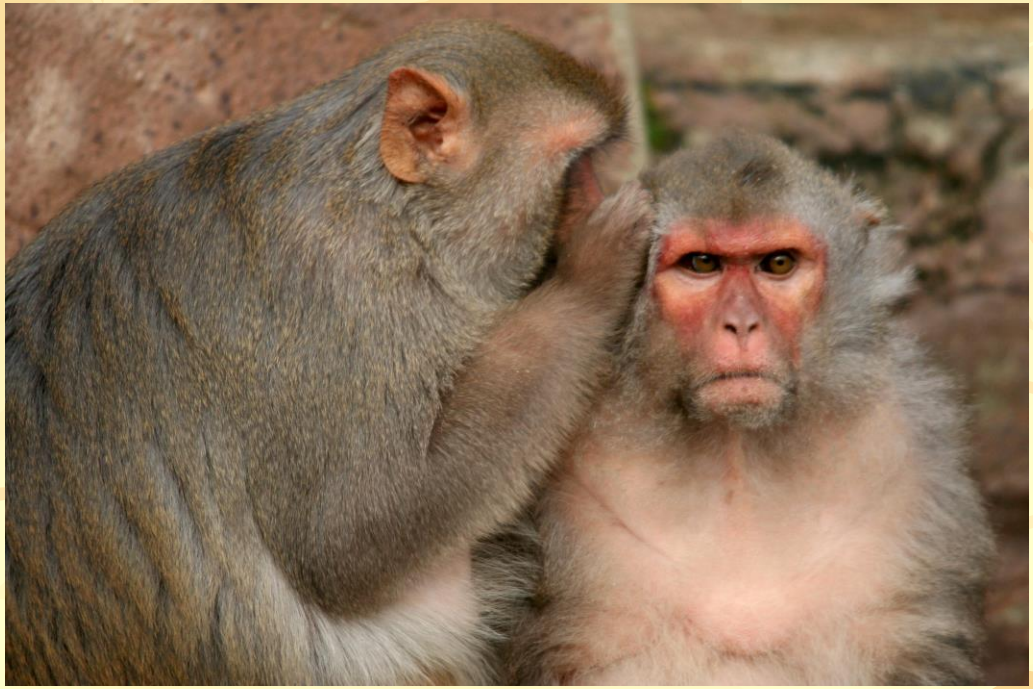
Scotty Cowling, WA2DFI

2016 TAPR/ARRL Digital Communications Conference

September 2016, St Petersburg, FL

WSPR and the Raspberry Pi

It *is* pronounced “WHISPER”



And we do *monkey* around with cool hardware

WSPR and the Raspberry Pi

But, you don't have to talk softly

WSPR and the Raspberry Pi

Or listen to
English
Blues

Unless you want to…

WSPR and the Raspberry Pi

So what is WSPR, then?

Weak ***S***ignal ***P***ropagation ***R***eporter

- Uses MEPT-JT mode*
- Worldwide network of low-power beacons
- Uses the Internet to expand connectivity
- Reports SNR for each path
- Can also report bearing and distance for each path

* Manned Experimental Propagation Transmitter – Joe Taylor

WSPR and the Raspberry Pi

Why would we want to do this?

Weak ***S***ignal ***P***ropagation ***R***eporter

- Real time propagation testing (measuring, not predicting)
- What bands are open *NOW* and to *WHERE?*
- Internet allows visibility of areas outside your location
  - In case you operate a remote SDR
- Real-life antenna pattern checking
  - Confirm Eznec simulation patterns

WSPR Technical Details

WSPR Beacon Transmission

- Takes 110.6 seconds per transmission
- Transmissions on even minutes + 1 second
- Contains Callsign, Maidenhead grid, TX power
- Compressed to 50 bits of data + FEC
- 1.4648 baud in a 6 Hz bandwidth
- Can be decoded down to –28dB S/N ratio

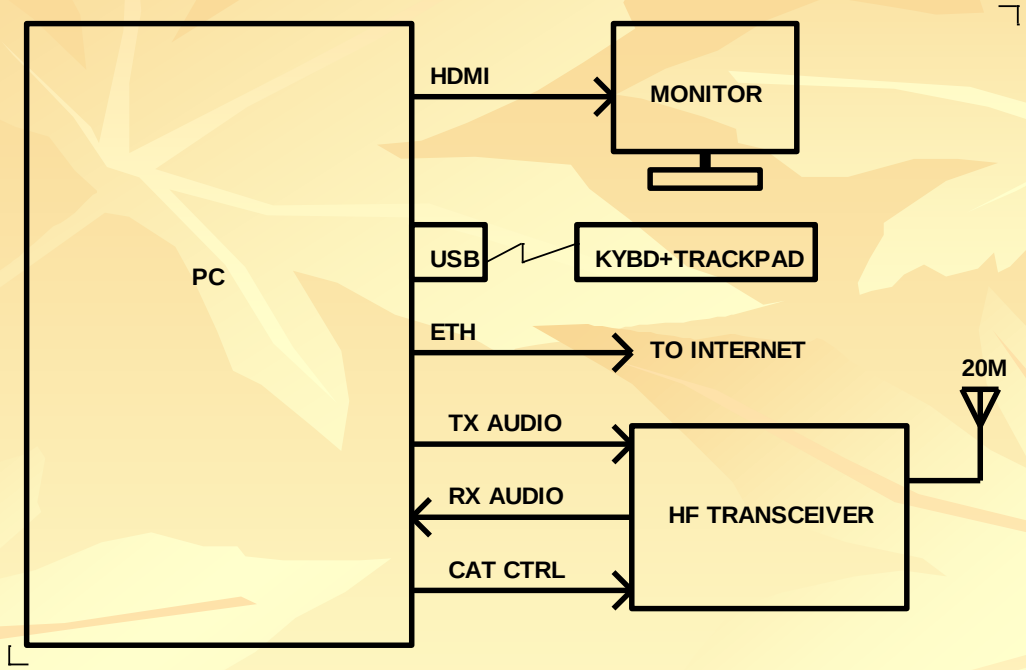
WSPR Technical Details

WSPR Beacon Reception

- Measures S/N in 2500Hz bandwidth
- Measures frequency
- Measures time offset error
- Measures frequency drift over transmission

Can calculate bearing and distance using received grid

WSPR Station Setup

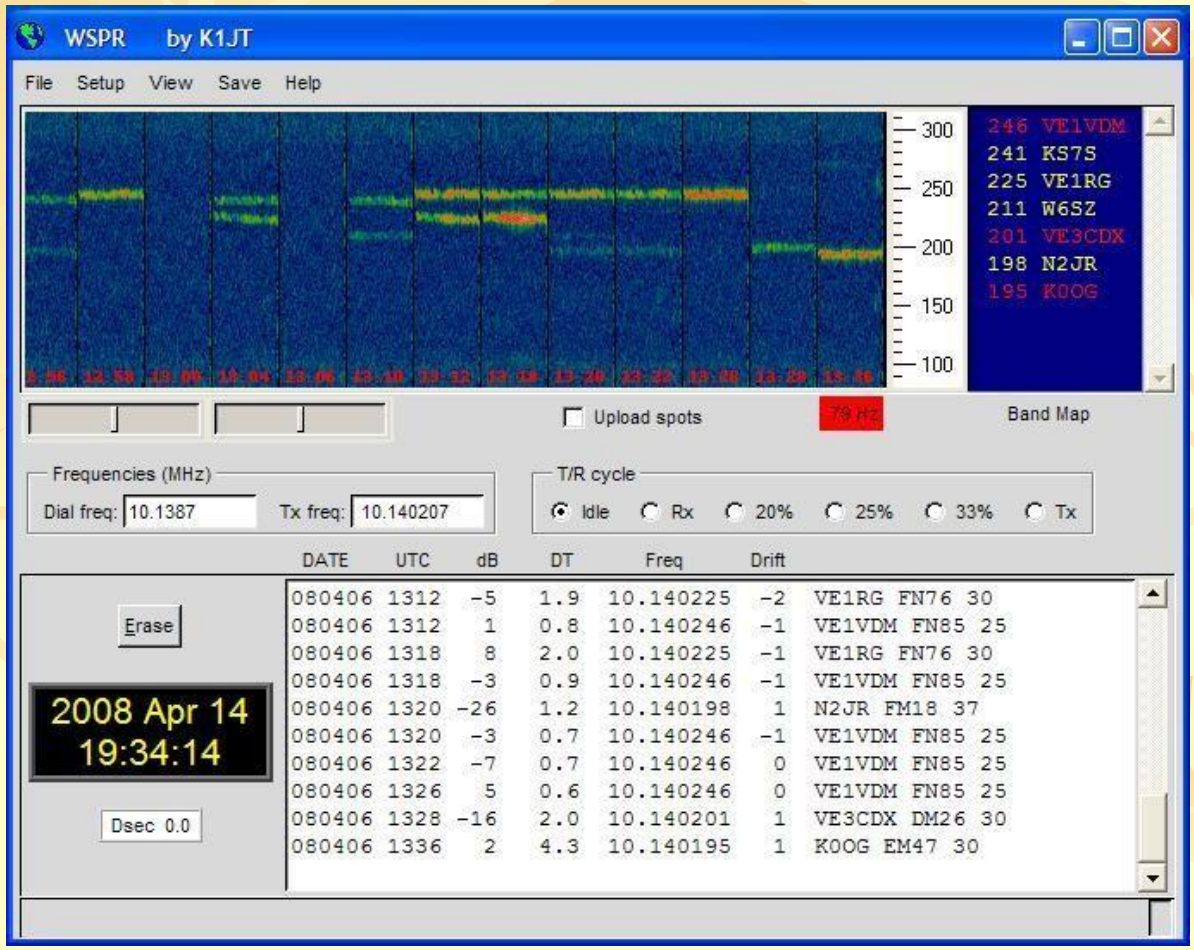


WSPR Transceive Setup

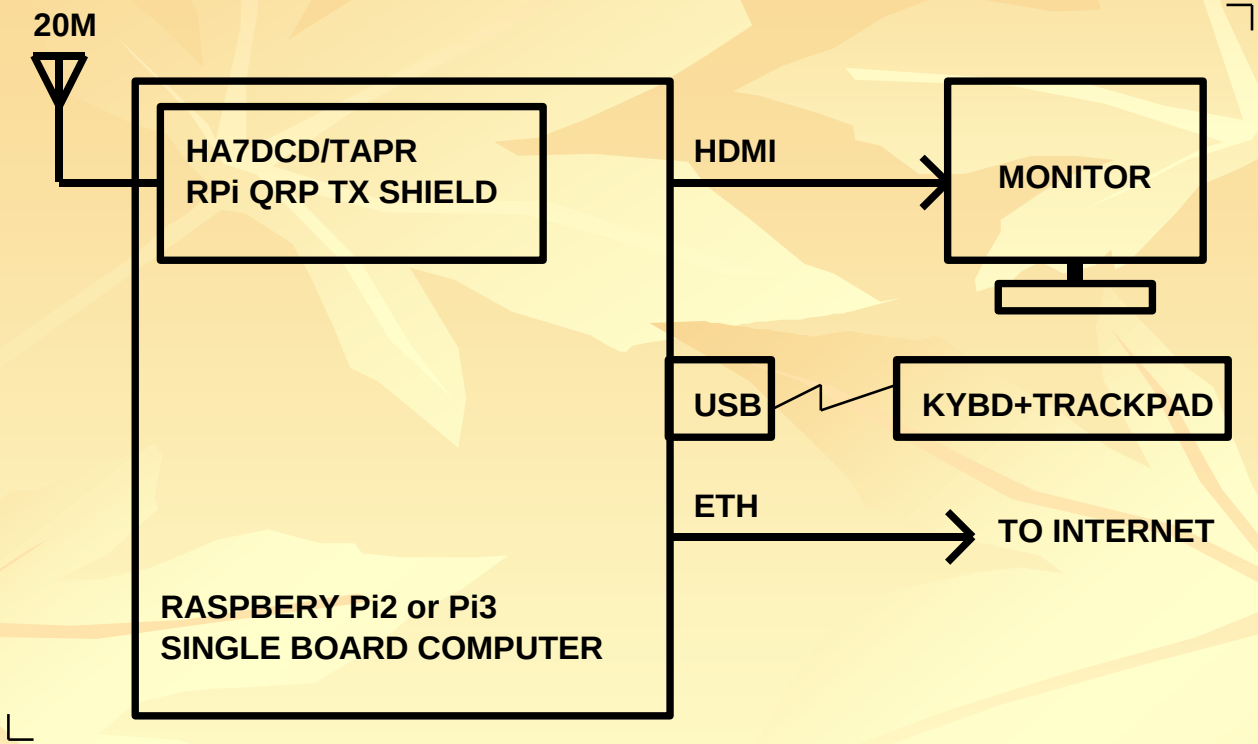
- Send beacons
- Receive beacons
- Gate received data to Internet

WSPR Software

WSPR by K1JT



WSPR Station Setup

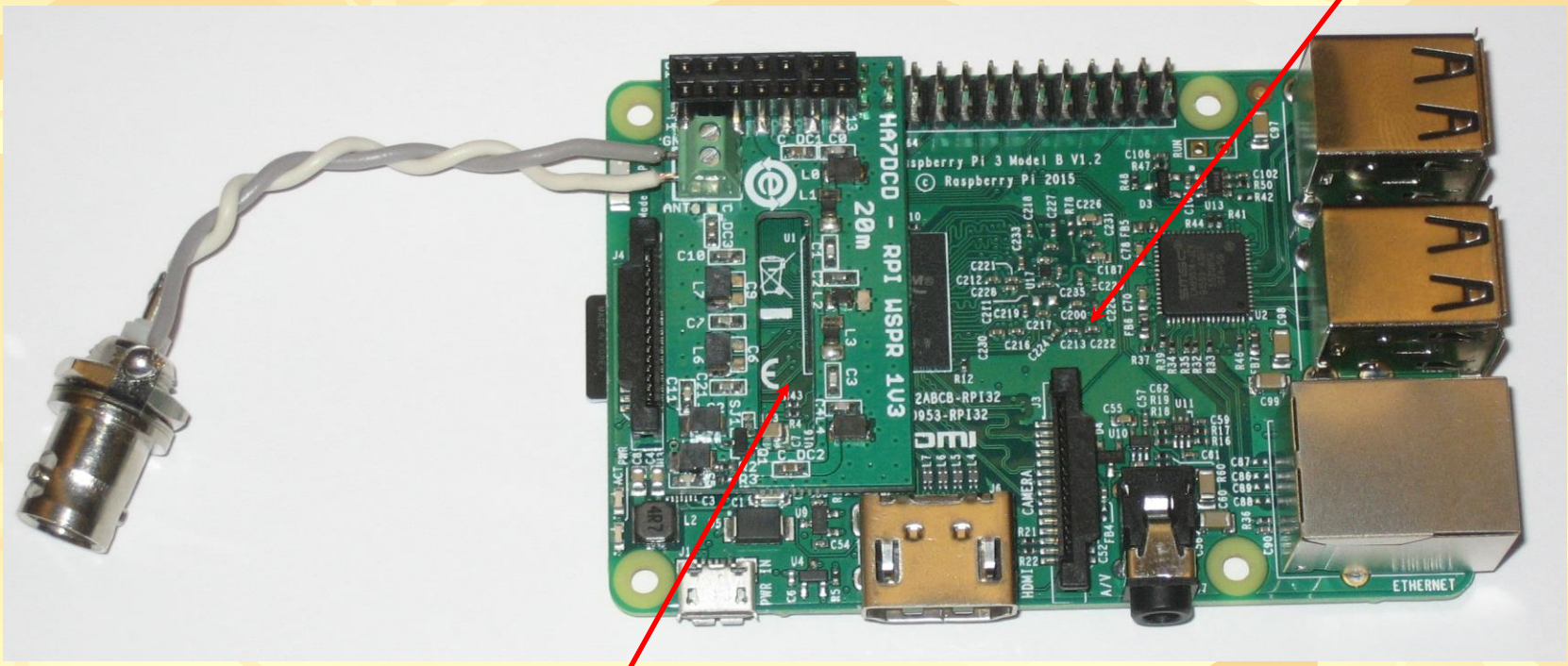


WSPR Beacon Only Setup

- Send beacons
- Manually observe Internet data

WSPR Station Hardware

Raspberry Pi



HA7DCD QRP TX Shield from TAPR

WSPR Station Hardware

What else do I need?

- 5V 1A micro-USB power supply
- USB keyboard and mouse
  - or Logitech K400 wireless keyboard+trackpad
- 4GB or larger micro-SD card
- HDMI monitor
- 20M antenna
- Optional: case for RPi+WSPR TX

Most of this is already available in a well-equipped ham shack!

WSPR Station Hardware

You can buy this tomorrow at Hamvention!

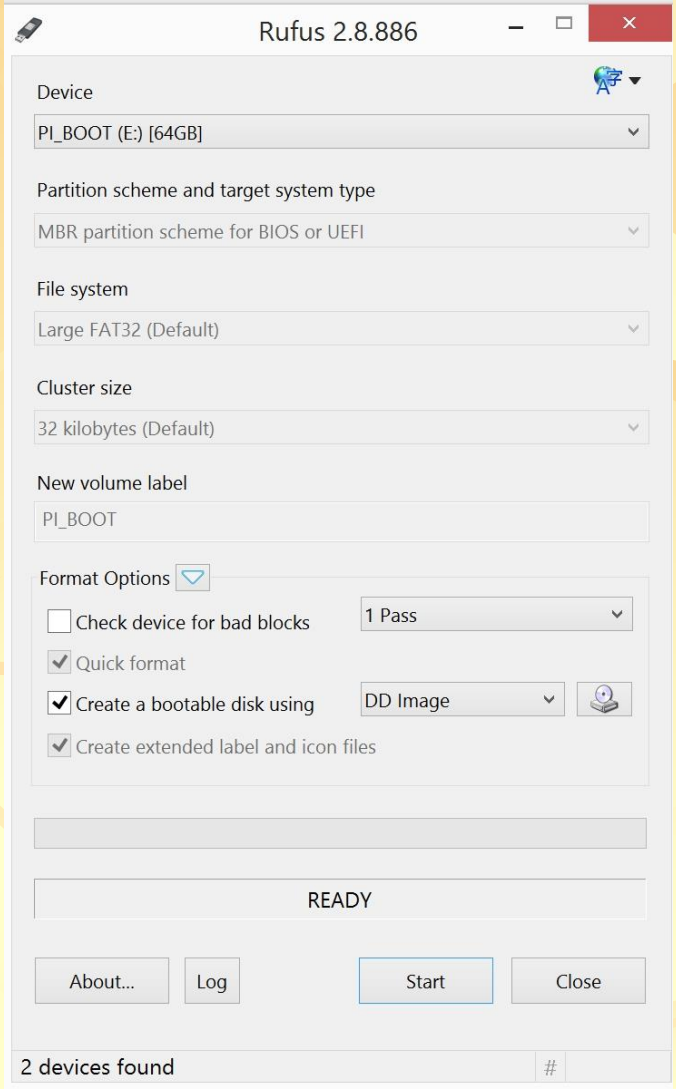
- MCM Electronics (booths SA0307-SA0311) will have:
  - RPi 3
  - microSD cards
  - Cases and power supplies
- TAPR (booths BA0451-BA454) will have:
  - HA7DCD 20M QRP WSPR TX Shield
- Vibroplex (booths NH0250-NH0252) will have:
  - Spiderbeam tri-band Yagi
- Luso (booth EH5000) will have:
  - 200 foot crank-up tower

Steps to get On the Air

See my article in the proceedings for details

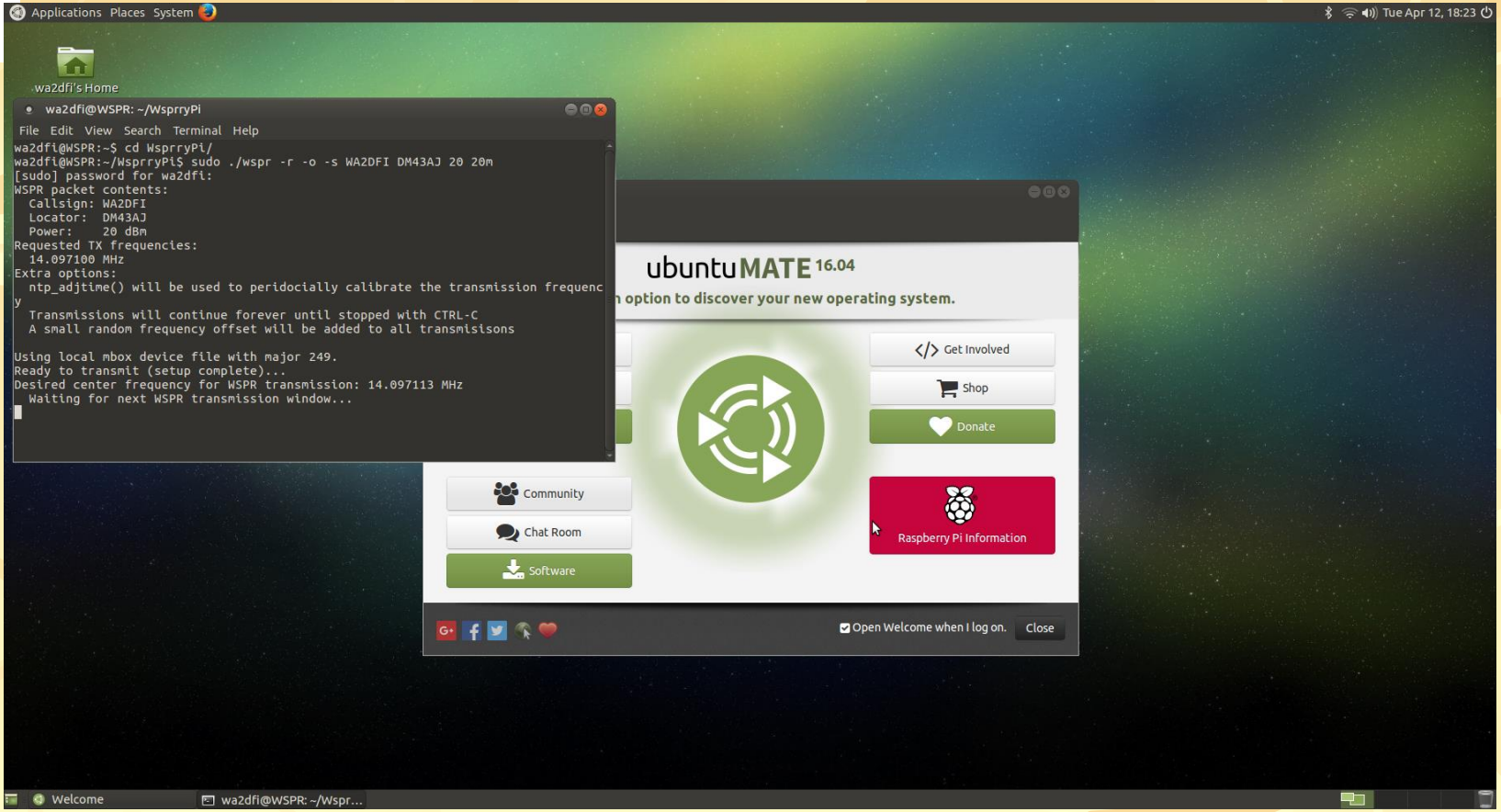
- Program micro-SD card with bootable image
  - download 7-zip, Rufus tools
  - download Ubuntu Mate
  - program image onto micro SD card
- Hook up all the hardware
  - PS, monitor, keyboard, mouse, antenna
- Boot Linux from the micro-SD card and set it up
- Download and compile WSPR application
- Run the WSPR application

Making a Bootable SD Card



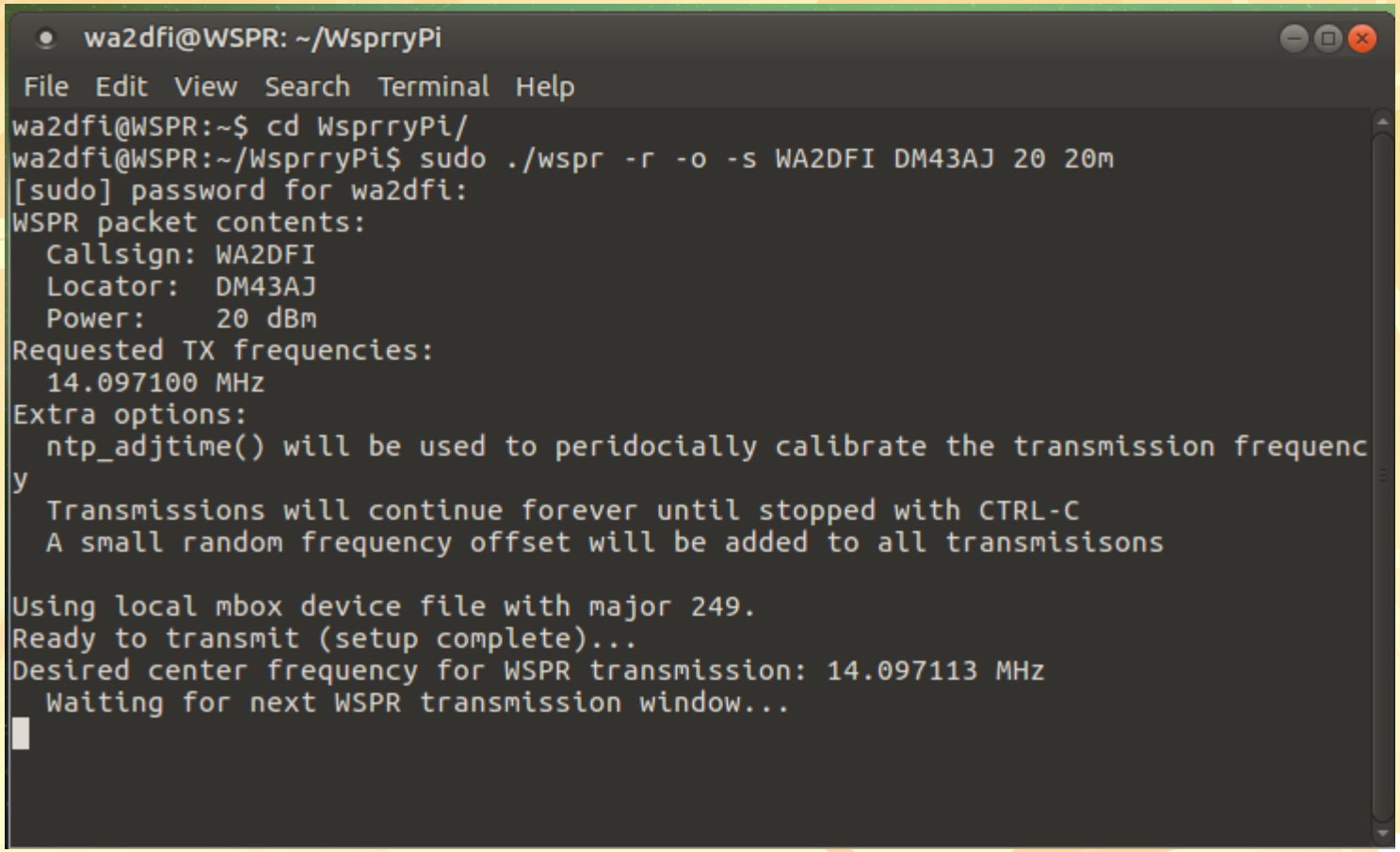
Rufus is one possible app

Running the WSPR App



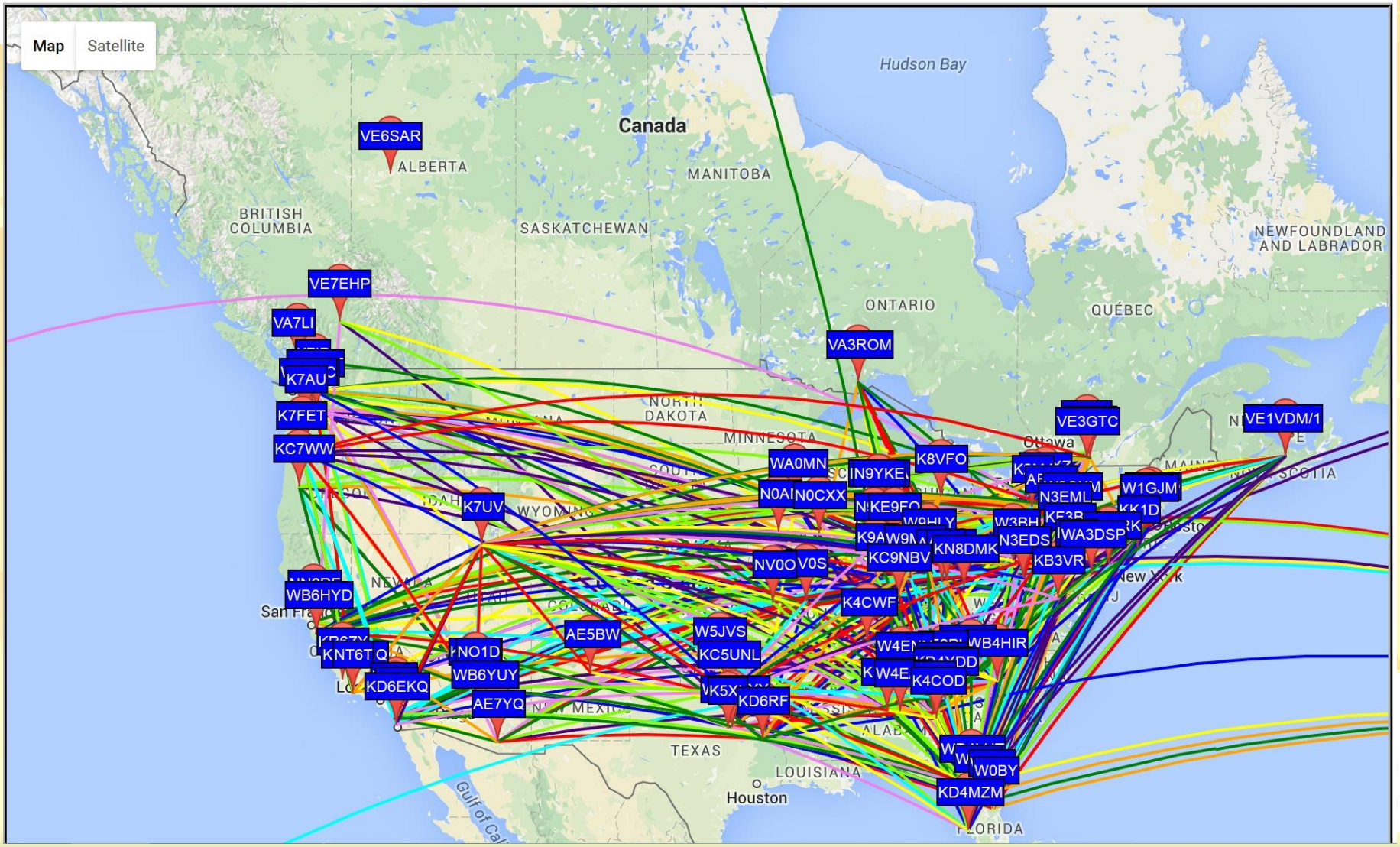
Screen shot of Ubuntu Mate running WSPR application

Running the WSPR App



Zoom-in on WSPR application window

The WSPRnet.org Website



TAPR's MISSION

Support digital radio development with:

R&D funding

- Breadboard prototypes
- Alpha PCBs

Early volume production

- Put leading edge technology into many hands

TAPR's MISSION

Result: An ever growing pool of contributors, experimenters and subsequent advancement of the radio art

Thank you!

WSPR Project information at:

Joe Taylor's WSPR page: physics.princeton.edu/pulsar/K1JT/wspr.html

Wiki: en.wikipedia.org/wiki/WSPR_(amateur_radio_software)

WSPRnet website: wsprnet.org

Boards available at:

TAPR: tapr.org

MCM Electronics: mcmelectronics.com

See One in Operation in the Demonstration Room