SHACK IN A PI

LOREN ANDERSON, KEØHz

BARRY BROCK, KDØRQU

What is a Shack in a (Raspberry) Pi?

- Pretty much any application you need to computerize your ham shack
  - Rig Control, Digital Modes, SDRs, logging, satellite tracking
  - Tools and calculators
- You can take it into the field with you
- Remote ops (VNC)
- HotSpot capability
- Inexpensive

Multiple Options

- Build your own
  - Raspbian Pi OS plus lots of open source software available
  - You're on your own but lots of YouTube videos
- HamPi
  - Created by Dave Slotter, W3DJS
  - https://github.com/dslotter/HamPi or find it at https://forums.qrz.com/index.php?threads/w3djs-raspberry-pi-ham-radio-image-v2-0-released.680336/
- Build-a-Pi (KM4ACK pi-build)
  - Created by Jason Oleman, KM4ACK
  - https://github.com/km4ack/pi-build
  - Instructional YouTube videos at https://www.youtube.com/channel/UCSQhXfGo_68Ta8-2wStAWkw

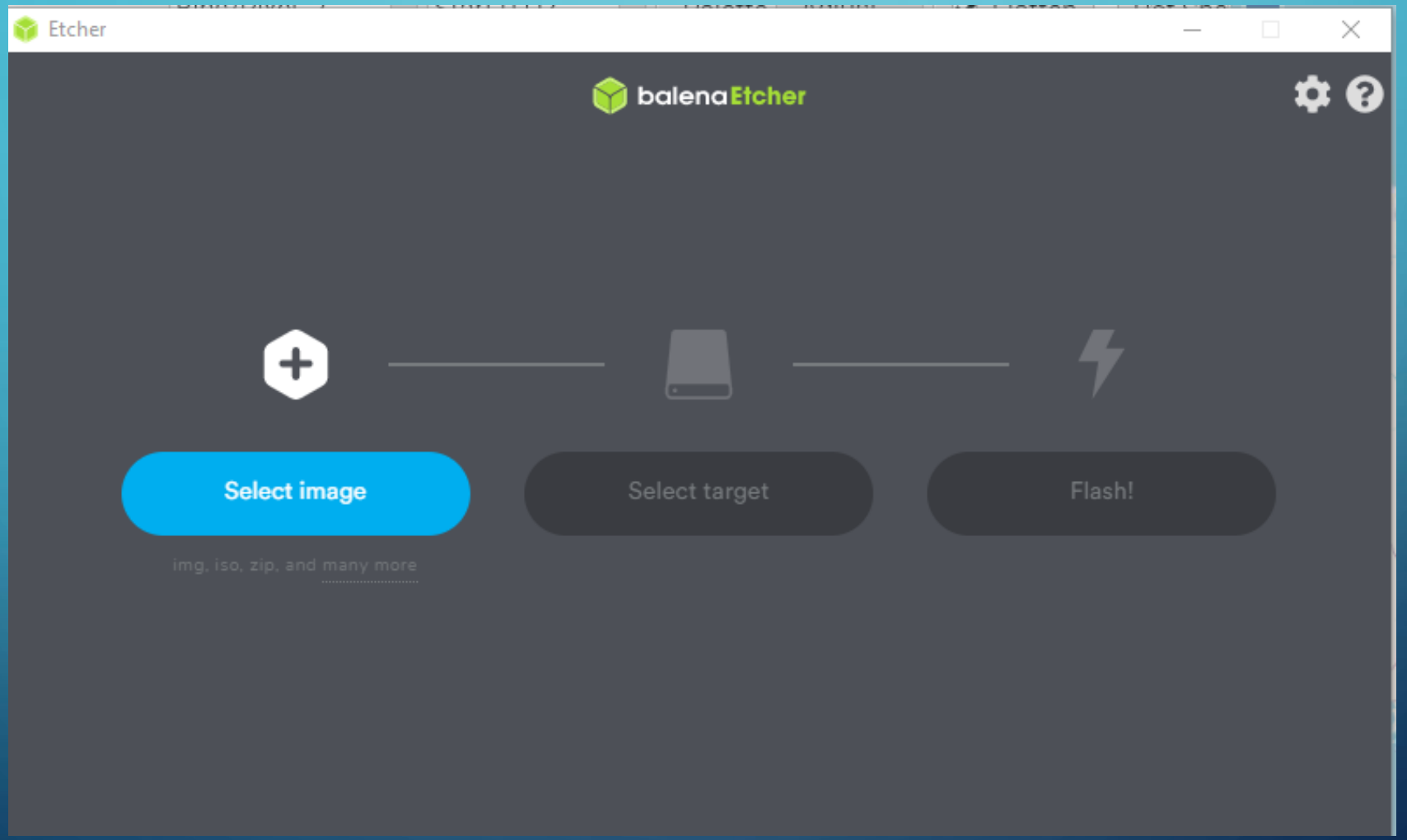
WHAT IS HamPi

- Raspberry Pi image that has preloaded pretty much any application you might need in your ham shack
- Based on Raspbian Buster
- Runs on Raspberry Pi 3 or 4 (may run on 2 but performance will suffer on some apps)
- Simple configuration

HAMPI: WHAT DO YOU NEED?

- Raspberry Pi 3B or 4B
- SD Card – 16GB or larger (32GB recommended)
- Power Source (USB 3.0)
- Keyboard (USB), Mouse(USB), Monitor (microHDMI) (temporary)
- WiFi or Ethernet connection
- Optional – Audio Interface from Rig (analog or digital (Signalink)), SDR dongle

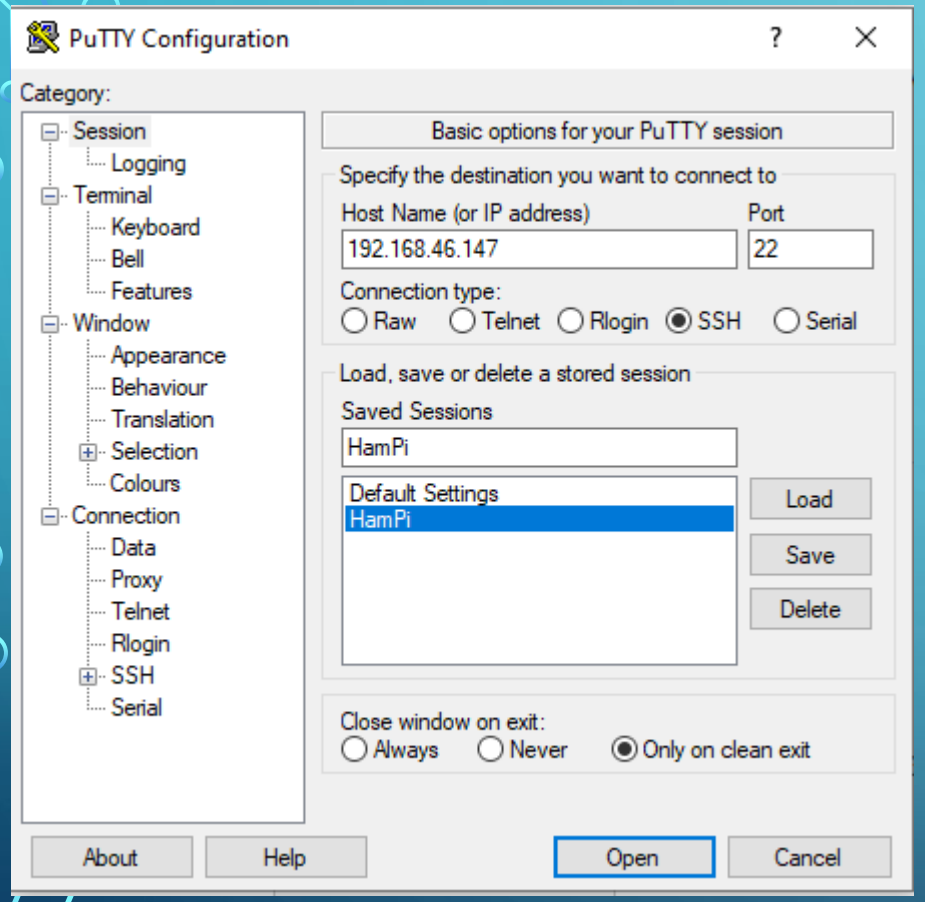
LOAD HamPi TO SD CARD

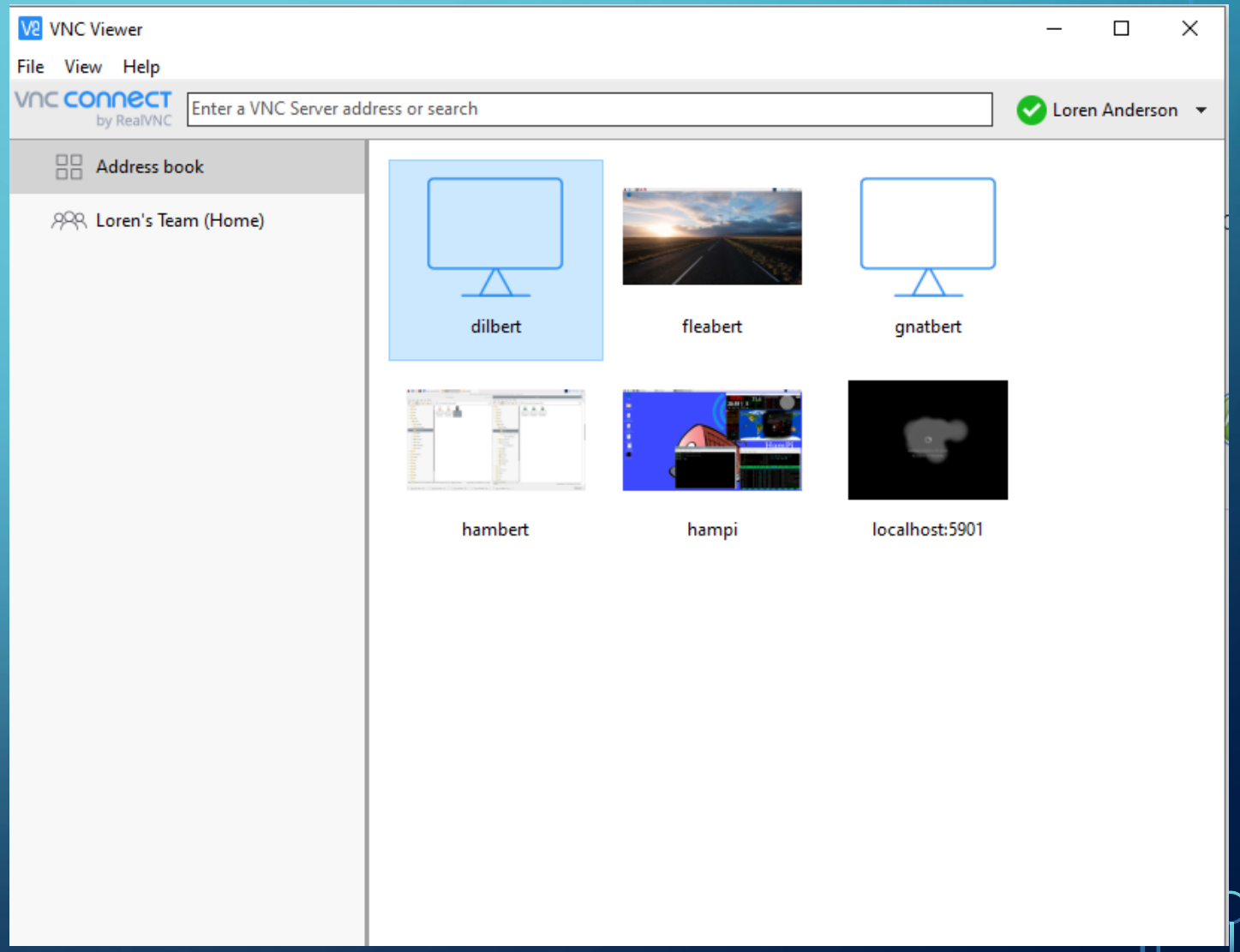


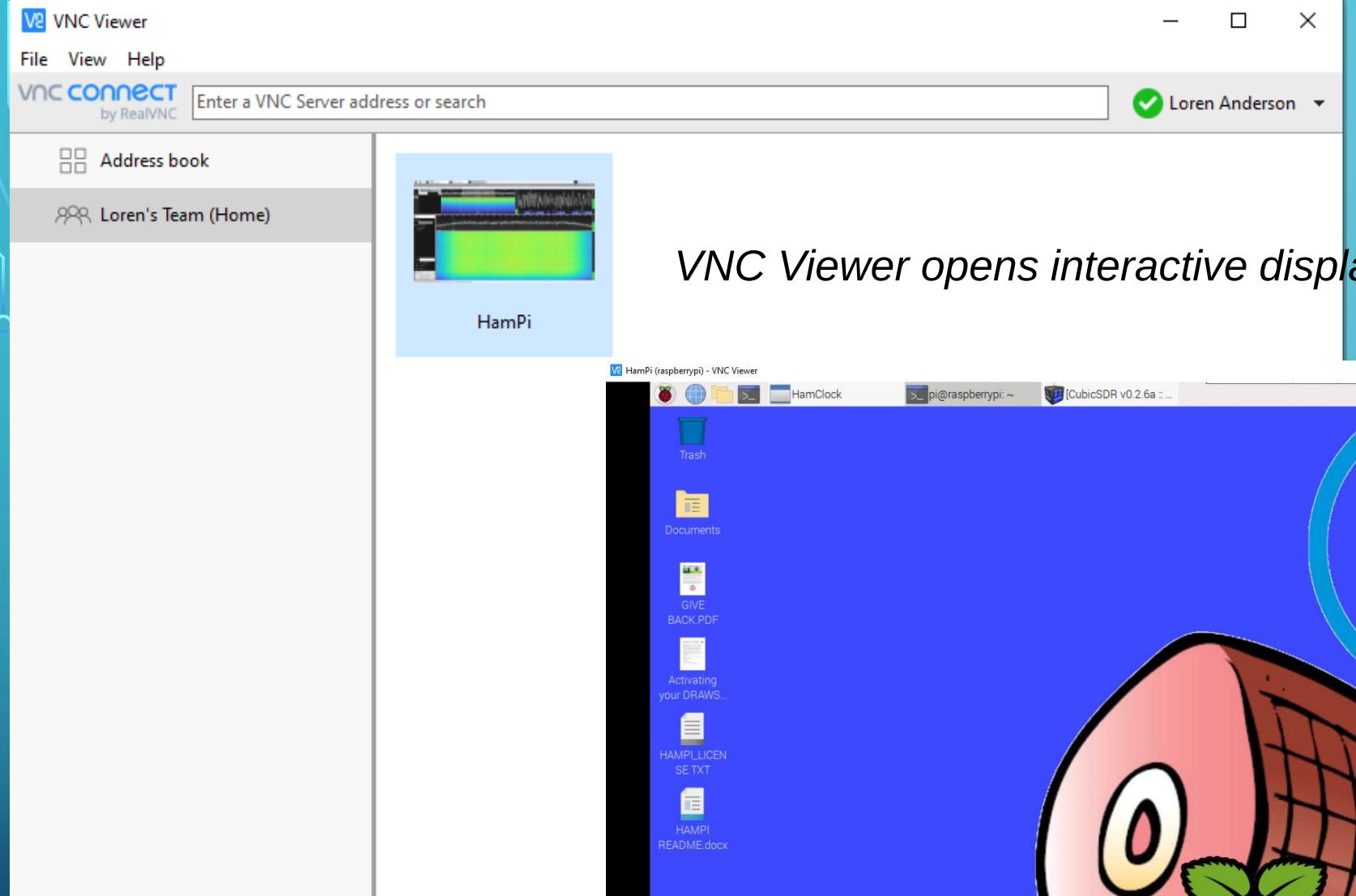
WHAT DID YOU MEAN "TEMPORARY"

- Keyboard, mouse, and display helpful when you first run setup
- With Putty you can run the Pi in Command Line from another computer on the network (Pi is "headless")
  - https://www.putty.org/
- With VNCViewer (RealVNC) you can control Pi's desktop from any computer on your network or off the network (via Internet)
  - https://www.realvnc.com/en/connect/download/viewer/

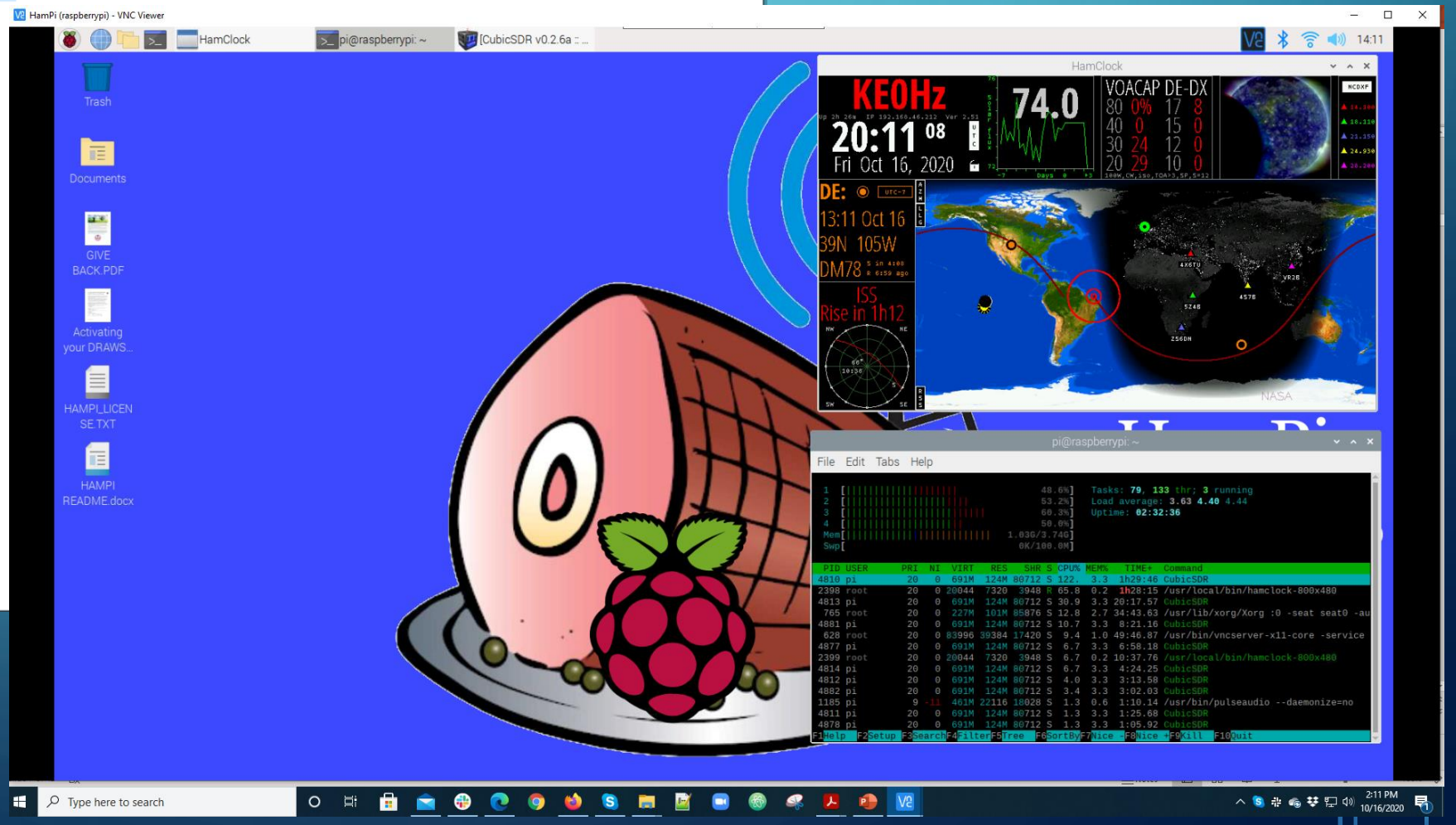
HEADLESS CONNECTION







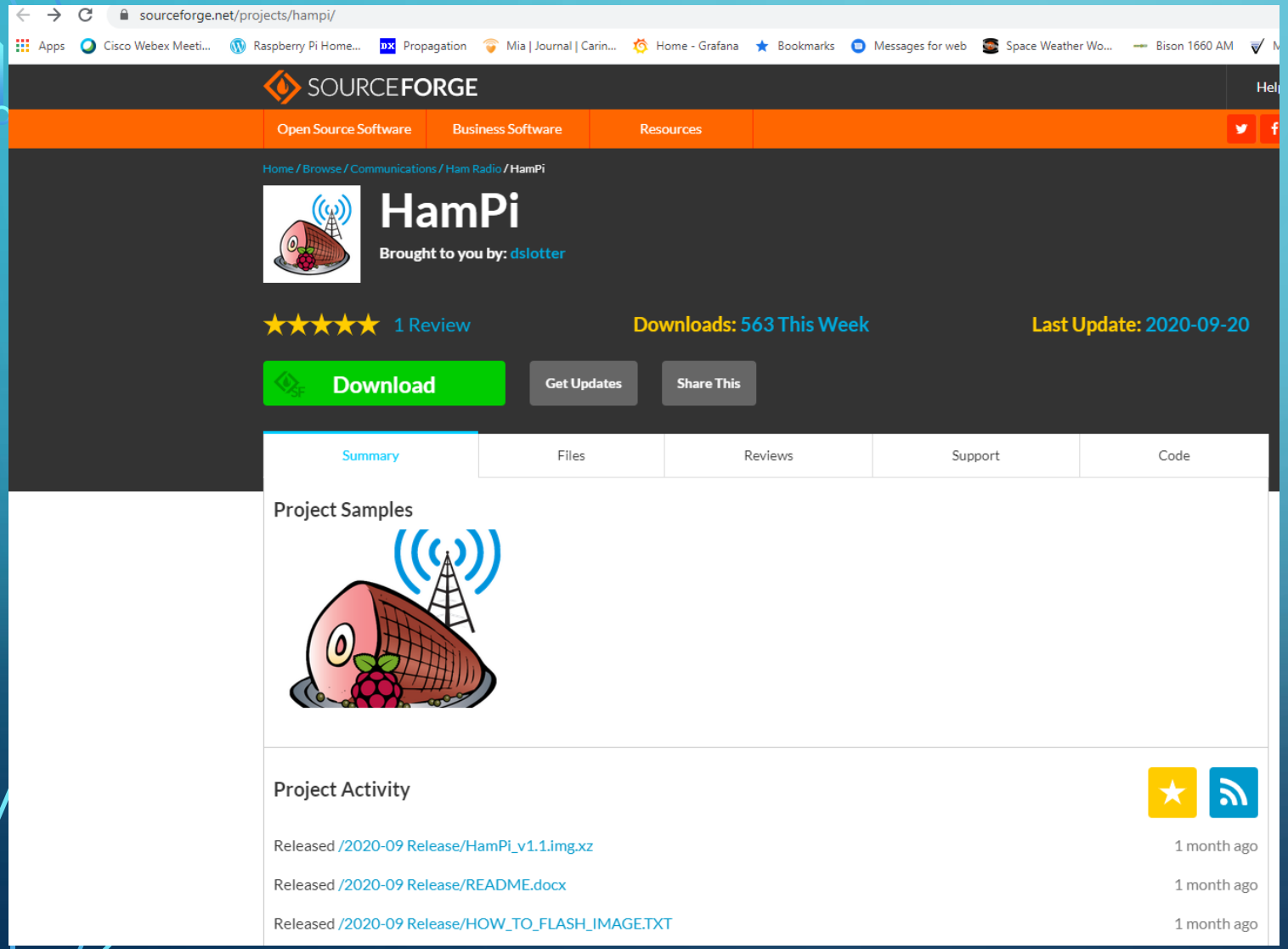
VNC Viewer opens interactive display on remote desktop



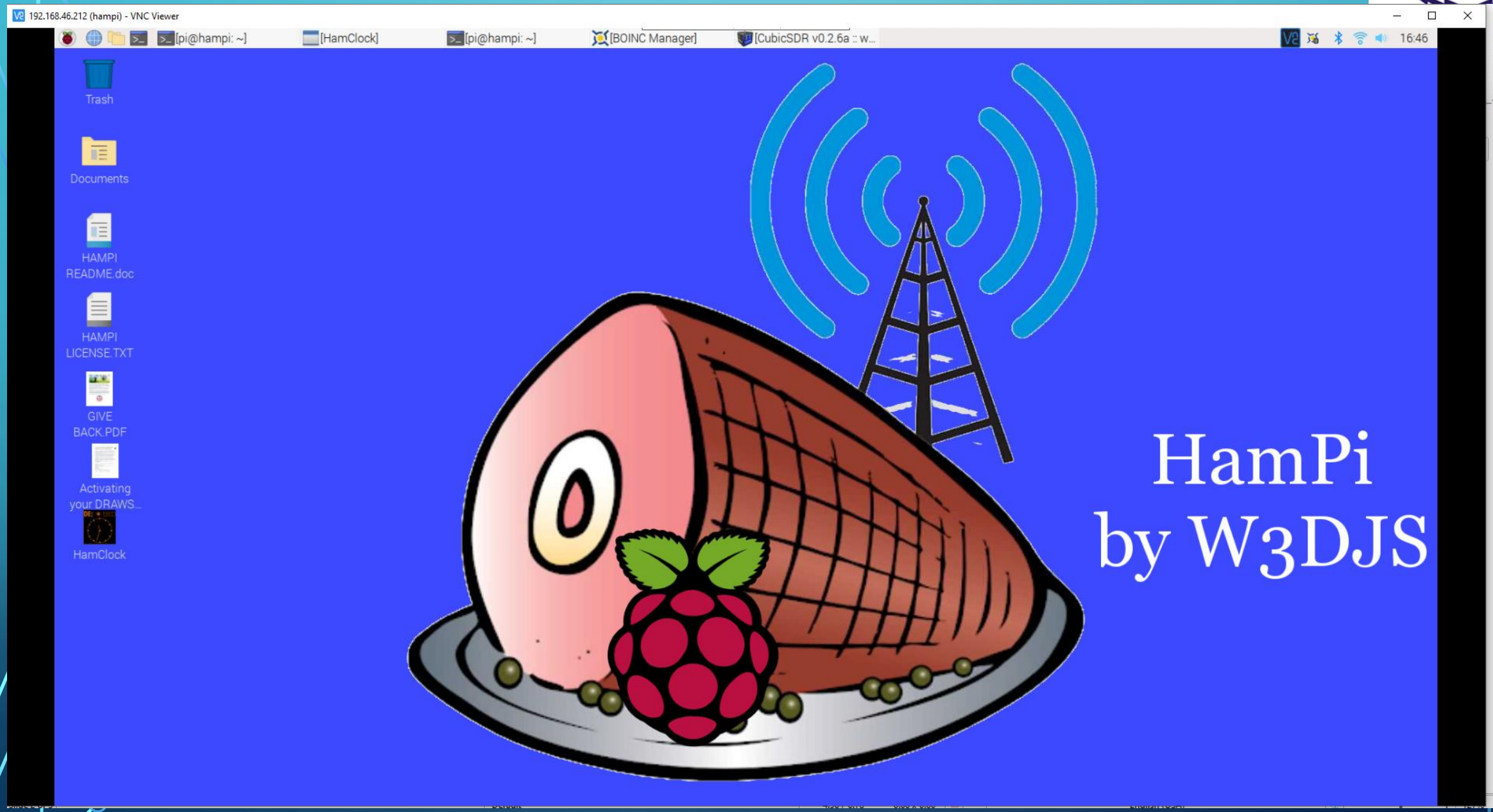
KEØHZ

- Raspberry Pi 4B
- RTL-SDR dongle
- Yaesu FT-DX3000
- CAT Cable for Rig Control
- Signalink – if connected to FT-817
- Note: No keyboard, mouse or display connections for Pi. Display above is using VNC Viewer.

DOWNLOAD HamPi



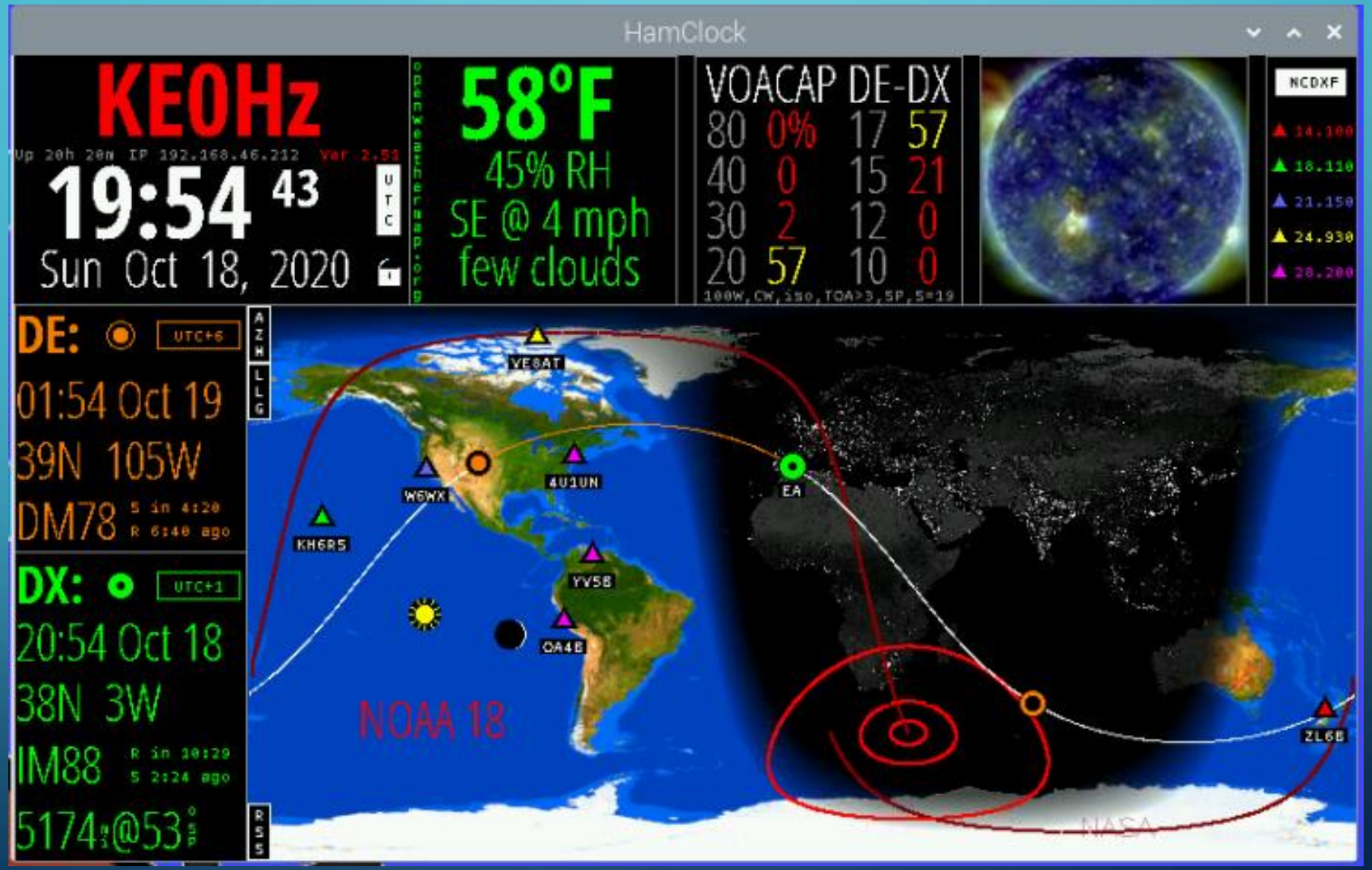
https://sourceforge.net/projects/hampi/


192.168.46.212 (hampi) - VNC Viewer
[pi@hampi: ~]
[HamClock]
[pi@hampi: ~]
[BOINC Manager]
[CubicSDR v0.2.6a :: w...
16:46
Trash
Documents
HAMPI README.doc
HAMPI LICENSE.TXT
GIVE BACK.PDF
Activating your DRAWS...
HamClock
HamPi
by W3DJS

HamPi APPLICATIONS

- Operating – Digital Modes (WSJT-X, JS8Call, PSK, WSPR), SDRs, ADS-B, HamFAX, DX Clusters, EchoLink, WinLink, APRS, SSTV
- Operating Tools – Satellite Tracking, DMR, Rig Control Libraries (flrig, HamLib), GridTracker
- Shack Management – Logging, Clocks, GPS
- Calculator/Design Tools – Antenna modeling, Smith charts, Propagation
- Morse Code – CW practice, CW decoding, eBooks to CW

HAMCLOCK


HamClock
KE0Hz
Up 20h 20m IP 192.168.46.212 Ver 2.51
19:54 43
UTC
Sun Oct 18, 2020
58°F
45% RH
SE @ 4 mph
few clouds
VOACAP DE-DX
80 0% 17 57
40 0 15 21
30 2 12 0
20 57 10 0
100W,CW,iso,TOA>3,SP,S=19
NCDXF
14.100
18.110
21.150
24.930
28.200
DE:
UTC+6
01:54 Oct 19
39N 105W
DM78
DX:
UTC+1
20:54 Oct 18
38N 3W
IM88
5174mi@53°
AZM
LFG
RSS
VE8AT
W6WX
4U1UN
EA
KH6RS
YV5B
OA4B
ZL6B
NOAA 18
NASA

KEØHZ HAMPI DEMO

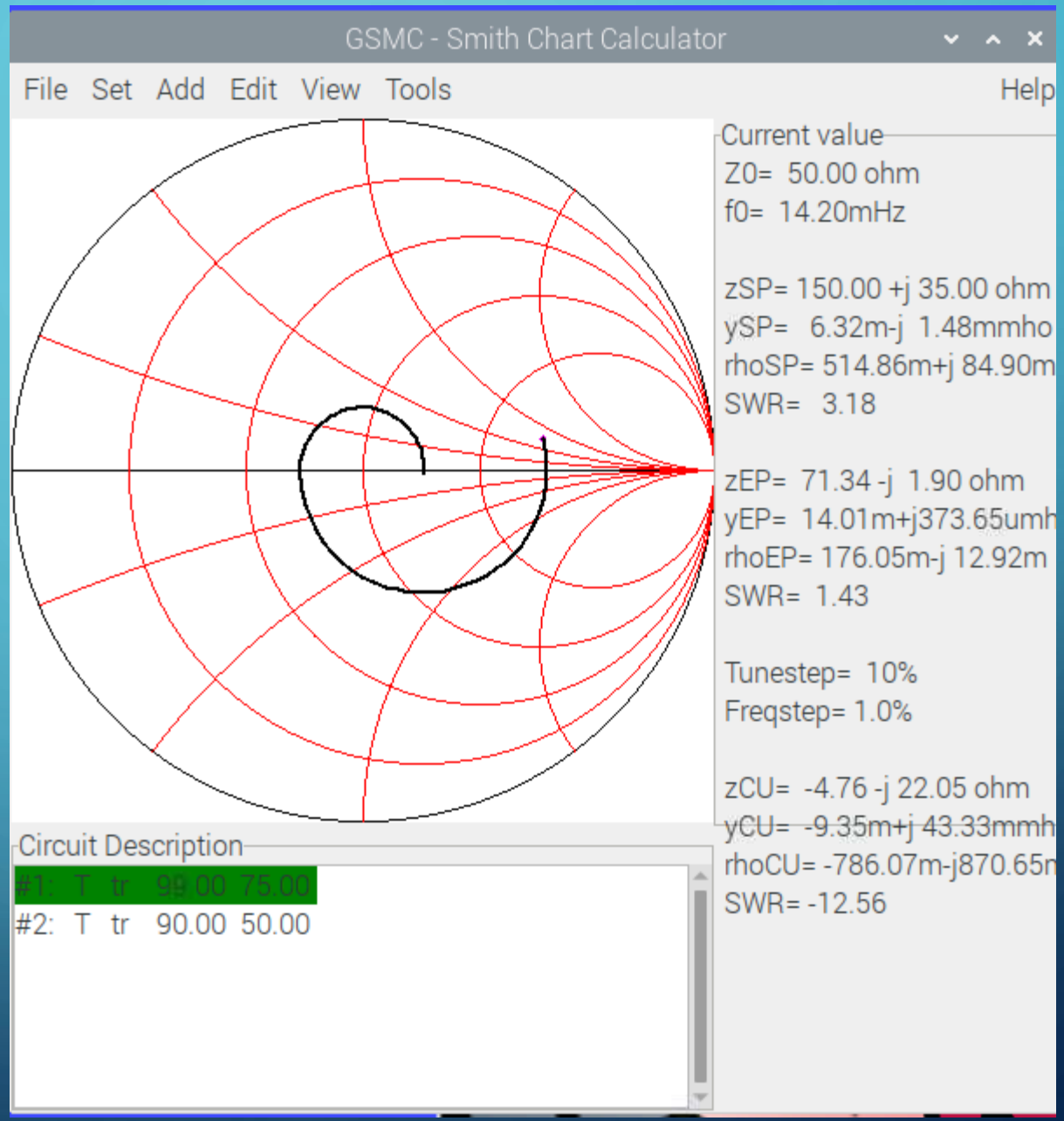
- HamClock
- GTK Smith Chart Calculator
- FLdigi
- FLcluster
- xcwcp Morse Code Trainer
- Ham Exam
- CubicSDR

SMITH CHART CALCULATOR

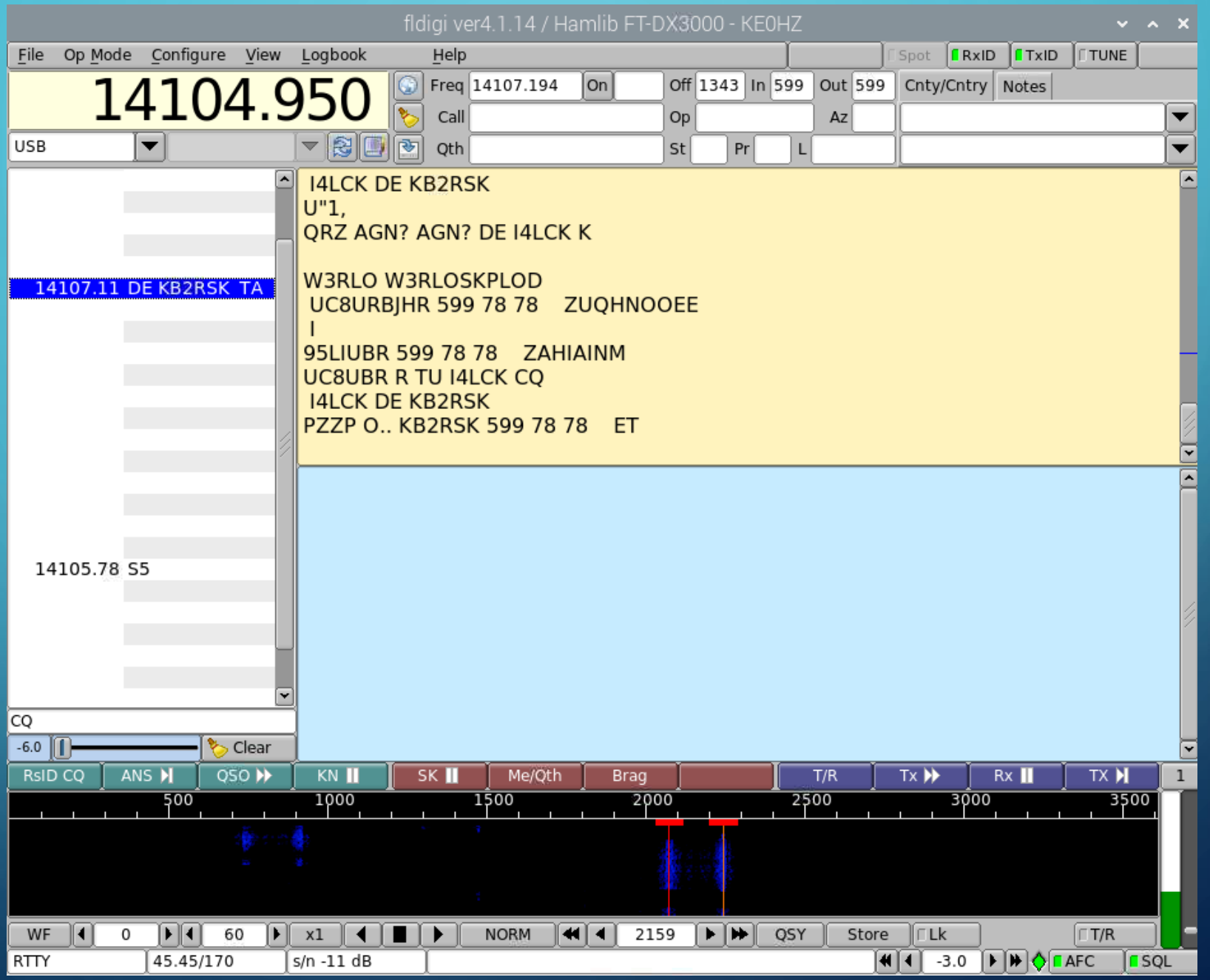
Transform antenna impedance
150 + j35 to near 50 ohms
SWR = 3.18

75 ohm coax, 99 degree length
(a bit over 1/4 wavelength)
plus
50 ohm coax, 90 degree length
(1/4 wavelength)

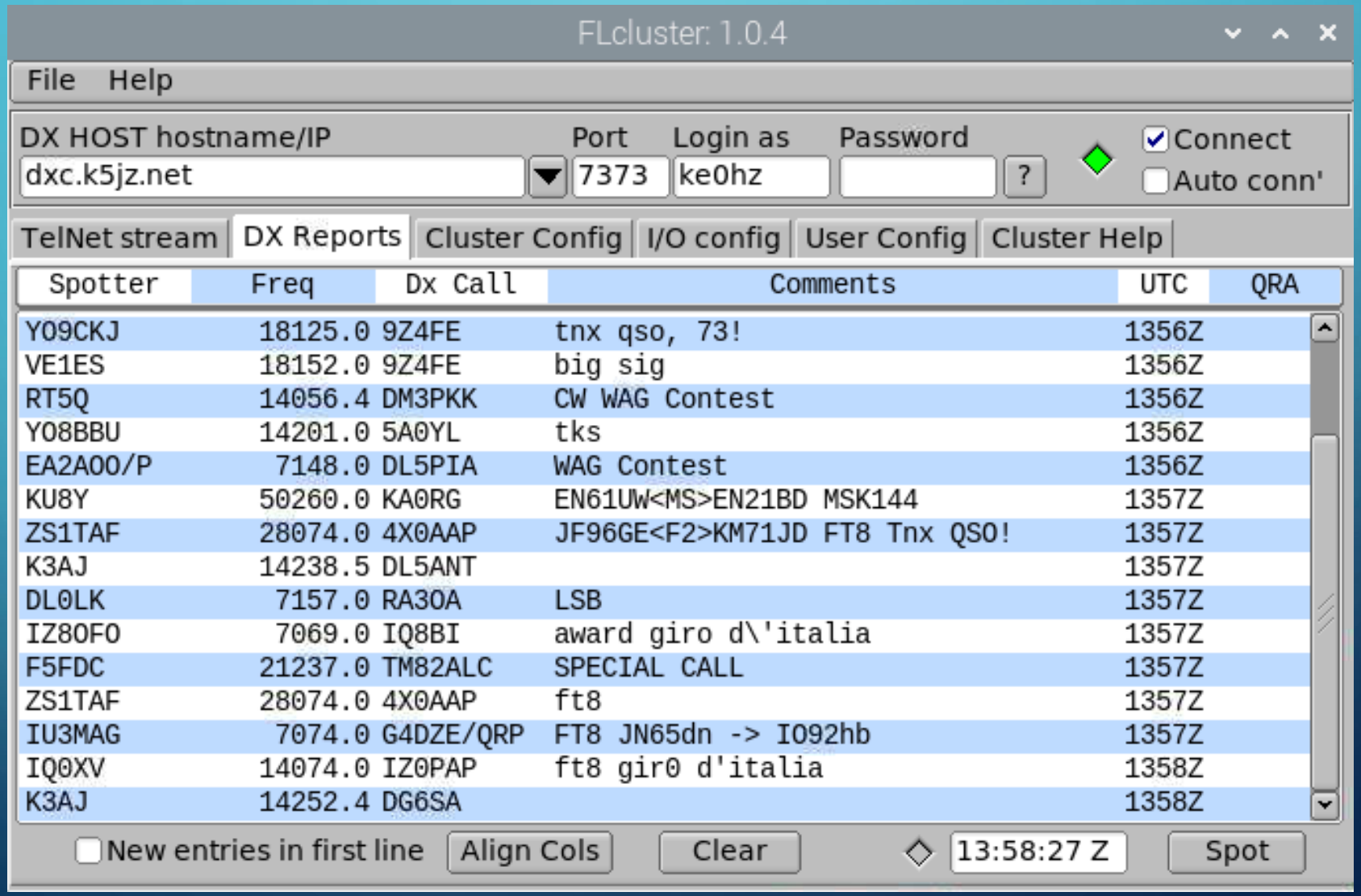
Transforms impedance to
71.34 + j0
SWR = 1.43
at transmitter output



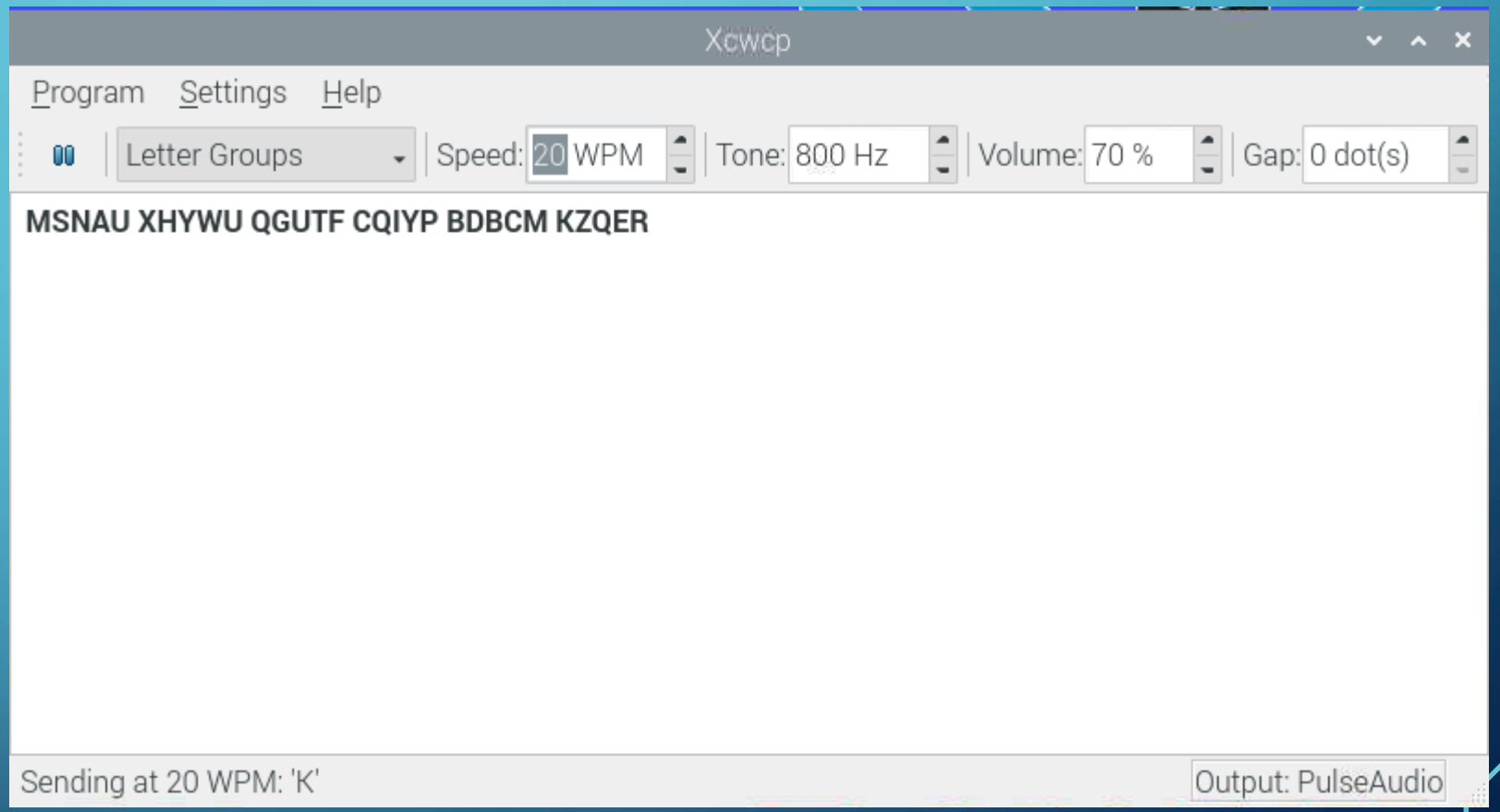
FLDIGI


fldigi ver4.1.14 / Hamlib FT-DX3000 - KE0HZ
File Op Mode Configure View Logbook Help
Spot RxID TxID TUNE
14104.950
Freq 14107.194 On Off 1343 In 599 Out 599 Cnty/Cntry Notes
Call Op Az
USB
Qth St Pr L
14107.11 DE KB2RSK TA
14105.78 S5
I4LCK DE KB2RSK
U"1,
QRZ AGN? AGN? DE I4LCK K
W3RLO W3RLOSKPLOD
UC8URBJHR 599 78 78 ZUQHNOOEE
I
95LIUBR 599 78 78 ZAHIAINM
UC8UBR R TU I4LCK CQ
I4LCK DE KB2RSK
PZZP O.. KB2RSK 599 78 78 ET
CQ
-6.0 Clear
RsID CQ ANS QSO KN SK Me/Qth Brag T/R Tx Rx TX 1
500 1000 1500 2000 2500 3000 3500
WF 0 60 x1 NORM 2159 QSY Store Lk T/R
RTTY 45.45/170 s/n -11 dB -3.0 AFC SQL

FLcluster


FLcluster: 1.0.4
File Help
DX HOST hostname/IP
Port
Login as
Password
dxc.k5jz.net
7373
ke0hz
?
Connect
Auto conn'
TelNet stream
DX Reports
Cluster Config
I/O config
User Config
Cluster Help
Spotter Freq Dx Call Comments UTC QRA
YO9CKJ 18125.0 9Z4FE tnx qso, 73! 1356Z
VE1ES 18152.0 9Z4FE big sig 1356Z
RT5Q 14056.4 DM3PKK CW WAG Contest 1356Z
YO8BBU 14201.0 5A0YL tks 1356Z
EA2AOO/P 7148.0 DL5PIA WAG Contest 1356Z
KU8Y 50260.0 KA0RG EN61UW<MS>EN21BD MSK144 1357Z
ZS1TAF 28074.0 4X0AAP JF96GE<F2>KM71JD FT8 Tnx QSO! 1357Z
K3AJ 14238.5 DL5ANT 1357Z
DL0LK 7157.0 RA3OA LSB 1357Z
IZ8OFO 7069.0 IQ8BI award giro d\'italia 1357Z
F5FDC 21237.0 TM82ALC SPECIAL CALL 1357Z
ZS1TAF 28074.0 4X0AAP ft8 1357Z
IU3MAG 7074.0 G4DZE/QRP FT8 JN65dn -> IO92hb 1357Z
IQ0XV 14074.0 IZ0PAP ft8 gir0 d'italia 1358Z
K3AJ 14252.4 DG6SA 1358Z
New entries in first line
Align Cols
Clear
13:58:27 Z
Spot

MORSE CODE TRAINER – XCWCP



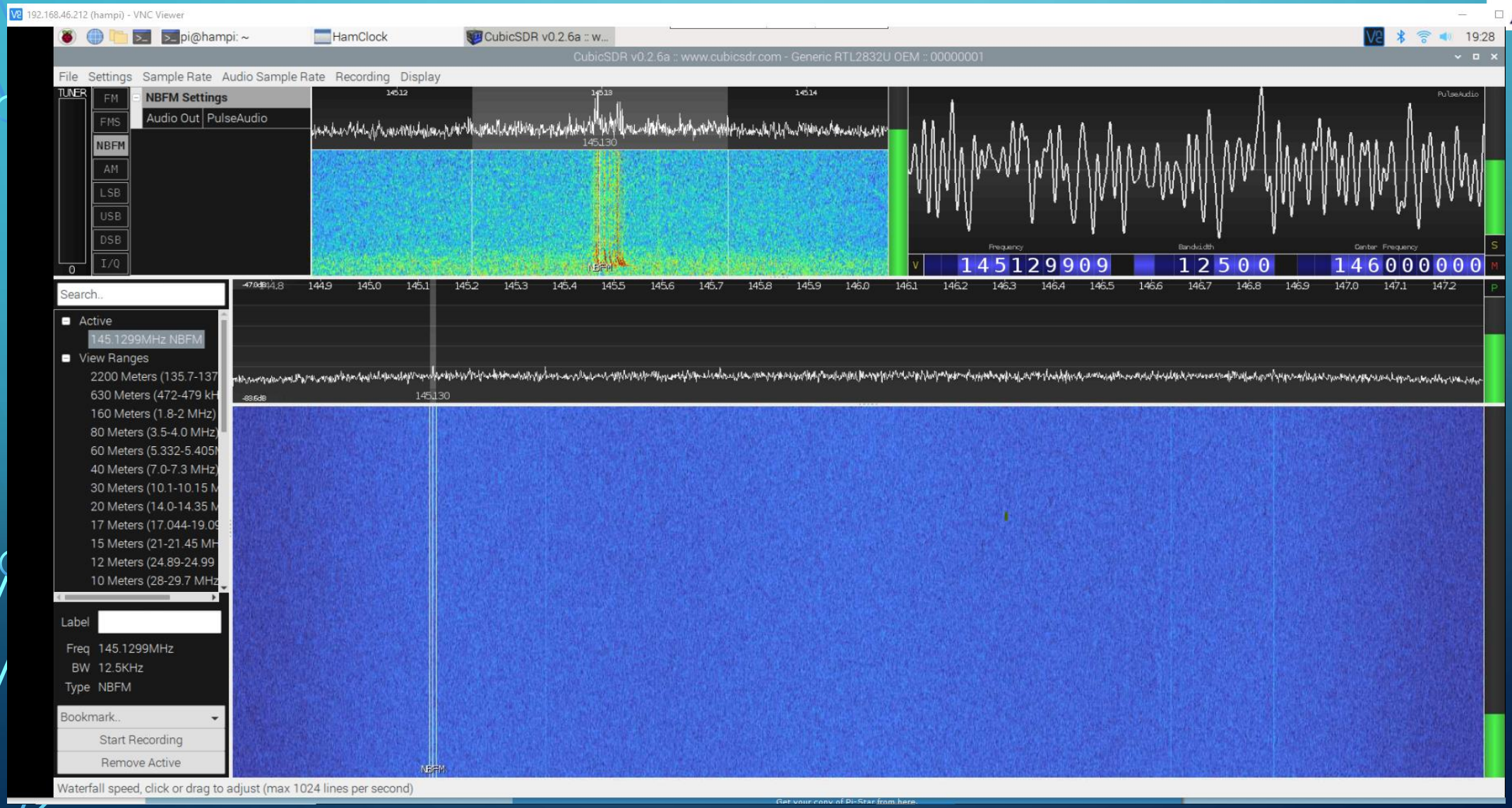
TRAINING: HAM EXAM

hamexam

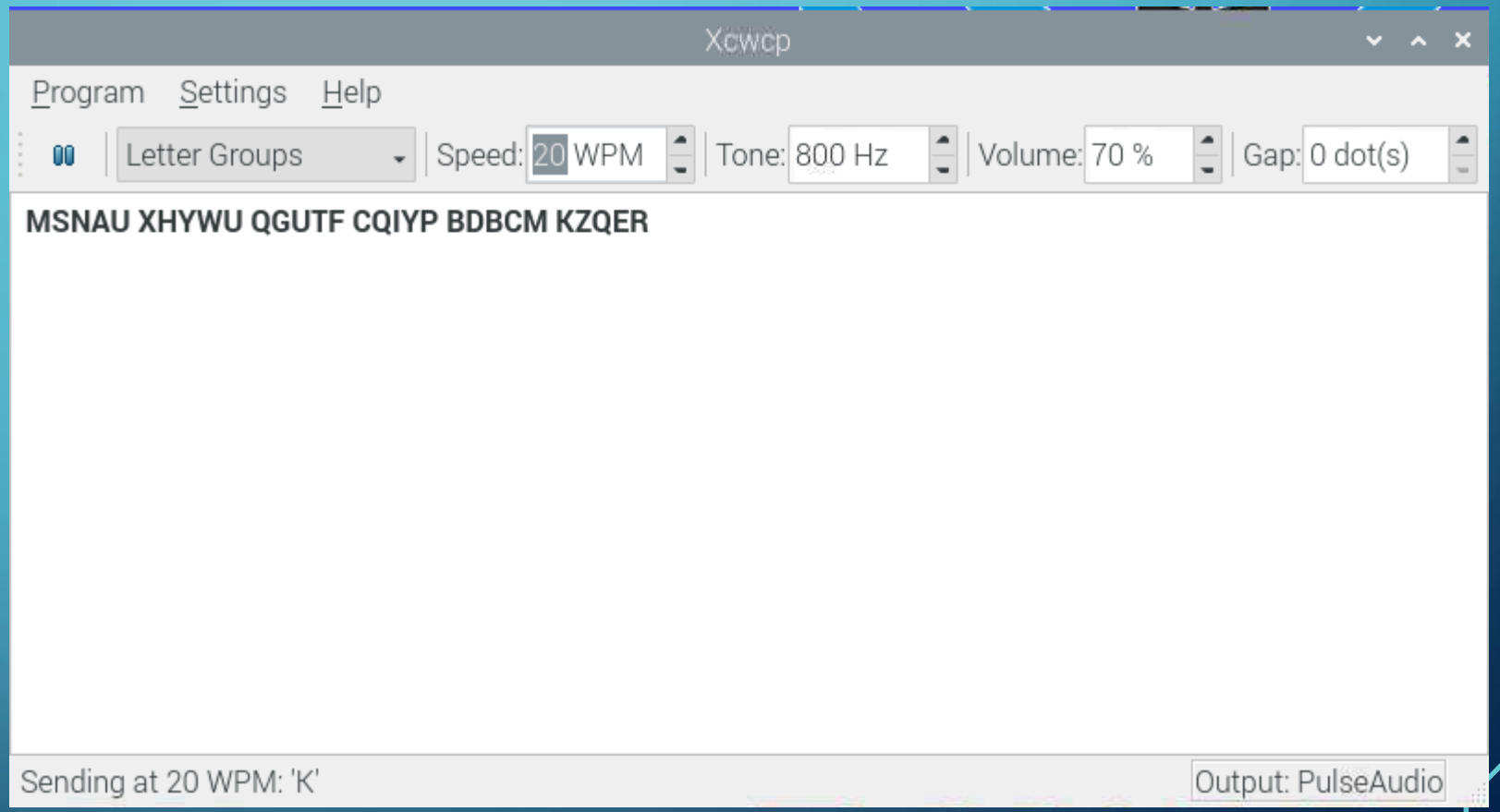
File Edit Tabs Help

```
usage: hamexam {t|g|e|q}
hamexam version 1.6.0
Technician, Element 2 effective July-2018 until July-2022
General, Element 3 effective July-2015 until July-2019
Extra, Element 4 effective July-2016 until July-2020
hamexam is an interactive study guide for USA FCC amateur radio (ham radio) examinations.
The 3 question pools are:
    t element 2, Technician Class (entry level),
    g element 3, General Class (also requires element 2),
    e element 4, Extra Class (also requires elements 2 and 3).
Questions are chosen randomly from the selected pool.
Incorrect answers cause the question to be asked again later.
Licenses are issued by the FCC, but exams are conducted by Volunteer Examiners.
For more information about USA amateur radio licensing: http://www.arrl.org/licensing-preparation-exams
Which pool? {t,g,e}: g
resuming remaining questions
458 questions remain in this pool

What is the output PEP of an unmodulated carrier if an average reading wattmeter connected to the transmitter output indicates 1060
 watts?
A. 530 watts
B. 1060 watts
C. 1500 watts
D. 2120 watts
b
.......correct

Which of the following is an advantage of using a Schottky diode in an RF switching circuit rather than a standard silicon diode?
A. Lower capacitance
B. Lower inductance
C. Longer switching times
D. Higher breakdown voltage
a
.......correct

What is a possible benefit to radio communications resulting from periods of high geomagnetic activity?
A. Auroras that can reflect VHF signals
B. Higher signal strength for HF signals passing through the polar regions
C. Improved HF long path propagation
D. Reduced long delayed echoes
```

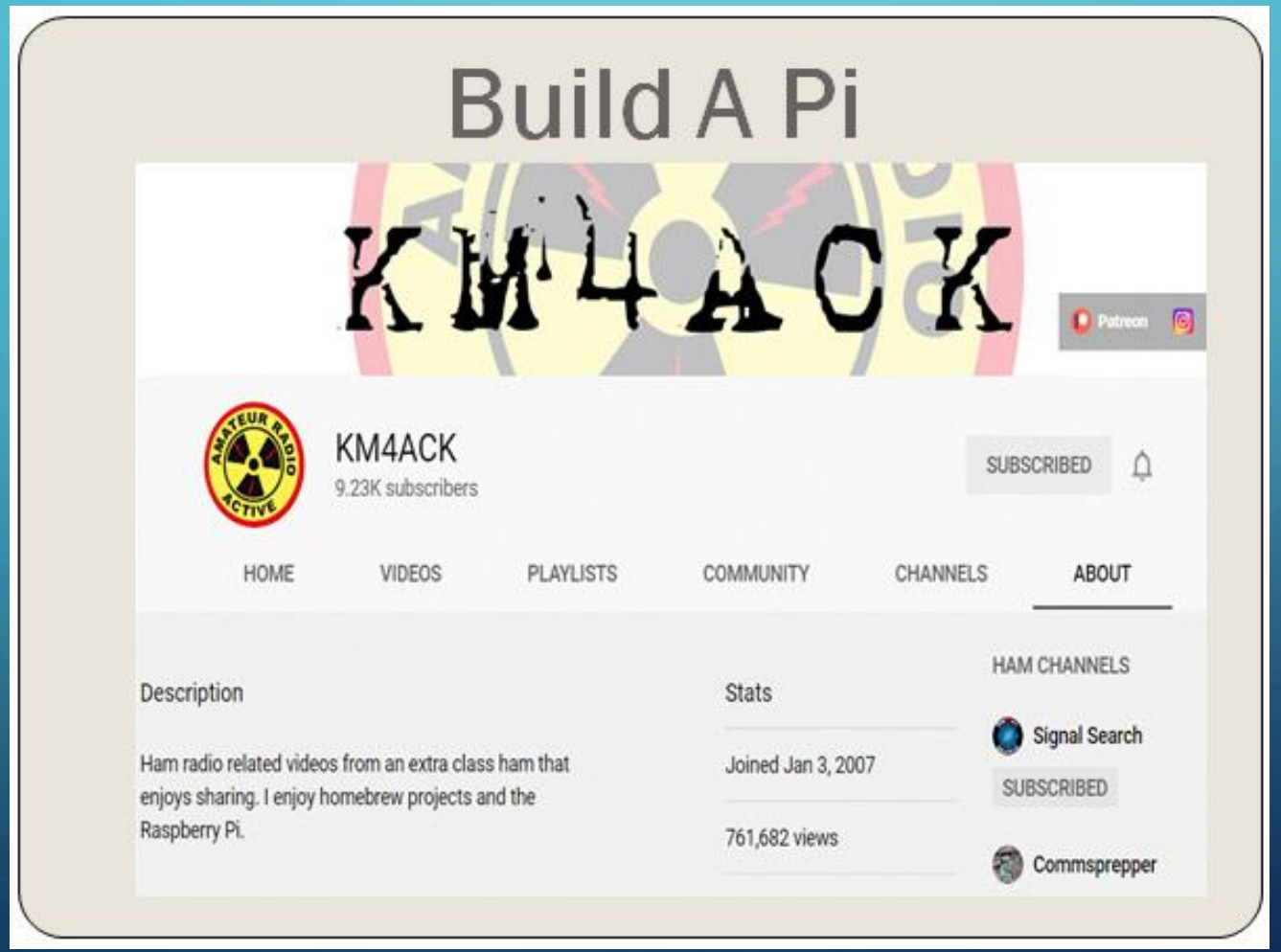
CubicSDR


192.168.46.212 (hampi) - VNC Viewer
pi@hampi: ~
HamClock
CubicSDR v0.2.6a :: w...
19:28
CubicSDR v0.2.6a :: www.cubicsdr.com - Generic RTL2832U OEM :: 00000001
File Settings Sample Rate Audio Sample Rate Recording Display
TUNER
FM
FMS
NBFM
AM
LSB
USB
DSB
I/Q
NBFM Settings
Audio Out PulseAudio
145.12
145.13
145.14
145.130
PulseAudio
Frequency
Bandwidth
Center Frequency
145129909
12500
146000000
Search..
Active
145.1299MHz NBFM
View Ranges
2200 Meters (135.7-137
630 Meters (472-479 kH
160 Meters (1.8-2 MHz)
80 Meters (3.5-4.0 MHz)
60 Meters (5.332-5.405
40 Meters (7.0-7.3 MHz)
30 Meters (10.1-10.15 M
20 Meters (14.0-14.35 M
17 Meters (17.044-19.09
15 Meters (21-21.45 MH
12 Meters (24.89-24.99
10 Meters (28-29.7 MHz
144.8 144.9 145.0 145.1 145.2 145.3 145.4 145.5 145.6 145.7 145.8 145.9 146.0 146.1 146.2 146.3 146.4 146.5 146.6 146.7 146.8 146.9 147.0 147.1 147.2
-88.6dB
145.130
Label
Freq 145.1299MHz
BW 12.5KHz
Type NBFM
Bookmark..
Start Recording
Remove Active
NBFM
Waterfall speed, click or drag to adjust (max 1024 lines per second)

MORSE CODE TRAINER – XCWCP



KDØRQU BUILD-A-PI DEMO



Build A Pi

Jason Oleham

KM4ACK

Patreon

KM4ACK
9.23K subscribers

SUBSCRIBED

HOME VIDEOS PLAYLISTS COMMUNITY CHANNELS ABOUT

Description

Ham radio related videos from an extra class ham that enjoys sharing. I enjoy homebrew projects and the Raspberry Pi.

Stats

Joined Jan 3, 2007

761,682 views

HAM CHANNELS

Signal Search

SUBSCRIBED

Commsprepper

About Build A Pi

- **The KM4ACK website is well maintained and Jason puts out a new video and News letter once a week**
- **Maintains a active forum or user group with a good following.**
- **Jason looks for input from other HAM's for programs to add and has a group of "Beta" testers to help him with the latest update or build.**
- **Jason often field tests his Pi and reports his success or failures.**
- **Build a Pi is designed for in the field portable use and primary focus is on emergency comms.**

KM4ACK Goals

- **To provide a usable platform for digital modes in the field.**
- **Pat Winlink – Gives us HF and VHF E-Mail**
- **APPRS – Position Reports, text messaging**
- **Digital Modes – FLDIGI, JS8Call - for E-comms**
- **FT8 - for play.**
- **Jason: “My hometown experience a tornado outbreak on Good Friday 2009. We lost cell service and power for several days. Because of that experience, my primary focus is on emergency comms. Most everything I do is slanted that direction.”**

The Build

- **You can select what software you want to install.**
- **During install you supply some basic information and Build a Pi will configure most programs for you. This is big deal and keeps you out of Linux.**
- **Sound card and radio will need to be configured.**
- **Jason puts out excellent how-to videos to walk you though the process.**

The Build Continued

- **Image will take a while to load (Up to 4 hours) depending on model of Pi and what you choose to install. However you can start the download and walk away.**

- **Programs are easily up-dated.**

- **Build a Pi is easily upgradable to different versions.**

- **Build a Pi has an auto Hot Spot if the main Wi-Fi SSID is lost or not available.**

Hot spot is used with VNC for portable use.

KD0RQU

- Yaesu FT-857D
- LDG Auto Tuner (Z100 Plus)
- Signalink – For PTT
- Pi 4
- GPS Dongle
- CAT Cable for Rig Control
- Data Cable
- Spider Beam push up pole 40’
- Antenna: 9:1 Unun with 36’ wire (while portabl
- Rig Runner 4004U – For Power distribution.
- 10.5 or 23.5 Dakota 12 volt
  lithium battery

Winlink

- **Winlink is a software bridge that links Packet Radio from the 1980's to the Internet of today.**
- **Pat Winlink is the Raspberry Pi's version of Winlink and is a slimed down version used on the Pi.**
- **You will need to register with Winlink to use Pat Winlink.**
- **Pat Winlink is one of the main programs used in this build so registering is a must.**

https://www.winlink.org

What is Winlink?

In it's simplest terms:

"A World-Wide System for Transferring Email via Radio."

Some of the Many Users:

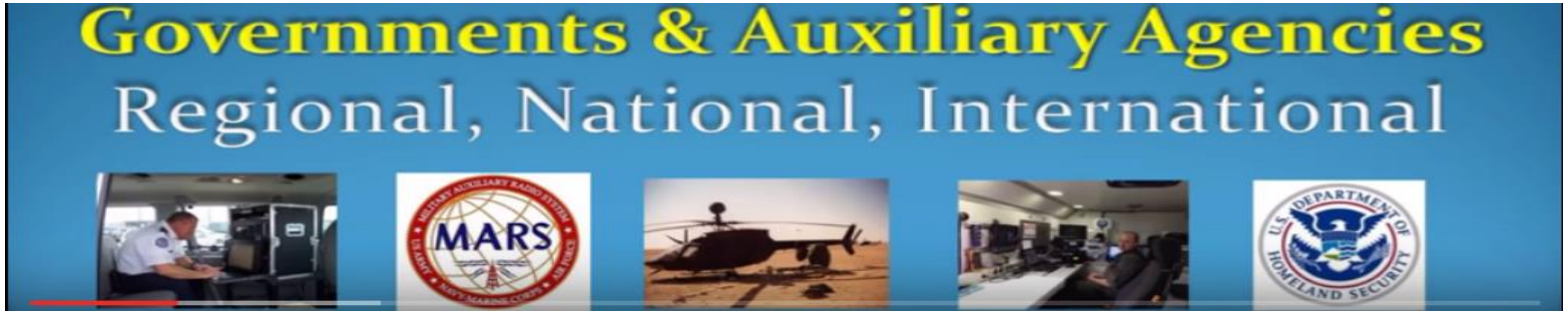
Amateur Radio (Hams)

Emergency Communications

Local, State, National, International

Governments & Auxiliary Agencies

Regional, National, International



Amateur Radio Safety Foundation

MILITARY AUXILIARY RADIO SYSTEM
MARS
U.S. ARMY
NAVY - MARINE CORPS
AIR FORCE

U.S. DEPARTMENT OF HOMELAND SECURITY
FEMA

A R R L

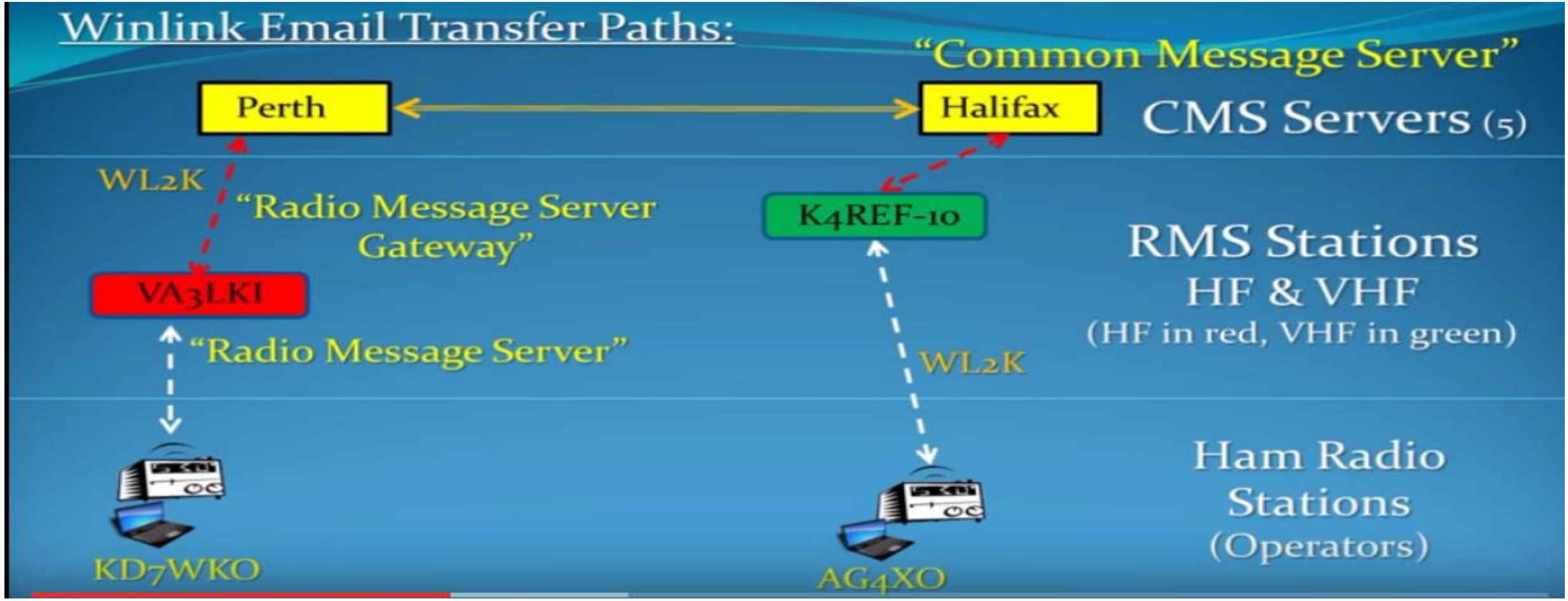
AMATEUR RADIO EMERGENCY SERVICE

American Red Cross

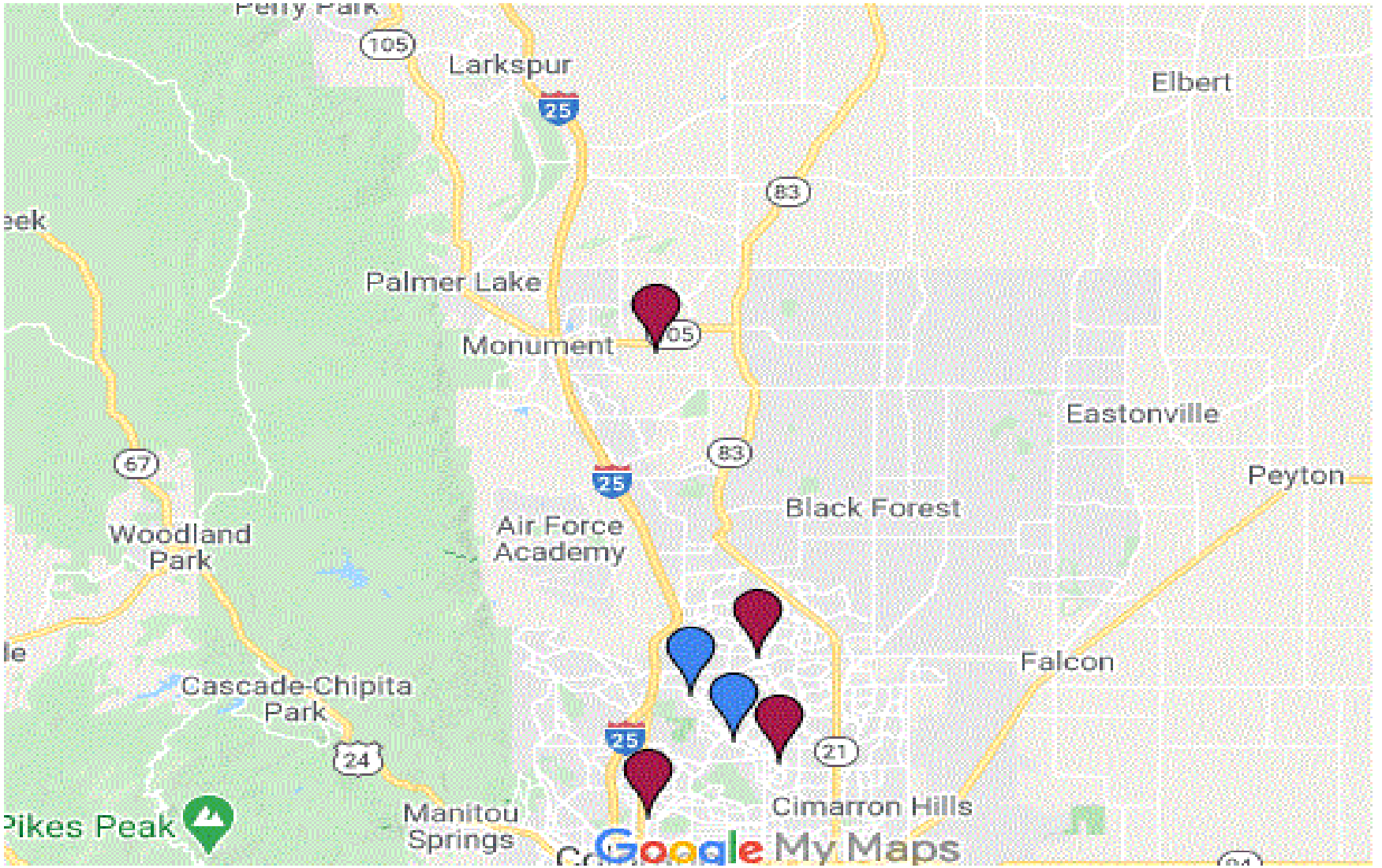
NATIONAL WEATHER SERVICE

EMERGENCY COMMUNICATIONS
R.A.C.E.S.
THRU RADIO AMATEUR OPERATORS

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA


Winlink Email Transfer Paths:
"Common Message Server"
Perth
Halifax
CMS Servers (5)
WL2K
"Radio Message Server Gateway"
K4REF-10
RMS Stations
HF & VHF
(HF in red, VHF in green)
VA3LKI
"Radio Message Server"
WL2K
Ham Radio Stations
(Operators)
KD7WKO
AG4XO

KE0GB-10
Richard Hendricks Sr.



Demo:

- **Build A Pi – GUI**
- **Pat Menu – Show interface**
- **Ardop - HF Modem**
- **Direwolf - Packet TNC (VHF)**

Send Packet e-mail by Packet

- **FLDIG - Narrow Band Emergency Messaging Software (NBEMS)**
- **JS8Call – Quick Overview.**
- **WSJTX – FT8 - Quick Overview**
- **Grid Tracker – Overlays, Call roster, PSK**

Install

The install is a two part process:

1. **Download and flash Raspbin buster to SD card and run the setup.**
2. **On Jason's github page you will find a video on the install process.**

   On this same page you will find a list of programs with a brief description that can be installed.

https://github.com/km4ack/pi-build

Install Continued

- **Whereas Build A Pi configures a lot of stuff for you, there will be some configuration left to do.**
- **Jason puts out excellent how-to videos to walk you though the process.**

LINKS:

KM4ACK (Jason Oleham)

https://github.com/km4ack/pi-build

https://www.youtube.com/watch?v=l4M9VVqGxoc

https://www.youtube.com/embed/XSCxKsl-83M

OH8STN (Julian Oulu)

https://www.youtube.com/user/SurvivalTechEU

WinLink

https://www.winlink.org

Real Time Clock

https://www.amazon.com/gp/product/B01JGNKNNA/ref=ppx_yo_dt_b_asin_image_o02_s00?ie=UTF8&psc=1

GPS Dongle

https://www.amazon.com/gp/product/B00NWEEWW8/ref=ppx_yo_dt_b_asin_title_o08_s00?ie=UTF8&psc=1

Card Reader

https://www.amazon.com/gp/product/B06ZYXR7DL/ref=ppx_yo_dt_b_asin_title_o09_s00?ie=UTF8&psc=1

- **While putting this presentation together I did some snooping on Jason's website. Boy, did I find a ton of stuff that I've missed. Grab a cup of coffee, sit back and do some snooping yourself. Interesting stuff!!**

- **https://app.simplenote.com/publish/C3bBxN**

MISC ACCESSORIES

- **VNC – Allows you to connect to any device by Wi-Fi to display user interface. You can connect to multiple devices at the same time.**

  Not being “Tied” to your radio with cables etc. is a really big deal.
- **Real Time Clock – FT8 and JS8Call require actuate time to run correctly.**
- **GPS Dongle will give you actuate time as well plus your GPS coordinates.**
- **Card Reader – Used for Back-up**

FINAL OBSERVATIONS

- HamPi has greater variety of applications
- HamPi is easier to get started, but....
  - No options – you get what you get
  - Contains some "bloatware"
  - Forces BOINC upon you
- Build-a-Pi tailorable to your needs
  - Better suited for portable operations
- Build-a-Pi better online YouTube support videos

COMPARISON OF APPLICATIONS

General Ham Radio Applications

HamLib - Ham Radio Control Libraries (HamPi & Build-a-Pi)

grig - graphical user interface to the Ham Radio Control Libraries (HamPi)

CHIRP - Radio Programming Software

APRS Message App for JS8Call - GUI to send APRS messages via JS8Call

QTel - EchoLink client

QSSTV - Slow Scan TV (e.g. "Fax")

Gpredict - Satellite prediction

FreeDV - Free digital voice vocoder

BlueDV - Client for D-Star and DMR

WsprryPi - WSPR software

ADS-B Flight Tracking Software

Pi3/4 Stats Monitor - by W1HKJ

VOACAP - HF propagation prediction

GPS Support

Auto WiFi Hotspot - Automatically turn your Pi into a WiFi hotspot when in the field!

wxtoimg - NOAA weather imaging software

twHamQTH - an online callsign look up program

twclock - a world clock and automatic ID for amateur radio operators

acfax - Receive faxes using your radio and sound card

colrconv - convers client with sound and ncurses color support

d-rats - A communication tool for D-STAR

fbb - Packet radio mailbox and utilities

gcb - Utility to calculate long and short path to a location

glfer - Spectrogram display and QRSS keyer

Xdx is a DX-cluster client

DXSpider - DX Cluster Server

fccexam - Study tool for USA FCC commercial radio license exams.

gnuais / gnuaisgui - GNU Automatic Identification System receiver

hamexam - Study guide for USA FCC amateur radio (ham radio) license examinations.

hamfax - Qt based shortwave fax

inspectrum - tool for visualising captured radio signals

predict-gsat - Graphical Predict client

splat - analyze point-to-point terrestrial RF communication links

wwl - Calculates distance and azimuth between two Maidenhead locators

Antenna Related Applications

antennavis - Antenna Visualization Software

gsmc - A GTK Smith Chart Calculator for RF impedance matching

nec2c - Translation of the NEC2 FORTRAN source code to the C language

xnecview - NEC structure and gain pattern viewer

yagiuda - software to analyse performance of Yagi-Uda antennas

Digital Mode Ham Radio Applications

WSJT-X - Weak Signal (FT8, FT4, etc.) by W1JT

GridTracker - Graphical mapping companion program for WSJT-X or JTDX

JTDX - Alternate client for Weak Signal (FT8, FT4, etc.)

JS8Call - Messaging built on top of FT8 protocol by KN4CRD

JS8CallTools - Get Grid coordinates using GPS

(FLDigi is in its own section below.)

gnss-sdr - GLONASS satellite system Software Defined Receiver

linpsk - amateur radio PSK31/RTTY program via soundcard

multimon - multimon - program to decode radio transmissions

multimon-ng - digital radio transmission decoder

psk31lx - a terminal based ncurses program for psk31

twpsk - a psk program

Software Defined Radio

CubicSDR - Software Defined Radio receiver

cutesdr - Simple demodulation and spectrum display prog

GQRX - Software defined radio receiver

SDRAngel - SDR player

lysdr - Simple software-defined radio

quisk - Software Defined Radio (SDR)

SoapyAudio - Soapy SDR plugin for Audio devices

SoapyHackRF - SoapySDR HackRF module

SoapyMultiSDR - Multi-device support module for SoapySDR

SoapyNetSDR - Soapy SDR module for NetSDR protocol

SoapyRemote - Use any Soapy SDR remotely

SoapyRTLSDR - Soapy SDR module for RTL SDR USB dongle

SoapySDR - Vendor and platform neutral SDR support library

SoapySDRPlay - Soapy SDR module for SDRPlay

Support for RTL-SDR

Support for SDRPlay SDR

Support for HackRF SDR

APRS Applications

Xastir - APRS GUI client / Digipeater / Igate

YAAC - Yet Another APRS Client

DireWolf - Software "soundcard" AX.25 packet modem/TNC and APRS encoder/decoder

aprsdigi - digipeater for APRS

aprx - APRS Digipeater and iGate

soundmodem - Sound Card Amateur Packet Radio Modems

FLDigi Application Suite from W1HKJ

flrig - Rig Control program which interfaces with fldigi

fldigi - Digital Modes Communications

flaa - RigExpert Antenna Analyzer Control Program

flamp - File transmissions via Amateur Multicast Protocol

flarq - ARQ data transfer utility for fldigi

flcluster - Telnet client to remote DX Cluster Servers

fllog - Logbook application which can use same data file as fldigi

flmsg - Editor for ICS 213 Forms

flnet - Net Control Assistant for Net Activities (Check-In Application)

flpost - NBEMs post office

flwrap - File encapsulation and compression for transmission over amateur radio

flwkey - Winkeyer (or clone) control program for K1EL Winkeyer series

Logging Applications

TrustedQSL - LotW client

CQRlog - Ham Radio Logging Application

PyQSO - Logging software (written in Python)

klog - The Ham Radio Logging program

tlf - console based ham radio contest logger

tucnak2 - VHF/UHF/SHF Hamradio contest log version 2

twlog - basic logging program for ham radio

wsjtx_to_n3fjp - Logging adapter to allow WSJT-X to log to N3FJP

xlog - GTK+ Logging program for Hamradio Operators

WinLink Applications

Pat WinLink - WinLink for Raspberry Pi (and other platforms)

ARDOP support for Pat WinLink

ARDOP-GUI - Provides graphical representation of ARDOP connections

Find ARDOP - Retrieves local ARDOP sources by KM4ACK

AX25 support for Pat WinLink

PMON - a PACTOR® Monitoring Utility for Linux

Morse Code Applications

aldo - Morse code training program

cw - sound characters as Morse code on the soundcard or console speaker

cwcp - Text based Morse tutor program

xcwcp - Graphical Morse tutor program

cwdaemon - morse daemon for the serial or parallel port

ebook2cw - convert ebooks to Morse MP3s/OGGs

ebook2cwgui - GUI for ebook2cw

morse - training program about morse-code for aspiring radio hams

morse2ascii - tool for decoding the morse codes from a PCM WAV file

morsegen - convert file to ASCII morse code

qrq - High speed Morse telegraphy trainer

twcw - sends morse code via the sound card or serial card (Needs RTC installed)

xdemorse - decode Morse signals to text

rscw - Receive CW through Soundcard

***** Ham Radio Wallpaper also included in image *****