What is a Raspberry Pi Computer?

- Credit card sized single board computer
- ARM Processor
- Limited memory, not expandable
- Low power consumption, USB cable
- MicroSDHC card for Hard Drive
- USB ports for peripherals
- HDMI port for monitor and sound
- GPIO pins for external I/O
- Poor Quality Sound Card
- Debian derived Linux Operating System (usually)
- List Price: $35
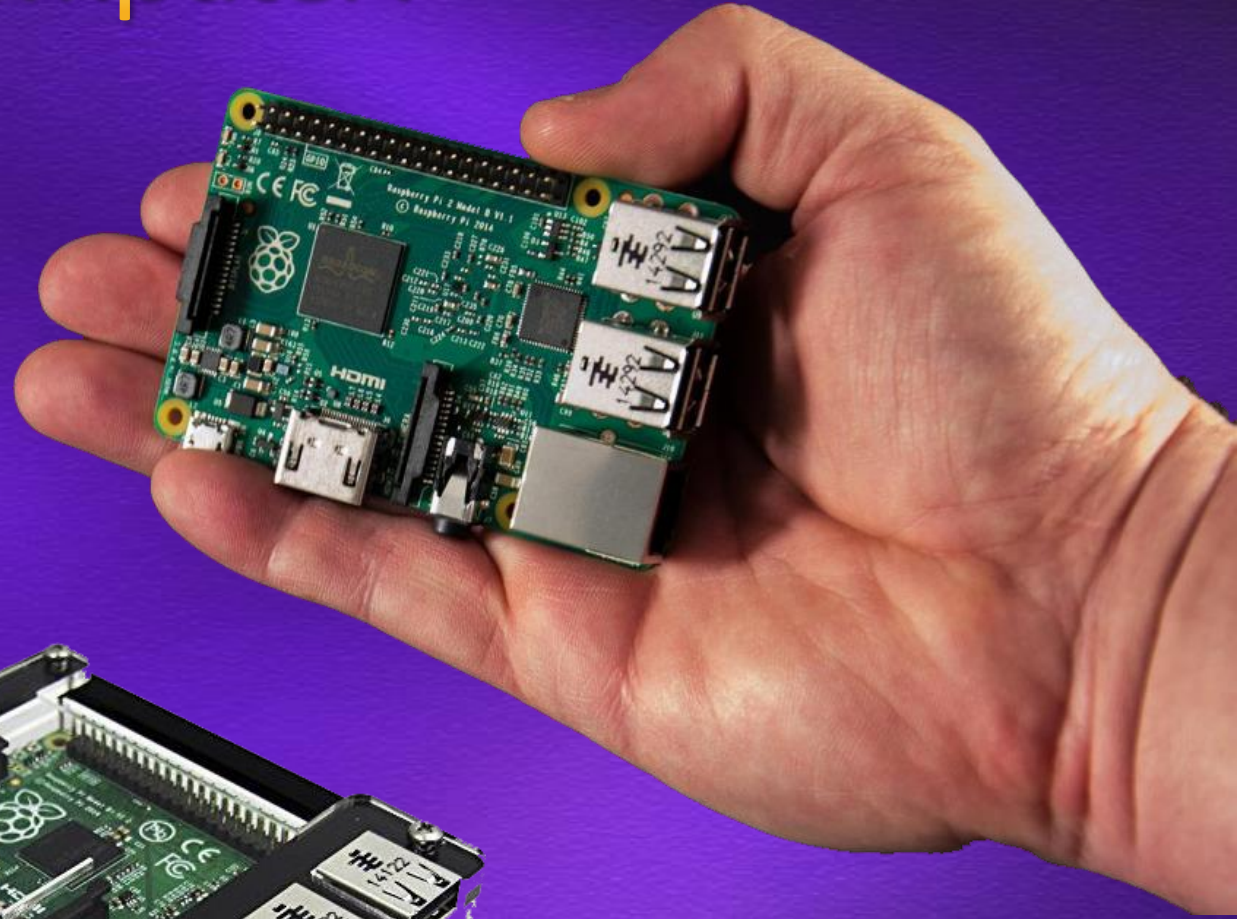
What models were made?

- Original RPi Model B:
  - Released Spring 2012
  - 700 Mhz single processor
  - 256 MB RAM
  - SDHC card for Hard Drive
  - 2 USB ports
  - 100 Mbps Ethernet

- RPi Model B+:
  - 700 Mhz single processor
  - 512 MB RAM
  - SDHC card for Hard Drive
  - 4 USB ports
  - 100 Mbps Ethernet

- RPi 2 Model B+:
  - 900 Mhz Quad Core processor
  - 1.0 GB RAM
  - MicroSDHC card for Hard Drive
  - 4 USB ports
  - 100 Mbps Ethernet

- RPi 3 Model B+:
  - 1400 Mhz Quad Core processor, 64 bit
  - 1.0 GB RAM
  - MicroSDHC card for Hard Drive
  - 4 USB ports
  - 100 Mbps Ethernet
  - 802.11 b/g/n WiFi and Bluetooth LE

Basic Hardware

- Raspberry Pi Model 3 B+
- 2.4A Power Supply
- Class 10 Micro SDHC card
  - 8GB Minimum
- HDMI A/V cable
- Optional:
  - Plastic Case
  - USB SDHC Card reader
  - USB Keyboard & Mouse
  - HDMI Monitor or TV

OS Software

- Debian Linux – Raspbian
  - Latest Linux kernel and OS components
  - Current version is Raspbian Stretch
  - On-Line repositories of thousands of software packages
  - Available programs are easily installed
  - Aptitude manages software installation
  - Other programs through 3rd party repositories and .DEB files
  - Downloadable as bootable image
- Compass Linux from NW Digital Radio
  - Based on latest Raspbian Linux
  - Purpose built for Amateur Radio Applications

Linux

- Linux Kernel
- X Windows
  - Various GUI Desktops and Frameworks
- GNU Utilities and programming languages

Popular Distros:
Linux Mint
Debian
Ubuntu
OpenSuse
Manjaro
Red Hat
CentOS
Mageia

Linus Torvalds

Richard Stallman

Ham Radio Applications

- Digital Voice Hotspot
  - D-STAR
  - DMR
  - Fusion
  - P25
  - NXDN
  - POCSAG

- Digital Voice AMBE Dongle
- AMBE Server
- D-RATS
- DR-1X Repeater Controller

- IRLP node
- Packet Radio / APRS
- Rig control
- CHIRP
- But wait…there's more
- Software Defined Radio-Not!

Digital Voice Hotspot

Digital Voice Hotspot - Hardware

DVMega RPi HAT

Original DVAP

DV4Mini

MoenComm
GMSK Modem

- RPi Computer with:
  - DVAP (MMDVM software)
  - DVMega (MMDVM software)
  - DV4Mini (proprietary software)
  - ZUMSpot/JumboSpot (MMDVM software)
  - GMSK Modem (BYOR) (MMDVM software)
- On-Board low power radio transceiver, 10 mW
- Use with your DV transceiver
- Create your own DV mini-repeater, simplex
- Connect to any repeater or gateway through your home Internet

ZUMSpot DV Hotspot - Hardware

- Raspberry Pi Zero W with ZUMSpot Radio Board
- All work with Pi-Star Software

RPi Zero with ZUMSpot Board

ZUMSpot USB

JumboSpot - Chinese Clone of ZUMSpot

Digital Voice Hotspot - Software

- Pre-Packaged MicroSDHC card images:
  - D-STAR Commander Image
    - Easiest setup. Up and running in 30 minutes.
  - Western D-STAR Image
    - Excellent alternative
  - Maryland D-STAR Image
  - Each based on G4KLX ircddbgateway software
- Roll-Your-Own:
  - Compile irdccbgateway from Source
  - Precompiled ircddbgateway (Compass Linux)

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OBSOLETE

Digital Voice Hotspot - Software

- Pi-Star Software from Andy Taylor – MW0MWZ
  - Image for Raspberry Pi SDHC Card
    - Easy setup. Up and running in 30 minutes.
  - MMDVM Software from G4KLX
    - Provides all the popular DV formats
  - Excellent dashboard
  - Web Browser based configuration and operation

Pi-Star Digital Voice Dashboard for W4LKS

Dashboard | Admin | Configuration

Modes Enabled

D-Star	DMR
YSF	P25
YSF XMode	NXDN
DMR XMode	POCSAG

Network Status

D-Star Net	DMR Net
YSF Net	P25 Net
YSF2DMR	NXDN Net
YSF2NXDN	YSF2P25
DMR2NXDN	DMR2YSF

Radio Info

Trx	Listening
Tx	441.100000 MHz
Rx	441.100000 MHz
FW	DVMEGA HR3.19

D-Star Repeater

RPT1	W4LKS B
RPT2	W4LKS G

D-Star Network

APRS	rotate.aprs2.net
IRC	rr.openquad.net

Linked to **REF029 A**
(DPlus Outgoing)

Gateway Activity

Time (PDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
07:39:08 Mar 13th	D-Star	K7RJD	CQCQCQ via REF029 A	Net	0.9	0%	0.0%
07:36:38 Mar 13th	D-Star	N7QXH/MIKE	CQCQCQ via REF029 A	Net	0.8	0%	0.0%
07:36:13 Mar 13th	D-Star	K7HRT	CQCQCQ via REF029 A	Net	1.2	0%	0.0%
07:35:12 Mar 13th	D-Star	W7SSK/DON	CQCQCQ via REF029 A	Net	47.5	0%	0.0%
07:31:51 Mar 13th	D-Star	KC9SIO	CQCQCQ via REF029 A	Net	159.3	0%	0.0%
07:29:58 Mar 13th	D-Star	W4QMT/D74	CQCQCQ via REF029 A	Net	74.6	0%	0.0%
07:29:10 Mar 13th	D-Star	KG7HZT	CQCQCQ via REF029 A	Net	31.9	0%	0.0%
07:24:26 Mar 13th	D-Star	KC8YQL/DVAP	CQCQCQ via REF029 A	Net	132.6	0%	0.0%
07:22:14 Mar 13th	D-Star	W7CDP/5100	CQCQCQ via REF029 A	Net	94.2	0%	0.0%
07:20:12 Mar 13th	D-Star	W4LKS/2820	CQCQCQ	RF	91.2	0%	0.0%
07:18:03 Mar 13th	D-Star	KD7AAT/JOHN	CQCQCQ via REF029 A	Net	91.2	0%	0.0%
07:16:13 Mar 13th	D-Star	W6AAX/AMBE	CQCQCQ via REF029 A	Net	37.3	0%	0.0%
07:14:48 Mar 13th	D-Star	WA7VFQ/JIM	CQCQCQ via REF029 A	Net	13.6	0%	0.0%
07:12:28 Mar 13th	D-Star	K9PTF	CQCQCQ via REF029 A	Net	69.8	0%	0.0%
07:11:15 Mar 13th	D-Star	KD7AAT/RSNC	CQCQCQ via REF029 A	Net	0.1	0%	0.0%
07:11:09 Mar 13th	D-Star	KI7ETS	CQCQCQ via REF029 A	Net	3.9	8%	0.0%
07:10:47 Mar 13th	D-Star	AB9GY/BILL	CQCQCQ via REF029 A	Net	3.4	0%	0.0%
07:07:41 Mar 13th	D-Star	N5DZO/LEO	CQCQCQ via REF029 A	Net	137.6	0%	0.0%
07:05:48 Mar 13th	D-Star	WA7BFN/DUFF	CQCQCQ via REF029 A	Net	47.1	0%	0.0%
07:04:14 Mar 13th	D-Star	N6CZE/AMBE	CQCQCQ via REF029 A	Net	52.4	0%	0.0%

Local RF Activity

Time (PDT)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
07:20:12 Mar 13th	D-Star	W4LKS/2820	CQCQCQ	RF	91.2	0.0%	

Pi-Star Digital Voice - Configuration

Dashboard | Admin | Expert | Power | Update | Backup/Restore | Factory Reset

Gateway Hardware Information

Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-star	4.9.35-v7+	Pi 3 Model B (1GB) - Embest, CH	0.52 / 0.42 / 0.34	53.7°C / 128.7°F

Control Software

| Setting	Value
Controller Software:	○ DStarRepeater ● MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	● Simplex Node ○ Duplex Repeater (or Half-Duplex on Hotspots)

Apply Changes

MMDVMHost Configuration

Setting		Value			
DMR Mode:	⬜	RF Hangtime:	40	Net Hangtime:	40
D-Star Mode:	🔴	RF Hangtime:	40	Net Hangtime:	40
YSF Mode:	⬜	RF Hangtime:	20	Net Hangtime:	20
P25 Mode:	⬜	RF Hangtime:	20	Net Hangtime:	20
NXDN Mode:	⬜	RF Hangtime:	20	Net Hangtime:	20
YSF2DMR:	⬜				
YSF2NXDN:	⬜				
YSF2P25:	⬜				
DMR2YSF:	⬜	Uses 7 prefix on DMRGateway			
DMR2NXDN:	⬜	Uses 7 prefix on DMRGateway			
POCSAG:	⬜	POCSAG Paging Features			
MMDVM Display Type:	Nextion ▼ Port: /dev/ttyUSB0 ▼ Nextion Layout: G4KLX ▼				

Apply Changes

DV AMBE Dongle

DV AMBE Dongle

- DV with NO radio transceiver.
  - Internet Labs DV Dongle ($190)
  - Internet Labs DV 3K Dongle ($150)
  - NWDR ThumbDV ($120)
  - NWDR PiDV ($100)
  - DVMega DVStick 30 ($130)
- Has AMBE vocoder on-board
- Plug into USB port
- Use your computer Mic/Headset as transceiver, even Android phone
- Use Blue DV Software for Android and Windows PCs
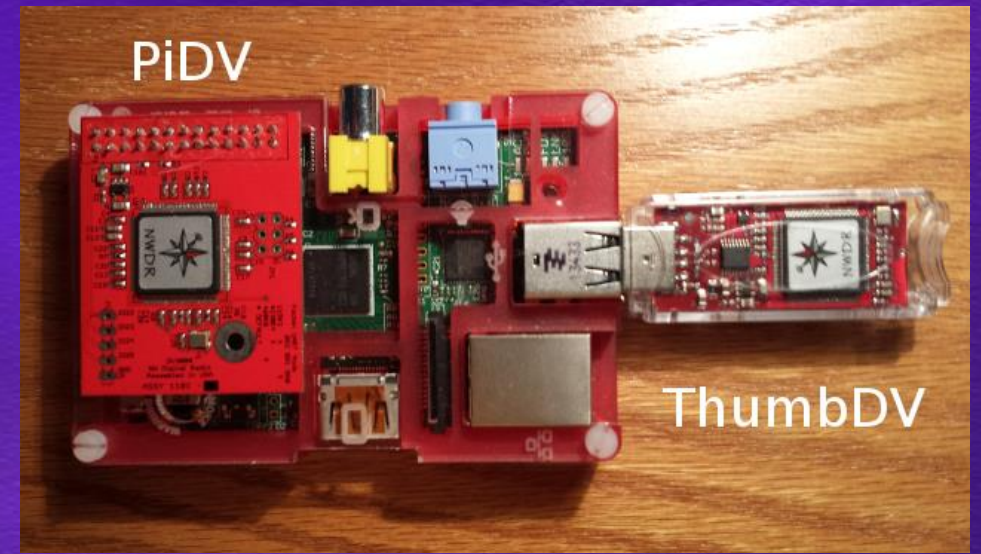
AMBE Server

AMBE Server

- Allow use of a single AMBE chip to be shared over your network
- Use RPi, ThumbDV or PiDV, and ambeserver software
- Connect to server from any computer on your network using G4KLX's dummyrepeater
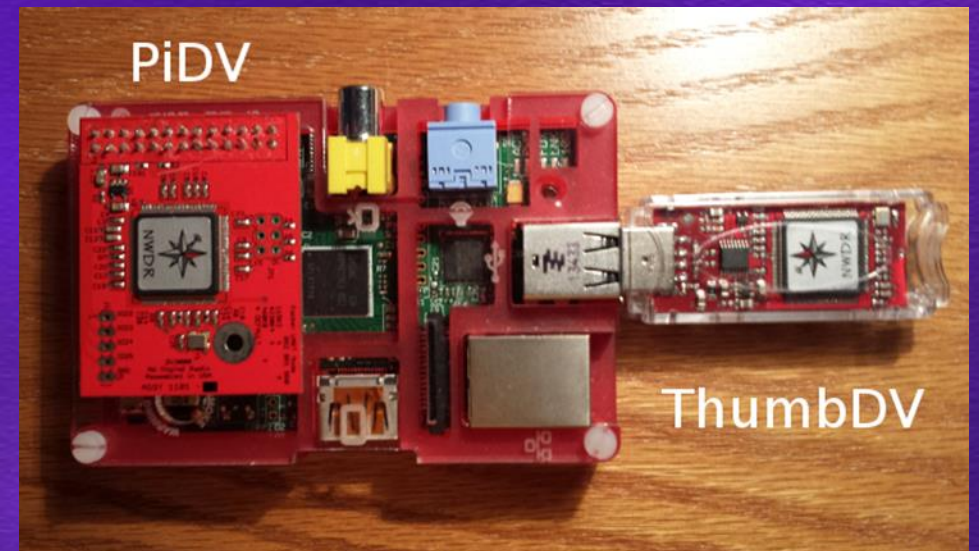
D-RATS

D-RATS

- Written by Dan Smith, KK7DS
- Utilize the data portion of the D-STAR transmission to send any kind of data
- Send messages, transfer files, have live chats over your D-STAR radio
- Connect to D-RATS servers directly through the network
- Installable from the normal Raspbian software repository

File   View   Help

Messages | Chat | Files | Event Log

New | Forward | Reply | Delete | Mark Read | Mark Unread | Send/Receive

Drafts
Inbox
Outbox
Sent
Trash
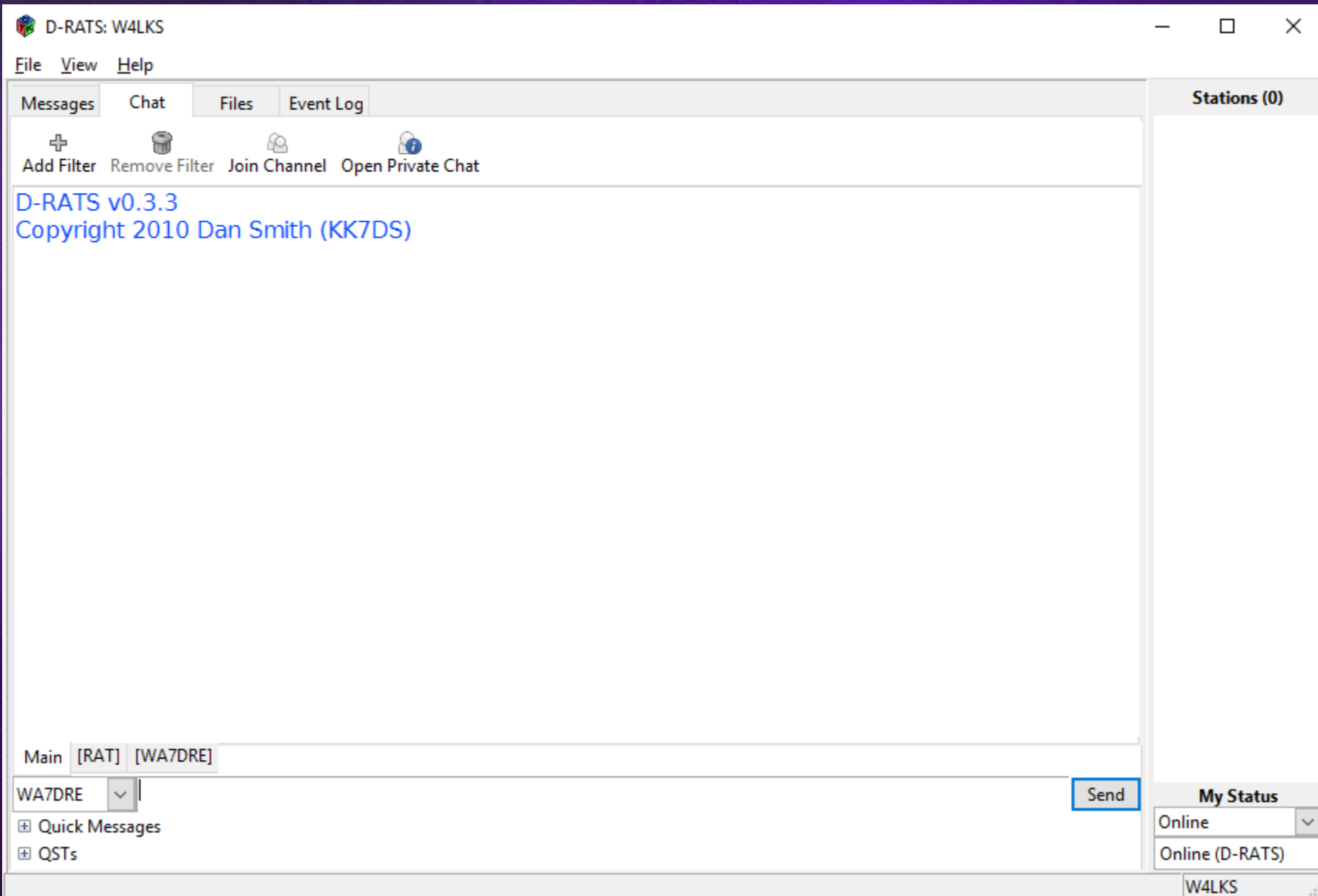
Sender   Recipient   Subject   Type   Date

Stations (0)

My Status

Online

Online (D-RATS)

W4LKS

D-RATS: W4LKS

File View Help

Messages | Chat | Files | Event Log

Add Filter | Remove Filter | Join Channel | Open Private Chat

D-RATS v0.3.3
Copyright 2010 Dan Smith (KK7DS)

Main [RAT] [WA7DRE]

WA7DRE

Send

⊞ Quick Messages
⊞ QSTs

Stations (0)

My Status

Online

Online (D-RATS)

W4LKS

DR-1X Repeater Controller

DR-1X Repeater Controller

- Add new capability to the $500 Yaesu Fusion Repeater
- DR-1X from the factory: Analog and C4FM digital
- NW Digital Radio UDRC-II Controller + RPi adds:
  - D-STAR Digital, DMR, Fusion, NXDN, etc.
  - Connect to world-wide DV networks using PiStar and MMDVM
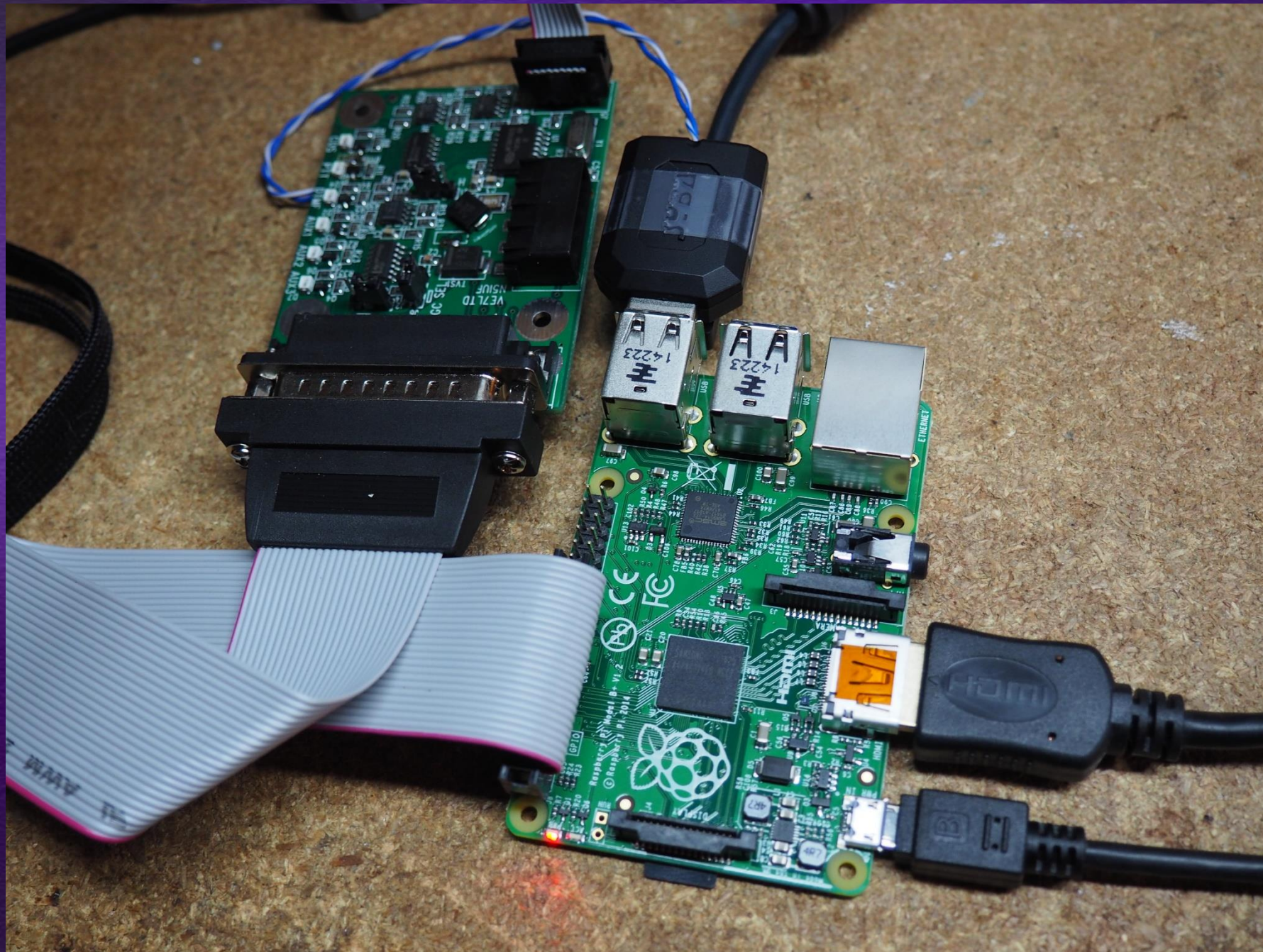 - Newest version from NW Digital Radio is called DRAWS, adds more features
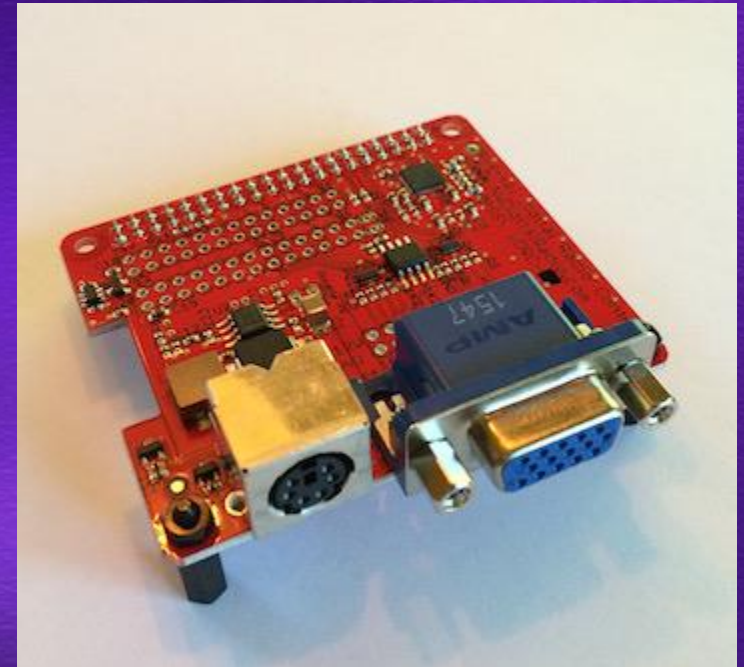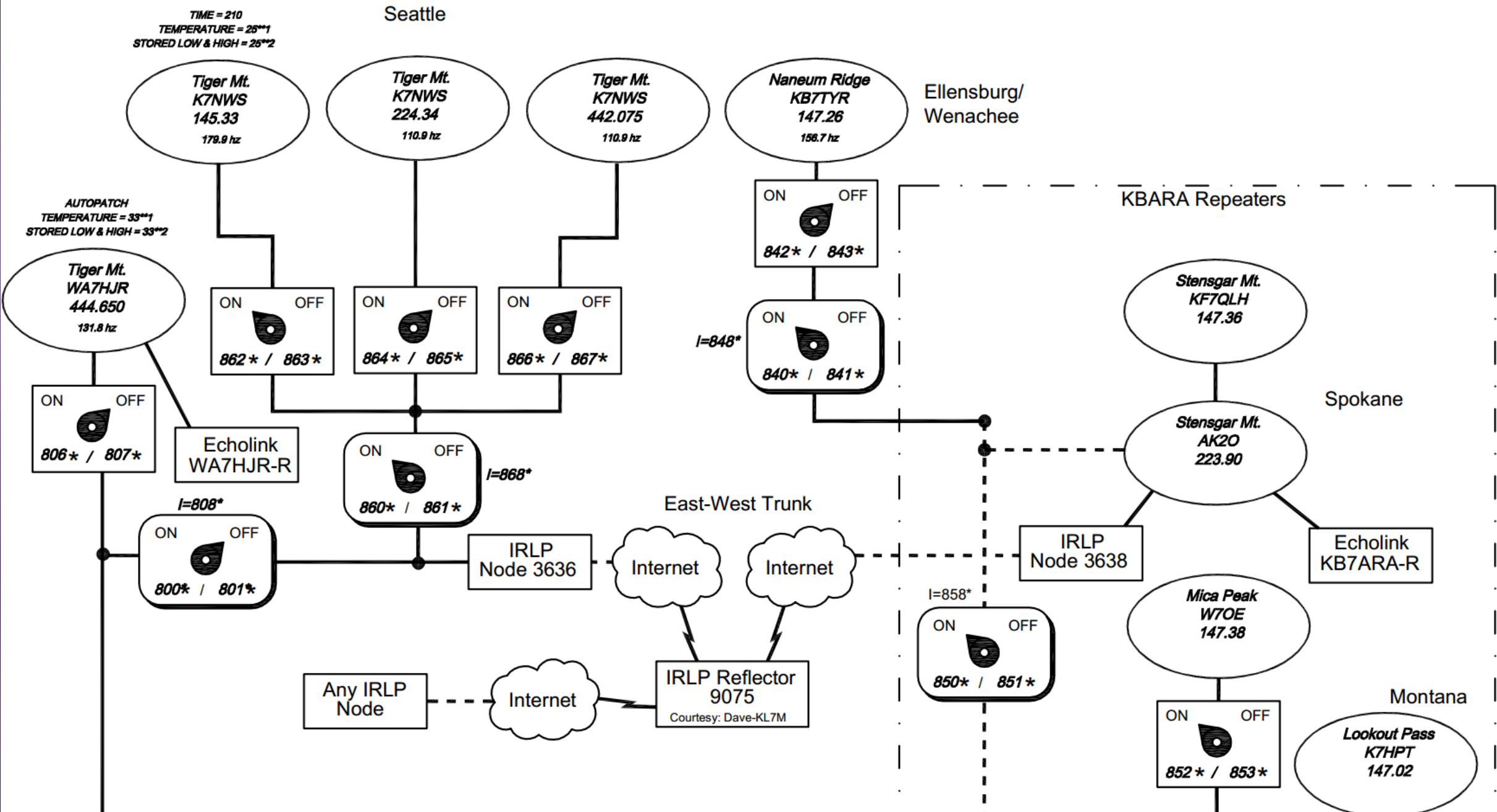
IRLP Node

IRLP Node

- PiRLP Complete Kit bundle from Internet Radio Linking Project ($330)
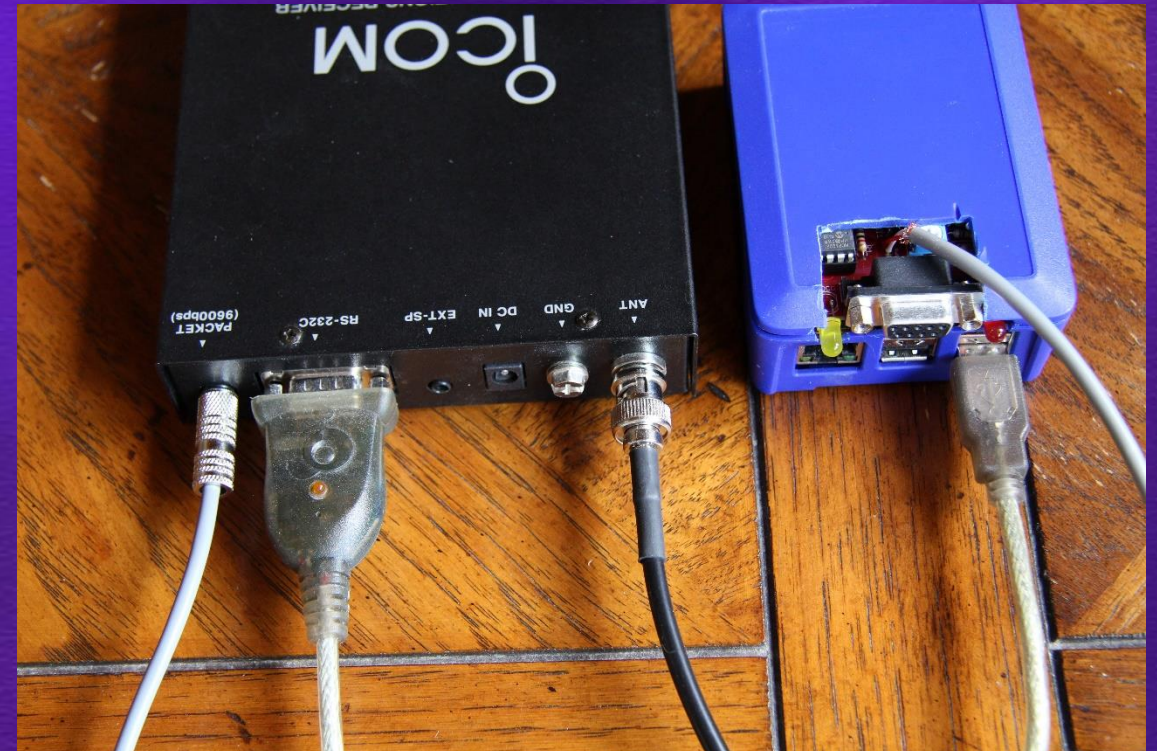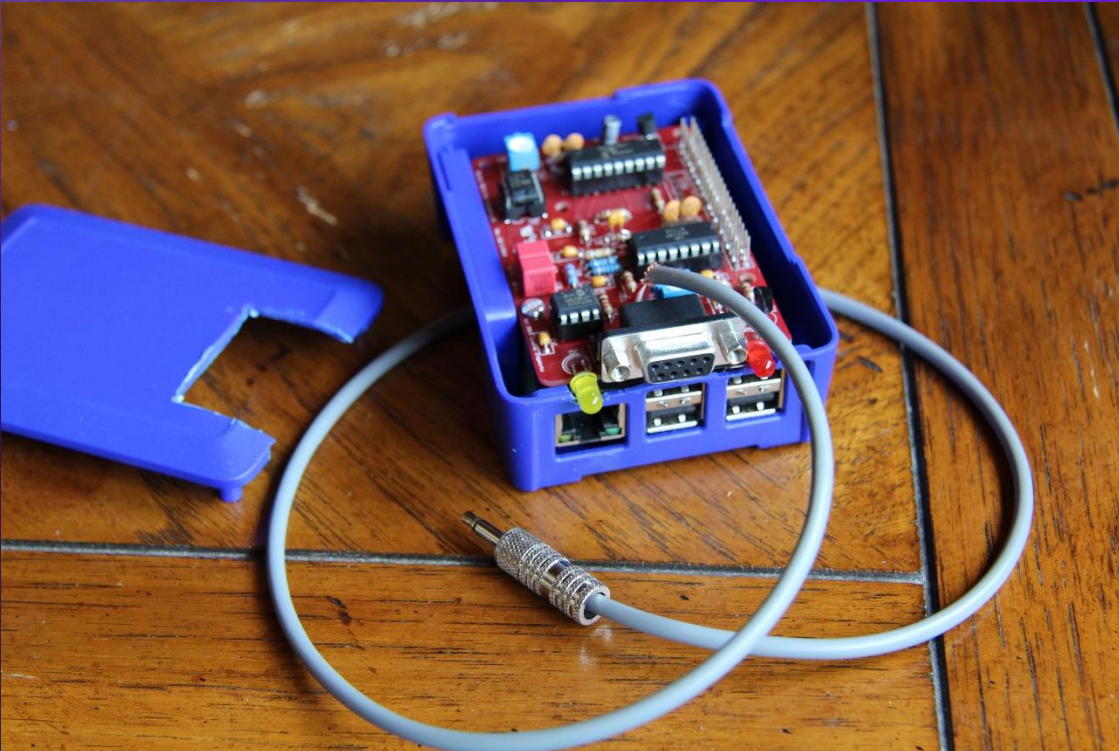
West Side Node, Tiger Mountain – IRLP Node 3636 connected to IRLP Reflector 9075

Packet Radio

Packet Radio

- TNC-Pi ($40 Kit, $65 assembled)
- APRS applications
- Winlink, Other applications?

APRS

APRS

- Linux Software:
  - Xastir
    - Graphical, map based APRS display, i-gate, messaging
    - BYO TNC
    - Old-ish GUI
  - YAAC – Yet Another APRS Client
    - Java based, platform independent
    - Very nice maps
  - Direwolf
    - Software and soundcard based TNC / APRS Digipeater / i-gate / APRStt Gateway
  - APRX - Linux based Digipeater, i-gate
  - Aprsg -Simple i-gate runs as a background service

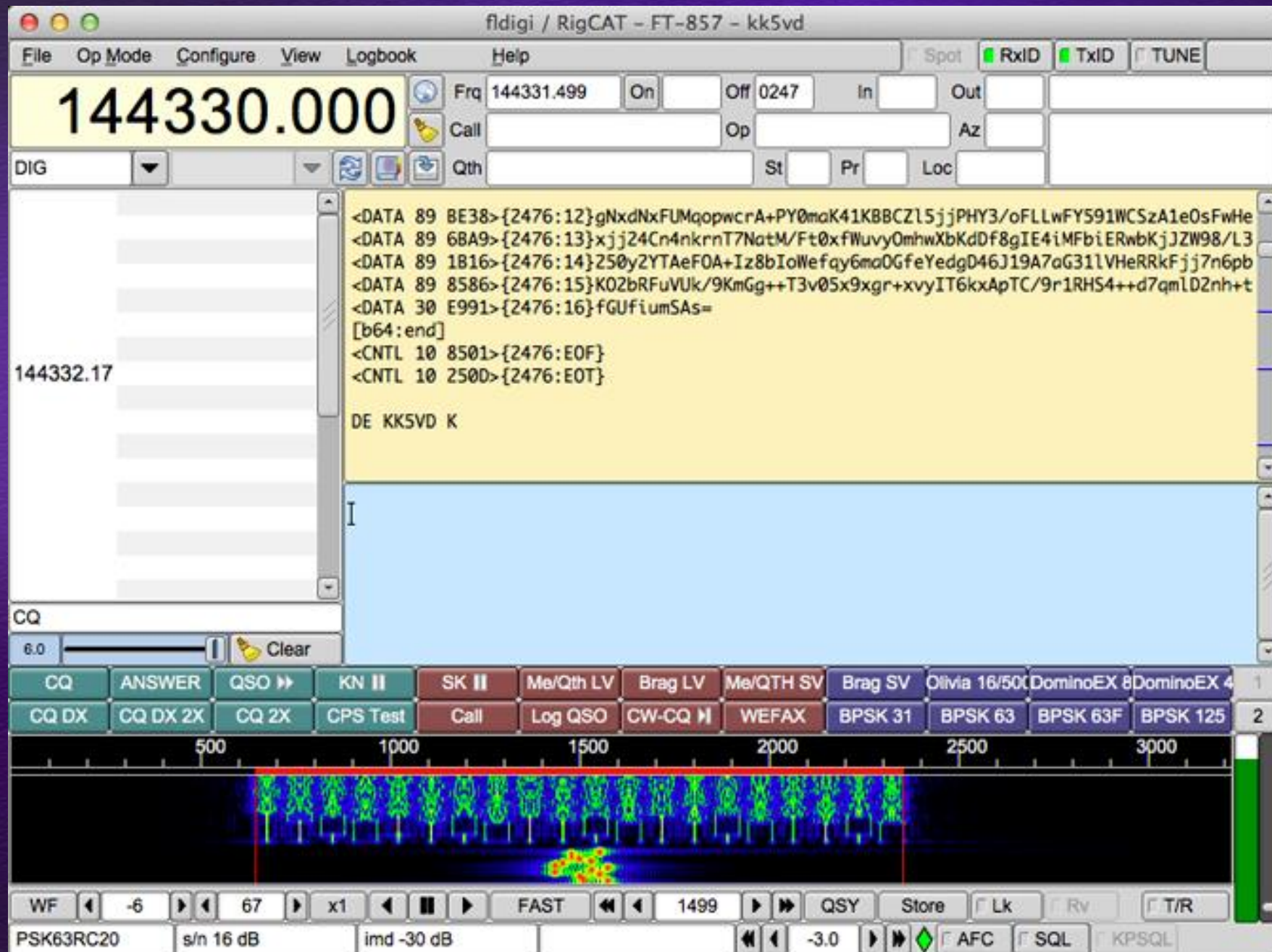# Rig Control –and digital modes

Rig Control –and digital modes

- FLDigi
  - Easily installed from the usual software repository
  - Need USB sound card (Signalink, etc.)
  - Does all the usual digital modes (PSK31, RTTY, etc)
  - Large list of HF rigs can be controlled
  - QSO and Contesting Logging
  - Easily controlled remotely using VNC
- WSJTX
  - JT65, F8, etc.

CHIRP

CHIRP

- Written by Dan Smith, KK7DS
- Amateur transceiver memory programming
- Wide assortment of supported radios
- Import frequencies from RFinder, RepeaterBook, etc.
- Written in Python, works on any platform
- Works great on Raspberry Pi

USBbuddy from Powerwerx
Provides ample USB power from
your car to run an RPi.

CHIRP

File   Edit   View   Radio   Help

Generic CSV: Untitled.csv* X

Memories   Memory range: 1 ⇕ - 250 ⇕ Go   ☐ Special Channels ☑ Show Empty

D-STAR	Loc ⌄	Frequency	Name	Tone Mode	Tone	ToneSql	DTCS Code	DTCS Pol	Duplex	Off
	1	145.110000	W7EXH	Tone	100.0	88.5	023	NN	-	0.6(
	2	145.110000	KB7PSM	Tone	103.5	88.5	023	NN	-	0.6(
	3	145.110000	W7EXH	Tone	100.0	88.5	023	NN	-	0.6(
	4	145.110000	KB7LNR	Tone	162.2	88.5	023	NN	-	0.6(
	5	145.130000	K7TVL	Tone	100.0	88.5	023	NN	-	0.6(
	6	145.150000	W7NYW	Tone	100.0	88.5	023	NN	-	0.6(
	7	145.150000	WA7ROB	Tone	94.8	88.5	023	NN	-	0.6(
	8	145.150000	W7NYW	Tone	110.9	88.5	023	NN	-	0.6(
	9	145.150000	WA7TYD	Tone	162.2	88.5	023	NN	-	0.6(
	10	145.150000	N7EZY	Tone	162.2	88.5	023	NN	-	0.6(
	11	145.170000	W7NYW	Tone	110.9	88.5	023	NN	-	0.6(
	12	145.170000	W7EXH	Tone	100.0	88.5	023	NN	-	0.6(
	13	145.190000	WA7ABU	Tone	100.0	88.5	023	NN	-	0.6(
	14	145.190000	K6QIE	Tone	162.2	88.5	023	NN	-	0.6(
	15	145.190000	W7OC	Tone	146.2	88.5	023	NN	-	0.6(
	16	145.190000	W7NTO	(None)	88.5	88.5	023	NN	-	0.6(
	17	145.210000	WA6RHK	Tone	136.5	88.5	023	NN	-	0.6(
	18	145.210000	N7HTN	Tone	110.9	110.9	023	NN	-	0.6(
	19	145.210000	KA7GNK	Tone	88.5	88.5	023	NN	-	0.6(

[0] Completed Getting memory 250 (idle)

Other Ham Radio Applications

- TAPR WSPR-Pi 20M QRP Transceiver
- ADS-B Aircraft tracker using an RTL-SDR dongle - FlightAware
- Simple Low power FM-Wide Transmitter
- Echolink using SVXLink software. Quad core Pi only.
- RPi based analog repeater controller using SVXLink hardware
  - openrepeater.com
- PiClock – Wall clock with weather
- Antenna design
- Satellite tracking
- Lots more! 129 packages under
"Amateur Radio" in Linux Mint

73 de W4LKS kn

- DV8 Digital modes net in Spokane on 146.56 mHz simplex
- Tuesdays and Thursdays at 1900, Sundays at 2000
- Information on our Groups.io page: https://groups.io/g/wa7dre