Intro to Digital Voice Modes, including D-STAR, DMR and YSF

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Who's
Brian Young - KA9QJT?

- Licensed in the early 1980s in South-Central Wisconsin
- Raleigh resident since early 2001
- Ham Interests:
  - HF through 440Mhz – mostly digital modes
  - 24/7 LinBPQ Packet Node on a Raspberry Pi (14.105 USB and internet-gated)
  - TARPN
  - D-STAR and DMR (Raspberry Pi-based Hotspots, OpenSpot)
  - Ham Public Service NC - Volunteering for, and coordinating events (HPSNC.org)
- I'm and enthusiast, not an expert

Agenda

- Demo
- Background: D-STAR, DMR and Yaesu System Fusion
- Options for personal operations
- DMR-focused hotspot setup example
- DMR Radios and other helpful info
- New! Understanding the PRN DMR Network
- A bit more D-STAR and YSF info
- Things I've learned
- Taking a Digital Hotspot on the road
- Additional Q&A

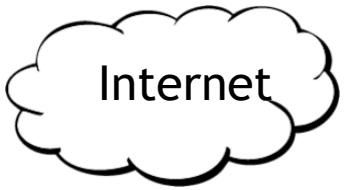
Let's keep it interactive! The slides will be available later for your reference.

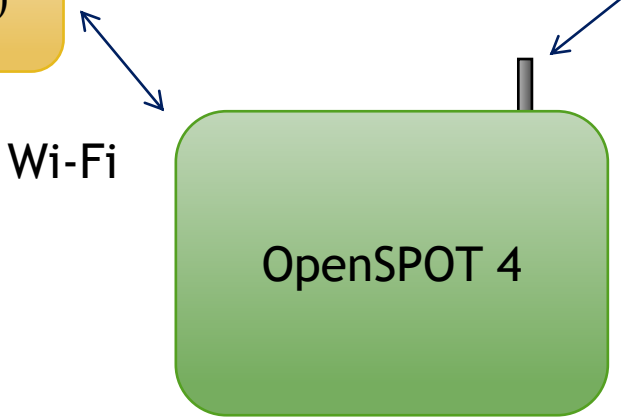
D-STAR and DMR Demos

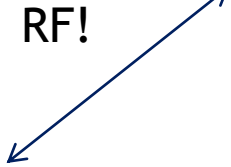
- D-STAR through a Hotspot
- DMR (Brandmeister Network) through a Hotspot
- And perhaps a DMR local contact through a NCPRN repeater

openSPOT 4 by SharkRF

- openSpot 4 (self-contained battery)
- SharkRF mobile app
- My Android cellphone







What are D-STAR and DMR Anyway?

- D-STAR: **D**igital **S**mart **T**echnologies for **A**mateur **R**adio
  - Developed in **Japan** in the late '90s, but most changes appeared in 2004
  - **Digital voice (DV) and Digital Data (DD)**
  - **Less bandwidth** than analog – just 6.25 kHz vs. 16 kHz
  - Radios by Icom, Kenwood*
  - 2m, 1.25cm*, 70cm, 23cm and HF
  - Longer P2P (point to point) distance compared to FM
  - Registration required for communications beyond your local repeater
    - **Access to Reflectors** (conference bridges)
  - Reflector networks include D-Plus (REF), along with DCS and D-Extra (XRF)

- DMR: **D**igital **M**obile **R**adio
  - **European** standard – commercial roots
  - DMR Tier II (used by amateurs) was published in 2005
  - 12.5 kHz channel spacing, effectively **2 time slots** on each channel (TDMA)
  - 2m and 70cm in use (differs by region)
  - Longer P2P distance compared to FM
  - ID required, which you program in your radio
  - **NCPRN and Western NC systems:** Wide-area repeater systems covering a lot of the Southeast
  - DMR-Marc: Worldwide, Motorola-focused wide-area repeater system
  - **Brandmeister and TGIF Networks** of worldwide homebrewed repeaters and well-supported by hotspots
  - **Talkgroups** are similar in concept to D-STAR Reflectors

And what about Yaesu System Fusion?

- System Fusion:
  - **Yaesu's implementation** of “Digital Amateur Radio”
  - **C4FM** - 4-level FSK Technology to transmit digital voice and data
  - **Less bandwidth** than analog – just 6.25 kHz or 12.5 kHz voice modes
  - Shared simultaneous voice and data sharing 12.5 khz
  - FDMA (Frequency Division Multiple Access)
  - 2m and 70cm in use
  - Longer P2P distance compared to FM
  - **Yaesu repeaters**: Analog or Digital conversations supported
  - Wires-X Network (all Yaesu – **“Rooms”**)
  - Alternative networks:
    - FCS Network
    - YSFReflector Network
  - Similar concept to D-STAR Reflectors and DMR Talkgroups

Why get interested in D-STAR, DMR or YSF?

- More repeater choices are always better, right?
- Digital audio fidelity* can become addictive
- The P2P (point to point) distance a signal remains intelligible will surprise you
- Talk worldwide with an HT (Internet-aided)
- RF and non-RF (PC-only) options for all
- Some support for cross-mode linking (YSF and DMR, D-Star and DMR)
- Opportunity to learn something new. Dive as deep as you want!
- It's another way you can put a Raspberry Pi to use

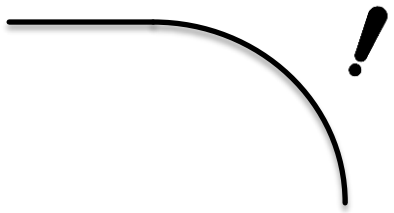
* Everyone's ears are different. Everyone has an opinion.

Digital FM

As distance increases, your signal remains clear… until you fall off the cliff

Analog FM

As distance increases, noise also increases on your signal



Repeaters vs. Hotspots

- Public Repeaters
  - Internet connection required
    - D-STAR: Access to **Reflectors**
    - DMR: Access to **Talkgroups**
    - YSF: Access to **Rooms** (Wires-X)
    - Access to other repeaters
  - Linking to Reflectors, Talkgroups ,or Rooms is defined by the repeater owner
    - Fixed/Scheduled or limited on-demand

- Personal Hotspots
  - Internet connection required
  - Some assembly (or configuration) required
  - Most DIY Hotspots involve a Raspberry Pi
  - There are also standalone hotspot products (OpenSpot)
  - You control access to what you connect to, and for how long
  - D-STAR: Access to the D-Plus (REF) Reflectors, along with DCS, XLX and D-Extra (XRF) Reflectors – many choices!
  - DMR: Hotspots allow access to the Brandmeister, TGIF and DMR+ networks' Talkgroups
    - Access back to repeater networks, only if a repeater owner provides a bridge to their repeater
  - YSF: Hotspots allow access to FCS and YSF Reflector networks

Where are the local Repeaters?

Several choices and more coming

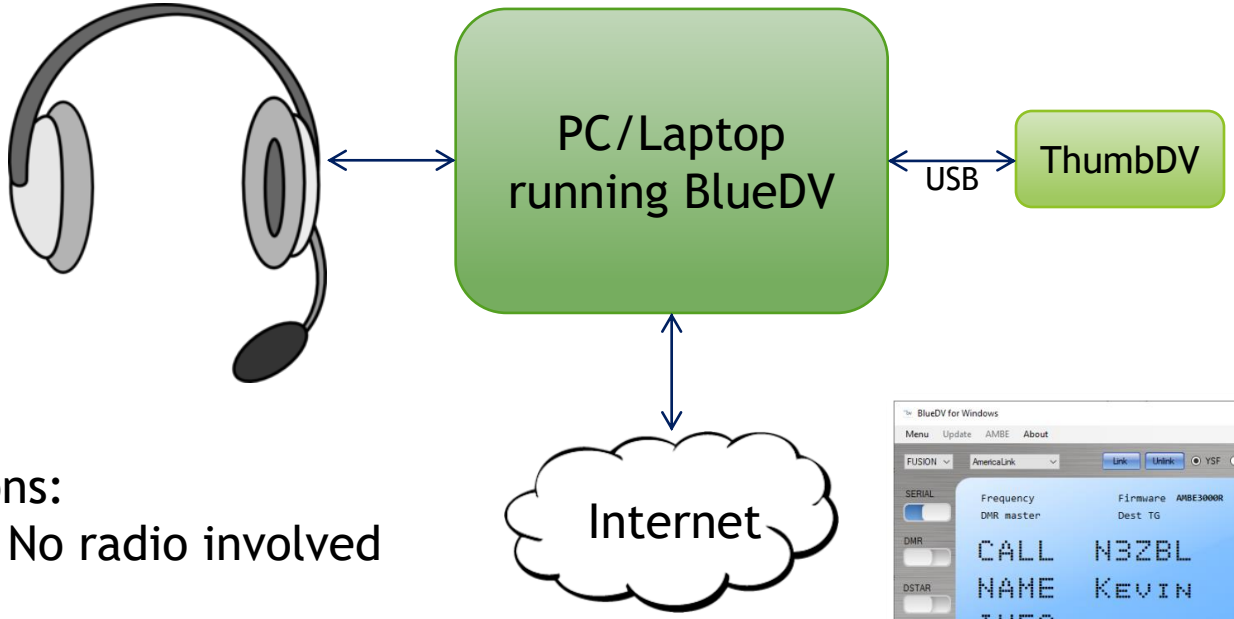
- D-STAR
  - Greensboro (ND4L): 441.9250 Mhz +5.00
  - Greensboro (W4GSO): 442.8625 Mhz +5.00 (and DMR, Fusion)
- DMR
  - Raleigh NCPRN (K4ITL): 443.3375 Mhz +5.00
  - Cary NCPRN (KB4CTS): 443.7875 Mhz +5.00
  - Hillsboro NCPRN (WR4AGC): 443.1375 Mhz +5.00
  - Nashville NCPRN (KB4CTS): 442.6125 Mhz +5.00
  - Cary Brandmeister (W1CKD): 441.3625 Mhz +5.00
  - (Developing) Rolesville Brandmeister? 444.950 Mhz +5.00
- YSF
  - Raleigh W4BAD: 443.175 +5.00 (Fusion, Wires-X)
  - Durham W4BAD: 147.36 +0.6 (Fusion, Wires-X) (up?)

What are my options for personal D-STAR, DMR and YSF operations?

ThumbDV™ by NW Digital Radio

Pros:

- No radio required to play
- Your Windows PC is the Digital Voice Terminal
  - D-STAR, DMR and YSF via the AMBE300x chip
- Uses simple BlueDV software
- Low price to play (~~$119~~ $99)



Cons:

- No radio involved

Alternate:

- DVMEGA DVStick30

DV Mega by PE1PLM (Guus van Dooren)

Pros:

- Supports Multiple Modes: D-STAR, DMR, YSF, others
- Allows “walk-about” access to your own Hotspot
- Easy to setup for multi-mode, portable use
- You’re in control (Reflector, Talkgroup connections)

D-STAR DMR YSF

RF!

DVMEGA

Single Band UHF or Dual Band Versions

Power Source

USB

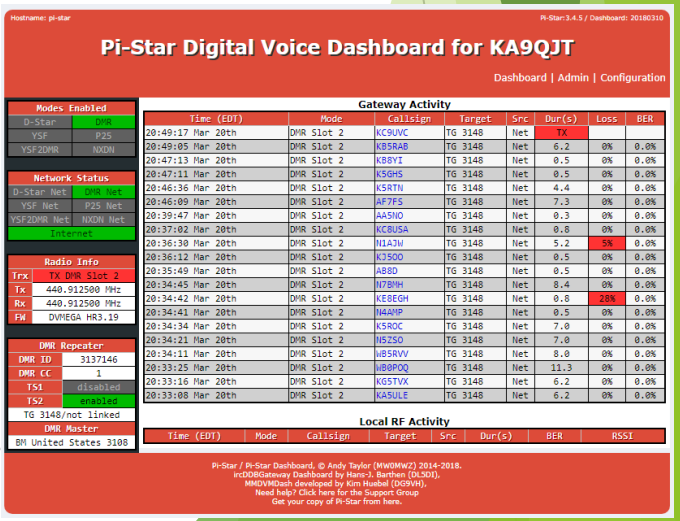
Raspberry Pi

Ethernet or Wi-Fi

Internet

Cons:

- Requires one or more radios
- Some “assembly” required
- ~$110+, plus R-Pi, etc.



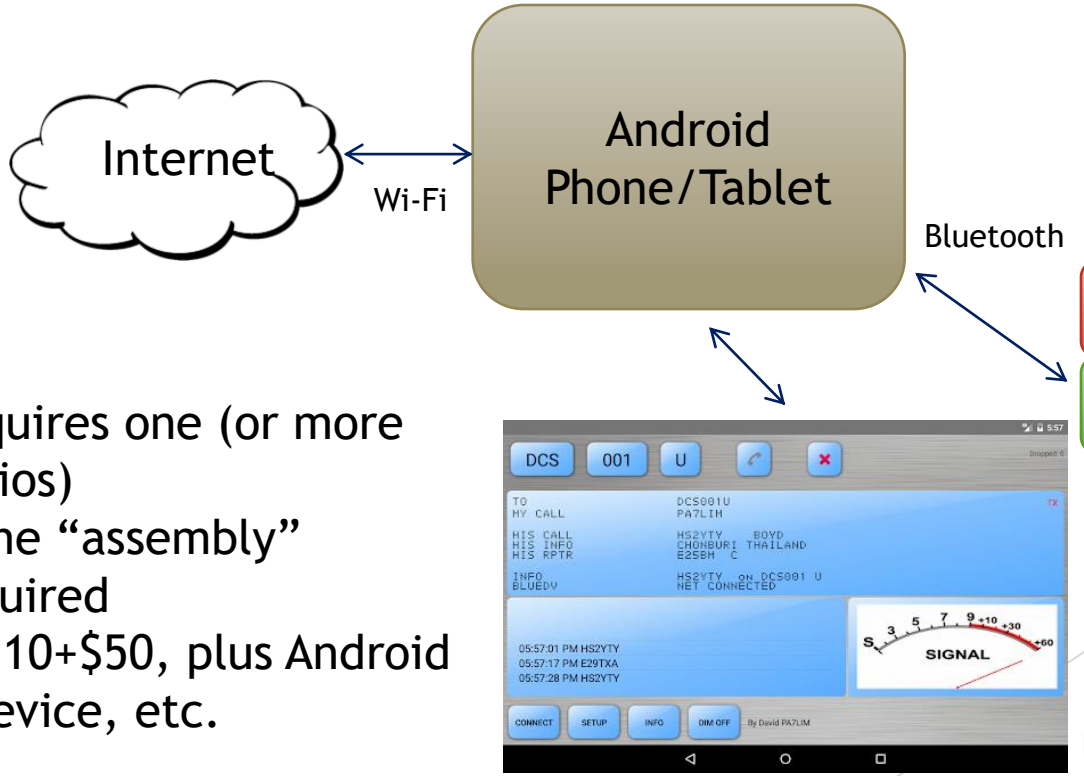
DV Mega with BlueStack Micro+

Pros:

- Supports Multiple Modes: D-STAR, DMR, YSF, others
- Android Phone/Tablet used as the control interface with PA7LIM BlueDV software (Android, iOS, Linux, Windows)
- Allows "walk-about" and portable access to your own multi-mode Hotspot
- You're in control (Reflector, Talkgroup connections)

D-STAR DMR YSF

RF!



Cons:

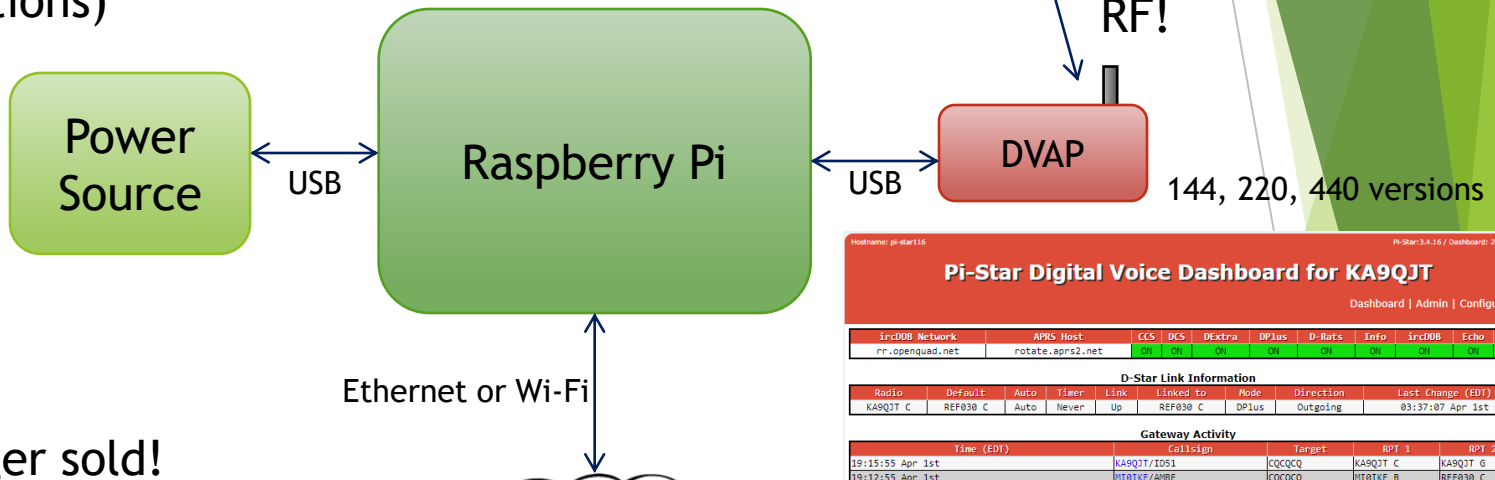
- Requires one (or more radios)
- Some "assembly" required
- ~$110+$50, plus Android device, etc.

DVAP (DV Access Point) by Internet Labs

Pros:

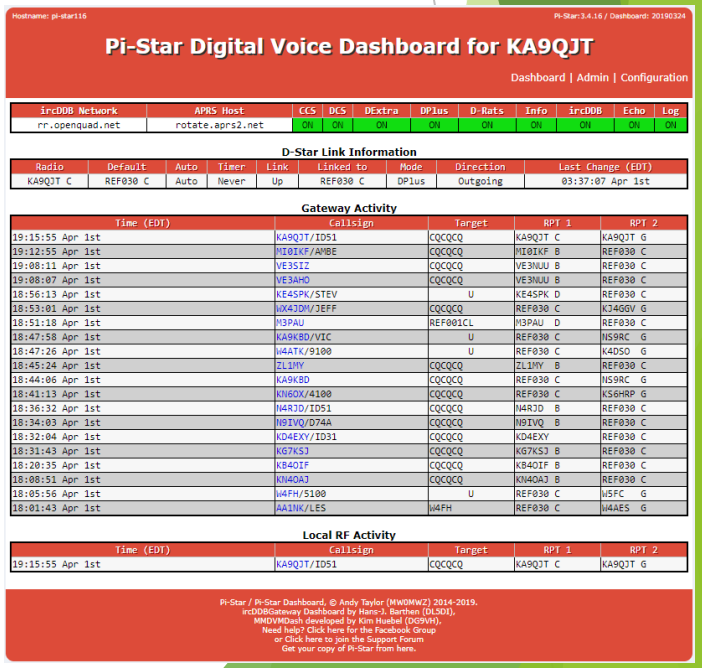
- Allows “walk-about” access to your own D-STAR Hotspot
- Easy to setup for portable use
- You’re in control (Reflector and Repeater connections)

RF!



Cons:

- No longer sold!
- D-STAR Only
- Requires a D-STAR radio
- Some “assembly” required (Pi or PC)
- ~$240, plus R-Pi (or PC), etc. (check eBay)



Hostname: pi-star116 — Pi-Star:3.4.16 / Dashboard: 20190324

Pi-Star Digital Voice Dashboard for KA9QJT

Dashboard | Admin | Configuration

ircDDB Network	APRS Host	CCS	DCS	DExtra	DPlus	D-Rats	Info	ircDDB	Echo	Log
rr.openquad.net	rotate.aprs2.net	ON	ON	ON	ON	ON	ON	ON	ON	ON

D-Star Link Information

Radio	Default	Auto	Timer	Link	Linked to	Mode	Direction	Last Change (EDT)
KA9QJT C	REF030 C	Auto	Never	Up	REF030 C	DPlus	Outgoing	03:37:07 Apr 1st

Gateway Activity

Time (EDT)	Callsign	Target	RPT 1	RPT 2
19:15:55 Apr 1st	KA9QJT/ID51	CQCQCQ	KA9QJT C	KA9QJT G
19:12:55 Apr 1st	MI0IKF/AMBE	CQCQCQ	MI0IKF B	REF030 C
19:08:11 Apr 1st	VE3SIZ	CQCQCQ	VE3NUU B	REF030 C
19:08:07 Apr 1st	VE3AHO	CQCQCQ	VE3NUU B	REF030 C
18:56:13 Apr 1st	KE4SPK/STEV	U	KE4SPK D	REF030 C
18:53:01 Apr 1st	WX4JDM/JEFF	CQCQCQ	REF030 C	KJ4GGV G
18:51:18 Apr 1st	M3PAU	REF001CL	M3PAU D	REF030 C
18:47:58 Apr 1st	KA9KBD/VIC	U	REF030 C	NS9RC G
18:47:26 Apr 1st	W4ATK/9100	U	REF030 C	K4DSO G
18:45:24 Apr 1st	ZL1MY	CQCQCQ	ZL1MY B	REF030 C
18:44:06 Apr 1st	KA9KBD	CQCQCQ	REF030 C	NS9RC G
18:41:13 Apr 1st	KN6OX/4100	CQCQCQ	REF030 C	KS6HRP G
18:36:32 Apr 1st	N4RJD/ID51	CQCQCQ	N4RJD B	REF030 C
18:34:03 Apr 1st	N9IVQ/D74A	CQCQCQ	N9IVQ B	REF030 C
18:32:04 Apr 1st	KD4EXY/ID31	CQCQCQ	KD4EXY	REF030 C
18:31:43 Apr 1st	KG7KSJ	CQCQCQ	KG7KSJ B	REF030 C
18:20:35 Apr 1st	KB4OIF	CQCQCQ	KB4OIF B	REF030 C
18:08:51 Apr 1st	KN4OAJ	CQCQCQ	KN4OAJ B	REF030 C
18:05:56 Apr 1st	W4FH/5100	U	REF030 C	W5FC G
18:01:43 Apr 1st	AA1NK/LES	W4FH	REF030 C	W4AES G

Local RF Activity

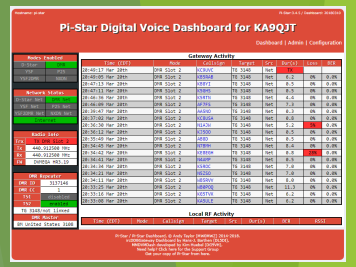
Time (EDT)	Callsign	Target	RPT 1	RPT 2
19:15:55 Apr 1st	KA9QJT/ID51	CQCQCQ	KA9QJT C	KA9QJT G

Other Raspberry Pi-based multi-mode hotspots (D-Star, DMR, YSF, others)

Zum Radio with Raspberry Pi Zero W and display - assembled
~$199

Common MMDVM Hotspot with Raspberry Pi W and small display
~$100+ (various sources, Amazon, eBay)

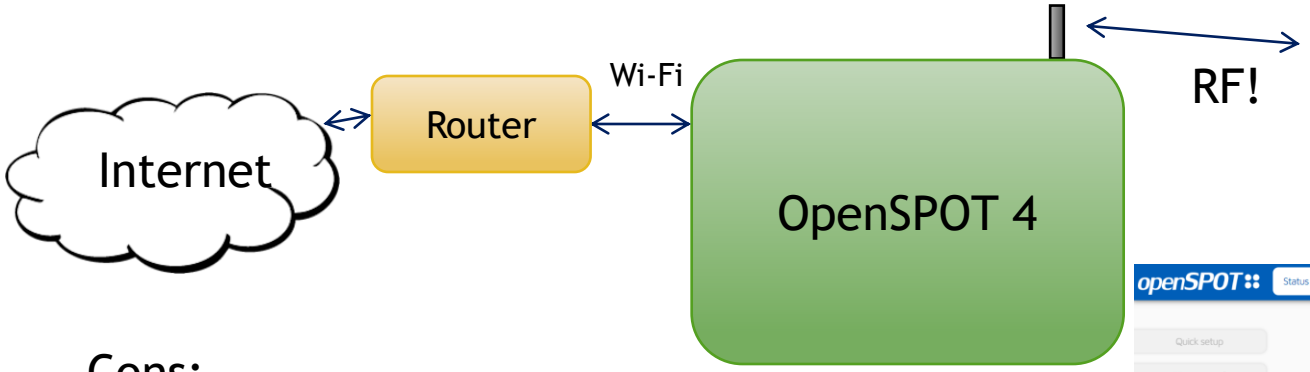
Rugged SPOT Nex-Gen with Raspberry Pi 3, display and case
~$249



openSPOT 4 and 4 Pro by SharkRF

Pros:

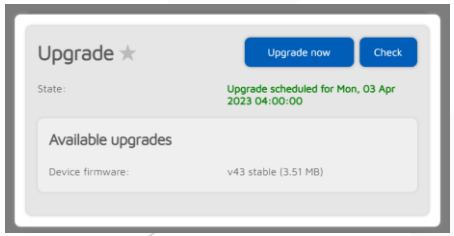
- Supports Multiple Modes: D-STAR, DMR, YSF, others
- Self-contained with battery (connect it via Wi-Fi)
- Configured and managed with a web browser/mobile app
- Allows “walk-about” access to your own multi-mode Hotspot
- You’re in control (Reflector, Talkgroup connections)
- Transcoding between D-Star and other modes



Cons:

- ~~Requires one or more radios~~
- Only supports a Wi-Fi connection (a con?)

Original “wired” OpenSPOT, still a good used value



The Openspot 4 Pro

The openSPOT4 Pro adds extra transcoding hardware.

- ✓ Use your D-STAR transceiver to access DMR, C4FM, NXDN networks
- ✓ Or use your DMR, C4FM, NXDN transceiver to access D-STAR networks

The Openspot 4 Pro also supports radio-less operation. Use their SharkRF Link app on your computer or phone to talk.

Usual Spring Sale, every April!
Openspot 4: 230 euro (~$250)
Openspot 4 Pro: 292 euro (~$320)


1 3 5
R 2 4 6

Walking through a setup experience

DMR with a MMDVM Hotspot

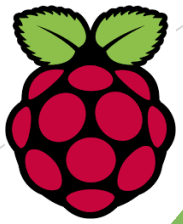
1st Step: Register for a personal DMR ID

- RadioID provides a registration service
- You only need one ID, even if you have multiple DMR Radios
- Today, there are nearly 240K registered DMR IDs worldwide, and 107K IDs in the US alone!

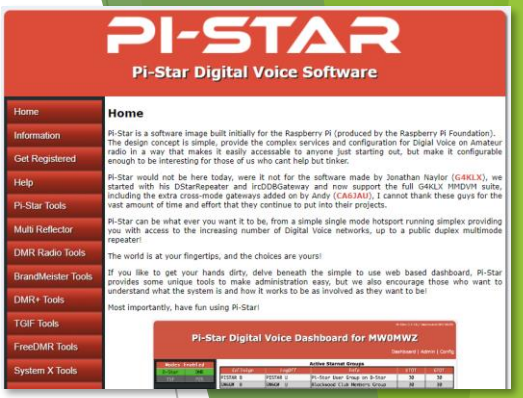
Fun fact: 70K US IDs in April ‘22

Example: DMR with a MMDVM Hotspot using a Raspberry Pi Zero W

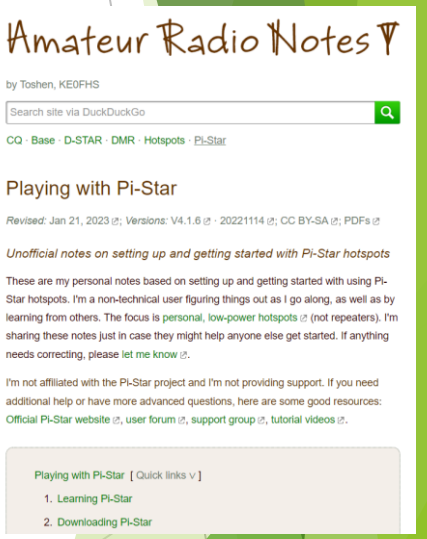
- What's needed?
  - MMDVM board (UHF or VHF) (eBay and other sources)
  - Raspberry Pi Zero WH (H = with the header)
  - USB Power Source (5V, 2.5A!) and cable
  - Accessible Wi-Fi
  - Quality 8GB or larger MicroSD Card (Class 10)
  - Pi-Star "image"
  - PC for downloading and writing the "image" to the card
  - DMR HT or mobile radio



The Image?
What Image?

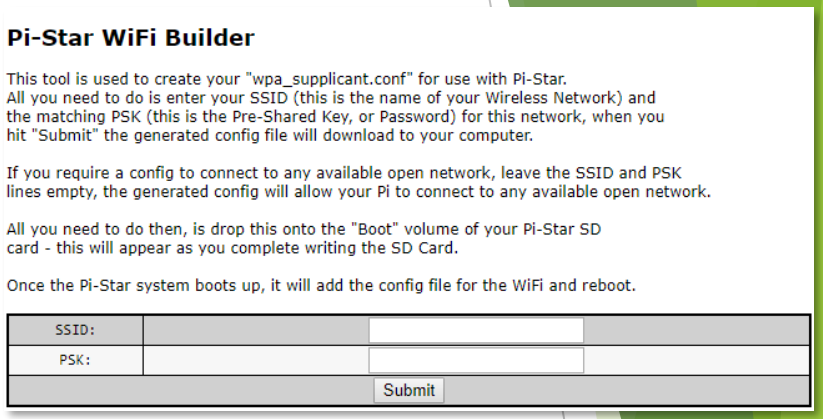


- Raspberry Pi runs Linux
  - The OS, file system and applications need to be organized on the MicroSD card
  - The chosen “image” must be written byte by byte to the card
- Ready-made image is downloadable
  - Pi-Star (Today’s gold standard!)
  - Read the Playing with Pi-Star notes from Toshen KE0FHS
- Install an SD Card Reader/Writer
  - Win32Disk Imager (Windows)
  - Etcher (Windows and macOS)
  - Others for macOS and Linux
- Write the image to the card
  - A MicroSD card might require a full-size adapter or a USB-connected reader/writer
  - Ignore Windows telling you to format the card
  - Properly “Eject” the card before removal (Etcher does this for you)



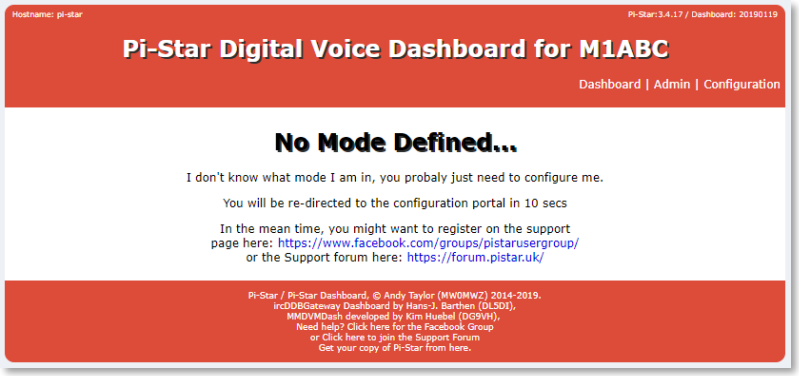
Preparing the Pi for 1st boot!

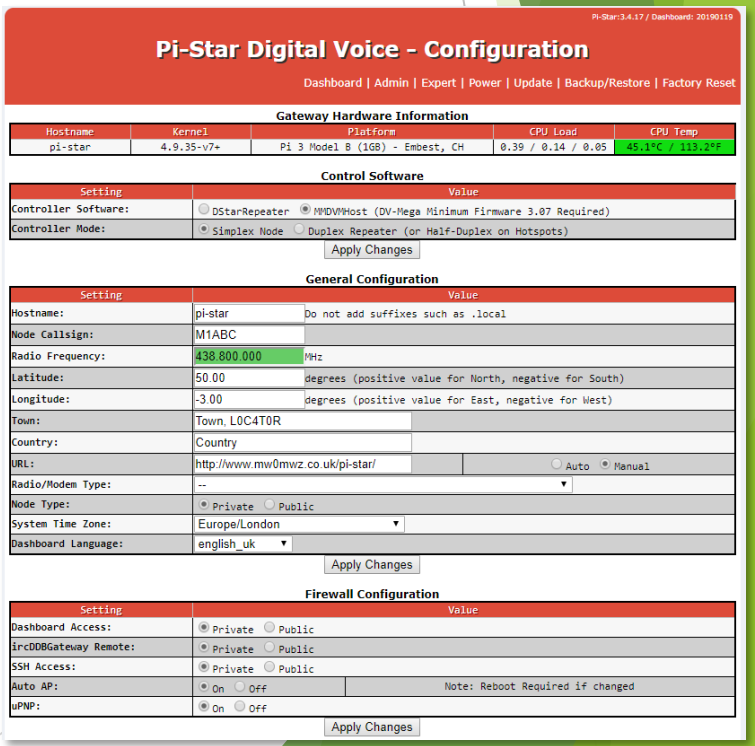
- Preparing for a Wi-Fi connection
  - Run the Pi-Star Wi-Fi Builder utility
  - Enter your Wi-Fi access point name (SSID) and password (PSK)
  - Creates a file called *wpa_supplicant.conf*
  - Copy this file onto your MicroSD card
  - On first boot, your Pi will immediately connect to your Wi-Fi network
- Carefully insert the MicroSD Card
  - One way in!
- Get ready to power things up
  - Suitable power supply? 2.5A or more
  - USB cable from power supply to Pi?
- Go for it!



Configuring Pi-Star for DMR use after 1st boot

- Find the Raspberry Pi on your home network – What IP address?
  - Check your router's DHCP clients list
  - Run an app like Fing to scan your network, looking for a Raspberry Pi
- Point your PC's web browser at the Pi's IP address (192.168.something.something, usually)
  - Success will result in you seeing the No Mode Defined screen (Normal!)





- Move on to setting things up for DMR connectivity

DMR Configuration

- Make the Control Software Selection
  - Choose MMDVH Host
  - Still a Simplex Node

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

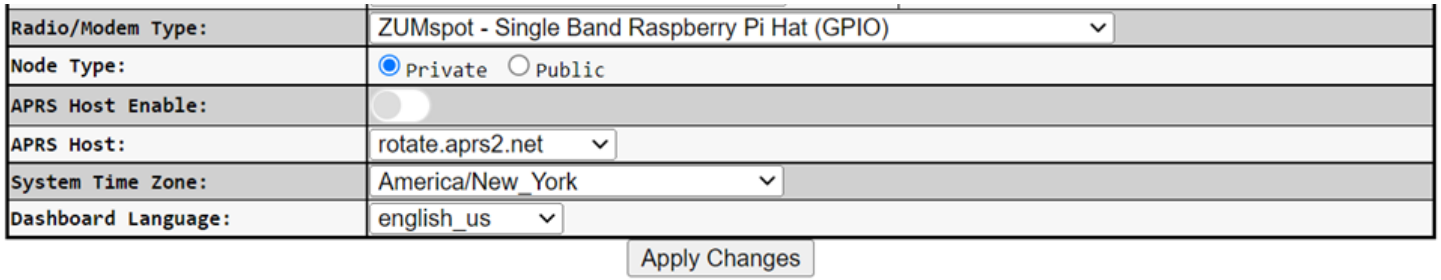
- Move on to General Configuration
  - Enter your Callsign
  - Enter your DMR ID
  - Enter the frequency for your Hotspot
  - Enter the Latitude and Longitude of your station
  - Enter your Town, locator and Country info
  - Select Auto, for callsign lookup, using QRZ

General Configuration

Setting	Value	
Hostname:	pi-star73 Do not add suffixes such as .local	
Node Callsign:	KA9QJT	
CCS7/DMR ID:	3137146	
Radio Frequency:	440.912.500 MHz	
Latitude:	35.897100 degrees (positive value for North, negative for South)	
Longitude:	-78.54960 degrees (positive value for East, negative for West)	
Town:	Raleigh NC	
Country:	USA	
URL:	https://www.qrz.com/db/KA9QJT	◉ Auto ○ Manual

Configuration continues…

- Choose ZumSpot Single Band Raspberry Pi Hat (GPIO) as your Radio/Modem Type
- Decide whether you want your Node Type (Hotspot) to allow Public access (other Hams will be able to us it with their radios) or remain private
- Enable APRS position reporting if interested
- Select the appropriate Timezone and Dashboard language
- Apply the Changes!



MMDVM Host Configuration…

- Turn on DMR Mode
  - Yes, you can use this section to add other modes. (KISS)
- If your board has a display, pick the MMDVM Display Type
  - OLED Type 3 in this example
- Apply the Changes! (after the reboot, the DMR Configuration settings section will appear)

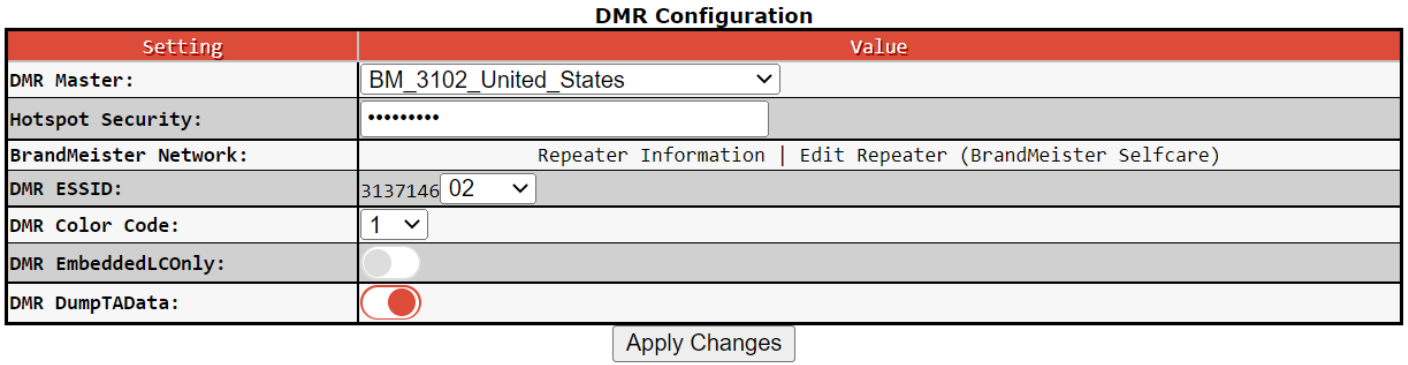
MMDVMHost Configuration

Setting	Value
DMR Mode:	RF Hangtime: 20 Net Hangtime: 20
D-Star Mode:	RF Hangtime: 20 Net Hangtime: 20
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:	OLED Type 3 Port: /dev/ttyAMA0 Nextion Layout: ON7LDS L2

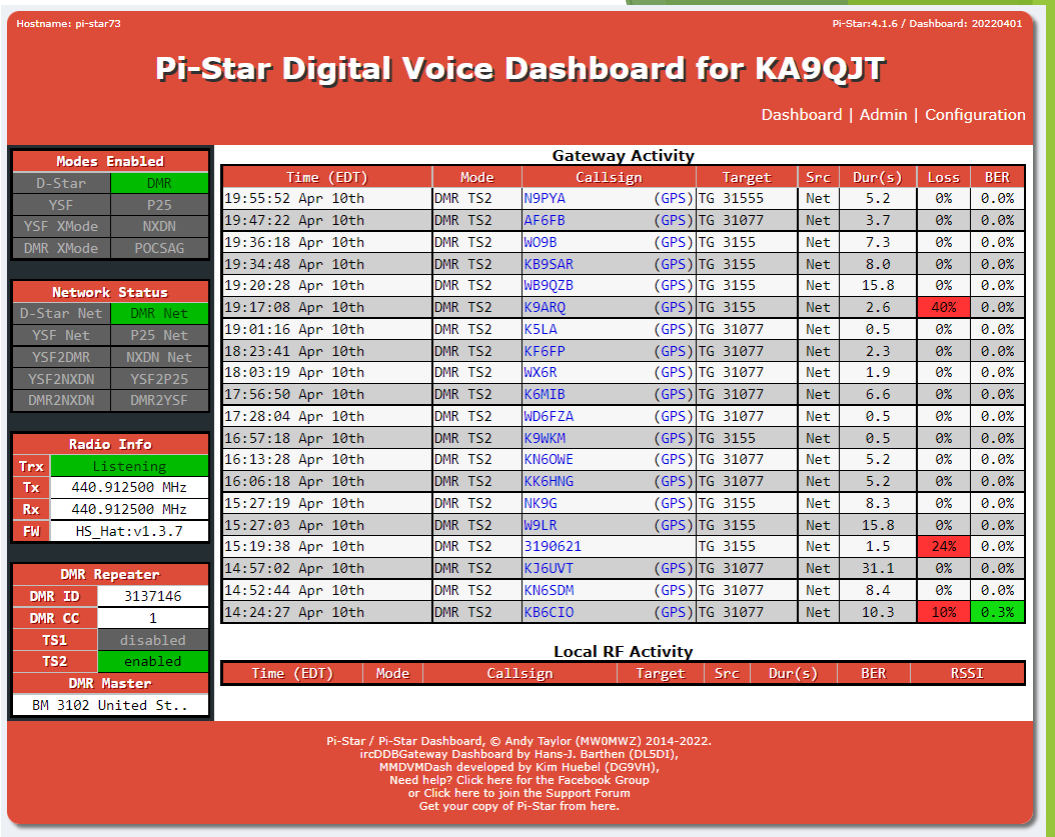
Apply Changes

DMR-specific Configuration…

- Select a DMR Master from the list (3102 is a good choice)
- The BrandMeister Network now requires a self-managed password – enter it here (See the article here)
- If you have more than one DMR hotspot, they share your ID, but you can add a suffix to keep them separate (02 in this example)
- Set DMR Color Code to 1
- Turn DumpTAData on – this allows your hotspot to pass “Talker Alias” information to your radio. (i.e., name, callsign, location)
- Apply Changes… again



Using your Hostspot for DMR



- After applying the final changes, the Hotspot will reboot again! Yay!
- Time to check out the Dashboard (same IP address again!)
  - Modes Enabled: DMR should be green
  - Network Status: DMR Net should also be green
  - Radio Info: Listing/Transmitting, your frequency and firmware info
  - DMR “Repeater”: ID, Color Code and Timeslot 2
  - Gateway Activity: Lists callsigns and info related to others heard
  - Local RF Activity: Should show information received from your radio!

Your DMR Radio

- Lots of radio choices
  - Anytone D878 HT and D578 mobile models
  - TYT MD-UV380 dual band HT
  - Connect Systems CS800D mobile
  - Radioddity GD-88 HT, others

- **Build or share a Codeplug**
  - A Codeplug is a file containing the channel information you program into your given radio
  - Download and save the one from your radio (CPS: Customer Programming Software and cable required)
  - Organized by Zones – These are collections of related channels
  - Channels are specific to a frequency, but also link to a given Timeslot (1 or 2) and a Talkgroup
  - Talkgroups and individual user information (contacts) are also kept in the CodePlug
    - Radios display the name and registered location associated with the numerical ID of the radio transmitting
  - You will have multiple channels for each repeater (or Hotspot) you want to use – 1 channel per Talkgroup!
  - Is your radio Promiscuous or not?

- Use a Contact Manager program
  - N0GSG DMR Contact Manager
  - Easy to use – allows Codeplug content reuse between different radios
  - Supports importing the most recent user ID list
    - Newer radios have room for >300K user IDs

Another DMR Radio option: RFinder B1+ radio

- Yes, it's a radio. VHF/UHF, 4W/2W
  - Analog and DMR
  - Also, an Android tablet and 4G LTE cellphone!
  - Bluetooth, Wi-Fi and GPS
  - RFinder Application supports location specific repeater data.
    - No Codeplug creation necessary!
  - DMRoIP Application uses Wi-Fi/cellular data to connect the radio to BrandMeister DMR Talkgroups
    - No Hotspot required!
  - Well-supported and frequent updates to software

More info at the Rfinder Shop

Helpful DMR-related websites

- (Local) NCPRN Last Heard
  - Great place to go to see how you're being heard and where the other NCPRN activity is
- Brandmeister Network
  - Overall Dashboard for the network
  - Create a user account to register and manage your Hotspot (e.g., adding/removing static Talkgroups)
- Brandmeister Hoseline
  - A place to go to listen to audio streams, including your own transmitted audio
- Miklor DMR Radio website
  - DMR Radio Reviews
  - Codeplug and other DMR info and links
- AmateurRadio.digital
  - Per-radio wizard for DMR Contacts Database downloads
  - $12/yr. (worth it for the convenience!)

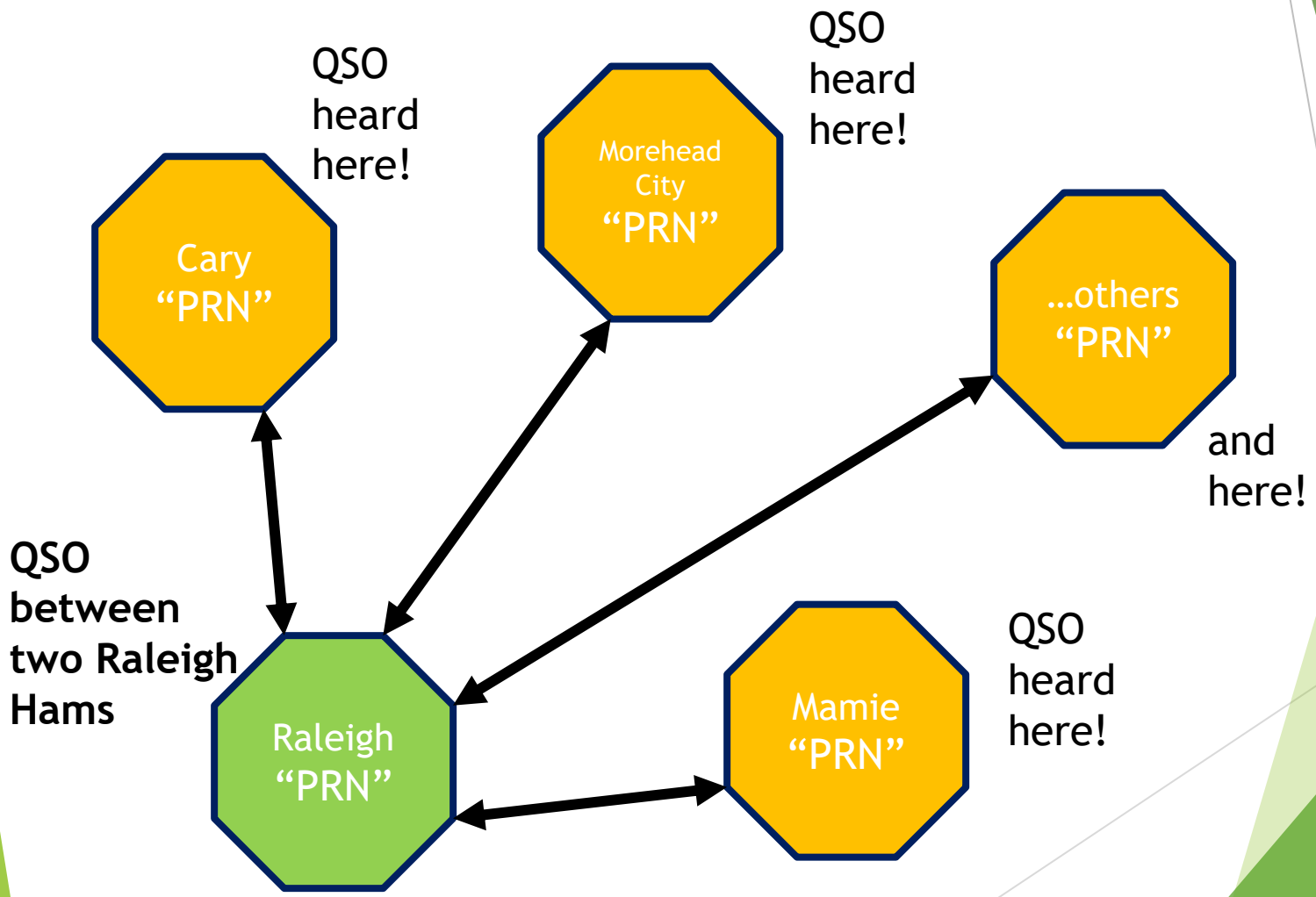

1 3 5
R 2 4 6

Understanding the PRN DMR Network

- Typically, you'll create a "Zone" for each repeater in the PRN system that you wish to use
- Example Zone: "Raleigh PRN"
  - Contains 5 Channels (All 443.3375+, 12.5k spacing, CC 1):
    - Raleigh PRN (PRN Talkgroup 2, Timeslot 2)
    - Raleigh Local (Local Talkgroup 27500, Timeslot 1)
    - Raleigh Chat 1 (Chat 1 Talkgroup 27501, Timeslot 1)
    - Raleigh Chat 2 (Chat 2 Talkgroup 27502, Timeslot 1)
    - Raleigh Echo (Echo Talkgroup 9998, Timeslot 1)
- A Cary PRN Zone will have the same structure, with five channels set to 443.7875+
- Repeater conversations can take place on Timeslot 1 and 2 at the same time!
- Now for some examples on how you can talk to others across the larger network of repeaters…

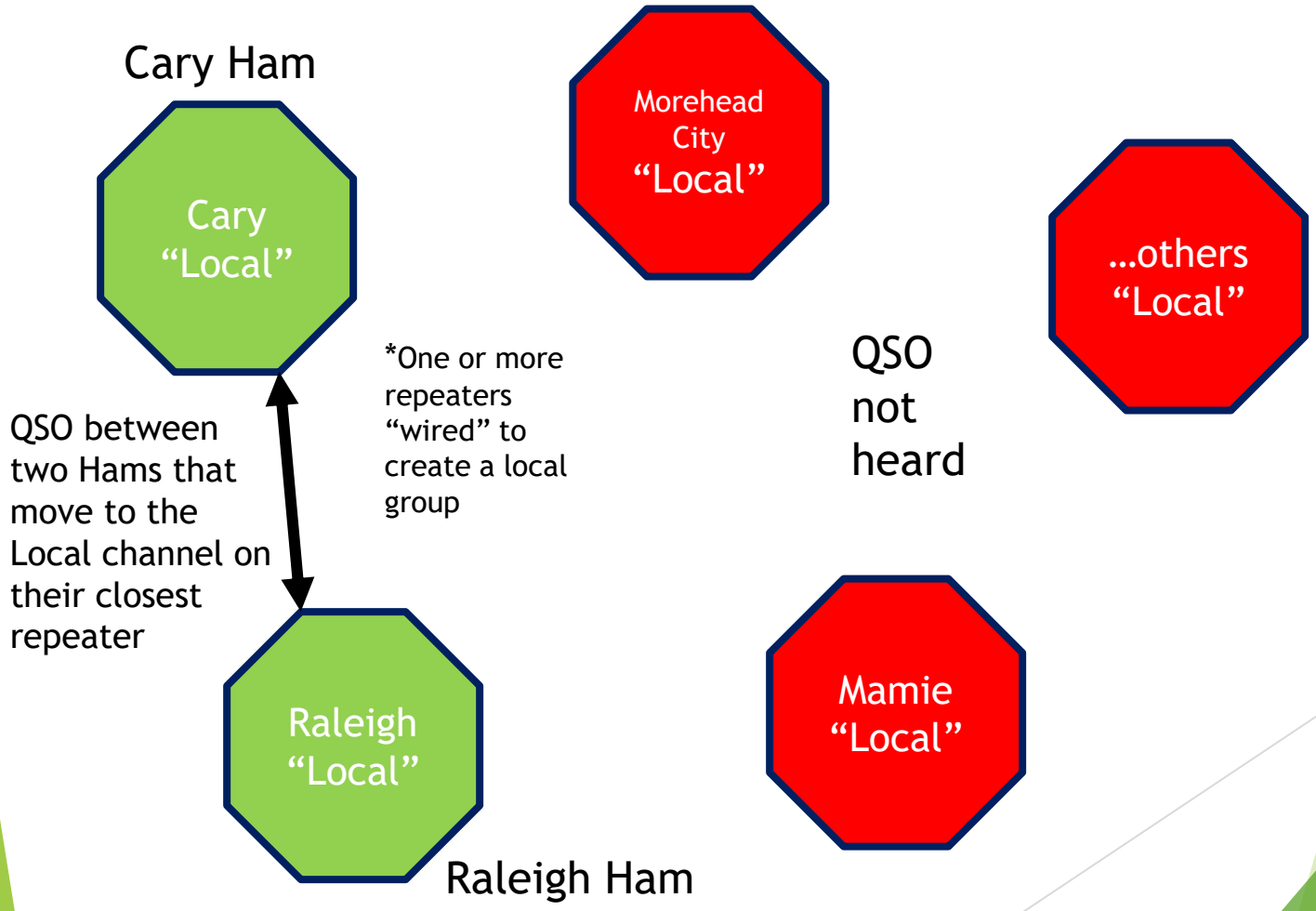
PRN Network

Talking on “PRN” Talkgroup



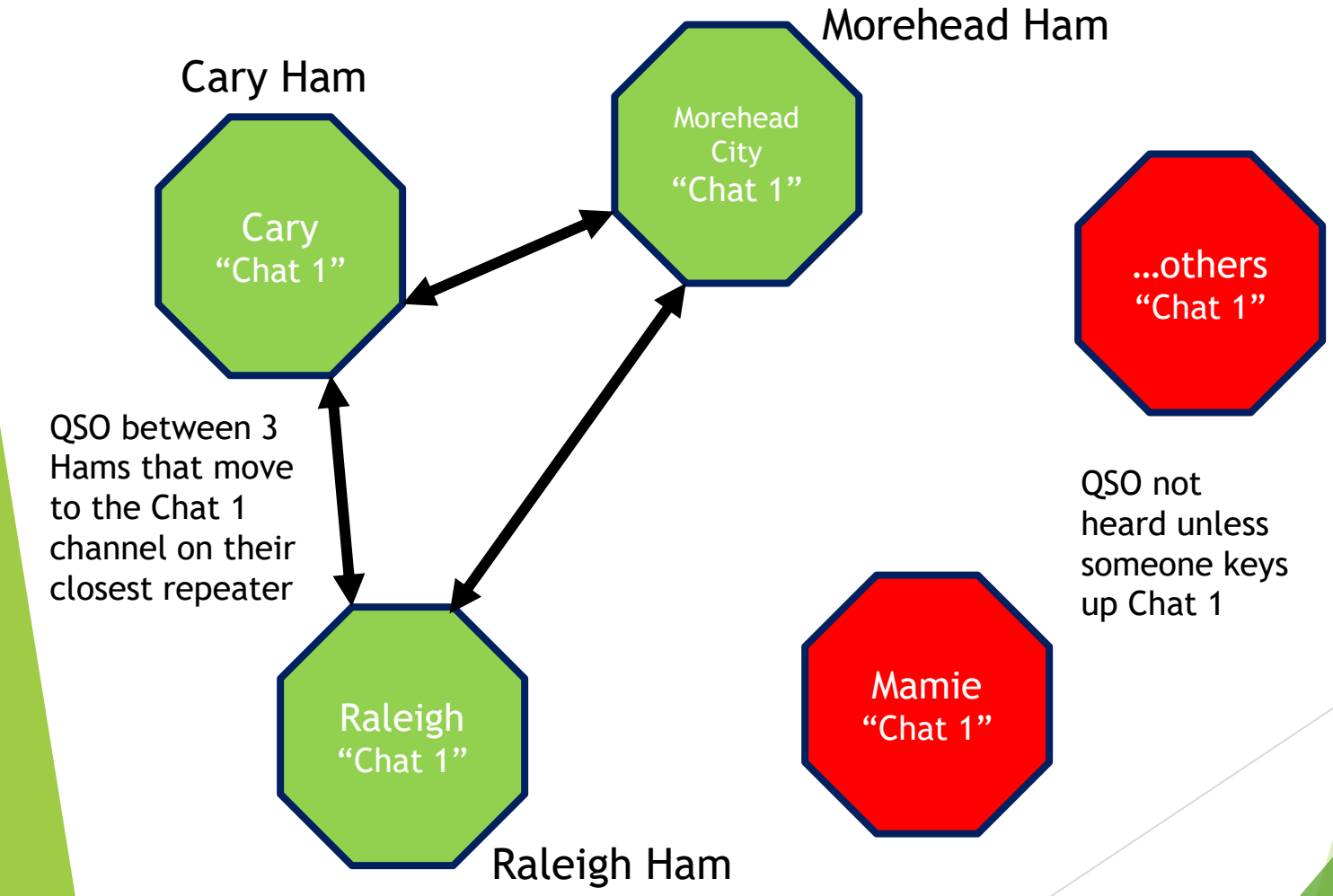
PRN Network

Talking on “Local” Talkgroup



PRN Network

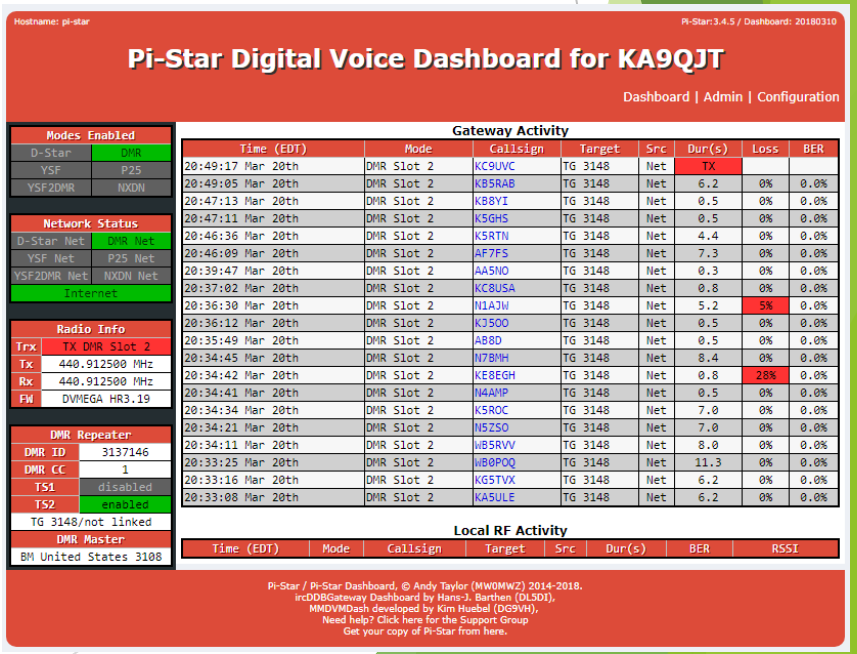
Talking on “Chat 1” Talkgroup




1 3 5
R 2 4 6

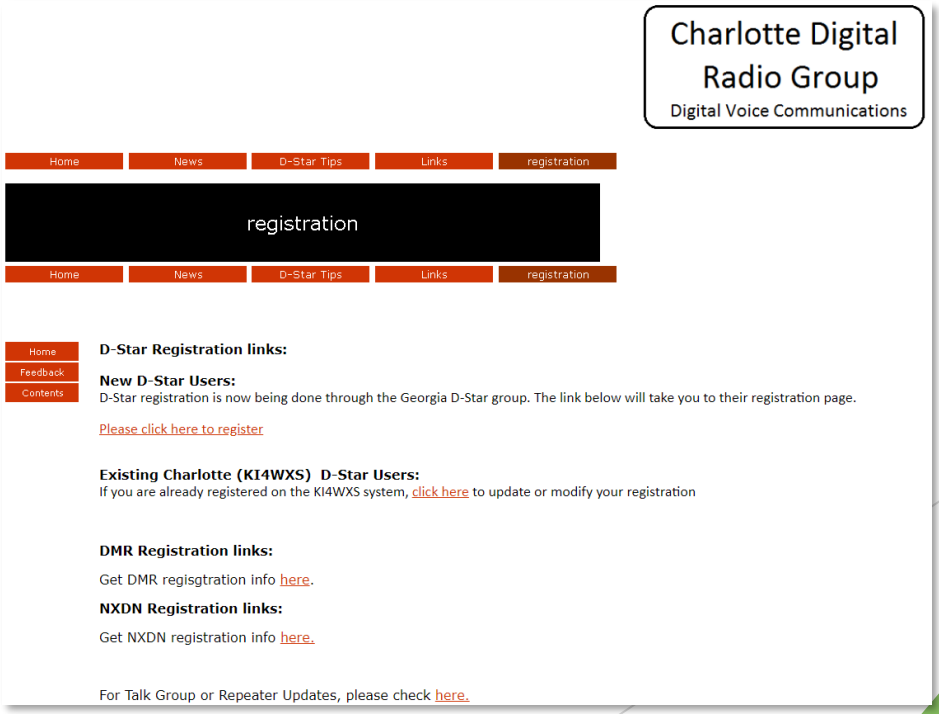
Now, a little about D-STAR and YSF options

- Buy a D-STAR or YSF radio and work the local repeaters
  - W4BAD (Raleigh and Durham) Fusion repeaters, or others
  - Unfortunately, no current Raleigh-area D-Star repeater. (Still) some plans in play.
- Buy a Hotspot
  - Shark OpenSpot 4, Zum Radio, etc.
- Setup your own Pi-powered Hotspot for D-STAR, YSF, and of course DMR access
  - Download and use Pi-Star for DMR, D-STAR, YSF, etc.
  - D-STAR example with DVAP in this deck



Get registered!

- In order to be recognized on other D-STAR Repeaters and Reflectors, you must register your callsign
  - Typically supported by your local D-STAR repeater group
  - Best option in this area may be to register with the Charlotte Digital Radio repeater group here.
    - Remember who you registered with, along with the password (callsign and password are case-sensitive)



Setting up your D-STAR radio

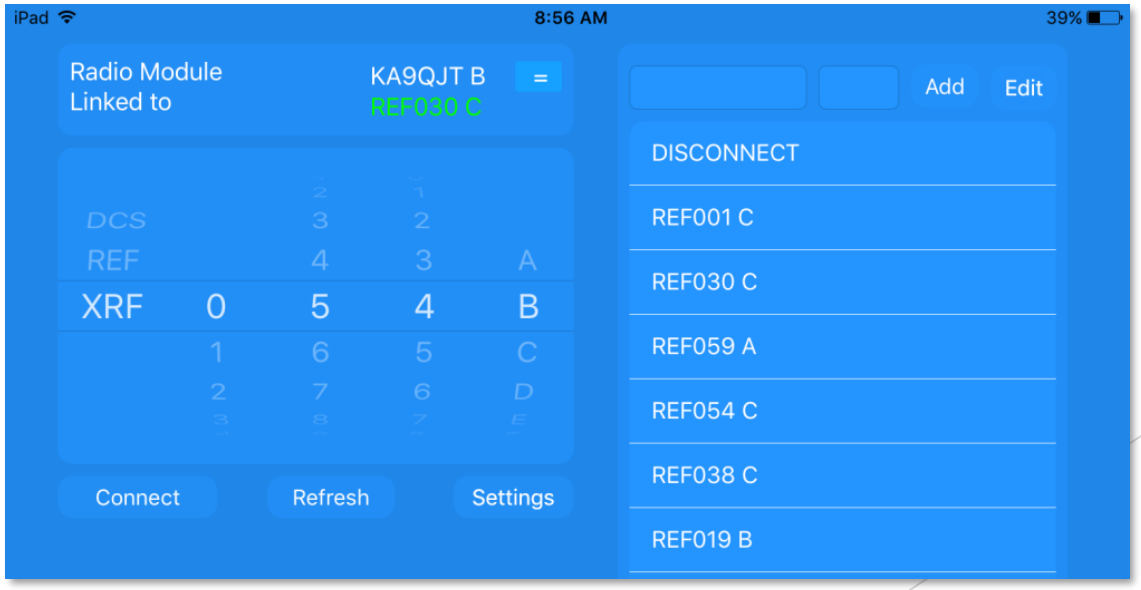
- To Transmit and Receive using D-STAR:
  - Set *Your Call* to: CQCQCQ
  - Set *My Call* to your FCC assigned callsign
  - Set *RPT1* to your callsign with the corresponding band letter, A, B, C or D in position 8 [UHF is typically B]
    - Add spaces if necessary
  - Set *RPT2* to your callsign (as set in the Gateway Tab) with a G in position 8
    - Again, add spaces if necessary
  - Set Operating Frequency to the frequency of your Hotspot
  - Set the Offset to + or –
  - Set the Offset Frequency to 0.000000
    - Hotspots are simplex, so the offset frequency must be 0 and the + or – doesn't matter
  - Make sure the radio's mode is set to DV (digital voice)
- Follow Pi-Star and your radio's documentation to configure memories for:
  - Repeater and Reflector selection (spin the dial, key the mic to link)
  - Hotspot Control (Unlink, Status, Echo Test, Restart, Reboot, Shutdown

Raspberry Pi and DVAP Hotspot

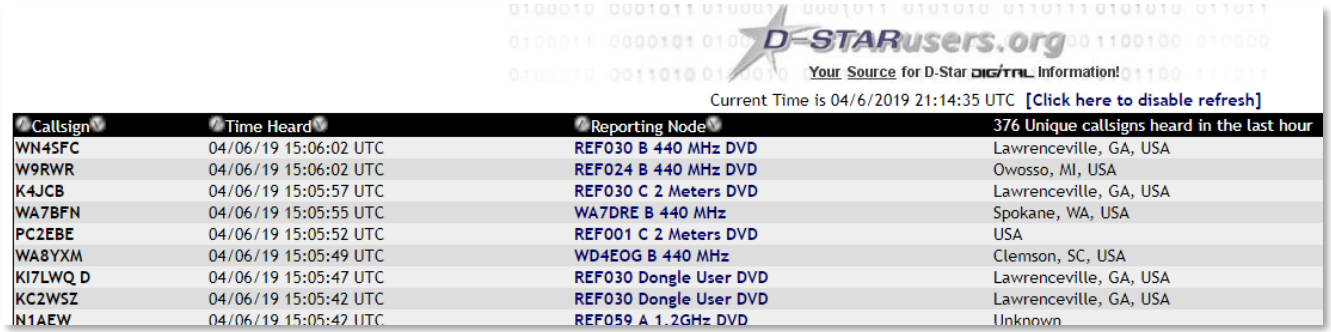
- UHF DVAP
- Raspberry Pi 3
- Pi-Star Image
- Wi-Fi and Headless
- DC to USB power converter
- Repurposed Pelican Case

What else?

- Remote Control your D-STAR Hotspot
  - Use your browser and the Pi-Star Admin web page to make Reflector selection
- (Easier) Use ircddb Remote app on your Android or iOS device
  - Select Reflectors on your hotspot(s)
  - Must be on the same Wi-Fi network as your Hotspot
  - Remote access is password-controlled (must match Remote Password)



Helpful D-STAR-related websites

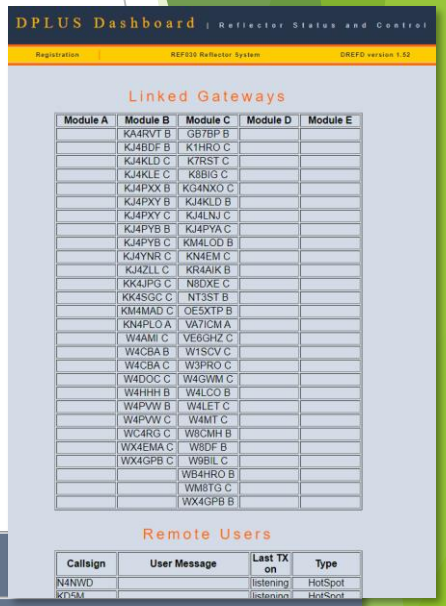

D-STARusers.org

Your Source for D-Star DIGITAL Information!

Current Time is 04/6/2019 21:14:35 UTC [Click here to disable refresh]

Callsign	Time Heard	Reporting Node	376 Unique callsigns heard in the last hour
WN4SFC	04/06/19 15:06:02 UTC	REF030 B 440 MHz DVD	Lawrenceville, GA, USA
W9RWR	04/06/19 15:06:02 UTC	REF024 B 440 MHz DVD	Owosso, MI, USA
K4JCB	04/06/19 15:05:57 UTC	REF030 C 2 Meters DVD	Lawrenceville, GA, USA
WA7BFN	04/06/19 15:05:55 UTC	WA7DRE B 440 MHz	Spokane, WA, USA
PC2EBE	04/06/19 15:05:52 UTC	REF001 C 2 Meters DVD	USA
WA8YXM	04/06/19 15:05:49 UTC	WD4EOG B 440 MHz	Clemson, SC, USA
KI7LWQ D	04/06/19 15:05:47 UTC	REF030 Dongle User DVD	Lawrenceville, GA, USA
KC2WSZ	04/06/19 15:05:42 UTC	REF030 Dongle User DVD	Lawrenceville, GA, USA
N1AEW	04/06/19 15:05:42 UTC	REF059 A 1.2GHz DVD	Unknown

- D-STAR Info
  - Repeater and Reflector List
- D-STAR Users Last Heard List
- DPLUS Reflector Dashboards
  - Access to who is currently connected, and who was last heard
  - Example: REF30
- D-STAR Dplus (REF) Activity Monitor by NJ6N


DPLUS Dashboard | Reflector Status and Control

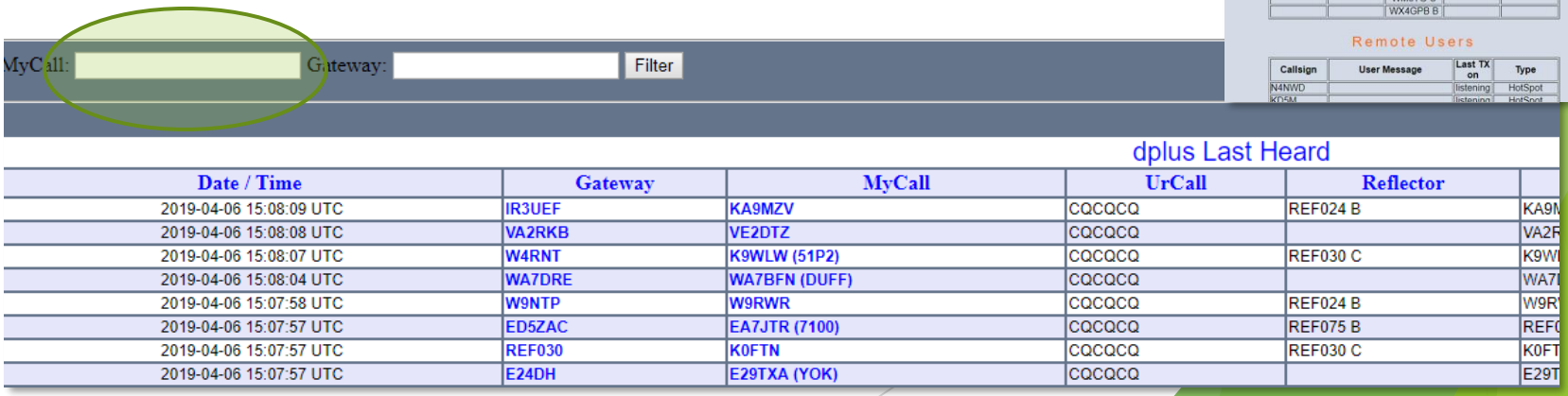
Registration | REF030 Reflector System | DREFD version 1.52

Linked Gateways

Module A	Module B	Module C	Module D	Module E
	KA4RVT B	GB7BP B		
	KJ4BDF B	K1HRO C		
	KJ4KLD C	K7RST C		
	KJ4KLE C	K8BIG C		
	KJ4PXX B	KG4NXO C		
	KJ4PXY B	KJ4KLD B		
	KJ4PXY C	KJ4LNJ C		
	KJ4PYB B	KJ4PYA C		
	KJ4PYB C	KM4LOD B		
	KJ4YNR C	KN4EM C		
	KJ4ZLL C	KR4AIK B		
	KK4JPG C	N8DXE C		
	KK4SGC C	NT3ST B		
	KM4MAD C	OE5XTP B		
	KN4PLO A	VA7ICM A		
	W4AMI C	VE6GHZ C		
	W4CBA B	W1SCV C		
	W4CBA C	W3PRO C		
	W4DOC C	W4GWM C		
	W4HHH B	W4LCO B		
	W4PVW B	W4LET C		
	W4PVW C	W4MT C		
	WC4RG C	W8CMH B		
	WX4EMA C	W8DF B		
	WX4GPB C	W9BIL C		
		WB4HRO B		
		WM8TG C		
		WX4GPB B		

Remote Users

Callsign	User Message	Last TX on	Type
N4NWD		listening	HotSpot
KD5M		listening	HotSpot


MyCall: Gateway: Filter

dplus Last Heard

Date / Time	Gateway	MyCall	UrCall	Reflector	
2019-04-06 15:08:09 UTC	IR3UEF	KA9MZV	CQCQCQ	REF024 B	KA9M
2019-04-06 15:08:08 UTC	VA2RKB	VE2DTZ	CQCQCQ		VA2R
2019-04-06 15:08:07 UTC	W4RNT	K9WLW (51P2)	CQCQCQ	REF030 C	K9WL
2019-04-06 15:08:04 UTC	WA7DRE	WA7BFN (DUFF)	CQCQCQ		WA7I
2019-04-06 15:07:58 UTC	W9NTP	W9RWR	CQCQCQ	REF024 B	W9R
2019-04-06 15:07:57 UTC	ED5ZAC	EA7JTR (7100)	CQCQCQ	REF075 B	REF
2019-04-06 15:07:57 UTC	REF030	K0FTN	CQCQCQ	REF030 C	K0FT
2019-04-06 15:07:57 UTC	E24DH	E29TXA (YOK)	CQCQCQ		E29T

Shift to 6th, we're coming down the front straightaway!

Things your Mother never told you

- Backup your MicroSD Card or Copy it to a 2nd card
  - They will fail!
  - See below
- Mind your power supply
  - Don't use a low-Amperage power supply for your Raspberry Pi
    - 2.5 Amp or greater, especially if you're also powering a "hat", or something connected via USB
  - Don't(!) just turn off the power – Properly shutdown your Pi!
- USB Cables are not created equally
  - Use higher quality/shielded cables
  - Keep lengths short (My DVMEGA on the BlueStack board had a lot of problems until I used a better quality, much shorter cable)
- Power matters
  - Don't overload your hotspot with unnecessary RF power from your HT or Mobile (lowest power!)
  - Similarly, a DVAP, DVMEGA or similar shouldn't be connected to outside antennas (easily overloaded front-ends)
- Good Etiquette: Pause between transmissions
  - Gives others time to disconnect from a Reflector/Talkgroup / Room if they need to from their radio
  - Also gives other stations a chance to make their presence known (quick key, or verbal)
  - Take ragchewing off a busy Reflector, Talkgroup or Room
  - Turn your radio's beacon feature off
  - Never try to run two hotspots on the same frequency!

Avoiding digital audio frustration

- Trouble hearing another, or being heard?
  - The internet on your end, their end, or both ends affects success
    - 100% copy on both sides, occasional drop-outs - “R2D2” (High Bit Error rates)
  - The same goes for repeater-based digital transmissions
  - If you’re being told by someone that they didn’t copy everything you said, don’t assume the problem is on your end (or on the other guy’s end).
  - Ask for a 3rd party’s opinion of the situation
    - Lots of people monitor the D-STAR Reflectors, DMR Talkgroups and YSF rooms
    - They’re more than willing to tell you what they heard (everyone has an opinion)
  - Test things out by listening to yourself
    - Echo Test for D-STAR, Parrot for DMR, etc.
  - If you’re using a PC and USB dongle like the ThumbDV, your PC is in charge of your “transmit” audio level
    - Test, get some feedback, remember the settings that work best (Windows might play games with your settings)

Taking your Hotspot on the road

- You'll need a reliable source of power
  - Must be constant vs. ignition switch-controlled
  - Remember that it's important to avoid just pulling the plug on a Raspberry Pi
  - "Shutdown" properly, then remove power
  - USB battery packs work well
    - "Pass-through" feature is important (harder to find)

- Wi-Fi on the road
  - Personal "MiFi" device, or another Cellular-based Wi-Fi hotspot
  - Your Cellphone in "Personal Hotspot" mode
    - No punctuation in the Wi-Fi SSID!
  - Your D-STAR/DMR/YSF hotspot just needs to be configured to point at this new Wi-Fi source
  - Pi-Star allows you to add more than one Wi-Fi configuration

Additional Questions?

Contact Information

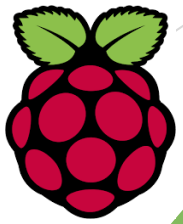
Brian Young
KA9QJT
ka9qjt@hotmail.com

Walking through a setup experience

D-Star DVAP with Raspberry Pi

Example:
D-STAR with a Raspberry Pi and a DVAP

- What's needed?
  - DVAP (2m or 70cm model) (Only Available Used!)
  - Raspberry Pi (go for the 3!)
  - USB Power Source (5V, 2.5A!) and cable
  - Accessible Wi-Fi (or wired Ethernet connection)
  - Quality 8GB or larger MicroSD Card (Class 10)
  - Pi-Star "image"
  - PC for downloading and writing the "image" to the card
  - D-STAR capable radio (Icom ID-51A, ID-52A, ID-5100, Kenwood TH-D74, etc.)

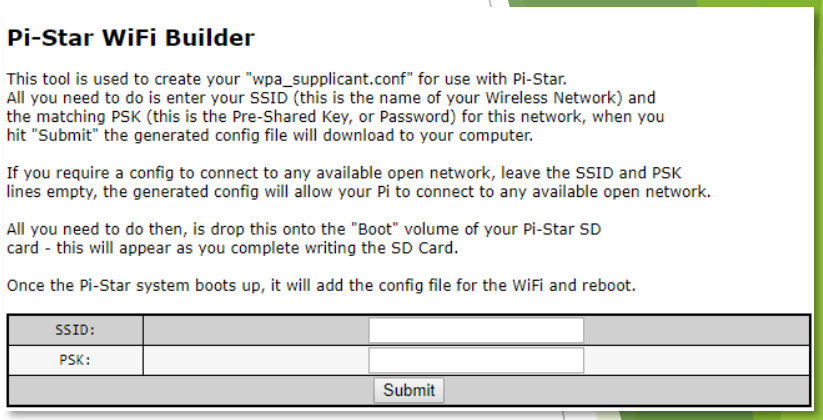


The Image? What Image?

- Raspberry Pi runs Linux
  - The OS, file system and applications need to be organized on the MicroSD card
  - The chosen “image” must be written byte by byte to the card
- Ready-made, D-STAR-focused image are downloadable
  - Pi-Star (Today’s gold standard!)
  - Read the Playing with Pi-Star notes from Toshen KE0FHS
- Install an SD Card Reader/Writer
  - Win32Disk Imager (Windows)
  - Etcher (Windows and macOS)
  - Others for macOS and Linux
- Write the image to the card
  - A MicroSD card might require a full-size adapter or a USB-connected reader/writer
  - Ignore Windows telling you to format the card
  - Properly “Eject” the card before removal (Etcher does this for you)

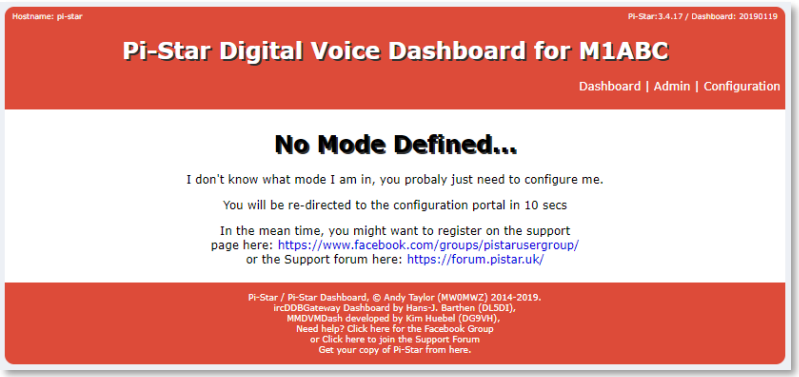
Preparing the Pi for 1st boot!

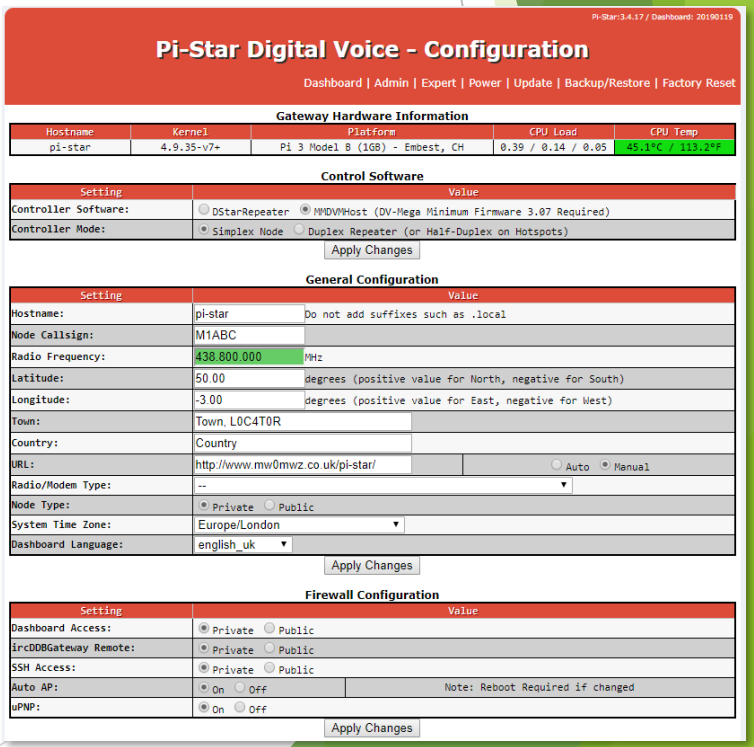
- Preparing for a Wi-Fi connection
  - Run the Pi-Star Wi-Fi Builder utility
  - Enter your Wi-Fi access point name (SSID) and password (PSK)
  - Creates a file called *wpa_supplicant.conf*
  - Copy this file onto your MicroSD card
  - On first boot, your Pi will immediately connect to your Wi-Fi network
- Carefully insert the MicroSD Card
  - One way in!
- Connect the DVAP to a USB Port
  - Pick one, stick with it
- Get ready to power things up
  - Suitable power supply? 2.5A or more
  - USB cable from power supply to Pi?
- Go for it!



Configuring Pi-Star for D-STAR use after 1st boot

- Find your Raspberry Pi on your home network – What IP address?
  - Check your router's DHCP clients list
  - Run an app like Fing to scan your network
- Point your PC's web browser at the Pi's IP address (192.168.something.something, usually)
  - Success will result in you seeing the No Mode Defined screen (Normal!)





- Move on to setting things up for D-STAR connectivity

D-STAR Configuration

- Make the Control Software Selection
  - Choose DStarRepeater instead of MMDVM Host
  - Still a Simplex Node

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

- Move on to General Configuration
  - Enter your Callsign
  - Enter the frequency for your Hotspot
  - Enter the Latitude and Longitude of your station
  - Enter your Town, locator and Country info
  - Select Auto, for callsign lookup, using QRZ

General Configuration

Setting	Value	
Hostname:	pi-star80 Do not add suffixes such as .local	
Node Callsign:	KA9QJT	
Radio Frequency:	441.175.000 MHz	
Latitude:	35.896997 degrees (positive value for North, negative for South)	
Longitude:	-78.54960 degrees (positive value for East, negative for West)	
Town:	Raleigh, NC FM05rv	
Country:	USA	
URL:	http://www.qrz.com/db/KA9QJT	(•) Auto ( ) Manual

- Continue General Configuration
  - Choose DVAP (USB) as your Radio/Modem Type
  - Decide whether you want your Node Type (Hotspot) to allow Public access (other Hams will be able to us it with their radios) or remain private
  - Select the appropriate Timezone and Dashboard language
  - Apply the Changes!

Finishing D-STAR Configuration

General Configuration

Setting	Value	
Hostname:	pi-star80	Do not add suffixes such as .local
Node Callsign:	KA9QJT	
Radio Frequency:	441.175.000	MHz
Latitude:	35.896997	degrees (positive value for North, negative for South)
Longitude:	-78.54960	degrees (positive value for East, negative for West)
Town:	Raleigh, NC FM05rv	
Country:	USA	
URL:	http://www.qrz.com/db/KA9QJT	(•) Auto ( ) Manual
Radio/Modem Type:	DVAP (USB)	
Node Type:	(•) Private ( ) Public	
System Time Zone:	America/New_York	
Dashboard Language:	english_us	

Apply Changes

- After the reboot, a D-Star Configuration section should appear

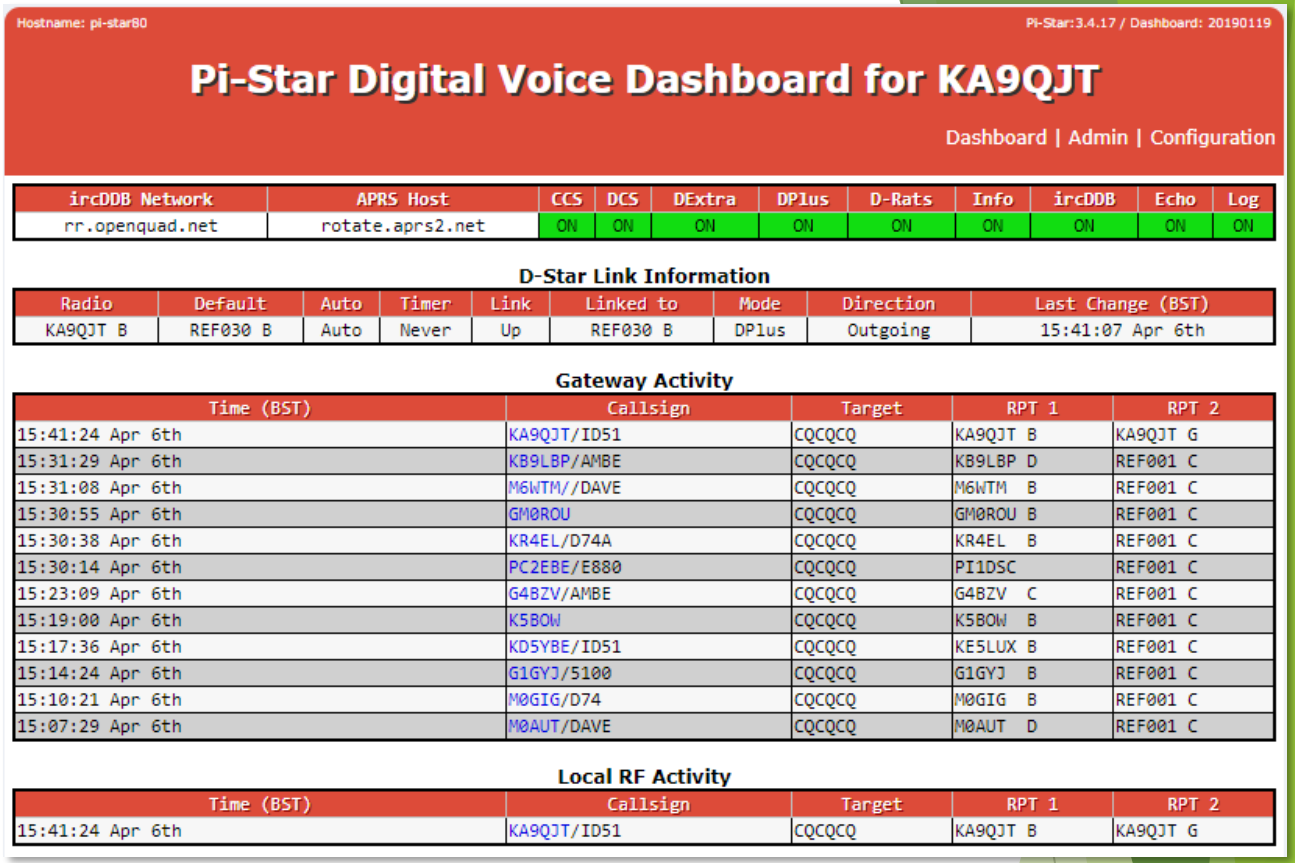
D-Star Configuration

Setting	Value	
RPT1 Callsign:	KA9QJT B	
RPT2 Callsign:	KA9QJT G	
Remote Password:	•••••	
Default Reflector:	REF030 B	(•) Startup ( ) Manual
APRS Host:	rotate.aprs2.net	
ircDDBGateway Language:	English_(US)	
Time Announcements:		
Use DPlus for XRF:		Note: Update Required if changed

Apply Changes

- After the reboot, a D-Star Configuration section will appear
  - RPT1 and 2 Callsigns should be OK as-is
  - Change the Remote Password – Important Later
  - Pick a default start-up Reflector (REF030 C in Atlanta is a good choice)
  - Pick a US-based APRS Host
  - Select an appropriate ircDDBGateway Language (It talks!)
  - Decide if you want Time Announcements

Using your D-STAR Hotspot



Hostname: pi-star80 — Pi-Star:3.4.17 / Dashboard: 20190119

Pi-Star Digital Voice Dashboard for KA9QJT

Dashboard | Admin | Configuration

ircDDB Network	APRS Host	CCS	DCS	DExtra	DPlus	D-Rats	Info	ircDDB	Echo	Log
rr.openquad.net	rotate.aprs2.net	ON	ON	ON	ON	ON	ON	ON	ON	ON

D-Star Link Information

Radio	Default	Auto	Timer	Link	Linked to	Mode	Direction	Last Change (BST)
KA9QJT B	REF030 B	Auto	Never	Up	REF030 B	DPlus	Outgoing	15:41:07 Apr 6th

Gateway Activity

Time (BST)	Callsign	Target	RPT 1	RPT 2
15:41:24 Apr 6th	KA9QJT/ID51	CQCQCQ	KA9QJT B	KA9QJT G
15:31:29 Apr 6th	KB9LBP/AMBE	CQCQCQ	KB9LBP D	REF001 C
15:31:08 Apr 6th	M6WTM//DAVE	CQCQCQ	M6WTM B	REF001 C
15:30:55 Apr 6th	GM0ROU	CQCQCQ	GM0ROU B	REF001 C
15:30:38 Apr 6th	KR4EL/D74A	CQCQCQ	KR4EL B	REF001 C
15:30:14 Apr 6th	PC2EBE/E880	CQCQCQ	PI1DSC	REF001 C
15:23:09 Apr 6th	G4BZV/AMBE	CQCQCQ	G4BZV C	REF001 C
15:19:00 Apr 6th	K5BOW	CQCQCQ	K5BOW B	REF001 C
15:17:36 Apr 6th	KD5YBE/ID51	CQCQCQ	KE5LUX B	REF001 C
15:14:24 Apr 6th	G1GYJ/5100	CQCQCQ	G1GYJ B	REF001 C
15:10:21 Apr 6th	M0GIG/D74	CQCQCQ	M0GIG B	REF001 C
15:07:29 Apr 6th	M0AUT/DAVE	CQCQCQ	M0AUT D	REF001 C

Local RF Activity

Time (BST)	Callsign	Target	RPT 1	RPT 2
15:41:24 Apr 6th	KA9QJT/ID51	CQCQCQ	KA9QJT B	KA9QJT G

- After applying the final changes, the Hotspot will reboot again
- Time to check out the Dashboard
  - Status - Is it all working correctly?
  - Link Info – What reflector are you linked to?
  - Gateway Activity - Who's active on that reflector?
  - Local RF Activity - Does your Hotspot hear your radio?