

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



Presented By: John Betz
KI5YIF

Rio Rancho, NM

Developed by: Paul
Bouthillier

KBØWMA

Albuquerque, NM

Who is Paul Bouthillier - KBØWMA?

- ▶ First licensed as a Technician in May 1996 in Denver Colorado
- ▶ Moved to Albuquerque, New Mexico in 2001
- ▶ Upgraded to General in November 2023
- ▶ Upgraded to Amateur Extra in April 2024

- ▶ Ham Interests:
 - ▶ HF through 440Mhz - Both Analog and Digital modes
 - ▶ Own and operate a 24/7 [YSF Reflector](#)
 - ▶ YSF Reflector ID: [US-NM505-KBØWMA](#)
 - ▶ D-STAR, DMR, YSF, FT8, Wires-X, AllStarLink and EchoLink (openSPOT, Raspberry Pi Hotspots, etc.)
 - ▶ [Bernalillo County ARES](#) (BCARES) - Volunteer Member

- ▶ I'm an enthusiast, not an expert

Who is John Betz II - KI5YIF?

- ▶ First licensed as a Technician in October 2022
- ▶ Born and Raised in Rio Rancho NM
- ▶ Upgraded to General in February 2023
- ▶ Upgraded to Amateur Extra in April 2024

- ▶ Ham Interests:
 - ▶ HF through 440Mhz - Both Analog and Digital modes
 - ▶ D-STAR, DMR, YSF, FT8, Wires-X, AllStarLink and EchoLink (openSPOT, Raspberry Pi Hotspots, etc.)
 - ▶ nmscares.org (SCARES) - Volunteer Member
 - ▶ Building anything and everything
- ▶ Education is learning what you didn't even know you didn't know.

Agenda

- ▶ Background: D-STAR, DMR and Yaesu System Fusion
- ▶ Options for personal operations
- ▶ DMR-focused hotspot setup
- ▶ More D-STAR and YSF info
- ▶ Things I've learned
- ▶ Portable operation
- ▶ Q&A

What is D-STAR and DMR Anyway?

▶ D-STAR: Digital Smart Technologies for Amateur Radio

- ▶ 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: Digital Mobile Radio

- ▶ 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
- ▶ 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?

- ▶ **YSF (C4FM): Yaesu 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
- ▶ The P2P (point to point) distance signal remains intelligible
- ▶ Talk worldwide with an HT (Internet-aided)
- ▶ RF and non-RF (PC-only) options for all
- ▶ Support for cross-mode linking
- ▶ It's another way you can put a hotspot to use
- ▶ Learn something new in ham radio communications

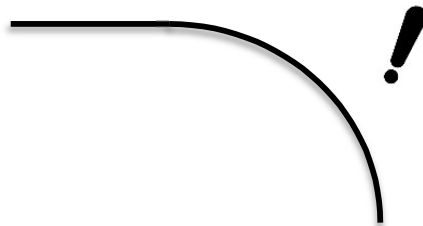
Digital FM

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 and DMR+ networks' Talkgroups
 - ▶ Access to back to repeater networks, only if a repeater owner provides a bridge between the networks
- ▶ YSF: Hotspots allow access to FCS and YSF Reflector networks



Where are the local Repeaters?

▶ D-STAR

- ▶ Albuquerque, Op Center (K5URR): 449.450 MHz -5.00
- ▶ Albuquerque, OP Center (K5URR): 146.860 MHz -0.6
- ▶ Albuquerque, Sandia Crest (W5MPZ): 443.800 MHz +5.00
- ▶ Belen, Capilla Peak (W5URD): 444.525 MHz +5.00

▶ DMR

- ▶ Albuquerque, Sandia Crest (WA5IHL): 442.250 MHz +5.00
- ▶ Albuquerque, Sandia Crest (NM5HR): 442.900 MHz +5.00
- ▶ Albuquerque, Sandia Crest (WR7HLN): 443.300 MHz +5.00
- ▶ Albuquerque, 9 Mile Hill (WR7HLN): 443.550 MHz +5.00
- ▶ Albuquerque, Southeast (N5GU): 444.600 MHz +5.00
- ▶ Rio Rancho, Southern (NM5SH): 442.525 MHz +5.00
- ▶ Mountainair, Capilla Peak (N5QD): 443.200 MHz +5.00

▶ YSF

- ▶ Albuquerque (KBØWMA): US-NM505-KBØWMA YSF Reflector
- ▶ Los Lunas, Meadow Lake (KC5OUR): 145.430 MHz -0.6
- ▶ Belen (KC5OUR): 442.700 MHz -5.00
- ▶ Belen (KC5OUR): 146.700 MHz -0.6

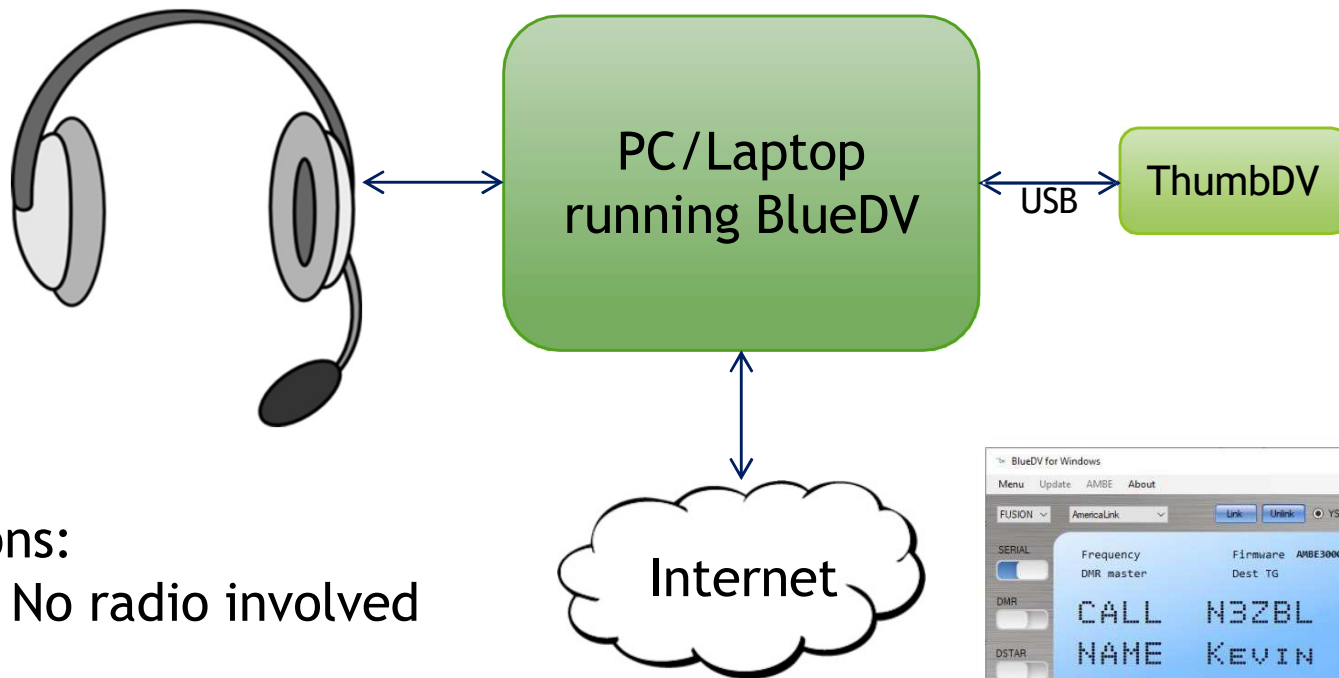
What are your options for personal D-STAR, DMR and YSF operations?



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



Cons:

- No radio involved

Alternate:

- DVMEGA [DVStick30](#)



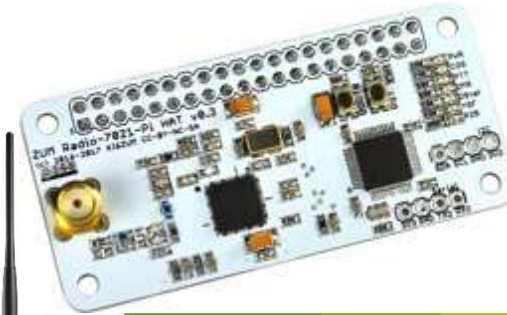
ZUMspot by [ZUM Radio](#)

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)

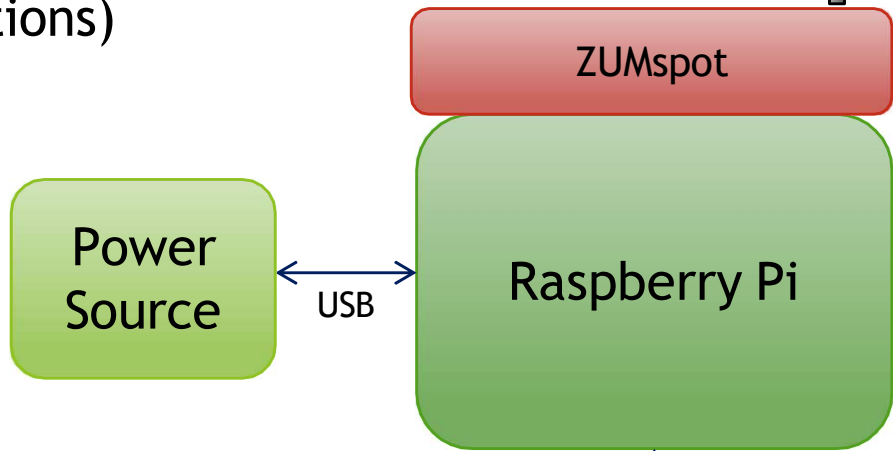


D-STAR DMR YSF



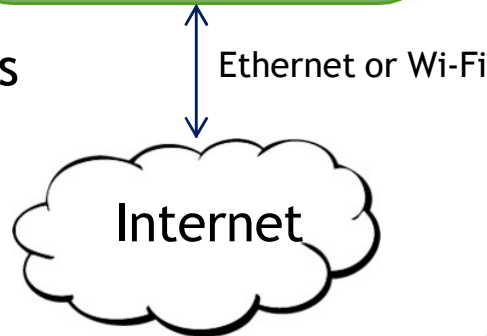
RF!

Single Band UHF or Dual Band Versions



Cons:

- Requires one or more radios
- Some “assembly” required
- Configuration and setup required



Hostname: pi-star Pi-Star 3.4.5 / Dashboard: 20180318
 Dashboard | Admin | Configuration

Pi-Star Digital Voice Dashboard for KA9QJT

Modes Enabled		Gateway Activity									
Mode	Net	Time (EDT)	Mode	CallSign	Target	Src	Dir(s)	Loss	BER		
D-Star	DMR	20:49:17 Mar 20th	DMR Slot 2	KC9UVC	TG 3148	Net	TX	0%	0.0%		
YSF	P25	20:49:05 Mar 20th	DMR Slot 2	K8SRAB	TG 3148	Net	6.2	0%	0.0%		
YSF/DMR	NXDN	20:47:13 Mar 20th	DMR Slot 2	K8BYI	TG 3148	Net	0.5	0%	0.0%		
		20:47:11 Mar 20th	DMR Slot 2	K5GHS	TG 3148	Net	0.5	0%	0.0%		
		20:46:36 Mar 20th	DMR Slot 2	K5RTN	TG 3148	Net	4.4	0%	0.0%		
		20:46:09 Mar 20th	DMR Slot 2	AF7FS	TG 3148	Net	7.3	0%	0.0%		
		20:39:47 Mar 20th	DMR Slot 2	A4SND	TG 3148	Net	0.3	0%	0.0%		
		20:37:02 Mar 20th	DMR Slot 2	KC8USA	TG 3148	Net	0.8	0%	0.0%		
		20:36:39 Mar 20th	DMR Slot 2	N1AJW	TG 3148	Net	5.2	0%	0.0%		
		20:36:12 Mar 20th	DMR Slot 2	K3SOD	TG 3148	Net	0.5	0%	0.0%		
		20:35:49 Mar 20th	DMR Slot 2	A8BD	TG 3148	Net	0.5	0%	0.0%		
		20:34:45 Mar 20th	DMR Slot 2	N78NH	TG 3148	Net	8.4	0%	0.0%		
		20:34:42 Mar 20th	DMR Slot 2	K8REGH	TG 3148	Net	0.8	0%	0.0%		
		20:34:41 Mar 20th	DMR Slot 2	N4AMP	TG 3148	Net	0.5	0%	0.0%		
		20:34:34 Mar 20th	DMR Slot 2	K5RSC	TG 3148	Net	7.0	0%	0.0%		
		20:34:21 Mar 20th	DMR Slot 2	N5ZSO	TG 3148	Net	7.0	0%	0.0%		
		20:34:11 Mar 20th	DMR Slot 2	N6SRVV	TG 3148	Net	8.0	0%	0.0%		
		20:33:25 Mar 20th	DMR Slot 2	W8POQ	TG 3148	Net	11.3	0%	0.0%		
		20:33:16 Mar 20th	DMR Slot 2	K6STVX	TG 3148	Net	6.2	0%	0.0%		
		20:33:08 Mar 20th	DMR Slot 2	KASULE	TG 3148	Net	6.2	0%	0.0%		

Radio Info		Local RF Activity									
Trx	TX DMR Slot 2	Time (EDT)	Mode	CallSign	Target	Src	Dir(s)	BER	RSSI		
Rx	440.912500 MHz										
Fw	DMVEGA HR3.19										

DMR Repeater
 DMR ID: 3137146
 DMR CC: 1
 TS1: Disabled
 TS2: Enabled
 TG 3148 not linked
 DMR Master
 BM United States 318

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0NHZ) 2014-2018.
 iD0DIGateway Dashboard by Hans J. Barthel (DL5DQ).
 MMDVMdash developed by Kim Huebel (DG9VH).
 Need help? Click here for the Support Group.
 Get your copy of Pi-Star from here.

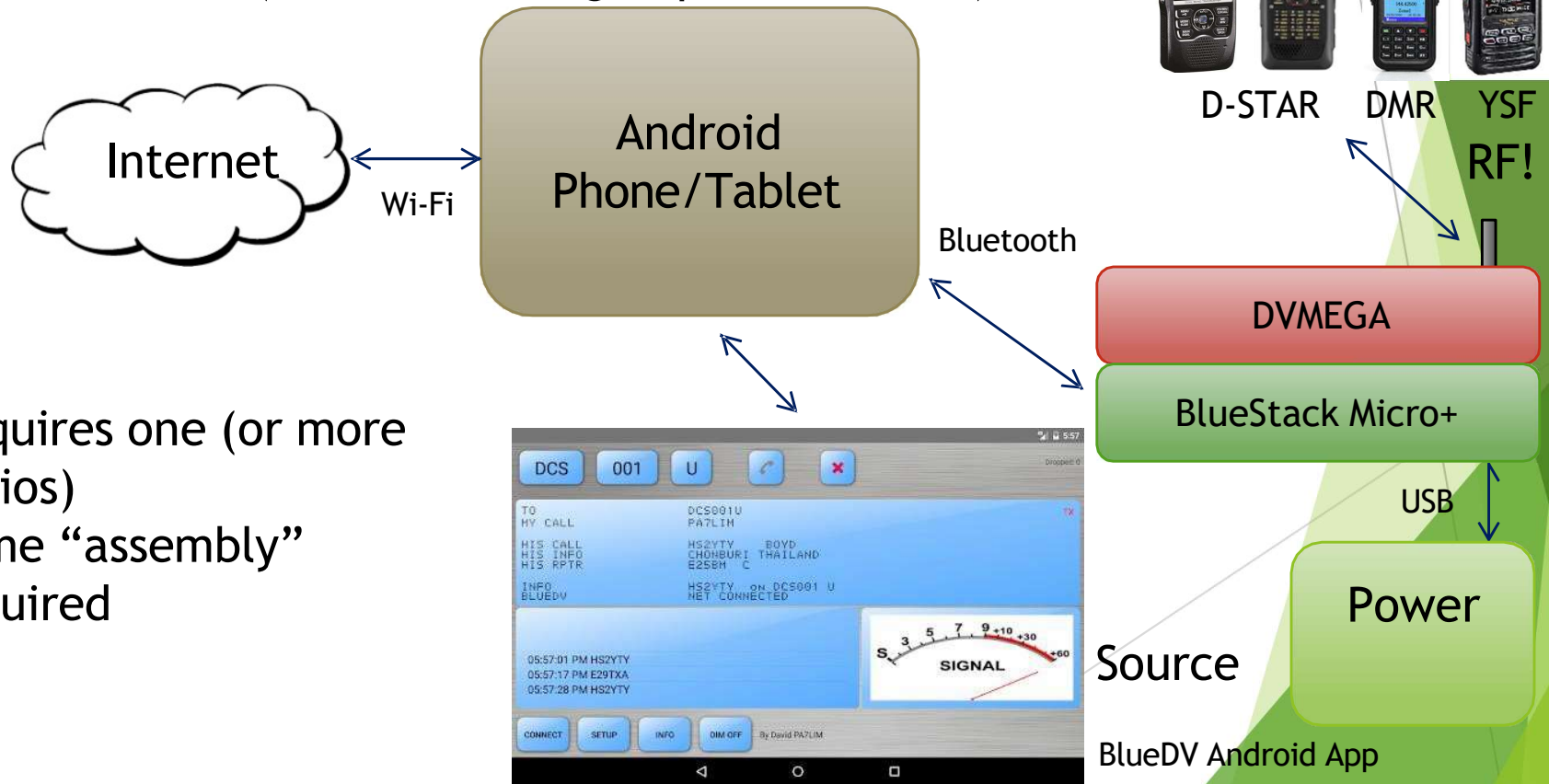
DV Mega with BlueStack Micro+

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)

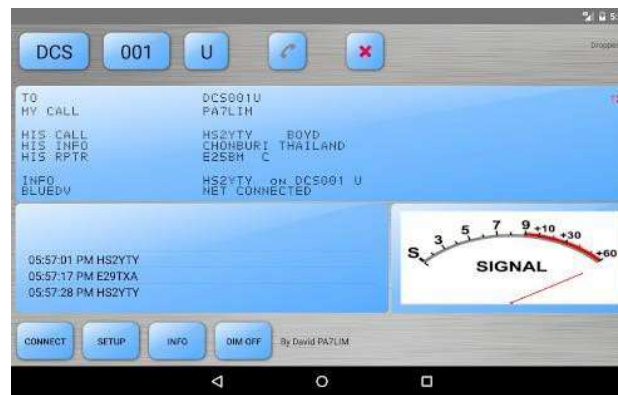


D-STAR DMR YSF
RF!



Cons:

- Requires one (or more radios)
- Some “assembly” required



BlueDV Android App

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



Zum Radio with Raspberry Pi
W with display



Common MMDVM Hotspot with Raspberry
Pi W with small display



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

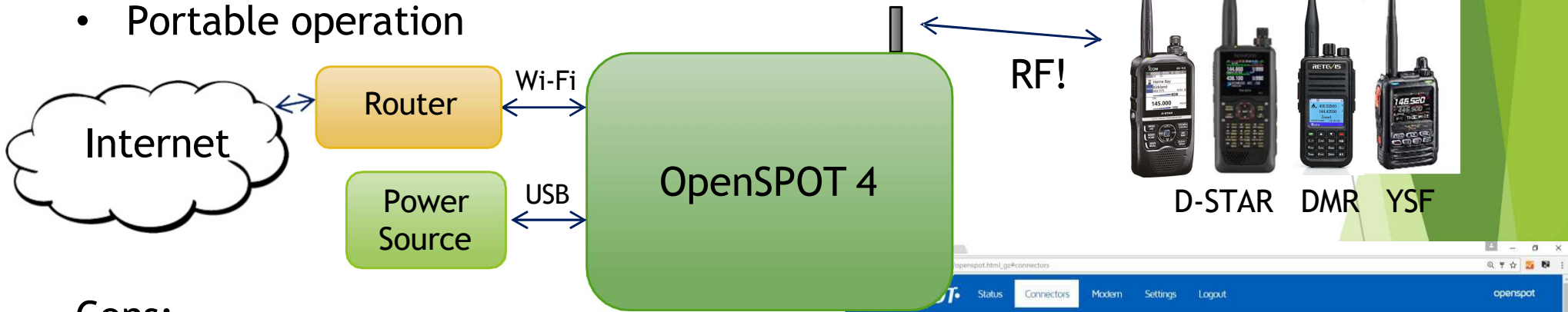
Turnkey Options



openSPOT 4 by [SharkRF](#)

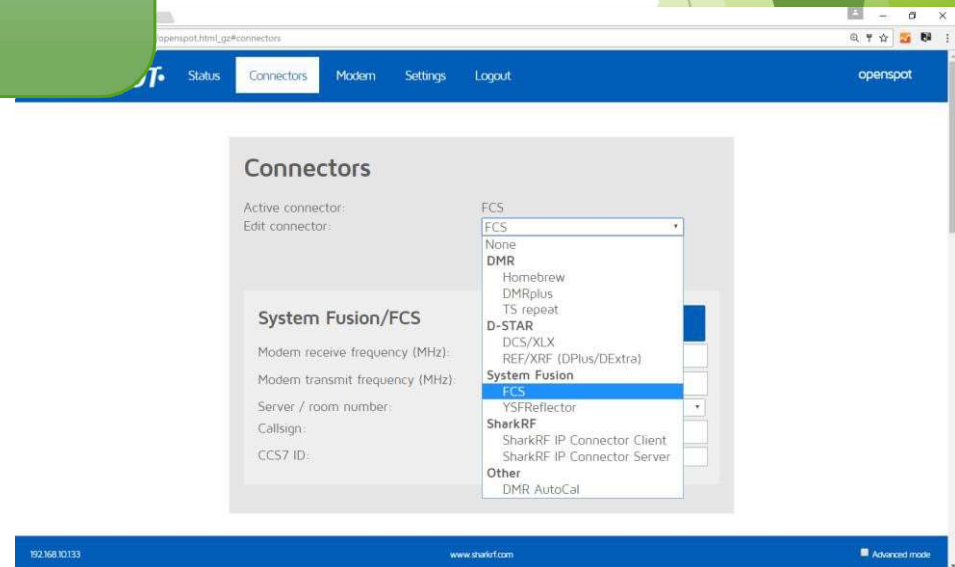
Pros:

- Supports Multiple Modes: D-STAR, DMR, YSF, others
- Self-contained with battery (connect it via Wi-Fi)
- Configured and managed with a web browser or phone app
- Allows “walk-about” access to your own multi-mode Hotspot
- You’re in control (Reflector, Talkgroup connections)
- Transcoder! Your one radio can work on multiple modes
- Portable operation



Cons:

- Only supports a Wi-Fi connection
- Very Pricy!



Cross-modes on the openSPOT 4 and 4 Pro

The openSPOT4 does transcoding, which allows it to be used as a cross-mode hotspot system.

It supports the following cross modes:

- ✓ You can use your [DMR transceiver](#) to access D-STAR®, C4FM, NXDN® networks
- ✓ You can use your [D-STAR® transceiver](#) to access DMR, C4FM, NXDN® networks
- ✓ You can use your [C4FM transceiver](#) to access DMR, D-STAR®, NXDN®, P25 networks



AllStarLink Nodes



What is AllStarLink?

AllStarLink is a network of Amateur Radio repeaters, remote base stations and hotspots accessible to each other via **Voice over Internet Protocol**.

Features:

- ▶ Full Feature Repeater Controller
- ▶ VoIP Full Duplex Linking with great audio
- ▶ ASL/EchoLink Linking
- ▶ Simplex (half-duplex) Station
- ▶ Autopatch and reverse autopatch
- ▶ Frequency Agile Remote Base Station
- ▶ Based on Asterisk - the Open Source PBX
- ▶ Real-time status reporting to [AllStarLink Active Nodes List](#)



SHIFTING GEARS



Walking through a setup
experience

DMR with a MMDVM Hotspot



1st Step: Register for a personal DMR ID


- ▶ RadiolD provides a [registration service](#)
- ▶ You only need one ID, even if you have multiple DMR Radios
- ▶ Today, there are nearly 70K registered DMR IDs in the US alone!

 RadiolD.net
Your unique digital ID

 Database ▼

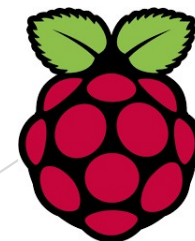
 Contacts ▼

 FAQ

 Support

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? Which 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!)
 - ▶ [The WPSD Project](#) (Highly Recommended Option!)
 - ▶ 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!

Pi-Star WiFi Builder

This tool is used to create your "wpa_supplicant.conf" for use with Pi-Star. All you need to do is enter your SSID (this is the name of your Wireless Network) and the matching PSK (this is the Pre-Shared Key, or Password) for this network, when you hit "Submit" the generated config file will download to your computer.

If you require a config to connect to any available open network, leave the SSID and PSK lines empty, the generated config will allow your Pi to connect to any available open network.

All you need to do then, is drop this onto the "Boot" volume of your Pi-Star SD card - this will appear as you complete writing the SD Card.

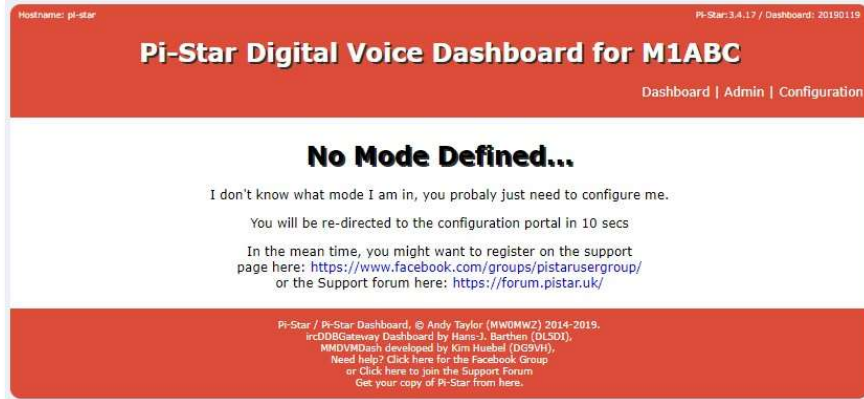
Once the Pi-Star system boots up, it will add the config file for the WiFi and reboot.

SSID:	<input type="text"/>	<input type="text"/>
PSK:	<input type="text"/>	<input type="text"/>
		<input type="button" value="Submit"/>



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
- ▶ Point your PC's web browser at the Pi's IP address (192.168.xxx.xxx) or type <http://pi-star.local>
 - ▶ Success will result in you seeing the No Mode Defined screen (Normal!)



Hostname: pi-star Pi-Star:3.4.17 / Dashboard: 20190119

Pi-Star Digital Voice Dashboard for M1ABC

Dashboard | Admin | Configuration

No Mode Defined...

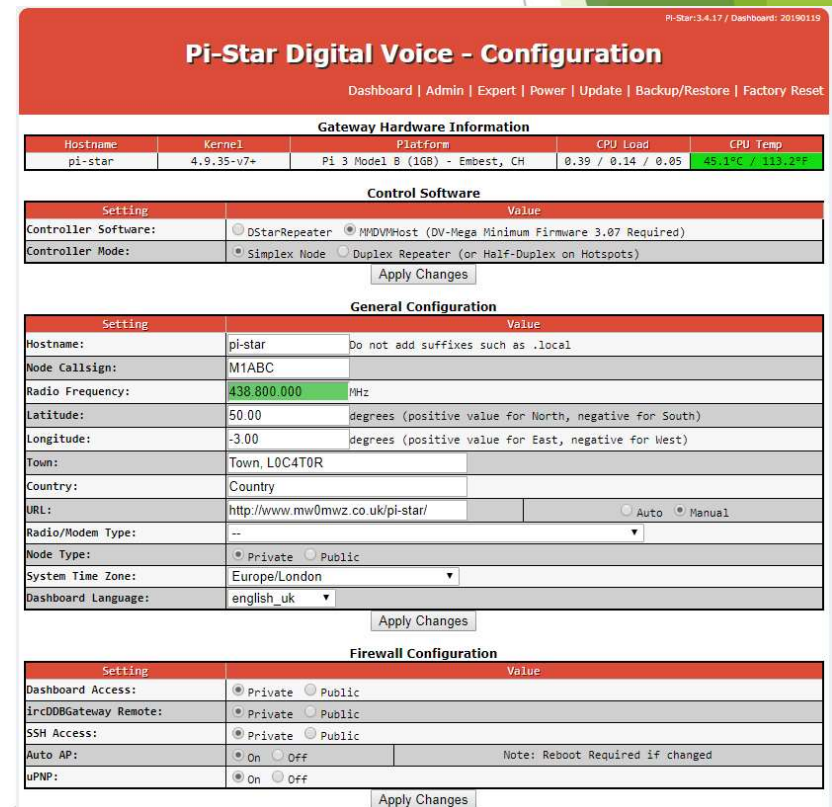
I don't know what mode I am in, you probably just need to configure me.

You will be re-directed to the configuration portal in 10 secs

In the mean time, you might want to register on the support page here: <https://www.facebook.com/groups/pistarusergroup/> or the Support forum here: <https://forum.pistar.uk/>

Pi-Star / Pi-Star Dashboard, © Andy Taylor (M4DMWZ) 2014-2019.
ircDDBGateway Dashboard by Hans-J. Bartsien (DLSDJ),
MMDVMDash developed by Kim Huebel (DG9VH).
Need help? Click here for the Facebook Group
or Click here to join the Support Forum
Get your copy of Pi-Star from here.

- ▶ Move on to setting things up for DMR connectivity



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	0.39 / 0.14 / 0.05	45.1°C / 113.2°F

Control Software

Setting	Value
Controller Software:	<input type="radio"/> DStarRepeater <input checked="" type="radio"/> MMDVHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	<input checked="" type="radio"/> Simplex Mode <input type="radio"/> Duplex Repeater (or Half-Duplex on Hotspots)

Apply Changes

General Configuration

Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	M1ABC
Radio Frequency:	438.800.000 MHz
Latitude:	50.00 degrees (positive value for North, negative for South)
Longitude:	-3.00 degrees (positive value for East, negative for West)
Town:	Town_L0C4T0R
Country:	
URL:	http://www.mw0mwz.co.uk/pi-star/ <input type="radio"/> Auto <input checked="" type="radio"/> Manual
Radio/Modem Type:	--
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public
System Time Zone:	Europe/London
Dashboard Language:	english_uk

Apply Changes

Firewall Configuration

Setting	Value
Dashboard Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
ircDBGateway Remote:	<input checked="" type="radio"/> Private <input type="radio"/> Public
SSH Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
Auto AP:	<input checked="" type="radio"/> On <input type="radio"/> Off Note: Reboot Required if changed
uPNP:	<input checked="" type="radio"/> On <input type="radio"/> Off

Apply Changes

DMR Configuration

► Make the Control Software Selection

- Choose MMDVH Host
- Still a Simplex Node

Control Software

Setting	Value
Controller Software:	<input type="radio"/> DStarRepeater <input checked="" type="radio"/> MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	<input checked="" type="radio"/> Simplex Node <input type="radio"/> 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:	<input type="text" value="pi-star73"/> Do not add suffixes such as .local
Node Callsign:	<input type="text" value="KA9QJT"/>
CCS7/DMR ID:	<input type="text" value="3137146"/>
Radio Frequency:	<input type="text" value="440.912.500"/> MHz
Latitude:	<input type="text" value="35.897100"/> degrees (positive value for North, negative for South)
Longitude:	<input type="text" value="-78.54960"/> degrees (positive value for East, negative for West)
Town:	<input type="text" value="Raleigh NC"/>
Country:	<input type="text" value="USA"/>
URL:	<input type="text" value="https://www.qrz.com/db/KA9QJT"/> <input checked="" type="radio"/> Auto <input type="radio"/> 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 use it with their radios) or remain private
- ▶ Enable APRS position reporting if interested
- ▶ Select the appropriate Timezone and Dashboard language
- ▶ Apply the Changes!

Radio/Modem Type:	ZUMspot - Single Band Raspberry Pi Hat (GPIO) ▼
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public
APRS Host Enable:	<input type="checkbox"/>
APRS Host:	rotate.aprs2.net ▼
System Time Zone:	America/New_York ▼
Dashboard Language:	english_us ▼

Apply Changes

MMDVM Host Configuration...

- ▶ Turn on DMR Mode
 - ▶ Yes, you can use this section to add other modes. (KISS principle applies)
- ▶ 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:	<input checked="" type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>
D-Star Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>
YSF Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>
P25 Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>
NXDN Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>
YSF2DMR:	<input type="checkbox"/>		
YSF2NXDN:	<input type="checkbox"/>		
YSF2P25:	<input type="checkbox"/>		
DMR2YSF:	<input type="checkbox"/>	Uses 7 prefix on DMRGateway	
DMR2NXDN:	<input type="checkbox"/>	Uses 7 prefix on DMRGateway	
POCSAG:	<input type="checkbox"/>	POCSAG Paging Features	
MMDVM Display Type:	<input type="text" value="OLED Type 3"/> ▾	Port: <input type="text" value="/dev/ttyAMA0"/> ▾	Nextion Layout: <input type="text" value="ON7LDS L2"/> ▾

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 DumpTADData on - this allows your hotspot to pass “Talker Alias” information to your radio. (i.e., name, callsign, location)
- ▶ Apply Changes... again

Setting	Value
DMR Master:	BM_3102_United_States
Hotspot Security:
BrandMeister Network:	Repeater Information Edit Repeater (BrandMeister Selfcare)
DMR ESSID:	3137146 02
DMR Color Code:	1
DMR EmbeddedLConly:	<input type="checkbox"/>
DMR DumpTADData:	<input checked="" type="checkbox"/>

Apply Changes

Using your Hotspot for DMR



Hostname: pi-star73 Pi-Star:4.1.6 / Dashboard: 20220401

Pi-Star Digital Voice Dashboard for KA9QJT

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	440.912500 MHz
Rx	440.912500 MHz
FW	HS_Hat:v1.3.7

DMR Repeater	
DMR ID	3137146
DMR CC	1
TS1	disabled
TS2	enabled

DMR Master	
BM	3102 United St..

Gateway Activity									
Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER		
19:55:52	Apr 10th	DMR TS2 N9PYA (GPS)	TG 31555	Net	5.2	0%	0.0%		
19:47:22	Apr 10th	DMR TS2 AF6FB (GPS)	TG 31077	Net	3.7	0%	0.0%		
19:36:18	Apr 10th	DMR TS2 W09B (GPS)	TG 3155	Net	7.3	0%	0.0%		
19:34:48	Apr 10th	DMR TS2 KB9SAR (GPS)	TG 3155	Net	8.0	0%	0.0%		
19:20:28	Apr 10th	DMR TS2 WB9QZB (GPS)	TG 3155	Net	15.8	0%	0.0%		
19:17:08	Apr 10th	DMR TS2 K9ARQ (GPS)	TG 3155	Net	2.6	40%	0.0%		
19:01:16	Apr 10th	DMR TS2 K5LA (GPS)	TG 31077	Net	0.5	0%	0.0%		
18:23:41	Apr 10th	DMR TS2 KF6FP (GPS)	TG 31077	Net	2.3	0%	0.0%		
18:03:19	Apr 10th	DMR TS2 WX6R (GPS)	TG 31077	Net	1.9	0%	0.0%		
17:56:50	Apr 10th	DMR TS2 K6MIB (GPS)	TG 31077	Net	6.6	0%	0.0%		
17:28:04	Apr 10th	DMR TS2 WD6FZA (GPS)	TG 31077	Net	0.5	0%	0.0%		
16:57:18	Apr 10th	DMR TS2 K9WKM (GPS)	TG 3155	Net	0.5	0%	0.0%		
16:13:28	Apr 10th	DMR TS2 KN6ONE (GPS)	TG 31077	Net	5.2	0%	0.0%		
16:06:18	Apr 10th	DMR TS2 KK6HNG (GPS)	TG 31077	Net	5.2	0%	0.0%		
15:27:19	Apr 10th	DMR TS2 NK9G (GPS)	TG 3155	Net	8.3	0%	0.0%		
15:27:03	Apr 10th	DMR TS2 W9LR (GPS)	TG 3155	Net	15.8	0%	0.0%		
15:19:38	Apr 10th	DMR TS2 3190621	TG 3155	Net	1.5	24%	0.0%		
14:57:02	Apr 10th	DMR TS2 KJ6UVT (GPS)	TG 31077	Net	31.1	0%	0.0%		
14:52:44	Apr 10th	DMR TS2 KN6SDM (GPS)	TG 31077	Net	8.4	0%	0.0%		
14:24:27	Apr 10th	DMR TS2 KB6CIO (GPS)	TG 31077	Net	10.3	10%	0.3%		

Local RF Activity							
Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWZ) 2014-2022.
 ircDDB Gateway Dashboard by Hans-J. Barthen (DL5DI),
 MMDVM Dash developed by Kim Huebel (DS9VH),
 Need help? Click here for the Facebook Group
 or Click here to join the Support Forum
 Get your copy of Pi-Star from here.

- ▶ 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
 - ▶ Retevis RT3S dual band HT with GPS
 - ▶ TYT MD-UV380 dual band HT
 - ▶ Connect Systems CS800D mobile
- ▶ **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 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 list
 - ▶ Newer radios have room for >200K users



OpenDG77 Amateur Radio Firmware for DMR Radios

[website](#)

Makes your current DMR radio into a real Ham Radio

RADIOS & CPS	
	CPS OpenGD77CPS
	GD-77 / DM-1801 / RD-5R / GD-77S
	TYT MD-9600 / Retevis RT-90
	TYT MD-UV380/390 / UV380/390 Plus 10W / Retevis RT-3S / Baofeng DM-1701 / DM-1701B / Retevis RT-84
	TYT MD2017 / Retevis RT-82
	Other unsupported radios

Helpful DMR-related websites

- ▶ (Local) [NM5SH](#) DMR Repeater Information Page
 - ▶ Codeplug and other DMR info and links
- ▶ 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
- ▶ DMR-MARC [website](#)
- ▶ TGIF Network [website](#)
- ▶ 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. Donation

SHIFTING GEARS



Now, a little about D-STAR and YSF options

- ▶ Buy a D-STAR or YSF radio and work the local repeaters
- ▶ Buy a Hotspot
 - ▶ Shark RF 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.

Hostname: pi-star Pi-Star 3.4.5 / Dashboard: 20180310

Pi-Star Digital Voice Dashboard for KA9QJT

Dashboard | Admin | Configuration

Modes Enabled		Gateway Activity								
D-Star	DMR	Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER	
YSF	P25	20:49:17 Mar 20th	DMR Slot 2	KC9UVC	TG 3148	Net	TX			
YSF2DMR	NXDN	20:49:05 Mar 20th	DMR Slot 2	KB5RAB	TG 3148	Net	6.2	0%	0.0%	
Network Status		20:47:13 Mar 20th	DMR Slot 2	KB8YI	TG 3148	Net	0.5	0%	0.0%	
D-Star Net	DMR Net	20:47:11 Mar 20th	DMR Slot 2	K5GHS	TG 3148	Net	0.5	0%	0.0%	
YSF Net	P25 Net	20:46:36 Mar 20th	DMR Slot 2	K5RTN	TG 3148	Net	4.4	0%	0.0%	
YSF2DMR Net	NXDN Net	20:46:09 Mar 20th	DMR Slot 2	AF7FS	TG 3148	Net	7.3	0%	0.0%	
Internet		20:39:47 Mar 20th	DMR Slot 2	AA5NO	TG 3148	Net	0.3	0%	0.0%	
Radio Info		20:37:02 Mar 20th	DMR Slot 2	KC8USA	TG 3148	Net	0.8	0%	0.0%	
Tx	TX DMR Slot 2	20:36:30 Mar 20th	DMR Slot 2	W1A7W	TG 3148	Net	5.2	5%	0.0%	
Tx	440.912500 MHz	20:36:12 Mar 20th	DMR Slot 2	KJ500	TG 3148	Net	0.5	0%	0.0%	
Rx	440.912500 MHz	20:35:49 Mar 20th	DMR Slot 2	AB8D	TG 3148	Net	0.5	0%	0.0%	
FW	DVMEGA HR3.19	20:34:45 Mar 20th	DMR Slot 2	N78MH	TG 3148	Net	8.4	0%	0.0%	
DMR Repeater		20:34:42 Mar 20th	DMR Slot 2	KE8EGH	TG 3148	Net	0.8	28%	0.0%	
DMR ID	3137146	20:34:41 Mar 20th	DMR Slot 2	H4AMP	TG 3148	Net	0.5	0%	0.0%	
DMR CC	1	20:34:34 Mar 20th	DMR Slot 2	K5ROC	TG 3148	Net	7.0	0%	0.0%	
TS1	disabled	20:34:21 Mar 20th	DMR Slot 2	N5ZSO	TG 3148	Net	7.0	0%	0.0%	
TS2	enabled	20:34:11 Mar 20th	DMR Slot 2	W85RVQ	TG 3148	Net	8.0	0%	0.0%	
TG 3148/not linked		20:33:25 Mar 20th	DMR Slot 2	W80PQQ	TG 3148	Net	11.3	0%	0.0%	
DMR Master		20:33:16 Mar 20th	DMR Slot 2	K6STVX	TG 3148	Net	6.2	0%	0.0%	
BM United States	3108	20:33:08 Mar 20th	DMR Slot 2	KA5ULE	TG 3148	Net	6.2	0%	0.0%	
Local RF Activity		Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI	

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWC) 2014-2018.
 ircDDB Gateway Dashboard by Hans-J. Berthen (DL5D1).
 MMDVMdash developed by Kim Huebel (DG9VH).
 Need help? Click here for the Support Group.
 Get your copy of Pi-Star from here.

Get Registered!

- ▶ In order to be recognized on other D-STAR Repeaters and Reflectors, you must register your callsign

Extremely Important!!

If you have already registered on another gateway, do not submit an additional registration request. You only need to register once on any gateway to be able to use all of the gateways in the G2/G3 network.

- ▶ [D-STAR Registration Instructions](#)
- ▶ [D-STAR Gateway System \(REGIST\)](#)



D-STAR Gateway System (REGIST)

REVISION 3.0B



Already registered?

Login with Callsign and Password.

Please note that Callsign and Password are case sensitive!
Callsign must be in UPPER CASE!

CallSign :

Password :

Login

New user?

This registration site is provided by volunteers to enable D-STAR enthusiasts who **do not have** a local gateway system to register with; a place to register for access to the D-STAR network. You must have a valid amateur radio license issued in your country of origin to register here.

Register

Forgot password?

CallSign :

Registered E-Mail Address :

Submit

D-STAR is a digital protocol developed by the Japan Amateur Radio League (the JARL) and stands for **Digital Smart Technology for Amateur Radio**.

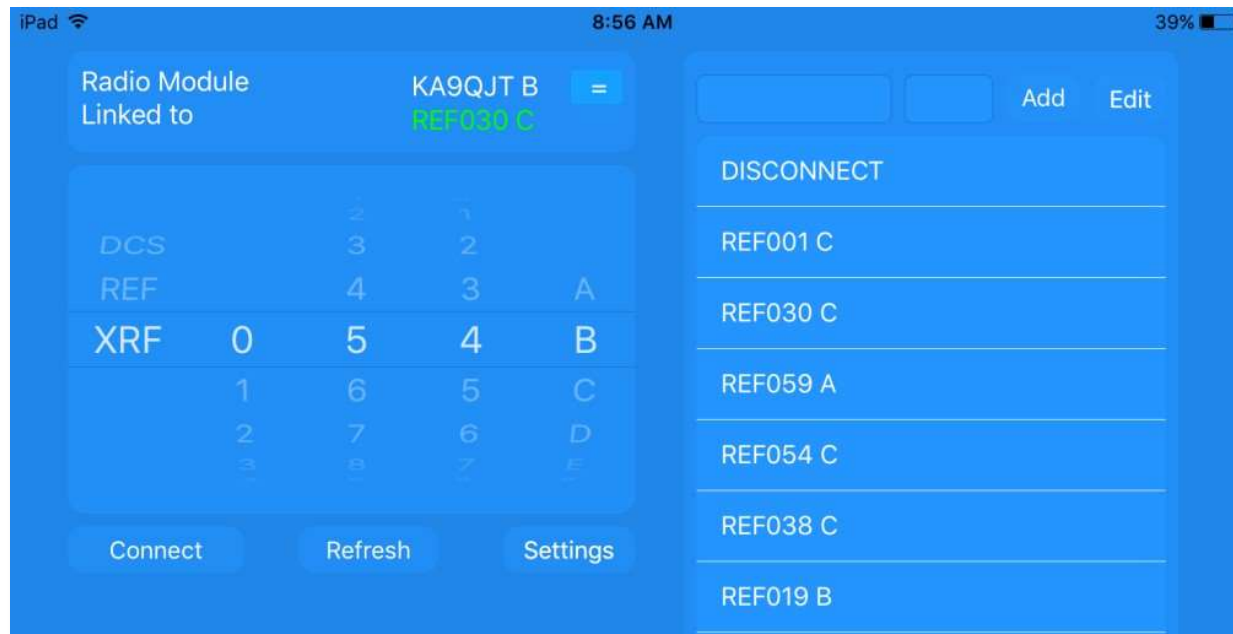
Setting up your D-STAR radio

- ▶ 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 the 8th position [The DVAP was UHF, so B]
 - ▶ Add spaces if necessary
 - ▶ Set *RPT2* to your callsign (as set in the Gateway Tab) with a G in the 8th position
 - ▶ 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
 - ▶ We're simplex, so the offset frequency must be 0 and the + or - doesn't matter
 - ▶ Make sure the 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)




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



 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: [REF055](#)
- ▶ D-STAR Dplus (REF) [Last Heard List](#) by NJ6N

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		VA2F
2019-04-06 15:08:07 UTC	W4RNT	K9WLW (51P2)	CQCQCQ	REF030 C	K9W
2019-04-06 15:08:04 UTC	WA7DRE	WA7BFN (DUFF)	CQCQCQ		WA7
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	REF0
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

SHIFTING GEARS



Learnings

- ▶ 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
- ▶ Power matters
 - ▶ Don't overload your hotspot with unnecessary RF power from your HT or Mobile (lowest power!)
- ▶ 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 someone, 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)

Portable Operation

- ▶ 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 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



Contact Information

Paul Bouthillier

KBØWMA

kb0wma@outlook.com

John Betz

KI5YIF

KI5YIF@yahoo.com