Digital Voice Progress - 2017

Dongles & Hotspots

Charlotte Hamfest

March 11, 2017

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Charlotte Digital Radio Group

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Digital Voice Communications

Topics

- Digital Voice introduction
- DV Networks and Reflectors
- DV Dongles
- DV Access Points (Hotspots)
- DV Access Point Hardware (for hotspots)
- DV Access Point Hardware (for repeaters)
- Q&A

These slides are on our web site – www.charlottedstar.org

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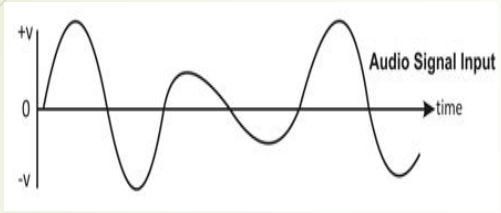
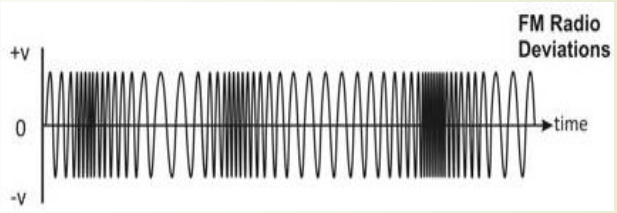
Analog FM

MIC

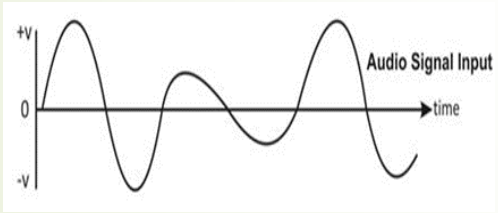


Modulator



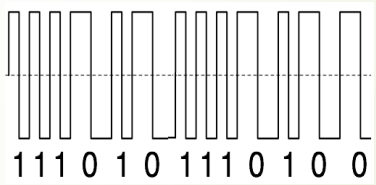
Digital Voice

MIC



Vocoder

AMBE by Digital Voice Systems, Inc.



Modulator

D-STAR – GMSK
DMR – 4FSK
Fusion – C4FM
P25 – C4FM

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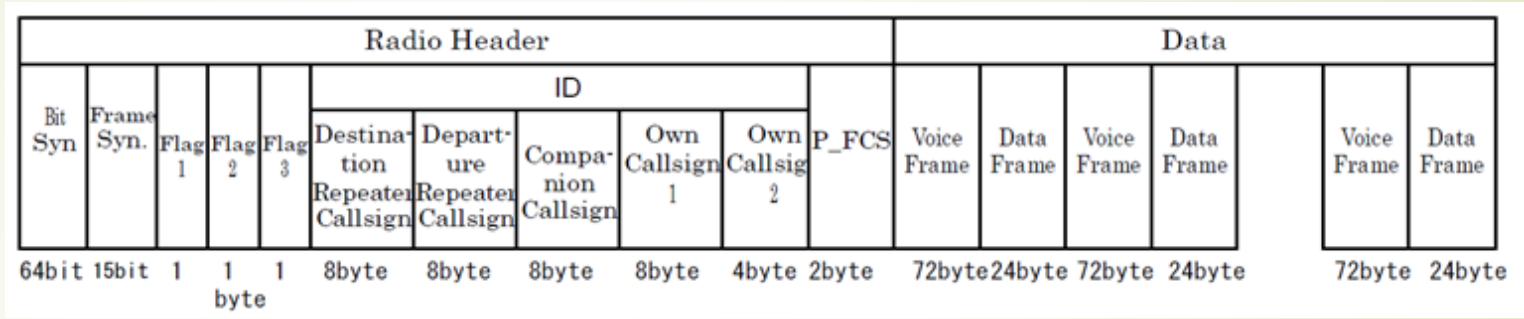
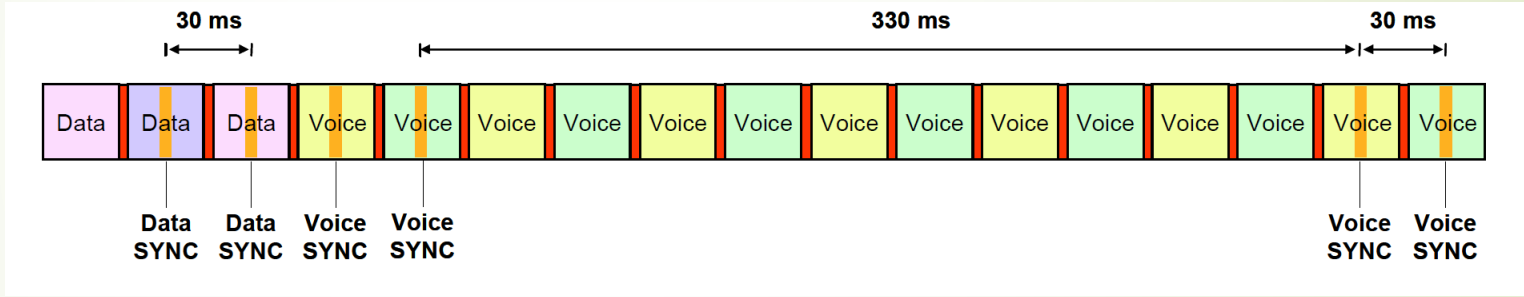
Digital Voice Packet Structure

GMSK mod.
6.25 KHz BW



4FSK mod.
2 channel
12.5 KHz BW



C4FM mod.
12.5 KHz BW

FS	FICH	DCH (0)	VCH (0)	DCH (1)	VCH (1)	DCH (2)	VCH (2)	DCH (3)	VCH (3)	DCH (4)	VCH (4)
40	200	72	72	72	72	72	72	72	72	72	72

Number of bits
Total 960 bit

C4FM mod.
12.5 KHz BW

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DV Networks and Reflectors

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Why Network?

- Repeaters are very quiet without users.
- Internet connectivity brings more users to the repeater.
- Reflectors provide multiple repeater connectivity.
- Increased coverage and wide area nets are possible.
- User network control gives the user choice, but some repeater owners prefer to retain control.
- Dongles and hotspots are better suited for user control.
- User control can cause network problems.

Reflector – What is it?

- It is software typically running at a location that has a robust internet pipe.
- It receives an incoming data stream and sends it back out to every currently connected device – i.e. it reflects the data.
- Terminology:
  - D-STAR calls them Reflectors
  - DMR calls them Talk Groups and/or Reflectors
  - WIRES-X calls them Rooms
- There are many different reflector systems:
  - D-STAR – REF, XRF, DCS*, XLX
  - DMR – IPSC (Motorola), IPMSC (Hytera), PCS*, BrandMeister (DMR+)
  - WIRES-X – Yaesu rooms, YSF rooms (G4KLX), FCS*
  - P25 – PCS*

* DCS, PCS and FCS developed by the DV4Mini group

Network Awareness and Courtesy

- Linked networks can involve many repeaters / hotspots.
- When you use a reflector, talk group or room know what it is intended for and limit your use accordingly. A nation-wide TG should not be used for round-table rag chews. Make a call and after contact move to a less used TG.
- Leave a gap between overs. This gives someone listening time to disconnect.
- Always yield to a breaking station.
- Use common sense.

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Most Popular Repeater Connections

- D-STAR
  - Many repeaters are linked to REF001C, REF030C
  - Our Charlotte repeaters are linked to REF054C
- DMR
  - DMR-MARC
  - Regional networks – Piedmont Radio Network (PRN)
  - BrandMeister Talk Group 3100 (DCI Bridge)
- C4FM (System Fusion WIRES-X)
  - America-link room
  - MN-WIS room – our repeaters are connected

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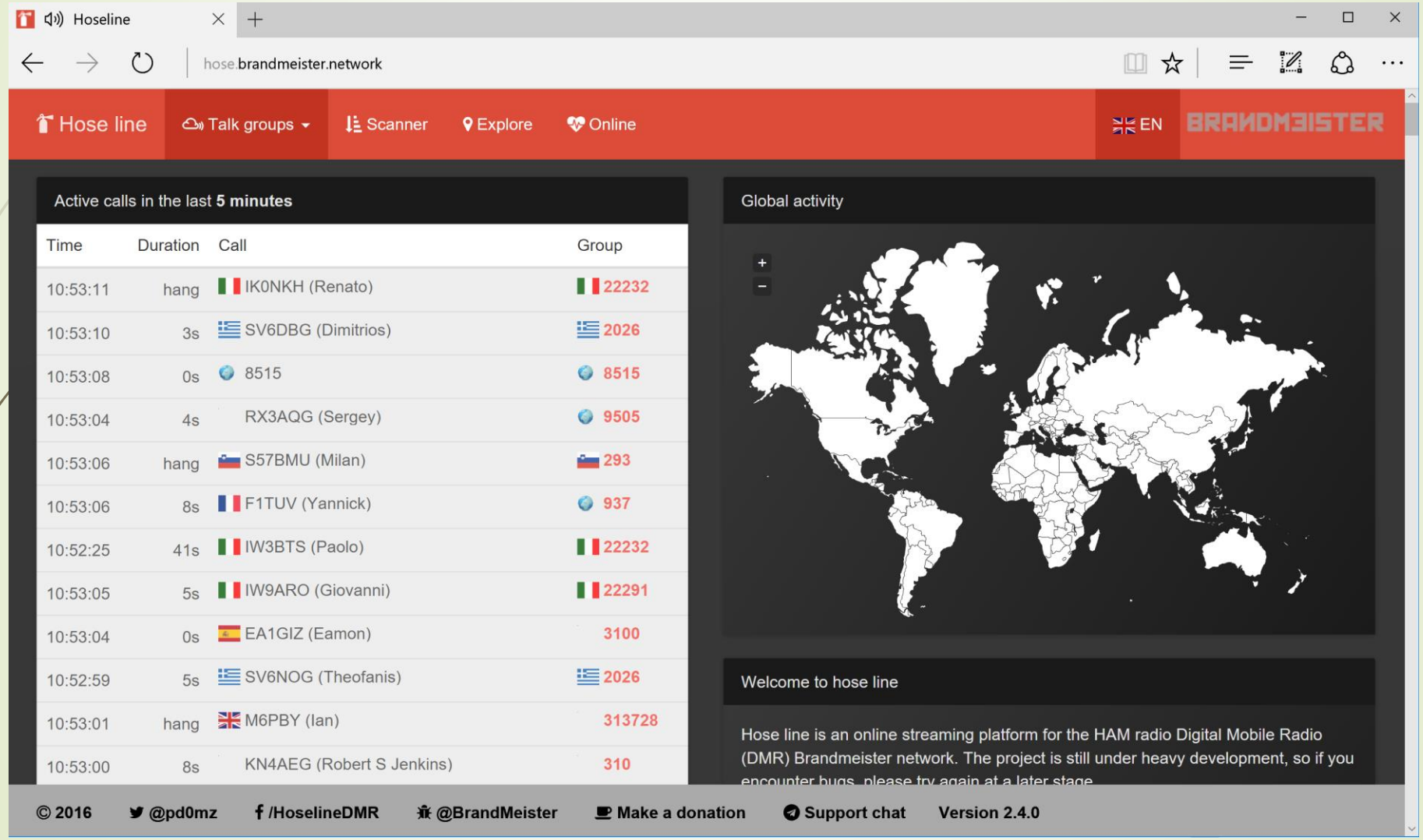
Hoseline – a very unique DMR dashboard



DV Dongles

An inexpensive way to get started (It's how I started)

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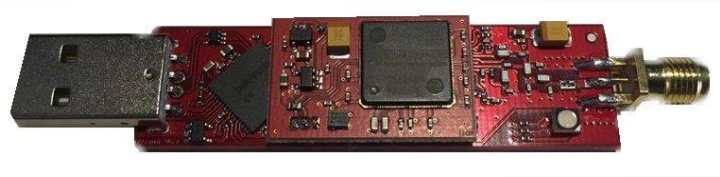
DV Dongles

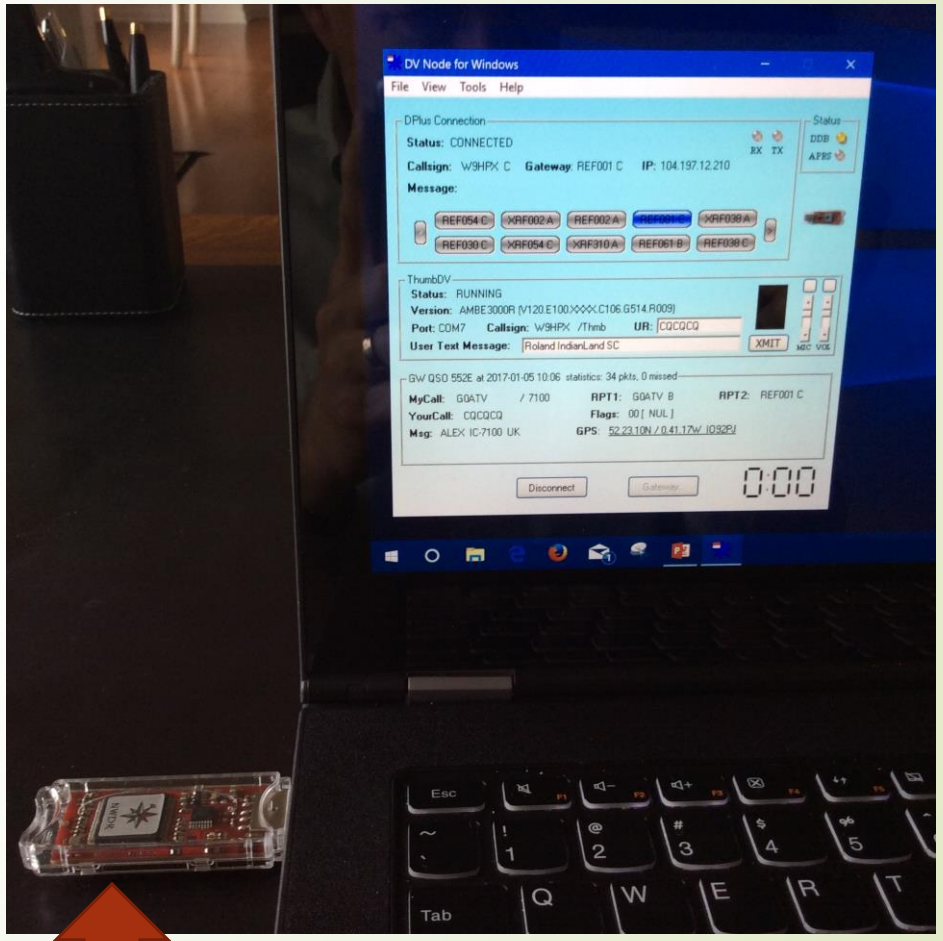
- Get on D-STAR without a radio
- Easy to use with your PC
- Great for travelers
- Inexpensive way to start with D-STAR



Device	Manufacturer	Supports	Vocoder	Connects to	Price
DV Dongle	Internet Labs	D-STAR	AMBE-2000	USB via cable	190
DV 3K Dongle	Internet Labs	D-STAR	AMBE-3000	USB plug-in	145
PiDV	Northwest Digital Radio	D-STAR	AMBE-3000	RaspPi GPIO	100
ThumbDV	Northwest Digital Radio	D-STAR	AMBE-3000	USB plug-in	120
DV4Mini AMBE	Wireless Holdings	5 modes	AMBE-3000	USB plug-in	228

DV Dongle PC Set-up

- Uses PC microphone & speakers Alternatively, you can use a USB headset for better audio
- "DV Node for Windows" by Fred van Kempen, KA4YBR
- Get it from Fred's web site: http://www.dutch-star.eu (Free download, but must have a user ID for his website.)
- Easy to set up
- Supports all D-STAR reflector systems



ThumbDV

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DV Dongle Summary

- The ThumbDV ($120) is best value USB solution
- The PiDV ($100) costs less, but limited to a Raspberry Pi. Option: configure it as AMBE network server
- The original blue DV Dongle from Internet Labs uses the older AMBE 2000 chip and is expensive
- WinDV is the most comprehensive Windows software
- Buster is available for an Apple MAC – download from NWDR
- Dummy Repeater* is the best Raspberry Pi supporting software. Windows version is also available.
- DVTool software by AA4RC only supports Internet Lab's devices and only supports D-STAR D-PLUS (very limited)

* Part of Jonathan Naylor's, G4KLX, software package

Access Points (aka Hotspots)

Commercially available

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New ICOM D-STAR Radios / Features

ICOM ID-51A+2

- Dual band
- DR Mode
- Pre-programmed repeaters
- Internal GPS
- DPRS reporting
- Repeater geo search
- uSD card storage & record
- $499 in any of 5 colors

Two new added features

- Terminal Mode - the radio works like a DV dongle using the radio's mic and speaker. The radio does not transmit.
- Access Point Mode - the radio transmits and receives and passes the signal to the internet. Need a 2nd radio.
- Requires data cable to a PC running or an Android device running ICOM's software.
- Requires G3 gateway.
- Requires public (Global) IP address.

ICOM ID-4100A

price and availability not yet available

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Yaesu System Fusion WIRES-X

You can run your own YSF node and room!

Yaesu – FTM-100DR

- Dedicated transceiver running in HRI-200 mode
- $300

Yaesu HRI-200

- Radio to PC interface
- Specialized sound card
- $125

You still need another Fusion Radio to use it.

- There are ~1,500 active rooms with 75% unoccupied and another 15% with only one connection.

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Commercial Access Points
Stand alone hot spots – PC not needed to use

SharkRF openSPOT

- D-STAR, DMR, C4FM (YSF)
- RJ45 Ethernet cable router connection
- Configures from a web page
- Cross mode DMR <-> C4FM
- www.sharkrf.com/products/openspot/
- Frequent firmware updates to add features
- $215 complete

DV4Home

- Supports all DV modes to the internet via RJ45 Ethernet cable
- Configures from front panel or from a web page
- DV4Mini socket (DV4Mini not incl.)
- wirelesshold.com/dv4home.aspx
- $449 – includes 2 AMBE 3000 vocoders, microphone & speaker
- $249 compact version

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DV Access Point Summary - Commercial

- ICOM's new radios with built in terminal and access point modes merges popular radios with what previously required separate hardware. Downsides - must be tethered to a PC or Android device, requires a public facing IP address and only supports D-STAR.
- WIRES-X (System Fusion) is a feature rich easy to set up single-mode system. Downsides - Yaesu controls the network, requires a public facing IP address, afirly expensive and only supports WIRES-X.
- SharkRF openSPOT is an economical, stand alone multi-mode device with cross-mode capability. Easy to set up and use. It has become quite popular, but it takes about a month to get.
- DV4Home combines features of a dongle and an access point with cross-mode capability. Fairly expensive.

Access Point Devices

For that “I gotta build it” compulsion

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Access Point Devices for Builders

- No repeater nearby?
- Build your own 10 mW simplex repeater
- Radio required for each mode

Device	Manufacturer	Supports	Connects to	Price
DVAP – 2 M	Internet Labs	D-STAR	USB	185
DVAP – 1¼ M	Internet Labs	D-STAR	USB	245
DVAP – 70 cm	Internet Labs	D-STAR	USB	145
DV MEGA –70 cm	Dooren Elect.	D-STAR+DMR+YSF	RaspPi GPIO	130
DV MEGA – dual	Dooren Elect.	D-STAR+DMR+YSF	Arduino UNO	125
DV MEGA – dual	Dooren Elect.	D-STAR+DMR+YSF	RaspPi GPIO	170
DV4Mini – 2 M	Wireless Holdings	All	USB	149
DV4Mini – 70 cm	Wireless Holdings	All	USB	129
DV4Mini AMBE	Wireless Holdings	All	USB	228

- Add a PC or Rasp Pi and the appropriate software

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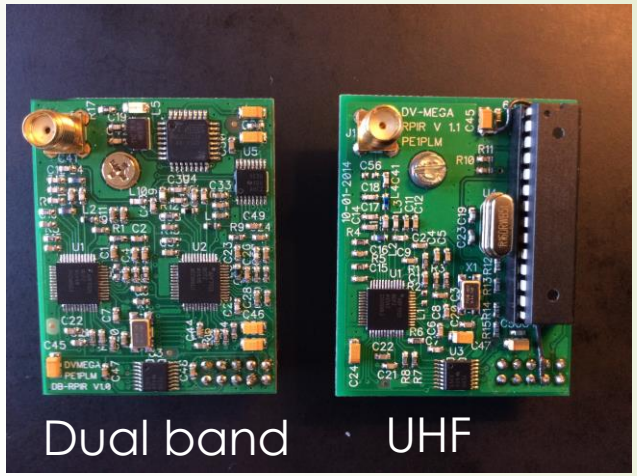
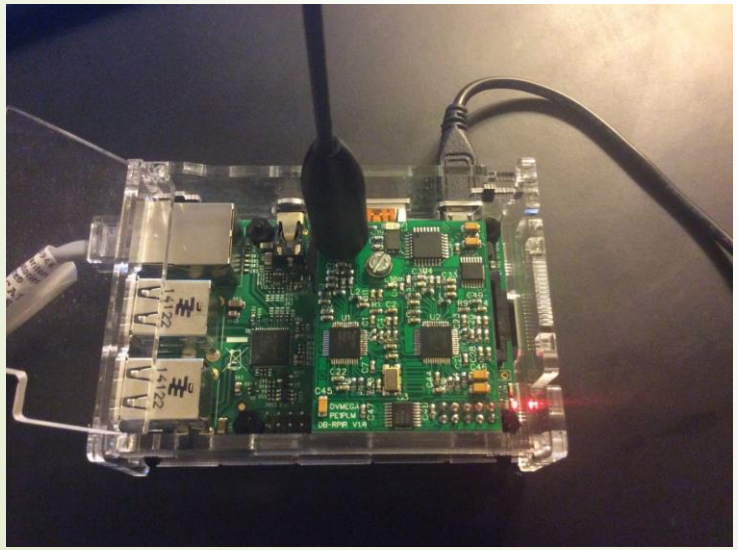
3 Mode DVMega Raspberry Pi Hotspot

- Developed by Guus van Dooren, PE1PLM - www.dvmega.auria.nl
- UHF and dual band versions plug into the Pi's GPIO pins
- Also available is a dual band version for Arduino Uno





- Use G4KLX MMDVMHost software
- Most common way to get set up is with a pre-built Raspberry Pi image
- Auto switching for D-STAR, DMR, C4FM
- 2-3 sec mode detection time lag creates operating problems

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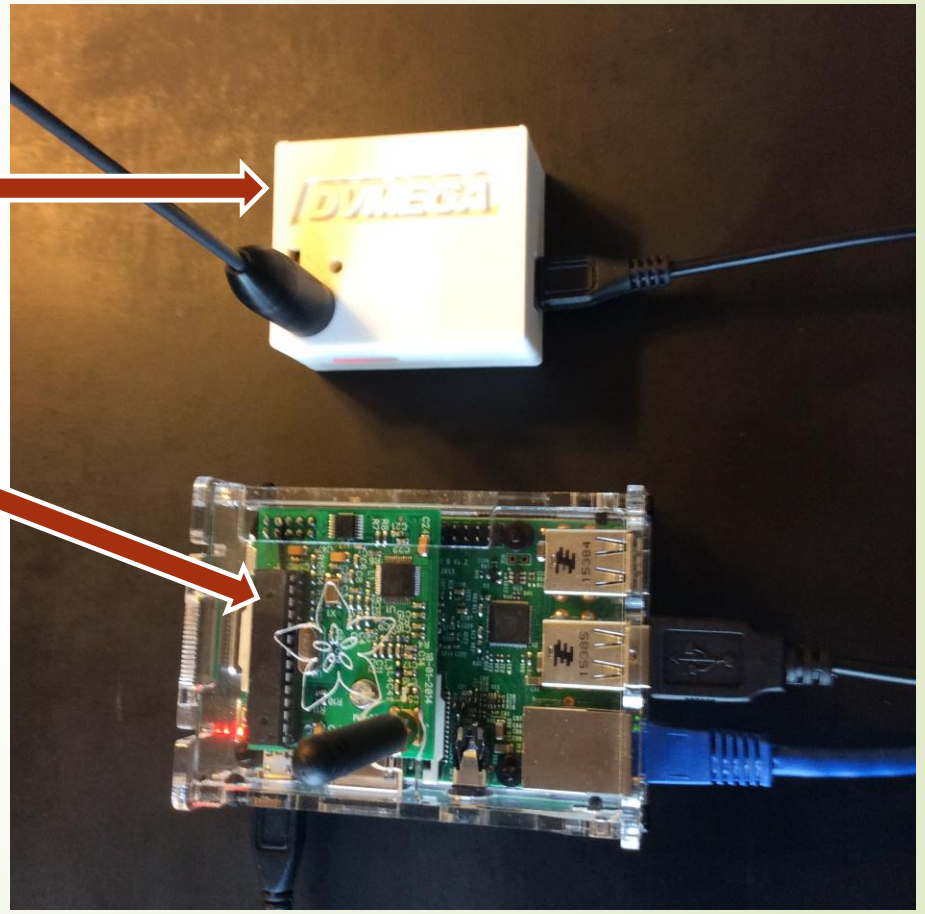
3 Mode Raspberry Pi Hotspot with 2 DVMegas

- Dual band DVMega (for 2M) on a BlueStack board plugged into a Pi USB port
- UHF DVMega plugged into the Pi's GPIO interface
- Software:
  - 2M D-STAR using G4KLX dstarrepeater and ircddbgateway
  - DMR and YSF on UHF using G4KLX MMDVMHost



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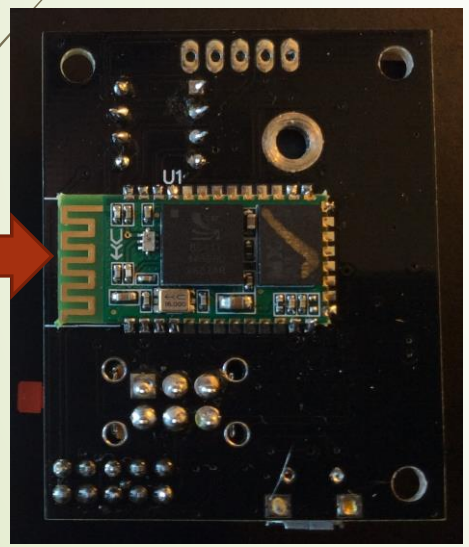
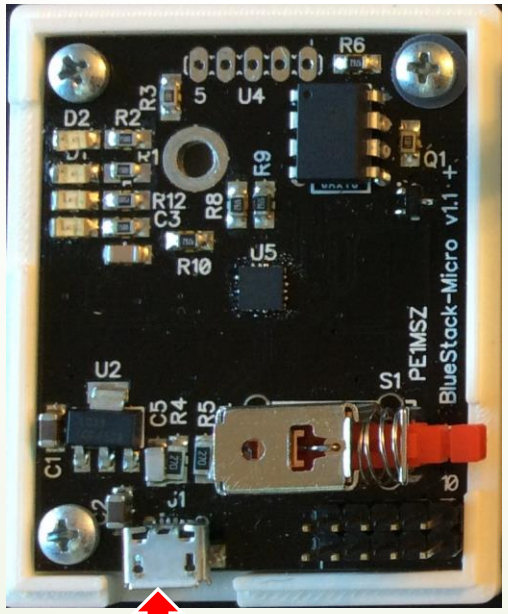
BlueStack Board

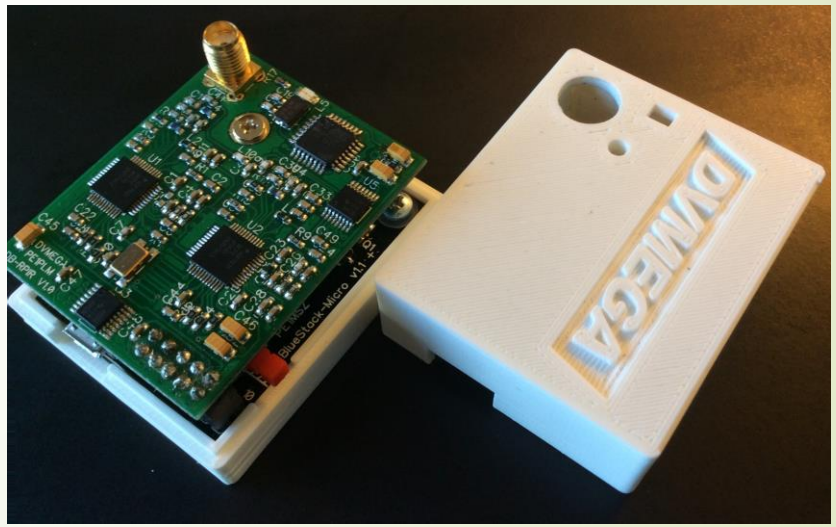
- DVMega interface to provide serial data connectivity using Bluetooth or USB
- Also used to flash the DVMega's firmware
- Available from www.combitronics.nl - BlueStack-Micro-Plus model - 40.00€
- Also get a nice 3D printed case from www.pd5dj.nl - 15.00€

Bluetooth module





USB/Power port



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Take Your Hotspot Mobile

- Install BlueDV on your Android phone from the Play Store
- Power from a 5V supply
- Set up Bluetooth pairing
- Set frequency & ID
- Uses the phone's WiFi, 3G or 4G
- Select mode and talk group/ reflector and use your radio on low power
- Supports D-STAR, DMR, & YSF
- Makes a compact mobile hotspot
- Also can use on a PC with the BlueDV Windows version

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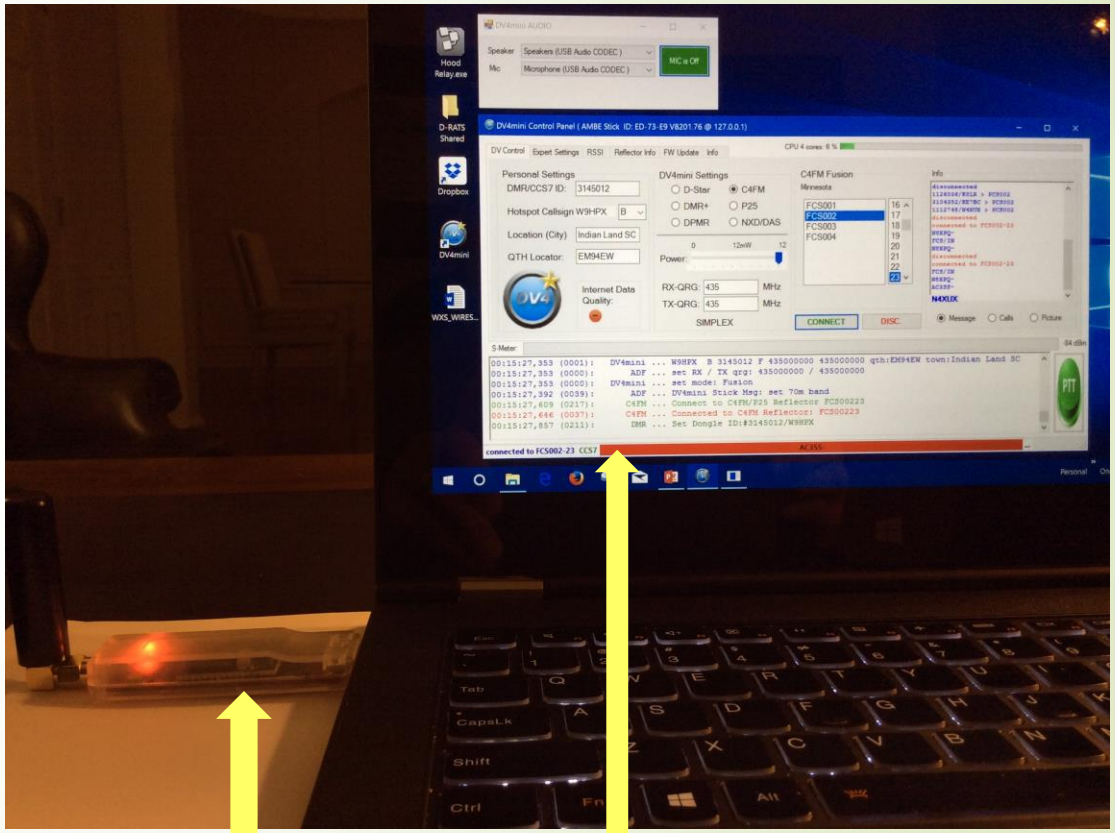
5 Mode DV4Mini AMBE Hotspot on Windows

- Developed by Stefan, DG8FAC, Torsten, DG1HT and Kurt, DJ0ABR
- Sold in USA by wirelesshold.com
- 2 M, 70 cm & 70 cm AMBE versions
- Use with D-STAR, DMR, C4FM, P25 & NXDN
- Use the control panel to connect to REF, XRF, DCS, FCS, PCS, NXD and DMR+ TG's / reflectors
- Rasp Pi control panel available
- Easy to set up and use
- Control panel necessary for use



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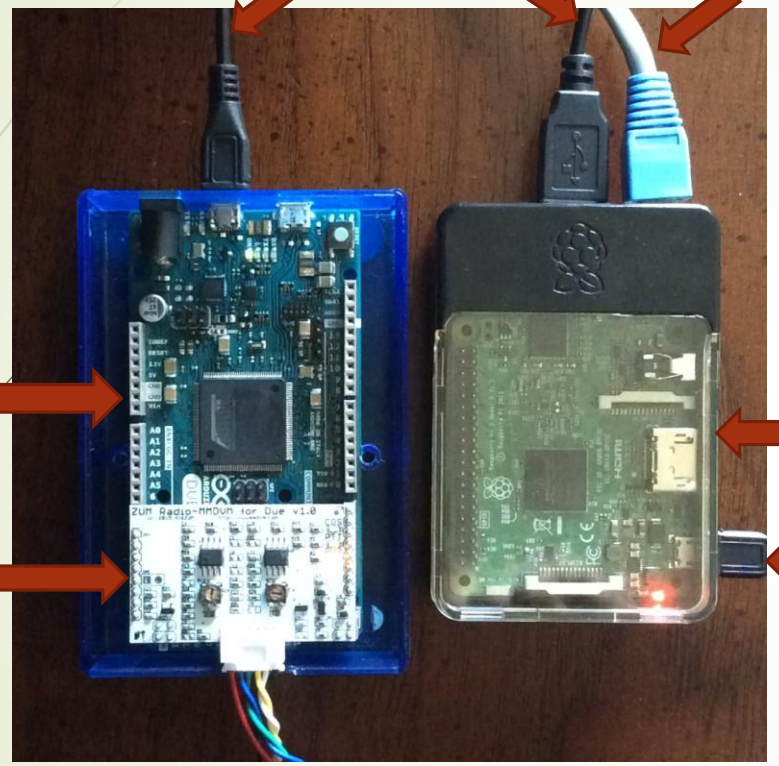
DV Access Point Summary – user assembled

- DV4Mini is a flexible, low cost product that works well. Windows and Raspberry Pi control panel software is well designed, but must be kept running on your PC.
- DVMega is flexible, low cost, and high quality. It requires a Raspberry Pi, or a BlueStack board to connect via USB or Bluetooth. Automatic mode detection. No control panel needed to operate. Basic Linux operation is necessary.

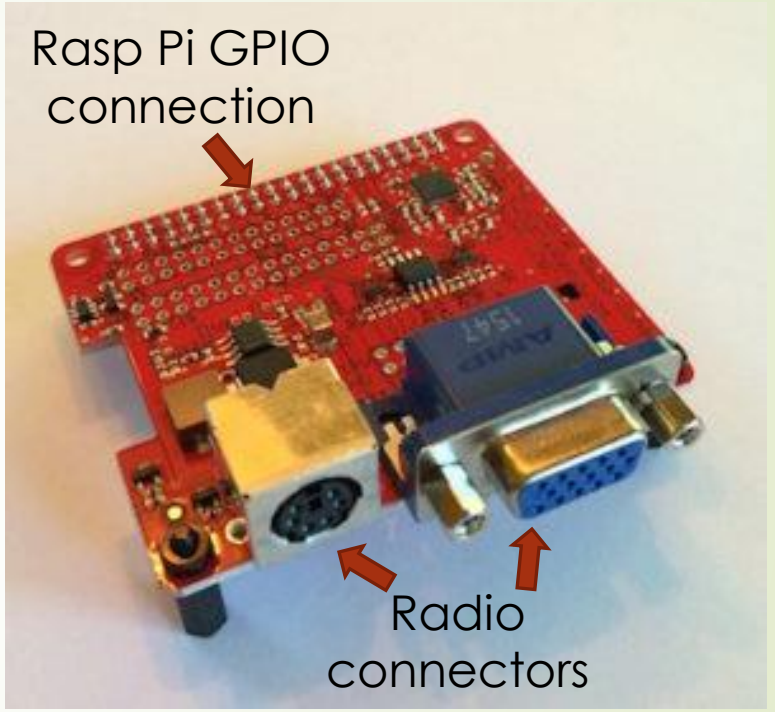
Hardware to Build Your Own DV Repeater



To Radio(s)

MMDVM

(Multi-mode Digital Voice Modem)



UDRC-II

(Universal Digital Radio Controller)

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DV Repeater Hardware Summary

- The MMDVM connected to two FM radios can make a DV repeater and be multi-mode with auto detect. This can be challenging to do well. It is the kind of experimentation that certain hams really like.
- The G4KLX MMDVM software is very flexible, open source and continuously being improved.
- Your FM radio choice can make or break the project. Sometimes older radios work better than newer.
- Cost to make a repeater is much lower than buying a commercial repeater.
- Northwest Digital's UDRC-II is a low cost RaspPi interface to connect to a radio. It can do more than just DV. Northwest Digital Radio support is readily available.
- Any DV repeater project is for the ham that likes to experiment. It is not "plug and play".

Info on the Internet

- www.charlottedstar.org – This is our web site. Use Quick Registration Page to register for D-STAR if you live in the Carolinas.
- groups.yahoo.com/neo/groups/clt-dstar/info – This is our Yahoo group. Please join. There are many more Yahoo groups for D-STAR, Fusion, WIRES-X, DMR, mmdvm, and even for specific radios. Just search for them.
- www.dstar101.com – good beginner's web site to learn about D-STAR.
- www.dstarinfo.com – download repeater lists to import into your D-STAR radio.
- www.dstarusers.org – D-STAR repeater directory
- www.maryland-dstar.org – for Raspberry Pi D-STAR hotspot image
- kdj.metro-uhf.org/dvap/ - easy to use command line Raspberry Pi image for D-STAR and DMR with good instructions
- www.ncprn.net – Web site for our area DMR repeaters. Area code plugs for many radios available for download.
- www.dmr-marc.net – Register for DMR here for free.
- hose.brandmeister.network – live worldwide DMR activity
- www.trbo.org/docs/Amateur_Radio_Guide_to_DMR.pdf – Basic guide.
- https://www.brandmeister.us/files/US_BM_User_Guide.pdf - Explains Brandmeister talk groups.
- www.hamoperator.com – good site to learn about System Fusion and WIRES-X. Look for the WIRES-X bible under Fusion Help.

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Questions?

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