

Charlotte Digital Radio Group

History, Purpose, Repeaters, Technology



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Topics

- **Charlotte Digital Radio Group's purpose**
- Some group history
- Organization
- Our repeaters
- How digital voice differs from FM
- Networking
- Currently available radios
- Access points (Hotspots)
- Bridges

What we do

- We are digital voice enthusiasts
- We promote and support digital voice modes
 - 12 digital voice repeaters
 - 5 sites
 - 5 digital voice modes
- We try to educate hams about digital voice modes
- We have a forum where we can answer your questions

The Beginning - D-STAR

- Nov. 2006, KA4YMY and KC4YOZ experimented with a Kenwood TKR-850 repeater interfaced with a Satoshi homebrew modem board to **make the area's first D-STAR** repeater.
- Nov. 2007, SERA began coordinating 12.5 kHz splinter channels for D-STAR. We were the first to get a pair assigned.
- ICOM D-STAR repeaters were added over the years to several sites - Spencer Mt, Crowders Mt, Wingate and Dallas.

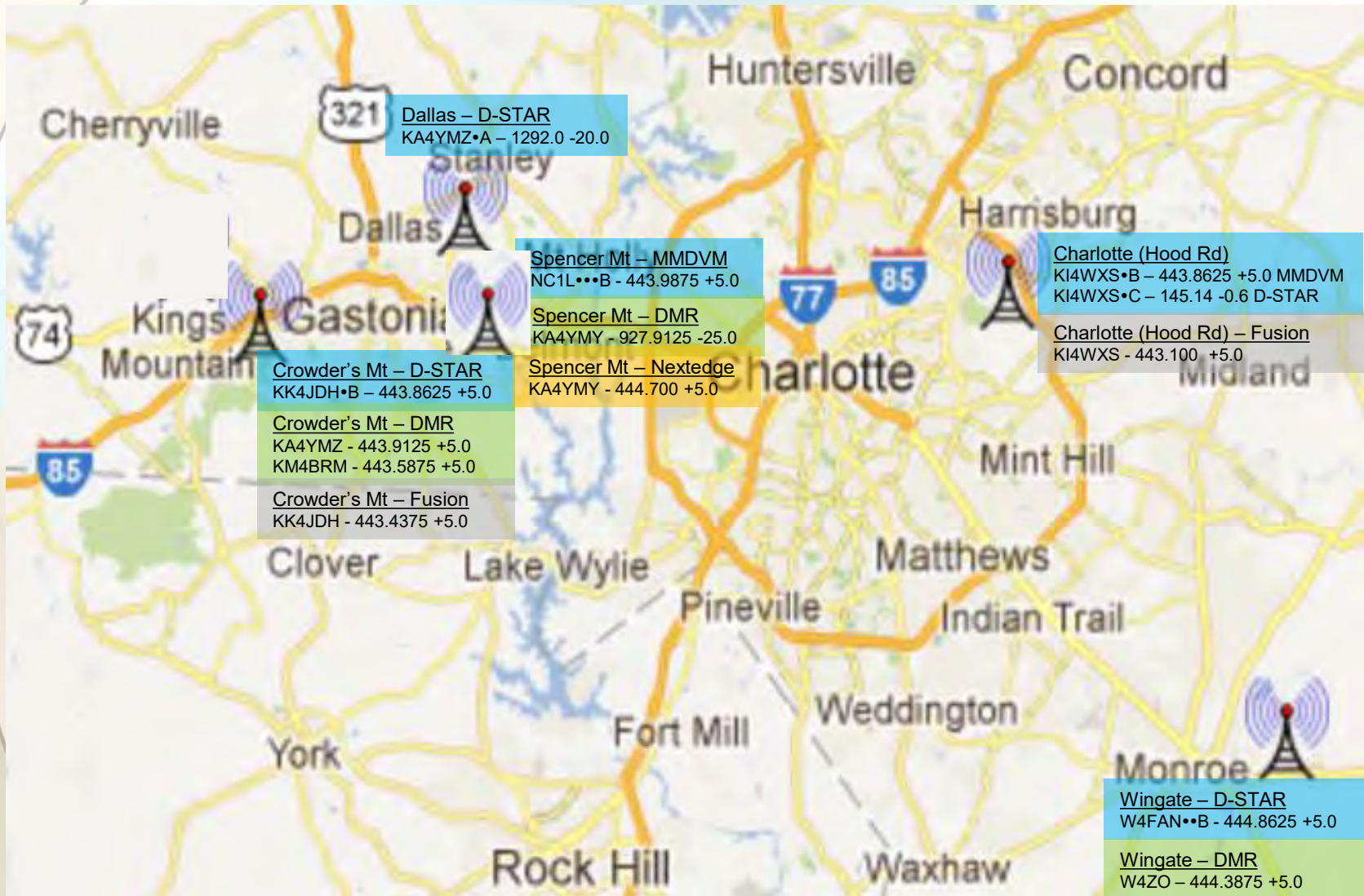
Next addition - DMR & Fusion

- In early 2014, we installed a DMR repeater at Crowders Mt networked to a DMR master controller owned by Ralph, W4ZO, located in NE Charlotte. 4 repeaters were networked.
- Later the network was replaced with a c-bridge controller and later by a software controller to allow expansion to form the NCPRN DMR network today.
- In Dec. 2014, we installed a System Fusion repeater at Crowders Mt. A second Fusion repeater came a year later at Hood Rd.

How we are organized

- We are not a club.
- We have always been a loose knit group.
- There are no elected officers.
- Users come and go.
- We have no membership nor dues.
- We pay our bills from private donations.
- Volunteers maintain our repeaters.
- We occasionally need professional tower climbers to repair/replace antennas.

Charlotte Area Digital Voice Repeaters



What is Digital Voice?

Analog FM



What is Digital Voice?

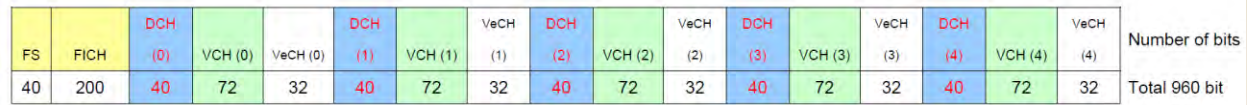
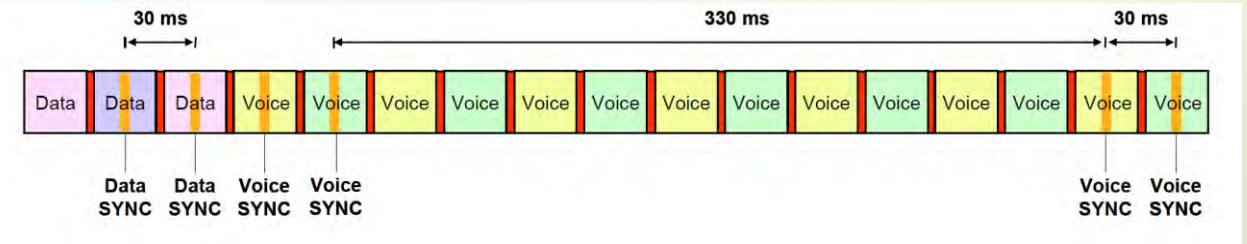
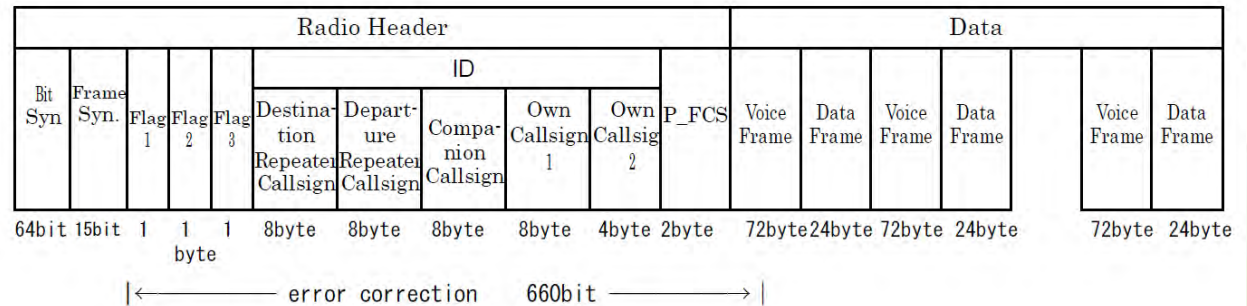
Analog FM



Digital Voice



Digital Voice Packet Structure



Tech Spec Comparison

	D-STAR	DMR	Fusion	M17
Vocoder	AMBE+	AMBE+2	AMBE+2	Codec 2
Modulation	GMSK	4FSK	C4FM	4FSK
Multiplex Method	FDMA	TDMA	FDMA	FDMA
Transmission Rate	4.8 kbps	4.8 kbps x 2	9.6 kbps	9.6 kbps
Bandwidth	6.25 kHz	12.5 kHz	12.5 kHz	9 kHz
Channels supported	1	2	1	1
Standard Developer	JARL	ETSI	Yaesu	M17 Team

AMBE = Advanced Multi-Band Excitation (patented Digital Voice Systems, Inc.)

Codec 2 = Codec 2 developed by David Rowe, VK5DGR, (LGPL license)

GMSK = Gaussian Minimum Shift Keying

4FSK = 4-level Frequency Shift Keying

C4FM = Continuous 4-level Frequency Modulation

FDMA = Frequency Division Multiple Access

TDMA = Time Division Multiple Access

Why Network?

- Repeaters are very quiet without users.
- Internet connectivity brings more users to the repeater and increases the coverage area.
- Reflectors provide multiple repeater connectivity.
- Wide area nets are possible.
- User network control gives the user choices, but some repeater owners prefer to limit control.
- Access Points (hotspots) give the user full control.

Reflector - What is it?

- Software running on a PC with robust internet connection.
- It receives an incoming data stream and sends it back out to every connected repeater - i.e. it reflects the data.
- Terminology:
 - D-STAR calls them Reflectors
 - DMR calls them Talk Groups, but Europe calls them Reflectors
 - WIRES-X - Yaesu calls them Rooms
- There are many different reflector networking systems:
 - D-STAR - REF, XRF, DCS, XLX
 - DMR - IPSC (Motorola), IPMSC (Hytera), PCS, BrandMeister (DMR+), TGIF (DMR+)
 - Fusion - WIRES-X Rooms, YSF reflectors, FCS reflectors

Current D-STAR Radios



- Base - ICOM IC-9700 \$1,700 VHF/UHF/1.2G
- Field - ICOM IC-705 \$1,350 HF/VHF/UHF
- Mobile - ICOM ID-4100A \$320 VHF/UHF
- Mobile - ICOM ID-5100A \$400 VHF/UHF
- Mobile - ICOM IC-7100 \$730 HF/VHF/UHF
- HT - ICOM ID-52A \$650 VHF/UHF

System Fusion

Current System Fusion Radios

- Base - Yaesu FT-991A \$1,230 HF/VHF/UHF
- Mobile - Yaesu FTM-200DR \$400 VHF/UHF
- Mobile - Yaesu FTM-300DR \$460 VHF/UHF
- Mobile - Yaesu FTM-400XDR \$590 VHF/UHF
- HT - Yaesu FT-70DR \$175 VHF/UHF
- HT - Yaesu FT-5DR \$450 VHF/UHF



Current DMR Radios

- Mobile - Anytone D578UV Pro \$400 VHF/UHF
- Mobile - TYT MD-9600 \$269 VHF/UHF
- HT - Anytone D878UV \$220 VHF/UHF
- HT - Wouxun KGUVN1 \$140 VHF/UHF
- HT - TYT MD-2017 \$169 VHF/UHF
- HT - TYT MD-UV380 \$110 VHF/UHF
- HT - TYT MD-380 \$100 UHF

Access Points (Hotspots)

- Commercial

- OpenSPOT 3 \$450
- DVMEGA Cast \$400
- TGIFSPOT \$318

- Do-It-Yourself (components)

- ZumSpot Elite \$250
- ZumSpot Kit \$160 - also need Raspberry Pi
- Thumb DV \$120 - also need PC
- DVMEGA \$120 - also need Raspberry Pi
- DV Stick 30 \$110 - also need PC

Hotspot Software

Hostname: pi-stars

Pi-Star:4.1.0 / Dashboard: 20200528

Pi-Star Digital Voice Dashboard for W9HPX

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	430.100000 MHz
Rx	430.100000 MHz
FW	ZUMspot:v1.4.17
TCXO	14.7456 MHz

D-Star Repeater	
RPT1	W9HPX B
RPT2	W9HPX G

D-Star Network	
APRS	rotate.aprs2.net
IRC	rr.openquad.net

Linked to REF054 C
(DPlus Outgoing)

Gateway Activity

Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
10:42:24 Jun 3rd	D-Star	KA4VUK/MIKE	CQCQCQ	Net	1.0	0%	0.0%
09:32:35 Jun 3rd	D-Star	KF8PM/ALAN	CQCQCQ	Net	3.1	0%	0.0%
09:32:30 Jun 3rd	D-Star	W9HPX/9700	CQCQCQ	RF	26.6	0%	0.0%
09:23:04 Jun 3rd	D-Star	W9HPX/51AD	CQCQCQ	RF	13.4	0%	0.0%
09:19:41 Jun 3rd	D-Star	W9HPX/INFO	CQCQCQ	Net	7.2	0%	0.0%
09:18:14 Jun 3rd	YSF	N2RON	*****EAYgj	Net	28.2	0%	0.0%
09:17:40 Jun 3rd	YSF	K9VMY	ALL	Net	17.5	0%	0.0%
09:14:29 Jun 3rd	YSF	K04LJ	ALL	Net	0.5	0%	0.0%
07:22:35 Jun 3rd	YSF	W4OLE	ALL	Net	0.5	0%	0.0%
06:26:40 Jun 3rd	YSF	WB4FCU	ALL	Net	19.2	0%	0.0%
06:26:17 Jun 3rd	YSF	KB4BCY	ALL	Net	66.2	0%	0.0%
21:43:30 Jun 2nd	D-Star	ND4L/ID51	CQCQCQ via REF054 C	Net	6.8	0%	0.0%
21:43:27 Jun 2nd	D-Star	KI4UDZ/ID51	CQCQCQ	Net	6.0	0%	0.0%
21:40:47 Jun 2nd	D-Star	N2RON/AMBE	CQCQCQ	Net	15.5	37%	0.3%
21:38:14 Jun 2nd	D-Star	KC8YQL/AMBE	CQCQCQ	Net	45.0	0%	0.0%
21:36:10 Jun 2nd	D-Star	W9HPX/9700	CQCQCQ	Net	132.0	0%	0.0%
21:32:49 Jun 2nd	D-Star	K4MVM/9700	CQCQCQ	Net	49.4	0%	0.0%
21:30:59 Jun 2nd	D-Star	KD8AGO H/JOHN	CQCQCQ	Net	69.9	0%	0.0%
21:24:26 Jun 2nd	D-Star	KF4BY/5100	CQCQCQ	Net	61.2	7%	0.0%
21:22:58 Jun 2nd	D-Star	K4FPP/RICH	CQCQCQ	Net	106.7	0%	0.0%

Local RF Activity

Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
09:32:30 Jun 3rd	D-Star	W9HPX/9700	CQCQCQ	RF	26.6	0.0%	S9+46dB (-47 dBm)
09:23:04 Jun 3rd	D-Star	W9HPX/51AD	CQCQCQ	RF	13.4	0.0%	S9+46dB (-47 dBm)

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWZ) 2014-2020.
ircDDBGateway Dashboard by Hans-J. Barthen (DL5DI),
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.

Free download at: <http://www.pistar.uk/>

Charlotte Digital
Radio Group
Digital Voice Communications

BlueDV software by David PA7LIM

- Least expensive way to get started - no radio to buy
- Buy an AMBE USB stick from several sources such as Northwest Digital Radio or DVMEGA
- Free software download from www.pa7lim.nl

BlueDV for Windows

Menu Update AMBE About

DSTAR XLX054 A Link Unlink REF DCS XRF XLX

By David PA7LIM Version 1.0.0.9581

SERIAL Frequency Firmware AMBE3000R LISTENING
DMR master Dest TG BER

CALL
NAME
INFO

IDLE Status None TX RX

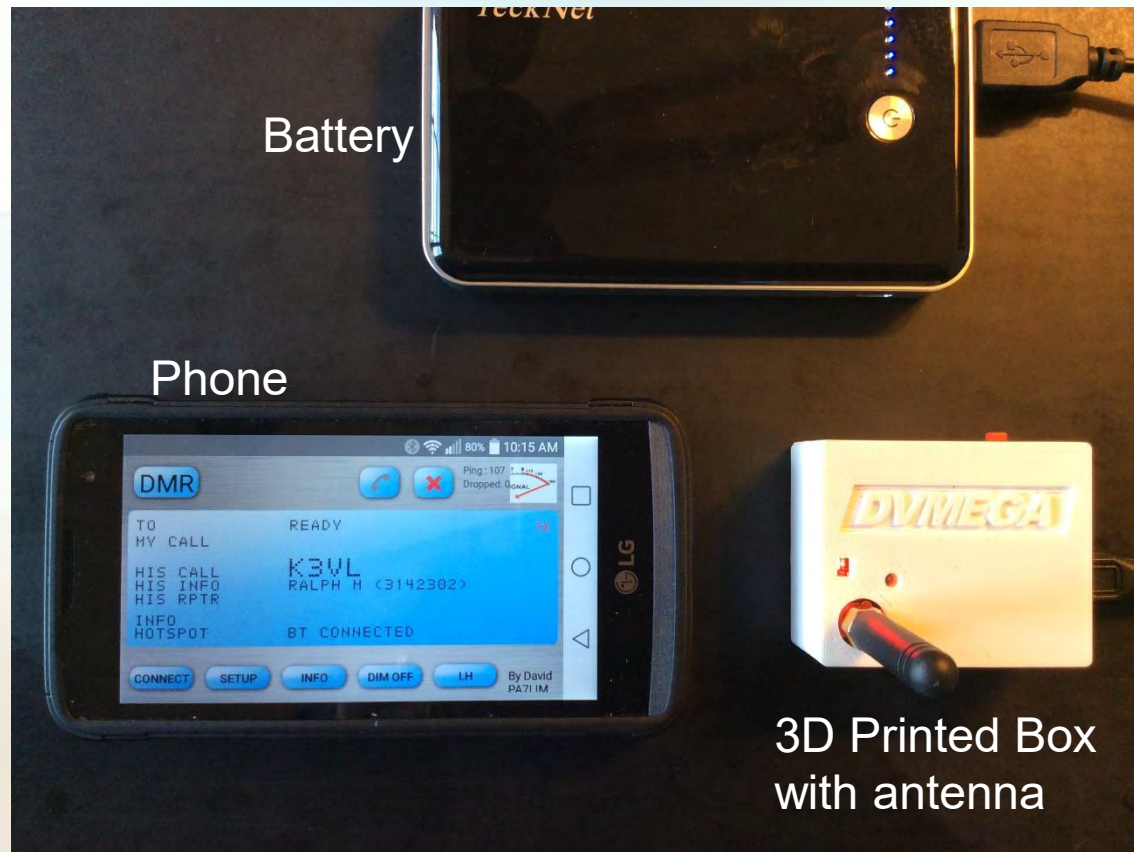
Lastheard	AMBE	BM lookup	APRS chat
Time	Call	Name	Mode
11:37 AM	WA3GDB	William	DSTAR
11:38 AM	W9HPX	Roland	DSTAR
11:38 AM	W9HPX	Roland	DSTAR

DMR DSTAR FUSION AMBE3000

Donate Call Status Logged Out Call Status Linked to DCS054 A Call Status Not linked Mute spk

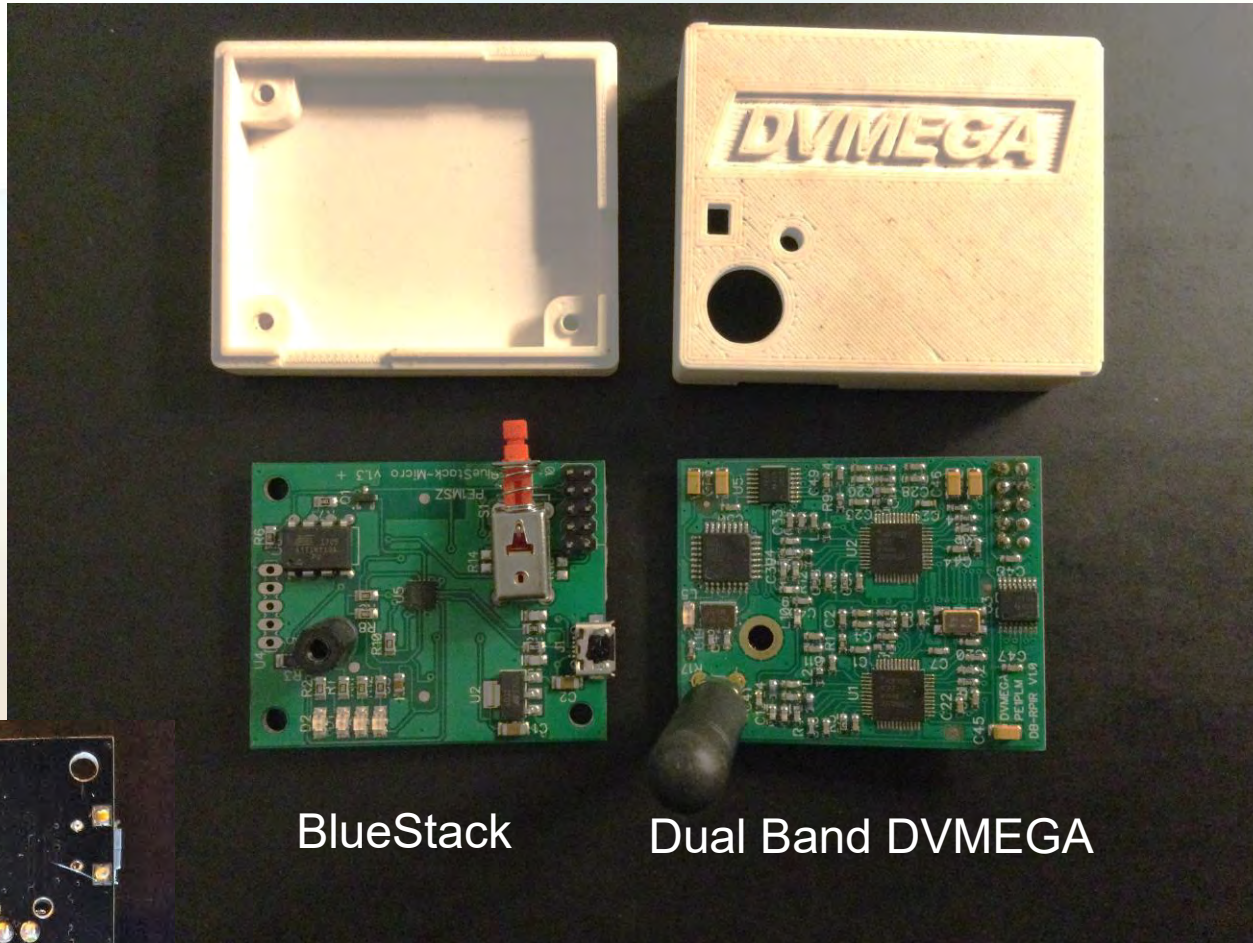


My Mobile Hotspot



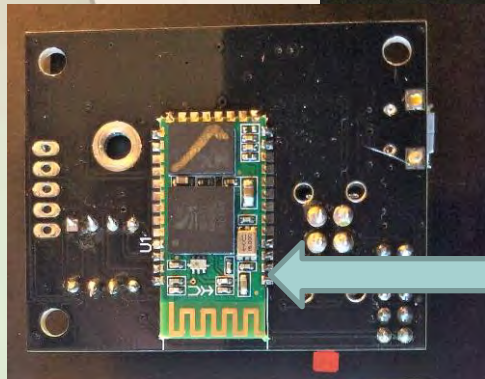
DVMEGA on BlueStack Board paired via Bluetooth to an Android phone running BlueDV software
D-STAR, DMR, YSF

What's in the Box?



BlueStack

Dual Band DVMEGA



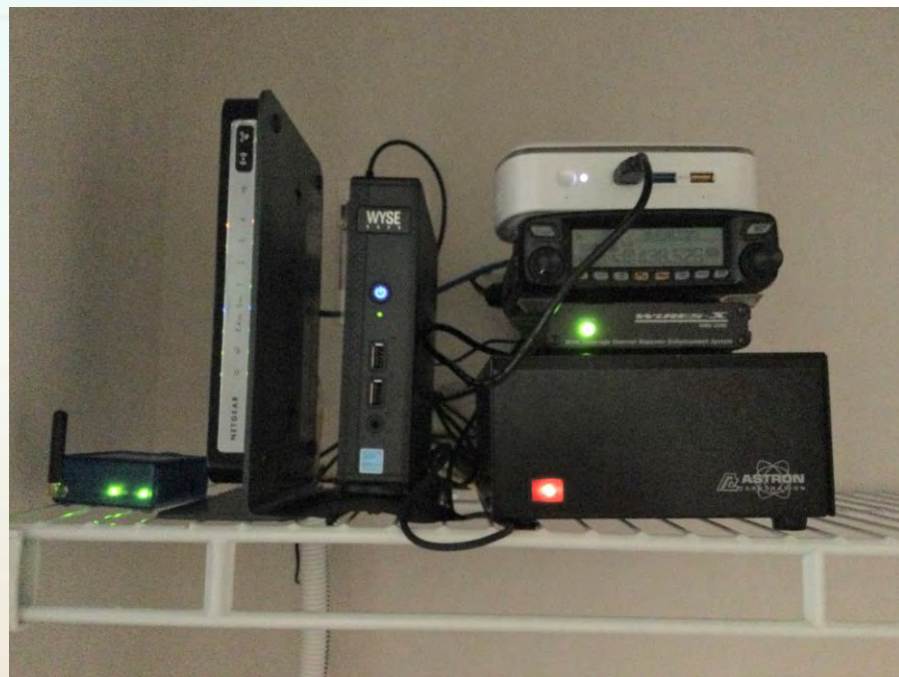
Bluetooth Module

Bridging DV Modes

- Why bridge?
 - Need to own fewer radios
 - Talk to hams that use a different DV mode
 - Expand beyond proprietary networks
- What is needed to create a bridge?
 - PC(s)
 - Software
 - Internet
 - Transcoder
 - Radios (only if an RF link is needed)


Carolina Link Bridge


- Originally started by Steve, K4SQI (SK)
- Interconnects:
 - D-STAR DCS054A
 - WIRES-X Room 43008
 - YSF 79602
 - DMR TGIF TG 31374
- Dashboards:
 - <http://xrf054.metro-uhf.org/index.php>
 - <http://ysf.metro-uhf.org/>





Additional Information Sources

- <http://www.charlottedstar.org/> – This is our web site.
- <https://groups.io/g/CharlotteDigitalRadio> – This is our group. Please join to keep up with what we are doing. Post a message or a question.

- <http://www.charlottedstar.org/D-STAR DR Mode.pdf> – How to use DR mode.
-  www.dstarinfo.com – download current repeater data (.cvs file) to import into your compatible D-STAR radio.
- www.dstarusers.org – Official D-STAR repeater directory.

- www.ncprn.net – Web site for our area DMR repeaters.
-  <https://radioid.net/register#!> – Register your call sign here for DMR.
- www.trbo.org/docs/Amateur_Radio_Guide_to_DMR.pdf – Basic DMR guide.

-  <https://wp.hamoperator.com/> – learn about System Fusion and WIRES-X. Look for the WIRES-X bible under Fusion Help.

-  <https://m17project.org/> - website for M17 development.

Manufacturer's web sites have the most relevant specific radio information.



QUESTIONS?