A Comparison of Amateur Radio Digital Voice Systems

presented by

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Charlotte Digital Radio Group

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Topics

- Digital voice description
- Technical comparison
- Operational features
- Programmability
- Radio choices
- Charlotte DV repeaters
- Information sources
- Q & A

See p30 April 2015 QST

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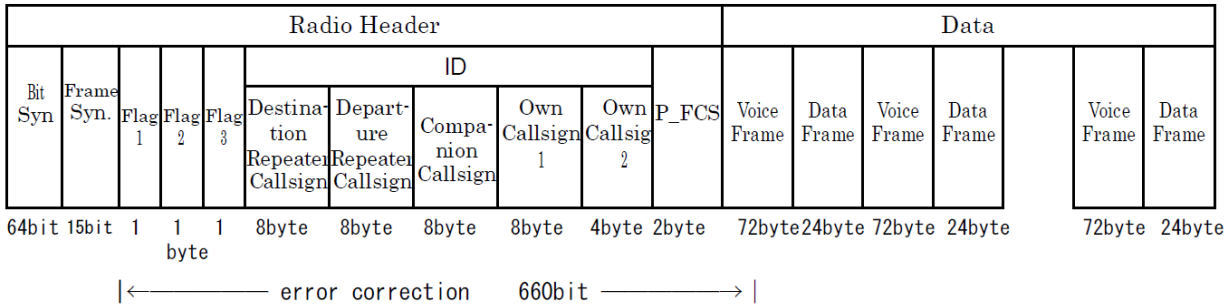
What is Digital Voice?

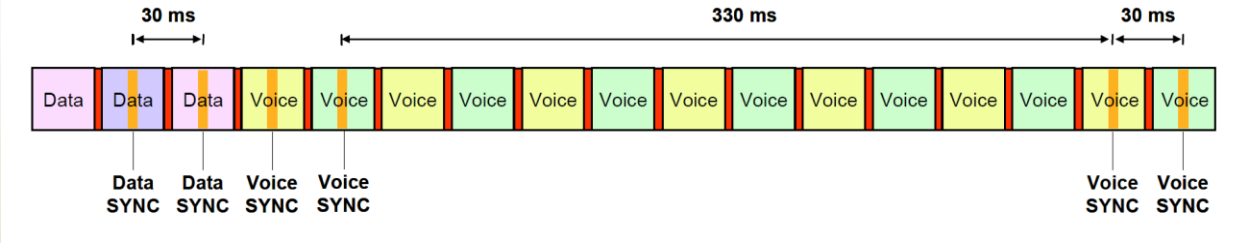
- Digital data modulating an RF carrier
- The data is digitized audio from an A/D converter
- It is processed through a vocoder to compress the data and add forward error correction
- The data is sent serially in uniform length packets
- Header data is pre-pended to provide sync bits, routing instructions and user identity
- Other data is often interleaved or substituted for the voice to send text, pictures or other files

Pictorial view

D-STAR



DMR



Fusion

FS	FICH	DCH (0)	VCH (0)	VeCH (0)	DCH (1)	VCH (1)	VeCH (1)	DCH (2)	VCH (2)	VeCH (2)	DCH (3)	VCH (3)	VeCH (3)	DCH (4)	VCH (4)	VeCH (4)	Number of bits
40	200	40	72	32	40	72	32	40	72	32	40	72	32	40	72	32	Total 960 bit

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Tech Spec Comparison

	D-STAR	DMR	Fusion
Vocoder (see note)	AMBE+	AMBE+2	AMBE+2
Forward Error Corr.	Voice Only	Voice Only	Voice Only
Modulation	GMSK	4FSK	C4FM
Multiplex Method	FDMA	TDMA	FDMA
Transmission Rate	4.8 kbps	4.8 kbps x 2	9.6 kbps
Bandwidth	6.25 kHz	12.5 kHz	12.5 kHz
Channels supported	1	2	1
Standard Developer	JARL	ETSI	Yaesu

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

Note: Newer radios implement the vocoder in the DSP chip

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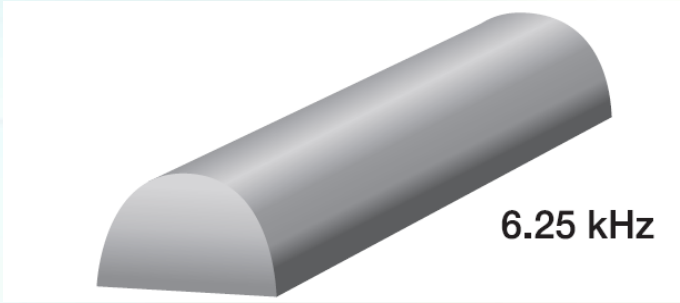
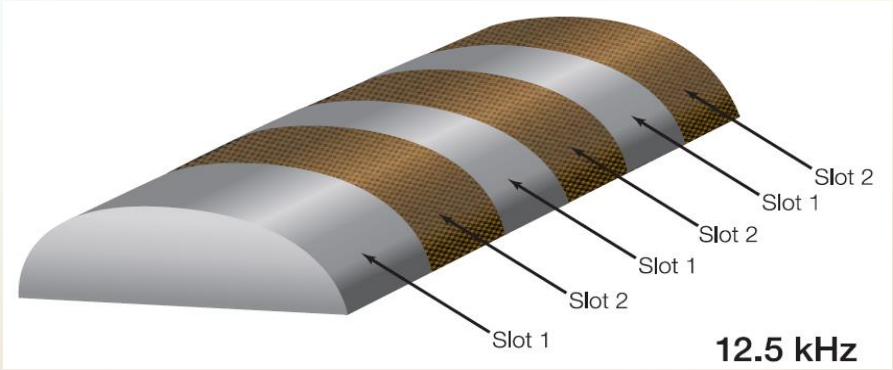
Bandwidth Comparison

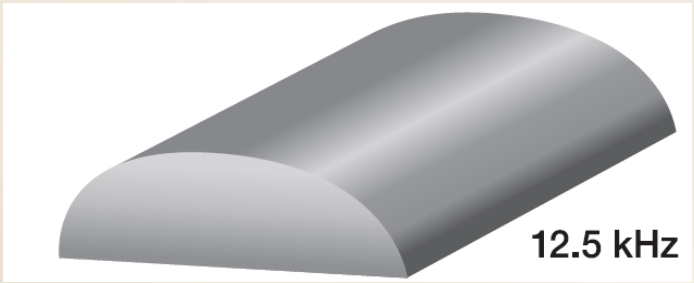
D-STAR



DMR



Fusion



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User Identification

	D-STAR	DMR	Fusion
Registration required?	Yes	Yes	No
User identity	Call sign	Subscriber ID	Call sign
ID displayed on radio's display	Call sign	Subscriber ID*	Call sign
Other text display options	4 characters 20 characters	No	No
Adequate for FCC ID?	Yes†	No	Yes†

* Call sign displayed if the receiving station's subscriber ID is in the radio's contact list; otherwise subscriber ID appears.

† IDing by voice is still a good idea for the benefit of everyone listening.

Repeater Connectability

	D-STAR	DMR	Fusion
Talk locally	Yes	Yes	Yes
Link to another repeater	Yes	No	No
Multi-repeater connection	Reflectors	Talk Groups	WIRES-X Rooms
Selection method	UR entry	Channel Dial	Room name
Route to another ham	Yes	No	No
Echo test	Yes	Yes	No
Request link status	Yes	No	No

Radio Operating Features

	D-STAR	DMR	Fusion
Memory selection	Dial or GPS search	Key Press	Dial
Repeater connection selection	Dial	Dial	Key press
Mode selection method	Key press	Fixed in memory	Key press *
Radio programming complexity	Difficult/Easy ◊	Difficult	Easy
Newbie learning curve	Steep	Fairly easy	Fairly easy
User manual pages - older HT	131 (IC-91)	65 (CS-700)	247 (FT-1DR)
User manual pages - newer HT	425 (ID-51)		340 (FT-2DR)

* Fusion radios have AMS (automatic mode select)

◊ Older D-STAR radios are more difficult to program. Newer ones are pre-programmed, but must be updated as repeaters change.

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Signal Readability

	FM	D-STAR	DMR	Fusion *
Voice naturalness	Good	Good	Good	Narrow – good Wide - very good
Signal noise	Varies	None	None	None
Sync robustness	N/A	Fair	Good	Good
Sync recoverability	N/A	Poor	Best	Best

* Fusion has two bandwidth voice modes. Wide sounds slightly better than narrow.

Sync robustness is the tendency to fall out of sync
Sync recoverability is the ability to recover sync quickly

The opinions shown here are highly subjective. Your opinion may differ.

Networking Characteristics

- D-STAR
  - User control capability – substantial
  - Networking options – G2, D-Plus, ircDDB
  - Innovation ability – many efforts and accomplishments
- DMR
  - Centrally controlled structure – inflexible
  - Networking options – c-bridge, hytera
  - Innovation ability – limited, but not impossible
- Fusion
  - Yaesu controlled servers – inflexible
  - Networking options – WIRES-X
  - Innovation ability – limited, but Hams are just getting started

D-STAR HT's

ID-31A

- Single band (70cm)
- 5W
- uSD card record
- 500 memories
- Internal GPS
- Repeater geo search
- $295 new

ID-51A Plus

- Dual band
- 5W
- uSD card record
- 1300 memories
- Internal GPS
- Repeater geo search
- $450 new

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D-STAR Mobile's

Older - ID-880H

- Dual band
- 50W
- 1050 memories
- $420 new

Newer - ID-5100A

- Dual band Touch Screen
- 50W
- 1000 + 1500 DR memories
- Internal GPS & DPRS
- SD card recording
- Repeater geo search
- $600 new

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DMR HT's

MotoTrbo - XPR-7550

- 440 MHz band
- 4W
- Color screen
- 1000 channels
- $ 700 new

Hytera PD782G-U1

- 440 MHz band
- 4W
- Color screen
- 1024 channels
- $ 545 new

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DMR HT's (cont.)

Connect Systems - CS700

- 440 MHz band
- 4W
- 1000 memories
- Chinese copy of XPR6550
- $ 200 new

DMR Mobile's

MotoTrbo - XPR-5550

- 440 MHz band
- 40W
- 1000 channels
- Color screen
- $ 600 new

Hytera - MD782G-U1

- 440 MHz band
- 45W
- 1024 channels
- Color screen
- $ 530 new

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System Fusion HT's

Yaesu - FT-1DR

- Dual band
- 5W
- Automatic Mode Select
- 900 memories
- GPS & APRS
- $300 new

Yaesu - FT-2DR (new)

- Dual band
- 5W
- Automatic Mode Select
- 1245 memories
- GPS & APRS
- Touch screen
- $550 new

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System Fusion Mobile

Yaesu - FT-400DR

- Dual band
- 50W
- Automatic Mode Select
- 1000 memories
- GPS & APRS
- Color Touch screen
- $500 new

Yaesu - FT-100DR (new)

- Dual band
- 50W
- Automatic Mode Select
- 1000 memories
- GPS & APRS
- $400 new

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Base Stations

ICOM - IC-7100

- HF + 6M – 100W
- 2M - 50W + 70 cm - 35W
- 1600 memories
- GPS
- Touch screen
- $1,100 new

Yaesu - FT-991

- HF + 6M – 100W
- 2 & 70 cm – 50W
- Color TFT display
- Automatic antenna tuner
- Automatic Mode Select
- 1000 memories
- GPS & APRS
- $1,600 new

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Other Digital Voice Suppliers

DV Dongle

- Internet Labs
- D-STAR on your PC
- $200 new

Thumb DV

- Northwest Digital Radio
- D-STAR on your PC
- Uses AMBE 3000
- Other modes?
- $120 new

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Other Digital Voice Devices

DV Access Point

- Internet Labs
- Hotspot repeater
- Single band
- 2M $240 new
  70 cm $260 new

DV Mega

- Guus van Dooren PE1PLM
- Hotspot repeater
- Dual band
- $180 new

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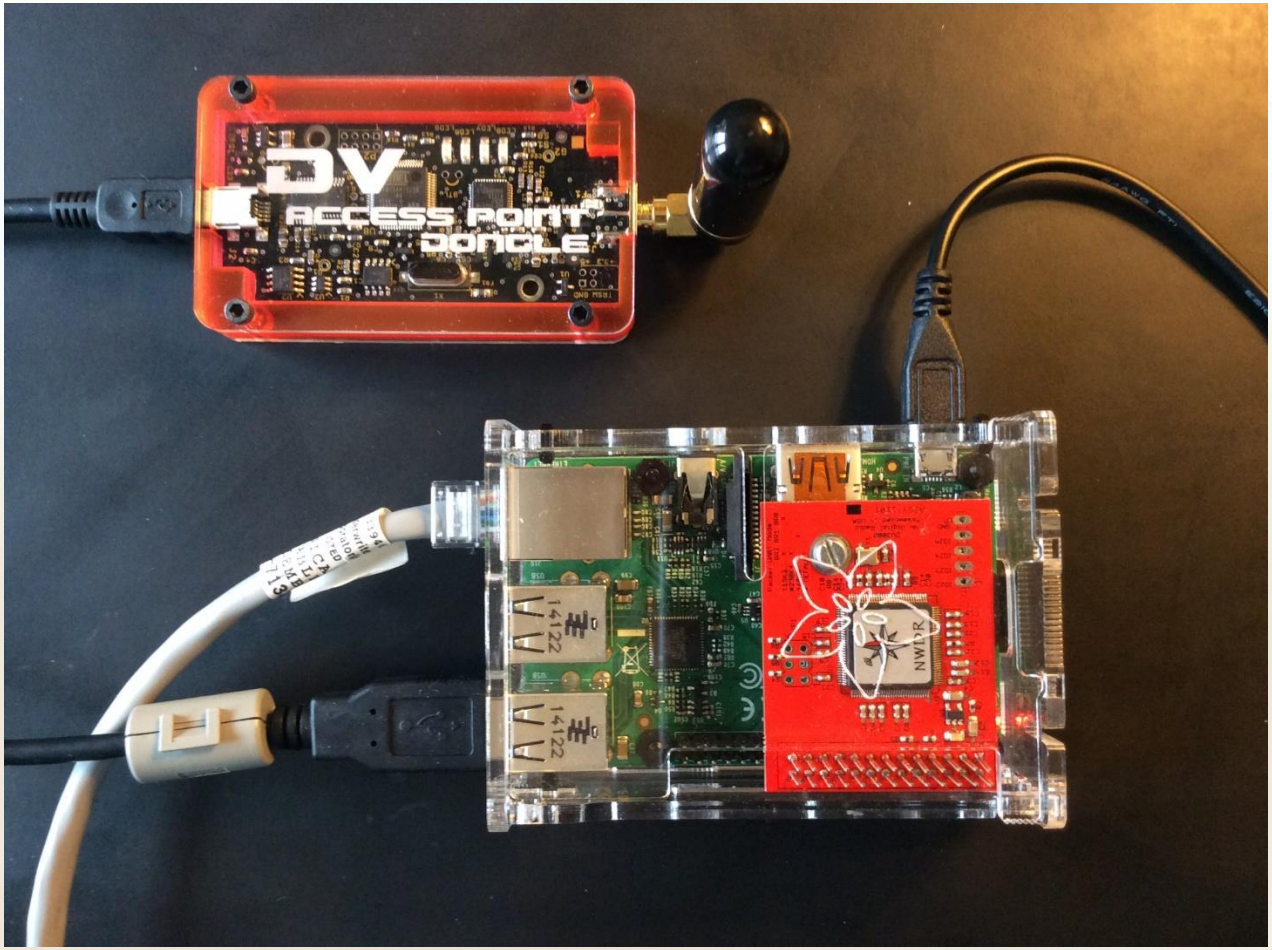
Not near a D-STAR Repeater? Make your own – with this…



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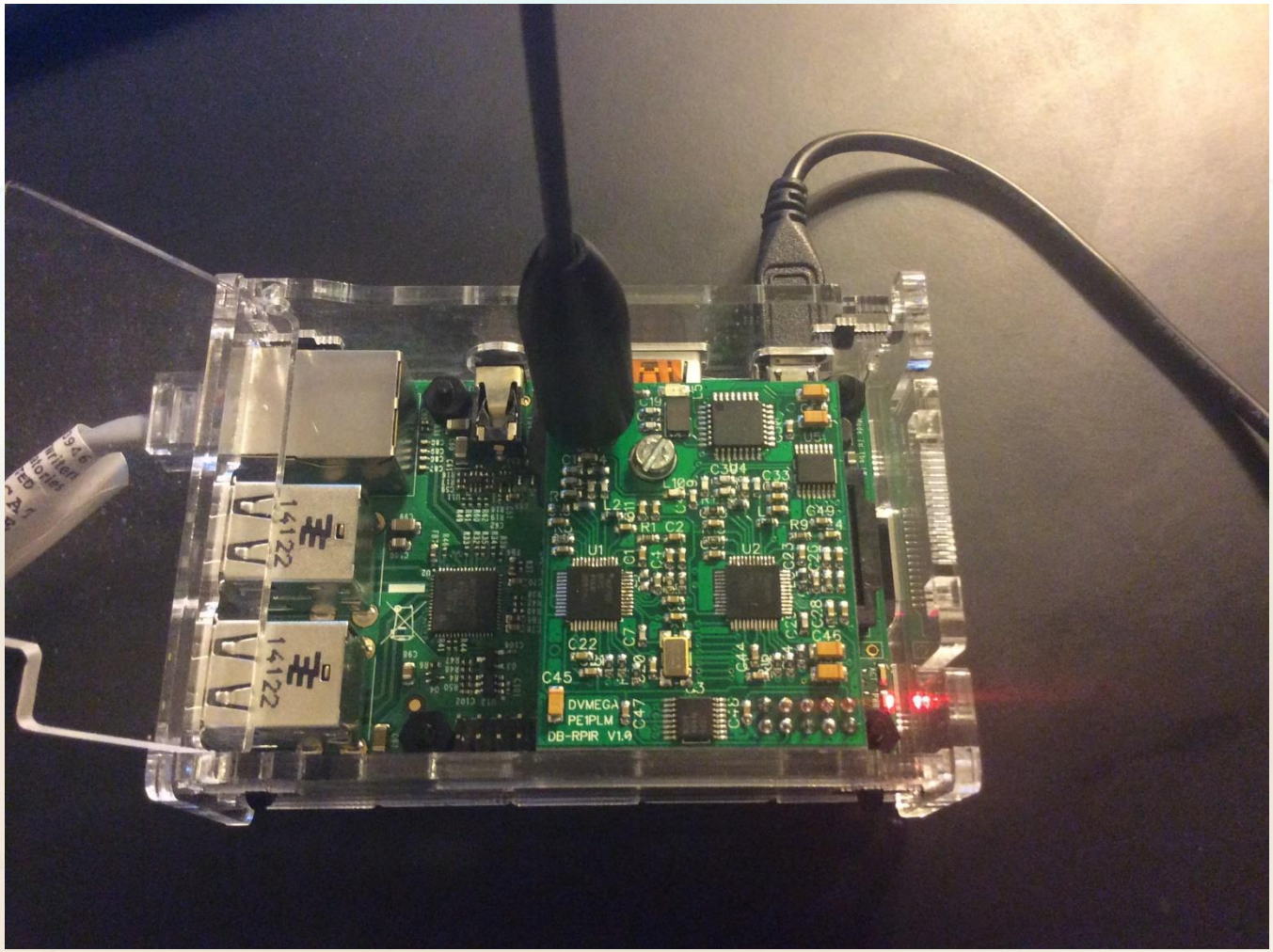
Or this…



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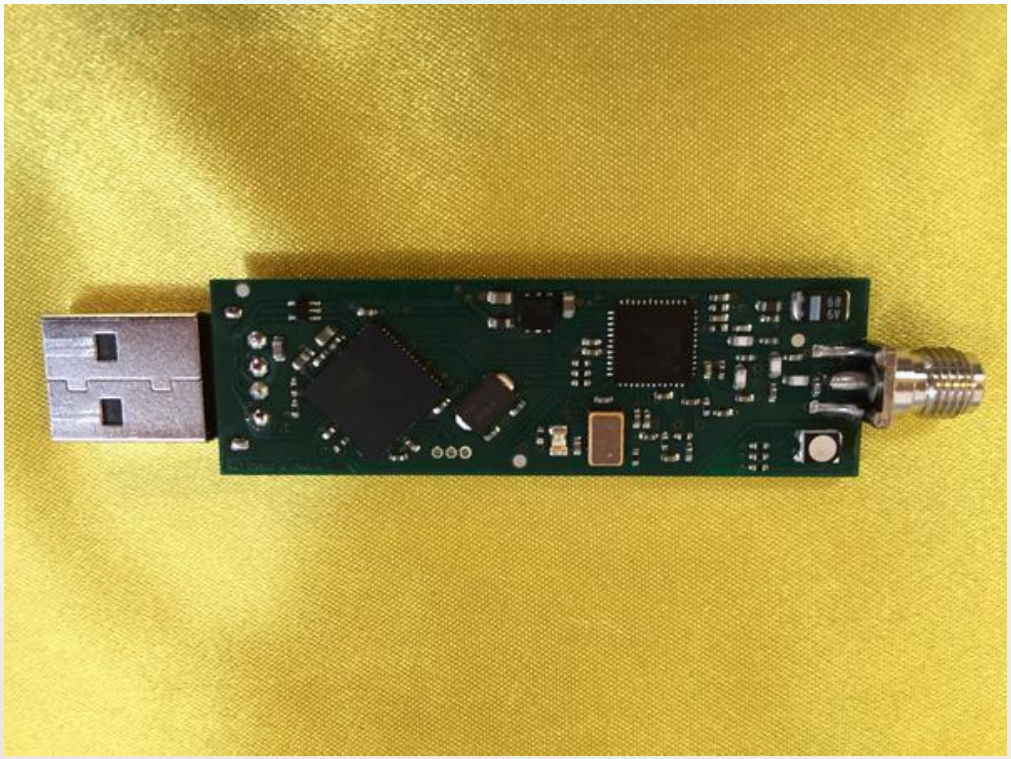
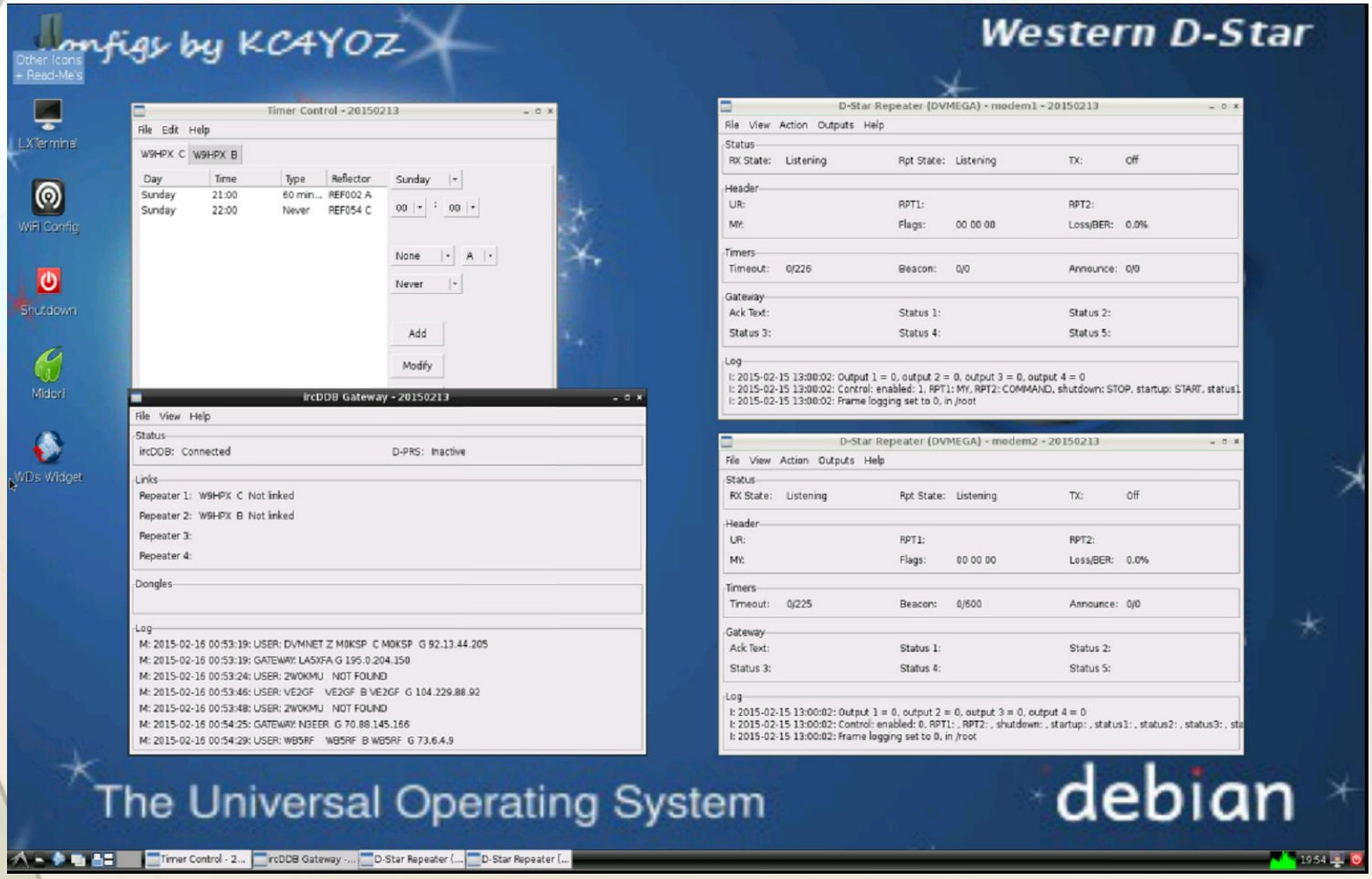
Or something not yet available…



DV4mini for DMR and D-STAR – 100 euro, available August

Raspberry Pi G4KLX GUI



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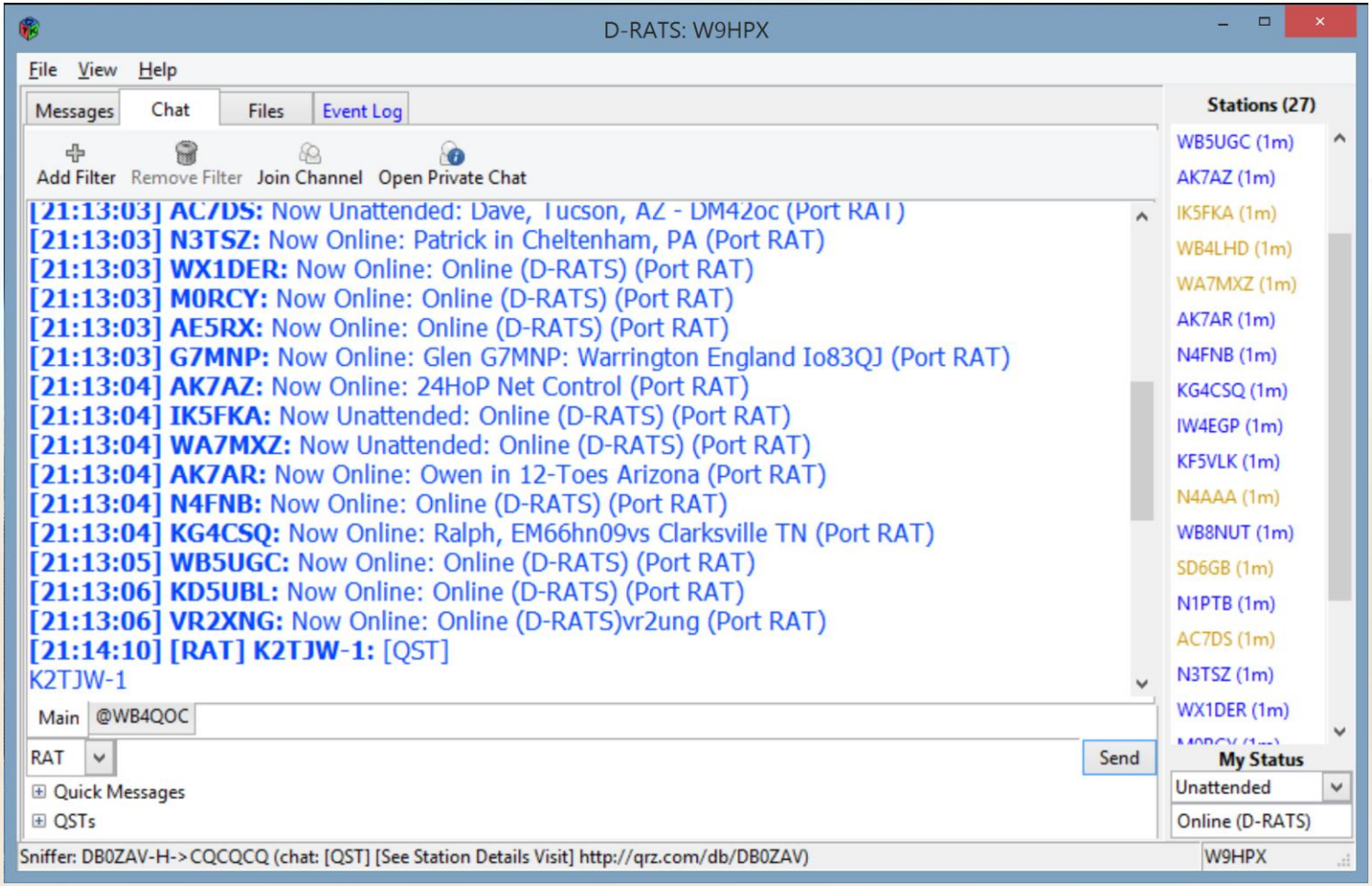
D-RATS



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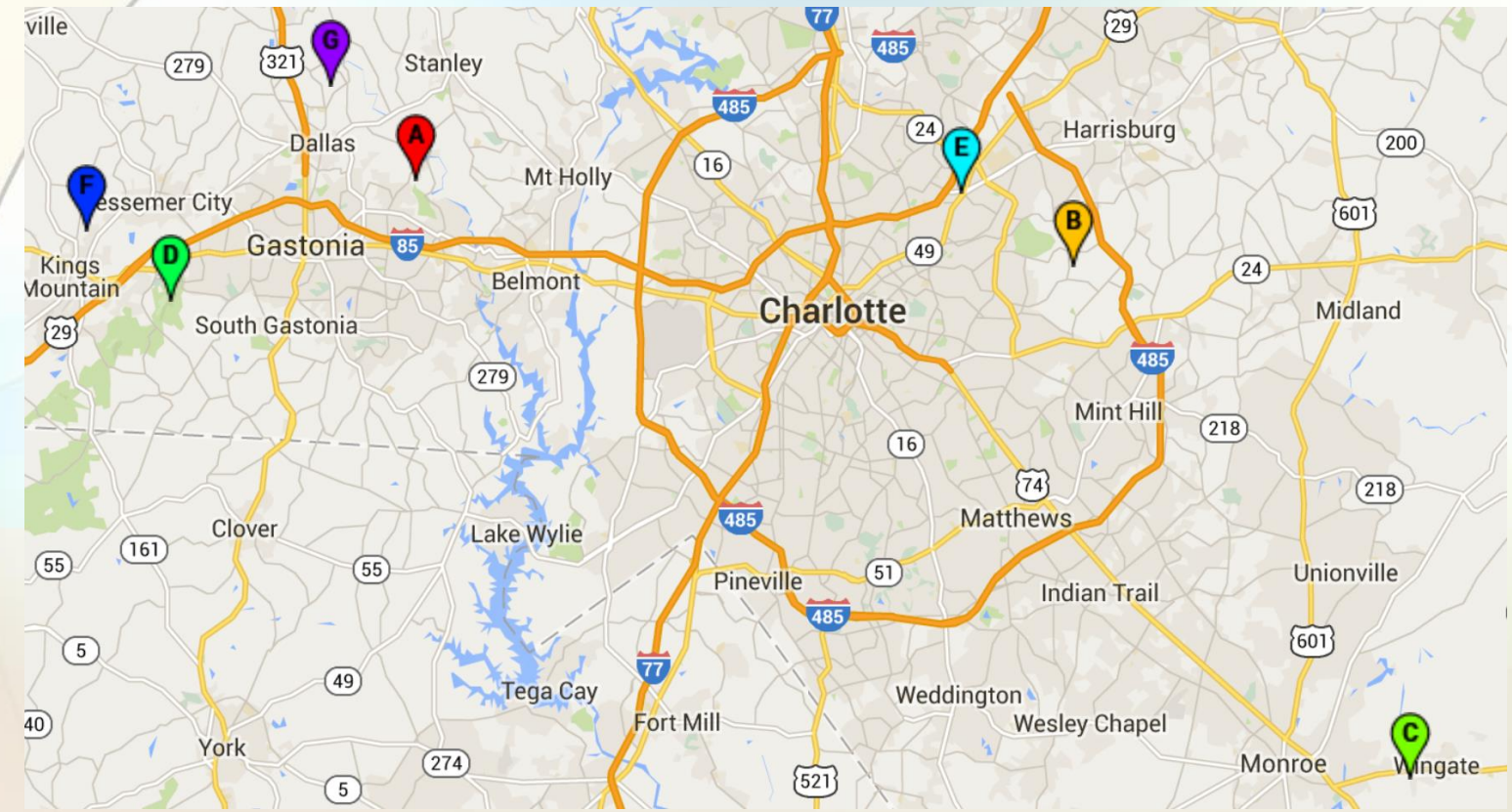
For More Information

- www.charlottedstar.org - This is our web site. Register for D-STAR here.
- groups.yahoo.com/neo/groups/clt-dstar/info
  This is our Yahoo group, but search for other Yahoo groups of interest such as D-STAR, Fusion, DMR, Connect Systems, etc. There's many.
- www.dstar101.com
- www.dstarinfo.com
- www.dstarusers.org
- www.maryland-dstar.org - for Raspberry Pi enthusiasts
- www.ncprn.net - Web site for our area DMR repeaters & code plugs.
- www.dmr-marc.net
- www.trbo.org
- www.trinityos.com/HAM/Yaesu-System-Fusion/Yaesu-fusion-and-c4fm-v7.pdf - Talk given by David Ranch KI6ZHD at 2015 Bay-Net meeting.
- arvideonews.com/hrn/ - Ham Radio Now – watch episodes 161 & 195
- https://www.youtube.com/watch?v=eOYio06rsuo – John Hays K7VE

Charlotte Area Digital Voice Repeater Locations



A – Spencer Mt. – D-STAR (70cm), DMR (70cm Hytera)
B – Hood Rd. – D-STAR (2M & 70cm & 23cm), Fusion (70cm)
C – Wingate – D-STAR (70cm), DMR (70cm)
D – Crowder's Mt. – D-STAR (23cm), DMR (70cm), NexEdge (70cm)
E – Charlotte – DMR (70cm)
F – Shelby – D-STAR (2m & 70cm)
G – Charlotte (Dallas) DMR (33cm)

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Questions?

Art, W9HPX (SK)
first licensed 1933
my Elmer

Roland, W9HPX
first licensed 1959
w9hpx@arrl.net

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