Many slides adopted from-
Roland Kraatz W9HPX
John Davis WB4QDX

Background and Update on DSTAR with A Comparison of Amateur Radio Digital Voice Systems

MOTOTRBO™

Hytera

System Fusion

KENT HUFFORD

KQ4KK

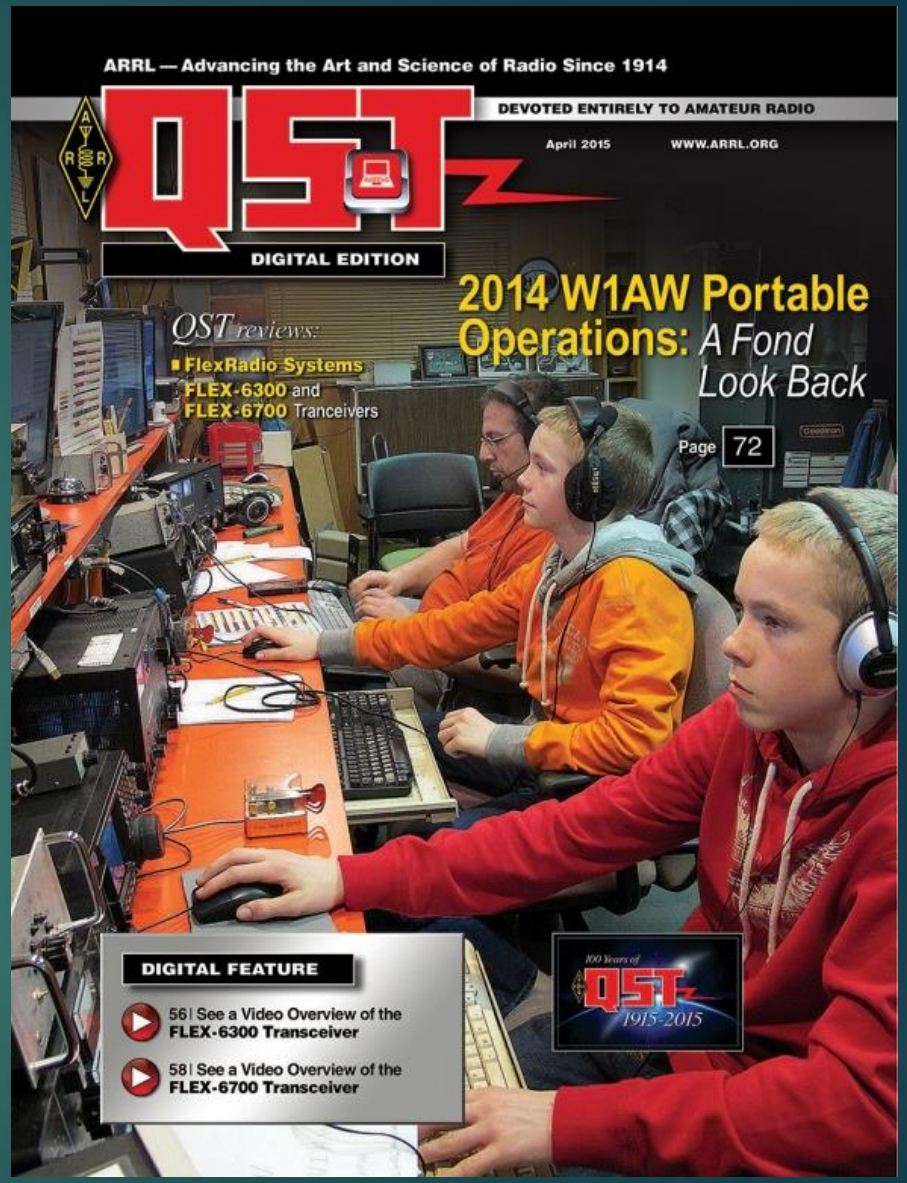
APRIL 21, 2015

CSRA DSTAR UNIVERSITY USC AIKEN JANUARY 2015

CSRA DSTAR UNIVERSITY USC AIKEN JANUARY 2015

Topics

- DSTAR
- Digital voice description
- Technical comparison
- Operational features
- Programmability
- Radio choices
- Q & A



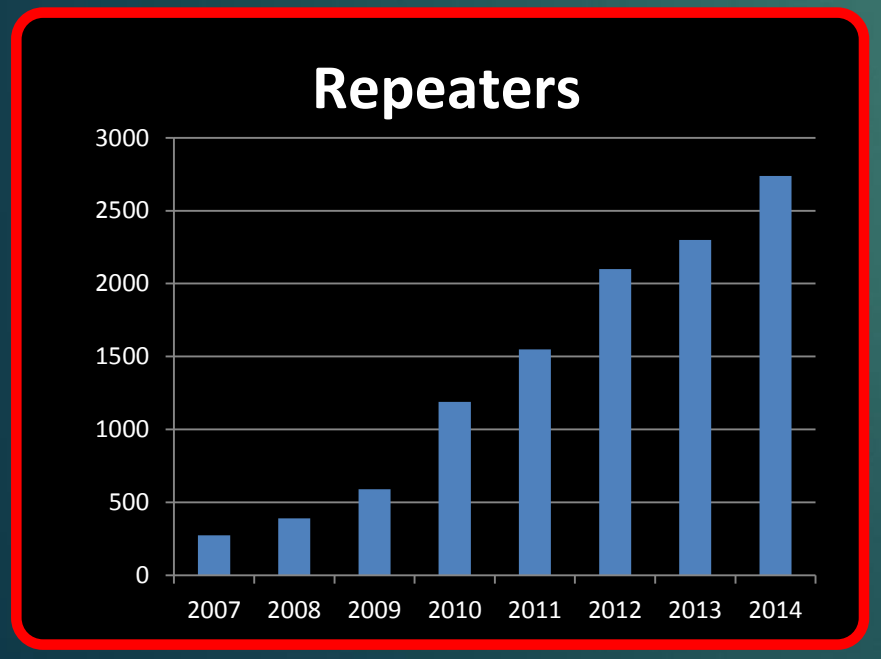
See p30 April 2015 QST

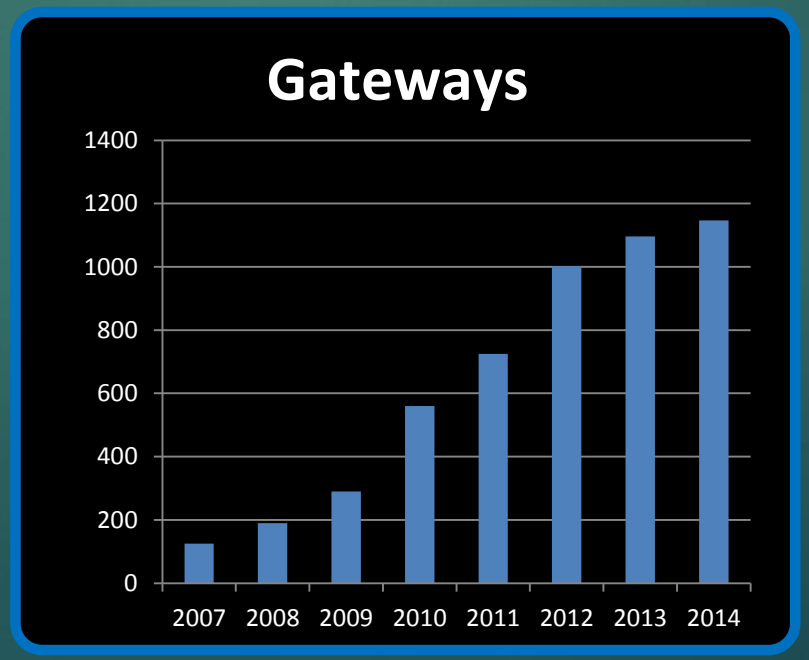
What is Digital Voice?

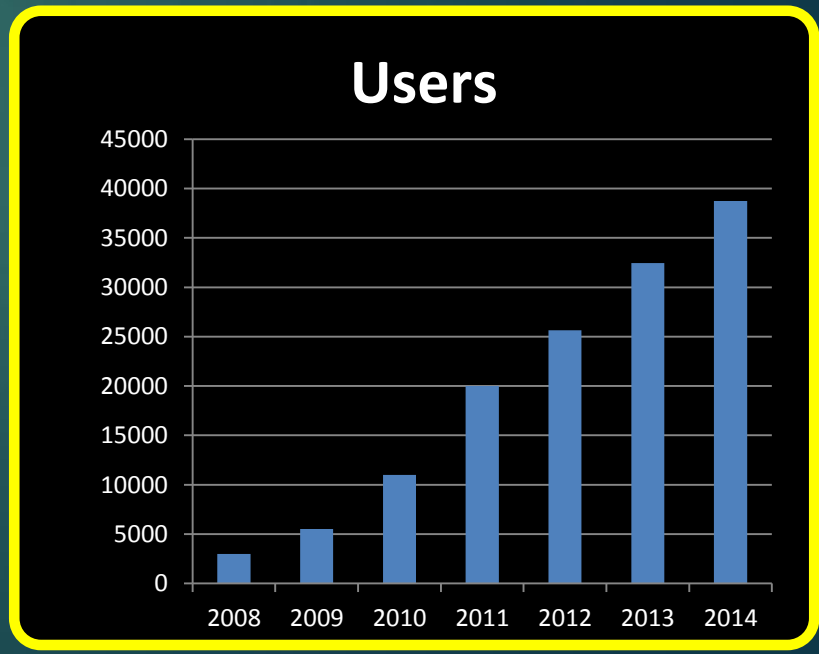
- Digital data modulating an RF carrier
- The data is digitized audio from an A/D converter
- It is processed through a vocoder to compress the data and add forward error correction
- The data is sent serially in uniform length packets
- Header data is pre-pended to provide sync bits, routing instructions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

D-STAR Continues to Grow

- *As of January 1, 2015 – 1,147 DPlus Gateways, over 2,738 Voice Repeaters, 225 Data Modules and 38,724 registered users on US Trust Server.*
- ***Over 1,200 Internet connected repeaters in US,***
- ***Over 270 DSTAR Reflectors***
- *Does not include ircDDB repeaters*







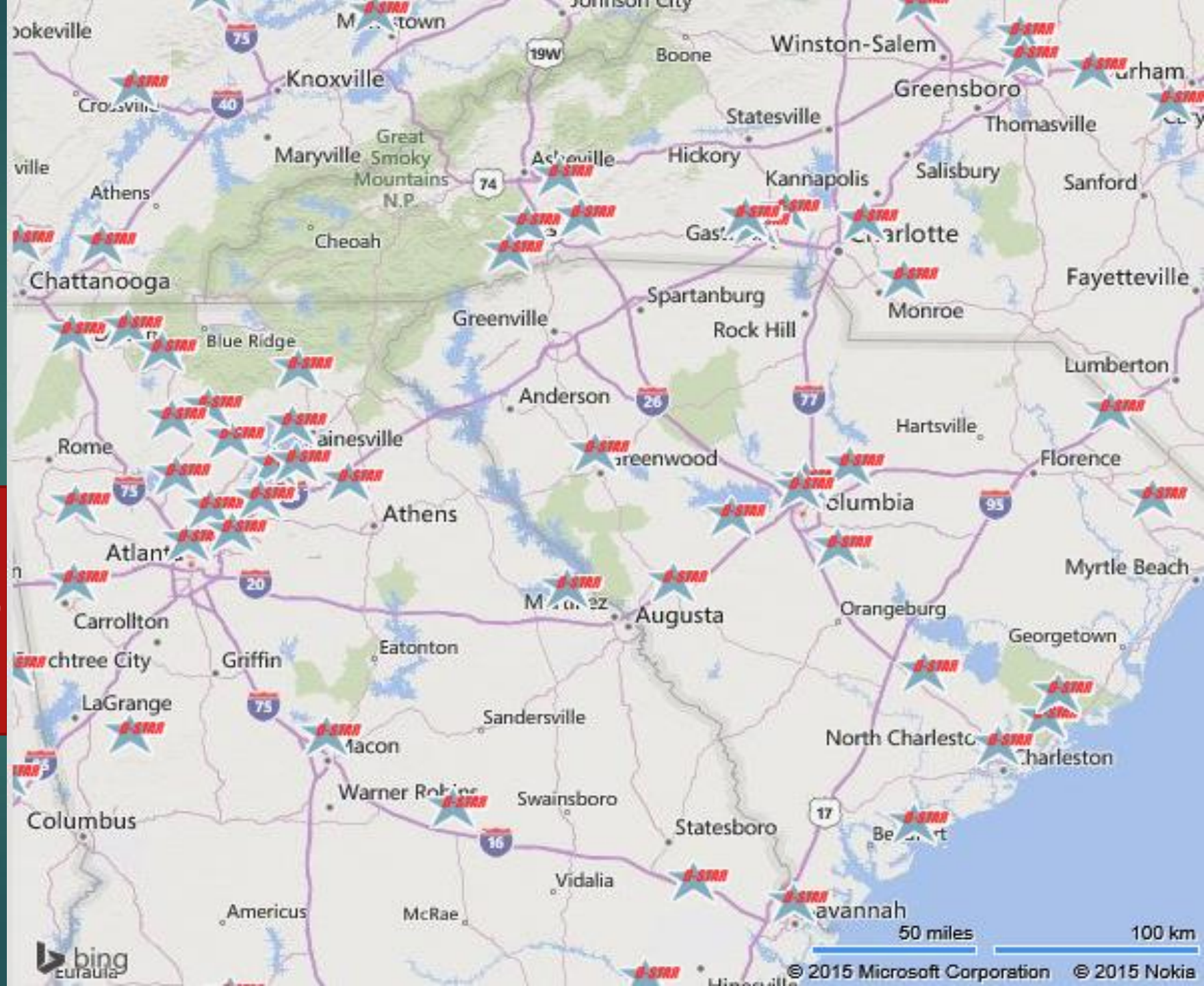
DSTAR Repeater Stack Locations

47 REPEATERS in GA (less 1.2g)

19 REPEATERS in SC (less 1.2g)

115+ DSTAR "Devices" in CSRA

VHF/UHF Stack going to Beech Island



Application 1

Digital voice (DV mode)

Analog audio is modulated to a digital signal and transmitted in the digital mode signal by the D-STAR radio.

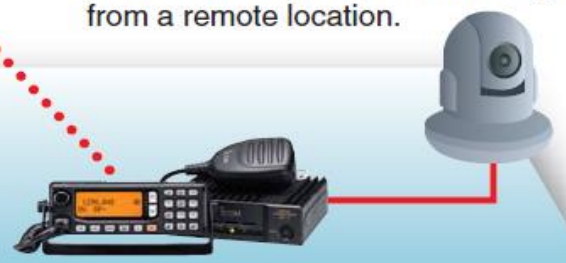
Internet connection*

The Internet gateway allows linking of D-STAR repeater sites over the Internet. You can uplink to your local repeater and downlink from a remote repeater, even from a foreign country!

Application 5

IP camera (DD mode)

You can transmit live images in DD mode and watch real-time images from a remote location.



Application 2

Short data message (DV mode)

Call sign identification and short data messages are available.

Application 4

Internet access (DD mode)*

In DD mode operation, you can access to the Internet via a D-STAR Internet gateway. Connect a PC with the ID-1 and you can browse web sites or check e-mail.

ICOM produced chart

Application 3

GPS tracking (DV mode)

With a GPS receiver, you can send your current position information to another radio.

Internet
DV mode (4.8kbps)
DD mode (128kbps)

* Some restrictions may apply depending on specific countries' regulations.

D-STAR Radio Generations

- 1st Generation
  - Utilize Standard Memories for D-STAR or FM
- 2nd Generation
  - First Implementation of DR Mode
- 3rd Generation
  - Current Implementation of DR Mode
  - Nearest D-STAR Repeater
- 3rd Generation Plus
  - Nearest FM Repeater
  - CSV Import from SD Card
  - High-Speed DV Data

	Event	Date
1st Generation	ID-1	Aug-03
	IC2200H	Mar-04
	ID-800H	Mar-05
	RP2000, RP4000	May-06
	IC-91AD	May-06
	RP2C, RP2D, RP2V – Upgraded Repeater	Jul-06
	ID-2820	Mar-07
	ID-92	Mar-08
2nd Generation	ID-80 / ID-880H	Apr-09
	ID-9100	Mar-11
3rd Generation	ID-31	Apr-12
	ID-51	Apr-13
	ID-7100	Jul-13
3b Generation	ID-5100	Apr-14
	RS-MS1A Android App	Mar-14
	ID-51+ Anniversary Edition	Oct-14

Software Extensions to D-Star By 3rd Parties

- **DPlus** linking and REF-type Reflectors (REF014)
  - –Add-on to existing ICOM Gateway server
  - –D-Star‘s “Killer App“ – Linking is easier and natural
- **ircDDB** – faster Callsign Routing (add-on)
- **G4KLX ircDDBGateway** (replaces ICOM gateway)
  - –DPlus, DExtra, DCS Linking support
  - –CCS - MUCH Improved Callsign Routing
  - –Split Repeater

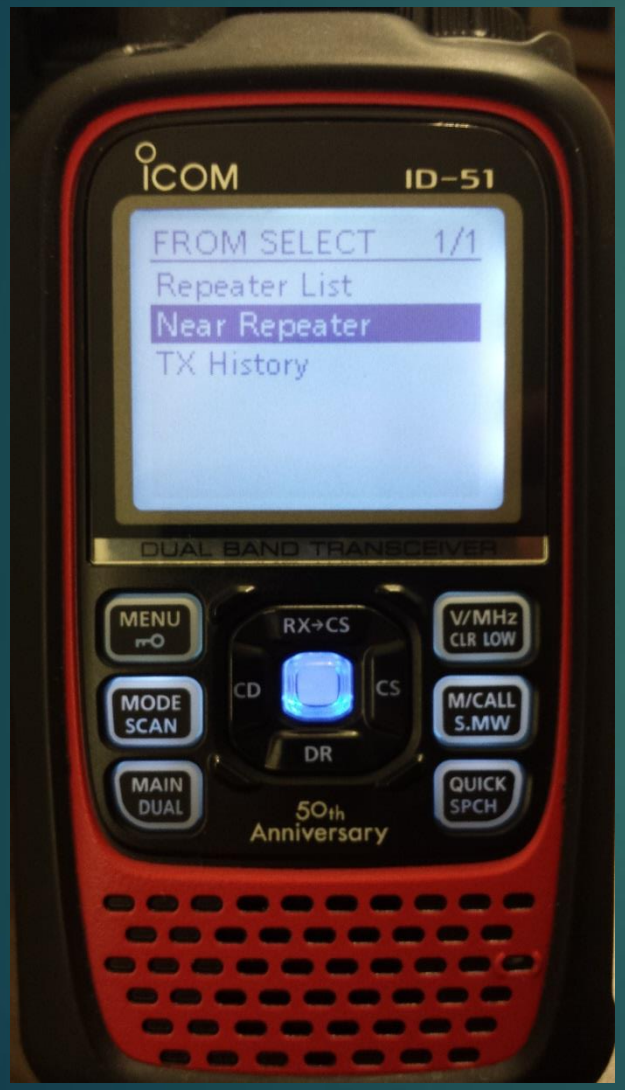
DR Mode – Easiest to Use

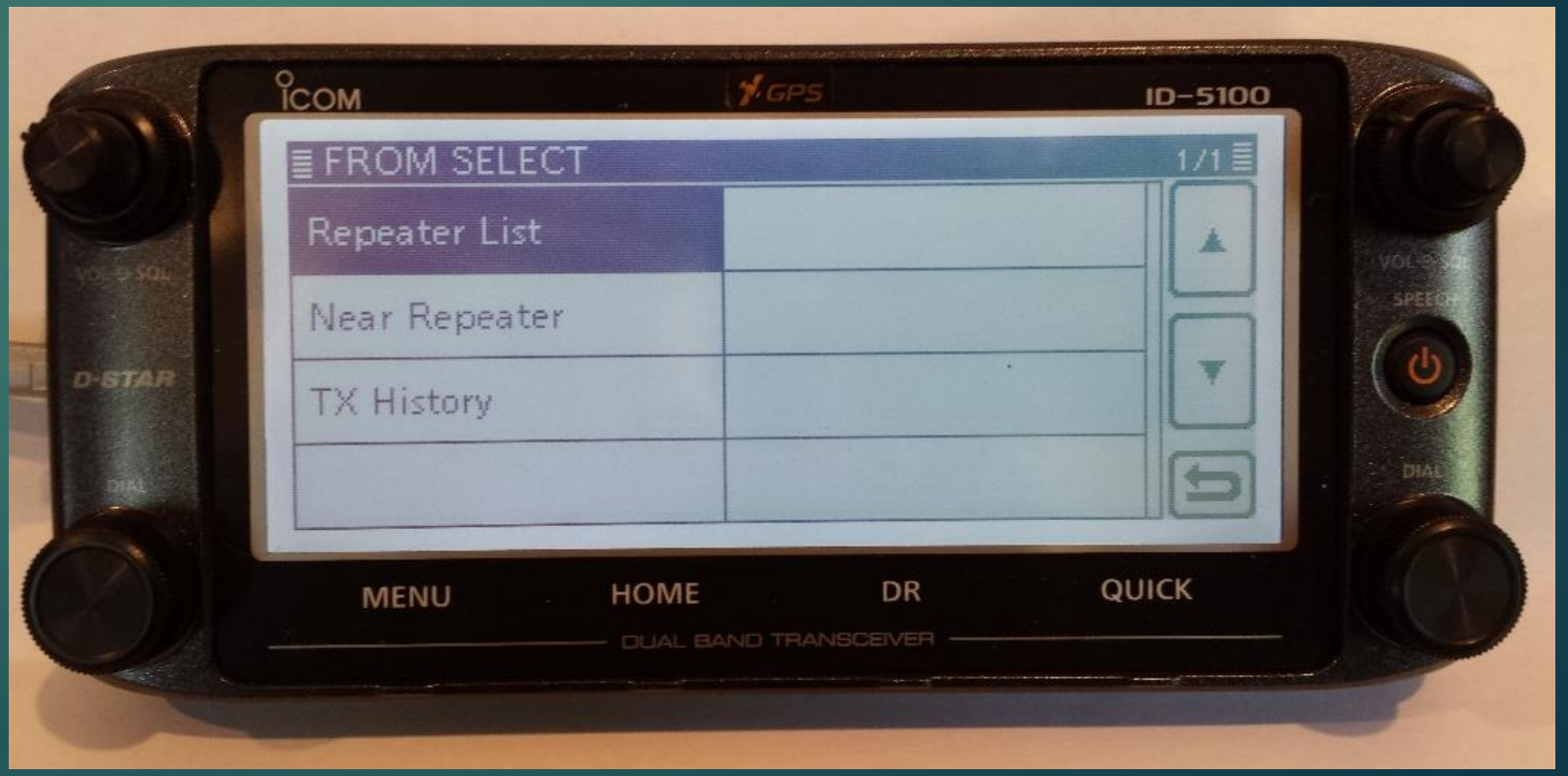
- DR Mode is Digital Repeater Mode
- Current generation of radios have two sets of memories
  - Regular Memories for traditional frequency storage
  - Repeater List is geocoded for location-based lookup
- Easy to Use
  - Press DR
  - Select Source Repeater in FROM field
    - Pick by region
    - Find Nearest Repeater to current location
  - Select function in TO field

- Automatic Programming of Radio

What Repeater?

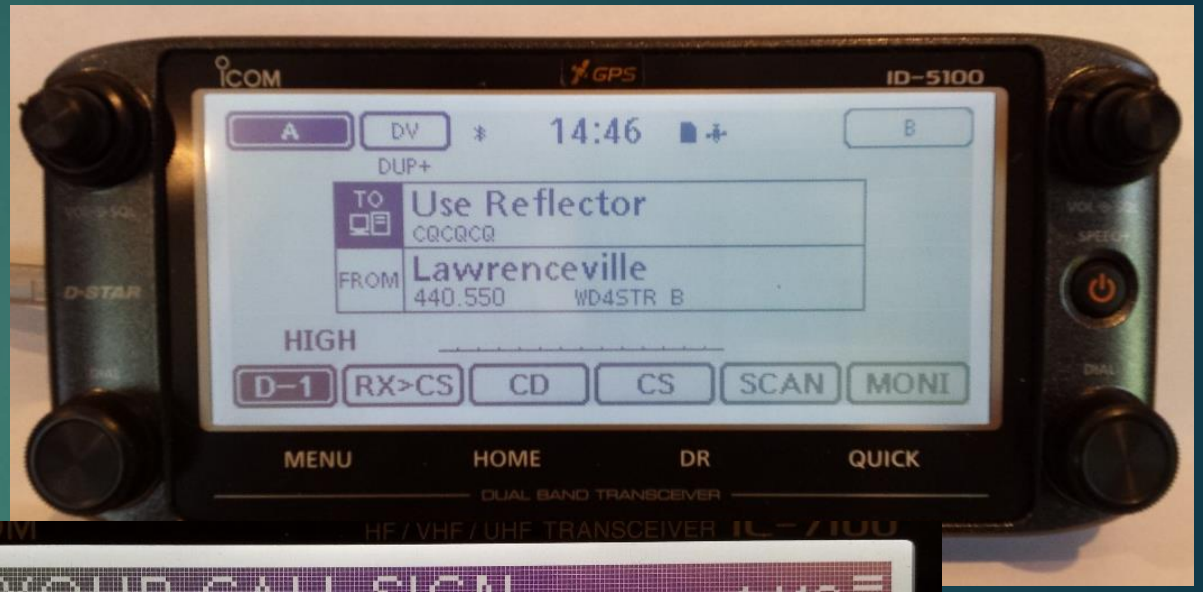
- Select FROM field:
- Repeater List shows region, then list of repeaters
- Near Repeater uses built-in GPS to show list of nearest repeaters

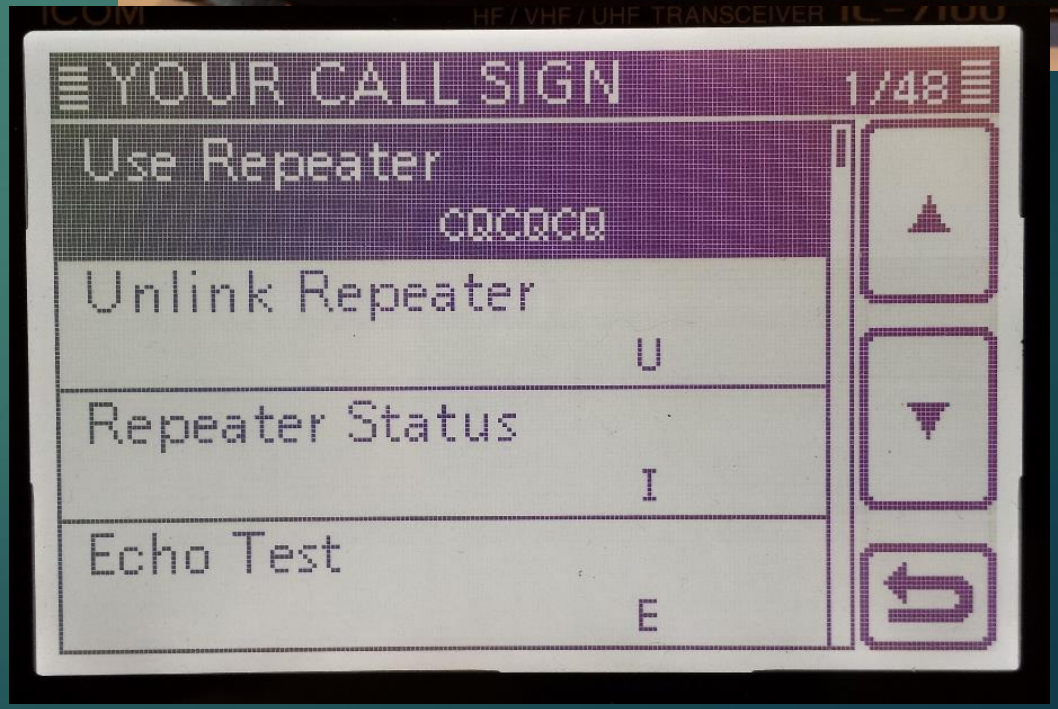




Which CQ?

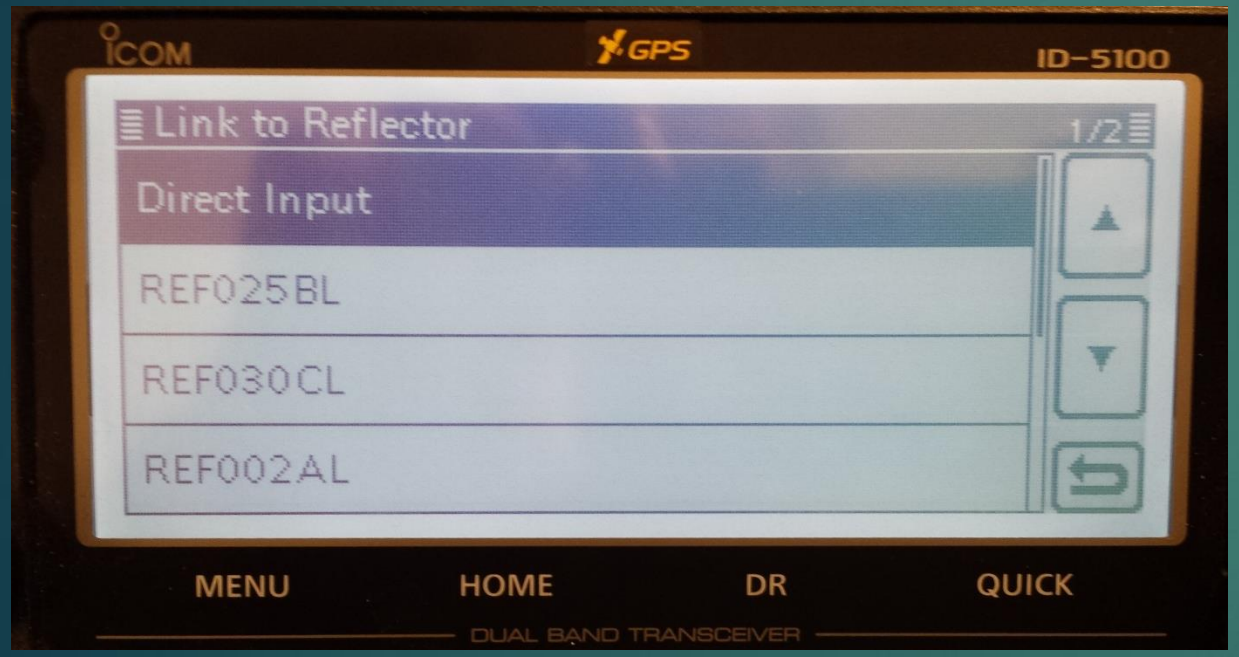
- Select TO on screen
- DO NOT USE Local CQ
  - Shows as CQCQCQ
- 3rd Generation (ID-31, ID-51, ID-7100)
  - Select "Your Call Sign"
  - Select "Use Repeater" to talk
- 3rd + Generation (ID-51+, ID-5100)
  - Select ("Reflector")
  - Select ("Use Reflector") to talk

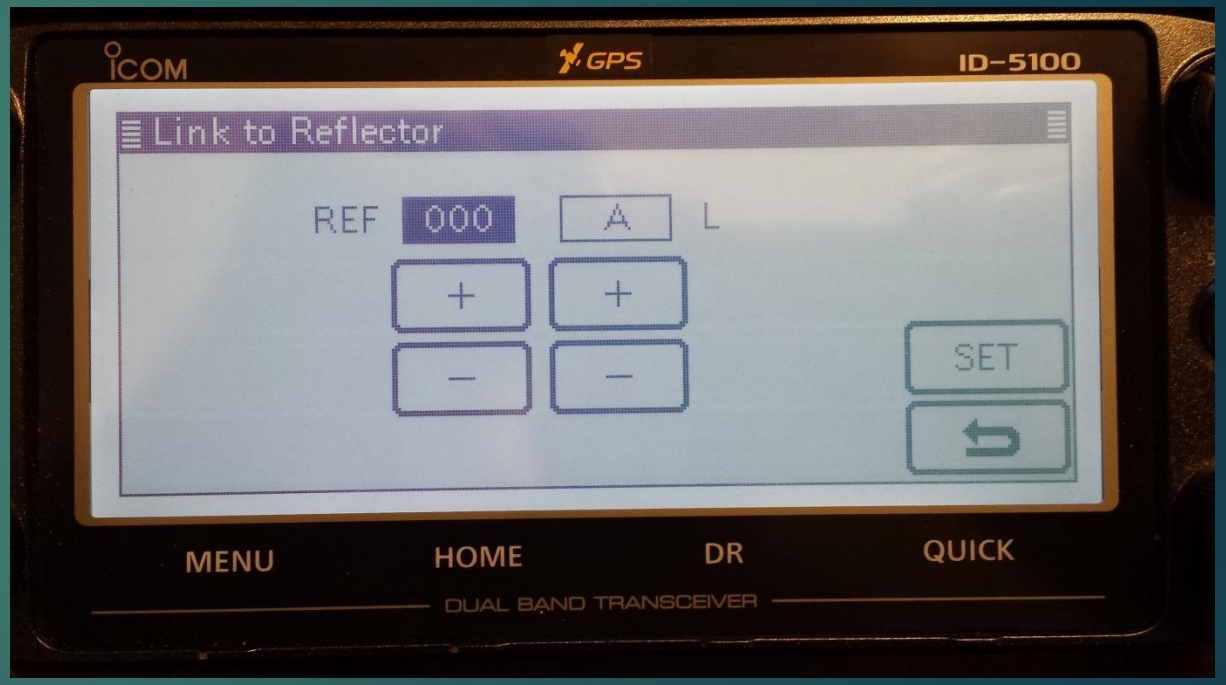




Linking to Reflectors

- To link to a Reflector, select Reflector, Link to Reflector, Direct Input, then select Reflector and Module

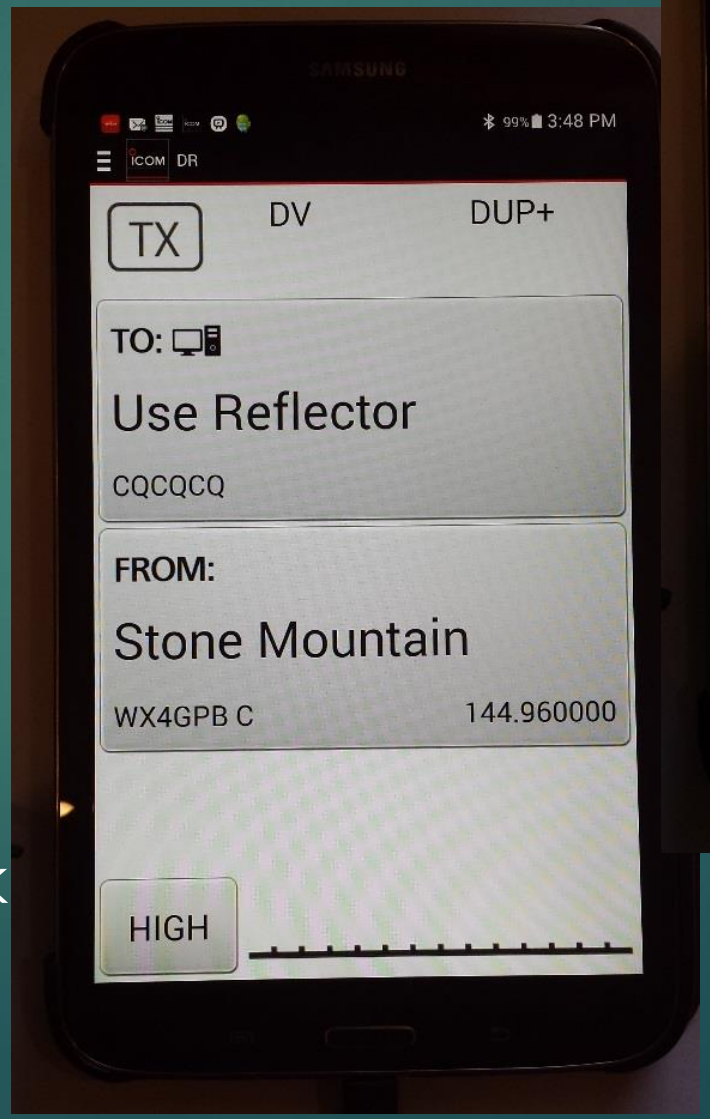


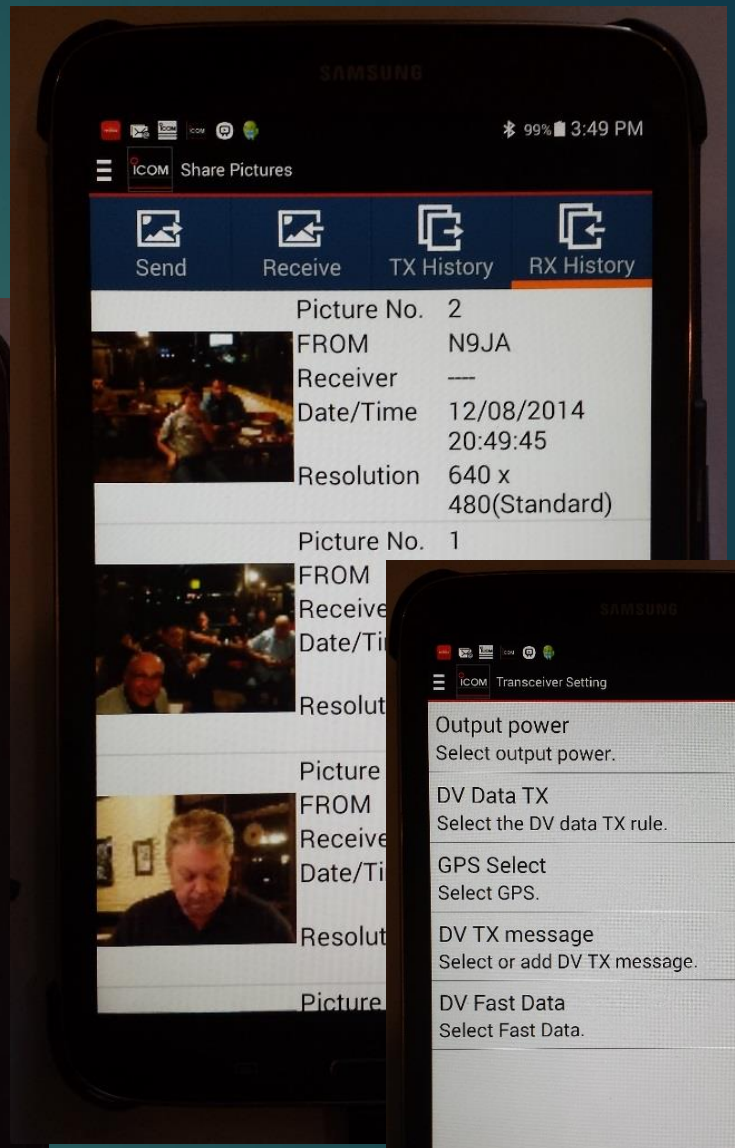


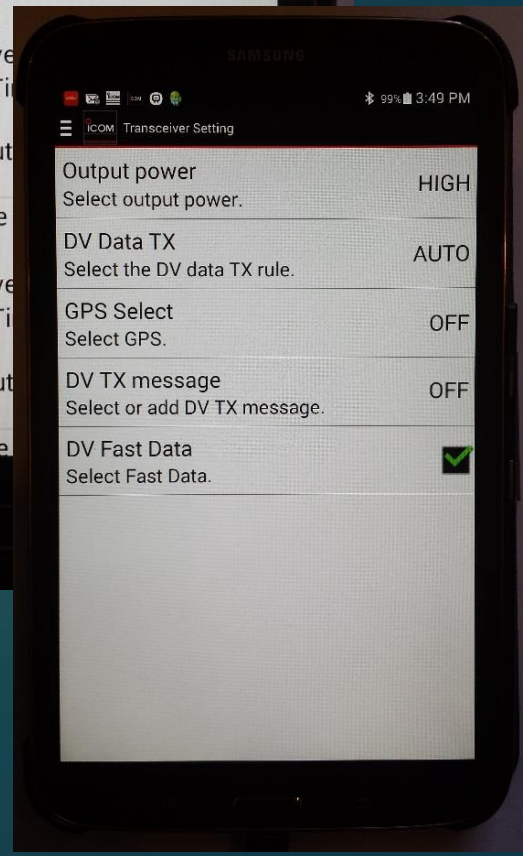
Once a Reflector has been selected, it's listed for quick selection

D-STAR ICOM Android App

- Free app for Android phones, tablets – RS-MS1A
  - Works with ID-51A,(+), 7100, with OPC-2350LU cable
  - ID-5100 using cable or Bluetooth
- Use to display DR and radio settings
- Send/receive photos between compatible radios
- Text messaging in familiar look
- Expanded Repeater List

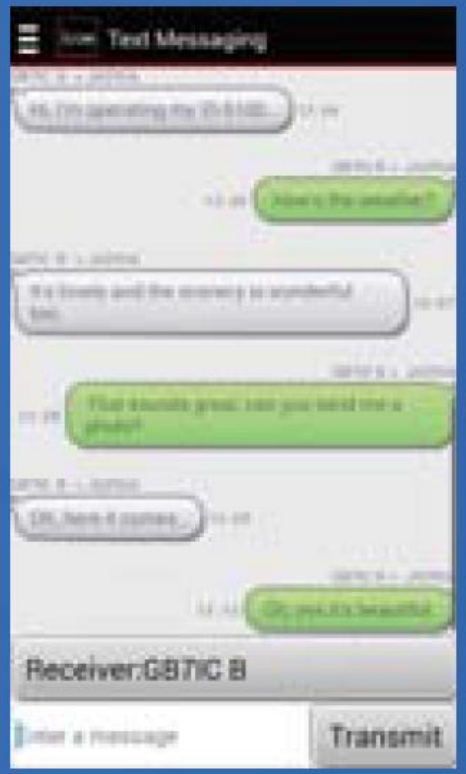




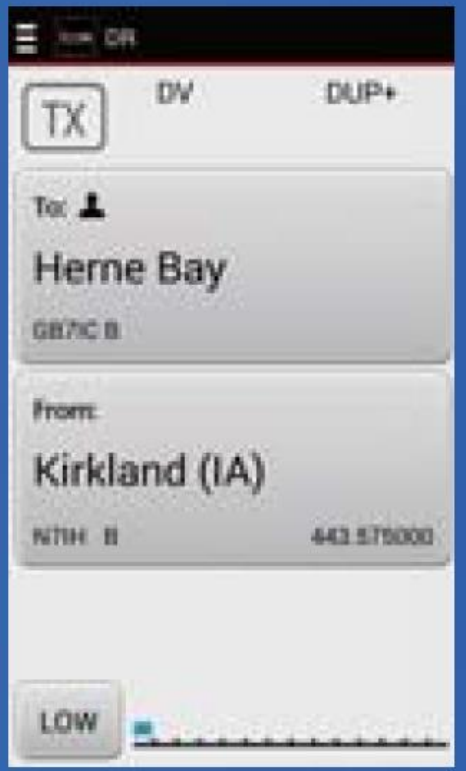


DV Fast Data Mode

The optional OPC-2350LU data cable is required to connect to an Android™ device.



Text messaging example

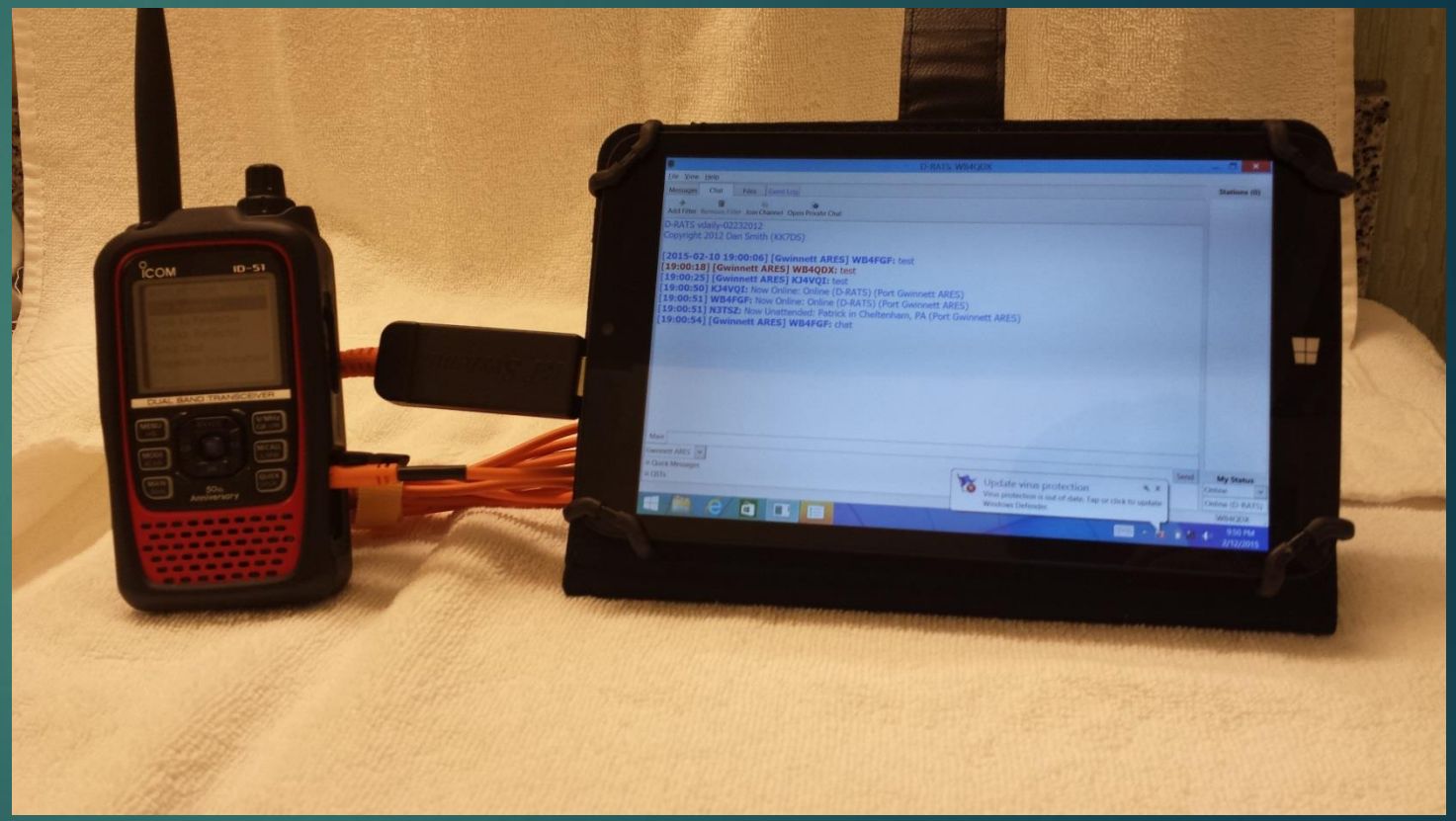


DR function setting example

Repeater map example

Windows 8.1 Tablets

- Windows 8.1 tablets have full size USB A host port
- Supports DV Dongle, DVAP or connection to D-STAR radio data port for D-RATS
- Programming radios using current Windows-based programs
- WinBook 7” for $69.99 from MicroCenter and Amazon
- Also available in 8” and 10” versions

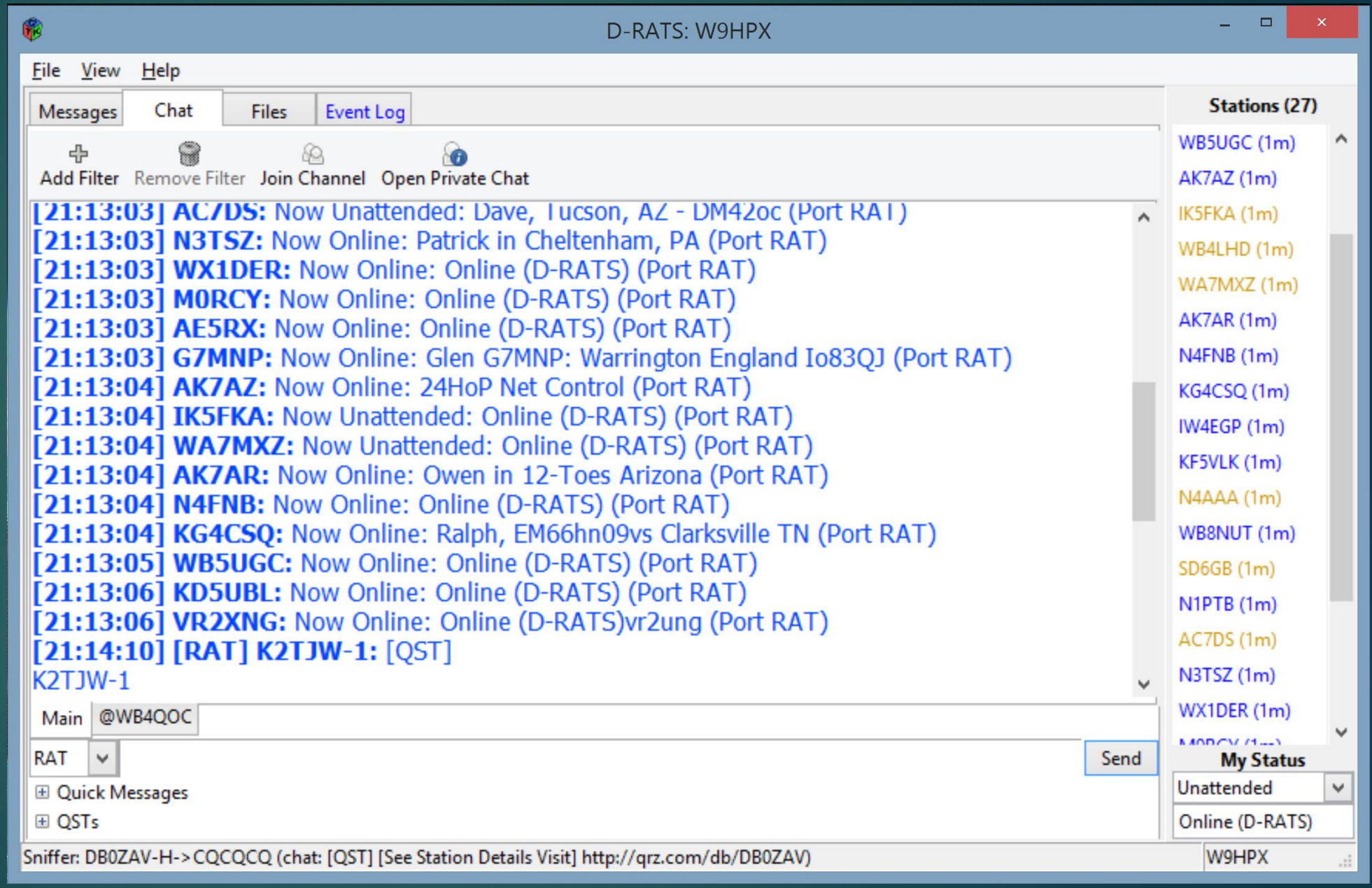


D-RATS

Use on any DSTAR device

Also as x.25 Packet software

Free



New Raspberry Pi $35

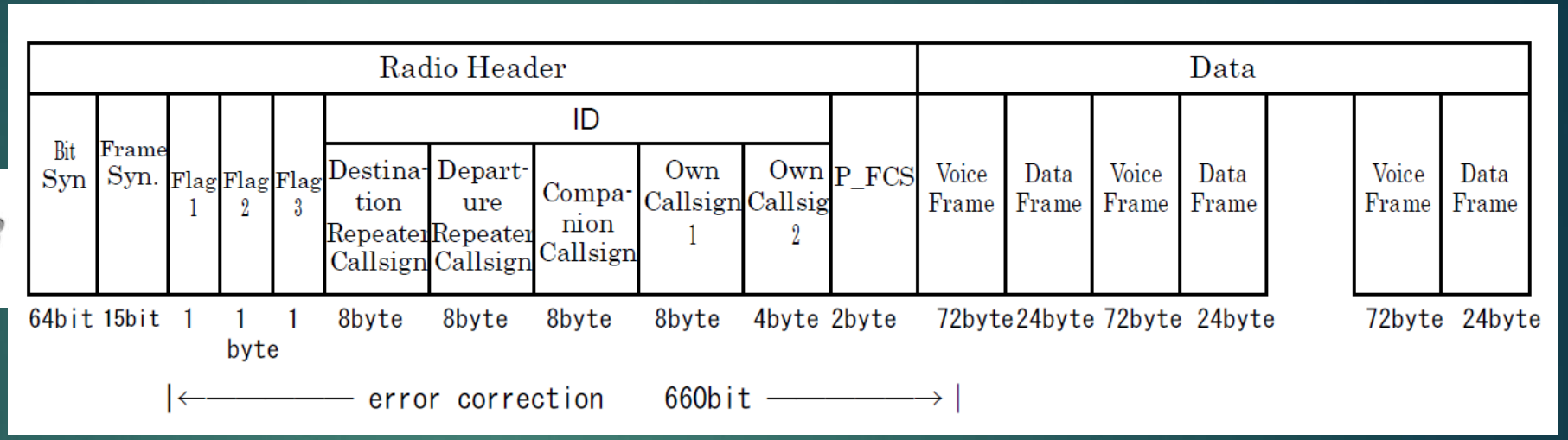
- Raspberry Pi 2 Model B now available
- Faster Processor – Quad core ARM 7
- More RAM – 1 GB
- Keeps 4 USB ports and micro SD as in Model B+
- Great for DV Dongle, DVAP, D-RATS applications

AMBE 3000 Info

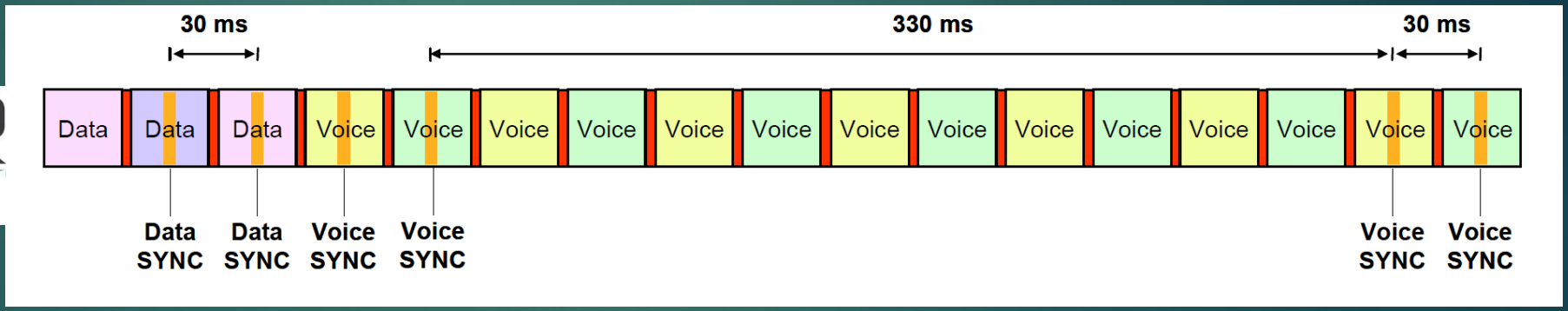
- Field reports indicated better audio in devices using AMBE 3000.
- DVSI reports that improved algorithm results in better voice quality
  - AMBE 3000 to AMBE 2020
  - AMBE 3000 to AMBE 3000
- No difference in AMBE 2020 to AMBE 3000
- AMBE 3000 chip has the “ability” to hold DSTAR, DMR and FUSION “code”

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

Tech Spec Comparison

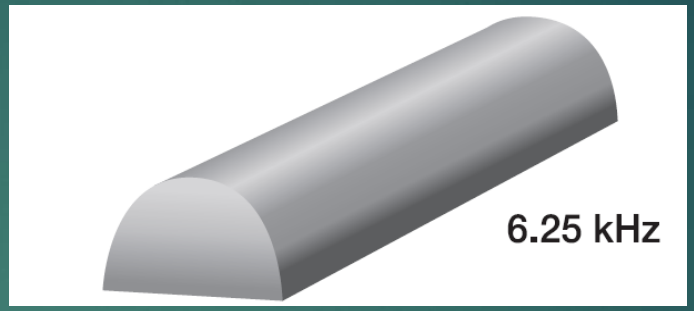
	D-STAR	DMR	Fusion
Vocoder (see note)	AMBE+	AMBE+2	AMBE+2
Forward Error Corr.	Voice Only	Voice Only	Voice Only
Modulation	GMSK	4FSK	C4FM
Multiplex Method	FDMA	TDMA	FDMA
Transmission Rate	4.8 kbps	4.8 kbps x 2	9.6 kbps
Bandwidth	6.25 kHz	12.5 kHz	12.5 kHz
Channels supported	1	2	1
Standard Developer	**JARL**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

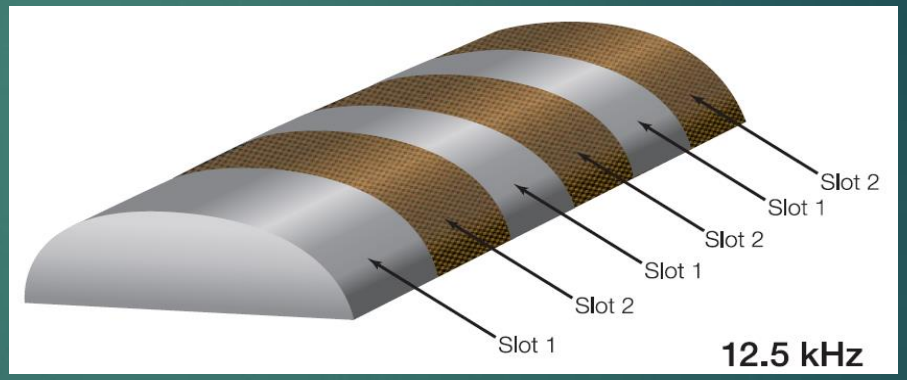
Note: Newer radios implement the vocoder in the DSP chip

Bandwidth Comparison

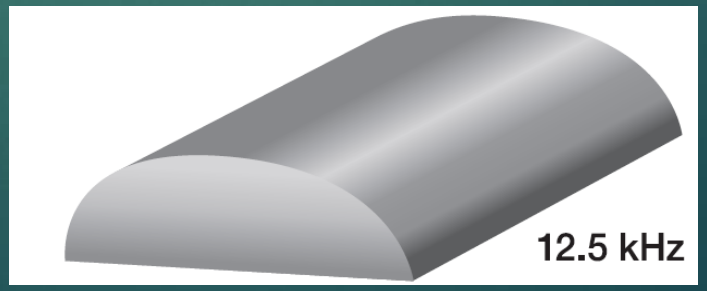
D-STAR



DMR



Fusion



Official FCC Emission Designators

FM	16K0F3E	16 KHz
D-STAR	6K00F7W	6 KHz
DMR	7K60FXE	7.6 KHz
NXDN	4K00F1E	4 KHz
P25	8K00F1E	8 KHz

FUSION(C4FM) similar to DMR 7.6-8 KHZ

Mixed mode tho would be FM

Source – GA SERA Freq Coordinator

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 (end of 2015)
Multi-repeater connection	**Reflectors**	**Talk Groups**	**Rooms**
Selection method	UR entry	Channel Dial	DTMF
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
Repeater channel selection	Dial	Dial	Dial
Repeater connection selection	Dial	Dial	DTMF code
Mode selection method	Key press	Program	Key press *
Radio programming complexity	Difficult/Easy ◊	Difficult	Easy
Newbie learning curve	Steep	Fairly easy	Easy
User manual pages - older HT	131 (IC-91)	65 (CS-700)	247 (FT-1D)
User manual pages - newer HT	425 (ID-51) (Advance Manual)		

* 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 occasionally as repeaters change.

Signal Readability

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

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 be different.

Networking Characteristics

- D-STAR
  - User control capability – excellent
  - 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
- Fusion
  - Yaesu controlled servers – inflexible
  - Networking options – WIRES-X
  - Innovation ability –limited

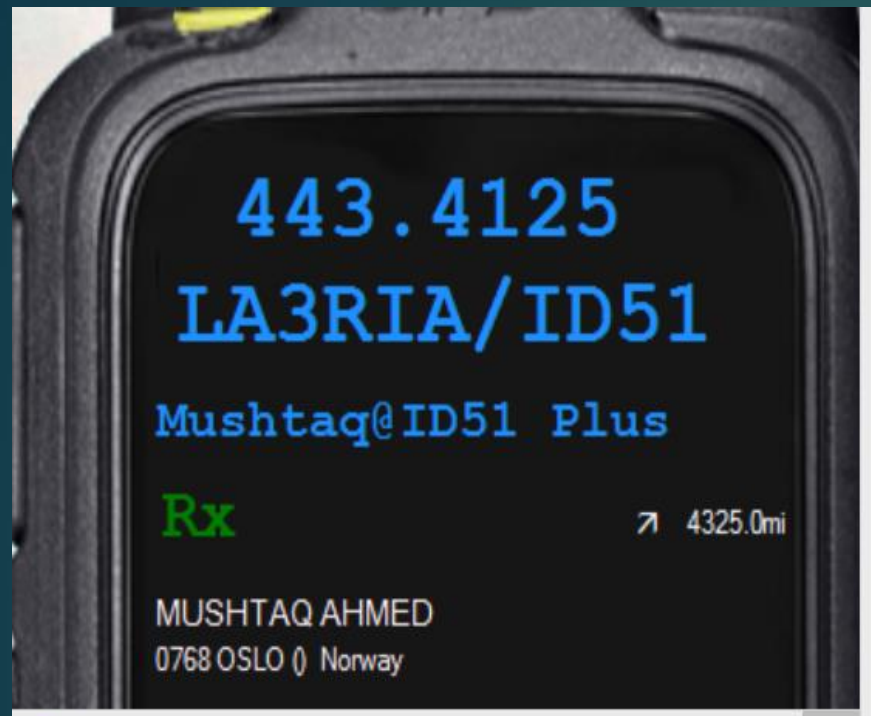
D-STAR HT's

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



Net Control

Sort Settings

UnAcknowledged Calls			Acknowledged Calls		
LA3RIA	/ID51	10:59	K4DII	/FRED	10:41
G0TTQ	/880H	10:58			
N9NMH	/	10:58			
KR4AIK	/LMSG	10:57			
KA9ZRZ	/	10:56			
WI3J	P/STU	10:55			
AD4ZU	/3975	10:54			

19 Total --> 1 Total

DV Pro Radio Interface

File Settings Window Help

1.0.0.35528

Frequency Information
+ 443.4125 5.000 DV

Received Call Sign Information
My Call: LA3RIA/ID51
UR Call: CQCQCQ
RPT1: KR4AIK G
RPT2: KR4AIK B

TX Message
LA3RIA /ID51 Mushtaq@ID51 Plus

D-PRS/APRS Information
CallSign: LA3RIA
Latitude: 59.948
Longitude: 10.652
Distance: 4325.0 mi. @ 34°

D-PRS/APRS Message
CallSign: LA3RIA
Message:

 www.DSTARInfo.com

Stations | Levels | Configuration | QRZ

Last Heard List

LA3RIA	/ID51	10:59	2I0DJM	/IC28	10:34
G0TTQ	/880H	10:58	GI0BFO	/5100	10:29
N9NMH	/	10:58	KE4JLL	/ID51	10:29
KR4AIK	/LMSG	10:57	N4ERL	/DNGL	10:04
KA9ZRZ	/	10:56	KJ6SET	/	10:00
WI3J	P/STU	10:55	AK4Z	/	09:54
AD4ZU	/3975	10:54	KB5NFL	/DVAP	09:50
W9WLX	/7100	10:54	N0SO	/7100	09:41
KQ4KK	/7100	10:51	W2UIS	/DVAP	09:39
K6UDA	/2820	10:50			
KK4FU	/	10:49			
KE4BFG	/DVAP	10:48			
KG6MZV	A/DVAP	10:46			
K4DJL	/5100	10:44			
WB5RF	/RICK	10:43			
K4DII	/FRED	10:41			
KC4S	/5100	10:39			

26 Total

QRZ Available COM9

Voice Packet Loss

Sun 4/12/15 14:59:41 UTC Sun 4/12/15 10:59:41AM -04:00

D-STAR Mobile's

Older – ID-880H

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

Newer – ID-5100A

- Dual band Touch Screen
- 50W
- 1000 + 1200 DR memories
- Internal GPS & DPRS
- uSD card data base and recording
- Repeater geo search
- $600 new

D-STAR HF/VHF/UHF Transceivers

IC-7100

- DSTAR on all bands
- 100/50W
- Touch Screen
- SD Card and Full USB control
- $1200 new

IC-9100

- DSTAR on all bands with card
- 100/100/100w
- Two bands at once
- Satellite tracking mode
- Full USB control
- $2500 new, plus DSTAR card

D-STAR on HF

- Icom IC-7100 and IC-9100 are both DV capable on HF
- Other ICOM, YAESU AND KENWOODs with 6 pin DATA ports can be made DV capable with STAR board and DVDongle
- Operates at similar bandwidth to AM – 6.2khz
- D-STAR HF net now operating six times a week
- Net info at http://www.dstarinfo.com/DSTARHFNet.aspx

D-STAR on HF

International DSTAR HF Testing Net –

- Routinely have two way communications coast to coast, to Canada, Europe and Australia. We have had two way contacts to Japan. And have been heard in South Africa
- We are on each band only for 5 min
- MONITOR REF030C to coordinate
- Do not want to step on any AM or SSB activity
- Use web page to keep track - http://hf.dstar-relay.net/
- Check-in to this web site anytime 24/7 to find a DSTAR HF Ham
- FREE FORM **PRENET** for 30 min. before the start of the scheduled NET.
- See how to do DSTAR HF with an ICOM at- http://www.youtube.com/watch?v=oGF-qkdoid4
- "Digital voice is defined in the Commission's rules as voice (i.e. phone), not data, per Section 97.3(c)(5) of the Rules."

http://apps.fcc.gov/ecfs/document/view?id=7521063715

http://hf.dstar-relay.net/

HF D-STAR QSO Finder

File Edit View Favorites Tools Help

Page Safety Tools

HF D-STAR QSO Finder

You are logged in.

29.4800 Mhz.
KE4BFG
F4EGG
KQ4KK
VE5RS
WI3J
KD4CVR
K4DII
KF0TW
KA2BSM
K4WHE
KB5ZZB
W9SUS
W9WLX
W2MGF
KG0PP

14.3200 Mhz.
DL1AS

14.280 Mhz.
M0JMM

24.9380 Mhz.
WB5RF MOBILE
WW6USA IN NM

18.1480 Mhz.
MW0RUH

21.3800 Mhz.
K6UDA

Chat

1/4/2015 10:51:35 AM
WI3J: QSY 29.4800
1/4/2015 10:51:51 AM
K4DII: QSY 29.4800
1/4/2015 10:51:56 AM
W9WLX: QSY 29.4800
1/4/2015 10:51:59 AM
VE5RS: 2w w18j on 12m
1/4/2015 10:52:28 AM
VE5RS: QSY 29.4800
1/4/2015 10:52:35 AM
KD4CVR: QSY 29.4800
1/4/2015 10:52:37 AM
W9SUS: QSY 29.4800
1/4/2015 10:54:12 AM
KG0PP: QSY 29.4800
1/4/2015 10:54:32 AM
W2MGF: ww6usa 2 way
1/4/2015 10:54:43 AM
KA2BSM: QSY 29.4800
1/4/2015 10:54:45 AM
WW6USA IN NM: QSY 24.9380
1/4/2015 10:54:45 AM
WW6USA IN NM: QSY 24.9380
1/4/2015 10:55:10 AM
WI3J: 2w with WW6USA on 10m

Links
Video
Software

K7VE Blog
NW Digital
HF Net Sked

Frequency Selector
Your Frequency Update Clear
Presets
51.180 | 29.4800 | 24.9380 | 21.3800 | 18.1480 | 14.3200 | 7.2850 | 3.8800

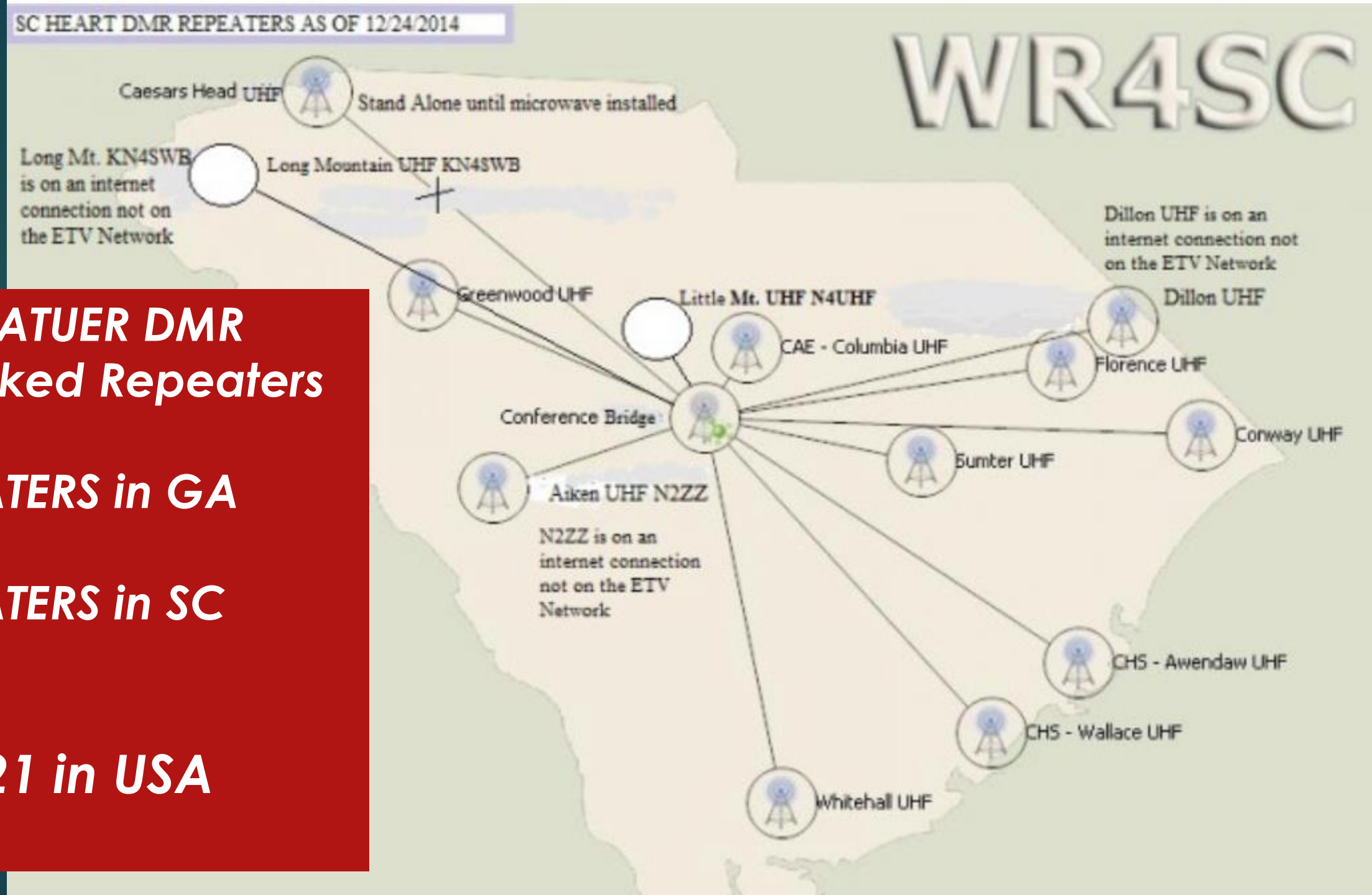
K4WHE David FM07GS

K4WHE

David H Wheeler
7 Pathfinder Drive
Lexington, VA 24450
United States
Map

Close

Users Logged In
g0hwc | KE4BFG | KJ4VO | CT1HDC | DL1AS | F4EGG | KQ4KK | KA2BSM | KD4CVR | KF0TW | K4WHE | VE5RS | WI3J | K4DII | KB5ZZB | MW0RUH | W9SUS
W9WLX | WB5RF MOBILE | K6UDA | W2MGF | WW6USA IN NM | KG0PP



AMATUER DMR Networked Repeaters

12 REPEATERS in GA

14 REPEATERS in SC

221 in USA

DMR HT's

MotoTrbo – XPR-7550

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

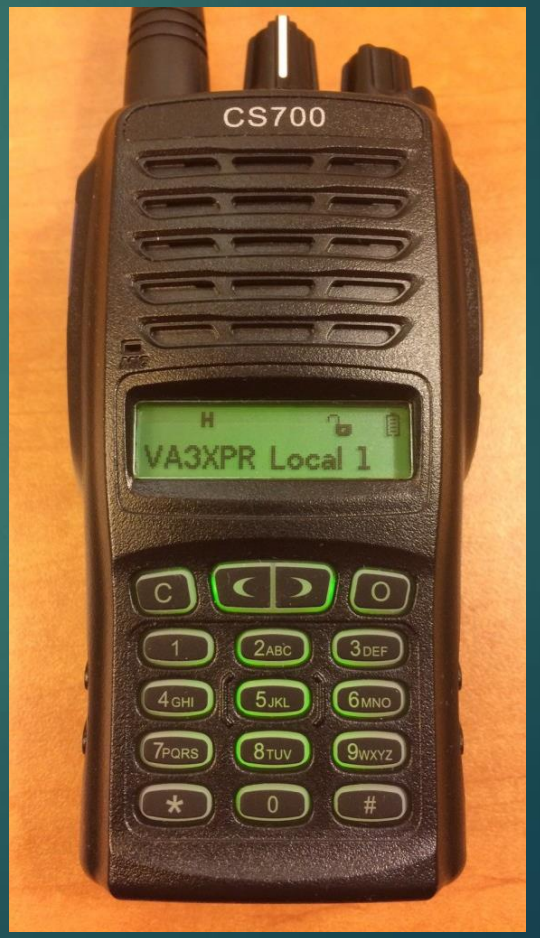
Hytera PD782G-U1

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

DMR HT's (cont.)

Connect Systems – CS700

- 440 MHz band
- 4W
- 1000 memories
- $ 200 – 250 new



AnyTone®

AT-D858

DMR Digital + Analog

General		
Frequency Range	VHF: 136-174MHz UHF: 350-390MHz UHF: 400-480MHz UHF: 450-520MHz	
Channel Capacity	1000 channels	
Channel Spacing	25KHz (Wide Band) 12.5KHz (Narrow Band)	
Phase-locked Step	5KHz, 6.25KHz	
Operating Voltage	7.4V DC ±20% /(1800mAh)	
Frequency Stability	±2.5ppm	
Operating Temperature	-20? ~ +55?	
Size	128×61×40mm (with battery pack)	
Weight	257g (with battery pack, antenna)	

Receiving Part		
	Wide band	Narrow band
Sensitivity(12dB SINAD)	≤0.25μV	≤0.35μV
Digital Sensitivity	0.3uV/-117.4dBm (BER 5%) 0.7uV/-110dBm (BER 1%)	
Adjacent Channel Selectivity	≥70dB	≥60dB
Intermodulation	≥60dB	≥60dB
Spurious Rejection	≥70dB	≥70dB
Blocking	84db	
Hum & Noise	≥45dB	? 40dB
Audio Distortion	≤5%	
Audio Power Output	1000mW/16Ω	

Transmitting Part		
	Wide band	Narrow band
Power Output	5W/1W	
Modulation	±5.0KHz@25KHz	±2.5KHz@12.5KHz
Adjacent Channel Power	≥70dB	≥60dB
Hum & Noise	≥40dB	≥36dB
Spurious Emission	≤-36dB	≤-36dB
4FSK Digital Modulation	12.5KHz（data）7K60FXD 12.5KHz（data+voice）7K60FXE	
Audio Distortion	≤5%	
Error rate	≤3%	

Beifeng TD501DMR
UHF 400-470MHz
Digital

$270
AMAZON.COM

DMR Mobile's

MotoTrbo - XPR-5550

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

Hytera – MD782G-U1

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

DR-1X Duty Cycle

- *50% at 50 Watts*
- *Will cut power back with excessive heat*
- *Even though power is cut back, excessive heat is still causing abuse of the finals/relays.*
- *Be Aware of your power settings and adjust apropriatly.*

Slide from YAESU WEBINAR Apr 12, 2015

C4FM
Digital Clear Voice
Clear and Crisp Voice Technology

System Fusion HT's

Yaesu – FT-1DR

- Dual band
- 5W
- Automatic Mode Select
- 900 memories
- GPS & APRS
- $300-310 new

Yaesu FT-2DR (new)

- Dual band
- 5W
- Automatic Mode Select
- 1245 channels
- GPS & APRS
- Touch screen
- On sale late May 2015
  $550 new

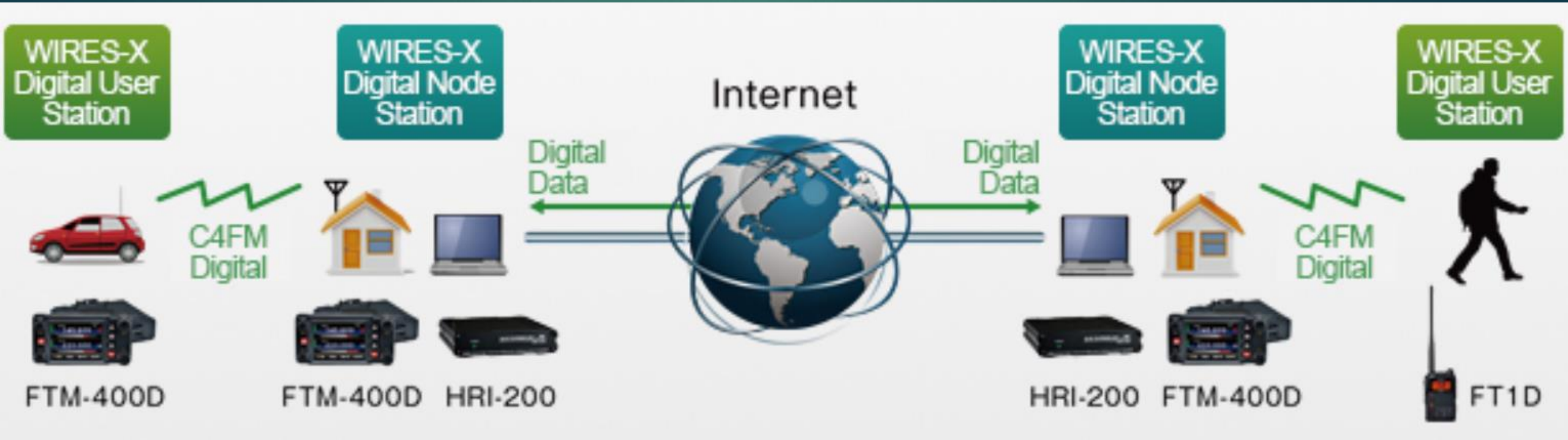
System Fusion Mobile

Yaesu – FTM-400DR

- Dual band
- 50W
- Automatic Mode Select
- 900 memories
- GPS & APRS
- Bluetooth
- uSD Card
- Color Touch screen
- $500 new

YAESU FUSION WIRES-X HRI-200

$125



YAESU
The radio

HRI-200 Interface

- Only Supports DR-1X in Analog Mode
- Digital Linking coming soon
- All repeater features not yet known
- Plugin System in WiRES-X Sofware
- Requires a PC and Internet Connection

Slide from YAESU WEBINAR Apr 12, 2015

17 YAESU WIRES-X IDs issued in Georgia
(1 in the CSRA)

5 Yaesu System Fusion (C4FM) capable repeaters found in Georgia
(2 in Waynesboro)

NO WIRES capable REPEATERS FOUND in Georgia

1 WIRES-X ID issued in South Carolina

1 Yaesu System Fusion (C4FM) capable repeater found in South Carolina

1 WIRES capable repeater found in South Carolina

358 WIRES-X IDs issued in USA

As of Apr 21, 2015

System Fusion HF/VHF/UHF

Yaesu – FT-991

- All Mode MF/HF/VHF/UHF
- C4FM Digital Capable
- 100/50W
- USB Capable
- Color Touch screen
- $1670 new

Installation Program Shirts - First Quarter 2015

- *300 Shirts are on Order*
- *Estimated Shipping Day May 5th, 2015.*
- *Club name and callsign will appear*
- *Some people will receive a final confirmation*
- *If you have already received a confirmation please disregard*

Slide from YAESU WEBINAR Apr 12, 2015

Other Digital Voice Suppliers

DV Dongle

- Internet Labs
- **DSTAR** on your PC
- $190 new

Thumb DV

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

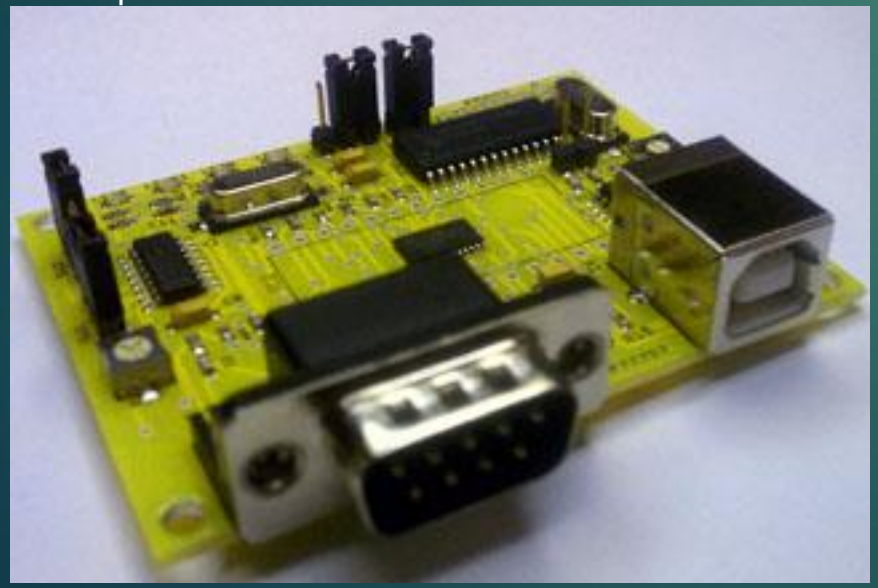
Other Digital Voice Suppliers

MoenComm
Digital Amateur Radio

STAR Board

GMSK Node Adapter

- Make your PC or PI a **DSTAR** Hot Spot with FM mobile
- Add DVDongle and make FM or HF a DSTAR radio
- $119 new



STAR* DV

- **D-STAR** on your PC or PI
- Uses AMBE 3000
- Connector for Speaker/Mike
- $129 new


Delete
Fn
control
option
command
OFF
ON

Star*DV Controller Ver. 1.54

Menu | Band Memory | Help

Main | Presets | Configuration

Local Settings

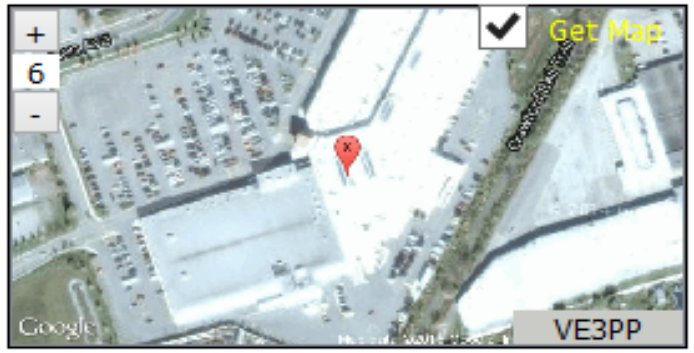
MyCall: KQ4KK __ / KENT

UrCall: CQCQCQ__

Rpt1Call: KQ4KK B

Rpt2Call: KQ4KK G

RF Rpt Override



Message: StarDV on Surface P

Use Modem | RX Invert | TX Invert

Reflector: REF001 Mod: C

Link | Unlink | Info | Echo

Network In

RF In

PTT

Use PC Audio

Use Spk/Mic

Out: Speakers (Realtek High Definition Audio)

In: Microphone (Realtek High Definition Audio)

Refresh List

Incoming:

MY: VA3EMG / ID51 UR: CQCQCQ D: 15.04.2015 T: 11:24 Msg: GENE IN ELLIOT LAKE

Read configuration file.

Other Digital Voice Devices

DV Access Point

- Internet Labs
- **DSTAR** Hotspot repeater
- Single band
- 2M $240 new
  70 cm $270 new

DV Mega

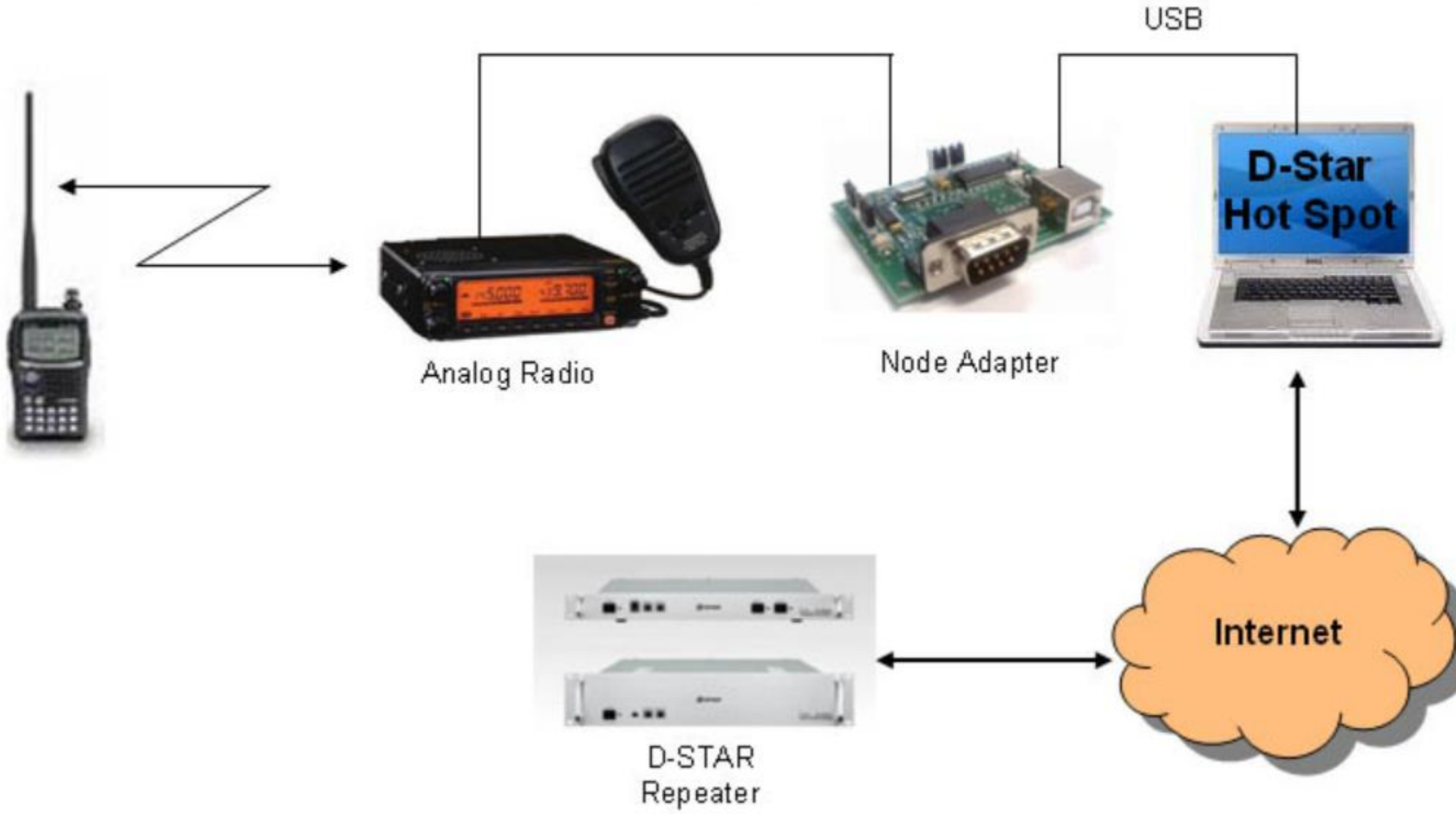
- Guus van Dooren PE1PLM
- **DSTAR** Hotspot repeater
- Dual band
- $139 new or PI kit from GigaParts for $230

Other Digital Voice Devices

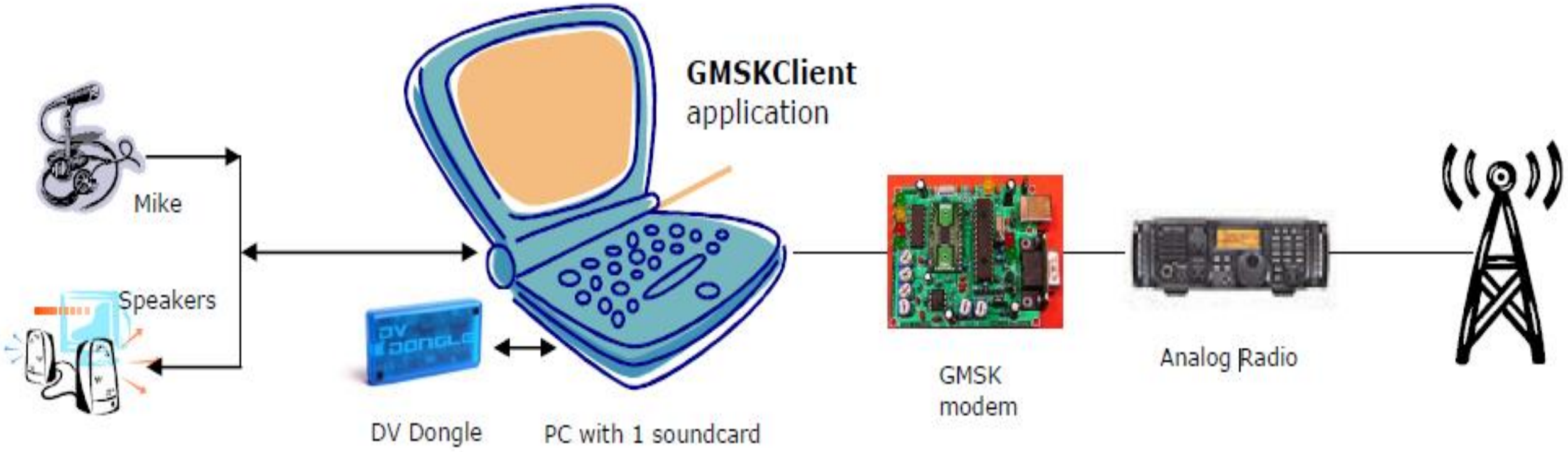
D-HAP

- Add DVAP **(DSTAR HOT SPOT)**
- Contains Raspberry PI, Wi-Fi, Batteries
- $300

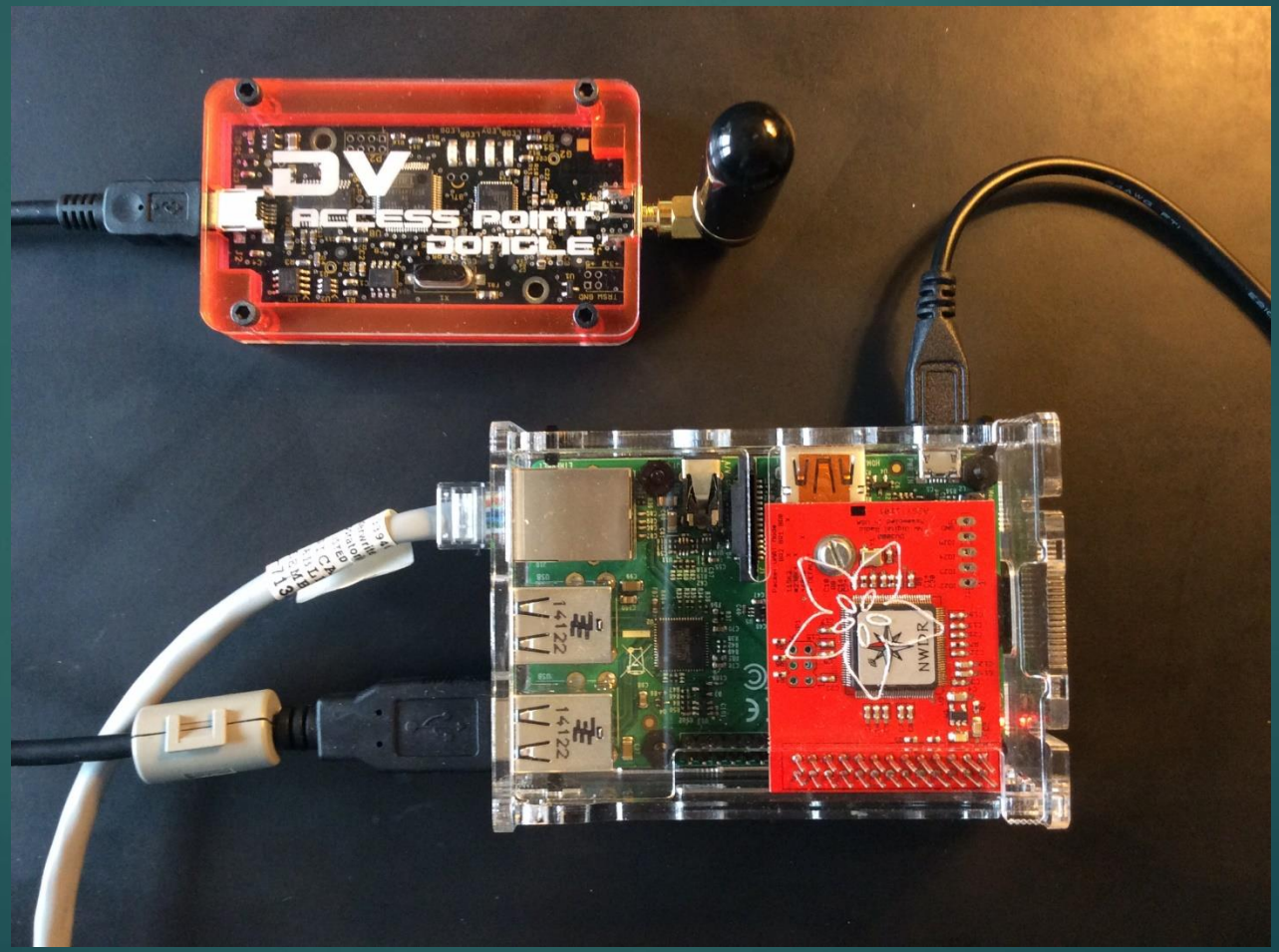
D-STAR Hot Spot - System Diagram



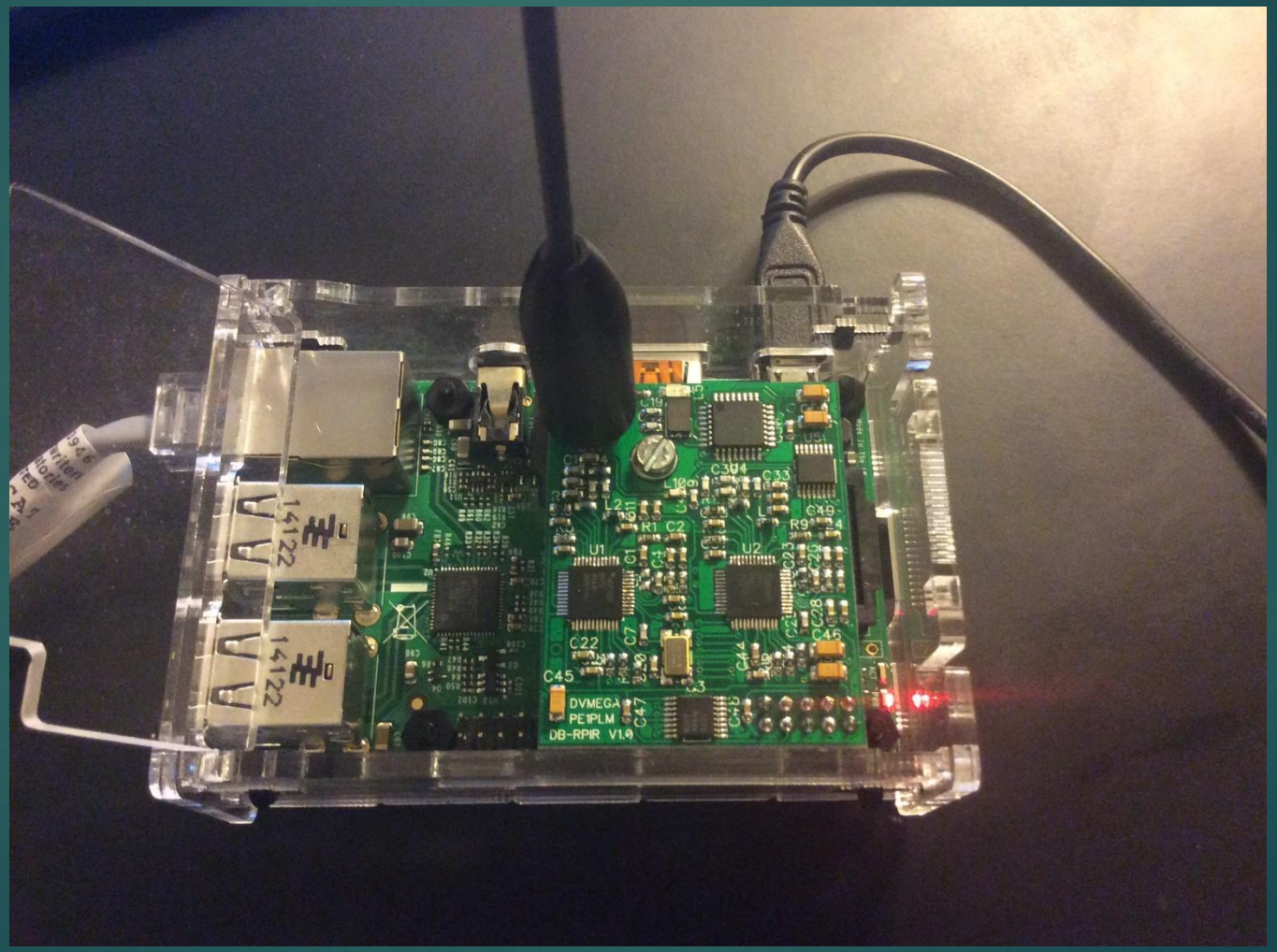
Transmit D-Star DV over Analog FM radio



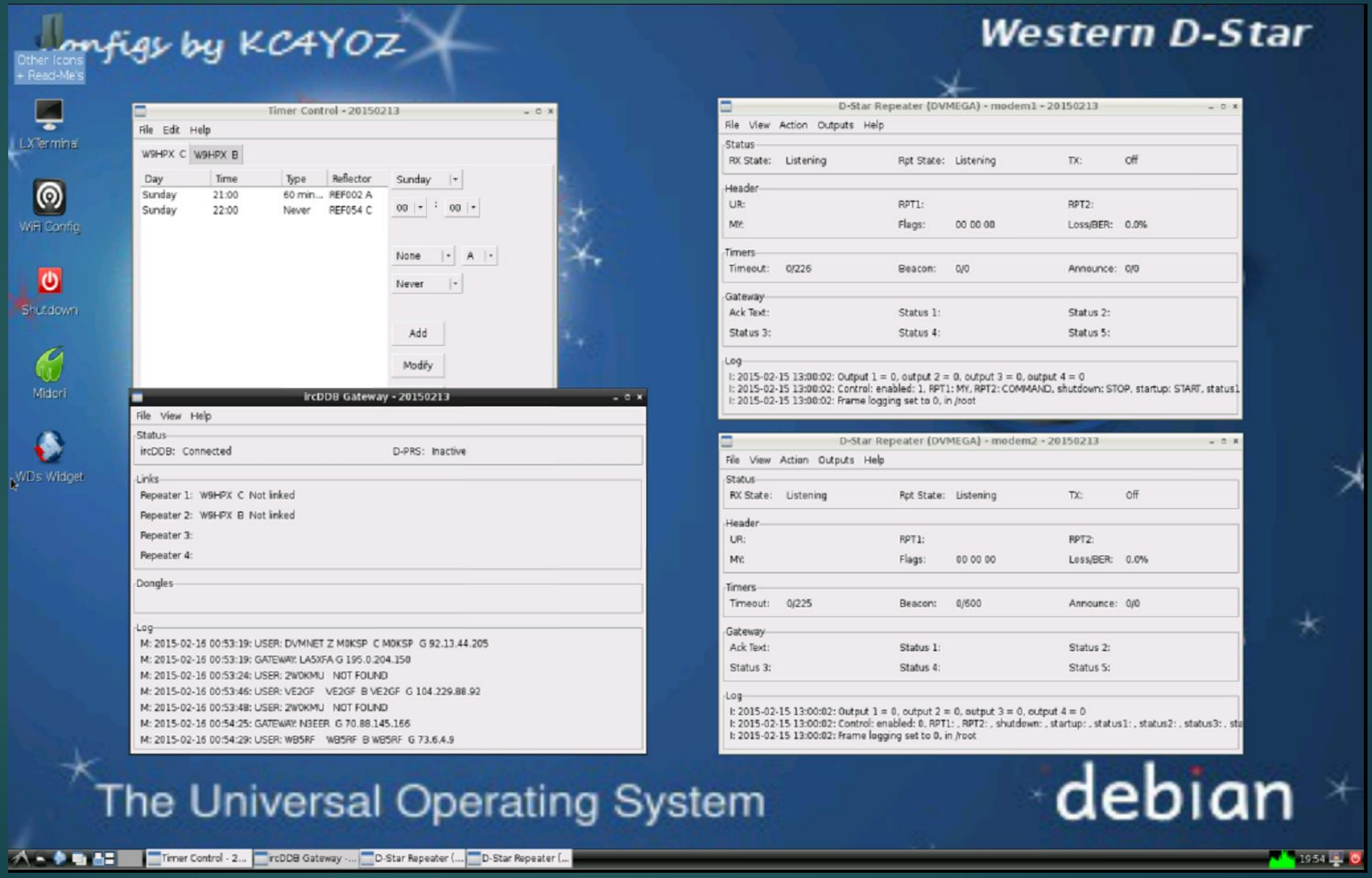
Not near a D-STAR Repeater? Make your own – with this…



Or this…



Raspberry Pi G4KLX GUI



The End of Modes

- Amateur Radio is facing the end of modes.
- While voice, text, and video were formerly their own modulations, these all become just different kinds of data carried over some form of digital radio.
- What formerly were modes will now just be different bandwidths of digital radio channels. What "mode" those channels carry will change from moment to moment.

Bruce Perens K6BP

For More Information

- www.dstar101.com
- www.dstarinfo.com
- www.dstarusers.org
- www.maryland-dstar.org - for Raspberry Pi enthusiasts
- www.dmr-marc.net
- www.trbo.org
- www.youtube.com/watch?v=C1ClH3R17m0 – Unscientific simplex field comparison.
- http://www.dstarinfo.com/csra-d-star-university-2015.aspx
- http://www.dstarinfo.com/InfoCon2014.aspx
- https://www.moencomm.com// - STAR*DV board

QUESTIONS?

Kent
KQ4KK@ARRL.NET