

# September 2020 W0TLM Meeting

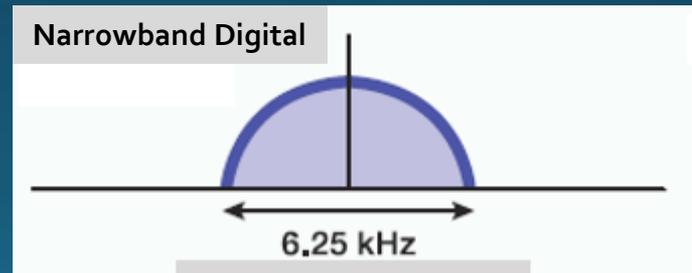
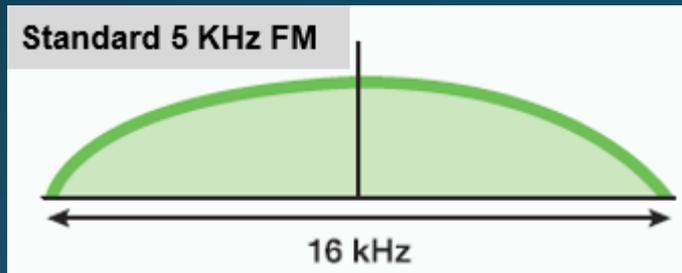
- Digital VHF/UHF Radios and Modes
  - D-STAR
  - DMR
  - System Fusion (C4FM)
  - NXDN
  - P25

Presented by:  
Tim Romashko – K4RA



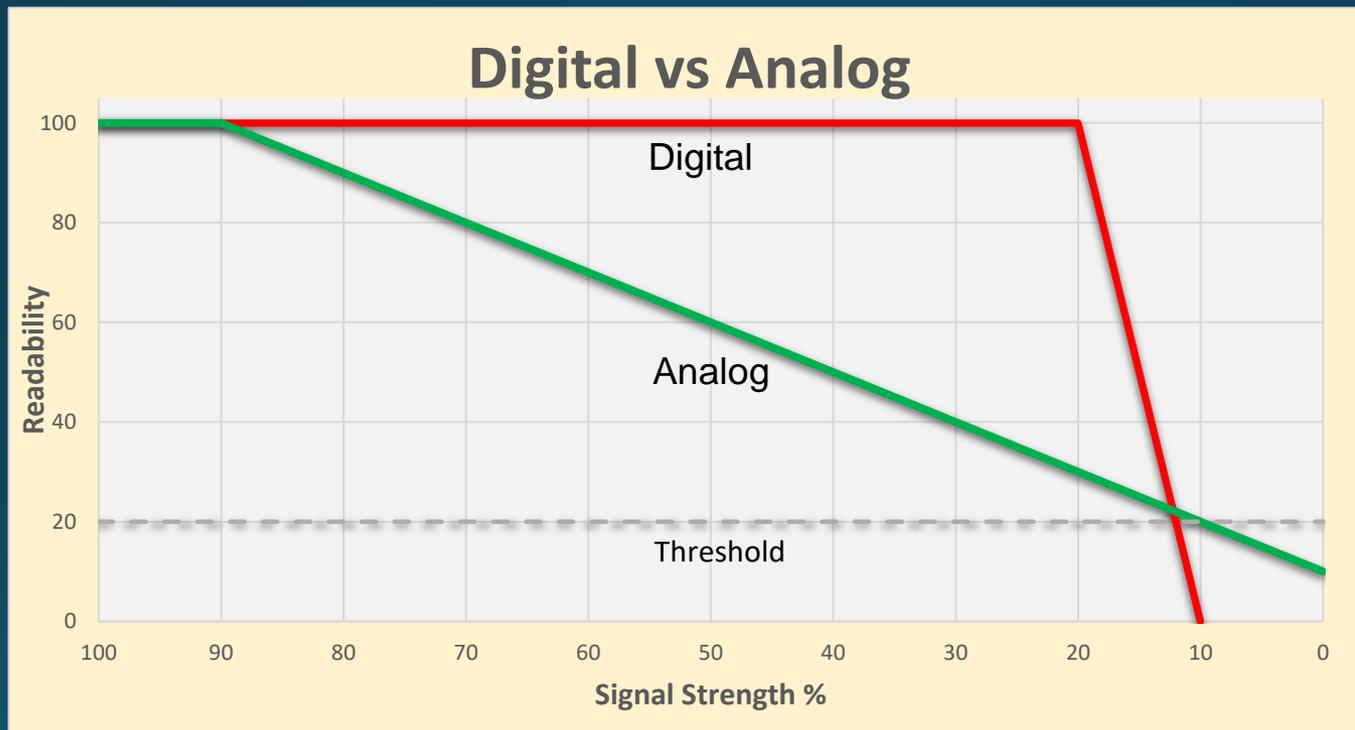
# Digital Basics

- Voice (analog) is converted to data
- Data may be added to voice to produce a single data stream containing voice and data
- Radio is modulated as a data carrier
- Occupied bandwidth is determined by data bit rate and type of modulation
- Generally, digital voice and data occupies less spectrum than analog FM



# Digital Basics

- Digital voice does not gradually degrade in quality as signal level decreases



# Digital Mode Comparison

	D-STAR	DMR/MotoTRBO	System Fusion
Number of users	>74,000 +	172,000 +	>10,000 +
Repeaters	2,428	4,699	>10,644 (most operating in mixed or FM modes)
Bandwidth	6.25 KHz	6.25 KHz	7.6-9 KHz
Channel spacing	10, 12.5 KHz pairs	12.5 KHz pairs	20, 25 KHz pairs
Repeater Linking	Open via Internet (DPLUS or ircDDB)	Proprietary (Motorola IPSC) or Hytera, via Internet	2 servers for worldwide connectivity Wires-X nodes connect to radio
Linking / routing control	Determined by user, sent from radio	Defined by admin, sent from radio	Best information is that currently repeater linking in C4FM is still not available
Data	1200, 3600 bps  128 kbps (1.2 GHz)	SMS only implemented in Amateur Radio version	4800, 9600 bps
Radio Programming	Front panel, software, numerous vendors including CHIRP	Mfg. software or aftermarket app (written by Hams)	Front panel, software
Other user devices	Multiple vendors (Dongle, DVAP, GMSK modems, hotspot adapters)	Multiple radio vendors, Hotspots	Hotspots

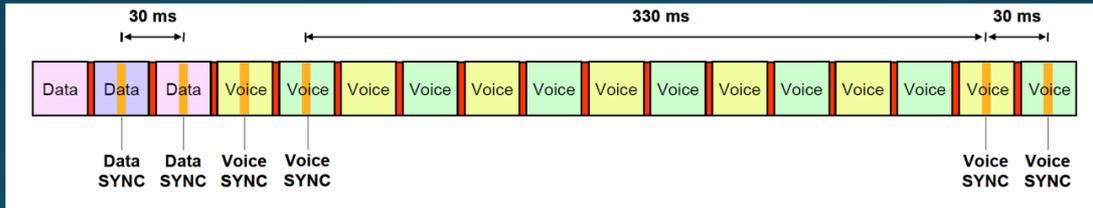
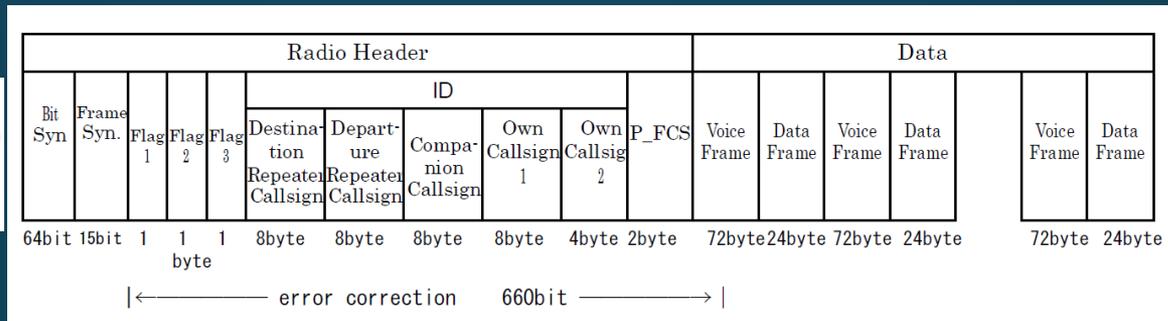


# What is ircDDB?

The ircDDB-Network is an amateur radio network for exchanging routing information. There are several amateur radio systems that are able to reach individual ham radio operators, due to the use of unique callsigns around the world. These systems need to be fed with the latest data where ham radio operators are reachable. For example, ICOM introduced the first radios with digital voice (D-Star) on the amateur radio market, which are capable of addressing QSO partners directly (call sign routing). The ircDDB-Network provides a solution to distribute the essential routing information across its entire network.



# Pictorial View



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

D-STAR = Digital Smart Technologies Amateur Radio

DMR = Digital Mobile Radio

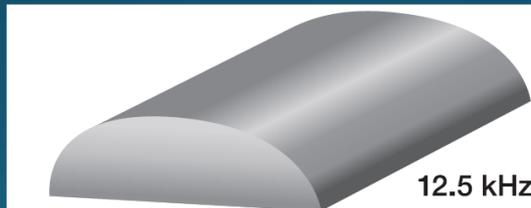
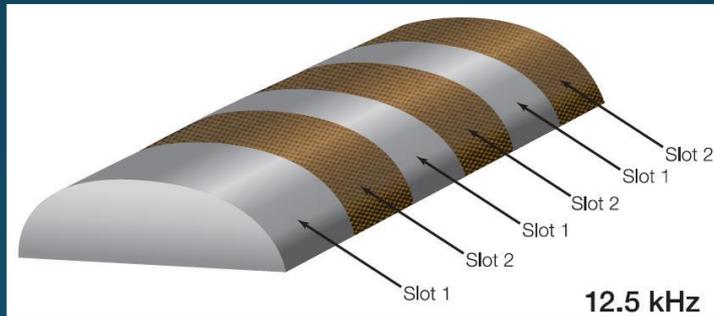
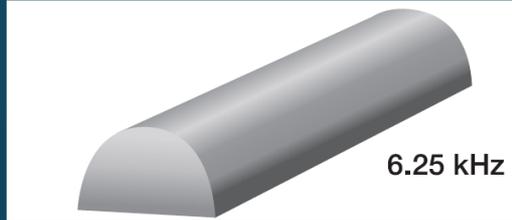
AMBE = Advanced Multi-Band Excitation

ETSI = European Telecommunications Standards Institute

JARL = Japan Ameteur Radio League



# Bandwidth Comparison



# 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.

\*\* No registration is necessary unless you want to have a WIRES-X Node on the network.

\*\*\* 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	Moderate	Fairly easy

\* 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.



# 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.



# Not near a Repeater?

## Pi-Star Hot Spot



Pi-Star:3.4.16 / Dashboard: 20200813

### Pi-Star Digital Voice - Configuration

Dashboard | Admin | Expert | Power | Update | Backup/Restore | Factory Reset

#### Gateway Hardware Information

Hostname	Kernel	Platform	CPU Load	CPU Temp
k4rapi-star	4.9.35+	Pi Zero W Rev 1.1 (512MB)	2.52 / 1.95 / 1.87	41.2°C / 106.2°F

#### 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](#)

#### MMDVMHost Configuration

Setting	Value
DMR Mode:	<input checked="" type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
D-Star Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
YSF Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
P25 Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
NXDN Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 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:	OLED Type 3 Port: modem Nextion Layout: ON7LDS L3

[Apply Changes](#)



# Pi-Star Hot Spot in Action

Hostname: k4rapi-star
Pi-Star:3.4.16 / Dashboard: 20200813

## Pi-Star Digital Voice Dashboard for K4RA

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	446.250000 MHz
Rx	446.250000 MHz
FW	HS_Hat:v1.3.7

DMR Repeater	
DMR ID	3113269
DMR CC	1
TS1	disabled
TS2	enabled

DMR Master	
EM United States	..

Gateway Activity									
Time (MDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER		
20:22:13 Sep 8th	DMR Slot 2	4000	K4RA	Net	1.0	0%	0.0%		
20:22:09 Sep 8th	DMR Slot 2	K4RA	TG 4000	RF	0.7	0%	0.0%		
20:20:35 Sep 8th	DMR Slot 2	WORMT	TG 31088	Net	81.4	0%	0.0%		
20:19:54 Sep 8th	DMR Slot 2	K6FW	TG 31088	Net	0.5	0%	0.0%		
20:18:52 Sep 8th	DMR Slot 2	VA6PW	TG 31088	Net	0.8	0%	0.0%		
20:18:17 Sep 8th	DMR Slot 2	N4BYU	TG 31088	Net	0.8	0%	0.0%		
20:18:03 Sep 8th	DMR Slot 2	N7EAL	TG 31088	Net	2.3	0%	0.0%		
20:17:57 Sep 8th	DMR Slot 2	WOGTA	TG 31088	Net	1.2	0%	0.0%		
20:17:56 Sep 8th	DMR Slot 2	K9KDJ	TG 31088	Net	0.5	0%	0.0%		
20:12:57 Sep 8th	DMR Slot 2	KC6UQT	TG 31088	Net	20.3	1%	0.0%		
20:12:18 Sep 8th	DMR Slot 2	WB3EHB	TG 31088	Net	12.7	0%	0.0%		
20:06:22 Sep 8th	DMR Slot 2	KI4UTY	TG 31088	Net	18.5	0%	0.0%		
20:02:45 Sep 8th	DMR Slot 2	W4JEW	TG 31088	Net	15.2	0%	0.0%		
20:02:26 Sep 8th	DMR Slot 2	VA7EWT	TG 31088	Net	1.6	0%	0.0%		

Local RF Activity								
Time (MDT)	Mode	Callsign	Target	Src	Dur(s)	BER	RSST	
20:22:09 Sep 8th	DMR Slot 2	K4RA	TG 4000	RF	0.7	0.0%	S9+46dB (-47 dBm)	

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



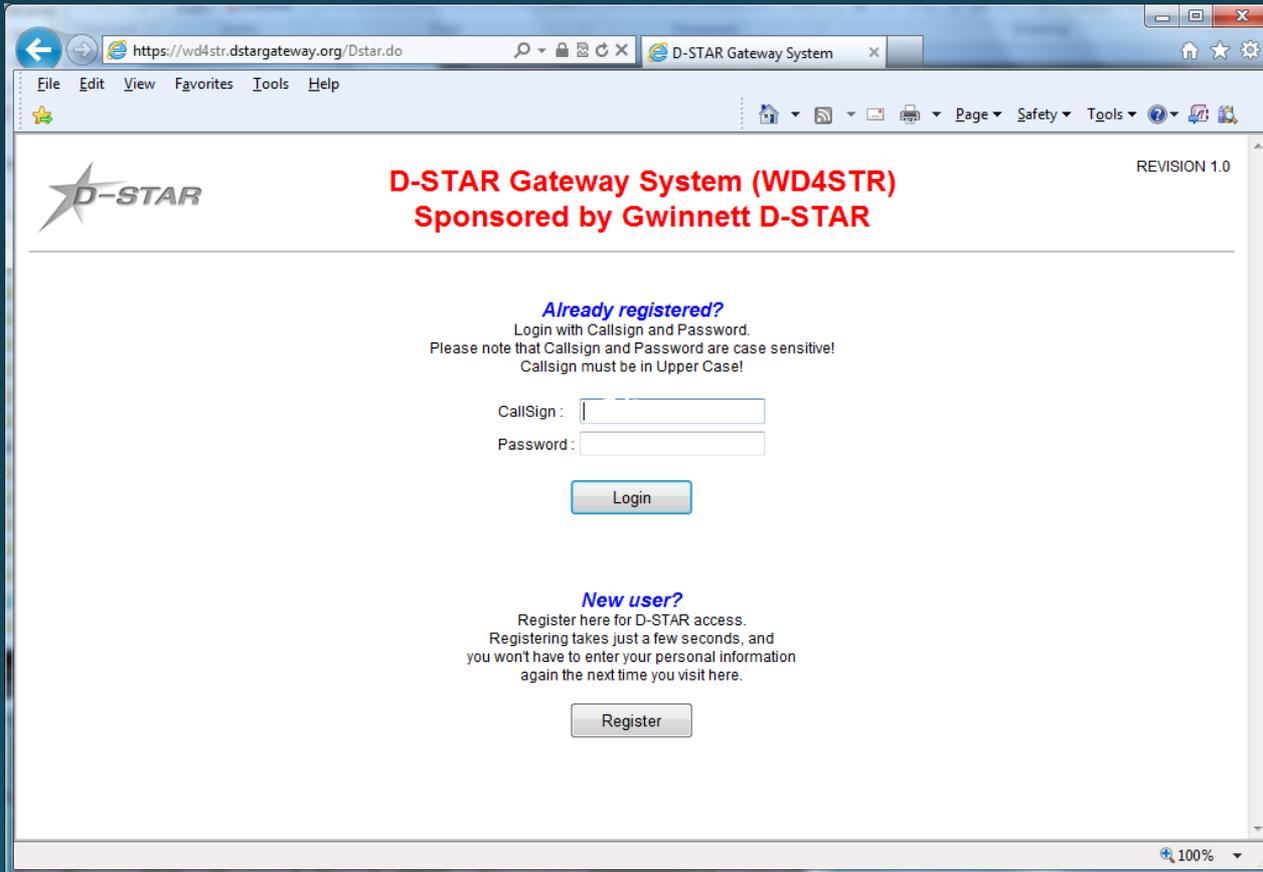
# The D-STAR Registration Process

- Why register?
- Registering your callsign allows access to more functions on DPLUS repeaters (not required for ircDDB repeaters)
- Registration is required for passing through Gateways
- Register on your local or the closest system, if possible
- Register on **one and only one** system (local registration syncs with all systems throughout world)
- Registration is a three-step process (*all three steps must be completed*)



# Starting Registration

- Step 1 – Browse to desired system and register as new user (<https://callsign.dstargateway.org/Dstar.do>)



The screenshot shows a web browser window with the address bar displaying <https://wd4str.dstargateway.org/Dstar.do>. The page title is "D-STAR Gateway System (WD4STR) Sponsored by Gwinnett D-STAR". The page content includes the D-STAR logo, the text "D-STAR Gateway System (WD4STR) Sponsored by Gwinnett D-STAR", and "REVISION 1.0". Below this, there are two sections: "Already registered?" with a "Login" button, and "New user?" with a "Register" button. The "Login" section includes fields for "CallSign" and "Password" and a note that "CallSign must be in Upper Case!".

**D-STAR**

**D-STAR Gateway System (WD4STR)**  
Sponsored by Gwinnett D-STAR

REVISION 1.0

**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

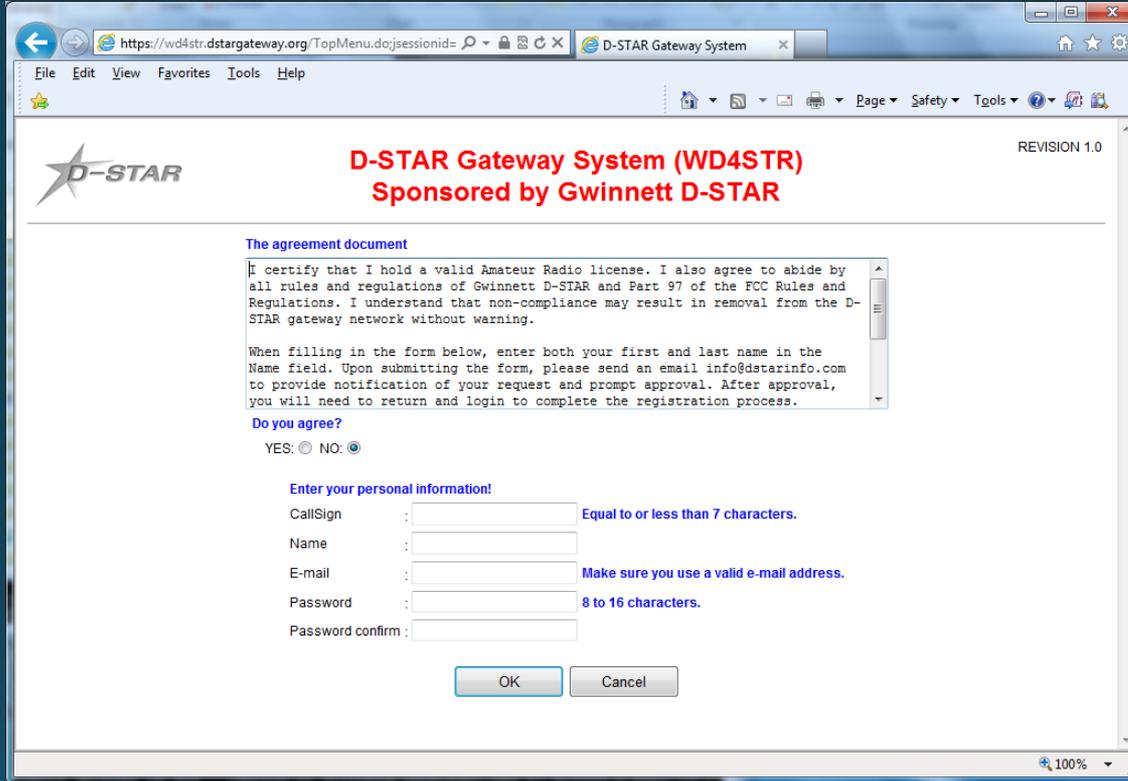
**New user?**  
Register here for D-STAR access.  
Registering takes just a few seconds, and  
you won't have to enter your personal information  
again the next time you visit here.

Register



# Fill Out Your Info

- Fill out the info (callsign, name, email address and desired password)



The screenshot shows a web browser window with the URL <https://wd4str.dstargateway.org/TopMenu.do;jsessionid=>. The page title is "D-STAR Gateway System (WD4STR) Sponsored by Gwinnett D-STAR" and it is labeled "REVISION 1.0". The page contains a registration form with the following sections:

- The agreement document:** A text area containing a certification statement: "I certify that I hold a valid Amateur Radio license. I also agree to abide by all rules and regulations of Gwinnett D-STAR and Part 97 of the FCC Rules and Regulations. I understand that non-compliance may result in removal from the D-STAR gateway network without warning." Below this is a paragraph of instructions: "When filling in the form below, enter both your first and last name in the Name field. Upon submitting the form, please send an email [info@dstarinfo.com](mailto:info@dstarinfo.com) to provide notification of your request and prompt approval. After approval, you will need to return and login to complete the registration process."
- Do you agree?:** Radio buttons for YES and NO, with NO selected.
- Enter your personal information!:** A series of input fields with labels and constraints:
  - CallSign: [input field] Equal to or less than 7 characters.
  - Name: [input field]
  - E-mail: [input field] Make sure you use a valid e-mail address.
  - Password: [input field] 8 to 16 characters.
  - Password confirm: [input field]
- Buttons:** OK and Cancel buttons.

- ◉ **Step 2** – System administrator must approve your initial registration. *You may need to send email to admin.*



# Add a Terminal

- Step 3 – Add at least one terminal with a space in first row under Initial, then type a pc-name (lower case, e.g. wb4qdx-dstar)

**D-STAR Gateway System (WD4STR)**

Revision: 1.0

Login: WB4QDX [Logout](#)

[User Information](#) | [GW Information](#) | [Terminal Information](#) | [Personal Information](#)

Please, edit after making a left check box on.

Name : John Davis

E-mail : jdavis@gtworks.com

Password :

Password Confirm :

If the station has multiple radios, Target CS are distinguished by initial (last character) of a space or a capital english letter.  
Definition character as follows..... (G) is a gateway. (S) is a local server.  
Usually RPT (Repeater) isn't checked, initial AreaRPT CS is the port A of ZoneRPT CS.  
If RPT is checked, AreaRPT CS is the same as Target CS.

	Initial	RPT	local IP	pcname	Del
<input type="checkbox"/>	1: WB4QDX		10.210.206.240	wb4qdx	<input type="checkbox"/>
<input type="checkbox"/>	2: WB4QDX N		10.210.206.241	wb4qdx-node	<input type="checkbox"/>
<input type="checkbox"/>	3: WB4QDX	<input type="checkbox"/>	10.210.206.242		
<input type="checkbox"/>	4: WB4QDX	<input type="checkbox"/>	10.210.206.243		
<input type="checkbox"/>	5: WB4QDX	<input type="checkbox"/>	10.210.206.244		
<input type="checkbox"/>	6: WB4QDX	<input type="checkbox"/>	10.210.206.245		
<input type="checkbox"/>	7: WB4QDX	<input type="checkbox"/>	10.210.206.246		
<input type="checkbox"/>	8: WB4QDX	<input type="checkbox"/>	10.210.206.247		

Check item and change a set value.  
Click the Update button.

[Update](#)

Note: You only need one terminal, a "space" for use. Adding more terminals can add confusion

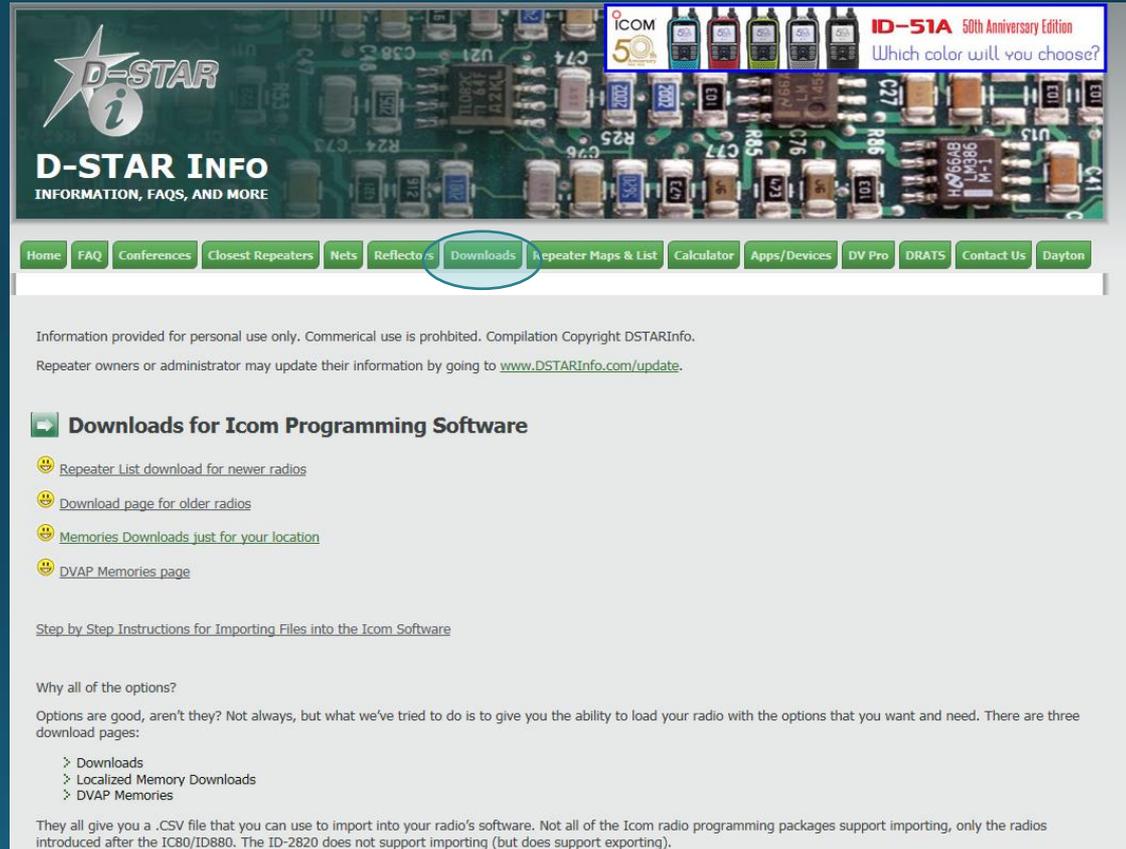
# Add Your Callsign to your Radio

- For a radio, program your callsign (caps, no spaces) in MYCALL or MY field
  - Found in Menu under MY STATION in newer radios
- For a DVAP, DV Dongle or Hotspot, program call in callsign field exactly as entered in registration terminal
  
- Get on and talk!



# Updating Radio Memory

- Customized, localized download files available at [www.DSTARinfo.com](http://www.DSTARinfo.com)
- Creates CSV files to import to most Icom radios
- Create updated geocoded Repeater List for DR Mode
- Build DVAP Memories



The screenshot shows the D-STAR INFO website interface. At the top, there is a banner for ICOM 50th Anniversary Edition ID-51A with the text "Which color will you choose?". Below the banner is a navigation menu with buttons for Home, FAQ, Conferences, Closest Repeaters, Nets, Reflectors, Downloads (highlighted with a red circle), Repeater Maps & List, Calculator, Apps/Devices, DV Pro, DRATS, Contact Us, and Dayton. The main content area contains a disclaimer: "Information provided for personal use only. Commercial use is prohibited. Compilation Copyright DSTARInfo. Repeater owners or administrator may update their information by going to [www.DSTARInfo.com/update](http://www.DSTARInfo.com/update)." Below this is a section titled "Downloads for Icom Programming Software" with a list of links: "Repeater List download for newer radios", "Download page for older radios", "Memories Downloads just for your location", and "DVAP Memories page". There is also a link for "Step by Step Instructions for Importing Files into the Icom Software". A section titled "Why all of the options?" explains that there are three download pages: "Downloads", "Localized Memory Downloads", and "DVAP Memories". At the bottom, it states: "They all give you a .CSV file that you can use to import into your radio's software. Not all of the Icom radio programming packages support importing, only the radios introduced after the IC80/ID880. The ID-2820 does not support importing (but does support exporting)."



# HF Operations

- Full quieting signals on HF
- D-STAR HF Net
- [www.DSTARInfo.com/DSTARHFNet.aspx](http://www.DSTARInfo.com/DSTARHFNet.aspx)
- IC-9100
- IC-7100
- Flex 6000 series
- Many radios with added GMSK Modem



# Getting Help

- Website:  
[www.DSTARinfo.com](http://www.DSTARinfo.com)
- Email:  
[info@dstarinfo.com](mailto:info@dstarinfo.com)

**D-STAR INFO**  
INFORMATION, FAQs, AND MORE

Home FAQ Conferences Closest Repeaters Nets Reflectors Downloads Repeater Maps & List Calculator Apps/Devices DV Pro DRATS Contact Us Dayton

D-STAR Expanding...

### Newest D-STAR Repeaters

Callsign	City	Country, State
MB6BF	Blandford Forum	United Kingdom, England
DB0LAM	Freden	Germany, Lower Saxony
NSTAM	Natchez	United States, Mississippi
GB7RN	Portsmouth	United Kingdom, England
GB7KH	Kelvedon Hatch (Ongar)	United Kingdom, England
GB7DN	Dungiven	United Kingdom, England
9A0DZG	Zagreb	Croatia (Local Name: Hrvatska)
VA3ITL	Maple	Canada, Ontario
ED7ZAE	Granada	Spain
KD0ZSA	Faribault	United States, Minnesota

### Existing Repeaters Updated

Callsign	City	Country, State
KD0ZSA	Faribault	United States, Minnesota
W7AES	Las Vegas	United States, Nevada
W9IPA	Dayton	United States, Ohio
KG7PJV	Tucson	United States, Arizona

### Top 15 Countries (Voice)

Country	Voice Nodes
United States	991
Germany	252

## Welcome to D-STAR Info!

This site is dedicated to helping D-STAR users world wide. From basic information on what D-STAR is to detailed technical information, This site can hopefully solve any of your cravings!

Check out the D-STAR activities at the Hamvention.

### D-STAR @ Dayton 2015

Watch Icom's Live Streaming of Dayton

**HotSpot NOW**  
D-STAR Infocon @Dayton is BACK! Check it out at [DSTARInfoCon 2015](#)

Want a great class on D-STAR? From new users to old ones. From using your radio the easy way to HotSpots, this class will cover it all!

**AmateurLogic** has been covering a lot of information on D-STAR lately.

- [AmateurLogic 75: DV3000 Raspberry Pi Hot Spot using the NWDigital DV3000 card](#)
- [AmateurLogic 77: Using the ThumbDV with the NWDigital ThumbDV](#)

**MoenComm** has introduced their Star\*DV USB device that comes with the AMBE CODEC and a Sound Card interface

### ID-51 Anniversary Edition Radios

are starting to run out. We've added support the ID-51 Anniversary Edition and the ID-51+. Head over to Repeater Downloads to update the D-STAR database and add a lot more

### SE Hurricane Net

Hurricane Net Forms (Right Click to Download form)

### New Downloads

Includes FM repeaters for US D-STAR Repeater Downloads Updated Supports

- ID-31 (D-STAR Repeaters)
- ID-51 (D-STAR Repeaters)
- ID-7100 (D-STAR Repeaters)
- ID-5100 (D-STAR & FM)
- ID-51+ (D-STAR & FM)
- RS-M1A (D-STAR & FM)

### For New ID-51 / 31 Users

D-STARInfo ID-51 Quick-Start Guide

Repeater owners or administrator may update their information at [www.DSTARinfo.com/update](http://www.DSTARinfo.com/update).

**DVAP DVAPTool 1.04**  
DVDongle DVTool-2.0beta5

**D-RATS** D-RATS Software D-RATS 0.3.3 update



# DMR Registration – Radioid.net

**RFinder**  
Fully Self-contained!



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We use them to give you the best experience. If you continue using our website, we'll assume that you are happy to receive all cookies on this website.  
[Continue](#) [Learn more](#)

- Home
- FAQ
- Support
- Database
- Rptr Map
- Register
- Signin

## Terms and Conditions

I will...

- Ensure that my radios [ARS] feature is turned off while operating on any of the DMR-MARC repeaters. (If equipped)
- Disable [AGC] on my radio for best audio performance.
- Agree not to experiment with any new hardware or software (including 3rd party Motorola applications) that might overall affect the entire network without having prior written permission from all repeater trustees whom my actions may affect.

### Data Privacy

- Digital ID, Callsign, First name and Country are minimum public required personal information in order apply for a Digital ID(a)
- You will have access to change most information, callsign will only be changed via a Admin action once verified.
- You agree to allow Radioid.net to host your information, which can be changed/modified at your convenience.
- You agree to allow Radioid.net to share your public information via database dumps, partners and searches for public consumption.

(a) for Registration, more information may be required to validate who you are.

### Repeaters/ NXDN / Capacity-Plus Registration(b)

- DMR **Repeater** ID, **NXDN** ID and **Cap-Plus** ID's are all available **AFTER** you register for an account (b)
- There is no need to create a new account or register a repeater as a separate account, simply create your primary account under your callsign.
- Make sure you upload a copy of your Amateur Radio License, then contact support and ask for allocations for Repeaters / NXDN / Cap-Plus.(b)
- **CAP-PLUS** are very limited in supply, you need a pretty good reason for us to give you one. Contact support if you require one.(b)

[Register RPTR](#)

[Register NXDN](#)

(b) Capacity-Plus IDs will not work on Brandmeister system.

I will not...

- Register a new callsign when I already have a (CALLSIGN / DMR ID), even if you do not think you have an account. - See [FAQ](#)
- Register a repeater under it's own account. - See [FAQ](#)
- Register on this site if I am from the EU or Africa - Goto [register.ham-digital.org](http://register.ham-digital.org) instead.
- Register on this site unless I am a Licensed Amateur Radio Operator with a Government Issued Callsign.

I AGREE TO THE ABOVE TERMS AND CONDITIONS

[Register Account](#)



# Register for C4FM (WIRES-X)

The screenshot displays the YAESU WIRES-X website interface. The top navigation bar includes the YAESU logo with the tagline "The radio" and the WIRES-X logo. A left sidebar menu contains links for "What is WIRES-X?", "User page", "WIRES-X ID list", "Opening a node", "Member login", "WIRES-X ID registration >> [Member registration]", "Forgot your member ID?", "Forgot your password?", and "Contact us".

The main content area is titled "WIRES-X TOP > New member registration" and features a "Member registration" section. Below this is a sub-section "Inputting your e-mail address" with a text input field. The instructions state: "Input your e-mail address, then click 'Send'. Confirm your address before clicking 'Send'." It further explains that users will receive an automatically-transmitted e-mail with a registration URL and should visit that URL. A note mentions that if an e-mail is not received despite correct input, users should contact the "Contact us" page.

At the bottom of the registration form, there is an "E-mail address" input field and a "Send" button. Below the input field, an example is provided: "(Ex): aaaaaaa@bbb.com" and a note: "※The mobile e-mail address can not be used."



# Can I talk on one mode to another ham on a different mode?

- Digital modes are not cross-compatible
- Cross-mode connectivity can be accomplished by using a Mega site
- Nearby Mega sites:
  - Parker Radio Association ([www.parkerradio.org](http://www.parkerradio.org))
  - High Country Digital Radio ([www.coloradodigital.net](http://www.coloradodigital.net))



# So what? Why should I care?

- Technician license gets you talking globally!
- Relatively low cost of entry (under \$250)
- Digital systems are very flexible
- Reflectors/Talk Groups/Rooms for most any hobby and location
- Digital platforms support experimentation
- FCC is very interested in Digital modes due to smaller bandwidth requirements



# What do I do next?

- Find an Elmer!
- Discuss your goals with your Elmer
- Decide what mode is best for you to get started with digital radio
- Get your FCC license
- Buy a radio (and hot spot if possible)
- Get your Elmer to help you program your radio and hot spot (very important)
- Get on the air and have FUN!



# Questions?

