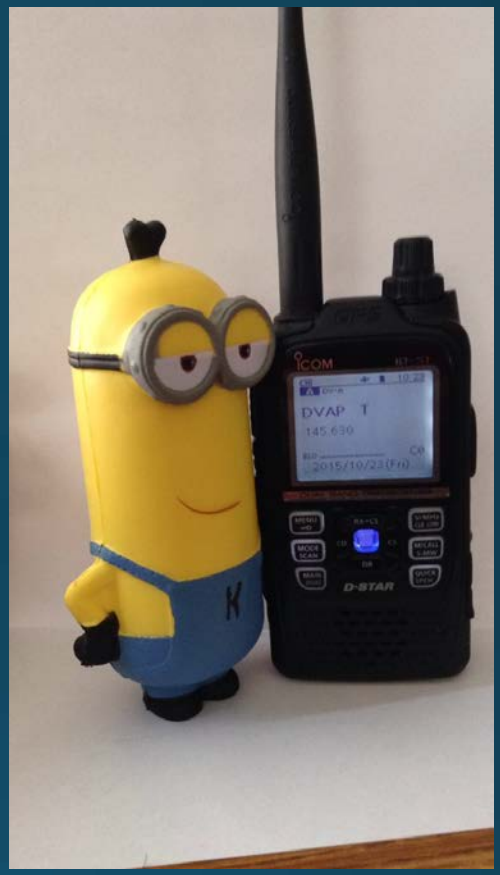


WPARC

July 18th, 2017

DSTAR Basics

Kevin Amey-AA6KA

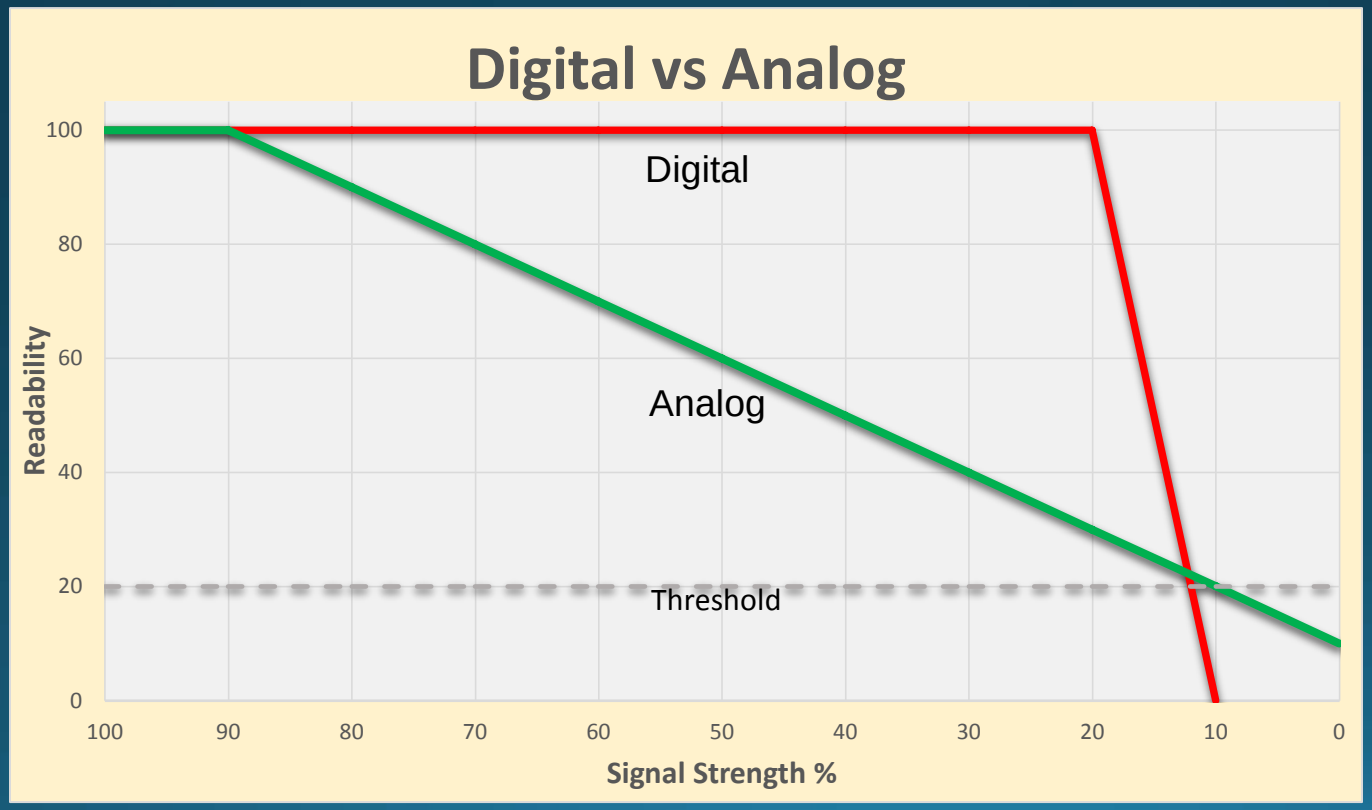
Discover DSTAR-ICOM

What is D-STAR?

- D-STAR is an open standard for digital voice and data designed specifically for Amateur Radio
- One of several digital modes used in Amateur Radio (DSTAR, DMR, Fusion, P-25 etc.)
- Developed by Japan Amateur Radio League (JARL) in 1999-2000
- Uses AMBE vocoder chip from DVSI to convert analog speech to data and vice versa
- D-STAR has lead the way encouraging experimentation and open development

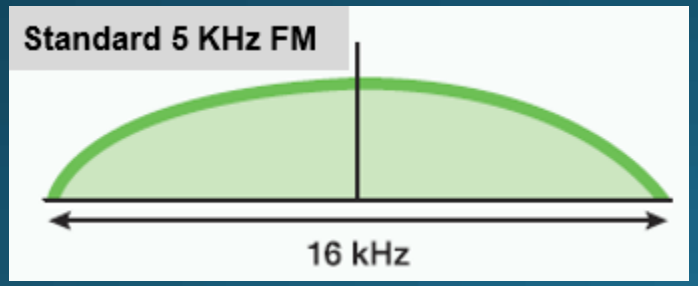
Digital Basics

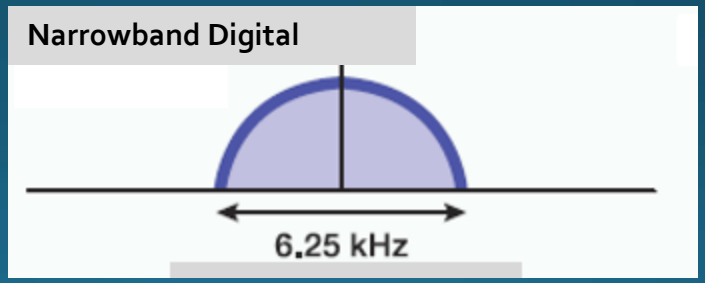
- Digital voice does not gradually degrade in quality as signal level decreases. It's either there or not.



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 Mode Comparison

	D-STAR	DMR/MotoTRBO	System Fusion
Number of users	>54,000	>45,000	>15,000
Repeaters	>3,000	>1,500	>1,500 (most operating in mixed or FM modes)
Bandwidth	6.25 KHz	7.6 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), Hytera or special limit3ed reflectors via Internet	Wires-X nodes connect to radio
Linking / routing control	Determined by user, sent from radio	Defined by admin, sent from radio	Not yet available for repeater (Repeater firmware upgrade required)
Data	1200, 3600 bps 128 kbps (1.2 GHz)	SMS only implemented in Amateur Radio version	4800, 9600 bps
Radio Programming	Front panel, software	Licensed software	Front panel, software
Other user devices	Multiple vendors (Dongle, DVAP, GMSK modems, hotspot adapters)	Multiple radio vendors, multi-mode devices available with limited networking	DV4 Mini,SharkRF openSPOT

How does D-STAR work?

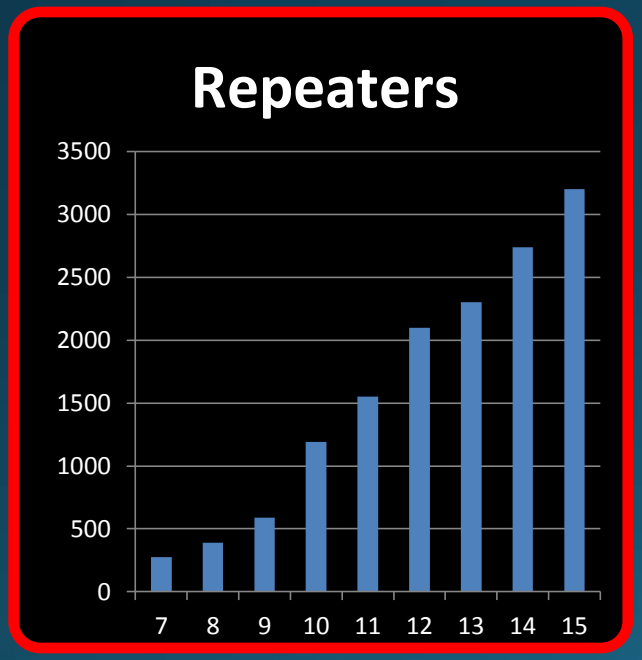
- Voice is converted to digital modulation and transmitted at 4800 bps
  - 2400 bits for voice
  - 1200 bits for Forward Error Correction on voice
  - 1200 bits for data (error correction usually in applications
- True narrowband digital signal
  - Voice and data occupy one 6.25 KHz signal (versus wider bandwidth for FM voice, P25,Fusion and DMR)
- Can operate simplex, repeater or linked to other repeater(s)

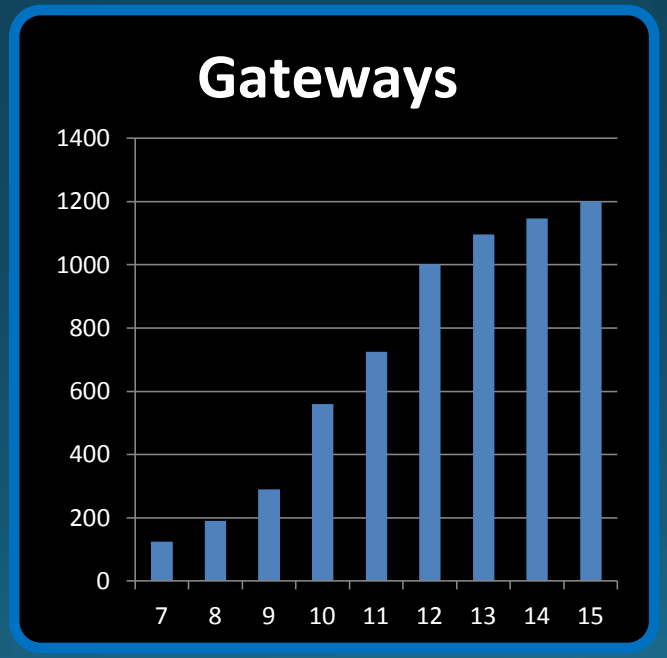
What can D-STAR Do?

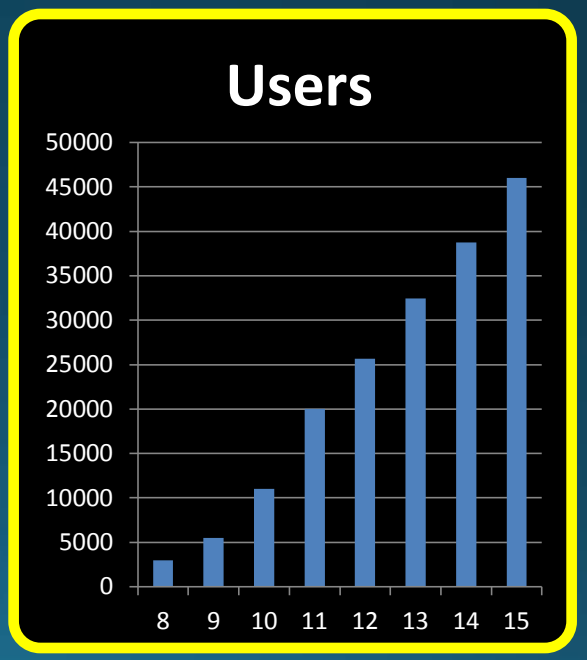
- Transmit or receive voice and 1200 baud data simultaneously on 2m,220,440 and 1.2 GHz (no TNC required)
- 128 Kb data transmission on 1.2 GHz with Internet connectivity (Ethernet bridge to Internet with IP address)
- D-PRS (digital APRS) automatic position reporting simultaneous with voice with GPS
- Flexible repeater linking with Gateway and Internet connection
- Reflectors act as conference bridge for linking multiple repeaters (82 DPLUS Reflectors, >150 DCS and XRF Reflectors now in operation worldwide)
- DV Dongle, DV Access Point (DVAP) / Hotspots and DV Node Adapters allow voice and data access to D-STAR via Internet connection (similar to EchoLink)

D-STAR Growth Continues

- *As of May 1, 2017 – over 3,500 Voice Repeaters, 252 Data Modules and over 54,000 registered users on US Trust Server.*
- *Over 1,500 repeaters in US*
- *Additional ircDDB repeaters and users*







D-STAR Equipment

- D-STAR radios (mobiles, handhelds, repeaters) commercially produced by ICOM and Kenwood
- DV Dongle is non-radio device (PC Connected) allowing access to repeaters and reflectors via Internet (similar to EchoLink)
- DV Access Point (DVAP)/Shark RF openSPOT/DV4 Mini create low power hotspot via Internet
- Hotspot boards (DV/MEGA/Blue Stack create low power access point with Raspberry Pi
- Node Adapters (GMSK Board)converts FM transceiver to D-STAR hotspots and repeaters

Icom Radios

- Offers line of mobiles, handhelds and repeaters
- Most radios are dual band (2m, 70cm)
  - ID-31A is 70cm only
  - ID-1 is 23cm only, allows high speed data
- All radios operate standard FM and D-STAR digital modes
- All Icom radios have built-in serial port for data transmission
- All offer GPS as built-in, a part of speaker/mic or connection via serial or USB port

Icom Mobiles

- ID-4100 (ICOM's Newest Mobile)
  - Dual band, single receive
  - Built-in GPS
  - Voice and data storage (Micro SD card)
  - Android & iOS applications available

- ID-5100 mobile offers new features
  - Dual-Band, dual receive
  - GPS built into head unit
  - Touchscreen display
  - Optional Bluetooth interface
  - DR Mode with 1200 geocoded memories

- ID-7100 HF/50/144/440 mobile
  - Angled touchscreen display
  - Voice and data storage (Micro SD card)
  - 32 bit floating point DSP
  - 100 watt power output

Icom Handhelds

- IC-91AD was initial D-STAR handheld
  - Dual-band, dual receive
- IC-92AD dual-band, dual receive
  - Slightly larger frame with more heat sink
  - Waterproof
  - GPS spkr/mic optional accessory
- IC-80 introduced as lower cost handheld
  - Dual-band, single receive
  - GPS spkr/mic accessory available
- ID-31A is 70cm handheld
  - Waterproof
  - SD card for memory storage, update memory from downloads
  - Built-in GPS
  - User friendly DR Mode, locate closest repeater
- ID-51A is latest dual band handheld
  - All features of ID-31A, but dual band, dual receive
  - Anniversary Edition/Plus model includes nearest FM repeater location
  - 3X data rate with other 51A/5100 radios

ID-51 A PLUS2

Terminal Mode

Connect the ID-51A/E PLUS2 to the Internet through a PC or Android® device, and send your voice and/or data through the Internet gateway to a destination repeater.

Access Point Mode

Use an ID-51A/E PLUS2 radio connected to the Internet through a PC or Android® device, as an Access point. You can use another D-STAR radio to send your voice and/or data through the Access point radio, and communicate with D-STAR stations all over the world.

- PC OS: Windows Vista®, Windows® 7, Windows® 8.1, Windows® 10
- Android® OS: Android® 4.0/4.1/4.2/4.3/4.4/5.0/6.0
- A public IP address is required for the Internet connection. (Either a dynamic or static IP address can be used.)
- The Terminal mode and Access point mode require the latest gateway server application to be installed.

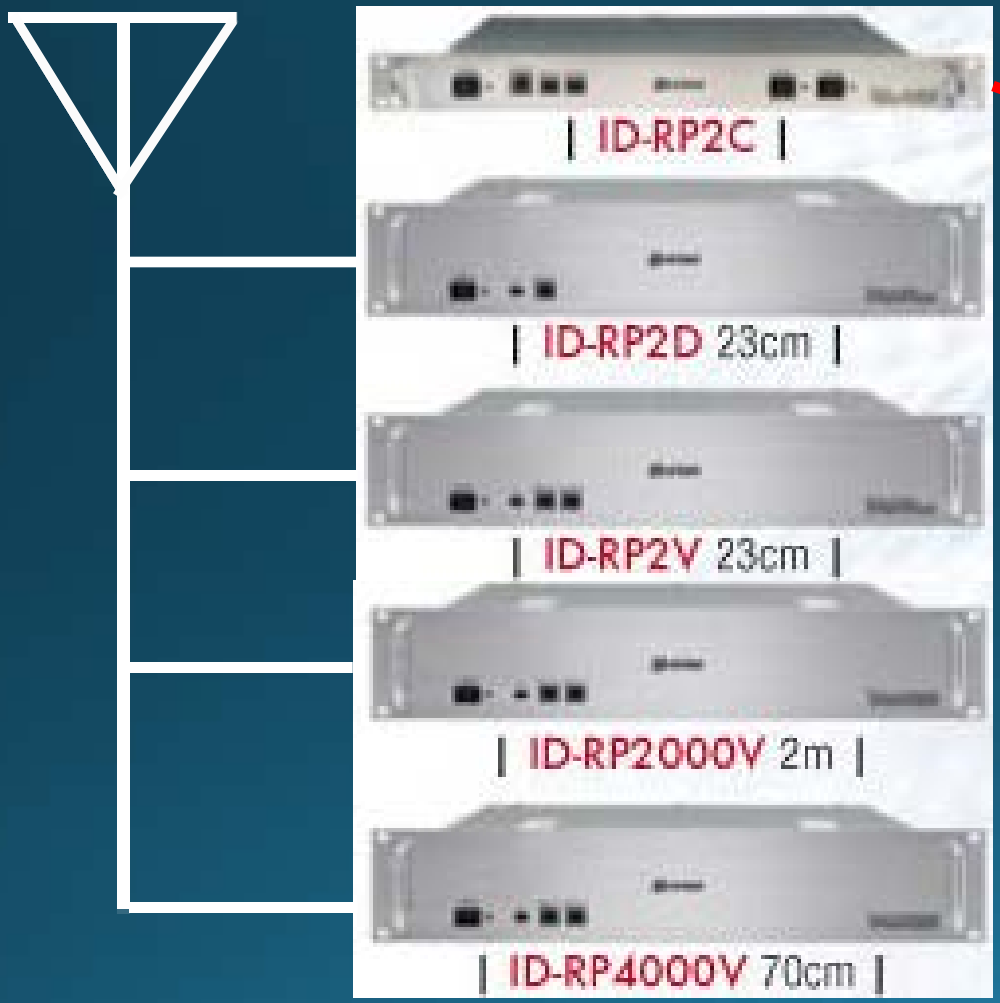
ID-1 for 1.2 GHz Voice and Data

- Operates FM, Digital Voice (DV), low speed data and high speed data (DV)
- High speed data connection is Ethernet compatible
- Acts as Ethernet bridge

Kenwood TH-74D

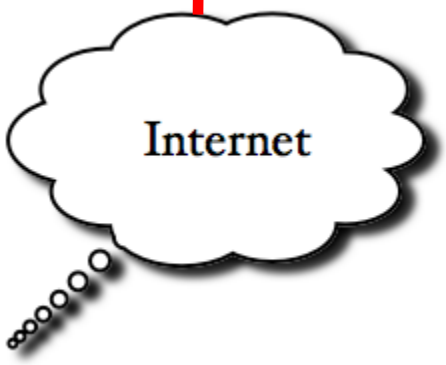
- Tri-Band 144/220/440
- Integrated GPS
- APRS/DPRS
- Bluetooth Compliant
- Extended Receive with HF/SSB/CW
- Built-in 1200/9600 bps TNC
- 1000 Memories

D-STAR Repeater Architecture



Linux Gateway PC
Running G2 Gateway
software

Runs third-party
apps, Dongle,
DVAP



SharkRF openSPOT

- Digital Hotspot or Node (DMR/Fusion/DSTAR)
- Allows access to reflector/talkgroups where no repeater is available
- Can cross-mode DMR and Fusion but not with DSTAR yet
- 20mw power output
- User friendly PC interface via web browser on PC or smart device
- Cat-5 connection only (Can go wireless with mini mobile router)
- Can change reflectors / talkgroups via radio or software

DVAP

- Digital Hotspot /Node (DSTAR ONLY)
- Allows access to reflectors when no repeaters are available
- Must be used with a computer (PC,Linux,Raspberry Pi, etc)
- Many software interfaces available for free (Win DV,ircDDB,DVAP Tools) IRCDDB software App available on IPHONE and Android devices
- 10 mw power output
- Can change reflectors via radio/software
- 2 Meters/1.25 Meters/70 CM available

DV Dongle

- Digital Voice utilizing a microphone and headset connected to a soundcard (No radio needed)
- Must be used with a computer
- Easy access to reflectors via software
- Many software programs available for free (WinDV/IRCDDB/DV Tools)

DV4mini

- VHF or UHF USB stick containing 2m or 70cm data transceiver. Works with DSTAR, DMR, Fusion, APCO25 and other digital modes which are based on GMSK, 2FSK or 4FSK

- USB stick containing 70 cm data transceiver. This version contains an AMBE chip which allows the use of your computer's microphone and speaker to talk simultaneously to reflectors and through the DV4mini to other digital radios in range. DMR, DSTAR, NXDN and C4FM/Fusion are supported with the AMBE chip. All modes are also supported like in the regular DV4mini using a handheld.

Raspberry Pi 3

- The Raspberry Pi 3 is the third-generation Raspberry Pi. It replaced the Raspberry Pi 2 Model B in February 2016.
- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- 1GB RAM
- BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
- 4 USB 2 ports
- 4 Pole stereo output and composite video port
- Full size HDMI
- DSI display port for connecting a Raspberry Pi touchscreen display
- Micro SD port for loading your operating system and storing data
- Upgraded switched Micro USB power source up to 2.5A

DV MEGA Board

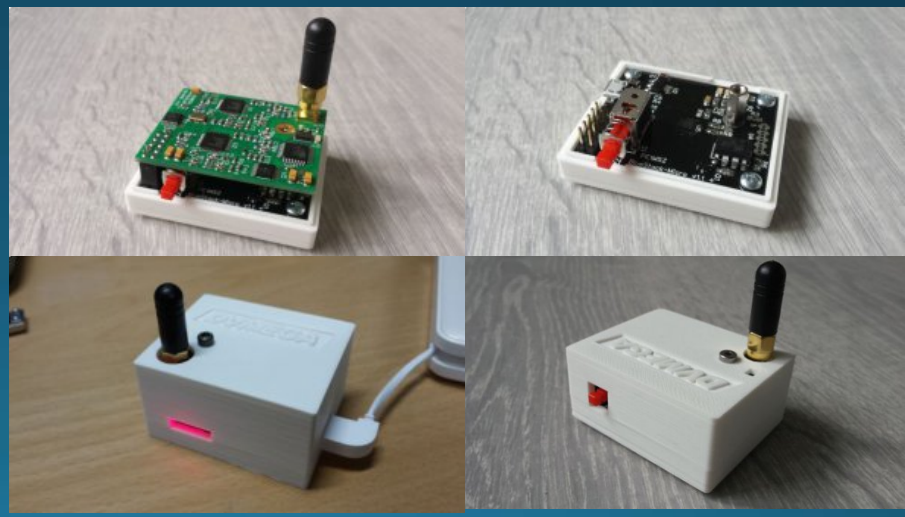
- DVMEGA RPI Dual band radio is a radio module that fits without a modem or node adapter directly on the Raspberry PI. The combination RPI and RPI DVMEGA radio is a complete D-Star compatible hotspot with an output power of 10mW. The DVMEGA RPI radio comes with firmware and is ready for use. There are 2 radio's available, configured to operate in the VHF and UHF band

- Also comes in single band (70cm) version

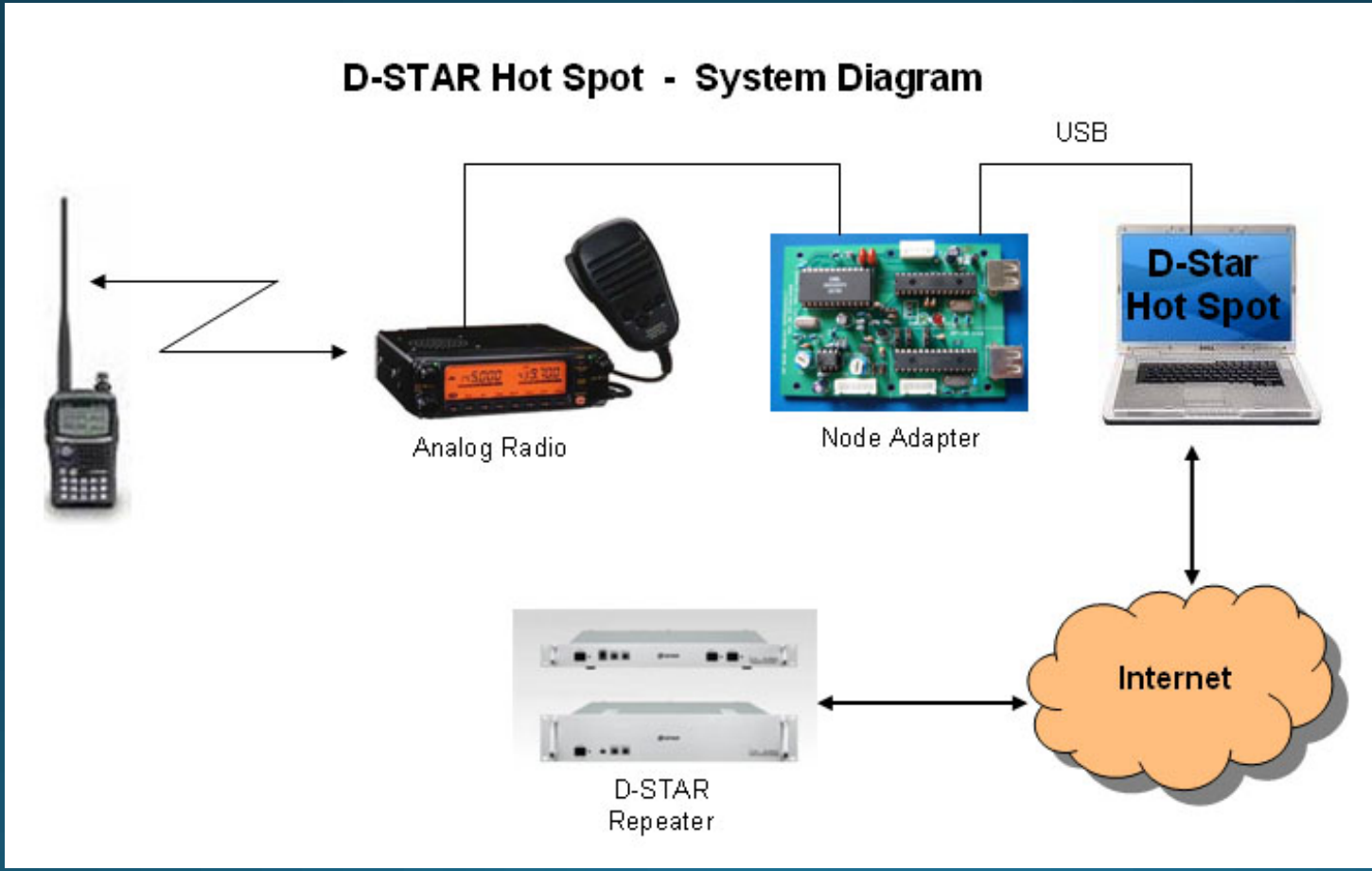
- Many competitor versions available

DV Blue Stack Board

- Bluestack board attaches to DV Mega board to make a complete unit (Instead of Raspberry Pi) Uses Android tablet or phone
- Uses Blue DV app or PC Software from David (PA7LIM)
- DSTAR,DMR, and Fusion Hotspot



DSTAR HOTSPOT

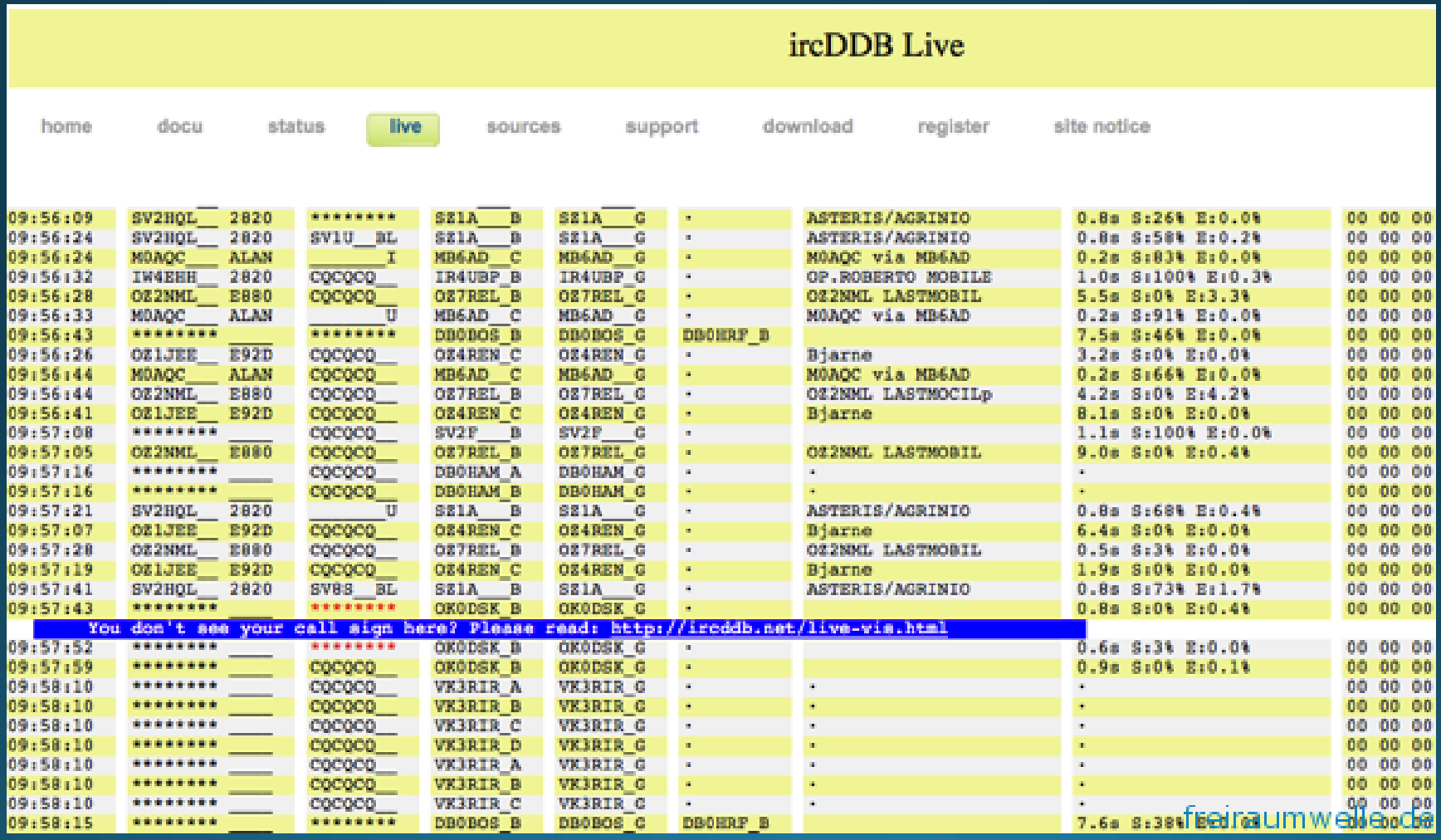


Available Software

- Win DV Software – By Dutch Star (dutch-star.eu/software/)
- IRCDDB Software with DSTAR Commander interface –By W6KD (w6kd.boards.net/thread/2/dstar-commander-public-release-download)
- DVAP Tool/DV Tool-By Robin Cutshaw AA4RC

IRCDDB-Remote

IRCDDB Live



ircDDB Live

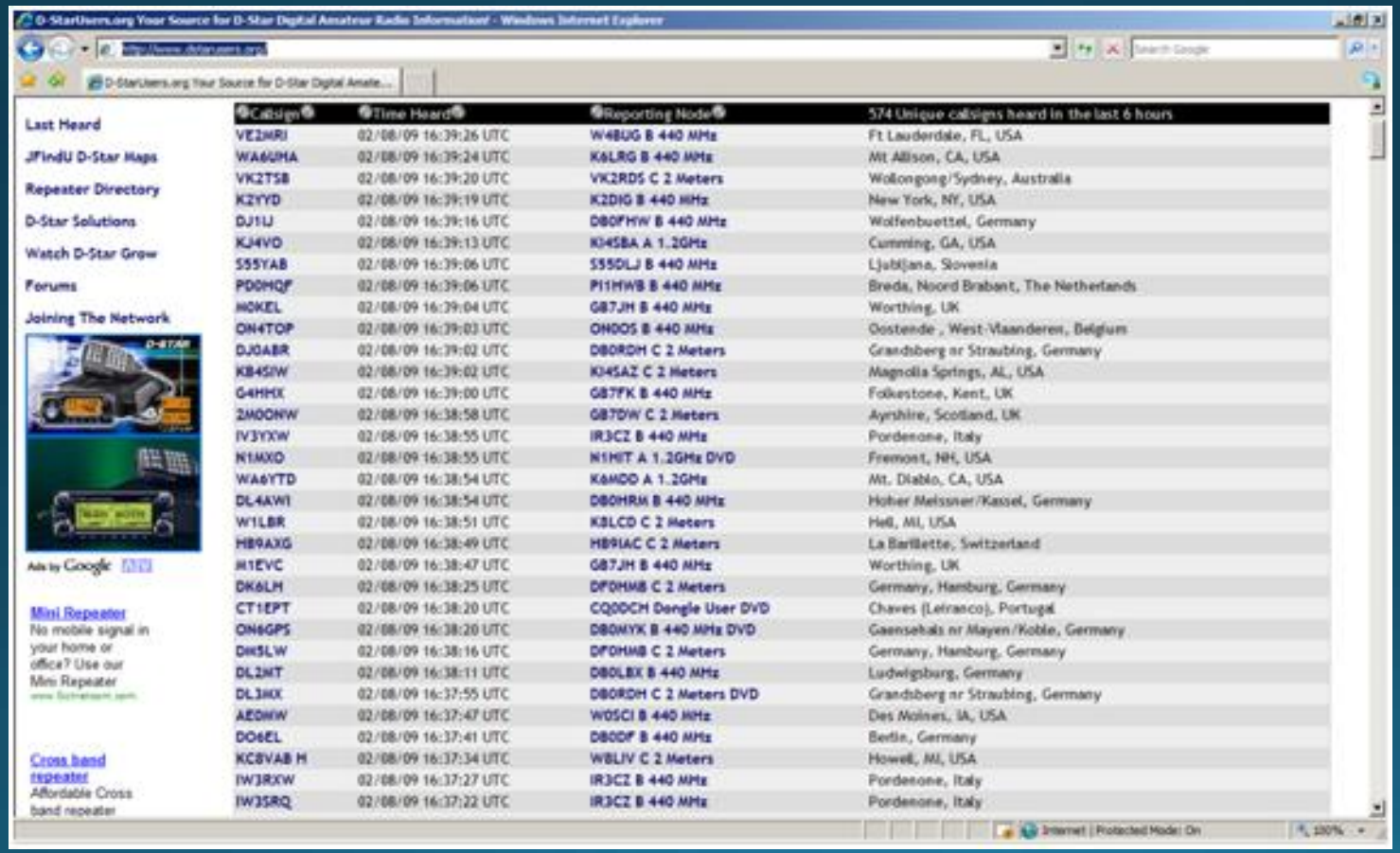
home docu status live sources support download register site notice

09:56:09	SV2HQL__ 2820	********	SZ1A___B	SZ1A___G	-	ASTERIS/AGRINIO	0.8s S:26% E:0.0%	00 00 00
09:56:24	SV2HQL__ 2820	SV1U__BL	SZ1A___B	SZ1A___G	-	ASTERIS/AGRINIO	0.8s S:58% E:0.2%	00 00 00
09:56:24	M0AQC___ ALAN	_______I	MB6AD__C	MB6AD__G	-	M0AQC via MB6AD	0.2s S:83% E:0.0%	00 00 00
09:56:32	IW4EHH__ 2820	CQCQCQ__	IR4UBP_B	IR4UBP_G	-	OP.ROBERTO MOBILE	1.0s S:100% E:0.3%	00 00 00
09:56:28	OZ2NML__ E880	CQCQCQ__	OZ7REL_B	OZ7REL_G	-	OZ2NML LASTMOBIL	5.5s S:0% E:3.3%	00 00 00
09:56:33	M0AQC___ ALAN	_______U	MB6AD__C	MB6AD__G	-	M0AQC via MB6AD	0.2s S:91% E:0.0%	00 00 00
09:56:43	******** ____	********	DB0BOS_B	DB0BOS_G	DB0HRF_B		7.5s S:46% E:0.0%	00 00 00
09:56:26	OZ1JEE__ E92D	CQCQCQ__	OZ4REN_C	OZ4REN_G	-	Bjarne	3.2s S:0% E:0.0%	00 00 00
09:56:44	M0AQC___ ALAN	CQCQCQ__	MB6AD__C	MB6AD__G	-	M0AQC via MB6AD	0.2s S:66% E:0.0%	00 00 00
09:56:44	OZ2NML__ E880	CQCQCQ__	OZ7REL_B	OZ7REL_G	-	OZ2NML LASTMOCILp	4.2s S:0% E:4.2%	00 00 00
09:56:41	OZ1JEE__ E92D	CQCQCQ__	OZ4REN_C	OZ4REN_G	-	Bjarne	8.1s S:0% E:0.0%	00 00 00
09:57:08	******** ____	CQCQCQ__	SV2F___B	SV2F___G	-		1.1s S:100% E:0.0%	00 00 00
09:57:05	OZ2NML__ E880	CQCQCQ__	OZ7REL_B	OZ7REL_G	-	OZ2NML LASTMOBIL	9.0s S:0% E:0.4%	00 00 00
09:57:16	******** ____	CQCQCQ__	DB0HAM_A	DB0HAM_G	-	-	-	00 00 00
09:57:16	******** ____	CQCQCQ__	DB0HAM_B	DB0HAM_G	-	-	-	00 00 00
09:57:21	SV2HQL__ 2820	_______U	SZ1A___B	SZ1A___G	-	ASTERIS/AGRINIO	0.8s S:68% E:0.4%	00 00 00
09:57:07	OZ1JEE__ E92D	CQCQCQ__	OZ4REN_C	OZ4REN_G	-	Bjarne	6.4s S:0% E:0.0%	00 00 00
09:57:28	OZ2NML__ E880	CQCQCQ__	OZ7REL_B	OZ7REL_G	-	OZ2NML LASTMOBIL	0.5s S:3% E:0.0%	00 00 00
09:57:19	OZ1JEE__ E92D	CQCQCQ__	OZ4REN_C	OZ4REN_G	-	Bjarne	1.9s S:0% E:0.0%	00 00 00
09:57:41	SV2HQL__ 2820	SV8S__BL	SZ1A___B	SZ1A___G	-	ASTERIS/AGRINIO	0.8s S:73% E:1.7%	00 00 00
09:57:43	******** ____	********	OK0DSK_B	OK0DSK_G	-		0.8s S:0% E:0.4%	00 00 00

You don't see your call sign here? Please read: http://ircddb.net/live-via.html

09:57:52	******** ____	********	OK0DSK_B	OK0DSK_G	-		0.6s S:3% E:0.0%	00 00 00
09:57:59	******** ____	CQCQCQ__	OK0DSK_B	OK0DSK_G	-		0.9s S:0% E:0.1%	00 00 00
09:58:10	******** ____	CQCQCQ__	VK3RIR_A	VK3RIR_G	-	-	-	00 00 00
09:58:10	******** ____	CQCQCQ__	VK3RIR_B	VK3RIR_G	-	-	-	00 00 00
09:58:10	******** ____	CQCQCQ__	VK3RIR_C	VK3RIR_G	-	-	-	00 00 00
09:58:10	******** ____	CQCQCQ__	VK3RIR_D	VK3RIR_G	-	-	-	00 00 00
09:58:10	******** ____	CQCQCQ__	VK3RIR_A	VK3RIR_G	-	-	-	00 00 00
09:58:10	******** ____	CQCQCQ__	VK3RIR_B	VK3RIR_G	-	-	-	00 00 00
09:58:10	******** ____	CQCQCQ__	VK3RIR_C	VK3RIR_G	-	-	-	00 00 00
09:58:15	******** ____	********	DB0BOS_B	DB0BOS_G	DB0HRF_B		7.6s S:38% E:0.0%	00 00 00

Dstarusers.org



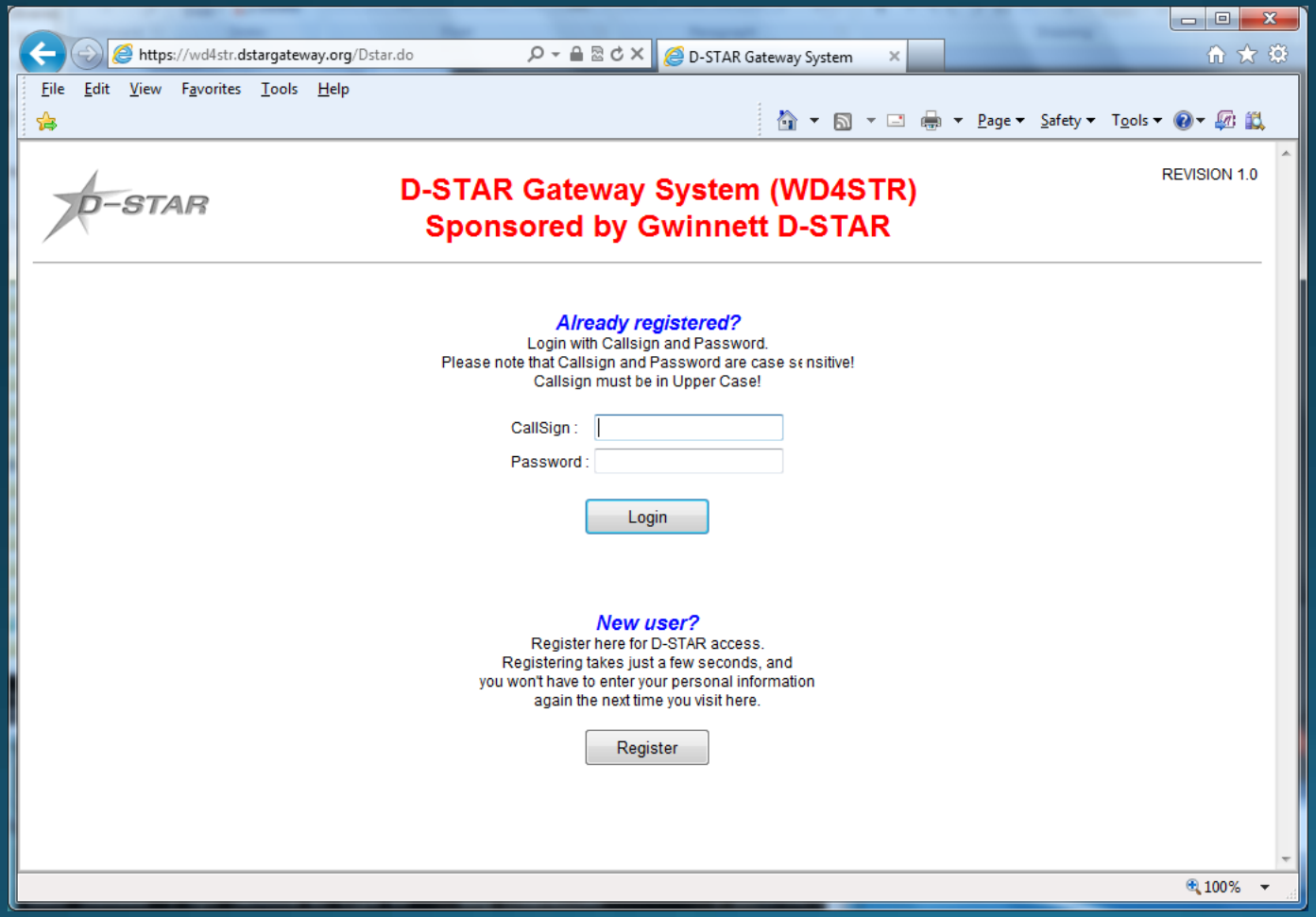
Callsign	Time Heard	Reporting Node	
VE2HRI	02/08/09 16:39:26 UTC	W4BUG B 440 MHz	Ft Lauderdale, FL, USA
WA6UMA	02/08/09 16:39:24 UTC	K6LRG B 440 MHz	Mt Allison, CA, USA
VK2TSB	02/08/09 16:39:20 UTC	VK2RDS C 2 Meters	Wollongong/Sydney, Australia
KZ1YD	02/08/09 16:39:19 UTC	K2DIG B 440 MHz	New York, NY, USA
DJ1IJ	02/08/09 16:39:16 UTC	DB0FHW B 440 MHz	Wolfenbuettel, Germany
KJ4VO	02/08/09 16:39:13 UTC	KI4SBA A 1.2GHz	Cumming, GA, USA
S55YAB	02/08/09 16:39:06 UTC	S55DLJ B 440 MHz	Ljubljana, Slovenia
PD0HQF	02/08/09 16:39:06 UTC	PI1HWB B 440 MHz	Breda, Noord Brabant, The Netherlands
M0KEL	02/08/09 16:39:04 UTC	GB7JH B 440 MHz	Worthing, UK
ON4TOP	02/08/09 16:39:03 UTC	ON0OS B 440 MHz	Oostende , West-Vlaanderen, Belgium
DJ0ABR	02/08/09 16:39:02 UTC	DB0RDH C 2 Meters	Grandsberg nr Straubing, Germany
KB4SIW	02/08/09 16:39:02 UTC	KI4SAZ C 2 Meters	Magnolia Springs, AL, USA
G4HHX	02/08/09 16:39:00 UTC	GB7FK B 440 MHz	Folkestone, Kent, UK
2M0ONW	02/08/09 16:38:58 UTC	GB7DW C 2 Meters	Ayrshire, Scotland, UK
IV3YXW	02/08/09 16:38:55 UTC	IR3CZ B 440 MHz	Pordenone, Italy
N1MXO	02/08/09 16:38:55 UTC	N1NIT A 1.2GHz DVD	Fremont, NH, USA
WA6YTD	02/08/09 16:38:54 UTC	K6MDD A 1.2GHz	Mt. Diablo, CA, USA
DL4AWI	02/08/09 16:38:54 UTC	DB0HRM B 440 MHz	Hoher Meissner/Kassel, Germany
W1LBR	02/08/09 16:38:51 UTC	K8LCD C 2 Meters	Hell, MI, USA
HB9AXG	02/08/09 16:38:49 UTC	HB9IAC C 2 Meters	La Barillette, Switzerland
M1EVC	02/08/09 16:38:47 UTC	GB7JH B 440 MHz	Worthing, UK
DK6LH	02/08/09 16:38:25 UTC	DF0HMB C 2 Meters	Germany, Hamburg, Germany
CT1EPT	02/08/09 16:38:20 UTC	CQ0DCH Dongle User DVD	Chaves (Leiranco), Portugal
ON6GPS	02/08/09 16:38:20 UTC	DB0MYK B 440 MHz DVD	Gaensehals nr Mayen/Koble, Germany
DH5LW	02/08/09 16:38:16 UTC	DF0HMB C 2 Meters	Germany, Hamburg, Germany
DL2HT	02/08/09 16:38:11 UTC	DB0LBX B 440 MHz	Ludwigsburg, Germany
DL3HX	02/08/09 16:37:55 UTC	DB0RDH C 2 Meters DVD	Grandsberg nr Straubing, Germany
AE0HW	02/08/09 16:37:47 UTC	W0SCI B 440 MHz	Des Moines, IA, USA
DO6EL	02/08/09 16:37:41 UTC	DB0DF B 440 MHz	Berlin, Germany
KC8VAB H	02/08/09 16:37:34 UTC	WB8LIV C 2 Meters	Howell, MI, USA
IW3RXW	02/08/09 16:37:27 UTC	IR3CZ B 440 MHz	Pordenone, Italy
IW3SRQ	02/08/09 16:37:22 UTC	IR3CZ B 440 MHz	Pordenone, Italy

The Registration Process

- Why register?
- Registering your callsign allows access to more functions on DPLUS repeaters (not required for ircDDB repeaters)
- 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*)

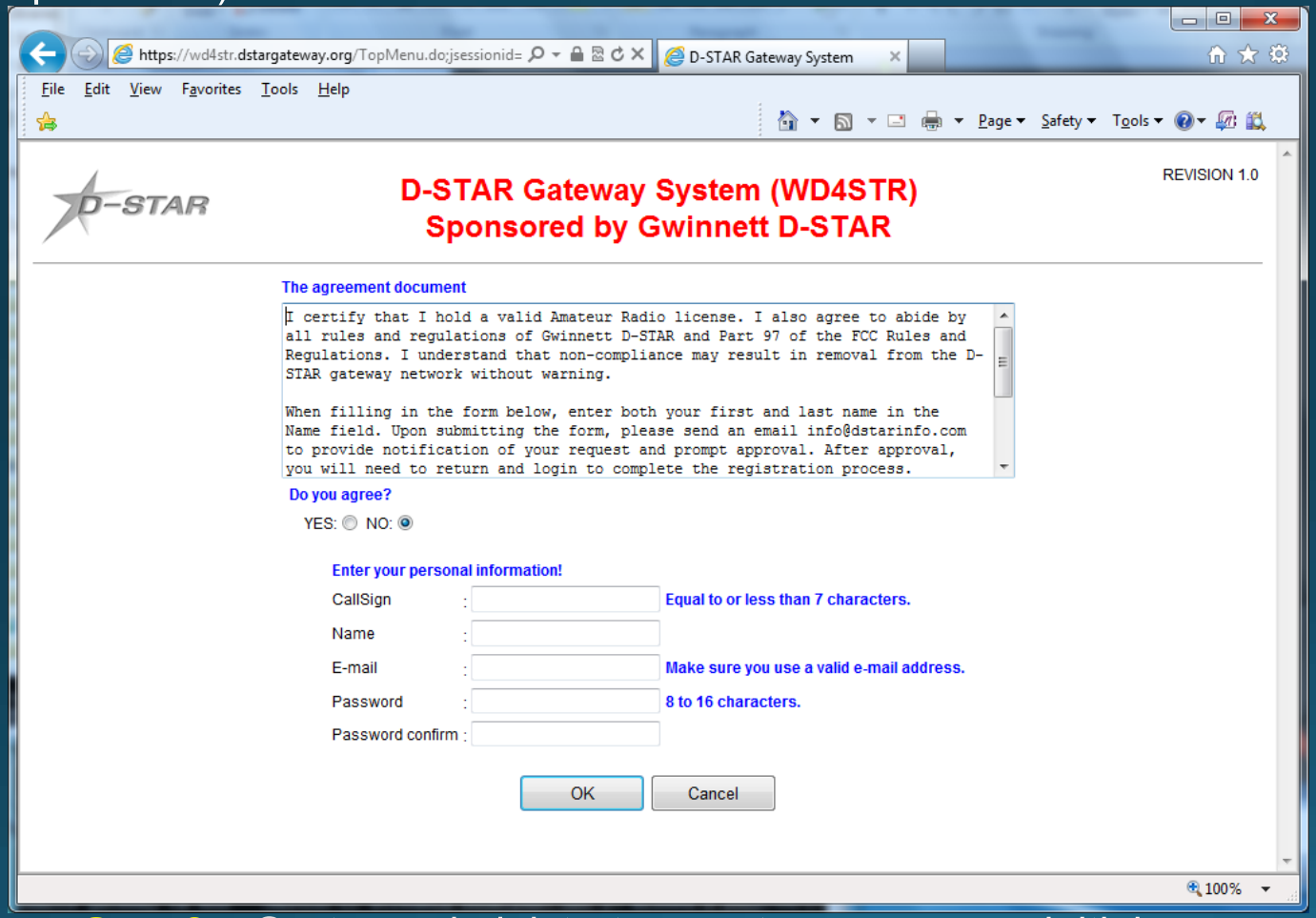
Starting Registration

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



Fill Out Your Info

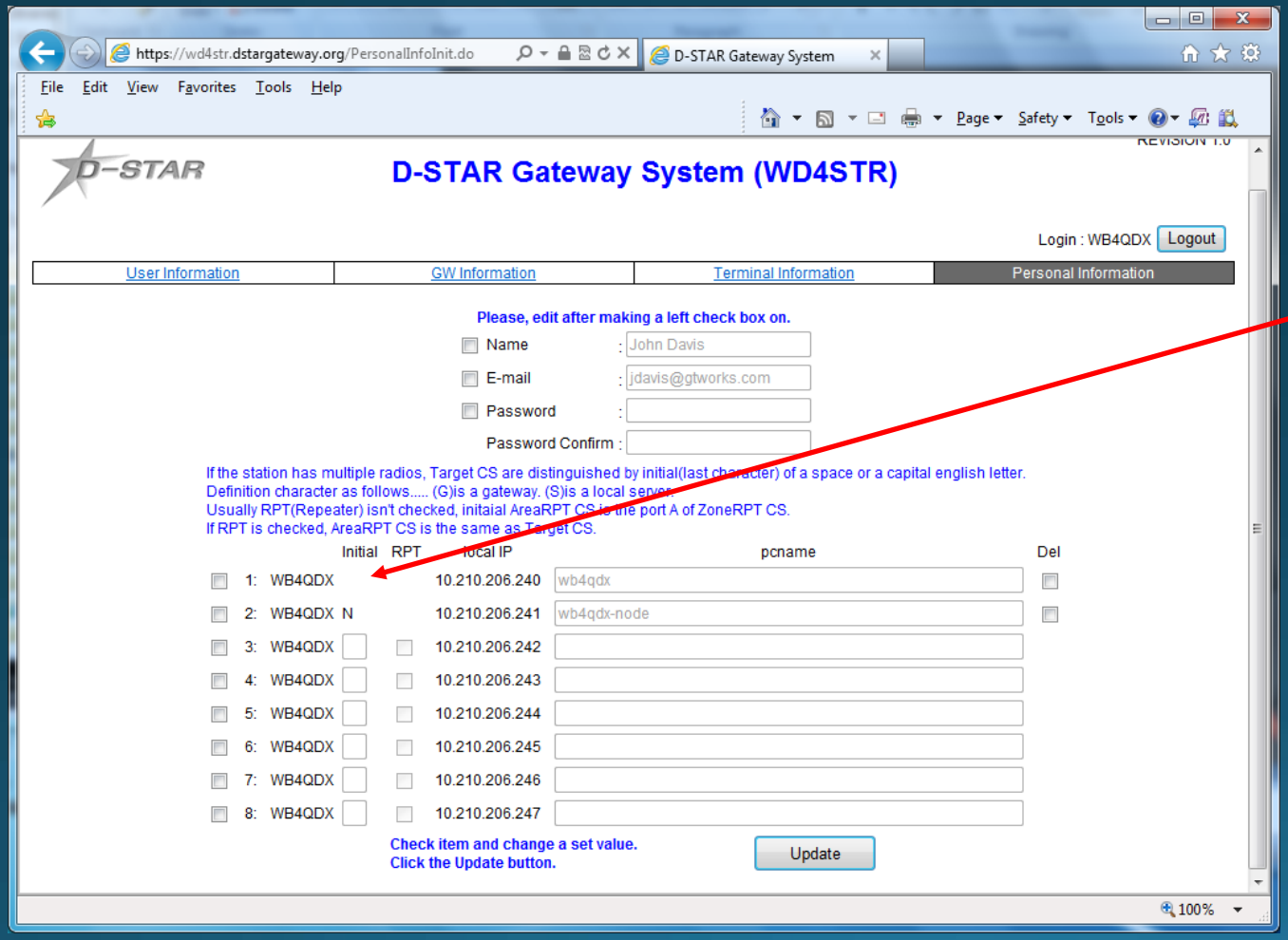
- Fill out the info (callsign, name, email address and desired password)



- 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)



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

Add Your Callsign to 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!