

A REVIEW OF DIGITAL RADIO (DMR, DSTAR, YSF)

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July 13, 2020



Definitions

- **DIGITAL RADIO** – converts analog signals to digital format then sends those out using a modem built into the radio
- **CODEC** – hardware chip or software program that compresses audio signals into a digital format
- **DSTAR** – Digital Smart Technology for Amateur Radio; came from Icom Japan 2001
- **DMR** – Digital Mobile Radio; came out of UK in 2005
- **YSF** – Yaesu System Fusion; came from Yaesu Japan 2013

Full Disclosure...

Digital Radio - DMR, DSTAR & YSF - can be a lot of fun and provide significant benefits to users and repeater operators, BUT...

Digital Radio requires digital infrastructure which may not be working when you need it, and Repeaters are more complicated. **Plus signal to noise is WORSE**

**THE BEST RADIO FOR EMERGENCY
COMMUNICATIONS IS
PLAIN OLD BORING ANALOG FM!!!!**

What is the appeal of Digital?

- Essentially “audio discussion groups” and linked repeaters
- Leverages power of the internet to join
 - DSTAR REF, XRF, DCS Reflectors (~360, like REF069C for W1AAD)
 - DMR “Talk Groups” (> 1500)
 - YSF/FCS “Rooms” (> 1000 – many are temporary & local)
- All users & repeaters that are connected to the same Reflector/Talk Group/Room hear each other over the internet and over the air as well.

I listen to the AMSAT Reflectors (DMR 98006, YSF 11689) & W1AAD REF069C

What's the downside of digital?

- Infrastructure Dependent (no internet => no groups)
- Radios & Repeaters more expensive than analog
- Repeater Operators incur monthly internet expenses
- More complicated to setup radios
- Claim of "Quiet Digital" is a false narrative – granted you don't hear static with a weak signal; instead you hear nothing at all. Need more power for same distance.
- What protocol do you choose? (DMR, DSTAR, YSF)

New England & RI Digital Repeaters

Band	Analog	DMR	DSTAR	YSF
2M	318	54	24	30
70cm	208	75	32	24
Totals	526	129	56	54
RI	35	3	3	6

As of July 2020

NOTE: YSF Repeaters “usually” support Analog FM as well

Basic Tradeoffs

	Local RF	NewEng RF	Ease of Programming	Cost of HT	Key Advantage	Key Disadvantage
DSTAR	*	**	**	\$\$\$	Oldest Base	COST \$\$\$
DMR	*	***	*	\$	Popularity	Hardest to Program
FUSION	**	**	***	\$	Both Analog & Digital	Playing catchup

My personal preference has evolved over time. Started out ten years ago as a strong advocate for DSTAR, but evolving HotSpots find DMR better aligned with my needs.

DSTAR Radios

Original Digital Radio (2001)

Large Base of Users

EXPENSIVE

Falling behind rapidly

Icom DISCONTINUING!!!!



ID-51A - Dual Band HT: \$350.
DISCONTINUED

ID-31A – UHF Only: \$180.
DISCONTINUED

TH-D74A – Dual Band HT: \$500.



ID-4100A Mobile: \$330

ID-5100A Mobile: \$400

Many Icom HF/VHF/UHF:

IC-7100: \$860

IC-9700: \$1500

YSF Radios

Fairly inexpensive HT
Easiest to Program
Repeaters do BOTH Analog & Digital
About as popular as DSTAR
Single Source



FT-70D: \$175
FT-2DR: \$370



FTM-400XDR: \$540
FT-991A All Band: \$1130

DMR Radios

More DMR RF & Growing

MANY Brands

HTs are inexpensive

Most Radios from China

Programming is not obvious

Analog Portion underperforms



Alinco DJ-MD5TGP: \$160

RadioDDity GD-73: \$60



TYT MD9600DMR: \$270

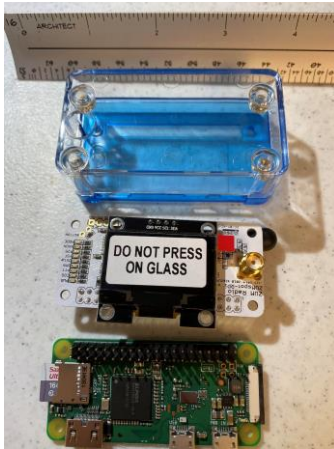
Anytone AT-D578UV: \$400

HotSpots (Used with a Digital HT)

- A HotSpot is a local simplex repeater. Usually listens and talks on a 70cm Simplex frequency at low power (10mW).
- Gives 3-story home coverage + yard using stubby rubber duck
- Needs an internet connection (WiFi or wired)
- Will support any protocol (DMR/DSTAR/YSF) including some cross mode (YSF to DMR).
- Several Brands (ZumSpot, DVMEGA, JumboSpot)

ZumSpot

- 70cm monoband with OLED Display* & case \$195
- Runs Pi-Star (fantastically stable and Auto Updates)
- Easy to setup via built in server (WiFi Setup is easy too)



Kit 1.3" OLED
Case &
Software



Assembled – just needs
a USB Power Supply
and WiFi Connection

- OLED Display is NOT necessary but is useful during setup or when using a WiFi connection

Pi-Star

Hostname: pi-star

Pi-Star:3.4.17 / Dashboard: 20200706

Pi-Star Digital Voice Dashboard for WB4SON

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 DMR

Tx

431.075000 MHz

Rx

431.075000 MHz

FW

ZUMspot:v1.3.3

D-Star Repeater

RPT1

WB4SON B

RPT2

WB4SON G

D-Star Network

APRS

newengland.aprs2

IRC

rr.openquad.net

Linked to REF069 C

(DPlus Outgoing)

DMR Repeater

DMR ID

3144032

DMR CC

1

TS1

disabled

TS2

enabled

DMR Master

BM United States ..

Gateway Activity

Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
12:23:35 Jul 11th	DMR Slot 2	KF5CQ	TG 98006	Net	2.3	0%	0.0%
12:23:12 Jul 11th	DMR Slot 2	K5WH	TG 98006	Net	12.7	0%	0.0%
12:21:46 Jul 11th	DMR Slot 2	W5MF	TG 98006	Net	5.9	0%	0.0%
12:21:11 Jul 11th	DMR Slot 2	WB5ITT	TG 98006	Net	1.6	69%	0.0%
12:20:29 Jul 11th	DMR Slot 2	W5ACM	TG 98006	Net	4.1	0%	0.0%
12:16:46 Jul 11th	DMR Slot 2	K5JBT	TG 98006	Net	3.7	0%	0.0%
12:15:54 Jul 11th	DMR Slot 2	K5SAF	TG 98006	Net	5.9	0%	0.0%
12:11:16 Jul 11th	DMR Slot 2	W5MAB	TG 98006	Net	6.2	0%	0.0%
12:00:00 Jul 11th	D-Star	WB4SON/TIME	CQCQCQ	Net	4.2	0%	0.0%
11:53:56 Jul 11th	DMR Slot 2	AB5SS	TG 98006	Net	0.5	0%	0.0%
11:49:59 Jul 11th	DMR Slot 2	W4BCX	TG 98006	Net	12.4	0%	0.0%
11:48:30 Jul 11th	DMR Slot 2	W3FGP	TG 98006	Net	36.1	0%	0.0%
11:26:32 Jul 11th	DMR Slot 2	WB4SON	TG 98006	Net	2.3	15%	0.0%
11:18:37 Jul 11th	DMR Slot 2	WB4SON	TG 98006	RF	1.1	0%	0.4%
11:18:06 Jul 11th	D-Star	K1PGS/880H	CQCQCQ	Net	1.0	0%	0.0%
11:12:10 Jul 11th	DMR Slot 2	K5ENG	TG 98006	Net	5.5	0%	0.0%

Local RF Activity

Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
11:18:37 Jul 11th	DMR Slot 2	WB4SON	TG 98006	RF	1.1	0.4%	S9+46dB (-47 dBm)

- Built-in server <http://pi-star.local/>
- Dashboard to view activity & status
- Shows both internet and local RF
- Automatically updates itself
- Runs for MONTHS without issue
- Draws ~150ma@5V

Supports some cross-mode YSF2DMR

Which one do I choose?

- **That's up to you and your interests!**
 - Are you interested in RF only, then maybe DSTAR in RI
 - Want to use your HT, then maybe a HotSpot
- Check the references for lists of all the reflectors

How about an approach that doesn't require RF at all? (Saves the cost of buying a HT, or buying the "wrong one")

AMBE

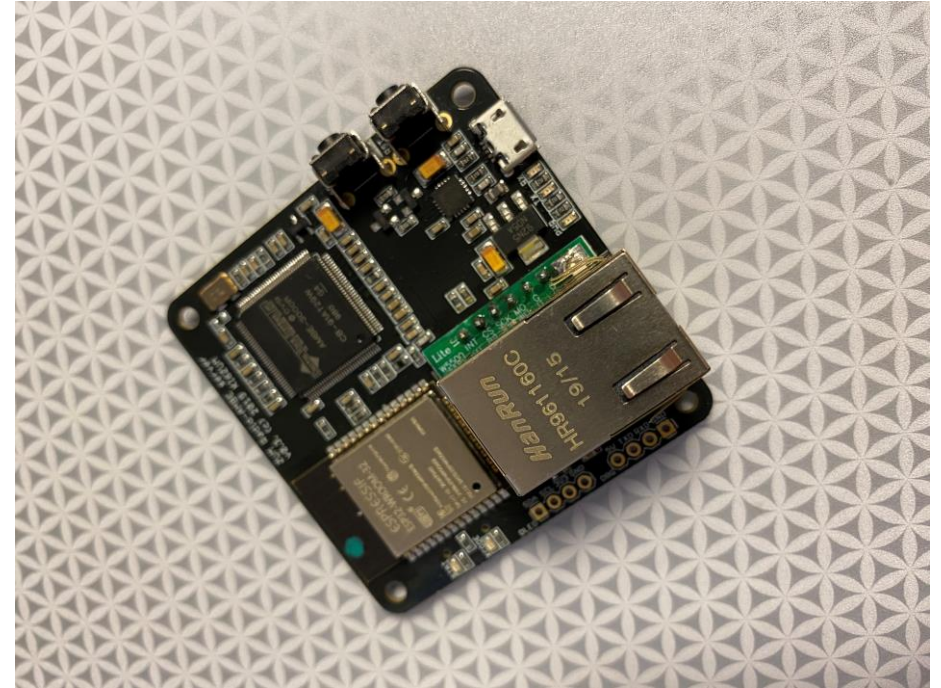
- One vendor produces a CODEC chip that is capable of handling almost any digital voice mode, including DSTAR, DMR and Fusion (Others too). The company is called DVSI, and the chip is the AMBE-3000 series.
- Your digital HT probably has a similar chip inside it
- First users of the AMBE chips designed them into USB Dongles. ***The PC that had it installed*** could run a software program that allowed you to hear/speak using PC audio.

AMBE Server

- The AMBE 3000 Chip is installed in an AMBE Server that connects to your WiFi or wired network.
- ANY computer on that network can connect to the AMBE Server
- Software on Windows, Linux, MacOS & IOS support some or all of the DV protocols (BlueDV on Windows is great)

ZumRadio AMBE Server

- Small PCB about 2.5" on a side
- Has WiFi AND Hardwired Ethernet connection
- Power from USB adapter
- MicroSD card configures for your network
- All Code on a ESP32 chip (so no OS to update)
- Costs \$150 for the board and \$21 for the case

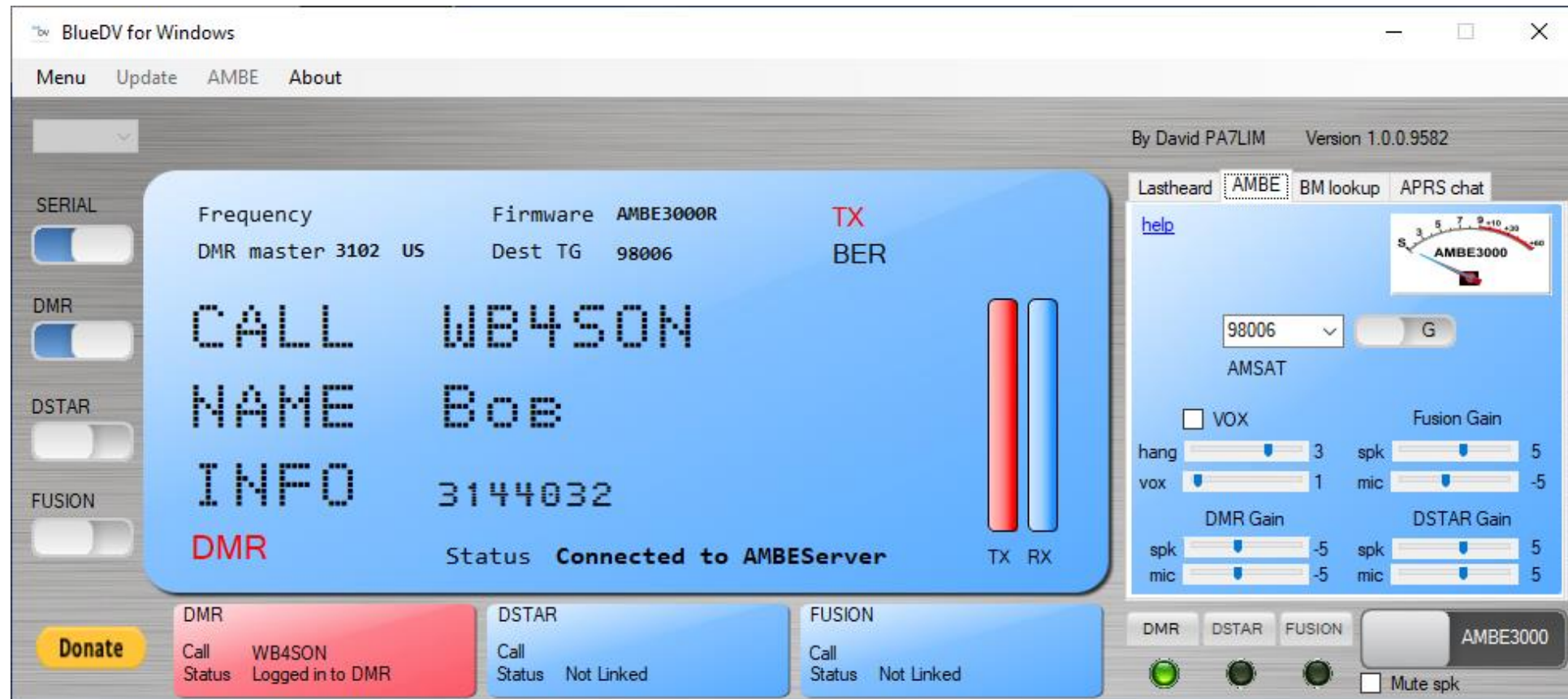


ZumRadio AMBE Server

- Pictured here installed in plastic case
- Optional 1.3" OLED display helpful when first setting the unit up (displays WiFi information IP addresses) but not needed after initial configuration
- About 3" on a side by 1" thick.
- MicroUSB 5 volt PS at 0.5 amps
- Hardwired Ethernet or WiFi



BlueDV (Windows)



Supports DSTAR, DMR & Fusion using AMBE Server (No radio required)

Some Resources

- Good Basic Intro to System Fusion: <https://yrdg.org/the-beginners-corner-for-wires-x-and-system-fusion/>
- Good Intro to DSTAR: https://www.sbara.org/downloads/DSTAR/D-STAR_101_Basic_Setup_And_Operation.pdf
- Introduction to DMR: <https://cdn.shopify.com/s/files/1/0833/9095/files/digital-mobile-radio-dmr-101.pdf?4243079753219475177>
- New England Repeater Directory: <https://www.nerepeaters.com>
- Source of ZumSpot: <https://www.hamradio.com/detail.cfm?pid=H0-016491>
- Source of ZumSpot Case: <https://www.hamradio.com/detail.cfm?pid=H0-016979>

Some Resources

- Source of AMBE Server:
<https://www.hamradio.com/detail.cfm?pid=H0-017021>
- Source of AMBE Server Case:
<https://www.hamradio.com/detail.cfm?pid=H0-017052>
- BlueDV (PA7LIM) for Windows:
<http://www.pa7lim.nl/bluedv-windows/>
- BrandMeister DMR TalkGroups:
[https://www.pistar.uk/dmr bm talkgroups.php#](https://www.pistar.uk/dmr_bm_talkgroups.php#)
- BrandMeister “Hose” (Listen on your PC):
<https://hose.brandmeister.network/group/98006/>

Some Resources

- YSF Reflectors: https://www.pistar.uk/ysf_reflectors.php
- FCS Reflectors: https://www.pistar.uk/fcs_reflectors.php
- DSTAR Reflectors: <http://www.dstarinfo.com/reflectors.aspx>
- XRF Reflectors: <http://xrefl.net/>
- DCS Reflectors: <http://xreflector.net/>