
DMR
DIGITAL MOBILE RADIO ASSOCIATION

DMR -- Digital Mobile Radio

- Developed in Germany and under the control of ETSI (European Telecommunications Standard Institute) in 2005
- DMR was initially made for commercial use only. This explains why DMR is so “unfriendly”
- There is a steep learning curve.
- Fortunately, there is a wealth of information and tutorials on the internet.

Other Digital Modes

- 1) D-STAR (Digital Smart Technologies for Amateur Radio)
  - developed by JARL (Japan Amateur Radio League) in ~1998
  - used by Kenwood, Flexradio and Icom
  - Can be used on HF, VHF, UHF and microwave
  - Intended for consumer and commercial use

Other Digital Modes

- 2) System Fusion
  - developed by Yaesu as a proprietary mode ~2005
  - was intended for consumer use from the start
  - is the easiest to learn and use

Other Digital Modes

- 3) P25 (Project 25)
  - used by public safety and first responders
- 4) NDXN
  - developed by Kenwood and Icom for commercial use
  - used by public safety and Private Land Mobile Radio
- 5) POCSAG
  - digital beepers
- 6) many other modes

$$ Money $$

- So why do many hams choose DMR over D-star and System Fusion?
- DMR radios are generally made in China and are significantly cheaper.
- You can get started for under $100.00, but $150-200 is more realistic for a radio and hotspot. Kenwood, Icom and Yaesu are 2-3 times more expensive.
- Some hams claim the audio is better on a DMR radio

Getting Started With DMR Radio

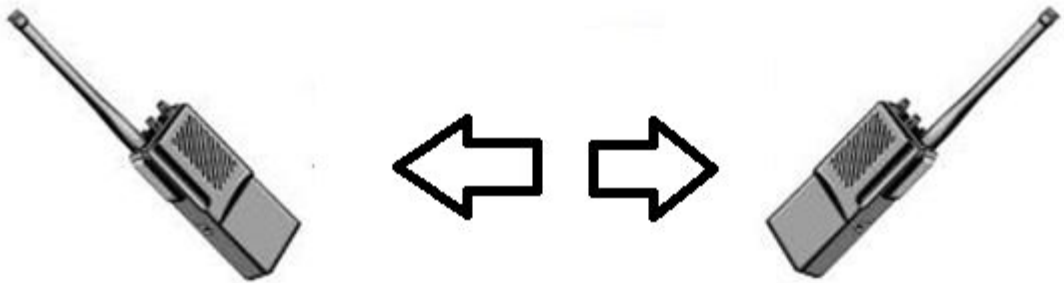
Anytone AT-D878UV

Radioddity GD-77

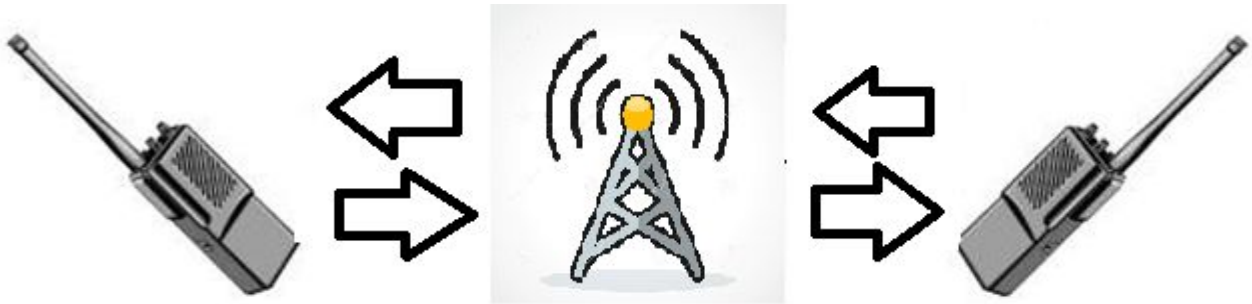
TYT MD-UV380

How to use a DMR radio

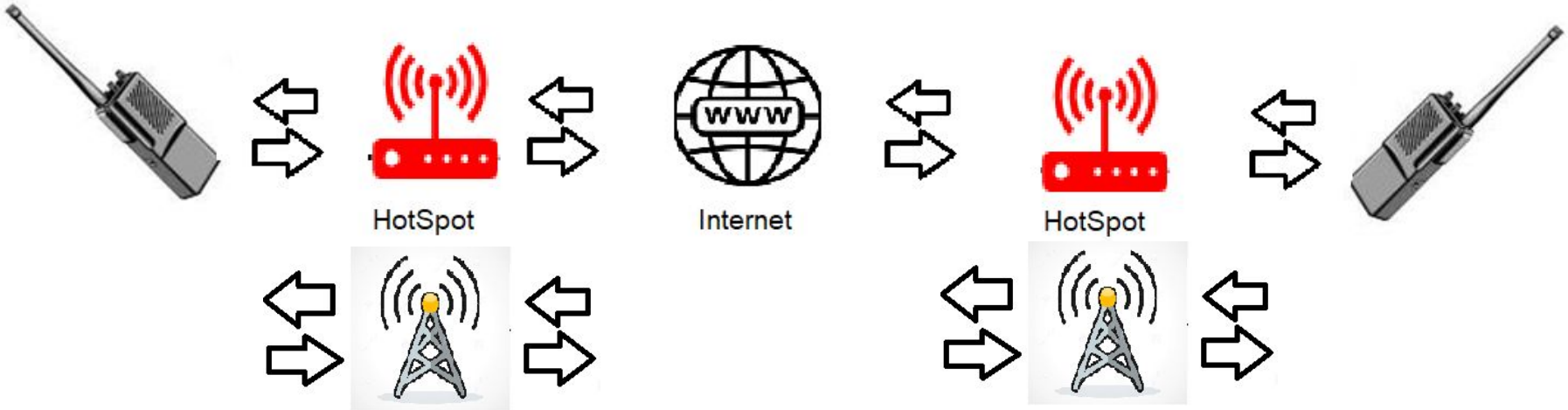
- Just like your analog radio, you can talk direct radio to radio.
- This can be a public or private conversation. No encryption allowed.



- You can also talk radio to repeater to radio.
- This generally gives you better range just like our 94 and 440 systems.



- Here is where the magic begins
- The third method allows you to talk to other hams around the world.
- Your DMR radio transmits your signal over the internet instead of thru the air. It does this thru a repeater or a device called a personal hotspot.



Hotspots vs Repeaters

- A Hotspot is a personal repeater that connects your radio to a network server on the internet
- The network server does all the grunt work to make sure you signal gets to the person you are talking to
- Generally, repeaters are better for local direct communication and personal hotspots are better for long distance communication
- One is not better than the other, they are just better at certain aspects of DMR communications

Hotspot

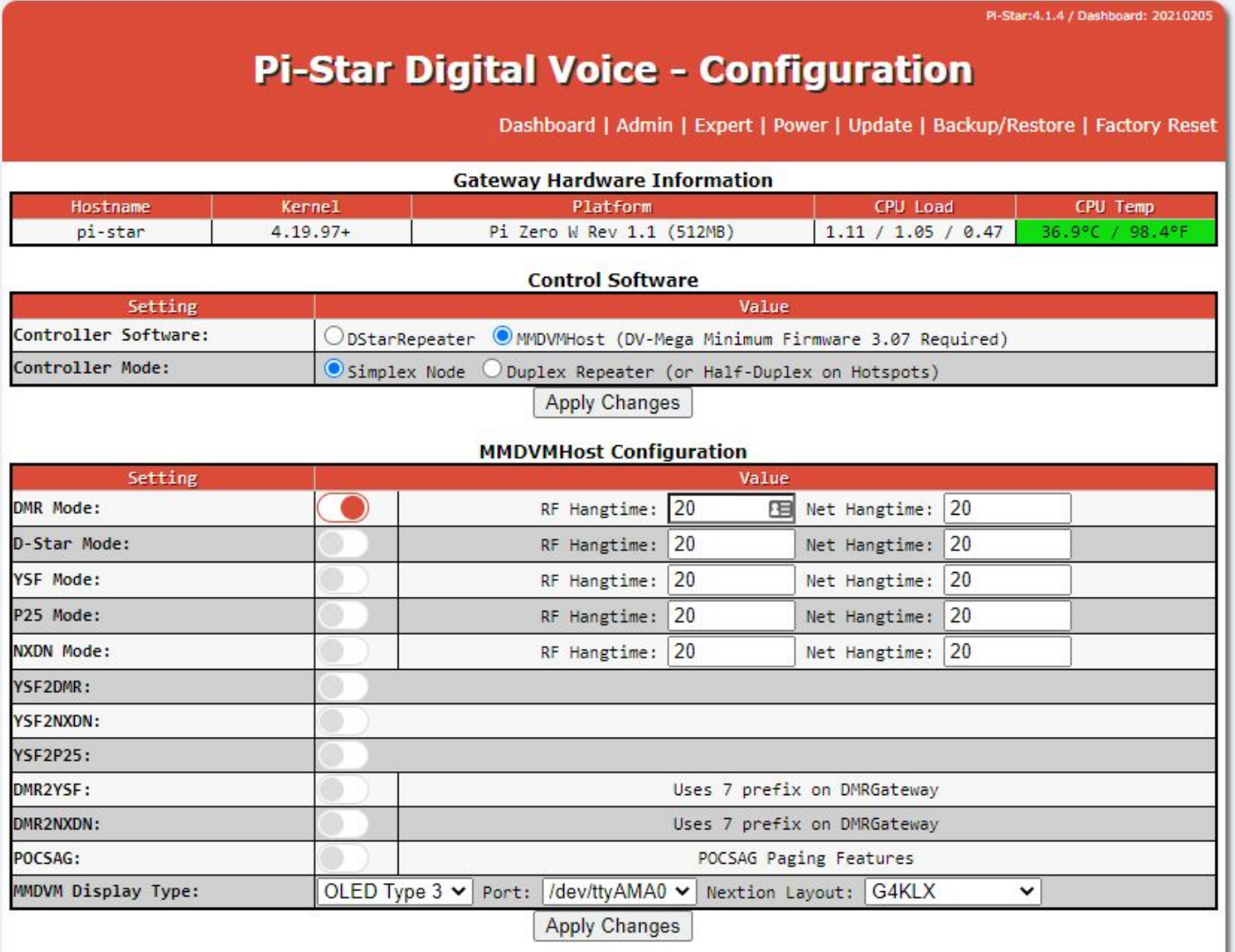
Hotspot Size

After you get your DMR radio and hotspot

- Get your DMR ID number from www.radioid.net.
  - You will need an official copy of your FCC license
  - 3162942
- Configure your DMR radio using the software that came with it
  - Similar to configuring your analog radio, but...
  - It is more complicated than programming a analog radio
  - You may need an Elmer to help you get started
- Configure your hotspot
  - Pi-Star, OpenSpot or BlueDV software
  - You may need an Elmer to help you get started

BlueDV


BlueDV for Windows
Menu
Update
AMBE
About
FUSION
AmericaLink
Link
Unlink
YSF
FCS
XLX
By David PA7LIM
Version 1.0.0.9581
SERIAL
DMR
DSTAR
FUSION
Frequency
Firmware AMBE3000R
TX
DMR master
Dest TG
BER
CALL N3ZBL
NAME KEVIN
INFO
3160370
C4FM
Status None
TX RX
Lastheard
AMBE
BM lookup
APRS chat
Time Call Name Mode
11:17 AM KA3UDW Unknown FUSION
11:17 AM N3ZBL Kevin FUSION
11:18 AM KA3UDW Unknown FUSION
11:19 AM N3ZBL Kevin FUSION
11:20 AM KA3UDW Unknown FUSION
11:20 AM KB2KBD Unknown FUSION
11:20 AM N3ZBL Kevin FUSION
11:21 AM KB2KBD Unknown FUSION
11:22 AM N3ZBL Kevin FUSION
11:23 AM KB2KBD Unknown FUSION
11:25 AM N3ZBL Kevin FUSION
11:26 AM KB2KBD Unknown FUSION
11:29 AM N3ZBL Kevin FUSION
Donate
DMR
Call
Status Not Connected
DSTAR
Call
Status Not Linked
FUSION
Call N3ZBL/KE
Status Linked to AmericaLink
DMR
DSTAR
FUSION
AMBE3000
Mute spk


Pi-Star:4.1.4 / Dashboard: 20210205
Pi-Star Digital Voice - Configuration
Dashboard | Admin | Expert | Power | Update | Backup/Restore | Factory Reset
Gateway Hardware Information
Hostname
Kernel
Platform
CPU Load
CPU Temp
pi-star
4.19.97+
Pi Zero W Rev 1.1 (512MB)
1.11 / 1.05 / 0.47
36.9°C / 98.4°F
Control Software
Setting
Value
Controller Software:
DStarRepeater
MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:
Simplex Node
Duplex Repeater (or Half-Duplex on Hotspots)
Apply Changes
MMDVMHost Configuration
Setting
Value
DMR Mode:
RF Hangtime: 20
Net Hangtime: 20
D-Star Mode:
RF Hangtime: 20
Net Hangtime: 20
YSF Mode:
RF Hangtime: 20
Net Hangtime: 20
P25 Mode:
RF Hangtime: 20
Net Hangtime: 20
NXDN Mode:
RF Hangtime: 20
Net Hangtime: 20
YSF2DMR:
YSF2NXDN:
YSF2P25:
DMR2YSF:
Uses 7 prefix on DMRGateway
DMR2NXDN:
Uses 7 prefix on DMRGateway
POCSAG:
POCSAG Paging Features
MMDVM Display Type:
OLED Type 3
Port:
/dev/ttyAMA0
Nextion Layout:
G4KLX
Apply Changes

Pi-Star

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

Charlotte Digital Radio Group
Digital Voice Communications

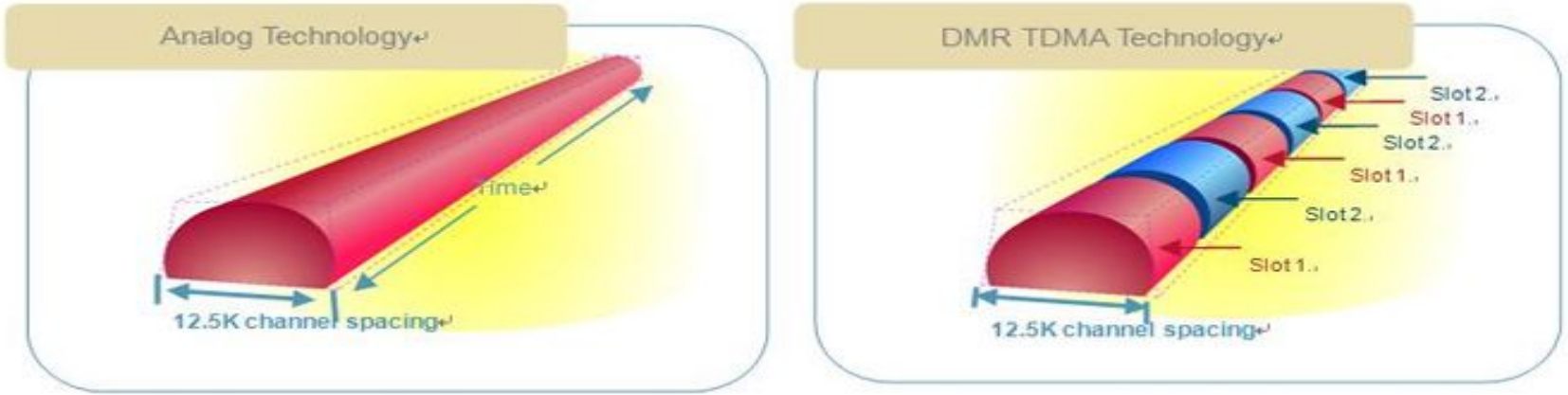
How Are DMR, D-STAR and Fusion Different?

- They all speak a different language, i.e. French, German and Italian
- They don’t understand each other
- They don’t like each other
- They don’t cooperate with each other
- Each mode uses different terminology for the same item
- All the modes use outdated terminology
- Welcome to the world of digital radio!!!

Terminology TDMA

Time Division Multiple Access

Let's talk briefly about how DMR works. DMR uses a narrow band (12.5 kHz) signal and divides the signal into segments called "Time Slots." There are two time slots, TS1 and TS2. Each time slot is 30ms long. Each time slot contains the packets of compressed digital information and the time slots alternate. This allows a DMR radio to monitor two conversations (talk groups) at the same time.



Talk Groups

- Remember AOL chat rooms? This is what a talk group is.
  - DMR -- talk groups
  - Fusion -- rooms
  - D-star -- reflectors.
-
- A DMR talk group usually has a subject matter, a language or represents an area on the map such as a locality, a state, a nation, or the whole world
-
- TG31655 Venture Overland
- TG3121 Kentucky

TG916 Italian

TG1776 USA

TG91 Worldwide

Talk Groups, cont’d

- Each talk group usually has a weekly net where you can talk and listen to people with similar interests. Or you can ragchew with people of similar interests when the net is not on.

- You can do some cross mode activity between DMR, Fusion and D-STAR. I have been in a DMR talkgroup where there were participants using Fusion radios.

Code Plugs and Color Codes

- A code plug is the configuration file for your radio. Like analog radio, you program each channel you want to communicate using the software that came with your radio.

- Color codes are like PL tones. They allow you to distinguish two repeaters on the same frequency

- So why the crazy names??????

Code Plug

Digital radio was developed before USB flash drives were popular

The word CODE is the DMR radio configuration file. They did not have user friendly software to create a configuration file. They literally wrote and coded a program to configure their DMR radio. This program was then copied to the plug

The word PLUG is the physical device you plugged into your digital radio

You might have a different code plug for each repeater you communicated with

Color code...You aren't going to believe this.

They painted each code plug a different color to tell them apart.

Color code = a different color plug for each set of code

I believe there were initially 4 colors. ETSI has since expanded this to a numeric system of 16 numbers but kept the word color code. You know a nerd did this because instead of numbering them 1-16, he numbered them 0-15.

Network Servers

The networks are a collection of servers around the world that act as communication traffic cops. These servers do the grunt work that make sure your voice transmission gets to its destination.

- Brandmeister
- DMR+ (DMRPlus)
- DMRMARC
- TGIF
- PAPA

Each network has their own list of talk groups.

There are close to 200,000 registered DMR users worldwide and there are thousands of talk groups available.

I use the Brandmeister network

- Brandmeister is very popular right now
- It has over 1500 talk groups
- Brandmeister has 44 master network servers around the world
- There are three Brandmeister master servers in the United States. Generally, you choose the one closest to you. I use master server 3102 located in Texas
- Brandmeister now requires a master server password. If you don’t have this password, you cannot transmit

Kerchunk!!

- To get on a talk group, you kerchunk it. Choose the talk group on the radio and press the PTT button briefly. After that you will be able to hear any activity on the talk group.

- To exit a talk group you should disconnect. You do this by kerchunking talk group 4000 when there is a pause in the conversation.

Talk Group types

- Dynamic talk groups: You will automatically lose your connection to the talkgroup after approximately 15 minutes of inactivity on your end. If you kerchunk before the 15 minutes, the timeout starts over. If your radio suddenly go silent, you probably just timed out. Kerchunk to get back on.
- Static talk group: There is no timeout. You can monitor the talk group as much as you want. You still need to disconnect when done, talk group 4000
- Other

Conclusion

- The DMR world is rapidly growing and expanding in users and features. It will certainly be a major factor in ham radio in the years to come
- It allows Technician Class hams to talk all over the world for under $200.00
- DMR is not a replacement for HF radio. DMR is just an addition to our shack for us to enjoy
- The digital modes will have to stop their rivalry and allow more cross mode activity
- DMR is an exciting technology for hams to explore

Sources

- https://amateurradionotes.com/dmr.htm is a great starting point. This is my favorite site for step by step instructions. He does not assume you know anything about DMR
- http://www.mikemyers.me/blog/2016/2/19/d-star-dmr-fusion-which-is-right-for-you-7nhdl
- https://barconline.org/wp-content/uploads/BARC-April-11-Presentation-Comparison-of-Amateur-Radio-DV-7.pdf
- https://n6pet.com/digital-voice-war/
- https://www.dmrfordummies.com/
- Bridgecomm Systems https://www.youtube.com/channel/UC5JzbaXRst_EPZIH1UrXJew