How do I?

An occasional series

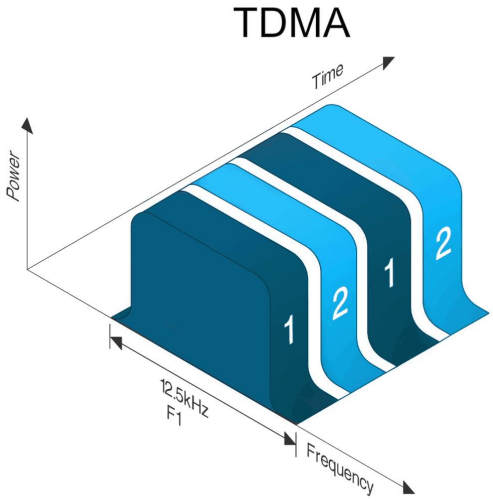
This week: DMR Radio What is it?

Another article in the series *Fun with VHF*

Digital Mobile Radio (DMR) has been around since 2005 but seems to be becoming a major player in the Digital Voice VHF/UHF space. While conventional analog FM is the primary mode, the ARRL Repeater Directory is filled with repeaters a ham from 10, 20, 30, 40 or 50 years would instantly recognize and be comfortable using, digital voice (D-Star, System Fusion and DMR) have become the three main players. See other articles in the ***Fun With VHF*** series at https://www.radioclub-carc.com/resources/ for articles on **FM repeaters, D-Star**, **System Fusion**, and **NXDN**.

DMR was established in 2005 by the European Telecommunications Standards Institute as an international digital radio standard. The goal was to improve voice quality, add more functions (such as location information), provide improved security (encryption and authentication) and improved channel utilization efficiency.

DMR uses two-slot TDMA. What is TDMA?



Time Domain Multiple Access (TDMA) provides two channels in each 12.5KHz channel space. In this regard TDMA works like **NXDN** and is about the same age. Note: DMR, while it cannot be heard on analog receivers, cannot be encrypted in the amateur radio service. Commercial systems using DMR may be encrypted, but not amateur stations.

All digital voice systems have the following characteristics according to a presentation given by Roland Kraatz W9HPX of the Charlotte Digital Radio Group.

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

While DMR uses Time Domain Multiple Access, D-Star and System Fusion use Frequency Domain Multiple Access. D-Star uses the AMBE+ Vocoder while DMR and System Fusion use the AMBE+2 vocoder.

Because of the differences involving modulation, multiplexing, transmission rates, bandwidth and channels, I don't think we will ever see one radio that can talk to DMR, Fusion and D-Star users at once.

Why use DMR? D-Star was created by the Japanese Radio Relay League and is used by commercial manufacturers including Icom and Kenwood. System Fusion is a proprietary Yaesu product. DMR is used by several brand-name manufacturers and quite a few "off brands" began selling relatively cheap DMR radios. In contrast, it appears that Icom, Kenwood and Yaesu are attempting to keep prices higher for their products.

According to Roland W9HPX, System Fusion is the easiest to program and is fairly easy to learn. He rates D-Star as the hardest in both categories. While DMR initially is difficult to program, once that is done, it is easy to use. Undoubtedly that helped DMR become more mainstream.

Another consideration… While Analog FM may have noise issues, the Digital modes are all or nothing. You either have a signal or you do not.

Roland W9HPX describes D-Star has having substantial user control and good opportunities for innovation. At the time of his writing Fusion was just becoming a stiff competitor and in many places now is the primary digital repeater found. He rates DMR as very inflexible and without much opportunity for innovation. I think the main difference is that with D-Star, just like an analog radio, you can find an unknown person and have a QSO. I believe that while System Fusion relies heavily on talk groups, you can contact other users outside of talk groups, DMR requires users register with the system and they can only use DMR within the talk group. If I am a newly licensed ham radio operator, chances are I can find an analog repeater, program the DTMF tones and make contact without specialized knowledge. If I don't want to take those steps, or if I cannot complete all the steps, I can at least listen. With DMR you not only need to be registered but you have to be in the talk group. For example, if your interest is storm spotting in York County, there are a few steps you need to go through to get to the correct DMR group. That can work, but it seems like a barrier to entry.

That brings us back to the radio equipment. I think many users are interested in trying a VHF digital mode. Today you can buy an analog two- meter Handheld Transceiver (HT) from Kenwood, Icom or Yaesu for $125-$140. In order to provide maximum play value and make full use of the D-Star System, Kenwood and Icom D-Star HTs often include GPS and possibly APRS functions. Most likely these radios offer dual band VHF/UHF so they are priced up in the $400 to $500 range. That is kind of expensive for something you may decide you don't really want or quickly becomes out of date. Yaesu System Fusion HTs are in the same price range but can be found on sale in the high $300s.

A popular online retailer, Gigaparts https://www.gigaparts.com lists several DMR HTs.

The "most mainstream" brand is Alinco [http://www.alinco.com/products.html]. Alinco sells a variety of niche radios. I have always been intrigued by them, but never owned one and rarely meet anyone who owns one. They have a DMR Dual Band HT for $149.00 That gives you a dual band VHF/UHF radio with DMR for about the same money as an analog-only Icom V86 or Yaesu FT-270. They also have slightly more expensive Alincos and well as Anytone DMR radios.

Baofeng [https://baofengtech.com], and BridgeCom [https://www.bridgecomsystems.com] are two other sellers in this digital marketplace.

In the Harrisburg, PA area, the only DMR repeater I know of is part of the W3ND Central Pennsylvania Repeater Network. It is a DMR-MARC network machine. What does that mean? Under the DMR umbrella, there are networks of linked repeaters. If you live in Pennsylvania it would be nearly impossible to get the right combination of power and atmospheric conditions to get your analog FM signal to connect with a ham across the pond in England. By using DMR and the internet you can connect to your local repeater where your signal gets on the internet and is passed to a repeater in England where a local ham using his ham radio transceiver can hear you and reply. (D-Star and Fusion can do this as well).

These networks require user registration (as does Echolink) and different repeater networks have different protocols. The two most common protocols in the US seem to be DMR-MARC and BrandMeister. Which is "best" depends on where you live and what is available locally. MARC is the Motorola Amateur Radio Club. BrandMeister originated in Europe. John Miklor K3NKU has an excellent web page https://www.miklor.com/DMR/DMR-Network.php describing talk groups and repeater networks.

The ARRL Eastern Pennsylvania Section Manager, George Miller W3GWM, has a You Tube Channel where you can find a nice presentation " Beginners Guide to Digital Mobile Radio -- recently given by Mark Wheeler KZ3MW. Mark is a very knowledgeable on the DMR topic. George is a YouTube noobie who is doing a good job sharing information. Once you are on www.youtube.com search for George Miller W3GWM. Look for the video titled **DMR 7 29 2020**

This article is longer than some I have written and still it is just skimming the surface of a very technical topic. I hope you will think of the Cumberland Amateur Radio Club and its website www.RadioClub-CARC.com when you are seeking information about ham radio.

I invite you to visit with us on-the-air Sunday evenings at 7:00 p.m. local time on 146.490 FM Simplex where we hold a weekly net. Guest and Visitors are always welcome. If you are located out of range for line-of-sight communications you can find us on Echolink as station AF3I-L and Node 259045.

Catch ýa on the air!
Frank, KB3PQT