DMR (Digital Mobile Radio)

ANOTHER MODE FOR HAM USERS

By Dean Thompson | KD8YNY | 02/18/2017

What is DMR

DMR, short for Digital Mobile Radio, is a system that has been around for many years. It is mainly a commercial product that companies like Motorola use across the USA and many other countries. There are many types of businesses that use these types of radios, Police, Fire Departments, Security, and Construction use.

DMR has been adopted by the Ham community and is a work in progress or as many would say "Experimental".

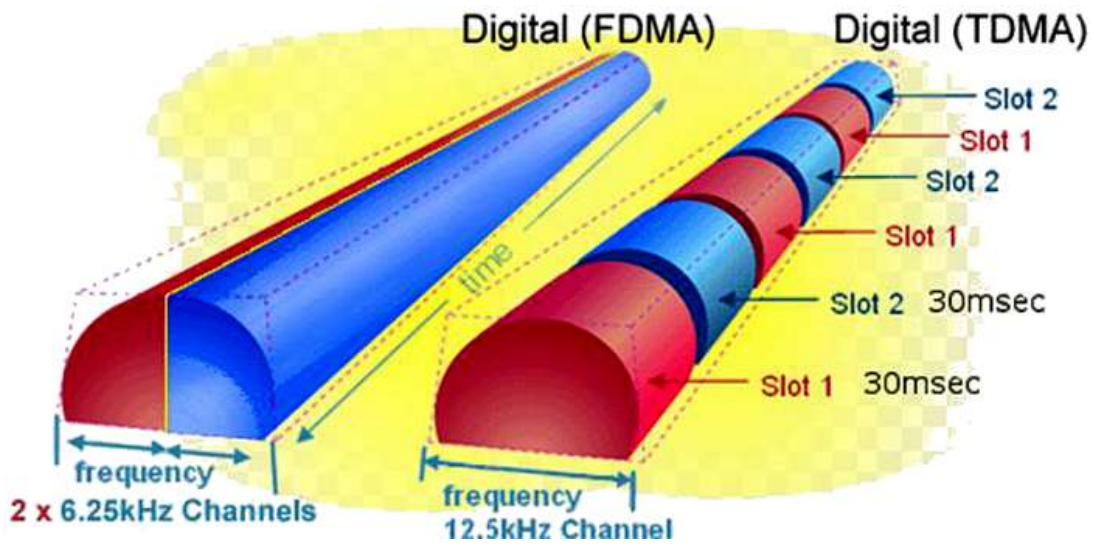
How Does It Work

The radios, either mobile, base or HT work very much the same as a normal Ham radio. The only difference being is, all the radios on DMR are of course digital, they have no VFO. The channels are preset using a CODEPLUG, we can do direct dial to other users, either go via a repeater or peer to peer operation.

The Digital System uses TDMA (Time division multiple access) technology. TDMA allows multiple users to share the same frequency channel by dividing the signal into 2 different time slots. The users transmit in rapid succession, one after the other, each using its own time slot.

A single frequency with a bandwidth of 12.5 Khz @ 30 msec per time slot. This allows for two simultaneous conversations to happen at the same time. User 1 could be transmitting to one group (on slot 1) while user 2 could be having a conversation with another group (on slot 2), all of which are predefined in the codeplug as mentioned before.

TDMA example vs FDMA



FDMA, is used with systems much like Yeasu System fusion, Yeasu uses either both channels for voice @ 12.5 Khz, or is used for 6.25 Khz for voice and the other slice of 6.25 Khz for Data.

TDMA divides the channel into the two timeslots, which delivers twice the capacity through a repeater or in RF range using peer to peer.

The performance is the same or better than 12.5 Khz FDMA, a single repeater does the work of two repeaters, this in turn reduces the cost of equipment as only one repeater is needed.

The interesting part of TDMA is battery life, this is increased by around 40% which is critical to most HT users. Due to the rapid on off switching of the radios TX at around every 30 msec, your radio is technically only keeping up for half of the time a similar FDMA radio would be.

DMR Benefits

Not only can you communicate with other users around you (peer to peer), you can also use a repeater (ad-hoc), or even use a cluster type system (Brandmeister, DMR-Marc) systems.

Using the Cluster type repeater systems, you can communicate via VOIP method. Without getting into the fine points of how it works, but again with a programmed codeplug you can have talkgroups setup. Talkgroups are basically a predefined channel, but using the same frequency as the repeater you access, you will have an ID for the

talkgroup. For instance, TG3100 is the Brandmeister channel for USA Nationwide, here everyone in the USA that is on TG3100 will be able to communicate with one another.

Confusing huh? Well maybe a little bit. Let me try to clear this up a little. Your radio and all channels within it transmits on say 447.500 Mhz and receives on 442.500 Mhz which is my repeater frequency (temporary), when you change channel, the frequency stays the same, but the TalkGroup (TG) would change, moving to the channel USA nationwide would land you on TG3100, while moving to North America would land you on TG93.

I could go on about talkgroups, but there are hundreds of them, we have country TGs, we have regional TGs, and we have TGs by state. So, you could talk to thousands of people, all over the world while accessing a Ham DMR repeater.

Radios and Prices

Depending on the radio you buy will obviously dictate the price, be careful of buying cheap Chinese radios from eBay and Amazon. These radios need to be Tier II compatible to work correctly.

One cheap Chinese radio, the TYT MD380 will cost you around $100, while a Motorola XPR7550 will run you between $800 and $1200. For a starter radio, I would certainly suggest the MD380 of which both radios were on show during the demonstrations at the club meetings.

Motorola XPR7550

TYT MD380

The TYT comes with everything you need to get on the air, program cable, software for the codeplugs and so forth. The Motorola on the other hand will set you back even more, you must buy a 3-year subscription to use the program software, plus other items you may need, program cable etc.

Codeplugs could be made up by the repeater owner, in this case neither club own the repeaters unless they are interested in building one, which I would recommend. Either way, we can help with codeplugs or write them for you.

What Do I Need

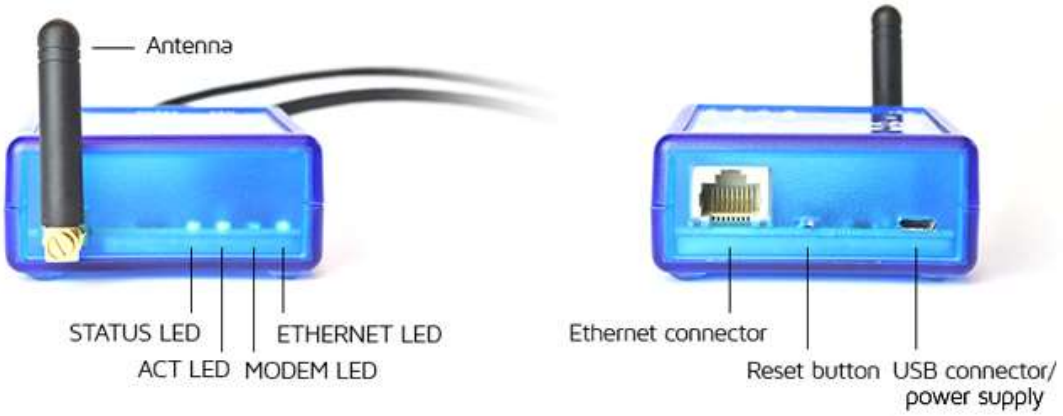
You will need a DMR ID, this is free and you can get one from https://www.dmr-marc.net/cgi-bin/trbo-database/register.cgi read the information given, then click on the link at the bottom marked "User Registration". Your 7 digit ID will turn up within a few days.

You will also need a radio and a way to connect to the network. This brings us to many options on how you are going to connect to the network, in this section we are going to talk about hotspots, pricing, and usage to an extent.

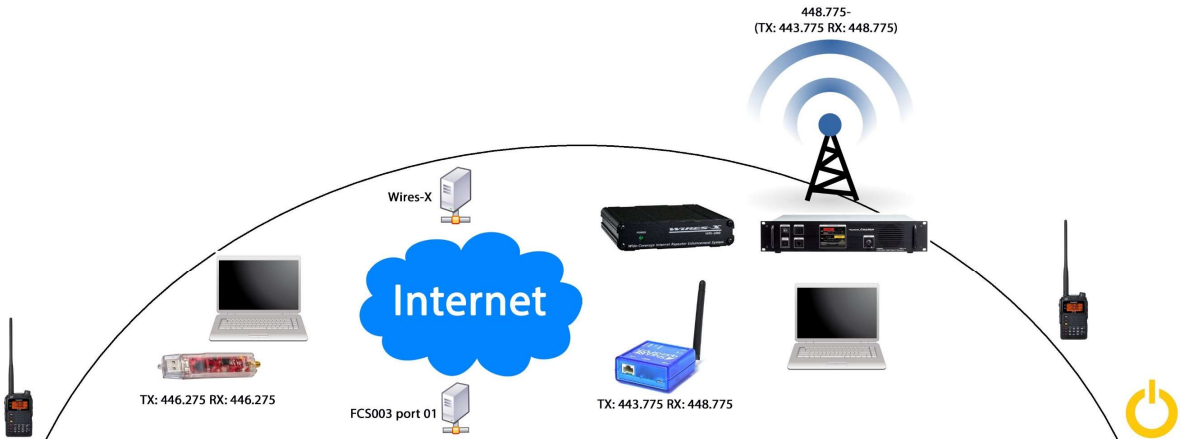
A hotspot, is a device that locally connects to your internet and acts as the gateway to the network you are connecting too (more about networks soon). It is a small repeater, the output depending on model is about 20 mw and can have an incredible range if you hook it up to an outdoor antenna. I have heard of reports of it covering communities, but really varies on surroundings as would any other 70cm signal.

One unit, one of which I demonstrated at some of the club meetings was the Openspot by SharkRF. These little units are a power packed horse of a hotspot, it can do several modes and allow you to use a DMR radio on the Yeasu system fusion C4FM mode, you can also use a Yeasu C4FM radio to use DMR. If you have a D-Star radio, you can also use it as a D-Star gateway, but can't use the D-Star radio to access C4FM or DMR.

The price on the openspot is around $200, it is easy to flash firmware too and just does a fantastic job overall. I have never had an issue with mine and I now use it when I travel from city to city, state to state and will be taking it abroad with me. Once you have a code plug configured for it, you should never need to change anything ever again.



The openspot is available from several outlets, I bought mine direct from the manufacturer in Lithuania I believe, you can see more information on it here https://www.sharkrf.com/products/openspot/ ordering is all done on backorder, so it could take up to a month.



There are other options, one I do not recommend is the DV4Mini, they are difficult to set up, constantly have issues on the DMR network, so please avoid this unit.

More complex would be the Raspberry Pi + Arduino DUE and MMDVM ZUM Modem board. You can use these to setup a repeater or use it as a hotspot. These units take time to gather materials and setup. It is fun building the setup and you can see my forum for build instructions if you're willing to attempt it. http://digiham.boards.net/thread/13/dmr-repeater

The other option is a repeater with access to the network, this is something Josh and myself are working on, we are looking for high places to mount a repeater, it must have internet access or it will not work.

Network

There are a couple of DMR networks out there, Brandmesiter and DMR-Marc, I personally have not used the DMR-Marc system, but both Brandmeister and DMR-Marc are similar, they also share or have reflectors to talkgroups.

The "Networks" provide us with the ability to connect with talkgroups, either locally or globally. They provide the means to direct our communications to other users, essentially the path to each other. Just like when you make a phone call on your cellphone, it is the same principle, in fact very close to how each system works.

On your phone, you dial 304291xxxx and get connected with me, on your radio, it is basically the same way, you select the talkgroup 3100, press the PTT for a second and you are connected. In this case, it is a group call, or a partyline as such, where many people will be hanging out, waiting to chew the rag with you.

There are also several nets and more coming in weekly, check into a net in London England, check into a net in Texas, check into our net on TG3154 (*West Virginia DMR and Service Net)* each Thursday at 8:00pm EST.

The main network I use is Brandmeister, WV has several repeaters linked on Brandmeister via Talkgroup 3154 which is found on WV repeaters static TG3154 on Time Slot 2. Remember the two-time slots we talked about? Most repeater sysops assign a static local TG to time slot 2, leaving time slot 1 open for users to change to a PTT Talkgroup.

Wow, all this seems daunting and complex, it is different for us Ham radio users, we are used to dialing in using a VFO, or setting a frequency in memory on our HTs. This is going to be a learning curve, but a short one. It is fairly easy to pick up.

I think, if we have enough people interested, I would like to host a class on how to use the system, what to do, how to do it, and a question time about it.

Can I Go Mobile

Yes, you can, here is a nice image that just shows you what you can do.

The openspot is connected to a TP Link mini router, the router is connected to your phone via WiFi and both the Router and the hotspot get powered from either your car, or you can get a small USB rechargeable pack.

Data Requirements

I have had this question time and time again. Depending on usage will be a key factor in the total data that you may use through a hotspot. I do not see any more than 25Kbps while in use, either from my Hotspot or repeater.

So, What Now

Don't jump into all this blind, this is a reason why I have written this info packet, it is to help you decide on how to go about this. If you need more information, as mentioned above, let's all get together and talk about it, try the system out and play around with it.

You need at least the following to be able to use DMR.

(1) Peer to Peer you need at least 2 radios and be within range of one another
(2) A hotspot / Gateway to the DMR Network
(3) A repeater with access to the DMR Network
(4) A codeplug to enable your radio to use the Network and or talk to another radio

That, in a nutshell is it, sort of simple, I know it sounds complex but once it is up and running, I know you will enjoy it.

I hope this was helpful, if you are interested in a meeting with this setup, please let your club president know, we can then arrange something and a venue.

73s to you all,

De KD8YNY