

LEARNING CURVE

BY RON OCHU, KOØZ

Introduction to DMR

Generally, your “Learning Curve” editor makes every effort to stay just ahead of the curve with each monthly article. This month’s column is different. I am on the other side of the curve, which is to say, the learning side. I am having fun learning about a new mode: Digital Mobile Radio, or DMR. This month’s article will be an attempt to share with you what I’ve discovered so far, in hopes it may serve to pique your interest as well. Future articles will update you on my progress.

What is Digital Radio?

Digital radio is not new. It’s been around for quite some time, even on the HF (High Frequency) bands. Analog signals (voice, etc.) are converted into digital streams of ones and zeros using a device or program called a *codec*, which is a blend between *coder* and *decoder*. In other words, a codec takes an analog signal, converts it to digital, and then changes the signal from digital back to analog.

According to <https://tinyurl.com/yxh5f9pz> and an article by Randolph Ramsay, “Digital radio is to normal radio what digital television is to your standard analog TV. It’s the most significant upgrade to happen since the introduction of FM in Australia in the 1970s and the leap in quality is comparable to FM versus AM ... the result is close-to-CD-quality sound output. While AM/FM radio quality can suffer from interference caused by signals bouncing off walls, buildings, hills and other structures, digital radio receivers have built-in technology that cleans and filters transmissions, making interference practically non-existent. The downside is that you either get signal or you don’t.”

My limited experience with digital radio via DMR is the audio quality can be good, but it still can be distorted and I agree, either you get a signal, or you don’t. Unlike analog voice modes, there isn’t too much in between. Nonetheless, digital radio is fun to play with and it does offer a lot of exciting ham radio communication possibilities.

Regrettably, there isn’t a standard amateur radio digital platform (mode). ICOM has D-STAR, Yaesu has Fusion (also known as C4FM), and there’s DMR. None of these digital platforms can communicate **directly** with one another. However, there are ways for these platforms to communicate between each other, but that’s a topic for a future article.

My DMR Introduction

A little over a year ago, a close friend, Carlos Arzuagas, W9FE (Photo A), was excited to show me his latest endeavor into digital communications. Carlos brought his TYT DMR handheld radio (HT) and his *open spot*. An open spot or hot spot listens for the HT’s digital signal and, using Bluetooth tethered to his cell phone, Carlos was able to chat with hams in the U.S. and even in England from a rural, central Illinois town well beyond the range of any digital repeaters. I was intrigued.

At a club meeting about a year later, Mark Lewis, KD9EFO (Photo B), gave a presentation about digital radio and the

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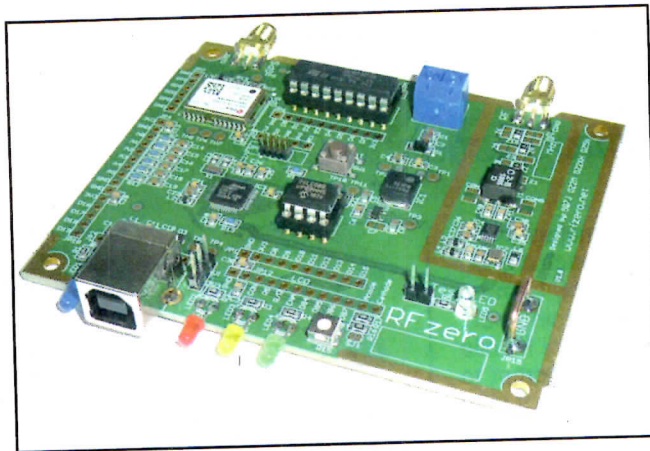


Photo A. Meet Carlos Arzuagas, W9FE, my DMR Elmer! (All photos except for Photo H, by KOØZ)

three major platforms. KD9EFO’s presentation further piqued my interest. This year at the Dayton Hamvention®, I mentioned to two friends, John King, W9KXQ, and Ken Norris, KK9N (Photo C), that I was planning to purchase a DMR radio and was looking for a good deal. They found one for me in the flea market. Even better, my friends knew the owner and could vouch for his integrity and the HT’s quality. Consequently, I could venture into the digital world, do some exploring and not invest a sizable amount of money into a niche of our hobby that I wasn’t sure I was ready to dive into headfirst.

My newly acquired TYT MD-380 (Photo D) puts out either 5 watts or 1 watt, it comes equipped with a rubber duck antenna and a 2,000-mAh Li-ion battery. Again, thanks to W9KXQ and KK9N, they took my newly purchased HT and programmed it during the Hamvention® to get me started. My DMR MD-380 is a digital modulated, dual-band HT, very high frequency (VHF 136-174 MHz), ultra-high frequency (UHF 400-480 MHz) transceiver with 1,000 programmable channels.

DMR radios are also capable of transmitting and receiving analog FM signals. TYT is a very popular introductory digital HT, but I hear a lot of hams also using AnyTone AT-D878UV HTs. In addition, several other Chinese manufac-



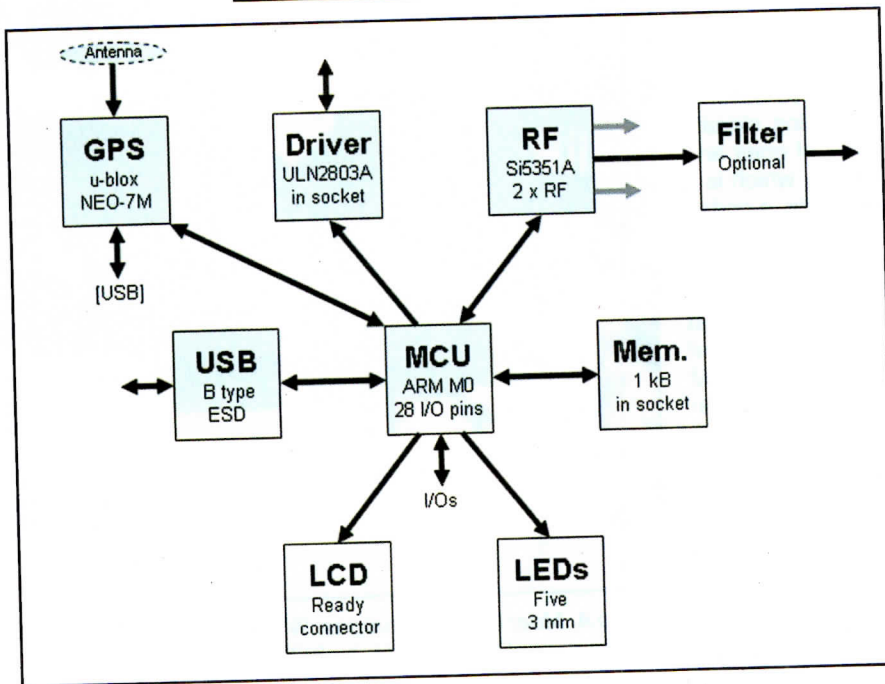
RF-Zero

feature-rich GUI applications which can be run on the desktop.”

While you are at *The MagPi Magazine* site, check out their tutorials at <www.raspberrypi.org/magpi/tutorials>. Among the many projects is “Pictures From Space Via Ham Radio,” which utilizes a Raspberry Pi and an RTL2832U-SDR USB dongle to receive and view SSTV pictures transmitted from the International Space Station (ISS). This project was also featured in the April 2019 issue of the magazine (which at the time of this writing was available as a free download from their website at <<https://tinyurl.com/yyg6wuaq>>. The April issue also featured a 5-page section on Amateur Radio and Raspberry Pi projects, including a digital voice hotspot, satellite tracking, APRS IGate, remote SDR scanner, WSPR transmitter, and an ADS-B flight tracker.

What Else is Out There?

Do you know of a Microcontroller Devices (μCD) in Amateur Radio project, or are you working on one yourself? I always welcome your email comments and questions to make this column better.



The RFzero block schematic.

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TOP 10 Raspberry Pi HATS

The April 2019 Issue of The MagPi magazine featured a section on Raspberry Pi in amateur radio.

MagPi FEATURE

AMAZING HAM RADIO PROJECTS

Raspberry Pi and ham radio – a match made in amateur heaven. By Rob Zwetsloot

If you're a regular reader of the MagPi, you may have noticed a notice in your email inbox a while ago about the magazine. One of the questions I asked the editor for this issue was "What projects, for amateur radio, did you think were most interesting to feature in this issue?"

The answer? Well, it's a bit of a surprise, but it's been a long time since I've read something like that. So, it's a bit of a surprise, but it's been a long time since I've read something like that. So, it's a bit of a surprise, but it's been a long time since I've read something like that.

The MagPi magazine article included six radio-related projects and a number of nice words about amateur radio.

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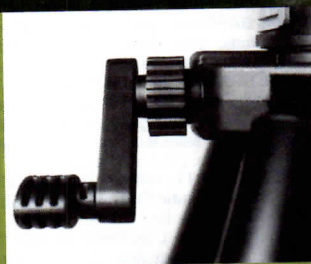
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turers offer DMR radios and Alinco has a full line of DMR gear, including handhelds, mobile transceivers and repeaters. At this point in my "learning curve" I can't offer any advice on either of these radios, other than to point out that TYT HTs are less expensive than AnyTone HTs. So far, in my very limited experience, I haven't experienced any difficulties and I've received good signal reports from others.

Advice on Getting Started

W9FE suggests watching YouTube videos to get acquainted with DMR. I found Hamradio 2.0 to be a great resource <<https://tinyurl.com/y4klqaeq>>. W9FE points out that there is a definite learning curve to digital radio. With learning anything new, it's advisable that taking your time, containing your exuberance, and asking for help will speed up the learning process. I've found W9FE's advice to be spot on. Carlos also advises to read all you can about DMR. He has an excellent website <<https://qsl.net/w9fe/dmr.html>> that offers just about anything you need to know concerning DMR and that includes instructions on how to program your own code plugs. W9FE has taken a lot of information and consolidated it into one website. Think of it as a one stop DMR spot! In fact, his website has an extremely well-written "Introduction to DMR" by The DMR Documentation Project at <<http://pnwdigital.net/info/IntroductionDMR.pdf>>. W9FE enjoys helping fellow hams and any readers who may have questions can reach Carlos at <Carlos@w9fe.com>.

DMR Jargon

Perhaps a good place to further our "forage into digital" is to wrap our minds around some DMR basic concepts and jar-

gon. If I do my job correctly, you'll get some answers and not end up too confused. Let's give it a whirl.

Code plugs: A code plug is a commercial term for programming a radio. For example, with an analog FM radio one of the first things you'll need to do is to program your radio for simplex (transmit and receive on the same frequency) or repeater operation (transmit on one frequency and receive on another). Once the frequency is entered, you'll need to add CTCSS (continuous tone coded squelch system) frequencies, power output, etc. Some radios are easy to program, while others are far easier to program via a software program such as Chirp or radio-specific programs from RT Systems. TYT HTs have a software program that makes programming it far easier. Code plugs are not hard to program and you don't need to be a computer programmer to populate a code plug. It's simply a matter of putting the correct information such as frequency, etc., into the proper slot in the software program, but first you'll need to know the terms. For instance, we know that in the analog repeater world, the term offset refers to the difference between a repeater's input and output frequencies. DMR is similar but uses different terms.

Talk group: A talk group is another term for a channel that groups similar interests ranging from very broad to very specific. Think of it as a ham radio club. There are national clubs, local clubs, DX (long distance) clubs, QRP (low power) clubs, DIY (do it yourself) clubs, etc. DMR for Dummies defines a DMR talkgroup as: "simply a way of grouping many radio IDs into a single digital contact. Or put another way, a talkgroup is a method of organizing radio traffic specific to the DMR users that all want to hear the same thing and not be bothered by other radio traffic on a DMR network that they are

ANNOUNCEMENTS *(from page 56)*

LONGMONT, COLORADO — The Boulder Amateur Radio Club will hold the 65th Annual BARCFest Hamfest beginning 8 a.m., Sunday, October 6 at the Boulder County Fairgrounds, 9595 Nelson Road. Contact: Mike, W3DIF, (303) 404-2161. Email: <barc70@arll.net>. Website: <www.qsl.net/w0dk>. VE exams.

WEST FRIENDSHIP, MARYLAND — The Columbia Amateur Radio Association will hold the 2019 CARAFest beginning 6 a.m., Sunday, October 6 at the Howard County Fairgrounds, 2210 Fairgrounds Road. Contact: David Parkison, KB3VDY, (410) 977-1249. Email: <vendorsales@carafest.org> or <info@carafest.org>. Website: <www.carafest.org>. VE exams, DX card checking.

WEST LIBERTY, IOWA — The Muscatine Amateur Radio Club and the Washington Area Amateur Radio Club will hold the Southeast Iowa Hamfest and 2019 ARRL Iowa State Convention from 7 a.m. to 2 p.m., Sunday, October 6 at the Muscatine County Fairgrounds, 101 N. Clay Street. Contact: C. Scott Richardson, NØMRZ, (563) 506-0304. Website: <www.waarc.net>. Talk-in 146.910- (PL 192.8) or 147.760-. VE exams, card checking.

MELBOURNE, FLORIDA — The Platinum Coast Amateur Radio Society will hold the 54th Annual Melbourne Hamfest and 2019 ARRL Florida State Convention from 1 to 7 p.m., Friday, October 11 and from 9 a.m. to 3 p.m., Saturday, October 13 at the Melbourne Auditorium, 625 E. Hibiscus Boulevard. Email: <hamfest@pcars.org>. Website: <http://pcars.org>. Talk-in 146.850-. VE exams, DXCC card checking.

LIMA, OHIO — The Northwest Ohio Amateur Radio Club will hold its Fall Hamfest beginning 8 a.m., Saturday, October 12 at the Rabbit Barn – Allen County Fairgrounds, 2750 Harding Highway. Contact: Bob Butlet, KE8BCJ, (419) 230-7977. Email: <officer-bob28@yahoo.com>. Website: <www.nwoarc.com>. Talk-in 146.670.

MORRILTON, ARKANSAS — The Randy Griffin Memorial Radio Club will hold the K5BOC Memorial HamFest from 8 a.m. to 3 p.m., Saturday, October 12 at Petit Jean Lutheran Camp, 110 Montgomery Trace. Phone: (501) 771-1111 or (501) 626-6252. Website: <http://k5boc.org>. VE exams

WINSTON-SALEM, NORTH CAROLINA — The Forsyth Amateur Radio Club will hold the Winston-Salem Fallfest from 7 a.m. to noon, Saturday, October 12 at the Robinhood Road Baptist Church, 5422 Robinhood Road. Website: <http://w4nc.com>. Talk-in 145.470 (PL 100).

EAST RIDGE, TENNESSEE — The Chattanooga Amateur Radio Club will hold Hamfest Chattanooga 2019 and the 2019 ARRL Delta Division Convention Friday, October 18 and Saturday, October 19 at the Camp Jordan Arena, 323 Camp Jordan Parkway. Contact: Gary Ownsby, AK4ZX, <gownsby@w4am.net> or Barclay (Mac) Thomas, WT4BT, <macthomas@w4am.net>. VE exams, DXCC card checking, fox hunts.

SAN RAMON, CALIFORNIA — The Mt. Diablo Amateur Radio Club will hold PACIFICON 2019 and the 2019 ARRL Pacific Division Convention from Friday, October 18 through Sunday, October 20 at the San Ramon Marriott, 2600 Bishop Drive. Website: <www.pacificon.org>. VE exams, special event station, T-hunt.

GREENEVILLE, TENNESSEE — The Andrew Johnson Amateur Radio Club will hold the 7th Annual Greeneville Hamfest from 6 a.m. to 2 p.m., Saturday, October 19 at the Greene County Fairgrounds – The Commercial Building, 123 Fair Grounds Road. Contact: Rodney Webb (423) 235-4351. Email: <w4wreares@gmail.com>. Talk-in 145.390- (PL 88.5), 147.060+ (PL 123), 443.150+ (PL 100), or 443.200+ (PL 100). VE exams.

MUSKEGON, MICHIGAN — The Muskegon Area Amateur Radio Council and the Muskegon County RACES will hold the Muskegon Color Tour Hamfest from 8 a.m. to noon, Saturday, October 19 at the Fellowship Reformed Church, 4200 E. Apple Avenue. Contact: Jim Duram, (213) 638-7010. Email: <mcthamfest@gmail.com>. Talk-in 146.82 (PL 94.8).

RICKRREAL, OREGON — The Mid Valley ARES will hold Swap-Tober-Fest from 9 a.m. to 3 p.m., Saturday, October 19 at the Polk County Fairgrounds, 520 S. Pacific Highway West. Contact: Don Brusck, K7UN, <k7un@swaptoberfest.net>.

SHELBYVILLE, INDIANA — The Blue River Valley Amateur Radio Society will hold the 2019 Shelbyville Tailgate from 8 a.m. to noon, Saturday, October 19 at the Shelby County Fairgrounds, 500 Frank Street. Website: <www.brvars.com>. Talk-in 145.48 (PL 88.5).

SINTON, TEXAS — The South Texas Hamfest Association will hold the South Texas Hamfest & Electronics Expo 2019 from 8 a.m. to 3 p.m., Saturday, October 19 at the San Patricio County Fairgrounds-Event Center, 219 W. 5th Street. Website: <www.south-texashamfest.org>.

WISCONSIN RAPIDS, WISCONSIN — The 21st Annual Wisconsin State ARES / RACES Conference will be held from 9:30 a.m. to 4 p.m., Saturday, October 19 at the McMillan Memorial Library, 490 East Grand Avenue. Website: <http://wi-aresraces.org>.

CAMBRIDGE, MASSACHUSETTS — The Harvard Wireless Club, MIT Electronics Research Society, MIT UHF Repeater Association, and the MIT Radio Society will hold the Flea at MIT from 9 a.m. to 2 p.m., Sunday, October 20 at the Parking Garage on the corner of Albany and Main Streets. Phone: (617) 253-3776. Website: <www.swapfest.us>. Talk-in 449.725- (PL 114.8).

KALAMAZOO, MICHIGAN — The Kalamazoo Amateur Radio Club and the Southwest Michigan Amateur Radio Team will hold the 37th Annual Kalamazoo Hamfest & Amateur Radio Swap and Shop from 8 a.m. to noon, Sunday, October 20 at the Kalamazoo County Expo Center and Fairgrounds, 2900 Lake Street. Phone: (269) 205-3560. Email: <info@kalamazoohamfest.com>. Website: <http://kalamazoohamfest.com>. Talk-in 147.040 (PL 94.8). VE exams.

SELLERSVILLE, PENNSYLVANIA — The RF Hill Amateur Radio Club will hold its Hamfest from 7 a.m. to 1 p.m., Sunday, October 20 at the Sellersville Fire House, 50 N. Main Street. Contact: Jim Soete, WA3YLQ, (215) 622-4344, Fax: (215) 257-0724. Email: <wa3ylq@hotmail.com>. Website: <www.rfhillarc.club>. Talk-in 145.31- (PL 131.8). VE exams.

KIRKWOOD, MISSOURI — The Saint Louis Amateur Radio Club will hold the Saint Louis Halloween Hamfest from 7:30 a.m. to noon, Saturday, October 26 at the Kirkwood Community Center, 111 S. Geyer Road. Contact: Steve Welton, (314) 941-8500. Email: <slwelton@gmail.com>. Website: <http://halloweenhamfest.org>. Talk-in 147.75-. VE exams.

LYNNVILLE, INDIANA — The Tri-State Amateur Radio Society will hold the Southern Indiana Second Annual Hamtober Fest from 7 a.m. to noon, Saturday, October 26 at the Lynnville Community Center, 416 W. State Road 68. Email: <hamfest@w9og.net>. Website: <http://hamtoberfest.com>. Talk-in 146.790 (PL 88.5).

MARICOPA, ARIZONA — The Maricopa Amateur Radio Association will hold COPAFEST 2019 from 7 a.m. to 1 p.m., Saturday, October 26 at the Ultrastar at Ak-Chin Circle, 16000 N. Maricopa Road. Website: <www.copafest.org>. Talk-in 449.125 (PL 136.5), 145.210 (PL 162.2), or 446.300 (PL 100).

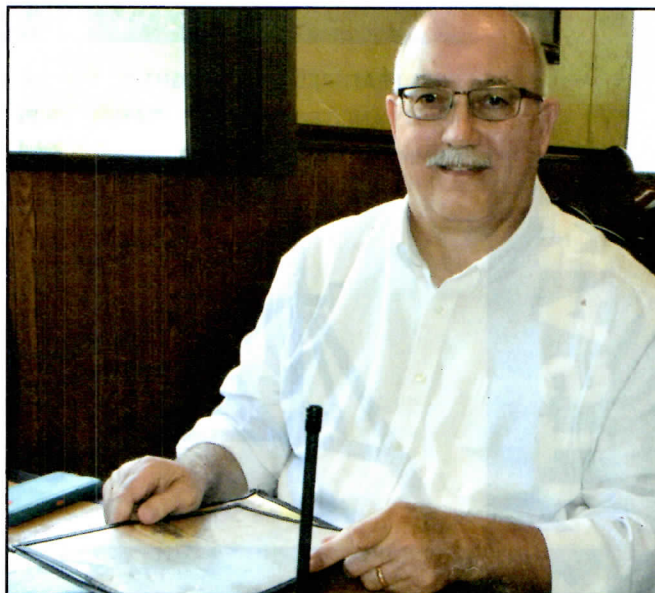


Photo B. Mark Lewis, KD9EFO, another digital ham using Yaesu Fusion.



Photo C. John King, W9KXQ, and Ken Norris, KK9N, are my other DMR Elmers. John owns the K7QLL DMR repeater.

not interested in hearing.” Some talk group examples are Tac 310, Tac 311, Illinois State, Parrot, etc.

Zone: DMR radios use zones. Think of a zone as a filing cabinet in which one file of the cabinet may contain BNC connectors, another file has PL-259 connectors, and yet another has N connectors. The BNC, PL-259 and N connectors can all be grouped under the Zone “RF connectors.” Furthering this example, you have another file with carbon resistors. A second file has wire-wound resistors and still another file is filled with surface mount resistors. You group these resistors under the category (zone) of resistors. You get the idea. In the DMR world, a zone contains talk groups. Each zone can hold up to 16 different talk groups using any name you want to call your zone. The TYT MD-380 has a menu screen (Photo E) that includes zones. I simply use one



Photo D. My introduction to DMR radio a TYT MD-380 DMR HT.

of the arrow keys to scroll down to zones and then I press the confirm button. This action now brings me to the zone screen. Currently on my HT I have four zones: Home, STL, Shiloh and Analog (Photo F). There are talk groups in each zone. For example, one of the talk groups in my "Home Zone" is TAC 310 (Photo G). My analog zone contains local FM analog repeater frequencies. Remember, DMR transceivers are also capable of transmitting and receiving normal FM repeaters. Part of the fun of DMR is that *you* get to name a zone and to assign which talk groups go into your zone.

R2Dish: Sometimes, while listening to DMR transmissions, the audio will sound garbled and distorted. Digital hams refer to this as R2Dish or "gollywobble" audio. It doesn't happen all the time, but it does happen. Generally, R2Dish or gollywobble audio happens when digital packets collide and there are bandwidth issues.

DMR Uses RF to Communicate

DMR uses RF (radio frequency) to communicate utilizing the VHF and UHF spectrum. DMR can communicate via simplex, via a DMR repeater, or through a hot spot. The point is that DMR does, indeed, use RF! Let's take a closer look at each RF mode.

Simplex: DMR can use simplex (transmit and receive on the same frequency). I don't know of too many examples of simplex operation, but I am a new-

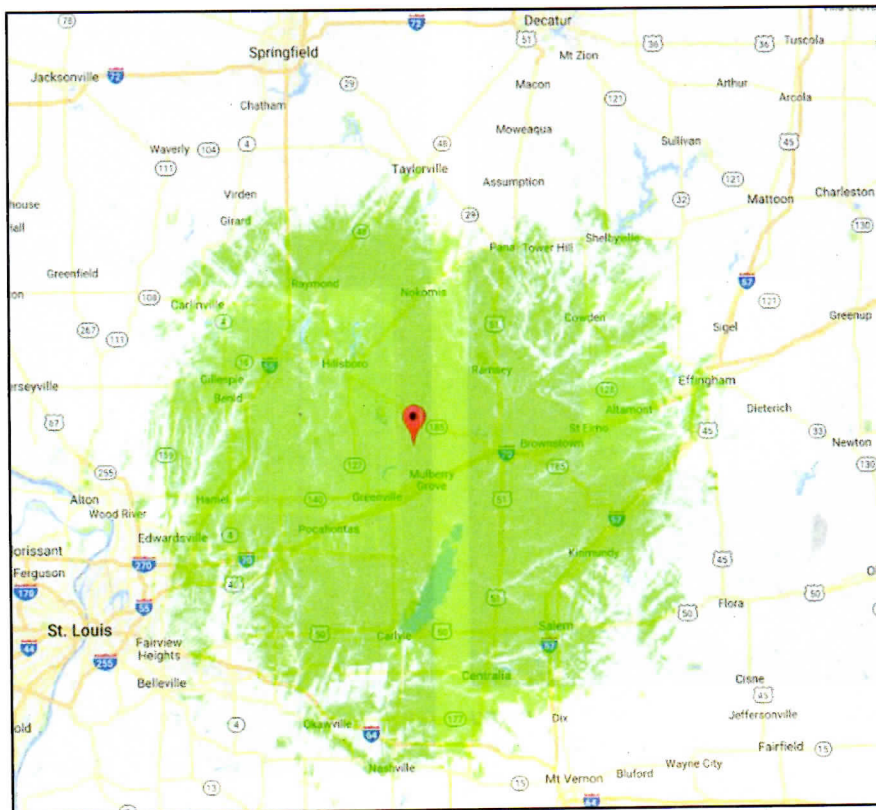


Figure 1. John King's K7QQL DMR repeater coverage area in central Illinois. (Courtesy of John King)

bie. I suspect simplex could be used at public service events or between friends looking for deals at a swapfest.

DMR repeaters: There are quite a few DMR repeater trustees and clubs that sponsor / support them as well as other digital repeaters such as Fusion and D-STAR. I use John King's K7QQL DMR repeater in Greenville, Illinois <www.w9kxq.com/dmr>. The K7QQL repeater is approximately 40 miles away from my QTH. My TYT MD-380 on 5 watts connected to a roof mounted dual-band vertical can reach it on most days. KXQ's repeater has excellent coverage (Figure 1) because his antenna is located on top of a 190-foot tower and it's fed with low-loss cable (Photo H). DMR repeaters are like analog repeaters in that they extend the usable digital range of a HT or mobile radio. But there are a few, significant differences.

DMR Repeaters

FM analog repeaters use frequency pairs. For example, the WS9V FM analog repeater listens on a frequency of 449.250 MHz and transmits on 444.250 MHz. It uses a CTCSS frequency of 103.5 Hz. A DMR repeater also has a frequency pair assigned to it. K7QLL/R

listens for a digital signal on 448.43125 MHz and transmits digitally on 443.43125 MHz. It has a color code of 7. A color code acts the same as a CTCSS tone does for an analog repeater. Just like CTCSS tones, color code encryption helps to limit the repeater from being keyed-up by stray signals.

DMR repeaters contain talk groups. The repeater owner chooses which talk groups are available on the repeater. These talk groups are assigned by the repeater owner to time slots (Figures 2 and 3). DMR repeaters use two time slots. A DMR is a wideband signal that occupies approximately 25 kHz in bandwidth, but is usually split into two subbands. Hence, it is common practice to assign one 12.5-kHz signal to a time slot and another to a second time slot.

Another way to look at it, in terms of bandwidth, is to reference our familiar AM (amplitude modulated) signal, which is typically 6 kHz wide. The scientists at Bell Labs discovered that the upper and lower sidebands within the AM signal contained the same information. The bandwidth of these sidebands are 3 kHz each. Why not separate the upper from the lower sideband and get two usable channels where there was



Photo E. The MD-380 HT menu screen. Note that zones is third down on the list.

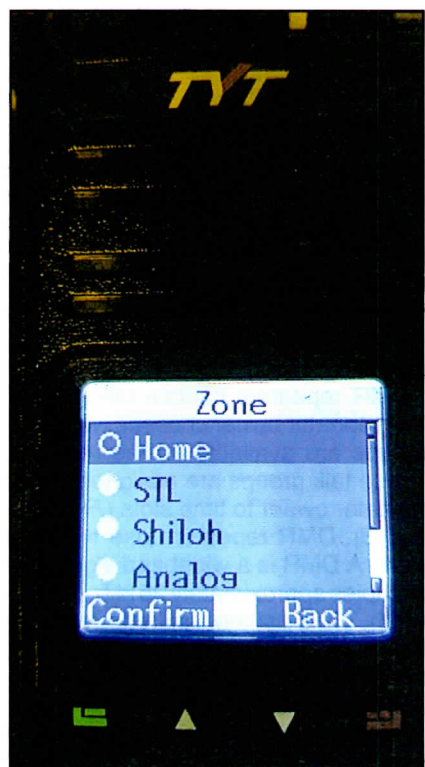


Photo F. My TYT MD-380's zone screen display. I have Home Zone which includes talk groups on the Greenville K7QLL DMR repeater, STL Zone: St. Louis talk groups, Shiloh Zone: Shiloh, Illinois talk groups and Analog Zone: allowing me to use my digital HT as a "normal" FM analog HT on various, local repeaters.

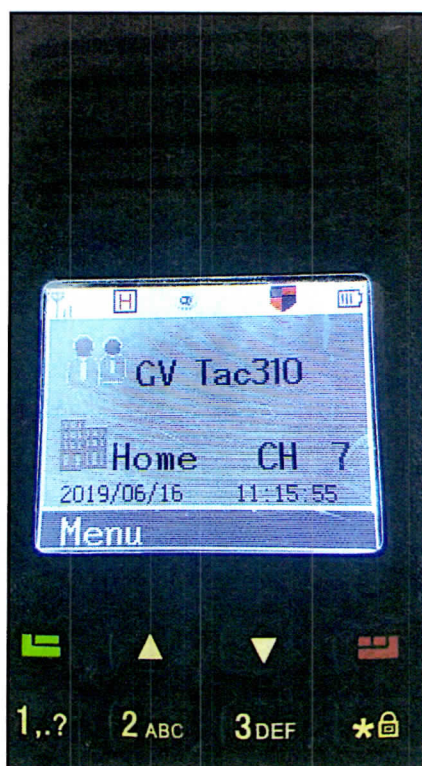


Photo G. I often find myself using the talk group TAC 310 on my DRM HT.

once just one? That's a more efficient use of spectrum. DMR does the same thing, but in a digital manner.

Obviously, when it comes time to program your DMR radio to include area repeaters, a repeater directory will contain the necessary information such as callsigns, frequency pairs, color codes, time slots, and other vital information.

DMR repeaters most certainly use radio frequencies, but like Echolink or IRLP (Internet Radio Linking Project), they also use the internet to allow them to connect to other DMR sites. Internet usage offers more flexibility to repeater users. Another advantage is more consistent and reliable coverage to distant areas that is not dependent on the ionosphere for propagation. Some may argue that isn't true ham radio, but if ham radio is all about communication and expanding the radio art, then where's the harm? DMR is just one more tool in our expanding communications toolbox. In fact, DMR's ability to connect with the internet offers folks, such as myself, living in rural areas or subdivisions with antenna restrictions, even greater communications flexibility.

Hot Spots

A hot spot is a device that can be pro-

grammed to send and to receive on ham radio auxiliary frequencies with your DMR radio, while at the same time connect to the internet either through WiFi in your home or Bluetooth via your cell phone. W9FE uses an older version of Shark Open Spot combined with a Bluetooth device that allows him to use DMR in rural areas or on the road if he has cell phone coverage (Photo I). I just purchased a MMDVM Hotspot Radio Station (Photo J), which does the same thing as the Shark Open spot, but it is smaller and equipped with both WiFi and Bluetooth. I ordered it from Amazon.com: <<https://tinyurl.com/y24592fk>>.

A big advantage of having a hot spot is that I'm not dependent on the time slots / talk groups in a DMR repeater. I'll be able to program code plugs for the talk groups that may not be in the repeater. My hot spot will allow me to use my DMR while mobile and not within range of a DMR repeater. To be sure, I will be using data and I'm dependent on cell phone coverage to use my DRM. At this point in time, I'm not inclined to use my DMR HT for emergency communications in rural Illinois, but it is allowing me to learn more about digital communications and WiFi, and it's another fun aspect of our hobby. Although I like DMR, I won't be giving up the thrill of working an ATNO (all-time new one) as a DXer (long distance communicator) on the HF bands or weak-signal work on the VHF-UHF bands for DMR.

Digital Etiquette

W9FE advises newbies, such as me, to make ourselves aware of digital etiquette. First off, just don't press the PTT (push to talk) key and call out. Listen first. Listen for at least 3 minutes. Most DMR radios are set for 180-second transmissions. That means that even though the frequency may sound quiet, there could be a QSO (conversation) in progress and you won't even hear it until one of the transmitters on the time slot kicks out. Next, don't call, "CQ" on digital frequencies. Instead, after waiting about 180 seconds, I will key up my radio and wait a few seconds (to allow digital connections) before announcing, "KOØZ listening on TAC 310." I announce the talk group that I'm listening to, because folks scanning may hear my callsign, but they may not see which talk group I am monitoring. DMR radio does have a screen that will display the callsign and the talk group, but the screen doesn't stay lit for very long. In addition, when in a QSO and the other station turns it back to you, wait a while

K7QLL/R DMR Repeater Available Talkgroups	
on=Always on	
15=15 min PTT	
5=5 min PTT	
2=2 min PTT	
Timeslot #1	
Local 1 (3181) -- ChicagoLand	on
Illinois 1 (3117)	on
Wisconsin 1 (3155) -- ChicagoLand	15
Comm 1 (3777215) -- DMRX	on
California 1 (3106) -- BM	15
Georgia 1 (3113) -- DMRX	15
Indiana (3118) -- BM	15
Iowa (3119) -- BM	15
Kentucky 1 (3121) -- DMRX	15
Massachusetts 1 (3125) -- DMRX	15
Michigan 1 (3126) -- DMRX	15
Missouri 1 (3129) -- BM	on
Minnesota 1 (3127) -- K4USD	15
Ohio 1 (3139) -- DMRX	15
Pennsylvania 1 (3142) -- DMRX	15
Tennessee 1 (3147) -- BM	15
Texas 1 (3148)	15
Washington 1 (3153) -- BM	15
Mid Atlantic Region (3173) -- MARC	15
Mountain Region (3177) -- MARC	15
Northeast Region (3172) -- MARC	15
Southern Region (3175) -- MARC	15
Southeast Region (3174) -- MARC	15
Southwest Region (3176) -- MARC	15
UA English 1 (113) -- MARC	15
TAC 312 1 (312) -- K4USD	15
TAC 317 1 (317) -- K4USD	15
Allstar 1 (3167) -- Chi-DMR	15
EchoLink-IRLP 1 (63951) -- CR	15

Figure 2. The K7QLL time slot 1 talk group offering to area users. (Courtesy of John King)

before going back to the other station. In the analog FM world, we call it "dragging your heels," so that someone else can join the QSO. The digital world is the same, but the wait time is longer. Digital ops are used to not getting an immediate response. To be honest, I'm guilty of being "too quick on the PTT trigger."

Another exciting DMR feature is the Parrot talk group. It's like EchoLink's "echotest." The DMR Parrot will parrot (repeat) back your digital transmission. That way, you can hear exactly how you sound on the system without having to ask for audio checks on talk groups. Another point of etiquette, if you join a wide area talk group such as a state-wide group that may simultaneously engage many repeaters, limit your transmissions. If a QSO begins to become lengthy, invite the other op to QSY to a more localized talk group. In the analog world, rather than tie up an entire networked repeater system, if the other station is within simplex range or

Timeslot #2	
Local 2 (3166) -- ChicagoLand	on
MidWest 2 (3169) -- MARC	on
Comm 2 (3777216) -- DMRX	on
Bridge 2 (3100) -- DMRX	15
TAC1 2 (8951) -- DMRX	15
TAC310 2 (310) -- DMRX	15
TAC311 2 (311) -- DMRX	15
Parrot 2 (9998) -- DMRX	2
Audio Test 2 (9999) -- DMRX	2
UA English 2 (123) -- MARC	15
1776 (1776) -- MIT	15
NA 2 (3) --- MARC	15
Wwe 2 (13) --- MARC	15
WW 2 (1) --- MARC	15

Figure 3. K7QLL's time slot 2 talk groups available for users. (Courtesy of John King)

in the coverage of a non-linked repeater, I'll ask the op to QSY (change frequency) as a courtesy to others on the linked repeater system. W9FE has a complete list of things to do on his website regarding etiquette.

Digital ID

Since DMR uses ham radio frequencies as well as the internet, you'll need to register with RadiID.net to get a DMR ID. It's easy and it's free. The website, <www.dmrfordummies.com/dmr-radio-id>, offers this ID explanation: "A Radio ID is a unique number assigned to you (and your callsign) by the RadiID.net Team. Like a telephone number or IP address, your Radio ID identifies you as a unique radio user on the various DMR networks and repeaters around the world. Because DMR is digital, we have so much more that we can do with the RF flowing to and from our radios. For example, because of Radio IDs we can see and display the callsign of the person talking to us on the radio face by the use of the RadiID.net Database.

Every time you PTT your DMR radio, your Radio ID gets transmitted to the DMR network and everyone can see who you are. Pretty cool, right? BUT DON'T FORGET. YOU MUST STILL ID BY VOICE TO BE LEGAL. Even though your callsign shows up in the network logs and on other users' radios, this does not mean you are identifying yourself as a licensed ham. You must ID like you do on analog.

"So why else is this so cool? Identifying every radio and repeater uniquely with an ID enables the very essence of DMR networking to function, i.e., making private calls to each other, organizing specific talkgroups for countries, states, regions, cities, clubs, special interest groups etc."

I have a DMR ID and it is neat to see my callsign and location come across a digital screen. It also aids with phonetic pronunciation. Did Carlos say, W9FD, W9FC or was it W9FE?

Wrapping it up

We've covered a lot of material in this

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TC-24



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AN762 (140W)	AR313 (300W)
EB63A (140W)	EB104 (600W)
EB27A (300W)	AR347 (1000W)



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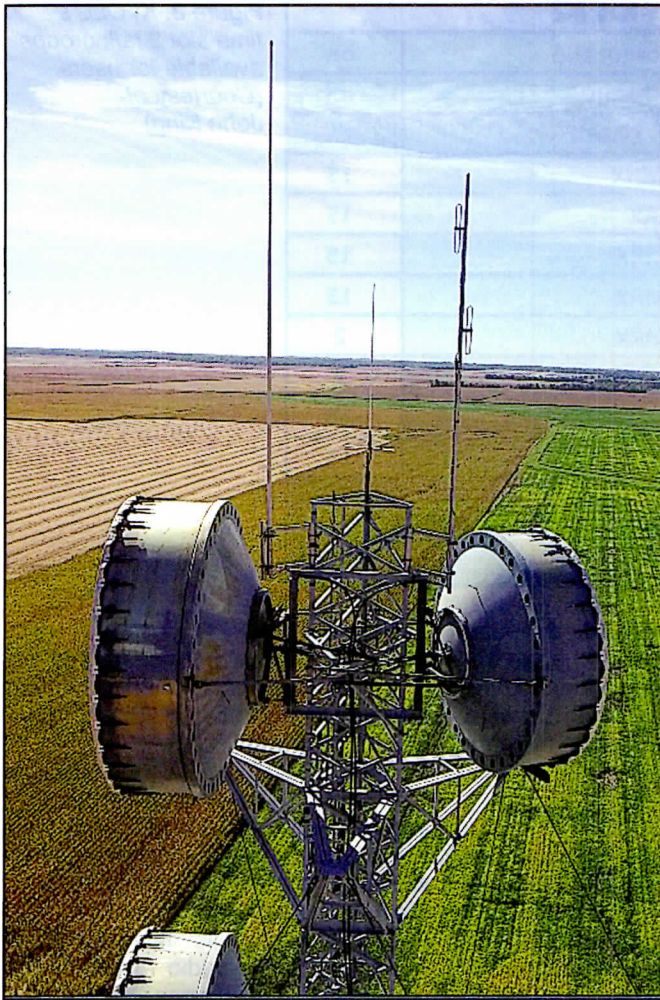


Photo H. The K7QLL DMR repeater tower. The DMR antenna is mounted at 190 feet providing excellent UHF coverage. (Photo by John King, W9KXQ)



Photo J. My MMDVM hot spot allows me to use my home's WiFi for internet connectivity so I can communicate with more talk groups.



Photo I. W9FE's Shark RF OpenSpot allows Carlos to use DMR on the road or at home with his WiFi connection.

article. As W9FE told me, there is a learning curve to DMR radio, but it isn't too steep of a curve. Mostly, wrapping our minds around terms such as code plugs, talk groups, color codes, etc., is a hurdle. The etiquette associated with DMR usage is a bit different from analog FM repeater usage due to the way DMR signals are generated. On the other hand, learning something new is the fun of amateur radio. There's a lot more to DMR radio and we've only scratched the surface. For an introductory DMR article, I didn't want to get "too deep into the weeds" because there's a lot to grasp. Besides, I'm a DMR newbie and I'd have a difficult time taking on the "weeds." Taking baby steps is the way to go and learning as I go along has served me well in the past. I'm lucky that I have elmers (friendly mentors) such as Carlos, Ken, and John to aid me. Perhaps this article has piqued your interest in digital communications. If nothing else, hopefully, when you hear other hams talking about DMR you won't feel as if you're alone in left field.

- Thank you for reading CQ and 73 de Ron, KOØZ