Digital Mobile Radio

DMR Tech Rally

July 11, 2020

WA3NOA – Jim

Amateur DMR Networks

- Over 6,600 registered repeaters
- Over 165,517 registered users
- Repeaters in 60 Countries
- The fastest growing segment of Amateur Radio today

What is DMR?

- Digital Mobile Radio (DMR) was developed by the European Telecommunications Standards Institute (ETSI) and is used worldwide by professional mobile radio users
- DMR Association working to ensure interoperability
  - Includes:
    - Motorola, Hytera, Tytera, Vertex (Yaesu), Kenwood, Icom, Anytone, Connect Systems, etc.
- DMR is divided into three tiers
  - Tier I
    - Simplex only
  - Tier II
    - Adds repeaters
  - Tier III
    - Adds trunking

Tier II

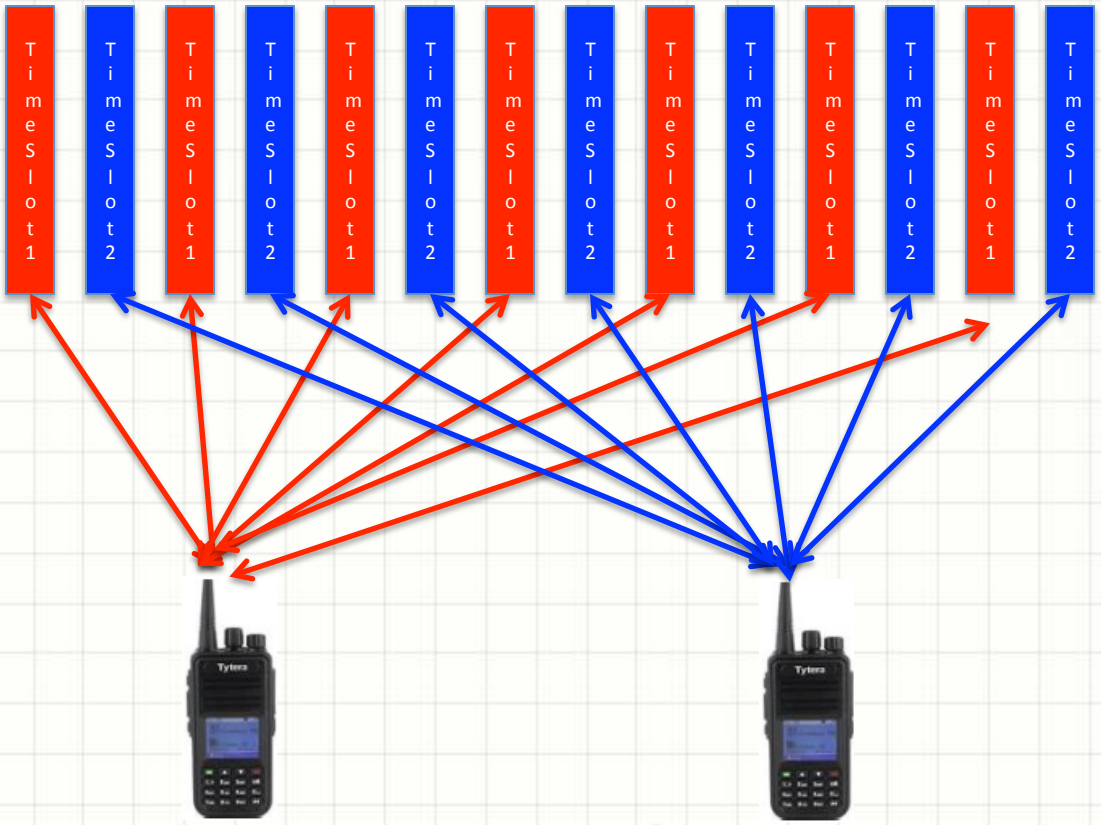
The Standard for Amateur Networks

- 2-slot TDMA 12.5 kHz peer-to-peer and repeater mode specification, resulting in a spectrum efficiency of 6.25 kHz per channel
- Most amateur radio implementations of DMR are using voice on both time slots

Time Division Multiple Access (TDMA)

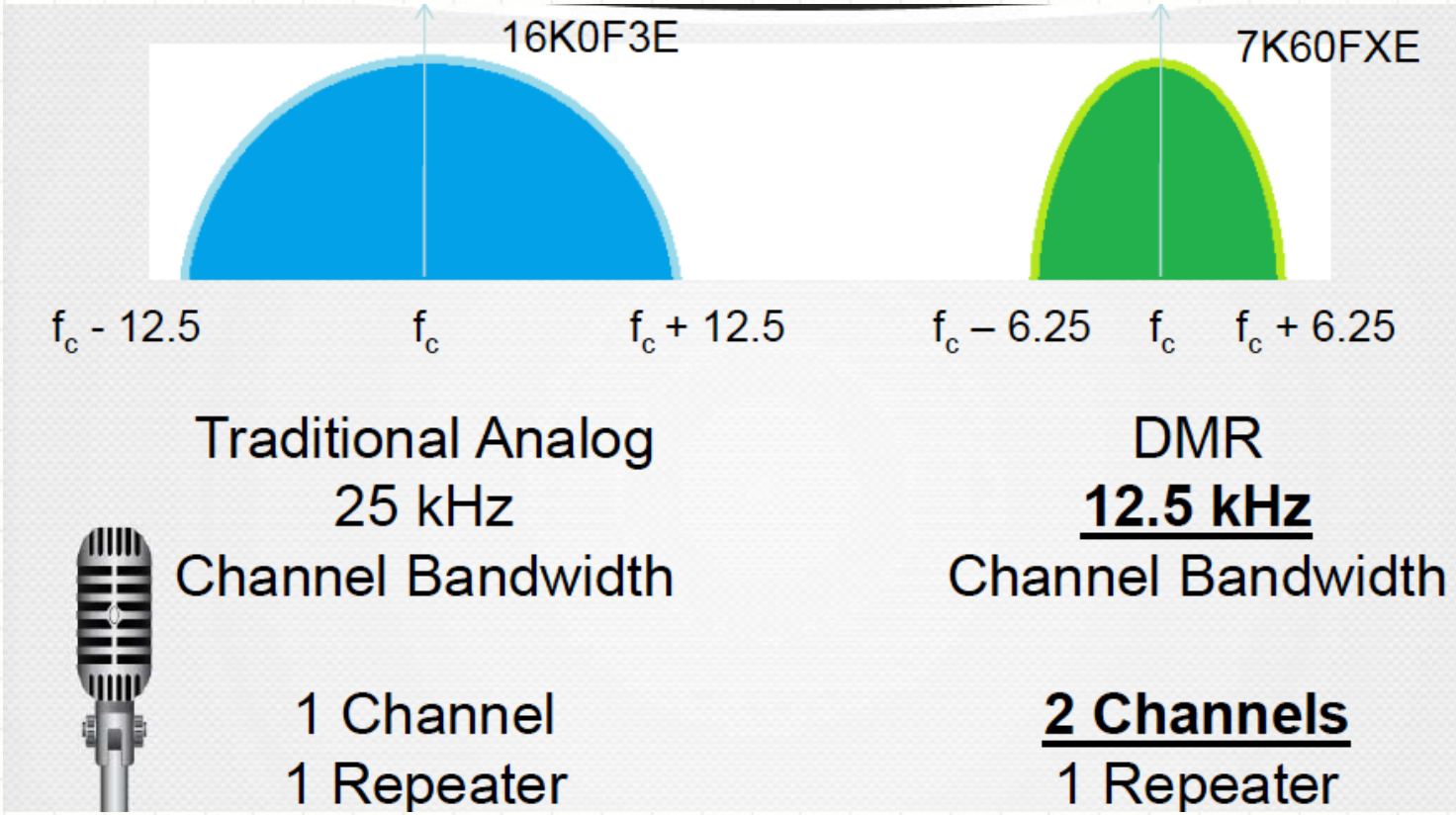
DMR

2-slot TDMA

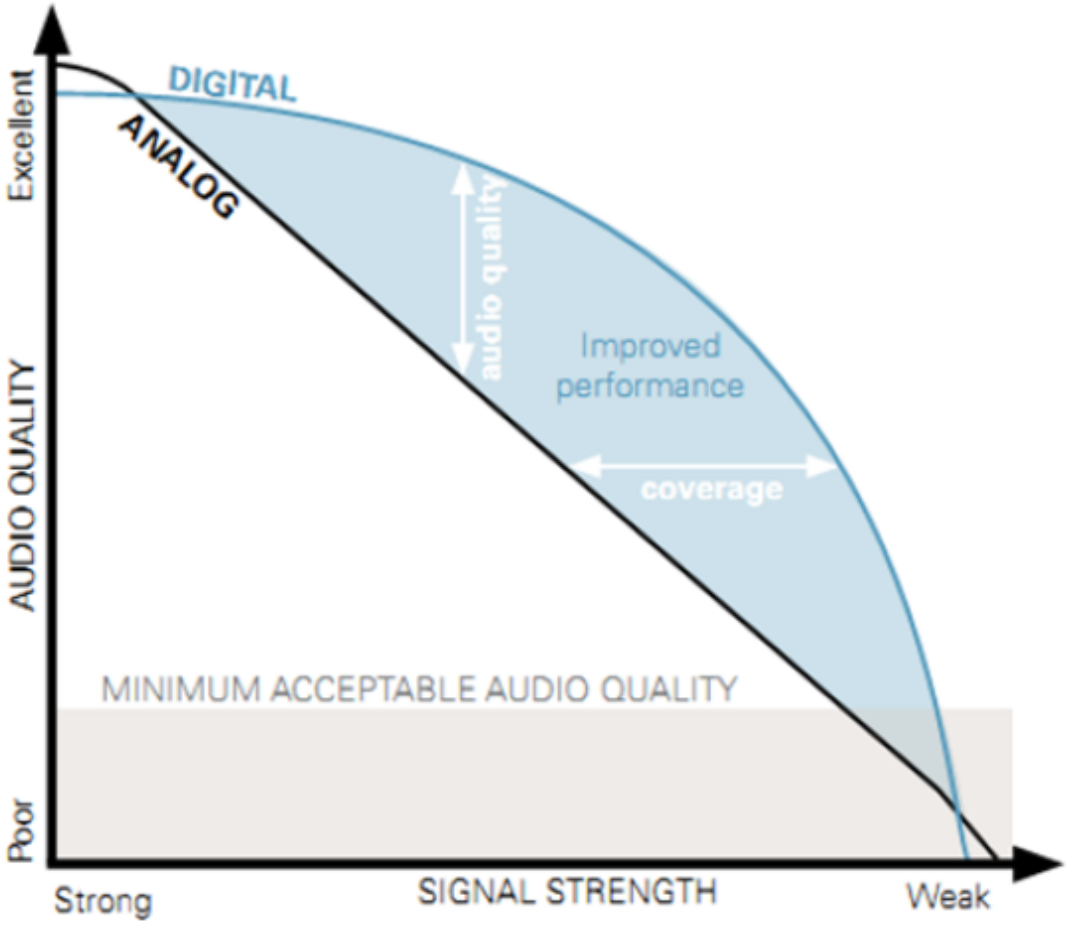


One - 12.5 kHz Repeater Channel

Bandwidth Efficiency



Digital provides better signal quality



Digital voice retains better quality than analog as signal strength decreases.

How does DMR compare to other digital standards?

Format Feature	P25 Phase 2	DMR	D-Star	C4FM/Fusion	NXDN/IDAS
Protocol	TDMA	TDMA/4FSK	GMSK	FDMA/C4FM	FDMA
Vocoder	AMBE+2	AMBE+2	AMBE	AMBE+2	AMBE+2
Forward Error Correction	Yes	Yes	No	No	Yes
Spatial Effeciency	12.5kHz (dual 6.25kHz slots)	12.5kHz (dual 6.25kHz slots)	6.25kHz	12.5kHz	6.25kHz/ 12.5kHz
Adopted World-wide Standard	Yes – public safety	Yes – commercial + amateur	Yes- amateur only	Yes – amateur only	Yes – limited (Icom&Kenwood)
Number of amateur repeaters in the USA	406	1,685	1,050	1,869	70

DMR has a whole new ‘lingo’

Term	Definition
Talk Group (TG)	A virtual radio channel, typically assigned by geography or language
Zone	A grouping of individual channels
Timeslot (TS)	A brief interval to which a DMR radio, especially a repeater, accepts data from another radio (two-30 ms. Timeslots)
Color Code (CC)	A number that is analogous to a PL tone used in analog FM
User ID	A unique number assigned to each radio in a DMR network
Code Plug	The software file with settings for a DMR radio

Talk Groups (TG)

- Talk Groups (TG) are a way for groups of users to share a time slot (one-to-many) without distracting and disrupting other users of the time slot
- It should be noted that only one talk group can be using a time slot at a time
- If your radio is not programmed to listen to a talk group, you will not hear that talk group's traffic

Zones

- User DMR radios support Zones, a Zone is just a grouping of individual channels
- Some model radios may limit the number of channels per Zone and the number of Zones allowed

Color Codes (CC)

- DMR repeaters use Color Codes (CC) much like analog repeaters use CTCSS or DCS
- To access a repeater you must program your radio to use the same CC as the repeater.
- There are 16 different CCs (CC0-CC15). The factory default is CC1
- The use of Color Codes is not optional on DMR systems
- If your Color Code is not set correctly, you will not be able to access the repeater
- The only real purpose of using different Color Codes is when multiple repeaters operating on the same frequency have overlapping coverage areas

Code Plugs

DMR

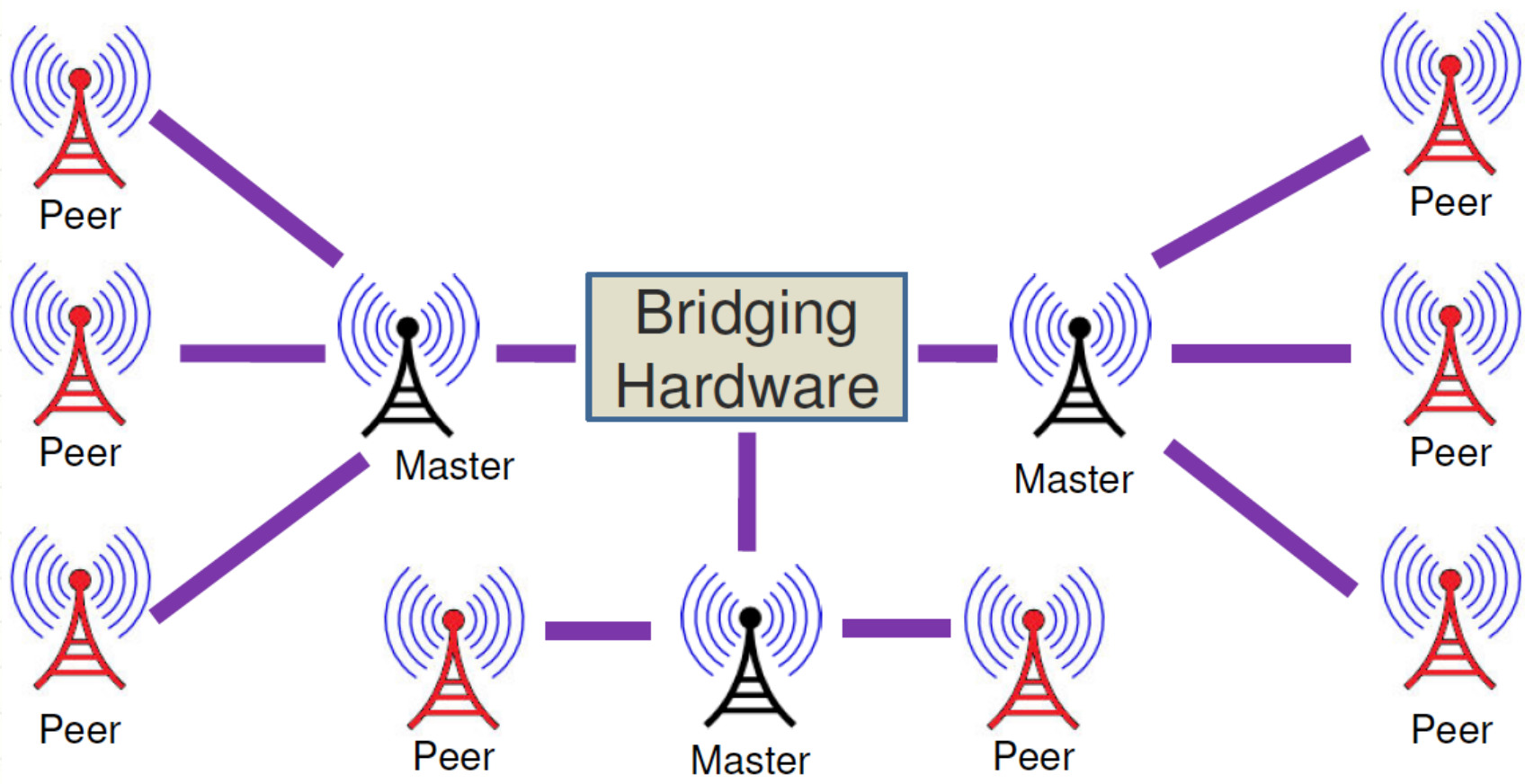
- A code plug is simply a radio's configuration file
- Using a manufacturer's programming software you configure the channels and operating parameters of a radio, this file is uploaded to the radio
- Building a code plug can be frustrating, but only if you do it randomly! Stay tuned….
- The code plug can also contain a Contact List of Radio IDs, call signs, and names to be displayed
- All DMR radios support a limited number of entries in the Contact List

I will provide samples of code plugs for some common DMR radios

All Amateur DMR Radios provide standard FM, as well as DMR!

- One radio (HT or mobile) provides for your current use, as well as allowing you to use DMR

Networking makes it all great!



CCAR DMR Strategy

- Charlestown DMR repeater
  - 440.200 MHz, +5, CC1
  - On the air for several years (as part of WR3IRS Interstate System)
  - Time Slot 2 (TS2) has three basic talk groups defined
    - TG9 ~ Local
    - TG26 ~ CCAR talk
    - TG9998 ~ “Parrot”
  - TS1 has a few talk groups defined
    - TG3142 ~ PA Statewide
    - TG8804 ~ Packrats
- Future repeaters planned
  - Pocopson
    - 445.08675 MHz, -5, CC1
  - Bucktown
    - 445.08125 MHz, -5, CC1
- All CCAR DMR repeaters will be networked together via the CCAR high-speed microwave backbone

Proper DMR Etiquette

- All radios must have a valid 7-digit DMR ID
  - Request from https://www.radioid.net/register#!
  - Do not make up one!
- Always use the most local talk group possible
  - You could be keying up (and tying up) hundreds of repeaters
- Always announce which repeater/talk group you are on when sending out a call
- If two or more operators are on the same repeater… always move to that local repeater channel (TG 9)

Well, that stuff looks cool, but how can I afford to get into it?

Best way is with an inexpensive H.T.

- Dual band (2m & 70cm)
- 3000 Memory Channels
- 5W transmit power
- Analog and DMR
- SMS (texting) (DMR)
- GPS

TYT

MD-UV380

Roll over image to zoom in

TYT MD-UV380 Dual Band Portable Handheld Radio W/GPS DMR/MotoTRBO (TDMA Tier I and Tier II) Amateur Radio (HAM)

by TYT

4.4 ★★★★☆ 23 ratings | 6 answered questions

Price: $115.99 prime & FREE Returns

Get $100 off instantly: Pay $15.99 ~~$115.99~~ upon approval for the Amazon Prime Rewards Visa Card. No annual fee.

- 1. IMPORTANT: Package include ONE Common 6.5'' Dual Band Antenna, HESENATE x TYT Handheld Transceiver Series, ONE YEAR U.S Based Warranty, Warehouse (Domestic Return) in CA State--No Further Return Issue.
- 2. Great LOW-COST option to get started with DMR Handheld Transceiver (HTs). FCC Part 90 Certified, Well Built with a Solid Feel, Superb Audio, Multi-coloured LCD Display, Handheld with Dual Mode Digital/Analog Transmit, TX Frequency: VHF 150-174MHz, UHF 450-480MHz, 5/1W Output Power, 1000 Channels.
- 3. Features: Updated Firmware/Software available for new Features; Remote Kill/Stun/Activate; Voice Prompt; Encryption Function; Built-in CTCSS/DCS; Priority Scan; Complying with Digital Protocol ETSI TS 102 361-1, -2, -3; Compatible with MotoTRBO Tier 1 & 2; DTMF decoding and encoding; Private Call, Group Call, All Call & Text Messages in Digital Mode.
- 4. Programming cable for easier Computer/PC (Microsoft Window 7/8/10 ONLY, No Mac supported) programming, Useful Tips on MIKLOR or FB Group, Free Driver/Firmware/Programming Software available on manufacturer TYT official website or Download at ❤️❤️【https://hnt.s3.us-east-2.amazonaws.com/UV380-390.zip】, Mess of video tutorials on YouTube (KEY: MD380Tools firmware & Codeplug from DMR-MARC site)
- 5. Package includes: TYT MD-UV380, 7.4 V 2000mAh Li-ion Battery Pack, Stubby 6.5" Antenna, Belt Clip, Adapter, Desktop Charger, Driver & Software CD, Programming Cable, User Manual

$115.99

prime & FREE Returns

FREE delivery: **Sunday, July 5**

Details

In Stock.

Qty: 1

Add to Cart

Buy Now

Secure transaction

Sold by Hesenate Radio US and Fulfilled by Amazon.

Add a Protection Plan:

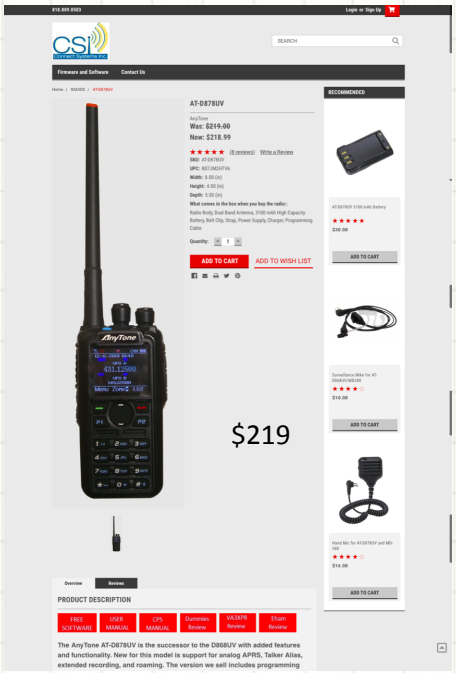
- 3 Year Electronics Protection Plan for $21.99
- 2 Year Electronics Protection Plan for $15.99

Add gift options

Deliver to James - West Chester 19380

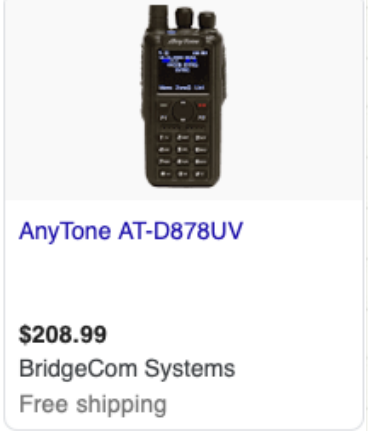
Add to List

Or…a little more expensive, but feature-rich, H.T.



- Dual band (2m & 70cm)
- 4000 Memory Channels
- 7W (2M) and 6W (70cm)
- Analog and DMR
- SMS (texting) (DMR)
- Analog APRS transmit
- GPS
- Optional Bluetooth (a little more $)

Anytone AT-D878UV



AnyTone AT-D878UV

$208.99
BridgeCom Systems
Free shipping

AnyTone AT-D878UV GPS Non-Bluetooth Version and 2 Free Items! Updated firmware Upgraded 3100mAh Battery Dual Band DMR/Analog 144 & 480 MHz Radio

by AnyTone

★★★★½ 76 ratings | 55 answered questions

Price: $208.39 & **FREE Shipping**

Get $70 off instantly: Pay $138.39 ~~$208.39~~ upon approval for the Amazon Prime Rewards Visa Card. No annual fee.

- To fully utilize all the features you have to use Windows PC to program this radio. Not Compatible with CHIRP and RT systems software. FCC Part 90 Certified, FCC ID: T4KD878UV
- New Features on AT-D878UV GPS version Roaming (Auto/Manual) Repeater Check (Out-of-range checking for repeater) Talker Alias (Send and Displays) Analog and DMR APRS Set channel name to yellow or white color Custom Standby background picture Compatible with 868 Codeplug

Anytone D878UV-BT ZAT-D878UV-BT

$239.00
GigaParts.com
Free shipping

There are also mobile radios

AT-D578UVIII BASIC

AnyTone

$299.00

- Tri-Band
- 50W VHF/45W UHF
- 4,000 Channels

$ 399.99

- AnyTone AT-D578UVPRO
- - $399.99
- GPS Antenna
- - $21
- BridgeCom AnyTone DMR Training
- - $97
- Total value - $517.99
- Your cost - $399.99

- Tri-Band
- 50W VHF/45W UHF
- 4,000 Channels
- GPS
- APRS
- Bluetooth

CS-800D Dual Band DMR & Analog

$349

- Dual-Band
- 45W
- 4,000 Channels
- Commercial Grade

Looks cool, but all that lingo stuff looks impossible!

- The number one question posed in on-line forums is: “Do you have a code plug for …”
- The number two question is: “How do I make my own code plug?”
- YouTube is full of tutorials
  - Some great…some good…some…bad
- Best advice, though, is…don’t just ask for one, get it, use it, and have no idea how it works… jump in and get your feet wet by rolling your own

It’s pretty simple, once you learn the basics

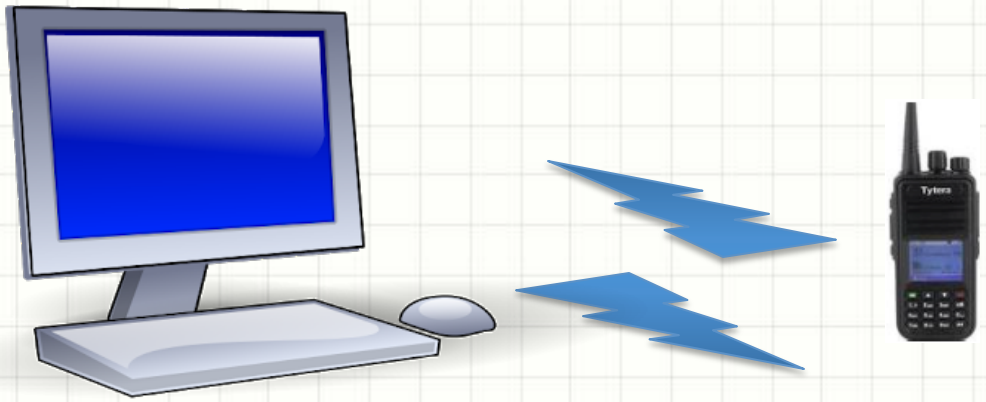
- Understand what each piece is used for
- Plan ahead for how you want things organized
- Follow a logical process to build up your code plug
- If it doesn’t work…don’t sweat it…it’s just a simple error, and can be easily fixed

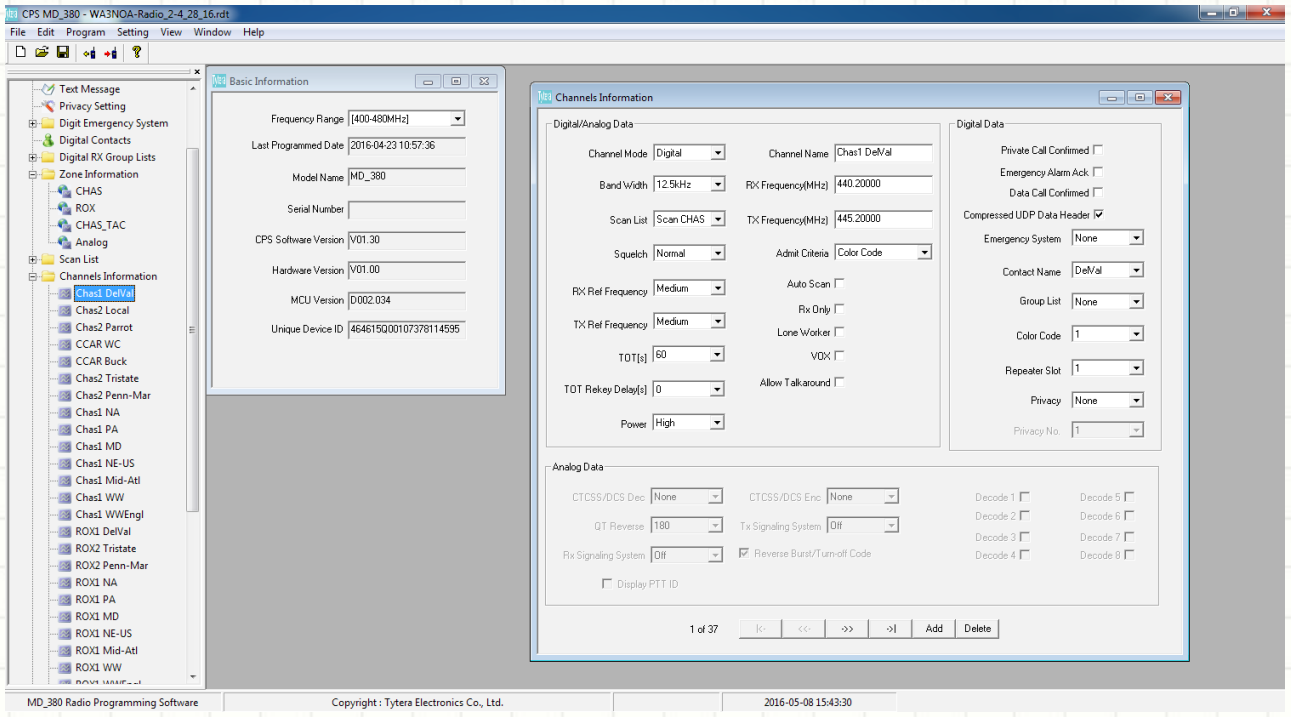
WA3NOA's Logical Approach to Building a Code Plug

1. Enter your Radio ID into the CPS (Code Plug Software)
2. List all of the talk groups you plan to use
    a. More can be added later, but spend some time getting most of them first
3. Enter those talk groups into the software
    a. Assign meaningful names to each talk group and enter the appropriate TG number
4. Create a list of each channel
    a. You need one channel per each 'unique' situation
        i. Repeater and talk group
        ii. Hotspot and talk group
5. Enter your channels into the software
    a. Assign meaningful names to each channel
        i. E.g Charles-CCAR, PiStar-EPA, etc.
6. Create a list of each zone you want to create
    a. I usually create a CCAR Analog, a CCAR Charlestown, a CCAR Pi-Star, etc.
7. Enter your zones into the software, and assign your channels to these zones

It’s best to show you…live

DMR





Questions?