Intro: Anytone DMR in PNW

North Bend ARES® Team

Jan 2020

DMR

DIGITAL MOBILE RADIO

Agenda:

- Overview of DMR and terminology
- Connecting your Anytone radio to your laptop
- Updating your Anytone radio firmware/base band/icons
- Preparing a Code Plug and writing to the radio
- How to use your Anytone radio
- Testing your radio and audio level
- First QSO, simplex & repeater
- Useful resources

Your Elmers Today…

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NBAT is an all-volunteer non-profit serving the City of North Bend during emergencies and public service events.

When all else fails…Amateur Radio

Digital Mobile Radio - DMR

- A method for modulating a Radio Frequency carrier with digital audio, text, and data information
- Information is formed into “packets” before modulation
- Analog voice is converted to its digital form before modulation
- Forward Error Correction (FEC) reduces lost info
- Only used in VHF/UHF bands (30MHz-1GHz)

Benefits of DMR

- Greater effective range of transceiver coverage
  - Forward Error Correction (FEC) allows receiver to recover lost information, even when near the noise floor
  - Finite digital modulation states easier to detect near noise floor
- Allows two simultaneous conversations
  - Two “slots” of information for the same RF carrier
- Wide regional/continental/planetary coverage
  - Designed for network linkage of repeaters & hotspots
  - Eg: PNW DMR linked repeater system
- Clear, clean speech audio reduces confusion
- Longer battery life

DMR is Exploding in Popularity

- 19 million commercial users worldwide, + hams
- More hams use DMR than D-STAR+Fusion combined
- Gaining adoption in EmComm
- Fastest growing Amateur Radio digital voice mode
  - Fueled by inexpensive radios from Anytone, Radioddity, Baofeng, TYT, Retivis, Alinco, Connect Systems, etc
  - Motorola radio conversions for ham use
  - Less expensive repeater equipment

Anytone D878UV Handheld Transceiver (HT)

- Does BOTH analog FM and DMR
  - One radio works with old world and new world
- Global Positioning System (GPS) and Automatic Packet Radio System (APRS) built-in
  - For geographic location reporting/mapping
- BlueTooth built-in
  - Hands-free while driving, using earbud/headset+mic, PTT
- Info-rich color display displays QSO CallSigns
- Stores thousands of repeaters, Talk Groups, CallSigns
- Scanning, Roaming, and more

Simplex vs Repeater

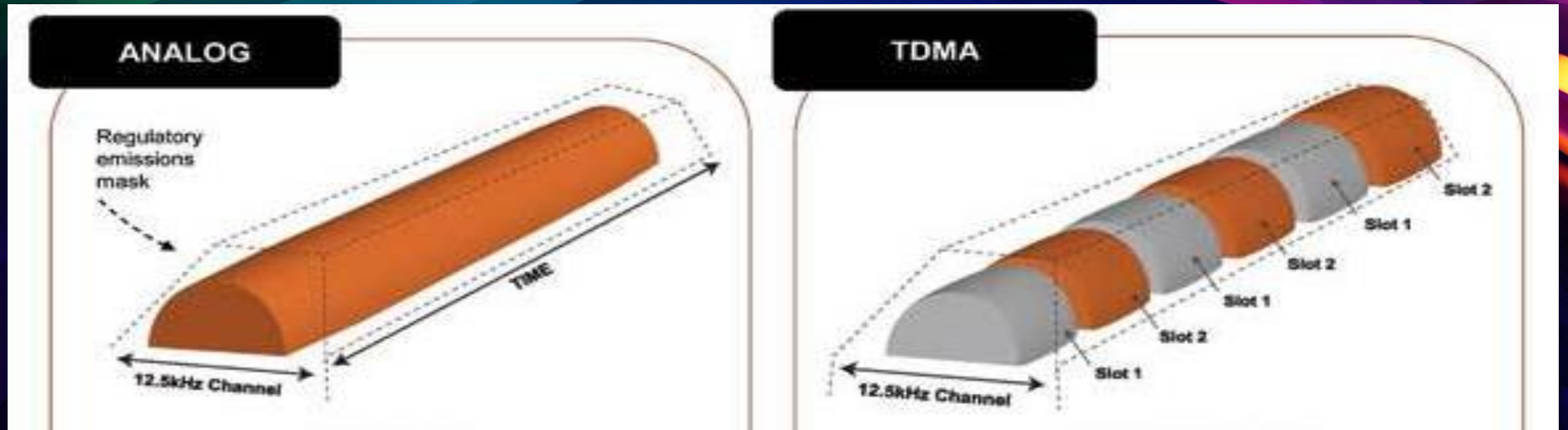
- DMR can be used for simplex communications
  - Ie, direct transmissions between user radios
  - Low power and low elevation of HTs limit coverage range
  - Simplex is valuable fallback when repeater is busy or down
- DMR can be used with repeaters
  - Ie, transmissions between users and an intermediary relay radio
  - Repeater's higher power, higher gain antenna, and higher elevation significantly expands coverage range
  - Linking repeaters expands coverage range further

PNW DMR Linked Repeater Network

- 49 repeaters as of Dec 2019
  - +10 SAR repeaters in OR with restricted usage policy
- Link network is IP (TCP/UDP)
  - Public Internet and HamWan
- Bridges to other repeater networks across the USA and global international
- Managed by a private group of volunteers in WA
  - Email: admin@pnwdigital.net
  - Web: pnwdigital.net ; DMR.groups.io/PNW

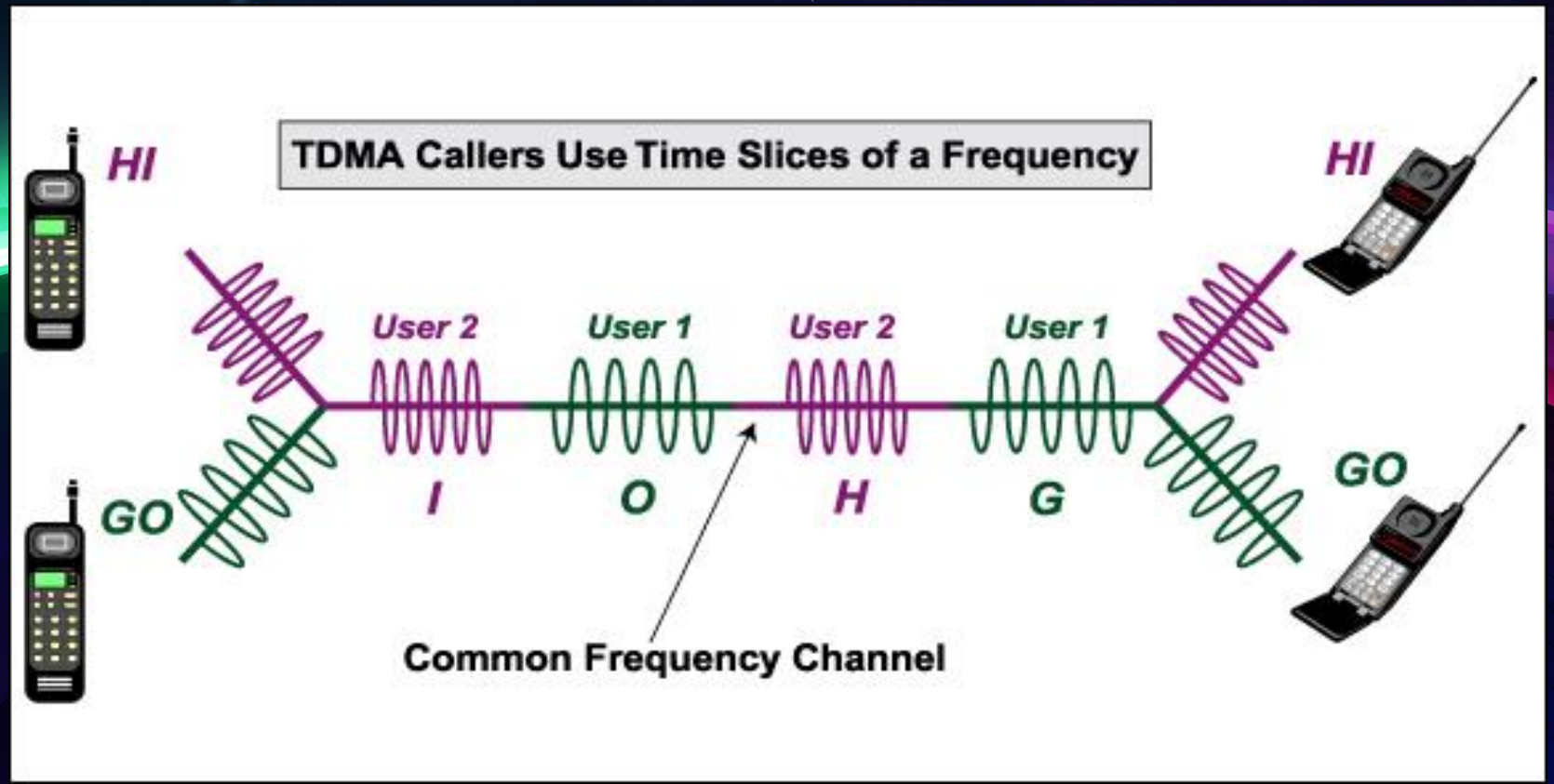
DMR TDMA

- 12.5KHz wide “narrow band” frequency channels
- 4-state Frequency Shift Keying (FSK) RF modulation
  - 4 states enable digital codes to be sent at abt 9600bps
- Two 30ms Time Slots for information packets
  - Nets abt 7200bps = 3600Hz analog audio bandwidth



Two Conversations on One Repeater Channel

- Tx 1 “User 1” reaching Rx 1 via Time Slot 1 (TS1)
- Tx 2 “User 2” reaching Rx 2 via Time Slot 2 (TS2)



DMR Repeater Talk Groups

- A Talk Group is assigned has a unique ID number, and is assigned to a Time Slot
  - “Local 1” (ID 3181) is on TS1; “Local 2” (ID 3166) is on TS2 (in PNW)
  - “Wash 1” (ID 103153) is on TS1; “Cascades East” (ID 3191) in on TS2
- Each end of a conversation needs to be on the same Talk Group
- Talk Groups are used for selecting an AREA of coverage via linked repeaters
- Repeater owners decide what Talk Groups they support

PNW DMR linked repeater Talk Groups

- List of Talk Groups & coverage descriptions:
  - http://pnwdigital.net/talkgroups/index.html
- List of Repeaters & their “heat map” coverage:
  - http://www.pnwdigital.net/repeaters.html
- Matrix of Repeaters & their supported Talk Groups:
  - http://pnwdigital.net/matrix.html

Zones: User Convenience Option

- "Zones" = A collection of desired "Channels"
  - A way to whittle down a lot of Channels to only those the user desires to browse through and select during operation
- Entirely customizable by the user in CPS
- Can be organized in flexible ways:
  - A DMR repeater containing a Channel for each Talk Group
  - A set of analog Channels for repeaters, simplex, etc
  - A Talk Group, with a Channel for each nearby repeater supporting it
  - Any combination of analog, DMR, receive-only Channels

What is a Code Plug?

- "Code Plug" = configuration file for a radio
  - Radio's internal computer accesses it during operation
  - Typically prepared on a laptop/desktop computer and written to the radio via cable connection
- Contains:
  - Functional settings for the radio (keys, display, volume, etc)
  - List of Channels (frequencies & parms for simplex & repeaters)
  - List of Talk Groups
  - List of Zones
  - List of callsigns vs DMR IDs

Today: Anytone D878/868 Preparation & Test

1. Connecting radio to Windows laptop computer
2. Installing Customer Programming Software (CPS)
3. Updating radio Firmware, Base Band, Icons
4. Creating the “CodePlug” in CPS
5. Downloading & Importing Digital Contact List
6. Configuring radio settings
7. Writing the CodePlug to the radio
8. Learning/testing radio operation (simplex & repeater)
9. Helpful resources & Nets

Anytone D878UV Plus Preparation

- MUCH easier to configure using the Customer Programming Software (CPS)
  - Channels = Repeaters + Talk Groups
  - Zones = grouping of user selected Channels
  - Contact Lists = CallSign database
  - Scan lists
  - Roaming lists
  - Other functional settings
- Basic Firmware, Base Band, Icons are updated frequently
  - Improved functionality & quality

Anytone CPS requirements

- Windows 10 OS laptop
- Anytone programming cable (in radio box)
- Anytone USB driver, CPS, Firmware, JSON-to-CSV tool, etc (software download or in radio box)

Let's Get Started!

1. Install CPS
2. Connect radio to USB port on laptop
3. Check Device Manager for "Ports" -> "GD32 Virtual Com Port" and note COM port number
4. Follow Firmware update procedure document

CodePlug Options

- Create your own from scratch
  - Programming documentation & help is thin
  - May take a long time, but you'll learn a lot
- Download "stock PNW" codeplug for your radio
  - You must join PNW DMR Digital at:
  - https://dmr.groups.io/g/PNW
- Use some other Anytone radio owner's
  - Groups can collaborate on a "standard" for their use

Let's Get Started!

- Open starting codeplug (.rdt) file in CPS
- Enter your callsign & DMR radio ID number
- Customize Power-On (name, phone)
- Review other settings
- Save your codeplug file on your laptop!

Updating the Digital Contact List

- For USA: https://www.RadioID.net/
  - Same place you got your DMR radio ID number
  - At top menu bar: “Database” -> “Database Dump Files” -> right-click to download “users.json”
  - Convert the JSON file to CSV
- In CPS: “Tool” -> “Import” -> “Digital Contact List”, select the CSV file you just created
- Save your codeplug file!
- Write to the radio (make sure “Set” -> “Set COM” has proper COM port HI-LITED via click)

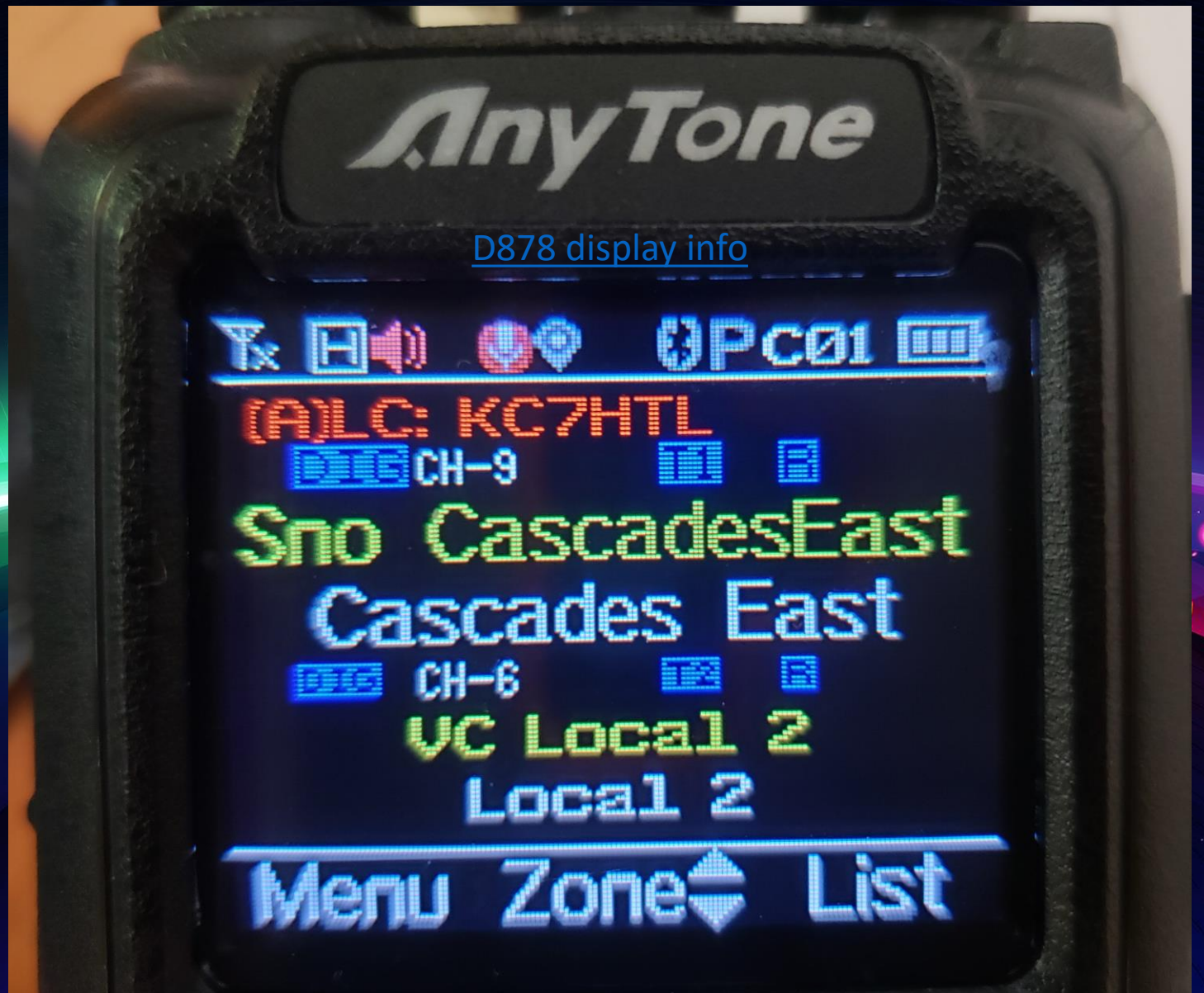
First Contacts

1. Select closest DMR repeater
   - Select a Zone that has the desired repeater Channels
2. Select the “Parrot” Talk Group Channel
3. Ker-chunk (momentary PTT) to activate the TG on the repeater
   - Hear confirmation tone
4. PTT: Tx a short message (callsign and say “Parrot”)
5. Listen for playback of your message
6. Check audio level: http://www.w7ncx.com/levels.php
7. Check radio signal: http://44.12.9.10:42420/MinimalNetwatch?filter=PNW

Proper DMR operation protocol

- Announce what Talk Group you are on when first calling, and when Clearing
  - Examp: “This is W9SK on Wash 2, looking for a radio check”
  - Examp: “N7ROO, this is W9SK on Local 2”
  - Even if Digital Monitor is on, no one will know what TG to speak to you on if you do not announce it.
- Wait a couple seconds after the other party stops Tx before you press PTT, and a couple seconds after you push your PTT before speaking
  - Alert Tones help guide you

Anytone D878UV Display (sample)



Let's Get Started!

- Select "Local 2" TG on your closest repeater
  - "Local" TGs are not linked to other repeaters, thus are ONLY heard in local repeater coverage area
  - Call for another ham (announce your TG when you call)
- Select "TAC 2" TG on your closest repeater
  - This is an example of a PTT (Part Time Talkgroup), requiring PTT "ker-chunk" to activate
  - Wait for confirmation alert before Tx
  - Call for another hame (announce your TG when you call)

DMR Simplex Ad Hoc Setup

- Ad hoc via Anytone radio front panel:
  1. Switch from memory to VFO Mode (push proper button)
  2. Enter 8 digit frequency with number pad (avoid conflicts)
  3. Menu -> Settings -> Chan Set -> Channel Type -> D-Digital (or A-Analog)
  4. Menu -> Settings -> Chan Set -> Channel Type -> DMR Mode -> Simplex
  5. *Optional:* Color Code 1, Simplex 99 TG, etc

Above is for Temporary (ad hoc) use in the field; for permanent programming, use CPS to create the simplex Channel and write codeplug to radio.

DMR Simplex CPS Setup

- Recommended: Create Channel with frequency and Simplex 99 Talk Group
  - Simplex 99 (DMR ID 99), CC1, is DMR simplex standard (“Simplex 99” TG is in PNW stock code plug)
  - Time Slot 1 recommended to assure compatibility with other brand DMR radios
  - Color Code 1

Go Forth and Multiply QSOs!

- Participate for practice on a DMR Net:
  - Not-a-Net-Gathering: Wed 1900-2000PT on Wash 2
  - Coffee Nets: M/W/F 0800PT on Cascades East
  - DMR EmComm Net: Sun 1830PT on PNW Reg 2
  - BayNet (CA): Thu 2000-2100PT on Net 2
- For EmComm:
  - monitor Local 2 TG (local repeater only)
  - “Digi Monitor Double Slot” monitors both TS
  - Participate in a Local emcomm group DMR checkin Net
  - Avoid repeater & simplex conflicts with other groups

Be Aware

- DMR is susceptable to multi-path degradation (eg, urban buildings)
- When traveling:
  - TGs may not use the same TS between repeaters outside PNW
  - “Roaming” in Anytone 868/878 is not reliable currently
- RadioID.net database updated daily with new DMR hams
- Anytone radio firmware/CPS updates 2mos average
- RF Power Amplifiers have to be made for DMR…and they are very rare
- Higher gain antenna is the best Rx and Tx improvement you can make
- Anytone D578UV radio provides more power, for vehicle or home base station
- Analog APRS location tracking is a benefit for EmComm, SAR, and hiking/skiing

Q&A…Feedback…Back for More?

- NBAT does frequent special workshops/training in North Bend
  - Eg: APRS configuration and use: 25 Jan 2020, North Bend Umpqua Bank
- Consider incorporating DMR practice into your emcomm team group
  - SETs (eg, 5th Saturday SETs)
  - Windshield Survey (mobile)
  - Formal messaging (ICS213) via radio relay
  - Add a DMR Net in addition to your regular FM analog net