DMR OPERATING BASICS & BEST PRACTICES

KØNGA MIKE

ROCKY MOUNTAIN HAM RADIO

MIKE'S DMR DOCTRINE

DMR was created for commercial use.

It was never designed nor intended for Amateur Radio use.

Some things about DMR are not going to make sense.

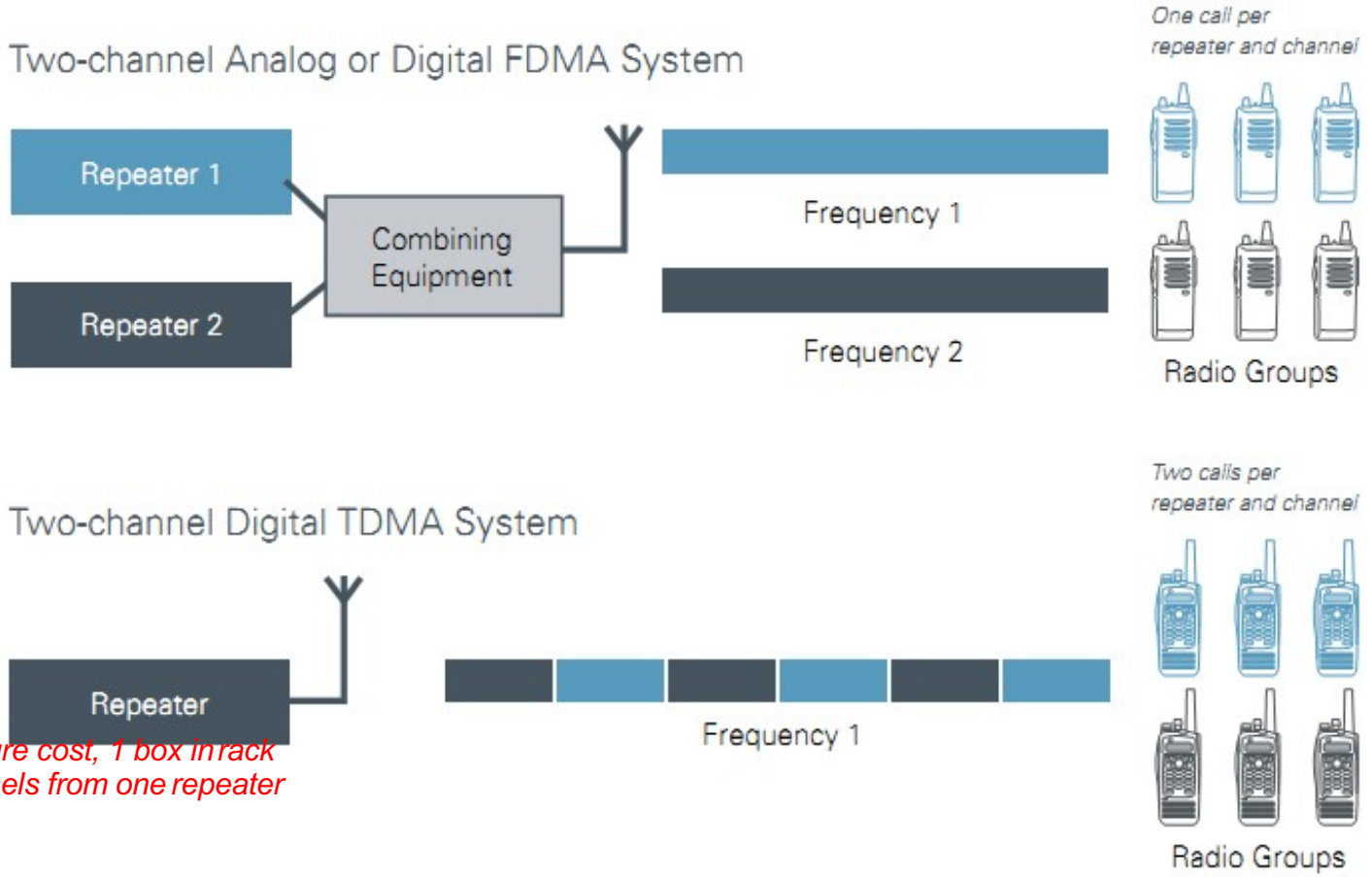
Accept this. It will make your life easier.

WHAT IS DMR/TRBO?

- DMR (Digital Mobile Radio) is an international commercial digital radio standard that originated in Europe
- TRBO refers to MotoTRBO which is Motorola's implementation of the DMR standard
- Many Amateur Radio repeater networks use MotoTRBO equipment, which is why they are commonly referred to as "TRBO" networks
- You do not need to use a Motorola MotoTRBO radio to use these networks

TWO REPEATERS IN ONE!

TDMA saves licensing and equipment costs by enabling the equivalent of two 6.25 kHz channels within a single licensed 12.5 kHz channel



Lower infrastructure cost, 1 box in rack
TWO voice channels from one repeater

NEW CONCEPTS

- Frequency Pair – not new
- Color Code – Functions similar to a CTCSS or DCS access tone
- Repeater Slot – Each DMR Repeater has two, you must specify which one to use
- Talk Group – Each repeater slot can be logically segmented further into talk groups
- Receive Group – List of talk groups to monitor on the channel's assigned repeater slot

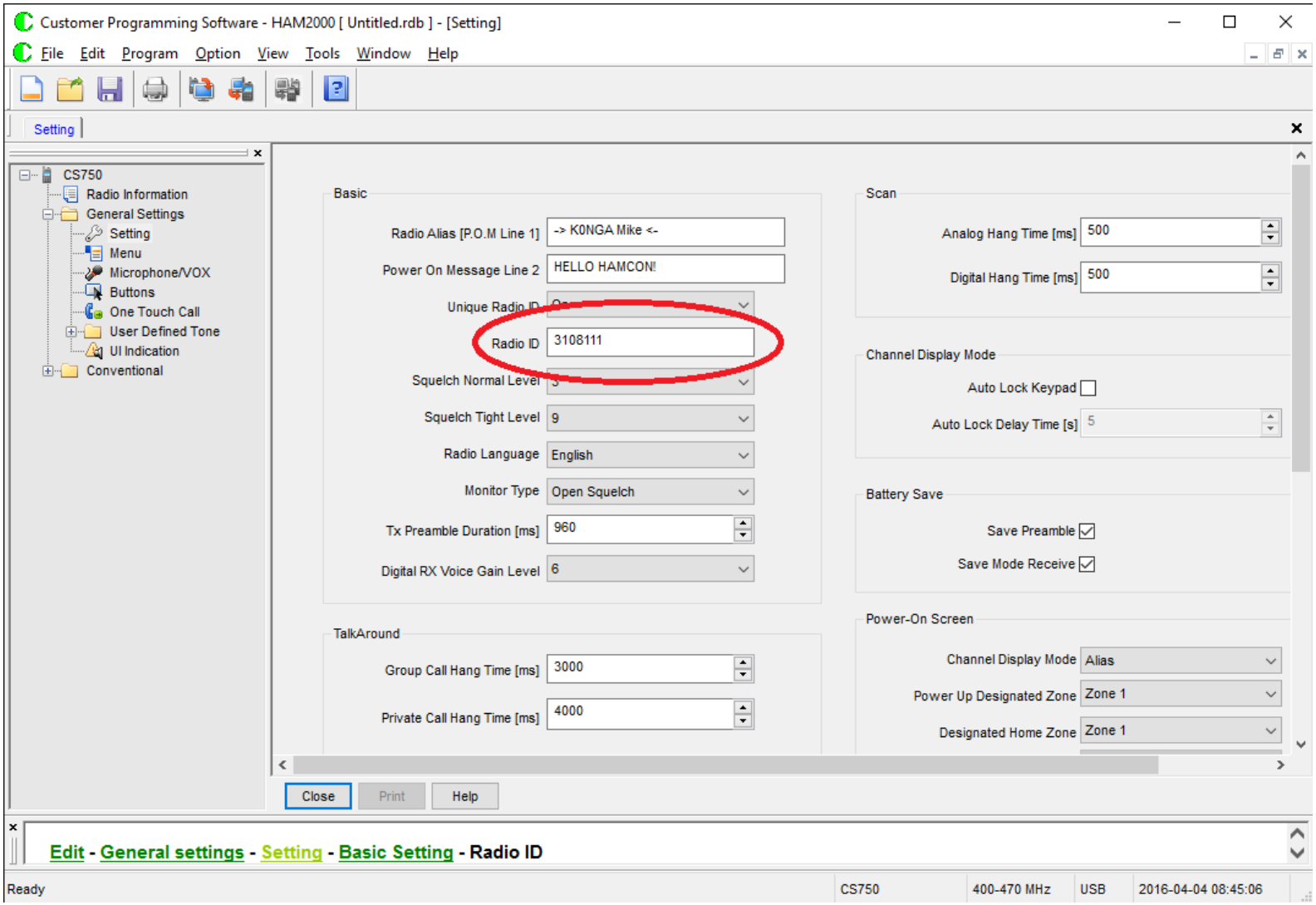
GET A RADIO

- You must have a Tier 2 DMR Radio (very common)
- You get what you pay for
  - Low cost radios on the market are not created equal
  - Ask around about user experience
  - Check the radio list at rmham.org
- Feature sets can vary widely among manufacturers
- Choice of radio is mainly a matter of what is important to you. I'm a contact list junkie.
- Recommendation: Get a radio that has a sample codeplug available, or is supported by the N0GSG utility.

GET A RADIO ID

- https://www.radioid.net/ -> Register ID -> User Registration (at the bottom of the page)
- Everything works best when each radio has a unique ID
- Put your Radio ID in the codeplug and upload to the radio
- Radio ID is NOT a replacement for ID'ing. You must still ID vocally every 10 minutes per FCC regulations.

RADIO ID


Customer Programming Software - HAM2000 [Untitled.rdb] - [Setting]
File Edit Program Option View Tools Window Help
Setting
CS750
Radio Information
General Settings
Setting
Menu
Microphone/VOX
Buttons
One Touch Call
User Defined Tone
UI Indication
Conventional
Basic
Radio Alias [P.O.M Line 1] -> K0NGA Mike <-
Power On Message Line 2 HELLO HAMCON!
Unique Radio ID
Radio ID 3108111
Squelch Normal Level
Squelch Tight Level 9
Radio Language English
Monitor Type Open Squelch
Tx Preamble Duration [ms] 960
Digital RX Voice Gain Level 6
TalkAround
Group Call Hang Time [ms] 3000
Private Call Hang Time [ms] 4000
Scan
Analog Hang Time [ms] 500
Digital Hang Time [ms] 500
Channel Display Mode
Auto Lock Keypad
Auto Lock Delay Time [s] 5
Battery Save
Save Preamble
Save Mode Receive
Power-On Screen
Channel Display Mode Alias
Power Up Designated Zone Zone 1
Designated Home Zone Zone 1
Close Print Help
Edit - General settings - Setting - Basic Setting - Radio ID
Ready CS750 400-470 MHz USB 2016-04-04 08:45:06

LEVERAGE THE SAMPLE CODEPLUGS

- Available on the RMHAM Website
  - www.rmham.org
  - MotoTRBO/DMR -> Sample Codeplugs
- All RMHAM TRBO repeaters programmed in
- Quickest way to get on the air
- Use as a foundation for your own codeplug
- Use as a starting point for the N0GSG utility

TALK GROUPS AND REPEATER SLOTS

- Each repeater has 2 repeater slots (time slots)
- Each slot can handle 1 conversation at a time. Thus, each repeater can handle 2 simultaneous separate conversations
- Some networks allow multiple talk groups on the same repeater slot
- Only one talk group can be transmitting at a time on a single repeater slot
- It may be necessary to monitor the other talk groups on a repeater slot to determine if the slot is free to operate on

ID YOUR TALK GROUP

- When calling, identify which talk group you are transmitting on.
- "This is K-0-N-G-A on Rocky Mountain"
- Many Hams scan various channels and may want or need to turn scan off and tune to your channel to respond.
- If you don't ID the talk group, the responding ham may not know which channel to tune to.

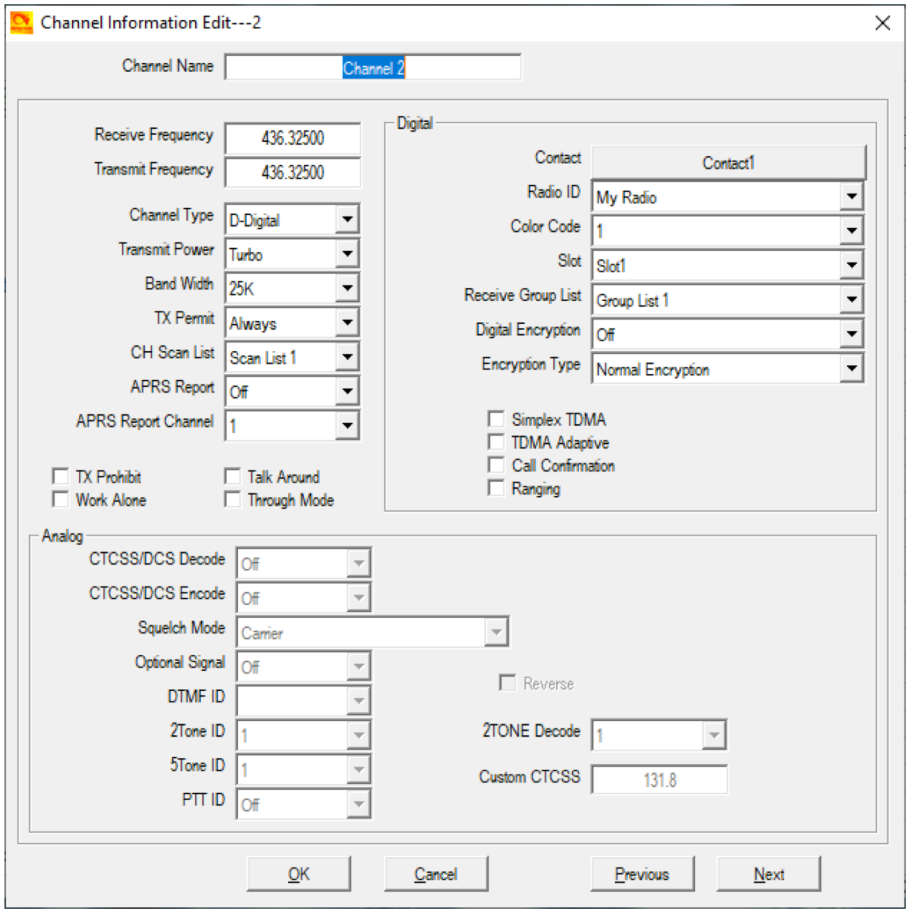
DMR PROGRAMMING

"To experience true DMR freedom, you must learn to program your radio yourself." -Me, constantly

BASIC PROGRAMMING CONCEPTS

- In order to program a DMR radio for repeaters, you must know:
  - Repeater frequencies
  - Repeater Color Code
  - Desired Talk Group
  - The Repeater Slot that Talk Group is on

CHANNEL EXAMPLE



COLOR CODE

- DMR repeaters use a Color Code as the first access point after the receive frequency
- Color Codes are designed to allow two repeaters with the same frequency to operate effectively if they are relatively close to each other
- You must know the Color Code of the repeater in order to successfully use the repeater

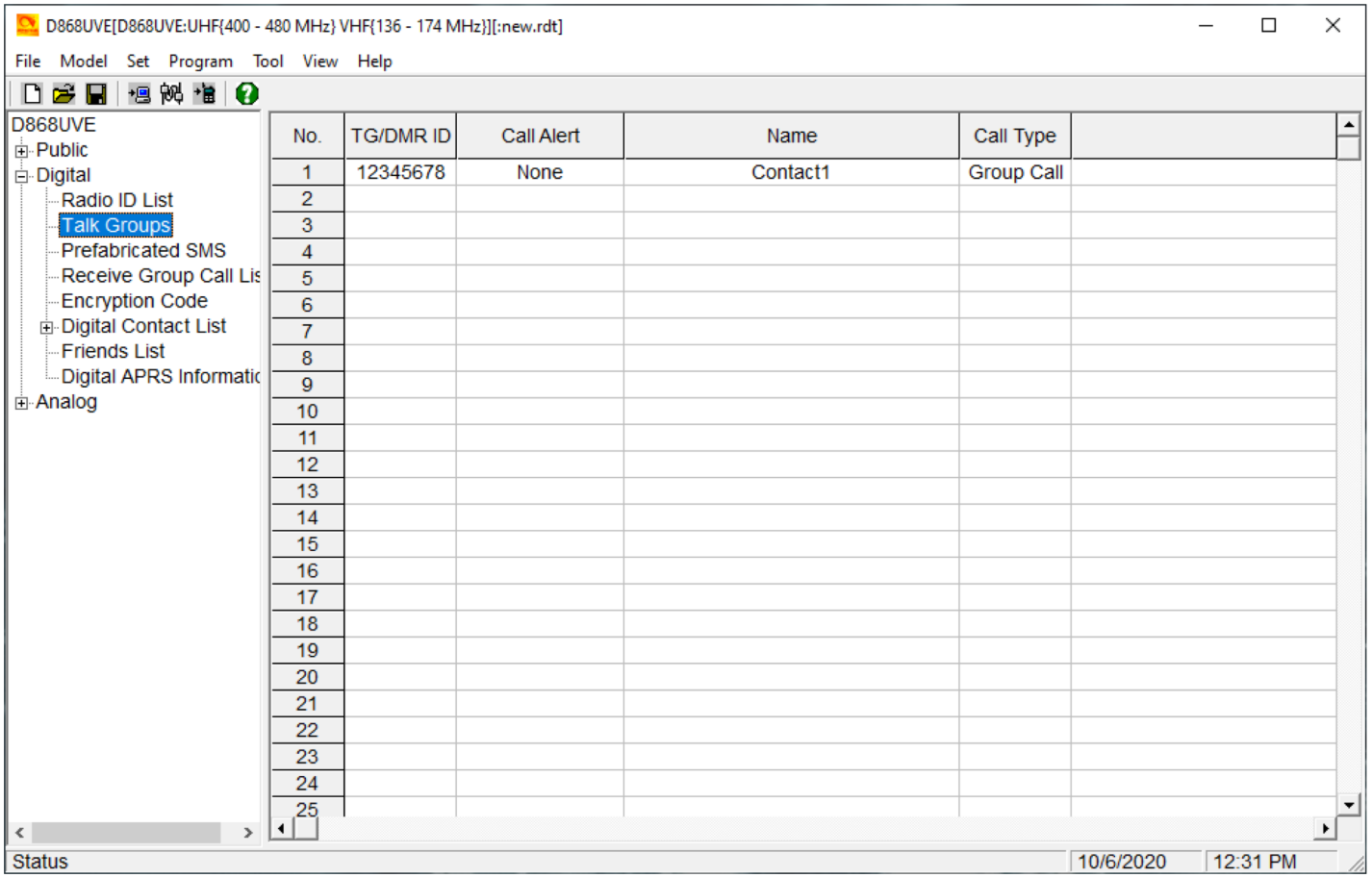
CONTACT LIST

- DMR radios use a Contact List for:
  - Private Call (used for Radio IDs)
  - Talk Groups (required for most repeaters)
  - All Call (often used for simplex)
- Radios with displays will show the Radio ID of person who is transmitting
- If you have the Radio ID in your radio's Contact List, the contact name or tag will display instead of the Radio ID
- Typical contact names include call sign and name

TALK GROUPS

- Access Control (analogous to tones on analog radios) is accomplished with Talk Groups
- If a repeater uses Talk Groups, you must know which Talk Groups the repeater uses in order to use the repeater with your radio
- Talk Groups are assigned to a Repeater Slot in a repeater
- More than one Talk Group can be assigned to a single Repeater Slot, but only one Talk Group can use the slot at any given time

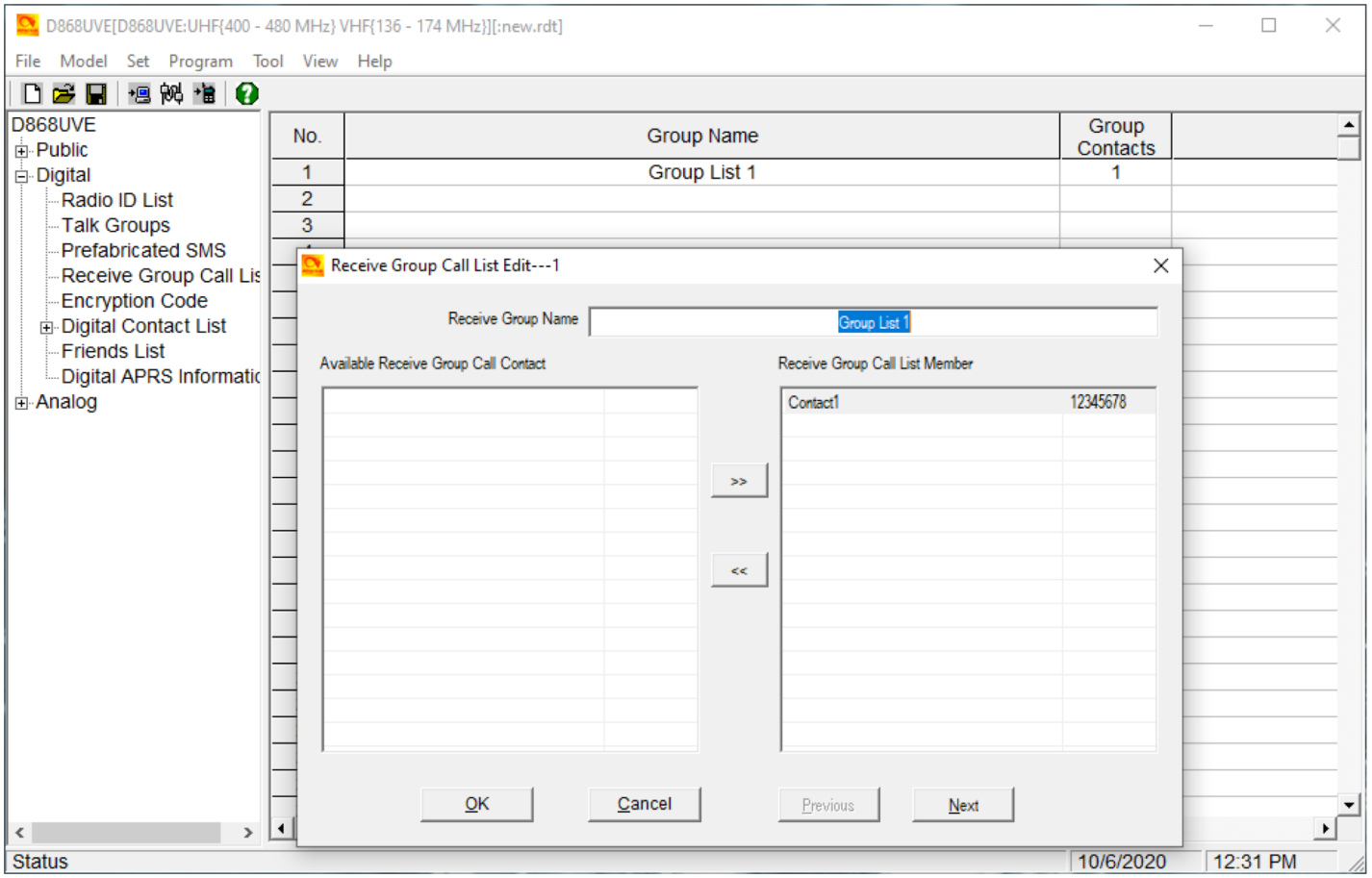
CONTACT LIST EXAMPLE



RECEIVE GROUPS

- Receive Groups are how DMR radios use Talk Groups when receiving signals
- Talk Groups are assigned to Receive Groups. Receive Groups are assigned to the receive frequency on the channel in your radio.
- More than one Talk Group can be assigned to a Receive Group
  - Recommended when a repeater slot offers more than on talk group
  - Can cause confusion when scanning
- Remember Mike's DMR Doctrine

RECEIVE GROUP EXAMPLE



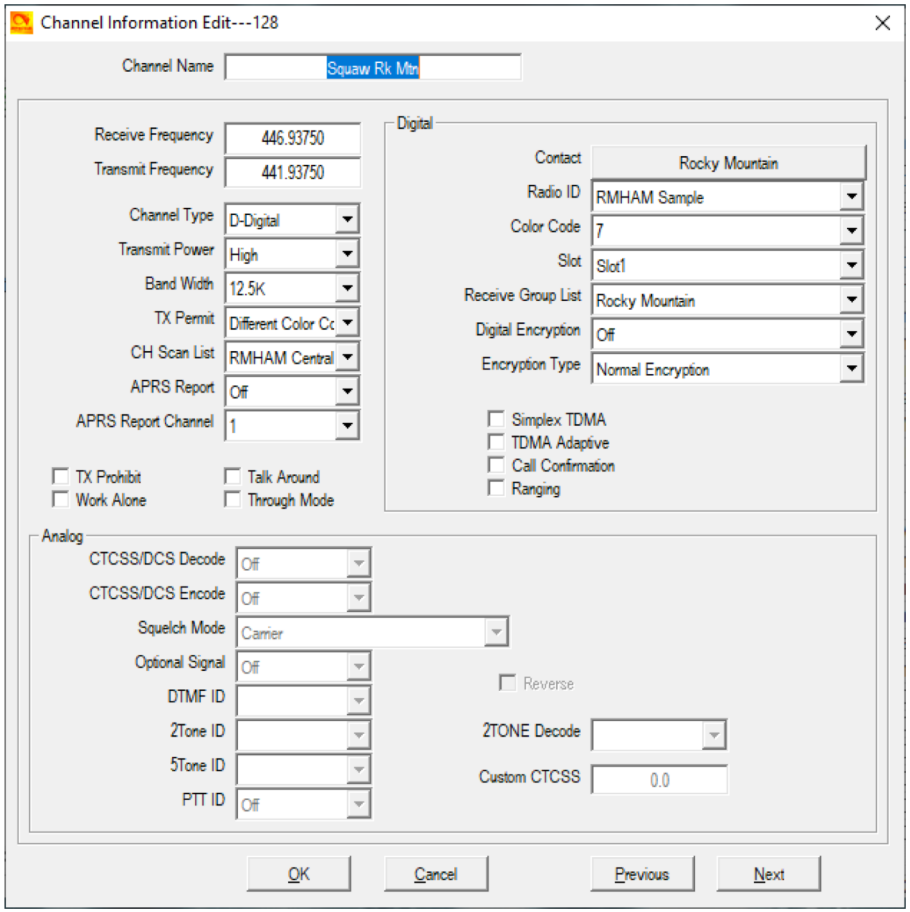
REPEATER SLOTS

- DMR repeaters have 2 "time slots" that share a frequency, allowing for two separate, simultaneous conversations
- This means one repeater can do the work of two while using less bandwidth than a single analog repeater
- You must know which Repeater Slot you wish to use in order to set up your radio (more on this later)

EXAMPLE CHANNELS

Channel	Color Code	Time Slot	Receive Frequency	Transmit Frequency	Talk Group
Squaw Rky Mtn	7	Slot 1	446.9375	441.9375	Rocky Mountain
Squaw Central	7	Slot 2	446.9375	441.9375	Central
Lee Hill WW	1	Slot 1	445.05	440.05	DMR MARC WW
Lee Hill WW Eng	1	Slot 1	445.05	440.05	DMR MARC WW Eng
Lee Hill NA	1	Slot 1	445.05	440.05	DMR MARC NA
Lee Hill LCL	1	Slot 2	445.05	440.05	DMR MARC LCL
Lee Hill MTN	1	Slot 2	445.05	440.05	DMR MARC MTN

EXAMPLE CHANNEL - RMHAM



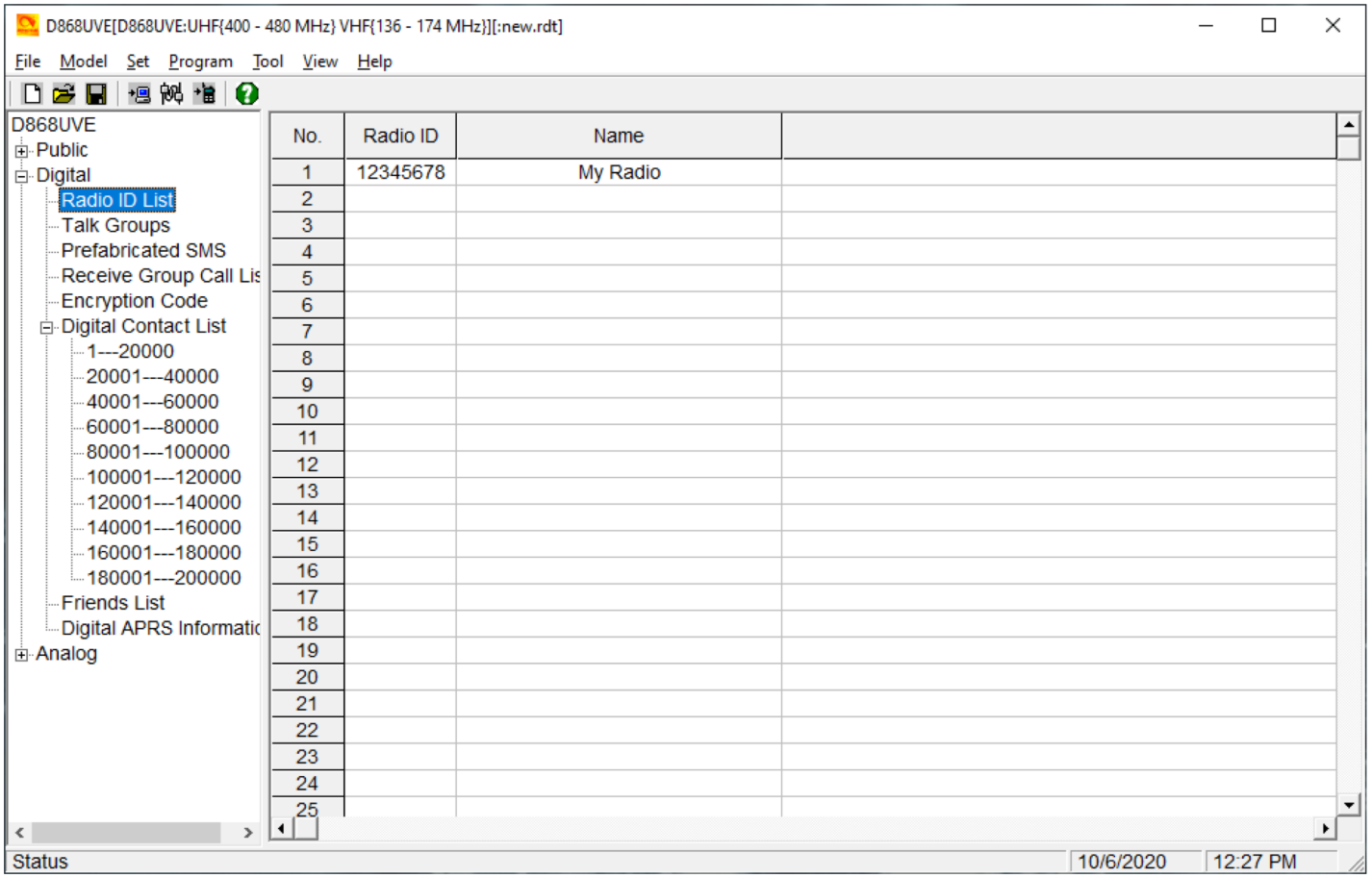
ADMIT CRITERIA

- Used to prevent transmit when a frequency is in use
- For Digital Channels, use "Color Code"
- For Analog Channels, do not use admit controls.
- Prevents "doubling" or transmitting at the same time without knowing
- Default settings in sample codeplugs

RADIO ID

- Identifies the radio to the DMR Repeater
- Each Radio's ID should be unique on the repeater/network
- Not a replacement for Call Sign
- Required for operation with the repeater

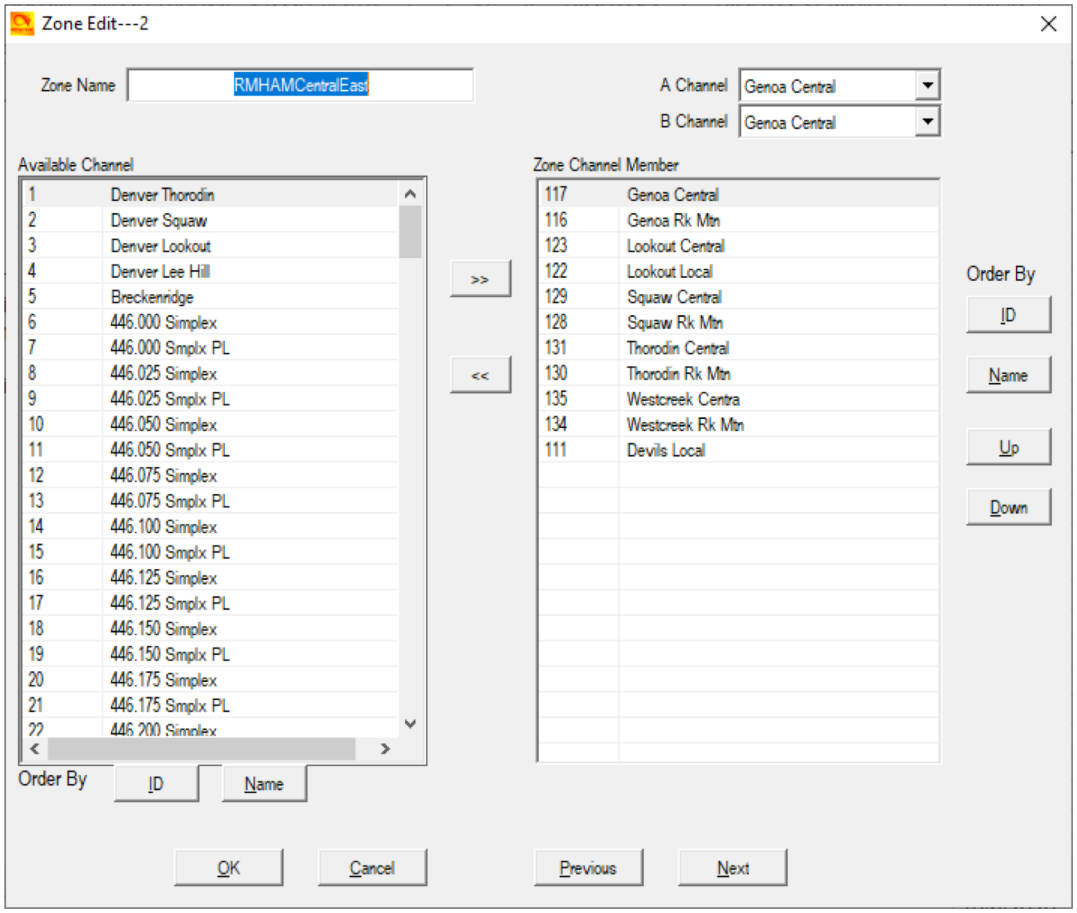
RADIO ID


D868UVE[D868UVE:UHF{400 - 480 MHz} VHF{136 - 174 MHz}][:new.rdt]
File Model Set Program Tool View Help
D868UVE
Public
Digital
Radio ID List
Talk Groups
Prefabricated SMS
Receive Group Call Lis
Encryption Code
Digital Contact List
1---20000
20001---40000
40001---60000
60001---80000
80001---100000
100001---120000
120001---140000
140001---160000
160001---180000
180001---200000
Friends List
Digital APRS Informatic
Analog
No.
Radio ID
Name
1
12345678
My Radio
Status
10/6/2020
12:27 PM

ZONES

- Channels are assigned to Zones
- Only one (1) Zone can be in use at a time
- On HTs, corresponds with channel selection dial
- Radios can have numerous zones
- Channels can be a member of more than one Zone

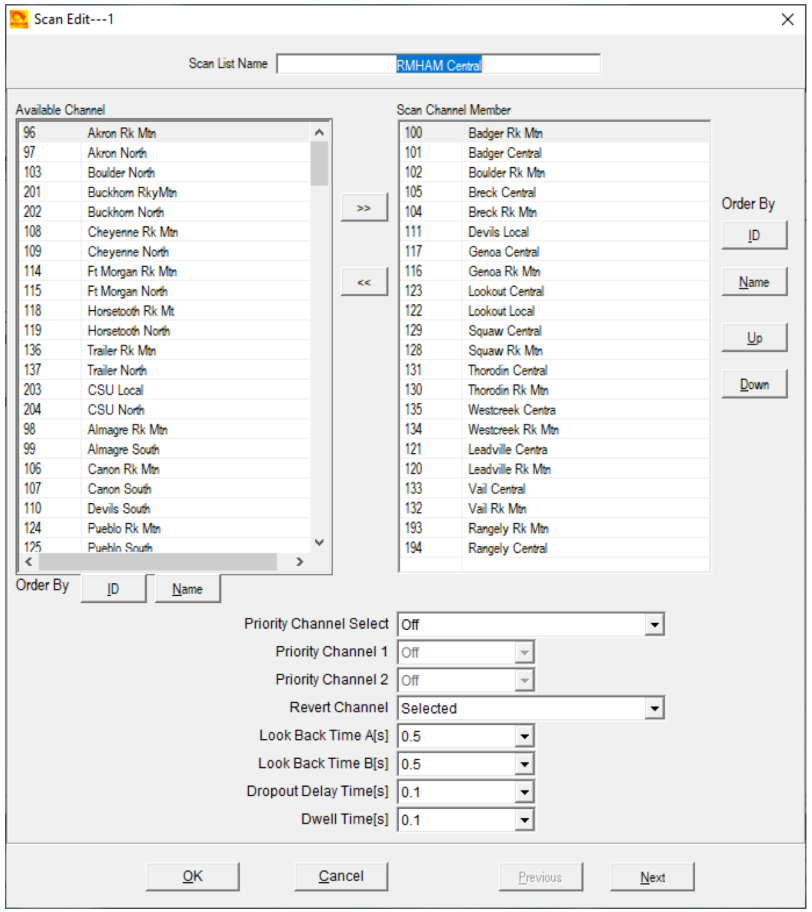
ZONE EXAMPLE



SCAN LIST

- Named list of channels grouped together
- List is assigned to a channel
- When that channel is activated, the list assigned to that channel will be scanned
- Lists can contain digital and analog channels
- Some radios have advanced scan list settings

SCAN LIST EXAMPLE



REPEATER NETWORKS

One of these things is not like the other…

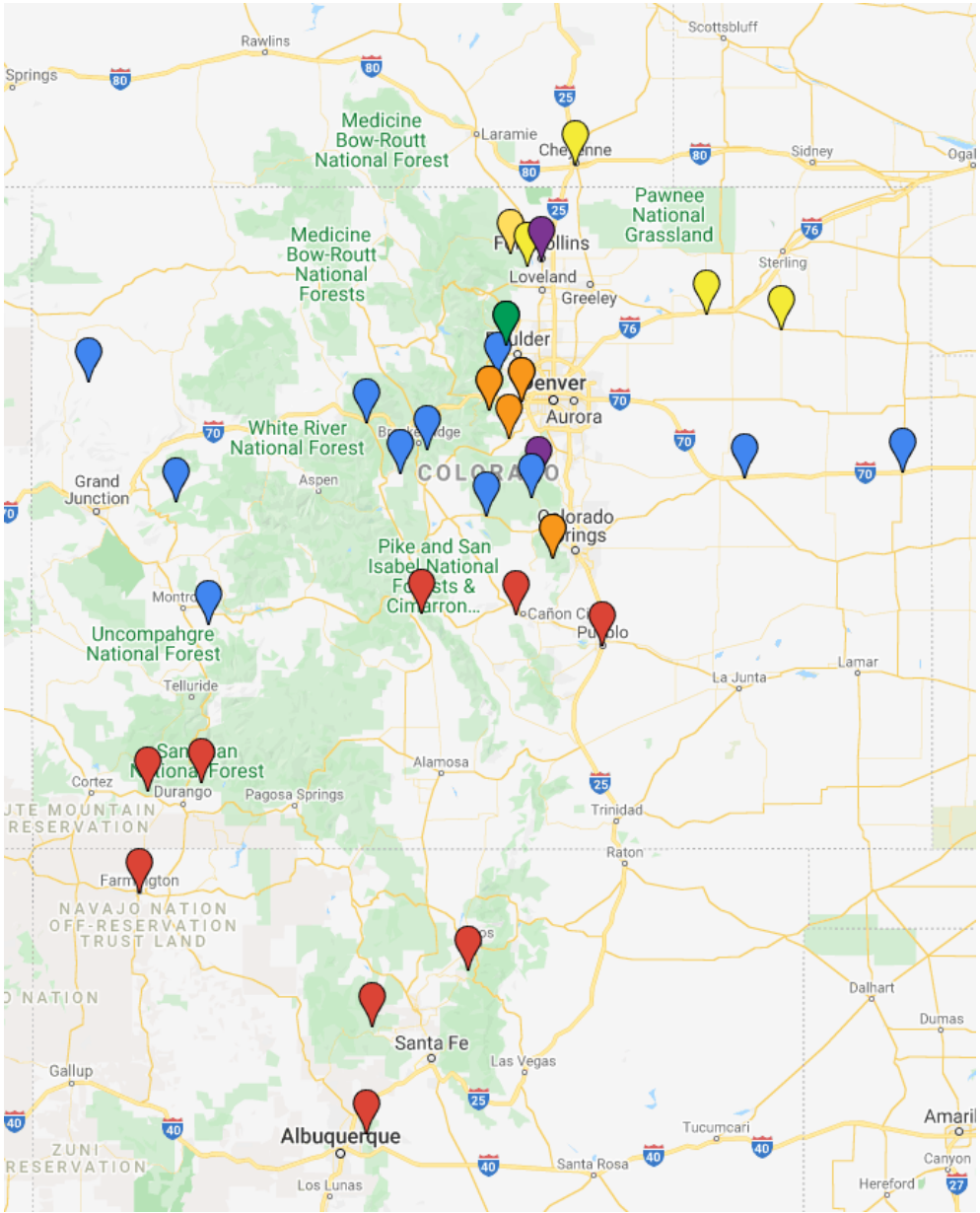
WHAT IS A REPEATER NETWORK

- A repeater network is comprised of two or more repeaters connected together in such a way that when one repeater receives a transmission, it is broadcast by the other connected repeaters.

KNOW YOUR NETWORK

- Network: A collection of repeaters linked together to achieve a larger area of coverage
- Three most well-known networks in Colorado:
  - Rocky Mountain Ham Radio (RMHAM)
  - DMR-MARC
  - Brandmeister
- Each network works a little differently in how the repeaters interact with each other
- Read up on each network's website
- Know the difference between static and dynamic (user-activated) talk groups

RMHAM DMR MAP



RMHAM DMR NETWORK

- Five Original Talk Groups: Rocky Mountain (wide), North, South, Central, and Lookout Local
- Newer Talk Groups: Other "Local" TGs, Eastern (mostly VHF today), Four Corners, New Mexico
- Use the smallest area coverage talk group necessary for contact
- For example: In Denver, the smallest talk group coverage is "Lookout Local" or "Devilshead Local"(one repeater each)
- Use Rocky Mountain to initiate contact, then move to a "smaller" talk group if possible
  - This leaves Rocky Mountain open for other Hams to make contact

BRANDMEISTER

- World Wide, MANY talk groups
- All Talk Groups are dynamic; A Talk Group can be made static on a repeater by the repeater operator
- All Talk Groups (unless made static on a repeater) are user activated
- Remote users cannot activate a Talk Group on a remote repeater
- Desired Talk Group must be programmed into the radio channel (with
  - some advanced exceptions)

BRANDMEISTER

- Two ways to access the Brandmeister network:
  - Traditional Repeater
    - Brandmeister site has a map of all repeaters
    - Work mostly like any other DMR repeater
  - Hotspot
    - Different types available
    - Short-range, only practical for personal use
    - OpenSpot currently to most widely used

HOTSPOTS

KØNGA MIKE

ROCKY MOUNTAIN HAM RADIO

WHAT IS A HOTSPOT?

- A small/portable device which connects over the internet to one of list of networked repeater systems allowing communication via certain types of radios, most commonly digital radios

WHY DO I WANT ONE?

- Do you?
- Coverage issues
  - No repeater in your area
  - Drive around in dead spots a lot
  - Repeaters in your area too busy
  - Repeater owners blocking TGs you want to talk on (Brandmeister)
- Uh… why not? / For the fun of it

TYPICAL RADIO PROTOCOLS SUPPORTED

- DMR
- D-Star
- System Fusion/C4FM
- NXDN
- P25
- POCSAG (for some reason)

NETWORKS SUPPORTED

- DMR
  - Brandmeister
  - DMR-MARC
- D-Star reflectors
  - DCS/XLX
  - REF/XRF
- System Fuson
  - FCS
  - YSFReflector
- Others?

HOTSPOT SELECTION

- Turn-Key
  - SharkRF openSPOT is by far the most popular
    - Current version is openSPOT2
    - Low-power, wifi built in
  - Various USB dongles
    - Require a computer
- Kits/Shields/Boards
  - Require a processing board (such as Raspberry Pi)
  - Many versions, including Chinese knock-offs
  - Assembly required
  - Pi-Star software most common

RadioID.net
Your unique DMR ID

WHICH ONE IS BETTER? WHICH ONE SHOULD I CHOOSE?

- This is my own opinion
- If you don't want to fiddle around with it, want something that's as plug and play as possible, and you have the money, get an openSPOT
- If you want to get hands on, like building kits, have some extra time, don't mind doing a little research and want to control options, go with a kit (ZUMspot/Raspberry Pi)

STUFF AND THINGS

- RMHAM Website – http://www.rmham.org
- Interactive DMR repeater map: http://bit.ly/rmham-trbo-map
- Radio ID – https://www.radioid.net/
- DMR-MARC Website – http://www.dmr-marc.net
- Brandmeister
- Dashboard: https://brandmeister.network/
- Audio Feeds: http://hose.brandmeister.network/
- Wiki: https://wiki.brandmeister.network
- Contact Me: K0NGA@arrl.net

DMR NETS

- RMHAM TRBO Tech Net
  - First Saturday of the Month, 7:00 PM, Rocky Mountain talk group
- World Wide DMR-MARC Net
  - World Wide talk group, Saturdays, 16:00 UTC Summer, 17:00 UTC Winter
- DMR-MARC Tech Net
  - North America talk group, Thursdays, 01:00 UTC Summer, 02:00 UTC Winter (This translates to Wednesday Night in the States)