

# **DMR PROGRAMMING**

## **WORKSHOP — RMHAM-U**

**KØNGA MIKE**

**ROCKY MOUNTAIN HAM RADIO**



# MIKE'S DMR DOCTRINE

DMR is a commercial radio protocol.

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.



# WRITE THIS DOWN

- 438.6 / -5mhz offset
- Color Code 1
- Time Slot 2
- Talk Group 3108
  - BM Colorado



# AGENDA

- Basics Review
- Vendor/CPS differences
- What you need to know
- Programming workflow



# BASICS REVIEW

“No, I will not fix your computer.” -Me, constantly



# WHAT IS DMR/TRBO?

- DMR (Digital Mobile Radio) is an international commercial digital radio standard (ETSI) 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



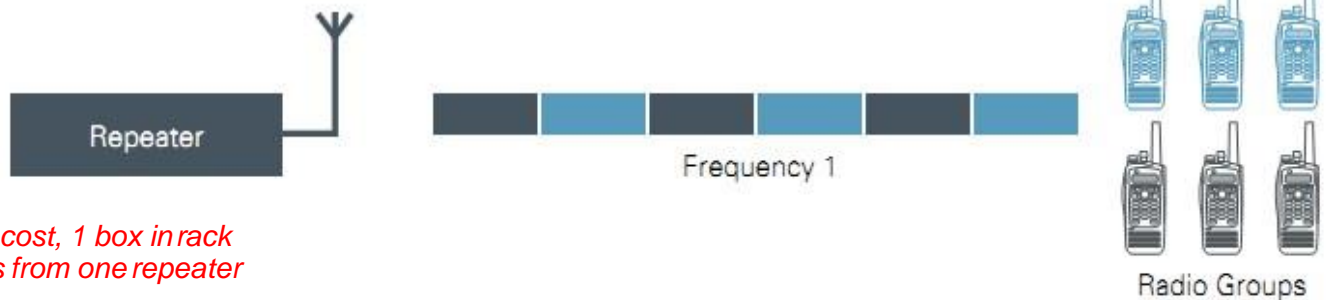
# TWO REPEATERS IN ONE!

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

Two-channel Analog or Digital FDMA System



Two-channel Digital TDMA System



*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





# VENDOR/CPS DIFFERENCES

“What do you mean there’s no codeplug for this brand-new bleeding-edge DMR radio from a company nobody’s ever heard of?” -Too many people, too often



# RANT, SORT OF

- Chinese radios are typically more affordable than Motorola
  - Less expensive to purchase
  - CPS typically free
- Typically, each Chinese radio (and, more often than not, each model) comes with its own CPS, which won't work with other radios/models
- Each CPS will have its own quirks
  - Terms will differ
  - Things that should be pull-downs will be buttons for some reason
  - Settings will be in different places
- Just because it's the newest doesn't mean it's better than what came before



# WHAT YOU NEED

“Yes, you need a computer to run computer software.”  
-Me, on an actual AOL support call.



# WHAT YOU NEED

- Tier 2 DMR Radio (very common)
  - Programming cable
  - Programming software (Customer Programming Software – CPS)
  - Windows Computer
- Radio ID
  - <https://radioid.net>
  - Create an account
  - You'll need a downloaded copy of your license
- Information about the repeater
  - Frequency pair
  - Color code
  - Talk group(s)
  - Time slot / repeater slot



# PROGRAMMING WORKFLOW

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



# 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] -> KONGA Mike <-

Power On Message Line 2 HELLO HAMCON!

Unique Radio ID 00

Radio ID 3108111

Squelch Normal Level 3

Squelch Tight Level 9

Radio Language English

Monitor Type Open Squelch

Tx Preamble Duration [ms] 960

Digital RX Voice Gain Level 6

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

TalkAround

Group Call Hang Time [ms] 3000

Private Call Hang Time [ms] 4000

Close Print Help

Edit - General settings - Setting - Basic Setting - Radio ID

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# BASIC PROGRAMMING CONCEPTS

- In order to program a DMR radio for repeaters, you must know:
  - Repeater frequencies
  - Repeater Color Code
  - Desired Talk Group/Receive Group
  - The Repeater Slot that Talk Group is on
- The order you need to add them to your codeplug:
  - Talk Groups
  - Receive Groups
  - Create Channels where you bring it all together
  - Add Channels to Zones so your radio knows what to do





# EXAMPLE CHANNELS

| Channel          | Color Code | Time Slot | Receive Frequency | Transmit Frequency | Talk Group      |
|------------------|------------|-----------|-------------------|--------------------|-----------------|
| Thorodin Rky Mtn | 7          | Slot 1    | 441.8             | 446.8              | Rocky Mountain  |
| Thorodin Central | 7          | Slot 2    | 441.8             | 446.8              | 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    |





# 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

- 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



# CONTACT LIST EXAMPLE

Customer Programming Software - HAM2000 [ C:\Users\michael\CloudStation\RMHAM\Connect Systems\RMHAM\_CS750\_SampleCodeplug\_2016-03-31\_Ne... ]

File Edit Program Option View Tools Window Help

Contact

CS750

- Radio Information
- General Settings
- Conventional
  - Zone
  - Channel
  - Scan
- DMR Services
  - Text Message
  - Contact
  - Rx Group List
  - Encrypt
- Emergency
- Personality
- DTMF Services
- MDC Services
- 2Tone Services
- 5Tone Services
- Smart Call

| No. | Contact Name     | Call Type    | Call Id | Receive Tone |
|-----|------------------|--------------|---------|--------------|
| 1   | DMR MARC WW      | Group Call   | 1       | No           |
| 2   | DMR MARC LCL     | Group Call   | 2       | No           |
| 3   | DMR MARC NA      | Group Call   | 3       | No           |
| 4   | DMR MARC WW Eng  | Group Call   | 13      | No           |
| 5   | DMR MARC Simplex | Group Call   | 99      | No           |
| 6   | Rocky Mountain   | Group Call   | 700     | No           |
| 7   | Lookout Local    | Group Call   | 710     | No           |
| 8   | South            | Group Call   | 719     | No           |
| 9   | Denver           | Group Call   | 720     | No           |
| 10  | North            | Group Call   | 721     | No           |
| 11  | NoCo Net         | Group Call   | 3171    | No           |
| 12  | DMR MARC MTN     | Group Call   | 3177    | No           |
| 13  | NR2Y Marinus     | Private Call | 3108001 | No           |
| 14  | WA2YZT Paul      | Private Call | 3108002 | No           |
| 15  | K0JSC Jeff       | Private Call | 3108003 | No           |
| 16  | N2PDQ Dirk       | Private Call | 3108004 | No           |
| 17  | KF0KR Thomas     | Private Call | 3108005 | No           |
| 18  | N0GQX Gerald     | Private Call | 3108006 | No           |
| 19  | N0VBY Mike       | Private Call | 3108007 | No           |

Add  
Insert  
Delete  
Sort By Name  
Sort By Id

Close Print Help

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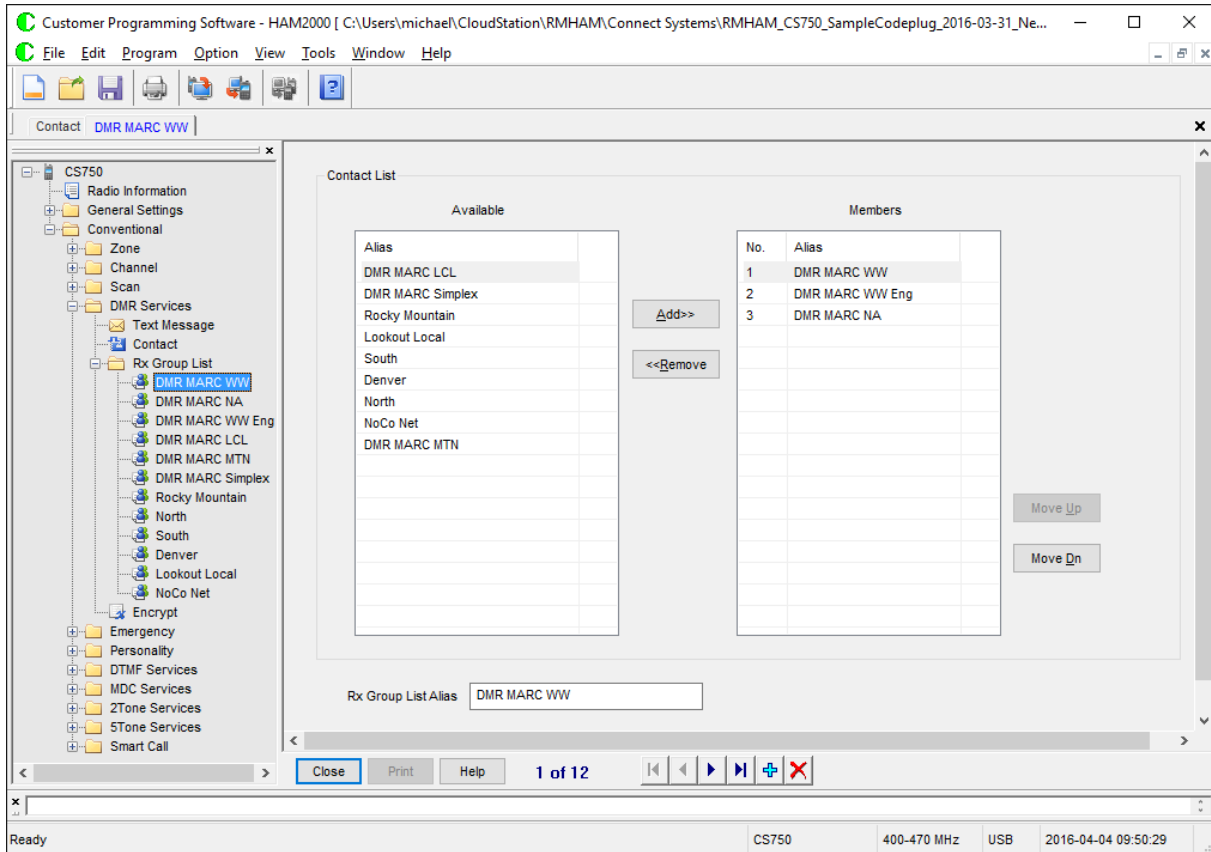


# RECEIVE GROUPS

- 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 config by DMR-MARC
  - Can cause confusion when scanning
- Remember Mike's DMR Doctrine



# RECEIVE GROUP EXAMPLE



# CHANNEL EXAMPLE

Customer Programming Software - HAM2000 [Untitled.rdb] - [DCH 1]

File Edit Program Option View Tools Window Help

ACH 1 DCH 1

CS750

- Radio Information
- General Settings
- Conventional
  - Zone
  - Channel
    - Analog Channel
    - Digital Channel
      - DCH 1
- Scan
- DMR Services
- Emergency
- Personality
- DTMF Services
- MDC Services
- 2Tone Services
- 5Tone Services
- Smart Call

Channel Alias: DCH 1

Digital ID: 1

Color Code: 1

Repeater/Time Slot: Slot 1

Scan List: None

Auto Scan Start: ☐

Rx Only: ☐

Talk Around: ☐

Lone Worker: ☐

VOX: ☐

Receive

Frequency [MHz]: 400.000000

Offset [MHz]: 0.000000

Ref Frequency [MHz]: Middle

Rx Group List: None

Emergency Alarm Indication: ☐

Emergency Alarm Ack: ☐

Emergency Call Indication: ☐

Transmit

Frequency [MHz]: 400.000000

Ref Frequency [MHz]: Middle

Tx Contact: Contact1

Emergency System: None

Power Level: High

Close Print Help 1 of 1

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# 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



# 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 CHANNEL - RMHAM

Customer Programming Software - HAM2000 [ C:\Users\michael\CloudStation\RMHAM\Connect Systems\RMHAM\_CS750\_SampleCodeplug\_2016-03-31\_Ne... ]

File Edit Program Option View Tools Window Help

Contact | DMR MARC WW | Thorodin Rk Mtn

Canon South  
Cheyenne Rk Mtn  
Cheyenne North  
Devils South  
Devils Denver  
Durango Rk Mtn  
Durango South  
Ft Morgan Rk Mtn  
Ft Morgan North  
Horsetooth Rk Mt  
Horsetooth North  
Lookout Local  
Lookout Denver  
Pueblo Rk Mtn  
Pueblo South  
Salida Rk Mtn  
Salida South  
Squaw Rk Mtn  
Squaw Denver  
**Thorodin Rk Mtn**  
Thorodin Denver  
Lee Hill WW  
Lee Hill WW Eng  
Lee Hill NA  
Lee Hill LCL  
Lee Hill MTN  
Colo Springs WW  
Colo Spgs WW E  
Colo Springs NA  
Colo Springs LCL  
Colo Springs MTN

Digital ID 12345  
Color Code 7  
Repeater/Time Slot Slot 1  
Scan List TRBO Denver  
Auto Scan Start ☐  
Rx Only ☐  
Talk Around ☒  
Lone Worker ☐  
VOX ☐

Receive  
Frequency [MHz] 446.800000  
Offset [MHz] 0.000000  
Ref Frequency [MHz] Middle  
Rx Group List Rocky Mountain  
Emergency Alarm Indication ☐  
Emergency Alarm Ack ☐  
Emergency Call Indication ☐  
Encrypt

Transmit  
Frequency [MHz] 441.800000  
Ref Frequency [MHz] Middle  
Tx Contact Rocky Mountain  
Emergency System None  
Power Level High  
Tx Admit Color Code Free  
Tx Time-Out Time [s] Infinite

Apply

Close Print Help 29 of 69

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# ZONES

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



**QUESTIONS?**



# 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>
- Colorado Hotspot Frequencies:  
<https://www.ccarc.net/wordpress/hot-spots/>
- Contact Me: K0NGA@arrl.net

