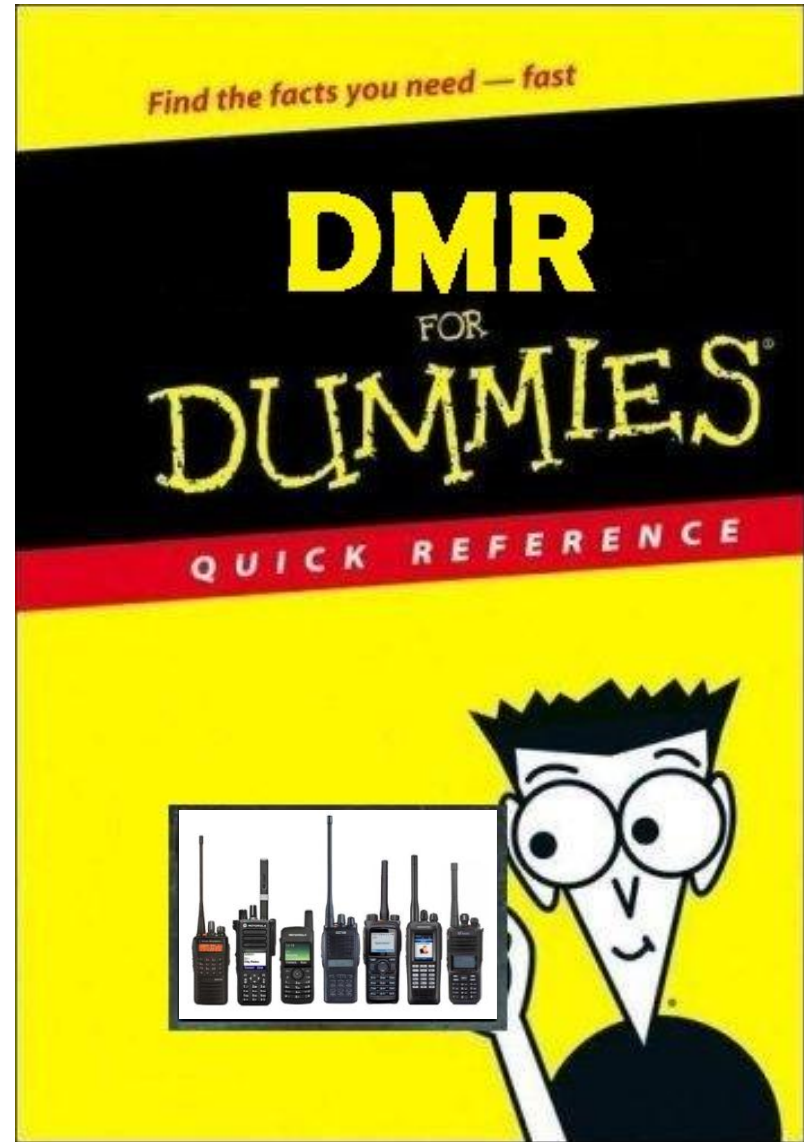


# The DMR Basics & No Frills

- **What is DMR?**
- **Digital vs. Analog**
- **Time Slots [TDMA] & Talk Groups**
- **Zones**
- **Color Codes**
- **Code Plugs**
- **Scanning and Roaming**
- **Simplex**
- **Admit Criteria**
- **Repeater Access**
- **Basic Programming**



# DMR for DUMMIES

**Digital Mobile Radio (DMR)** was developed by the **European Telecommunications Standards Institute (ETSI)** and is used worldwide by professional mobile radio users. [<http://www.dmrassociation.org>]

DMR is divided into three tiers.

- Tier I is a single channel specification originally for the European unlicensed dPMR446 service. It is a single channel FDMA 6.25 kHz bandwidth; the standard supports peer-to-peer (mode 1), repeater (mode 2) and linked repeater (mode 3) configurations. The use of the Tier I standard has been expanded into radios for use in other than the unlicensed dPMR446 service. [<http://www.dpmm-mou.org>]
- **Tier II is 2-slot TDMA 12.5 kHz wide peer-to-peer and repeater mode specification, resulting in a spectrum efficiency of 6.25 kHz per channel. Each time slot can be either voice and/or data depending upon system needs. IP Site Connect (IPSC) for interconnecting repeaters over the Internet is vendor specific and is not part of the ETSI standards at this time. Most amateur radio implementations of DMR are using voice on both time slots.**
- Tier III builds upon Tier II, adding trunking operation involving multiple repeaters at a single site. Not all manufacturers' trunking implementation is Tier III compatible. Vendor specific protocols have expanded the trunking to multiple site operations.

# DMR for DUMMIES

## Digital vs. Analog

- If you are use to operating on analog FM repeaters, you will have noticed that the audio quality degrades as a station's signal into the repeater (uplink) gets weaker; you start hearing an increase in noise bursts intermixed with the audio until the signal gets so weak that the station can no long access the repeater or you can not understand the audio because of noise. As you move further from the repeater you will start hearing the same noise bursts into your receiver as the repeater's signal gets weaker (downlink) until you can no longer hear the repeater. A combination of a station's weak signal into a repeater and a repeater's weak signal to the listener can make the usability degrade faster.
- The **basic difference with digital repeaters is that the audio quality remains the same on the uplink and downlink until the very end of the coverage range; then the audio starts sounding broken (missing portions of the speech) on DMR systems caused by lost packets. The Internet can also drop the UDP packets used for moving traffic between repeaters and bridges, causing the same broken audio affect.** Analog static is a thing of the past using DMR.
- **DMR has Forward Error Correction (FEC)** which can correct small bit errors, slightly extending the usable range and improving communication quality.
- Better quality receivers can operate at a lower noise floor, higher power transmitters, and higher gain antenna systems will also extend coverage of both analog and digital systems.

# DMR for DUMMIES

## Two-Slot TDMA

- DMR Tier II/Tier III occupies a **12.5 kHz** bandwidth that two channels share using **Time-Division Multiple Access (TDMA)**.
- This results in spectrum efficiency of 6.25 kHz per channel. Comparing the spectrum efficiency of DMR to a wideband analog FM, DMR only uses 25% of the bandwidth per talk channel.
- Each **channel can carry either voice and/or data** depending on system design. The two time slots are called **Time Slot 1 (TS1)** and **Time Slot 2 (TS2)**.



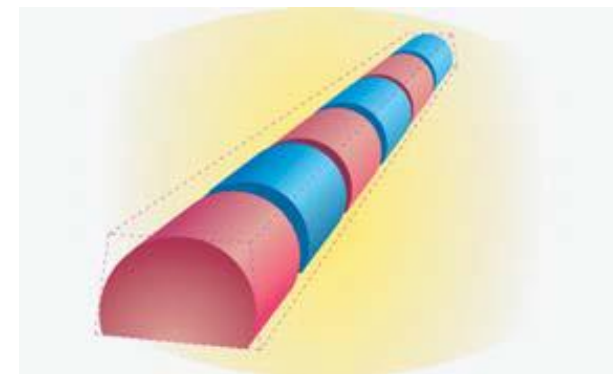
$f_c - 12.5$     $f_c$     $f_c + 12.5$

Wideband Analog FM  
25 kHz Channel  
Bandwidth  
(25 kHz per Channel)



$f_c - 6.25$     $f_c$     $f_c + 6.25$

DMR  
12.5 kHz Channel  
Bandwidth  
(6.25 kHz per Channel)



# DMR for DUMMIES

## Talk Groups

- **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.
- The DMR-MARC Mototrbo™ network supports three Talk Groups on **TS1; World Wide (TG1, PTT), North America (TG3), and World Wide English (TG13)**. **TS2 is for Local (TG2), state (TG3112), and regional(TG33174) Talk Groups** [<http://www.dmr-marc.net/TG.htm>]. The DCI/TRBO network uses TG3163 for North America and TG3161 for World Wide, and TG3 for World Wide English on TS2 [<http://trbo.info/dci/talkgroups/index.html>]. Check with your local repeater operator to find out what Talk Groups are available on its repeater.
- The DMR standard also supports private calls (one-to-one), encryption, and data. **Private calls are not allowed by most of the amateur networks** and many consider private calls not amateur friendly; private calls tie up a large number of repeater time slots across the network. Encryption is not legal on amateur radio! Data and text messaging is supported on some networks.

# DMR for DUMMIES

## Talk Groups (continued)

- For simplex traffic, the accepted standard in the amateur community is to use TG99 on TS1 with CC1.
- When programming your DMR radio, **you may find it easier to program multiple Talk Groups for receive.** I have two RX Group lists programmed in my radios, one for TS1 and one for TS2; this allows my radio to listen to all the possible Talk Groups used on a time slot when I have my radio set to any channel.
- There are **Talk Groups implemented for individual states** and **regional** on many networks. Some Talk Groups are available all the time, while others only at preprogrammed times. Some Talk Groups require a local 6 user to PTT on the Talk Group to activate it for a period of time. Since only one Talk Group can be active at a time on a time slot, many systems will disable other Talk Groups when a local user is active on a different Talk Group on the time slot. Be ham friendly and try to use Talk Groups that tie up the fewest number of repeaters if you are going to have a long QSO. Further information about specific Talk Groups can be found on the DMR-MARC, DCI, and regional group websites.

<http://www.dmr-marc.net>

<http://dmrx.net>

<http://ecs.org>

<http://eqdmrmap.com>

# DMR for DUMMIES

## Group Contacts

1	WW	World Wide
2	LO	Local Network
3	NA	North America
9	LR	Local Repeater
13	EN	World Wide English
14	SP	World Wide Spanish
310		TAC 310
311		TAC 311
3112	FL	FL Statewide
3174	SE	SE USA
16777215	AC	All Call

## Private Contacts

<u>3112249</u>	KG4FUR	Gerry	Boca Raton	FL	USA
<u>7400002</u>	HC2GBT	Gerry	Guyaquil	Guayas	ECU

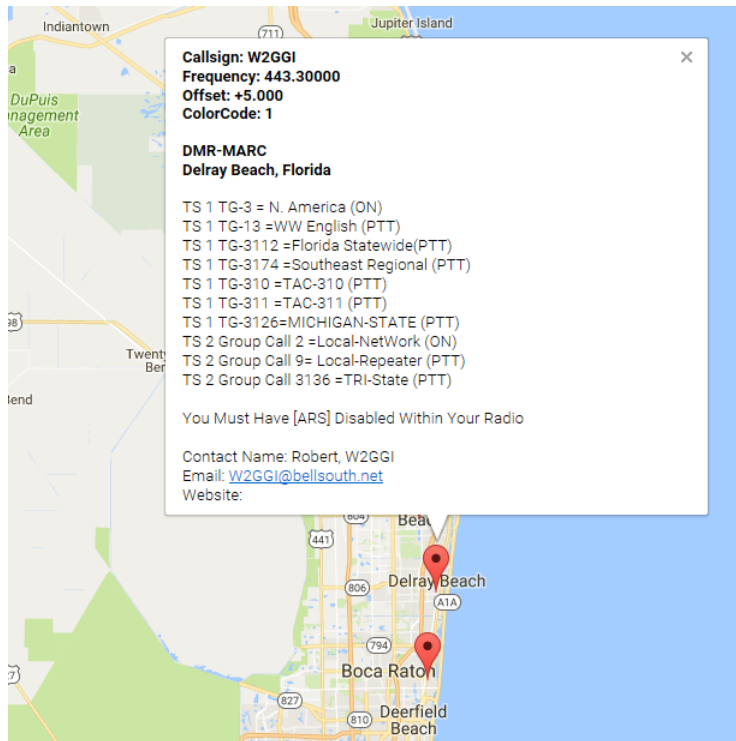
## ISIM ID Key (Mobile Country Code (MCC))

<u>xxx</u> <u>yyyzzz</u>	User (7 digit)	2 Europe
<u>xxx</u> <u>yyzz</u>	Repeater (6 digit)	3 North America
		4 Asia, Middle East
		5 Oceania
		6 Africa
		7 South/Central America

x = Country  
y = State/Province  
z = Sequence

# DMR for DUMMIES

<http://www.dmr-marc.net>



Call sign: W2GGI  
Frequency: 443.30000  
Offset: +5.000  
Color Code: 1

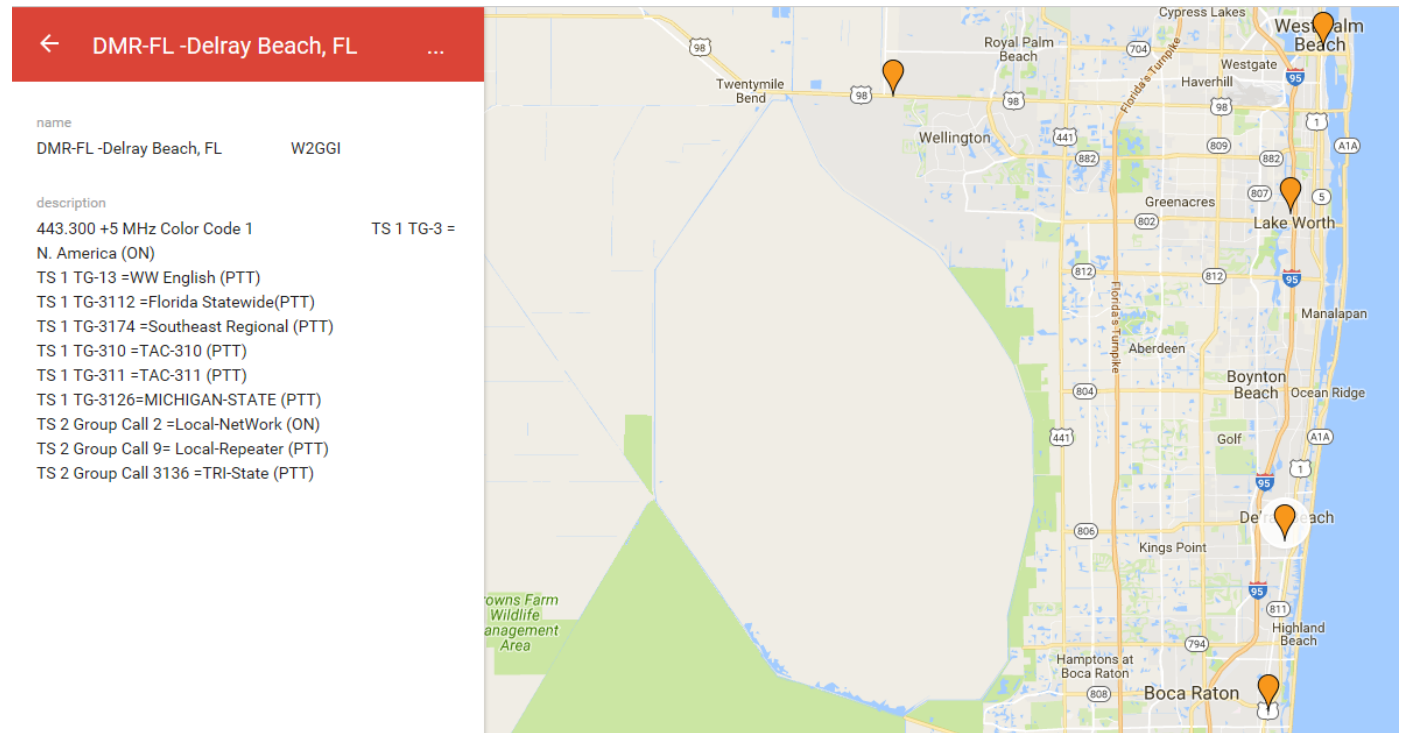
**DMR-MARC**  
Delray Beach, Florida

TS 1 TG-3 = N. America (ON)  
TS 1 TG-13 = WW English (PTT)  
TS 1 TG-3112 = Florida Statewide (PTT)  
TS 1 TG-3174 = Southeast Regional (PTT)  
TS 1 TG-310 = TAC-310 (PTT)  
TS 1 TG-311 = TAC-311 (PTT)  
TS 1 TG-3126 = MICHIGAN-STATE (PTT)  
TS 2 Group Call 2 = Local-NetWork (ON)  
TS 2 Group Call 9 = Local-Repeater (PTT)  
TS 2 Group Call 3136 = TRI-State (PTT)

You Must Have [ARS] Disabled Within Your Radio

Contact Name: Robert, W2GGI  
Email: [W2GGI@bellsouth.net](mailto:W2GGI@bellsouth.net)  
Website:

<http://dmr-ecs.org>



DMR-FL -Delray Beach, FL

name  
DMR-FL -Delray Beach, FL      W2GGI

description  
443.300 +5 MHz Color Code 1      TS 1 TG-3 =  
N. America (ON)  
TS 1 TG-13 = WW English (PTT)  
TS 1 TG-3112 = Florida Statewide (PTT)  
TS 1 TG-3174 = Southeast Regional (PTT)  
TS 1 TG-310 = TAC-310 (PTT)  
TS 1 TG-311 = TAC-311 (PTT)  
TS 1 TG-3126 = MICHIGAN-STATE (PTT)  
TS 2 Group Call 2 = Local-NetWork (ON)  
TS 2 Group Call 9 = Local-Repeater (PTT)  
TS 2 Group Call 3136 = TRI-State (PTT)



# DMR for DUMMIES

## 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. **TYT and CS limit is 16 channels per Zone.**
- You could program Zones for local channels (DMR or analog), another Zone for a neighboring state, and a Zone for business and government channels. If you do program non-amateur channels in your radio, make sure they are RX only unless you are licensed or authorized to use them as per FCC 90.427(b); otherwise you will be in violation of FCC R&Rs and enforcement action could be taken against you. If you have a VHF model, you could program a Zone for all the possible NWS Weather Channels (again, make sure you program the channels as receive only).
- Zones are just a way to manage large number of channels, much like file folders or directories on your computer. **You may want to equate Zones with Repeaters.**

# DMR for DUMMIES

## Color Codes

- DMR repeaters use **Color Codes (CC)** much like analog repeaters use **CTCSS (PL) 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 **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.
- Note: **CC1 is most often used in Florida**.

# DMR for DUMMIES

## Code Plugs

- 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 and typically should also be saved on your computer as a backup. You can also download the code plug from a radio to modify it.
- Building a code plug can take many hours, especially if you want to program hundreds of channels.
- The code plug can also contain a Contact List of Radio IDs, call signs, and names to be displayed. You can find copies of configured code plugs on the web for different models of radio; check out the different Yahoo DMR groups. All DMR radios support a limited number of entries in the Contact List; you can download Code Plugs with the Contact List populated using a generator on the DMR-MARC home.

# DMR for DUMMIES

## Scanning

- All DMR radios allow you to configure scanning of channels.
- Remember, you will only hear traffic on the frequency, time slot, and groups you have programmed on a channel.
- Typically you scan both time slots on my local repeater and a simplex channel.
- You can also scan analog channels mixed with the digital channels.
- Scanning will decrease the battery life on your radio.

# DMR for DUMMIES

## Roaming

- **Roaming is not supported on all DMR radios.** Check your owner's manual or manufacturer website to see if roaming is supported. In some radios it may be an additional cost option.
- **Roaming is NOT scanning.** Roaming is similar but different. **Roaming is designed to have your radio automatically select the best channel if your current channel's Receive Signal Strength Indicator (RSSI) falls below a defined level as you move throughout the coverage area of a group of repeaters that carry the same Talk Groups on the same time slots.** You should select channels that have the same time slot and receive groups configured; if you do not, roaming may not work correctly. Repeaters can be configured to transmit beacons at predefined intervals of inactivity so roamers will be on the correct channel. Without the repeater beacons, roaming will still work, but the radio will only change channels if it hears a repeater on the air.
- Roaming would be really great if all the DMR repeaters were on the same set of repeater pairs across the country, but it is too much to expect the Repeater Councils to work together for a unified rebanding of existing coordinations. It would also help if the different DMR networks could agree on which time slots were used by which Talk Groups, on the same time slots in your radio and be able to travel across North America and be able to access all DMR repeaters?

# DMR for DUMMIES

## Simplex

- On the professional side of **DMR**, *Talk-Around* refers to operating simplex on a repeater output channel. **This allows a direct communication while still being able to hear the repeater. This allows users to directly contact other users listening on the repeater output frequency.** Amateurs typically use dedicated simplex channels so as not to interfere with repeaters. The amateur DMR community has published a list of recommended simplex frequencies to be used instead of operating simplex on repeater outputs:
  - UHF**
    - 1) 441.000
    - 2) 446.500
    - 3) 446.075
    - 4) 433.450
  - VHF**
    - 1) 145.790
    - 2) 145.510
- [Use TG99 / CC1 / TS1 /Admit Criteria: Always / In Call Criteria: TX or Always]
- **Do not use 146.520 or 446.000**; they are the national analog simplex channels and operating DMR on these common analog use frequencies will just cause disharmony within the amateur community. Also, avoid repeater inputs and outputs, locally used non-DMR simplex channels, satellite sub-bands, and any other frequencies that could disrupt other amateur communications.

# DMR for DUMMIES

## Admit Criteria

- The Admit Criteria determines when your radio is allowed to transmit.
- The recommended setting for DMR repeater channels is ***Color Code Free***; this configures your radio to be polite to your own digital system. You should configure your In Call Criteria to ***Follow Admit Criteria***.
- Simplex channels should be configured as ***Always*** for both Admit Criteria and ***Always*** or ***Follow TX*** for In Call Criteria.
- Analog repeater channels should be configured as **Channel Free**

# DMR for DUMMIES

## Accessing a DMR Repeater

- When you want to access a DMR repeater, **you must have the frequency, Color Code, and Talk Group set correctly.** When you key your transceiver, you send a signal to the repeater and the repeater responds back to you to acknowledge you can transmit your message. If you do not receive the repeater's acknowledgement, your radio will stop transmitting and you will hear a negative confirmation tone. This is one of the advantages of TDMA: allowing bidirectional communications between user and the repeater when transmitting. The repeater can also signal your radio to stop transmitting if there is contention on the network because more than one station is transmitting at a time.
- **Not all DMR repeaters are interconnected on the Internet.** Internet connectivity may not be available at the repeater site, or not available at a reasonable cost. Some repeater operators may just prefer to keep their repeater for local usage only, or maybe only want it connected to a small local/regional network, without connecting to the larger world wide networks.



# DMR for DUMMIES

## Analog

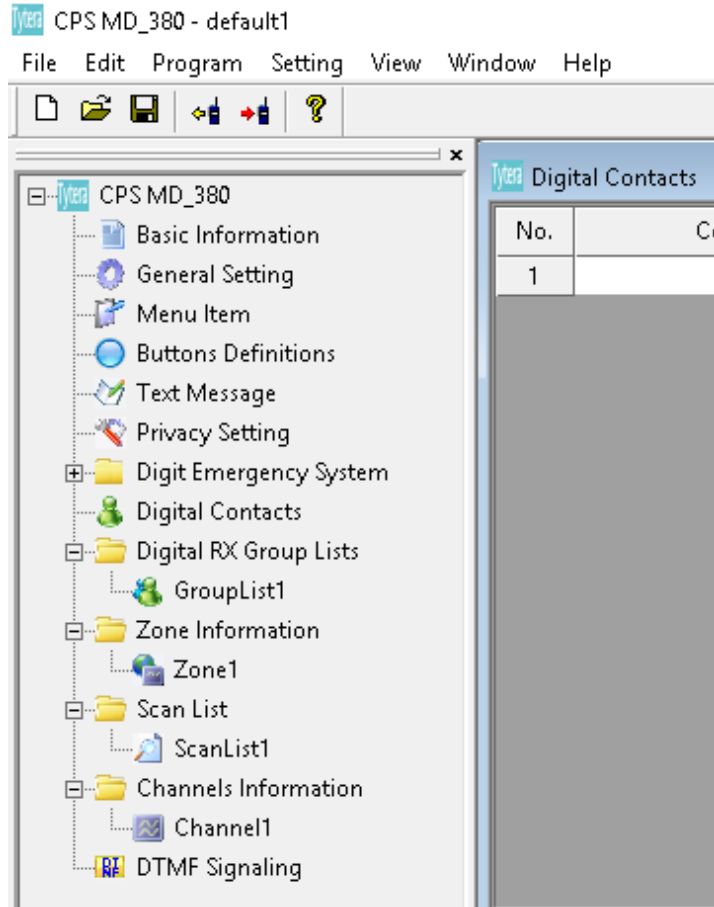
- Frequency Pair (440 + 5.0 offset)
- 25.0 kHz Bandwidth
  - 1 full bandwidth slot
  - -
  - -
- Repeater
- Sub Auditable Tones [CTSCC (PL) or DCS]
- Program/Configuration File

## DMR (Digital Mobile Radio)

- Frequency Pair (440 + 5.0 offset)
- TDM 12.5 kHz:
  - 2 Time Slots [TS1, TS2]
- Talk Groups [TG]
  - Group Contacts
  - Private Calls
  - All Call
- Zones
- Color Codes [CC0-CC15]
- Code Plug
- Admit Criteria
  - Color Code                      DMR
  - Always                              Simplex
  - Channel Free                      Analog
- Programming your DMR Radio

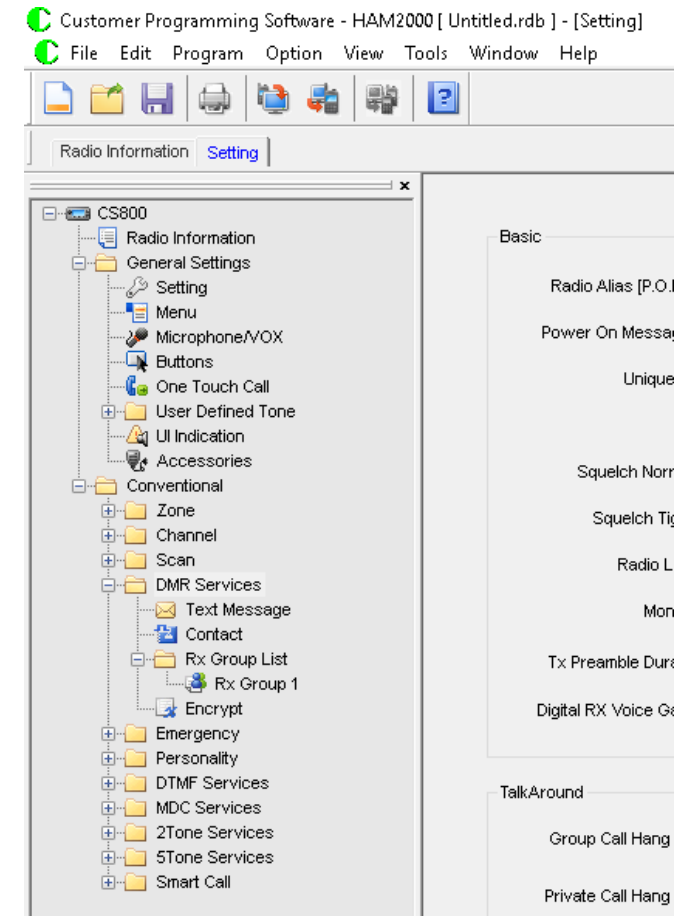
# DMR Programming for DUMMIES

## MD 380/390



1. General Setting / [Setting](#)
2. Menu Items / [Menu](#)
3. Buttons Definitions / [Buttons](#)
4. Text Message / [Text Message](#)
5. Digital Contacts / [Contacts](#)
6. Digital RX Groups / [RX Group List](#)
7. Channels Information / [Channel](#)
8. Zone Information / [Zone](#)
9. Scan List / [Scan](#)

## CS-750/800



# DMR Programming for DUMMIES

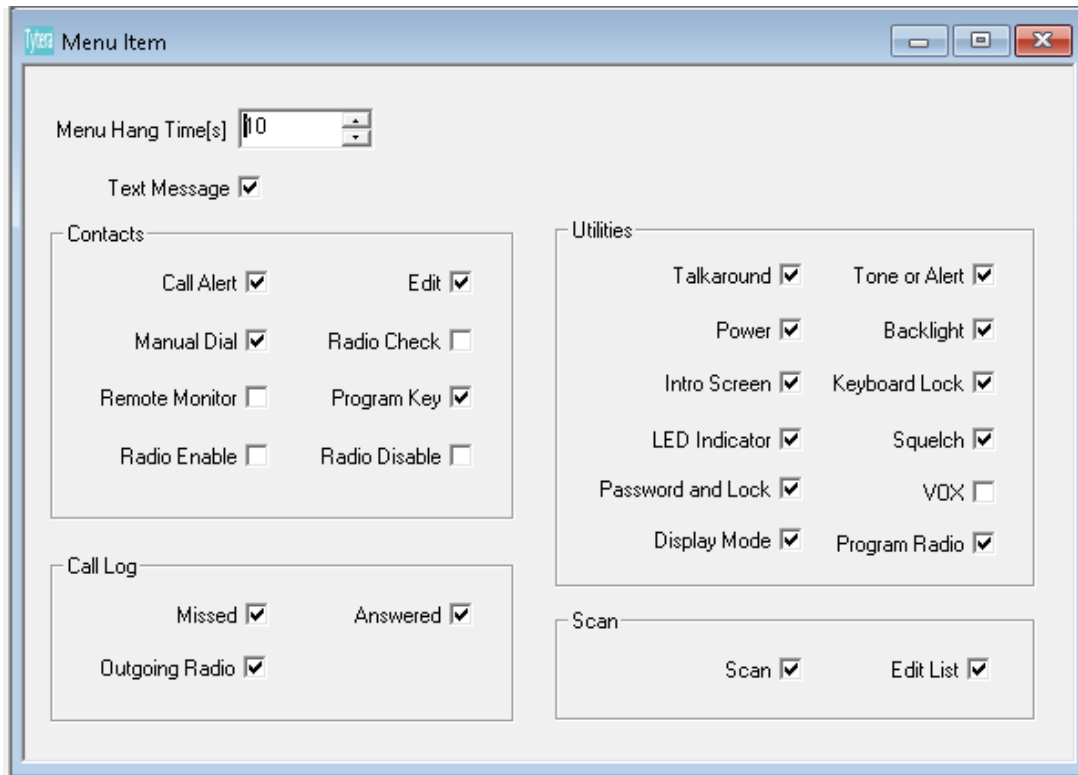
The screenshot shows the 'General Setting' window with the following visible settings:

- Save:** Save Preamble , Save Mode Receive
- Alert Tone:** Disable All Tone , CH Free Indication Tone , Talk Permit Tone: Analog & Digital, Call Alert Tone Duration[s]: Continue
- Scan:** Scan Digital Hang Time[ms]: 1000, Scan Analog Hang Time[ms]: 1000
- Lone Worker:** Lone Worker Response Time[min]: 1, Lone Worker Reminder Time[s]: 10
- Power On Password:** Password and Lock Enable , Power On Password: 00000000
- Radio Name:** HC2GBT
- Radio ID:** 7400002
- Monitor Type:** Silent
- VOX Sensitivity:** 3
- TX Preamble Duration[ms]:** 300
- RX Low Battery Interval[s]:** 120
- PC Programming Password:** (empty)
- Radio Program Password:** 00000000
- Back Light Time[s]:** Always
- Set Keypad Lock Time[s]:** Manual
- Disable All LEDs:**
- Talkaround:** Group Call Hang Time[ms]: 3000, Private Call Hang Time[ms]: 4000
- Intro Screen:** Intro Screen: Char string, Intro Screen Line 1: HC2GBT gbg, Intro Screen Line 2: 7400002

## General Settings

- Radio Name: your call sign
- Radio ID: your 7 digit DMR ID
- Intro Screen Line 1: your call sign and name (up to 10 digits)
- Intro Screen Line 2: your DMR ID or name

# DMR Programming for DUMMIES



## Menu Items

- Verify checked items

# DMR Programming for DUMMIES

Buttons Definitions

Long Press Duration(ms) 1000

Radio Buttons

Short Press Long Press

Side Button1 Scan On/Off Zone Select

Side Button2 High/Low Power Zone Select

One Touch Access

No.	Mode	Call	Call Type	Message/Encode
1	Digital	DMR WW	Text Message	no lo haces! (Hello, How dc
2	Digital	DMR WW	Text Message	no lo haces! (Hello, How dc
3	Digital	DMR WW	Text Message	no lo haces! (Hello, How dc
4	Digital	DMR WW	Text Message	no lo haces! (Hello, How dc
5	Digital	DMR WW	Text Message	no lo haces! (Hello, How dc
6	Digital	DMR WW	Text Message	no lo haces! (Hello, How dc

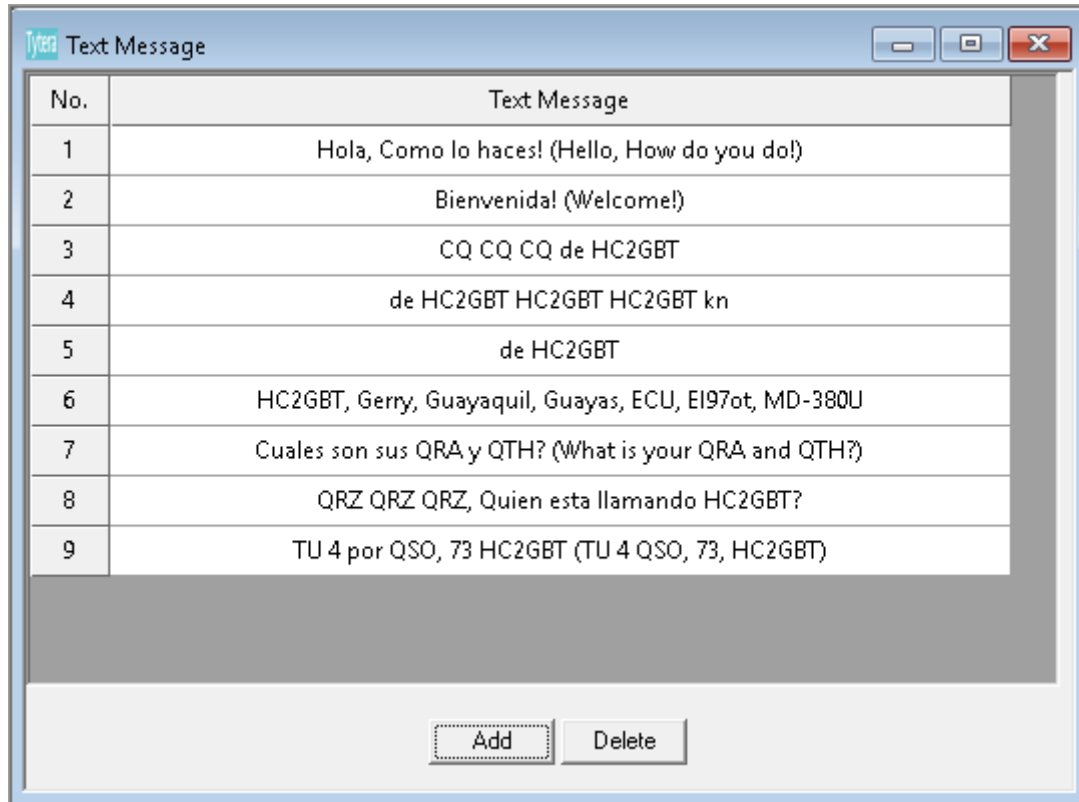
Number Key Quick Contact Access

Number Key	None
Number Key0	None
Number Key1	None
Number Key2	None
Number Key3	None
Number Key4	None
Number Key5	None

## Buttons Definitions

- Select Short/Long Press and Side Button settings
- These may vary by personal preference
- Note: CS 750/800 have more options

# DMR Programming for DUMMIES



The screenshot shows a software window titled 'Text Message' with a list of 9 entries. Each entry has a number in the 'No.' column and a text message in the 'Text Message' column. At the bottom of the window, there are two buttons: 'Add' and 'Delete'.

No.	Text Message
1	Hola, Como lo haces! (Hello, How do you do!)
2	Bienvenida! (Welcome!)
3	CQ CQ CQ de HC2GBT
4	de HC2GBT HC2GBT HC2GBT kn
5	de HC2GBT
6	HC2GBT, Gerry, Guayaquil, Guayas, ECU, EI97ot, MD-380U
7	Cuales son sus QRA y QTH? (What is your QRA and QTH?)
8	QRZ QRZ QRZ, Quien esta llamando HC2GBT?
9	TU 4 por QSO, 73 HC2GBT (TU 4 QSO, 73, HC2GBT)

## Text Message

- Personal Selection

# DMR Programming for DUMMIES

Digital Contacts

No.	Contact Name	Call Type	Call ID	Call Receive Tone
1	DMR WW	Group Call	1	Yes
2	DMR LO	Group Call	2	Yes
3	DMR NA	Group Call	3	Yes
4	DMR LR	Group Call	9	Yes
5	DMR EN	Group Call	13	Yes
6	DMR SP	Group Call	14	Yes
7	DMR SX	Group Call	99	Yes
8	TAC 310	Group Call	310	Yes
9	TAC 311	Group Call	311	Yes
10	NYC METRO	Group Call	444	Yes
11	SEFL DMR LO	Group Call	855	Yes
12	SEFL DMR LN	Group Call	856	Yes
13	DMR US	Group Call	1776	Yes
14	DMR BR	Group Call	3100	Yes
15	DMR FL	Group Call	3112	Yes
16	DMR GA	Group Call	3113	Yes
17	DMR IL	Group Call	3117	Yes

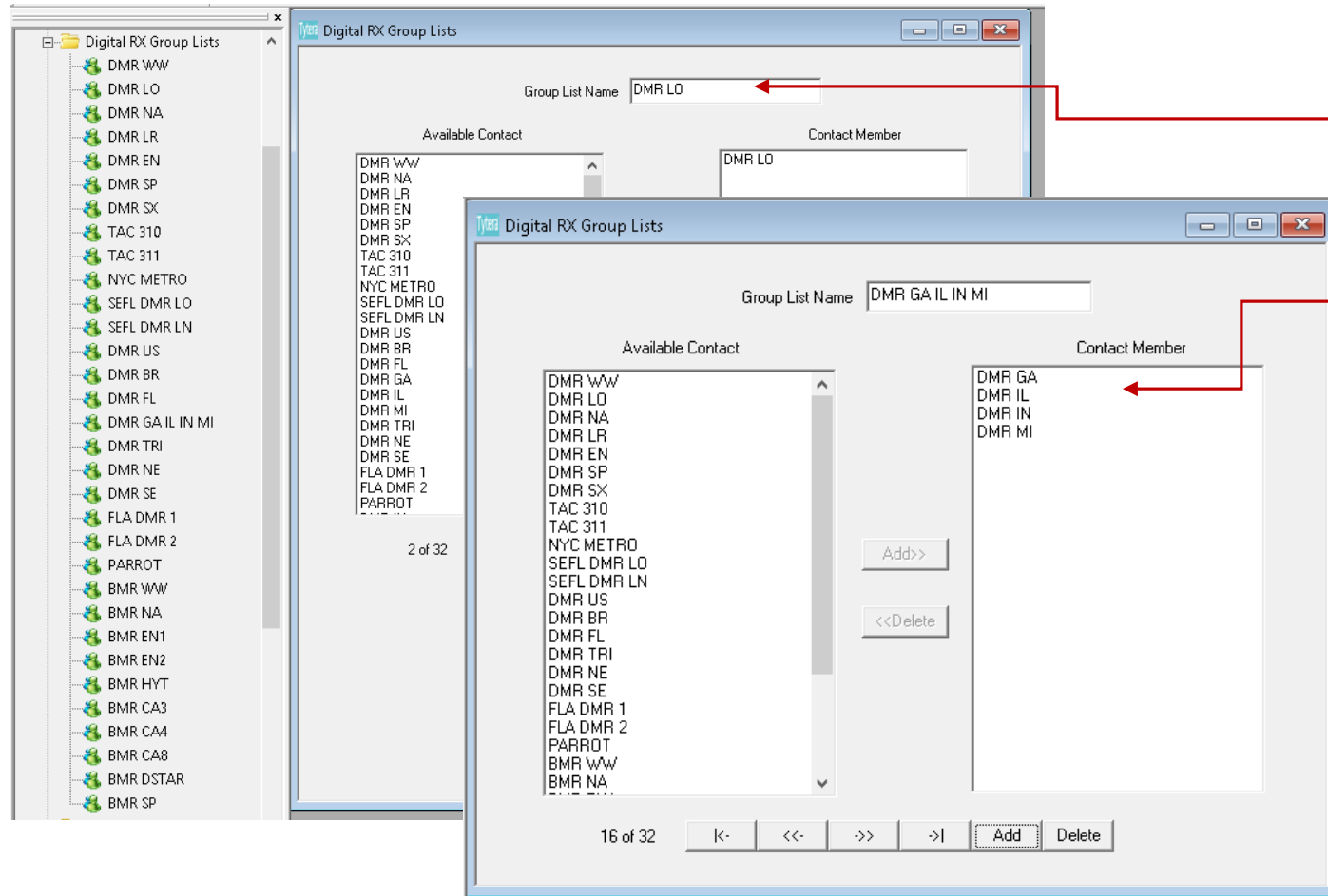
Add Delete

Digital Contacts

No.	Contact Name	Call Type	Call ID	Call Receive Tone
26	KC2SKU Walter	Private Call	3112001	No
27	K4XF Rich	Private Call	3112002	No
28	N4PL Wald	Private Call	3112003	No
29	W4ROA Chuck	Private Call	3112004	No
30	KD4HKR Charlie	Private Call	3112005	No
31	K4MAP Marshall P1	Private Call	3112009	No
32	W4RCC Richard P1	Private Call	3112010	No
33	AC4XQ Rick P1	Private Call	3112011	No
34	WB2TQE Howard	Private Call	3112013	No
35	W4YVM Juan P1	Private Call	3112014	No
36	W4YVM Juan M1	Private Call	3112015	No
37	AC4XQ Rick M1	Private Call	3112017	No
38	W4YVM Juan P2	Private Call	3112019	No
39	WD4CLZ Fidel	Private Call	3112020	No
40	W2GGI Bob	Private Call	3112021	No
41	W2WDW Dean P1	Private Call	3112022	No
42	W2WDW Dean M1	Private Call	3112023	No

Add Delete

# DMR Programming for DUMMIES

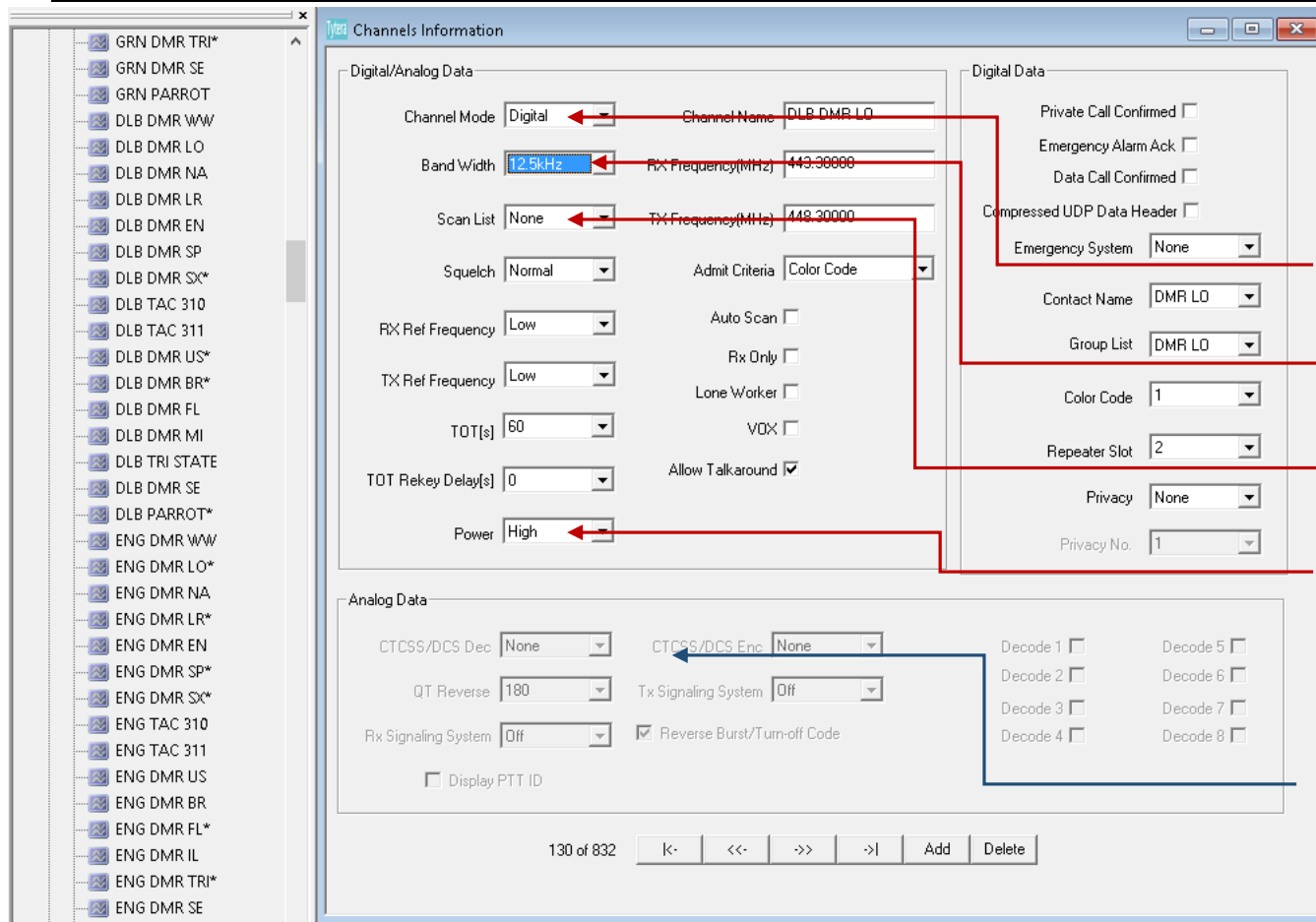


## Digital RX Groups

- You need one for every Talk Group
- You may combine Talk Groups under on RX Group List.
  - See DMR GA IL IN MI



# DMR Programming for DUMMIES



## Channels Information

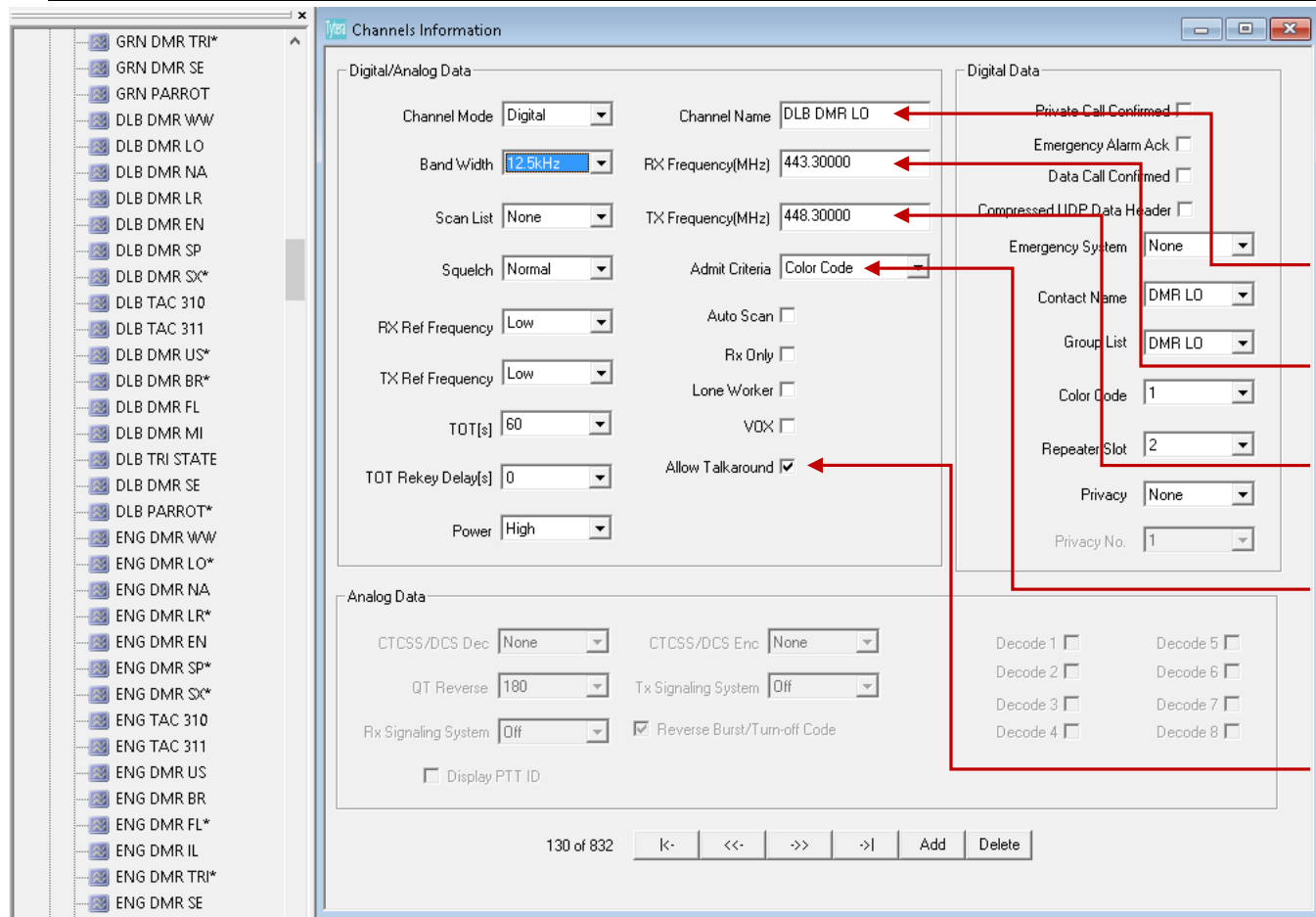
### Digital Analog Data-1<sup>st</sup> Column

- Channel Mode (**digi**/analog)
- Band Width (**12.5** or 25.0)
- Scan List
- Power (**hi**/lo)

### Analog Data

- CTCSS/DCS Dec/Enc

# DMR Programming for DUMMIES

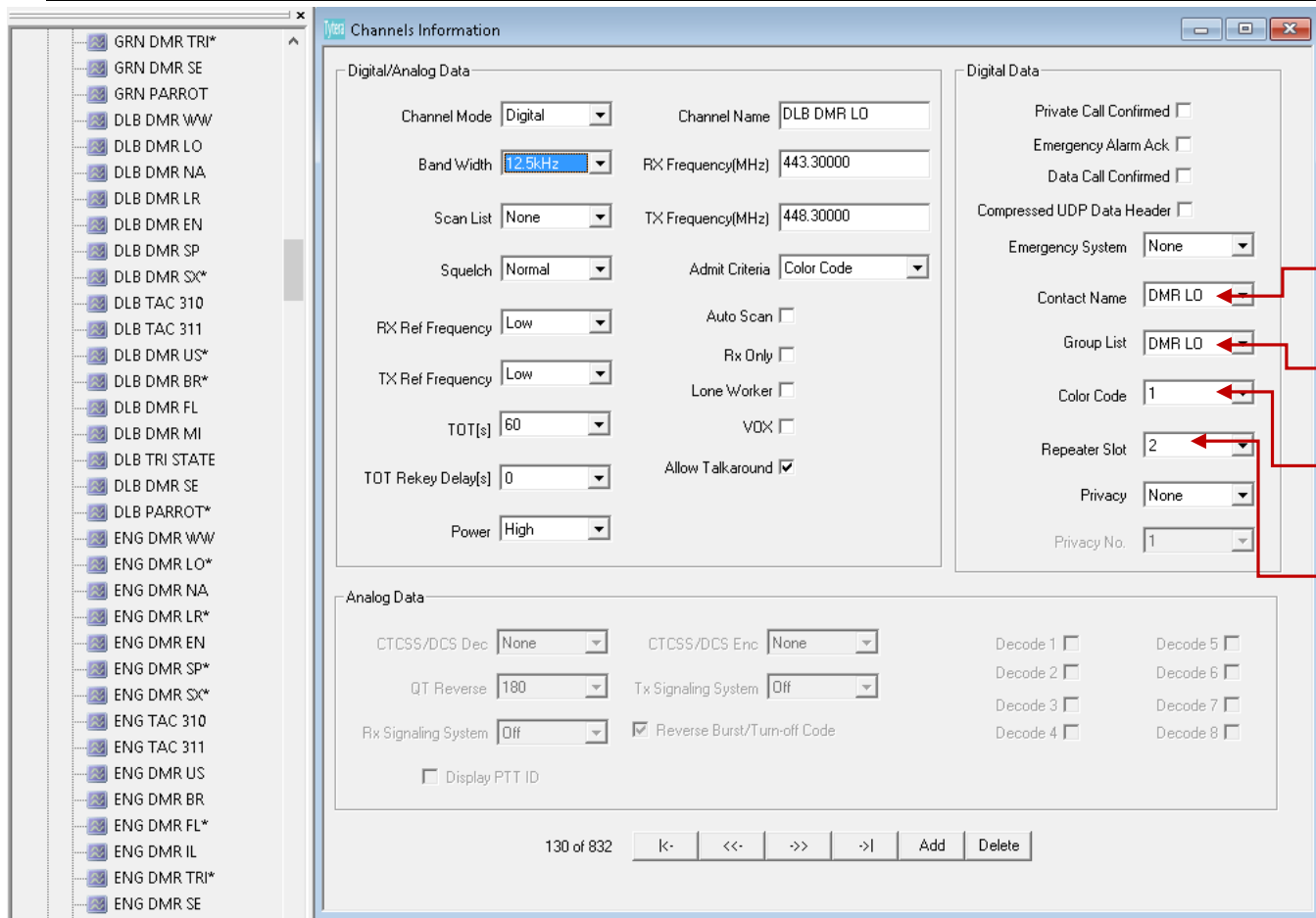


## Channels Information

### Digital Analog Data-2<sup>nd</sup> Column

- Channel Name (**DLB DMR \_\_**)
- RX Freq (**443.30000**)
- TX Freq (**448.30000**)
- Admit Code (Always/Channel Free/**Color Code**)
- Allow Talkaround (on repeaters only)

# DMR Programming for DUMMIES

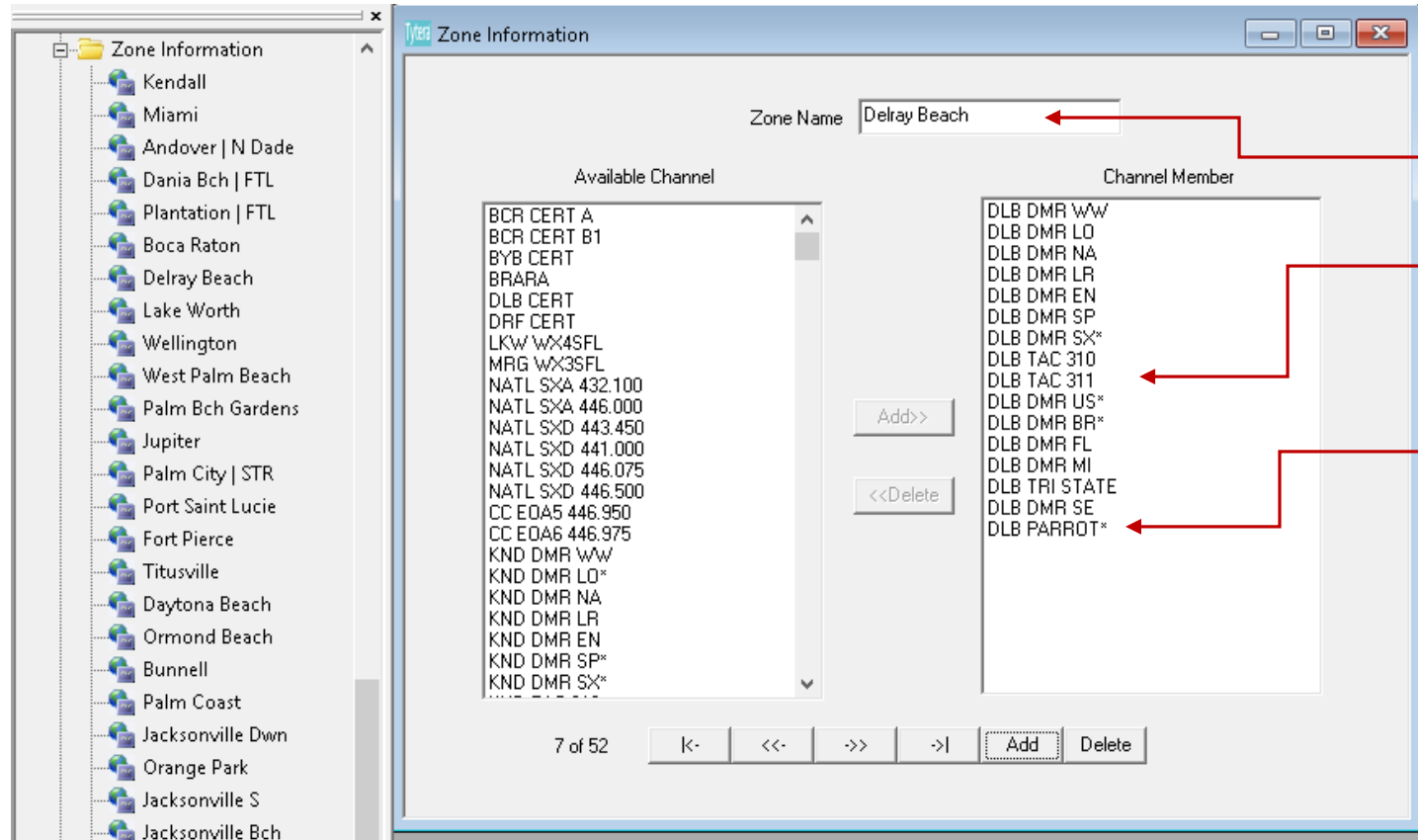


## Channels Information

### Digital Analog Data-3<sup>rd</sup> Column

- Contact Name(DMR \_\_)
- Group List (DMR \_\_)
- Color Code (0-15)
- Repeater Slot (1-2)

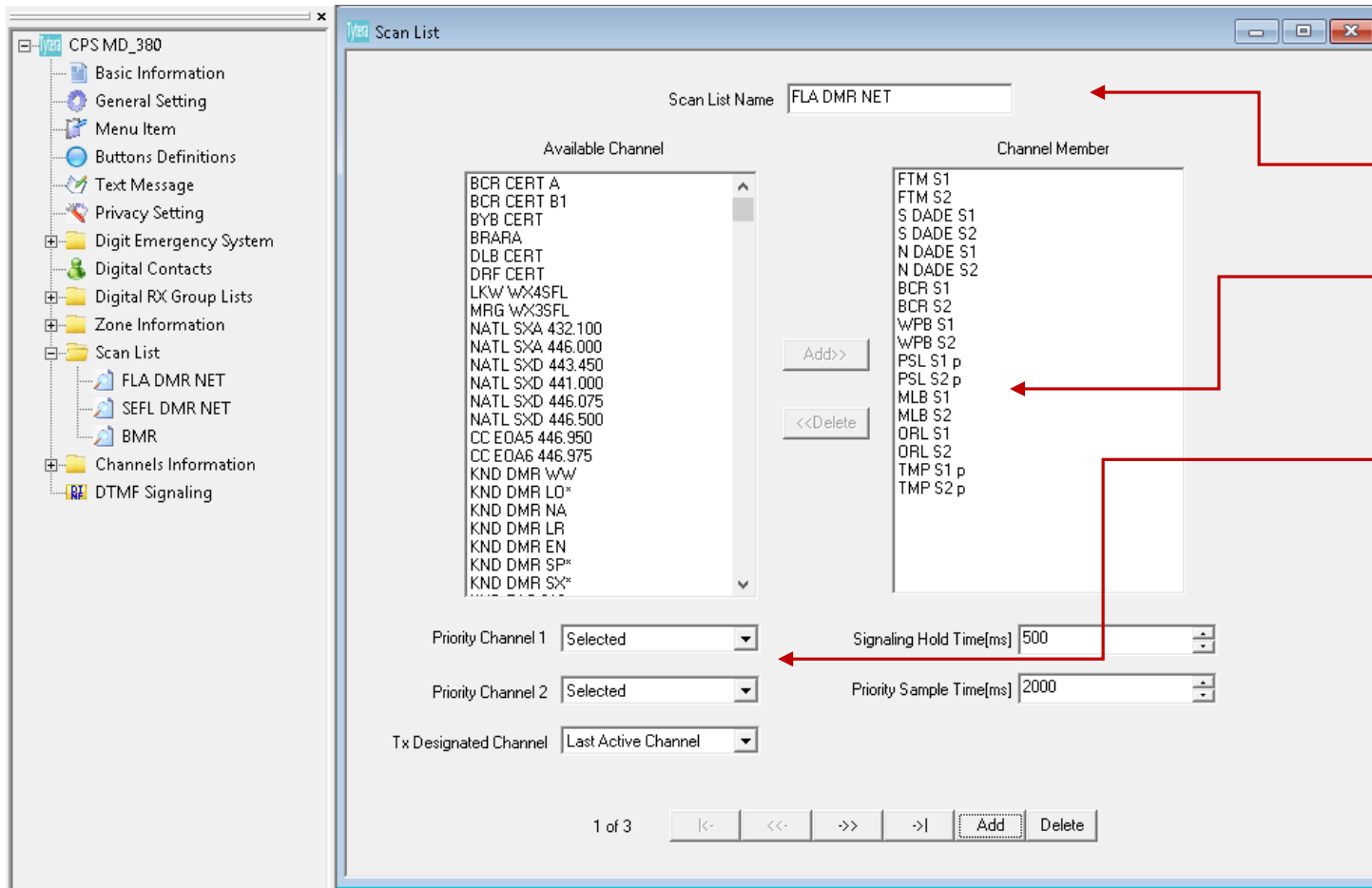
# DMR Programming for DUMMIES



## Zone Information

- Zone Name
- Up to 16 Channels per Zone
- Non Active Channels indicated by:
  - \* MD 380/390
  - X CS 750/800

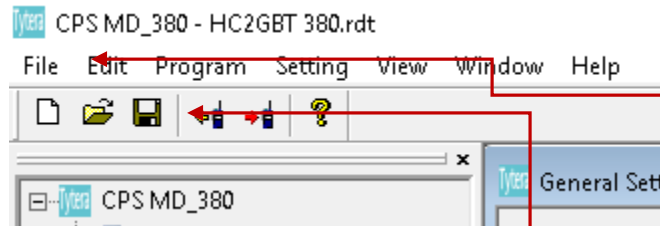
# DMR Programming for DUMMIES



## Scan

- Scan List Name
- Not limited 16 Channels per List
- Priority Channels are Optional

# DMR Programming for DUMMIES



Remember to Save your Work by either:

- File
  - Save
  - Save as
- Selecting the Floppy Disk
  - Save

Otherwise your work will not be saved