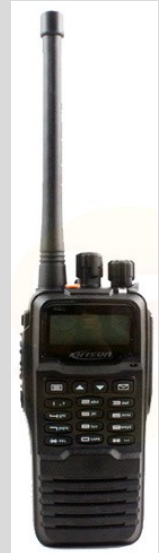


Introduction to Digital Mobile Radio (DMR)



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January 2017

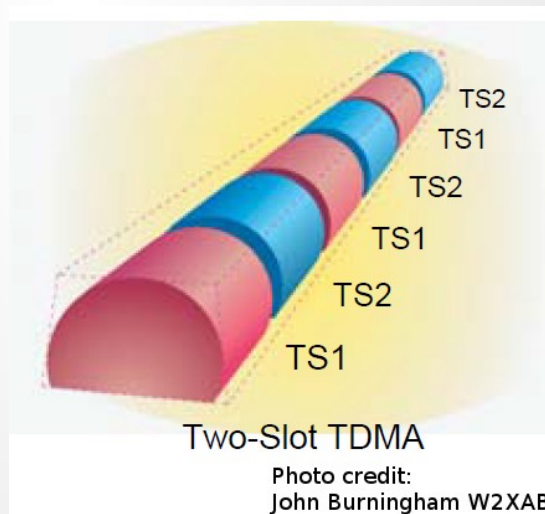
What is DMR?

- Digital Mobile Radio (DMR) was developed by the European Telecommunications Standards Institute (ETSI) and is used worldwide in professional mobile radio services.
- DMR is divided into three tiers.
 - Tier I (single channel)
 - Tier II (2-slot TDMA– the standard for Amateur Radio)
 - Tier III (trunking protocol)



What is DMR?

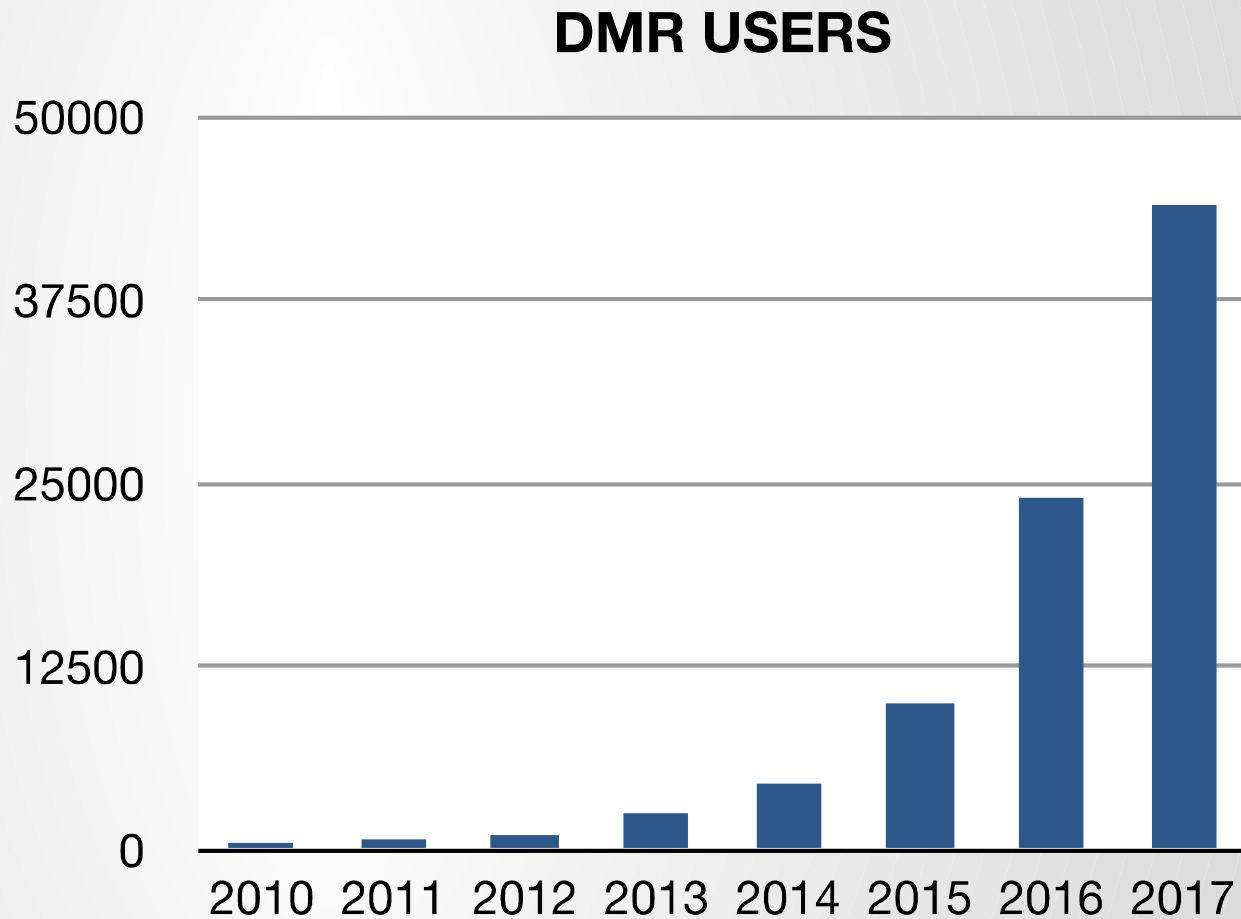
- DMR uses a digital Vocoder employing Forward Error Correction providing for enhanced signal reliability and superior voice fidelity.
- DMR signals occupy a 12.5 kHz bandwidth shared by two “channels” (Time Slots) using Time-Division Multiple Access (TDMA), this results in a spectrum efficiency of 6.25 kHz per channel.
- Each Time Slot 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).



Why use DMR?

- Low cost of entry – new radios available for about \$100
- Easy to use – logical talkgroup layout
- Work the world from your handheld
- Great voice quality
- Spectrum efficiency – about 1/3 the bandwidth of traditional analog FM
- Long battery life – talk time is about 40% more compared to an analog radio of the same power rating
- Becoming very popular – registered repeaters and users have tripled in about the past 18 months
 - Over 3,000 registered repeaters
 - Over 44,000 registered users
 - *The number of users has **tripled** since May 2015*

DMR is Growing



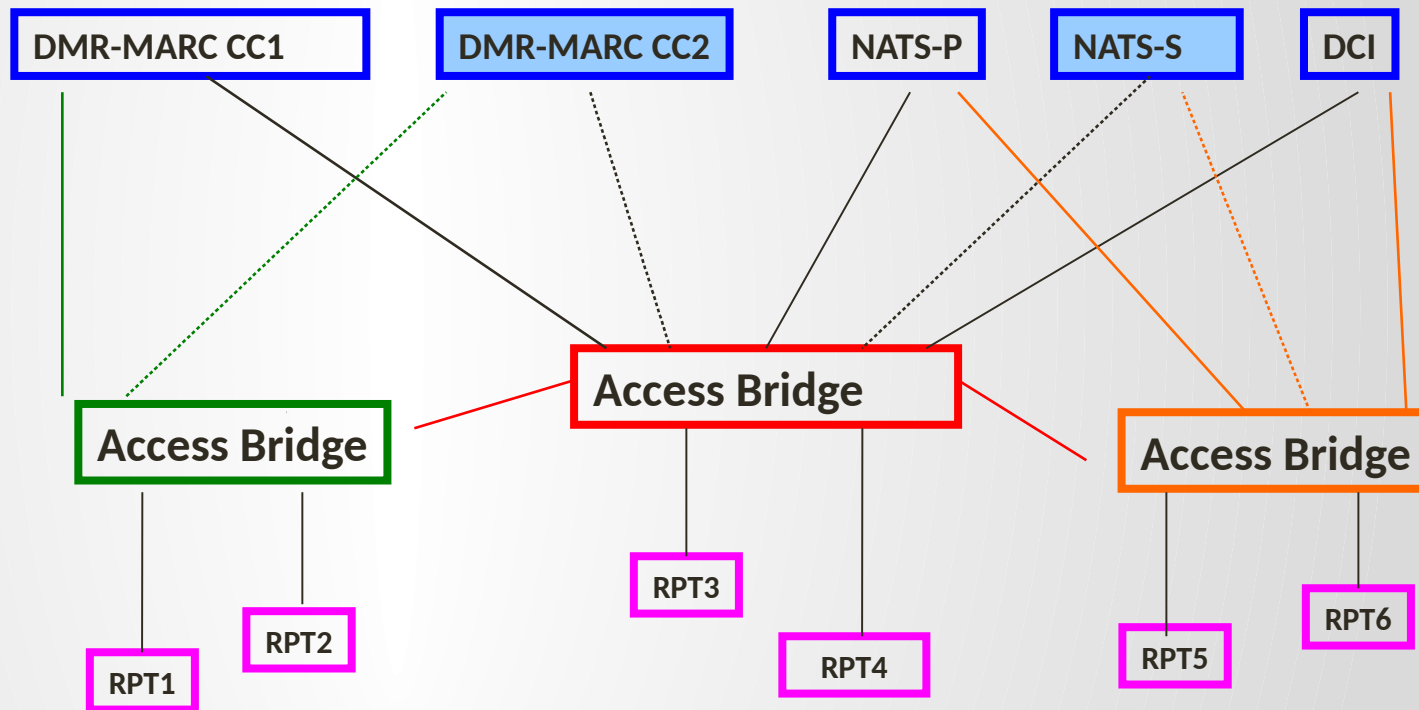
Credit: Stephen Smith W9GPI

DMR Network

- Many cooperating networks are connected together to provide local, regional, national and international connectivity.



DMR Network



Credit:
John Burningham W2XAB

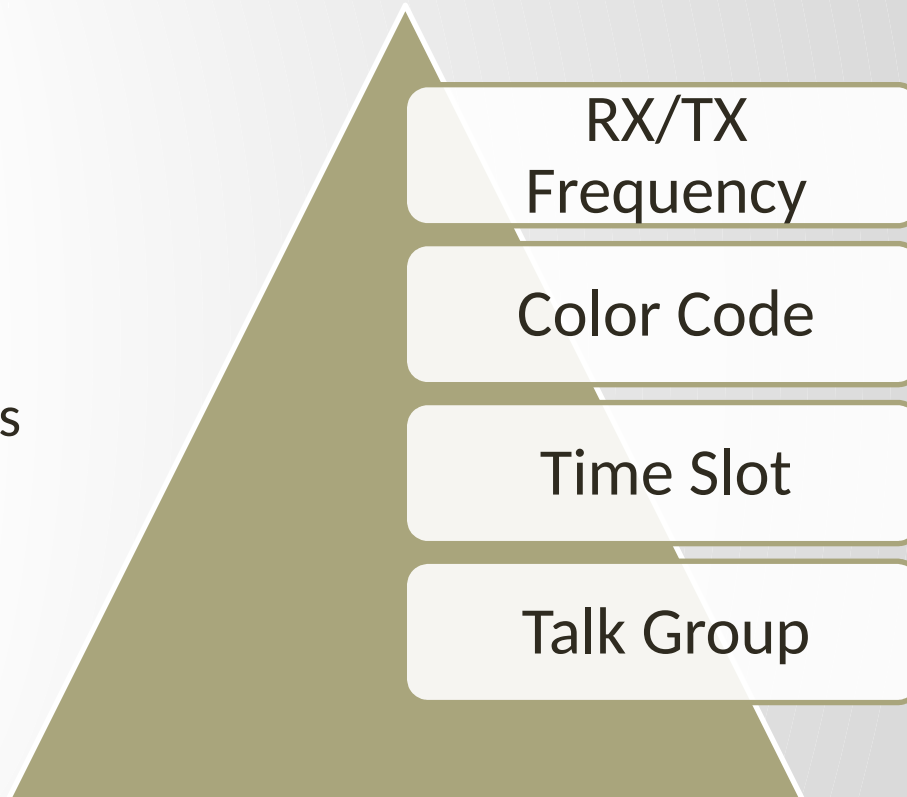
Getting Started

- **Register and receive a DMR User ID!**
DMR-MARC.net -> Register ID
- Determine frequency band(s) in use in your local area. 70cm is most common.
- Purchase a radio (Amazon, Connect Systems, others)
- Install programming software
- Obtain a local/regional Code Plug
- **Change the Radio ID to your assigned ID**
- Program your radio
- Enjoy!

Note: N0GSG DMR Contact Manager is a nice tool for tweaking Code Plugs

DMR Terminology (or HUH???)

- Color Codes
- Time Slots
- Talk Groups
- Zones
- Code Plugs
- FT / PTT Talk Groups



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.

Credit:
John Burningham W2XAB

Time Slots (TS)

- Each DMR repeater can service two Time Slots simultaneously.
- They are referred to as Time Slot 1 or Time Slot 2.
- Time Slots may also be referred to as “Repeater Slot” in your radio’s programming software.
- In order to access a specific Talk Group, the Time Slot must be set correctly.
- International and National Talk Groups are typically on TS1.
- Regional and Local Talk Groups are typically on TS2.

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.
- **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.

Credit:

John Burningham W2XAB

Talk Group Hierarchy



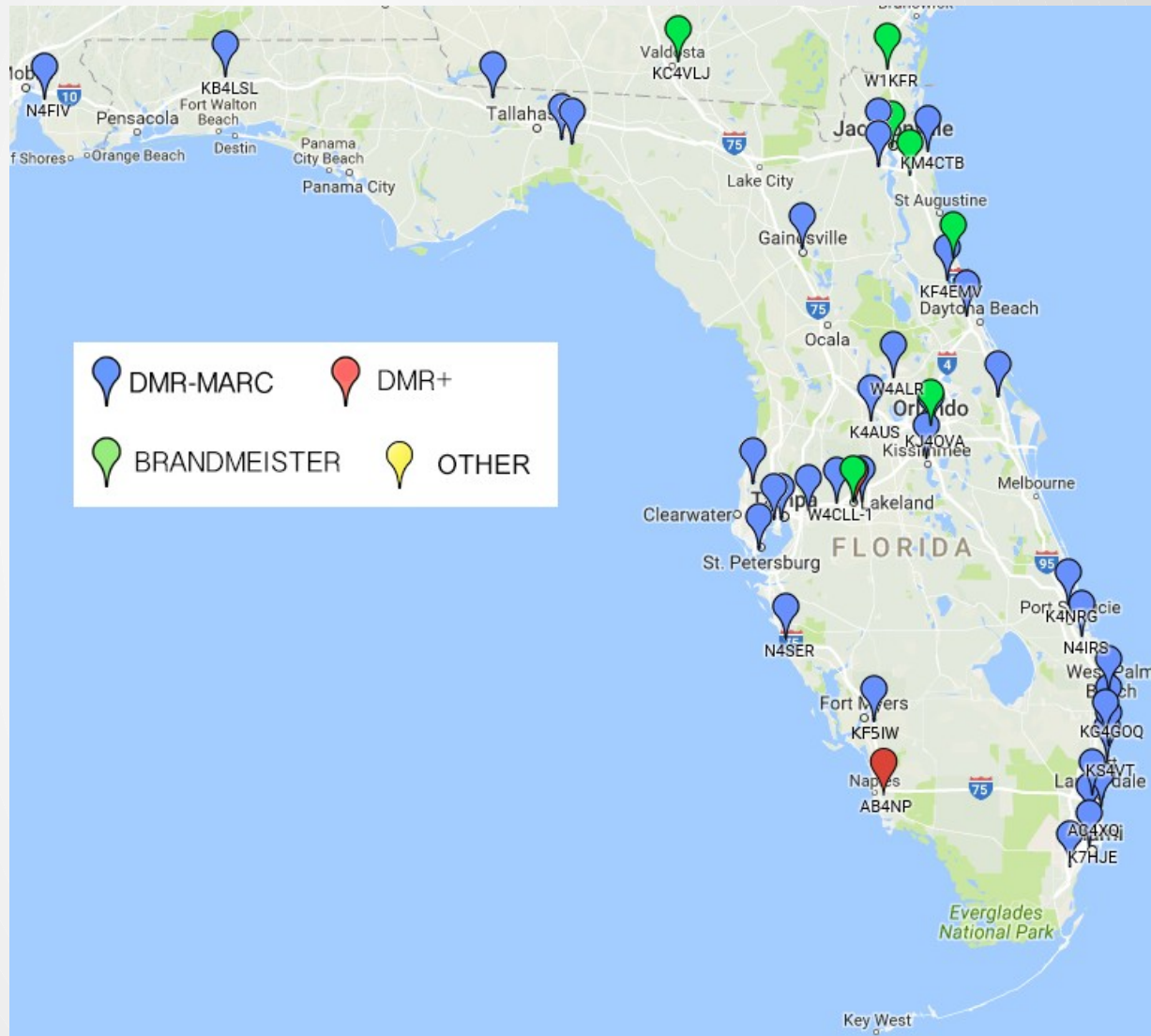
Credit:
Stephen Smith W9GPI

Regional Talk Groups



Credit:
DMR-MARC.net

Florida DMR Repeaters



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.

Credit:
John Burningham W2XAB

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.
- 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.

Credit:

John Burningham W2XAB

FT / PTT Talk Groups

- Individual Talk Groups may be designated as Full Time (FT) or Push-to-Talk (PTT).
- A Full Time Talk Group will be broadcast by the repeater whenever there is activity on that Talk Group anywhere on the network.
- A PTT Talk Group requires a local user to transmit on that Talk Group before it becomes active on that local repeater.
- A PTT Talk Group remains active on the local repeater for about 5 minutes after the last transmission is received by that repeater.
- PTT TGs are designed to reduce Time Slot congestion by broadcasting that TG only when desired by a local user.

Some Talk Groups

Talk Group	TG	TS	FT/PTT
WW	1	1	PTT*
NA	3	1	FT
Local 2	2	2	FT
SE	3174	2	FT/PTT**
FL	3112	2	FT
TAC310	310	2	PTT*
TAC311	311	2	PTT

* Becomes Full Time for scheduled nets

** FT in-region, PTT out of region

Repeater Operation

- Listen for the beep when keying your PTT switch. A high pitched beep indicates a successful connection to the repeater, whereas a low beep indicates a connection failure.
- Remember that on most Full Time Talk Groups, your QSO is being transmitted by dozens if not thousands of repeaters across the world.
- Be courteous to others and leave ample time for break-ins to be heard.
- If your QSO is becoming or will become lengthy, consider moving to a TAC or User Accessible Talk Group.
- Remember to properly identify with your callsign. Your DMR ID is not a legal callsign!

Repeater Operation

- When calling another station, please specify which Talk Group you are using. The other party may be scanning and not looking at their radio's display. Examples:
 - **W2XAB from KF5IW on Southeast**
 - **This is KF5IW listening Florida state**
- When building scan lists, you may want to include only Full Time Talk Groups as PTT Talk Groups are normally inactive.

Simplex Operation

- In professional radio services, Talk-Around refers to operating simplex on a repeater output channel. This facilitates communications when out of range of a repeater. This is frowned upon in the Amateur community as it can interfere with repeater operations.
- Do not use 146.520 or 446.000 as these are the standard analog frequencies.

Recommended DMR Simplex Frequencies				
70cm	441.000	446.500	446.075	433.450
2m	145.790	145.510		
TG99 / CC1 / TS1 / Admit Criteria: Always / In Call Criteria: TX or Always				

For More Information

- *Amateur Radio Guide to Digital Mobile Radio (DMR)*, by John Burningham W2XAB, available on K4USD.org
- DMR-MARC.net
- K4USD.org
- TRBO.org
- DMRX.net