DMR radio

AN INTRODUCTION

7/21/2017

What is DMR?

- DMR stands for Digital Mobile Radio
- Based off commercial radio standard developed by Motorola, then known as MotoTRBO
  - Motorola placed technology into public domain
  - Modified into international digital radio standard developed by the European Telecommunications Standards Institute (ETSI), and first ratified in 2005.
  - DMR uses time-division (TDMA) and uses the DSVI AMBE+2™ vocoder

Types of Digital Radio

- D-Star (ICOM / Kenwood / Flex) proprietary AMBE vocoder with Gaussian minimum shift keying or GMSK
  - GMSK is a continuous-phase frequency-shift keying modulation scheme
- Fusion (Yaesu) AMBE CODEC with C4FM [4-level FS] modulation
- DMR utilizes the DSVI AMBE+2™ 3600 bps vocoder by agreement of the manufacturers. Uses TDMA (Time Division) variant of C4FM

Why DMR?

- HAMS adopted Commercial Equipment
  - Relatively LOW cost
- Digital has lower noise / better sound quality
- Internet linking lets you access world

Basics of DMR – including some lingo

A. TIERS of DMR
B. FEATURES of DMR
C. Timeslots
D. “Color Codes”
E. Talkgroups

(A) DMR TYPES (TIERS) – You want TIER 2

- Tier 1: unlicensed
  - equipment works in Direct Mode (unit-to-unit) on public frequencies
- **Tier 2: licensed conventional**
  - This Tier is aimed to be a direct replacement for the analog conventional radio system
- Tier 3: trunked system
  - Proprietary by Manufacturer

(A) REGISTER your Radio

- Think “computer network” … Just as every terminal has own IP address & MAC; Users have logins…
- Each radio is assigned an unique ID Number
- First thing you have to do after buying, is register for user-specific MARC ID
  - Go to https://dmr-marc.net/cgi-bin/trbo-database/register.cgi
  - Select “User Registration” at bottom of page
  - Validates callsign using QRZ
  - Sends acknowledgement in day or two (usually)

DMR “MARC” ID

- Registration filed on Internet…
- https://www.dmr-marc.net/cgi-bin/trbo-database/
- Again, select USER
- **SHOWN on NEXT SLIDE**

NAME	CALL	DMR ID
Richard Nelson	KF5WRD	1148431
Marty Fitzgerald	W5MF	1148439
Ron Matusek	WA6TQH	3148924

DMR-MARC
Motorola Amateur Radio Club Worldwide Network

Translations:

Home | Database | Repeaters | About Us | Register ID | Contact Us

DMR Advanced Database Search

User Database | Rptr Database

User Search Criteria

DMR ID	Equals	
Callsign	Equals	KF5WRD
Surname	Equals	
City	Equals	
State/Prov	Equals	
Country	Equals	

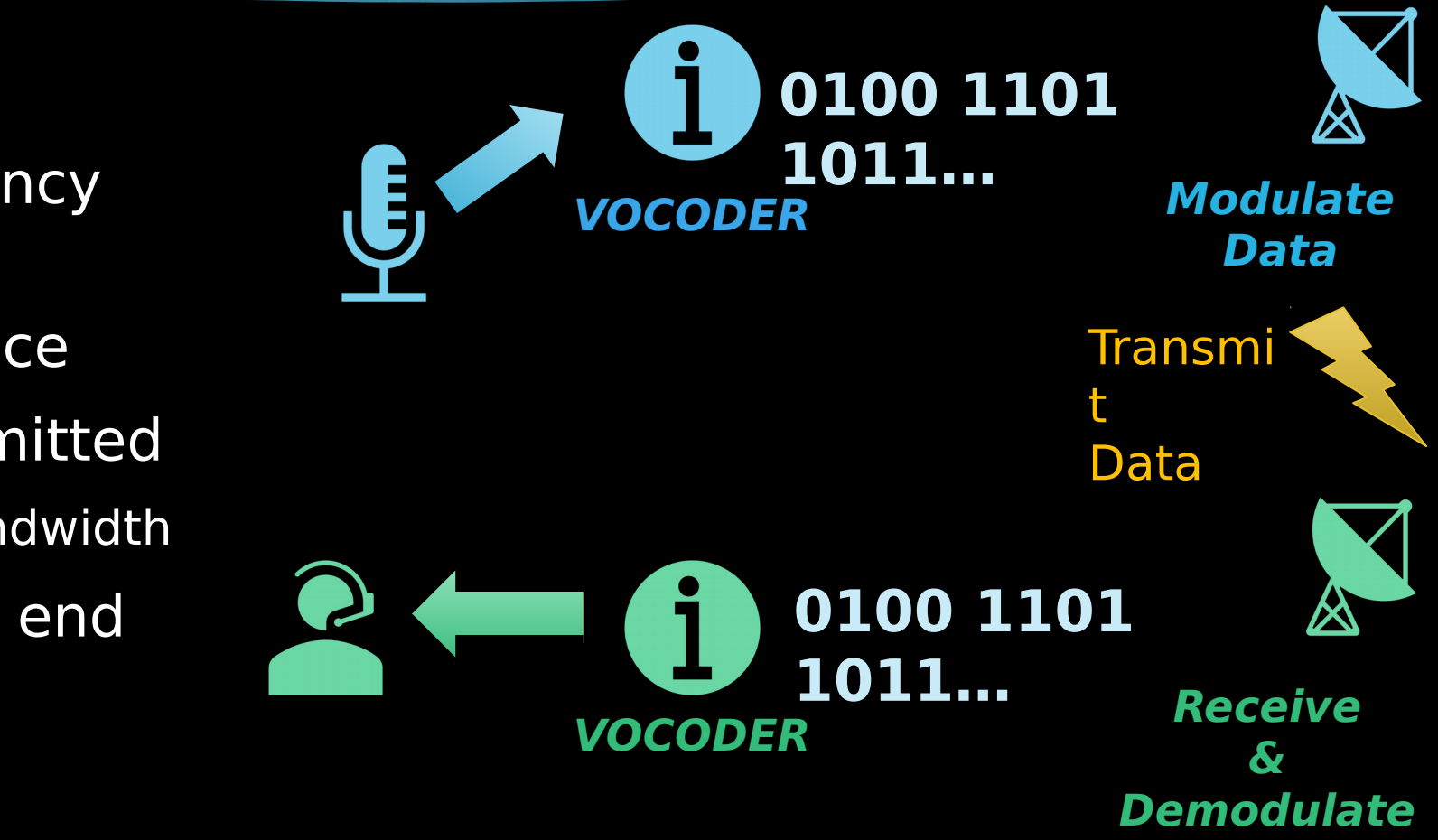
Search

Users Search: 1 Results

DMR ID	Callsign	Name	City	State/Prov	Country	Remarks
1148431	KF5WRD	Richard Nelson	Spring	Texas	United States	DMR

(B) Digital part of DMR

- Rather than directly modulate the frequency (like analog FM)
- Vocoder digitizes Voice
- Digital data is transmitted
  - Reduces required bandwidth
- Vocoder at receiving end decodes signal



(B) Reduced Bandwidth ⎵ More data

- Just as digital TV has allowed more stuff to be put onto old TV channel bands… same is true of DMR
- Recall FCC pushing for NARROWBAND (12.5 MHz instead of 25 MHz)
- So DMR can double-up data ⎵ which it does using TIMESLOTS {next slide}
  - Compresses 60 ms of voice into 30 ms

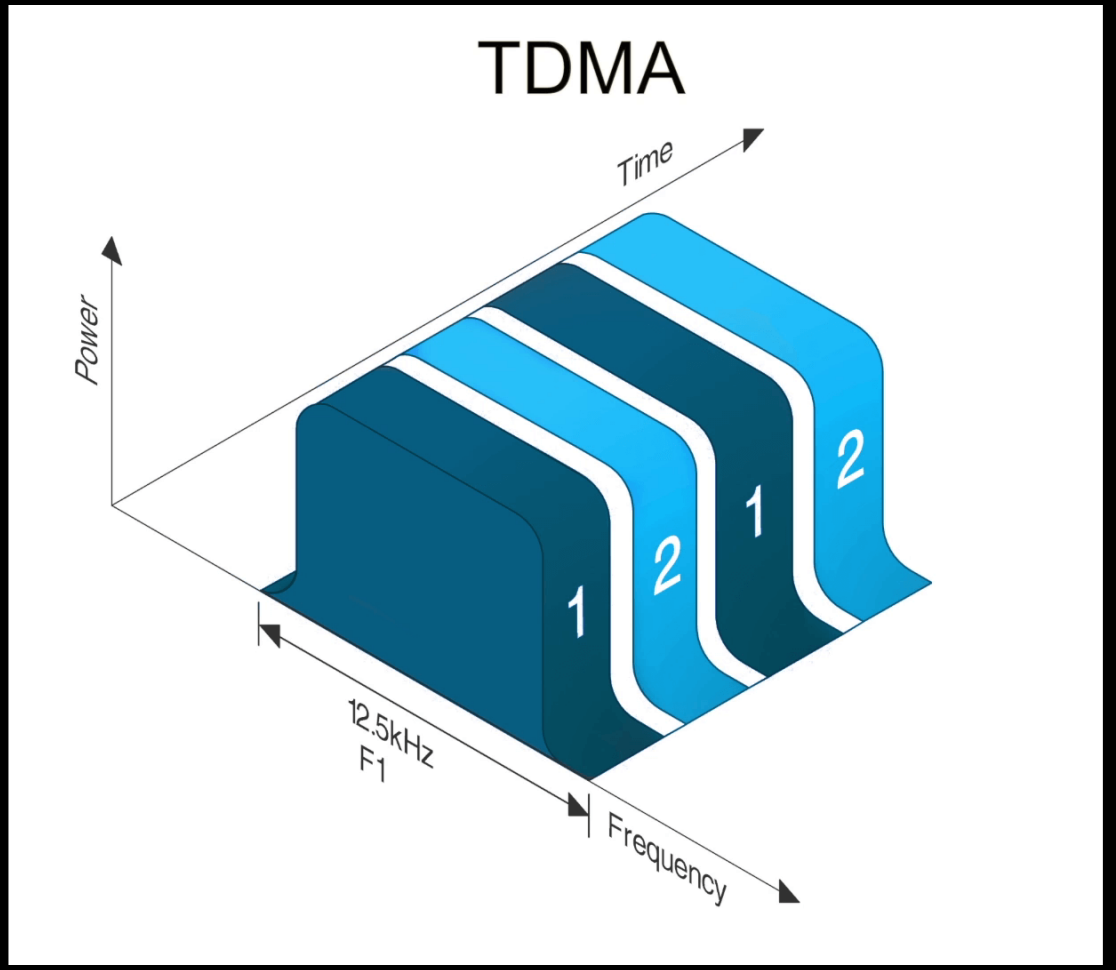
(C) TIME SLOTS (TDMA)

Time Division Multiple Access

- two logical channels
- each 12.5-kilohertz channel space
- Separated by 30 ms

http://www.taitradioacademy.com/wp-content/uploads/2014/12/Image-21.png

Radio only monitors 1 or 2 – NOT BOTH



(C) Timeslots Cont.

- Timeslots require synchronization of timing among all users
  - This only matters if on a repeater or on a network
    - If operating simplex, the radio ignores the Timeslot
  - Same thing (time synch & sharing) happens on computer network

(D) “Color” Codes

- Has nothing to do with color
  - **Don’t blame me – I didn’t name it**
- Similar to CTCSS on FM
  - Purpose is to filter or ignore other users not using same color code

(E) TALKGROUPS or “TG” for short

DMR uses “code numbers” called Talk Group

-- similar to computer “chatrooms” to tell computer who you want to talk to

(E) TG used to route signals

- Uses “Talkgroups” which are analogous to an IP address on internet
  - Tells system where to direct message traffic
  - System is roughly geographical in nature

A caveat…

- There are actually multiple networks…
  - Brandmeister
  - MARC (Motorola Am. Radio Club)
  - DMR Plus
- These number / name the talkgroup channels differently

Several of us have SharkRF OPENSPOT which accesses BRANDMEISTER
YOU can listen via some browsers (Chrome) using **Hoseline - BrandMeister**
https://hose.brandmeister.network/
THIS DOESN'T WORK on Microsoft's IE

TG Geographic by Continent ▭ Country

3-Digit Country Code

United States

(310 or 311)

3 1 n xxx

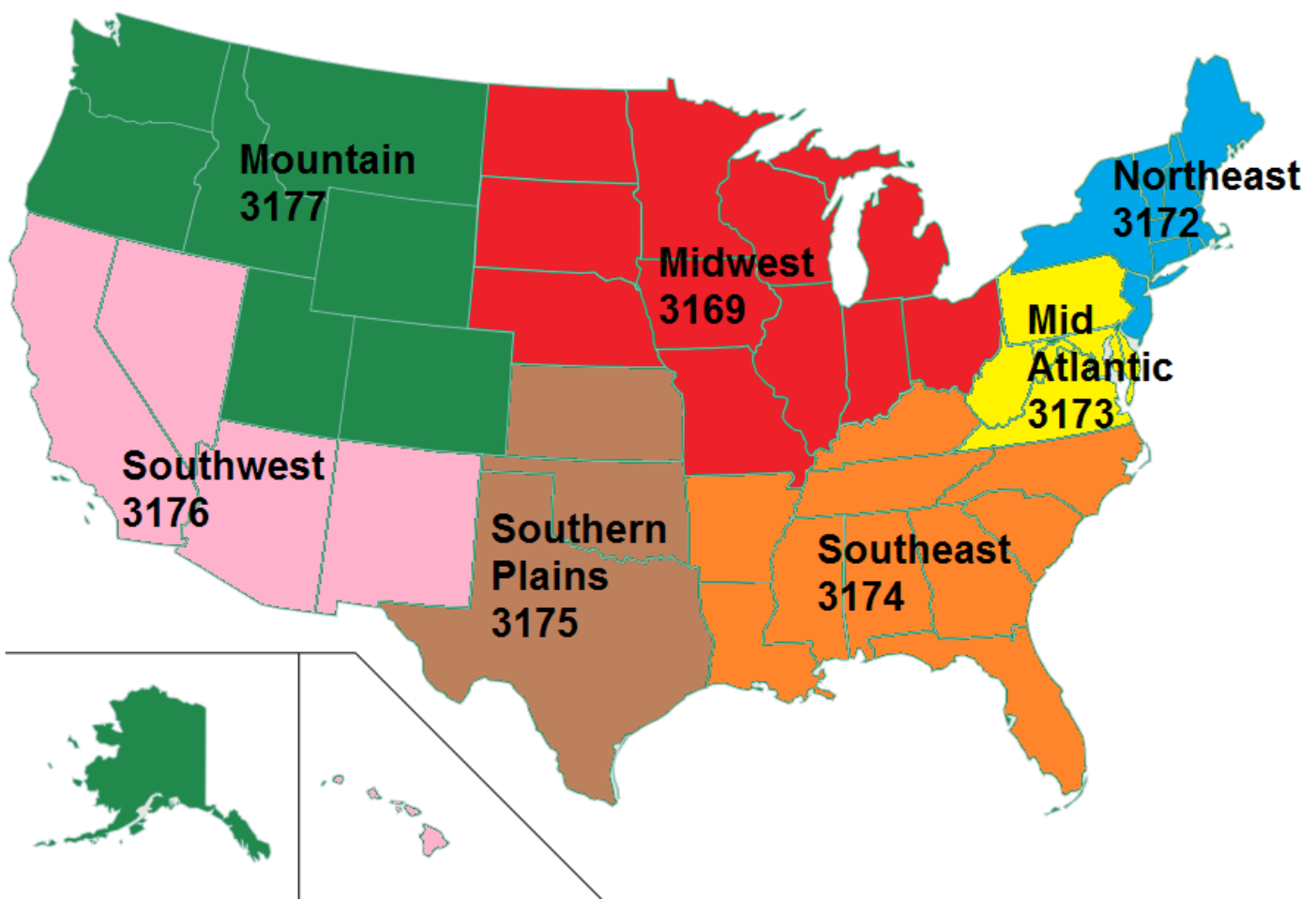
GEORGRAPHIC REGION

N. AMERICA

(E) TG are Geographic by Continent

0	TEST NETWORKS	9	WORLDWIDE
2*xx*	EUROPE	**3***xx*	N. AMERICA & CARRIBEAN
	208 = France ; 235 = UK; 262 = Germany		302 = Canada ; 310 = US; 334 = Mexico
4xx	ASIA & MIDDLE EAST	***5xx***	OCEANIA
	208 = France ; 235 = UK; 262 = Germany		505 = Austrailia ; 310 = US; 334 = Mexico
6xx	AFRICA	***7xx***	S. & CENTRAL AMERICA
	208 = France ; 235 = UK; 655 = S. Africa		302 = Canada ; 310 = US; 334 = Mexico

Regional Talkgroup Structure



3175	S. (Plains) TX + OK
3148	Texas
3140	Oklahoma

TG can get more specific within each region; Some ignore pattern

TG	NAME	COMMENTS
1 / 91	Worldwide	Any Language
2	Local/Metro	Common Local Area Metro or Local Repeaters
3 / 93	North America	United States/Canada (DMR-MARC)
9	Repeater	Used with SharkRF Openspot
13	Worldwide English	English Olnly
9990	Parrot (Echo)	test
4000	Disconnect	Used with SharkRF Openspot
5000	Status (Echo)	Used with SharkRF Openspot

US and Texas Talkgroups

TG	NAME	COMMENTS
310	TAC 310	North America Repeater-to-Repeater TG
3100	DCI Bridge	a general "ragchew talkgroup“ the Bridge has evolved into a worldwide talkgroup since it's cross connection to the Brandmeister platform
3102	Brandmeister TG	
3148	Texas	"Lonestar Talk Group"
3175	Southern Plains	TX/OK/KS/AR
3185	Cactus	TX/AZ/CA
8207	Houston Area Local	Activates all Upper Gulf Coast Repeaters

More Detail (5 & 6 Digit codes)

- STATE Sub-Units (5 Digits) , so TX = 3148
  - 31481 = N Texas; 31482 = S Texas; 31483 = W Texas
- REPEATERS – 6 Digits (4 State + 2 ID)

NOTE: When connecting via REPEATER you are limited to just those Talk Groups the Repeater
Operator has designated

Talkgroups vs. REFLECTORS

- On Brandmeister network
  - Reflectors numbers range from 4000-4999
  - These are a link to a talkgroup
  - DV4Mini users need these links
- https://wiki.brandmeister.network/index.php/United_States_of_America

REFLECTOR	TALKGROUP
4000	disconnect
4639 ㅛ	TG 91 Worldwide
	No Longer 3100
5000	Where am I?

BRIDGING

- **<u>If your access node is set up with the correct “Bridge”</u>**
  - Allows cross-over to other digital modes
    - Brandmeister to DMR-MARC
    - DMR to D-Star

(F) CODEPLUG

- One Downside of most DMR radios is they are **very difficult** to program using front-panel
- The Talkgroup, Color Code, Timeslot, and Repeater data (frequency, tone, offset) all need to be entered
- All of this data is programmed into a “CODEPLUG”
  - A Codeplug is data file
  - Use a computer and programming cable to put on the radio

Radio “Channels” [TYT Radios]

- Each channel is for a specific repeater and talk group
- You can have a different repeater/TG per channel
- You can change out all of the channels when you switch zones.
  - So, if you are often in both NY and Texas, you can have a TX Zone with fully different set of repeaters and channels you switch between

- Go to https://dmrtexas.net/tag/texas/ AND http://www.nflarc.com/DMR/index.htm for lists

RADIO Options

- Most hams buying UHF HT radios
- Most DMR repeaters on 0.70 cm (440 MHz)
  - Cheaper than Dual band

- TYT, TERK, HYTERA, Connect Systems
- Main Trading has their own ReBrand

DMR is Networked Radio

- Hotspots and Repeaters are NODES;
- NODES connect to internet using Network Gateway
- Radio uses “Physical Channel” ⎵ frequency bandwidth and uses “logical Chanel” ⎵ Timeslot
- If connecting via a Repeater or Hotspot, can only use Talkgroups recognized on that device.
  - Some repeaters only have 1-2 Talkgroups
  - Brandmeister TG different than MARC

What’s the catch?

- Most current ham radios are still analog
- Have incompatible digital standards across brands
- Limited Talkgroups depending upon how you access
  - May require internet access

REFERENCES

- DMR MARC http://www.dmr-marc.net/ - information & ID Registration
- Brandmeister Net. https://brandmeister.network/ This is what we use & UHF DMR HT
  - HOSELINE http://hose.brandmeister.network/ CAN'T USE INTERNET EXPLORER
  - BM Wiki https://wiki.brandmeister.network/index.php/Main
- https://dmrtexas.net/tag/texas/ by Jason Johnson of Ham 2.0 & Grapevine Am. Radio
- http://www.nflarc.com/DMR/index.htm TG Lists
- Part 97 use - http://www.va3xpr.net/fcc-officially-gives-the-green-light-to-dmr-for-us-hams/