Digital Mobile Radio

SARA Club November 19, 2024

Mark – N6ARP

BEFORE WE BEGIN.....

- Amateur Radio is Experimental
- Amateur Radio is Learning and Fun!
- Amateur Radio is pushing the boundaries in technology
- Amateur Radio is Amateur Radio and Fun!
- DMR is not the replacement of Analog, DStar, IRLP, Echolink, Packet Radio, HF Radio, Moonbounce, Scatter, Contesting, Electronics, the universe....

WHAT IS DIGITAL MOBILE RADIO

- Commonly Known as "DMR"
- A Standard for Digital Voice Communications
- Published by the European Telecommunications
 Standards Institute (ETSI) in 2005 (Tier 1 & Tier 2) | 2015
- The goal of the standards to create a digital systems are:
 - Low Cost
 - Low Complexity
 - Interoperable Between Vendors



World Class Standards

DMR ASSOCIATION

- A Global Organization Focused on Growing the DMR Market
- Provides
 - Interoperability Testing
 - Certification
 - DMR Education, Promotion and Encourages Discussion

DMR ASSOCIATION MEMBERS



Respond & Achieve

THE DMR STANDARD

- Specifies the Air Interface Between Radios
- 2-Slot Time Domain Multiple Access (TDMA)
- 12.5 kHz Channel Width
- Digital Modulation (4FSK)
- Frequencies Between 30MHz 1 GHz
- DMR Association Members Have Agreed to Use the AMBE +2 Vocoder

BENEFITS OF USING DMR

- Allows 2 Simultaneous Voice Conversations using a Single Repeater
- Improved Audio Performance Over Analog
- More Efficient Use of Radio Spectrum vs Analog
- Longer Battery Life vs. Analog
- Lowest Total Cost of Ownership for Clubs Compared to Other Ham Digital Modes
- +12 DMR Radio Manufactures = Lower Radio Prices
- Capable of Being Linked to Over 1,800 Repeaters Worldwide

FEATURES OF HAM DMR NETWORK

| Features | Benefits |
|--|---|
| Multiple Talk Groups | Allows users to access groups of other users by geography or language by simply keying their rados. No node numbers to dial or remember |
| Dual Timeslots | Allows 2 simultaneous conversations using a single repeater. Like having 2 repeaters on one frequency. |
| Text Messaging | A quick and convenient way to send messages to a group or a single person. |
| Roaming | Allows DMR radios to switch between repeaters automatically, common TG |
| Remotely IP Programmable Repeaters | Allows the repeater sponsors to make changes remotely |
| APRS | Radios beacon location (radios with GPS Built in) Brandmeister Network Only |

DMRVSANALOG



Analog Repeater

Voice Channel

IMPROVED VOICE PERFORMANCE



IMPROVED VOICE PERFORMANCE



EFFICIENT USE OF RADIO SPECTRUM

DMR PROVIDES **4X** AS MANY VOICE CONVERSATIONS USING THE SAME SPECTRUM AS ONE FM REPEATER @ 25 KHZ.



LONGER BATTERY LIFE

- Up to 40 percent in talk time compared to analog radios.
- Radio is transmitting half the time due to TDMA



DMR NETWORK DEFINITIONS

| Term | Definition |
|------------|---|
| Talkgroup | A Virtual Radio Channel, Typically assigned by geography or language. |
| Timeslot | A brief interval to which a DMR radio, especially a repeater, accepts data from another radio. For DMR there are two (2) 30ms time slots. |
| Color Code | A number that is analogous to the PL or CTCSS tone used during analog FM Analog Operation. |
| C-Bridge | A Server that bridges together regional DMR Networks. Or Brandmeister |
| User ID | A unique number assigned to each radio on the DMR Network. Also known as "Subscriber ID" or a "Radio ID" |
| CPS | Short for Customer Programming Software, which is the software used to program a DMR Radio. |
| vocoder | A Synthesizer in DMR Radio that converts analog voice to digital data. |
| Master | A DMR Repeater that connects to a c-Bridge on a ham DMR Network. All other DMR repeaters that connect to the network through the master are called peers. |

DIGITAL VOICE SYSTEMS

| Format Feature | P25 Phase II | DMR | DSTAR | FUSION | NXDN/IDAS | |
|----------------------|-----------------------------|-------------------|-------------------|------------|------------------------------|--|
| Operating Band | VHF, UHF, 700/800 | 70cm, 2m, 33cm | 2m, 70cm, 33cm | 2m, 70cm | 70cm, 2m, 33mc | |
| Dual Band | Yes | No | Yes | Yes | No | |
| Battery Life | 40% Longer | 40% Longer | Normal | Normal | 20% Longer | |
| Dual Time Slot | Yes | Yes | No | No | N/A | |
| Range | 20-25% over wideband analog | | | | | |
| Manufacture Specific | No | No | Yes, Icom | Yes, Yaesu | Yew, Kenwood, Ritron/Icom | |
| # of Manufactures | >6 | 25+ | 1 | 1 | 2/1 | |

DIGITAL VOICE SYSTEMS

| Format Feature | P25 Phase II | DMR | DSTAR | FUSION | NXDN/IDAS |
|-------------------------------|-------------------------|---------------------------------|----------------------------|---------------------------|---------------------|
| Protocal | TDMA | TDMA/4FSK | GMSK | FDMA/C4FM | FDMA |
| Vocoder | AMBE+2 | AMBE+2 | AMBE | AMBE+2 | AMBE+2 |
| Forward Error Correction | Yes | Yes | No | No | Yes/Yes |
| Spatial Efficiency | 12.5kHz dual 6.25kHz | 12.5kHz dual 6.25kHz | 6.25kHz | 12.5kHz | 6.25kHz/12. 5Khz |
| Adopted Worldwide Standard | Yes, Public Safety | Yes, Commercial & Amateur | Yes, Amateur Radio Only | No, Amateur Radio Only | No |
| # Repeaters in US | 170 | 908 | 1100 | 219 | 52 |

DMR STANDARDS

- Tier 1
 - FDMA (frequency division multiple access)
 - PMR 446 MHz European Unlicensed Service
- Tier 2
 - 2 Slot TDMA (Time Domain Multiple Access)
 - IP Site Connect (Vendor Specific)
- Tier 3
 - 2 Slot TDMA
 - Trunking

AMATEUR RADIO DMR NETWORKS

- Over 6,578 Repeaters Worldwide
- Over 4,360,000 Registered Radios ID's Worldwide
- Over 197,000 US Registered Radios
- Networks Divided by Infrastructure
 - CBridge, SmartPTT Mototrbo (Motorola Solutions)
 - Primarily US/UK
 - Brandmeister Hytera, Mototrbo, Homebrew, MMDVM, DV4Mini, DVMega
 - Worldwide Growth Newest System
 - DMR +
 - Original Hytera Network
 - Growth slowing and decreasing in use

LOW COST OF OWNERSHIP

Example: A Ham Radio Club of 20 Members

| | Quantity | FUSION | DSTAR | DMR |
|------------------------------|----------|----------------------|----------------------|----------------------|
| Digital Repeater | 1 | \$620 ¹ | \$1,548 ⁶ | \$1,800 ² |
| Programming Cable & Software | 1 | \$0 | \$0 | \$375 |
| Digital Portables | 20 | \$6,000 ³ | \$6,000 ⁵ | \$3,980 ⁴ |
| Total | | \$6,620 | \$7,548 | \$6,155 |

MOTOTRBO

REPEATERS





SLR 5700

PORTABLE RADIOS

| | | Image: Second | Vertex Standard Vertex Standar |
|--|--|---|---|
|--|--|---|---|

| Connect | ТҮТ | Motorola | Motorola | Vertex/Standard | Hytera |
|----------------|----------|----------|----------|-----------------|----------|
| -Systems CS750 | MD380 | XPR6550 | XPR7550 | EVX-539 | PD-782 |
| \$239.00 | \$120.00 | \$450.00 | \$700.00 | \$350.00 | \$585.00 |

MOBILE RADIOS



NETWORK - HOW ITWORKS



NETWORK - HOW ITWORKS



COMMON COURTESY

- All Radios Must Register for a 7-Digit DMR ID <u>http://dmr-</u> marc.net
- ID You Must ID the same as you would on Analog Per FCC Rules
- Remember you might be keying up 100+ repeaters
- Test If you want to test go to Echo Test (Parrot) and ID
- **Pause** pause between your communications to allow others to join

COMMON COURTESY

- What to do when keying up talk group
 - Give your Call and the Talk Group you are on
 - You can simply say "W7XM on SNARS Listening"
 - or "W7XM on SNARS"
 - $\circ~$ or "W7XM on SNARS Looking for QSO"
 - Do whatever you feel comfortable

TIMESLOTS AND TALKGROUPS

A Virtual Radio Channel, Typically assigned by geography or language.

Sample Talkgroups on the SNARS Systems

| Talkgroup | Time Slot | Name | Connection | Timers |
|-----------|-----------|---------------|----------------|-----------------|
| 6968 | 1 | SNARS | Always Active | |
| 3132 | 2 | Nevada | Always Active | Hold Off 5 Mins |
| 3107 | 2 | California | Always Active | Hold Off 5 Mins |
| 1 | 2 | World | User Activated | 5 Min Activity |
| 3 | 2 | North America | User Activated | 5 Min Activity |

GETTING STARTED AS A DMR USER

- 1. Check that you're within the coverage area of a DMR Repeater
- 2. Request a User ID
- 3. Obtain a DMR Radio, programming hardware and software
- 4. Program your DMR Radio
- 5. Code Plugs available on websites, groups



OTHER WAYS TO ACCESS DMR



OTHER WAYS TO ACCESS DMR



Brandmeister Network http://hose.brandmeister.network

- Scanning (5 Talk Groups)
- Archive of Audio (30 Days)
- Audio Meters
- Save Scan List via URL
 - /scan/TG1,TG2, etc

BRANDMEISTER DASHBOARD



DMR - REPEATERS

- Mount Bullion UHF: Output: 444.7875 Input: 449.7875 CC: 1 Mount Bullion VHF: Output: 144.9375 – Input: 147.4375 – CC: 1 Mount Oso: Output: 440.1875 – Input: 445.1875 – CC: 1
- Paterson Pass UHF: Output: 441.8250 Input: 446.8250 CC:1
- <u>My. Vaca VHF: Output: 144.950 Input: 147.4500 CC:7</u>
- PAPA System Southern California and Nevada

LOCAL REPEATER

D878UV[D878UV:UHF[400 - 480 MHz] VHF[136 - 174 MHz]][:C:\AnyTone_D878UV(BLUE)\Data\D878 CPS 304 as of 10062024 WSER new.rdt] Version 3.04 File Model Set Program Tool View Help

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| D87 | 78UV | No. | Receive | Transmit | Channel Type | Power | Band | CTCSS/DCS | CTCSS/DCS | Channel Name | Contact | Radio ID | Optional Signal |
|-----|------------------------------|-----|-----------|-----------|--------------|-------|-------|-----------|-----------|------------------|------------------|----------|-----------------|
| Ð | Common Setting | 400 | Frequency | Frequency | D D' 11 | 1.6.1 | Width | Decode | Encode | D ID III - I | | NCADD | 07 |
| | Channel | 120 | 441.82500 | 446.82000 | D-Digital | IVIID | 12.5K | Οπ | Οπ | PatPasULocal | Local | N6ARP | UT |
| | Zone | 121 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | O# | Ott | PattPasU.TARCTik | TARCTalk | N6ARP | Ott |
| | Scan List | 122 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.Cal3106 | California3106 | N6ARP | Off |
| | Roaming Channel | 123 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.NorCA68 | NorCal31068 | N6ARP | Off |
| | Roaming Zone | 124 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.NorCA69 | NorCal31069 | N6ARP | Off |
| | FM | 125 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.NorthAm | NorthAm | N6ARP | Off |
| | Auto Repeater Offset Frequer | 126 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.Guild | Guild | N6ARP | Off |
| | - Device Information | 127 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.MtWst62 | MtnWest62 | N6ARP | Off |
| | - Optional Setting | 128 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.MtWst63 | MtnWest63 | N6ARP | Off |
| | - Alarm Setting | 129 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.Parrot | Local | N6ARP | Off |
| | - Local Information | 130 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.DynDisc | DynamicDisconect | N6ARP | Off |
| | Hot Key | 131 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.DynStat | DynamicStatus | N6ARP | Off |
| | APRS | 132 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.SNARS | SNARS | N6ARP | Off |
| | GPS Roaming | 133 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.SoCal66 | SoCal31066 | N6ARP | Off |
| | Diatal | 134 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.SoCal67 | SoCal31067 | N6ARP | Off |
| | Analog | 135 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.Tac310 | Tac310 | N6ARP | Off |
| | Allalog | 136 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.Tac311 | Tac311 | N6ARP | Off |
| | | 137 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.Tac312 | Tac312 | N6ARP | Off |
| | | 138 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.Tac317 | TAC317 | N6ARP | Off |
| | | 139 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.TG9 | TG9.RefBridge | N6ARP | Off |
| | | 140 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PatPasU.TGIF | TGIF | N6ARP | Off |
| | | 141 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.US3100 | U.S. 3100 | N6ARP | Off |
| | | 142 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.USEmCom | U.S.EmComm9911 | N6ARP | Off |
| | | 143 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.WW91 | WW | N6ARP | Off |
| | | 144 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.DMRofAn | DMR of Anarchy | N6ARP | Off |
| | | 145 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.GNCA515 | GNorcal5150 | N6ARP | Off |
| | | 146 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.DMRTrk8 | DMRTrack31489 | N6ARP | Off |
| | | 147 | 441.82500 | 446.82500 | D-Digital | Mid | 12.5K | Off | Off | PattPasU.Carla | CARLA | N6ARP | Off |
| | | 148 | 441.82500 | 446.82500 | D-Digital | High | 12.5K | Off | Off | PattPasU.APRS | APRS | N6ARP | Off |

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REPEATER ZONES

| | 0.00 | | | | |
|--------------------------------|-------|--------------|---------------|------------------|------------------|
| 378UV | No. S | Name | Zone Channels | A Channel | B Channel |
| - Common Setting | 1 | blbx-V | 29 | blbxV.SNARS | blbxV.Local |
| Channel | 2 | Blbx-U | 30 | Blbx-U.TARCTalk | Blbx-U.Local |
| Correliat | 3 | Uoso | 31 | osoU.TARCTalk | osoU.Local |
| Bassia Changel | 4 | PatPas-U | 29 | PattPasU.TARCTIk | PattPasU.Local |
| Deaming Channel | 5 | Fremnt-V | 29 | Frmont-V.TARCTal | Frmont-V.Local |
| EM | 6 | PalAlto-U | 29 | PalAIU.TARCTalk | PalAIU.Local |
| Auto Depenter Officit Exercise | 7 | SnJose-U | 29 | SnJose-U.Local | SnJose-U.Local |
| Davias Information | 8 | blmwU | 28 | blmwU.TARCTalk | blmwU.NorCA68 |
| Optional Setting | 9 | Tulare-U | 29 | TulareU.TARCTalk | TulareU.NorCA68 |
| Alarm Setting | 10 | Sonora-V | 29 | Sonora-V.TARCTIk | Sonora-V.NorCA68 |
| Alarm Seurig | 11 | Sonora-U | 29 | Sonora-U.NorCA68 | Sonora-U.Cal3106 |
| Local mornauon | 12 | Snora2-U | 29 | Snora2-U.TARCTIk | Snora2-U.Local |
| ADDS | 13 | Tahoe-U | 29 | Tahoe-U.TARCTIk | Tahoe-U.Local |
| CDS Deaming | 14 | Gardvl-U | 29 | Gardvl-U.TARCTal | Gardvl-U.Local |
| Diatel | 15 | Santiago-U | 29 | SantiagU.TARCTal | SantiagU.Local |
| Applog | 16 | MtLuken-U | 29 | MtLukenU.TARCTal | MtLukenU.Cal3106 |
| Analog | 17 | CDF CMD | 9 | CDF Cmd 1 | CDF Cmd 1 |
| | 18 | CDF TAC | 6 | CDF Tac 6 | CDF Tac 1 |
| | 19 | CDF AIR TAC | 6 | CDF AirTac 4 | CDF AirTac 4 |
| | 20 | Simplex | 16 | simplexU-443.250 | simplexV-SARA |
| | 21 | QTH | 19 | SARA-DTree | TARC2M |
| | 22 | GMR-ARES | 29 | GMRS CH02 | GMRS CH01 |
| | 23 | DMRSPLX | 12 | 433.4500 SM | 433.0000 SM |
| | 24 | Analog-Other | 12 | Manteca | MMC |
| | 25 | RACE Day | 9 | VeloPromo | VeloProm#3 |
| | 26 | Packet | 16 | PKT530 | PKT030 |
| | 27 | WSER | 19 | 16-foresthill 3 | 8-Foresthill 1 |
| | 28 | Death Ride | 7 | LOOP | HAWKINS |
| | 29 | APRS | 1 | 445.9250 SM | 445.9250 SM |
| | 30 | | | | |

BRANDMEISTER TALK GROUPS (168)

| Roaming Zone 📃 \land | No. | TG/DMR ID | Call Alert | Name | Call Type |
|---------------------------|-----|-----------|------------|------------------|--------------|
| Auto Repeater Offset Fred | 424 | 310023 | None | East Central AL | Group Call |
| Device Information | 425 | 310035 | None | Gold Coast ARA | Group Call |
| Ontional Setting | 426 | 310501 | None | NSX Local | Group Call |
| Alarm Setting | 427 | 310506 | None | NSX Beta | Group Call |
| - Local Information | 428 | 310604 | None | CARLA | Group Call |
| Hot Key | 429 | 310658 | None | TARCTalk | Group Call |
| APPS | 430 | 310670 | None | San Diego CA | Group Call |
| GPS Roaming | 431 | 310703 | None | Tri-LERT | Group Call |
| inital | 432 | 310815 | None | The Fun Machine | Group Call |
| | 433 | 310991 | None | PVRA Connecticut | Group Call |
| | 434 | 310992 | None | CDRA Connecticut | Group Call |
| | 435 | 310997 | None | Parrot | Private Call |
| - Receive Group Call List | 436 | 311752 | None | Central IL | Group Call |
| Encrution Code | 437 | 312647 | None | W2GLD Local | Group Call |
| AES Encryption Code | 438 | 312656 | None | DARN (Kalamazoo) | Group Call |
| APC4 Encruption Code | 439 | 313323 | None | GMARS | Group Call |
| Digital Contact List | 440 | 313324 | None | GMARS 2 | Group Call |
| 1 20000 | 441 | 313327 | None | LARK | Group Call |
| 20001 | 442 | 313976 | None | W8SDR Local | Group Call |
| 40001 60000 | 443 | 314242 | None | SVARC | Group Call |
| 60001 80000 | 444 | 314401 | None | W1DMR | Group Call |
| 80001 | 445 | 314706 | None | Mem Metro | Group Call |
| 100001 120000 | 446 | 314710 | None | 314710 Green Top | Group Call |
| 120001120000 | 447 | 314732 | None | TNtechNet314732 | Group Call |
| 140001 160000 | 448 | 315409 | None | K8DLT Beckley WV | Group Call |
| 140001180000 | 449 | 315615 | None | KC7DHF Local | Group Call |
| 180001200000 | 450 | 316274 | None | KSC | Group Call |
| | 451 | 310999 | None | APRS | Private Call |
| T Honda Llat | 452 | 50539 | None | NevGen | Group Call |

RESOURCES

http://snars.org/dmr

http://dmr-marc.net

http://mountainwestdmr.org

http://norcaldmr.org

http://papasys.com/dmr

http://brandmeister.network

http://hose.brandmeister.network

http://utah-dmr.net

http://www.trbo.net

QUESTIONS ?



