



# CT DMR Networks 101

Meriden Amateur  
Radio Club

August 2017

Sma – version 2..0 8/2017

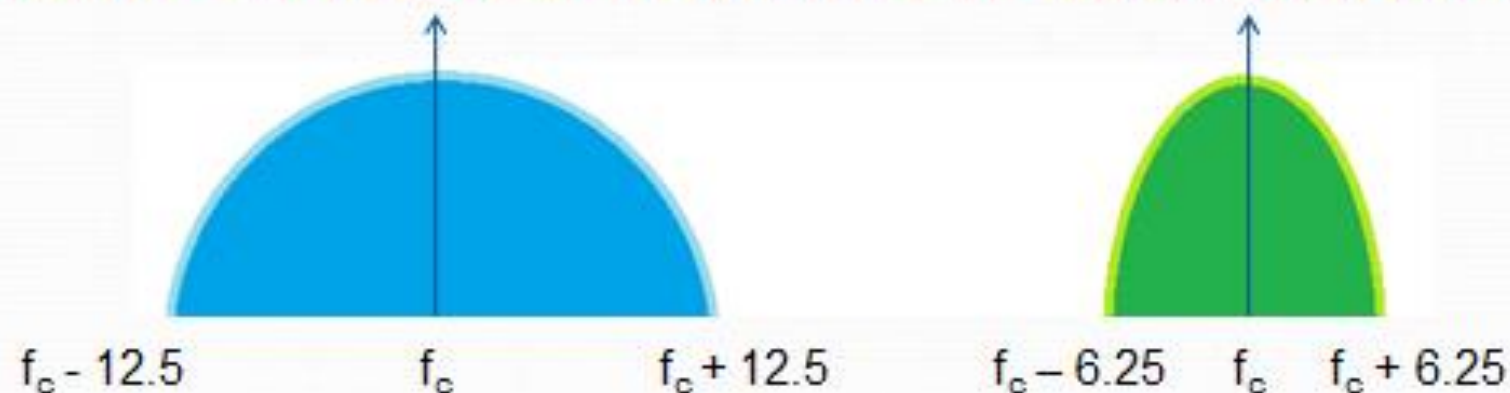
SMA – version 2.1 3/2018 – KC1SA

SMA – version 2.2 3/2018 – KC1SA

# DMR basics or DMR 101

- This is my perspective on DMR
  - Some material borrowed from Nearfest 2016
- Started this presentation with assistance of
  - KB1JL
  - WA1VXH (SK)
  - And a few DMR repeater owners.
- Original draft summer 2017
- Some material lifted from Nearfest
- If you like 2M FM repeater usage you'll probably like DMR.
- It's a rag chewing thing
- It uses the Internet, so it's prone to go down.
  - *When all else fails, so will this!*

# Half the Channel Bandwidth



Traditional Analog  
25 kHz

Channel Bandwidth

1 Channel  
1 Repeater

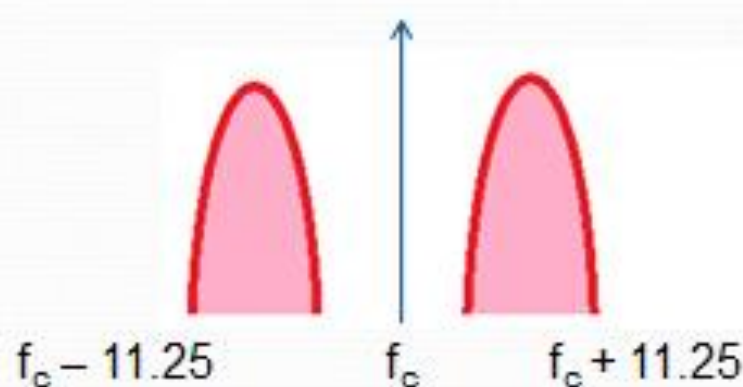
DMR

**12.5 kHz**

Channel Bandwidth

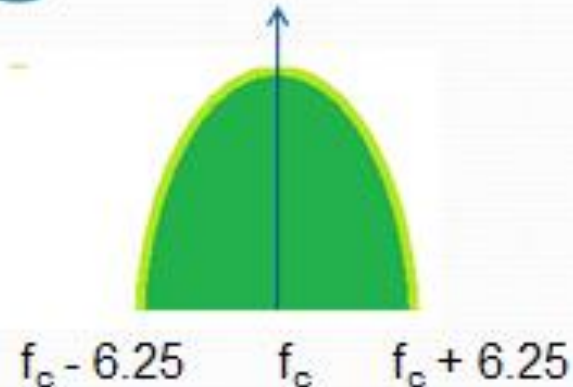
**2 Channels**  
1 Repeater

# More Spectrum Efficient than Older Digital Modes



Guard Band  
as large as 10 kHz  
between channels

**Total BW= 22.5 kHz**



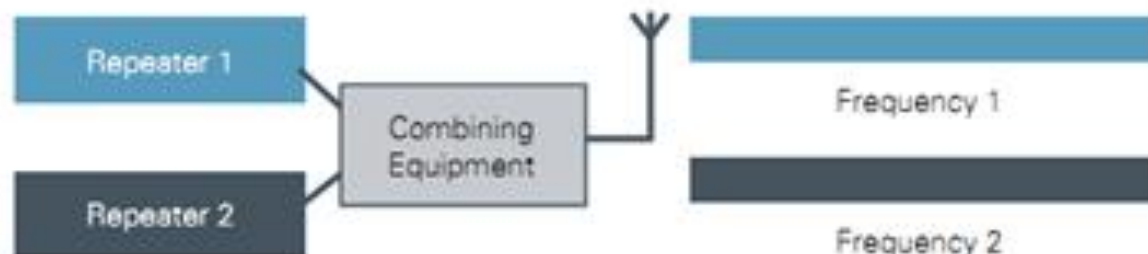
No Guard Band  
between 2  
channels

**Total BW= 12.5 kHz**

# 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



One call per repeater and channel



Radio Groups

Two-channel Digital TDMA System



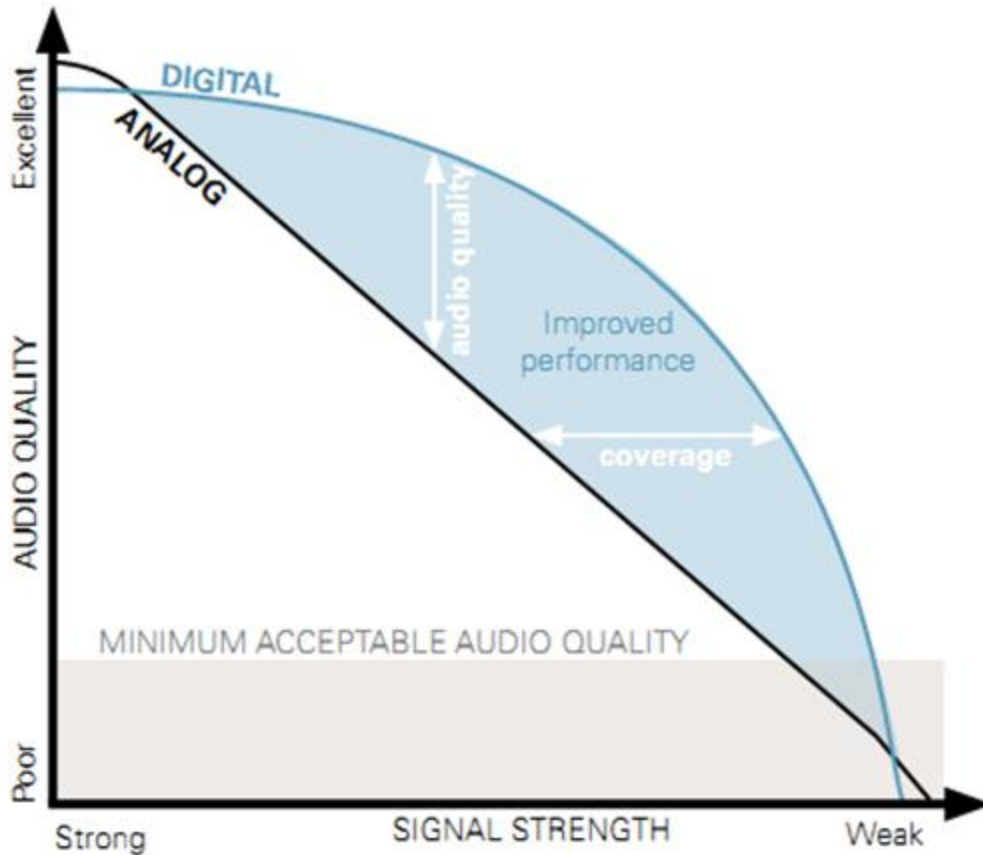
Two calls per repeater and channel



Radio Groups

*Lower infrastructure cost, 1 box in rack  
TWO voice channels from one repeater*

# Better Signal Quality



Digital voice retains better quality than analog as signal strength decreases.

- No hiss, popping, or static
- Better RF range than older digital technologies
- Forward Error Correction and Cyclic Redundancy Check coders

# Longer Battery Life



Older Digital Modes  
(FDMA)



DMR  
(TDMA)

“For each hour of usage the TDMA radios show between 19% and 34% less battery capacity is required than for the FDMA models.”

“40 percent improvement in talk time in comparison with analogue radios “

# Data and Voice at the Same Time



Slot 1 Voice



Slot 2 GPS Location

(or second channel voice when not sending GPS data)



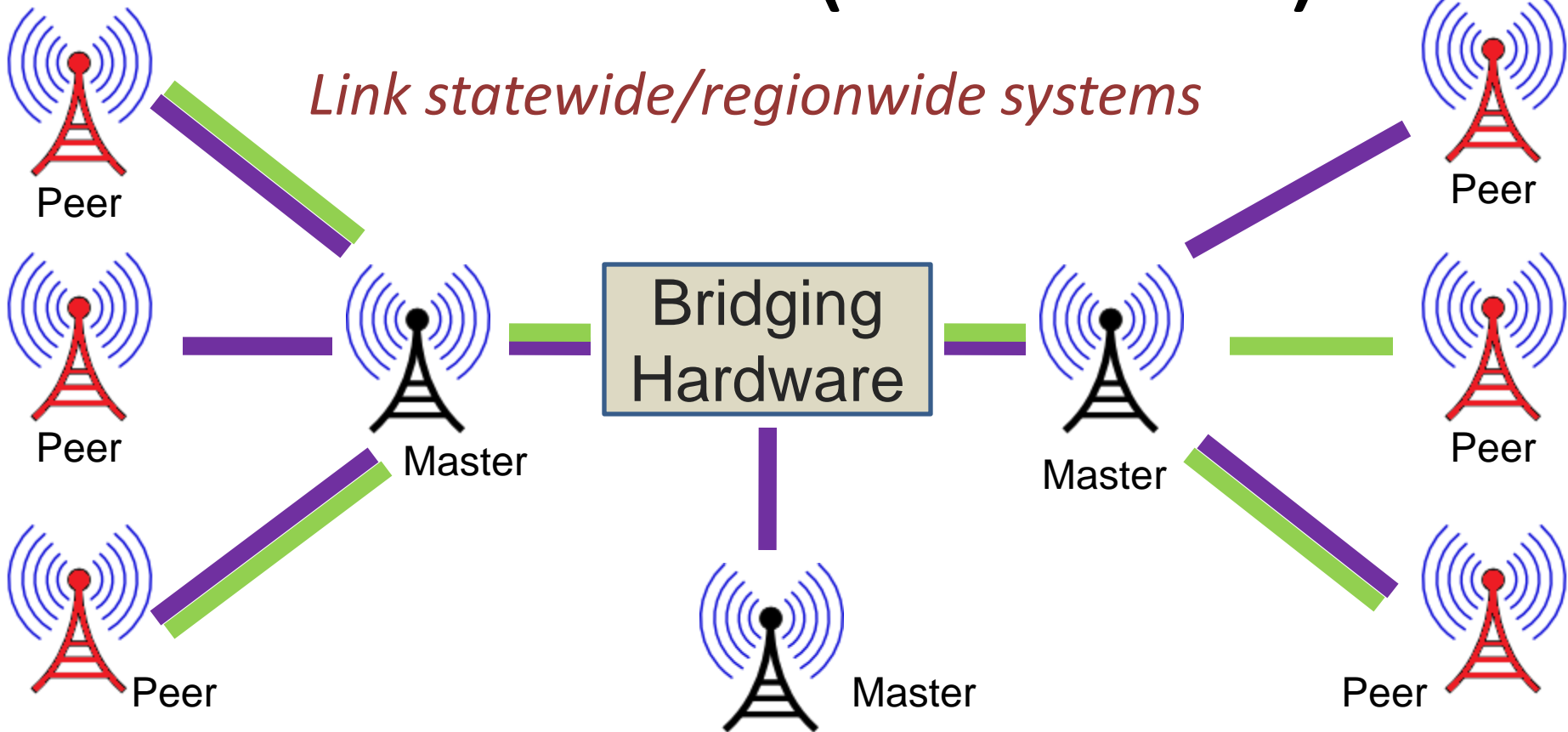
Give your location **WHILE** talking!



# IP Site Connect

## 1 or 2 slots (channels)

*Link statewide/regionwide systems*



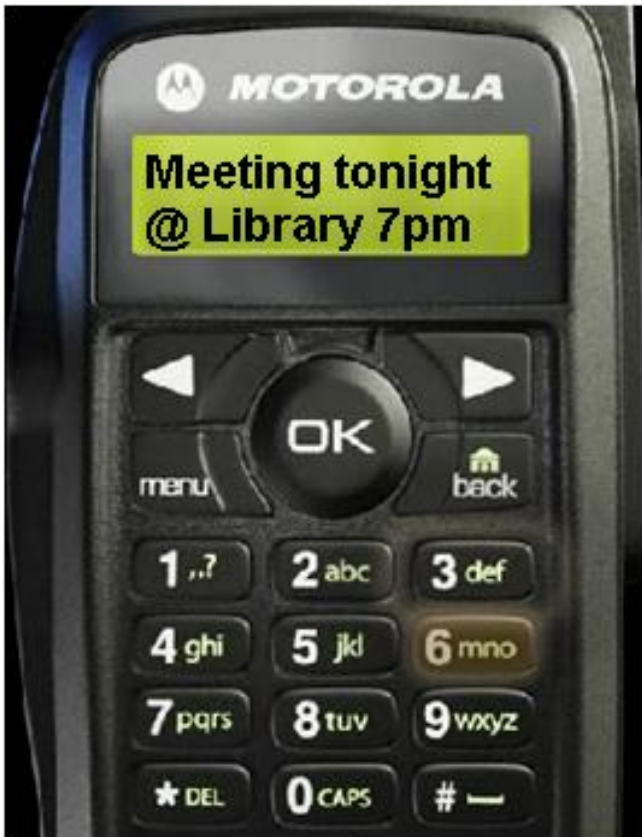
# Dynamic Mixed Mode: First in – First Out



*Repeater dynamically detects the type of input  
IP site connect currently not supported in DMM*

*This is a stand-alone repeater option only.*

# Free Text Messaging



Send to one person, or a group of people.

- Weather Alerts
- Club Meetings
- Announcements



- Motorola Amateur Radio Clubs and other private XPR8300/8400 and MTR3000 repeater owners
- 160 site network in USA, Germany, Australia, South Africa, New Zealand, Spain, Switzerland, Austria, Canada, Finland, Sweden, Italy, Mexico, and the UK.
- 100% Pure Digital. Voice and text messaging supported.
- Weekly nets to discuss technical issues
- More than 2700 registered users
- To register or learn more <http://dmr-marc.net>
- There you will also find links to our bridge partners, our Yahoo group and other programming aids.

# Talk Groups Increase Capacity!

- Time Slot 1, Talk Group 3 – Native English speakers (USA, Canada, Australia, New Zealand, South Africa, and U.K.)
- Time Slot 1, Talk Group 1 – Primary English language countries to secondary English speaking Europeans
- Time Slot 2, talk group 2 – Local Repeater QSOs.
- Time Slot 2, first 4 digits of state ID (KS = 3120) for statewide linked TS2 systems. Also, country talk groups are 3 digits (Canada = 302)
- Be courteous and use the local time slot for local repeater QSOs and don't monopolize the linked network time slot 1 if you don't have to.

# Talk Group Mappings



## TG1, TS1 (World)

- Saturday Nets
- Calls to second language English speakers
- Don't use for UK-> USA or Australia-> Canada, etc.

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## TG3, TS1 (NA/English)

- Calls to native English speakers
- Share with other users!
- Use local/regional TG/TS when possible



# Other Talk Groups

<i>Network</i>	<i>Region</i>	<i>Talk Group ID</i>	<i>Assignment</i>	<i>Notes</i>
DMR-MARC	Europe	1	Intercontinental	TS1 only
DMR-MARC	Europe	2	Europe Continental	TS1
DMR-MARC	Europe	9	Europe Local Repeater	TS2
DMR-MARC	Europe	214	Spain	TS1 or TS2
DMR-MARC	Europe	222	Italy	TS2
DMR-MARC	Europe	228	Switzerland	TS1 or TS2
DMR-MARC	Europe	232	Austria	TS1 or TS2
DMR-MARC	Europe	235	United Kingdom	TS2
DMR-MARC	Europe	240	Sweden	TS1 or TS2
DMR-MARC	Europe	244	Finland	TS1 or TS2
DMR-MARC	Europe	262	Germany	TS1 or TS2
DMR-MARC	N. America, UK, S. Pacific, S. Africa	1	Intercontinental	TS1 only, use only for Sat. nets and calls to Europe
DMR-MARC	N. America, UK, S. Pacific, S. Africa	3	N. America	TS1 only, All English speaking countries
DMR-MARC	S. Pacific	5	Australia/New Zealand Only	TS2
DMR-MARC	N. America	302	Canada	
DMR-MARC	N. America	334	Mexico	TS2
DCI	N. America	3100	DCI Bridge	
GA-DMR	N. America	3113	GA Statewide	TS 2
SF-TRBO	N. America	3115	HI Statewide	TS 2
MIT	N. America	3125	New England Network	TS 2
DCI	N. America	3126	MI Statewide	TS 2
KØUSY Group	N. America	3130	KS Statewide	TS 2
NorCal	N. America	3148	TX Statewide	TS 2
DCI	N. America	3153	WA Statewide	
DCI	N. America	3160	DCI 1	
DCI	N. America	3161	DMR-MARC World	TS2
DCI	N. America	3162	DCI 2	
DCI	N. America	3163	DMR-MARC N. Am.	TS2
DCI	N. America	3166	Test1	
DCI	N. America	3167	Net1	
DCI	N. America	3168	I-5	CA, OR, WA
DMR-MARC	N. America	3170	Midwest USA	TS2
N. Colorado	N. America	3171	N. Colorado	TS2
DMR-MARC	S. Pacific	5054	Queensland	TS 2

# ID Scheme

- DMR supports 16777215 IDs. We ask max 2 IDs per person. You can reuse same ID on multiple radios that you use-> Recommended!
- 8-digits: Admin tools and resources
- 7-digits: Subscribers (mobiles and portables)
- 6-digits: Repeaters
- 4-digits: Regional Talk Groups
- 3 digits: Country Talk groups

XXXYZZZ

where XXX= Country

Y= State/Province

ZZZ= Sequentially assigned subscriber number

Repeater IDs are 6 digits: XXXYWW

where XXX= Country

Y= State/Province

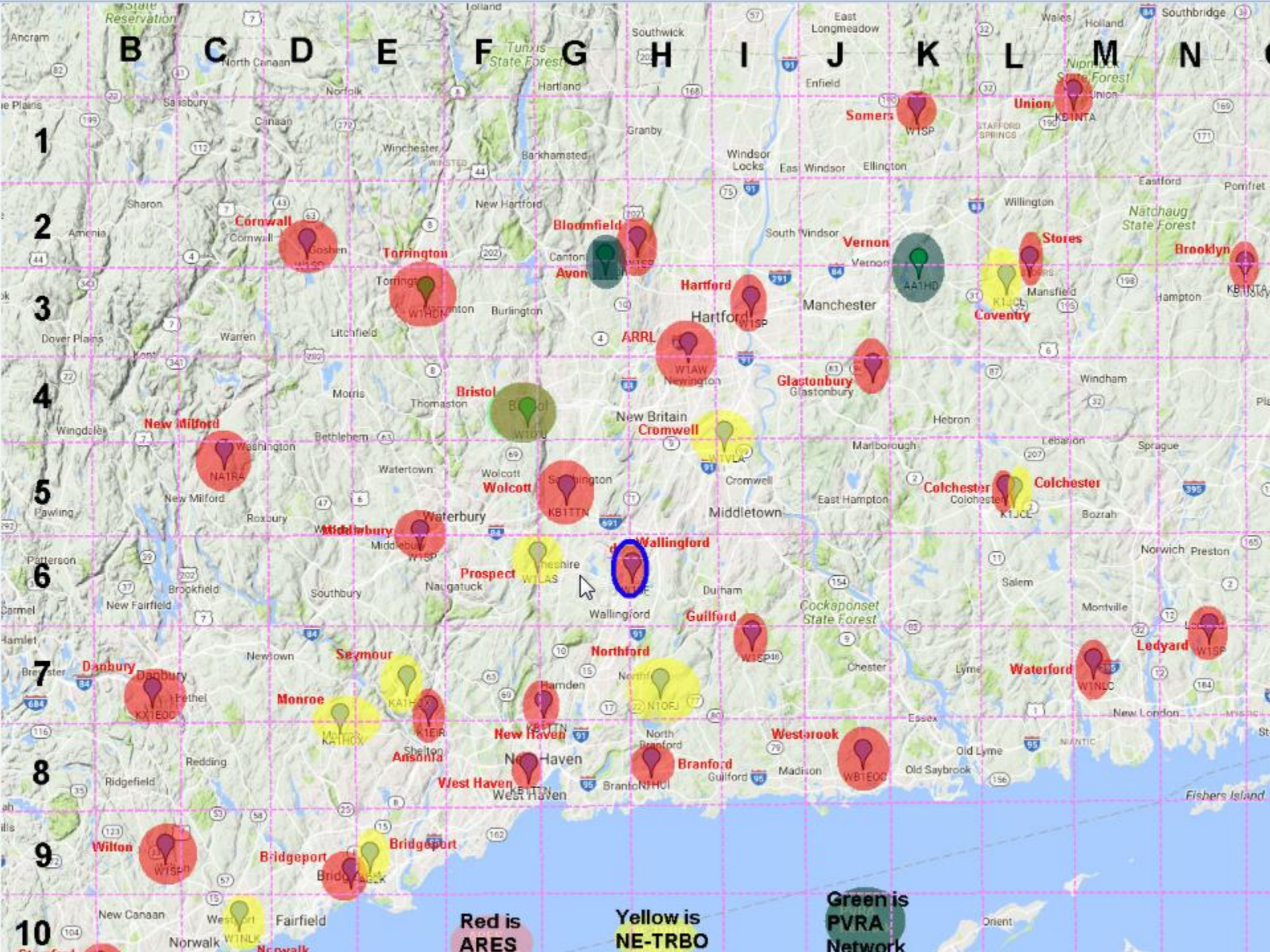
WW= Sequentially assigned repeater number

Examples: Subscriber IDs are 7 digits:



# Common Courtesy

- ALL RADIOS MUST HAVE A VALID 7-DIGIT DMR ID from our website <http://dmr-marc.net>, Under “Contact Us” Radios without an official ID should not be on the system. Period. Do not make up your own ID.
- Do not key up on TS1 and blow into mic to test your radio. You key up 100+ repeaters and that is annoying to all of us who listen.
- Do radio tests on TS2 with a voice ID.
- You must identify your callsign just like you did in the past on an analog repeater per FCC rules.



Red is  
ARES

Yellow is  
NE-TRBO

Green is  
PVRA  
Network

# Wallingford Accessible Repeaters

- Roughly 8 repeaters in Wallingford's footprint
  - ARES
    - Wolcott
    - New Haven
    - Branford
    - Guilford
    - Wallingford (off-line)
  - CTDARN (part of NE-TRBO)
    - Prospect
    - Northford
  - Brandmeister
    - Bristol

# ARES Local Talkgroups

- Local to ARES Connecticut Repeaters
  - TG8900 – TG8914
    - 8900-8906 – Time Slot 2
    - 8907-8914 – Time Slot 1
  - TG9 Local
    - Time Slot 1 & 2
  - TG99
    - Simplex
  - Testing TGs
    - Parrot and VU meter

# ARES Wide Talkgroups

- Talkgroups heard outside ARES CT Network
  - TG3172 – Northeast Region
    - Time Slot 2
  - Time Slot 1 Talkgroups
    - TG1 – Worldwide (PTT)
    - TG3- North America
    - TG13 – Worldwide English
    - TG310 – TAC310 (PTT)
    - TG311 – TAC311 (PTT)
    - TG3100 – Conference Bridge (PTT)

# CTDARN Network (NE-TRBO)

- Much truncated TG list
  - Time Slot 1
    - TG1 – Worldwide (PTT)
    - TG3 – North America
    - TG13 – Worldwide English (off 1800Z-2200Z)
    - TG310 – TAC310
    - TG3172 – Northeast
  - Time Slot 2
    - TG9 – Local
    - TG3109 – CT, Matituck LI & Selden LI
    - TG3181 – CT, MA, RI, VT, NH, ME & New Brunswick
  - Testing
    - Parrot and VU meter

# Brandmeister

- Three repeaters in Connecticut
  - Avon
  - Vernon
  - Bristol
    - was ARES – MARC, switched in August to BM
- Bristol can dynamically switch in TGs even though the repeater only has TGs 91, 93, 31091, 3148 and 310992.  
Example:
  - Create a channel for TG 3151 (Virginia State Wide) using the Bristol repeater.
  - PTT the channel on the Bristol repeater
  - You are now connected to Virginia State Wide.

# Our CT code plug

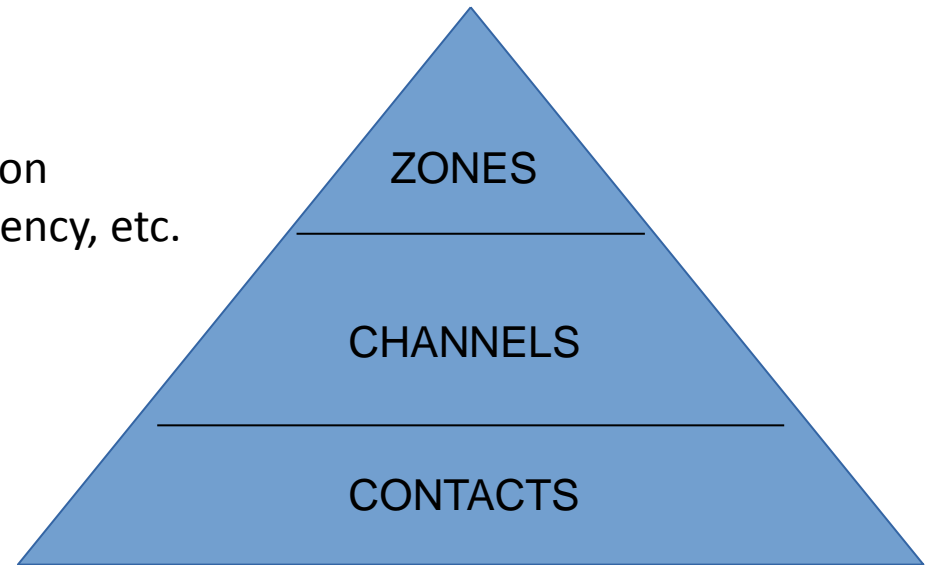
Missing & Overkill TGs?

- ARES has 10 local TAC channels
  - Assumed two for each of the 5 regions
- ARES missing New England TGs that are on the TRBO network
  - Suggest we include TG3109 and TG3181
- Lots of little errors
  - Wrong TS assignments
  - Inconsistent channel naming
  - Incorrect TG on repeaters
    - Bristol has all ARES TGs but now it's Brandmeister



# More DMR thoughts

- MD380 Hierarchy
  - Contacts are the foundation
    - People (KC1XYZ, etc)
    - Talkgroups (TG1, TG3109, etc)
  - Channels
    - Holds repeater specific information
      - TG#, TS#, Color Code, Frequency, etc.
  - Zones
    - Contain up to 16 Channels



# Limitations

- MD380
  - 1000 contacts
    - Repeaters and people
      - Can easily be exceeded if you download the MARC database and try and use it.
      - I've heard the radio locks up if you exceed the 1000 contacts
        - No proof of this.
  - 250 Zones
    - Probably more than enough for most of us
    - Most likely we have too many Zones in our current code plug.
  -

# Lots of Edits

- Connecticut has more than 40 repeaters.
  - Assume Each Repeater has 16 channels.
    - More than 600 records need to be created for your Code Plug!
- Contacts
  - Between ARES & CTDARN
    - Only 35 Talk Groups (Contacts)
  - Small group of ARES (WARG) and Personal Ham Contacts
    - Less than 100 Contacts are really needed
    - Current Code Plug has about 700 HAM DMR Numbers
      - Seems Silly, however if the HAM is in the phone Contacts database then their call sign appears on the second line when they speak rather than their DMR number.

# RF Footprint

- Current Code Plug has Zones for most all CT repeaters
  - Most are not within our Wallingford RF footprint
    - Below are the repeaters that most could hit from Wallingford.
      - Bristol
      - Wolcott
      - Prospect
      - Cromwell
      - Prospect
      - Northford
      - New Haven
      - West Haven
      - Guilford
      - Branford
      - Wallingford

# Zone Recommendations

- Make new Code Plug for WARG
  - Include 11 or so primary repeaters in our RF Footprint
  - Add other secondary repeaters where we may travel to
    - Newington (ARRL), Bloomfield, Torrington, Union, etc.

# Zone Recommendations

- Create Travel Zones
  - These are Zones that have a specific Channel from different repeaters in the Zone
    - Example: Have ARES Statewide (TG8901)
      - Their could be several TZ (Travel Zone) Zones
        - TZ8901\_A
          - Has TG8901 from
            - Bloomfield
            - Bristol
            - Union
            - Newington
        - **TZ8901\_B**
          - Has TG8901 from
            - New Haven
            - Wolcott
            - Middlebury
            - Ansonia
            - Bridgeport
    - Benefit of this Zone structure
      - Set for Scan mode
      - As you travel from RF footprint to RF footprint the MD380 will pick up the repeaters without fiddling with the radio
      - Works a bit like the Motorola Radios

•

# Recommended Channel Pruning

- Remove all CT-TAC channels from TS1 on ARES Zones and CT-TAC4 and 5 (TS2)
  - Keep them in the Code plug but remove them from the Zone.
  - Simplifies Zone
  - Eliminates the need for an A and B Zone for each ARES Zone.
    - Removes
      - TAC4, 5, 11, 12, 13, 14, 15
      - VU Meter Test

# CTDARN / NE-TRBO Repeaters

- No changes to our code plug
- For TZ Zones we should add
  - TG3109 & TG3181
    - These would have to off CTDARN repeaters
  - TZ Zones would / could have Channels from different repeaters
    - RF foot print compliant.
      - EX:
        - Seymour – Ansonia
        - Prospect – Wolcott
        - Northford – New Haven



# Code Plug

## Channel assignments

### ARES REPEATERS

Chan	Name	Mode
1	S WIDE ARRL	Digital
2	S WIDE B ARRL	Digital
3	TAC 1 ARRL	Digital UA
4	TAC 2 ARRL	Digital UA
5	TAC 3 ARRL	Digital UA
6	TAC 310 ARRL	Digital UA
7	TAC 311 ARRL	Digital UA
8	LOCAL ARRL	Digital
9	LOCAL B ARRL	Digital
10	NORTHEAST ARRL	Digital
11	W WIDE ARRL	Digital UA
12	WW ENG ARRL	Digital
13	N AMERICA ARRL	Digital
14	NJ TRBO ARRL	Digital UA
15	PARROT ARRL	Digital UA
16	SIM 446.075 DMR	Digital

### CTDARN REPEATERS

Chan	Name	Mode
1	SNE NFord-	Digital
2	NE Wide NFord-	Digital
3	TAC 310 NFord-	Digital UA
4	LOCAL NFord-	Digital
5	NORTHEAST NFord-	Digital
6	W WIDE NFord-	Digital UA
7	WW ENG NFord-	Digital
8	NA NFord-	Digital
9	PARROT NFord-	Digital UA
10	SIM 446.075 DMR	Digital

### BRANDMEISTER REPEATERS

Chan	Name	Mode
1	W WIDE BRIS_b	Digital
2	N AMERICA BRIS_b	Digital
3	USA1 BRIS_b	Digital
4	S WIDE TX BRIS	Digital
5	VA S WIDE BRIS	Digital
6	CDRA BRIS_b	Digital
7	SIM 446.075 DMR	Digital

# Scan Lists

Channel Members .. used 13 of 31

Chan	Name	Mode	
318	S WIDE WALL	Digital	
289	S WIDE B WALL	Digital	
122	LOCAL WALL	Digital	
86	LOCAL B WALL	Digital	
361	TAC 1 WALL	Digital	
536	TAC 2 WALL	Digital	
566	TAC 3 WALL	Digital	
604	TAC 310 WALL	Digital	
634	TAC 311 WALL	Digital	
201	NJ TRBO WALL	Digital	
240	NORTHEAST WALL	Digital	
737	W WIDE WALL	Digital	
777	WW ENG WALL	Digital	

# Some products

TYT MD-2017



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**\$199.95** · [eBay](#)

Tyt Md-2017 Dmr Dual Band Vhf/uhf Handheld ...

**\$169.95** · [GigaParts.com](#)

TYT MD-2017GPS TYT MD-2017 Dual Band DMR ...

**\$179.95** · [Newegg.com](#)

TYT MD-2017 Dual Band DMR HT Radio

**\$189.95** · [Newegg.com](#)

TYT MD-2017 Dual Band DMR HT Radio with GPS

Product details

**Brand:** TYT

**Frequency:** VHF, UHF

Tytera (TYT) MD-380  
DMR Digital Two Way  
R...



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Product details

**Brand:** TYT

**Frequency:** VHF, UHF

**Number of channels:** 1,000 channel

[View more details](#)



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# openSPOT.

openSPOT is a standalone digital radio IP gateway / hotspot

[Learn more! »](#)

## Key features:

- Supports **DMR** (Brandmeister, DMRplus), **D-Star** (DCS, REF/DPlus, XRF/DExtra, XLX), **System Fusion** (FCS, YSFReflector) networks. More supported networks and features will be available with new firmware releases.
- Supports cross modem modes. Talk with your C4FM radio on DMR, and with your DMR radio on System Fusion networks!
- Very easy to use, works without a



## Links

[Learn more about](#)

[User manual](#)

[HTTP API docum](#)

[UDP API docum](#)

[High resolution](#)

[SharkRF IP Con](#)

[Beta firmware](#)

## Latest firm

srf-osp-1.1-013  
14:01 UTC)

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# NW Digital Radio

## ThumbDV™ AMBE+2 Vocoder with USB Interface

### Features:

- DVSI [AMBE3000](#) Chip
- USB 2.0 Low Power (<100mA)
  - FTDI [FT230XS](#)
  - Windows, Linux, OS X
- UART Packet Interface
  - 460.8 kbaud

### D-STAR Applications:

- ircddbgateway
- Analog Bridge (DummyRepeater)
- dvtool file converter
  - Bi-directional analog to AMBE
- WinDV
- UDRX Support for D-STAR DV

Check the [website](#) for availability

### AMBE HW Vocoder For:

- DMR\*
- dPMR\*
- Yaesu Fusion
- P25 Phase 2

