



DMR – PART 2

TONTO AMATEUR RADIO ASSOCIATION

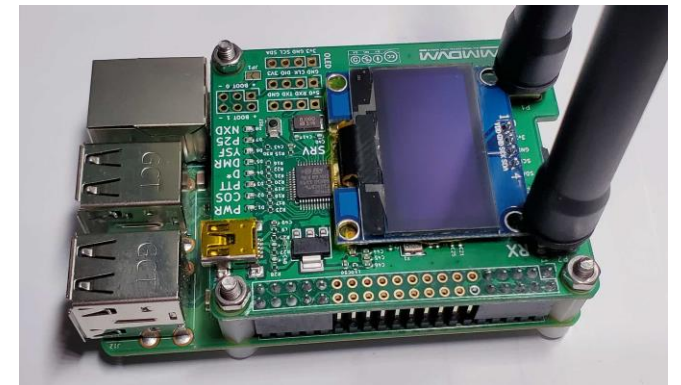
OCTOBER 14, 2023 – RICK LOVDAHL KJ7ROX

N7TAR.ORG



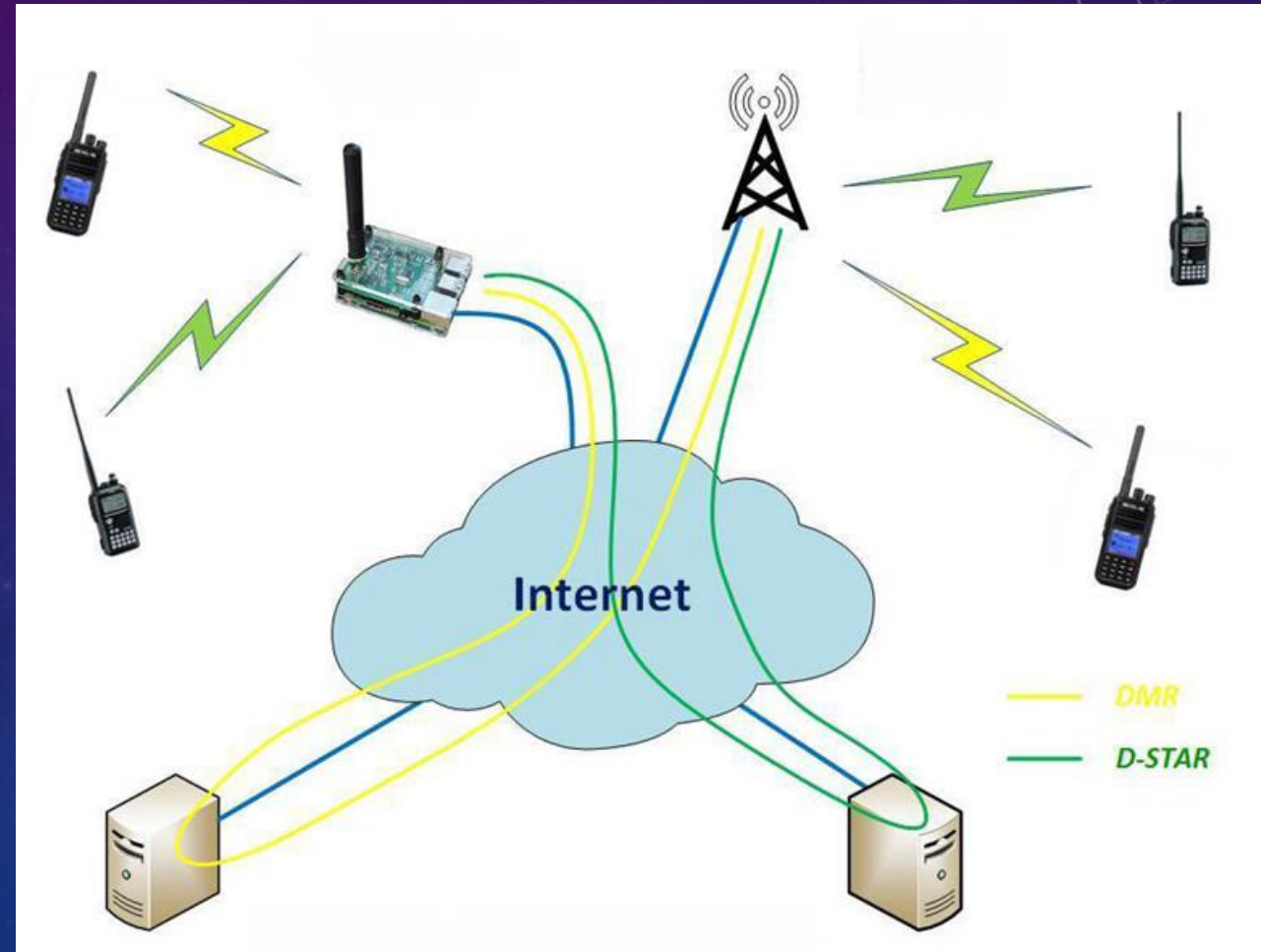
WHAT IS DMR?

(DIGITAL MOBILE RADIO)



THERE ARE MULTIPLE DIGITAL NETWORKS

- DMR (Today's Focus)
- D-Star
- YSF/Wires-X

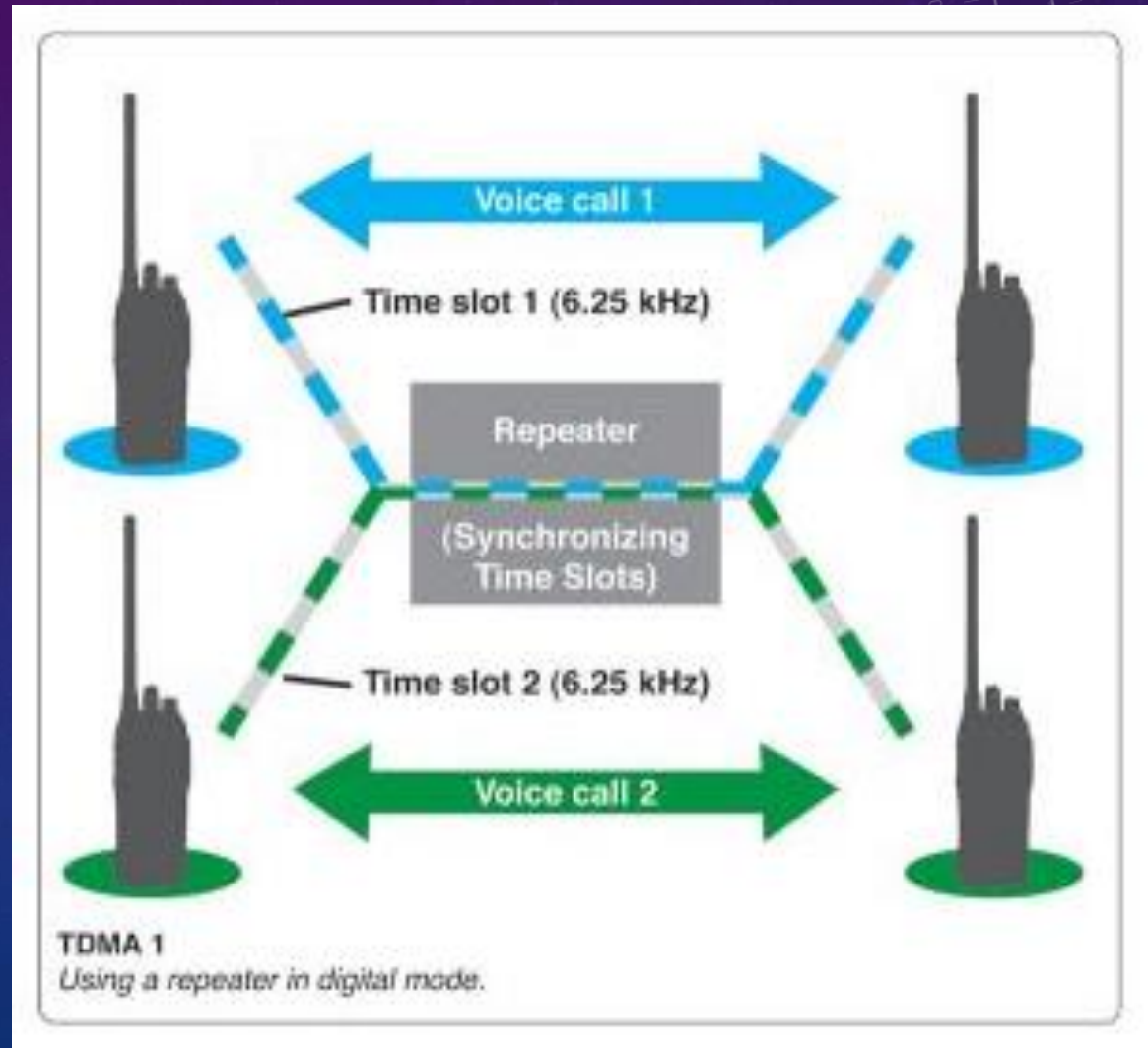


DMR RADIOS

- DMR ht's typically 5-7w
 - Anytone
 - TYT
 - Radioddity
 - Baofeng & BTech
- DMR Mobile Radios up to 50w
 - Anytone
 - Btech
 - TYT
 - Radioddity
 - There are others...
- All DMR radios allow use of TGs and usually are dual band analog also
- Additional features vary
 - GPS/APRS
 - Crossband
 - Mesh
 - Audio Recording
 - Greater memory capacity



HOW DOES DIGITAL MOBILE RADIO WORK?



TALKGROUPS

- A Talkgroup acts like a repeater channel where multiple callers can interact
- There are **1633** available TalkGroups on the BrandMeister network.
- Talkgroups can be based on a geographic location or an interest group or...
- Talkgroup # 311568 is TARA_DMR

TG 3100	USA Bridge
TG 3101	Alabama - 10 Minute Limit
TG 3102	Alaska - 10 Minute Limit
TG 3104	Arizona - 10 Minute Limit
TG 3105	Arkansas - 10 Minute Limit
TG 3106	California - 10 Minute Limit
TG 3108	Colorado - 10 Minute Limit
TG 3109	Connecticut - 10 Minute Limit
TG 3110	Delaware - 10 Minute Limit
TG 3111	D.C. - 10 Minute Limit
TG 3112	Florida - 10 Minute Limit
TG 3113	Georgia - 10 Minute Limit
TG 3115	Hawaii - 10 Minute Limit
TG 3116	Idaho - 10 Minute Limit
TG 3117	Illinois - 10 Minute Limit
TG 3118	Indiana - 10 Minute Limit
TG 3119	Iowa - 10 Minute Limit
TG 3120	Kansas - 10 Minute Limit
TG 3121	Kentucky - 10 Minute Limit
TG 3122	Louisiana - 10 Minute Limit
TG 3123	Maine - 10 Minute Limit
TG 3124	Maryland - 10 Minute Limit
TG 3125	Massachusetts - 10 Minute Limit
TG 3126	Michigan - 10 Minute Limit
TG 3127	Minnesota - 10 Minute Limit
TG 3128	Mississippi - 10 Minute Limit
TG 3129	Missouri - 10 Minute Limit
TG 3130	Montana - 10 Minute Limit
TG 3131	Nebraska - 10 Minute Limit
TG 3132	Nevada - 10 Minute Limit

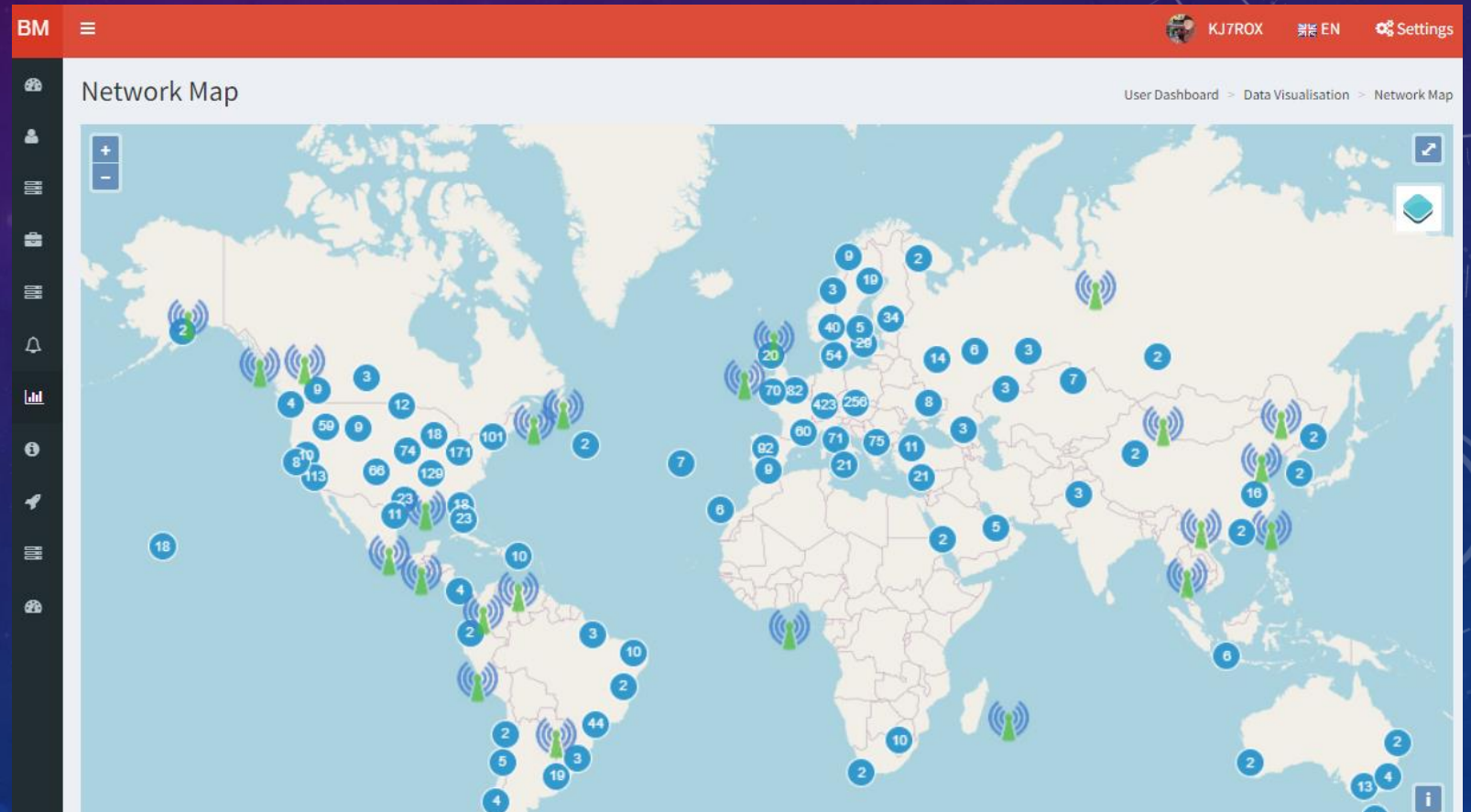
DMR NETWORKS

- Brandmeister
- DMR-MARC
- DMR+
- TGIF
- AZ-TrboNet
- Others...

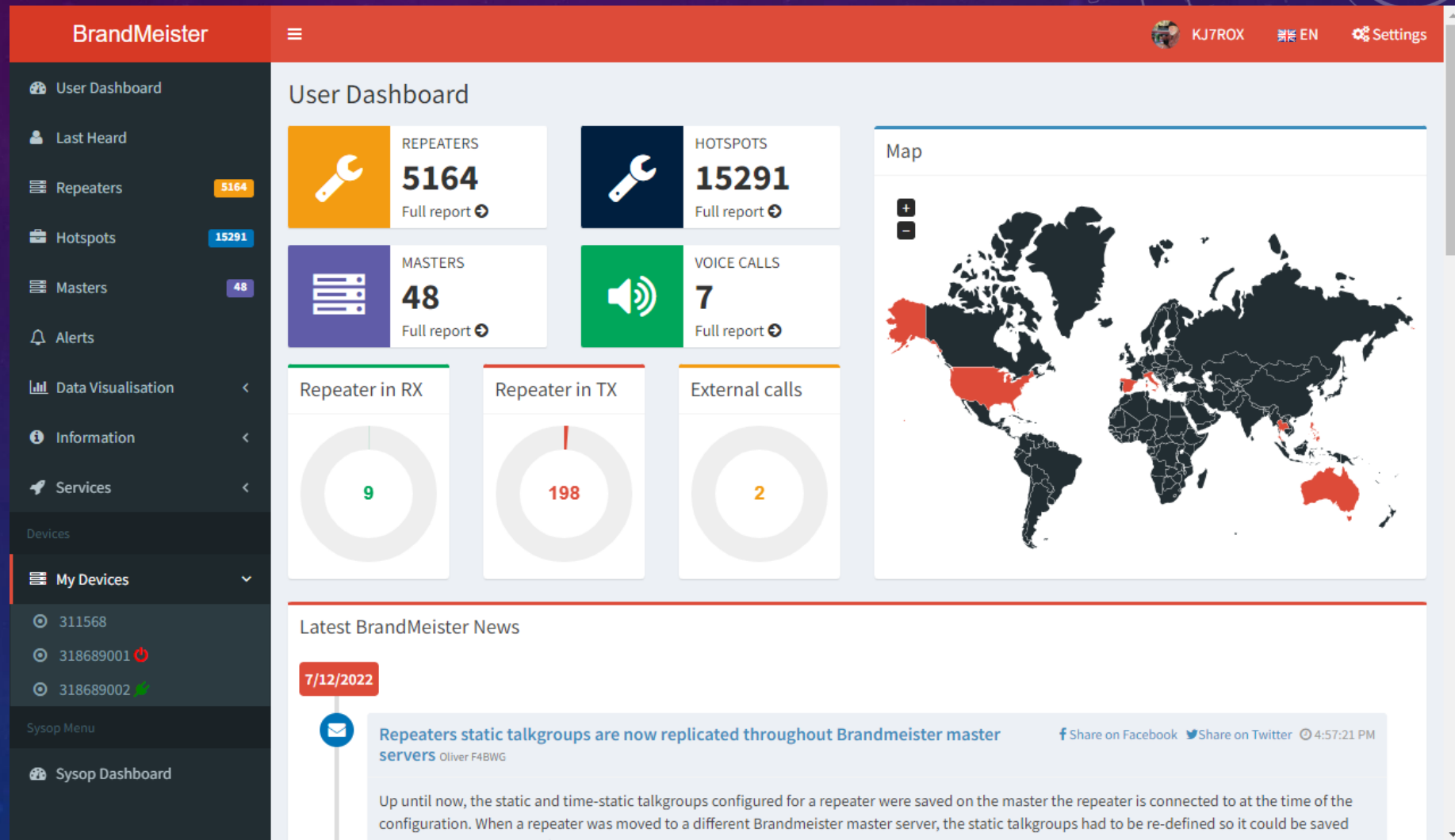


WHO CAN I TALK TO ON DMR?

Brandmeister Network Map
(repeaters)



BRANDMEISTER DASHBOARD



Demonstration: Brandmeister Dashboard

Brandmeister account setup:

- Callsign
- DMR ID
- Setup 'Selfcare' password
- Activate a hotspot/repeater
- APRS setup

The screenshot displays the Brandmeister web interface. The top navigation bar is orange and contains the 'BrandMeister' logo, a hamburger menu, the user identifier 'KJ7ROX', the language 'EN', and a 'Settings' link. A dark sidebar on the left lists navigation options: 'User Dashboard', 'Last Heard', 'Repeaters' (with a count of 5661), 'Hotspots' (16382), 'Masters' (48), 'Alerts', 'SelfCare', 'Information', 'Devices', 'My Devices' (expanded, showing a list of IDs: 3111568, 318689002, 318689003), 'Device Logs', 'Sysop Menu', and 'Sysop Dashboard'. The main content area is titled 'Settings of KJ7ROX (view)' and includes a breadcrumb trail: 'User Dashboard > My Devices > KJ7ROX > Edit'. The 'General Settings' section contains input fields for 'Priority Message', 'Description', 'Website' (http://www.rz.com/db/kj7rox), 'Location (City)' (Payson Arizona, DM44), 'Latitude' (34.333400), 'Longitude' (-111.300800), 'Power (ERP)' (1), and 'Height AGL in m' (0). A blue 'Save changes' button is at the bottom of this section. Below is the 'Sysops' section with a table of actions: 'Callsign', 'Read Settings', 'Write Settings', 'Manage Sysops', and 'Actions'. The 'Actions' row contains buttons for 'Get IP address', 'Drop call on slot 1', 'Drop dynamic groups on slot 1', 'Drop call on slot 2', 'Drop dynamic groups on slot 2', and 'Reset connection'. At the bottom, there are two 'Static Talkgroups' sections, each with a 'Timeslot' label and input fields with directional arrows.

REPEATER OR HOTSPOT?

- DMR via a Repeater does not require Internet (at the radio)
 - Limited by the repeater's range
- DMR via Hotspot can be used anywhere there is WiFi/Internet
 - DMR Hotspots can be
 - Simplex (only 1 Timeslot TS1 or TS2)
 - Duplex (both Timeslots TS1 + TS2)

WHAT IS A HOTSPOT?

Internet



Simplex vs. Duplex hotspots



Simplex hotspots:

- Have a single antenna (and single freq)
- Manage only 1 Timeslot
- Can only have one active Talkgroup at a time
- Usually built on Raspberry Pi Zero or Zero 2

Duplex hotspots:

- Have two antennas (TX & RX like a repeater)
- Can manage 2 Timeslots
- Can have 2 active Talkgroups at the same time
- Can be built on Raspberry Pi Zero or 3B/4B full size



BUY A HOTSPOT
...OR
BUILD A HOTSPOT



BUILD A JUMBOSPOT HOTSPOT

- Buy a RaspberryPi Zero 2 W
- Buy a MMDVM Modem “Hat”
- Solder a header on the Zero 2 W
- Assemble
- Load the Pi-Star OS on a SD-micro card



PI-STAR

Pi-Star's Dashboard gives you important information about your signal quality and connections you have made

<http://pistar.uk>

Hostname: pi-star

PI-Star:4.1.6 / Dashboard: 20220728

Pi-Star Digital Voice Dashboard for KJ7ROX

Dashboard | Admin | Configuration

Modes Enabled

D-Star	DMR
YSF	P25
YSF XMode	NXDN
DMR XMode	POCSAG

Network Status

D-Star Net	DMR Net
YSF Net	P25 Net
YSF2DMR	NXDN Net
YSF2NXDN	YSF2P25
DMR2NXDN	DMR2YSF

Radio Info

Trx	Listening DMR
Tx	431.662500 MHz
Rx	431.662500 MHz
FW	HS_Hat:v1.4.17
TCXO	14.7456 MHz

DMR Repeater

DMR ID	3186890
DMR CC	1
TS1	disabled
TS2	enabled
DMR Master	
BM 3104 United St..	

Gateway Activity

Time (MST)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
22:07:07 Aug 12th	DMR TS2	KJ7ROX (GPS)	TG 311568	RF	0.4	0%	0.0%

Local RF Activity

Time (MST)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
22:07:07 Aug 12th	DMR TS2	KJ7ROX (GPS)	TG 311568	RF	0.4	0.0%	S9+46dB (-47 dBm)

Simplex
(1-Timeslot)

Duplex
(2-Timeslots)

Hostname: pi-star3

PI-Star:4.1.6 / Dashboard: 20230713

Pi-Star Digital Voice Dashboard for KJ7ROX

Dashboard | Admin | Configuration

Modes Enabled

D-Star	DMR
YSF	P25
YSF XMode	NXDN
DMR XMode	POCSAG

Network Status

D-Star Net	DMR Net
YSF Net	P25 Net
YSF2DMR	NXDN Net
YSF2NXDN	YSF2P25
DMR2NXDN	DMR2YSF

Radio Info

Trx	Listening DMR
Tx	439.400000 MHz
Rx	434.400000 MHz
FW	HS_Hat:v1.5.2
TCXO	12.2880 MHz

DMR Repeater

DMR ID	3186890
DMR CC	1
TS1	enabled
TS2	enabled
DMR Master	
BM 3104 United St..	

Gateway Activity

Time (MST)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
10:49:49 Aug 11th	DMR TS2	KJ7ROX (GPS)	TG 31040	RF	0.4	0%	0.5%
19:21:08 Aug 10th	DMR TS1	K9ZG (GPS)	TG 311568	Net	16.7	0%	0.0%
19:20:47 Aug 10th	DMR TS1	K85SPW (GPS)	TG 311568	Net	3.4	0%	0.0%
19:20:31 Aug 10th	DMR TS1	W7MIN (GPS)	TG 311568	Net	19.6	0%	0.0%
19:14:28 Aug 10th	DMR TS1	KJ7ROX (GPS)	TG 311568	RF	54.7	0%	0.2%
19:11:55 Aug 10th	DMR TS1	N7VIA (GPS)	TG 311568	Net	5.2	0%	0.0%
19:11:04 Aug 10th	DMR TS1	AC7EP (GPS)	TG 311568	Net	17.4	0%	0.1%

Local RF Activity

Time (MST)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
10:49:49 Aug 11th	DMR TS2	KJ7ROX (GPS)	TG 31040	RF	0.4	0.5%	S9+25dB (-68 dBm)
19:14:28 Aug 10th	DMR TS1	KJ7ROX (GPS)	TG 311568	RF	54.7	0.2%	S9+37dB (-56 dBm)

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWZ) 2014-2023.
ircDBGateway Dashboard by Hans-J. Barthen (DL5DI),
MMDVM Dash developed by Kim Huebel (DG9VH),
Need help? Click here for the Facebook Group
or Click here to join the Support Forum
Get your copy of Pi-Star from here.

PI-STAR CONFIGURATION

Pi-Star can be configured for:

- DMR
- D-Star
- Yaesu System Fusion/Wires-X
- P25
- NXDN

Pi-Star:4.1.5 / Dashboard: 2022/07/28

Pi-Star Digital Voice - Configuration

Dashboard | Admin | Expert | Power | Update | Backup/Restore | Factory Reset

Gateway Hardware Information

Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-star	5.10.63-v7+	Raspberry Pi Zero 2 Rev 1.0	0.41 / 0.33 / 0.14	40.8°C / 105.4°F

Control Software

Setting	Value
Controller Software:	<input type="radio"/> DStarRepeater <input checked="" type="radio"/> MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	<input checked="" type="radio"/> Simplex Node <input type="radio"/> Duplex Repeater (or Half-Duplex on Hotspots)

Apply Changes

MMDVMHost Configuration

Setting	Value
DMR Mode:	<input checked="" type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
D-Star Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
YSF Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
P25 Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
NXDN Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
YSF2DMR:	<input type="checkbox"/>
YSF2NXDN:	<input type="checkbox"/>
YSF2P25:	<input type="checkbox"/>
DMR2YSF:	<input type="checkbox"/> Uses 7 prefix on DMRGateway
DMR2NXDN:	<input type="checkbox"/> Uses 7 prefix on DMRGateway
POCSAG:	<input type="checkbox"/> POCSAG Paging Features
MMDVM Display Type:	OLED Type 3 Port: modem Nextion Layout: ON7LDS L2

Apply Changes

General Configuration

Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	KJ7ROX
CCS7/DMR ID:	3186890
Radio Frequency:	431.662 500 MHz
Latitude:	34.33338 degrees (positive value for North, negative for South)
Longitude:	-111.3007 degrees (positive value for East, negative for West)
Town:	Payson, DM44ih
Country:	USA
URL:	http://www.qrz.com/db/kj7rox <input type="radio"/> Auto <input checked="" type="radio"/> Manual
Radio/Modem Type:	STM32-DVM / MMDVM_HS - Raspberry Pi Hat (GPIO)
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public

Demonstration: Pi-Star Dashboard & Configuration

Pi-Star configuration:

- Particulars of MMDVM modem
- General Config (your info)
- Enable Service (DMR, YSF, etc)
- DMR Configuration
- WiFi Configuration

Hostname: pi-star3

Pi-Star:4.1.6 / Dashboard: 20230713

Pi-Star Digital Voice Dashboard for KJ7ROX

Dashboard | Admin | Live Logs | Power | Update | Configuration

Gateway Hardware Information					
Hostname	Kernel	Platform	CPU Load	CPU Temp	
pi-star3	5.10.63-v7l+	Raspberry Pi 4 Model B Rev 1.5	0.43 / 0.35 / 0.3	52.6°C / 126.7°F	

Service Status					
MMDVMHost	DMRGateway	YSFGateway	YSFPParrot	P25Gateway	P25Parrot
DStarRepeater	ircDDBGateway	TimeServer	PiStar-Watchdog	PiStar-Remote	PiStar-Keeper

Active BrandMeister Connections			
BrandMeister Master	Repeater ID	Static TGs	Dynamic TGs
BM 3104 United States	318689003	None	None

Gateway Activity							
Time (MST)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
10:49:49 Aug 11th	DMR TS2	KJ7ROX (GPS)	TG 31040	RF	0.4	0%	0.5%
19:21:08 Aug 10th	DMR TS1	K9ZG (GPS)	TG 311568	Net	16.7	0%	0.0%
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19:20:31 Aug 10th	DMR TS1	N7MIN (GPS)	TG 311568	Net	19.6	0%	0.0%
19:14:28 Aug 10th	DMR TS1	KJ7ROX (GPS)	TG 311568	RF	54.7	0%	0.2%
19:11:55 Aug 10th	DMR TS1	N7VIA (GPS)	TG 311568	Net	5.2	0%	0.0%
19:11:04 Aug 10th	DMR TS1	AC7EP (GPS)	TG 311568	Net	17.4	0%	0.1%

Local RF Activity							
Time (MST)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
10:49:49 Aug 11th	DMR TS2	KJ7ROX (GPS)	TG 31040	RF	0.4	0.5%	S9+25dB (-68 dBm)
19:14:28 Aug 10th	DMR TS1	KJ7ROX (GPS)	TG 311568	RF	54.7	0.2%	S9+37dB (-56 dBm)

Modes Enabled	
D-Star	DMR
YSF	P25
YSF XMode	NXDN
DMR XMode	POCSAG

Network Status	
D-Star Net	DMR Net
YSF Net	P25 Net
YSF2DMR	NXDN Net
YSF2NXDN	YSF2P25
DMR2NXDN	DMR2YSF

Radio Info	
Trx	Listening
Tx	439.400000 MHz
Rx	434.400000 MHz
Fw	HS_Hat:v1.5.2
TCXO	12.2880 MHz

DMR Repeater	
DMR ID	3186890
DMR CC	1
TS1	enabled
TS2	enabled

DMR Master	
BM 3104 United St..	

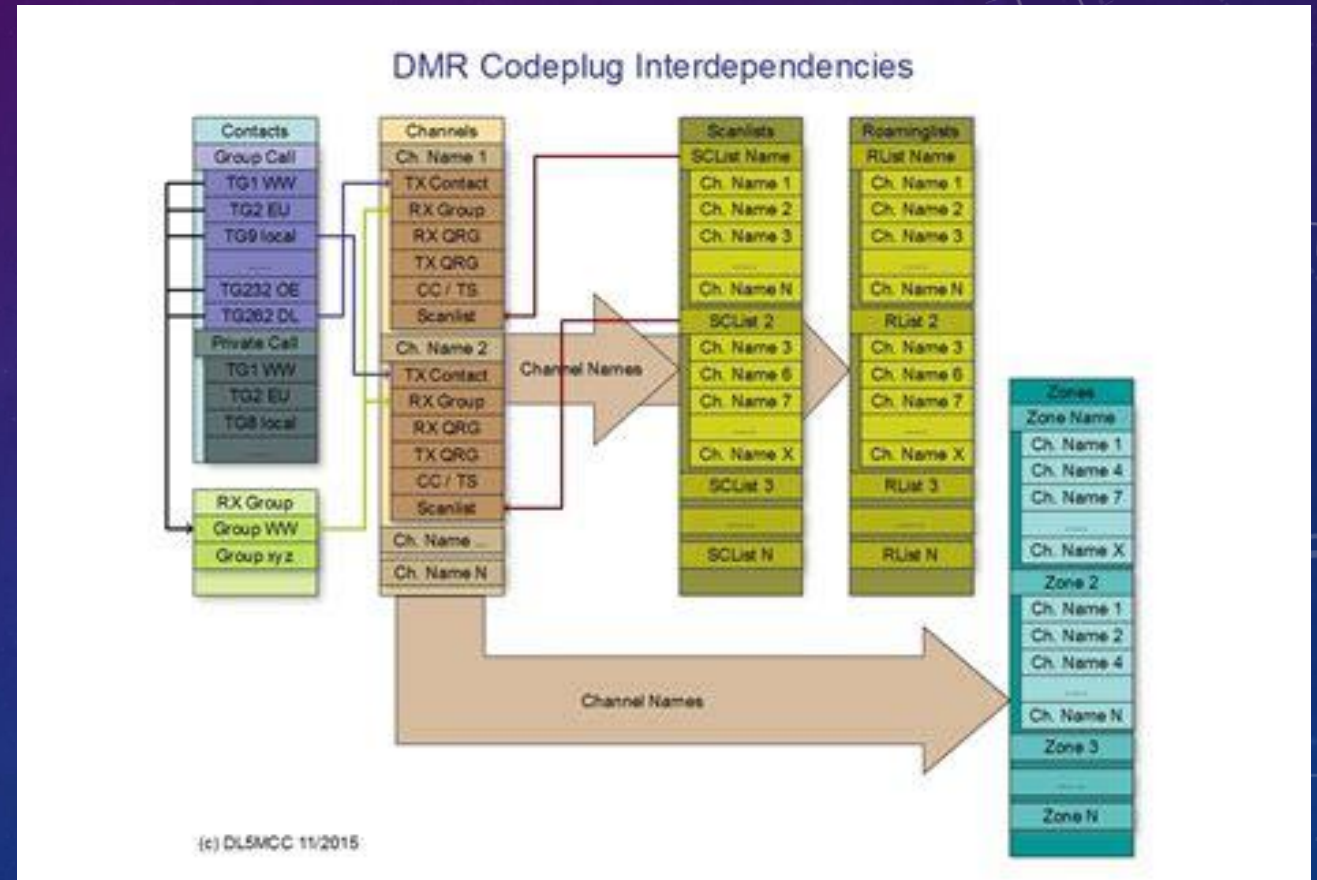
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or Click here to join the Support Forum
Get your copy of Pi-Star from here.

WHAT IS A CODEPLUG?

The term 'Codeplug' comes from back when there was actually a module that plugged-in to a Motorola radio running MotoTurbo.

Now it refers to the collection of information that must be programmed into a DMR radio to enable it to select audio from a talkgroup

- Contacts (TG's and individual DMR IDs)
- Channels (freq & PL tones to access a TG)
- Zones (groups of channels)
- Scanlists (groups of channels to scan)
- Radio settings



ANALOG VS DMR RADIO PROGRAMMING

CHIRP (2023-08-08 AnyTone_5888UV.img)

File Edit View Radio Help

2023-08-08 AnyTone_5888UV.img X

Memories Settings

	Frequency	Name	Tone Mode	Tone	Tone Squelch	DTCS	RX DTCS	DTCS Polarity	Cross mode	Duplex	Offset	Mode	Tuning Step	Skip	Power	Comment
100	147.390000	TARA V	Tone	100.0						+	0.600000	FM	5		Mid1	
101	448.775000	TARA U	Tone	77.0						-	5.000000	FM	5		High	
102	443.125000	K7MWD	Tone	100.0						+	5.000000	FM	5		Mid2	
103	147.360000	RL ORD	Tone	162.2						+	0.600000	FM	5		High	
104	448.500000	RL MING	Tone	100.0						-	5.000000	FM	5		High	
105	146.920000	ML ORD	Tone	162.2						-	0.600000	FM	5		High	
106	146.820000	ML MING	Tone	162.2						-	0.600000	FM	5		High	
107	146.960000	ML USER	Tone	162.2						-	0.600000	FM	5		High	
108	146.960000	RAC ORD	Tone	141.3						-	0.600000	FM	5		High	
109	146.740000	RAC SIG	Tone	162.2						-	0.600000	FM	5		High	
110	146.960000	RAC SIM										FM	5		High	
111	147.120000	NM2J	Tone	88.5						+	0.600000	FM	5		Mid2	
112	147.080000	WSIX	Tone	88.5						+	0.600000	FM	5		Mid2	
113	147.040000	NSIA	Tone	88.5						+	0.600000	FM	5		Mid2	
114	449.475000	WA6RT	Tone	77.0						-	5.000000	FM	5		Mid2	
115	449.850000	NSWSB	Tone	100.0						-	5.000000	FM	5		Mid2	
116	145.115000	NM5ML	Tone	67.0						-	0.600000	FM	5		Mid2	
117	145.170000	NSIA-2	Tone	100.0						-	0.600000	FM	5		Mid2	
118	146.980000	K5GAR	Tone	103.5						-	0.600000	FM	5		Mid2	
119	448.800000	WY5G	Tone	100.0						-	5.000000	FM	5		Mid2	
120	448.875000	WATACA	Tone	100.0						-	5.000000	FM	5		Mid2	

AnyTone 5888UV

Simple table of freq, offset, PL

D878UVII[D878UVII:UHF(Rx(400 - 480 MHz) Tx(403 - 470 MHz)) VHF(136 - 174 MHz)] C:\Users\nick\Documents\Radio\Anytone\

File Model Set Program Tool View Help

D878UVII

Common Setting

Channel

Scan List

Roaming Channel

Roaming Zone

FM

Auto Repeater Offset Frequ

Device Information

Optional Setting

Alarm Setting

Local Information

Hot Key

APRS

GPS Roaming

Digital

Radio ID List

Contact/Talk Group

Prefabricated SMS

Receive Group Call List

AES Encryption Code

Digital Contact List

Friends List

Talk Alias Settings

Encryption Code

Analog

Analog Address Book

STone Setting

2Tone Setting

DTMF Setting

No.	Name	Zone	Channels	A Channel
1				
2	RIM LINK	8	RL PINAL	
3	METRO LINK	6	ML ORD AUTP	
4	AZ DPS	22	STATEWIDE	
5	GILA COUNTY	16	ORD (2 MT ORD)	
6	FD Local	8	WFPD	
7	USFS GF PLUS	11	FIRE 1	FIRE 2
8	Pine Trail Run	18	TARA VHF	RL ORD
9	ZG Run	4	RL ORD	ZG Run-SIMPLEX
10				
11	GMR5	25	GMR519	DiaP675
12	Robin_Bruce	8	Robin Ch15 550	Robin Ch16 575
13	HS1 TARA-Local	29	TARA VHF	HS TARA_DMR
14	HS1 USA Local AZ	8	HS1 DISCONNECT	USA Area 7
15	HS1 USA States	56	Alabama	Arkansas
16	HS1 USA DMR	17	USA Area 3	USA Area 4
17	HS1 INTL DMR	13	WorldWide	WW English
18	HS1 RACES	17	RACES ORD	RACES ORD
19	HS1 EmComm	19	Arizona EmComm	EmComm US
20	HS2 TARA-Local	32	TARA UHF	HS2 TARA_DMR
21	HS2 USA Local AZ	10	HS2 TARA_DMR	Parrot
22	HS2 USA States	67	HS2 DISCONNECT	Oklahoma
23	HS2 USA DMR	23	HS2 DISCONNECT	United States
24	HS2 INTL DMR	10	HS2 DISCONNECT	Parrot
25	HS2 RACES	20	TARA VHF	TARA UHF
26	HS2 EmComm	12	Arizona EmComm	EmComm US
27				
28				
29				
30	HS3 TARA-Local	34	HS3 TARA_DMR	TARA VHF
31	HS3 USA Local AZ	10	Arizona	Arizona TAC
32	HS3 USA States	58	Arizona	California
33	HS3 USA DMR	25	United States	USA Nationwide
34	HS3 INTL DMR	10	WorldWide	WW English
35	HS3 RACES	20	RACES ORD	Arizona EmComm
36	HS3 EmComm	11	HS3 SD Red Cross	63 SD ARES2
37				
38				

D878UVII

List Zone

This shows a brief message of 250 Zones

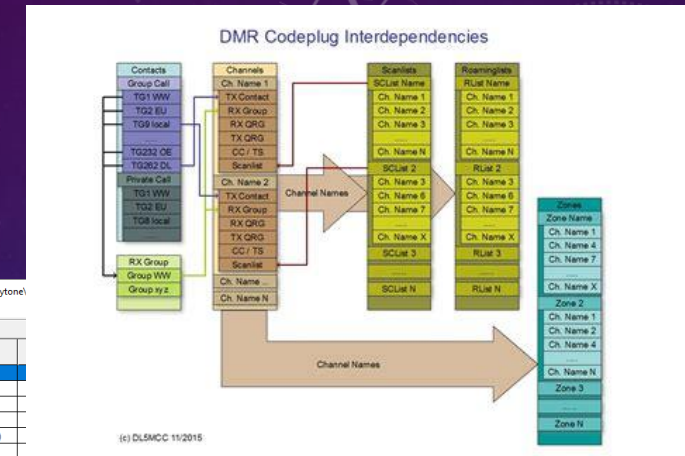
Double click to enter the editing interface

NOTE: Once you use the radio and with the up/down key switch between zones, holding the key down for up or down rapidly switches the zones instead of repetitively pushing it to switch.

Status

8/11/2023 10:54 AM

Several linked tables of freqs, linked TG, Zone, etc.

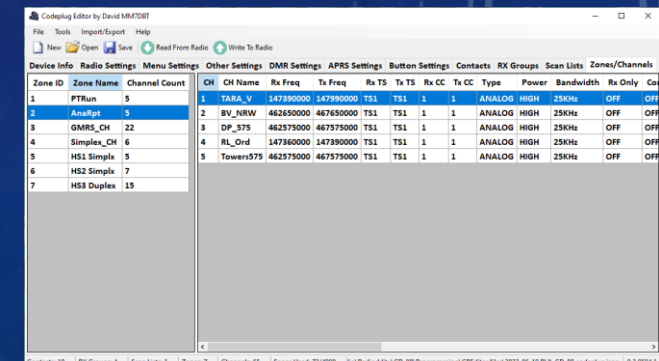
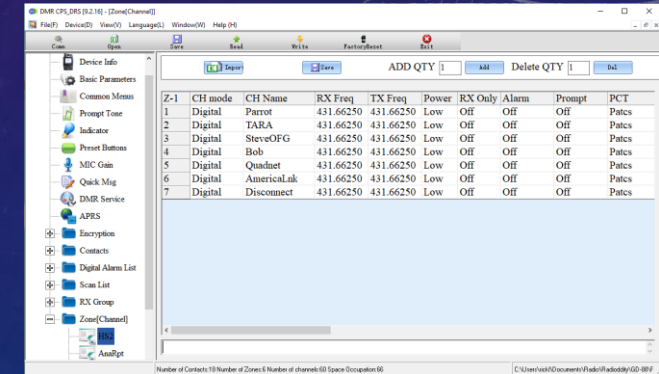
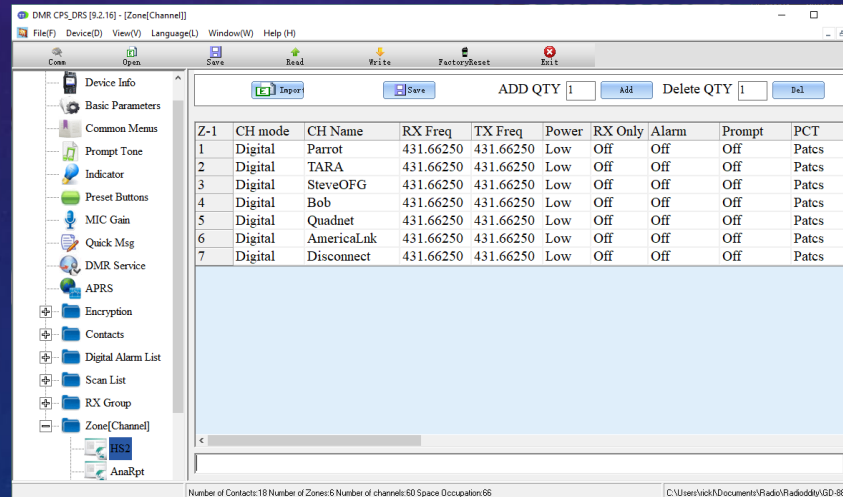
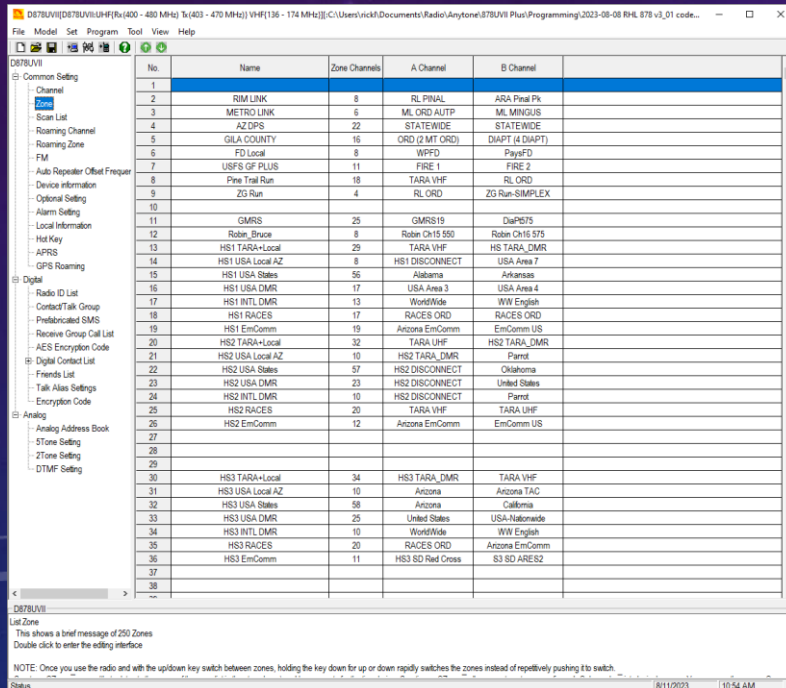


Demonstration: DMR Radio Programming Via CPS (Customer Programming Software)

Anyone

Radioddity GD-88

TYT MD UV380



STEPS TO GET STARTED IN DMR:

1. Get a DMR ID (free) – Requires that you send a pdf of your FCC Ham License
<https://www.radioid.net/register>
2. Get a DMR radio (not free)
3. Setup your account on the Brandmeister Network (free)
4. Find a DMR repeater or get a DMR Hotspot (or both)
5. Program your radio with the DMR TalkGroups that you want to use (codeplug)
6. Get talking!

SOME HELPFUL DMR LINKS:

- <https://www.dmrfordummies.com/library/>
- <https://www.radioid.net/register>
- <https://brandmeister.network/>
- <http://w0wc.com/resources/brandmeister-dmr-nets/>
- <https://www.pistar.uk/index.php>
- <https://www.pishop.us/>