

GETTING STARTED WITH DMR

Matt Gumbley MØCUV

WKARS July 2025

SCOPE

- Brief overview of DMR / Digital Voice modes
- A range of reasonable handset choices
- Build on what we know from analogue to understand how DMR is different
- DMR modulation and protocol *basics*
- Building the configuration
- Repeaters, Networks, Hotspots, bridging.. oh my!!

DMR & OTHER DV MODES

- DMR - open digital mode standardised in 2005
- Design for commercial use worldwide but adapted for amateur use - low cost, many manufacturers!
- Intended for commercial technician setup for fleets
- D-STAR (JARL, Icom, Kenwood, Alinco)...
- System Fusion/C4FM (Yaesu) [best audio quality]...
Both open standards, designed for amateur use specifically
- M17... watch this space... a later talk perhaps...

BAOFENG DM-UV32

- 8W? 10W?
- Built-in GPS / APRS
- Type-C Charging
- **No spurious emissions!!!**
- 250 Zones
4000 Channels
50000 DMR Contacts
- £51 Aliexpress
- See TechMinds
YouTube about it...



TYT MD-UV380

- £85 from Martin Lynch
- Programming cable included
- 3000 Channels
- 100,000 Contacts



ANYTONE AT-D168UV

- New!
- £120 from Martin Lynch
- Compact, No GPS or Bluetooth
- Type C Charging
- 4000 Channels
10,000 Talk Groups
500,000 DMR Contacts
- 2 Batteries, 2 Antennas



RETEVIS AILUNCE H1

- New!
- £167 from Retevis / AliExpress
- GPS, APRS (TX and RX)
- 6W output
- Type-C charging
- 4000 Channels,
500,000 Contacts
- AND: SFR (Single Frequency Relay)



ANYTONE AT-D878UVII PLUS

- £186 from Martin Lynch
- GPS, APRS and Bluetooth
- No Type-C charging
- 4000 Channels
10000 Talk Groups
500,000 DMR Contacts
250 Zones



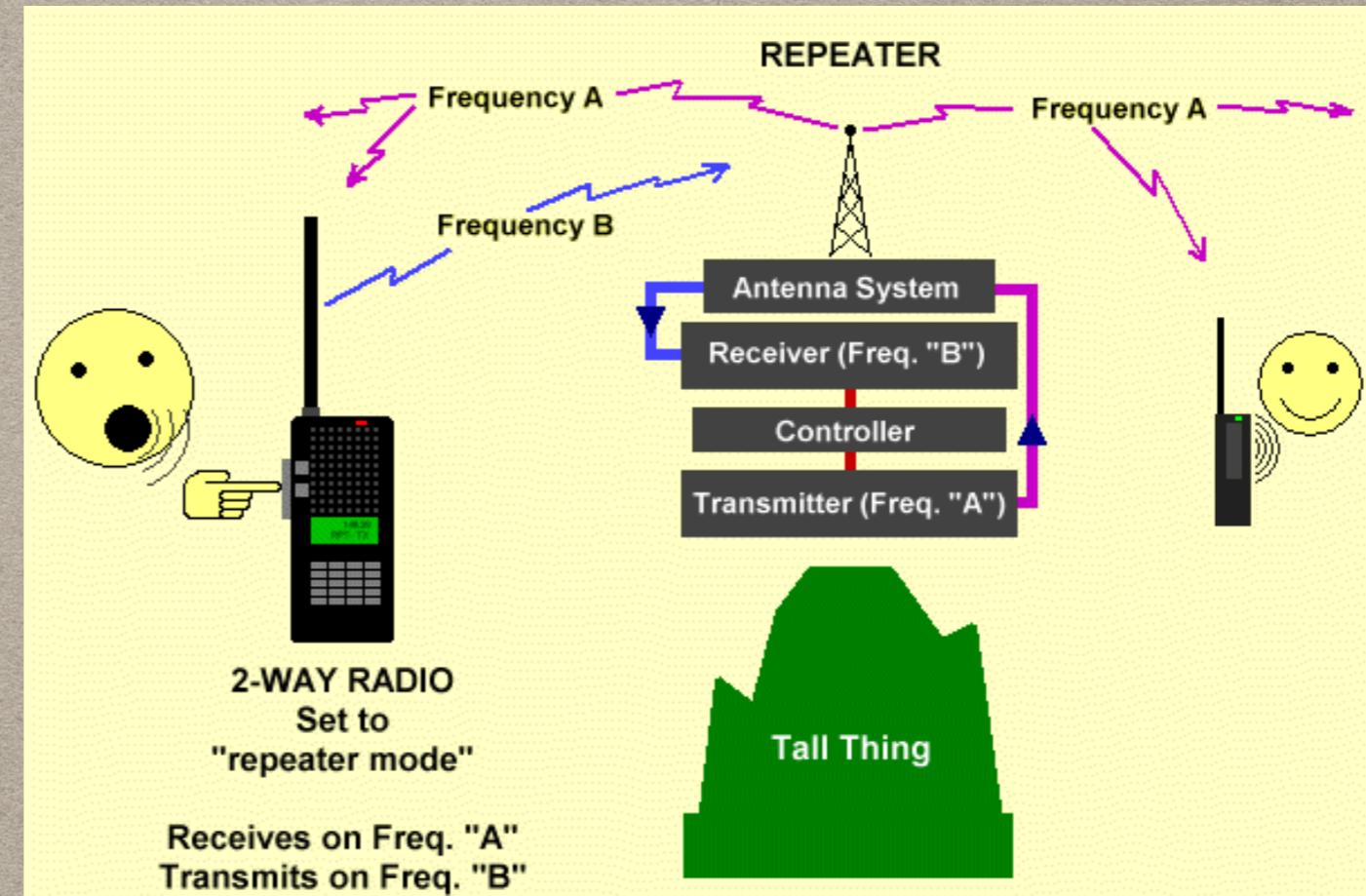
ZUMSPOT MINI 2.4" OLED LCD PI ZERO 2

- £178.00 from ML&S
- Fully built and tested
- Setup required by you
- Cable & PSU separate
- DMR, D-Star, Fusion, NXDN, P25, M17, POCSAG



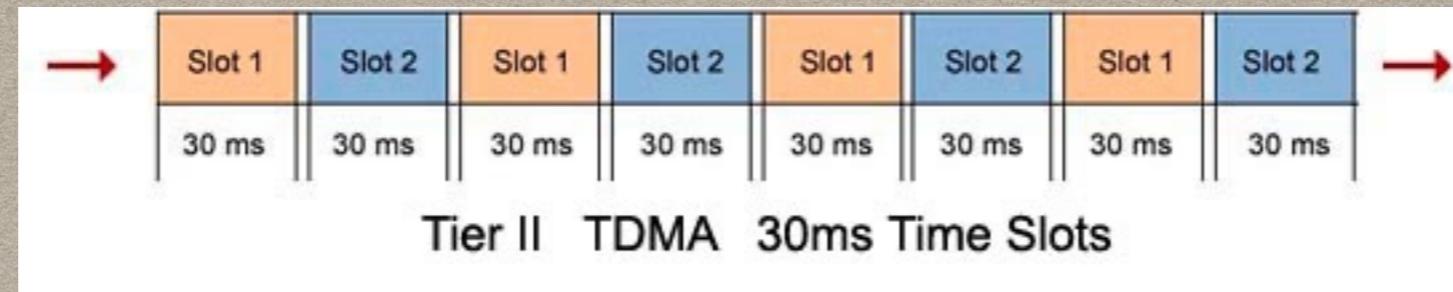
REVIEW OF ANALOGUE REPEATERS..

- Simple!
- Split frequency
- CTCSS



- GB3IK is a VHF FM repeater in Rochester
TX 145.7625MHz RX 145.1625MHz CTCSS 103.5
*55 to connect to [Hubnet](#)
*56 to connect to [Freedom Network](#)
*10 to disconnect last known station

DMR MODULATION BASICS



- FM with 12kHz bandwidth - FCC mandate to improve channel utilisation
- Time Division Multiple Access switches between two **Time slots**, each of 30ms (TS1, TS2)
- 6dB improvement on straight FM due to error correction
- 40% increased battery life due to TDMA (when transmitting a single time slot)
- Noise cancellation & digital voice - static/noise rejection (but... robotic codec)

TIME SLOTS

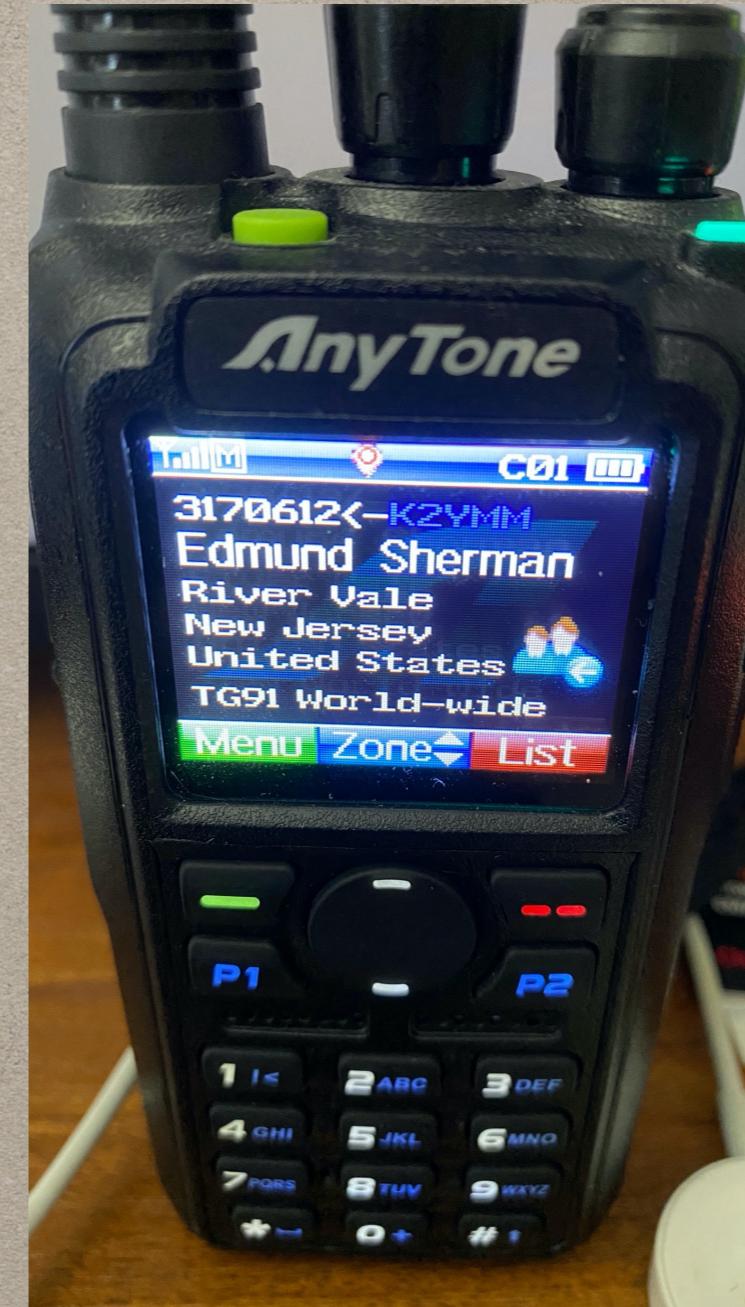
- A repeater can listen on both time slots simultaneously
- Each time slot can deliver different content
- The content a repeater delivers is determined by the user requesting a ***Talk Group***
- To 'open up' a repeater time slot you must choose the right ***Colour Code***
- Callers using different time slots listen to the repeater's synchronisation signal before transmitting - to get the 30ms timing right

SOURCE ID – WHO YOU ARE

- Your transmissions contain a Source and Destination ID
- The Source ID is your unique **DMR ID** that you register at <https://radiooid.net>
- There are currently 285881 DMR IDs worldwide
- The full DMR ID database is *usually* loaded into your handset (unless you have a tiny memory – see next slide)
- Download via <https://www.miklor.com/DMR/DMR-ID-DB.php>
- When you hear a station, your handset will display their details (callsign, name, location)
- Repeaters use the Source ID to verify you're allowed to use a network



DMR ID – WHAT INFO? WHAT'S DISPLAYED?



DMR ID

RadioD.net
Your unique Digital ID

MOCUV 

Matt Gumbley
Paddock Wood, England
United Kingdom

Subscription Status: Not a Subscr...

Things you are missing out on by not being a subscriber:

- Contacts Generator
- Buddy Watch/On Air Alerts
- Buddy Mail - Securely Message Other Subscribers
- Flagged as a **Subscriber** in Supporter's Log
- Subscriptions help RadioID Pay the bills
- Plus New Exciting Future Additions!
- * Subscription not required to receive a Digital Call

Your Radio ID's

Radio ID	Callsign	Type	Expires	Status
2349608	MOCUV	DMR / P25 / CCS7	Does not expire	Approved
2349608[nn]	MOCUV	HOTSPOT 	--	Approved

Detected Brandmeister Devices

Device ID	Callsign	Device	TX	RX	CC
2349608	MOCUV	MMDVM_ZUMspot	438.8000	438.8000	1

Digital Contact Edit---184965

Name	Edmund
Call Type	Private Call
TG/DMR ID	3170612
Call Alert	None
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Previous"/> <input type="button" value="Next"/>	
City	Sherman
Callsign	K2YMM
State/Prov	River Vale
Country	New Jersey
Remarks	United States

Digital Contact Edit---58210

Name	Mat
Call Type	Private Call
TG/DMR ID	2349608
Call Alert	None
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Previous"/> <input type="button" value="Next"/>	
City	
Callsign	M0CUV
State/Prov	
Country	
Remarks	

TALKER ALIAS

- A user-configurable alphanumeric string that can be added to your outgoing transmission
- Can contain your callsign, name, etc. to help when handsets do not contain the full DMR ID database
- Not all handsets support it; neither do all repeaters

DESTINATION ID – WHERE YOU WANT TO TALK

- **Group Calls (most common):**
This is the Talk Group (TG) number you've selected
Examples:
TG 9 (Local repeater)
TG 91 (Worldwide), TG 2351 (UK),
TG 23510 (specific regional groups)
- Talk Groups can be local to a repeater or Internet-linked on a **Network**
- The radio sends this as the destination to tell the network which talk group to route your transmission to
- **Private Calls:**
This would be another user's individual DMR ID
Used for direct radio-to-radio communication

DMR SIMPLEX

Time Slot 1 Colour Code 1 Talk Group 9 (local)

UHF	VHF
DH1 438.5875	DV1 144.5875
DH2 438.6000	DV2 144.6000
DH3 438.6125 (DV CALLING CHANNEL)	DV3 144.6125 (DV CALLING CHANNEL)
DH4 438.6250	DV4 144.6250
DH5 438.6375	DV5 144.6375
DH6 438.6500	DV6 144.6500
DH7 438.6625	DV7 144.6625
DH8 438.6750	DV8 144.6750

United Kingdom Talk Groups



BrandMeister

<http://tiny.cc/BM-UK>

235 UK Call
2350 UK & Phoenix
2351 Chat 1
2352 Chat 2
2353 Chat 3



SCOTLAND
2355
23550 Chat
23557 East
23558 H & I
23559 West

N. Ireland
2354
23540



North East
23560

Isle Of Man
2357

Yorkshire
23530

North West
23520

East Midlands
23590

Wales
2356
23570

East Anglia
23490

West Midlands
23580

London
2358

South West
2359 & 23500

South East
23510

<http://tiny.cc/BM-UK>

DMR NETWORKS

- BrandMeister
7192 repeaters; 19953 hotspots; 47 servers
<https://brandmeister.network/>
- Phoenix
<https://dvsp.net>
Also connects D-Star, YSF, M17, NXDN, P25, TETRA, FM
- FreeSTAR / IPSC2
- DMR-MARC
- TGIF
<https://tgif.network>
- Many repeaters can bridge between networks

OTHER NETWORKS

- AllStar - analogue FM Internet linked network (e.g. GB3IK) - systems on AllStar can bridge to DMR
- Hubnet - Built on AllStar, linking repeaters that had fallen into disuse. Multimode (DMR, Echolink, D-Star, Fusion) - the largest AllStar platform in the UK
<https://hubnetwork.uk>
(Phoenix and BrandMeister TG 23526)
- Extended Freedom Network - analogue and digital: AllStar, DMR, SIP (Voice over IP), cross-platform bridging
<https://extendedfreedom.network>
(Phoenix and TGIF TG 23525)

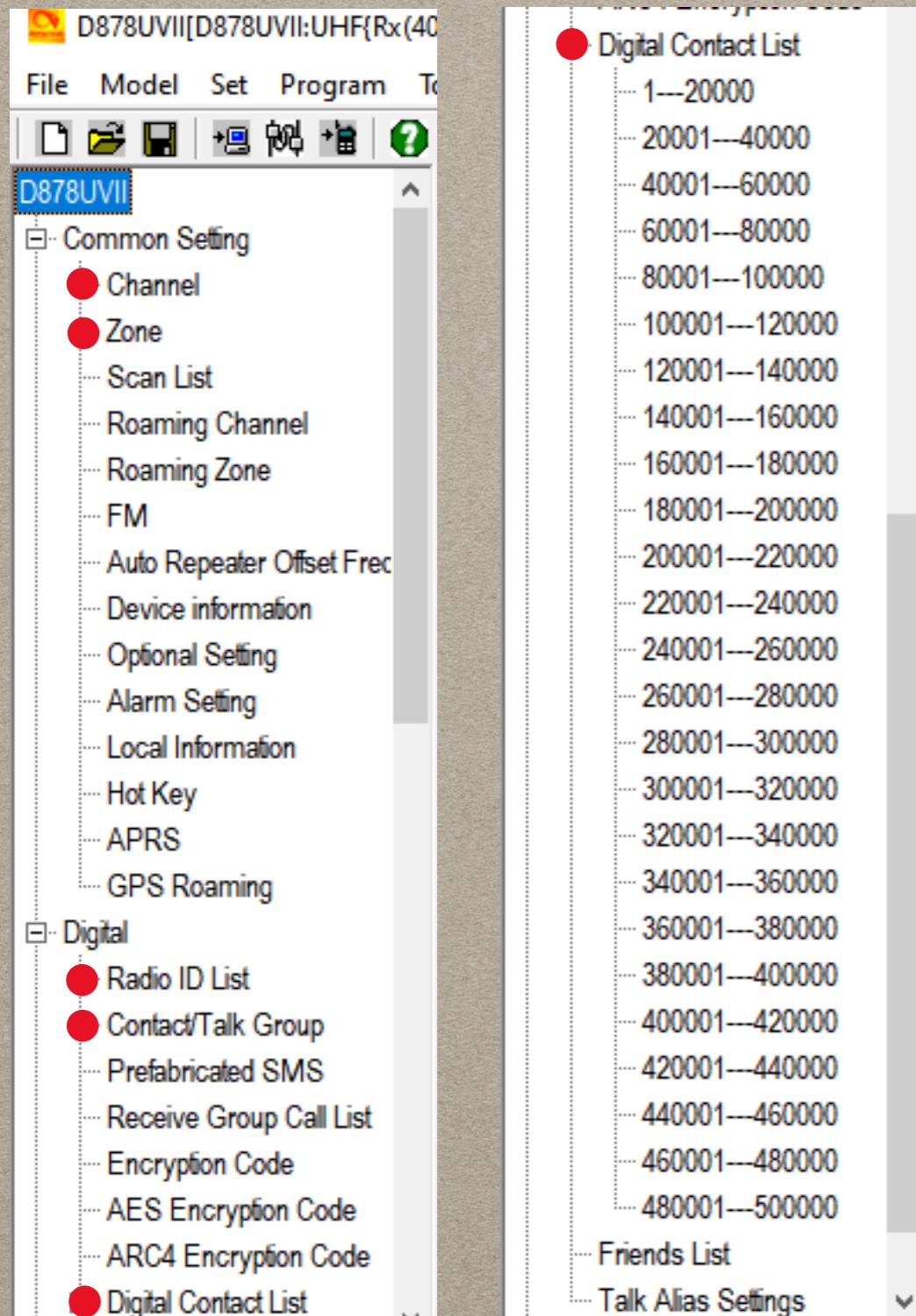
LOCAL DMR REPEATERS

- <https://ukrepeater.net> (limited info)
<https://repeaterbook.com> (more info)
<https://qrz.com> (hopefully everything)
- GB7IK - Rochester
TX 439.53750 RX 430.53570 (-9.0 MHz) co-located with
Colour Code 3
Uses TS1 and TS2
Network: Phoenix / DMR+
- | | TS1 | TS2 | |
|-------|--------------------------|-------------------------|--|
| TG | 1 Worldwide | 9 Local (repeater only) | |
| | 2 Europe | 801 South East England | |
| 235 | UK Calling | 9990 Echo test | |
| 2350 | BM UK Calling | | |
| 23525 | Extended Freedom Network | | |
| 23526 | Hubnet | | |
| 23531 | Raynet (BM Link) | | |

BUILDING A CODEPLUG

- You'll need the CPS (customer programming software) for your handset, and programming cable
- Read your radio config first and save it
- Register your DMR id at <https://radioid.net>
- Download the DMR database, Talk Group list from <https://www.pistar.uk/downloads/anytone/>

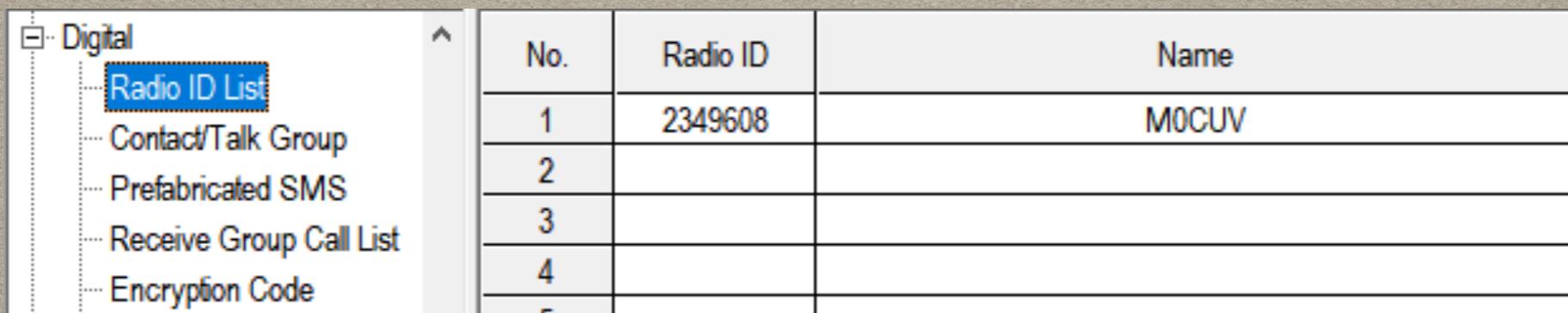
CPS MENU TREE



- ← *Don't need ALL this!*
- ↓ Just these in this order
- Radio ID List
- [Contact/Talk Group]
- Channels
- Zones
- [Digital Contact List]

RADIO ID

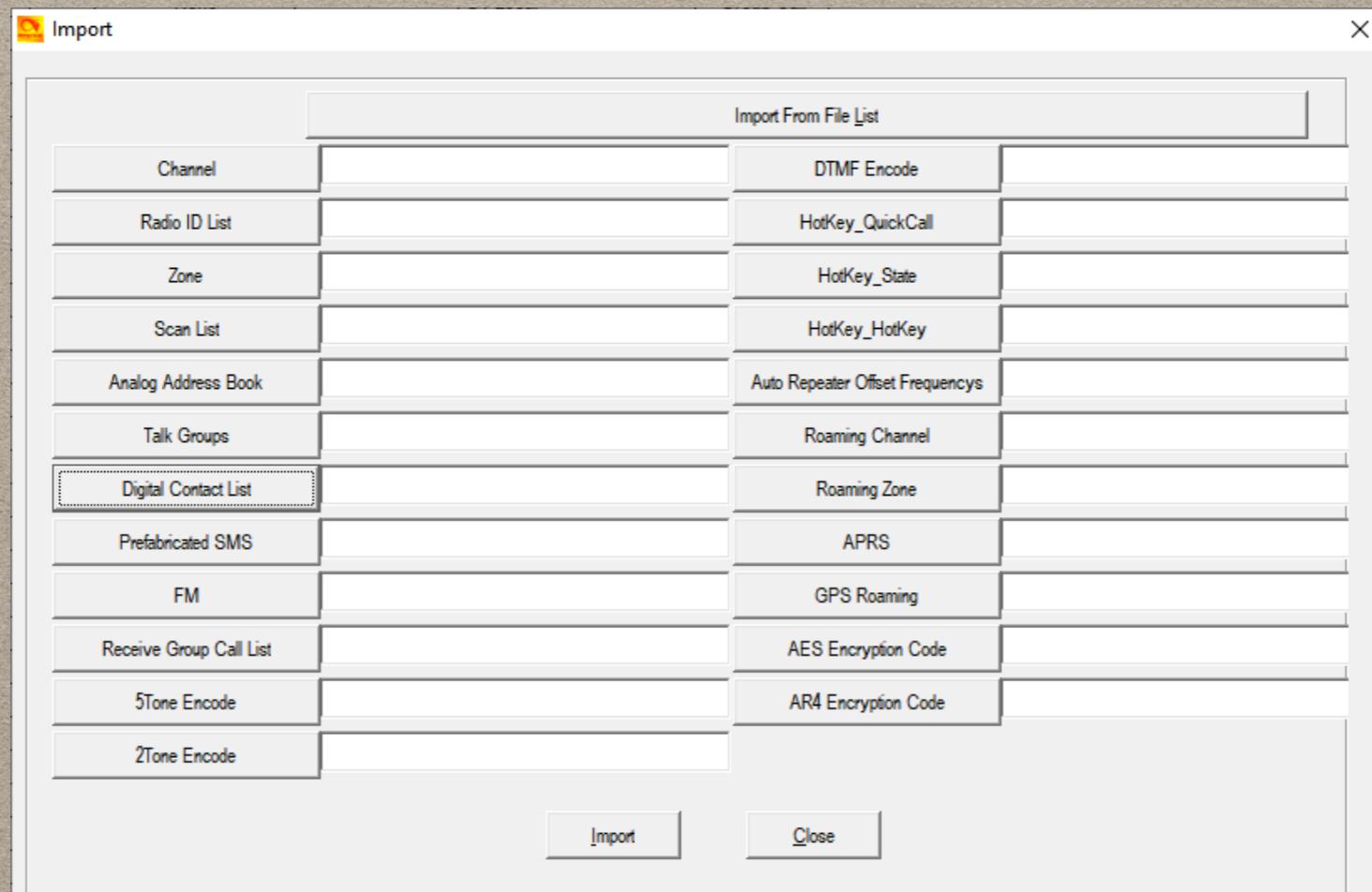
- Enter the DMR ID you have been allocated into the Radio ID List, with your callsign



No.	Radio ID	Name
1	2349608	M0CUV
2		
3		
4		
5		

IMPORT BULK DATA

- Tool / Import menu item (not left-hand tree)
- Click 'Digital Contact List' to import the DMR database
- Click 'Talk Groups' to import the Talk Group list



CHANNELS 'SPREADSHEET'

30	439.53750	430.53750	D-Digital	Turbo	12.5K	Off	Off	TG1 World IK	TG1 Local	M0CUV
31	439.53750	430.53750	D-Digital	Turbo	12.5K	Off	Off	TG2 Europe IK	TG2 Cluster	M0CUV
32	439.53750	430.53750	D-Digital	Turbo	12.5K	Off	Off	TG13 EngWW IK	TG13 English WW	M0CUV
33	439.53750	430.53750	D-Digital	Turbo	12.5K	Off	Off	TG235 UK Call IK	TG235 UK Call -	M0CUV
34	439.53750	430.53750	D-Digital	Turbo	12.5K	Off	Off	TG801 SE Eng IK	TG801 SE England	M0CUV
35	439.53750	430.53750	D-Digital	Turbo	12.5K	Off	Off	TG23526 Hubne IK	TG23526 Hubnet U	M0CUV
36	439.53750	430.53750	D-Digital	Turbo	12.5K	Off	Off	PC9990 DedPar IK	PC9990 Parrot	M0CUV
37	439.53750	430.53750	D-Digital	Turbo	12.5K	Off	Off	PC4000 Discon IK	PC4000 Disconnec	M0CUV

- Channels 'spreadsheet' shows basic info on each channel you program into your handset
- One entry for each Talk Group on each repeater
- Program all the TGs you want / PC9990 / PC4000
- Or use List / <scroll> / Select / Select Contact
- Or hold down Zero, manually enter TG, PTT

ANALOGUE SIMPLEX CHANNEL DETAIL

Channel Information Edit---66

Channel Name	2m V30 WKARS
Receive Frequency	145.37500
Transmit Frequency	145.37500
Correct Frequency[Hz]	0
Channel Type	A-Analog
Transmit Power	Turbo
Band Width	12.5K
Busy Lock	Off
Scan List	None
APRS Report Type	Analog
Analog APRS PTT Mode	End Of Transmission
Digital APRS PTT Mode	Off
Digital APRS Report Channel	1
Exclude channel from roaming	off
DMR MODE	DMO/simplex
Analog APRS Report Freq	1

PTT Prohibit Talk Around(Simplex) APRS RX

Work Alone DataACK Disable Auto Scan Ana Aprs Mute

Digital

Contact	TG1 Local
Radio ID	M0CUV
Color Code	1
Slot	Slot1
Receive Group List	None
Digital Encryption	Off
Extend Encryption	AES
ARC4 Encryption Code	Off
AES Digital Encryption	Off
Multiple Key	Off
Random Key	Off
SMS Forbid	Off

Send Talker Alias Call Confirmation Ranging

Slot Suit SMS Confirmation

Analog

CTCSS/DCS Decode	Off
CTCSS/DCS Encode	Off
Squelch Mode	Carrier
Optional Signal	Off
DTMF ID	
2Tone ID	1
5Tone ID	1
PTT ID	Off

Reverse 2TONE Decode 1

Custom CTCSS

R5toneBot	1
R5ToneEot	1

OK Cancel Previous Next

Icons: ECG, Heartbeat, Earth, Magnifying Glass, Battery, Antenna, Satellite, GPS, Network, Map.

ANALOGUE REPEATER CHANNEL DETAIL

Channel Information Edit---11

Channel Name	GB3IK Rochester	<input type="button" value="X"/>																																
Receive Frequency	145.76250	<input type="button" value=""/>																																
Transmit Frequency	145.16250	<input type="button" value=""/>																																
Correct Frequency[Hz]	0	<input type="button" value=""/>																																
Channel Type	A-Analog	<input type="button" value=""/>																																
Transmit Power	High	<input type="button" value=""/>																																
Band Width	12.5K	<input type="button" value=""/>																																
Busy Lock	Off	<input type="button" value=""/>																																
Scan List	None	<input type="button" value=""/>																																
APRS Report Type	Off	<input type="button" value=""/>																																
Analog APRS PTT Mode	Off	<input type="button" value=""/>																																
Digital APRS PTT Mode	Off	<input type="button" value=""/>																																
Digital APRS Report Channel	1	<input type="button" value=""/>																																
Exclude channel from roaming	off	<input type="button" value=""/>																																
DMR MODE	DMO/simplex	<input type="button" value=""/>																																
Analog APRS Report Freq	1	<input type="button" value=""/>																																
<input type="checkbox"/> PTT Prohibit <input type="checkbox"/> Talk Around(Simplex) <input type="checkbox"/> APRS RX <input type="checkbox"/> Work Alone <input type="checkbox"/> DataACK Disable <input type="checkbox"/> Auto Scan <input type="checkbox"/> Ana Aprs Mute																																		
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Multiple Key	Off																																	
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Analog <table border="1"> <tr> <td>CTCSS/DCS Decode</td> <td>CTCSS</td> <td>103.5</td> <td><input type="button" value=""/></td> </tr> <tr> <td>CTCSS/DCS Encode</td> <td>CTCSS</td> <td>103.5</td> <td><input type="button" value=""/></td> </tr> <tr> <td>Squelch Mode</td> <td>CTCSS/DCS</td> <td><input type="button" value=""/></td> <td><input type="checkbox"/> Reverse</td> </tr> <tr> <td>Optional Signal</td> <td>Off</td> <td><input type="button" value=""/></td> <td>2TONE Decode <input type="button" value="1"/></td> </tr> <tr> <td>DTMF ID</td> <td><input type="button" value=""/></td> <td><input type="button" value=""/></td> <td>Custom CTCSS</td> </tr> <tr> <td>2Tone ID</td> <td><input type="button" value="1"/></td> <td><input type="button" value=""/></td> <td>R5toneBot <input type="button" value="1"/></td> </tr> <tr> <td>5Tone ID</td> <td><input type="button" value="1"/></td> <td><input type="button" value=""/></td> <td>R5ToneEot <input type="button" value="1"/></td> </tr> <tr> <td>PTT ID</td> <td>Off</td> <td><input type="button" value=""/></td> <td></td> </tr> </table>			CTCSS/DCS Decode	CTCSS	103.5	<input type="button" value=""/>	CTCSS/DCS Encode	CTCSS	103.5	<input type="button" value=""/>	Squelch Mode	CTCSS/DCS	<input type="button" value=""/>	<input type="checkbox"/> Reverse	Optional Signal	Off	<input type="button" value=""/>	2TONE Decode <input type="button" value="1"/>	DTMF ID	<input type="button" value=""/>	<input type="button" value=""/>	Custom CTCSS	2Tone ID	<input type="button" value="1"/>	<input type="button" value=""/>	R5toneBot <input type="button" value="1"/>	5Tone ID	<input type="button" value="1"/>	<input type="button" value=""/>	R5ToneEot <input type="button" value="1"/>	PTT ID	Off	<input type="button" value=""/>	
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<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Previous"/> <input type="button" value="Next"/>																																		
        																																		

DMR SIMPLEX CHANNEL DETAIL

Channel Information Edit---102

Channel Name	2m Call
Receive Frequency	144.61250
Transmit Frequency	144.61250
Correct Frequency[Hz]	0
Channel Type	D-Digital
Transmit Power	Turbo
Band Width	12.5K
TX Permit	Always
Scan List	None
APRS Report Type	Off
Analog APRS PTT Mode	Off
Digital APRS PTT Mode	Off
Digital APRS Report Channel	1
Exclude channel from roaming	off
DMR MODE	DMO/simplex
Analog APRS Report Freq	1

PTT Prohibit Talk Around(Simplex) APRS RX
 Work Alone DataACK Disable Auto Scan Ana Aprs Mute

Digital

Contact	TG9 Local
Radio ID	M0CUV
Color Code	1
Slot	Slot1
Receive Group List	None
Digital Encryption	Off
Extend Encryption	AES
ARC4 Encryption Code	Off
AES Digital Encryption	Off
Multiple Key	Off
Random Key	Off
SMS Forbid	Off

Send Talker Alias Call Confirmation Ranging
 Slot Suit SMS Confirmation

Analog

CTCSS/DCS Decode	Off
CTCSS/DCS Encode	Off
Squelch Mode	Carrier
Optional Signal	Off
DTMF ID	
2Tone ID	1
5Tone ID	1
PTT ID	Off

Reverse
2TONE Decode: 1
Custom CTCSS
R5toneBot: 1
R5ToneEot: 1

OK Cancel Previous Next

Icons: ECG, Earth, Magnifying Glass, Battery, Network, Tools, Help

DMR REPEATER CHANNEL DETAIL

Channel Information Edit---30

Channel Name	TG1 World IK	
Receive Frequency	439.53750	
Transmit Frequency	430.53750	
Correct Frequency[Hz]	0	
Channel Type	D-Digital	
Transmit Power	Turbo	
Band Width	12.5K	
TX Permit	Always	
Scan List	None	
APRS Report Type	Off	
Analog APRS PTT Mode	Off	
Digital APRS PTT Mode	Off	
Digital APRS Report Channel	1	
Exclude channel from roaming	off	
DMR MODE		
Repeater		
Analog APRS Report Freq		
Analog		
CTCSS/DCS Decode	Off	
CTCSS/DCS Encode	Off	
Squelch Mode	Carrier	
Optional Signal	Off	
DTMF ID		
2Tone ID	1	
5Tone ID	1	
PTT ID	Off	
Digital		
PTT Prohibit	<input type="checkbox"/>	
Talk Around(Simplex)	<input type="checkbox"/>	
APRS RX	<input type="checkbox"/>	
Work Alone	<input type="checkbox"/>	
DataACK Disable	<input type="checkbox"/>	
Auto Scan	<input type="checkbox"/>	
Ana Aprs Mute	<input type="checkbox"/>	
Contact	TG1 Local	
Radio ID	M0CUV	
Color Code	3	
Slot	Slot1	
Receive Group List	None	
Digital Encryption	Off	
Extend Encryption	AES	
ARC4 Encryption Code	Off	
AES Digital Encryption	Off	
Multiple Key	Off	
Random Key	Off	
SMS Forbid	Off	
<input type="checkbox"/> Send Talker Alias	<input type="checkbox"/> Call Confirmation	<input type="checkbox"/> Ranging
<input type="checkbox"/> Slot Suit	<input type="checkbox"/> SMS Confirmation	
Reverse		
2TONE Decode	1	
Custom CTCSS		
R5ToneBot	1	
R5ToneEot	1	

OK Cancel Previous Next

ZONES

No.	Name	Zone Channels	A Channel	B Channel
1	Analogue	38	GB3KN Maidstone	GB3KN Maidstone
2	Hotspot	14	PC4000 Disconn	PC9990 Parrot
3	DMR Simplex	9	2m Call	2m Call
4	GB7IK Rchestr PH	7	TG235 UK Call IK	PC4000 Discon IK
5	GB7AR Ridley BR	3	TG98 Test AR	TG235 UK Call AR
6	GB7KB Hthfd BM	5	PC4000 Discon KB	PC9990 Parrot KB
7	GB7KD Hailshm BM	4	PC4000 Discon KD	PC9990 Parrot KD
8	GB7EG EGstd FDMR	2	PC4000 Discon EG	PC9990 Parrot EG
9	GB7KE Chatham BR	3	PC9990 Discon KE	PC9990 Parrot KE
10				
11	GB7AS Ashford BR	4	PC4000 Discon AS	PC9990 Parrot AS
12	Ana. 2m Simplex	32	2m V40 Calling	2m V30 WKARS
13	Ana. Repeaters	5	GB3RE Maidstone	GB3KN Maidstone

- Group your channels any way you like!
- Perhaps one zone per repeater with all its TGs
- All analogue channels
- All DMR simplex channels
- Your common net channels

OPERATING TIPS

- Click PTT momentarily to join and monitor a Talk Group
- This will appear as a transmission from you, and be visible to others who are on that TG – it's called 'kerchunking'
- Or monitor the TG via the BrandMeister 'Hose' at <https://hose.brandmeister.network/> and when it's quiet, launch into your call
- Due to DMR TS delays, key PTT then wait a second before talking
- Disconnect (PC4000) to leave a TG (but requires delay between overs to register)

FURTHER READING

- <https://www.m7spi.co.uk/downloads/> has a PDF of "Dummies guide to DMR" << recommended
- Book: Work the world with DMR, Andrew Barron, RSGB
- DMR for Dummies <https://www.dmrfordummies.com/>
- www.miklor.com << many DMR articles
- <https://hamradiosouthernrepeaters.co.uk/anytone-dmr.html> short link <http://tiny.cc/Any-DMR>

That's all Folks!