



RAYNET-UK DMR

Release 1.10.1.post20200504175005

Guy (M0GUY)

Oct 29, 2023

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The RAYNET-UK DMR server is a DMR (Digital Mobile Radio) service for RAYNET members. Please contact your local RAYNET group controller to request access.

The server is divided into RAYNET groups and zones. Each group has 100 Talkgroups allocated which can be renamed, enable/disable, and set Access Control on. Group controllers can also invite members to join their group.

Members can send traffic via their hotspots or via some public repeaters. By using your own hotspot you can customise how you interact with the service and is the recommended method.

DMR BASICS

DMR (Digital Mobile Radio) is fast becoming the most popular digital mode for amateur usage. It started out in the commercial world championed by Motorola. There are a number of different derivatives of it which are still used commercially. DMR is an open standard making it easier to build and integrate. Like all new things it does come with new technical speak to also become familiar with. Below are these key terms with a brief definition to get you started.

More information about DMR can be found on the [Digital Mobile Radio Association](#) website.

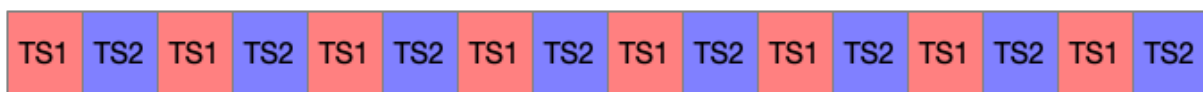
1.1 DMRID

You will require a DMRID. DMRID is a unique 7 digit number which will be linked to one of your callsigns. You can have multiple DMRIDs assigned to the same callsign though they are limited so expect a request for justification if you request multiple.

Transmitting on DMR the DMRID is the number which is passed around rather than your callsign. For the UK the number will start 234 or 235. This needs to be requested from <https://radioid.net>. It's free to do, you will need to create an account and upload a copy of your license. This usually takes 24 hours to complete. Once radioid have allocated your number it may take another 24 hours for it to be propagated to the RAYNET server.

1.2 Timeslot (TS)

With DMR we have 2 Timeslots, this means two calls can be held in parallel on the same frequency and within the 12.5Khz bandwidth. Each call is sliced into chunks and interleaved with the call on the other Timeslot.



When programming your radio to use a repeater you need to make a note of the Timeslot for a each Talkgroup. If you have a simplex hotspot then all the traffic will be on Timeslot 2.

1.3 Colour Code (CC)

This performs a similar function as Continuous Tone-Coded Squelch System (CTCSS) tones used for analog radio. When using a hotspot the colour code will normally be 1. When using a repeater you will need to make sure your radio is set to the same as the repeater

1.4 Talkgroups (TG)

A talkgroup is a number like a phone number, this is how your traffic is routed around the DMR network. Users select to listen or transmit on a talkgroup and will then hear traffic for that talkgroup number.

1.4.1 On Hotspots using different Networks

So, you have your Hotspot. The next issue is which Talkgroups or Reflectors do you use? Obviously, this will be to some extent a personal decision. However, depending on which Network you are on, the choice may make all the difference to your DMR experience. Of the two UK Networks, Brandmeister offers the most Talkgroups and, with the Brandmeister API installed, the most control. Phoenix is more UK centric but has limited Talkgroup controls. If you only want to use one Network then select that as DMR Master; otherwise, you will have to use DMRGateway as the Master.

1.4.2 The Basics

In order to use a particular Talkgroup you need to do two things. The Network needs to be enabled on your Hotspot and there needs to be a Channel in your radio set to use the Hotspot and with the appropriate Talkgroup or Digital Contact ID, Group Call set. Then simply keying up the Channel will activate the Talkgroup. Note – you may need to key it up before you hear anything.

Changing channels to a different Talkgroup and keying that up will switch to that one instead. Except things are never that straight forward on DMR – it depends which Network you are on! The Hotspot is treated like a Repeater by the Networks, particularly by Phoenix. This means that Talkgroups may be timed out by the Network. For instance, listening to TG840 on Phoenix will necessitate keying it up at least every 15 minutes; this is different behaviour to RF repeaters that have defined Static Talkgroups (including 840 in East Anglia). The three different Networks discussed in this document all act differently in respect to keeping Talkgroups active on Hotspots:

Talkgroups can be either Static – available all the time, or Dynamic – non-static for a period available after you have used it, or until perhaps you chose another non-static one.

- Brandmeister has configurable Statics, as well as dynamic and pseudo-statics.
- Phoenix has fixed Statics and User Activated (dynamic) Talkgroups.
- RAYNET has configurable Statics and remembers the last Talkgroup used as a Dynamic.

It is good practice not to ‘rag-chew’ on the calling or primary channels. Once a contact has been established (QSO) you should change Talkgroup (QSY) to one of the many chat or tactical Talkgroups. However, a short ‘over’ is permissible. The problem is the wider the coverage of a Static Talkgroup the more repeaters you use; blocking their use by other people. It only takes one irresponsible operator to chat to people on World Wide 1 to effectively bring down the entire Phoenix repeater base in the UK.

1.4.3 Brandmeister

This network is the most comprehensive, with around 1573 Talkgroups. For a full list go to https://www.pistar.uk/dmr_bm_talkgroups.php

Talkgroups can be set Static using the controls added to the dashboard using the Brandmeister GUI. This lists the active Talkgroups and allows you to change them. The Brandmeister support for Reflectors is to be discontinued; Talkgroup 9 will then be spare.

On a Simplex Hotspot keying up a non-static Talkgroup will make it auto-static, sort of an extra Static one. If you then key up another Talkgroup that is not Static this takes the place of the auto-static one;

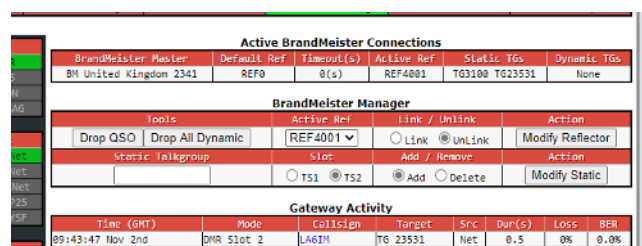


Fig. 1.1: Brandmeister GUI

which then becomes Dynamic for a period of time. You can still use Talkgroup 4000 to disconnect the current Talkgroup if sent as a private call.

DMR uses 2 Time Slots. Brandmeister uses whichever Time Slot the repeater keeper has set, or either on a Duplex Hotspot. Simplex Hotspots only have Time Slot 2.

Some recommended Talkgroups:

- 1 World Wide English
- 2 EU W
- 235 UK W
- 2351 UK Talk 1
- 2353 UK Talk 3
- 23515 East Anglia
- 310-319 Tac1 – Tac 10
- 3100 USA
- 31001 USA Net 1
- 31002 USA Net 2
- 31000 Echo
- 4000 Disconnect
- 9 Local (Reflectors)
- 91 World Wide
- 92 EU Wide
- 93 Nth America
- 94 Asia
- 95 Australia / NZ.

1.4.4 Phoenix

This network is particularly strong in the UK with 52 Talk Groups, but does have International coverage and it is linked to the 228 DMR+ ones. (In fact, access to Phoenix from a Hotspot is via the DMR+ Network; confused?)

- For Phoenix Talkgroups go to <http://www.dmr-uk.net/index.php/layout/>
- For DMR+ go to https://www.pistar.uk/dmr_dmr+_talkgroups.php

On the Repeater Network, Phoenix Talkgroups are either Static or User Activated (aka Dynamic). Static Talkgroups are always on, User Activated will not be heard until keyed up. They then become 'Static' for 15 minutes after each outgoing transmission. Make sure you key up before they time out if you are only listening, or are on a protracted Net. In the list below Static Talkgroups on Repeaters are in **BOLD**. Also, Phoenix defines particular Time Slots for particular Talkgroups.

The Phoenix Network treats Hotspots differently in that no Talkgroups are Static and on a Simplex Hotspot everything is on Time Slot 2 regardless. On a Duplex Hotspot either Time Slot can be used, providing you are not running DMRGateway.

Unlike Brandmeister, there are no controls on the dashboard to control Talkgroups. There is, however, an Options field in the DMR+ Configuration section. The default contents of this are:

```
StartRef=4000;ReLinkTime=60;UserLink=1; TS2_I=9;
```

This takes some explaining. When the Pi-star starts up it read this line and does the following:

- *StartRef=4000*; This is the Reflector to use. 4000 means disconnect.
- *ReLinkTime=60*; If the user changes the reflector from the initial one, restore it after 60 minutes.
- *UserLink=1*; Allows the user to change the reflector. Set it to '0' to inhibit.
- *TS2_1=9*; Sets Talkgroup 9 as static. You can set up to 5 static Talkgroups per Timeslot (*TS2_2=840*; say)

On a Duplex Hotspot there are two Time Slots. So, in the above Option field *TS1_1*= Time Slot 1 and *TS2_1* = Time Slot 2. Time Slot 1 only works on a Duplex Hotspot running DMR+; and not if it is running DMRGateway (as the default Talkgroup Rewrite rules routes all traffic over Time Slot 2 for DMR+ Talkgroups, but this can be changed)

If you use the Options field to set things it may be lost if you subsequently change other settings. There is no way of inhibiting individual Talkgroups set using this command. This means if you set a busy Talkgroup you will not be able to switch away from it whilst busy.

Some recommended Talkgroups are as follows (use Hubnet 23536 at your own peril):

- Time Slot 1:
 - 1 World Wide
 - 13 WW English
 - 113 WW English
 - 119 WW
 - 123 WW English
 - 129 WW
 - 235 UK Wide
 - 80 UK Wide 1 – 84 UK Wide 5
 - 9 Local
- Time Slot 2:
 - 840 East Anglia
 - 841 Suffolk Coastal
 - 9 Local
 - 9990 Echo (Regional Talkgroups are Static in their own area and User Activated everywhere else)

1.4.5 RAYNET-UK

This network is private and the Talkgroups are not available on the public Networks. The available Talkgroups will depend on the Admin settings for each individual user. Each Talkgroup can be configured to be on either or both Time Slots. If you have a Duplex Hotspot you can have some on each Time Slot and some on Both, depending on your requirements.

Some recommended ones are as follows:

- 5023531 National Activity
- 5089900 Nat Net
- 5089901 Nat Call 1
- 5089910 Nat Event 1
- 5089911 Nat Event TG 1
- 5089999 Echo Test
- Zonal set as above (50904xx for Suffolk)

- County set as above (50858xx for Suffolk)
- Group set (50260xx for East Suffolk)

1.4.6 Switching Networks within Pi-star using DMR Gateway

DMR Gateway allows you to connect to multiple DMR Networks at the same time but requires additional work; both in the Pi-star configuration and in the Code Plug(s) for your radio(s). This is to allow the Hotspot to determine which DMR Network you are trying to access from your radio. By default, almost all traffic will be routed over the Brandmeister Network.

Whilst running DMR Gateway (and if you want the RAYNET private server you will have to be even if you just want that one Network) you can enable and disable Brandmeister and Phoenix from the Configuration menu on the web interface. Just scroll down to the DMR Configuration section. Move the slider to disable either Brandmeister or DMR+ to disable Brandmeister or Phoenix respectively. Then click on Apply Changes.

Changing the Status of the RAYNET DMR server is a bit more difficult. To alter this, you need to click on Configuration> Expert on the Pi-star tool bar and then under Full Edit DMR GW. Scroll down to the [DMR Network 4] section. Change the line Enabled=1 to Enabled=0 to turn it off, and from 0 to 1 to turn it on. Click on Apply Changes.

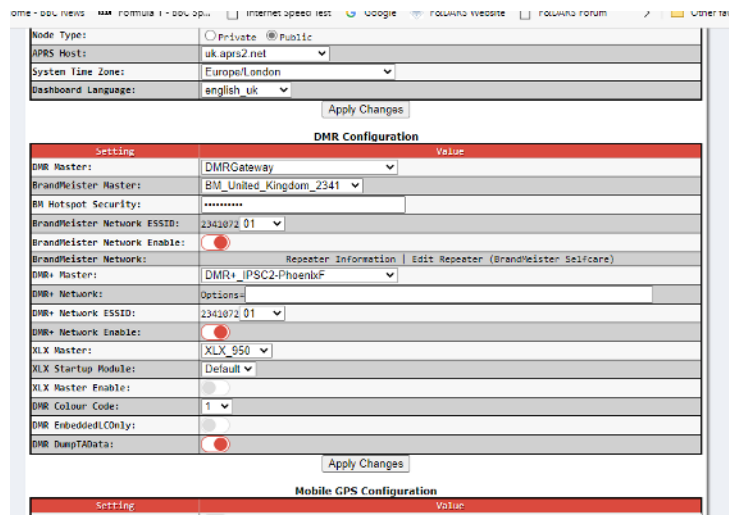


Fig. 1.2: DMR Gateway

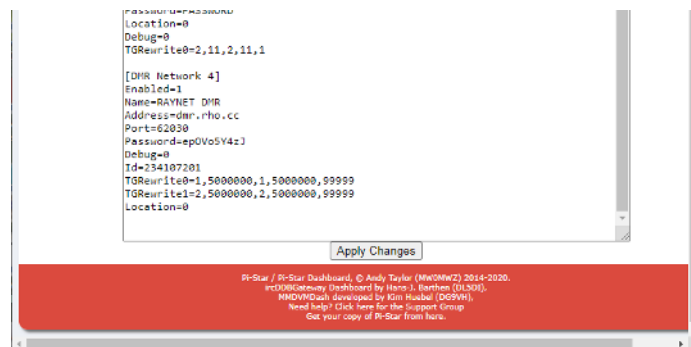


Fig. 1.3: RAYNET Settings

If you use the dashboard to turn on a specific Network, by turning off the ones you don't want, you can listen to one Network at a time. In Brandmeister mode you can connect, say, to TG 3211 and it will work. Alternatively, in Phoenix mode you can use TG 235 and it might. However, for Phoenix to work you have to use redirect statements in the Pi-star configuration and have an extra set of Talkgroups for Phoenix through the Hotspot.

1.4.7 Phoenix Talkgroup Redirects

In order to get Phoenix to co-exist with Brandmeister (or any other DMR Networks for that matter) using DMR-Gateway you need to ensure there is no overlap in Talkgroup IDs. The way to do this is to add additional Talkgroup IDs to your radio, prefixing each existing Phoenix ID with an '8' and as many leading '0's as required to make them 6 digits long.

For instance, TG 235 becomes TG 800235, TG 840 becomes TG 800840, etc. These new Talkgroups do not replace the Repeater originals and are only used to create Channels assigned to a Hotspot in DMRGateway mode.

Having done this, you then need to change the Pi-star configuration file to suit. It is always good practice to back up your configuration before making major changes! From the Dashboard you need to select 'Configuration', 'Expert' and then in the Full Edit: section select 'DMR GW'. In the [DMR Network 2] section replace all the existing TGRewrite and PCRewrite lines with the following:

```
TGRewrite0=2,8,2,9,1
TGRewrite1=2,800505,2,505,1
TGRewrite2=2,800800,2,800,100
TGRewrite3=2,803801,2,3801,8
TGRewrite4=2,823531,2,23531,1
TGRewrite5=2,809990,2,9990,1
TGRewrite6=2,800001,1,1,9999
TGRewrite7=2,800001,2,1,9999
PCRewrite0=2,804000,2,4000,1001
```

Select the "Apply Changes" button and wait for the Hotspot to restart. Then when you transmit on a channel with a modified Phoenix Talkgroup ID, this lookup table ensures the call is routed to the Phoenix Network. If using a Duplex Hotspot, they prevent the use of Time Slot1 for the Phoenix Network, everything works on Time Slot 2.

1.4.8 Monitoring Concurrent Networks – A Warning

If you run DMRGateway and have multiple Networks active at the same time you may experience problems with Static Talkgroups.

Perhaps you are listening to BM 3100 USA. If during a quiet period a QSO is started on a Talkgroup on a different Network that is also Static, say Phoenix 840 East Anglia, this will become the current Talkgroup being handled by your Hotspot. The chances are you won't hear this because you are focused on the original Talkgroup (unless you are running promiscuous mode on Talkgroups of course)

More importantly you would have no way of 'killing' the unwanted QSO and returning to your original QSO! The Brandmeister API allows you to drop Static and Dynamic Talkgroups from your Pi-star dashboard. The RAYNET private server allows you to do the same but from the server web page. However, if you have used the Options field to set Static Talkgroups on Phoenix you will be unable to clear them without clearing the Options field and restarting the Pi-star; and that doesn't always work straight away.

If you set a busy Talkgroup as Static you may not be able to change Talkgroups at all until there is a big enough gap in the QSO to break away – it has been known for users to be stuck on Hubnet against their will! If you are going to be on a Net, say, you would need to use the different Network's controls to remove all the other Statics before you start.

If you really must be able to use multiple Networks concurrently ideally you need a Duplex Hotspot. These are more difficult to set up (perhaps requiring additional channels in your Code Plug for the different Timeslot and different redirect statements) but allow you to use different Timeslots for different Networks. For example, have Timeslot 1 for Phoenix and Timeslot 2 for Brandmeister / RAYNET. This will allow you to select the Network of interest or, even, run two radios one on each Timeslot.

1.4.9 Reflectors – The Basics

Before Talkgroups there were, and on some Networks still are, Reflectors. A Reflector is effectively a User Activated Talkgroup. There are many more Reflectors on some Networks than there are Talkgroups. They tend to give access to specialist groups, such as ‘Hunting and Fishing’ and ‘Astronomy’. At the time of writing there are 92 (and 1481 Talkgroups) on Brandmeister, 374 on DMR+ and 18 on Phoenix (all linking to existing Phoenix Talkgroups) Reflectors all start with a ‘4’ and are four digits long. Brandmeister Reflectors are listed at www.pistar.uk/dmr_bm_talkgroups.php. DMR+ Reflectors can be found on the same site. If you are using DMR-Gateway all Reflector set-up calls are routed over the Brandmeister Network; assuming you are using the standard Talkgroup redirects.

The way to operate using a Reflector is as follows:

- Put a Private Call out using the 4-digit ID of the Reflector, eg 4513, Hunting and Fishing.
- Switch your radio to Talkgroup 9. This is where the audio will be. If you are quick you may hear a connected announcement.
- When you have finished your QSO you should disconnect by making a Private Call to 4000. Listening on Talkgroup 9 you should hear a disconnect message.
- If you don’t send a disconnect the Reflector (on a Repeater) will time out after 15 minutes.

If you really want to, this also works on Phoenix RF Repeaters. If you make a Private Call to 4400 on Time Slot 2, the Repeater will map the Local Talkgroup 9 on to Talkgroup 235 on Time Slot 1. Any transmissions then made on 9 Local TS2 will appear on 235 UKW on TS1. On all the idle UK Repeaters!

Oddly on a Phoenix RF Repeater, if you make a Private Call to 4504 you connect 9 local TS2 to Oost Nederland which is on Brandmeister Reflector 4504 (and Talkgroup 2044); not DMR+ 4504 which is listed as ‘Satellites’. However, if you Private Call 4850 you connect to DMR+ Reflector 4850 (New Zealand). It does seem to be a bit hit and miss as to which Network will carry a Reflector.

Lots other useful information can be found at: <https://amateurradionotes.com/pi-star.htm>

1.5 Code Plug

A code plug is an old name for the programming of the radio. You will need to use the software provided by the radio manufactures which likely only runs on Windows. The programming software is often hard to use when dealing with multiple Talkgroups and channels so it’s often simpler to use a spreadsheet application to make your bulk changes and reimport into the programming software.

[qdmr](#) - A GUI application and command-line-tool to program DMR radios. Copyright (C) 2019-2020 Hannes Matuschek, DM3MAT. This software works on linux system and provides support for a growing number of digital radios.

[chirp](#) - is a free, open-source tool for programming your amateur radio. It supports a large number of manufacturers and models, as well as provides a way to interface with multiple data sources and formats.

1.5.1 Contacts

Many radios support uploading an address book of contacts. Without which the radio will be displaying DMRIDs rather than call signs. These are usually imported as a CSV (Comma Separated Values) file.

Below are contact files for common radios ready to be imported. These files contain world wide contacts, which might not fit on your radios memory.

- [Anytone](#)

1.5.2 Zone

This is a collection or group of channels on the radio. This allows you to group together channels/Talkgroups, for example you could create a zone for your local repeater and add the Talkgroups to it making it easy to switch between talkgroups on the repeater.

1.6 Hotspot

The best way to access the DMR network is via your own hotspot. This gives you complete control of which DMR network you connect with and which talkgroups you want to communicate on. Building your own hotspot is very simple it doesn't have to require soldering just a simple matter of connecting together two PCBs via their connectors. The most common hotspot to build is the Pi-Star hotspot.

You can usually build your own hotspot for around £50.

You will need

- [Raspberry Pi computer](#) (Pi-zero, Pi 3 or Pi 4)
- SD Card 8Gb or bigger
- MMDVM Modem board (Duplex or simplex)
- USB power supply
- [pi-star software](#)

It is recommended to use the pi-star software, <https://pistar.uk>. This software is free to download and use and offer great flexibility and functionality.

Here are some of the different hotspots types you can use and details of how to set them up.

A hotspot or a peer is a small device which is listening for RF traffic from the radio and sending that traffic via the internet onto the DMR server.

1.6.1 Pi-Star

[Pi-Star](#) is a software image built initially for the Raspberry Pi (produced by the Raspberry Pi Foundation). The design concept is simple, provide the complex services and configuration for Digital Voice on Amateur radio in a way that makes it easily accessible to anyone just starting out, but make it configurable enough to be interesting for those of us who cant help but tinker.

1.6.1.1 Hardware

This short document shows you how to assemble the most basic Hotspot around – A Pi-star MMDVM device. This is constructed from two main boards – a Raspberry Pi single-board computer and an MMDVM Modem HAT.

Once constructed the Hotspot can then be configured using Pi-star software installed using a microSD card. This is dealt with in a separate note.

The Hotspot is very easy to put together and, at worst, needs only some header pins soldered to the Raspberry Pi board. If you don't wish to do this then a version of the board is available with the header pins already fitted.

DMR Hotspot Hardware

Hotspot Hardware

- Raspberry pi (either)
 - Pi Zero WH (WiFi and Headers)
 - Pi 3 or above
- MMDVM Modem board (either)
 - Simplex
 - Duplex
- Micro SD Card 16Gb



Pi 3/4

pi-Zero WH



Simplex

Duplex

Where to buy the parts?

Pi-Hut <https://thepihut.com>

- Can buy SD cards here
- Check delivery charges
- Lots of fun things to buy



Ebay <https://ebay.co.uk>

- Search "MMDVM"
- Prices vary should be around £20-£30
- Check delivery charges
- Likely ships from China



Amazon <https://amazon.co.uk>

- Search "micro SD"
- Search "MMDVM"
- Search "Pi"
- MMDVM likely ships from China
- Not always cheapest



Software

<https://pistar.uk>

- Free to download/use
- Well maintained
- Write pistar software to SD card using desktop computer
- Put SD card in pi and boot



DMRID

<https://radioid.net>



- Register on radioid.net to obtain your DMRID.
- You will need to upload a copy of your license

Example DMR Radios

Lots of choose from for different budgets

Anytone 868/878	£160
TYT MD-380/390	£100
Radioddity GD77	£70
Baofeng RD-5R	£50



Anytone



MD390



GD77



RD-5R

More help <https://raynet.m0guy.com/help>

1.6.1.1.1 Sourcing the Parts

The best place to find the items needed is online; Ebay, Amazon etc. There are two main parts that you will need: A Raspberry Pi single board computer and an MMDVM HAT.

Any Raspberry Pi will do but the best fit is a Pi Zero -W. It is perhaps worth spending a little bit more to get the -WH version as this has the GPIO Header pins already soldered on. It must be a -W as you need the wi-fi for the internet connection. They may be slightly dearer but will be top quality if you buy from an official distributor. I buy mine from one of the UK suppliers (<https://thepihut.com>)

The MMDVM HAT is the modem / radio board. I prefer the ones with an on-board OLED Type 3 display. This allows you to see the hotspot is working without connecting to it over the local network with a browser. There are a large number of Chinese clones about and these are of variable quality. If possible, source the board from a UK supplier as it is easier to return faulty ones. The one I used for this document came complete with a case and aerial, pre-packaged in a box secured with Chinese tape. Presumably imported as a job lot and then resold. The leads for the display were too long and fouled the GPIO pins on the Pi. I simply cut them off but it did serve to show the build quality. Also, the board had absolutely no maker's markings.

To make the hotspot work you also need a class10 microSD card. 8GB is more than big enough. Again, I source these from a UK supplier. You also need a microUSB lead to supply the power and possibly a 5volt 1amp USB power adapter. Get a lead designed to charge mobile phones as they have thicker conductors. There are inexpensive, official Raspberry Pi power supplies available.

The example shown here also came with a two-part metal case. This is a worthwhile addition but not essential. It all depends on where you are going to use the hotspot.

1.6.1.1.2 Assembling the parts

First gather the items together. This picture shows them laid out ready for assembly. The whole process takes less than 10 minutes! If you have brought the Pi Zero without the header pre-fitted you will need to solder in place the two sets of pins supplied with MMDVM board. These will need to be located either end of the row of connector holes.

Left to right we have:

- Aerial – comes with the MMDVM Board
- MMDVM Board with display
- Pi Zero-WH with microSD card
- Two-part case with screws and spacers.

Step 1 – Fix the Pi Zero to the case base.

Make sure you fit the board the correct way around! The short slot in the case is for the microSD card, the longer slot is for a camera cable. It is easy to get it wrong.

Retain the board using the two short screws, one either end of the board adjacent to the 40-pin GPIO connector.

Don't do the screws up too tight at this stage.



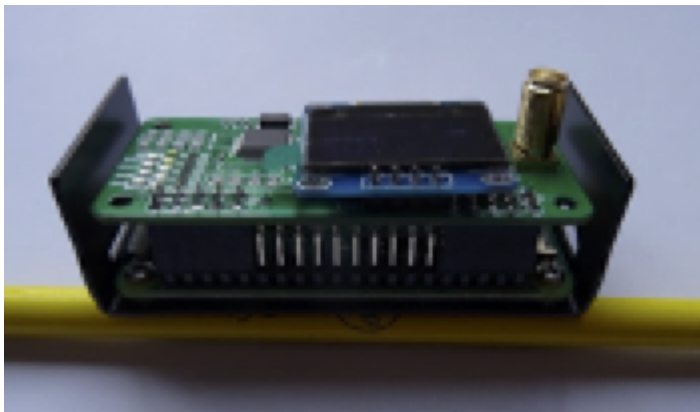


Step 2 – Mount the MMDVM Modem board.

This plugs onto the Pi GPIO Connector pins. It only fits one way around, just make sure it is properly located on all the pins.

Then, using the two spacers and the two longer screws, bolt through both boards into the base. Once all four screws are located, they can be tightened properly.

Remove the protective film on the display if there is one.



Step 3 – Fit the top part of the case.

This is the trickiest part of the whole process. The case is a friction fit and you need to 'open' the top part and ease it over the four mounting lugs on the bottom half end pieces. Make sure you get it the right way around – with the holes lining up with the various connectors on the Pi Zero board. You may find the case will need 'adjusting' with a small file to make the ports fit properly.

Finally screw on the aerial.

You now have an assembled Raspberry Pi based Hotspot. Simply insert the microSD card and power it up. Follow the instructions in the *Software* document and you should be up to speed in no time.



1.6.1.2 Software

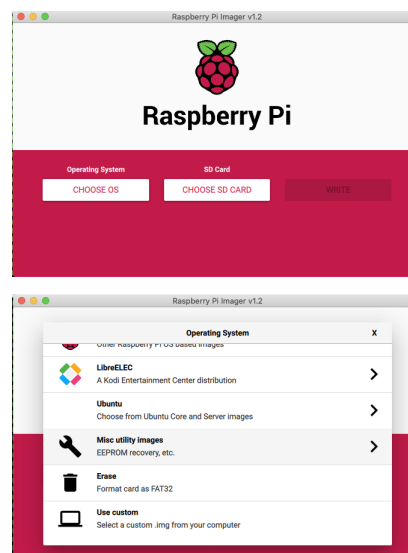


Downloading Pi-Star software <https://www.pistar.uk/downloads/>

Select the image for your system, typically using a Pi-Zero select

- Pi-Star_RPi_V4.1.2_20-May-2020.zip

expand the zip file, inside will be a .img the file.



Download and install software to write the image to the micro SD card for example Raspberry Pi Imager

- <https://www.raspberrypi.org/downloads/>

Select “Choose OS” and scroll down to “use Custom”.

Insert a SD card (16Gb is plenty of space) and select it and write the image. It should only take 5-10 minutes.

Once complete you can remove the SD card from the computer.

1.6.1.2.1 Set WiFi credentials

Insert the SD card into your computer and it should mount the BOOT partition. If you want only a single WiFi connection you can use the tool on the pistar.uk website (you can always add more once it is running) If you want more to start with then use a simple text editor, such as notepad, create a file called “wpa_supplicant.conf” which will define your WiFi. You can add multiple WIFI networks, e.g. mobile phone, home WiFi, office WiFi, etc. The Pi will then look and try to connect to each in turn. (Also see Auto AP in the Advanced Features section below)

Copy these lines to the new file “wpa_supplicant.conf” and save it to the SD card, (BOOT partition).

```
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
ap_scan=1
fast_reauth=1
country=GB

network={
  ssid="MY SSID"
  psk="My SUPER SECRET PASSWORD"
  id_str="0"
  priority=100
}
```

Each subsequent network should have a decreasing priority number, this is the order the Pi searches for networks.

Once written, eject the SD card and you're ready to boot the Pi-Star.

Put the SD card into your pi-star and power it on. After a short time it should complete boot, you should be able to reach it with the URL <http://pi-star.local>. If not you might need to find it's IP address. This can be easily done by logging into your internet router and looking at the list of DHCP leases.

1.6.1.2.2 Initial configuration

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)
<input type="button" value="Apply Changes"/>	

Setting	Value
Hostname:	pi-mobile <small>Do not add suffixes such as .local</small>
Node Callsign:	M1ABC
Radio Frequency:	438.800.000 MHz
Latitude:	50.00 degrees (positive value for North, negative for South)
Longitude:	-3.00 degrees (positive value for East, negative for West)
Town:	Town, LO4TOR
Country:	Country
URL:	http://www.mw0mwz.co.uk/pi-star/ <input type="radio"/> Auto <input checked="" type="radio"/> Manual
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public
APRS Host:	euro.aprs2.net
System Time Zone:	Europe/London
Dashboard Language:	english_uk
<input type="button" value="Apply Changes"/>	

Connect to <http://pi-star.local>, and login with the credentials

- username: **pi-star**
- password: **raspberrypi**

Work your way down the “General Configuration” settings.

- Node Callsign
- DMR ID
- Radio Frequency, pick one that's free where you plan to use it.

- Location settings are optional.
- Node Type, if set to private will only accept radios with your DMR-ID, make public if you have multiple, though rules suggest this might not be permissible in the UK. This can be overcome by [Whitelisting DMRIDs](#).

Select apply changes. Once refreshed which can take a few seconds more config options will display

Before going much further set the radio/modem type to match your MMDVM modem ([Identifying your MMDVM Modem](#)) and select apply again. It's often necessary to set this twice on first configuration.

Setting	Value
DMR Mode:	<input checked="" type="radio"/> RF Hangtime: 20 Net Hangtime: 20
D-Star Mode:	<input type="radio"/> RF Hangtime: 20 Net Hangtime: 20
YSF Mode:	<input type="radio"/> RF Hangtime: 20 Net Hangtime: 20
P25 Mode:	<input type="radio"/> RF Hangtime: 20 Net Hangtime: 20
NXDN Mode:	<input type="radio"/> RF Hangtime: 20 Net Hangtime: 20
YSF2DMR:	<input type="radio"/>
YSF2NXDN:	<input type="radio"/>
YSF2P25:	<input type="radio"/>
DMRZYSF:	<input type="radio"/> Uses 7 prefix on DMRGateway
DMR2NXDN:	<input type="radio"/> Uses 7 prefix on DMRGateway
POCSAG:	<input type="radio"/> POCSAG Paging Features
MMDVM Display Type:	OLED Type 3 Port: /dev/ttyAMA0 Nextion Layout: ON7LDS L2

- Enable DMR and select Apply.
- Set the Display details if you have one.
- Apply changes

1.6.1.2.3 DMR Configuration

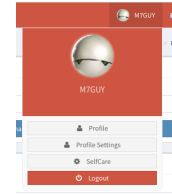
Setting	Value
DMR Master:	DMRGateway
BrandMeister Master:	BM_Europe_2001
BM Hotspot Security:	
BrandMeister Network ESSID:	2348240 02
BrandMeister Network Enable:	<input checked="" type="radio"/>
BrandMeister Network:	Repeater Information Edit Repeater (BrandMeister Selfcare)
DMR+ Master:	DMR+_IPSC2-PhoenixF
DMR+ Network:	Options=
DMR+ Network ESSID:	2348240 02
DMR+ Network Enable:	<input type="radio"/>
XLX Master:	XLX_950
XLX Startup Module:	Default
XLX Master Enable:	<input type="radio"/>
DMR Colour Code:	1
DMR EmbeddedLOnly:	<input type="radio"/>
DMR DumpTADData:	<input checked="" type="radio"/>

- set DMR master to “DMRGateway”
- Apply changes

We will start with the Brandmeister network. Set the BrandMeister Master: “BM_United_Kingdom_2341”, The is the UK one but others are available.

The ESSID can be left blank if you only have one Pi, but could be set to ‘01’. If you have multiple Hotspots make sure each is unique.

1.6.1.2.4 Brandmeister API key



The API key allows the pi-star hotspot to interact with brandmeister servers and set and unset static talk groups and reflectors from your admin dashboard.

You'll need to create an account with Brandmeister, <https://brandmeister.network>, creating an account is straight forward and just requires for DMR-ID for validation.

Once your account is enabled, you can login and select "Profile Settings",

Under Security Settings, on the right hand side is a button "API Keys", selecting this to manage your keys.



Select "Add" to create a new key, pick a name for the key. Not sure the value of the QR code, so just copy the string at the top, you can select the "Copy" button.

With it copied reconnect to your new Pi-star and select configuration, and then select "Expert", you're now looking for the button "BM API". Click on this.

You can now paste this key into the field presented and select "apply changes" to finish. The Admin Dashboard will now have controls to allow you to edit Static Talkgroups on the Network.

1.6.1.2.5 Phoenix

An alternative network to Brandmeister is Phoenix. In the DMR Configuration section activate the DMR+ Master and select DMR+_ISPC2-PhoenixF from the list. As with the Brandmeister section add the ESSID, also “01” if it is your first Hotspot.

1.6.1.2.6 DMR Gateway

DMR Gateway allows you to connect to multiple DMR Networks at the same time but requires additional work; both in the Pi-star configuration and in the codeplug for your radio(s). This is to allow the Hotspot to determine which DMR Network you are trying to access from your radio. By default, almost all traffic will be routed over the Brandmeister Network.

1.6.1.2.7 Dashboards

There are two dashboards you can watch, “Dashboard” and “Admin”. The Dashboard provides a good overview of the pi-stars operation. The Admin board provides additional details on Brandmeister static talk groups, and with the API key set allows to add and remove them.

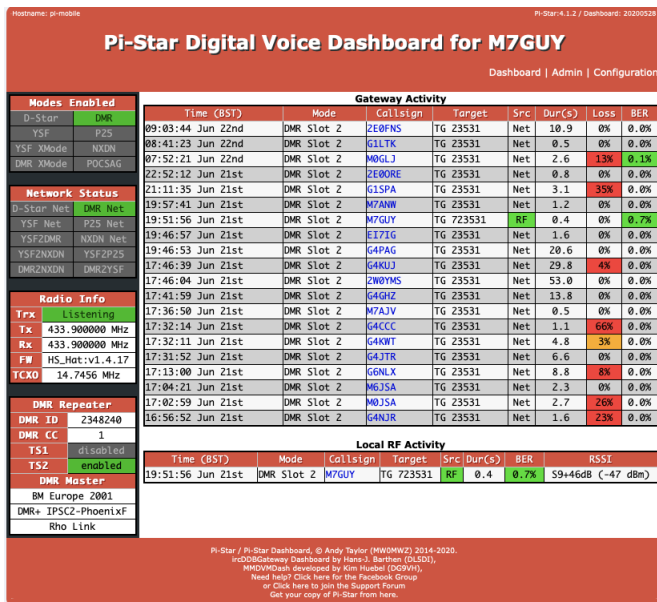


Fig. 1.4: Dashboard

1.6.1.2.8 Advanced Features

There are many things the Pi-star software will do. It will, for instance, support other Digital modes, simultaneously if required but only one at a time! It can even form the basis of a Repeater using appropriate hardware. This section will include these as and when they are discovered.

Things like different display settings. If your MMDVM board has an OLED display you may find it upside down. In the main Configuration

section, there is an Invert function which corrects this. You can also set a Scroll mode, set to 1 it gives a scrolling display on idle.

You can use “Configuration”, “Expert”, “CCS Tool” to change the colours of the Browser User Interface.

1.6.1.2.9 Auto AP

Use Auto AP when you start Pi-star for the first time without setting any WiFi credentials, or when you need to connect to a new WiFi network, for example, when traveling. When Pi-star doesn't find a known network within about three minutes after power on, Auto AP will automatically activate its own access point, and you'll use that to connect to Pi-star in order to configure WiFi settings.

Wait at least three minutes for Auto AP to activate its access point.

On a Windows, Mac, or Linux-based computer (not the hotspot itself) that has WiFi enabled, look in the WiFi settings to find the Pi-star access point, and then select it to connect to it:

If you're starting Pi-star for the first time, it'll be named “Pi-Star-Setup.” If this isn't the first time, but you need to connect to a new WiFi network, it'll be named using the Hotspot's hostname, by default, “pi-star” (or whatever you changed it to in the General Configuration settings).

Enter the Pi-Star-Setup network security password: **raspberry**.

Once your device is connected to the Hotspot access point you can use a browser to login to the Pi-star using <http://pi-star/>, <http://pi-star.local/> or 192.168.50.1 and make any required configuration changes. For instance, to set new WiFi credentials.

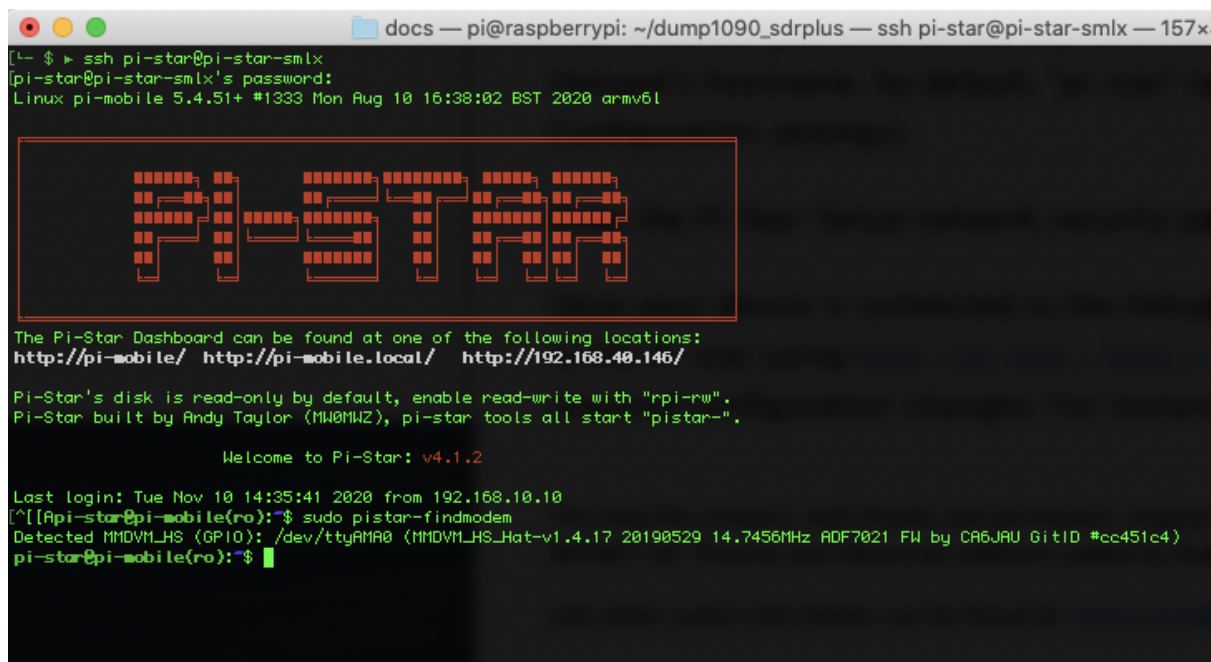
1.6.1.2.10 Identifying you MMDVM Modem

If you're not sure which type/model of MMDVM modem you have then Pi-Star have provided a simple command to run to help determine it.

Login to the SSH prompt for your Pi-Star and issue the following command

```
sudo pistar-findmodem
```

Note the details provided and match against the list of possible modems that are supported.



1.6.1.2.11 Using the Pi-Star MMDVMCAL Test programme

Pi-Star has a very useful built-in test programme for setting up and evaluating the hotspot hardware.

To fire it up first go to 'Configuration/Expert/SSH Access' in the Pi-Star dashboard. Log in using the appropriate Pi-Star login and password (by default **pi-star** and **raspberrypi**). You should then see this screen:



Type in the following command: `sudo pistar-mmdvmcal`

Eventually you should see the following list of commands:

```

H/h      Display help
Q/q      Quit
W/w      Enable/
→disable modem debug messages
E/e      Enter␣
→frequency (current: 433000000 Hz)
F        Increase frequency
f        Decrease frequency
Z/z      Enter frequency step
T        Increase deviation
t        Decrease deviation
P        Increase RF power
p        Decrease RF power
C/c      Carrier Only Mode
K/k      Set FM Deviation Mode
D/d      DMR Deviation Mode␣
→(Adjust for 2.75Khz Deviation)
M/m      DMR Simplex␣
→1031 Hz Test Pattern (CC1 ID1 TG9)
K/k ␣
→ BER Test Mode (FEC) for D-Star
b        BER Test␣
→Mode (FEC) for DMR Simplex (CC1)
B        BER␣
→Test Mode (1031 Hz Test Pattern)␣
→for DMR Simplex (CC1 ID1 TG9)
J        BER Test Mode (FEC) for YSF
j        BER Test Mode (FEC) for P25
n ␣
→ BER Test Mode (FEC) for NXDN
g        POCSAG 600Hz Test Pattern
S/s      RSSI Mode
I/i      Interrupt Counter Mode
V/v      Display version of MMDVMCal
<space> Toggle transmit

```

Firstly, use the **E** (or **e**) command to set your required test frequency in hertz (default is 433.000MHz) e.g. 434.9875MHz will go in as 434987500

The **Spacebar** toggles transmit ON/OFF.

The command **C** (or **c**) will transmit a carrier only for checking the transmit frequency error and RF power level. The frequency can be tuned while transmitting, using **F** to increase or **f** to decrease. The step size, in hertz, is set using the command **Z** (or **z**). Minimum step size is 10Hz. The frequency error, in hertz, can then be corrected in the 'RXOffset' and 'TXOffset' boxes in the 'Modem' section of 'Configuration/Expert/MMDVMHost'. The RF power level can be adjusted, while transmitting, using **P** to increase and **p** to decrease. The power level is shown as a percentage of the maximum.

The command **D** (or **d**) is used to check/set the deviation level. The level can be adjusted, while

transmitting, using **T** to increase or **t** to decrease. The correct value is 2.75kHz. The level is shown on the screen as a percentage. When you have found the correct value make a note of it as it is the value that goes into the 'DM-RTXLevel' box in the 'Modem' section of 'Configuration/Expert/MMDVMHost'. The default value is 50. If you have an SDR receiver then the deviation can be set very precisely by zooming in to the transmission on the SDR display so that you can see the carrier and the modulation sidebands. Then adjust the deviation level to null the carrier. If the theory behind this interests you then there is a very good explanation by F5UII at <https://tinyurl.com/y2gs9xo9>.

The command **M** (or **m**) transmits a DMR Simplex 1031Hz Test Pattern on the test frequency to Colour Code 1, Radio ID 1 and Talkgroup 9. If all is well you should hear a smooth 1031Hz audio tone, with no glitches, from a receiving DMR radio. I can't help thinking that this could be used as a reference signal for setting up microphone audio levels?

The command **b** can be used to check the DMR Bit Error Rate (BER) of the transmissions from the radio that you use to talk to the hotspot. **B** does the same for a DMR 1031Hz Test Pattern transmission (from another hotspot say). A YSF transmission can be checked for BER using the **J** command.

The command **S** (or **s**) displays the RSSI value of the RF signal that the hotspot is receiving.

The command **W** (or **w**) toggles the display of modem debug messages when transmitting from RF into the hotspot.

I haven't been able to check out the P25, NXDN and D-Star functions.

The command '**K/k** Set FM Deviation Modes' appears to be an error?

Commands that produce a continuous scrolling display (like RSSI Mode) can be cancelled by selecting another command.

If you are using the Pi-Star with a Digital Voice Modem (like the STM32-DVM) then there are extra commands for setting up the modulation/demodulation.

The command **Q** (or **q**) quits the test programme and puts the hotspot back to normal operation.

1.6.1.2.12 Fixing DMRGateway Issue (June 4-5th 2021)

Over the night of June 4-5th 2021. Pi-Star was updated with new versions of DMRGateway and MMDVMHost. This update has a miss configuration which can cause you hotspot not to connect to any DMR services.

Andy of Pi-Star is already fixing this and in the next auto update it should be corrected.

To correct this issue manually it quite straight forward.

Login into your Pi-Star, select “Configuration” and then “Expert”.

Select the “MMDVMHost” menu option. Scroll down to the “DMR Network” block.

DMR Network	
Enable	1
Address	127.0.0.1
Port	62031
Jitter	360
Password	none
Slot1	1
Slot2	1
Debug	0
ModeHang	20
Local	62032
Type	Direct

Apply Changes

Look for the entry “Type”. At the moment this is set to “Direct”. This needs to be changed to “Gateway”. Once changed make sure to click on the “Apply Changes” button below this box. You should now be able to go back to the Dashboard and in a few seconds your connections to the DMR services should be restored.

You can confirm this by looking at the RAYNET DMR server dashboard and seeing your peer is now connected.

1.6.2 Radioddity GD77



Fig. 1.6: Radioddity GD77

The Radioddity GD77 DMR hand-held transceiver is a pretty mediocre budget Chinese dual-band DMR radio out-of-the-box. However, flash it with the [OpenGD77 firmware](#) and it becomes a full-featured amateur analogue/DMR radio. With the OpenGD77 firmware installed it can also be used with a Raspberry Pi, running Pi-Star, as a high-power hotspot.

- Details of how to [flash the firmware](#)
- Details of how to [set up the hotspot](#)

The GD77 is connected to a USB port on the Raspberry Pi using the programming cable supplied with the radio.

The hotspot mode is set in the GD77 as follows:

- Press the green key to bring up the menu system.
- Scroll down to 'Options' using the down arrow key.
- Press the green key to select it.
- Scroll down to the 'Hotspot:' entry – default value will be Off.
- Press the right arrow key to select 'MMDVM'.
- Press the green key to confirm the setting and return to the main screen.

With the Raspberry Pi and the GD77 powered down, connect the GD77 to one of the Pi's USB ports using the programming cable. Switch on the GD77 and then power up the Raspberry Pi. Once the Pi has booted up the GD77 should automatically switch into hotspot mode on the frequency set in the Pi-Star dashboard. Any of the Pi's USB ports can be used for this.

The RF power level can be preset in the Pi-Star dashboard by changing the value in the 'RFLevel' box in the 'Modem' section of 'Configuration/Expert/MMDVMHost'.

Alternatively you can leave this value at 100 (default) and set the RF power level manually before the GD77 goes into Hotspot mode (by holding down the blue side button on the GD77 and using the left and right arrow keys to select the required RF power level).

The complete [User Guide for the OpenGD77 firmware and CPS](#)

1.6.3 Mobile hotspot

Many people have built or purchased a pi-star hotspot and connected to their home WiFi network. Some have popped them in their cars and connected to their mobile phones using mobile hotspot. These all can work very well, however for me I want to be independant of my mobile. This is for several reasons

- Power drain on the phone is high, so I would need to keep the phone connected to power for long duration usage
- Phone needs to remain in close proximity of the hotspot.

Ultimately I want a self contained unit which has a battery and mobile connection. There are two ways to handle the internet connection.

1. WiFi connection to a MiFi device
2. USB GSM Dongle

Using a MiFi device does offer an advantage in that other devices such as laptops could also use the same internet connection, however in my case I'm only interested in providing internet to the DMR hotspot. A possible downside is getting the devices to communicate with each other. They also both require power which might reduce the run time specially as they are both using RF to run the WiFi connections.

For the DMR hotspot I picked the “Jstvro duplex” as I wanted a small footprint but also duplex. The price of this unit seems to have rocketed up to over £100, when I bought mine it was £50. Any of the simplex versions also work if the price doesn’t drop back down.



1.6.3.1 Parts List

- Jstvro MMDVM Duplex hotspot
- Huawei E3372 USB GSM modem
- OTG (On The Go) USB cable
- Micro USB power cable
- USB Battery pack

1.6.3.2 Building

Set up the pi-star hotspot as documented elsewhere, there is no additional settings or installs required to support the 4G USB module. When it’s plugged in the pi-star will see it as ethernet device (eth1) and will start sending traffic over it. By default the pi will report having an IP address of 192.168.8.100, and the USB module will be addressable as 192.168.8.1.

If the pi-star is setup to for “(AP) Access Point” mode, then connecting a laptop to the Pi-Star’s WiFi will allow access to the pi-star for further configuration. It is also possible to allow routing to the wider internet as well.

1.6.3.3 Bandwidth Usage

For each DMR network used the hotspot will use around 18Mb per hour just to remain connected. For example If connected to Pheonix and Brandmeister the hotspot will use 36Mb (18*2). As you make/receive calls this usage will of course increase.

1.6.3.4 Mobile Phone service

The GSM modem is unlocked and can take any SIM card. The hard part here is finding the right mobile phone provider and tariff to sign up to. Depending on how much usage you are expecting to have will highly determine the right service for you.

At the moment I'm using the hotspot infrequently and so would rather not pay a regular monthly cost for the service which might not be used much for a few months and then other months be used very heavily.

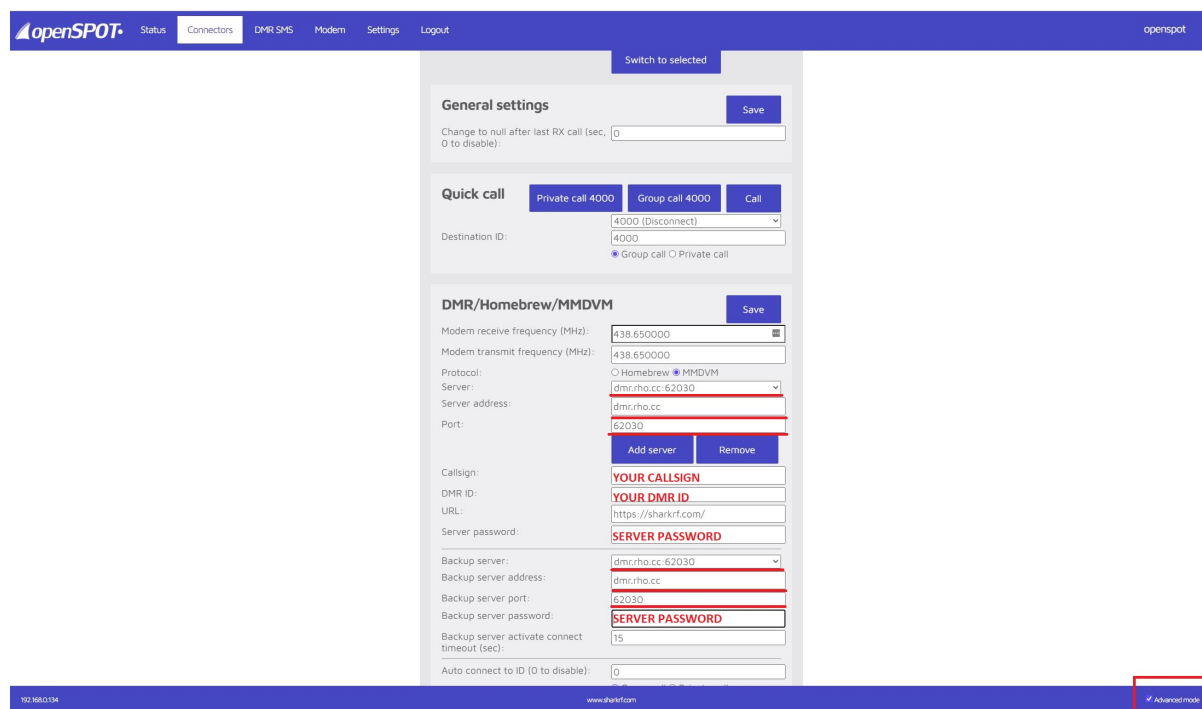
If I an running frequently then a monthly tariff is likely the most cost effective, for example "smarty" are offering 4Gb per month for £6.

For this device I've chosen to use [1pmobile](#) which offers a flat fee of 1p per MB. The advantage here is that the data expires after a long time. For £30 you get 3Gb of data to use over a year. You can top up at anytime and as you top up, depending on how much determines how long it lasts before expiring. DMR traffic is very low when not sending audio so this should offer several months of usage.

1.6.4 OpenSPOT

SharkRF

An openSPOT can also be connected to the RAYNET DMR service.



Below is a short video which steps you through this process

1.6.5 DV Switch

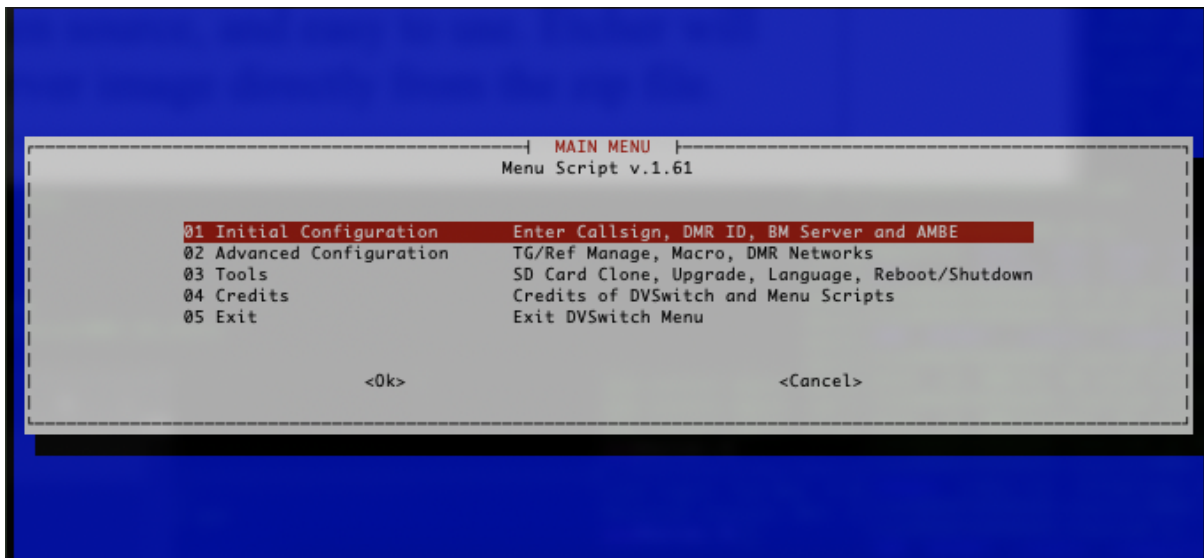
DVSwitch is a Client-Server application for Amateur Radio Digital Voice. The application provides a “Server” component which runs on a Raspberry Pi (RPi) or other Linux platform. It can also be installed on a cloud server running Linux. The server component is distributed as an RPi image with all features and functions installed. Therefore, no additional modules or programs need to be downloaded installed for a Raspberry Pi. There are two clients available for DVSwitch. An Android client is available on the Google App store for virtually any type of Android device. In addition, the python Client (pyUC) is available to use on Windows, or Mac.

Details of installing DVSwitch can be found here http://dvswitch.org/DVSwitch_install.pdf. This guide provides an excellent step by step procedure to setup your DV Switch on a raspberry pi.

Warning: The communication between your client and DVSwitch is in no way protected. If you expose your DVSwitch server to the internet other people **will** be able to connect and send traffic

Once the system has booted you can login via the console or SSH. the default username and password is “dvswitch”. On first login you will be required to change the password. Log back in and issue the command “dvs”. This will bring up a text based menu allowing you to configure the system.

Use the “tools” menu to update and upgrade the Pi-Star, this will install all the latest version of all the packages which might take a while to complete.



Work through the “Initial Configuration” menu, which will ask basic questions such as your callsign, DMRID, and what repeater ID this should be. At this point you should be connected to your chosen DMR service.

Warning: DVSwitch must be seen as a simplex repeater. To do this you need to make sure the Fake TX and RX frequencies are the same. These frequencies are not used for any transmission but required as part of the configuration.

You can access the DVSwitch dashboard via the URL <http://<DVSwitch-IP>/>

DVSwitch Dashboard

RX Monitor

Status

Analog Bridge Info	
Callsign	M0GUY
GW ID	2349193
RPT ID	234919315
Mode	DMR
Tx TG	9
AB ver	1.6.4

TRX Info
Listening

DMR Master
raynet.m0guy.com

YSF Net
Not Linked

P25 Net
Not Linked

NXDN Net
Not Linked

D-Star Net
IRC rr.openquad.net
Not Linked

Gateway Activity

Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
08:32:52 May 28	D-Star	M0GUY/INFO	CQCQCQ	Net	2.5	0%	0.0%

Local Activity

Time (EDT)	Mode	Callsign	Target	Src	Dur(s)
------------	------	----------	--------	-----	--------

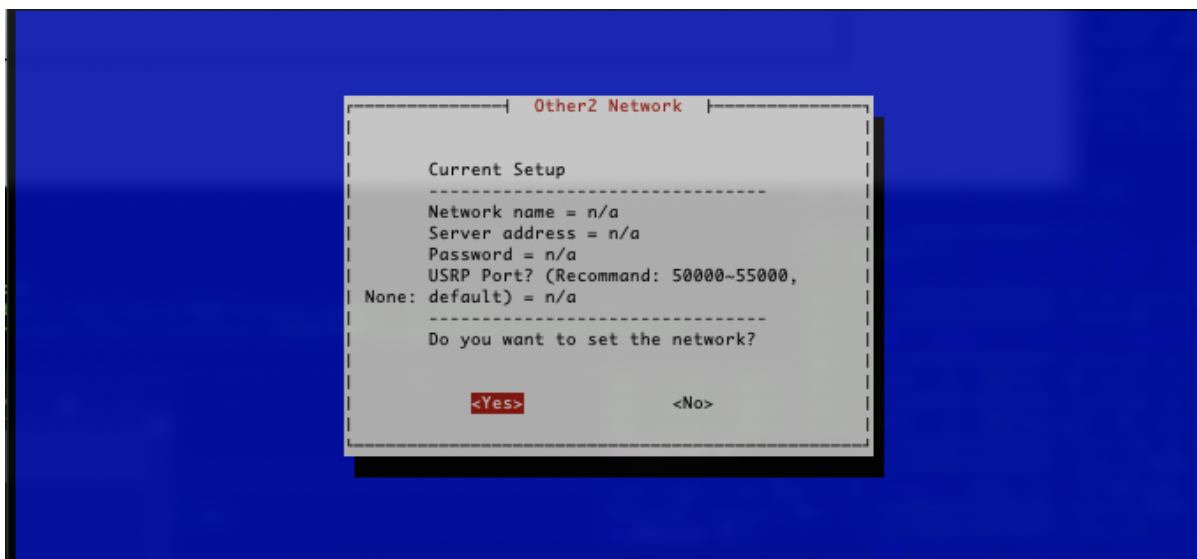
Modes
DMR
YSF
NXDN
P25
D-Star
Networks
DMR Net
YSF Net
NXDN Net
P25 Net
D-Star Net

Hardware Info

Hostname	Kernel release	Platform	Disk used	Memory used	CPU Load	CPU Temp
IP: 192.168.40.151 fd20:235d:c94d:4:ba95:9962:21ae:fd0a dvswitch-server	5.10.17-v7l+	Unknown ARM based System	13%	3%	0.5 / 0.3 / 0.3	37°C / 99°F

DVSwitch Dashboard 2020-2021
 Dashboard based on Pi-Star Dashboard, © Andy Taylor (MW0MWZ) and adapted to DVSwitch by SP2ONG

To switch over to RAYNET you need to use the “Advanced Configuration”, and select “Additional DMR Networks”. Select “Configure DMR Server”, “Other1 Network”



You can now work through these settings. Make sure to create the peer on the RAYNET server and that it matches the “RepeaterID” for this system and copy created password over DVSwitch.

Once You’ve completed the configuration you can move back up the menus and “Change Default DMR Server”.

You should now be connected to RAYNET DMR and you can exit the dvs menu system.

1.6.6 DroidStar

DroidStar is the new kid on the block, it’s a closed source derivative of DudeStar <https://github.com/nostar/dudestar>. Which installs on Android or iPhone tablets and phones. It supports most of the digital modes and now allows users to add their own servers to the list so it’s possible to connect it to the RAYNET DMR server.

The Droidstar app connects vi WiFi or mobile phone network to the DMR server, there’s no RF needed. The app is available in the google playstore and currently in Beta for IOS.

If you wish to install on IOS then you need to install the “TestFlight” app first and then request to join the beta programme <https://testflight.apple.com/join/bYvpb8nG>

Note: On IOS you need to turn off the silent switch to hear audio traffic.

First you will need to enter your settings, your DMRID, Callsign and the ESSID. The ESSID is the last 2 digits to add to your DMRID making your peer ID. This needs to match up with the peerID that you have defined on the RAYNET DMR server.

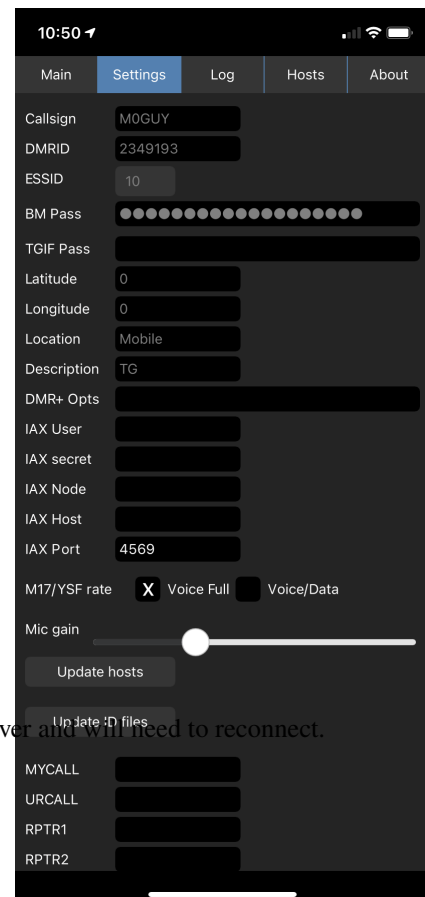
The RAYNET DMR server is not by default in the long list of possible DMR servers. You will need to add an entry to the host list. Copy the password from the RAYNET server for this peerID. Below is the line you need to add replacing <PASSWORD> with your peer’s password. Enter this completely into the hosts settings box. You might need a newline after it.

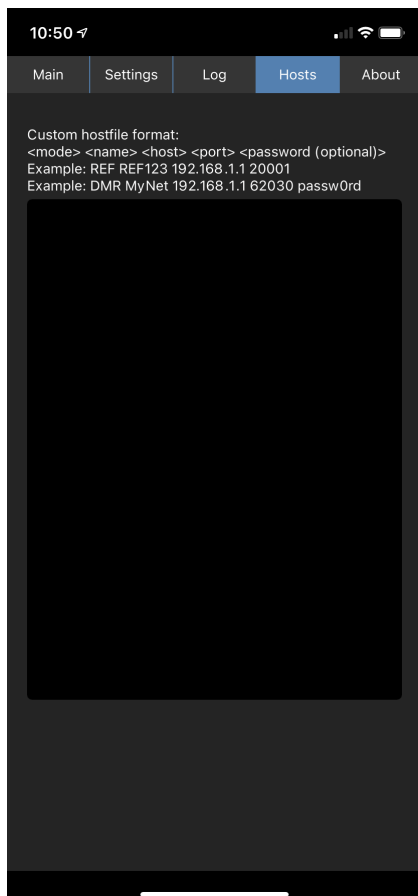
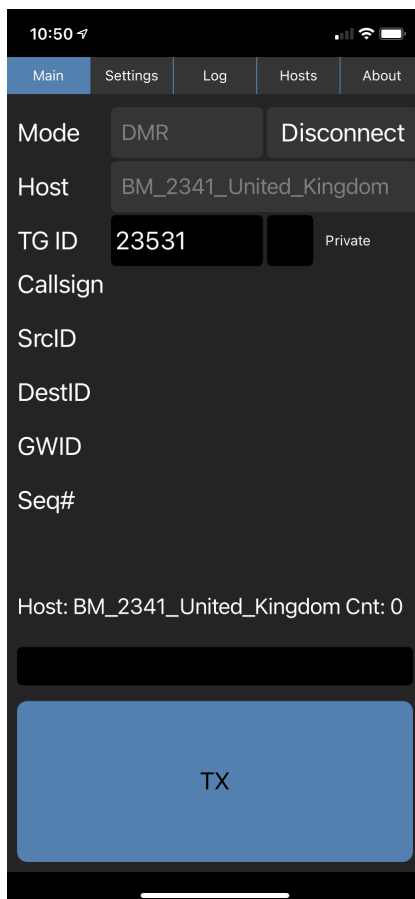
```
DMR RAYNET raynet.m0guy.com 62030 <PASSWORD>
```

You should then be able to select DMR and select the new host you’ve just added. If your details are correct then pressing “Connect” should connect you to the server. You can confirm connection by viewing your profile peers in the RAYNET server and seeing that this peer is reporting connected.

Enter a Talkgroup you would like to communicate on, for example 5023531. Pressing the big TX button at the bottom, press again to stop transmission.

Note: If you leave the app then you are disconnected from the DMR server and will need to reconnect.





RAYNET-UK DMR

RAYNET-UK DMR server is a DMR server dedicated to RAYNET-UK. In order to use it you will need to be a member of RAYNET and have an account on the server. Your Group controller can create your account for you.

Below is a video walk throughs on the RAYNET-UK DMR server interface. These videos step through the RAYNET-UK DMR servers web interface, starting from creating your account, to registering your DMR ID and creating a hotspot configuration.

2.1 Dashboard

Once authenticated you will be presented with the Dashboard. At the top of the dashboard is the latest service announcement. Closing the notification is remembered until you logout and login again.

The dashboard information is split into tabs.

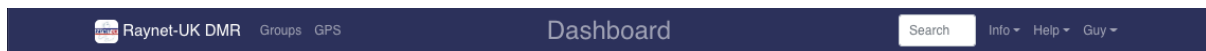
- Last heard - shows a list of the most recent calls made via this system.
- Connected Peers - All the hotpots which are currently connected. In brackets is the number of currently connected peers.
- Repeaters - Public Repeaters which have been configured to work with this service.
- OpenBridges - Cross links between other networks.
- Net Schedules - Details of any scheduled nets on the system.

The screenshot shows the Raynet-UK DMR Dashboard with the 'Lastheard' tab selected. The dashboard includes a search bar, navigation links for 'Info', 'Help', and 'Guy', and tabs for 'Connected Peers (67)', 'Repeaters (10)', 'OpenBridges', and 'Net Schedules'. The main content is a table with the following columns: Callsign (DMR ID), Name, Via, Talkgroup, Time (BST) ↓, and Duration.

Callsign (DMR ID)	Name	Via	Talkgroup	Time (BST) ↓	Duration
GW7FYG (2340574)	Chris W	GW7FYG (2340574) IO82KR	Local Calling 01 Powys County 5085501	16:42:17 23rd Aug	00:00:01
G7OJA (2348436)	Paul M	G7OJA (234843601) Hayfield, IO93AJ	Local Calling 01 Derbyshire Dales 5023101	16:16:22 23rd Aug	00:00:03
G3VEH (2351757)	Chris M	G3VEH (235175701) Winchester	ECHO Test NATIONAL 5089999	15:52:46 23rd Aug	00:00:10
G6NLX (2352131)	George R	G6NLX (235213105) Stalham, UK	National Calling NATIONAL 5023531	15:36:57 23rd Aug	00:00:01
M6CXW (2351448)	Adam	BM UK (2341) BRIDGE London	National Calling NATIONAL 5023531	15:13:30 23rd Aug	00:00:00
M0MKL (2348266)	Matthias M	GB3PP (234109) BRPB Preston	ECHO Test NATIONAL 5089999	14:52:04 23rd Aug	00:00:06
MW0VCK (2353644)	Paul H	BM UK (2341) BRIDGE London	National Calling NATIONAL 5023531	14:33:18 23rd Aug	00:00:07
M6RVR (2345190)	Raj V	BM UK (2341) BRIDGE London	National Calling NATIONAL 5023531	13:37:02 23rd Aug	00:00:00
G4WQB (2341847)	Keith H	G4WQB (234184714) Amersham, Bucks., UK	National Calling NATIONAL 5023531	13:33:08 23rd Aug	00:00:00
G8GQJ (2352863)	Ray C	G8GQJ (234856503) CHINNOR, OXON	ENDURANCE EVENTS 80 2022 Aylesbury 5019605	12:47:28 23rd Aug	00:00:06
G1SPA (2347400)	Derek H	G1SPA (234740001) CASTLE DONINGTON	Local Calling 01 Derbyshire Dales 5023101	08:29:49 23rd Aug	00:00:03

2.2 Navigation Bar

The navigation bar at the top of the page allows for quick access to important information. The options listed will depend on your level of access.



- Groups - List all groups you are a member of.
- Users - (admin only) - List users on the system.
- GPS - Show GPS logs for people who have permitted you access to see.
- Info
 - YSF Dashboard - Display the YSF room dashboard.
 - Announcements - All service announcements.
 - Stats - Service stats for the RAYNET-UK DMR service.
 - Logs - System logs relevant to your access.
- Help
 - Help - This help documentation.
 - Forum - External private forum <https://raynet-uk-dmr.boards.net>.
- <Your Name>
 - User profile - Your personal profile page.
 - Logout - Logout from the service GUI.

2.3 Setup

Welcome to the RAYNET-UK DMR Service. This system is for RAYNET-UK members only.

If you have not yet setup a peer, then you can follow *Software*. Once you have a working pi-star you can follow these steps to get yourself setup and communicating on the private server.

- *DMRIDs* - Add your DMRIDs to the system.
- *Your Hotspots* - Create a peer configuration and apply it to your pi-star.
- *Static Talkgroups* - Add static Talkgroups to always hear traffic.
- *Paging Setup* - Setting up hotspot to join the Raynet Paging network.

2.4 User Profile

2.4.1 DMRIDs

This tab shows the DMRIDs and Callsigns registered to your account.

Although this is a private DMR server you still need to register with **Radio ID** to obtain valid IDs. When adding them to your profile the ID is validated against the public database.

[Lastheard](#)
[Hotspots](#)
[Repeaters](#)
[DMRIDs](#)
[Groups](#)
[Call Logs](#)
[GPS Logs](#)

Listed here are the DMRIDs you have registered with the service; these are required to connect your peers and make radio calls.

You can and should add all your DMRIDs to your account, this will prevent others sniping them. The DMRID and callsign you enter will be checked against the official DMRID database, if it doesn't match then it will not be added. Each DMRID can only appear once, ie no sharing DMRIDs.

If you don't have a DMRID then you will need to request one from [RadioID.net](#). You will need to create an account and upload a copy of your license. The DMRID database can be downloaded and added to your radio. The radio will then be able to show callsign, name and location information.

DMRID	Callsign	Action
234003	GB7GP	
2348794	M7GUY	
2349047	2EOGUW	
2349193	M0GUY	

1 to 4 of 4 << < Page 1 of 1 > >>

Filter the table by clicking the icon while hovering over a column heading.

You can and should add all the DMRIDs that you have/use. This will prevent anyone else registering them under their accounts.

- Your DMRID must be in the range defined for UK which currently is between 2340000 and 2379999.
- Your call sign must match the callsign registered for this DMRID.

2.4.2 Lastheard

The Last Heard table details your previous transmissions through the server. Each entry shows the call sign used, which Peer it was carried by, The Talkgroup, Slot, Time of the transmission and the Duration.

[Lastheard](#)
[Hotspots](#)
[Repeaters](#)
[DMRIDs](#)
[Groups](#)
[Call Logs](#)
[GPS Logs](#)

Here you can see where you have last been heard on the system

Via	Callsign (DMR ID)	Talkgroup	Slot	Time (BST)	Duration
M0GUY (2349193)	M7GUY (2348794)	Alt Calling NATIONAL 5089900	2	17:32:58 Sep 2021	00:00:00
GB7GP (234003) <small>RPTR</small> High Wycombe, IO91	M0GUY (2349193)	National Calling NATIONAL 5023531	1	08:55:59 Aug 2022	00:00:00

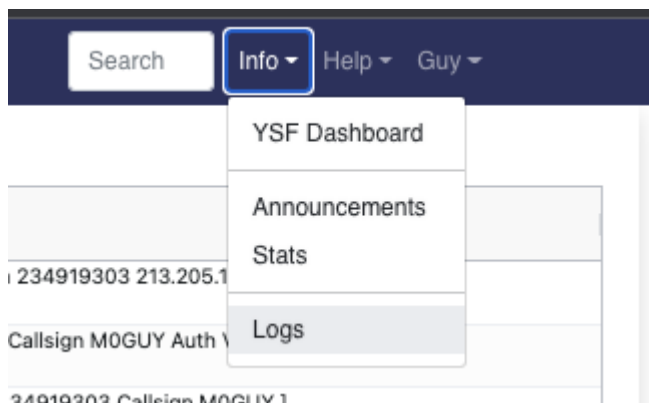
1 to 2 of 2 << < Page 1 of 1 > >>

Filter the table by clicking the icon while hovering over a column heading.

- If you click on the Callsign you will open a new browser window onto the QRZ.com database page for that callsign; if it exists.
- If you click on the talkgroup number you will be taken to the Talkgroup detail page

2.4.3 Logs

Under “Info” -> “Logs”. Users are able to review their own log entries.



These logs show all communications except pings between the RAYNET server and the users hotspots. This is a great place to look for errors as to why your hotspot isn't connecting correctly. Or if you are transmitting but it's not appearing on the dashboard.

The logs are limited to the last 50 entries. You can however search for log message content, such as your DMRID or peer id. The system will purge logs after 2 months.

Log Search		
Date	User	Message
04:33:04 Aug 2022	Plunkett, Guy	[RPTL Login request from 234919303 213.205.198.49:51281]
04:33:04 Aug 2022	Plunkett, Guy	[RPTK Login 234919303 Callsign M0GUY Auth VALID]
04:33:04 Aug 2022	Plunkett, Guy	[RPTC Peer config sync 234919303 Callsign M0GUY]
04:29:18 Aug 2022	Plunkett, Guy	[RPTL Login request from 234003 192.168.240.21:49871]
04:29:18 Aug 2022	Plunkett, Guy	[RPTK Login 234003 Callsign GB7GP Auth VALID]
04:29:18 Aug 2022	Plunkett, Guy	[RPTC Peer config sync 234003 Callsign GB7GP]
03:33:02 Aug 2022	Plunkett, Guy	[RPTL Login request from 234919302 192.168.40.146:57110]
03:33:02 Aug 2022	Plunkett, Guy	[RPTK Login 234919302 Callsign M0GUY Auth VALID]
03:33:02 Aug 2022	Plunkett, Guy	[RPTC Peer config sync 234919302 Callsign M0GUY]
21:37:47 Aug 2022	Plunkett, Guy	[RPTL Login request from 234919303 213.205.198.49:40401]
21:37:47 Aug 2022	Plunkett, Guy	[RPTK Login 234919303 Callsign M0GUY Auth VALID]
21:37:47 Aug 2022	Plunkett, Guy	[RPTC Peer config sync 234919303 Callsign M0GUY]
13:12:05 Aug 2022	Plunkett, Guy	[RPTL Login request from 234919303 213.205.192.194:39427]

2.4.3.1 Log details

Each log line has a prefix which defines the type of log entry it's for.

- RPTL - Login Request
- RPTK - Login Accepted
- RPTC - Peer configuration received
- DMR - Radio traffic
- ST - Rewrite a talkgroup for bridge

2.4.4 Page Messages

Send Paging Message via Browser

Recipient Callsign: -- Select Group --

Message: Send Page

Received

Filter the table by clicking the icon while hovering over a column heading.

Sent (BST) ↓	From	To	Message
07 Aug 23 01:21:01	Guy P	MOGUY (0349193)	Device apcups.int.britewhite.net re covered from Devices up/down
07 Aug 23 01:20:01	Guy P	MOGUY (0349193)	Alert for device apcups.int.britewhite.net - Devices up/down

From here you can send a new page. Enter the recipients callsign or RIC number, and message. As a Raynet member you are a member of a number of Groups. Selecting the group here allows you to select which hotspots/repeaters will receive this page. ie you are sending a page to someone else within your own group then select that group. If however you are sending outside then select a wider group which might be Zone or National. Note National will send the page to **every** hotspot/repeater which is registered on the system for paging.

The Table shows the messages you've sent and received. Clicking on the button switches between the two.

2.4.5 Paging Setup

Setting up paging on a Pi-star hotspot is a little more complicated than configuring for DMR. This is because the DAPNetgateway on the Pi-Star only supports a single connection and uses TCP for that connection. For performance and scalability RAYNET uses UDP connections. To solve this we need to add an additional executable which acts as a proxy which can connect to both DAPNET and RAYNET and forward messages onto the DAPNETGateway and thus onto the air.

To make this as simple as possible we've created an installer script which will make all the necessary changes. To run this script you will need to connect to the shell of the pi-star, either via SSH or through the web interface.

Pi-Star: 4.1.6 / Dashboard: 20230713

Pi-Star Digital Voice - Expert Editors

Dashboard | Admin | Update | Upgrade | Backup/Restore | Configuration

Quick Edit: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMR GW | YSF GW | P25 GW | NXDN GW | DAPNET GW

Full Edit: DMR GW | PiStar-Remote | WiFi | BM API | DAPNET API | System Cron | RSSI Dat

Tools: CSS Tool | SSH Access

SSH - Pi-Star

```
pocket-hs login:
```

The username is "pi-star", and the password by default is "raspberr", or if you've changed it, the same password you use to access this web interface.

Once logged in, issue the following command:

```
curl -L raynet.m0guy.com/pagerInstall | bash
```

This will fetch the latest version of the script and run it.

2.4.5.1 Install Script Functional Steps

Outlined below are the functions this script performs.

- Make sure the file system is in read/write mode

```
sudo mount -o remount,rw /
```

- Download the PagerProxy binary file

```
curl -o /tmp/pagerProxy 'https://raynet.m0guy.com/download/pagerProxy'
```

- Move it to /usr/local/sbin/ and make it executable

```
chmod 755 /tmp/pagerProxy
sudo mv /tmp/pagerProxy /usr/local/sbin/pagerProxy
```

- Check if the configuration file already exists. If not create it

/etc/pager_proxy.json

```
{
  "DAPNET_ENABLED": true,
  "DAPNET_HOST": "db0dbn.ig-funk-siebengebirge.de:43434",
  "DAPNET_CALLSIGN": "",
  "DAPNET_AUTHKEY": "",
  "RAYNET_ENABLED": true,
  "RAYNET_HOST": "raynet.m0guy.com",
  "RAYNET_GWID": ,
  "RAYNET_CALLSIGN": "",
  "RAYNET_AUTHKEY": "",
  "LOCAL_TIME": true,
  "TIMEZONE": "Europe/London",
  "MY_RIC": "",
  "FREQUENCY": ""
}
```

- Update the firewall rules to allow UDP 43434 traffic in and out

```
echo 'Setting iptable Rules..'
INPUT_RULE="INPUT -p udp -m udp --dport 43434 -j ACCEPT"
OUTPUT_RULE="OUTPUT -p udp -m udp --dport 43434 -j ACCEPT"
sudo iptables -C $INPUT_RULE || sudo iptables -I $INPUT_RULE
sudo iptables -C $OUTPUT_RULE || sudo iptables -I $OUTPUT_RULE
sudo bash -c 'iptables-save > /etc/iptables.rules'
```

- Write a service script to make the PagerProxy script start up on boot. It **must** be started before Pi-Stars own DAPNETGateway process.

/lib/systemd/system/pagerProxy.service

```
[Unit]
Description=Pager Proxy For RAYNET Service
After=syslog.target network.target
Before=dapnetgateway.service

[Service]
Type=exec
ExecStart=/usr/local/sbin/pagerProxy
```

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```
StandardOutput=syslog
StandardError=syslog

[Install]
WantedBy=multi-user.target
```

2.4.5.2 Configuration

Once the script has run, you will need to edit the configuration file “/etc/pager_proxy.json”

Warning: Check the pi-star is in Read/Write mode (rw) rather than Read Only (ro) the default. You can verify which mode the pi is in by looking at your prompt, look for (ro) or (rw). It will switch back to Read Only automatically after some time. If you need to change back to Read/Write then use the command `rpi -rw`

```
sudo pico /etc/pager_proxy.json
```

This is a JSON file format, make sure to retain the layout and formatting. ie the comas at the end of lines and quotes around the string values.

- DAPNET_ENABLED - Should the proxy connect to DAPNET (true/false)
- DAPNET_HOST - The address of the DAPNET Server to connect to. You can copy this directly from the pi-star configuration. Make sure to include the :43434 at the end.
- DAPNET_CALLSIGN - This is your username for DAPNET, likely just your callsign
- DAPNET_AUTHKEY - The password they sent you to connect
- RAYNET_ENABLED - Should the proxy connect to RAYNET (true/false)
- RAYNET_HOST - RAYNET Server to connect to. Currently can only be raynet.m0guy.com
- RAYNET_GWID - This is the hotspot ID as set on the server side. (It will be your DMRID+2digits)
- RAYNET_CALLSIGN - Your callsign, used as the Ident sent as a page message to RIC 8.
- RAYNET_AUTHKEY - the password as set on the RAYNET server for this pager proxy
- LOCAL_TIME - Should the proxy block time sync messages from DAPNET and instead send it's own (true/false)
- TIMEZONE - If LOCAL_TIME is enabled, then what timezone counts as LOCAL for you (Europe/London)
- MY_RIC - The RIC of your pager. This is used to message you when the hotspot is connected.
- FREQUENCY - The frequency used to send pages out on.

You can copy a sample configuration file from the RAYNET server which has all the RAYNET side already configured, select the hotspot and select “Hotspot Configuration”. This will show both the DMR and Pager configuration.

2.4.5.2.1 DAPNETGateway Configuration

Last step is to configure the DAPNETGateway in Pi-Star to point to this Proxy.

Select “Expert” -> “DAPNET GW”, here you can manually set the DAPNET Address.

DAPNET	
Address	dapnet.afu.rwth-aachen.de
Port	43434
AuthKey	TOPSECRET
SuppressTimeWhenBusy	1
Debug	0

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWZ) 2014-2023.
Need help? Click here for the Support Group
Get your copy of Pi-Star from here.

Change the “Address” field to “127.0.0.1”, The AuthKey here doesn’t matter, it’s no longer used. If you have already set it for DAPNET or left it as default you do not need to change it.

The easy to way finish and verify everything is now working is to reboot the hotspot, either via the cli `sudo reboot` or through the webpage. When it finishes booting you should start to see DAPNET Gateway activity. This will be the combined traffic from DAPNET and RAYNET.

You can also check you have connection to RAYNET by looking at the Hotspot and see the Pager is now connected.

Go ahead and send yourself a page!

2.4.5.3 Debugging

Check the two configuration files

- `sudo cat /etc/pager_proxy.json`

below is an example configuration file. You will need to adjust the values to match your settings.

```
{
  "DAPNET_ENABLED": true,
  "DAPNET_HOST": "db0dbn.ig-funk-siebengebirge.de:43434",
  "DAPNET_CALLSIGN": "GB7GP",
  "DAPNET_AUTHKEY": "password",
  "RAYNET_ENABLED": true,
  "RAYNET_HOST": "raynet.m0guy.com",
  "RAYNET_GWID": 12345678,
  "RAYNET_CALLSIGN": "GB7GP",
  "RAYNET_AUTHKEY": "password",
  "LOCAL_TIME": true,
  "TIMEZONE": "Europe/London",
  "MY_RIC": "01234567",
  "FREQUENCY": "439650000"
}
```

- `sudo cat /etc/dapnetgateway`

```
[General]
Callsign=GB7GP
RptAddress=127.0.0.1
RptPort=3800
LocalAddress=127.0.0.1
LocalPort=4800
Daemon=0

[Log]
DisplayLevel=2
FileLevel=1
FilePath=/var/log/pi-star
```

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```
FileRoot=DAPNETGateway
```

```
[DAPNET]
```

```
Address=127.0.0.1
```

```
Port=43434
```

```
AuthKey=wibblewobble
```

```
SuppressTimeWhenBusy=1
```

```
Debug=0
```

Make sure the “Address” points to this proxy process which if it’s running on the pi-star should be “127.0.0.1”.

Check both processes are running

```
ps axuw | grep pagerProxy
```

```
ps axuw | grep dapnetgateway
```

Log files might also provide insight into any issues

The ‘syslog’ contains logs from many different processes on the pi-star and using the ‘tail -f ‘ command will show continuous scrolling log entries. press ‘ctrl-c’ to stop and return to a prompt.

```
tail -f /var/log/syslog
```

DAPNET logs can be viewed in the ‘/var/log/pi-star/DAPNETGateway-’ file, not the filename ends with the current date. If you press ‘tab’ it will either complete the filename or offer possible options.


2.4.6 RAYNET Groups





















This tab shows all the RAYNET groups that are assigned to you. These groups determine which talkgroups you are allowed to access. Generally, you would expect to have your local Group, as well as your County and National talkgroups. Other groups may be defined later.

The download button (Under Action), allows you to download a CSV file of the currently active talkgroups for this group. This can readily be imported into the radio CPS software.

[Lastheard](#)
[Hotspots](#)
[Repeaters](#)
[DMRIDs](#)
[Groups](#)
[Call Logs](#)
[GPS Logs](#)
[Page Messages](#)

Listed here are all the RAYNET-UK groups you have been added to and your status within the group. If you feel you're missing some please contact the group admin to discuss.

Filter the table by clicking the  icon while hovering over a column heading.

Name	Group Code	Admin	Group Enabled	Action
NATIONAL	899	Enabled	Enabled	 
Zone 6	06/06/906	Enabled	Enabled	 
Buckinghamshire County	06/BU/806	Disabled	Enabled	 
Aylesbury	06/BU/196	Disabled	Enabled	 
Technical Team	99/NT/755	Enabled	Enabled	 
Training Team	99/NT/756	Disabled	Enabled	 
Berkshire	06/BK/012	Disabled	Enabled	 
Berkshire County	06/BK/804	Disabled	Enabled	 
SW Hertfordshire	04/HT/053	Disabled	Enabled	 
Emergency Planning Team	99/NT/751	Disabled	Enabled	 

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2.4.7 Repeaters

If you are a repeater keeper for a high power DMR repeater which you would like to connect to RAYNET-UK DMR, then please contact the admins with your details. They will review the request and allocate you repeater status.

[Lastheard](#)
[Hotspots](#)
[Repeaters](#)
[DMRIDs](#)
[Groups](#)
[Call Logs](#)
[GPS Logs](#)

You have been authorised to add your repeaters to the RAYNET-UK DMR service. The repeater must have your callsign set as the trustee.

-- Select DMRID -- Add Repeater

Callsign (DMRID) Location	Name	Type	Connected (BST)	Last Seen (BST)	IP
 GB7GP (234003)  High Wycombe, IO91	GB7GP	Duplex	04:29:18 Aug 2022	20:46:58 Aug 2022	192.168.240.21

This will allow you to register your repeater with the service.

Select the Call sign for the repeater and note the configuration details which you will need to enter into the repeaters configuration.

Expanding the entry will show the same details as for a peer.

Callsign (DMRID) Location	Name	Type	Connected (BST)	Last Seen (BST)	IP
GB7GP (234003) <small>RPTTR</small> High Wycombe, IO91	GB7GP	Duplex	04:29:18 Aug 2022	20:48:28 Aug 2022	192.168.240.21

Repeater Details

Name GB7GP Edit

CCS7/DMR ID 234003

Callsign GB7GP

Location High Wycombe, IO91

Country UK

Latitude +51.6400

Longitude -000.7000

Height 0

Type Duplex

Version 20210617_PS4

Modem MMDVM

RX Freq 430,650,000

TX Freq 439,650,000

Power

Colour Code 5

Repeater Connection Status

Created 09:57:18 Jan 2021

Connected Since 04:29:18 Aug 2022

Last Seen 20:48:28 Aug 2022

Ping Count 5862

Authentication Count 0

Repeated Auth Count 0

IP Address 192.168.240.21

UDP Port 49871

URL https://gb7gp.m0guy.com

API Key Copy New Key

Notify When off-line YES NO

Blocked YES NO

Hotspot Configuration
Delete Hotspot

Static Talkgroups

-- Select RAYNET-UK Group --
-- Select Talkgroup --
Add Static Talkgroup

Talkgroup	ACL	Timeslot	Action
National Calling <small>NATIONAL 5023531</small>	TX RX	SLOT2	Enabled Remove
Local Net <small>Buckinghamshire County 5080600</small>	TX RX	SLOT2	Enabled Remove
Alt Calling <small>NATIONAL 5089900</small>	TX RX	SLOT2	Enabled Remove
Local Net <small>Aylesbury 5019600</small>	TX RX	SLOT2	Enabled Remove
Local Net <small>SW Hertfordshire 5005300</small>	TX RX	SLOT2	Enabled Remove
ENDURANCE EVENTS 80 2022 <small>Aylesbury 5019605</small>	TX RX	SLOT2	Enabled Remove
Local EVENTS ENGINEERING <small>Aylesbury 5019609</small>	TX RX	SLOT2	Enabled Remove
QO-100 <small>Technical Team 5075510</small>	TX RX	SLOT2	Enabled Remove

1 to 8 of 8 Page 1 of 1

Filter the table by clicking the ☰ icon while hovering over a column heading.

Dynamic Talkgroups

Callsign (DMR ID)	Talkgroup	slot	Time (BST)	Action
No Rows To Show				

2.4.8 Your Hotspots

Here you will configure the peer or hotspot you wish to use with the service. There are a number of different types of hotspots however most are derived from [pi-star](#).

These are your hotspots. To connect your hotspots to this service, you must add at least one DMRID and create is below. Each hotspot has a unique password and should not be shared.

-- Select DMRID --
-- Select Hotspot Number --
Add Hotspot

	Callsign (DMRID) Location	Name	Type	Connected (BST)	Last Seen (BST)	IP
▶	M7GUY (234879404)		Simplex	Disconnected		
▶	MOGUY (234919302) High Wycombe, IO91	Trunking Peer	Simplex	03:33:02 Aug 2022	20:24:08 Aug 2022	192.168.40.146
▶	MOGUY (234919303) Mobile	Car Hotspot	Duplex	Disconnected	18:15:30 Aug 2022	213.205.198.49
▶	MOGUY (234919304) High Wycombe, IO91	YSF2DMR	Simplex	Disconnected	16:41:13 Jun 2022	192.168.40.146
▶	MOGUY (234919305) Town, LOC4TOR	Holiday Hotspot	Simplex	Disconnected	05:58:21 Jul 2022	70.79.121.57
▶	MOGUY (234919306) Town, LOC4TOR	Pocket HS	Duplex	Disconnected	17:15:25 Aug 2022	192.168.40.188
▶	MOGUY (234919310) Mobile	TXr	Simplex	Disconnected	15:16:44 Feb 2022	192.168.10.80
▶	MOGUY (234919311)		Simplex	Disconnected	12:43:59 Apr 2022	109.249.187.100

You can register up to 99 peers for each DMRID you have. Each peer must have a unique ID which is made up of the DMRID and a 2 digit suffix.

2.4.8.1 Create Peer

Select a DMRID, a “Hotspot Number” and click on “Add Hotspot”. This will create your hotspot configuration. You will need to repeat the process for each peer you wish to connect. A new hotspot line will appear in the list.

2.4.8.2 Peer Details

Use the button (Arrow) on the left side to expand the hotspots details.

From here you can name the hotspot, this is just a reference name for you, view the hotspot configuration (Green button), or delete the peer if it’s no longer required. You can also manage which Talkgroups you would always like to be sent to this hotspot (Static Talkgroups). This means whenever there is traffic for the Talkgroup it will be sent to your hotspot.

Callsign (DMRID) Location	Name	Type	Connected (BST)	Last Seen (BST)	IP
M7GUY (234879404)		Simplex	Disconnected		

Hotspot Details

Name: Edit

CCS7/DMR ID: 234879404

Callsign: M7GUY

Location:
Country:
Latitude:
Longitude:
Height:
Type: Simplex

Version:
Modem:
RX Freq:
TX Freq:
Power:
Colour Code:

Hotspot Connection Status

Created: 13:54:58 Aug 2022

Connected Since: Disconnected

Last Seen:
Ping Count: 0
Authentication Count: 0
Repeated Auth Count: 0

IP Address:
UDP Port:
URL:
API Key: Copy New Key

Notify When off-line: NO

Blocked: NO

Hotspot Configuration
Delete Hotspot

Static Talkgroups

-- Select RAYNET-UK Group --
-- Select Talkgroup --
Add Static Talkgroup

Talkgroup	ACL	Timeslot	Action
National Calling NATIONAL 5023531	TX RX	SLOT2	Enabled Remove
Local Net Zone 6 5090600	TX RX	SLOT2	Enabled Remove

1 to 2 of 2 << < Page 1 of 1 > >>

Filter the table by clicking the icon while hovering over a column heading.

Dynamic Talkgroups

Callsign (DMR ID)	Talkgroup	slot	Time (BST)	Action
No Rows To Show				

0 to 0 of 0 << < Page 0 of 0 > >>

Filter the table by clicking the icon while hovering over a column heading.

Warning: Never share your peer password with anyone, not even admins or group_admins.

When complete copy the lines from the window, these are the necessary configuration lines for your pi-star.

2.4.8.2.1 Static Talkgroups

The Static talkgroups section allows you to set or unset static talkgroups. To add a static talkgroup select it from the drop-down list. This list shows only the talkgroups you are allowed to use. If there are any that you think you should have, please contact your administrator.

If you wish to delete an existing static TG, just click on the 'Remove' Red button, on the line describing the TG you wish to remove.

Each static entry lists

- Number - The Talkgroup number
- Name - Talkgroup name, this can be changed by the group admins.

- ACL - (Access Control List), shows if you are permitted to Receive (RX) and or Transmit (TX) on this Talkgroup. The ACL is managed by the Group Admins.
- Timeslot - If you are using a simplex hotspot then this will be set to SLOT2 and cannot be changed. Duplex hotspots can use both Timeslots and selecting this button allows to change which Timeslot the traffic should be sent.
- Enabled/Disabled - If you wish to temporarily stop listening to traffic on a Talkgroup you can disable it.
- Delete - To permanently remove the Talkgroup from your static list. (You can re-add from the list)

Add 'Static' TG to the selected Peer

Click on the drop-down list 'Static talk-groups'. Scroll and select the TG of interest, then click it. Then click the blue 'Add static talk-group' button next to the selection just made. It will then appear in the list of static groups your Peer (aka HotSpot or repeater) will receive traffic from.

Program/configure your radio(s) as needed to accept/use that new TG, or list that you have selected.

Note! If your radio transmits a call to any of the known RAYNET Private TG's, but you have not explicitly setup such in the above webpage, then it will still be accepted and become an active "Dynamic" TG, that will remain in force until you TX on another TG that if also un-configured will then replace the previous Dynamically selected TG.

If however, you TX on a known/configured "Static" TG, then the last used "Dynamic" TG will be dropped (deleted.)

2.4.8.2.2 Dynamic Talkgroups

The table also duplicates part of the Dynamic talkgroups list; showing the dynamic talkgroup assigned to the peer, if there is one.

Dynamic Talkgroups

Callsign (DMR ID)	Talkgroup	slot	Time (BST)	Action
MOGUY (2349193)	5023531 NATIONAL 5023531	SLOT2	2022-08-16 12:02:41	Remove

1 to 1 of 1 << < Page 1 of 1 > >>

Filter the table by clicking the ☰ icon while hovering over a column heading.

The callsign of the user who activated it on this peer, the talkgroup name and when used. Any calls originating on this talkgroup will be passed to the peer until you either use a different one on that peer or you press the Delete button. Static talkgroups can be assigned to a peer by selecting it in the Your Peers tab

2.4.8.3 Configuring your Pi-Star

If you've not yet setup your pi-star please review [Software](#)

To allow the pi-star to route traffic to multiple DMR services, you must set the "DMR Master" to "DMRGateway". Once applied, you can the select your Brandmeister Master, which might be "BM_United_Kingdom_2341", or "BM_Europe_2001", or anything else which makes sense for you.

DMR Configuration	
Setting	Value
DMR Master:	DMRGateway
BrandMeister Master:	BM_Europe_2001
BM Hotspot Security:	*****

Login and select configuration -> Expert

Pi-Star:4.1.2 / Dashboard:20200813

Pi-Star Digital Voice - Expert Editors

[Dashboard](#) | [Admin](#) | [Update](#) | [Upgrade](#) | [Backup/Restore](#) | [Configuration](#)

Quick Edit: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMR GW | YSF GW | P25 GW | NXDN GW | DAPNET GW
Full Edit: DMR GW | PiStar-Remote | WIFI | BM API | DAPNET API | System Cron | RSSI Dat **Tools:** CSS Tool | SSH Access

From the “Full Edit:” line select the “DMR GW” option. This will present a large textbox with all the DMR GW settings. Scroll to the bottom of this textfield and paste the configuration in.

Click “Apply Changes” to commit this change. Switching back to “Dashboard” or “Admin” should now show a new DMR service called “RAYNET DMR”.

Radio Info	
Trx	Listening
Tx	433.900000 MHz
Rx	433.900000 MHz
FW	HS_Hat:v1.4.17
TCXO	14.7456 MHz
DMR Repeater	
DMR ID	2348240
DMR CC	1
TS1	disabled
TS2	enabled
DMR Master	
BM United Kingdom..	
DMR+ IPSC2-PhoenixF	
RAYNET DMR	

You can confirm that the peer has registered with RAYNET DMR by refreshing your profile page and looking at the peers connection status. It will change to show the time of connection and also start showing when it was last seen on the network as well as the public IP address it connected from. If you don't see a current time listed then your peer hasn't established a connection, go back and verify your configuration.

The screenshot shows the user profile page for 'Guy Plunkett'. At the top, there's a navigation bar with 'Raynet-UK DMR', 'Groups', 'GPS', and 'Guy'. A search bar and 'Info', 'Help', 'Guy' dropdown are also present. The profile name 'Guy Plunkett' is at the top left with an 'Edit' button. Below are two main sections: 'User settings' and 'Account Statistics'. 'User settings' includes E-Mail (guy.plunkett@raynet-uk.net), Timezone (Europe/London), and Time Format (19:18:07 Aug 22). 'Account Statistics' shows Account Created (08:56:42 Sep 2020), Signin Count (41), Current Signin (17:57:12 Aug 2022), Current Signin IP (10.42.1.8), Last Signin (18:58:40 Aug 2022), and Last Signin IP (10.42.1.8). Below these is a 'Lastheard' tab with a table of activity. The table has columns: Via, Callsign (DMR ID), Talkgroup, Slot, Time (BST), and Duration. Two entries are shown: one from M0GUY (2349193) via M7GUY (2348794) on slot 2 at 17:32:58 Sep 2021, and another from GB7GP (234003) via M0GUY (2349193) on slot 1 at 08:55:59 Aug 2022. A footer note says 'Filter the table by clicking the icon while hovering over a column heading.'

Use your profile page to update your details. From here you can edit your personal details such as your name. You can also set your preferred time format and time zone. By default time is in UTC but you might prefer “London” which will adjust for Day light saving. The time format defines how the time/date is displayed on the site. If there’s a specific time format you would like that’s not currently listed please contact us to have it added.

The 'Edit Name' dialog box has a title bar with 'Edit Name' and a close button. The main text reads: 'You can change you personal details below. It is not possible to change your e-mail address. Should you need to, please contact an admin to discuss.' Below this text are two text input fields. The first field contains 'Guy' and the second field contains 'Plunkett'. To the right of the second field is a blue button labeled 'Update Name'.

The profile page is split into multiple tabs, providing useful information concerning your activity on the server and allowing changes to be made. These are explained in more detail below.

- *Lastheard* - Which Talkgroups you been last heard
- *Your Hotspots* - Manage your hotspots (peers).
- *Repeaters* - If you have been allocated repeater keeper status, you can manage your repeater here.
- *DMRIDs* - Manage your DMRIDs
- *RAYNET Groups* - Lists all the RAYNET groups you have currently been allocated.
- *Call Logs* - Logs showing your PTTs to the DMR system.
- *Page Messages* - Messages sent and received by you.
- *Exports* - Export of useful data for import into your radio codeplug

2.5 Group Admin

2.5.1 ACLs

ACL or Access Control List, provides a way to secure Talkgroups. This allows to prevent users from either transmitting or receiving on a Talkgroup.

2.5.1.1 Global ACL

Using the global ACL enabled or disables all users default ability to transmit (TX) and receive (RX) to the Talkgroup.

NATIONAL-National Calling

Talkgroup Details

Group NATIONAL

Talkgroup Number 5023531

Active YES

Default ACL TX RX

Locked NO

Public Access YES

You can then define entries for individual users to get the security you require.

2.5.1.2 Per user ACL

Example 1 - Everyone is able to TX and RX, except one

Lastheard
ACL
Static Users
Dynamic Users
Call Log
Net

ACL (Access Control List) for this talkgroup

Enter email addresses...

Add ACL

ACLS control who can transmit and receive on this talkgroup.

By default any member of RAYNET is able to access this talkgroup via dynamic (outside of the group you can't set it as a static but can set the radio to the talkgroup and press the PTT).

If you want to restrict access for everyone you can use the "Default ACL" to disable access. If you want to restrict for a few users then you can add the users e-mail addresses and then set the ACL for them specifically.

User ↓	ACL	Action
Guy Plunkett	TX RX	Remove

1 to 1 of 1
<< < Page 1 of 1 > >>

Filter the table by clicking the ☰ icon while hovering over a column heading.

Here you can see everyone is able to transmit and receive, except Cc Clark, they will not be able to transmit or receive traffic for this Talkgroup.

Example 2 - Allow only one person to transmit, everyone receive

Tech-Local Calling 07

Talkgroup Details

- Group: **Technical Team**
- Talkgroup Number: 5075507
- Active: **YES** (toggle on)
- Default ACL: **TX** (disabled) **RX** (enabled)
- Locked: **NO** (toggle off)
- Public Access: **NO** (toggle off)

Talkgroup Net Schedule

ACL (Access Control List) for this talkgroup

Enter email addresses...

Add ACL

ACLS control who can transmit and receive on this talkgroup. By default any member of RAYNET is able to access this talkgroup via dynamic (outside of the group you can't set it as a static but can set the radio to the talkgroup and press the PTT). If you want to restrict access for everyone you can use the "Default ACL" to disable access. If you want to restrict for a few users then you can add the users e-mail addresses and then set the ACL for them specifically.

User ↓	ACL	Action
Guy Plunkett	TX (disabled) RX (enabled)	Remove

1 to 1 of 1 | Page 1 of 1

Filter the table by clicking the ☰ icon while hovering over a column heading.

Here the global TX is disabled, this means no one can transmit, but RX is allowed. So anyone is allowed to receive but not transmit. However

2.5.2 Disable Users

You can not remove users from a group, you can however disable them.

If a user is no longer a member of a group, you can disable the users access to the group. When disabled they will no longer be able to see the group, or define static Talkgroups for your group.

2.5.3 Enrol Users

Enter one or as many e-mail addresses as you need. If you manage multiple groups then select the group from the pull down list. Select “Register User”. Each address will be sent an e-mail with a unique link to allow the user to register themselves.

Warning: E-Mail address should be “@raynet-uk.net” addresses, these will be automatically accepted and activated. If however you enrol a non raynet e-mail address, the user will be able to register but will not be allowed to login until global admins to authorise the account.



The screenshot shows the 'Users (257)' interface with two main sections:

- Register user by E-mail:** This section allows adding multiple email addresses. It includes instructions that users must have an email ending in @raynet-uk.net for automatic activation. A text area contains the email 'gg@britewhite.net', which is also listed in a small table below. A 'Register' button is at the bottom.
- Add user by Callsign:** This section allows adding users already registered on the RAYNET server by their callsign. It features a text area for 'Enter Callsigns' and an 'Add' button.


These new users will be listed under “Waiting Enrolment”.

Waiting Enrolment

These users have been sent a registration e-mail to the address listed, however they have yet to click on the link in the e-mail to complete the registration process.

E-Mail	Token	Group	Created (BST)	Last Sent	By	Action
gg@britewhite.net	SSRRCGEEFRFKDAX	NATIONAL	21:07:01 Aug 2022	21:07:01 Aug 2022	1 Plunkett, Guy	 

1 to 1 of 1 << >> Page 1 of 1 >>>

Filter the table by clicking the  icon while hovering over a column heading.

You can remove the entry if you have mistyped the e-mail address, or if they have lost the mail etc you can “resend” the enrolment mail.

Once the user has enrolled the entry will be removed from the waiting list.

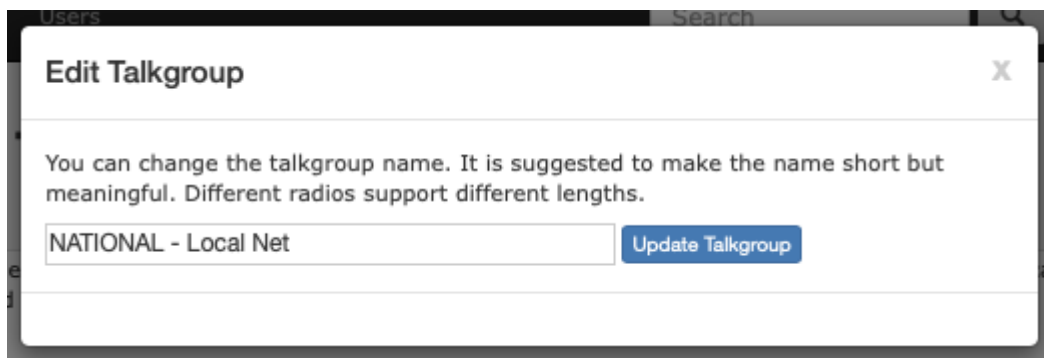
2.5.4 Talkgroup Management

Group admins are able to configure the region Talkgroups.

- Rename Talkgroup.
- Enable/Disable Talkgroup.
- Talkgroup ACL.

2.5.4.1 Rename a Talkgroup

Select the “Edit button” for the Talkgroup to change the name for the Talkgroup. The name must be unique and will fail to update if not. You should ideally have a short but meaningful name, with a reference to your group.



2.5.4.2 Enable/Disable Talkgroup

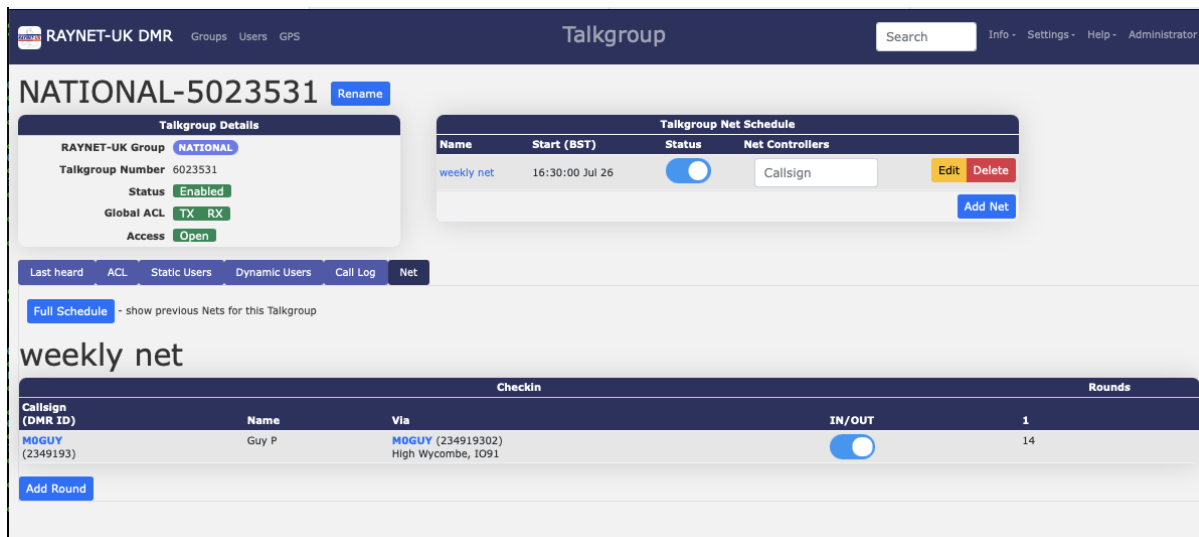
If you wish to stop all access to a Talkgroup you can disable it. It will stop showing in lists, and no call traffic will be passed. Click on the “Enabled” button to turn off the Talkgroup. You can re-enable it by clicking on the button again.

2.5.4.3 Talkgroup ACL

Each Talkgroup can have it’s own set of *ACLs* (Access Control Lists).

2.5.4.4 Net Control

Net Control provides digital assistance when running a Net. The Net control system will log checkins and traffic which occur during the net.



2.5.4.4.1 Scheduling

Group controllers can schedule nets for a Talkgroup within their group and assign net controllers who will run the net.

Talkgroup Net Schedule				
Name	Start (BST)	Status	Net Controllers	
weekly net	16:30:00 Jul 26	<input checked="" type="checkbox"/>	<input type="text" value="Callsign"/>	<input type="button" value="Edit"/> <input type="button" value="Delete"/>
				<input type="button" value="Add Net"/>

Create a new net by selecting the “Add Net” button. Add a name and specify the date and time when the net is to begin.

Note: The time for the net needs to be entered in UTC

New Net for Talkgroup

Schedule a net for this talkgroup

Name

Start Time (UTC)

Notes

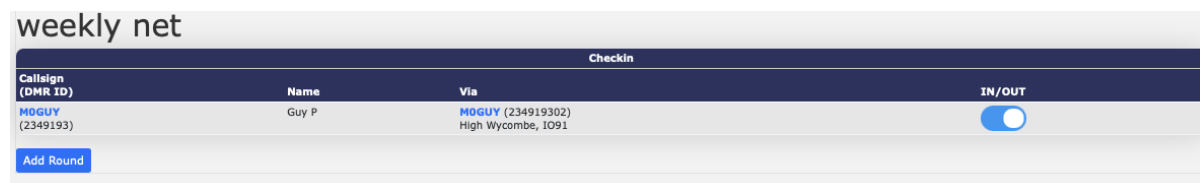
Once scheduled you can add net controllers one at a time by adding callsigns and pressing return. Anyone who is a member of this group can be a net controller.

The “Status” switch is used to close the net when complete.

Warning: If there are multiple nets scheduled for the Talkgroup, the oldest “OPEN” net will used.

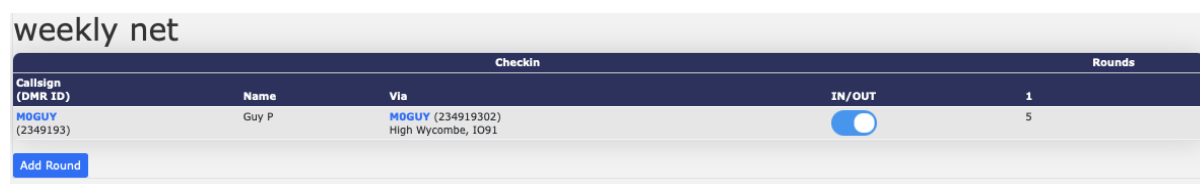
2.5.4.4.2 Running the net

The net will start automatically when the schedule date/time is reached. As users key up on the Talkgroup they will automatically be added to the roster in the order they made contact.



Once checkin is complete the net controller can start a round by clicking the “Add Round” button. As a user then makes their transmission their activity will be hi-lighted. Once their over is complete a duration in seconds will be shown for this round.

New users can join the net at anytime, they will be added to the bottom of the roster as they key up.



Once all members have had their over, the net controller clicks the “Add Round” button to end the current round and start the next round.

If a user no longer wishes to take part then the net controller can switch “IN/OUT” button for the user to record it. This does not stop the user from further transmissions, and serves as a note to the controller.

If a user does not make a transmission during a round, it will be recorded as a “pass”.

Once the net is complete the Net controller closes the net by switching the “status” switch to off. This will stop logging of traffic and return the Talkgroup to normal operation.

Below is a 15 minute video outlining the extra features you have as a group controller, such as inviting members and managing talkgroups.

As a group admin you have control over your group. You can

- *Enrol Users* to your group.
- *Disable Users* in your group.
- *Talkgroup Management* for the group.
- *ACLs* configuration.

RAYNET-UK Group Details

RAYNET-UK Group NATIONAL

Group controllers [Guy Plunkett](#), [Cathy Clark](#), [Greg Mossop](#)

Groupcode 899

Number 899

Talkgroup Numbers 50899XX

Talkgroup Prefix NATIONAL

Talkgroups [Users \(257\)](#)

Name	Number ↑	Status	Global ACL	User Level ACLs	
National Calling	5023531	YES <input checked="" type="checkbox"/>	TX RX	None	Open Edit
Alt Calling	5089900	YES <input checked="" type="checkbox"/>	TX RX	None	Open Edit
Working CH 1	5089901	YES <input checked="" type="checkbox"/>	TX RX	None	Open Edit
Working CH 2	5089902	YES <input checked="" type="checkbox"/>	TX RX	None	Open Edit
Working CH 3	5089903	YES <input checked="" type="checkbox"/>	TX RX	None	Open Edit
Local Calling 04	5089904	YES <input checked="" type="checkbox"/>	TX RX	None	Open Edit
Local Calling 05	5089905	YES <input checked="" type="checkbox"/>	TX RX	None	Open Edit
Local Calling 06	5089906	YES <input checked="" type="checkbox"/>	TX RX	None	Open Edit

2.6 Admin

Global admin have access to all the groups and users and can perform all the same functions as any group controller.

2.6.1 Time Formats

A new time format can be added using the standard printf syle formatters. Under settings, select “Time Formats”, create a new format using the variables as outlined below.

Table 2.1: Formatters

	Var	Description	
Month	M	1 2 ... 11 12	
	Mo	1st 2nd ... 11th 12th	
	MM	01 02 ... 11 12	
	MMM	Jan Feb ... Nov Dec	
Quarter	MMMM	January February ... November December	
	Q	1 2 3 4	
	Qo	1st 2nd 3rd 4th	
	Day of Month	D	1 2 ... 30 31
Do		1st 2nd ... 30th 31st	
DD		01 02 ... 30 31	
Day of Year	DDD	1 2 ... 364 365	
	DDDdo	1st 2nd ... 364th 365th	
	DDDD	001 002 ... 364 365	
Day of Week	d	0 1 ... 5 6	
	do	0th 1st ... 5th 6th	
	dd	Su Mo ... Fr Sa	
	ddd	Sun Mon ... Fri Sat	
Day of Week (Locale)	dddd	Sunday Monday ... Friday Saturday	
	e	0 1 ... 5 6	

continues on next page

Table 2.1 – continued from previous page

	Var	Description	
Day of Week (ISO)	E	1 2 ... 6 7	
Week of Year	w	1 2 ... 52 53	
	wo	1st 2nd ... 52nd 53rd	
	ww	01 02 ... 52 53	
Week of Year (ISO)	W	1 2 ... 52 53	
	Wo	1st 2nd ... 52nd 53rd	
	WW	01 02 ... 52 53	
Year	YY	70 71 ... 29 30	
	YYYY	1970 1971 ... 2029 2030	
	YYYYYY	-001970 -001971 ... +001907 +001971	
	Y	1970 1971 ... 9999 +10000 +10001	
Era Year	y	1 2 ... 2020 ...	
Week Year	gg	70 71 ... 29 30	
Hour	H	0 1 ... 22 23	
	HH	00 01 ... 22 23	
	h	1 2 ... 11 12	
	hh	01 02 ... 11 12	
	k	1 2 ... 23 24	
	kk	01 02 ... 23 24	
	Minute	m	
	mm	00 01 ... 58 59	
	Second	s	0 1 ... 58 59
	ss	00 01 ... 58 59	

2.6.2 Logs

Global admins can search the DMR logs for any user or DMRID.

2.6.3 User Delete

It's not possible to delete a user account via the GUI. This is very deliberate. Deleting a user is very destructive. Removing the user account removes all references of it including their peers, DMRIDs.

Deleting a user can only be completed via the CLI

```
# rake "user:delete[wibble@example.com]"
Confirm? Enter 'z3npq4' to confirm:
z3npq4
"Deleting user: Example User"
```

2.6.4 List Admin

```
# rake user:listAdmins
```

2.6.5 Adding User To Admin

```
# rake "user:MakeGlobalAdmin[wibble@example.com]"
"User - wibble@example.com"
"user is now admin"
```

2.6.6 Removing user from Admin

```
# rake "user:RemoveGlobalAdmin[wibble@example.com]"
"User - wibble@example.com"
"user is no longer admin"
```

2.7 Usage

2.7.1 DMR Weekly Activity

Raynet technical team run a weekly activity period on DMR. This activity period is run on Sunday afternoon at 1600 (local). The net is open for all Amateur operators to join, and is targeted to Raynet members to test out equipment and pass any traffic. The net usually runs for an hour and a half, with each operator given two overs.

Talkgroups	
Brandmeister	23531
Pheonix	23531
Wires X	23531
Raynet DMR	5023531

The netcontroller (**G4NRC**), will follow the script below.

2.7.1.1 Net Control Script

Tip: Speak Slowly, Clearly, and into the microphone at all times.

Prior to starting the net ensure you have the latest list of known stations on the talkgroup on hand.

CQ RAYNET This is **G4NRC** operated today by *Name*, **CALLSIGN**, serving as Net control for the RAYNET-UK Weekly Activity Net. This net meets each Sunday afternoon at 4:00PM local and is open to all RAYNET-UK operators.

The primary purpose of this net is to provide the opportunity for members, to test equipment, exchange traffic, news, opinions, and information. Additional information and announcements are available on the RAYNET-UK website which can be found at, RAYNET-UK.NET.

This is a directed net, which means all calls are to be made to the net control station unless you are instructed otherwise. All amateur radio operators are invited and encouraged to check into the net.

When checking into the net please announce your call sign slowly and phonetically followed by your name and whether or not you have traffic for the net. If you do not wish to have an over then please say "In and Out". After a few check-ins the net control will pause and review the check-in list. If your check-in is not acknowledged, then please try again.

We will now begin taking check-ins to the RAYNET-UK Weekly Activity Net. Calls will be taken in callsign number order. Any stations with **8** in their call wishing to check-in to the net, please call now.

Thank you for these check-ins.

I have copied:

Recite check-in's received, this is G4NRC

Are there any additional check-ins with **8** in their callsign, Please call now.

Thank you for these check-ins.

I have copied:

Recite check-in's received, this is G4NRC

Repeat above for 7,6,5,4,3,2,1 until callsigns with 'zero' in the call and break
↳ those up into M0, G0 and any other zeroes.

At this time I would ask any strays who have missed their slot to call in now

I have copied:

Recite check-in's received, this is G4NRC

I would now like to invite any **international stations** wishing to call in to please do so now, this is **G4NRC**

I have copied:

Recite check-in's received, this is G4NRC

Before we proceed down the list let's look at the news about RAYNET-UK and the digital voice networks this week.

Insert RAYNET-UK messages here

That ends the National RAYNET-UK messages.

I shall now call on stations on the check-in list, if you wish to leave the net after your call please say so:

Work down the list of Callsigns checked-in, one at a time

At this time we will now take in any additional check-ins. Any additional check-ins please call now.

Receive check-ins

Thank you for these check-ins.

I have copied:

Recite check-in's received, this is G4NRC

This is **G4NRC** operated today by **CALLSIGN**, I will now work down the list again but without those stations who said they wanted to leave after the first turn.

Work down the list of Callsigns checked-in minus the leavers, one at a time

Before we close the net for today, if there are any additional check-ins, please call now.

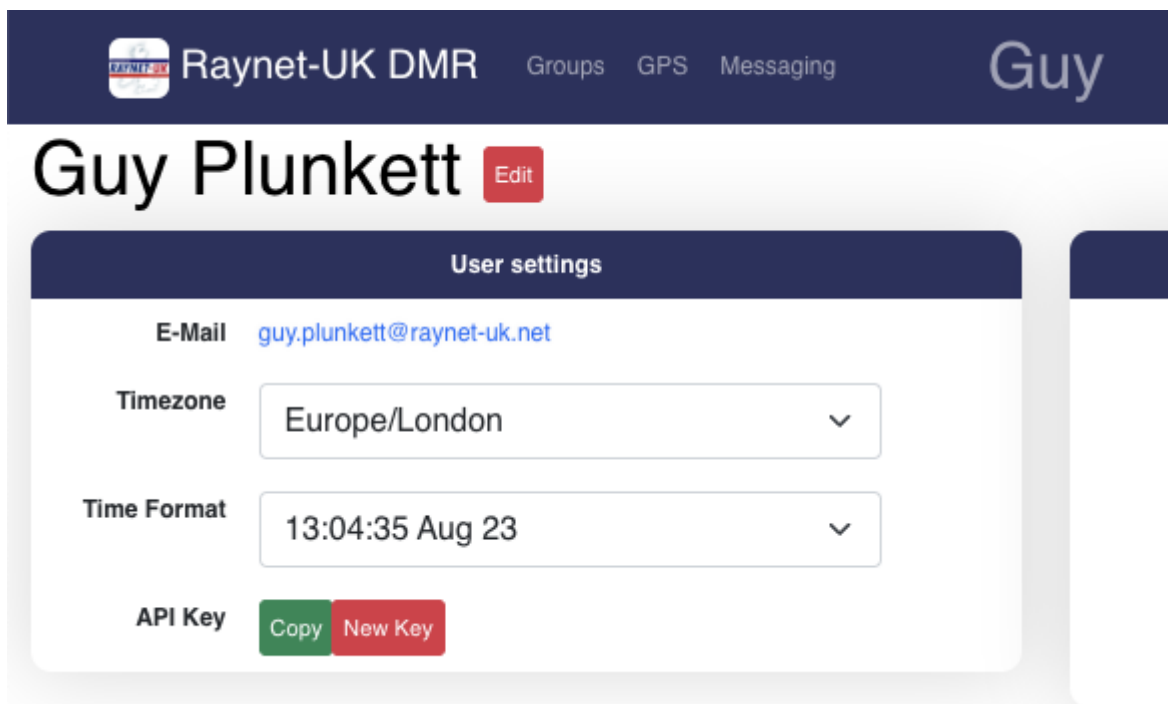
Recite any late check-ins, and let them pass traffic, if any, as done above

I wish to thank all stations for taking time out of their busy schedules to participate in afternoon's net. Be careful and have a good week. Until next Sunday afternoon at 4:00PM local time, I now close the RAYNET-UK Weekly Activity Net and return the network to normal amateur radio use.

73 to all this is **G4NRC** now closing and I will revert to my normal callsign of **CALLSIGN**.

2.7.2 Paging via API

In order to send a page via the API it's necessary to have an API key. You can obtain your API key or generate a new one on your profile page.



If you don't already have an API key you can create a "New Key". Use the "Copy" button add the key to your copy buffer ready to paste it into your code.

Note: The page can either be sent to a RIC or callsign.

```
curl 'https://raynet.m0guy.com/api/v1/page' -H 'Content-Type: application/json' -u_
↳ '<APIKEY>:'
-d '{ "rics":["123456"],
      "groups":[ 281 ],
      "message":'Hello World'
    }'
```

If you use a callsign then the first RIC which matches for the callsign will be used.

```
curl 'https://raynet.m0guy.com/api/v1/page' -H 'Content-Type: application/json' -u_
↳ '<APIKEY>:'
-d '{ "callsigns":["m0guy"],
      "groups":[ 281, 116 ],
      "message":'Hello World'
    }'
```

The "groups" field is an array of raynet group IDs, 281 is the NATIONAL Group which everyone is a member of, so in this case, the page will be sent to all hotspots and repeaters which are currently on-line. To find the group ID, look on your profile page under "Groups", and click on the group you want the number for and look at the URL in the address bar (<https://raynet.m0guy.com/group/281>, for National, so the group ID is 281).

As a good practice it's suggested to pick the smallest group which is likely to get the message to the intended recipient. You can specify multiple groups if you need to span multiple groups.

Warning: You can only send to a group to which you are a member

2.7.3 Private Call

The RAYNET server supports private calls. The server will look up the number and if it matches a DMRID registered on the system it will send the traffic to the peer where it was last heard.

The hard part is configuring the hotspot to route the private traffic to the correct DMR server. By default Brandmeister is often set to route all private calls. On Pi-Star hotspots, If you look in the “DMR GW” file under expert mode you will see see

```
PassAllPC0=1
PassAllPC1=2
```

These two lines capture all private calls on Timeslot 1 and 2 and send them to the BM server. If you want to send all private calls via RAYNET then simply delete these lines from the BM configuration “DMR Network 1”, and add them to the RAYNET configuration lines, “DMR Network 4”.

There are “PCRewrite” rules which can be used to rewrite from RF to Net, but they do not rewrite the other way. So they are not useful in this case.

Details of the rewrite rules can be found here: <https://github.com/g4klx/DMRGateway/wiki/Rewrite-Rules>

2.7.4 APRS (GPS)

The server supports the capturing of APRS GPS information. To do this you will need to configure your radio to send APRS information to the Talkgroup **5075599**.

You can send traffic as a group call or private call. However if you want to use private call then you need to make sure your hotspot is sending the private call traffic to the server.

```
PCRewrite0=1,5075599,1,5075599,1
PCRewrite1=2,5075599,2,5075599,1
```

These lines should be included in the “[**DMR Network 4**]” part of the DMR Gateway expert configuration. Newer members should have these lines already included in their configurations.

The APRS information is not forwarded anywhere else and stays on the RAYNET server. You can review your GPS log entries by looking at your profile page and selecting the “GPS Logs” tab. Expanding the log lines will show all GPS entries recorded on the system. You can delete any GPS log entry which you do not want to remain.

Note: If you want to keep your GPS position between RAYNET and you then you should also look to turn off the Pi-Star configuration option “**APRS Host Enable**”

GPS Access Control

Here you can see who can see your GPS locations, and whose you can see. Users can request to see your GPS location but until you accept it here they will not be permitted. The GPS Map will show all the users who have permitted you to see their locations. This can also be accessed with the Info menu at the top.

People who can see your GPS information.

If you add them they are automatically approved. If they have made the request then you must approve it first.

User
<input type="text" value="Callsign or E-Mail"/> <input type="button" value="Add"/>

People whose GPS information you are permitted to see.

The user will need to approve your request before you can see their GPS information

User	Status
<input type="text" value="Callsign or E-Mail"/> <input type="button" value="Add"/>	

Your GPS Information



Here is a list of all the GPS log entries that you've made from your DMRIDs. You can delete any of your entries from the system via this page. To post your GPS location from your radio you will need to configure your radio to send APRS information to DMR Talkgroup **6075599**.

Callsign (DMRID)	Time (BST)	Longitude	Latitude	Speed	Direction
2E0GUW (2349047)	21:35:37 Jun 08	-0.700121 W	51.6362 N	22.62	301.72 (WNN)
MOGUY (2349193)	15:32:12 Jun 13	-0.713833 W	51.65 N	0.0	121.0 (ESE)

2.7.4.1 Access Control

Inside the RAYNET server you can control who can access your GPS information. By default only you can see your own GPS data. There are two Access Control lists. Those listing who you can see, and those listing those who can see you. You have full control over this list. You can add and delete entries at any time with immediate effect. To add other members you can use their e-mail address or registered callsign.

- **“People who can see your GPS information”**, those people will be able to see your last location. Other members may request access, however you will need to approve it or delete it.
- **“People whose GPS information you are permitted to see”**, here is a list of users who you are permitted to see, you can add users to this list to request access to view other peoples GPS information. The other user **must** approve it before you can see them.

To see shared GPS information use the “Info -> GPS Tracking” menu item on the Navigation bar.

2.8 FAQ

Here are some questions and answers that often crop up when using the RAYNET DMR service.

2.8.1 Pi-Star Keeps re-authenticating

You might have received an e-mail from the server telling you that your hotspot is requesting to authenticate too often, or you might have noticed under the “Peer / Hostspots” tab the “Authentication count” is increasing.

This is likely the SD card in the Pi-Star hotspot is having performance issues. You should take a **configuration backup** ASAP and **reboot** the Pi. During reboot the Pi will attempt to correct any errors on the SD card. If this starts to occur frequently then it points to the imminent failure of the SD card and you should look to replace it.

2.8.2 Unknown Peer

Unlike other DMR servers the RAYNET DMR server needs to know about each hotspot/peer before it connects. Each hotspot has it's own unique password. Before you can connect a hotspot to the RAYNET server you must create an entry on the server and copy it's configuration over to your hotspot. You **must not** have multiple hotspots sharing the same configuration.

2.8.3 Registered but can't login

If you've just created your account but are not able to login with the credentials.

Your account hasn't been activated yet. If you used a non raynet-uk.net e-mail address then your account will need to be manually activated before you can login. The Admins have received an e-mail notifying them of the necessary action and it will be actioned ASAP. The more information you include on the registration page the quicker this will likely be as the admins can quickly verify your status.

2.9 System Design

2.9.1 API

The API functions provide a method of setting and unsetting static talkgroups on the DMR server. Each peer (hotspot) has it's own API token which is generated by the server and can be seen under each peers details.

The token and the peer needs to be passed with each call. The token can either be submitted in the data as a parameter, or as part of the authentication. In curl this is with the "--user" option. If you use the authentication route then you will need to append : to the token. For example

```
curl 'https://raynet.m0guy.com/api/list_talkgroups.json' --user '<TOKEN>:' -d 'peer=<DMRID>'
```

The unique DMRID is the ID of the peer, either 9 or 7 digits long.

The server will return with a json array with the results or **OK** if the request is correct and completed. If something went wrong or the request is invalid then it will respond with **invalid**.

2.9.1.1 List Talkgroups

Return an array of number and name for Talkgroups which you are allowed to request as a static on this peer.

```
curl 'https://raynet.m0guy.com/api/list_talkgroups.json' -d 'peer=<DMRID>&token=<TOKEN>'
```

Example results

```
[{"number": "5090600", "name": "Z6-Local Net"}, {"number": "5090601",  
↪ "name": "Z6-Local Calling 01"}, {"number": "5090602", "name": "Z6-Local Calling 02"}, {"number": "5090603",  
↪ "name": "Z6-Local Calling 03"}, {"number": "5090604", "name": "Z6-Local Calling 04"}, {"number": "5090605",  
↪ "name": "Z6-Local Calling 05"}, {"number": "5090606", "name": "Z6-Local Calling 06"}, {"number": "5090607",  
↪ "name": "Z6-Local Calling 07"}, {"number": "5090608", "name": "Z6-Local Calling 08"}, {"number": "5090609",  
↪ "name": "Z6-Local Calling 09"}, {"number": "5090610", "name": "Z6-Local Event 1"}, {"number": "5090611",  
↪ "name": "Z6-Local Event 1 - TG1"}, {"number": "5090612", "name": "Z6-Local Event 1 - TG2"}, {"number": "5090613",  
↪ "name": "Z6-Local Event 1 - TG3"}]
```

(continues on next page)

(continued from previous page)

```

{"number":"5090614","name":"Z6-Local Event 1 - TG4"}, {"number":"5090615",
↪ "name":"Z6-Local Event 1 - TG5"},
{"number":"5090616","name":"Z6-Local Event 1 - TG6"}, {"number":"5090617",
↪ "name":"Z6-Local Event 1 - TG7"},
{"number":"5090618","name":"Z6-Local Event 1 - TG8"}, {"number":"5090619",
↪ "name":"Z6-Local Event 1 - TG9"},
{"number":"5090620","name":"Z6-Local Event 2"}, {"number":"5080400",
↪ "name":"Berkshire County-Local Net"},
{"number":"5001200","name":"Berkshire-Local Net"}, {"number":"5080600",
↪ "name":"Bucks-Local Net"}]

```

2.9.1.2 Get Talkgroups

Return an array of currently set static and dynamic Talkgroups for peer.

- timeslot - Which timeslot the traffic will be sent
- enabled - Is this static Talkgroup enabled/disabled. If should traffic be sent. Having it disabled does not stop a user sending traffic, the Talkgroup will be set as a dynamic instead.

```
curl 'https://raynet.m0guy.com/api/get_talkgroups.json' -d 'peer=<DMRID>&token=<TOKEN>'
```

Examples results

```

{"static_talkgroups": [{"number": "6075600", "name": "Training Team-Local Net",
↪ "timeslot": "SLOT2", "enabled": true},
{"number": "6090600", "name": "Z6-Local Net", "timeslot": "SLOT2",
↪ "enabled": true},
{"number": "6080400", "name": "Berkshire County-Local Net",
↪ "timeslot": "SLOT2", "enabled": true},
{"number": "6001200", "name": "Berkshire-Local Net",
↪ "timeslot": "SLOT2", "enabled": true},
{"number": "6019600", "name": "Aylesbury-Local Net",
↪ "timeslot": "SLOT2", "enabled": true},
{"number": "6089990", "name": "NATIONAL-TEST", "timeslot": "SLOT2",
↪ "enabled": true}],
"dynamic_talkgroups": [{"number": "6089999", "name": "NATIONAL-Echo TEST",
↪ "timeslot": "SLOT2"}]}

```

2.9.1.3 Set Talkgroup

Add or update a static Talkgroup. If the Talkgroup has already been set then setting again will update its values, eg changing timeslot or enabled.

Optional parameters

- timeslot - defaults 2
- enabled - defaults to active

Note: If the peer is a simplex node then timeslot needs to be set to 2. Setting anything else will be ignored and set to 2.

```
curl 'https://raynet.m0guy.com/api/set_talkgroup.json' -d 'peer=<DMRID>&token=<TOKEN>&tg=<Talkgroup
Number>&enabled=<[true|false]>&timeslot=<[1|2]>'
```

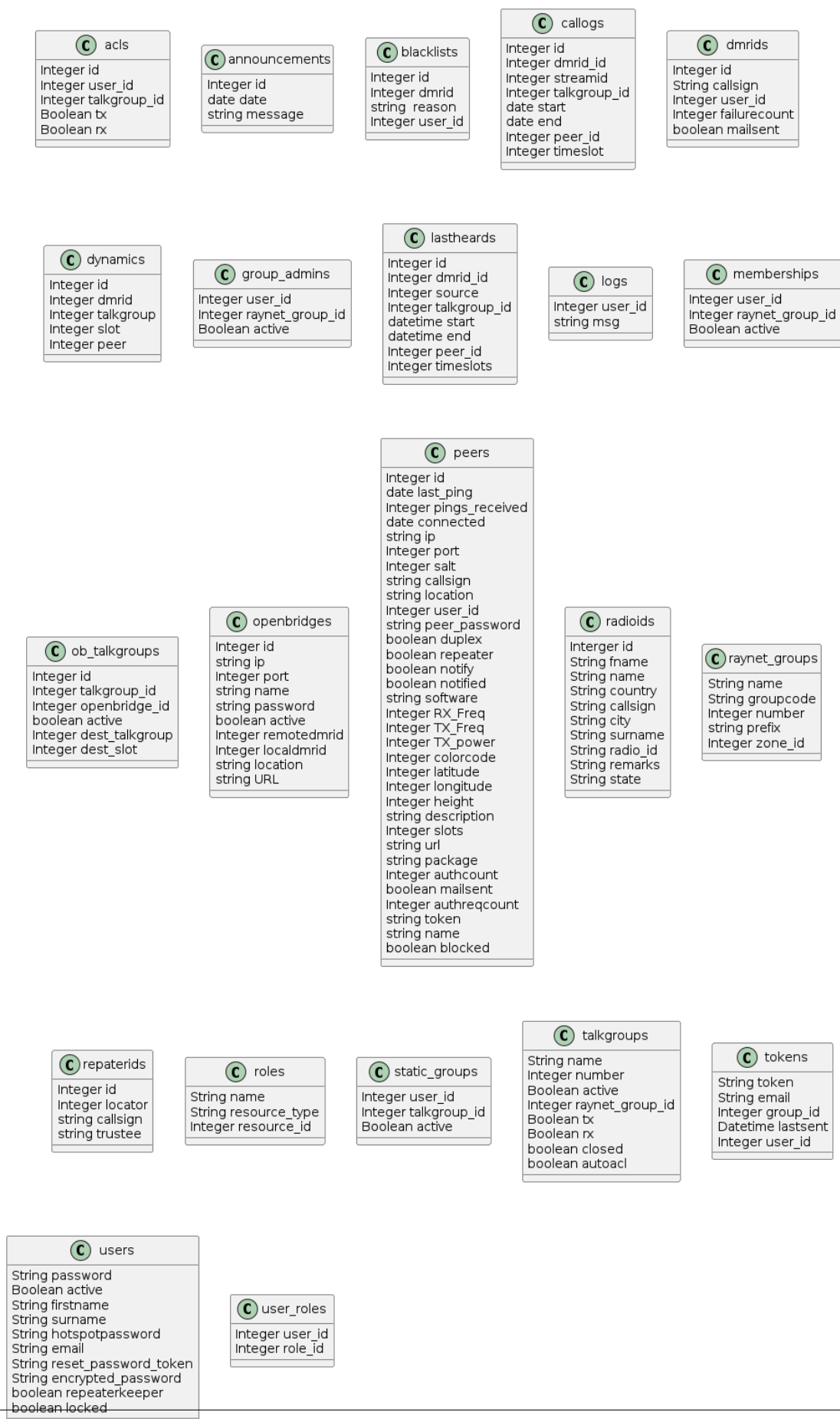
Returns **OK** if it completed successfully, **invalid** otherwise.

2.9.1.4 Delete Talkgroup

Remove the Talkgroup from the static and dynamic lists.

```
curl 'https://raynet.m0guy.com/api/del_talkgroup.json' -d 'peer=<DMRID>&token=<TOKEN>&tg=<TALKGROUP>
```

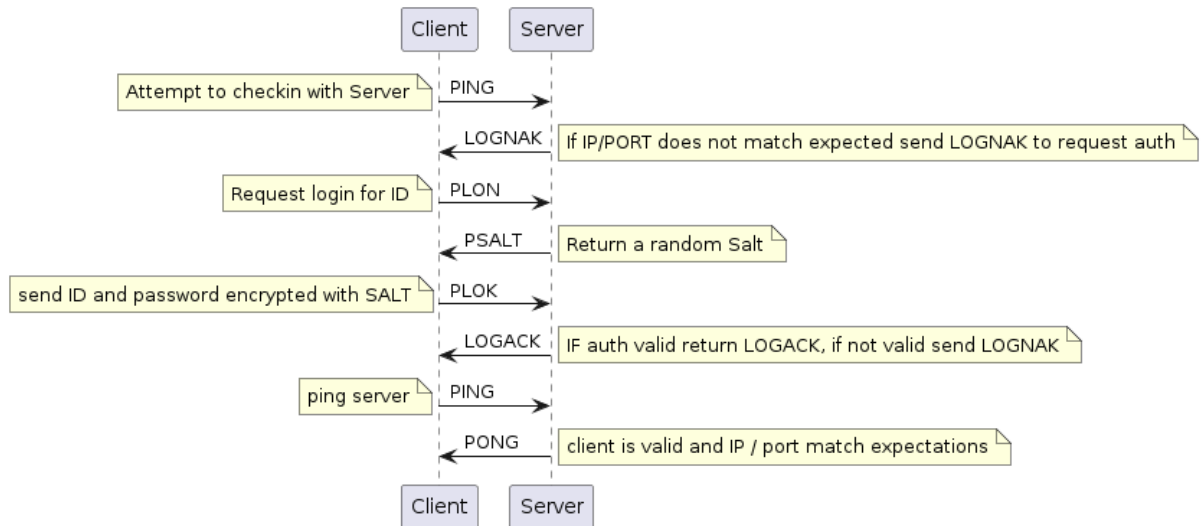

2.9.2 Database Design



2.9.3 Paging

DAPNet server makes use of a TCP connection between the hotspots and server, however that doesn't really scale well so for the RAYNET Paging system we've defined a new protocol using UDP. This protocol is very light weight on both sides.

Below is the basic authentication and PING/PONG response between the hotspot and server. The PING/PONG is used to make sure any firewalls and routers remember the UDP path between the two.



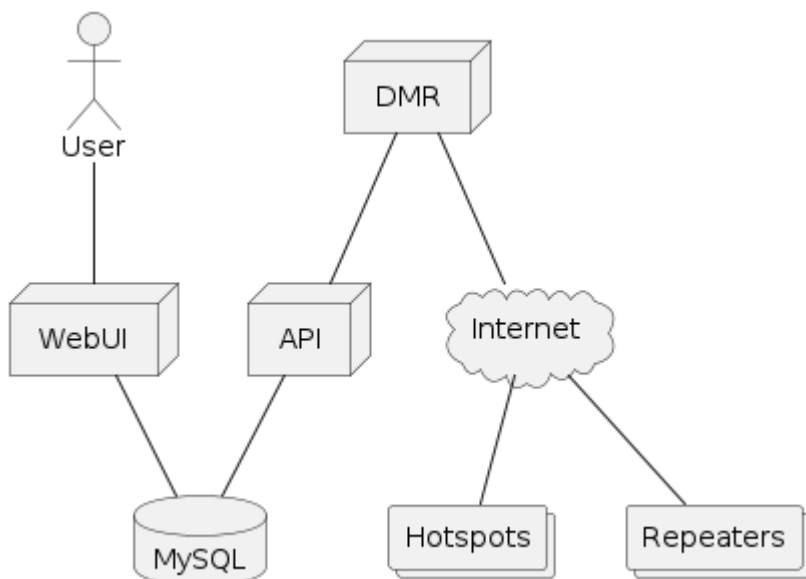
A paging message is sent via this UDP path as byte stream starting with "PAGE" followed by the message syntax.

- type (5, timesync, 6, text message)
- speed (message speed 1 - 1200)
- RIC (Paging code)
- Fucntion (function bit or sub RIC)
- text message (Text message)

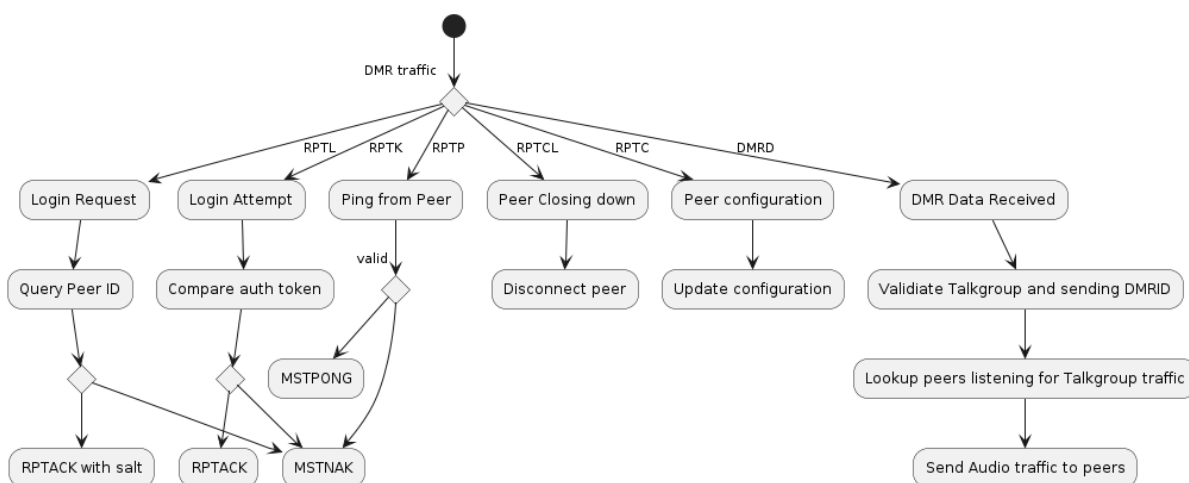
The system has been designed from the ground up specifically for RAYNET usage. The system is split into separate docker containers which are run on a Kubernetes cluster.

The primary containers are

- DMR traffic is handled via golang binary
- Web UI interface is written in Ruby on Rails
- Backend database uses MySQL
- Documentation is written using SPhinx-Doc generating static HTML pages which are hosted on an nginx container.



2.9.4 DMR Service



The DMR server is written in golang listens on UDP port 62030 and queries the backend SQL database via an API interface.

2.9.5 Web Portal

The web portal is written in Ruby on Rails and runs inside a docker container. It provides users with a UI to interact with the service.

- Users are able to add their DMRIDs
- Create peers/hotspots.
- View lastheard information
- Connection logs
- Group membership
- Call logs

HINTS & TIPS

3.1 Fix for mapping Talkgroup 50XXXXX to Callsigns

3.1.1 The issue

RadioID have started to allocate 50xxxxx for Malaysia amateur operators.

Note: This in no way effects our ability to use these Talkgroup numbers. When configured for Raynet any Group call (Talkgroup) starting with 50 will be routed to the Raynet server.

The pi-star is routing the Talkgroup traffic over to the Raynet server, however at the same time the pi-star (well in fact the MMDVM modem) is **always** looking up numbers to see if it has a match. I've tried to file a bug with MMDVM/pi-star about this as it doesn't make sense to me to try looking up a Talkgroup number (Private call yes) but they disagree.

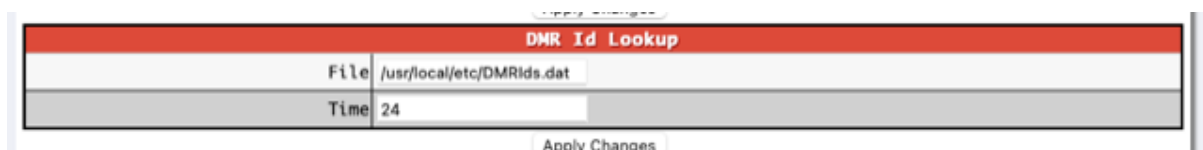
The Dashboard is watching the the MMDVM logs, the Talkgroup number to callsign lookup is written logs and the Dashboard displays it.

The problem here is just in displaying the callsign rather than using the Talkgroup Number.

3.1.2 Work Around

The Pi-star configuration can be modified to use a different DMRid file, which does not have the 50 IDs in it.

Under Configuration, expert mode, MMDVM, scroll down to the DMR id Lookup block.



You can then change the file to point to a new file. for example `/home/pi-star/DMRIDs-50.dat`.

Next you need to create this file, to do that you can ssh into the pi-star and issue this simple grep command:

```
$ grep -v '^5020' /usr/local/etc/DMRIDs.dat > /home/pi-star/DMRIDs-50.dat
```

The above command searches the “official” DMRID file `/usr/local/etc/DMRIDs.dat` and removes all the IDs which start with 5020. The results are then written to the new file `/home/pi-star/DMRIDs-50.dat`.

There are two downsides to this approach.

1. You need to keep updating this new file so new DMRs are updated as they are created. This can simply be done via a regular cronjob.

Save the following script in the `/etc/cron.daily/` directory

Listing 3.1: new_dmrids.sh

```
#!/bin/bash
grep -v '^5020' /usr/local/etc/DMRIDs.dat > /home/pi-star/DMRIDs-50.dat
```

- If you are ever on a public DMR server and on a talk group which one of these users are talking then their callsign will not show up on the pi-star dashboard but instead you'll see the number.

3.2 YSF Configuration of a Pi-star Hotspot for use with the RAYNET server

Open your Pi-star dashboard and select Configuration.

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	4.19.97+	Pi Zero W Rev 1.1 (512MB)	3.95 / 1.64 / 0.6	33.6°C / 92.5°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 checked="" 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: /dev/ttyAMA0 Nextion Layout: G4KLX

Apply Changes

General Configuration

Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	M0JSA

Change the setting of YSF Mode to switch it on. Then click on Apply Changes.

When the Pi-star restarts there will be a new **Yaesu System Fusion Configuration** section appear, beneath the **DMR Configuration** one.

By default, this selects FCS00290 as the host. Change this to YSF23501 – GB-CQ-UK-YCS – (YCS235). Also change the **WiresX Passthrough** to on.

Once again click on **Apply Changes**. When the Pi-star reboots you will notice that the once steady LEDs on the MMDVM board are now alternating between the two enabled modes.

The dashboard will now look something like this:

XLX Master:	XLX 950
XLX Startup Module:	Default
XLX Master Enable:	<input type="checkbox"/>
DMR Colour Code:	1
DMR EmbeddedLCOnly:	<input type="checkbox"/>
DMR DumpTAData:	<input checked="" type="checkbox"/>

Apply Changes

Yaesu System Fusion Configuration

Setting	Value
YSF Startup Host:	FCS00290 - AMERICA-LINK-WIRESEX
UPPERCASE Hostfiles:	<input checked="" type="checkbox"/> Note: Update Required if changed
WiresX Passthrough:	<input type="checkbox"/>

Apply Changes

Mobile GPS Configuration

Setting	Value
MobileGPS Enable:	<input type="checkbox"/>

Hostname: pi-star2 Pi-Star:4.1.2 / Dashboard: 20200813

Pi-Star Digital Voice Dashboard for MOJSA

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

Gateway Hardware Information

Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-star2	4.19.97+	Pi Zero W Rev 1.1 (512MB)	2.07 / 2.07 / 1.71	41.2°C / 106.2°F

Service Status

MMDVMHost	DMRGateway	YSFGateway	YSFParrot	P25Gateway	P25Parrot
DStarRepeater	ircDDBGateway	TimeServer	PiStar-Watchdog	PiStar-Remote	PiStar-Keeper

Active BrandMeister Connections

BrandMeister Master	Default Ref	Timeout(s)	Active Ref	Static TGs	Dynamic TGs
BM United Kingdom 2341	REF0	0(s)	None	TG23531	None

BrandMeister Manager

Tools	Active Ref	Link / Unlink	Action
Drop QSO Drop All Dynamic	None	<input type="radio"/> Link <input checked="" type="radio"/> UnLink	Modify Reflector

Static Talkgroup	Slot	Add / Remove	Action
<input type="text"/>	<input type="radio"/> TS1 <input checked="" type="radio"/> TS2	<input checked="" type="radio"/> Add <input type="radio"/> Delete	Modify Static

YSF Link Manager

Reflector	Link / Un-Link	Action
None	<input checked="" type="radio"/> Link <input type="radio"/> UnLink	Request Change

Gateway Activity

Time (BST)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
15:52:29 Oct 22nd	YSF	M06ER	ALL at FCS23525	Net			
15:52:27 Oct 22nd	YSF	M0JSA	ALL	Net	0.6	0%	0.0%
15:42:38 Oct 22nd	YSF	KC3P3N	ALL at FCS002-90	Net	0.6	0%	0.0%
15:41:28 Oct 22nd	YSF	AMERICANLNK	ALL at FCS002-90	Net	55.4	0%	0.0%
15:40:26 Oct 22nd	YSF	4X4LT	ALL at FCS002-90	Net	54.5	0%	0.0%
15:39:21 Oct 22nd	YSF	2M0IJU	ALL at FCS002-90	Net	33.5	0%	0.0%
14:38:45 Oct 22nd	DMR Slot 2	M06IG	TG 5023531	Net	0.5	0%	0.0%
14:34:59 Oct 22nd	DMR Slot 2	W8IFF	TG 23531	Net	0.5	0%	0.0%
13:23:23 Oct 22nd	DMR Slot 2	G3UJB	TG 5023531	Net	0.8	0%	0.0%

Local RF Activity

Time (BST)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
------------	------	----------	--------	-----	--------	-----	------

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	TX YSF
Tx	434.000000 MHz
Rx	434.000000 MHz
FW	HS_Hat:v1.4.7
TCXO	14.7456 MHz

DMR Repeater

DMR ID	2341072
DMR CC	1
TS1	disabled
TS2	enabled

DMR Master

BM United Kingdom..
DMR+ IPSC2-PhoenixF
RAYNET DMR

YSF Network

Room: GB-CQ-UK-YCS

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWZ) 2014-2020.
 ircDDBGateway Dashboard by Hans-J. Barthen (DL5DI),
 MMDVMDash developed by Kim Huebel (DG9VH),
 Need help? Click here for the Facebook Group.

You will notice in the **Service Status** section that you now have, as well as the DMRGateway, YSFGateway and YSFParrot; hopefully all showing green. Also bottom left you will see a **YSF Network** panel that shows you are connected to the GB-CQ-UK-YCS room.

Now go to the radio but be sure you can also see the dashboard. The radio I used is an FT-991 with a touch screen. Consult your radio manual for the appropriate controls and displays on your radio.

Tune the radio to the Hotspot. Press the **Mode** button on the radio and select **C4FM**. The mode on the display should then change to C4FM. If you can see YSF traffic on the Hotspot dashboard you should be able to hear the QSO. If not, press the **PTT** to get the hotspot into YSF mode.

Go back to the Hotspot Admin Dashboard. In the **YSF Link Manager** section select **Unlink** and click on **Request Change**. This will prevent you hearing other Fusion traffic.



Static Talkgroup	Slot	Add / Remove	Action
	<input type="radio"/> TS1 <input checked="" type="radio"/> TS2	<input checked="" type="radio"/> Add <input type="radio"/> Delete	Modify Static

Reflector	Link / Un-Link	Action
YSF23501 - GB-CQ-UK-YCS - (YCS235)	<input type="radio"/> Link <input checked="" type="radio"/> UnLink	Request Change

Gateway Activity								
Time (BST)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER	
16:12:13 Oct 22nd	YSF	MOJSA	ALL	Net	0.6	0%	0.0%	
16:11:38 Oct 22nd	YSF	MOJSA	ALL	RF	5.2	0%	0.9%	
16:10:19 Oct 22nd	YSF	MB6ER	ALL at FCS23525	Net	32.6	0%	0.0%	

Now, on the radio briefly key the **PTT**. You should see your transmission appear in the **Local RF Activity** section of the dashboard.

If so then so far, so good.

Press the **F / M-List** button on the radio to bring up the function keys display. On this touch the **X** button to activate WiresX. The radio will then attempt to connect to the Hotspot. This may take one or two attempts! Just press **X** again. While connecting a Green box will appear top-left on the display, inside which will be a flashing red X.

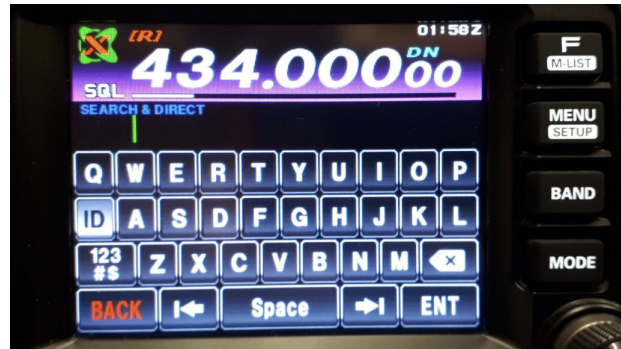


Once it is connected the red X will go steady and the display will change to show, beneath the S-meter, a connected message and the name of the node. In my case this was MOJSA-ND MOJSA_Pi-Star. Yours will be similar but with your own call sign. (Note, there will be no box beneath this. In the example I had previously connected to the RAYNET-UK room; shown greyed out as not connected.)



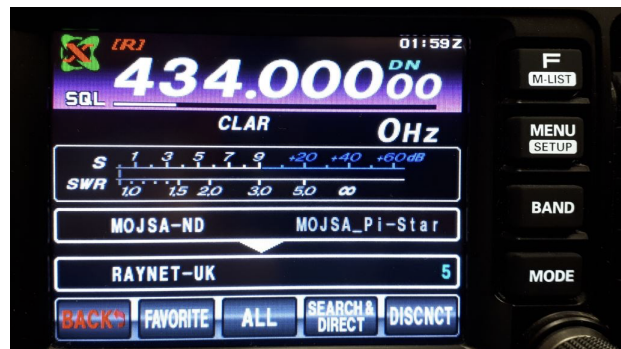
Touch the **SEARCH&DIRECT** button to bring up an on-screen keypad. Touch the **DIRECT** button and then the **ID** button.

This will bring up a numeric keypad. Enter 23531 after the # and press **ENT**. The number entered will flash and the radio will attempt to connect to the room.



Once connected the display will change again to show the room underneath the Node. In our case it should say RAYNET-UK.

You should be able to transmit and, if all goes well, come out of the DMR Server on 5023531. If you do not transmit or the room is idle the connection will drop. Just touch the **RAYNET-UK** box on the display (now greyed out) to re-establish the connection.



Alan Jones,

MOJSA East Suffolk Group

In the MMDVMHost Configuration section of the Configuration page there are pairs of RF Hangtime and Net Hangtime edit boxes for each of the modes.

These determine how long the Hotspot will hold a Mode following a transmission (either from RF or the net) before reverting to search mode.

Apply Changes

Setting		Value	
DMR Mode:	<input checked="" type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>
D-Star Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>
YSF Mode:	<input checked="" type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>
P25 Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>
NXDN Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="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 <input type="button" value="v"/>	Port: <input type="text" value="/dev/ttyAMA0"/>	Nextion Layout: <input type="text" value="G4KLX"/>

Apply Changes

Setting		Value	
Hostname:	<input type="text" value="pi-star2"/>	Do not add suffixes such as .local	

In the MMDVMHost Configuration section of the Configuration page there are pairs of RF Hangtime and Net Hangtime edit boxes for each of the modes. These determine how long the Hotspot will hold a Mode following a transmission (either from RF or the net) before reverting to search mode.

3.3 Whitelisting DMRIDs

Under the terms of the UK Amateur Radio Licence an NOV is required to run a Repeater. It has been argued that running your personal Hotspot in ‘Public’ mode could need an NOV; particularly if it is Unattended operation. If you keep the Hotspot at hand and only run very low power this requirement probably does not apply.

New in version Pi-Star: 4.1.4

3.3.1 New Method

Since version 4.1.4 of the Pi-Star software you can now add DMRIDs on the standard configuration page. Change the “Node Type” to public and apply changes. You can now see the additional configuration to add DMRIDs to the whitelist.

Radio/Modem Type:	MMDVM_HS_Dual_Hat (DB9MAT, DF2ET & DO7EN) for Pi (GPIO)
Node Type:	<input type="radio"/> Private <input checked="" type="radio"/> Public
DMR Access List:	2349193, 2348794, 2349047
APRS Host Enable:	<input checked="" type="checkbox"/>
APRS Host:	euro.aprs2.net
System Time Zone:	Europe/London
Dashboard Language:	english_uk

Simply add the DMRIDs in a comma separated list to the “DMR Access List” box.

Deprecated since version Pi-Star: 4.1.4

3.3.2 old Method

This is the old method for setting up whitelisting of DMRIDs. It’s left here as a reference.

Setting the Hotspot to ‘Private’ locks it to the single DMR ID you have set. However, if you have more than one DMR ID, or other users will need to use it, you will have to set it to ‘Public’. Because the software is able to be used as a proper Repeater it includes tools to manage the users. In particular you can set a Whitelist of DMR IDs allowed to use it. The way to do this is not straight forward and you must take a backup before you start.

Then, from the Dashboard you need to select ‘Configuration’, ‘Expert’ and then in the Full Edit section click on ‘SSH Access’. This will open a window and ask for your Username and Password for the Pi-star. If you haven’t changed them, they are pi-star and raspberry. The following display then appears.



You now need to enter the following commands at the \$ prompt, exactly as shown:

- `rpi-rw` This is to allow the editor to change the file.
- `cd /etc` This is to change the working directory.
- `sudo nano mmdvmhost` This opens the configuration file into an editor.

Scroll down (using the cursor keys) the file to the [DMR] section. On the end of this section append the following line (the capitalisation is important):

`WhiteList=2341072,2346185` This is the comma separated list of the DMR IDs you wish to allow. Replace the examples given with your list of DMR IDs.

Having added the lines, you need to press <Ctrl>O to write the file, <RTN> to use the same filename as before, back to the sdcard. Once saved press <Ctrl>X to exit the editor. Close the SSH session by typing exit at the \$ prompt. This will show logout followed by Session Closed.

You will now be back to the normal display. Select 'Configuration' again and scroll down to the General Configuration section. In the Node Type: field change the option from Private to Public (if you haven't done so already).

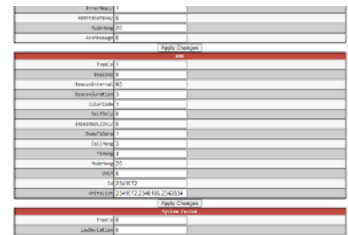
Finally, to make your changes take effect you need to restart the services. Just click on any of the 'Apply Changes' buttons (even if you didn't need to change the Node Type option) This causes the Hotspot to restart, reloading your new configuration file in the process.

If all has gone well, the Hotspot will now only respond to radios using the DMR IDs you listed in the WhiteList command.

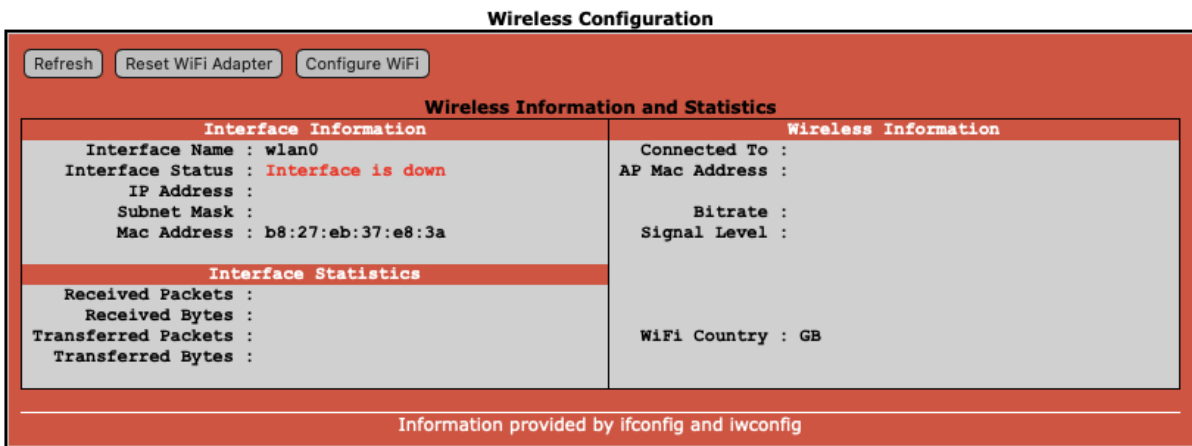
Please note that if the Hotspot is a simplex device, local radios with 'blocked' DMR IDs will still be able to hear transmissions to and from the Hotspot and transmit locally to other local stations. If it is a duplex Hotspot, they will only be able to transmit locally if they know the appropriate frequency split. In neither case will their transmissions be transferred through the Hotspot.

If you wish to change the DMR IDs, or add some more then go to the 'Configuration', 'Expert' screen and select 'MMDVMHost'.

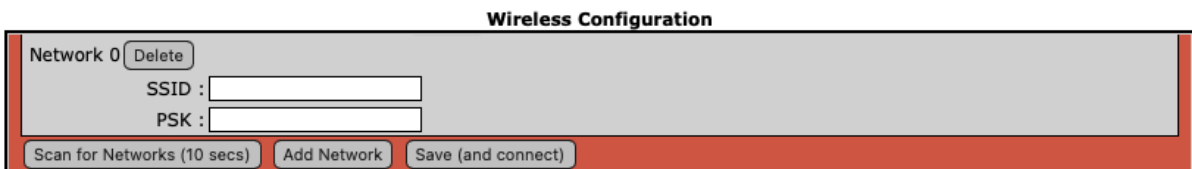
At the bottom of the DMR section there will be a field called WhiteList where you can change the entries. Remembering to select 'Apply Changes' to make them take effect.



3.4 Additional WiFi Networks

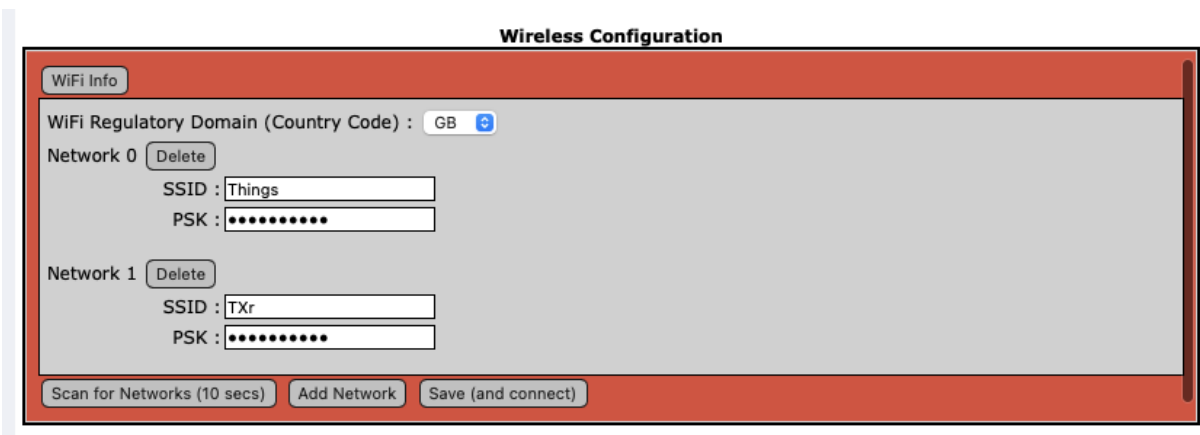


The Pi-Star can have multiple WiFi networks configured. The Pi-Star will search for WiFi networks and if the SSID matches it will attempt to join. From the webpage you can select "Configuration", and scroll down to the "Wireless Configuration" block. Select "Configure WiFi"



Add your additional WiFi network credentials, SSID and Password (PSK).

If you plan to connect your hotspot to your mobile phone, you can add the name and password for your phones wifi.



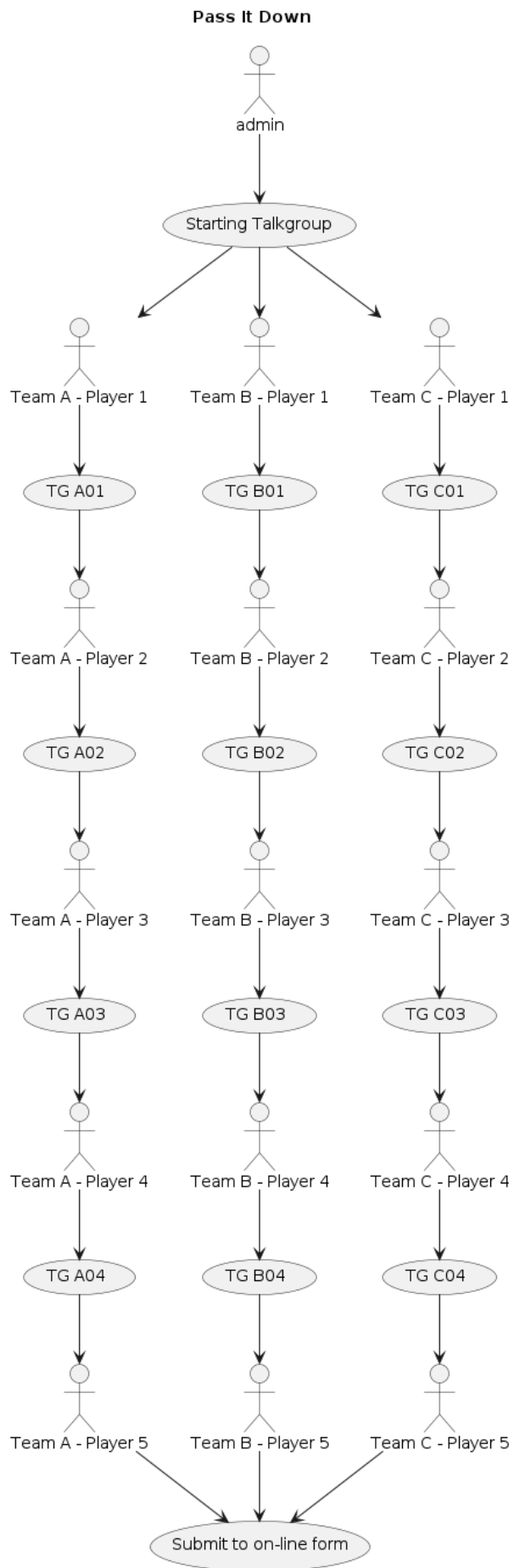
If you also enable “Auto AP”, then should the Pi-Star fail to connect to any WiFi networks then it will start to broadcast it’s own WiFi network for you to join to configure the hotspot, however until the Pi-Star is able to join a network it will not be able to pass any radio traffic.

GAMES

These are games for helping members develop skills in using raadio and passing traffic. Many of these games work well on RAYNET-UK DMR service because of the multiple talkgroups and ACLs which can be applied to define the traffic paths.

4.1 Pass It Down

I'm sure you know this game by many other names. The object of the game is to pass a message down the line of people as accurately and quickly as possible.



4.1.1 Setup

Players should be using personal hotspots rather than public repeaters for at least two reasons

- Repeaters might be taken over by other users during the game, thus losing the message.
- Other players might be listening on the same repeater and short circuit the game message path.

During the game it's advisable for players to make sure they do not have static talkgroups set which are not part of this game. The only static talkgroup they should set is the "Status TG", this will allow them to hear game announcements.

It's necessary to know the players and teams in advance so the ACLs for talkgroup can be defined. Any number in each team is possible as is the number of teams. Each team must of course be of the same length. It is advisable not to have too long a chain, but instead limit to less than 10. Too long a chain will have players hanging around for long times without knowledge of progress. The use of the Talkgroups is shown here, rather than the numbers. In the diagram shown 12 'hop' TGs, 1 each of 'starting' and 'Discussion', giving a total of 15 Talkgroups. Keeping these groups as defined makes it easy to reset and run the game multiple times.

- **Starting Talkgroup** - Admin can TX, only player 1 from each team can RX.
- **TG Hops** - Only the previous and next player can TX and RX on this channel. One for each Team for each hop. The receiving player can set this TG as a static.
- **Status TG** - All players have RX access to this group, Admin has RX/TX access. This talkgroup is used to announce end of game or other in game notifications.
- **Discussion TG** - All players have TX and RX access to this group, before the start of the game and at the end. This is where players should head once they have passed their traffic. When the game is complete the results will be announced here and discussions on issues etc can be held.

4.1.2 Playing

Before starting the game the Admin will announce to all payers on the "Status TG" to remind them of the rules and actions necessary.

The Admin starts the game by reading a message on the Starting Talkgroup. The Admin will read the message several times. Once the Team player believes they have a good reception of the message they should switch (QSY) to their TX channel and begin QSO with the next player passing the message on.

After they have passed their message they should QSY to the "Discussion TG" to hear end of game discussions.

When the last player in the team receives the message they will submit the message to the on-line form to stop the clock and have it reviewed for accuracy.

Once all teams have submitted their messages, the admin will announce the end of the game on the "Status TG" and advise all players to switch to the "Discussion TG". The messages will be reviewed by the admin for accuracy as well as speed. The winning team is the one which passes the message most accurately and fastest.

The results will be announced on the "Discussions TG" and allow all players an opportunity to provide feedback. The game can be run multiple times as the Talkgroup memberships do not change.

4.1.3 Scoring

Scoring is done by converting the time taken in to seconds, and adding 30 for each error. The team with the lowest score being the winner.

4.1.4 Progression

- Have multiple messages in flight. The admin can slowly increase the number of messages and reduce the time between messages.
- Use random numbers and letters in the message.

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