

# GB3WL

## Wythall Multimode Repeater

The Wythall repeater situated south of Birmingham (UK) covers most of the West Midlands region. It was initially FM analogue only but now also supports the three main digital modes (D-Star, Fusion, DMR). There has been some confusion as to accessing these modes so this guide tries to simplify their use. The first section explains how to use the REPEATER directly using RF followed in the second section explaining the use of using a HOTSPOT and accessing the REFLECTOR via the internet. The repeater deals with the RF side whereas the reflector deals with the digital internet traffic. The two are connected together so that each re-transmits the input to the other in the appropriate mode.

The following information should allow you to set up your radio (and later your hotspot).

### **DIRECT ACCESS TO REPEATER USING RF**

#### **FM Analogue**

Receiving Frequency:	430.950 MHz	
Transmitting Frequency:	438.550 MHz	(i.e. a POSITIVE repeater shift of 7.6 MHz)
CTCSS Tone:	67 Hz	

## DMR Direct Access

Receiving Frequency: 430.950 MHz

Transmitting Frequency: 438.550 MHz

Talk Group: TG4002

Colour Code: 5 Slot: 2

(see codeplug for Analogue FM later in HOTSPOT configuration section)

## YSF (Fusion) -C4FM Direct Access

Receiving Frequency: 430.950 MHz

Transmitting Frequency: 438.550 MHz

Mode: DN

Tx ID: 12 Rx ID: 00

(The Tx ID seems to default to 12 so 00 will also work)

## D-Star Direct Access

Receiving Frequency: 430.950 MHz

Transmitting Frequency: 438.550 MHz

To: Local CQ to call reflector XLX\_279 and GB3WL repeater

Gateway CQ to access other reflectors or internet destinations

From: WYTHALL 430.950 GB3WL B

# ACCESS TO THE REFLECTOR (AND THE REPEATER) OVER THE INTERNET

You can set up a HOTSPOT, which is a device connected to the internet either by WiFi, direct network (RJ45) or even Personal Hotspot linking on your phone (note that the latter is usually used to link laptops to the internet, not ham radios!). The HOTSPOT also allows an RF connection to a transceiver. Once you realise that there are two separate connections to set up then configuration becomes clearer (hopefully). The HOTSPOT will only function with digital connections so FM Analogue has no function in regard to using this device.

## Radio and HOTSPOT:

Frequency: 434.000 MHz or 438.800 MHz  
(or 438.775 MHz or 438.7875 MHz)

These are the frequencies suggested by the RSGB for personal HOTSPOTS and bandwidth should be set to 12.5kHz. Most will use a SIMPLEX connection but a DUPLEX connection is possible.

Ensure that your Callsign (and DMR ID for DMR) are correct in both your radio and HOTSPOT.

Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-star	5.10.103-v7+	Raspberry Pi 3 Model B Rev 1.2	1.78 / 0.96 / 0.88	51.5°C / 124.7°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 Mode <input type="radio"/> Duplex Repeater (or Half-Duplex on Hotspots)
<input type="button" value="Apply Changes"/>	

  

MMDVMHost Configuration	
Setting	Value
DMR Mode:	<input checked="" type="radio"/> RF Hangtime: 20 Net Hangtime: 20
D-Star Mode:	<input checked="" type="radio"/> RF Hangtime: 20 Net Hangtime: 20
M17 Mode:	<input type="radio"/> RF Hangtime: 20 Net Hangtime: 20
YSF Mode:	<input checked="" 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"/>
DMR2YSF:	<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: modem Nextion Layout: G4KLX
<input type="button" value="Apply Changes"/>	

  

General Configuration	
Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	G7IBO
CCS7/DMR ID:	235
Radio Frequency:	434.000000 MHz
Latitude:	52. degrees (positive value for North, negative for South)
Longitude:	-1. degrees (positive value for East, negative for West)
Town:	Solihull
Country:	UK
URL:	http://www.mw0mwz.co.uk/pi-star/ <input type="radio"/> Auto <input checked="" type="radio"/> Manual
Radio/Modem Type:	MMDVM_HS_Hat (DBPMAT & DF2ET) for Pi (GPIO)
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public
APRS Host Enable:	<input type="radio"/>
APRS Host:	euro.aprs2.net
System Time Zone:	Europe/London
Dashboard Language:	english_uk
<input type="button" value="Apply Changes"/>	

## D-Star

### Radio:

Freq as above in DV mode

To: Use Reflector CQ CQ CQ

From: Pi-Star 434.000

### Hotspot:

Enable D-Star mode.

RPT1: Your Callsign B

RPT2: Your Callsign G

Default Reflector: DCS279 D

D-Star Configuration	
Setting	Value
RPT1 Callsign:	G71BO B ▾
RPT2 Callsign:	G71BO G
Remote Password:	*****
Default Reflector:	DCS279 ▾ D ▾ <input checked="" type="radio"/> Startup <input type="radio"/> Manual
ircDOBGateway Language:	English (UK) ▾
Time Announcements:	<input checked="" type="checkbox"/>
Callsign Routing:	<input type="checkbox"/> Connect ircDOB for call routing
Use DPlus for XRF:	<input type="checkbox"/> Note: Update Required if changed

Apply Changes

## Yaesu System Fusion (YSF) – C4FM

### Radio:

Frequency: Freq as above in DN mode

Tx ID: 12 Rx ID: 00

(The Tx ID seems to default to 12 so 00 will also work)

### Hotspot:

Enable YSF mode.

YSF Startup Host: YSF01527 – GB-GB3WL – WRC Reflector

Yaesu System Fusion Configuration	
Setting	Value
YSF Startup Host:	YSF01527 – GB-GB3WL – WRC Reflector ▾
UPPERCASE Hostfiles:	<input checked="" type="checkbox"/> Note: Update Required if changed
MiresX Passthrough:	<input checked="" type="checkbox"/>

Apply Changes

## DMR

### Radio:

This is the mode that causes most confusion as you need to set up a CODEPLUG for the radio. The full explanation of this is beyond the scope of this article and my brain but I will endeavour to explain the setup in regard to GB3WL.

### In **CODEPLUG**:

Basic Information:      Ensure Radio Name (Callsign) is correct.

                                Ensure Radio ID (DMR ID) is correct.

Digital Contacts:      TG6 LOCAL      Group Call      6      Yes

                                TG4002      Private Call      4002      No      (but NOT used for HOTSPOT)

### Channels Information:

I have set up three channels to use GB3WL. The first is a **direct Analogue** channel, the second a **direct Digital (DMR)** channel, and the third through a **HOTSPOT**.

**Channels Information**

**Digital/Analog Data**

Channel Mode: **Analog**      Channel Name: **GB3WL**

Band Width: **12.5kHz**      RX Frequency(MHz): **430.95000**

Scan List: **None**      TX Frequency(MHz): **438.55000**

Squelch: **Normal**      Admit Criteria: **Always**

RX Ref Frequency: **Low**      Auto Scan: ☐

TX Ref Frequency: **Low**      Rx Only: ☐

TOT[s]: **Infinite**      Lone Worker: ☐

TOT Rekey Delay[s]: **0**      VOX: ☐

Power: **High**      Allow Talkaround: ☐

Send GPS Info: ☐

Receive GPS Info: ☐

**Digital Data**

Private Call Confirmed: ☐

Emergency Alarm Ack: ☐

Data Call Confirmed: ☐

Compressed UDP Data Header: ☐

Emergency System: **None**

Contact Name: **None**

Group List: **None**

Color Code: **1**

Repeater Slot: **1**

Privacy: **None**

Privacy No.: **1**

GPS System: **1**

**Analog Data**

CTCSS/DCS Dec: **None**      CTCSS/DCS Enc: **67.0**

QT Reverse: **180**      Tx Signaling System: **Off**

Rx Signaling System: **Off**      ☒ Reverse Burst/Turn-off Code

☐ Display PTT ID

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Channels Information

Digital/Analog Data

Channel Mode Digital
Channel Name GB3WL-DMR

Band Width 12.5kHz
RX Frequency(MHz) 430.95000

Scan List None
TX Frequency(MHz) 438.55000

Squelch Normal
Admit Criteria Always

RX Ref Frequency Low
Auto Scan ☐

TX Ref Frequency Low
Rx Only ☐

TOT[s] 180
Lone Worker ☐

TOT Rekey Delay[s] 0
VOX ☐

Power High
Allow Talkaround ☐

Send GPS Info ☐
Receive GPS Info ☐

Digital Data

Private Call Confirmed ☐
Emergency Alarm Ack ☐
Data Call Confirmed ☐
Compressed UDP Data Header ☐

Emergency System None

Contact Name TG4002

Group List SLOT2

Color Code 5

Repeater Slot 2

Privacy None

Privacy No. 1

GPS System 1

Analog Data

CTCSS/DCS Dec None
CTCSS/DCS Enc 67.0

QT Reverse 180
Tx Signaling System Off

Rx Signaling System Off
☒ Reverse Burst/Turn-off Code

Display PTT ID ☐

Decode 1 ☐
Decode 5 ☐

Decode 2 ☐
Decode 6 ☐

Decode 3 ☐
Decode 7 ☐

Decode 4 ☐
Decode 8 ☐

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⏴
⏵
Add
Delete

Channels Information

Digital/Analog Data

Channel Mode Digital
Channel Name Pr-Star

Band Width 12.5kHz
RX Frequency(MHz) 434.00000

Scan List None
TX Frequency(MHz) 434.00000

Squelch Normal
Admit Criteria Always

RX Ref Frequency Low
Auto Scan ☐

TX Ref Frequency Low
Rx Only ☐

TOT[s] 180
Lone Worker ☐

TOT Rekey Delay[s] 0
VOX ☐

Power Low
Allow Talkaround ☐

Send GPS Info ☐
Receive GPS Info ☐

Digital Data

Private Call Confirmed ☐
Emergency Alarm Ack ☐
Data Call Confirmed ☐
Compressed UDP Data Header ☐

Emergency System None

Contact Name TG6 LOCAL

Group List SLOT2

Color Code 1

Repeater Slot 2

Privacy None

Privacy No. 1

GPS System 1

Analog Data

CTCSS/DCS Dec None
CTCSS/DCS Enc None

QT Reverse 180
Tx Signaling System Off

Rx Signaling System Off
☒ Reverse Burst/Turn-off Code

Display PTT ID ☐

Decode 1 ☐
Decode 5 ☐

Decode 2 ☐
Decode 6 ☐

Decode 3 ☐
Decode 7 ☐

Decode 4 ☐
Decode 8 ☐

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Add
Delete

## Hotspot:

Enable DMR mode.

Enable XLX master.

XLX Master:                XLX\_279

XLX Startup Module:    B

Colour Code:            1            ( This is where most people go wrong!!! It is not CC 5 )

DMR Configuration	
Setting	Value
DMR Master:	DMRGateway ▾
BrandMeister Master:	BM_2341_United_Kingdom ▾
BM Hotspot Security:	*****
BrandMeister Network ESSID:	235 ▾ None ▾
BrandMeister Network Enable:	<input checked="" type="checkbox"/>
BrandMeister Network:	Device Information   Edit Device (BrandMeister Selfcare)
DMR+ Master:	DMR+_IPSC2-DMR-GATEWAY ▾
DMR+ Network:	Options=
DMR+ Network ESSID:	235 ▾ None ▾
DMR+ Network Enable:	<input type="checkbox"/>
XLX Master:	XLX_279 ▾
XLX Startup Module:	B ▾
XLX Master Enable:	<input checked="" type="checkbox"/>
DMR Colour Code:	1 ▾
DMR EmbeddedLCOnly:	<input type="checkbox"/>
DMR DumpTADData:	<input checked="" type="checkbox"/>

Apply Changes

The Colour Code relates to the RF link from the HOTSPOT to the Radio and this must match. It does not match the CC used to access the repeater directly with RF (ie CC5).

The other important thing to note is that the default Talkgroup used on the Pi-Star is TG 6. This can be changed in EXPERT mode but it is best to leave it alone and simply use TG 6 on the CODEPLUG channel. (Use TG9 if you wish to venture into EXPERT territory, as this is the standard 'local' TG channel).

So, just to clarify, connecting from the HOTSPOT to your Radio does **not** require TG4002 or CC5 – this is purely for accessing the repeater directly with RF.

(Actually, using XLX Startup Mode B is equivalent to selecting TG4002)

## **Notes:**

I am using a Pi-Star HOTSPOT but the information provided should allow others to be configured correctly eg OpenSpots, DVMini, DVMega, etc

FM Analogue uses 25 kHz (wideband) whereas all digital modes use 12.5 kHz spacing.

DMR splits the channel into Slot1 and Slot2 each using 6.25 kHz.

C4FM uses 12.5 kHz in VM mode but only 6.25 kHz in DN mode (the other 6.25 kHz being used to carry data).

ECHO Test can be used by changing to Tx ID 14 in YSF, or Starup Mode E in DMR. Also to default reflector E in D-Star.

## **Update on Pi-Star Hotspot**

I have shown the configuration using Pi\_Star Firmware. This works well and has recently had some development. However, there is an offshoot of this firmware (WPSD) which does the same job but has a better, more modern interface (in my opinion) and certainly has a more feature rich DMR facility. They are both extremely robust pieces of work and the ability to cycle between modes is fantastic (and not really seen with other hotspots that I have used). You can simply pick up a DSTAR, C4FM, or DMR radio, transmit, and you are in to the reflector. What more could you ask for?

## **Links:**

**Original Pi\_Star**

<https://www.pistar.uk/>

**WPSD**

<https://w0chp.radio/wpsd/>

**DSTAR Registration:** <https://regist.dstargateway.org/Dstar.do>

**DMR Registration:** <https://radioid.net/>

Thank you to the fantastic efforts of some very clever people in our club in setting up and maintaining the Wythall Repeater. It is great to have such a capable resource at our disposal.

I hope that this article helps in the understanding of the system and enables more widespread usage.

Good Luck!

73's

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