Running Duplex Hotspots on Multiple Modes.

Ham radio hotspots enable you to use the digital modes like DMR, D-Star, Fusion, and others, to have QSO's around the world. This document discusses the use of a duplex hotspot for scanning multiple digital modes.

You may be aware that conventional hotspots usually have a single outside antenna to send and receive the RF signal. They are operating in the Simplex mode. Duplex hot spots usually will have two antennas, one for the transmit frequency and the other for receive frequency. This MMDVM modem has the Raspberry Pi 3B computer and a 4.2 inch screen and currently sells for around $165 US dollars from BI7JTA bi7jta.org. Of course you can build your own for less.

A duplex hotspot can also be used to create your own personal repeater. Since the power output is in the milliwatt range, it will only serve over a short distance. We won't pursue the repeater application in this document.

We will cover the duplex hotspot when used with two handy-talkies (HTs) so you can scan and transmit on either of two digital modes. For example, you can program the hotspot to scan to monitor a DMR HT and a Fusion HT on your favorite channels.

To simplify the setup, plug the Raspberry Pi computer into an Ethernet cable that is plugged into your router. Then use an app like "AdvancedIP Scanner" to learn the IP address of the connection. Enter that address in a browser window to display the Pi-Star pages.

The duplex hotspot will require some changes to the Pi-Star programming. Begin by switching the "Control Mode" on the top of the "Configuration" page to "Duplex Repeater" and click on "Apply Changes".

Control Software	
Setting	Value
Controller Software:	○ DStarRepeater ● MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	○ Simplex Node ● Duplex Repeater (or Half-Duplex on Hotspots)

Apply Changes

At the bottom of the "MMDVM Configuration" frame you will be required to select the type of screen display being used. In this example a "Nextion" 4.2 inch screen is used and the port is "Modem".

DMR2NXDN:	○	Uses / prefix on DMRGateway
POCSAG:	○	POCSAG Paging Features
MMDVM Display Type:	Nextion ⇕ Port: Modem ⇕ Nextion Layout: G4KLX ⇕	

Apply Changes

Next, on the same "General Configuration" page, separate the transmit and receive frequencies by 10 Mhz instead of the normal 5Mhz, then "Apply Changes". This will reduce the chance of crossover between your HTs when transmitting.

General Configuration	
Setting	Value
Hostname:	duplex42 Do not add suffixes such as .local
Node Callsign:	AE9EE
CCS7/DMR ID:	████████
Radio Frequency RX:	431.550.000 MHz
Radio Frequency TX:	421.550.000 MHz

Since this hotspot is transmitting on the 421.550 frequency as shown above, you will need to add a Digital Contact in your code plugs in each of your HTs for that frequency. Remember, the transmit frequency from your hotspot will be the RECEIVE frequency in your HT. The same applies to the HTs transmit frequencies. They will be set to the RECEIVE frequency on your hotspot.

Just below the frequency setting in Pi-Star is the "Radio/Modem Type" selection box. You need to set that to the type of modem you have, in this example it is a MMDVM hotspot dual hat. Then select "Apply Changes".

URL:	http://www.qrz.com/db/AE9E	⦿ Auto ◯ Manual
Radio/Modem Type:	MMDVM_HS_Hat_Dual Hat (VR2VYE) for Pi (GPIO) ⬍	
Node Type:	◯ Private ⦿ Public	

Establish a separate "Zone" and "Channels" in your code plugs in your HTs. If the hotspot is physically located close to the HTs, set their power output to their lowest power setting. In addition, you may need to increase the Squelch on your HTs if you hear any cross-over noise during test transmissions on either HT.

The settings in Pi-Star should initially be set to a Parrot channel so you can test the Duplex Hotspot with both of the Fusion and DMR HTs easily. Select "Apply Changes".

Your DMR code plug should allow you to select the 9990 parrot channel. Make sure it is set as a "Private" channel so it will work properly.

If your Fusion radio has "AMS" Automatic Mode Select, turn it off in the programming and select "DN" digital mode instead.

Before leaving the Pi-Star Configure page select the "Expert" menu item at the top. Then, select the "MMDVM Host". Within the first "General" box at the top of the page, put a "1" in the "Duplex" box and "Apply Changes".

General	
Callsign	AE9EE
Id	3102915
Timeout	240
Duplex	1
RFModeHang	300
NetModeHang	300
Display	Nextion
Daemon	1

At the bottom of the "Configuration" page Is the "Wireless Configuration" box. You can enter the WiFI channels you may be using with this hotspot. It will hold as many as 10 SSID addresses. The hot spot will then search for the strongest nearby signal from those entered and connect to that signal. This enables you to use your cell phone as a WiFi connection when operating mobile.

You can rename this hotspot to make it easier to find the IP address assigned to it when changing wifi networks. For example, if this was to be used for mobile applications, you could go to the "Configure" page. Locate the "General Configuration" box and find the "Hostname" field. You could change the name to "travelHS". Do not add any suffixes or special characters. Cycle the power to the hotspot and the new name will appear in the "Hostname" field at the top of the "Configure" page from that point on and it will appear in the name field in applications like "Advanced IP Scanner".

Troubleshooting Problems:
I discovered that my Fusion (YSF) handy talkie worked fine but when I transmitted on my DMR HT, it appeared on the screen of the hotspot, but it was not transmitting from the hotspot.

To test your connection to the server you are using, Brandmeister for example, open your Pi-Star connection and open the "ADMIN" page.

 In the ADMIN sub menu click on, "Live Logs".

It will produce a file on your screen as you test your DMR transmissions If you see something like this:

    E: 2020-12-21 16:44:15.440 DMR, Login to the master has failed, retrying network

It could be that your choice of network server is currently disabled. Try another server.

As of November of 2020 Brandmeister added a second "Hotspot Security" password that must be entered in the "DMR Configuration" box on the "Configure" page. Be sure you enter a second password that is different from your Brandmeister password.

If you have added an extension to your DMR number to identify each hotspot, for example 01, 02, or 03, make sure the same number you assigned to your hotspot matches the Security Password correctly.

Remember, talk groups like 3100 time out after a few minutes and you won't hear them and the call sign and name may not appear on the hotspot screen. Key up briefly to restore the connection.

If you have any questions, go to my QRZ page and use my email address. Good luck and 73.