

DMR to Fusion via the SharkRF OpenSpot

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Introduction

The SharkRF OpenSpot provides two methods to communicate over the Fusion radio network using a DMR radio via reflectors, which will be referred to as servers in the remainder of this document. One is to use the available YSF servers which associate each room (equivalent to a DMR talk group) to a single server, each of which has a link to Wires-X. The other is to use the available FCS servers which have ninety-nine possible rooms on a single server with a link to Wires-X. Each FCS server can have unique rooms or may have some rooms that are also hosted on other servers. The FCS servers should be inspected to determine which rooms are available on each. At the end of these instructions is a link to a web site where this information can be viewed.

The advantage of the YSF system is that it may be a bit more robust and less likely to fail since each room is on its own server with a server failure affecting only one room.

The disadvantage is switching among the YSF servers. Using the OpenSpot, switching among servers requires that the desired server be selected in the YSF configuration and the profile updated (saved). Using this method any of the YSF servers can be selected. To use the MD-380 to switch among YSF servers, an OpenSpot profile has to be dedicated to each room allowing for only four rooms on the remaining OpenSpot profiles in addition to the one being used for DMR.

The advantage to the FCS system is that the user can switch between all three of the FCS servers and any of the possible ninety-nine rooms on each server from the MD-380 using only one OpenSpot profile in addition to the one used for DMR.

Taking into consideration the pros and cons of the two Fusion systems, what follows are details for setting up a MD-380 DMR radio and SharkRF OpenSpot using the FCS servers so all the controls can be made from a DMR radio. (A supplemental section is provided at the end of this document showing a completed setup for a single YSF server for the Colorado Link. It is up to the user to edit to the OpenSpot profile to the YSF servers as desired.)

If any errors are found or there are suggestions for changes and improvements, feel free to provide details.

These instructions will cover:

On the MD-380

- Add the necessary Digital Contacts
- Add a Receive Group for administrative messages
- Add the necessary channels for a Fusion zone
- Add a ZONE for Fusion

On the SharkRF OpenSpot

- Create a Fusion Profile
- Create a Connector for FCS (Fusion)
- Edit Settings to identify the operator to the Fusion network (callsign and name)

Operations

- Enabling Fusion from the MD-380 and back to DMR
- Changing room numbers
- Changing servers and room numbers
- Who is communicating
- Observed errors/issues
- Viewing the Dashboard to see who is using what servers/rooms

MD-380 Setup

Digital Contacts

Create three **Digital Contacts** as shown below. These are **OS Admin**, **DMR Enable** and **Fusion Enable** but can be named to whatever is convenient. Talk Group 9 (**OS Admin**) is used for two purposes. All OpenSpot administrative messages are sent on Talk Group 9. OpenSpot also uses Talk Group 9 to route Fusion traffic to the DMR radio. For two of the channels, Talk Group 9 will be defined in a **Digital RX Group** so administrative messages can be heard. Talk Group 9 will be used on the normal DMR to Fusion communications channel to hear the Fusion traffic and to hear the OpenSpot administrative messages. If Talk Group 9 already exists, there is no need to create a new one. Just use the name that already exists in place of **OS Admin**.

DMR Enable and **Fusion Enable** contacts are used as private call types to send commands to the OpenSpot to switch between the DMR and Fusion profiles that will be created later in these instructions.

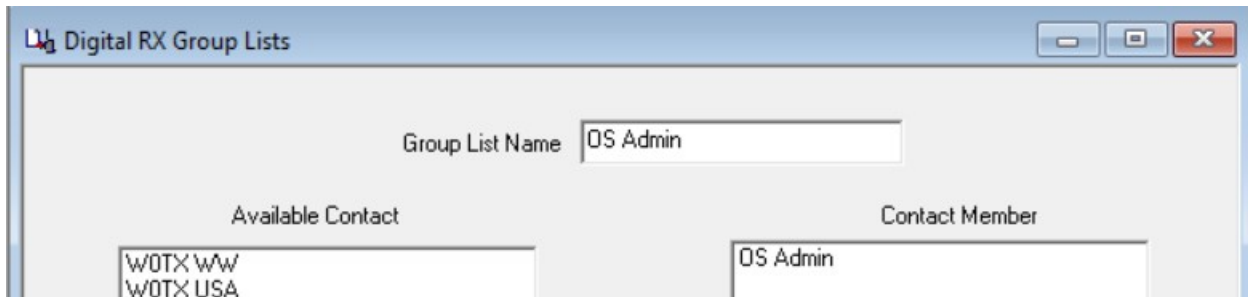
The format for the **DMR Enable** and the **Fusion Enable** talk group numbers is 9000x where x is an OpenSpot profile number. E.g. if the OpenSpot DMR profile is 3, then the number for **DMR Enable** should be 90003.

The assumption made here is that the OpenSpot DMR profile is 0 and profile 1 is not currently being used. Therefore, Talk Group 90000 and 90001 are used to switch between OpenSpot profiles 0 and 1 respectively.

Contact Name	Call Type	Call ID	Call Receive Tone
OS Admin	Group Call	9	No
OS Echo	Group Call	9997	No
OS Status	Group Call	9998	No
DMR Enable	Private Call	90000	No
Fusion Enable	Private Call	90001	No

Digital RX Group

Create a **Digital RX Group**. This group will only contain **OS Admin** (TG9). This is used so admin messages and Fusion traffic can be heard. In the **Available Contact** section, select **OS Admin** and click **Add** to move it to the **Contact Member**. The **Contact Member** section should appear as below.



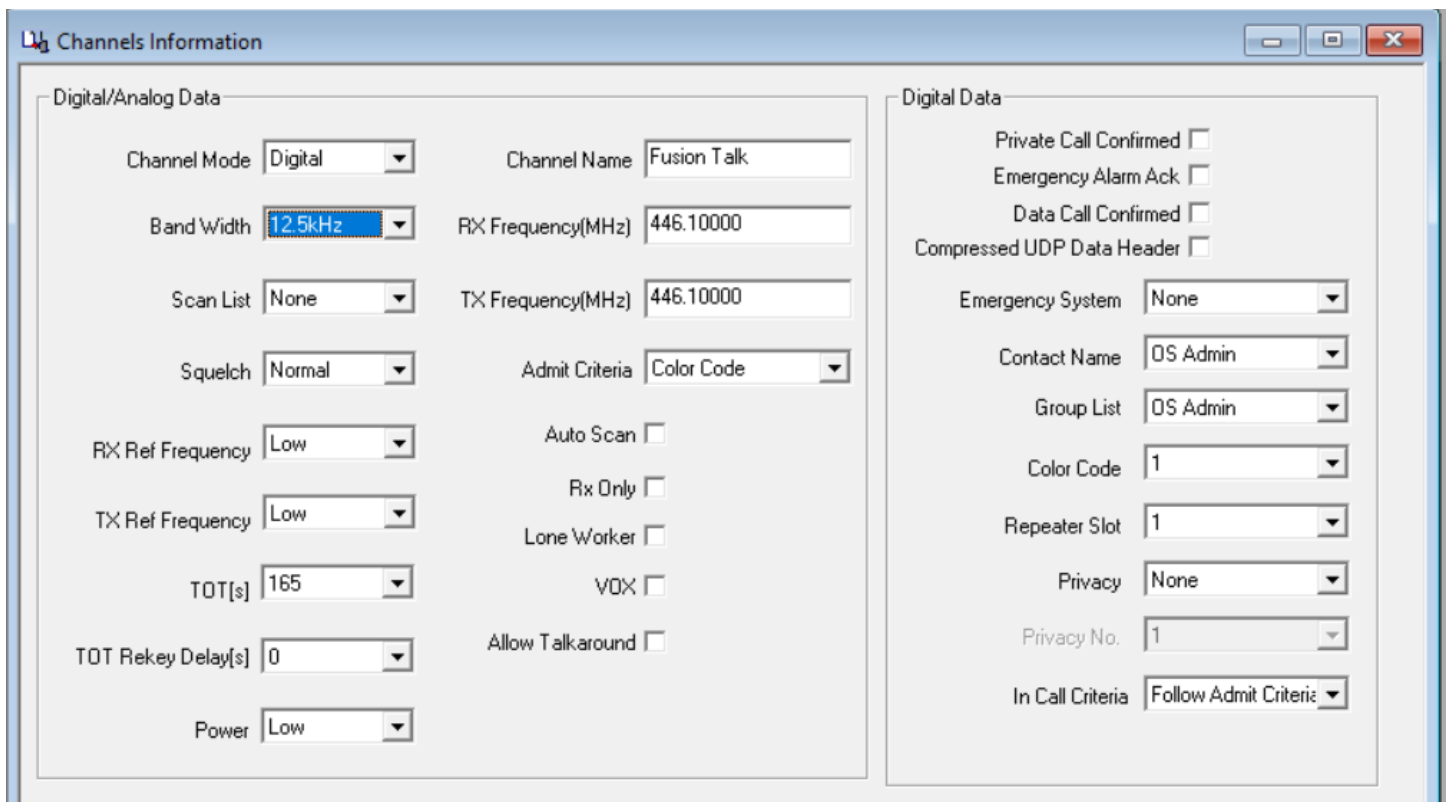
Channels

Three channels will be created.

The first is **Fusion Talk**. This channel is used for normal communications between DMR and Fusion. The **Contact Name** is **OS Admin** because OpenSpot uses the same channel for Fusion communications as it does for administrative messages.

Note the Group List entry that is needed.

Remember to use your own RX Frequency and TX Frequency.



The second is **DMR Enable**. This channel is used to switch the OpenSpot to the DMR profile. Note the Group List entry that is needed.

Remember to use your own RX Frequency and TX Frequency.

Channels Information

Digital/Analog Data

Channel Mode

Digital

Channel Name

DMR Enable

Band Width

12.5kHz

RX Frequency(MHz)

446.10000

Scan List

None

TX Frequency(MHz)

446.10000

Squelch

Normal

Admit Criteria

Color Code

RX Ref Frequency

Low

Auto Scan

TX Ref Frequency

Low

Rx Only

TOT[s]

165

Lone Worker

TOT Rekey Delay[s]

0

VOX

Power

Low

Allow Talkaround

Digital Data

Private Call Confirmed

Emergency Alarm Ack

Data Call Confirmed

Compressed UDP Data Header

Emergency System

None

Contact Name

DMR Enable

Group List

OS Admin

Color Code

1

Repeater Slot

1

Privacy

None

Privacy No.

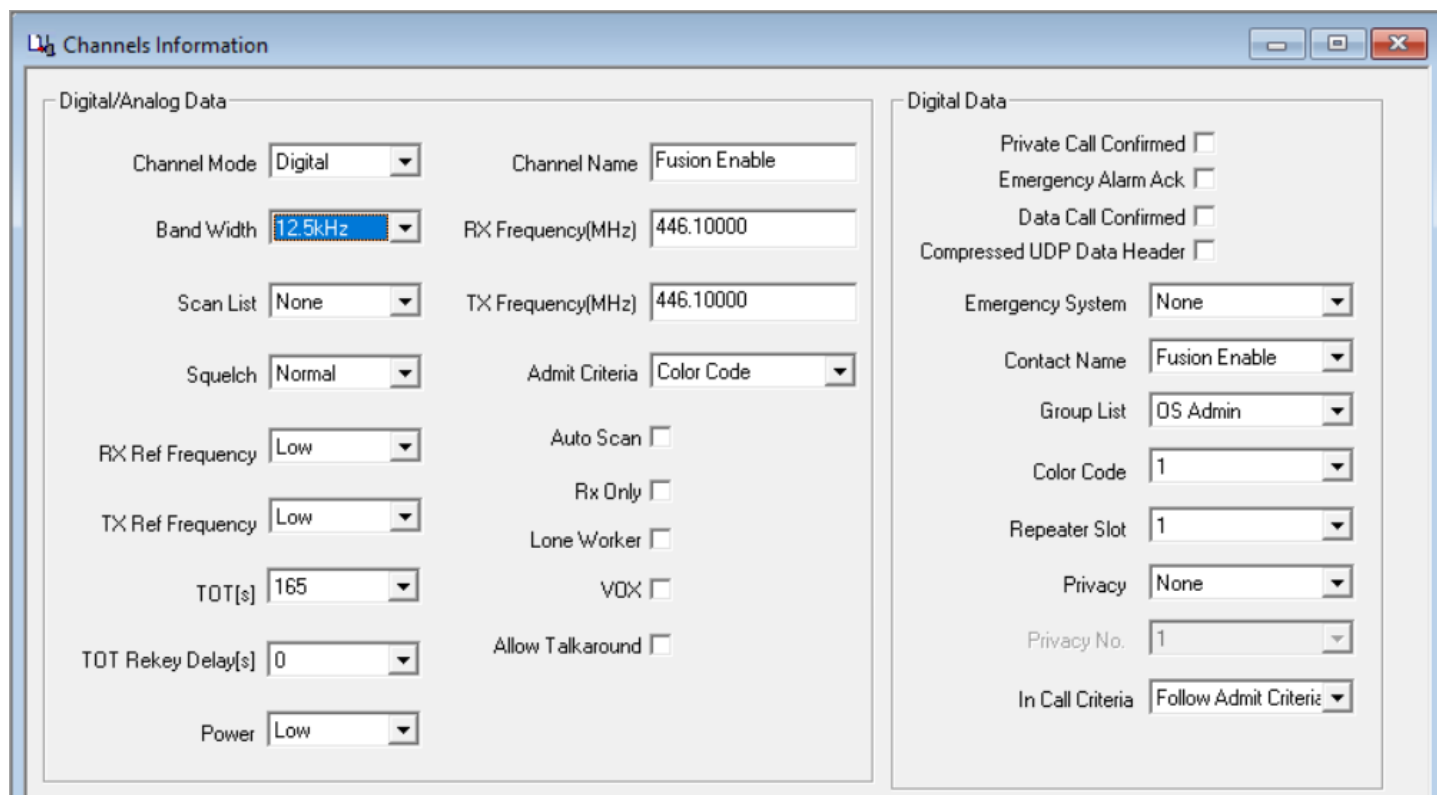
1

In Call Criteria

Follow Admit Criteria

The final channel is **Fusion Enable**. This channel is used to switch the OpenSpot to the Fusion profile. Note the Group List entry that is needed.

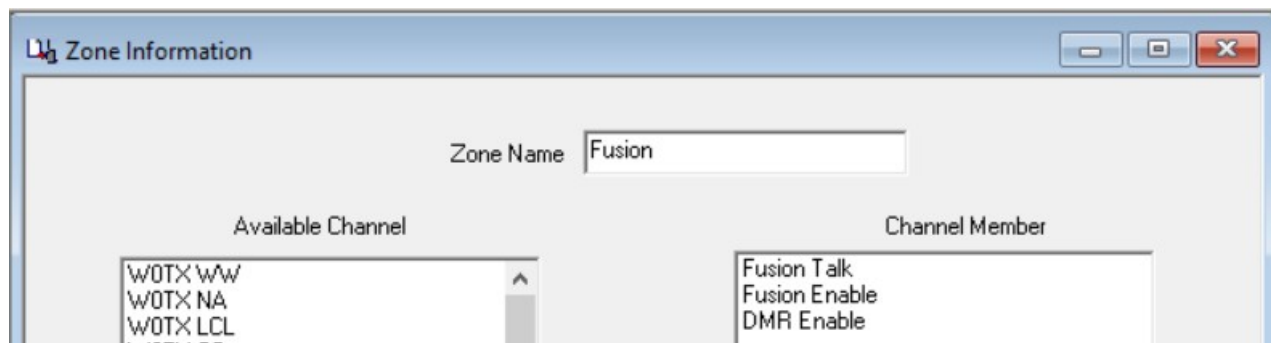
Remember to use your own RX Frequency and TX Frequency.



Zones

Create a ZONE for Fusion. (An existing zone can be used but three unassigned channels must be available for Fusion)

The Fusion zone has three channels. In the **Available Channel** section, select **Fusion Talk** and click the **Add** button to move it to the **Channel Member**. Do the same for **Fusion Enable** and **DMR Enable**. The **Channel Member** section should appear as shown below.



This completes the Codeplug programming. Save the configuration and download it to your MD-380.

At this point, set the radio to the Zone normally used for DMR.

SharkRF OpenSpot Setup

The examples shown below are with the OpenSpot not in the Advanced mode, which is the default.

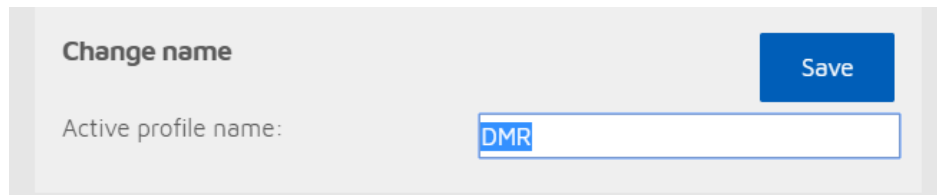
Profiles

The assumption in these instructions is that **Profile 0** is for DMR and **Profile 1** is not used and can be used for Fusion.

If **Profile 0** is not the DMR profile, replace all references to **Profile 0** in these instructions with the DMR profile number. If **Profile 1** is not available as an available profile, use the first available unused profile number and replace all references to **Profile 1** with that profile number. *The **Digital Contact** list must reflect the profile numbers used for **DMR Enable** and **Fusion Enable**. See the first step on page one.*

The following step is not necessary to make Fusion work, but it may help keep the profiles straight as to what each one does.

Go to the **Settings** tab. In the **Change name** section, the **Active profile name:** will read '0 (default)'. This is **Profile 0**. Change this to DMR (or any other name you wish) Click **Save**.

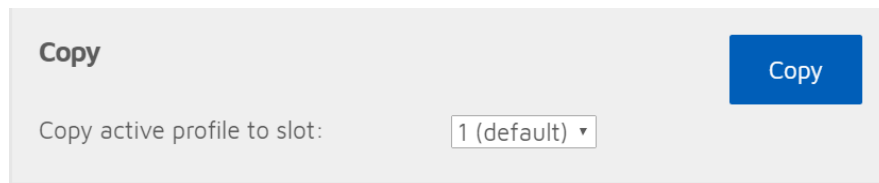


Change name

Active profile name:

Save

Copy the DMR profile to a new profile that will be used for Fusion. This is done by clicking on the **Copy** button in the **Copy** section. This will copy all DMR settings to a new profile number shown in the dropdown window.



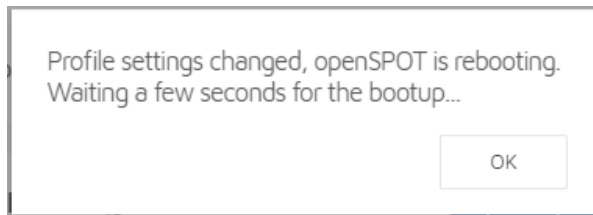
Copy

Copy active profile to slot:

Copy

Note: the next step will cause the OpenSpot to reboot !!!!

In this step, after clicking the **Change** button, a message box as shown below will appear warning that a reboot is taking place. Clicking the OK box is not needed. Once the reboot is complete, log back into the OpenSpot and proceed with the next step.



In the **Change active profile** section as shown below, the drop down box should already show '1 (default)', but if the first available profile number used to copy the DMR profile into was not 1, use the drop down box to select the profile number the DMR profile was copied into in the previous step.

Click the **Change** button in the **Change active profile** section to change the active profile to the new profile just created.

Change active profile

Change

Active profile slot:

Change to profile slot:

0 (DMR)

1 (default) ▾

As in the previous profile name change step, the following step is not necessary to make Fusion work, but it may help keep the profiles straight as to what each one does.

Change the profile name by entering **Fusion** in the **Active profile name:** field of the **Change name** section and click the **Save** button. Profiles 0 and 1 will now be identical profiles but with names DMR and Fusion respectively. The Active profile slot will now show the name 1 (Fusion).

Change active profile

Change

Active profile slot: 1 (Fusion)
Change to profile slot: 0 (DMR) ▾

Change name

Save

Active profile name: Fusion

Set OpenSpot in the **Advanced mode** by clicking the check box in the bottom right hand corner of the screen display.



Scroll down to the **C4FM settings** section.

An entry in the **Default callsign for DMR calls:** will allow the Fusion users to see who you are on the Fusion side. The suggested format is your call followed by your name. Only 10 characters are allowed.

Once entered, click **Save**.

C4FM settings

Save

Special command/cross mode private call DTMF code: *

Cross mode group call DTMF code: #

Default callsign for DMR calls: AAODH-DAVE

SQL code from modem: 0

Replace SQL code to modem: 0

Replace SQL code to net: 0

☒ Auto mute DTMF commands

☒ Transmit RX confirmation

☐ Only receive SQL code from modem

☐ Replace SQL code to modem enabled

☐ Replace SQL code to net enabled

Go to the **Connectors** tab and using the drop down box next to the **Edit connector:**, select **FCS**.

Note: In the next step, two events will occur !!!!

First, a popup as shown below will appear asking if the modem setting should be changed to C4FM. When this appears, click the **IGNORE** button. The modem setting should **NOT** be changed. The modem must remain as DMR Hotspot. If by accident the modem setting is changed, it can be corrected in a later step.

Second, once the **IGNORE** button is clicked, the OpenSpot will reboot. Following the reboot, log in to the OpenSpot and continue with the next step on the following page.

Warning: current modem mode doesn't match
the selected connector.

Would you like to switch modem to C4FM
mode?

IGNORE

CHANGE MODEM MODE

Click the **Switch to selected** button. This will associate the Fusion Connector with the Fusion profile.

Once the reboot is complete, log into the OpenSpot and complete the following:

Select the FCS server and room number. There are three servers with up to 99 rooms on each server. Selecting **007 (Colorado)** as shown below connects to the room the DRC Fusion repeater is connected to. Click **Save**.

Make sure the Modem receive frequency, Modem transmit frequency, Call sign, and CCS7 ID (DMR ID) are shown correctly in the fields below as they appear in your Codeplug.

System Fusion/FCS		Save
Modem receive frequency (MHz):	<input type="text" value="446.100000"/>	
Modem transmit frequency (MHz):	<input type="text" value="446.100000"/>	
Server / room number:	<input type="text" value="007 (Colorado)"/>	
Server address:	<input type="text" value="fcs002.xreflector.net"/>	
Port:	<input type="text" value="62500"/>	
	<input type="button" value="Add server"/>	<input type="button" value="Remove"/>
Callsign:	<input type="text" value="AAODH"/>	
CCS7 ID:	<input type="text" value="1108274"/>	
Reflector:	<input type="text" value="FCS002"/>	
Room number:	<input type="text" value="7"/>	
Keepalive interval (sec):	<input type="text" value="1"/>	
RX timeout (sec):	<input type="text" value="30"/>	

Go to the **Modem** tab and check the **Modem settings** section to make sure the **Modem settings Mode/submode** is still set to **DMR Hotspot**. If not, select **DMR Hotspot** from the dropdown and click **Save**. This is where the correction is made if the modem was accidentally allowed to change when the FCS connector was activated in the previous step.

Check the **Frequency** section to insure the **Modem receive frequency** and **Modem transmit frequency** are still set to the same frequencies used in the MD-380 Codeplug. If not, correct them and **Save**.

Modem settings

Save

Mode/submode:

DMR Hotspot ▼

Frequency

Save

Modem receive frequency (MHz):

446.100000

DMR demodulation mode:

Mode D ▼

Modem transmit frequency (MHz):

446.100000

Transmit power:

13 dBm (19.95 mW)

That completes the changes needed on the OpenSpot for access to Fusion.

Go to the **Status** tab.

If all has gone well, the status screen should appear similar to the one below (ignoring the call log), showing the **Active config profile** as Fusion, **Active Connector** as FCS, **Modem mode** as DMR/Hotspot and **Connected to:** as FCS002/007 (Colorado).

If this is not the case, some of the settings may have been entered incorrectly or the **SAVE** button was not pushed after changes were made. Go back through the procedure and check all settings.

The screenshot shows the 'Status' tab interface. At the top, there are two buttons: 'Clear call log' and 'Export call log'. Below these is a list of call logs. Each log entry shows 'To: ALL' and 'From: [Name]' (KEODNL or KOSVT), followed by 'Group C4FM voice call from net' and a timestamp 'At: 13:01:26 (late entry, DN mode 2)'. Below the call logs, the system status is displayed in a table-like format:

Status:	standby
Active config profile:	1 (Fusion - C4FM)
Active connector:	FCS
Modem mode:	DMR/Hotspot
Modem RX/TX frequency, power:	446.100000/446.100000 100%
Connected to:	FCS002/007 (Colorado)

Testing Fusion on OpenSpot

On the MD-380, select the Fusion Zone and **Fusion Talk** channel.

On OpenSpot, go to the **Connectors** tab and change the room number from **007** to **099** and click **Save**. This is the Fusion echo room.

The screenshot shows the 'System Fusion/FCS' settings screen. It has a 'Save' button at the top right. The settings are as follows:

Modem receive frequency (MHz):	446.100000
Modem transmit frequency (MHz):	446.100000
Server / room number:	099 (ECHO)
Callsign:	AAODH
CCS7 ID:	1108274

Key the radio and speak a test message. The message should be repeated back indicating Fusion is set up correctly. If the message is not repeated, go back and check all the Fusion settings.

On the **Connectors** tab, change the room number back to 007 and click **Save**.

Validating DMR is still Operational

To validate that the DMR profile still works, go to the **Settings** tab and in the **Config Profile** area, click the **Change** button in the **Change Active profile** section. It should appear as below. **This will cause a reboot of the OpenSpot.**

Config profile

Change active profile

Active profile slot:
Change to profile slot:

1 (Fusion)
0 (DMR) ▼

Change

After the reboot, on the MD-380, select the DMR zone. If DMR is not working, then the OpenSpot DMR profile may have become corrupted and will need to be checked for errors.

Operations using the MD-380

Going from **DMR to Fusion**

- On the MD-380, select the Fusion Zone
- Select the channel labeled **Fusion Enable**
- Momentarily press the **PTT** button
- The OpenSpot will reboot and provide a message announcing the change to profile 1, the FCS server and room number
- Switch the MD-380 channel back to the **Fusion Talk** channel for normal communications
- It may take a few minutes for Fusion traffic to actually start arriving. Checking the OpenSpot status screen will show Callsigns of Fusion users once that begins to occur
- User FCS/INFO is the user ID that is sent by the FCS server
- User 9998 is the user ID used for anyone not found in the MD-380 user database. See **Observed Errors/Issues** below

Going from **Fusion to DMR**

- On the MD-380 select the Fusion Zone if not already selected
- Select the channel labeled **DMR Enable**
- Momentarily press the **PTT** button
- The OpenSpot will reboot and provide a message announcing the change to profile 0 and the connection to the Brandmeister system
- Change zones to the preferred DMR zone

Changing Room Numbers in Fusion

There are three reflector servers that each contain up to 99 rooms although some are not fully populated. These are FCS001, FCS002 and FCS003. Rooms within a server can be changed in two ways as follows:

From the OpenSpot:

While in the Fusion profile, select the **Connectors** tab and change the room number and server in the **System Fusion/FCS** section. Press **Save**.

From the MD-380:

Go to **Utilities**, then **Private call**. Clear any existing entry using the **Red Delete** key, enter the desired room number, press the **Confirm** button, then momentarily press the **PTT** button. A voice announcement will be heard with a notification that the room has changed.

Clear the **Private Call** by rotating the channel selector to another channel and then return to the **Fusion Talk** channel.

By looking at the Status display of the OpenSpot the room number change can also be confirmed.

E.g. 24 will put the radio on room 24 of the current FCS server. Entering 7 will return the radio to room 7 (Colorado).

Note: Rather than manually entering the room number as a private call on the radio, Digital Contacts can be created with favorite room numbers. Channels can then be created with these Digital Contacts with the channels placed in the Fusion zone. The process would be to select the channel for the desired room, momentarily pressing the PTT switch followed by switching back to the **Fusion Talk** channel to communicate with those in the room.

Changing servers and room numbers in Fusion

From the OpenSpot:

While in the Fusion profile, select the **Connectors** tab and change the room number and server in the **System Fusion/FCS** section. Press **Save**.

From the MD-380:

Go to **Utilities**, then **Private call**. Clear any existing entry using the **Red Delete** key, enter the server number and room number as three digits, press the **Confirm** button, then momentarily press the **PTT** button. Clear the **Private Call** by turning the channel selector to another channel and then return to the **Fusion Talk** channel.

E.g. 124 will put the radio on server FCS001, room 24. Entering 207 will return the radio to the FCS002 server, room 7 (Colorado) used by the DRC repeater.

Note: Rather than manually entering the server/room number as a private call on the radio, Digital Contacts can be created with favorite server/room numbers. Channels can then be created with these Digital Contacts with the channels placed in the Fusion zone. The process would be to select the channel for the desired room server/room, momentarily pressing the PTT switch followed by switching back to the **Fusion Talk** channel to communicate with those in the room.

Who is communicating

DMR radio operators will not see the callsign of those using a Yaesu radio. The MD-380 expects to see an alias and/or a DMR ID. If an alias is present it will be sent to the DMR radio. If a DMR ID is present the DMR radio user database will be searched for a match.

To see this information on a DMR radio when someone using a Yaesu radio, the Yaesu radio operator needs to enter a DMR ID instead of a callsign in their Yaesu radio. This is not normal practice since it makes so sense to anyone using another Yaesu radio that does not use the DMR database. The callsign would appear as a number on their Yaesu radio.

If an alias is sent by another DMR radio, the MD-380 will only see the first one it gets from the network and then ignores any other aliases after that. To see a new alias, the radio has to change channels or possibly be shut down and restarted.

All callsigns are visible in the OpenSpot log on the Status page. If the callsigns need to be seen, the operator can log into the OpenSpot using a computer, tablet or smart phone and watch the log on the status screen to see the callsign of who is communicating.

Observed Errors/Issues

Since this technology is relying on the Internet and servers plus an OpenSpot to convert from DMR to Fusion and back, it is not as reliable as an analog radio connected directly to a repeater or even native DMR.

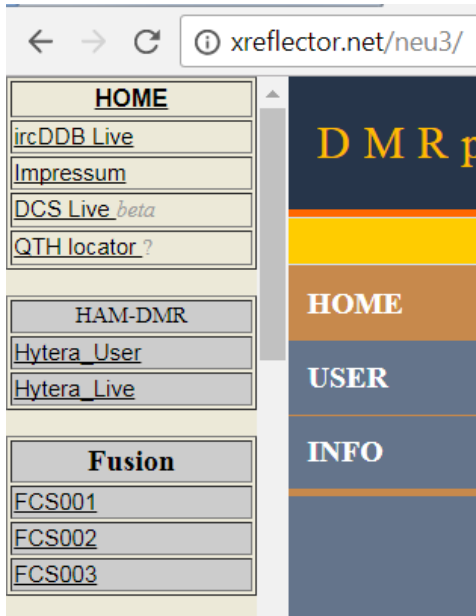
- It takes some time for the Fusion connection to be fully established before traffic to be passed to the DMR radio. **Give it at least 2 minutes** before expecting to hear anything or see any traffic on the OpenSpot log.
- The DMR radio will not show Fusion user IDs unless they are coming from other DMR users. The default ID in the OpenSpot for non-DMR users is 9998. This is what will be seen on the DMR radio.
- Communications can experience interruptions more often than with native DMR.
- At times the FCS server will repeat the announcement "CONNECT" every 15 – 45 seconds. This is not an OpenSpot problem, but a message coming from the FCS server. These are keep-alives and appear to be unreliable. Ignore it, change to another room or try later.
- The OpenSpot can become confused if switched between Fusion and DMR often and too quickly. Reboot the OpenSpot.
- Communications to the FCS can be lost completely, requiring a reboot of the OpenSpot or switching from Fusion to DMR and back. This essentially establishes a new connection to the FCS server.
- The three digit number for switching to the server/rooms on the FCS003 server shown on <http://xreflector.net/neu3/> are listed as being in the A100 to A199 range. Three digits are needed on the OpenSpot to switch to another server and room. For FCS003 the range is 300 to 399, not 100 – 199 as listed. See **Fusion Dashboard** below.

Fusion Dashboard

The Fusion Dashboard can be accessed at <http://xreflector.net/neu3/>

The three Fusion servers are shown on the left of the screen. FCS004 is not shown but can be accessed at FCS004.xreflector.net. FCS005 is a test server.

As an example, click on FCS002 in the Fusion section. The links available are HOME, USER and INFO.



Clicking on **INFO** will show all the room numbers on FCS002. The one or two digit code in the column **Group Nr** is the room number.

Clicking on **HOME** will show who logged in, when and on what server/room (Group), etc.

Clicking on **USER** will show the last heard information in the active rooms (Group).

DMRplus FCS002 Dashboard Reflector Status and Control					
Fusion Reflector System by DG1HT			Status System v0.1 FCS Server v0.1_64Bit		
HOME	Nr.	CALL	Last Heard	Name	Group
USER	1	N5YX	10 s	America Link WIRES-X	90
	2	KE0JYZ	38 s	Colorado	07
INFO	3	KJ4UGO	1 m 48 s	Alabama	02
	4	W0MEG	2 m 39 s	Minnesota	23
	5	AB2HM	6 m 7 s	New Jersey	30
	6	KF4TIM	7 m 30 s	America-Ragchew (Wires-X)	85
	7	AA0KM	9 m 23 s	Missouri	25
	8	AA5SG	10 m 3 s	Mississippi	24
	9	N0EIR	10 m 14 s	Missouri	25
	10	VA7XJ	10 m 35 s	America Link WIRES-X	90
	11	W4ZWA	14 m 43 s	America Link WIRES-X	90
	12	KC1EKZ	18 m 9 s	America Link WIRES-X	90
	13	KD6IOW	22 m 44 s	SoCal Link Society	70
	14	KA1CNF	29 m 43 s	America Link WIRES-X	90
	15	KC4SIG	29 m 46 s	Central Alabama	55
	16	N2TOX	30 m 36 s	America Link WIRES-X	90

Supplement for Fusion via YSF servers

MD-380 setup

- On the MD-380 create a new Private Call Digital Contact called Fusion-YSF with a Call ID of 90002
- Copy the Channel named Fusion Enable to a new channel and name it Fusion-YSF
- Change the Contact Name in the new channel to Fusion-YSF
- Add the Fusion-YSF channel to the Fusion zone
- Copy the new CodePlug to the MD-380

OpenSpot setup

- On the **Settings** tab, in the **Config profile** section, copy the Fusion profile to default profile 2
- Switch to that profile making it the active profile (a reboot will occur)
- Rename the default 2 profile name to one that will distinguish it from the FCS Fusion profile. Fusion-YSF is suggested

Config profile

Change active profile Change

Active profile slot: **2 (Fusion-YSF)**
Change to profile slot:

Change profile on modem RX timeout Save

Change after last RX call (sec, 0 to disable):
Change to profile slot:

Change name Save

Active profile name:

- On the **Connectors** tab create a connection as shown below. The procedure is the same as with creating a connector for the FCS servers.
- Switch to make this the active connector. A reboot will occur. Click the IGNORE button when asked to change the modem setting.
- The view below is set to the Colorado Link room used by the DRC. This view is with the OpenSpot in Advanced mode.

Connectors

Active connector: YSFReflector
Edit connector: YSFReflector ▼
Switch to selected

General settings

Save

Change to null after last RX call (sec, 0 to disable):

System Fusion/YSFReflector

Save

Modem receive frequency (MHz):
Modem transmit frequency (MHz):
Server: ▼
Server address:
Port:
Add server **Remove**
Callsign:
Keepalive interval (sec):
RX timeout (sec):

- The dashboard for this YSF server is located at:

<http://cartradioysf.ae2l.net/>

Operationally, on the MD-380 the procedure is the same as switching to the Fusion FCS profile:

- Select the **Fusion Zone**
- Select the channel for **Fusion-YSF**
- Momentarily press the **PTT** button
- Switch the channel selector back to **Fusion Talk**

Additional YSF servers can be configured but must be done by editing the OpenSpot Fusion-YSF profile or creating a new profile for each new YSF server and its associated channel on the MD-380 CodePlug. The list of available YSF servers and IP addresses can be seen in the dropdown list in the **System Fusion/YSFReflector** section on the **Connectors** tab.

The YSF server list can also be found at <https://register.ysfreflector.de/>