openSPOT•3

by **Shark RF**

Standalone digital radio IP gateway / hotspot
with built-in Li-ion battery

USER MANUAL

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openSPOT3 user manual

This user manual is for the **stable** firmware version **v68**. It's updated with new information when a new stable firmware is released.

The PDF version is available here, however we recommend using the online manual, as it gets updated when a new stable firmware is released.

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- APRS® is a registered trademark Bob Bruninga, WB4APR
- MMDVM® is a registered trademark of Shenzhen HKCNMA Co., Ltd.

Support information

The openSPOT3 is designed to be very simple to use, but if you have questions, feel free to ask them in email. You can also seek help in our community forum.

Please note that we don't have official support on other platforms like Facebook.

Package contents

The openSPOT3 package contains an **AC/USB power supply** and a **USB cable**. These are **all you need** to operate the openSPOT3, however, you will need a web browser on a computer, tablet or mobile phone for setting up the openSPOT3 through its web interface, but after that, the device can work **standalone**.

Please only use the supplied AC/USB power supply to charge the openSPOT3, unless you are plugging the openSPOT3 to a power bank, a computer or your vehicle's built-in USB power adapter. The usage of inappropriate power supplies voids the warranty.

First steps

Charging the battery

Connect the openSPOT3 to a USB power supply to start charging the battery. The openSPOT3 is fully functional while it is charging.

Powering up

Power up the openSPOT3 by pressing the power button for at least 1 second.

If the device is running with the factory default configuration, then there's an initialization running for about 15-20 seconds and the status LED will be blinking white:

After this, the LED will be slowly flashing white indicating that the device has entered access point (AP) mode and it's broadcasting its own Wi-Fi network called **openSPOT3 AP**:
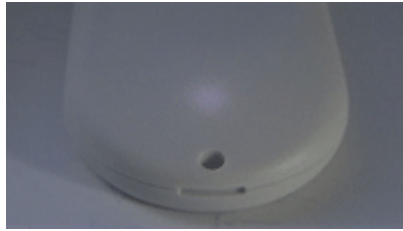
The AP mode is the openSPOT3's default mode of operation if no Wi-Fi networks are configured. AP mode lets you configure a Wi-Fi network which the openSPOT3 will connect in normal mode. You can switch between AP and normal mode anytime by pressing the Wi-Fi button for about 3 seconds.

Connecting the openSPOT3 to a Wi-Fi network

- Connect your web browser device (phone/tablet/computer) to the Wi-Fi network called **openSPOT3 AP**.

  If there is no Wi-Fi network called **openSPOT3 AP**, then make sure the openSPOT3 is in AP mode (status LED is flashing white). You can switch between AP and normal mode anytime by pressing the button for 3 seconds.

  Also make sure the openSPOT3 is placed close to your phone/tablet/computer.
- The initialization setup opens automatically.

  If the initialization setup won't open automatically, then you can open it by entering http://192.168.99.1/ into the web browser while your browser device is connected to the Wi-Fi network **openSPOT3 AP**.
- Select the country of operation, then click on the **Next** button.
- Select which Wi-Fi network the openSPOT3 will use (usually your own Wi-Fi network) by clicking on the **Connect** button at the desired Wi-Fi network. Enter the Wi-Fi network password in the Network key dialog (make sure you enter the password case sensitive), then click on the dialog's **Connect** button.
- The openSPOT3 stops broadcasting its own Wi-Fi network, and automatically tries to connect to the selected Wi-Fi network. This is indicated by the status LED becoming blue and then eventually alternating green/orange, or green.
- The web browser device (ex. your phone) detects that the **openSPOT3 AP** is no longer available, and drops the connection. It should automatically connect back to the previously used Wi-Fi network. If it does not, connect it to the same Wi-Fi network as the openSPOT3.

A successful connection to the Wi-Fi network is indicated by an alternating green/orange (or green) status LED on the openSPOT3 which means the Null connector is active and the device is connected to the Wi-Fi network.

If the openSPOT3 can't connect to the configured Wi-Fi network (the status LED stays flashing blue), then it will automatically switch back to AP mode (indicated by flashing white LED) after 1 minute. If this happens, then restart the steps written above and verify that the Wi-Fi password is entered correctly.

Quick Setup initialization

If the openSPOT3 is connected to the Wi-Fi network (indicated by green or green/orange) flashing LED, then open SharkRF Link in your web browser. Enter the openSPOT3's device UID (you can find this ID on the sticker at the bottom of the openSPOT3), then click on the **Connect** button.

The openSPOT3's web interface will open in your web browser. If not, then make sure your browser device (phone/tablet/computer) is connected to the exact same Wi-Fi network as the openSPOT3, and that the openSPOT3 is connected to the Wi-Fi network indicated be green/orange or green LED.

Fill in your callsign and IDs in the Quick setup, then click on the **Save** button.

Quick Setup

Quick Setup helps you to configure the openSPOT3 with your transceiver and connect to the preferred network.

- Select the type of your radio
- Set some basic settings like the frequency, and select the network you want to connect (this will set which connector will be used)
- Select the server to connect, set the needed network parameters (like your callsign, IDs, etc.), and click on the **Connect** button
- After the openSPOT3 is connected to the selected server it is **ready to use** with your transceiver

Setting up your transceiver

Here are some tips on setting up different types of transceivers.

DMR radio setup

- Set up a simplex channel (with the same RX and TX frequencies). You can set the timeslot to any value, as it is not used in simplex mode.
- Set the channel's color code to the openSPOT3's color code (by default it's 1, it can be changed on the Settings page, DMR settings section).
- Set the TX contact for the current channel to the talkgroup you want to talk on. If you want to use a reflector, or Homebrew call rerouting, set it to ID 9 with a group call (which means TG9).
- Create an RX group list and add TG9 to it. Assign this RX group list to the previously created simplex channel. This way you'll be able to hear the openSPOT3's voice announcements, which will be sent to TG9.
- Create a contact with private call to ID 9999, which is the openSPOT3's built-in local echo service. Make a call to this ID to test the connection between the transceiver and the openSPOT3.
- Run AutoCal in case you have voice quality issues. See the AutoCal's usage description in the Connectors section below.

Take a look at the example channel configurations.

D-STAR® radio setup

- Set the radio to single frequency mode.
- If you want to use a reflector, set the URCALL on your radio to CQCQCQ, and the local module on the openSPOT3 to D.
- If you want to use a gateway, set the URCALL on your radio to the gateway's callsign and remote module. The remote module should be the last character of the URCALL. Make sure you have registered your local module on the D-STAR® gateway registration system. If you have a registration, you have probably registered the "space" local module. In this case set your openSPOT3's local module to a space (empty) character.
- You can check your D-STAR® registration here.
- You don't have to care about RPT1 and RPT2 settings.
- You can make a test call to the openSPOT3's built-in local echo service to test the connection between the transceiver and the openSPOT3 by setting the URCALL to `.......E` (7 spaces and an E, replace dots with spaces).

Take a look at the D-STAR® APRS® page if you want to forward your transceiver's GPS position to the APRS® network.

If you use a Kenwood TH-D74A transceiver, then make sure the *Direct Reply* feature is turned off, as it basically causes automatic callsign routing, which could cause one's transmission to not be heard on the used reflector.

C4FM/Fusion® radio setup

- Set the radio to single frequency mode.
- Use digital narrow (DN) mode. Voice wide (VW) mode does not support late entry.
- If your radio has half deviation mode turned on, make sure you use the *C4FM Half Deviation* modem mode on the openSPOT3.
- You can make a test call to the openSPOT3's built-in local echo service to test the connection between the transceiver and the openSPOT3 by setting the DGID to 99 in your radio. Don't forget to set the DGID back to AUTO (or ALL or 00, depending what's available on your radio) after you've done with the local echo test.
- Run AutoCal in case you use the C4FM Half Deviation mode and there are voice quality issues. See the AutoCal's usage description in the Connectors section below.

Take a look at the Wires-X® button usage description and the C4FM/Fusion® APRS® page if you want to forward your transceiver's GPS position to the APRS® network.

NXDN® radio setup

- Set up a simplex channel (with the same RX and TX frequencies).
- Set the channel's Radio Access Number (RAN) to the openSPOT3's RAN (by default it's 0, it can be changed on the Settings page, NXDN® settings section).
- Create a contact with private call to ID 9999, which is the openSPOT3's built-in local echo service. Make a call to this ID to test the connection between the transceiver and the openSPOT3.
- Run AutoCal in case you have voice quality issues. See the AutoCal's usage description in the Connectors section below.

P25 radio setup

- Set up a simplex channel (with the same RX and TX frequencies).
- Set the channel's Network Access Code (NAC) to the openSPOT3's NAC (by default it's 0, it can be changed on the Settings page, P25 settings section). Note that **the openSPOT3 requires the NAC in decimal format** (example: if you have the NAC 0x293 in your radio then you have to enter 659 in the openSPOT3).
- Create a contact with private call to ID 9999, which is the openSPOT3's built-in local echo service. Make a call to this ID to test the connection between the transceiver and the openSPOT3.
- Run AutoCal in case you have voice quality issues. See the AutoCal's usage description in the Connectors section below.

POCSAG pager setup

- Make sure you set the your pager's receive frequency to the openSPOT3's POCSAG frequency, and that the baud rates match. Polarity should be

normal. The openSPOT3's POCSAG frequency and other settings can be changed on the Settings page, POCSAG settings section.

- Make sure you set the RIC(s) in your pager's configuration to the address(es) you want to receive messages on.
- See the DAPNET Wiki for more information about POCSAG and DAPNET.

Example DMR radio channel configurations

Hytera

Motorola

Voice Announcement File	None
Dual Capacity Direct Mode	☐
Timing Leader Preference	Eligible
Scan/Roam List	None
Auto Scan	☐
Color Code	1
Repeater/Time Slot	1
Phone System	None
ARS	Disabled
Enhanced GNSS	☐
Window Size	8
Privacy	☐
Privacy Alias	Privacy Key1
RAS Alias	None
Option Board	☐
Option Board Trunking	☐
Lone Worker	☐
Allow Talkaround	☐
IP Site Connect	☐
Per-Site RSSI Threshold (dBm)	-108
Messaging Delay (ms)	60
Compressed UDP Data Header	None
Text Message Type	Proprietary
Channel Inhibit	☐
Fist Microphone Disable	☐
Telemetry VIO 1 GPO Level	Default
Telemetry VIO 2 GPO Level	Default
Telemetry VIO 3 GPO Level	Default
Telemetry VIO 4 GPO Level	Default
Telemetry VIO 5 GPO Level	Default
RX Only	☐

RX

Frequency (MHz): 433.900000

Ref Frequency: Default

Group List	List1
Emergency Alarm Indication	☐
Emergency Alarm Ack	☐
Emergency Call Indication	☐
Emergency Call Decode Tone	☐

Offset (MHz): 0.000000

Copy

TX

Frequency (MHz): 433.900000

Ref Frequency	Default
Contact Name	TG216
Emergency System	None
VOX	☐
Power Level	Low
TOT (sec)	495
TOT Rekey Delay (sec)	0
Allow Interruption	☐
TX Interruptible Frequencies	☐
Admit Criteria	Channel Free
In Call Criteria	Always
RSSI Threshold (dBm)	-124
GNSS Revert	Selected
Private Call Confirmed	☐
Data Call Confirmed	☑
Location Data Delivery Mode	Follow Data Call Confirmed
Enhanced Channel Access	☐
CSBK Data	☐

Tyt

Digital/Analog Data

Channel Mode	Digital	Channel Name	OSW
Band Width	12.5kHz	RX Frequency(MHz)	433.90000
Scan List	None	TX Frequency(MHz)	433.90000
Squelch	Normal	Admit Criteria	Channel Free
RX Ref Frequency	Low	Auto Scan	☐
TX Ref Frequency	Low	Rx Only	☐
TOT[s]	555	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	TG216	
Group List	GroupList1	
Color Code	1	
Repeater Slot	1	
Privacy	None	
Privacy No.	1	

Analog Data

CTCSS/DCS Dec	None	CTCSS/DCS Enc	None	Decode 1 ☐
QT Reverse	180	Tx Signaling System	Off	Decode 2 ☐
Rx Signaling System	Off	☑ Reverse Burst/Turn-off Code		Decode 3 ☐
☐ Display PTT ID				Decode 4 ☐

Decode 5 ☐
Decode 6 ☐
Decode 7 ☐
Decode 8 ☐

DMR usage notes

There are two basic types of DMR calls your transceiver can transmit or receive: **private** and **group**. The openSPOT3 forwards what it receives from your radio to the network, or from the network to your radio. The network may forward your calls to its other connected stations (hotspots/repeaters/gateways) or calls from other connected stations to you based on linked **talkgroups** and **reflectors**.

Talkgroups and reflectors are network features, **they are completely handled by the network and not the openSPOT3**, and their behavior may be different on each network.

Talkgroups

DMR networks usually have **static** or **dynamic** linking available for a talkgroup. Statically linked TGs **remain linked all the time**, dynamically linked TGs stay linked for you **only for a limited amount of time after the last call** (usually 15 minutes on BrandMeister, depending on the currently used server's configuration).

Having a talkgroup linked either dynamically or statically means that stations which have the same linked talkgroup will receive all (usually group) calls sent to that talkgroup.

Dynamic talkgroups

You can link a TG dynamically by simply starting a (group) call to the talkgroup ID. The network will automatically link your openSPOT3 to the called TG ID.

To **unlink** all dynamically linked talkgroups, call TG4000 (start a short group call to DMR ID 4000).

Note: calling TG4000 will also unlink linked reflectors, not just all dynamic talkgroups.

Dynamic talkgroups on the BrandMeister Network

The BrandMeister Network lets you call any talkgroup ID and will create that talkgroup dynamically for you.

There's BrandMeister Network feature for hotspots called **auto static talkgroups**: the first talkgroup ID you call **after calling TG4000** will be linked auto static which means **it won't be unlinked after a timeout**. You can unlink this auto static TG by calling TG4000.

Static talkgroups on the BrandMeister Network

Statically linked TGs can be configured on the BrandMeister Network's dashboard after logging in, or by using the openSPOT3's BrandMeister Manager.

Static talkgroups on DMRplus/IPSC/other networks

You can define what TGs to link statically at the DMRplus options section at the bottom of the Homebrew/MMDVM® connector settings page.

MMDVM options for DMRplus

☑ Use DMRplus options

Start reflector:	4001 Germany
Start reflector ID:	4001
Relink time (min):	

☐ User link allowed

Static TG TS1 #1:	1
Static TG TS1 #2:	
Static TG TS1 #3:	
Static TG TS1 #4:	
Static TG TS1 #5:	
Static TG TS2 #1:	
Static TG TS2 #2:	
Static TG TS2 #3:	
Static TG TS2 #4:	
Static TG TS2 #5:	
Raw options:	StartRef=4001;UserLink=0;TS1_1=1;

Reflectors

Reflector IDs are between DMR ID 4000 and 5000. To link a reflector, start a short **private** call to the reflector ID. To unlink the reflector, start a short **private** call to DMR ID 4000.

Only 1 reflector can be linked at a time. To talk on the linked reflector, send your calls to DMR ID 9 with a group call (TG9). You'll receive all calls from the reflector also to TG9.

Reflectors on the BrandMeister Network

Reflectors have been turned off on the BrandMeister Network since 2020. Most servers already have them disabled. **Use talkgroups instead.**

Advices for hotspot usage

BrandMeister Network

Avoid statically linking talkgroups and only **use one auto static talkgroup at a time**.

DMRplus/IPSC/other networks

Define what TGs to link statically at the DMRplus options section at the bottom of the Homebrew/MMDVM® connector settings page.

Changing modules on XLX servers

To unlink the currently linked module, call DMR ID 4000. To connect to module A, call DMR ID 4001, for module B call DMR ID 4002 and so on.

Example

If you have TG969 linked either dynamically or statically, then the server will forward group calls (coming from other stations (repeaters, hotspots, gateways)) going to DMR ID 969 to your openSPOT3. Your openSPOT3 will transmit it on RF and your radio will receive it. Your radio will open the squelch if:

- The TX contact of the currently active channel is set to TG969, or
- You have an RX group list with TG969 in it and this RX group list is assigned to the currently active channel.

D-STAR® APRS®

You can set up the openSPOT3 to forward your D-STAR® transceiver's location information to the APRS® network, so it will be visible on APRS® maps like aprs.fi

Setting up the APRS® connection

First you have to set up the APRS® special connector using the openSPOT3's Quick Setup.

Make sure you check the **Enable in background** checkbox. You don't need to check the **Allow uploading device location** checkbox for D-STAR® location forwarding.

You can verify the APRS® connection status on the Status page.

Setting up your D-STAR® transceiver

The following setup is described using the Icom ID51's menu structure. The menu structure of your transceiver may be different, but the names of the settings should be the same or similar.

Enabling the GPS receiver

Go to **Menu** > **GPS** > **GPS Set** > **GPS Select** and select **Internal GPS**.

Selecting the position data format

Go to **Menu** > **GPS** > **GPS TX Mode** and select **D-PRS (DV-A)**. This is the easiest method. You can enable the **Course/Speed** extension.

Now your radio will transmit location information during your calls if it has a GPS fix and you hold the PTT for at least 5-10 seconds. The APRS® location comment will be your D-STAR® radio's TX message (**Menu** > **My Station** > **TX Message**).

Advanced settings

If you want to select your own APRS® symbol, SSID and comment for your transceiver then enable *Advanced mode*, go to the Connectors page, open the APRS® connector settings, and enable forced SSID/symbol/comment.

You can also set the APRS® symbol and SSID in your transceiver without using forced settings on the web interface: select the **NMEA(DV-G)** GPS TX mode. Enable the **RMC** and **GGA** GPS sentences. Other sentences are ignored by the openSPOT3 so turn them off.

You can set the APRS® symbol for your transceiver by entering it as the first 2 characters of the **GPS Message**. You can use the symbol selector on the openSPOT3's web interface at the APRS® connector settings to find out the character code of a symbol.

You can set an SSID for your transceiver by entering it after the APRS® symbol in the GPS Message.

Setting a symbol and an SSID is optional. You can enter 2 space characters for the APRS® symbol, or nothing for the SSID, or you can leave the GPS message completely empty if you want.

GPS message examples:

- House symbol with no SSID: `/y`
- Car symbol with SSID 9: `/>9`
- Default symbol with SSID 12: `..12` (replace the 2 dots with 2 spaces)

Using the Wires-X® button

If the openSPOT3's modem is in C4FM (or C4FM Half Deviation) modem mode, then the device will automatically broadcast Wires-X information which will be displayed on radios in **Wires-X mode**. You can switch your C4FM/Fusion® radio into Wires-X mode by **pressing its Wires-X button** (sometimes labelled as **DX button**).

Note that the transceiver on the animations shown on this user manual page display the device as "openSPOT 2". Everything described here apply both to the openSPOT2 and openSPOT3.

The openSPOT3 displays the currently active configuration profile number at the bottom right corner of the FT2D's display. Displayed information may look different on other type of C4FM/Fusion® radios. The examples here are demonstrated using an FT2D.

Using your openSPOT3 with a C4FM/Fusion® radio in Wires-X mode is very convenient as you'll always **see the active server's name**, and you can **easily switch between servers** using the radio's user interface.

Listing servers

You can get a server listing by selecting the **Search & Direct** option and then selecting the **All** button.

The first 5 entries will be your openSPOT3's configuration profiles. The list will contain the servers of the currently active connector. In case the currently active connector does not have a server list (ex. the Null connector), YSFReflector servers will be listed. To switch to an entry, select it using the dial and press PTT for a short time (or just tap on it in case you have a touch display).

Note that the openSPOT3 does not check server online count, that's why it is 0 for all servers. The reason is that it also supports connecting to cross mode servers using the X button, not just YSFReflectors.

Searching for servers

You can search in the server list by selecting the **Search & Direct** option and then selecting the **Search & Direct** button.

You can enter a part of the server name. All matching servers will be listed. To switch to a server, select it using the dial and press PTT for a short time (or just tap on it in case you have a touch display).

Direct ID entry

You can connect to YSFReflector servers directly if you know the desired server's ID. Select the **Search & Direct** option, then select the **Search & Direct** button, then select the **ID** button. Enter the server ID and then select the **ENT** button. Server IDs are 5 digit long, make sure you've entered all digits otherwise the radio won't let you select the **ENT** button. Also make sure the ID starts with a **# character** (not all transceivers enter the # before the ID automatically).
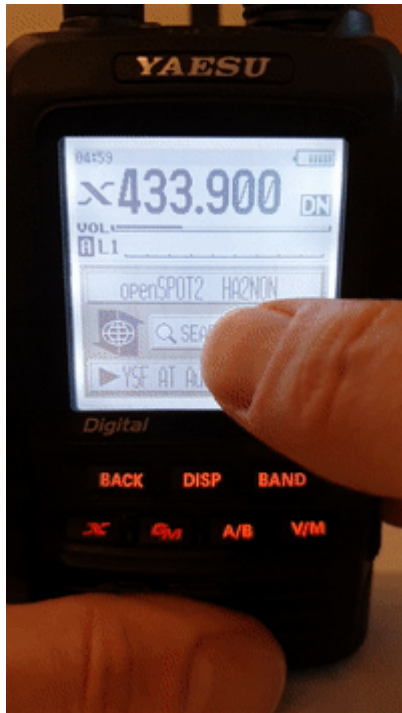
Categories

You can save your favorite servers by adding them to categories. The openSPOT3 will automatically switch to the saved server's connector in case it's needed.

Adding a server

Select the server name on the main Wires-X screen (the option at the bottom). This will load the station information screen. Select the **Add** button, then select a category.
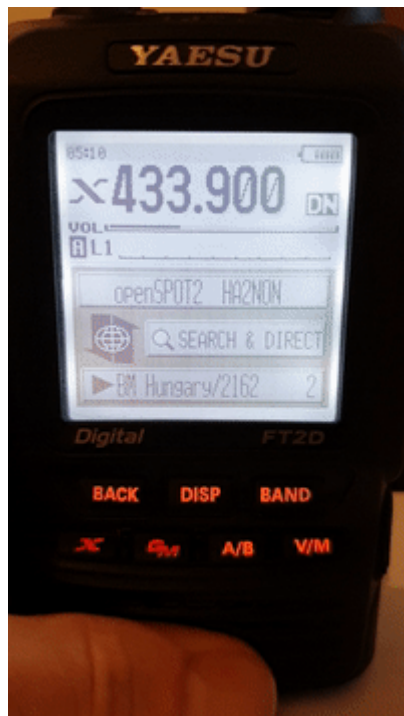
Recalling a server

Select the **Search & Direct** option, then select a category to list its saved servers. To switch to a server, select it using the dial and press PTT for a short time (or just tap on it in case you have a touch display).

Deleting/renaming

You can delete a server from a category in your radio's **main settings menu**. Select the **Wires-X** option and then the **Remove room/node** option.
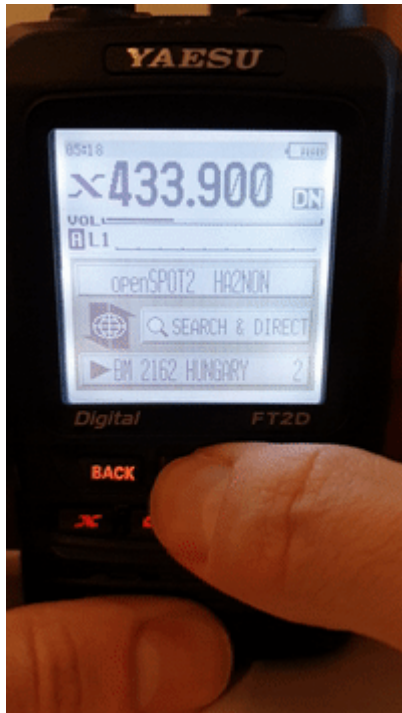
You can rename a category also in this **Wires-X** menu.

C4FM/Fusion® APRS®

You can set up the openSPOT3 to forward your C4FM/Fusion® transceiver's location information to the APRS® network, so it will be visible on APRS® maps like aprs.fi

Setting up the APRS® connection

First you have to set up the APRS® special connector using the openSPOT3's Quick Setup.

Make sure you check the **Enable in background** checkbox. You don't need to check the **Allow uploading device location** checkbox for C4FM/Fusion® location forwarding.

You can verify the APRS® connection status on the Status page.

Setting up your C4FM/Fusion® transceiver

The following setup is described using the Yaesu FT2D's menu structure. The menu structure of your transceiver may be different, but the names of the settings should be the same or similar.

Enabling the GPS receiver

Go to **DISP** > **APRS®** > **GPS POWER** and select **ON**.

Enabling GPS data sending during voice calls

Go to **DISP** > **TX/RX** > **DIGITAL** > **LOCATION SERVICE** and select **ON**.

Now your radio will transmit location information during your calls if it has a GPS fix and you hold the PTT for at least 2-3 seconds. The openSPOT3 will automatically set an SSID and symbol for location reports based on the transceiver type in the received location data.

Advanced settings

If you want to select your own APRS® symbol, SSID and comment for your transceiver then enable *Advanced mode*, go to the Connectors page, open the APRS® connector settings, and enable forced SSID/symbol/comment.

LED states

The openSPOT3 has two LEDs: one Status LED and one Power LED. Note that the appearance of the LEDs may differ from what is displayed below.

Status LED

- Factory default configuration, access point (AP) mode initializing:
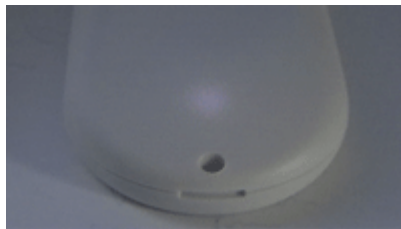
    This LED state is shown when the openSPOT3 is running with the factory default configuration. The initialization takes about 15-20 seconds.
- Access point (AP) mode active, no clients connected:
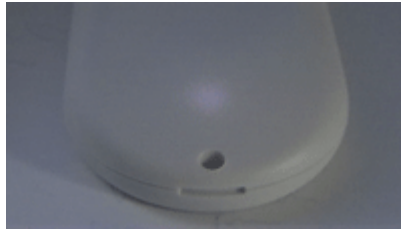
AP mode is the openSPOT3's default mode of operation if no Wi-Fi networks have been configured.

The LED will show this state if the openSPOT3 is broadcasting its own Wi-Fi network called **openSPOT3 AP**. See the Connecting the openSPOT3 to a Wi-Fi network section for information on how to connect to this access point and set up the openSPOT3.

If you've previously set up the openSPOT3 and want to switch it back to normal mode, press the Wi-Fi button for 3 seconds.

- Access point (AP) mode active, client connected:
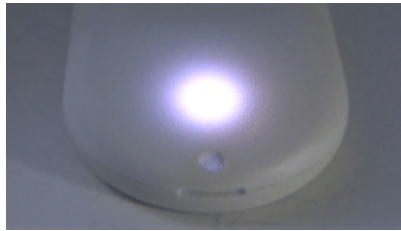
The LED will show this state if you've connected your browser device (phone/tablet/computer) to the openSPOT3's own Wi-Fi network called **openSPOT3 AP**.

- openSPOT3 is trying to connect to a Wi-Fi network:

Connecting to a Wi-Fi network should only take 10-20 seconds. If the LED is showing this state for too long, then please make sure you are in the range of a previously set Wi-Fi network, or turn on AP mode by pressing the Wi-Fi button for 3 seconds, and set up a new Wi-Fi connection again. See the Connecting the openSPOT3 to a Wi-Fi network information on how to set up a Wi-Fi network connection in AP mode.

Also please refer to the troubleshooting section for additional help.

- openSPOT3 is connected to the Wi-Fi network and trying to connect to the selected server:

Connecting to a server should only take a few seconds. If the LED is showing this state for too long, then please see more information in the Troubleshooting section.

- openSPOT3 is connected to the Wi-Fi network and a special connector is active (ex. Null connector or AutoCal):

- openSPOT3 is connected to the selected server and is standing by:

- openSPOT3 is connected to the selected server and is in powersave mode:

- openSPOT3 is connected to the Wi-Fi network, but there's a problem with the internet connection:

The LED will show this state if the openSPOT3 is connected to a Wi-Fi network, trying to connect to the selected server, but it can't because there's a problem with the internet connection. This error can be caused if the router, network, or the internet service provider is using a proxy or some kind of traffic filtering which blocks the openSPOT3 from connecting.

- Upgrading Wi-Fi module firmware:

The LED may show this state for 1-2 minutes after a successful firmware upgrade, if there's a new Wi-Fi module firmware is available and being flashed to the openSPOT3's Wi-Fi module.

Do NOT unplug the openSPOT3 during the upgrade!

- Modem transmitting:
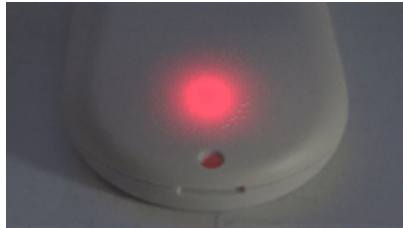
A brief yellow LED during transmission signals an invalid received packet sequence number (which means network packet loss).

- Modem trying to transmit, but an active BCLO is preventing it:

- Modem receiving:

- Hardware error:

If you see this LED state then please refer to the troubleshooting section for help.

- Bootloader running, standing by:
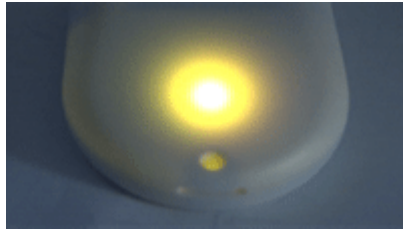
The LED will show this state only when the bootloader has been started manually. If you see this state after powering up the device, and normal device operation can't be resumed then please refer to the troubleshooting section for help.

- Bootloader working, upgrading firmware:
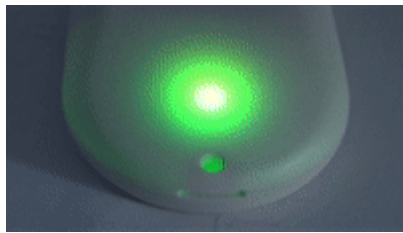
The bootloader will automatically reboot and start the openSPOT3 after an automatic firmware upgrade.

Do NOT unplug the openSPOT3 during the upgrade!

Power LED

- Fast charger detected
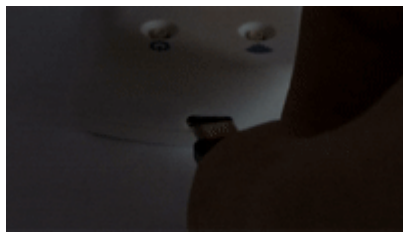
The openSPOT3 starts charger detection when a USB cable is plugged in. It signals that a fast charger is detected by blinking the power LED green twice.

- Normal charger detected

The openSPOT3 starts charger detection when a USB cable is plugged in. It signals that a normal charger is detected by blinking the power LED green once.

- Charging, full charge
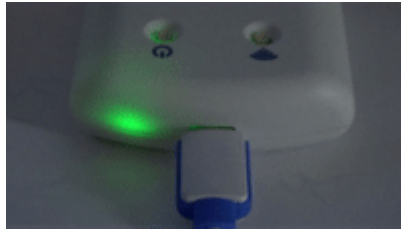
- Charging, almost full charge

- Charging, medium charge

- Charging, low charge

- Normal operation, full charge

- Normal operation, medium charge

- Normal operation, low charge

A low charge is also signalled by the beeper (if it's enabled).

- Charge error
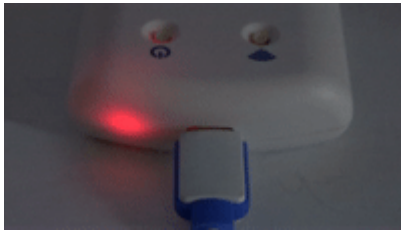
Please refer to the troubleshooting section for help.

Button usage
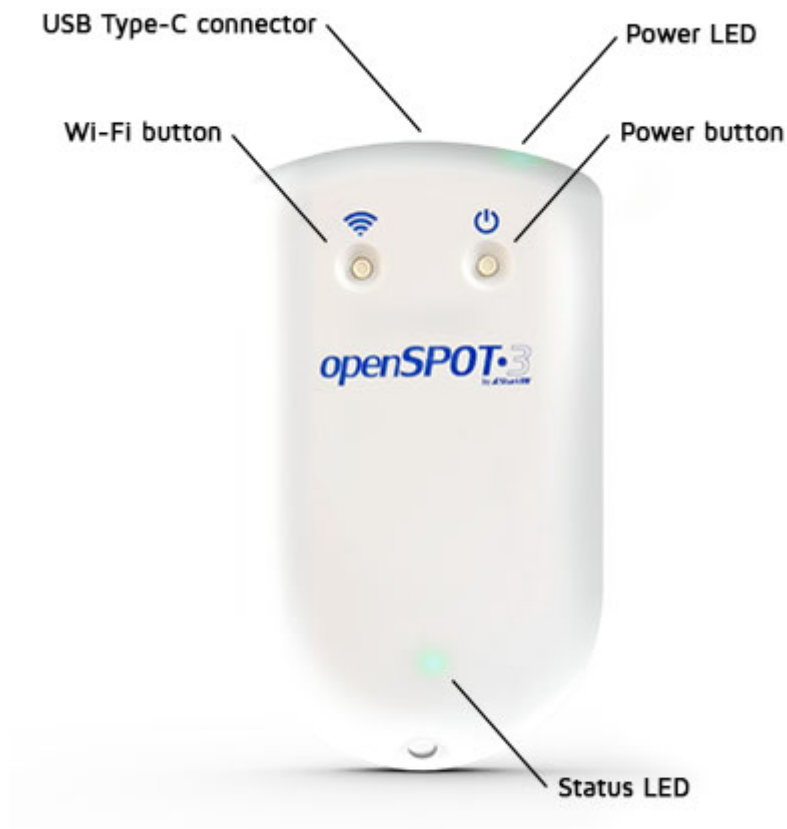
Please only use your fingers, or a ballpoint pen to press the buttons. Don't use sharp items like a needle!

Power button

You can turn on/off the device by pressing the power button for a few seconds. The device reboots if the power button is held more than about 8 seconds.

If the openSPOT3 is turned on, then the power LED will blink white while the power button is held. The blink interval indicates how much time is left until the power button press is confirmed. Confirmation is indicated by two short white power LED blinks and an audible beep (if the beeper is enabled). There will be no confirmation if the power button is held more than about 8 seconds (hard reset).

If you press the power button for a short time, then the power LED will immediately signal the current charge level.

Note that about 5-10 seconds have to pass after turning off the device before it can be turned on again.

Press the Power button 3 times quickly and the openSPOT3 will beep the letter P followed by the currently active profile number and the profile's name in Morse code. Note that if the **Unlink when power button pressed 3 times** setting is enabled on the Settings page, Miscellaneous settings section, then an unlink will be performed instead of playing back the currently active profile number and name on the beeper in morse code. Please see the Settings page, Miscellaneous settings for further details.

Wi-Fi button

Hold the Wi-Fi button for at least 3 seconds to switch the openSPOT3 between Wi-Fi access point (AP) mode and normal mode.

If the openSPOT3 is turned on, then the Wi-Fi LED will blink white while the Wi-Fi button is held. The blink interval indicates how much time is left until the Wi-Fi button press is confirmed. Confirmation is indicated by two short white status LED blinks and an audible beep (if the beeper is enabled).

- In **AP mode**, the openSPOT3 broadcasts its own Wi-Fi network called **openSPOT3 AP**. The status LED is flashing white in access point (AP) mode and steady white if a Wi-Fi client is connected. You can use this mode to set the openSPOT3's Wi-Fi networks. See the First steps section for more information.
- In **normal mode**, the openSPOT3 is trying to connect to one of the Wi-Fi networks which have been set on the Network page, Wireless settings section (or using the Initialization setup in AP mode).

  If there's no Wi-Fi network set on the Network page (Wireless settings section) then the openSPOT3 automatically switches to AP mode.

Hold the Wi-Fi button for 30 seconds to perform a full factory reset. In this case all configuration profiles will be cleared.

Press the Wi-Fi button 3 times quickly to enable/disable powersaving. A different confirmation tone will be played on the beeper if powersaving is enabled.

Opening the web interface

You can use SharkRF Link to easily open the web interface of the openSPOT3. Enter the **device UID** (you can find this ID on the **sticker at the bottom of the openSPOT3**), then click on the **Connect** button.

All entered device UIDs will be saved in your web browser's local storage so you don't have to enter them again. Just click on each openSPOT3's Connect button to open their web interfaces.
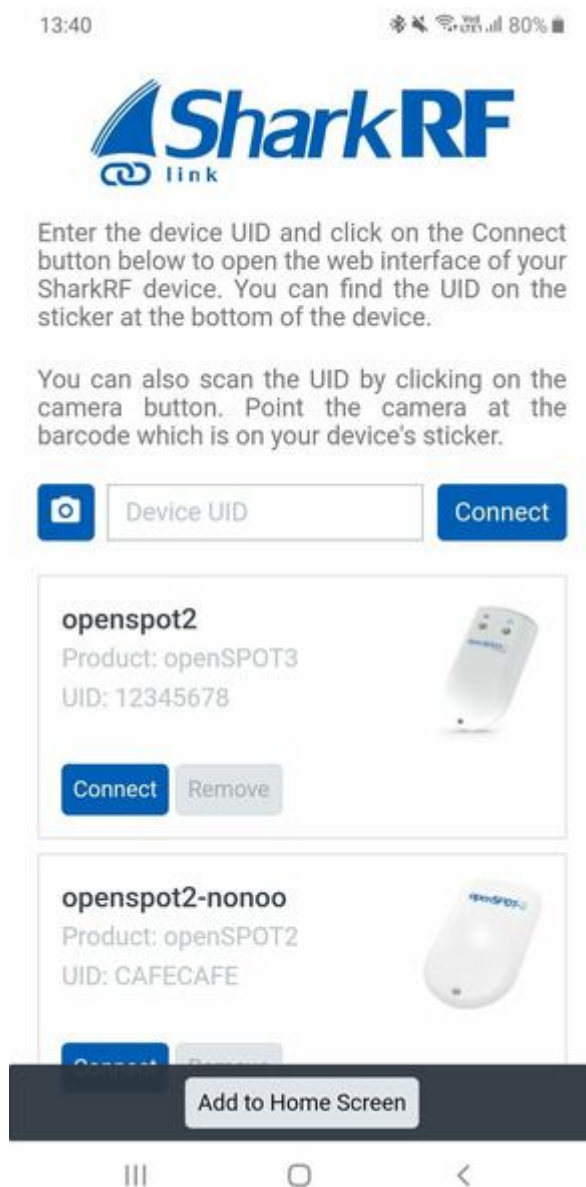
Please keep in mind that your computer/tablet/phone with which you've opened SharkRF Link needs to be on the same network the openSPOT3 is connected to.

You can also add the SharkRF Link application to your phone's home screen by clicking on the **Add to Home Screen** button at the bottom of the page on your mobile phone's browser.

If you are using an iPhone and the **Add to Home Screen** button does not appear at the bottom of the SharkRF Link page, you can use the following method to add the app icon to your home screen:

- Open SharkRF Link in the browser
- Click on the iPhone's **Share icon** at the bottom
- Click on the **Add to Home Screen** button

You can see the whole process on this animation:
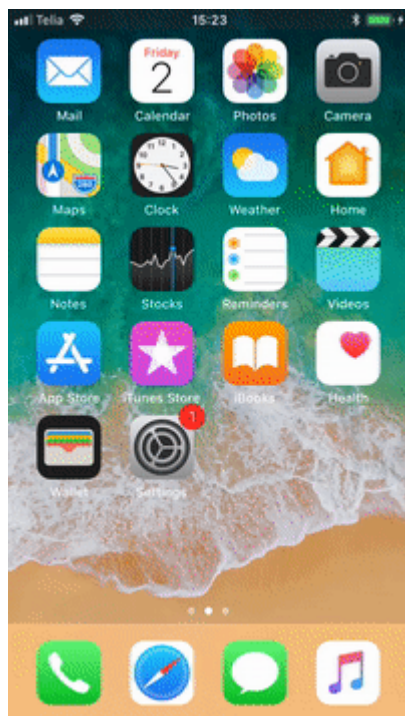
Other ways to open the web interface

You can also open the web interface by entering http://openspot3.local or http://openspot3/ or the openSPOT3's IP address into the web browser.

The recommended way is to use SharkRF Link to open the web interface.

Please keep in mind that **your computer/tablet/phone needs to be connected to the same network the openSPOT3 is connected to**. If the web interface does not open, then check if the openSPOT3 is connected to the Wi-Fi network by looking at its status LED. Please see the LED states section for possible status LED states. If the openSPOT3 is not connected to the Wi-Fi network according to the status LED, see the Troubleshooting page for help fixing the connection.

If the openSPOT3 is connected to the Wi-Fi network, but you still can't open the web interface, then check the **Wi-Fi client isolation** in your Wi-Fi router's settings. It should be turned off.

If you prefer opening the openSPOT3's web interface using its IP address, then there are several methods to find out the openSPOT3's IP address:

- Look at the DHCP clients list in your router's web interface.
- If voice announcements are enabled on the openSPOT3, you can query the active IP address:

    - **DMR:** start a call to the IP address query ID (by default it's 9997). In DMR mode, voice announcements are sent to TG9, so to hear them, make sure you have TG9 in your radio's RX group list.
    - **D-STAR®:** start a call to the repeater info callsign `.......A` (7 spaces and an A, replace dots with spaces), or enter DTMF code B.

- **C4FM/Fusion**®: enter the Special command/cross mode private call DTMF code (by default it's *) followed by DTMF code B.
    - **NXDN**®: start a call to the IP address query ID (by default it's 9997).
- On Android and iOS phones, you can use MDNS/Bonjour and network discovery applications. A recommended app for Android is Fing Network Tools.

Notes: Android phones do not support LLMNR or MDNS name resolving so http://openspot3/ and http://openspot3.local/ won't work. Use SharkRF Link or enter the IP address of the openSPOT3 into the browser to open the web interface.

If http://openspot3/ and http://openspot3.local/ do not work on your non-Android device then make sure multicast data is not disabled on your Wi-Fi network. Some Wi-Fi access points and routers have multicast data disabled by default. This is required for LLMNR and MDNS name resolving.

About the web interface
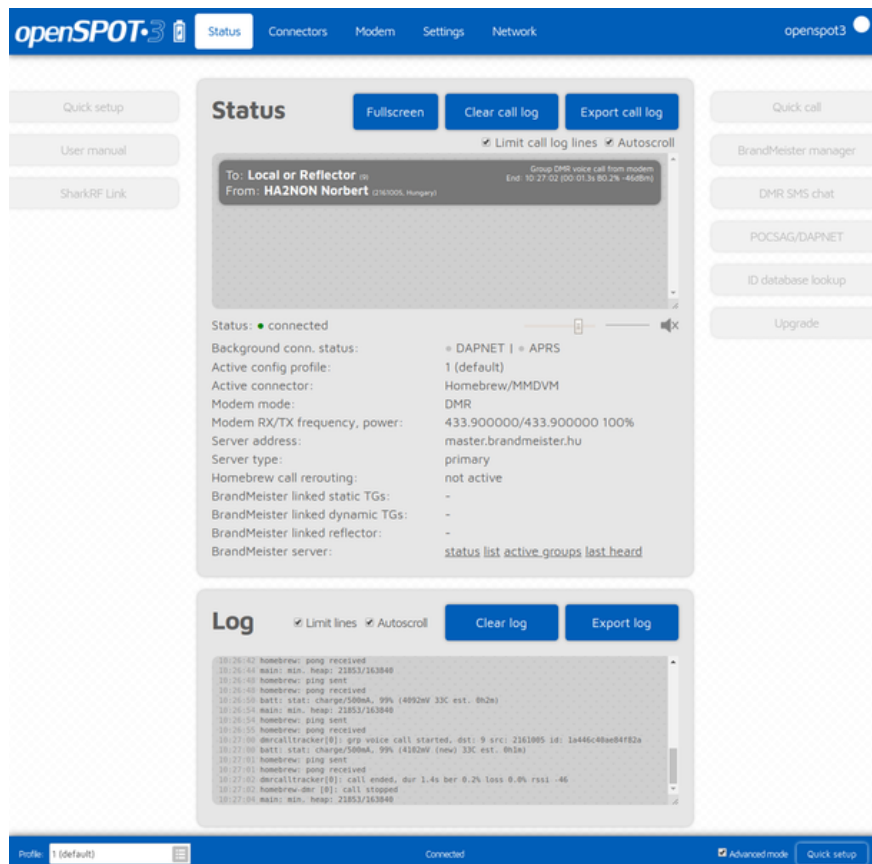
Header

The current **battery charge status** is shown right next to the openSPOT3 logo. Additional battery charge information is shown if the mouse is hovered over the battery icon (or the icon is clicked). Note that the displayed remaining battery charge/discharge time is a **rough estimate** and is affected by the device's recent power consumption.

The openSPOT3's **hostname** is displayed at the right of the page header. The device's **IP address** is displayed by hovering the mouse above the hostname. The hostname will be hidden on small displays (mobile phones). In this case, you can get the current IP address on the Network page, Network settings section. You can also see the device's IP address on the Network page, Current configuration section.

When the web interface is communicating with the openSPOT3, a **loader animation** (2 pulsating circles) is displayed next to the hostname at the right of the header.

Footer

The currently active configuration profile number and name is displayed at the left of the footer. You can also switch between configuration profiles there. Please read the Notes on configuration profiles section for more information about configuration profile switching.

The openSPOT3's **status** is displayed at the middle of the footer.

The **Advanced mode** checkbox is at the right of the footer. If this is checked, all advanced mode settings show up. Advanced mode is not needed for normal operation.

Light and dark web interface themes
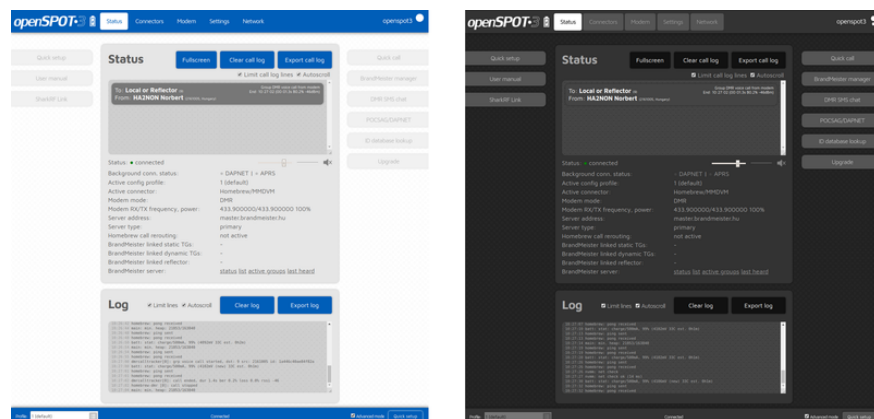
You can switch between dark and light web interface themes in the Quick Setup, or at the Miscellaneous section on the Settings page.

Status page

You can see information about the openSPOT3's current status, and listen to call audio on this page.

Call log
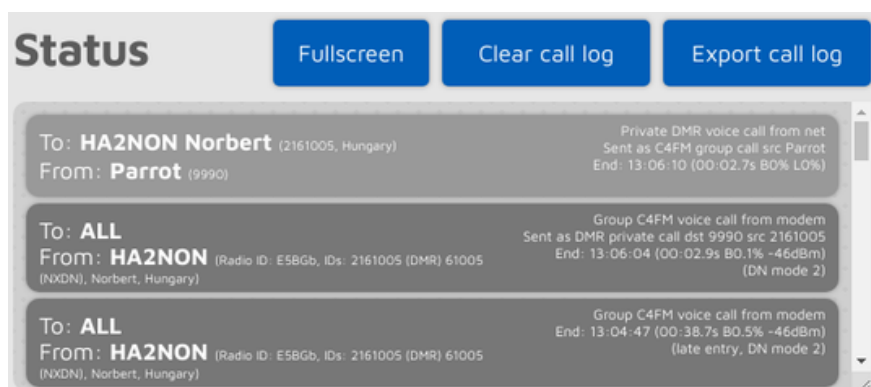
The call log displays all calls coming from the network, from the modem, or from the openSPOT3 itself (voice announcements). In modes where IDs are used as destination and source IDs (ex. DMR, NXDN®) the IDs are matched to the ID database and replaced with callsigns. You can get more information about an ID or callsign if you hover the mouse over it.

Each call log entry has information about the call at the top right corner of the entry bubble. BER is displayed in percent after the letter B, packet loss (in case of network calls) is displayed in percent after the letter L. The call duration is also displayed after a call ends.

You can export all call log entries in CSV format by clicking on the **Export call log** button.

If the **Limit call log lines** is checked (it's checked by default) then only a limited number of call log entries are allowed to be in the call log. This is good for limiting the web browser CPU/memory use.

Call audio
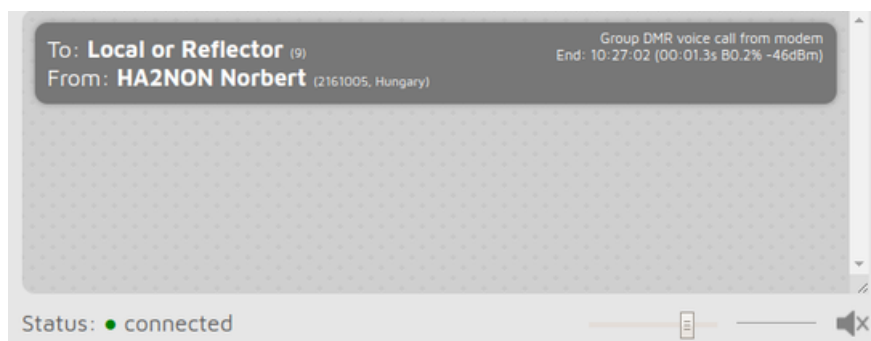
You can toggle call audio playback by clicking on the speaker icon under the call log, or with the keyboard shortcut `Ctrl+M` . There's a small oscilloscope view which shows call audio being played. Note that the oscilloscope view's signal levels does not actually represent the volume of the played back audio, as the openSPOT3 uses audio dynamic range compression. You can change the audio volume with the slider, or with the keyboard shortcuts `Ctrl+V` and `Ctrl+B` .

Note that smooth call audio playback requires a Wi-Fi connection with a good signal quality. If you have issues with call audio playback, then please try using different browsers and make sure they are updated to the latest version.

Browsers reduce CPU allowance on non-active tabs after a while. The tab of the web interface must be kept active, otherwise the audio will be garbled. This browser behavior cannot be changed. If the audio becomes garbled, activate the tab, and/or reload the web interface to fix it.

You can find the settings for the call audio playback on the Settings page.

P25 and C4FM VW mode call audio playback is not supported.

Log
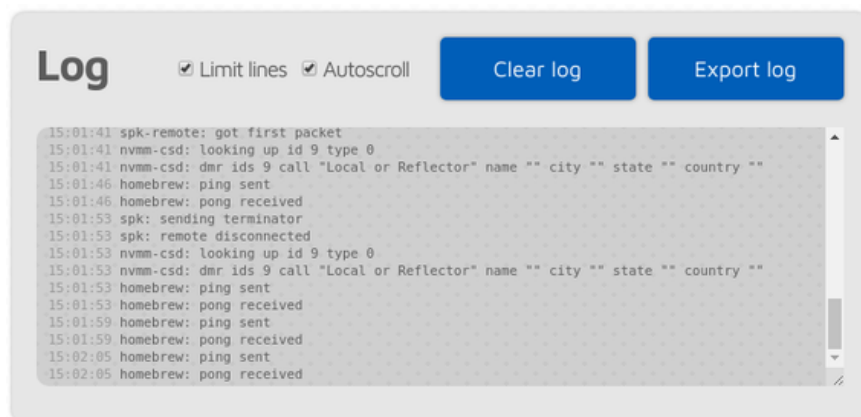
The device log is only shown if *Advanced mode* is enabled.

You can see all device log messages coming from the openSPOT3 here. All log lines are shown here except lines coming from the Wi-Fi module handler. Use the USB serial console log if you also want to see these messages.

If **Limit lines** is checked (it's checked by default) then only a limited number of log lines are allowed to be in the log. This is good for limiting the web browser CPU/memory use.

You can export the log lines to a .txt file by clicking on the **Export log** button.

openSPOT3 info

openSPOT3 info

Battery:	charge done	100%
Hardware version:	1.0	
Firmware version:	v1	
Firmware built at:	Wed, 27 Nov 2019 08:01:17	
Callsign database version:	N/A	
Bootloader version:	v8	
Device ID:	00000000	
USB data:	connected	
Uptime:	02:31:33	
Device time:	Wed, 27 Nov 2019 16:46:57	

You can see basic information about the device in this section.

Additional battery charge information is shown if the mouse is hovered over the charge percent (or the charge percent is clicked). Note that the displayed battery charge percentage and the remaining battery charge/discharge time is a **rough estimate** and is affected by the device's recent power consumption.

The **USB data** field shows **connected** when the openSPOT3 is connected to a host with USB enumeration capabilities (like a computer) using a USB cable which supports data transfer, not just charging. The USB serial console can only be used if this field shows connected. The supplied USB cable supports data transfer.

Graphs

RSSI ▼　　　　　　　　　　　　　　　■ dBm (-86)

BER ▶
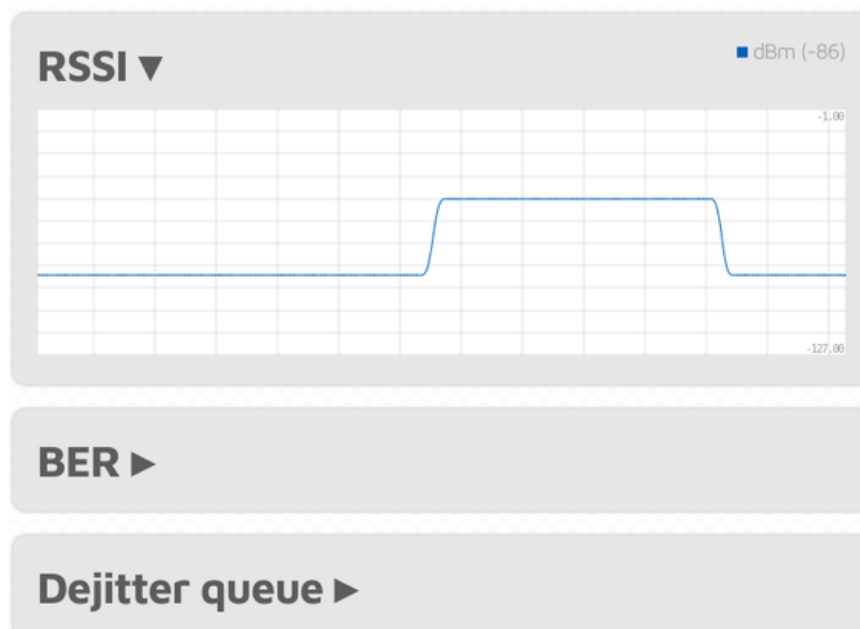
Dejitter queue ▶

The **RSSI graph** shows receive signal strength from the modem. The **BER graph** shows received Bit Error Ratio during a call. BER is calculated also for packets received from the network, not just from the modem. The **dejitter queue graph**

(only shown if *Advanced mode* is enabled) shows the number of packets waiting in the dejitter queue.

About the dejitter queue

All packets received from the network will first go to this queue to eliminate **network jitter**.

If the dejitter queue **length is too short**, the **graph's line can touch zero** during a call and the **audio can stop for a moment** as the modem runs out of frames to transmit.

If the queue's length is **too long**, the delay can be uncomfortably high.

You can use this graph to set a proper dejitter queue length. There should be at least a few packets in the dejitter queue when receiving a call from the network. You can set the dejitter queue length on the Network page (the setting only shows up if *Advanced mode* is enabled). As a **general rule**, if you have a good network connection to the selected connector's server, set dejitter queue length to 500ms, and if you have a 3G/4G internet connection or voice stutters a lot, try setting the length to at least 1000ms.

Connectors page

In openSPOT3 terms, a connector is the **protocol** which you use to connect the openSPOT3 to a server.

The easiest way to choose which connector to select is using the Quick Setup.

You can activate a connector by selecting it from the **Edit connector** list and clicking on the **Switch to selected** button. You can edit a connector's settings by selecting it from the **Edit connector** list. Don't forget to click on the **Save** button after changing a connector's settings.

Notes on connectors

Each connector has its own assigned **RX/TX frequencies** and **modem modes**. These frequencies and modem modes will be used when the connector becomes activated.

Some connectors have **Add server** and **Remove** buttons. These can be used to add and remove **custom servers** in the server list. Note that these custom servers are stored in the browser's local storage (they won't show up using another browser).

Some connectors have a **Keepalive interval** setting. This means the server requires the openSPOT3 to periodically send **keepalive messages** to the server. The **RX timeout** setting specifies the time after the last received valid network packet needed for the openSPOT3 to consider the connection is dead and it should reconnect. If the openSPOT3 **frequently disconnects** from the server, try increasing the RX timeout.

If a connector has both the **Keepalive interval** and **RX timeout** settings, then make sure the **RX timeout** is set to a greater value than the *Keepalive interval*.

The **Connect retry interval** sets the delay between server connect retries.

As a general rule, try to **use a server nearest to your location** to avoid packet loss and high latency.

Please see the Connectors section for more information about each connector.

General connector settings

General settings

Save

Change to Null connector after last call (sec, 0 to disable): 0

Change after last call from: ◉ Modem ○ Modem or network

☐ Power down instead of changing to Null connector

This section is only available if *Advanced mode* is enabled.

By setting the **Change to Null connector after last call** other than 0 will change the active connector to the Null connector after the last received call (minimum timeout value is 5 minutes). For example, if you set a timeout of 600 seconds, openSPOT3 will change to the Null connector if there is no call received in the last 10 minutes.

If **Power down instead of changing to Null connector** is checked, then the device turns off when the timeout is reached. This can be used as an auto sleep feature.

Modem page

You can change the modem settings on this page.

If you change the modem mode, RX or TX frequency on this page, the values will be copied to the currently active connector's settings. If *Advanced mode* is turned off, both RX and TX frequencies will be automatically set to the same value (the separate RX and TX frequency fields will be hidden).

If the **Idle modem mode** is activated then the openSPOT3's modem won't transmit and will ignore all received transmissions.

In case you have *half deviation* enabled in your C4FM/Fusion® radio (some models don't have this setting and have *half deviation* mode enabled by default), use the **C4FM Half Deviation** modem mode.

Frequency

The **Modem receive frequency offset** setting can be used to correct the frequency difference (RX offset) between the openSPOT3 and the used transmitter. This setting is only available if *Advanced mode* is enabled.

Setting an RX offset may be needed in case others report that transmissions coming from your transceiver have voice quality issues. This should rarely happen as the **openSPOT3 has a built-in, factory calibrated, extreme accurate clock reference**. You can also use the AutoCal special connector to find out the required RX offset value, or you can use the openSPOT3's built-in local echo service to find out the RX offset value yourself by listening back your recorded voice.

CW ID

You can set a CW ID which the openSPOT3 will transmit at the specified interval with the specified speed. You can use letters, numbers, slash (/) and space characters in the ID.

The openSPOT3 transmits an **unmodulated carrier wave** by default, so you'll only be able to hear it using a radio which is capable of CW/SSB demodulation. You can turn on **Audible CW ID**, so the carrier wave will be modulated, and you'll be able to hear it on a regular FM receiver. Note that if **Audible CW ID** is turned on, the openSPOT3 transmits the CW ID without going to RX between dits and dahs, so you won't be able to transmit using your transceiver while the CW ID is transmitted.

Before the openSPOT3 starts to transmit the CW ID, it waits at least **TX delay** seconds after the last received call. An incoming call (both from a radio or from the network) will interrupt the CW ID transmission, so enabling the CW ID does not interfere with the openSPOT3's normal operation.

Other modem settings

Modulation　　　　　　　　　　　Save

Modulation mode:　　　　　4FSK-RC (Raised Cosine)
Inner deviation (Hz):　　　　648

Other settings　　　　　　　　　　　Save

Call hang time (ms):　　　　3000
BCLO level (dBm, 0 - off):　　0
Ignore RX after TX (ms):　　0
Sensitivity level:　　　　6 (Low gain, high linearity)
Filter gain:　　　　8
　　　　　　　　　☐ Auto AGC
AGC low threshold (dBm):　　-50
AGC high threshold (dBm):　　-80
　　　　　　　　　☐ External VCO

Reset modem config to defaults

If *Advanced mode* is enabled, you can tweak various other modem parameters at the bottom of the modem page.

The **Call hang time** setting specifies how many milliseconds the openSPOT3 will wait after the last valid frame has been received to consider a call has been finished with a timeout.

If the **BCLO level** (BCLO - Busy Channel Lock Out) setting is not 0, then the openSPOT3's modem will only start a transmission if its RSSI meter does not measure a signal strength above the specified BCLO value in dBm.

The **Ignore RX after TX** setting specifies a time for which all received frames by the modem will be ignored after the last TX has ended. This is useful if you want to use the openSPOT3 to link a repeater to the internet through RF and the repeater has a lengthy internal buffer and it is still transmitting even after the openSPOT3 has finished transmitting (which means the openSPOT3 will start receiving its own stream again).

The modem's **Sensitivity level** can be changed in 6 levels. Note that increasing sensitivity decreases the linearity of the filters, which may result in incorrectly demodulated bits (which means increased BER). By default, sensitivity is low (level set to 5 or 6) for modem modes using 4FSK.

The sensitivity of the modem's filter can be changed with the **Filter gain** setting. Note that increasing sensitivity decreases the linearity of the filters, which may result in incorrectly demodulated bits (which means increased BER). By default, filter gain is set to 8.

The modem's AGC (Auto Gain Control) is configured by software for optimal values for low BER in 4FSK demodulation modes. However, you can turn automatic AGC on with the **Auto AGC** setting, but it is recommended to keep this checkbox off so the openSPOT3's AGC can work on its own.

When the AGC is turned on, you can set the **AGC low/high threshold** values. These values will be considered as low and high thresholds for the Auto AGC circuitry in the modem.

The **External VCO** checkbox should be checked when an external VCO is applied to the openSPOT3. Currently there's no external VCO used by the openSPOT3. Note that applying an external VCO is considered as an after-market modification and voids the warranty of the openSPOT3.

You can also reset all modem settings back to defaults by clicking on the **Reset modem config back to defaults** button.

All of the settings above are stored independently for each modem mode in the current profile.

Settings page

You can change the general settings of the openSPOT3 on this page.

Configuration profile

The openSPOT3 stores all its configuration in individual profiles. There are 5 of them, and profile #1 is active by default. Initially all configuration profiles have the factory default settings. You can switch between them on the web interface, or by using your radio (see the Control calls section for more information).

You can rename profiles, copy one to another slot or export/import to/from a file.

By setting the **Change after last call** setting to non-zero (this setting is available if *Advanced mode* is enabled), the openSPOT3 will switch to the specified profile slot after a timeout since the last call was received.

The **Don't show init setup on login** checkbox is checked if the Initialization setup has been completed.

Notes on configuration profiles

- Please keep in mind that all configuration profiles are **empty by default**, so if you switch to a previously unused profile, **the openSPOT3 will start in Wi-Fi AP mode** as there will be no configured Wi-Fi networks to connect.
- The openSPOT3 **reboots** on profile switch.
- Wi-Fi networks and passwords are stored for each profile separately.
- The web interface password is stored for each profile separately.

Firmware upgrade

The openSPOT3 will **automatically** check for firmware and data upgrades periodically, as specified by the **Check interval** setting (only available if *Advanced mode* is enabled). If **Automatic upgrade** settings are checked then the openSPOT3 will **automatically download** upgrades.

Data upgrades are applied immediately, but upgrading the firmware requires a reboot to the bootloader. If a new firmware has been downloaded, a reboot will be automatically scheduled for the (local) time set by the **Auto upgrade at** setting. By default it's set to 4am next day. The reboot will only be performed if there were no calls received for at least **Auto upgrade RX/TX delay** seconds (this setting is only available if *Advanced mode* is enabled).

Note that you have to plug the openSPOT3 into a USB power supply, otherwise the bootloader can't start and the firmware will not be upgraded.

Do NOT unplug the openSPOT3 during the firmware upgrade!

SharkRF Network

You can log your device in to the SharkRF Network. Currently only developers and alpha testers have access to the network's features. Eventually, these features will be available for all openSPOT3 users.

Voice announcements

The openSPOT3 has an own, built-in voice announcement system. Some announcements are played locally from the openSPOT3's built-in flash memory, but some are played using our open source voice announcement server.

Modem mode notes:

- **DMR**: voice announcements are sent to TG9, so to hear them, make sure you have TG9 in your radio's RX group list.
- **NXDN®:** voice announcements are sent to TG0.
- **P25:** voice announcements are sent to TG9.

If the battery charge percentage is 15% or below, and the *Enable battery low announcement* is turned on, then the openSPOT3 transmits battery charge status voice announcements every 5 minutes.

If the *Time announcement interval* is set, then the openSPOT3 will periodically announce current time. Interval is calculated from midnight, so for example if it is set to every 3 hours, then it will announce current time at 3AM, 6AM, 9AM and so on. Before announcing the time, the openSPOT3 checks if a call came from the network or the modem in the last 10 seconds. If yes, the time announcement will be skipped so it won't interfere with ongoing calls.

If you enable *Advanced mode*, the following settings will show up:

- You can shorten profile announcements by checking the **Shortened profile announcement** checkbox.
- If you don't want to hear the linked reflector/talkgroups list, then you can shorten BrandMeister announcements by checking the **Shortened BrandMeister announcement** checkbox.
- You can disable built-in voice announcements by checking the **Use server only** checkbox. Note that startup voice announcements played right after the openSPOT3 boots will still be played from the openSPOT3's flash memory.
- You can set your own voice announcement server's host and port.
- **Net state announcement int.** sets the interval of the announcement if the openSPOT3 can't connect to a Wi-Fi network.

See the Control calls section for more information about Profile query/change base ID, Connector query ID, IP address query ID, Battery status query ID, and Time query ID.

Location settings

Setting location data is optional. It is used by some connectors like the Homebrew/MMDVM® to report the location of the openSPOT3 to the connector's network.

Latitude and longitude is in decimal degrees. Google Maps will display a location's coordinates in decimal degrees if you click on it:
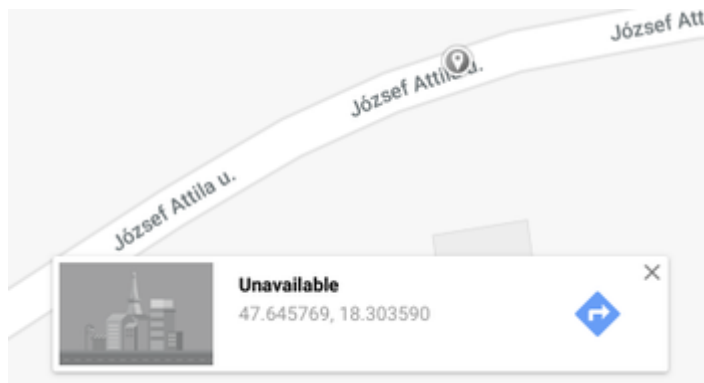
Both height values refer to the height of your openSPOT3 (they are used separately).

DMR settings

The modem will only process DMR calls with a matching **Color code**.

If the source callsign of a cross mode call has no associated DMR ID, and it can't be parsed into a number, then the **Default cross mode source DMR ID** will be used for the outgoing DMR call. If you are the only person using the openSPOT3, **set this to your DMR ID**, and then you don't need to change the callsign of your radio to your DMR ID.

If *Advanced mode* is enabled, the following settings show up:

If a call is received by the modem to the **Echo ID**, then the openSPOT3's built-in local echo service gets activated. It will record the call and plays it back after the call is finished. Both private and group calls are answered with a private echo call reply.

If the **Allow only IDs as cross mode callsigns** setting is enabled, and the source callsign of a cross mode call has no associated ID in the database, and also it can't be parsed into a DMR ID, then the call will be ignored.
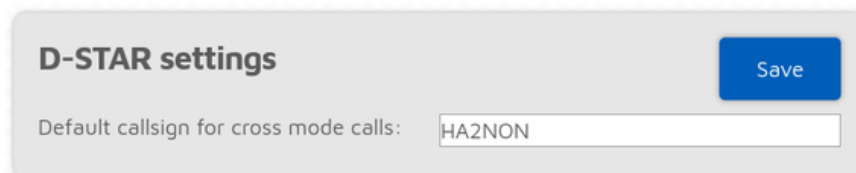
If the **Force source ID from modem** is set to other than 0, the source DMR ID of all voice calls received by the modem will be replaced with this ID.

If the **Send no in-band data to network** setting is enabled, then in-band data coming from the modem (like the talker alias or in-band GPS position information) won't be sent to the network.

If the **Force talker alias to DMR network** is set, then this talker alias will be sent for all calls coming from the modem.

If the **Send no in-band data to modem** setting is enabled, then the openSPOT3 will remove all in-band data from calls coming from the network. By default this setting is enabled. If you have a radio which supports **talker alias** decoding (like Hyteras with at least firmware version v8), **turn off** this setting to let the openSPOT3 pass through in-band data to your radio. If you have a radio which does not support talker alias decoding, **turn on** this setting to prevent issues with decoding voice calls containing in-band data (voice stuttering, calls dropping etc.).

D-STAR® settings

The **Default callsign for cross mode calls** will be used when a received DMR or NXDN call does not have a talker alias, or the call's ID doesn't have an associated callsign in the database (or the database is not available).

If *Advanced mode* is enabled, the following settings show up:

If a call is received by the modem to the **Echo callsign**, then the openSPOT3's built-in local echo service gets activated. It will record the call and plays it back after the call is finished.

If the **Force source callsign to D-STAR network for cross mode calls** is activated, then the source callsign of cross mode calls sent to the D-STAR® server will always be set to the **Forced src callsign for cross calls**. This is useful for example if you use a C4FM transceiver with a source callsign not exactly the same as your callsign (ex. you've appended your nickname to your callsign), but the server only accept calls with valid callsigns.
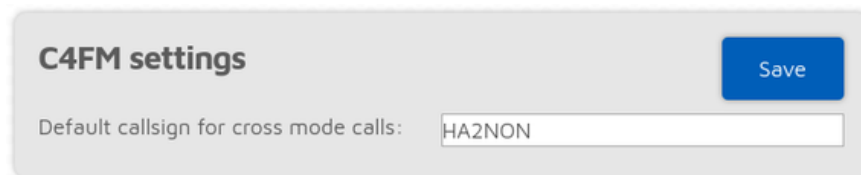
If the **Force message to D-STAR network in cross mode** is not empty, then the specified message will be sent to the D-STAR® network if a DMR, C4FM or NXDN call is received from the modem.

If the **Transmit RX confirmation** checkbox is checked, the openSPOT3 will transmit a short call confirmation after the PTT is released on the D-STAR® radio.

If the **Auto mute DTMF commands** checkbox is checked and a call is ongoing from the modem, and a DTMF sequence is being entered, then the call to the network will be automatically ended, so others won't be annoyed by hearing your DTMF tones on the same reflector/gateway.

If the **Ignore DTMF commands after 10 secs** checkbox is checked, then all DTMF commands will be ignored after 10 seconds have elapsed since call start. This is useful to avoid any mistakenly entered and decoded DTMF commands.

C4FM/Fusion® settings

The **Default callsign for cross mode calls** will be used when a received DMR or NXDN call does not have a talker alias, or the call's ID doesn't have an associated callsign in the database (or the database is not available).

If *Advanced mode* is enabled, the following settings show up:

- **Allow data calls to network**: if enabled, data calls will be forwarded from the modem to the network. This is not required for normal operation.
- **Ignore Wires-X® button commands**: Wires-X® button commands received by the modem will be ignored in case this settings is enabled.
- **Do not convert Wires-X® server names to uppercase**: all server names sent to the transceiver are converted to uppercase by default, and space characters are replaced with dashes. This conversion can be turned off with this setting. The conversion is done because some radios (like the Yaesu FT70) do not show lowercase characters on their displays, and space characters prevent the radio from saving the current server to a category.
- **Don't send automatic Wires-X® connect messages**: the openSPOT3 automatically sends Wires-X® connect messages in case it connects or disconnects to/from a server. These automatic messages can be disabled with this setting.
- **Hide profiles in Wires-X® "all" reply**: if this setting is enabled, configuration profiles won't be listed on the first page for a Wires-X® "all" server search.
- **Auto mute DTMF commands**: if a call is ongoing from the modem, and a DTMF sequence is being entered, and the first character is a **Special command / cross mode private call** or **Cross mode group call** DTMF code, the outgoing call to the network will be automatically ended, so others

won't be annoyed by hearing your DTMF tones on the same reflector/talkgroup.

- **Ignore DTMF commands after 10 secs**: if this checkbox is checked, then all DTMF commands will be ignored after 10 seconds have elapsed since call start. This is useful to avoid any mistakenly entered and decoded DTMF commands.
- **Special command/cross mode private call DTMF code**: this code is used as the first character for entering a control DTMF code, or starting a private call in cross modes. See more info at each connector's description, or at the Control calls section.
- **Cross mode group call DTMF code**: if a connector is active which supports group calls and C4FM cross mode, then this code can be used to start group calls to the ID entered after this code.
- If **Transmit RX confirmation** is checked, then the openSPOT3 will transmit a short call confirmation after the PTT is released on the C4FM radio.
- If a call is received by the modem to the **Echo DGID**, then the openSPOT3's built-in local echo service gets activated. It will record the call and plays it back after the call is finished.
- If the **Only receive DGID from modem** checkbox is checked, then calls only to the specified **DGID from modem** will be processed by the modem.
- If the **Replace DGID to modem enabled** checkbox is checked, then the DGID in all frames received from the network will be replaced with the specified *Replace DGID to modem* value.
- If the **Replace DGID to net enabled** checkbox is checked, then the DGID in all frames received from the modem will be replaced with the specified **Replace DGID to net** value.
- The **Cross mode DGID to net** setting specifies the DGID to use in cross mode calls sent to the network. Some servers change linked rooms depending on this value.

NXDN® settings

- The modem will only process NXDN® calls with a matching **Radio Access Number** if it is set other than 0.
- If a call is coming from a mode which does not have ID information (ex. C4FM), or the source ID is outside the NXDN® ID range (0-65535), then the **Default cross mode source ID** will be used as the source ID for the call. This ID will always be used if the **Always use this ID in cross mode** checkbox is checked.

  If you use a non-NXDN® network with your NXDN® radio, you can set this to your NXDN® ID.

If *Advanced mode* is enabled, the following settings show up:

- If a call is received by the modem to the **Echo ID**, then the openSPOT3's built-in local echo service gets activated. It will record the call and plays it back after the call is finished. Both private and group calls are answered with a private echo call reply.
- If a call is coming from a mode which does not have ID information (ex. C4FM), or the destination ID is outside the NXDN® ID range (0-65535), then the **Default cross mode destination ID** will be used as the destination ID for the call. This ID will always be used if the **Always use this ID in cross mode** checkbox is checked.
- If the **Allow only IDs as cross mode callsigns** setting is enabled, and the source callsign of a cross mode call has no associated ID in the database, and also it can't be parsed into an NXDN® ID, then the call will be ignored.

P25 settings

The modem will only process P25 calls with a matching **Network Access Code (NAC)**. Note that the **openSPOT3 requires the NAC in decimal format** (example: if you have the NAC 0x293 in your radio then you have to enter 659 in the openSPOT3).

If the source callsign of a cross mode call has no associated DMR/P25/CCS7 ID, and it can't be parsed into a number, then the **Default cross mode source P25 ID** will be used for the outgoing P25 call. If you are the only person using the openSPOT3, **set this to your DMR/P25/CCS7 ID**, and then you don't need to change the callsign of your radio to your DMR/P25/CCS7 ID.

If *Advanced mode* is enabled, the following settings show up:

If a call is received by the modem to the **Echo ID**, then the openSPOT3's built-in local echo service gets activated. It will record the call and plays it back after the call is finished. Both private and group calls are answered with a private echo call reply.

If the **Allow only IDs as cross mode callsigns** setting is enabled, and the source callsign of a cross mode call has no associated ID in the database, and also it can't be parsed into a DMR/P25/CCS7 ID, then the call will be ignored.

POCSAG settings

POCSAG settings

Reset frequency | Save

POCSAG frequency (MHz):	439.987500
Bitrate:	1200 bps (default)
TX delay in other modem modes (sec):	10

Allowed timeslots

☐ Do not allow DAPNET to override timeslots

☐ 0   ☐ 1   ☐ 2   ☐ 3   ☑ 4   ☑ 5   ☑ 6   ☑ 7
☐ 8   ☐ 9   ☐ A   ☐ B   ☑ C   ☑ D   ☑ E   ☑ F

This section is only available if *Advanced mode* is enabled.

If the modem is transmitting POCSAG messages then it will switch to the **POCSAG frequency**. The **TX delay in other modem modes** setting specifies how many seconds the openSPOT3 should wait after the last call has been finished to switch to POCSAG mode and start transmitting the queued messages.

There are 16 timeslots for POCSAG, these timeslot settings can be overridden by the DAPNET server when the DAPNET connector is connected unless the **Do not allow DAPNET to override timeslots** checkbox is checked. Each timeslot is 6.4 seconds long. The openSPOT3 will only start transmitting POCSAG messages if the current timeslot is allowed.

Transcode gain settings

Transcode gain settings

Save

DMR to D-STAR (dB):	12
DMR to C4FM (dB):	-12
DMR to NXDN (dB):	0
D-STAR to DMR (dB):	-12
D-STAR to C4FM (dB):	-18
D-STAR to NXDN (dB):	-12
C4FM to DMR (dB):	12
C4FM to D-STAR (dB):	18
C4FM to NXDN (dB):	12
NXDN to DMR (dB):	0
NXDN to D-STAR (dB):	12
NXDN to C4FM (dB):	-12

This section is only available if *Advanced mode* is enabled.

These settings allows you to adjust the gain used during transcoding to correct the volume difference between systems.

Lock settings

This section is only available if *Advanced mode* is enabled.

These settings allows you to lock the openSPOT3 to the given IDs and/or callsigns. If lock is enabled, the openSPOT3's modem will only allow calls originating from the given IDs or callsigns.

Call mute settings

This section is only available if *Advanced mode* is enabled.

These settings allows you to mute calls coming from the given IDs and/or callsigns (both coming from the network and the modem). Calls from muted IDs/callsigns will still be transmitted, but with silent audio.

Beeper settings

This section is only available if *Advanced mode* is enabled.

If the **Beep profile number on startup** setting is enabled, then the openSPOT3 will beep the letter P followed by the currently active profile number on startup in Morse code. If the **Beep profile number on startup** setting is enabled, then the profile's name will also be played in Morse code.

If the **Beep on modem mode change** setting is enabled, then the openSPOT3 will beep the modem mode's name in Morse code when it is changed.

Call audio settings

If the *Do not play audio from modem* setting is enabled, and call audio playback is enabled on the Status page, then audio of calls received by the modem won't be played. This is useful if you use the web interface to listen to call audio, and you want to answer calls using your transceiver.

RTC settings

This section is only available if *Advanced mode* is enabled.

You can set a daily wakeup and a powerdown time here. You can also set the profile to boot when waking up, so it's possible to jump between configuration profiles.

Miscellaneous settings

You can enable **Dark mode** and Power saving here.

Enabling the **Power off if no charger is connected** setting is useful if the openSPOT3 is installed in a vehicle, as the device will follow the USB power status (it will turn off if USB power is lost and it will turn on if USB power is restored).

If the **Unlink when power button pressed 3 times** setting is enabled (this is only visible if *Advanced mode* is enabled), and the power button is pressed 3 times quickly, then the openSPOT3 will do the following instead of beeping the currently active profile number and name in morse code:

- If the Homebrew/MMDVM® connector connector is active, then a quick call will be started to TG4000 to make the server unlink any linked dynamic talkgroups, and if the connector is connected using the Homebrew protocol, then a call interrupt command will also be sent to break any ongoing calls
- In case any other connector is active, the Null connector will be activated

You can also set the Status and Power LED brightness with the sliders. Please note that the new brightness setting will be only applied by the openSPOT3 at the next LED state change.

There are also buttons for turning off/reboot the device or resetting the config profile.

Network page

You can change the network settings of the openSPOT3 on this page.

Network status

Switch wireless mode

Current wireless mode: wireless client
Status: connected to bombegy
(6c:3b:6b:45:9f:a9, channel 6)
RSSI: -55 dBm ▶
Internet connection quality: ● (ok)
Wireless regulatory domain: FCC

Current configuration

Mode: DHCP
IP address: 192.168.3.106
Netmask: 255.255.255.0
Gateway: 192.168.3.1
DNS server #1: 192.168.3.1
DNS server #2: not set

The **Network status** section shows current network status. The **Wi-Fi RSSI graph** can be shown by clicking on the little arrow next to the RSSI value. The **Internet connection quality** is determined by the openSPOT3 by periodically measuring the network latency. You can get the measured latency value by hovering the mouse above the quality display circle. The **Wireless regulatory domain** is set by the country of operation.

The openSPOT3 can be switched between AP and normal modes by clicking on the **Switch wireless mode** button. This is the same as pressing the button for 3 seconds.

Network traffic
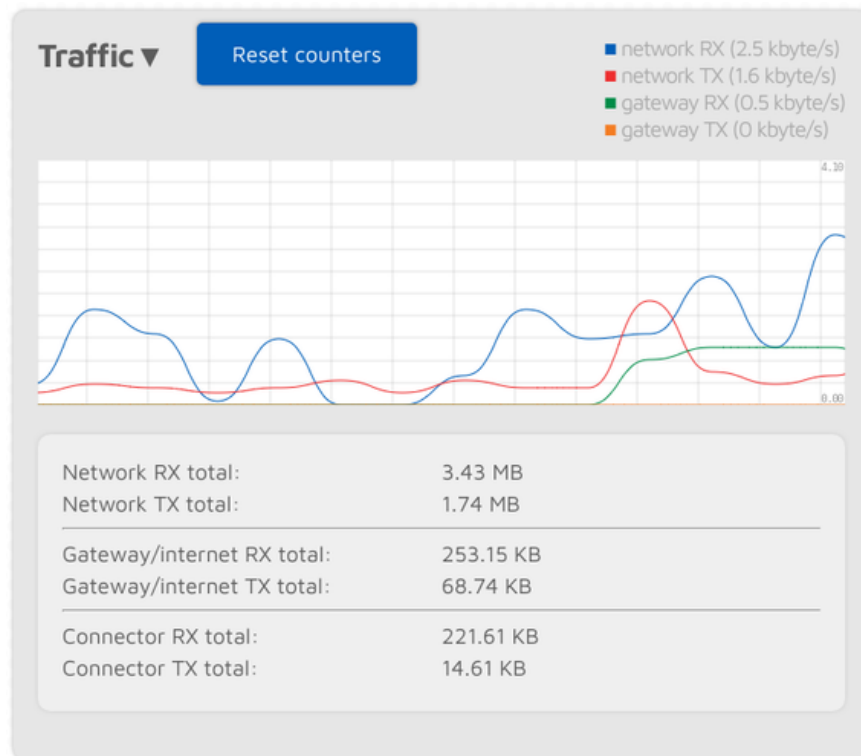
The **traffic graph** can be shown by clicking on the arrow at the top of the Traffic section. The **Network RX/TX total** shows total Wi-Fi traffic of the openSPOT3, the **Gateway/internet RX/TX total** shows the traffic coming/going from/to the gateway (which is usually the internet traffic consumed by the device), and the **Connector RX/TX total** shows the traffic used by the currently active connector.

The openSPOT3 uses very little internet traffic. Depending on the active connector, the data rate estimates are as follows:

- Quiet channel is 36-180 kB / hour
- Active channel is 3-6 MB / hour

Network settings

The web interface of the openSPOT3 is not password protected by default, which means anyone on the local network can open it. You can set a password by entering it in the **Change web int. password** input field. To reset the original behavior and clear the password, click on the **Clear password** button.

The **Hostname** is used by openSPOT3's built-in LLMNR and MDNS server which means you'll be able to open the web interface by entering http://hostname/ or http://hostname.local/ into the browser. The hostname is also displayed at the

top right corner of the web interface. If you have **multiple openSPOT3s on the same network**, make sure you use different hostnames for each of them.

The following settings are only available if *Advanced mode* is enabled.

Please see the About the dejitter queue section of the user manual for more information on the **Dejitter queue length** setting.

The openSPOT3 checks for internet connection availability and quality periodically. The interval of these checks is set by the **Internet conn. check interval** setting.

The openSPOT3 can send its log to a syslog server set by the **Syslog server** field. Check the **Send log to syslog server** checkbox to enable using the syslog server.

Please see the Powersaving section of the user manual for more information about the **Power saving** feature.

NTP settings
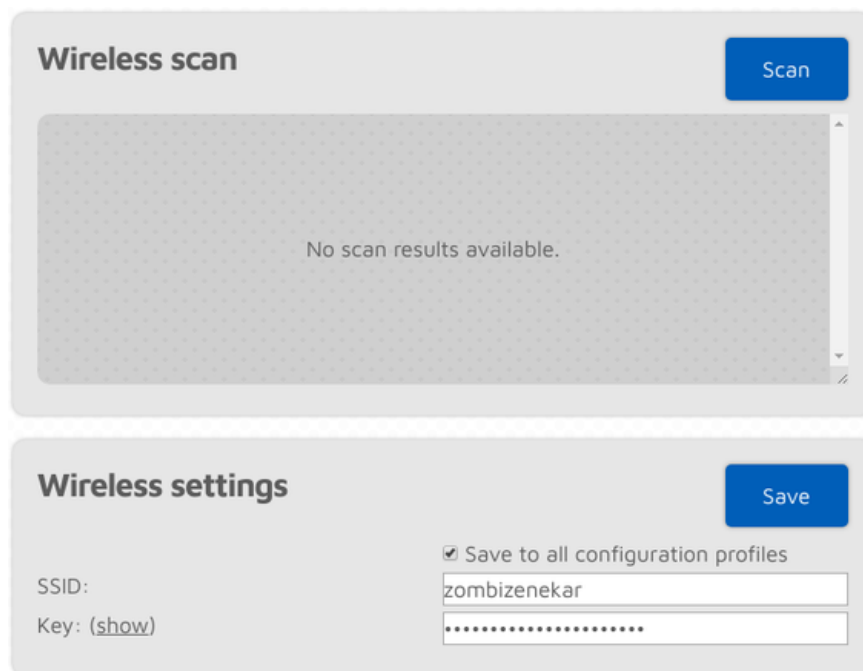
This section is only available if *Advanced mode* is enabled.

The openSPOT3 synchronizes date and time using the Network Time Protocol (NTP). By default, the NTP server advertised by the Wi-Fi network's DHCP server is used for synchronizing, but if the DHCP server does not advertise an NTP server, the host set at the **NTP server** setting will be used.

Note: The web interface loads the time from the openSPOT3 only **when the web interface is opened**. After that, the browser is updating the displayed clock and if the browser, or the web interface's browser tab is sent to the background then the time will be updated more irregularly due to the browser's CPU power saving mechanism. This causes the displayed openSPOT3 device time to be incorrect, but **this does not affect the openSPOT3's clock, it will stay correct**. Reload the web interface to make the displayed time accurate again.

Wireless settings

If *Advanced mode* is enabled, you can define **up to 5 Wi-Fi networks (per configuration profile)** to connect. If the first configured Wi-Fi network is not available, then the openSPOT3 will try connecting to the second one. If it's not available either, then it'll try the third one and so on. After trying connecting to all of the configured networks, it restarts the sequence with the first network.

If *Advanced mode* is enabled, the *Wireless scan* list will have a **Save** button for all previously unsaved networks instead of the **Connect** button. Clicking on the **Save** button lets you easily save the network to one of the 5 available Wi-Fi network slots.

If you are manually adding a connection to an iPhone's shared internet connection then make sure you **copy and paste** the phone's Wi-Fi SSID as the iPhone uses a special apostrophe character which looks nearly the same as the one you can enter with your keyboard, but it's different, and all characters need to match.

If the **Save to all configuration profiles** is active then the configured Wi-Fi networks will be saved to all profiles and will be common between profiles.

If no networks are configured then the openSPOT3 **switches to access point (AP) mode** and starts broadcasting its own Wi-Fi network. This is indicated by the status LED:
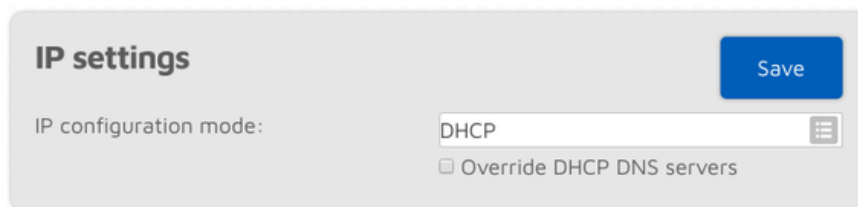
In this case, complete the steps described in the Initialization setup section of the user manual to set a Wi-Fi network for the openSPOT3.

The AP mode SSID can be set in the **AP SSID** input field. By default there's no Wi-Fi password set for the openSPOT3's AP mode, but you can set one at the **AP key** input field. The AP mode Wi-Fi channel can be set in the **Channel number** input field. If the **Always start in AP mode** checkbox is checked, then the openSPOT3 will always switch to AP mode after powered on even if there are configured Wi-Fi networks in the current configuration profile.

If a BSSID is configured for a network then it'll be used instead of the SSID. WEP encryption is also supported if the network key length is 5 or 13 characters.

IP settings

This section is only available if *Advanced mode* is enabled.

The openSPOT3 has two IP configuration modes:

- **DHCP:** This is the default mode. The device will use the Wi-Fi network's DHCP server for acquiring an IP address.
- **Static:** a static IP address can be set for the openSPOT3. This is only recommended for advanced users.

The DNS server settings which are advertised by the DHCP server can be overriden if the **Override DHCP DNS servers** checkbox is checked. If the openSPOT3 can't connect to a server (for ex. the openSPOT3 shows connector connecting after switching D-STAR® reflectors from your radio, but it can connect using the web interface otherwise), you can try overriding the DNS servers to 8.8.8.8 and 8.8.4.4.

MAC settings

This section is only available if *Advanced mode* is enabled.

You can change/clone the Wi-Fi MAC address of the openSPOT3 here. This is useful if you try to use a Wi-Fi network which uses a captive portal for authentication (example: hotel or airport networks). In this case, do the following steps:

- Connect to the Wi-Fi network with your phone/tablet/computer, log in on the captive portal to enable the internet access for your phone/tablet/computer's MAC address.
- Switch the openSPOT3 to access point (AP) mode by holding the button for 3 seconds.
- Connect your phone/tablet/computer to the **openSPOT3 AP**, but exit the Initialization setup and open the Network page.
- Set the captive portal Wi-Fi network's SSID and key at the **Wireless settings** section.
- Click on the **Clone** button at the MAC settings section (make sure **Advanced mode** is enabled so the MAC settings section is visible).
- Switch the openSPOT3 back to normal mode by holding the button for 3 seconds, or by clicking the **Switch wireless mode** button at the top of the Network page. The openSPOT3 will connect to the captive portal Wi-Fi network with your phone/tablet/computer's already logged in MAC address.

Please keep in mind that **MAC cloning may cause packet loss** and the network connection of both devices may get **periodically interrupted**.

Side panels / Tools page
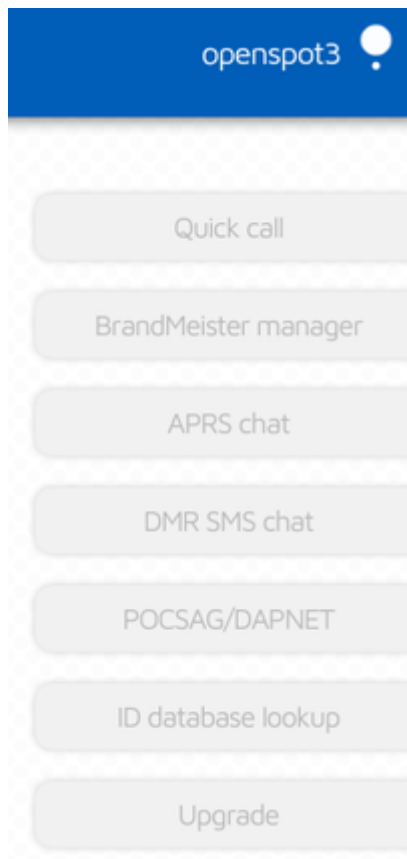
If you are using a computer, or a screen width enough width, the Tools page gets hidden and side panels will show up on the web interface. On small screens they are hidden, and their contents can be found on the Tools page.

Quick call

The quick call feature is available when the Homebrew/MMDVM® connector is active.

Reflector and talkgroup linking (and unlinking) is **done by the network, not the openSPOT3**. The openSPOT3 has to make quick calls, which are the same as pressing PTT for a short time on a radio (kerchunking). These empty calls will also show up on the BrandMeister Network's dashboard.

Quick call is useful for **linking/unlinking talkgroups and reflectors**. Starting a short private call to a reflector ID (between 4000 and 5000) will link the reflector. Starting a short group call to a talkgroup ID will link that TG. On the BrandMeister network, reflectors are unlinked by starting a **private** call to ID 4000, and both reflectors and talkgroups are unlinked by starting a **group** call to ID 4000.

Quick call shortcuts can be stored in the openSPOT3's current configuration profile. If you hover the mouse cursor over a saved talkgroup's button, or the button is pressed for a few seconds then the (BrandMeister) talkgroup's name will appear.

If the **Auto group call 4000 before shortcut call** checkbox is checked, then the openSPOT3 will automatically start a quick call to TG4000 to unlink everything before quick calling the desired ID.

BrandMeister Manager

The BrandMeister Manager (BMM) is available when the Homebrew connector is active, and it is configured for a BrandMeister server. With BMM, you can link/unlink **static** and **dynamic** talkgroups, and you can interrupt the currently ongoing call.

A BrandMeister **API key** is needed to use the BMM. You can get the API key by clicking on the **Get key** button, and logging into the BrandMeister SelfCare. Copy and paste the API key to the **API key** input field and click on the **Save** button. The API key's validity can be checked by clicking on the **Check key** button.

Note that only BrandMeister API v1 keys are stored in the openSPOT3. v2 keys are stored by your browser.

DMR SMS chat

This feature is available when the modem is in DMR mode, or the currently active connector supports DMR SMS sending.

Sent messages are displayed on the right, received messages are displayed on the left of the chat box. You can click on each message for additional information.

The modem radio button is disabled if the modem is not in DMR mode. Messages sent to openSPOT3's DMR echo ID (it's 9999 by default) will be echoed back to the sender. Note that the openSPOT3 only stores the last received message, so you have to keep open this page in your browser to receive more than one message at once.

Use ETSI format if you want to send a message to Hytera radios, UDP format for Motorola radios, and UDP/Chinese format for other Chinese radios (Tyt, Retevis, etc.).

If you want to receive messages from the network on the DMR SMS page, you have to check the **Handle messages to/from source ID** checkbox. If it's enabled, received SMS messages to the given **Source ID** won't be forwarded to your radio.

If you want to send received DMR SMS messages as POCSAG messages, check the **Handle messages to/from source ID** checkbox, and set a **POCSAG RIC** to send messages to.

You can simply use the ETSI format if you want to send messages through the network. Note that the network must know about the location of your **Source ID**. If you want to receive DMR SMS messages from the network, you have to set the **Source ID** to the DMR ID you set at the connector settings, or if you want to use another ID, then you have to start a short call from that DMR ID with your radio, so the network will know that your custom DMR ID can be reached through this openSPOT3.

POCSAG/DAPNET

You can see the POCSAG message queue here. Queued unsent messages are displayed with a blue background, sent messages are gray. All messages receveid from DAPNET or sent from this interface are first placed in the POCSAG message queue.

Note that the displayed current timeslot number and time is calculated by the browser and is not equal to the openSPOT3's internal device time and timeslot framing which is more precise.

If the **Send to** radio button is set to Modem then you can directly add messages to the queue which will be transmitted by the openSPOT3.

If you want to send a message to DAPNET, you have to set your DAPNET **user** callsign and user password first. Note that these have to be the DAPNET **user** callsign and password, **not** the transmitter callsign and auth key you've set for the DAPNET connector. Multiple destination callsigns and transmitter groups can also be specified in a comma separated list.

DAPNET messages are sent by your browser to the DAPNET API. Note that sometimes the DAPNET API server does not respond to message send requests and times out, but correctly processes received messages.

APRS® chat

You can send and receive messages via the APRS® network. This feature is available when the APRS® connector is enabled.

Sent messages are displayed on the right, received messages are displayed on the left of the chat box. The openSPOT3 stores the last 10 messages in its internal memory, so you can receive messages even if the web interface is not open. You'll get a notification about unread messages if you open the web interface. If you reboot the device then all stored messages will be lost.

Confirmed messages need to be acknowledged by the recipient. If the recipient is unavailable (which means no acknowledge is received for a specific time), then the openSPOT3 retries sending a few times before the message send times out. You can cancel the confirmed message send by clicking on the Cancel button.

If a message bubble is clicked then its callsign will be set as the message send destination callsign.

ID database lookup

You can look up IDs or callsigns and display information about them. The lookup will be done through the network if the openSPOT3 has not downloaded a valid ID database.

If the **Auto match ID and callsign fields** checkbox is checked, then all callsigns and IDs will be matched when saving connector settings, and a warning will be displayed if the entered callsign does not match the entered ID according to the database. This is to prevent typos or invalid IDs when trying to connect to a network, as most servers do not allow connections with invalid IDs or callsigns.

Upgrade
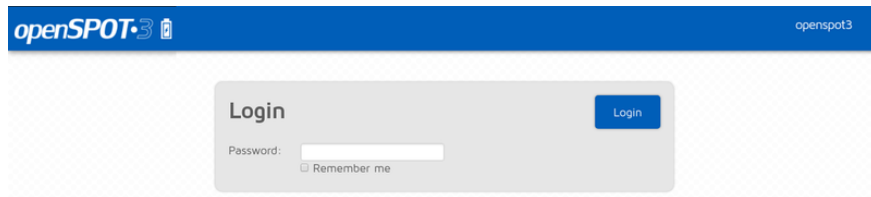
Information about firmware and data upgrades are displayed here. You can also request an immediate upgrade availability check, and manually start the upgrade process if auto upgrades are disabled on the Settings page, Firmware upgrade section.

Note that you have to plug the openSPOT3 into a USB power supply, otherwise the bootloader can't start and the firmware will not be upgraded.

Do NOT unplug the openSPOT3 during a firmware upgrade!

Login page

This is the page where you can log in to the web interface. The openSPOT3 does not have a web interface password by default, so the login page is not displayed initially. You can set a login password on the Network page, Network settings section.

If you check the **Remember me** checkbox, the openSPOT3 will not ask for a login password until the device gets rebooted, or the browser forgets the login cookie.

Null connector

The Null connector is a special connector – as its name says – it does not connect anywhere. This is the default active connector when the openSPOT3 is unconfigured.

Homebrew/MMDVM® connector

You can use this connector to connect to a network which supports the **Homebrew** or the **MMDVM®** protocol, like BrandMeister, DMRplus, Phoenix, DMR-MARC, XLX.

The easiest way is to use the Quick setup to connect to these networks.

This connector supports 2 protocols: **Homebrew** and **MMDVM®**. Use the Homebrew protocol to connect to BrandMeister network servers, and the MMDVM® protocol to connect to DMRplus, Phoenix, DMR-MARC or XLX servers.

The default server password for BrandMeister servers is *passw0rd* or *password*, but some servers do not use these defaults. In this case take a look at the BrandMeister wiki, or ask the server's admin for the password if the openSPOT3 won't connect with the default one.

If you can't connect to a BrandMeister server because the **authentication has failed**, then turn off **Hotspot Security** on your BrandMeister SelfCare page, or use the **hotspot password** you've set there as the server password.

If you are using a BrandMeister server in Homebrew protocol mode, you can see the list of currently linked static, dynamic talkgroups and reflectors on the openSPOT3's Status page.

Cross mode usage

The Homebrew/MMDVM® connector is a DMR connector, but it supports D-STAR®, C4FM and NXDN® cross modes.

In cross modes, you can set the **Route cross mode calls to ID** to the talkgroup ID you want to talk to (set the call type to **Group call**). If you use a cross mode which is ID-based (like NXDN®), then this ID (and call type) will be automatically updated based on what ID you call on your radio. This ID will be automatically used if you call the ID 0, or a callsign-based modem mode is used (like D-STAR® and C4FM).

You can also update the **Route cross mode calls to ID** with the Quick call feature.

If the currently used modem mode is callsign-based (like D-STAR® and C4FM), then you can use DTMF codes (see below) to update the **Route cross mode calls to ID** setting. If the **Unlink TG/ref. on cross mode DTMF call** setting is enabled (it is enabled by default), then the openSPOT3 will automatically do a quick group call to DMR ID 4000 before calling the new ID, to make sure only one talkgroup is linked at a time.

D-STAR® notes

You can update the **Route cross mode calls to ID** with a D-STAR® radio using three methods:

- Set the ID and call type in the D-STAR® radio's URCALL, then start a short call. After the short call, set back the URCALL to `CQCQCQ` . Examples:
    - `2161005P` - private call to 2161005
    - `216G` - group call to 216
    - `216` - group call to 216 (if there's no `G` character then the call type is set to group call)
- DTMF codes: you can start a short private call to an ID by entering * followed by the destination ID in DTMF code. You can start a short group call to an ID by entering # followed by the destination ID in DTMF code. Examples:
    - `#3100` - group call to 3100
    - `*4770` - private call to 4770 If you only enter * (without an ID) then a quick private call to 4000 will be started. If you only enter # (without an ID) then a quick group call to 4000 will be started.
- If you want to start a private call, then set the destination callsign in the D-STAR® radio's URCALL.

You can switch servers using the URCALL/your call method. This lets you change to the following server types:

- REF/XRX/Gateway: set the URCALL to for example `REF001 C` . Switching to REF/XRF servers or gateways this way changes the openSPOT3's active connector to the REF/XRF connector.
- DCS/XLX: set the URCALL to for example `DCS001 A` . Switching to DCS/XLX servers this way changes the openSPOT3's active connector to the DCS/XLX connector.
- BrandMeister: set the URCALL to `BM` followed by the BrandMeister server ID. Example: starting a call to destination callsign (URCALL) `BM2162` switches to BrandMeister server 2162 (Hungary). Switching to BrandMeister

servers this way changes the openSPOT3's active connector to the Homebrew/MMDVM connector.

- FCS: set the URCALL to the FCS server and room number. Example: starting a call to destination callsign (URCALL) `FCS00199` switches to FCS001 room 99. Switching to FCS servers this way changes the openSPOT3's active connector to the FCS connector.
- YSFReflector: set the URCALL to `YS` followed by the YSFReflector server ID. Example: starting a call to destination callsign (URCALL) `YS89804` switches to YSFReflector 89804 (AmericaLink). Switching to YSFReflector servers this way changes the openSPOT3's active connector to the YSFReflector connector.
- NXDNReflector: set the URCALL to `NX` followed by the NXDNReflector server ID. Example: starting a call to destination callsign (URCALL) `NX28299` switches to NXDNReflector 28299 (America-Ragchew). Switching to NXDNReflector servers this way changes the openSPOT3's active connector to the NXDNReflector connector.

C4FM notes

If you use a C4FM radio, make sure it is in digital narrow (DN) mode, otherwise your calls can't be converted and only silence will be sent to the network.

You can update the **Route cross mode calls to ID** with a C4FM radio using DTMF codes. You can start a short private call to an ID by entering the Special command/cross mode private call DTMF code (by default it's *) followed by the destination ID in DTMF code. You can start a short group call to an ID by entering the Cross mode group call DTMF code] followed by the destination ID in DTMF code.

So for example with the default DTMF codes, you can link TG3100 by entering DTMF code `#3100`, and link reflector 4770 by entering `*4770`. If you want to try the BM parrot, enter DTMF code `*9990`, release the PTT, then if you press the PTT again, the call will be forwarded to private call 9990, which is usually the BM server's parrot service ID.

If you only enter * (without an ID) then a quick private call to 4000 will be started. If you only enter # (without an ID) then a quick group call to 4000 will be started.

You can also use the Wires-X® button menu of your C4FM radio to select/search for servers.

Advanced settings

If *Advanced mode* is enabled, the following settings become available:

You can set a **backup server** which will be used if the openSPOT3 can't connect to the primary server for **Backup server activate connect timeout** seconds. If the backup server is disconnected then the primary one will be tried automatically again.

You can set the **DMO mode TDMA channel** for the network. DMO mode is enabled if the connector's RX and TX frequencies match. This setting specifies which TDMA channel is used for sending calls to the server. On the BrandMeister network the DMO mode links the two timeslots together, so this setting is irrelevant.

Auto connect

The **Auto connect to ID** will be quick called when the openSPOT3 connects to the server. Please see the Quick call's description for more information about this feature.

Using the auto connect feature is **not needed (and not recommended) on BrandMeister**, as this network supports auto static talkgroups: the first talkgroup you call **after** calling TG4000 will be set as **auto static**. Auto static talkgroups will not be unlinked after a timeout like dynamic talkgroups (this timeout is usually 15 minutes, but this depends on server settings). Example: start a short call to TG4000. Then start a short call to TG3100. Now TG3100 will be auto static, which means it won't be unlinked after a timeout.

If you are using auto connect to a talkgroup, it is advisable to check the **Unlink TG/ref. on auto connect** checkbox. If it's checked, the openSPOT3 will automatically quick call TG4000 after it is connected to the server, so the currently active TG/reflector will be unlinked. This is useful if you only want to use a talkgroup, but the server always links you to a reflector automatically.

Note that reflector and talkgroup linking (and unlinking) is **done by the network, not the openSPOT3**. The openSPOT3 has to make quick calls, which are the same as pressing PTT for a short time on a radio (kerchunking). These empty calls will also show up on the BrandMeister network's dashboard.

Call rerouting

You can enable rerouting by setting the **Reroute DMR TG9 calls to ID** other than 0. If rerouting is active, all voice calls are rerouted to and from TG9. This makes using talkgroups easier, as you don't have to set them in the RX group list on your radio.

For example, if you set the reroute ID to 3100/group call, then if you call TG9 on your radio, your call will be sent to TG3100, and if someone talks on TG3100, the call will be sent to TG9 on your radio, so it will receive it even if you don't have TG3100 in your RX group list.

Another example: if you set the reroute ID to 9990/private call, then if you call TG9, your call will go to the parrot service 9990, and the parrot reply will come back to you to TG9.

Rerouting is dynamic, so if you start a short voice call to a new reflector/talkgroup, the reroute ID will be automatically set to the new reflector/talkgroup with the appropriate call type.

SSIDs

You can optionally use SSIDs to connect **multiple hotspots** to the BrandMeister network. For example, if your DMR ID is 2161005, and you have 2 hotspots, use SSID 01 and 02 for them. Append the number to your DMR ID in the Homebrew connector settings DMR ID field like this: 216100501 and 216100502 on the other hotspot. BrandMeister will automatically link you as 2161005 with SSID 01 and 02. This way you **don't need multiple DMR IDs** for multiple hotspots.

Changing modules on XLX servers

To unlink the currently linked module, call DMR ID 4000 (either using the Quick Call on the web interface, or using a transceiver). To connect to module A, call DMR ID 4001, for module B call DMR ID 4002 and so on.

DMRplus dongle connector

You can use this connector to connect to a network which supports the DMRplus dongle protocol like DMRplus, Phoenix, DMR-MARC, XLX.

The easiest way is to use the Quick setup to connect to these networks.

You can change the used reflector ID by starting a short private call on your radio to the desired reflector ID (between 4000 and 5000).

Cross mode usage

The DMRplus dongle connector is a DMR connector, but it supports D-STAR®, C4FM and NXDN® cross modes.

D-STAR® notes

You can switch reflectors with a D-STAR® radio using two methods:

- Set the reflector ID as the D-STAR® radio's URCALL, then start a short call. After the short call, set back the URCALL to `CQCQCQ` .
- DTMF codes: enter * followed by the reflector ID in DTMF code.

C4FM notes

If you use a C4FM radio, make sure it is in digital narrow (DN) mode, otherwise your calls can't be converted and only silence will be sent to the network.

You can switch reflectors from your radio by entering **Cross mode group call DTMF code** (by default it's *) followed by the reflector ID in DTMF code, or use the Wires-X® button menu to select/search for servers.

Example: to switch to reflector 4770, enter DTMF code `*4770` .

DCS/XLX connector

You can use this connector to connect to a network which supports the DCS protocol like DCS or XLX.

The easiest way is to use the Quick setup to connect to these networks.

DCS and XLX servers usually do not need a valid D-STAR® registration, but you can check your callsign's registration by clicking on the **Check D-STAR® registration** button.

If you want to talk on a DCS or XLX reflector, set the URCALL on your radio to CQCQCQ, and the local module to D in the openSPOT3. Make sure you have not entered any space characters in your radio before or after CQCQCQ in the URCALL.

Switching reflectors/gateways using your radio

URCALL/your call method

You can switch reflectors using your radio by starting a short call to their names as the destination callsign (URCALL), like `DCS001 A` , or `XLX001 A` . Set the desired remote module as the last character of the URCALL. You can switch to gateways the same way.

The URCALL/your call method lets youe change to the following server types:

- REF/XRX/Gateway: set the URCALL to for example `REF001 C` . Switching to REF/XRF servers or gateways this way changes the openSPOT3's active connector to the REF/XRF connector.
- DCS/XLX: set the URCALL to for example `DCS001 A` . Switching to DCS/XLX servers this way changes the openSPOT3's active connector to the DCS/XLX connector.
- BrandMeister: set the URCALL to `BM` followed by the BrandMeister server ID. Example: starting a call to destination callsign (URCALL) `BM2162` switches to BrandMeister server 2162 (Hungary). Switching to BrandMeister

servers this way changes the openSPOT3's active connector to the Homebrew/MMDVM connector.

- FCS: set the URCALL to the FCS server and room number. Example: starting a call to destination callsign (URCALL) `FCS00199` switches to FCS001 room 99. Switching to FCS servers this way changes the openSPOT3's active connector to the FCS connector.
- YSFReflector: set the URCALL to `YS` followed by the YSFReflector server ID. Example: starting a call to destination callsign (URCALL) `YS89804` switches to YSFReflector 89804 (AmericaLink). Switching to YSFReflector servers this way changes the openSPOT3's active connector to the YSFReflector connector.
- NXDNReflector: set the URCALL to `NX` followed by the NXDNReflector server ID. Example: starting a call to destination callsign (URCALL) `NX28299` switches to NXDNReflector 28299 (America-Ragchew). Switching to NXDNReflector servers this way changes the openSPOT3's active connector to the NXDNReflector connector.

DTMF method

Here are some example DTMF command sequences:

Switching to REF servers:

- `*1C` or `*01C` or `*001C` will change the active connector to the REF/XRF connector and connects to REF001 module C.

Switching to XRF servers:

- `B8B` or `B08B` or `B008B` will change the active connector to the REF/XRF connector and connects to XRF008 module B.

Switching to XLX servers:

- `C5B` or `C502` or `C0502` connects to XLX005 module B.
- `C9D` or `C904` or `C0904` connects to XLX009 module D.

Switching to DCS servers:

- `D5A` or `D501` or `D0501` connects to DCS005 module A.
- `D1C` or `D103` or `D0103` connects to DCS001 module C.

Cross mode usage

The DCS/XLX connector is a D-STAR® connector, but it supports DMR, C4FM and NXDN® cross modes.

Server change using a DMR or NXDN® radio

You can change servers using a DMR or NXDN® radio with a **private call** to a special ID described below.

Server change using a C4FM radio

You can change servers by entering the Special command/cross mode private call DTMF code (by default it's *) or the Cross mode group call DTMF code] (by default it's #) followed by the special ID described below.

You can also use the Wires-X® button menu of your radio to select/search for servers.

Special IDs for server change

The format of the ID to call with your DMR or NXDN® radio, or the ID to enter using DTMF codes on your C4FM radio can be the following:

- **server type** + **module number** or
- **server type** + **server number** + **module number**

Server type can be:

- 1: REF
- 2: XRF
- 3: XLX
- 4: DCS

Module number is the remote module, and it is always 2 digits long. 01 is module A, 02 is module B, 03 is module C and so on.

Some examples:

- ID 4901 will connect to DCS009A (server type 4 (DCS), number 9 and module 01 which is A)
- ID 4812 will connect to DCS008L (server type 4 (DCS), number 8 and module 12 which is L)
- ID 10103 will connect to REF001C (server type 1 (REF), number 01 and module 03 which is C)
- ID 13003 will connect to REF030C (server type 1 (REF), number 30 and module 03 which is C)
- ID 312302 will connect to XLX123B (server type 3 (XLX), number 123 and module 02 which is B)

REF/XRF connector

You can use this connector to connect to a network which supports the Dplus protocol like REF or XRF.

The easiest way is to use the Quick setup to connect to these networks.

If you want to use a **reflector**, set the URCALL on your radio to CQCQCQ, and the local module to D in the openSPOT3. If you want to use a **gateway**, set the URCALL to the gateway's callsign and remote module. Remote module should be the last character of the URCALL. In this case, set the local module to a space character in the openSPOT3.

Note that if you are connecting to a repeater, you have to set the **Reflector/gateway ID** connector setting to the callsign of the repeater.

If the *Auto set URCALL to network* setting is enabled, and the REF/XRF connector (list) is set to Reflectors mode, then the destination callsign (URCALL) of calls coming from your transceiver will be automatically set to CQCQCQ. If the REF/XRF connector (list) is set to Gateways mode, then the URCALL will be automatically set to the gateway's callsign and remote module.

Some (classic) REF and XRF servers need a valid D-STAR® registration. If you connect to such a server with an invalid callsign registration, then the server may only serve a **read only** connection, which means you won't be able to transmit to the server. A warning notification will be shown on the openSPOT3's web interface, and also you'll see a warning at the *Connected to* field on the Status page.

You can check your callsign's registration by clicking on the **Check D-STAR® registration** button. Make sure you have registered your local module on the D-STAR® gateway registration system. If you have a registration, you have probably registered the "space" local module, in this case set your openSPOT3's local module to a space (empty) character.

Try remote module E on any reflector for the REF/XRF echo service (may not enabled on some servers).

Switching reflectors/gateways using your radio

URCALL/your call method

You can switch reflectors using your radio by starting a short call to their names as the destination callsign (URCALL), like `REF001 A`, or `XRF001 A`. Set the desired remote module as the last character of the URCALL. You can switch to gateways the same way.

The URCALL/your call method lets you change to the following server types:

- REF/XRX/Gateway: set the URCALL to for example `REF001 C`. Switching to REF/XRF servers or gateways this way changes the openSPOT3's active connector to the REF/XRF connector.
- DCS/XLX: set the URCALL to for example `DCS001 A`. Switching to DCS/XLX servers this way changes the openSPOT3's active connector to the DCS/XLX connector.
- BrandMeister: set the URCALL to `BM` followed by the BrandMeister server ID. Example: starting a call to destination callsign (URCALL) `BM2162` switches to BrandMeister server 2162 (Hungary). Switching to BrandMeister servers this way changes the openSPOT3's active connector to the Homebrew/MMDVM connector.
- FCS: set the URCALL to the FCS server and room number. Example: starting a call to destination callsign (URCALL) `FCS00199` switches to FCS001 room 99. Switching to FCS servers this way changes the openSPOT3's active connector to the FCS connector.
- YSFReflector: set the URCALL to `YS` followed by the YSFReflector server ID. Example: starting a call to destination callsign (URCALL) `YS89804` switches to YSFReflector 89804 (AmericaLink). Switching to YSFReflector servers this way changes the openSPOT3's active connector to the YSFReflector connector.
- NXDNReflector: set the URCALL to `NX` followed by the NXDNReflector server ID. Example: starting a call to destination callsign (URCALL) `NX28299` switches to NXDNReflector 28299 (America-Ragchew). Switching to NXDNReflector servers this way changes the openSPOT3's active connector to the NXDNReflector connector.

Alternatively you can set up different configuration profiles with different servers activated, and switch between the configuration profiles using your transceiver.

DTMF method

Here are some example DTMF command sequences:

Switching to REF servers:

- `*1C` or `*01C` or `*001C` connects to REF001 module C.

Switching to XRF servers:

- `B8B` or `B08B` or `B008B` connects to XRF008 module B.

Switching to XLX servers:

- `C5B` or `C502` or `C0502` will change the active connector to the [DCS/XLX connector](#) and connects to XLX005 module B.
- `C9D` or `C904` or `C0904` will change the active connector to the [DCS/XLX connector](#) and connects to XLX009 module D.

Switching to DCS servers:

- `D5A` or `D501` or `D0501` will change the active connector to the [DCS/XLX connector](#) and connects to DCS005 module A.
- `D1C` or `D103` or `D0103` will change the active connector to the [DCS/XLX connector](#) and connects to DCS001 module C.

Notes

The openSPOT3 will automatically set the local module to a space character if you are switching to a gateway, and to local module D if you are switching to a reflector using your radio.

Cross mode usage

The REF/XRF connector is a D-STAR® connector, but it supports DMR, C4FM and NXDN® cross modes.

Server change using a DMR or NXDN® radio

You can change servers using a DMR or NXDN® radio with a **private call** to a special ID described below.

Server change using a C4FM radio

You can change servers by entering the [Special command/cross mode private call DTMF code](#) (by default it's *) or the [Cross mode group call DTMF code]](#) (by default it's #) followed by the special ID described below.

You can also use the Wires-X® button menu of your radio to select/search for servers.

Special IDs for server change

The format of the ID to call with your DMR or NXDN® radio, or the ID to enter using DTMF codes on your C4FM radio can be the following:

- **server type** + **module number** or
- **server type** + **server number** + **module number**

Server type can be:

- 1: REF
- 2: XRF
- 3: XLX

- 4: DCS

Module number is the remote module, and it is always 2 digits long. 01 is module A, 02 is module B, 03 is module C and so on.

Some examples:

- ID 4901 will connect to DCS009A (server type 4 (DCS), number 9 and module 01 which is A)
- ID 4812 will connect to DCS008L (server type 4 (DCS), number 8 and module 12 which is L)
- ID 10103 will connect to REF001C (server type 1 (REF), number 01 and module 03 which is C)
- ID 13003 will connect to REF030C (server type 1 (REF), number 30 and module 03 which is C)
- ID 312302 will connect to XLX123B (server type 3 (XLX), number 123 and module 02 which is B)

FCS connector

You can use this connector to connect to a network which supports the FCS protocol like the FCS network.

The easiest way is to use the Quick setup to connect to these networks.

You can change rooms with your C4FM radio by entering the Special command/cross mode private call DTMF code DTMF code (by default it's *) or the Cross mode group call DTMF code] (by default it's #) followed by the special ID described below.

You can also use the Wires-X® button menu of your C4FM radio to select/search for servers.

Advanced settings

If you enter IDs into the **DGID list**, then they will be sent to the server. The server will link the specified DGIDs/rooms if it supports this functionality. Note that the server may override the **Room number** setting if the DGID list is not empty.

Cross mode usage

The FCS connector is a C4FM connector, but it supports DMR, D-STAR®, NXDN® and P25 cross modes.

Server and room change using a DMR, NXDN® or P25 radio

You can change servers and rooms using your DMR, NXDN® or P25 radio with a **private call** to a special ID described below.

You can switch the cross mode DGID sent to the network by making a short **group call** to 4000 + the desired DGID number. For example, if you want to set the cross mode DGID to 25, start a short group call 4025. To reset the DGID to 0, start a short group call to 4000.

Server and room change using a D-STAR® radio

- DTMF method

Enter DTMF code * followed by the special ID described below.

- URCALL/your call method

Set the URCALL to the FCS server and room number. Example: starting a call to destination callsign (URCALL) `FCS00199` switches to FCS001 room 99.

The URCALL/your call method lets you change to the following server types:

- REF/XRX/Gateway: set the URCALL to for example `REF001 C` . Switching to REF/XRF servers or gateways this way changes the openSPOT3's active connector to the REF/XRF connector.
- DCS/XLX: set the URCALL to for example `DCS001 A` . Switching to DCS/XLX servers this way changes the openSPOT3's active connector to the DCS/XLX connector.
- BrandMeister: set the URCALL to `BM` followed by the BrandMeister server ID. Example: starting a call to destination callsign (URCALL) `BM2162` switches to BrandMeister server 2162 (Hungary). Switching to BrandMeister servers this way changes the openSPOT3's active connector to the Homebrew/MMDVM connector.
- FCS: set the URCALL to the FCS server and room number. Example: starting a call to destination callsign (URCALL) `FCS00199` switches to FCS001 room 99. Switching to FCS servers this way changes the openSPOT3's active connector to the FCS connector.
- YSFReflector: set the URCALL to `YS` followed by the YSFReflector server ID. Example: starting a call to destination callsign (URCALL) `YS89804` switches to YSFReflector 89804 (AmericaLink). Switching to YSFReflector servers this way changes the openSPOT3's active connector to the YSFReflector connector.
- NXDNReflector: set the URCALL to `NX` followed by the NXDNReflector server ID. Example: starting a call to destination callsign (URCALL) `NX28299` switches to NXDNReflector 28299 (America-Ragchew). Switching to NXDNReflector servers this way changes the openSPOT3's active connector to the NXDNReflector connector.

You can switch the cross mode DGID sent to the network using a D-STAR® transceiver by entering DTMF code # followed by the desired DGID. For example, if you want to set the cross mode DGID to 25, enter DTMF #25. If you only enter # then the cross mode DGID will be reset to 0.

Special IDs for server and room change

The format of the ID to call with your DMR, NXDN® or P25 radio, or the ID to enter using DTMF codes on your D-STAR® radio can be the following:

- **room number** or
- **server number** + **room number**

Some examples:

- ID 5 will connect to the current server's room 5

- ID 99 will connect to the current server's room 99
- ID 205 will connect to FCS002 room 5
- ID 314 will connect to FCS003 room 14

YSFReflector connector

You can use this connector to connect to a network which supports the YSFReflector protocol, like YSFReflector servers.

The easiest way is to use the Quick setup to connect to these networks.

Advanced settings

If you enter IDs into the **DGID list**, then they will be sent to the server. The server will link the specified DGIDs/rooms if it supports this functionality.

Switching YSFReflector servers using your radio

You can switch YSFReflector servers with your radio by entering the Special command/cross mode private call DTMF code (by default it's *) or the Cross mode group call DTMF code (by default it's #) followed by the desired server's ID (5 digits).

You can also use the Wires-X® button menu of your radio to select/search for servers.

Cross mode usage

The YSFReflector connector is a C4FM connector, but it supports DMR, D-STAR®, NXDN® and P25 cross modes.

Using a DMR, NXDN® or P25 transceiver

You can change servers using DMR, NXDN® and P25 transceivers by calling their IDs with a private call.

You can switch the cross mode DGID sent to the network by making a short **group call** to 4000 + the desired DGID number. For example, if you want to set the cross mode DGID to 25, start a short group call 4025. To reset the DGID to 0, start a short group call to 4000.

Using a D-STAR® transceiver

You can switch YSFReflector servers using a D-STAR® transceiver by entering DTMF code * followed by the desired server's ID (5 digits).

You can also use the URCALL/your call method. This lets you change to the following server types:

- REF/XRX/Gateway: set the URCALL to for example `REF001 C` . Switching to REF/XRF servers or gateways this way changes the openSPOT3's active connector to the REF/XRF connector.
- DCS/XLX: set the URCALL to for example `DCS001 A` . Switching to DCS/XLX servers this way changes the openSPOT3's active connector to the DCS/XLX connector.
- BrandMeister: set the URCALL to `BM` followed by the BrandMeister server ID. Example: starting a call to destination callsign (URCALL) `BM2162` switches to BrandMeister server 2162 (Hungary). Switching to BrandMeister servers this way changes the openSPOT3's active connector to the Homebrew/MMDVM connector.
- FCS: set the URCALL to the FCS server and room number. Example: starting a call to destination callsign (URCALL) `FCS00199` switches to FCS001 room 99. Switching to FCS servers this way changes the openSPOT3's active connector to the FCS connector.
- YSFReflector: set the URCALL to `YS` followed by the YSFReflector server ID. Example: starting a call to destination callsign (URCALL) `YS89804` switches to YSFReflector 89804 (AmericaLink). Switching to YSFReflector servers this way changes the openSPOT3's active connector to the YSFReflector connector.
- NXDNReflector: set the URCALL to `NX` followed by the NXDNReflector server ID. Example: starting a call to destination callsign (URCALL) `NX28299` switches to NXDNReflector 28299 (America-Ragchew). Switching to NXDNReflector servers this way changes the openSPOT3's active connector to the NXDNReflector connector.

You can switch the cross mode DGID sent to the network using a D-STAR® transceiver by entering DTMF code # followed by the desired DGID. For example, if you want to set the cross mode DGID to 25, enter DTMF #25. If you only enter # then the cross mode DGID will be reset to 0.

NXDNReflector connector

You can use this connector to connect to a network which supports the NXDNReflector protocol, like NXDNReflector servers.

The easiest way is to use the Quick setup to connect to these networks.

Talkgroup handling

NXDNReflector servers handle only one talkgroup. You can find each server's talkgroup ID in the server list, or if you enable *Advanced mode*, then the talkgroup ID setting will be shown.

- If you use NXDN® modem mode, then make sure you send your calls as a group call to the talkgroup ID, otherwise the server will ignore your calls. Also make sure you have the talkgroup ID in your SelCall list (if SelCall is enabled), otherwise you won't hear incoming calls on your radio.
- If you use cross modes, then send your calls as a group call to the talkgroup ID, otherwise the server will ignore your calls.

  If you use a DMR radio, then make sure the talkgroup ID is set as the TX contact for the current channel in your radio, or the talkgroup ID is in an RX group list which is assigned to the current channel of your radio, otherwise you won't hear incoming calls from the server.

  You can also set the **Default cross mode destination ID** to the talkgroup ID and enable **Always use this ID in cross mode**. These settings are available on the Settings page, NXDN® settings section. This way your cross mode calls will be always sent to the correct talkgroup ID.

Switching NXDNReflector servers using your radio

You can switch NXDNReflector servers with your radio by calling the desired server's ID with a private call.

Cross mode usage

The NXDNReflector connector is an NXDN® connector, but it supports DMR, D-STAR®, and C4FM cross modes.

Using a DMR transceiver

You can switch NXDNReflector servers with your DMR transceiver by calling the desired server's ID with a private call.

Using a D-STAR® transceiver

You can switch NXDNReflector servers with your D-STAR® transceiver by entering DTMF code * followed by the desired server's ID (5 digits).

You can also use the URCALL/your call method. This lets you change to the following server types:

- REF/XRX/Gateway: set the URCALL to for example `REF001 C` . Switching to REF/XRF servers or gateways this way changes the openSPOT3's active connector to the REF/XRF connector.
- DCS/XLX: set the URCALL to for example `DCS001 A` . Switching to DCS/XLX servers this way changes the openSPOT3's active connector to the DCS/XLX connector.
- BrandMeister: set the URCALL to `BM` followed by the BrandMeister server ID. Example: starting a call to destination callsign (URCALL) `BM2162` switches to BrandMeister server 2162 (Hungary). Switching to BrandMeister servers this way changes the openSPOT3's active connector to the Homebrew/MMDVM connector.
- FCS: set the URCALL to the FCS server and room number. Example: starting a call to destination callsign (URCALL) `FCS00199` switches to FCS001 room 99. Switching to FCS servers this way changes the openSPOT3's active connector to the FCS connector.
- YSFReflector: set the URCALL to `YS` followed by the YSFReflector server ID. Example: starting a call to destination callsign (URCALL) `YS89804` switches to YSFReflector 89804 (AmericaLink). Switching to YSFReflector servers this way changes the openSPOT3's active connector to the YSFReflector connector.
- NXDNReflector: set the URCALL to `NX` followed by the NXDNReflector server ID. Example: starting a call to destination callsign (URCALL) `NX28299` switches to NXDNReflector 28299 (America-Ragchew). Switching to NXDNReflector servers this way changes the openSPOT3's active connector to the NXDNReflector connector.

Using a C4FM transceiver

You can switch NXDNReflector servers with your C4FM transceiver by entering the Special command/cross mode private call DTMF code DTMF code (by default it's *) followed by the desired server's ID (5 digits).

You can also use the Wires-X® button menu of your C4FM radio to select/search for servers.

P25Reflector connector

You can use this connector to connect to a network which supports the P25Reflector protocol, like P25Reflector servers.

The easiest way is to use the Quick setup to connect to these networks.

Talkgroup handling

P25Reflector servers handle only one talkgroup. You can find each server's talkgroup ID in the server list, or if you enable *Advanced mode*, then the talkgroup ID setting will be shown.

If the **Enable group call rerouting** setting is enabled (it's enabled by default), then all calls from your P25 radio will be forwarded to the correct talkgroup ID, and all calls from the network will be forwarded to talkgroup set at **Reroute group calls from net to ID** to your radio. In this case, make sure you have this talkgroup in your radio's selective call list (if SelCall is enabled), or set this talkgroup as the TX contact for the radio's current channel, otherwise you won't hear incoming calls on your radio.

Rerouting can be useful if you can't modify your radio's configuration (you don't have a programming cable or software for the radio). In this case, keep rerouting enabled, and set the **Reroute group calls from net to ID** to the talkgroup you already have in your radio.

If the **Enable group call rerouting** setting is disabled, then you have to send your calls to the correct talkgroup (the P25Reflector's TG ID), and incoming calls will be sent to their original destination ID (the P25Reflector's TG ID).

If you use C4FM modem mode, then your calls will be automatically sent to the P25Reflector's TG ID regardless of the **Enable group call rerouting** setting.

Switching P25Reflector servers using your radio

You can switch P25Reflector servers with your radio by calling the desired server's ID with a private call. If the **Allow server change with group calls** option is enabled (it is enabled by default), then starting a group call to the desired talkgroup's ID performs a server switch.

Cross mode usage

The P25Reflector connector is an P25 connector, but it supports C4FM cross modem mode. Make sure you use VW (Voice Wide) mode on your C4FM radio, otherwise your calls sent to the server will be silent.

You can switch P25Reflector servers with your C4FM radio by entering the Special command/cross mode private call DTMF code DTMF code (by default it's *) followed by the desired server's ID, or use the Wires-X® button menu to select/search for servers.

DAPNET connector

You can use this connector to connect to a network which supports the **DAPNET** protocol.

The easiest way is to use the Quick setup to connect to these servers.

This connector supports the POCSAG modem protocol which is the protocol used by pagers. You can find more information about POCSAG and DAPNET here.

The openSPOT3 acts as a transmitter on DAPNET, so make sure you use your DAPNET **transmitter** login and auth key for connecting the openSPOT3. These are not the same as your DAPNET user account. A separate transmitter registration is needed. See this page for more information.

This connector can stay active in the background if **Stay connected in background** is checked, which means you can use the openSPOT3 the same way as before with other active connector, but it will function also as a personal DAPNET/POCSAG transmitter. The openSPOT3 will automatically broadcast DAPNET/POCSAG messages when there's no call coming from the network or modem for POCSAG TX delay seconds (this can be set on the Settings page, POCSAG settings section), so ongoing calls won't be interrupted by POCSAG messaging. If the DAPNET connector is running in the background then you can see its connection status on the Status page.

If **Transmit time messages** is unchecked then the openSPOT3 won't transmit time messages from the DAPNET server. Some messages are ROT1 encoded, these will be automatically decoded if the **ROT1 decoder** is enabled. Note that not all ROT1 encoded messages can be recognized automatically so there can be received messages which won't be automatically decoded.

You can specify 8 RICs (IDs in POCSAG terminology) to filter messages to. If the **Enabled** checkbox is checked, then the openSPOT3 will only transmit POCSAG messages sent to these RICs by the DAPNET server.

DAPNET registration

You'll need 2 accounts to use DAPNET: one personal and one transmitter account. Here's how to create these accounts.

First, open a new ticket at support.hampager.de and select **New DAPNET Account with RIC** as the Help Topic. Fill in all required data and create the ticket. After this open a new ticket again and select **New DAPNET Transmitter** as the Help Topic. Fill in all required data and create the ticket.

You can set your callsign for both the personal and the transmitter account. For the transmitter registration, set the **Transmitter Type** to personal, and the **Antenna Type** to Omni. **Transmitter output power** is 0.02 for the openSPOT3. You can set the **Antenna gain in dBi** to 1 dB.

APRS® connector

You can use this connector to connect to the APRS® network. The easiest way is to use the Quick setup to set up the connection.

This connector can stay active in the background if the **Enable in background** checkbox is checked, which means you can use the openSPOT3 the same way as before with another active connector, but it will function also as an APRS® client.

The openSPOT3 will automatically receive APRS® chat messages and if enabled, it can transmit the device location or position information received from D-STAR® and C4FM/Fusion® radios. If the APRS® connector is enabled then you can see its connection status on the Status page.

You can also enable forwarding incoming APRS® chat messages to your POCSAG receiver by setting a RIC at **Send incoming messages to POCSAG RIC**.

If *Advanced mode* is enabled, then you can set forced a SSID, symbol and APRS® comment for forwarded location data.

SharkRF IP Connector Client connector

You can use this connector to directly connect to another openSPOT device, or a server which supports the SharkRF IP Connector protocol, or our open source SharkRF IP Connector Protocol Server. The protocol's documentation can be found on GitHub, so you can also develop your own application for the openSPOT3.
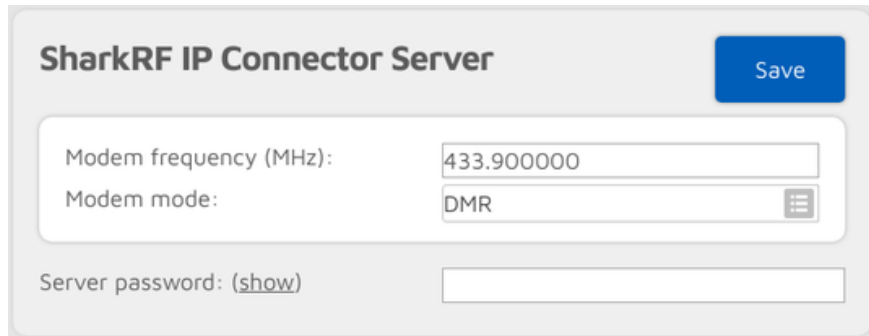
The easiest way is to use the Quick setup to connect to a SharkRF IP Connector server.

If you want to connect directly to another openSPOT or openSPOT3, make sure that the another device is set up as the server, and the UDP port used by this connector (by default it's 65100) is correctly set up on the server's router (it's open on the firewall and is forwarded to the server openSPOT1/2/3 on its local network).

All modem modes are supported by this connector, with automatic cross mode conversion between the following modes:

- DMR, D-STAR®, C4FM (DN mode) and NXDN®.
- C4FM (VW mode) and P25.

SharkRF IP Connector Server connector

You can use this connector to accept connections from another openSPOT device. This connector only supports 1 active connection, so if you want to link more than 1 device, you can use our open source SharkRF IP Connector Protocol Server. The protocol's documentation can be found on GitHub, so you can also develop your own application for the openSPOT3.

The easiest way is to use the Quick setup to set up this connector.

Make sure that the UDP port used by this connector (by default it's 65100) is correctly set up on your router (it's open on the firewall and is forwarded to the openSPOT3's IP address).

All modem modes are supported by this connector, with automatic cross mode conversion between the following modes:

- DMR, D-STAR®, C4FM (DN mode) and NXDN®.
- C4FM (VW mode) and P25.

AutoCal connector

AutoCal is a special connector - it does not connect to anywhere. It analyzes an incoming transmission from the modem and tries to find out the frequency difference (RX offset) between the openSPOT3 and the transmitter.

openSPOT3's oscillator has a frequency stability of 0.5ppm, and every openSPOT3 is factory calibrated by us, so you'll only need to use this special connector if your transceiver's transmit frequency is drifting. We suggest you to only run AutoCal if the openSPOT3 shows BER above 1% for your radio's transmission, as errors in the voice stream usually won't be noticeable if the BER is below 1%.

To use AutoCal, set the modem mode to the mode your radio uses and the modem frequency to the radio's transmit frequency, then click on the **Save** button. Hold the PTT button on your radio until all 3 phases are completed. The found RX offset will be displayed at the **Last found offset** field and it will be automatically saved for the current modem mode.

Keep in mind, that you can always check your own voice quality by using the openSPOT3's built-in local echo service.

If the AutoCal does not enter Phase 2, then hold the PTT on your transceiver for at least the time it takes for the progress bar to go from 0% to 100%. Make sure the transceiver is transmitting on the AutoCal frequency (433.900 MHz by default). If the AutoCal still does not enter Phase 2, then the RX offset between the transceiver and the openSPOT3 is greater than 500Hz. What you can do is to switch frequency on the transceiver or on the openSPOT3, or enter an RX offset greater than 500Hz manually on the modem page and use the openSPOT3's built-in local echo service to find out the lowest BER.

Powersaving

If powersaving is enabled, and it's active, the openSPOT3 consumes much less power. Powersaving is active if the standby status LED sequence is blinking in a much longer interval. The openSPOT3 can only enter powersaving state if the web interface is not open and there are no ongoing calls.

Enabling powersaving reduces LED brightness, and enables the Wi-Fi interface to enter power save mode if no important communication is ongoing. The built-in LLMNR and MDNS servers may not function properly in this mode, so opening the web interface by entering the openSPOT3's hostname into the browser (example: http://openspot3.local) may not work reliably. The recommended method is to use SharkRF Link to open the web interface.

Control calls

There are some special IDs and callsigns which trigger built-in services and actions when a call is received to them from your radio.

Local echo service

If the local echo service's ID or callsign is called, the openSPOT3 records the voice transmission and plays it back after the call from the radio is finished. This is useful for hearing your own voice back to test the connection between your radio and the openSPOT3. If you have local echo voice quality issues, see the AutoCal special connector.

The local echo service can be triggered if the call is sent to the following IDs/callsigns:

- DMR, NXDN® and P25:** ID 9999. Both private and group calls to this ID are answered with a private call.
- D-STAR®: call is sent to `.......E` (7 spaces and an E, replace dots with spaces). *Note that currently the D-STAR® echo reply is limited around 2 seconds.*
- C4FM: call DGID is set to 99.

Note that only about 10 seconds can be recorded and played back by the local echo service.

Current configuration profile query

The current configuration profile's number can be queried by calling the following IDs/callsigns:

- **DMR, NXDN® and P25:** ID 9000. Both private and group calls are interpreted.
- **D-STAR®:** call is sent to `.......P` (7 spaces and an P, replace dots with spaces), or DTMF code A is entered.
- **C4FM:** Special command/cross mode private call DTMF code (by default it's *) is entered followed by DTMF code A.

The current configuration profile number will be announced by the voice. The DMR/NXDN®/P25 profile query ID can be changed on the Settings page, Voice announcements section.

Change configuration profile

The active configuration profile can be changed by calling the following IDs/callsigns:

- **DMR, NXDN® and P25:** ID 9000+configuration profile number. Example: to switch to config profile 1, start a short call to 9001. Both private and group calls are interpreted.

- **D-STAR®**: call is sent to `.......1` (7 spaces and the configuration profile number, replace dots with spaces), or DTMF code A is entered followed by the configuration profile number.
- **C4FM:** Special command/cross mode private call DTMF code (by default it's *) is entered followed by DTMF code A, then the desired configuration profile number.

Connector status query

The currently active connector's status can be queried by calling the following IDs/callsigns:

- **DMR, NXDN® and P25**: ID 9998. Both private and group calls are interpreted.
- **D-STAR®**: call is sent to `.......I` (7 spaces and an I, replace dots with spaces), or DTMF code D or 0 is entered.
- **C4FM:** Special command/cross mode private call DTMF code (by default it's *) is entered followed by DTMF code D.

The connector status will be announced by voice. The DMR/NXDN®/P25 connector status query ID can be changed on the Settings page, Voice announcements section.

Active IP address query

The active IP address can be queried by calling the following IDs/callsigns:

- **DMR, NXDN® and P25**: ID 9997. Both private and group calls are interpreted.
- **D-STAR®**: call is sent to `.......A` (7 spaces and an A, replace dots with spaces), or DTMF code B is entered.
- **C4FM:** Special command/cross mode private call DTMF code (by default it's *) is entered followed by DTMF code B.

The IP address will be announced by voice. The DMR/NXDN®/P25 IP address query ID can be changed on the Settings page, Voice announcements section.

Battery status query

The battery status can be queried by calling the following IDs/callsigns:

- **DMR, NXDN® and P25**: ID 9996. Both private and group calls are interpreted.
- **D-STAR®**: call is sent to `.......B` (7 spaces and an B, replace dots with spaces), or DTMF code C is entered.
- **C4FM:** Special command/cross mode private call DTMF code (by default it's *) is entered followed by DTMF code C.

The battery status will be announced by voice. The DMR/NXDN®/P25 battery status query ID can be changed on the Settings page, Voice announcements section.

Time query

The current device time can be queried by calling the following IDs/callsigns:

- **DMR**, **NXDN®** **and P25**: ID 9995. Both private and group calls are interpreted.
- **D-STAR®**: call is sent to `.......T` (7 spaces and an T, replace dots with spaces), or DTMF codes CD is entered.
- **C4FM:** Special command/cross mode private call DTMF code (by default it's *) is entered followed by DTMF codes CD.

The current time will be announced by voice. The DMR/NXDN®/P25 time query ID can be changed on the Settings page, Voice announcements section.

D-STAR® unlink command

The openSPOT3 is designed to be always connected, however, the unlink (U) command is supported and activates the Null connector (which - as its name says - does not connect anywhere).

You can unlink if a call is sent to `.......U` (7 spaces and a U, replace dots with spaces), or DTMF code # is entered.

Cross modes

The openSPOT3 has a very powerful, yet easy to use cross mode system. It supports the following cross modes:

- You can use your **DMR** transceiver to access **D-STAR®**, **C4FM**, **NXDN®** networks
- You can use your **D-STAR®** transceiver to access **DMR**, **C4FM**, **NXDN®** networks
- You can use your **C4FM** transceiver to access **DMR**, **D-STAR®**, **NXDN®**, **P25** networks
- You can use your **NXDN®** transceiver to access **DMR**, **C4FM**, **D-STAR®** networks
- You can use your **P25** transceiver to access **C4FM** networks

Hardware transcoding is done automatically by the built-in **AMBE® vocoder chip**.

A software-based conversion method is used for the following cross modes:

- **C4FM** transceiver to access **P25** networks
- **P25** transceiver to access **C4FM** networks

Cross modes using a DMR transceiver

Using a D-STAR® network

After you've set up and activated the D-STAR® connector, switch the modem to DMR mode.

Your outgoing callsign will be the callsign associated with the DMR source ID. If there's no callsign associated to the ID, then the callsign will be the Default callsign for cross mode calls. If this is not set, your outgoing callsign will be your radio's DMR ID as text.

An incoming call's source DMR ID will be set to the ID associated with the source callsign. If there's no ID associated, and the source callsign can be parsed into a number, it will be used as the source DMR ID. Otherwise the Default cross mode source DMR ID will be used.

All calls coming from the D-STAR® network will be sent as a group call to DMR ID 9 (TG9). Make sure TG9 is the TX contact of your DMR radio's current channel, or it's in an RX group list which is assigned to the current channel in the radio, otherwise the squelch won't open and you won't hear the calls.

Using a C4FM network

After you've set up and activated the C4FM connector, switch the modem to DMR mode. Only calls in DN (Digital Narrow) mode will be converted to your DMR radio. If someone transmits in other modes on the C4FM network, you will hear silence on your DMR radio.

Your outgoing callsign will be the callsign associated with the DMR source ID. If there's no callsign associated to the ID, then the callsign will be the Default callsign for cross mode calls. If this is not set, your outgoing callsign will be your radio's DMR ID as text.

An incoming call's source DMR ID will be set to the ID associated with the source callsign. If there's no ID associated, and the source callsign can be parsed into a number, it will be used as the source DMR ID. Otherwise the Default cross mode source DMR ID will be used.

All calls coming from the C4FM network will be sent as a group call to DMR ID 9 (TG9). Make sure TG9 is the TX contact of your DMR radio's current channel, or it's in an RX group list which is assigned to the current channel in the radio, otherwise the squelch won't open and you won't hear the calls.

Using an NXDN® network

After you've set up and activated the NXDN® connector, switch the modem to DMR mode.

The source NXDN® ID of your DMR calls will be set to the same value as the DMR call unless the **Always use this ID in cross mode** setting is enabled for the **Default cross mode source ID** on the Settings page, NXDN® settings section.

Your DMR calls will be sent to the same NXDN® ID as the DMR call's destination ID unless the **Always use this ID in cross mode** setting is enabled for the **Default cross mode destination ID** on the Settings page, NXDN® settings section, or the destination DMR ID is out of the NXDN® ID range (0-65535). In this case, the **Default cross mode destination ID** will be used for the NXDN® call.

The destination and source DMR IDs for an incoming NXDN® call will be set to the same value as the incoming call's destination and source ID unless the **Always use this ID in cross mode** setting is enabled for the destination/source NXDN® IDs on the Settings page, NXDN® settings section.

Make sure the destination ID of the NXDN® calls (the NXDN® talkgroup) is the TX contact of your DMR radio's current channel, or it's in an RX group list which is assigned to the current channel in the radio, otherwise the squelch won't open and you won't hear the calls.

Cross modes using a D-STAR® transceiver

Using a DMR network

After you've set up and activated the DMR connector, switch the modem to D-STAR® mode.

The source DMR ID of your calls from the D-STAR® radio will be set to the ID associated with the source callsign. If there's no ID associated, then the source callsign will be parsed into a number and this will be used as the source DMR ID. If it can't be parsed into a number, then the Default cross mode source DMR ID will be used. You can set this to your DMR ID.

The callsign of incoming DMR calls will be set to the callsign associated with the DMR ID. If there's no callsign associated in the database, then the Default callsign for cross mode calls will be used. If it's not set, the callsign will be the source DMR ID as text.

Using a C4FM network

After you've set up and activated the C4FM connector, switch the modem to D-STAR® mode. Only calls in DN (Digital Narrow) mode will be converted to your D-STAR® radio. If someone transmits in other modes on the C4FM network, you will hear silence on your D-STAR® radio.

If there's an incoming call from the C4FM network, and the incoming call's source callsign can be found in the callsign database, then the openSPOT3 adds the caller's name and country code to the D-STAR® call's message.

Using an NXDN® network

After you've set up and activated the NXDN® connector, switch the modem to D-STAR® mode.

All D-STAR® calls will be sent to the Default cross mode destination ID on the NXDN® network.

The source NXDN® ID of your calls from the D-STAR® radio will be set to the ID associated with the source callsign. If there's no ID associated, then the source callsign will be parsed into a number and this will be used as the source NXDN® ID. If it can't be parsed into a number, then the Default cross mode source ID will be used. The default ID will be used if the **Always use this ID in cross mode** setting is enabled for the **Default cross mode source ID** on the Settings page, NXDN® settings section.

The callsign of incoming NXDN® calls will be set to the callsign associated with the NXDN® ID. If there's no callsign associated in the database, then the Default callsign for cross mode calls will be used. If it's not set, the callsign will be the

source NXDN® ID as text.

Cross modes using a C4FM transceiver

Using a DMR network

After you've set up and activated the DMR connector, switch the modem to C4FM mode (or C4FM Half Deviation mode, if your radio needs that). Only calls in DN (Digital Narrow) mode will be converted, if you transmit in other modes, DMR users will only hear silence.

The source DMR ID of your calls from the C4FM radio will be set to the ID associated with the source callsign. If there's no ID associated, then the source callsign will be parsed into a number and this will be used as the source DMR ID. If it can't be parsed into a number, then the Default cross mode source DMR ID will be used. You can set this to your DMR ID.

The callsign of incoming DMR calls will be set to the callsign associated with the DMR ID. If there's no callsign associated in the database, then the Default callsign for cross mode calls will be used. If it's not set, the callsign will be the source DMR ID as text.

Using a D-STAR® network

After you've set up and activated the D-STAR® connector, switch the modem to C4FM mode (or C4FM Half Deviation mode, if your radio needs that). Only calls in DN (Digital Narrow) mode will be converted, if you transmit in other modes, D-STAR® users will only hear silence.

Note that some (classic) REF and XRF servers need a valid D-STAR® registration. You can read more about this here. Make sure you've set the callsign in your C4FM transceiver to the exact same callsign that you have registered, otherwise servers which require a registered callsign won't accept the connection, or won't let the openSPOT3 to transmit data.

Using an NXDN® network

After you've set up and activated the NXDN® connector, switch the modem to C4FM mode (or C4FM Half Deviation mode, if your radio needs that). Only calls in DN (Digital Narrow) mode will be converted, if you transmit in other modes, NXDN® users will only hear silence.

All C4FM calls will be sent to the Default cross mode destination ID on the NXDN® network.

The source NXDN® ID of your calls from the C4FM radio will be set to the ID associated with the source callsign. If there's no ID associated, then the source callsign will be parsed into a number and this will be used as the source NXDN® ID. If it can't be parsed into a number, then the Default cross mode source ID

will be used. The default ID will be used if the **Always use this ID in cross mode** setting is enabled for the **Default cross mode source ID** on the Settings page, NXDN® settings section.

The callsign of incoming NXDN® calls will be set to the callsign associated with the NXDN® ID. If there's no callsign associated in the database, then the Default callsign for cross mode calls will be used. If it's not set, the callsign will be the source NXDN® ID as text.

Using a P25 network

After you've set up and activated the P25 connector, switch the modem to C4FM mode (or C4FM Half Deviation mode, if your radio needs that). Only calls in VW (Voice Wide) mode will be converted, if you transmit in other modes, P25 users will only hear silence.

The source P25 ID of your calls from the C4FM radio will be set to the ID associated with the source callsign. If there's no ID associated, then the source callsign will be parsed into a number and this will be used as the source P25 ID. If it can't be parsed into a number, then the Default cross mode source P25 ID will be used. You can set this to your DMR/P25/CCS7 ID.

The callsign of incoming P25 calls will be set to the callsign associated with the P25 ID. If there's no callsign associated in the database, then the Default callsign for cross mode calls will be used. If it's not set, the callsign will be the source P25 ID as text.

Cross modes using an NXDN® transceiver

Using a DMR network

After you've set up and activated the DMR connector, switch the modem to NXDN® mode.

The source DMR ID of your NXDN® calls will be set to the same value as the NXDN® call unless the **Always use this ID in cross mode** setting is enabled for the **Default cross mode source ID** on the Settings page, NXDN® settings section.

Your NXDN® calls will be sent to the same DMR ID as the NXDN® call's destination ID unless the **Always use this ID in cross mode** setting is enabled for the **Default cross mode destination ID** on the Settings page, NXDN® settings section.

The destination and source NXDN® IDs for an incoming DMR call will be set to the same value as the incoming call's destination and source ID unless the **Always use this ID in cross mode** setting is enabled for the destination/source NXDN® IDs on the Settings page, NXDN® settings section (or if the incoming DMR call's destination or source ID is out of the NXDN® ID range (0-65535)).

Private DMR calls are converted to NXDN® group calls.

Using a D-STAR® network

After you've set up and activated the D-STAR® connector, switch the modem to NXDN® mode.

Your outgoing callsign will be the callsign associated with the NXDN® source ID. If there's no callsign associated to the ID, then the callsign will be the Default callsign for cross mode calls. If this is not set, your outgoing callsign will be your radio's NXDN® ID as text.

An incoming call's source NXDN® ID will be set to the ID associated with the source callsign. If there's no ID associated, and the source callsign can be parsed into a number, it will be used as the source NXDN® ID. Otherwise the Default cross mode source ID will be used.

All calls coming from the D-STAR® network will be sent as a group call to the Default cross mode destination ID. If you don't hear calls on your radio then make sure this ID is in the selective call list (or SelCall is turned off), or it's the TX contact of the current channel.

Using a C4FM network

After you've set up and activated the C4FM connector, switch the modem to NXDN® mode. Only calls in DN (Digital Narrow) mode will be converted to your NXDN® radio. If someone transmits in other modes on the C4FM network, you will hear silence on your NXDN® radio.

Your outgoing callsign will be the callsign associated with the NXDN® source ID. If there's no callsign associated to the ID, then the callsign will be the Default callsign for cross mode calls. If this is not set, your outgoing callsign will be your radio's NXDN® ID as text.

An incoming call's source NXDN® ID will be set to the ID associated with the source callsign. If there's no ID associated, and the source callsign can be parsed into a number, it will be used as the source NXDN® ID. Otherwise the Default cross mode source ID will be used.

All calls coming from the C4FM network will be sent as a group call to the Default cross mode destination ID. If you don't hear calls on your radio then make sure this ID is in the selective call list (or SelCall is turned off), or it's the TX contact of the current channel.

Cross modes using a P25 transceiver

Using a C4FM network

After you've set up and activated the C4FM connector, switch the modem to P25 mode. Only calls in VW (Voice Wide) mode will be converted to your P25 radio. If someone transmits in other modes on the C4FM network, you will hear silence on your P25 radio.

Your outgoing callsign will be the callsign associated with the P25 source ID. If there's no callsign associated to the ID, then the callsign will be the Default callsign for cross mode calls. If this is not set, your outgoing callsign will be your radio's P25 ID as text.

An incoming call's source P25 ID will be set to the ID associated with the source callsign. If there's no ID associated, and the source callsign can be parsed into a number, it will be used as the source P25 ID. Otherwise the Default cross mode source P25 ID will be used.

All calls coming from the C4FM network will be sent as a group call to P25 ID 9 (TG9). Make sure TG9 is in the selective call list of your P25 radio's current channel, or SelCall is turned off, or TG9 is set as the TX contact for the current channel, otherwise the squelch won't open and you won't hear the calls.

USB serial console

The openSPOT3 shows up as a USB serial port (COM port) when plugged into a computer. You can reach the serial console by opening this USB serial port with serial terminal software like PuTTY, RealTerm, TeraTerm, minicom etc. To find out which is your openSPOT3's serial port device path (COM port number), look at the device list of your computer (in your operating system's control panel for example). You can use the following settings for opening the serial port, but in theory any configuration would work: baud rate 115200, 8 data bits, no parity bits, 1 stop bit.

The openSPOT3's serial console does not require drivers on modern operating systems, as it shows up as a standard USB ACM device with our official USB ID 0x1fc9:0x8125. You can download a driver for Windows XP, 7 and Vista here. Some users reported that Windows 8.1 also requires this driver, but it can only be installed if the signed driver requirement is turned off.

The serial console can be used to change basic network settings, reboot the openSPOT3, switch it to bootloader mode, see its debug log, reset the web interface password and many more. The list of available commands can be queried with the **help** command.

API

You can use both an HTTP/WebSocket and a UDP application programming interface to develop your own applications which use the openSPOT3.

You can find more information about the API protocols on our GitHub pages:

- openSPOT3 HTTP/WebSocket API
- SharkRF IP Connector Protocol (a server application is also available)
- SharkRF Voice Announcement server

Factory reset

Hold the Wi-Fi button for 30 seconds to perform a full factory reset. In this case all configuration profiles will be cleared.

Please only use your fingers, or a ballpoint pen to press the buttons. Don't use sharp items like a needle!

Factory reset using the web interface

The openSPOT3 can be reset to factory defaults if you click on the **Reset all config profiles** button at the bottom of the Settings page, or you hold the Wi-Fi button for at least 30 seconds (until the LED turns off). These methods will reset all configuration profiles to the default settings.

If you only want to reset the active configuration profile to defaults, you can use the **Reset config profile** button at the bottom of the Settings page, or you can enter the **rbc** USB serial console command.

Troubleshooting

Please make sure you **always use the latest firmware version**.

Do NOT unplug the openSPOT3 during the firmware upgrade!

If you can't find an answer to your issue, then please send us am email, or ask help in our community forum!

The web interface can't be opened

Use SharkRF Link to open the web interface.

SharkRF Link does not open the openSPOT3 web interface

Make sure your web browser device (phone/tablet/computer) is connected to the exact same Wi-Fi network the openSPOT3 is using.

Check if the openSPOT3 is connected to the Wi-Fi network by looking at its status LED. Please see the LED states section for possible status LED states. If the openSPOT3 is not connected to the Wi-Fi network according to the status LED, see the next troubleshooting question's answer on how to set up the openSPOT3's Wi-Fi connection.

Also check the Wi-Fi client isolation in your Wi-Fi router's settings. It should be turned off.

The openSPOT3 can't connect to the Wi-Fi network

Please first check the status LED's color on the device. You can see the list of LED states on this page. The openSPOT3 can't connect to the Wi-Fi network only if the status LED is flashing blue for a longer period of time (at least 2-3 minutes). If you see other status LED colors than blue, then the issue is not with connecting to the Wi-Fi network.

- You can reconfigure the Wi-Fi connection if you switch back the openSPOT3 to access point mode by pressing the button for 3 seconds.
- The openSPOT3 will start broadcasting its own Wi-Fi network called **openSPOT3 AP**, indicated by white status LED. You can connect to this network using your browser device (phone/tablet/computer).
- Make sure you place your browser device close to the openSPOT3 during this time.
- The initialization setup will pop up, where you can select the country of operation and configure a Wi-Fi network for the openSPOT3 to connect to. If the initialization setup won't open automatically, then you can open it by entering http://192.168.99.1/ into the web browser while your browser device is connected to the Wi-Fi network **openSPOT3 AP**. Note that this

address is only active while the openSPOT3 is in AP mode, indicated by white status LED.

- Make sure you've entered the Wi-Fi password case sensitive.
- After you've chosen the Wi-Fi network and entered the password, the openSPOT3 stops broadcasting its own Wi-Fi network and starts connecting to the selected network. At that moment, your browser device (phone/tablet/computer) will disconnect from the openSPOT3's network. What you have to do now is to connect to the exact same Wi-Fi network with your browser device as you've configured for the openSPOT3.
- If you have WEP encryption on your router, then make sure the password is in ASCII, not hex. The openSPOT3 only supports ASCII WEP passwords. The best is to switch the encryption to WPA2 or WPA because it's much safer.
- Make sure you have enabled 2.4GHz Wi-Fi, not just 5GHz.
- Place the openSPOT3 close to the Wi-Fi router.
- Make sure the Wi-Fi bandwith is set to max. 20Mhz in the Wi-Fi router (see explanation here).
- If it still does not work, try switching Wi-Fi channel on your Wi-Fi router. Only channels 1, 6 or 11 should be used (see explanation here).

You can also find more information on the Connecting the openSPOT3 to a Wi-Fi network page on the steps required to set up the openSPOT3's Wi-Fi connection.

The status LED is white

White status LED means that the openSPOT3 is in AP (access point) mode. In this mode, the openSPOT3 does not connect to any Wi-Fi network, so it is not connected to the internet, and SharkRF Link won't work.

- In this mode, the openSPOT3 broadcasts its own Wi-Fi network called **openSPOT3 AP**, indicated by white LED. You can connect to this network using your browser device (phone/tablet/computer).
- Make sure you place your browser device close to the openSPOT3 during this time.
- The initialization setup will pop up, where you can select the country of operation and configure a Wi-Fi network for the openSPOT3 to connect to. If the initialization setup won't open automatically, then you can open it by entering http://192.168.99.1/ into the web browser while your browser device is connected to the Wi-Fi network **openSPOT3 AP**. Note that this address is only active while the openSPOT3 is in AP mode, indicated by white status LED.
- Make sure you've entered the Wi-Fi password case sensitive.

- After you've chosen the Wi-Fi network and entered the password, the openSPOT3 stops broadcasting its own Wi-Fi network and starts connecting to the selected network. At that moment, your browser device (phone/tablet/computer) will disconnect from the openSPOT3's network. What you have to do now is to connect to the exact same Wi-Fi network with your browser device as you've configured for the openSPOT3.
- If you have WEP encryption on your router, then make sure the password is in ASCII, not hex. The openSPOT3 only supports ASCII WEP passwords. The best is to switch the encryption to WPA2 or WPA because it's much safer.
- Make sure you have enabled 2.4GHz Wi-Fi, not just 5GHz.
- Place the openSPOT3 close to the Wi-Fi router.
- Make sure the Wi-Fi bandwith is set to max. 20Mhz in the Wi-Fi router (see explanation here).
- If it still does not work, try switching Wi-Fi channel on your Wi-Fi router. Only channels 1, 6 or 11 should be used (see explanation here).

You can also find more information on the Connecting the openSPOT3 to a Wi-Fi network page on the steps required to set up the openSPOT3's Wi-Fi connection.

The status LED is green/yellow

Green/yellow LED means the openSPOT3 is connected to the configured Wi-Fi network and it is standing by (the Null connector is active).

What you have to do is to connect your browser device (phone/tablet/computer) to the exact same Wi-Fi network as you've configured for the openSPOT3 and use SharkRF Link to open its web interface. If it does not work, then make sure Wi-Fi client isolation is turned off in your Wi-Fi router's settings.

The web interface only loads partially

Make sure you use a supported browser (Chrome, Firefox or Safari), and that the browser is updated to the latest version.

If you're trying to do the initialization setup (the openSPOT3's status LED is white), then place the openSPOT3 close to your browser device (phone/tablet/computer) during the setup.

Otherwise, try placing the openSPOT3 closer to the Wi-Fi access point (your Wi-Fi router).

I need help connecting the openSPOT3 both to home and phone Wi-Fi network

Here's a quick tip on setting up the OS3 both for home and phone Wi-Fi connections:

First you should connect your openSPOT3 to your home Wi-Fi network and then when it's connected (status LED is green or green/yellow) open the web interface using sharkrf.link. After that you can set up additional Wi-Fi networks if you turn on *Advanced mode* (checkbox at the bottom right corner of the web interface) and go to the Network page, Wireless settings section. Set your home Wi-Fi as SSID #1 (and key) and your phone's Wi-Fi as SSID #2 (and key). If your home Wi-Fi (SSID #1) is not reachable then the openSPOT3 will automatically try to connect to your phone's Wi-Fi (SSID #2).

Make sure you enter passwords case sensitive.

If you use an iPhone then:

- Make sure you use the Save button at the Wireless scan list to save the iPhone's Wi-Fi network to SSID #2 as it contains a special apostrophe character which you can't enter using your keyboard
- Make sure you keep the iPhone's Wi-Fi hotspot settings page open while doing a wireless scan on the openSPOT3, because the iPhone only broadcasts its Wi-Fi network name if that page is kept open on the phone. We have tested the OS3 with iOS versions up to 13. Newer iOS versions may work differently.

The openSPOT3 won't turn on

- Press and hold the power button for at least 8 seconds
- Make sure you've charged the device for at least 30 minutes
- Use a different wall charge adapter or different USB port on a computer to charge the unit
- Try flipping the USB-C connector of the cable upside down

If it still does not turn on, or the power LED is unlit even when it's connected to a charger, and pressing the power button for at least 8 seconds doesn't help, then the firmware upgrade process probably got interrupted.

Please do the following to resume firmware upgrade:

1. Connect the openSPOT3 to a wall charge adapter or USB port on a computer
2. Press both the Wi-Fi and power buttons at the same time until the status LED lights up steady white
3. Release both buttons

The firmware upgrade process should resume indicated by red/green alternate status LED blinking. This usually takes several minutes. After the process is completed, the openSPOT3 will automatically reboot and you can continue using it.

If this don't help either, then do a manual firmware upgrade (method is described in the next troubleshooting entry).

I want to manually upgrade the firmware

- Download this file to your computer
- Plug the openSPOT3 using a USB cable into the computer
- Press and hold both buttons on the openSPOT3 for at least 10 seconds
- The LED will become steady white
- Release both buttons. The LED will become yellow and a flash drive will appear on your computer called BOOTLOADER
- Copy the previously downloaded file to this BOOTLOADER drive
- The LED will start blinking alternating red/green for about 2-3 minutes. After that it should be steady green
- The openSPOT3 will automatically reboot in 1 minute after the LED became steady green. Wait until it reboots and then you can continue using it (if the Wi-Fi module firmware is also upgraded then the LED will flash red/yellow for about 2-3 minutes after the reboot)

I get Connector authentication failed messages

Please take a look at this post.

You need to check the hotspot security setting on your BrandMeister SelfCare page. If hotspot security is turned on, you have to use the hotspot password you've set there as the server password in the openSPOT3. If hotspot security is turned off, then you have to use the default server password which is "passw0rd" (without the double quotation marks).

Note that servers nowadays usually require a hotspot security password to be set and enabled.

I get DMR ID not found messages

We update the openSPOT3's callsign-ID database weekly, usually on Mondays. Make sure your unit has upgraded to the latest database. You can see the currently active database version on the Status page. Check your ID again after the next week's update.
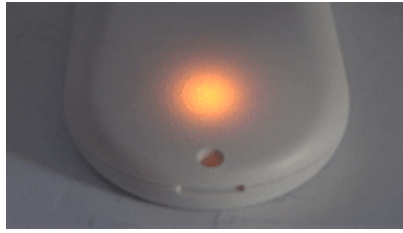
I'm not hearing anything on my radio

Please read the Setting up your transceiver section.

Check if your radio's LED is on when the openSPOT3 is transmitting. The openSPOT3 is transmitting if its status LED is blinking red:

If it's blinking alternating red/orange, then BCLO is on:

If this is the case then make sure it's turned off by setting it to 0 at the Other modem settings section.

If your radio's LED does not turn on when the openSPOT3 is transmitting, then make sure they are on the same RX and TX frequencies.

Make sure the openSPOT3's modem is set to the same mode as your radio, and the following settings are set:

- **DMR radio**: the color code (CC) match in your radio and the openSPOT3 (example: set it to the default 1). Make sure the talkgroup you want to hear is set as the TX contact of your DMR radio's currently active channel, or the talkgroup is in an RX group list which has been assigned to the currently active channel. You should also add TG9 to your the RX group list and assign it to the currently active channel to hear the openSPOT3's voice announcements.
- **C4FM radio**:
  - The DGID is set to the same value both in your radio and the openSPOT3 (example: set it to the default 0).
  - Make sure the Half Deviation setting is turned off in your transceiver, and use plain C4FM modem mode on the openSPOT3. If there's no such setting in your transceiver's menu, then you have to use C4FM Half Deviation modem mode, and run C4FM Half Deviation AutoCal on the openSPOT3 (or manually change the RX offset on the Modem page for the lowest BER). Test the connection between your transceiver and the openSPOT3 using the built-in local echo service.
- **NXDN® radio**: the radio access number (RAN) match in your radio and the openSPOT3 (example: set it to the default 0). Make sure the talkgroup you want to hear is in your NXDN® radio's contact list, or it is set as the TX contact of the currently active channel.

No one is hearing me on the network

Please read the Setting up your transceiver section.

Check where your radio is sending your call by looking at the Call log on the openSPOT3's web interface. Make sure your radio is sending the call to the desired talkgroup or reflector.

The openSPOT3's status LED should blink green when you press the PTT on your radio:

If not, then make sure the openSPOT3 and your radio are on the same RX and TX frequencies.

Make sure the openSPOT3's modem is set to the same mode as your radio, and the following settings are set:

- **DMR radio**: the color code (CC) match in your radio and the openSPOT3 (example: set it to the default 1).
- **C4FM radio**:
  - The DGID is set to the same value both in your radio and the openSPOT3 (example: set it to the default 0).
  - Make sure the Half Deviation setting is turned off in your transceiver, and use plain C4FM modem mode on the openSPOT3. If there's no such setting in your transceiver's menu, then you have to use C4FM Half Deviation modem mode, and run C4FM Half Deviation AutoCal on the openSPOT3 (or manually change the RX offset on the Modem page for the lowest BER). Test the connection between your transceiver and the openSPOT3 using the built-in local echo service.
- **NXDN® radio**: the radio access number (RAN) match in your radio and the openSPOT3 (example: set it to the default 0).

If you are using a D-STAR® server, then make sure your callsign registration is valid on this page. Also check if your registered callsign exactly match the callsign you've set on your D-STAR® or C4FM radio. There should be no suffixes. If you want to keep on using suffixes, then enable the **Force source callsign to D-STAR® network for cross mode calls** setting on the Settings page, D-STAR® settings section.

If you use a Kenwood TH-D74A transceiver, then make sure the *Direct Reply* feature is turned off, as it basically causes automatic callsign routing, which could cause one's transmission to not be heard on the used reflector.

The openSPOT3 can't connect to the selected server

If the status LED is flashing like this, then the openSPOT3 is trying to connect to the selected server, but it can't for some reason. If it's not flashing like on the animation, check the LED states section for more information about the current LED state.

The server may be currently offline, or there may be a connection issue between your openSPOT3 and the server. You can try using another server, or enable the Override DHCP DNS servers setting.

Also check if the server password is set correctly (in case there's a server password), and that your connector settings are valid (example: if there's a callsign setting, make sure your callsign is valid, if there's a DMR/CCS7 or NXDN® ID setting, make sure your ID is valid for your callsign).

If you want to connect to the BrandMeister network, and the openSPOT3 won't connect to any BrandMeister server, then make sure you use the hotspot security password you've set on your BrandMeister SelfCare page. If hotspot security is turned off on your BrandMeister SelfCare page, then you have to use the default server password, which is *passw0rd*. The UK server uses the default password *passw1rd*.

There are dropouts in incoming calls, voice is stuttering

Please note that dropouts can happen when there's an issue/interference with:

- The server
- The server's internet connection (most amateur radio servers are running on unstable home internet connections not suitable for international links)
- The link between the server and your Wi-Fi router, or your internet connection
- Your Wi-Fi router
- The Wi-Fi link between your openSPOT and your Wi-Fi router

These issues cause dropped packets, which are indicated on the Dejitter queue graph on the openSPOT3's Status page as "invalid seqnum errors". They may cause dropouts in the voice transmissions.

If there are no invalid seqnum errors, but the dejitter queue graph shows that the queue gets empty during a call, then you can try increasing the dejitter queue length at the Network settings section.

Make sure you use a server nearest to your location to avoid network dropouts and high latency. Please keep in mind, that packet loss and high latency can occur in VoIP (Voice over IP) streams even if you have a really high quality network connection.

What you can do to avoid dropouts are:

- Use a different server, which has a stable connection (try BrandMeister servers in cross mode)
- Place the openSPOT3 close to the Wi-Fi router.
- Make sure the Wi-Fi bandwith is set to max. 20Mhz in the Wi-Fi router (see explanation here)
- Try switching Wi-Fi channel on your Wi-Fi router. The currently used one may be overcrowded, which you may not notice during web browsing, as the web uses a protocol which resend missing data frames, but this can't be

done in real time VoIP streams so the packet loss issue becomes instantly noticable. Only channels 1, 6 or 11 should be used (see explanation here)

- Try using a different Wi-Fi router or internet connection

Wi-Fi disconnects (blue status LED) or internet connection errors (red/blue status LED)

Try to set another Wi-Fi channel in your Wi-Fi network. The currently used one may be overcrowded. It is advisable to use Wi-Fi channels 1, 6 or 11. Do not use the others as they only cause more interference. Also try placing the openSPOT3 closer to your Wi-Fi router / access point.

Color code mismatch warnings on the web interface

Make sure the color code programmed for your radio's current channel is matching the openSPOT3's color code. If they match, then probably there's an offset between the radio's TX frequency and the openSPOT3's RX frequency. Please use DMR AutoCal, or manually enter different frequencies in +-100 Hz steps at the RX offset on the Modem page for the lowest BER. You can test your voice using the openSPOT3's built-in local echo service by calling DMR ID 9999.

The device does not upgrade the firmware

Note that you have to plug the openSPOT3 into a USB power supply, otherwise the bootloader can't start and the firmware will not be upgraded. This also applies to overnight automatic firmware upgrades.

The device can't check firmware upgrades, it shows retrying

Make sure the NTP, HTTP and HTTPS outgoing traffic is not disabled in your router's firewall. You can also try turning the **Use DHCP server if available** option off.

Upgrade downloads are slow

Downloading upgrades is a low priority task so it won't interfere with normal operation and also the device won't consume much power during the download.

The device does not turn on

If pressing and holding the power button for 1-2 seconds does not turn on the device, then press and hold the power button for at least 8 seconds to do a hard reboot.

If the power LED is blinking 3 times, then the devices turns immediately turns off, then the battery is overheated, and its protection is active. Avoid exposing the device to direct sunlight and wait a few minutes so the battery can cool down.

If there is no LED activity at all, then the battery may be completely depleted. Connect the openSPOT3 to a USB power supply and leave it for at least 30 minutes, then turn the device on with the power button. If it still does not power on, hold the power button for at least 8 seconds to perform a hard reboot.

If it still does not power on, and both the power and status LEDs are dark, then probably the openSPOT3 had a power outage during a firmware upgrade. Connect the openSPOT3 to a USB power supply, and press both buttons at the same time for 10 seconds, then release them and the upgrade process will continue. If both LEDs are still dark and there's no way to get them light up, or the status LED stays yellow and the firmware upgrade process does not resume, contact us at info@sharkrf.com.

DMR ID is not in the database warnings on the web interface

A valid DMR ID is only required by the network/server you use. The openSPOT3 only displays a warning about that and does not care if your ID is valid or not. We update the DMR ID database weekly, usually on Mondays. Wait for the next update and your DMR ID will be there.

Battery is charged to 100% and shows (ex.) 92% when unplugged

The battery is still charging when it is showing 100%. Charge is completed when the battery status on the web interface is "charge done", and the power LED is steady green. Make sure the device is plugged in until the charge is completely done. Note that the battery charge percentage is only a rough estimate.

Battery status displays slow charging

Slow charging does not supply enough power for the openSPOT3 to operate, so it will drain the battery while the openSPOT3 is turned on. Make sure the charge speed is normal or fast: use the supplied wall charge adapter, or connect the openSPOT3 to a standard USB port of a computer, also try flipping the USB-C connector of the cable upside down. Also make sure you use the supplied USB cable, or another one which is good quality, otherwise the charge speed will be slow.

The device turns off even when it's connected to a charger

Make sure the charging speed is normal or fast, not slow. See the previous troubleshooting question/answer.

Web interface call audio playback is choppy

Note that smooth call audio playback requires a Wi-Fi connection with a good signal quality. If you have issues with call audio playback, then please try using different browsers and make sure they are updated to the latest version.

Browsers reduce CPU allowance on non-active tabs after a while. The tab of the web interface must be kept active, otherwise the audio will be garbled. This browser behavior cannot be changed. If the audio becomes garbled, activate the tab, and/or reload the web interface to fix it.

Battery depletes too quickly

Please make sure to charge the battery full. If the battery is fully charged then the power LED is constantly green and the charging status displays "charge done". The length of the discharge time is affected by a lot of things.

The battery will discharge faster if:

- The device is transmitting or receiving
- There's traffic on the connected Wi-Fi network (even if the traffic is not to/from the openSPOT3)
- Wi-Fi signal quality
- Cross mode is used
- Web interface is opened

You can increase the discharge time by enabling powersaving

Specifications

- Dimensions: 100 x 58 x 18.5 mm
- Weight: 77 grams
- Operating temperature range:
    - During battery charge: 0 - +45 °C
    - During normal operation: -20 - +60 °C
- Battery: Polymer Lithium-Ion 1200 mAh
- Power supply: 5 V DC through the USB-C port
- Power consumption: max. 800 mA @ 5 V (4 W)
- UHF modem:
    - RF power output: max. 13 dBm (20 mW, between 433-434MHz)
    - Receive/transmit frequency range: 421-458 MHz (JP: 430-440MHz, TW: 430-432MHz)
    - Receiver sensitivity (between 433-434MHz):
        - Gaussian 2FSK: -114 dBm @ 9.6 kbps
        - Raised Cosine 4FSK: -109 dBm @ 9.6 kbps
    - Oscillator frequency stability: 0.5ppm
    - Emission designators: A1A (CW ID), F1E/F1D (D-STAR®, System Fusion®, P25), FXE/FXD (DMR), F1E/F1W (NXDN®), F1D (POCSAG)
- Wi-Fi module:
    - Supported protocols: IEEE 802.11b/g/n
    - RF power output: +13 dBm (measured on uFL connector)
    - Receive/transmit frequency range: 2.4 - 2.495 GHz
    - Receiver sensitivity: -91 dBm (802.11b 1Mbps), -88 dBm (802.11g 6Mbps), -88 dBm (802.11n MCS0)

This device has been tested and certified according to the following standards and directives:

- EMC: EN 301 489-1 (V2.2.0), EN 301 489-3 (V2.1.1), EN 301 489-17 (V3.2.0)
- SAR: ICNIRP (1998), EN 50566 (2017), IEC 62209-2 (2010), EN 62209-2 (2010)
- Safety: IEC 62368-1 (2014)
- Battery: IEC 62133-2 CB (2017)

This device complies with Part 15C of the FCC Rules.

All product specifications and data are subject to change without notice to improve reliability, function or design or otherwise.

Acknowledgement

Thanks to our alpha testers for their continuous work: Lajos Horváth HA5OGR and István Száraz HA7PTY, and to everyone who use beta firmwares and help us finding bugs by reporting them on our community forum!

Open source licences

Here are the licences for various open source software used in the openSPOT3.

alertify.js

The MIT License

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js-sha256.js

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jsmn

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Javascript routines to convert from lat-lon to Maidenhead Grid Squares typically used in Ham Radio Satellite operations and VHF Contests

Inspired in part by K6WRU Walter Underwood's python answer http://ham.stackexchange.com/a/244 to this stack overflow question: How Can One Convert From Lat/Long to Grid Square http://ham.stackexchange.com/questions/221/how-can-one-convert-from-lat-long-to-grid-square

GetGitRevisionDescription.cmake

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