Customizing the AgileMesh Virtual Channel Map

Introduction

If you have ever used an industrial or professional quality portable two-way radio, you are probably familiar with the ability to change channels, often by turning a knob on the radio. Generally, for these devices, changing the channel means changing the communications frequencies to which the radio is tuned. You can then talk to other users that have radios tuned to the same channel.

In the same way, every AgileMesh wireless node can be "tuned" to a variety of "virtual channels", as represented by the channel indicator on an AV15xx or AV75xx device or on the virtual control panel connected to an AV12xx device. The channel number displayed is much more than a conventional channel indicator on, say, a radio, but is just as simple and straightforward to use.

When the channel knob on an AgileMesh node is turned, a new channel number is displayed. This channel number represents not only a new frequency for the AgileMesh wireless node, but also controls various other digital communications parameters. Here is a list of parameters that may be changed when the virtual channel is changed:

- The frequency band (may be 2.4GHz, 4.9GHz or 5.xGHz)

- The frequency channel within the band

- The SSID (Service Set Identifier) that is the identifying name of a particular network

- A WEP (Wired Equivalent Privacy) encryption key

- An AES (Advanced Encryption Standard) encryption key

Every AgileMesh virtual channel has an entry in a table (called the virtual channel map) that resides in each node. Each table entry specifies the list of parameters associated with that particular virtual channel. When an AgileMesh node is shipped from the factory, the virtual channel map on that node is populated with a default set of entries. Using tools also provided by AgileMesh, you may modify the map to create new channels or change existing ones so that there are some fully private and unique channels that only your nodes can use. Following are some instructions for making those kinds of changes.

Overview of Process

Changing the embedded virtual channel map in a set of AgileMesh nodes involves the following steps. Each of these is expanded in sections that follow.

Steps to Changing Virtual Channel Map

1. Modify or create the channel map file

    a. Start the Channel Map Editor

    b. Either create a new file or load and edit an existing file

    c. Save the file (preferably under a new filename)

2. For each node:

    a. Connect directly to the node.

    b. Download the new channel map using the AgileMesh Upgrade utility.

    c. Restart the node.

    d. Turn to the desired channel. You must actively turn to a channel with the new channel map in residence before the new parameters will take effect.

Before you Start…

When you received your system from AgileMesh, you should also have received an Installer CD. If you didn't, or if you can't find it, you can contact AgileMesh and arrange to download a new copy over the Internet.

The Installer CD includes two programs that you will need to have installed on your computer for this process. They are:

1. The Channel Map Editor

2. The Upgrade utility

Both of these will show up as icons on your desktop if they have been installed.

The Channel Map Editor

The AgileMesh Channel Map Editor is a utility that is designed to make it easy to set up and change the virtual channel map. It looks something like a spreadsheet where each row is one of the potential virtual channels and each column is one of the parameters associated with the channels. It will not allow you to enter invalid values in any of the fields. The various fields are as follows:

- **Frequency Band** Selection allows the user to select:

    – 2.4GHz DSSS (802.11b equivalent)

    – 2.4GHz OFDM (802.11g equivalent)

    – 5.xGHz OFDM (802.11a equivalent)

    – 4.9GHz OFDM (Public Safety band – requires PS hardware to use)

- **Channel** Selection allows selection of the 802.11 equivalent or FCC-defined public safety channel within the band

- **SSID string** – String used to "tag" and filter communications with other nodes – up to 31 alphanumeric characters

- **WEP key** – "Wired Equivalence Policy" encryption key

    – Up to 26 hexadecimal characters

    – 0123456789ABCDEF are the legal characters (case insensitive – either upper or lower case characters are OK)

    – If fewer than 26 characters are entered, the remainder of the field is automatically padded with "0"s

- **AES key** – "Advanced Encryption Standard" encryption key

    – Up to 64 hexadecimal characters

    – 0123456789ABCDEF are the legal characters (case insensitive – either upper or lower case characters are OK)

    – If fewer than 64 characters are entered, the remainder of the field is automatically padded with "0"s

Starting the Channel Map Editor

To start the Channel Map Editor, simply click on the Channel Map Editor icon on your desktop.

You should see a frame with several control icons at the top. If you decide to create a new file from scratch, you should choose the "New" icon.
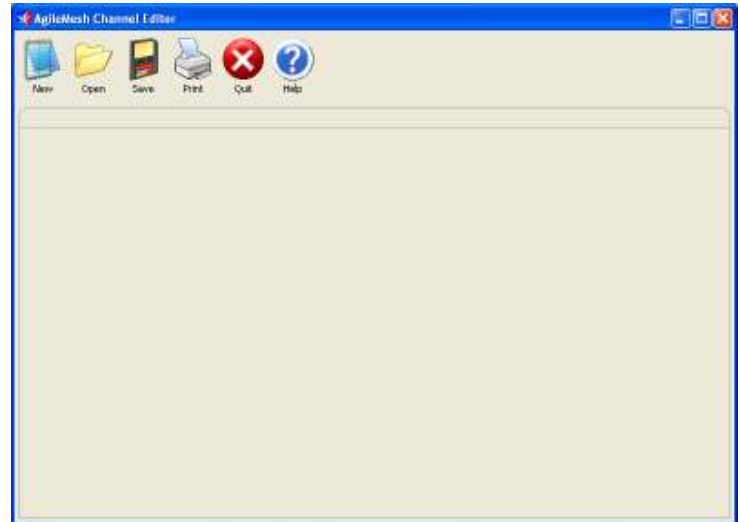
Editing an Existing Channel Map File

In most cases, you will probably just want to add some new channel definitions or modify existing ones. For this, just click on the "Open" icon at the top of the frame. You should see a screen with at least two files listed, AMchmap.cmf and USRchmap.cmf. Generally, you should choose the USRchmap.cmf file as your starting point. When you finish your customization, you will save it under a different filename.
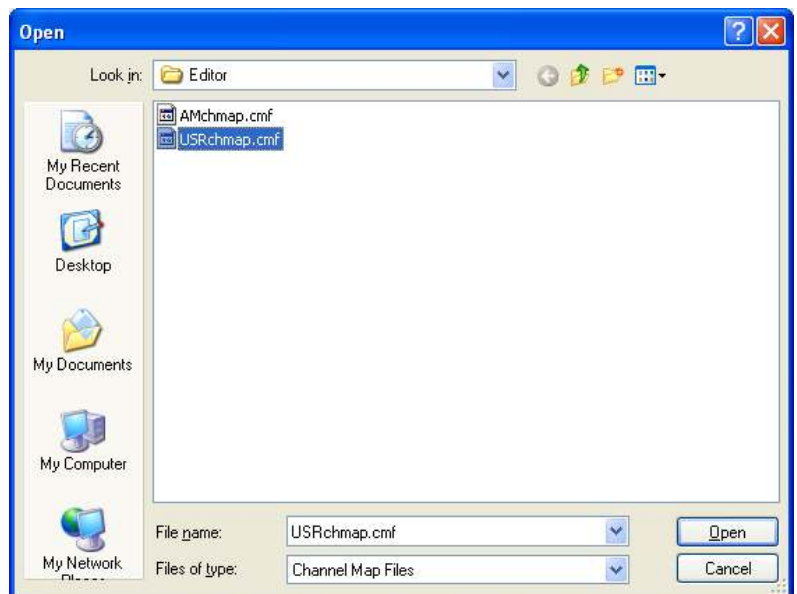
Once you choose the channel map file you wish to modify, you should see a table of entries ranging from 0 through 92. In the default channel map file, entries from 52 through 92 are not populated. These are available for new channel definitions, or you may modify the default channel definitions. Notice that the populated entries are color coded to represent the frequency range of those particular channels. Red is used for 2.4 GHz channels, Blue is for 5.x GHz channels and White is for 4.9 GHz Public Safety channels. This is to facilitate the selection of the correct antenna for each channel.

Adding New Virtual Channels

In any of the currently undefined entries in the table, you may enter new channel definitions. For example, if you would like to add one new encrypted channel for each of three frequency bands (e.g. 2.4 GHz, 5.x GHz and 4.9 GHz), you might choose to define the new channels as 53, 54 and 55, respectively, as shown in this example.

In the "Freq Band" and "Chan" columns, you will choose from a drop down menu. The other fields (SSID String, WEP Key and AES key) will require manual entry. If you do not wish to encrypt the channel, just leave the "WEP Key" and "AES Key" fields empty.
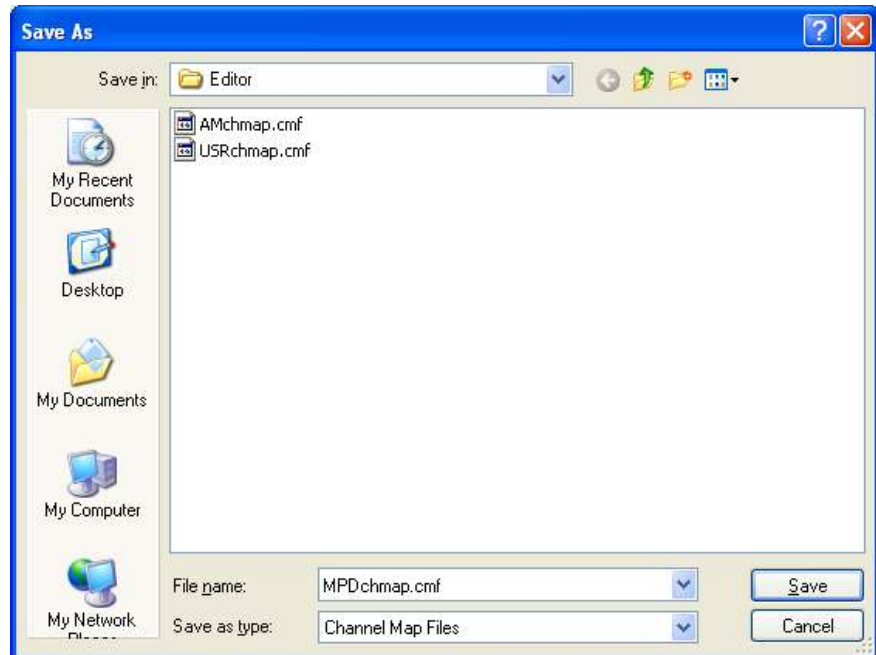
Saving a Custom Channel Map File

Once you are satisfied with your changes, save the customized file under a new filename. That way, you will preserve the option of dropping back to the default file at some future time. To save the file, simply click on the "Save" icon at the top of the Channel Map Editor frame and enter a filename that is meaningful to you. **Please note that the main part of the filename must be 8 characters or less in length.** In this example, we used MPDchmap.cmf as the new filename.

Loading the Channel Map into a Node

Once a custom channel map file has been developed, the file must then be loaded into each AgileMesh node that is to share that set of file definitions. This process requires the use of the Upgrade utility, another program that is included on the AgileMesh Installer CD.

To begin this process, the computer on which the new custom channel map file resides must be connected directly to the target AgileMesh node via an Ethernet cable. **Note: the Ethernet network interface on the computer must be assigned an IP address in the same subnet as the AgileMesh nodes.** "Safe" addresses (i.e. computer network addresses that will not conflict with those used by the AgileMesh equipment) are available in the range from 192.168.224.10 to 192.168.224.20.

You can set this address by selecting the "Internet Protocol (TCP/IP)" entry under "Properties" associated with the computer's Ethernet interface. You will then need to select the "Properties" for the Internet Protocol and then select "Use the following IP address". Then, enter an address (e.g. 192.168.224.17) with a subnet mask of 255.255.255.0.

Caution: Before you begin the process of loading the new virtual channel map, you should make sure that the node to which you are connected shows no neighbors. You can assure this by "tuning" that node to an unused channel and waiting for the neighbor count to drop to zero.

Using the Upgrade Utility to Load the Virtual Channel Map

Now that the custom channel map file is ready, the computer is connected to the target node and the target node has been "tuned" to a channel where it has no neighbors, you are ready to load the map into the node. Begin this process by double clicking on the AgileMesh Upgrade icon on your computer desktop.
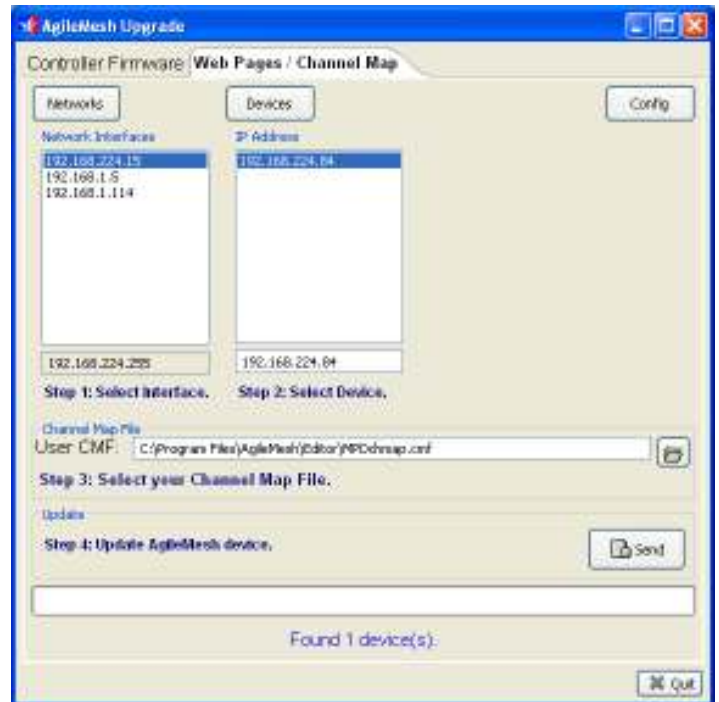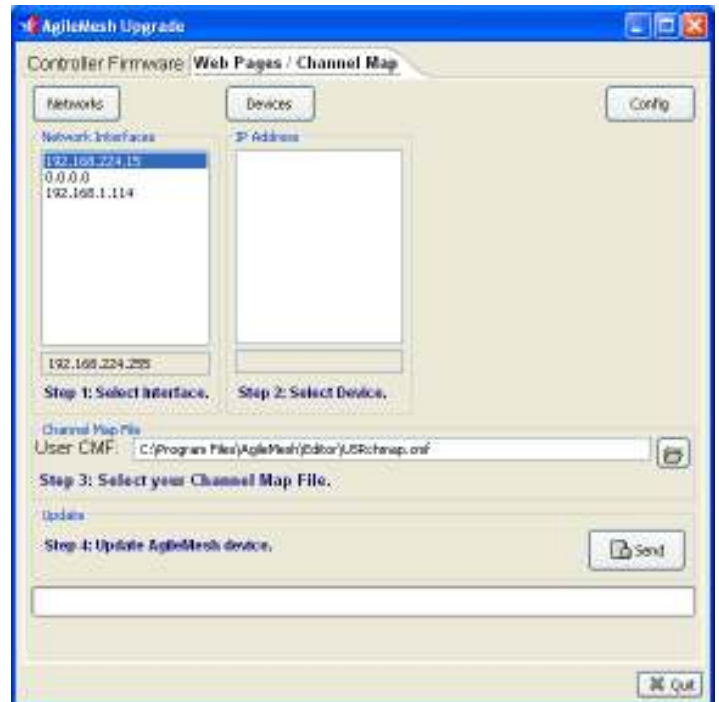
The following screen is displayed:
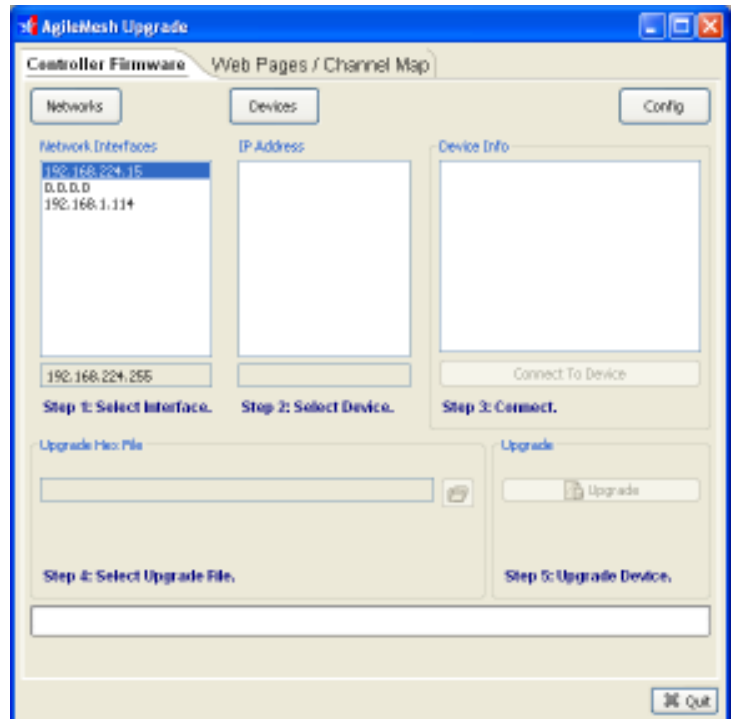
Highlight the "Web Pages/Channel Map" tab to select the proper control page for loading a new channel map.

Select the interface displayed in the "Network Interfaces" window that is connected to the AgileMesh node. It should be the one with the 192.168.224.xxx address.

Now, click on the "Devices" button and highlight the IP address that corresponds to the address of the front panel controller for that node. If there is only one address showing (there should be only one), select that address.

If more than one device IP address is showing, that indicates that this node has not yet been successfully isolated from other nodes on the mesh. Change the channel number to an unused channel and wait for the neighbor count to go to zero. Then re-click the "Devices" button.
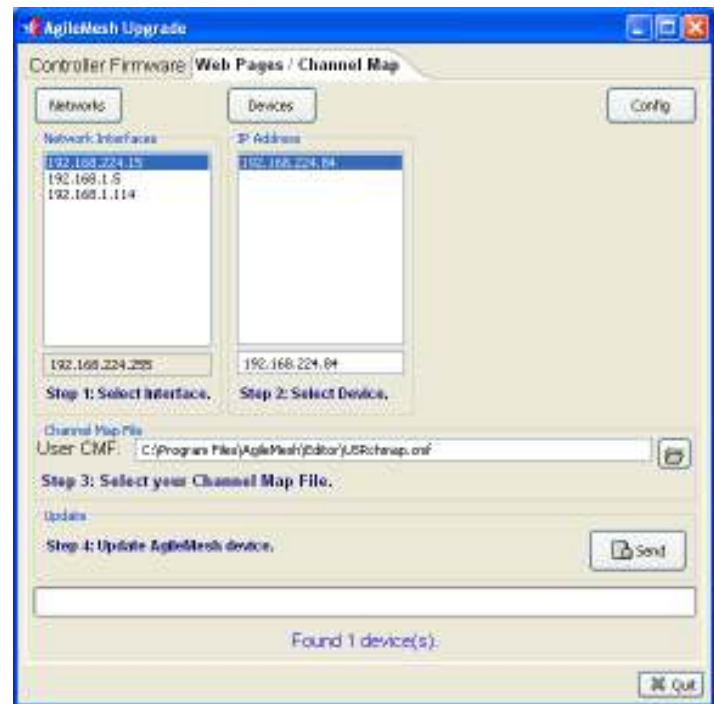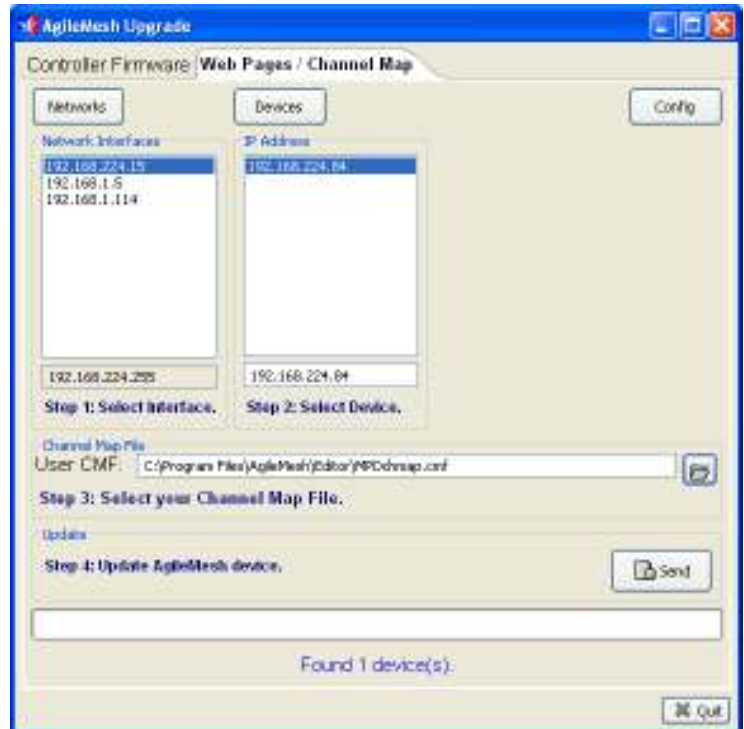
Select the channel map file by clicking on the the file folder icon and choosing the new file from the list presented (in the case of this example, the new file is called MPDchmap.cmf) and click on the "Open" button.
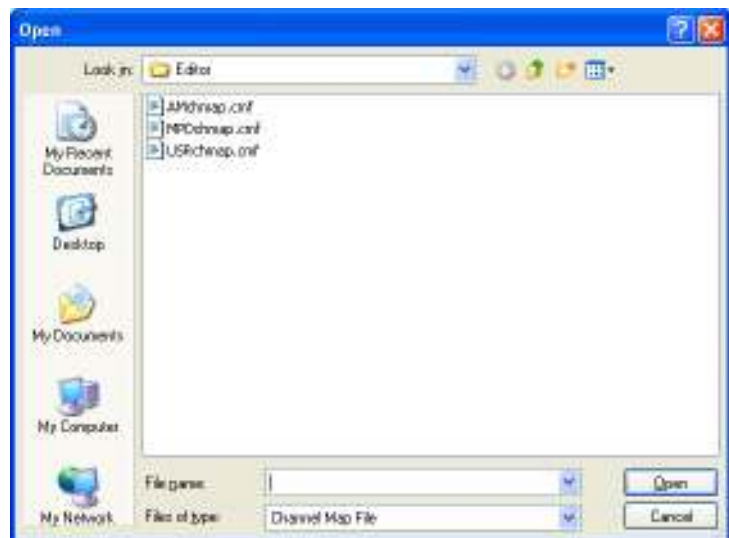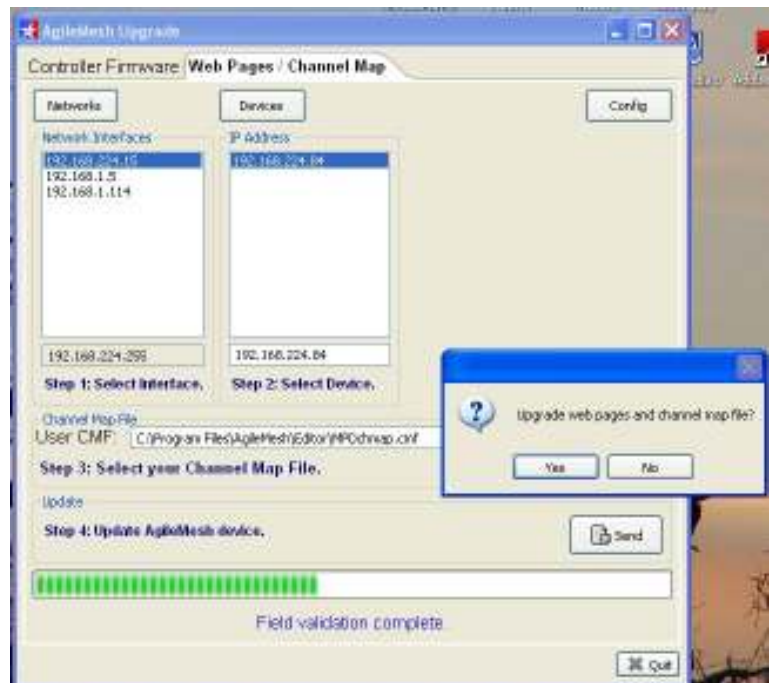
You are now ready to load the new virtual channel map file into the node. Start this by clicking on the "Send" button near the lower right corner of the frame.

In answer to the question "Upgrade web pages and channel map file?", click "Yes".
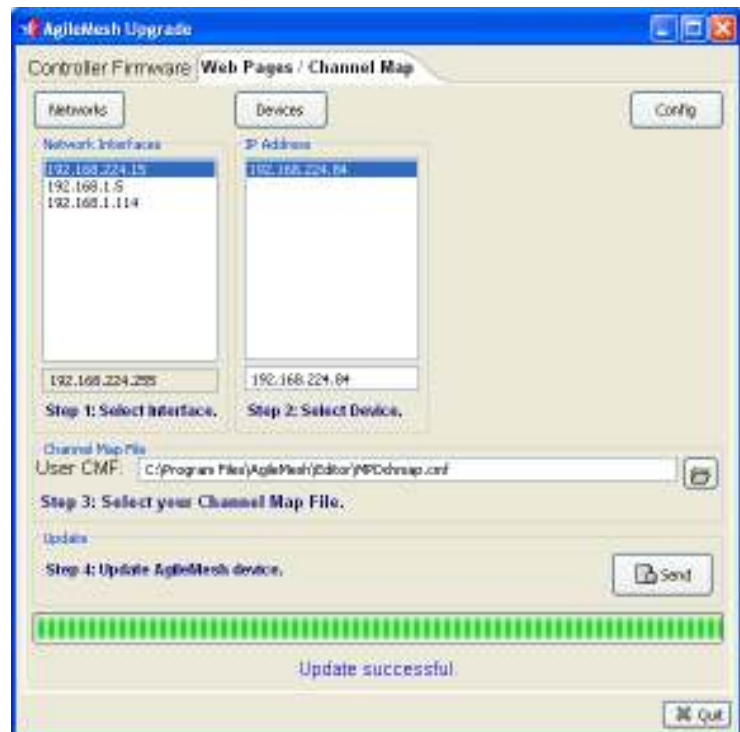
The download should be performed and the "Update successful" message should be displayed at the bottom of the frame.

The target node now has the new channel map file that will go into effect the next time the node is restarted.

Click on the "Quit" button to close the utility.

Restart the target node by turning power off and back on. When the Channel and Neighbors indicators stop flashing (after about a minute and a half), turn the channel knob to the desired channel. **Note: you must change the channel for the new settings to be used. If the channel displayed is the one you want to use, turn the channel knob to the next channel and then back immediately.**

If you have added some new channels, you should be able to tune to those as well as the ones that are there in the default channel map.

Repeat the above load process with each of the nodes (one at a time) you wish to use the new virtual channel map.

Interoperability Considerations

With the tools described here, the user has full control of the virtual channel control parameters and can assure that private channels can indeed be set up to be private by setting a unique combination of SSID and encryption keys. Often, though, it may be useful to retain the capability to link with AgileMesh equipment owned by other agencies. If you do not need to define more than 41 private channels (those in the range from 52 through 92), it may be wise to retain the default channels as originally defined. If all of the agencies that may at some point have a need to interoperate retain the default channels, pooling the equipment in a large deployment would just be a matter of tuning to one of the default channels.

Even if all of the user-changeable channels are customized, channels 97, 98 and 99 will remain as "failsafe" channels that can be used for interoperability, if required. Channel 97 is a channel in the 2.4GHz range, channel 98 is a channel in the 4.9GHz range and channel 99 is a channel in the 5.x GHz range.