ADTRAN®

Configuration Guide

DFS in vWLAN

This configuration guide provides an in-depth look at dynamic frequency selection (DFS) in ADTRAN Bluesocket virtual wireless local area network (vWLAN) products. Included in this guide are an overview of DFS, configuration of vWLAN products for DFS support, and general troubleshooting information.

This guide consists of the following sections:

Overview of DFS

DFS is a feature of the 802.11h protocol that allows wireless local area networks (WLANs) to operate on the same 5 GHz channels used by radar systems. When enabled, DFS causes the access point (AP) to continually search for radar pulses in the frequency channel in which it is operating. If radar is detected, the AP discontinues operation on that channel and searches for a new channel without detected radar. DFS is required for European 5 GHz outdoor vWLAN deployments, and without DFS, European 5 GHz indoor AP channels are limited to only four channels. The major benefit to using DFS is more channel availability, which results in more user capacity for high density deployments, less interference, higher throughput, and improved performance.

DFS in vWLAN

When DFS is enabled in vWLAN, the vWLAN system works to coordinate the channel selection of APs so that channel occupancy is optimal and that only approved channels are used by the APs. vWLAN operates in the following manner when using DFS:

1. The AP connects to the network (whether internal network or the Internet).

2. The AP discovers vWLAN via AP discovery.

3. vWLAN determines the country for which the AP is licensed, and the DFS domain for the AP is determined.

4. The default AP template is applied to the AP, and the AP enters channel scanning mode. This step detects RF neighbors for roaming and optimal channel and power settings. It is important to note that DFS channels (those with possible radar interference) are only scanned during the initial scanning period, and active AP beaconing is only done on non-DFS channels.

5. Once the channel scanning is complete, vWLAN decides which channel is optimal for the AP. This channel will most likely be a DFS channel (when DFS is enabled).

6. After a 60 second channel availability check, if no radar is detected, the channel is assigned and the AP begins allowing traffic to pass.

If radar is detected, the AP immediately looks for another channel without radar interference. The AP stays off the channel on which radar was detected for 30 minutes.

The method used by the AP when it changes channels due to radar detection operates as follows:

1. If the AP detects radar on the current channel, it stops data service to connected clients within 200 ms. This channel is added to the blocked channel list on the AP for 30 minutes.

2. The AP then moves to a new channel within 10 seconds. During this time, the AP can transmit data for an aggregated time period of 60 ms. The AP sends a channel switch announcement

(CSA) to the connected clients so they are aware of the channel change and do not attempt to probe to find a new channel.

3. The AP changes to a new channel and monitors the new channel for radar signals for 60 seconds. If radar is detected, the AP changes channels again and begins the process over. If no radar is detected, the new channel is broadcast to the clients.

Hardware and Software Requirements and Limitations

This document describes DFS configuration for vWLAN 1900 Series APs running vWLAN software versions 2.6 and AP firmware 7.0.0 or later, and vWLAN 2000 and 2100 Series APs running vWLAN software versions 3.1.0 and later.

For firmware release 2.6, DFS is supported natively on the BSAP 1925, 1935, and 1940 Series hardware. The BSAP 1920 and 1930 Series products will support DFS if they are using hardware revision K or higher. Each 192x and 193x Series unit that supports DFS is shipped with a "DFS Hardware Capable" sticker, as appears below, on the box and on the AP.

For firmware release 3.1.0, DFS is supported natively on the BSAP 2020 and 2100 Series hardware in European countries.

For firmware release 3.3.0, DFS is additionally supported on the BSAP 203x Series hardware in European countries, and the BSAP 2100, 203x, and 304x Series hardware in the United States.

The AP firmware version determines whether DFS operation is allowed for the BSAP licensed in a specific area. The following outlines the DFS support for APs licensed in European countries and the United States:

- Firmware release 2.6 allows for DFS operation with 1900 Series APs licensed in a European country only.
- Firmware release 3.1.0 allows for DFS operation with 2020 and 2100 Series APs licensed in a European country only.
- Firmware release 3.3.0 allows for DFS operation with 2135, 203x Series, and 304x Series APs licensed in a European country, and 2135 and 203x Series APs licensed in the United States.

DFS channel are only available on clients that support them. If a client does not support DFS channels, it will not scan them and therefore will not see the service set identifier (SSID) associated with those channels.

DFS and Channel Selection

When an AP detects a radar signal on its current channel, it switches to a new channel. The new channel will always be in the same channel width (for example, 40 MHz). The set of channels considered by the AP include DFS channels when DFS is supported and enabled. The list of valid channels available to the AP include the DFS channels for the country in which the AP is licensed. The blocked channel list includes any channels on which the AP has recently detected radar (or which are explicitly blocked by an administrator).

For European countries, supported DFS channels are:

- 52, 56 (40 MHz pair)
- 60, 64 (40 MHz pair)
- 100, 104 (40 MHz pair)
- 108, 112 (40 MHz pair)
- 132, 136 (40 MHz pair)
- 116, 140 (20 MHz only channels)
- 80 MHz channel groups include 52, 56, 60, 64 and 100, 104, 108, 112.
- Channels 36 to 48 and 52 to 64 are not allowed in outdoor deployments.

Channel Bonding Support

APs supporting 802.11n 40 MHz mode use two channels at once. In 40 MHz, two adjacent 20 MHz channels are used by the AP's radio. In the 5.0 GHz spectrum, strict channel pairing is enforced (for example, channel 40 can only be paired with 36 and not with 44). These pairs are independent of the country of operation as long as both channels in the pair are valid for the country. When using DFS in the 40 MHz mode, the AP monitors both channels in the pair for radar interference and leaves both channels immediately if radar is detected on one of the channels. The same requirement applies when using
80 MHz, where four channels are used. If a DFS channel that does not have a 40 MHz pair is manually selected for the AP, the vWLAN system will dial the AP back to 20 MHz mode for that AP. Dynamic RF will always select a 40 MHz channel when the AP is configured for 40 MHz.

DFS and Mesh Networking

When using mesh networking with DFS enabled, it is important to note that each part of the mesh network must check the channel for radar before it can support downstream mesh points. For a single hop mesh network, this means that it will take 60 seconds before the mesh point transmits traffic after the mesh portal has connected. For a two hop mesh network, this delay grows to 120 seconds.

If a mesh portal detects radar on its current channel, it must vacate the channel. The mesh portal issues a channel switch announcement, causing any associated mesh points to disconnect. If a mesh point detects radar on its current channel, a channel switch announcement is issued, and that portion of the mesh network and any downstream mesh points are disconnected. At this point, the vWLAN system will move the mesh portal to a new channel.

If a mesh uplink (mesh portal or mesh point servicing downstream mesh points) detects radar on its current channel, it stops data services to connected clients within 200 ms and issues a channel switch announcement. It then moves to a new channel within 10 seconds of the radar

detection event. During this 10 second time period, the device can transmit data as many times as necessary for an aggregated time period of 60 ms. Once the device moves to a new channel, it must monitor the new channel for radar signals for the next 60 seconds (if the channel is a DFS channel). If it detects radar on the new channel, the process begins again.

If a mesh device downstream detects radar on its current channel, it communicates the radar detection event to the mesh device upstream to which it is connected. When the upstream portal device receives the radar detection event from the downstream device, it reacts as if it detected the radar, issues a channel switch announcement, and proceeds to change channels.

Only a single channel is configured for a mesh portal. If the mesh portal detects radar interference, it will move channels. The channel block list applies only to the mesh portal and not the mesh point. If the mesh portal and mesh points are using different AP templates, only the mesh portal template block list applies.

Mesh portals change channels in only two cases: the administrator changes the mesh portal channel, or radar is detected. Mesh points change channels in only two cases as well: if the upstream mesh device changes channels or if the upstream devices changes channels because radar is detected.

DFS Configuration

DFS is configured in vWLAN using the AP template and in the AP's configuration. The following sections describe the AP configuration necessary to enable and use DFS.

Configuring the AP Template for DFS

The vWLAN administrator can choose for APs to use DFS channels by configuring the AP template to allow it. Each AP template contains a check box that enables or disables DFS. By default, DFS is disabled. Once DFS is enabled, you can optionally specify if special channels are used by the AP (such as channels that are only permitted on APs far enough away from weather radar or channels in certain countries that are only permitted for indoor use).

To configure the AP template for DFS, follow these steps:

> **NOTE** *The steps documented here apply to DFS configuration only. For more information about configuring AP templates in general, refer to the vWLAN Administrator's Guide, available online at https://supportforums.adtran.com.*

1. Navigate to the **Configuration** tab, and select **Wireless** > **AP Templates**. The first time you access this menu, the only AP template available is the default template. To create a new template, select **Create AP Template** at the bottom of the menu, or select **Domain AP**

Template from the **Create** drop-down menu (at the top of the menu). If you would like to edit the default AP template, select the default template from the list.
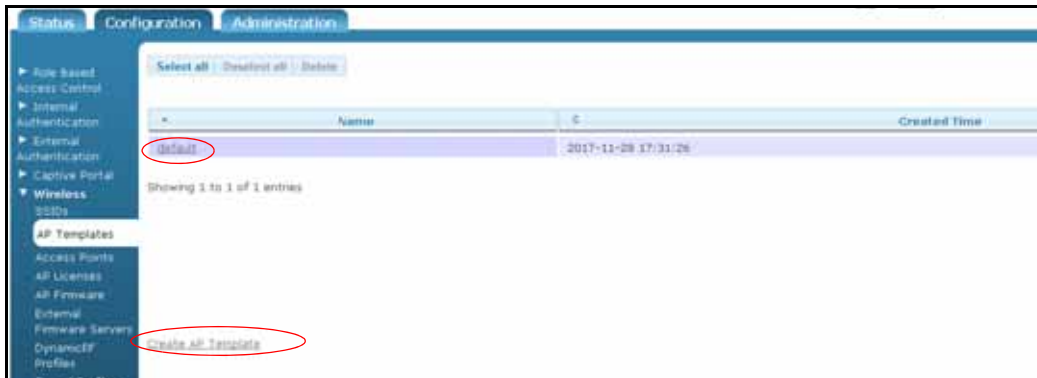
> **NOTE**
> *If you make changes to the default AP template, keep in mind that every AP using the default template will be affected, as well as any new APs added to the domain.*

2. Next, enable DFS in the AP template by selecting the **Enable DFS** check box.

3. Once DFS is enabled, you can optionally specify if special channels are used by the AP (such as channels that are only permitted on APs far enough away from weather radar or channels

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in certain countries that are only permitted for indoor use). Available DFS channels are listed in *DFS and Channel Selection on page 4*.

To specify a specific channel can be used by the AP, navigate to the **Per Radio Setting** menu and select **Channel List**. Specify that a channel is allowed by clicking and dragging the channel to the allowed list column (on the left). Specify that a specific channel cannot be used by the AP by clicking and dragging the channel to the blocked list column (on the right).

Selected channels are only included if they are legal in the regulatory domain.When a selected channel is blocked, all APs in the template that are using that channel (either as a primary or bonded channel) will automatically pick new channels.

> **NOTE**
> *As of vWLAN firmware release 3.1.0, the configuration of channels used on a per-radio basis configures the channels used for both DFS and DynamicRF.*

> **NOTE**
> *The channels listed are a generic channel list valid for all the regulatory domains. Channels 52,56,60 and 64 are valid even if DFS is disabled for some regulatory domains and the AP channel list is populated as per regulatory domain.*

> **NOTE**
> *If there are associated APs that are set with the channel, or use the channel for 40 MHz or 80 MHz mode, the next time DynamicRF runs it changes the APs to not use the specified channel. For 40 MHz mode, this implies that blocking channel 36 also blocks channel 40. For 80 MHz mode, this implies that blocking channel 100 also blocks channels 104, 108, and 112.*

> *DFS can cause service interruptions when the AP is required to vacate a channel on which radar has been detected. In addition, this value is ignored if the AP hardware does not support DFS or if the value is not legal for the regulatory domain.*

NOTE

4. If no other changes are needed for the AP template, once you have enabled DFS and optionally specified any DFS channels, select the **Create AP Template** or **Update AP Template** button at the bottom of the menu to create or update the template.
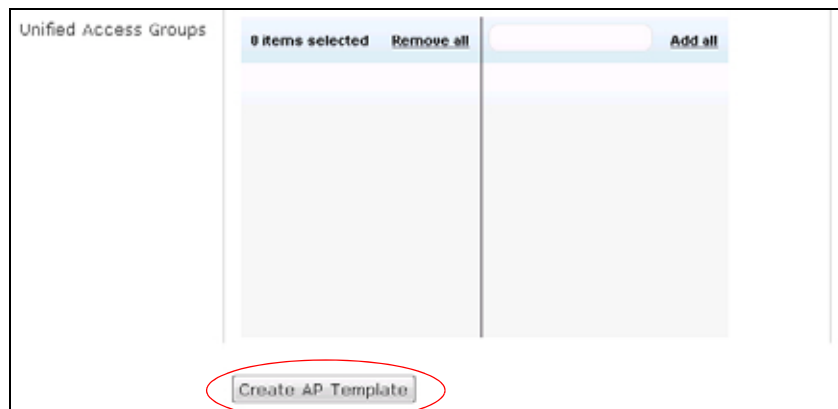
5. Once the template has been created or updated, you must apply it to the APs for the changes to take effect.

Configuring the AP for DFS

In addition to DFS configuration in the AP template, you can also configure DFS channels in the AP's configuration. If the AP platform supports DFS, and it is enabled (in the AP template), you can choose to select a DFS channel for the 5 GHz radio.

To configure DFS settings for an AP, follow these steps:

1. Navigate to the **Configuration** tab, and select **Wireless** > **Access Points**. Any configured APs are listed in this menu. Select the AP from the list whose settings you want to configure.

2. Specify the channel used by each radio from the **Channel** drop-down menus. For the United States, the 802.11b/g/n radio channels range from **1** to **11**, and the 802.11a/n/ac radio channels range in intervals from **36** to **161**. Other countries may have a different set of allowed channels. The **Auto** option specifies that the vWLAN system will assign the radio channel to

the AP. This is the default setting. To configure a specific channel for the AP, select the appropriate option from the drop-down menu. If DFS is supported by the AP platform, and is enabled in the AP template, DFS channels are available for selection on the 5 GHz radio.

> **NOTE**   *Channels 120 through 128 are not available for European countries for DFS functionality due to a 10 minute channel availability check. In addition, channel 116 is not available for 40 MHz mode.*

3. Lastly, specify whether the AP is an indoor or outdoor AP. By default, the AP is listed as indoor or outdoor based on the AP's serial number. If indoor is selected, all channels are available for the AP. If outdoor is selected, only the outdoor channels are available for the AP.

> **NOTE**   *Before specifying channel and transmit power settings manually, disable the DynamicRF mode in the AP template.*

4. Select **Update Access Point**. You will then need to manually apply the changes to the AP using the domain task link at the top of the vWLAN GUI.

With modification of the AP template and the AP's channel selection, DFS is enabled and configured for vWLAN.

DFS Troubleshooting in vWLAN

Within vWLAN, there are information messages, event reports, and status information that can be used to confirm DFS configuration.

Information Messages

Information messages are created when certain events occur within the vWLAN system. These messages document when certain configurations occurred, were implemented, failed, or succeeded, as well as when problems with the APs, vWLAN system, or the network occur. Information messages can be error, information, or debug messages and are classified using the notification template. In addition, information messages can track any configuration changes (creations, deletions, updates) and who authorized the change. Information message types are determined by notification templates, which allow you to classify the information notifications as you prefer.

> **NOTE**
> *For more information about information messages and notification templates, refer to the vWLAN Administrator's Guide, available online at https://supportforums.adtran.com.*

Information messages cannot be created by the administrator, but rather, notification templates are created which then classify the message type when the specified events occur. You cannot delete information messages, but you can edit the type of template to which they are associated.

To view information messages, follow these steps:

1. Navigate to the Configuration tab, and select **Notifications** > **Info Messages**. Select the **Domain** tab if you are working with messages for a specific domain, or select the **Platform** tab if you are working with messages for the vWLAN system. DFS messages are at the domain level. The messages that have been generated are listed and include the product with which the message is associated (AP, vWLAN, etc.), the message type (action that generated the message), and the notification template associated with the message (info, error, etc.).

2. By default, DFS information messages are associated with the Info Notification template (which generates a log message). To edit the type of template associated with a specific message, select the message from the list. Then, select the notification template to associate with the message from the drop-down menu. Available notification templates include error, info, and debug templates (by default), and any additional templates you have created. Select **Update Info Message** to apply the template change.

Viewing AP Details

Viewing the details of an AP allows you to verify its configuration. To view the details of a particular AP's configuration, follow these steps:

1. Navigate to the **Status** tab, and select **Access Points**. Each configured AP is listed in the menu. Select the AP you want to view from the list.

2. The details of the selected AP are displayed, including the AP configuration, radio interfaces, any associated clients, and any configured SSIDs associated with the AP. In addition, from this menu you can select to view maps, logs, alarms, alerts, and APs adjacent to the selected AP by using the links at the top right of the menu. These links bring up the view, specifically filtered by the AP in question.