

# Interoperability guide – Phoenix Contact WLAN clients with Cisco Wireless LAN Controllers (WLC)

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## Introduction

### Objectives:

The purpose of the following guide is to provide details on how create interoperable infrastructures of Cisco Wireless LAN Controllers, Cisco Wireless Access Points and Phoenix Contact WLAN devices configured as WLAN client devices. We will discuss interoperability with the following devices;

### Requirements:

The following hardware and software was used in the development of this procedure

#### o CISCO

WLC 5508 – Software AIR-CT5500-K9-8-5-120-0.aes

WLC 5520 – Software AIR-CT5520-K9-8-5-131-0.aes

#### o Phoenix Contact

FL WLAN 1101/2101 – FW 2.21

FL WLAN 5101/5111 - FW 2.64

## Procedure

### Default functions of CISCO Wireless LAN Controller (WLC)

Wireless LAN Controllers (WLC) are used very often in Cisco infrastructure deployments. The WLC is used to help deploy, maintain and monitor the WLAN system from a central location. The WLC is typically physically connected to switches/routers throughout a facility which then have connections to the actual Wireless Access Points (WAP). These WAPs provide the wireless communication to end devices. With Cisco WLCs, the default setup has a strict 1 to 1 MAC to IP binding policy which means the communication from the end device over the wireless connection can only have 1 IP address per MAC address.

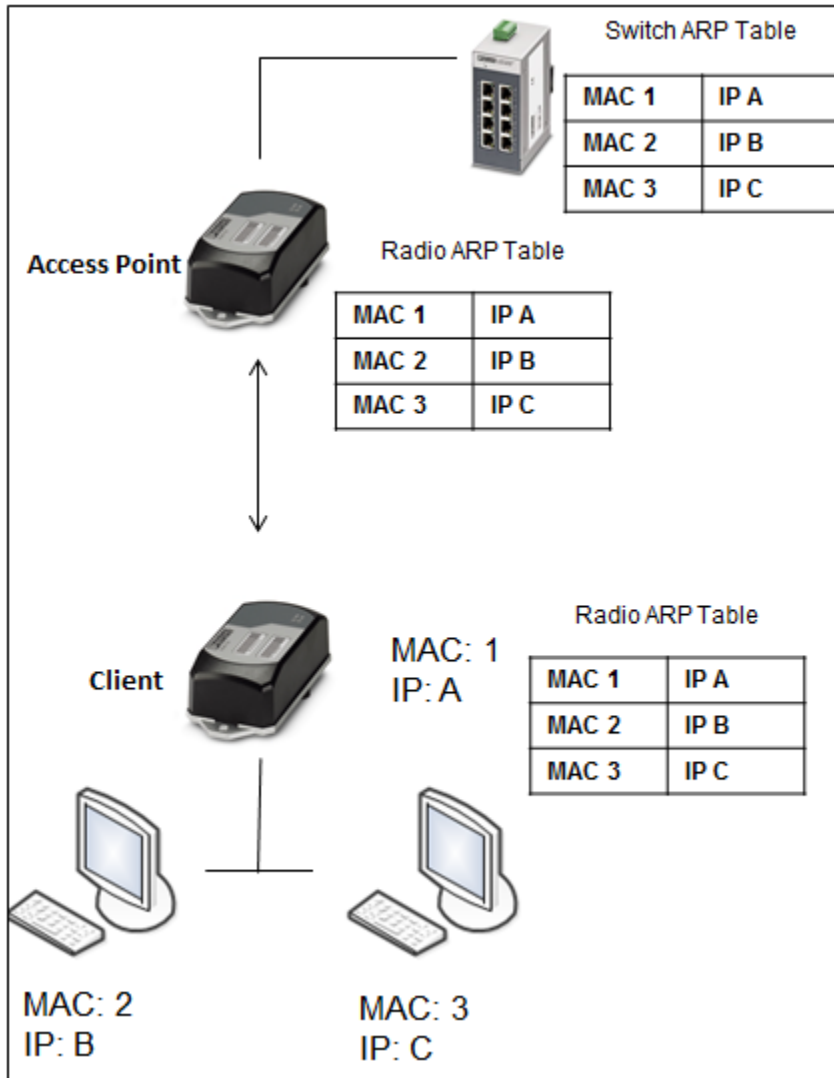
| Clients                           |                       |                                                                |
|-----------------------------------|-----------------------|----------------------------------------------------------------|
| Current Filter                    | None                  | <a href="#">[Change Filter]</a> <a href="#">[Clear Filter]</a> |
| Client MAC Addr                   | IP Address(Ipv4/Ipv6) | AP Name                                                        |
| <a href="#">00:a0:45:41:36:48</a> | 192.168.1.6           | 2702e_AP_2                                                     |
| <a href="#">00:a0:45:ee:b3:8b</a> | 192.168.1.50          | 2702e_AP_2                                                     |
| <a href="#">a8:74:1d:69:57:ef</a> | 192.168.1.5           | 2702e_AP_2                                                     |

The WLC also acts as an ARP proxy. When a wireless device associates and authenticates to the controller the communication is tunneled from the WAP to the WLC via a proprietary protocol called CAPWAP (Control and Provisioning of Wireless Access Points). The WLC creates an ARP entry, a single IP-MAC relationship for that device. Any ARP request that is then seen on the wired side of the network gets routed to the controller and the controller responds to the ARP request. No ARP requests from the wired network get sent out over the air even if it is a broadcast. If there is no ARP entry in the controller, then the ARP request is dropped by design.

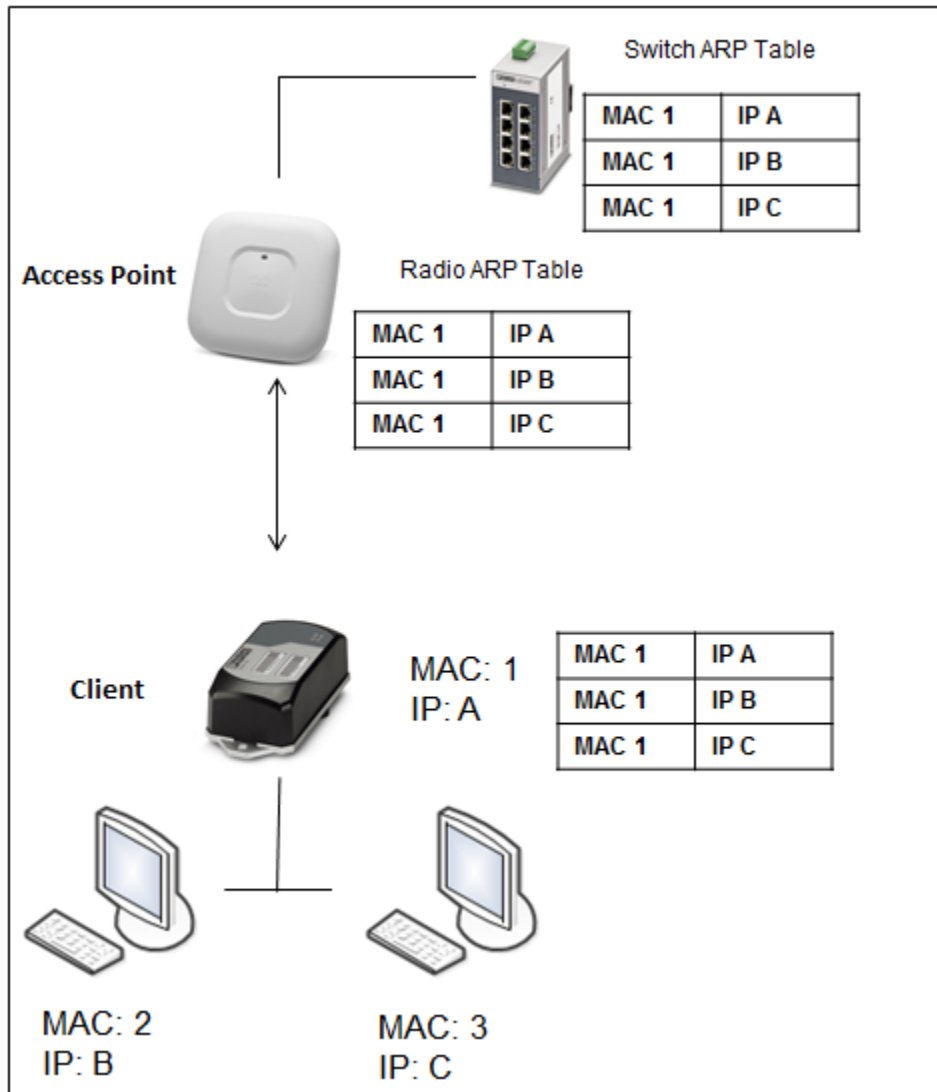
### Default functions of Phoenix Contact WLAN Client modes

The Phoenix Contact WLAN devices, FL WLAN 1101/2101/5111, have 3 modes of operation as a client; Fully Transparent Bridge (FTB), Multi Client Bridge (MCB) and Single Client Bridge (SCB). In all three modes of operation, the Phoenix Contact WLAN client is used to bridge wired end devices via the WLAN connection. Each mode functions in a different manner depending on the infrastructure wireless system (access point) it is connecting to. Some client modes have different levels of MAC-IP transparency to be interoperable with various wireless infrastructure manufacturers. The 3 modes of operation are defined below

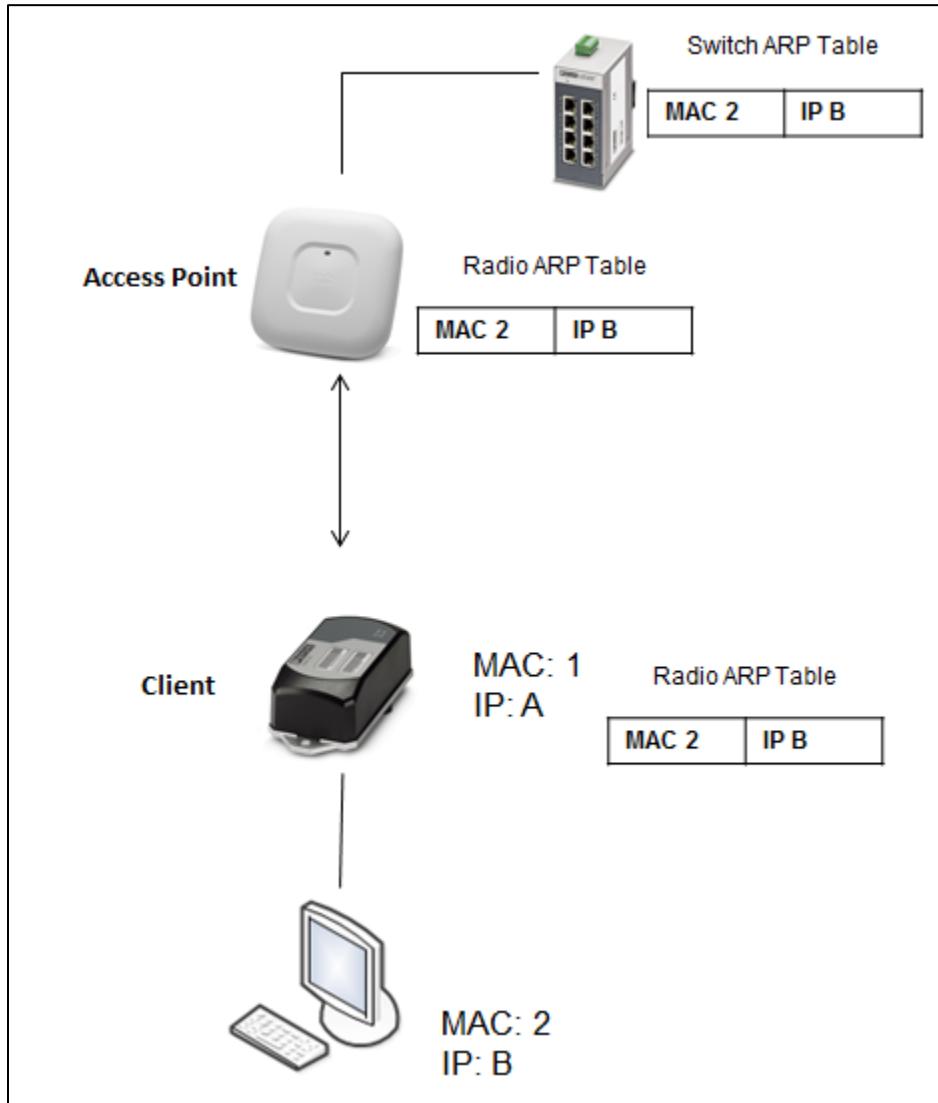
**Fully Transparent Bridge mode (FTB)** – FTB mode is used when wirelessly connecting to a Phoenix Contact WLAN module configured as an access point. In FTB mode, the client radio acts as a wireless bridge, allowing multiple wired end devices to communicate transparently via Layer 2 or Layer 3 communication. This type of communication is not an IEEE standard so it is only recommended to be used when communicated with a Phoenix Contact access point. This mode would be similar to Cisco's own proprietary WGB (work group bridge) function.



**Multi Client Bridge mode (MCB)** – MCB mode is used when connecting to 3<sup>rd</sup> party access points. In MCB mode, the Phoenix radio uses a Layer 2 NAT function when communicating to the access point. This allows multiple wired clients to communicate over the wireless connection to the main wired network. In this set up, all wired clients behind the Phoenix Contact WLAN device will be transmitted with the MAC address of the radio and the IP address of assigned to the end device (this could be static or via DHCP). This allows for better compatibility with 3<sup>rd</sup> party access points but needs to be tested to make sure the 3<sup>rd</sup> party system will allow the communication. In this mode, the number of wired clients connected to the Phoenix Contact radio is unlimited.



**Single Client Bridge mode – (SCB)** – SCB mode is used when communicating to a 3<sup>rd</sup> party access point and is fully compatible with all 3<sup>rd</sup> party systems. In this mode, the Phoenix Contact radio will become completely transparent to the wireless network and will forward information with the MAC and IP address of the wired client connected to its LAN port. Due to this functionality the WLAN access point will only see one MAC-IP pair which is what it expects to see. The Phoenix Contact radio will have an IP address assigned to it, but will only be accessible via the LAN connection. In this set up, the number of wired clients connected to the Phoenix Contact radio is limited to one.



### **Compatibility limitations with Phoenix Contact MCB client mode and WLC**

The most compatible client mode to set the Phoenix Contact WLAN device to for compatibility with a Cisco based infrastructure is SCB mode. In this mode the Phoenix Contact radio will transmit data using the MAC and IP of the wired end device. Assuming there are no ACL (access control lists) or Role based control enabled that prevent/block the wired end device, communication with the single end device should be possible every time.

In the Cisco WLC, you will see the MAC and IP associate with the wired client both in the controller webpage and the ARP table in the command prompt.

Like mentioned early in the document, to allow the communication to be compatible, the Phoenix Contact device needs to communicate with the wired clients' information only. Due to this, in SCB mode you are limited to a single wired client connection. In a lot of applications there is more than one wired client; IE the Phoenix Contact radio wired to an unmanaged switch connected to multiple devices like PLCs, HMI, Drives etc. In this application SCB mode will not be possible, the client mode will need to be configured to MCB mode (FTB mode is not an option as it is only fully compatible when communicating to a Phoenix Contact access point). With a MCB client mode setup, multiple wired clients can be connected to the Phoenix Contact WLAN, there are some settings that need to be made in the Cisco WLC to allow communication to be fully compatible.

## Configuring the WLC for compatibility

When the Phoenix Contact WLAN device joins the WLC (once it does its open system authentication and security handshake, if applicable) in MCB mode it will send a GRAT ARP for itself and all the wired clients connected to it. In its default setup, the Cisco WLC will only populate a single MAC-IP pair. Typically this is the IP and MAC of the radio itself, so the user will be able to communicate to the radio, but not to the wired client(s) behind the radio.

To allow compatibility between the Cisco infrastructure and the Phoenix Contact WLAN module in MCB client mode, there are 3 settings in the WLC that need to be made;

### 1. WLAN interface configured with a Dynamic Interface and VLAN:

This allows communications to be passed across a VLAN connection. This is a common configuration on most Cisco networks.

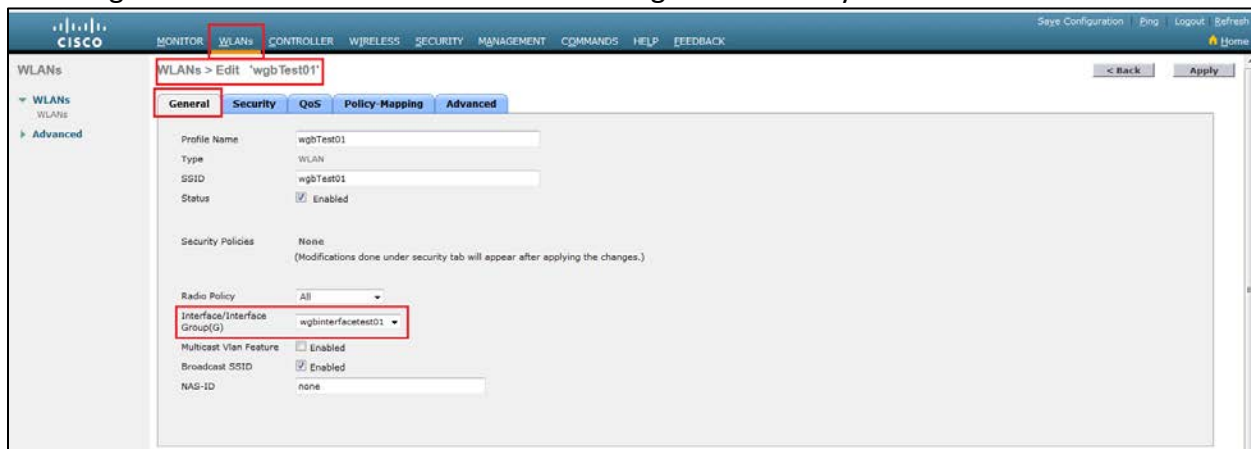
The image below shows the Dynamic Interface configured with a VLAN



The screenshot shows the Cisco WLC Controller configuration page for Interfaces. The 'Dynamic' tab is selected. A table lists the configured interfaces, with 'wgbiinterface01' highlighted in red.

| Interface Name        | VLAN Identifier | IP Address     | Interface Type | Dynamic AP Management | IPv6 Address |
|-----------------------|-----------------|----------------|----------------|-----------------------|--------------|
| management            | untagged        | 192.168.21.3   | Static         | Enabled               | ::/128       |
| redundancy-management | untagged        | 0.0.0.0        | Static         | Not Supported         |              |
| redundancy-port       | untagged        | 0.0.0.0        | Static         | Not Supported         |              |
| service-port          | N/A             | 192.168.20.201 | Static         | Disabled              | ::/128       |
| virtual               | N/A             | 192.168.2.254  | Static         | Not Supported         |              |
| wgbiinterface01       | 333             | 172.16.90.10   | Dynamic        | Disabled              | ::/128       |

The image below shows the WLAN Interface configured to the Dynamic Interface above.



The screenshot shows the Cisco WLC Controller configuration page for WLANs. The 'WLANs' tab is selected, and the 'wgbiTest01' WLAN is being edited. The 'General' tab is active, and the 'Interface/Interface Group' is set to 'wgbiinterface01', which is highlighted in red.

WLANs > Edit 'wgbiTest01'

General Security QoS Policy Mapping Advanced

Profile Name: wgbiTest01

Type: WLAN

SSID: wgbiTest01

Status: ☒ Enabled

Security Policies: None  
(Modifications done under security tab will appear after applying the changes.)

Radio Policy: All

Interface/Interface Group: wgbiinterface01

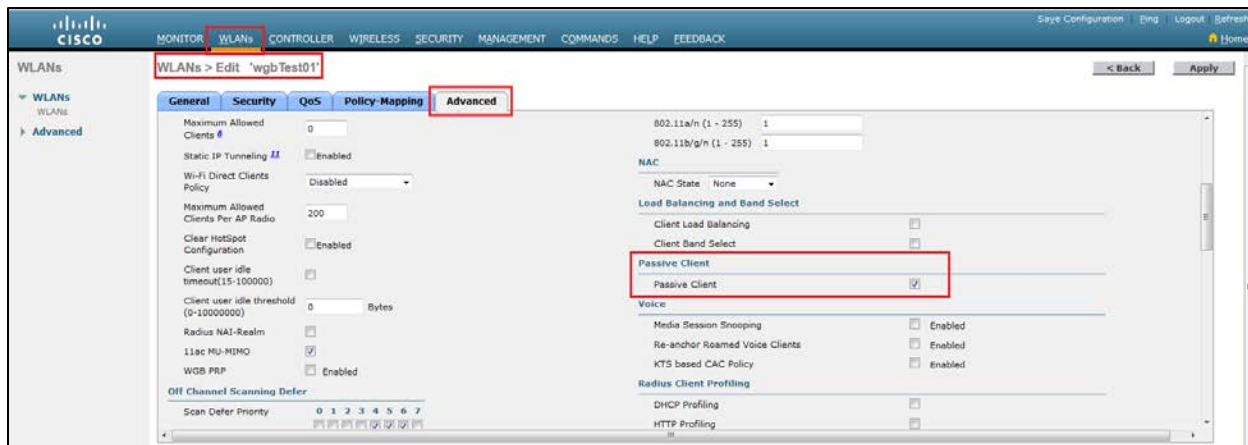
Multicast VLAN Feature: ☐ Enabled

Broadcast SSID: ☒ Enabled

NAS-ID: none

## 2. Configure the WLAN interface for Passive Client Bridge mode:

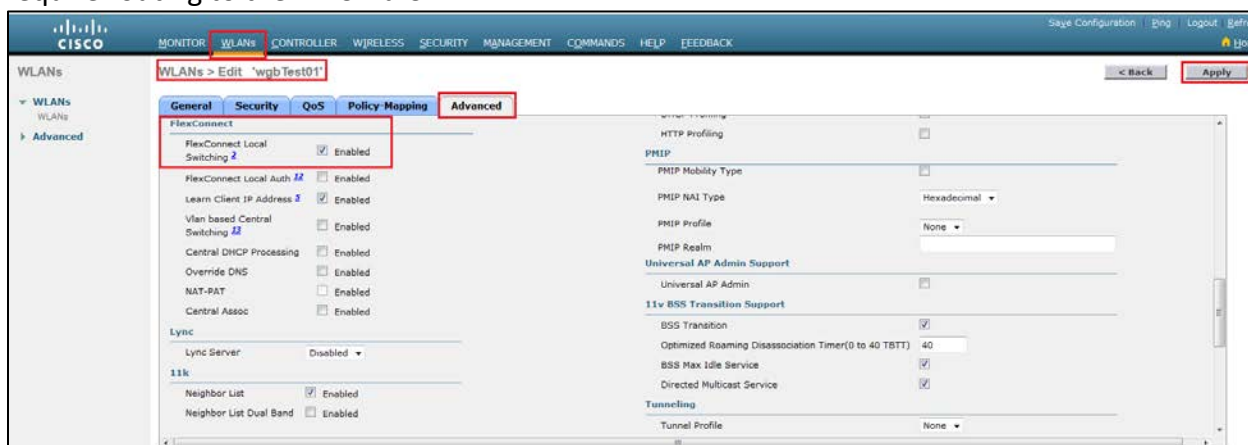
By default, any unknown or broadcast ARP packet will be dropped if it is not populated in the WLC. To allow broadcast ARP and unknown ARP requests to be sent out over the wireless port of the network the Passive Client Bridge mode must be enabled. This can be found on the WLAN -> Advanced menu of the WLC



[https://www.Cisco.com/c/en/us/td/docs/wireless/controller/8-3/config-guide/b\\_cg83/b\\_cg83\\_chapter\\_0100101.html](https://www.Cisco.com/c/en/us/td/docs/wireless/controller/8-3/config-guide/b_cg83/b_cg83_chapter_0100101.html)

## 3. Configure the WLAN interface for FlexConnect Local Switching:

This allows routing and switching of packets to happen on a VLAN at the router/switch level and not require routing to the WLC via CAPWAP.



Once these settings are made, the ARP traffic of the network will now be handled at the switch/router level and will not be required to be passed to the WLC via CAPWAP. This will allow the local switches and routers to populate the multiple ARP entries and pass broadcast ARP requests when required. The WLC will still never show more than one ARP entry per MAC address but the communication from the wired side of the network to the multiple wired clients behind the Phoenix Contact WLAN client in MCB will be successful.



## Conclusion

Due to the default ARP Proxy function and one-to-one MAC-IP function of the Cisco WLC multiple setting adjustments are needed to allow a Phoenix Contact WLAN client in MCB mode to pass traffic as intended. Without these changes in the WLC the Cisco infrastructure will limit the communication to a single device per wireless connection. To allow the Cisco infrastructure to allow traffic the following settings are needed

1. Create a Dynamic Interface with a VLAN for the intended wireless network.
  - a. Assign this Dynamic Interface to the WLAN interface with the Phoenix Contact Client modules
2. Enable Passive Client mode on the WLC
3. Enable FlexConnect Local Switching on the WLC.

## Disclaimers and notes

This document is intended to provide recommendations to allow communication between Phoenix Contact WLAN clients and a Cisco WLC. These configurations listed above were tested on an isolated network. It is the responsibility of the user to determine whether the settings described above are compatible with their network. It is recommended that the user evaluate the impact of making these configurations and the risk involved before making any changes.