MPCI-B4322L-AGN Product Configuration

Contents

Figures

Tables

1 Configuration

About This Chapter

The following table shows the contents of this chapter.

Section	Description
1.1Overview	This section describes the basic concepts of a WLAN.
1.2Configuring the Basic Attributes of a WLAN	This section describes how to configure the basic attributes of a WLAN.
1.3Configuring a WLAN-BSS Interface	This section describes how to configure a WLAN-BSS interface.
1.4Configuring a WLAN Service Class	This section describes how to configure a WLAN service class.
1.5Configuring the RF Interface	This section describes how to configure the RF interface.
1.6Configuring Spectrum Management	This section describes how to configure spectrum management.
1.7Maintenance	This section describes how to maintain a WLAN.
1.8Examples for Configuring a WLAN	This section provides examples for configuring a WLAN.

1.1 Overview

1.1.1 Introduction

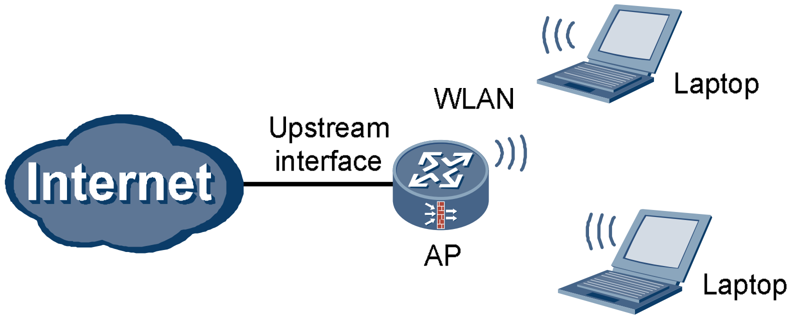
This product is compliant with mini PCI standard Adapter. The Broadcom 802.11b/g/n draft 2.0 SoC technique delivers up to 54Mbps or 300Mbps 11n data rate, the bandwidth support 20MHz and 40MHz for legacy WLAN standard and also fulfilled high throughput data rate requirement on 11n defined draft 2.0 specification, it is used 2sets of 2.4 Tx / Rx antenna's combinations, since the IEEE802.11g is CCK & OFDM modulation scheme and used CCK modulation to follow backward compatible with IEEE802.11b, up to 54Mbps on single 2.4GHz frequency band.

A Wireless Local Area Network (WLAN) refers to the computer local area network that uses the wireless channel as the transmission medium. The WLAN is the important supplement and extension of the wired network and gradually becomes an important part of the computer network. The WLAN is widely used in the domains where mobile data processing is required or the layout of physical transmission medium cannot be performed.

- As a new way of broadband access, the WLAN becomes more and more popular and develops rapidly.

802.11 is currently a common standard for constructing a WLAN because of the simple technology, stable communication quality, and comparatively larger transmission bandwidth. 0 shows the typical networking diagram of a WLAN.

Typical networking diagram of a WLAN



1.1.2 802.11 Protocol Suite

With the making and development of IEEE 802.11 wireless network standards, the wireless network technology becomes more mature and perfect. Currently, the common IEEE 802.11 standards are as follows:

- IEEE 802.11: is the first-version standard made by the IEEE. It defines the MAC layer and physical layer, the transmission rate as 2 Mbps, and the frequency band as 2.4 GHz.
- IEEE 802.11a: mainly supplements the physical layer, and defines the transmission rate as 54 Mbps and frequency band as 5 GHz.
- IEEE 802.11b: mainly supplements the physical layer, and defines the transmission rate as 11 Mbps and frequency band as 2.4 GHz.
- IEEE 802.11e: rectifies the MAC layer to improve the Quality of Service (QoS) and solves some security problems.

- IEEE 802.11g: is compatible with IEEE 802.11b, and defines the transmission rate as 54 Mbps and frequency band as 2.4 GHz.
- IEEE 802.11i: mainly supplements information about wireless network security.
- IEEE 802.11n: provides the maximum transmission rate of 600 Mbps, and supports the Multi-Input Multi-Output (MIMO) technology.

1.1.3 Common Terms

- Access Point (AP): provides the bridge function from the wireless station to the LAN and the frame conversion between wireless and wired modes.
- Basic Service Set (BSS): refers to the range covered by an AP.
- Service Set Identifier (SSID): identifies BSSs. To access the AP, the wireless station must be configured with the same SSID as that of the AP.
- Wired Equivalent Privacy (WEP): adopts the RC4 symmetric encryption technology at the link layer. To obtain network resources, the encryption key of the user must be the same as that of the AP.
- WiFi Protected Access (WPA): is a new technology that inherits basic WEP principles and corrects some WEP defects. WPA changes the mode of generating the key, improves the algorithm of generating the key, and changes key modes more frequently to obtain higher security. Thus WPA effectively solves the problems in WEP encryption.
- WPA2: is the latest version of WPA. It is securer than WPA and more suitable to the encryption ptotocol with CBC-MAC Protocol (CCMP) in a WLAN.
- 802.1X: is an interface-based network access control protocol. The client connected to the interface can access network resources only after passing the authentication.
- WiFi Multimedia (WMM): is a wireless QoS protocol that ensures the prior sending rights for the packets of high priority, thus ensuring the better quality of applications such as voice and video services on wireless networks.

1.2 Configuring the Basic Attributes of a WLAN

1.2.1 Establishing the Configuration Task

Applicable Environment

A WLAN is to be created.

Data Preparation

To configure the basic attributes of a WLAN, you need the following data:

- Country and zone code
- Interval for detecting the wireless station

1.2.2 Setting the Country and Zone Code

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan country-zone-code country-zone-code
```

The country and zone code is set.

The country and zone code determines the attributes of the RF signal, such as the energy level, number of channels, and channel distribution. Set the correct country and zone code according to the location where the USG is used.

By default, the country and zone code is US.

----End

1.2.3 (Optional) Setting the Interval for Detecting the Wireless Station

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan station idle-timeout interval
```

The interval for detecting the wireless station by the AP is set.

The AP sends null packets at the interval of **idle-timeout** *interval* to detect whether the associated wireless station is online. If the wireless station is online, it responds to the packets. If the wireless station does not respond, it indicates that wireless station is offline and the station is deleted from the network.

By default, the interval for detecting the wireless station by the AP is 60s.

----End

1.3 Configuring a WLAN-BSS Interface

1.3.1 Establishing the Configuration Task

Applicable Environment

A WLAN-BSS interface is to be created before WLAN service class configuration.

Pre-configuration Tasks

Before configuring a WLAN-BSS interface, complete the following tasks:

- Create a VLAN and set the IP address of the Layer 3 interface VLANIF corresponding to the VLAN.
- Start the Dynamic Host Configuration Protocol (DHCP) server on the VLANIF.
- Add the VLANIF to the security zone and enable the interzone rule to allow packets to pass through.

Data Preparation

To configure a WLAN-BSS interface, you need the following data:

- WLAN-BSS interface number
- VLAN to which a WLAN-BSS interface is added

1.3.2 Configuring a WLAN-BSS Interface

Run:

```
system-view
```

The system view is displayed.

Run:

```
interface wlan-bss interface-number
```

A WLAN-BSS interface is created and the interface view is displayed.

(Optional) Run:

```
description text
```

The description of the WLAN-BSS interface is configured.

(Optional) Run:

```
port access vlan vlan-id
```

The WLAN-BSS interface is added to the specified VLAN.

The VLAN is the one created in section 1.3.1"Establishing the Configuration Task."

A WLAN-BSS interface can be added to only one VLAN.

By default, the WLAN-BSS interface is added to VLAN 1.

----End

1.4 Configuring a WLAN Service Class

1.4.1 Establishing the Configuration Task

Applicable Environment

A WLAN service class is to be created after WLAN-BSS interface configuration. The binding between a WLAN-BSS interface and WLAN service class indicates that a virtual AP is successfully created.

Data Preparation

To configure a WLAN service class, you need the following data:

- Number and type of a WLAN service class
- SSID name
- Maximum number of users allowed to access

- Link layer security mode, authentication mode, encryption suite, and key

1.4.2 Creating a WLAN Service Class

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number { plain | crypto }
```

A WLAN service class is created and the service class view is displayed.

The value of *service-class-number* ranges from 0 to 1023. A maximum of 64 service classes are supported. By default, only service class 0 exists.

plain: indicates the plain service class. Data is sent in plain texts.

crypto: indicates the crypto service class. Data is sent in cipher texts.

After creating a service class, you cannot change its type.

After creating a service class, you can run the **wlan service-class** *service-class-number* command to directly access the service class view.

----End

1.4.3 Configuring the SSID Name

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

Run:

```
ssid ssid-name
```

The SSID name is configured.

The SSID name is a string of 1 to 32 characters. The characters can be all printable ASCII characters (except the question mark), including the space. The string of the SSID name cannot start or end with a space.

By default, only service class 0 has its default SSID named gateway.

----End

1.4.4 (Optional) Disabling the SSID Broadcast Function

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

Run:

```
undo broadcast-ssid enable
```

The SSID broadcast function is disabled, that is, the SSID is hidden.

By default, the SSID broadcast function is enabled.

After the SSID broadcast function is enabled, the USG responds to the broadcast detection frame and broadcasts its SSID. In this case, any wireless station can find the SSID and access the network. After the SSID broadcast function is disabled, the USG does not respond to the broadcast detection frame. In this case, wireless stations cannot find the SSID, which improves network security.

----End

1.4.5 (Optional) Setting the Maximum Number of Users Allowed to Access

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

Run:

```
station max-number max-number
```

The maximum number of users allowed to access is set.

By default, the maximum number of users allowed to access is 64 or 124. When the encryption suite is TKIP or CCMP, the default value is 64. When the encryption suite is WEP or not encrypted, the default value is 124.

----End

1.4.6 (Optional) Enabling Layer 2 Isolation

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

Run:

```
station-isolation enable
```

Layer 2 isolation is enabled.

By default, Layer 2 isolation is disabled.

If Layer 2 isolation is enabled, the two wireless stations on the same AP cannot access each other.

----End

1.4.7 (Optional) Configuring MAC Address Filtering

After blacklist-based MAC address filtering is configured, the wireless stations whose MAC addresses are in the blacklist are denied to access. Other wireless stations, however, are not restricted. After whitelist-based MAC address filtering is configured, only the wireless stations whose MAC addresses are in the whitelist are allowed to access. Other wireless stations, however, cannot access.

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

Run:

```
mac-filter { blacklist | whitelist } mac-address
```

The MAC address blacklist or whitelist is configured.

A maximum of 64 MAC addresses (64 for the blacklist and whitelist respectively) are supported in a service class. A maximum of 256 MAC addresses (256 for the blacklist and whitelist respectively) are supported on an USG.

Run:

```
mac-filter { blacklist | whitelist } enable
```

MAC address filtering is enabled.

By default, MAC address filtering is disabled.

----End

1.4.8 (Optional) Configuring the QoS Priority

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

Run:

```
qos-priority mapping-policy { normal | cos | tos }
```

The QoS priority policy of forwarding packets from the wired network to the wireless network is configured.

By default, the QoS priority policy is **tos**.

Run:

```
qos-priority mapping-table { dscp-lp | dot1p-lp }
```

The QoS mapping table view is displayed.

Run:

```
previous-priority pre-value-list mapped-priority mapped-value
```

QoS priority mapping is modified.

----End

1.4.9 Setting the Authentication Mode

The configuration described in this section is supported by only the service class of the crypto type.

The USG supports two authentication modes: Open System Authentication and Shared Key Authentication.

In Open System Authentication, the None, WPA, WPA-PSK, WPA2, WPA2-PSK, WPA-WPA2 and WPA-WPA2-PSK modes are supported. Shared Key Authentication is an early wireless authentication scheme that is used for the compatibility with the USGs of early versions. In Shared Key Authentication, the WEP mode must be adopted.

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

Run:

```
security-mode { open-system | shared-key }
```

The link layer security mode is set.

By default, the link layer security mode is **open-system**.

Run:

```
authentication-mode { none | wpa | wpa-psk | wpa-wpa2 | wpa-wpa2-psk | wpa2 | wpa2-psk }
```

The authentication mode is set.

This command is valid only when the link layer security mode is **open-system**.

By default, the authentication mode is **none**.

----End

1.4.10 Configuring the Encryption Suite

The configuration described in this section is supported by only the service class of the crypto type.

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

Run:

```
encryption-suite { ccmp | tkip | wep }
```

The encryption suite used during frame encryption is configured.

By default, the WEP encryption suite is used.

In Shared Key Authentication, only the WEP encryption suite is supported. In Open System Authentication, the supported encryption suites vary according to **authentication-mode**:

- When **authentication-mode** is set to **none**, only the WEP encryption suite is supported.
- When **authentication-mode** is set to **wpa2** or **wpa2-psk**, only the CCMP encryption suite is supported.
- When **authentication-mode** is set to other modes, the TKIP and CCMP encryption suites are supported.

Run:

```
wep key key-id { wep40 | wep104 } { pass-phrase | raw-key } key
```

The WEP key is configured.

This command is valid only when the WEP encryption suite is adopted.

Run:

```
wep current-key-id key-id
```

The ID of the used WEP key is set.

This command is valid only when the WEP encryption suite is adopted.

By default, WEP key 1 is valid.

Run:

```
pre-shared-key { pass-phrase | raw-key } key
```

The pre-shared key is configured.

This command is valid only when the authentication mode is WPA-PSK, WPA2-PSK or WPA-WPA2-PSK.

By default, there is no pre-shared key.

----End

1.4.11 (Optional) Configuring 802.1X

This configuration is available only when the authentication mode is WPA, WPA2 or WPA-WPA2.

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

(Optional) Run:

```
dot1x domain-1x domain-name
```

An 802.1X domain is created.

By default, an 802.1X domain named dot1x is already created.

Run:

```
dot1x quiet-period enable
```

The 802.1X quiet function is enabled.

By default, the 802.1X quiet function is disabled.

After a user fails to pass 802.1X authentication, the USG enters the quiet period. During the quiet period, the USG does not process the 802.1X authentication packets sent by the user.

Run:

```
quit
```

The system view is returned.

To configure Remote Authentication Dial-In User Service (RADIUS), do as follows:

Run:

radius-server template *template-name*

A RADIUS server template is created and the RADIUS server template view is displayed.

Run:

radius-server authentication *ip-address port*

The primary RADIUS authentication server is configured.

(Optional) Run:

radius-server authentication *ip-address port* **secondary**

The secondary RADIUS authentication server is configured.

Run:

radius-server type standard

The RADIUS protocol is configured.

In 802.1X authentication, only the **standard** protocol is supported.

Run:

radius-server shared-key *key-string*

The key of the RADIUS server is configured.

Run:

undo radius-server user-name domain-included

The transmission of the user name without the domain name to the RADIUS server is configured.

Run:

quit

The system view is returned.

To configure AAA, do as follows:

Run:

aaa

The AAA view is displayed.

Run:

authentication-scheme *scheme-name*

An authentication scheme is created and the authentication scheme view is displayed.

The authentication scheme that is being referred to cannot be deleted.

Run:

authentication-mode radius

The authentication mode is set to RADIUS.

Run:

quit

The AAA view is returned.

Run:

```
domain domain-name
```

A domain is created and the domain view is displayed.

The created domain is the 802.1X domain.

Run:

```
radius-server template-name
```

The RADIUS server template of the current domain is configured.

Run:

```
authentication-scheme scheme-name
```

The authentication scheme of the current domain is configured.

----End

NOTE

For the detailed configuration of AAA and RADIUS, see section 01-04 "Authentication and Authorization Configuration" in the *Configuration Guide Security Defense Volume*.

1.4.12 Enabling the Service Class

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan service-class service-class-number
```

The service class view is displayed.

Run:

```
service-class enable
```

The WLAN service class is enabled.

By default, only service class 0 is enabled.

----End

1.4.13 Checking the Configuration

0 shows the commands for checking service class configurations.

Commands for checking service class configurations

Action	Command	View
Checking the QoS priority mapping table	**display wlan qos-priority mapping-table** { **all** | **dot1p-lp** | **dscp-lp** } **service-class** *service-class-number*	All views
Checking the blacklist or whitelist of the specified service class	**display wlan mac-filter** { **whitelist** | **blacklist** } *service-class-number*	All views
Checking information about the specified service class	**display wlan service-class** [*service-class-number*]	All views

1.5 Configuring the RF Interface

1.5.1 Establishing the Configuration Task

Applicable Environment

The USG has only one RF interface, which supports 16 virtual APs at the same time. The configurations on the RF interface are applicable to all APs.

Data Preparation

To configure the RF interface, you need the following data:

- Basic attributes of the RF interface, including the working channel, maximum transmission power, and RF type
- Fragment threshold and maximum retransmission times for long or short frames
- 802.11n parameters
- WMM parameters
- Bound service class and WLAN-BSS interface

1.5.2 (Optional) Configuring the Basic Attributes of the RF Interface

Run:

```
system-view
```

The system view is displayed.

Run:

```
interface wlan-rf 4/0/0
```

The RF interface view is displayed.

Run:

```
shutdown
```

The RF interface is shut down.

Some RF interface parameters need to be set when the RF interface is shut down. It is recommended that you shut down the RF interface before modifying interface configurations.

By default, the RF interface state is open.

Run:

```
radio-type radio-type
```

The RF type used by the RF interface is set.

By default, the RF type is dot11gn.

The values of *radio-type* are: dot11a (802.11a type and 5 GHz frequency band), dot11an (802.11n type, 5 GHz frequency band, and compatible with 802.11a), dot11b (802.11b type and 2.4 GHz frequency band), dot11g (802.11g type, 2.4 GHz frequency band, and compatible with 802.11b), dot11gn (802.11n type, 2.4 GHz frequency band, and compatible with 802.11g and 802.11b).

Run:

```
channel { auto | channel }
```

The working channel of the RF interface is set.

The channel number varies according to the country and zone code and the RF type.

By default, the USG automatically determines the channel number according to the channel scanning result.

Run:

```
max-power max-power
```

The maximum transmission power of the RF interface is set.

By default, the maximum transmission power of the RF interface is 17 dbm.

Run:

```
dtim dtim
```

The Delivery Traffic Indication Message (DTIM) period of the beacon frame is set.

By default, the DTIM period of the beacon frame is 3.

----End

1.5.3 (Optional) Configuring Fragmentation and Retransmission

Run:

```
system-view
```

The system view is displayed.

Run:

```
interface wlan-rf 4/0/0
```

The RF interface view is displayed.

Run:

```
shutdown
```

The RF interface is shut down.

Some RF interface parameters need to be set when the RF interface is shut down. It is recommended that you shut down the RF interface before modifying interface configurations.

By default, the RF interface state is open.

Run:

```
fragment-threshold size
```

The fragment threshold for packets is set.

When the actual size of a packet exceeds the fragment threshold, the packet is transmitted in fragments.

By default, the fragment threshold for packets is 2346 bytes.

Run:

```
rts threshold size
```

The threshold of the frame length required for starting the Request To Send (RTS) mechanism is set.

When the frame length exceeds the threshold, the USG starts the RTS mechanism.

By default, the threshold of the frame length required for starting the RTS mechanism is 2347 bytes.

Run:

```
long-retry threshold count
```

The maximum retransmission times for long frames (the frame length exceeds the threshold) is set.

By default, the maximum retransmission times for long frames is 4.

Run:

```
short-retry threshold count
```

The maximum retransmission times for short frames (the frame length does not exceed the threshold) is set.

By default, the maximum retransmission times for short frames is 7.

----End

1.5.4 (Optional) Configuring 802.11n

The configuration described in this section is valid only when the RF interface type is 802.11n. For the setting of the RF interface type, see section 1.5.2 "(Optional) Configuring the Basic Attributes of the RF Interface."

802.11n supports both the 2.4 GHz and 5 GHz frequency bands, providing faster access rate for users. 802.11n makes the following improvements:

- Forms a 40 MHz bandwidth by binding two 20 MHz bandwidths. This improves the bandwidth.
- Provides MAC Protocol Data Unit (MPDU) convergence. That is, multiple MPDUs are converged to an A-MPDU and only the physical layer head is reserved. This improves network throughput.
- Provides MAC Service Data Unit (MSDU) convergence. That is, multiple MSDUs are converged to an A-MSDU for sending. The principle of MSDU convergence is similar to that of MPDU convergence.
- Provides the short Guard Interval (GI). This reduces the GI and improves the packet forwarding rate.

Run:

```
system-view
```

The system view is displayed.

Run:

```
interface wlan-rf 4/0/0
```

The RF interface view is displayed.

Run:

```
shutdown
```

The RF interface is shut down.

Some RF interface parameters need to be set when the RF interface is shut down. It is recommended that you shut down the RF interface before modifying interface configurations.

By default, the RF interface state is open.

Run:

```
channel bandwidth { 20 | 40 }
```

The bandwidth (channel) of the RF interface is set.

By default, the bandwidth is 40 MHz when the RF type is dot11an; the bandwidth is 20 MHz when the RF type is dot11a, dot11b, dot11g, or dot11gn.

Run:

```
short-gi enable
```

The short GI function is enabled.

By default, the short GI function is disabled.

Run:

```
a-mpdu enable
```

MPDU convergence is enabled.

This command cannot be used together with the **a-msdu enable** command.

By default, MPDU convergence is enabled.

Run:

```
a-msdu enable
```

MSDU convergence is enabled.

This command cannot be used together with the **a-mpdu enable** command.

By default, MSDU convergence is disabled.

----End

1.5.5 (Optional) Configuring WMM

The traditional WLAN treats all data equally. When traffic exceeds the available bandwidth, packets are all discarded regardless of priorities, which brings difficulties in forwarding the packets of high priority. WMM provides four priority queues from high priority to low priority: AC-VO (voice flow), AC-VI (video flow), AC-BE (best effort flow), and AC-BK (background flow). When congestion occurs, WMM ensures that the packets in the high priority queue are forwarded first.

WMM defines a set of enhanced distribution channel access (EDCA) parameters for each priority queue, including **AIFSN**, **ECWmin**, **ECWmax**, and **TXOPLimit**.

Run:

```
system-view
```

The system view is displayed.

Run:

```
interface wlan-rf 4/0/0
```

The RF interface view is displayed.

Run:

```
shutdown
```

The RF interface is shut down.

Some RF interface parameters need to be set when the RF interface is shut down. It is recommended that you shut down the RF interface before modifying interface configurations.

By default, the RF interface state is open.

Run:

```
wmm enable
```

WMM is enabled.

By default, WMM is enabled.

WMM is applicable to wireless multimedia services, such as voice and video services.

Run:

```
wmm edca { ap | station } { ac-vo | ac-vi | ac-be | ac-bk } { aifsn aifsn-value |
ecwmin ecwmin-value | ecwmax ecwmax-value | txop txop-value }
```

EDCA parameters are set.

It is recommended that the default value be adopted. If the value of the parameter needs to be changed, it is recommended that the following conditions be complied with:

- aifsn（ac-vo) <=aifsn （ac-vi) <=aifsn (ac-be) <=aifsn (ac-bk)
- ecwmin （ac-vo) <=ecwmin (ac-vi) <=ecwmin (ac-be) <=ecwmin (ac-bk)
- ecwmax （ac-vo) <=ecwmax (ac-vi) <=ecwmax (ac-be) <=ecwmax (ac-bk)

Run:

```
wmm u-apsd enable
```

Unscheduled automatic power-saving delivery (U-APSD) is enabled.

U-APSD is a new type of power-saving mode defined by WMM. It can further improve the power-saving capability of wireless stations.

By default, U-APSD is enabled.

Run:

```
wmm ap noack
```

The no-acknowledgement mode of the AP is enabled.

In no-acknowledgement mode, the USG does not use ACK packets to acknowledge the received packets. This effectively improves the transmission efficiency but may cause packet loss. Thus, the no-acknowledgement mode is not recommended when signal interference exists.

By default, the AP is in acknowledgement mode.

----End

1.5.6 Configuring the Binding Between a Service Class and WLAN-BSS Interface

The binding between a service class and WLAN-BSS interface indicates that a virtual AP is successfully configured.

Run:

```
system-view
```

The system view is displayed.

Run:

```
interface wlan-rf 4/0/0
```

The RF interface view is displayed.

Run:

```
bind service-class service-class-number interface wlan-bss wlan-bss-number
```

A service class and WLAN-BSS interface are bound.

By default, service class 0 and WLAN-BSS interface 0 are bound, and cannot be unbound.

Run:

```
undo shutdown
```

The RF interface state turn into open.

----End

1.5.7 Checking the Configuration

0 shows the commands for checking WMM configurations.

Commands for checking WMM configurations

Action	Command	View
Checking EDCA parameters	**display wlan wmm edca** { **ap** | **station** }	All views

1.6 Configuring Spectrum Management

1.6.1 Establishing the Configuration Task

Applicable Environment

Spectrum management is to be applied on a WLAN.

Data Preparation

To configure spectrum management, you need the following data:

- RF power constraint
- RF rate set

1.6.2 (Optinal) Enabling Spectrum Management

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan srm
```

The spectrum management view is displayed.

Run:

```
spectrum-management enable
```

Spectrum management is enabled.

This function and the automatic channel selection function are mutually exclusive. After spectrum management is enabled, the automatic channel selection function does not take effect.

After the running of this command, the AP controls the transmission power and scans the radar signals around to avoid radar signal interference. Also, the AP broadcasts the power capability and power constraint of the AP. All the wireless stations under the AP should comply with the power constraint broadcast by the AP.

By default, spectrum management is disabled.

Run:

```
power-constraint power-constraint
```

The RF power constraint is set.

This command is valid only when the **spectrum-management enable** command is enabled. When spectrum management is enabled, the RF power constraint is broadcast in the beacon frame.

By default, the RF power constraint is not set.

----End

1.6.3 (Optional) Configuring RF Rate Sets

Multiple wireless stations may access the AP and the rate sets supported by these wireless stations may be different. As a result, a rate supported by all wireless stations is required for sending broadcast and multicast packets. Also, a rate supported by wireless stations for sending unicast packets should be selected.

Rate sets vary according to different country and zone codes.

Run:

```
system-view
```

The system view is displayed.

Run:

```
wlan srm
```

The spectrum management view is displayed.

Run:

```
dot11g protection enable
```

The function of 802.11g protection is enabled.

Protocol 802.11g is compatible with protocol 802.11b.When the AP uses 802.11g and both 802.11g and 802.11b wireless stations exist (in composite networking mode), the 802.11g protection function needs to be enabled to ensure that various wireless stations can communicate normally.

By default, the function of 802.11g protection is disabled.

Run:

```
{ dot11a | dot11b | dot11g } mandatory-rate mandatory-rate
```

Basic RF rate sets are set.

By default, the basic rate set of **dot11a** consists of 6, 9, 12, and 24; the basic rate set of **dot11b** consists of 1 and 2; the basic rate set of **dot11g** consists of 1, 2, 5.5, and 11, in Mbps.

Run:

```
{ dot11a | dot11b | dot11g } supported-rate supported-rate
```

Supported RF rate sets are set.

By default, the supported rate set of **dot11a** consists of 18, 36, 48, and 54; the supported rate set of **dot11b** consists of 5.5 and 11; the supported rate set of **dot11g** consists of 6, 9, 12, 18, 24, 36, 48, and 54, in Mbps.

----End

1.7 Maintenance

1.7.1 Debugging

⚠ **CAUTION**

Enabling the debugging function affects system performance. Therefore, after debugging, run the **undo debugging all** command to immediately disable the debugging function.

When a running fault occurs, run the **debugging** command in the user view to view the debugging information, and locate and analyze the fault.

Action	Command
Enabling the function of debugging a WLAN	**debugging wlan** { **all** | **error** | **module** { **a-mpdu** | **a-msdu** | **assoc** | **dfs** | **forward** | **mbss** | **phy** | **power-manager** | **radar** | **rate** | **sec** } }

1.7.2 Viewing Information

0 shows the commands for viewing information about wireless stations and the WLAN.

Commands for viewing information about wireless stations and the WLAN

Action	Command	View
Viewing the MAC address of the associated wireless station	**display wlan station association** [*bss-number*]	All views
Viewing security statistics	**display wlan security** { **session** | **statistics** } *bss-number*	All views
Viewing the status of the specified wireless station	**display wlan station information** *mac-address*	All views
Viewing statistics on wireless stations	**display wlan statistics station** { **all** | **mac-address** *mac-address* }	All views
Viewing WMM statistics	**display wlan wmm statistics**	All views
Viewing information about the RF interface	**display interface wlan-rf** [*rf-number*]	All views
Viewing information about the WLAN-BSS interface	**display interface wlan-bss** [*bss-number*]	All views

1.7.3 Clearing Statistics

0 shows the commands for clearing statistics in the user view.

Commands for clearing statistics

Action	Command
Disconnecting from the specified wireless station	**reset wlan station** { **all** | **mac-address** *mac-address* }
Clearing statistics on wireless stations	**reset wlan statistics station** { **all** | **mac-address** *mac-address* }
Clearing WMM statistics	**reset wlan wmm statistics**
Clearing statistics on the RF interface	**reset counters interface** [**wlan-rf** [*rf-number*]]
Clearing statistics on the WLAN-BSS interface	**reset counters interface** [**wlan-bss** [*bss-number*]]
Clearing WLAN security statistics	**reset wlan security statistics** { **all** | *bss-number* }

1.8 Examples for Configuring a WLAN

1.8.1 Example for Configuring a WLAN (Crypto Service Class)

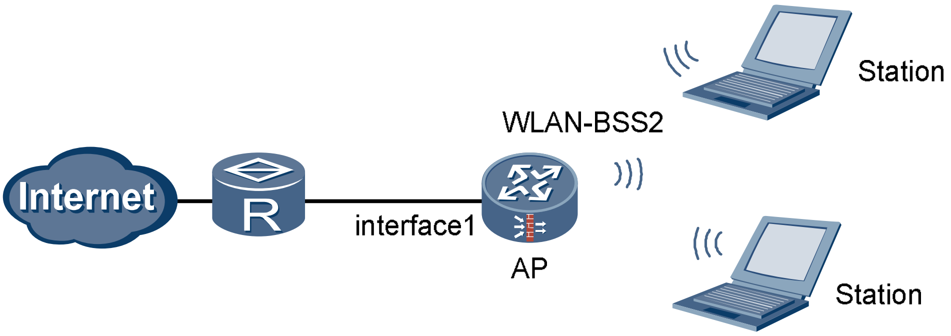
Networking Requirements

- The AP is connected to the router through Ethernet 0/0/0 (already added to the Untrust zone).
- The fixed IP address of Ethernet 0/0/0 is 202.169.10.1/24 and the IP address of the router is 202.169.10.2/24.
- The IP address of the DNS Server is 205.1.1.10. You can obtain it from the operator.
- The IP addresses of the two stations are 192.168.1.2/24 and 192.168.1.3/24.
- The stations use wireless network cards to connect to the AP (USG), with the SSID of WLAN100.
- Disabling the default AP (service-class 0).
- The authentication mode is WPA-WPA2-PSK, the pre-shared key is abcdefgh, and the CCMP and TKIP encryption suite is adopted.

The stations can access the Internet in wireless mode through the configuration of a WLAN.

Networking Diagram

Networking diagram of configuring a WLAN (Crypto service class)



interface1 Ethernet 0/0/0: 202.169.10.1/24

Configuration Procedure

Perform basic configurations.

# Create VLANIF 2.

```
<USG> system-view
[USG] vlan 2
[USG-vlan2] quit
[USG] interface Vlanif 2
[USG-Vlanif2] ip address 192.168.1.1 255.255.255.0
[USG-Vlanif2] quit
```

# Access the Trust zone view.

```
[USG] firewall zone trust
```

# Add VLANIF 2 to the Trust zone.

```
[USG-zone-trust] add interface Vlanif 2
[USG-zone-trust] quit
```

# Configure the interzone packet filtering rule.

```
[USG] firewall packet-filter default permit all
```

# Configure the country and zone code to ES (Spain).

```
[USG] wlan country-zone-code ES
```

Configure a WLAN-BSS interface.

# Create a WLAN-BSS interface.

```
[USG] interface wlan-bss 2
```

# Add the WLAN-BSS interface to VLAN 2.

```
[USG-Wlan-Bss2] port access vlan 2
[USG-Wlan-Bss2] quit
```

Configure a service class.

# Create a service class.

```
[USG] wlan service-class 2 crypto
```

# Set the SSID.

```
[USG-wlan-sc-2] ssid WLAN100
```

# Set the authentication mode.

```
[USG-wlan-sc-2] authentication-method wpa-wpa2-psk
```

# Configure the encryption suite for data frames.

```
[USG-wlan-sc-2] encryption-suite ccmp
[USG-wlan-sc-2] encryption-suite tkip
```

# Configure the pre-shared key.

```
[USG-wlan-sc-2] pre-shared-key pass-phrase abcdefgh
```

# Enable the service class.

```
[USG-wlan-sc-2] service-class enable
[USG-wlan-sc-2] quit
```

# Disabling the default AP (service-class 0).

```
[USG] wlan service-class 0
[USG-wlan-sc-0] undo service-class enable
[USG-wlan-sc-0] quit
```

Configure the RF interface.

# Set the RF type used by the RF interface to **dot11gn**.

```
[USG] interface wlan-rf 4/0/0
[USG-Wlan-rf4/0/0] shutdown
[USG-Wlan-rf4/0/0] radio-type dot11gn
```

```
[USG-Wlan-rf4/0/0] undo shutdown
```

# Configure the binding between the service class and WLAN-BSS interface.

```
[USG-Wlan-rf4/0/0] bind service-class 2 interface wlan-bss 2
[USG-Wlan-rf4/0/0] quit
```

Configure NAT.

# Configure the ACL rule.

```
[USG] acl 2001
[USG-acl-basic-2001] rule 1 permit source 192.168.1.0 0.0.0.255
[USG-acl-basic-2001] quit
```

# Configure the interzone packet filtering rule for the Trust zone and Untrust zone.

```
[USG] firewall interzone trust untrust
[USG-interzone-trust-untrust] packet-filter 2001 outbound
```

# Configure NAT.

```
[USG-interzone-trust-untrust] nat outbound 2001 interface Ethernet0/0/0
[USG-interzone-trust-untrust] quit
```

# Configure the default route.

```
[USG] ip route-static 0.0.0.0 0.0.0.0 202.169.10.2
```

Configure the wireless network cards on the client.

- Manually set the IP addresses of the wireless network cards to 192.168.1.2/24 and 192.168.1.3/24.
- Manually set the IP address of the DNS Server to 205.1.1.10.
- The SSID, encryption mode, authentication mode, and pre-shared key on the wireless network cards should be consistent with those on the USG.

----End

1.8.2 Example for Configuring a WLAN (Plain Service Class)

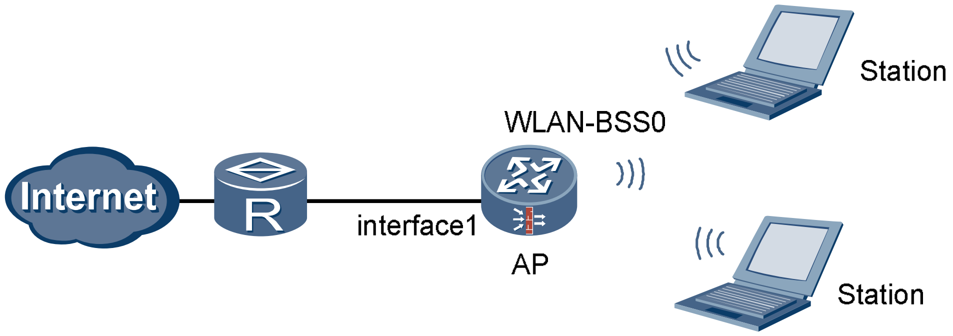
Networking Requirements

- The AP is connected to the router through Ethernet 0/0/0 (already added to the Untrust zone).
- The fixed IP address of Ethernet 0/0/0 is 202.169.10.1/24 and the IP address of the router is 202.169.10.2/24.
- The IP address of the DNS Server is 205.1.1.10. You can obtain it from the operator.
- The two stations automatically obtain IP addresses through DHCP.
- The stations use wireless network cards to connect to the AP (USG), with the SSID of WLAN100.

The stations can access the Internet in wireless mode through the configuration of a WLAN.

Networking Diagram

Networking diagram of configuring a WLAN (Plain service class)



interface1	Ethernet 0/0/0: 202.169.10.1/24

Configuration Procedure

Perform basic configurations.

# Create VLANIF 2.

```
<USG> system-view
[USG] vlan 2
[USG-vlan2] quit
[USG] interface Vlanif 2
[USG-Vlanif2] ip address 192.168.1.1 255.255.255.0
[USG-Vlanif2] dhcp select interface
[USG-Vlanif2] dhcp server dns-list 205.1.1.10
[USG-Vlanif2] quit
```

# Access the Trust zone view.

```
[USG] firewall zone trust
```

# Add VLANIF 2 to the Trust zone.

```
[USG-zone-trust] add interface Vlanif 2
[USG-zone-trust] quit
```

# Configure the interzone packet filtering rule.

```
[USG] firewall packet-filter default permit all
```

# Configure the country and zone code to ES (Spain).

```
[USG] wlan country-zone-code ES
```

Configure a WLAN-BSS interface.

# Enter the WLAN-BSS interface view.

```
[USG] interface wlan-bss 0
```

# Add the WLAN-BSS interface to VLAN 2.

```
[USG-Wlan-Bss0] port access vlan 2
[USG-Wlan-Bss0] quit
```

Configure a service class.

# Create a service class.

```
[USG] wlan service-class 0
```

# Set the SSID.

```
[USG-wlan-sc-0] ssid WLAN100
```

# Enable the service class.

```
[USG-wlan-sc-0] service-class enable
[USG-wlan-sc-0] quit
```

Configure the binding between the service class and WLAN-BSS interface.

```
[USG] interface wlan-rf 4/0/0
[USG-Wlan-rf4/0/0] bind service-class 0 interface wlan-bss 0
[USG-Wlan-rf4/0/0] quit
```

Configure NAT.

# Configure the ACL rule.

```
[USG] acl 2001
[USG-acl-basic-2001] rule 1 permit source 192.168.1.0 0.0.0.255
[USG-acl-basic-2001] quit
```

# Configure the interzone packet filtering rule for the Trust zone and Untrust zone.

```
[USG] firewall interzone trust untrust
[USG-interzone-trust-untrust] packet-filter 2001 outbound
```

# Configure NAT.

```
[USG-interzone-trust-untrust] nat outbound 2001 interface Ethernet0/0/0
[USG-interzone-trust-untrust] quit
```

# Configure the default route.

```
[USG] ip route-static 0.0.0.0 0.0.0.0 202.169.10.2
```

Configure the wireless network cards on the client.

- Configure the wireless network cards to automatically obtain IP addresses.
- Configure the wireless network cards to automatically obtain DNS Server.
- The SSID, encryption mode, and authentication mode on the wireless network cards should be consistent with those on the USG.

----End

1.8.3 Example for Configuring a WLAN (802.1X)

Networking Requirements

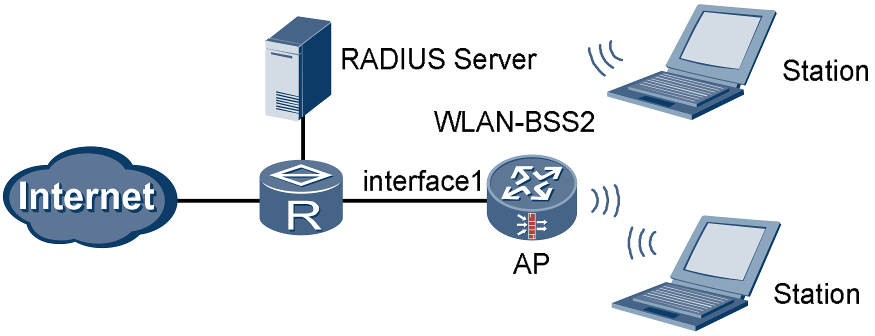
- The AP is connected to the router through Ethernet 0/0/0 (already added to the Untrust zone).
- The fixed IP address of Ethernet 0/0/0 is 202.169.10.1/24 and the IP address of the router is 202.169.10.2/24.

- The IP address of the DNS Server is 205.1.1.10. You can obtain it from the operator.
- The two stations automatically obtain IP addresses through DHCP.
- The stations use wireless network cards to connect to the AP (USG), with the SSID of WLAN100.
- Disabling the default AP (service-class 0).
- 802.1X authentication is enabled. The IP address of the RADIUS server is 202.169.10.100/24 and the key is hello.

The stations can access the Internet in wireless mode through the configuration of a WLAN.

Networking Diagram

Networking diagram of configuring a WLAN (802.1X)



interface1	Ethernet 0/0/0: 202.169.10.1/24

Configuration Procedure

NOTE
Select WPA, WPA2 or WPA-WPA2 for the authentication mode when configuring 802.1X.

Perform basic configurations.

# Create VLANIF 2.

```
<USG> system-view
[USG] vlan 2
[USG-vlan2] quit
[USG] interface Vlanif 2
[USG-Vlanif2] ip address 192.168.1.1 255.255.255.0
[USG-Vlanif2] dhcp select interface
[USG-Vlanif2] dhcp server dns-list 205.1.1.10
[USG-Vlanif2] quit
```

# Access the Trust zone view.

```
[USG] firewall zone trust
```

# Add VLANIF 2 to the Trust zone.

```
[USG-zone-trust] add interface Vlanif 2
[USG-zone-trust] quit
```

# Configure the interzone packet filtering rule.

```
[USG] firewall packet-filter default permit all
```

# Configure the country and zone code to ES (Spain).

```
[USG] wlan country-zone-code ES
```

Configure a WLAN-BSS interface.

# Create a WLAN-BSS interface.

```
[USG] interface wlan-bss 2
```

# Add the WLAN-BSS interface to VLAN 2.

```
[USG-Wlan-Bss2] port access vlan 2
[USG-Wlan-Bss2] quit
```

Configure a service class.

# Create a service class.

```
[USG] wlan service-class 2 crypto
```

# Set the SSID.

```
[USG-wlan-sc-2] ssid WLAN100
```

# Set the authentication mode.

```
[USG-wlan-sc-2] authentication-method wpa2
```

# Create an 802.1X domain.

```
[USG-wlan-sc-2] dot1x domain-1x abc
```

# Enable the service class.

```
[USG-wlan-sc-2] service-class enable
[USG-wlan-sc-2] quit
```

# Disabling the default AP (service-class 0).

```
[USG] wlan service-class 0
[USG-wlan-sc-0] undo service-class enable
[USG-wlan-sc-0] quit
```

Configure the binding between the service class and WLAN-BSS interface.

```
[USG] interface wlan-rf 4/0/0
[USG-Wlan-rf4/0/0] bind service-class 2 interface wlan-bss 2
[USG-Wlan-rf4/0/0] quit
```

Configure NAT.

# Configure the ACL rule.

```
[USG] acl 2001
[USG-acl-basic-2001] rule 1 permit source 192.168.1.0 0.0.0.255
[USG-acl-basic-2001] quit
```

# Configure the interzone packet filtering rule for the Trust zone and Untrust zone.

```
[USG] firewall interzone trust untrust
[USG-interzone-trust-untrust] packet-filter 2001 outbound
```

# Configure NAT.

```
[USG-interzone-trust-untrust] nat outbound 2001 interface Ethernet0/0/0
[USG-interzone-trust-untrust] quit
```

# Configure the default route.

```
[USG] ip route-static 0.0.0.0 0.0.0.0 202.169.10.2
```

Configure RADIUS.

# Create a RADIUS server template.

```
[USG] radius-server template test1
```

# Configure the RADIUS authentication server.

```
[USG-radius-test1] radius-server authentication 202.169.10.100 1812
```

# Configure the RADIUS protocol.

```
[USG-radius-test1] radius-server type standard
```

# Configure the key of the RADIUS server.

```
[USG-radius-test1] radius-server shared-key hello
[USG-radius-test1] undo radius-server user-name domain-included
[USG-radius-test1] quit
```

Configure AAA.

# Access the AAA view.

```
[USG] aaa
```

# Configure the RADIUS authentication scheme.

```
[USG-aaa] authentication-scheme mywlan
[USG-aaa-authen-mywlan] authentication-mode radius
[USG-aaa-authen-mywlan] quit
```

# Create a domain.

```
[USG-aaa] domain abc
```

# Configure the RADIUS server template of the current domain.

```
[USG-aaa-domain-abc] radius-server test1
```

# Configure the authentication scheme of the domain.

```
[USG-aaa-domain-abc] authentication-scheme mywlan
```

Configure the wireless network cards on the client.

- Configure the wireless network cards to automatically obtain IP addresses.
- Configure the wireless network cards to automatically obtain DNS Server.
- The SSID and authentication mode on the wireless network cards should be consistent with those on the USG.
- The user name and password for 802.1X authentication should be consistent with those on the RADIUS server.

----End

1.9 FCC Statement of Wireless Module

15.19

NOTICE:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and 2) This device must accept any interference received, including interference that may cause undesired operation.

15.21

NOTICE:

Changes or modifications made to this device not expressly approved by Huawei Technologies Co., Ltd. may void the FCC authorization to operate this device.

15.105

NOTE:

This device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to radio or television reception, which can be determined by connecting or disconnecting the device to a PC, the user is encouraged to try to correct the interference by adopting one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the distance between the device and the receiver.

Connect the device to an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio or TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this device.

This device is intended for OEM integrators only.

Host system must be labeled with "Contains FCC ID: QISHSMPCIAGN01", FCC ID displayed on label.

Antenna use:

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.