User Manual

EKI-6331AN-BE/ EKI-6332GN-AE

IEEE 802.11n Wi-Fi AP/Client/ Bridge

ADVANTECH

Enabling an Intelligent Planet

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Product Warranty (5 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for five years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

Part No. XXXXXXXXXX Edition 1

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Declaration of Conformity

CE

This product has passed the CE test for environmental specifications. Test conditions for passing included the equipment being operated within an industrial enclosure. In order to protect the product from being damaged by ESD (Electrostatic Discharge) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

FCC Class B

Note: This equipment 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 equipment 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 equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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.

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

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. To avoid the possibility of exceeding radio frequency exposure limits, you shall beep a distance of at least 100cm between you and the antenna of the installed equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end user.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Warnings, Cautions and Notes

Warning! *Warnings indicate conditions, which if not observed, can cause personal injury!*

Caution! *Cautions are included to help you avoid damaging hardware or losing data. e.g.*

There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Note! *Notes provide optional additional information.*

Document Feedback

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to: support@advantech.com

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:

- The power cord or plug is damaged.
- Liquid has penetrated into the equipment.
- The equipment has been exposed to moisture.
- The equipment does not work well, or you cannot get it to work according to the user's manual.
- The equipment has been dropped and damaged.
- The equipment has obvious signs of breakage.

15. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 80° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.
16. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
17. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
- Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

Contents

Chapter 1

Introduction

1.1 Introduction

EKI-6332GN-AE/EKI-6331AN-BE is a high-performance last-mile broadband solution that provides reliable wireless network coverage. Designed with IEEE 802.11n standard, 2x2 MIMO technology and high output power makes it possible deliver up to 300Mbps high data rate with longer range for general purpose application. EKI-6332GN-AE operates at 2.4GHz band while EKI-6331AN-BE operates at 5GHz band.

EKI-6332GN-AE/EKI-6331AN-BE can be used as the access point, the client, the WDS and the AP Repeater. While being as the access point, it can be deployed to provide wireless networking service. In the other way to be as the client, it can receive wireless signal over the last mile, helping WISPs deliver internet service to the new residential and the business customer where wired broadband internet service, such as cable and DSL, cannot serve in. In addition, the easy-to-install EKI-6332GN-AE/EKI-6331AN-BE features with outstanding throughput performance and a cost-effective design that allows users to have the reliable equipment at the affordable price.

1.2 Appearance

Figure 1.1 EKI-6332GN-AE/EKI-6331AN-BE

1.3 Key Features

- Compliant with IEEE 802.11n standard
- Support passive PoE which is supplied with 24V.
- High reliable watertight housing endures almost any harsh environments
- Support 64/128/152-bit WEP and 802.1X, WPA, WPA2, WPA&WPA2,WPA-PSK, WPA2-PSK, and WPA-PSK&WPA2-PSK etc
- User-friendly Web and SNMP-based management interface

1.4 Typical Application

EKI-6332GN-AE/EKI-6331AN-BE can be applied into the following environments:

- Cost-effectively provide long distance backhaul for remote areas (e.g. village, oil well, island, mountain and etc.)
- Establish local backhaul for campus, farm and factory
- Provide and access for video streaming or surveillance for industrial and mining enterprises

Figure 1.2 Typical Application

Chapter 2

Hardware Installation

This chapter describes safety precautions and product information you have to know and check before installing EKI-6332GN-AE/EKI-6331AN-BE.

2.1 Preparation before Installation

2.1.1 Professional Installation Required

Please seek assistance from a professional installer who is well trained in the RF installation and knowledgeable in the local regulations.

2.1.2 Safety Precautions

1. To keep you safe and install the hardware properly, please read and follow these safety precautions.
2. If you are installing EKI-6332GN-AE/EKI-6331AN-BE for the first time, for your safety as well as others', please seek assistance from a professional installer who has received safety training on the hazards involved.
3. Keep safety as well as performance in mind when selecting your installation site, especially where there are electric power and phone lines.
4. When installing EKI-6332GN-AE/EKI-6331AN-BE, please note the following things:

- Do not use a metal ladder;
- Do not work on a wet or windy day;
- Wear shoes with rubber soles and heels, rubber gloves, long sleeved shirt or jacket.

5. When the system is operational, avoid standing directly in front of it. Strong RF fields are present when the transmitter is on.

2.1.3 Installation Precautions

To keep EKI-6332GN-AE/EKI-6331AN-BE well while you are installing it, please read and follow these installation precautions.

1. Users MUST use a proper and well-installed grounding and surge arrestor with EKI-6332GN-AE/EKI-6331AN-BE; otherwise, a random lightening could easily cause fatal damage to EKI-6332GN-AE/EKI-6331AN-BE. EMD (Lightning) DAMAGE IS NOT COVERED UNDER WARRNTY.
2. Users MUST use the "Power cord & PoE Injector" shipped in the box with EKI-6332GN-AE/EKI-6331AN-BE. Use of other options will likely cause damage to EKI-6332GN-AE/EKI-6331AN-BE.

2.1.4 Product Package

The product package you have received should contain the following items. If any of them are not included or damaged, please contact your local vendor for support.

- EKI-6332GN-AE/EKI-6331AN-BE × 1
- Detachable 5dBi Antennas × 2
- Pole Mounting Ring × 2
- 24VDC Power Cord & PoE Injector × 1
- Ferrite Suppression Core × 1
- Grounding Wire × 1
- Product CD × 1

Note! *Product CD contains Quick Installation Guide and User Manual.*

Pole Mounting Ring

Round Cable Suppression Core

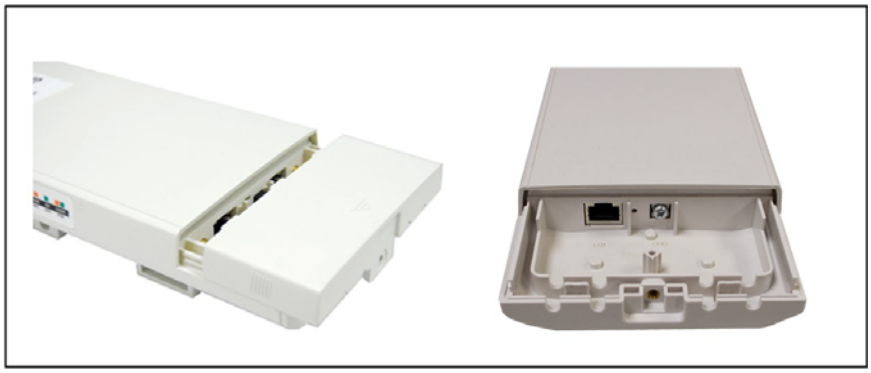
24V_{DC} Power Cord & PoE Injector

Warning! *Users MUST use the "Power cord & PoE Injector" shipped in the box with EKI-6332GN-AE/EKI-6331AN-BE. Use of other options will likely cause damage to EKI-6332GN-AE/EKI-6331AN-BE.*

2.2 Hardware Installation

2.2.1 Connect up

1. The bottom of the Access Point is a movable cover. Grab the cover and pull it back harder to take it out as the figure shown below.



2. Plug a standard Ethernet cable into the RJ45 port.

3. Slide the cover back and press down the lock button to seal the bottom of the Access Point.

2.2.2 Using the Grounding Wire

EKI-6332GN-AE/EKI-6331AN-BE is equipped with a grounding wire. It is important that the Access Point, cables, and PoE Injector must be properly connected to earth ground during normal use against surges or ESD.

1. Remove the screw on the grounding point at the bottom of the Access Point.

2. Put the grounding wire on the grounding point at the bottom of the Access Point. Then screw the grounding wire to tighten up.

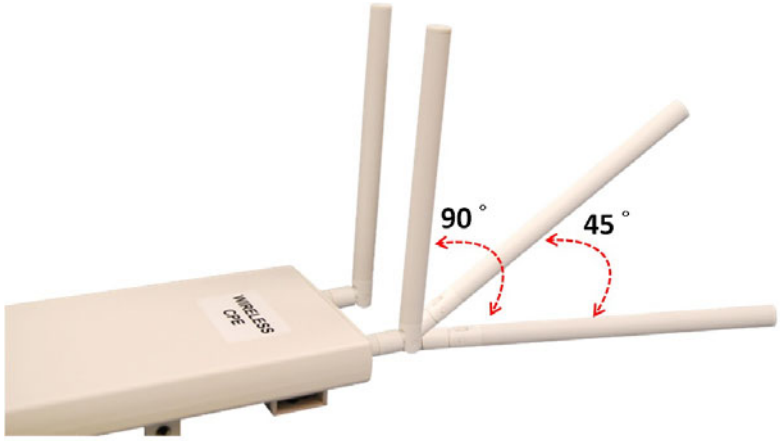
2.2.3 Install External Antennas

The Access Point provides two reverse SMA antenna connectors for connecting external antennas.

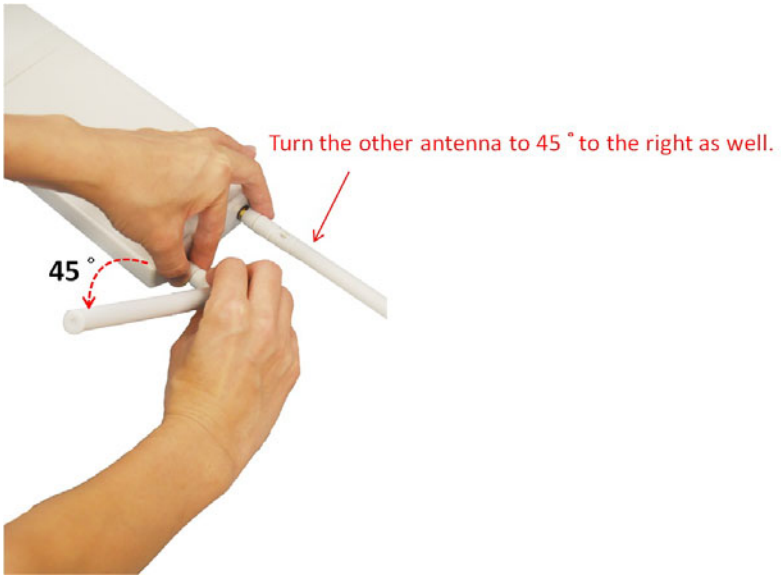
1. Connect external antennas that came with the package to the SMA-type connectors on top of the Access Point. For longer coverage distance, it is recommended that higher gain antennas be used to best suit the application.

Warning! *Users MUST power off the Access Point first before connecting the external antenna to it. Do not power on the device for a certain of time without physically attaching the external antenna; otherwise, damage might be caused to the unit itself.*

2. Bend the antennas to 90 degree or 45 degree.



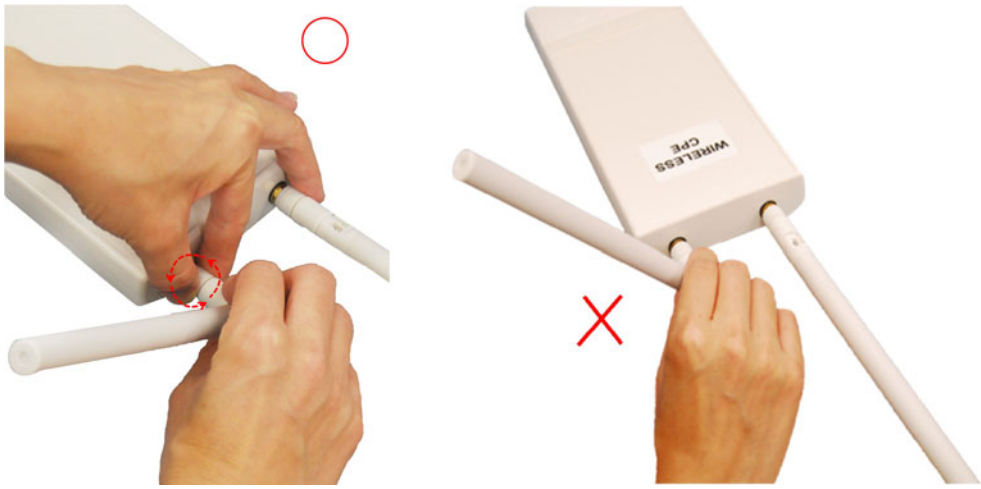
3. You may turn one antenna 45 degrees to the left and the other 45 degrees to the right. The tilted antennas are a reasonable way to operate and the best way if the antennas are fairly close together since they couple together much less than if they are both pointed in the same direction (parallel).



Note! *The polarization of antennas should be properly aligned. Maximum signal strength between bridges occurs when both bridges are using identical polarization.*

4. Tighten up the connector joint clockwise to fix the antennas.

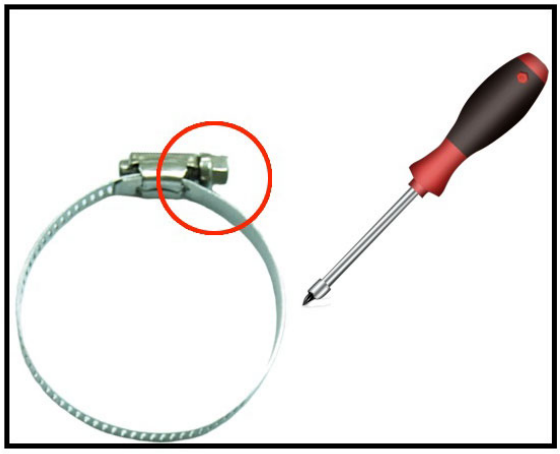
5. To adjust antennas, loose the connector joint counterclockwise first, then adjust antenna to the desired position. DO NOT bend or turn the antennas without loosening the connector joint, otherwise, damage might be caused to the antennas.



6. Antenna installation is complete.

2.2.4 Mount the AP on a Pole

1. Turn the Access Point over. Put the pole mounting ring through the middle hole of it. Note that you should unlock the pole mounting ring with a screw driver before putting it through the device as the following right picture shows.



2. Mount the Access Point steadily to the pole by locking the pole mounting ring tightly.

2.2.5 Power Up

1. Connect power cord to the PoE injector as the following right picture shows.

2. Connect the Ethernet cable that connects the Access Point to the “POE” port of the PoE injector as figured below.

3. Connect the power plug to a power socket. The Access Point will be powered up immediately.

2.2.6 Connect to the Access Point

To be able to configure and manage the Access Point, please do the followings:

1. Open the ferrite core by unsnapping the connector latches. The core will open, revealing a concave surface.

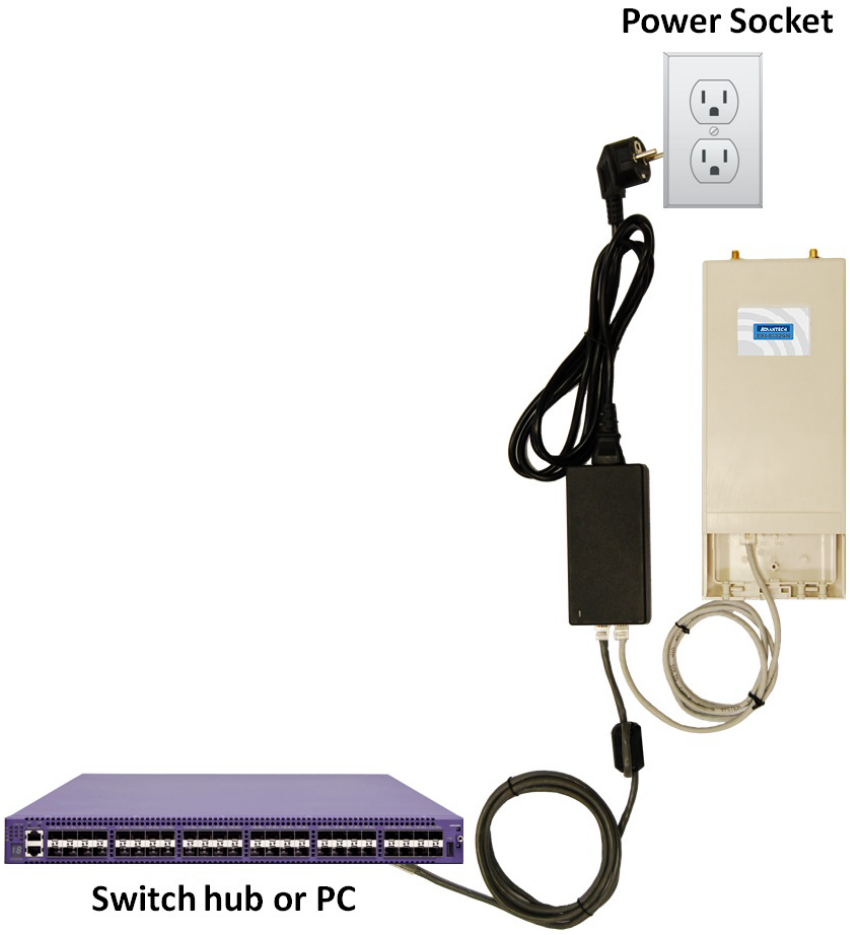
2. Lay the Ethernet cable into the core, usually within 2 to 3 inches of the connector. You may have to experiment with the final location depending on the effectiveness of the high frequency abatement.

3. Loop the cable around and through the core. This helps "lock" the core in place, and may be required in circumstances with severe interference.

4. Close the core and snap the halves back together.

5. Connect the Ethernet cable with suppression core to the “Data In” port of the PoE injector.

6. Connect the other end of Ethernet cable to a PC or a switch hub. The hardware installation is complete.



To configure the Access Point, please refer to Chapter 3 Basic Settings.

Chapter 3

Basic Settings

3.1 Factory Default Settings

We'll elaborate EKI-6332GN-AE/EKI-6331AN-BE factory default settings. You can re-acquire these parameters by default. If necessary, please refer to the "Restore Factory Default Settings".

Table 3.1: EKI-6332GN-AE/EKI-6331AN-BE Factory Default Settings

Features		Factory Default Settings
Username		admin
Password		password
Wireless Device Name		apXXXXXX (X represents the last 6 digits of Ethernet MAC address)
Operating Mode		AP
Data Rate		Auto
LAN	IP Address	192.168.1.1
	Subnet Mask	255.255.255.0
	Gateway	0.0.0.0
	Primary DNS Server	0.0.0.0
	Secondary DNS Server	0.0.0.0
Spanning Tree		Enable
Data Rate		Auto
Output Power		Full
WMM		Enabled
RTS Threshold (byte)		2346
Fragmentation Length (byte)		2346
Channel Protection		None
Short GI		Enable
Distance		1000m
Flow Control by AP		Disable
Security		Open System
Encryption		None
SNMP	Enable SNMP	Disable
	Server Port	161
	Get Community	Public
	Set Community	Private

3.2 System Requirements

Before configuration, please make sure your system meets the following requirements:

- A computer coupled with 10/ 100 Base-TX adapter;
- Configure the computer with a static IP address of 192.168.1.x, as the default IP address of EKI-6332GN-AE/EKI-6331AN-BE is 192.168.1.1. (X cannot be 0, 1, nor 255);
- A Web browser on PC for configuration such as Microsoft Internet Explorer 6.0 or above, Netscape, Firefox or Google Chrome.

3.3 How to Login the Web-based Interface

EKI-6332GN-AE/EKI-6331AN-BE provides you with user-friendly Web-based management tool.

- Open Web browser and enter the IP address (Default: 192.168.1.1) of EKI-6332GN-AE/EKI-6331AN-BE into the address field. You will see the login page as below.

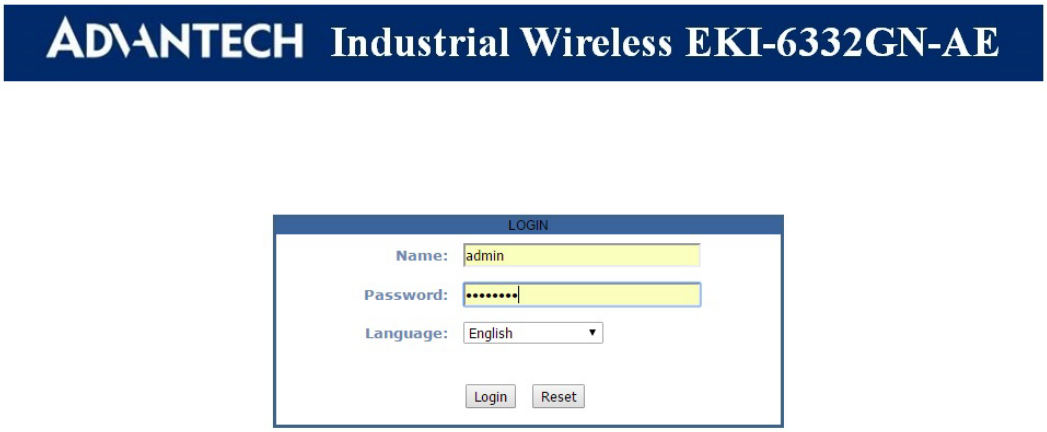


Figure 3.1 Login Page

- Enter the username (Default: admin) and password (Default: password) respectively and click “Login” to login the main page of EKI-6332GN-AE/EKI-6331AN-BE. As you can see, this management interface provides five main options in the black bar above, which are Status, System, Wireless, Management and Tools.

Figure 3.2 Main Page

Note! *The username and password are case-sensitive, and the password should be no more than 19 characters!*

3.4 Basic System Settings

For users who use EKI-6332GN-AE/EKI-6331AN-BE for the first time, it is recommended that you begin configuration from “Basic Settings” in “System” shown below:

Figure 3.3 Basic System Settings

- **Device Mode:** The device could be configured to Fat AP/Thin AP(Virtual)/Virtual AC/Virtual AC + Thin AP/Thin AP (CAPWAP) mode, but it is allowed to use Fat AP mode currently.
- **Device Name:** Specify the device name, which is composed of no more than 15 characters with (0-9), (A-Z), (a-z) or (-).
- **Country Region:** The availability of some specific channels and/or operational frequency bands is country dependent.

3.5 Network Settings

The Network Settings allows you to change network, IP address and configure few network parameters like spanning tree and management VLAN ID. Make configuration in “Network Settings” from “System”.

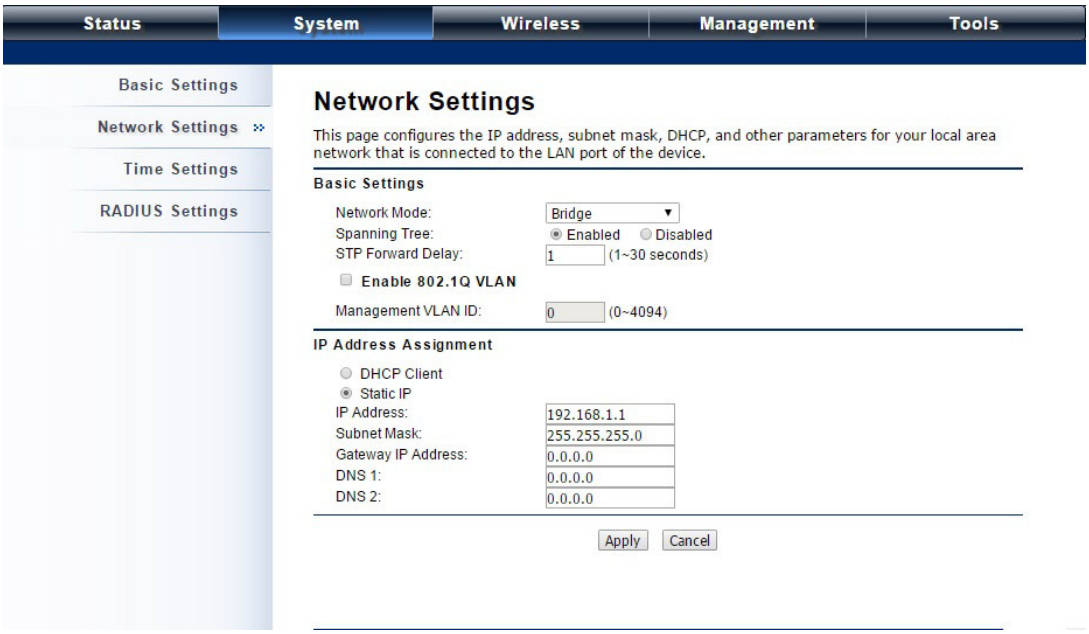


Figure 3.4 Network Settings

- **Network Mode:**
  Specify the network mode, including Bridge and Router. It is easy to configure parameters in Bridge Mode; however, users must pay extra attention to the way they configure the device when it is set to Router Mode. For details, please refer to TCP/IP Settings”.
- **Spanning Tree:**
  Spanning Tree Protocol (STP) is a link management protocol for AP which provides path redundancy while preventing loops in a network. STP allows only one active path at a time between the Access Points but establish the redundant link as a backup if the initial link fails.
- **STP Forward Delay:**
  STP Forward Delay is the time spent in detecting and learning network tree topology state before entering the forward state. Default time value is 1 sec.
- **802.1Q VLAN:**
  To allow users on the VLAN to access the WEB page of EKI-6332GN-AE/EKI-6331AN-BE, you need to enable “Enable 802.1Q VLAN” and assign a management VLAN ID for your device. Make sure the assigned management VLAN ID is identical to your network VLAN ID to avoid failures of accessing the Web page of EKI-6332GN-AE/EKI-6331AN-BE.
- **IP Address Assignment:**
  Users may change the settings for IP Address, Subnet Mask, and DHCP Server.
- **Obtain IP Address Automatically:**
  If a DHCP server exists in your network, you can check this option, thus EKI-6332GN-AE/EKI-6331AN-BE is able to obtain IP settings automatically from that DHCP server.

Note!

- *When the IP address of the Access Point is changed, the clients on the network often need to wait for a while or even reboot before they can access the new IP address. For an immediate access to the bridge, please flush the netbios cache on the client computer by running the "nbtstat –r" command before using the device name of the Access Point to access its Web Management page.*
- *In case EKI-6332GN-AE/EKI-6331AN-BE is unable to obtain an IP address from a valid DHCP server, it will fall back to default static IP address.*

- **Use Fixed IP Address:**
  Check this option. You have to specify a static IP address, subnet mask, default gateway and DNS server for the Access Point manually. Make sure the specified IP address is unique on your network in order to prevent IP conflict.
  If EKI-6332GN-AE/EKI-6331AN-BE configured as Router mode, you need to configure some additional TCP/IP parameters for accessing the Internet.

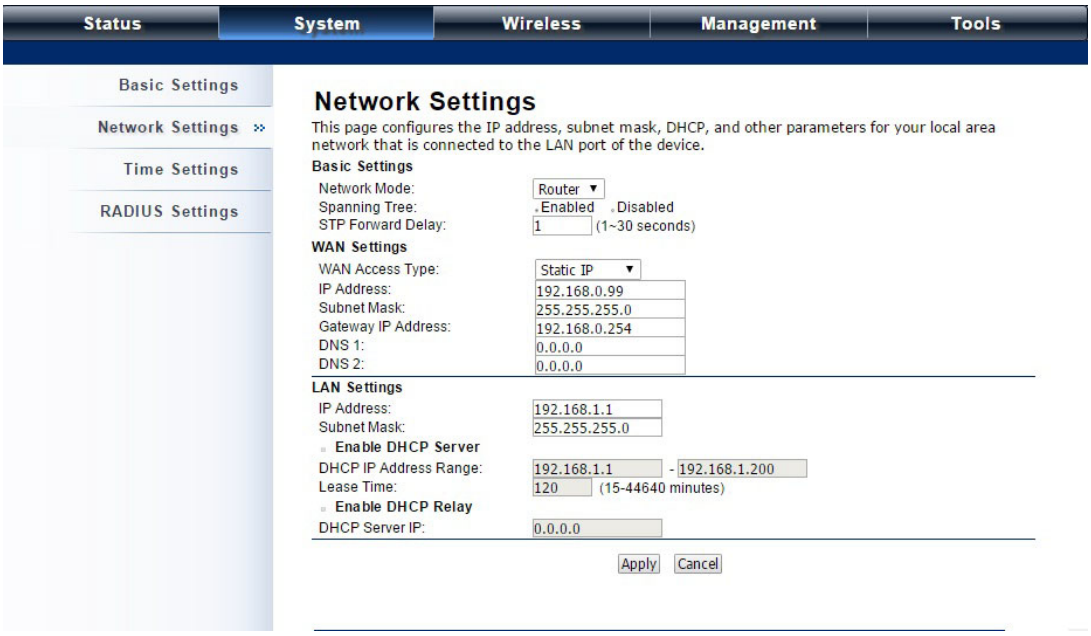


Figure 3.5 TCP/IP Settings (Router)

- **WAN Access Type:**
  Specify the Internet access method to Static IP, DHCP or PPPOE. Users must enter WAN IP Address, Subnet Mask, Gateway settings provided by your ISPs.
- **LAN Settings:**
  When DHCP Server is disabled, users can specify IP address and subnet mask for the Access Point manually. Make sure the specified IP address is unique on your network in order to prevent IP conflict. When DHCP Server is enabled, users may specify DHCP IP Address Range, DHCP Subnet Mask, DHCP Gateway and Lease Time (15-44640 minutes). A DHCP relay agents is used to forward DHCP requests and replies between clients and servers when they are not on the same physical subnet. To enable the DHCP relay agent, check the "Enable DHCP Relay" checkbox and enter the IP address of the DHCP server.

Warning!

- *In AP mode, EKI-6332GN-AE/EKI-6331AN-BE must establish connection with another wireless device before it is set to Router mode. To access the unit in Router mode via wired port, please type the WAN IP address to enter the web page for WAN is on wired port and LAN is on wireless port. Or, you can access device through the wireless device connected with the Access Point.*
- *In wireless client mode, users can access the Access Point via its wired port, for WAN is on wireless port and LAN is on wired port when device is set to Router mode.*
- *Bridge mode and AP Repeater mode are similar to AP mode when device is set to Router mode; WAN is on wired port and LAN is on wireless port. Thus users must also connect the Access Point with another wireless device before it is set to Router mode and access the Access Point via the connected wireless device.*

3.6 Time Settings

Compliant with NTP, EKI-6332GN-AE/EKI-6331AN-BE is capable of keeping its time in complete accord with the Internet time. Make configuration in “Time Settings” from “System”. To use this feature, check “Enable NTP Client Update” in advance.

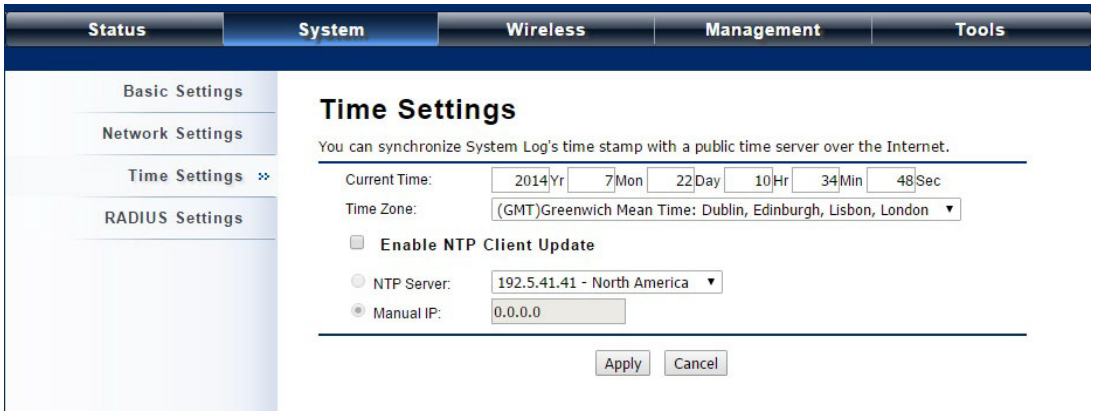


Figure 3.6 Time Settings

- **Current Time:**
  Display the present time in Yr, Mon, Day, Hr, Min and Sec.
- **Time Zone Select:**
  Select the time zone from the dropdown list.
- **NTP Server:**
  Select the time server from the “NTP Server” dropdown list.
- **Manual IP:**
  Manually input the IP address of available time server. Hit “Apply” to save settings.

3.7 RADIUS Settings

RADIUS (Remote Authentication Dial-In User Service) is a server for remote user authentication and accounting; playing a central role in the network in providing the capabilities of authenticating, authorizing, accounting, auditing, alarming and etc. It allows an organization to maintain user profiles in a central database that all remote servers can share.

Open “RADIUS Settings” in “System” to make RADIUS configuration.

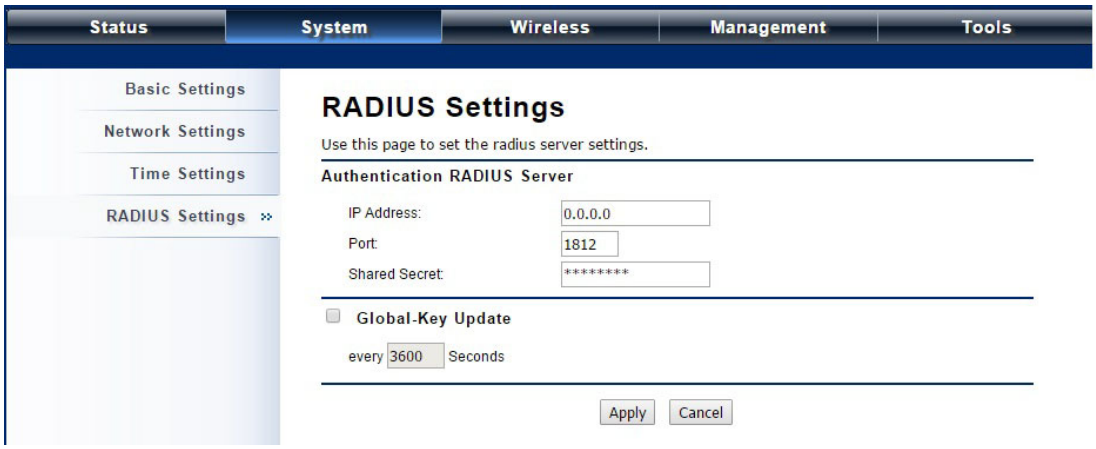


Figure 3.7 RADIUS Settings

- **Authentication RADIUS Server**
  This is for RADIUS authentication. It can communicate with RADIUS through IP Address, Port and Shared Secret.
  - **IP Address:** Enter the IP address of the Radius Server;
  - **Port:** Enter the port number of the Radius Server;
  - **Shared Secret:** This secret, which is composed of no more than 31 characters, is shared by EKI-6332GN-AE/EKI-6331AN-BE and RADIUS during authentication.
- **Global-Key Update:**
  Check this option and specify the time interval between two global-key updates.

3.8 Firewall Settings

The firewall is a system or group of systems that enforce an access control policy between two networks. It may also be defined as a mechanism used to protect a trusted network from an un-trusted network. IEEE 802.11b/g/n Wireless CPE has capabilities of Source IP Filtering, Destination IP Filtering, Source Port Filtering, Destination Port Filtering, Port Forwarding as well as DMZ. This is available only under Router Mode.

Source IP Filtering: The source IP filtering gives users the ability to restrict certain types of data packets from your local network to Internet through IEEE 802.11b/g/n Wireless CPE. Use of such filters can be helpful in securing or restricting your local network.

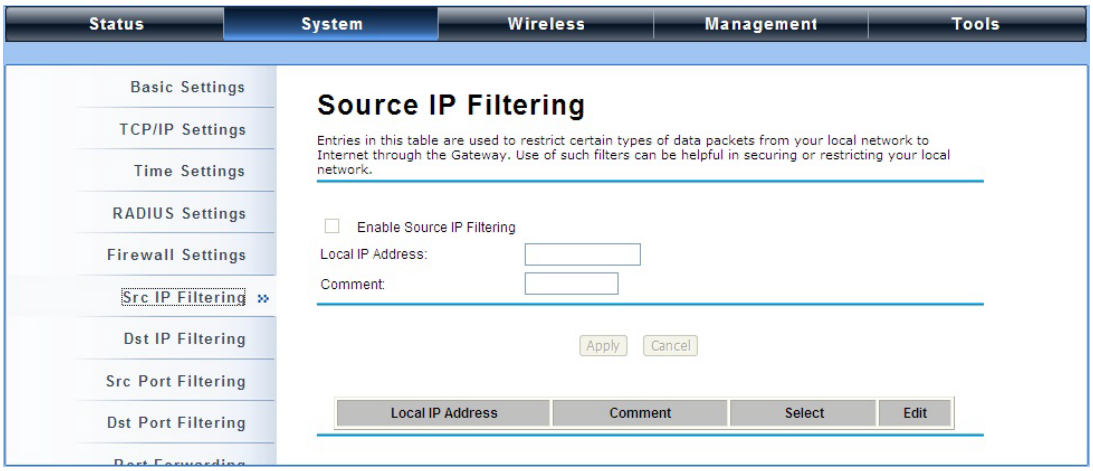


Figure 3.8 Source IP Filtering

3.9 Port Forwarding

The port forwarding allows you to automatically redirect common network services to a specific machine behind the NAT firewall. These settings ne are only necessary if you wish to host some sort of server like a web server or mail server on the private local network behind IEEE 802.11b/g/n Wireless CPE's NAT firewall.

Figure 3.9 Port Forwarding

3.10 DMZ

A Demilitarized Zone is used to provide Internet services without sacrificing unauthorized access to its local private network. Typically, the DMZ host contains devices accessible to the Internet traffic, such as Web (HTTP) servers, FTP servers, SMTP (e-mail) servers and DNS servers.

Figure 3.10 DMZ

3.11 Basic Wireless Settings

Open “Basic Settings” in “Wireless” as below to make basic wireless configuration.

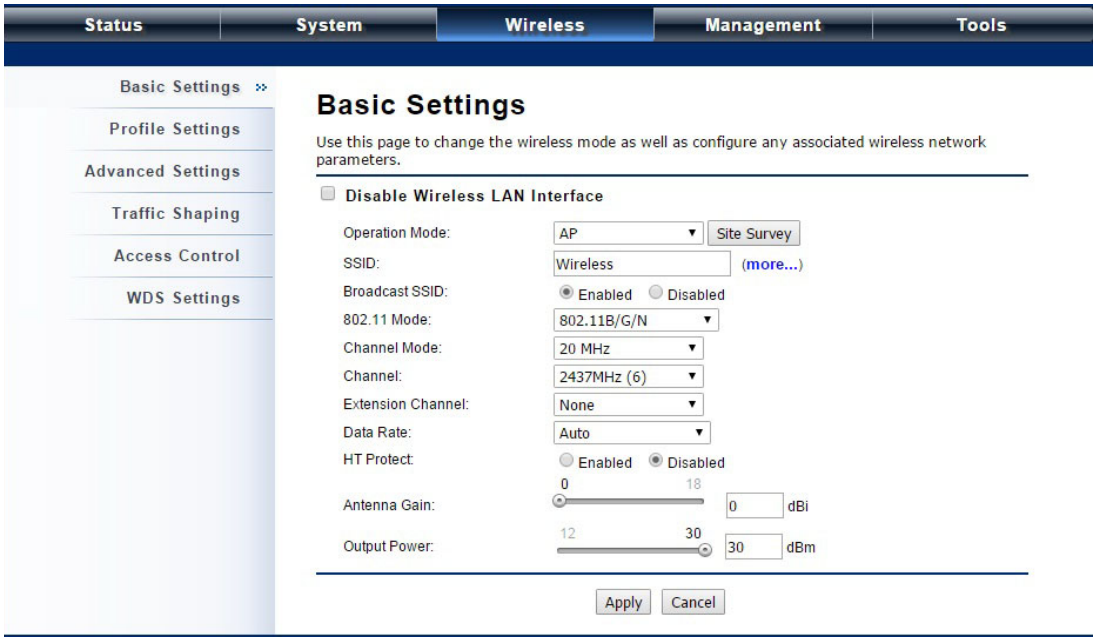


Figure 3.11 Basic Wireless Settings

- **Disable Wireless LAN Interface:**
  Check this option to disable WLAN interface, then the wireless module of EKI-6332GN-AE/EKI-6331AN-BE will stop working and no wireless device can connect to it.
- **Operation Mode:**
  Four operating modes are available in EKI-6332GN-AE/EKI-6331AN-BE.
  - AP: EKI-6332GN-AE/EKI-6331AN-BE establishes a wireless coverage and receives connectivity from other wireless devices.
  - Wireless Client: EKI-6332GN-AE/EKI-6331AN-BE is able to connect to the AP and thus join the wireless network around it.

- Bridge: EKI-6332GN-AE/EKI-6331AN-BE establishes wireless connectivity with other APs by keying in remote MAC address. Please refer to the “WDS Setting” for detailed configuration.
- AP Repeater: EKI-6332GN-AE/EKI-6331AN-BE servers as AP and Bridge concurrently. In other words, EKI-6332GN-AE/EKI-6331AN-BE can provide connectivity services for ACCESS POINTs under Bridge mode.

- **Wireless Network Name (SSID):**
  This wireless network name is shared among all associated devices in your wireless network. Keep it identical on all those devices. Note that the SSID is case-sensitive and cannot exceed 32 characters.
- **Broadcast SSID:**
  Under AP mode, hiding network name is necessary when you are in a wireless environment that may have potential risk. By disabling broadcast SSID, the STA can not scan and find EKI-6332GN-AE/EKI-6331AN-BE, so that malicious attack by some illegal STA could be avoided.
- **802.11 Mode:**
  EKI-6332GN-AE can communicate with wireless devices of 802.11b/g or 802.11b/g/n. For EKI-6331AN-BE, which is 802.11a/n
- **Channel Mode:**
  20MHz and 40MHz are selectable. The last one can enhance data throughput, but it takes more bandwidth, thus it might cause potential interference
- **Channel:**
  Channel varies much as the available band differs from country to country. Select a proper operating channel in the drop-down list according to your situation.
- **Extension Channel:**
  Only applicable to AP, AP Repeater, and 40MHz channel width) indicates the use of channel bonding that allows EKI-6332GN-AE/EKI-6331AN-BE to use two channels at once. Two options are available: Upper Channel and Lower Channel.
- **Data Rate:**
  Usually “Auto” is preferred. Under this rate, EKI-6332GN-AE/EKI-6331AN-BE will automatically select the highest available rate to transmit. In some cases, however, like where there is no great demand for speed, you can have a relatively-low transmit rate for compromise of a long distance.
- **HT Protect:**
  Enable HT (High Throughput) protect to ensure HT transmission with MAC mechanism. Under 802.11n mode, wireless client can be divided into HT STA and Non-HT STA, among which the one with HT protect enabled gets higher throughput.
- **Antenna Gain:**
  Allows you specify the gain of the external antenna. The antenna gain calculates the TX power back off needed to remain in compliance with regulations. Tuning the value will not affect actual antenna gain value.
- **Output Power (per chain):**
  Specify the signal transmission power. The higher the output power is, the wider the signal can cover, but the power consumption will be greater accordingly.
- **Enable MAC Clone:**
  Available only under wireless client mode, it hides the MAC address of the AP while displays the one of the device connected to the Access Point. Default is Auto MAC Clone. User may choose to enter the MAC address to be cloned manually.

3.12 Site Survey

Under wireless client mode, EKI-6332GN-AE/EKI-6331AN-BE is able to perform site survey, through which, information on the available Access Points will be detected.

Open “Basic Settings” in “Wireless”, by clicking the “Site Survey” button beside “Wireless Mode” option, the wireless site survey window will pop up with a list of available AP in the vicinity. Select the AP you would like to connect and click “Selected” to establish connection.

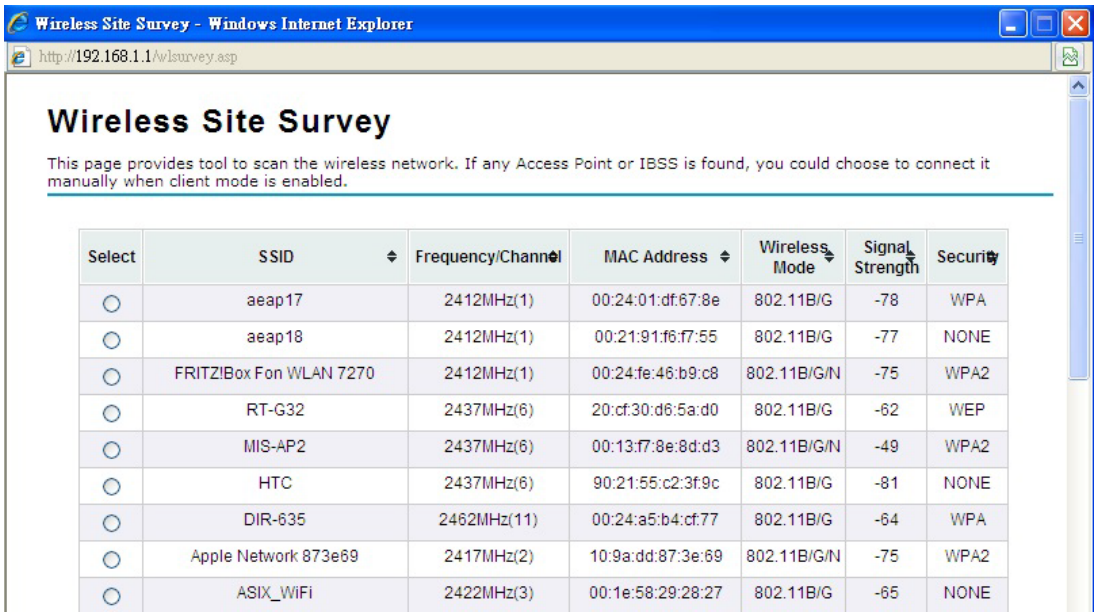


Figure 3.12 Site Survey

3.13 VAP Profile Settings

Available in AP mode, EKI-6332GN-AE/EKI-6331AN-BE allows up to 8 virtual SSIDs on a single BSSID and to configure different profile settings such as security and VLAN ID to each SSID. To create a virtual AP, you may check the Enabled box of the profile and click on the profile (eg. Profile 2) to configure wireless and security settings. Hit Apply to active the profile.

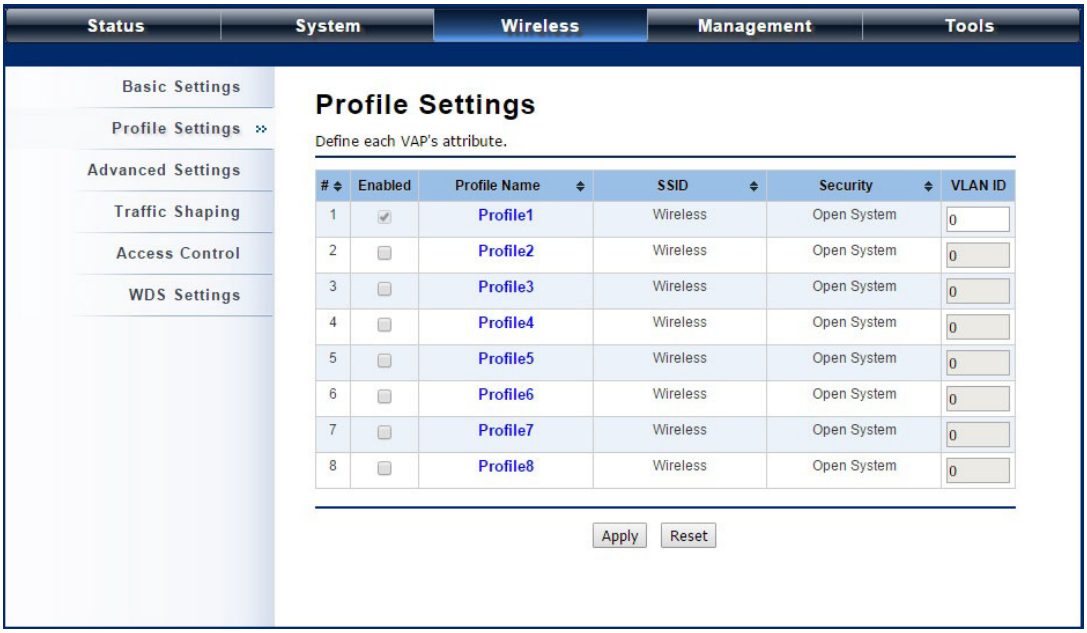


Figure 3.13 VAP Profile Settings

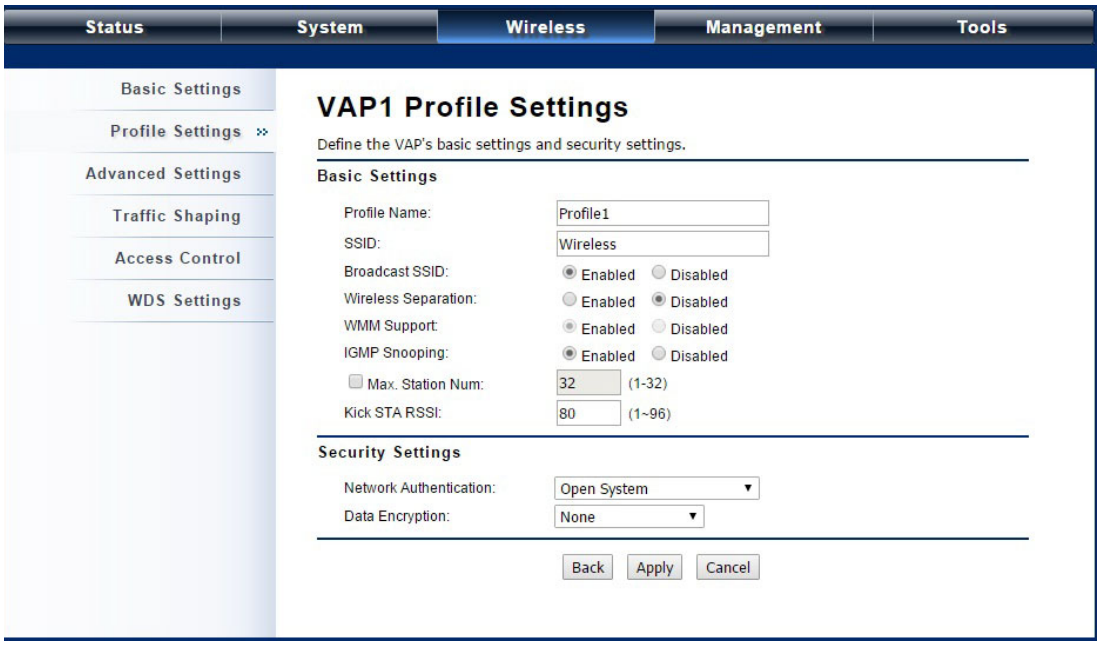


Figure 3.14 VAP Profile Settings

- **Profile Name:**
  Name of the VAP profile
- **SSID:**
  Assign a network name for the VAP
- **Broadcast SSID:**
  In AP mode, hiding network name is necessary when you are in a wireless envi-

ronment that may have potential risk. By disabling broadcast SSID, the STA cannot scan and find EKI-6332GN-AE/EKI-6331AN-BE, so that malicious attack by some illegal STA could be avoided.

- **Wireless Separation:**
  Wireless separation is an ideal way to enhance the security of network transmission. Under the mode except wireless client mode, enable “Wireless Separation” can prevent the communication among associated wireless clients.
- **WMM Support:**
  WMM (Wi-Fi Multimedia) is a subset of 802.11e. It allows wireless communication to define a priority limit on the basis of data type under AP mode only, thus those time-sensitive data, like video/audio data, may own a higher priority than common one. To enable WMM, the wireless client should also support it
- **Max. Station Number:**
  By checking the “Max. Station Num” the Access Point will only allow up to 32 wireless clients to associate with for better bandwidth for each client. By disabling the checkbox the Access Point will allow up to 128 clients to connect, but it is likely to cause network congestion or poor performance.
- **IGMP Snooping:**
  Available in AP/Router mode, IGMP snooping is the process of listening to IGMP network traffic. By enabling IGMP snooping, the AP will listen to IGMP membership reports, queries and leave messages to identify the ports that are members of multicast groups. Multicast traffic will only be forwarded to ports identified as members of the specific multicast group or groups.
- **Security Setting:**|
  To prevent unauthorized radios from accessing data transmitting over the connectivity, EKI-6332GN-AE/EKI-6331AN-BE provides you with rock solid security settings. For detailed information please go to Chapter 4 Wireless Security Setting.

Chapter 4

Advanced Settings

4.1 Advanced Wireless Settings

Open “Advanced Settings” in “Wireless” to make advanced wireless settings.

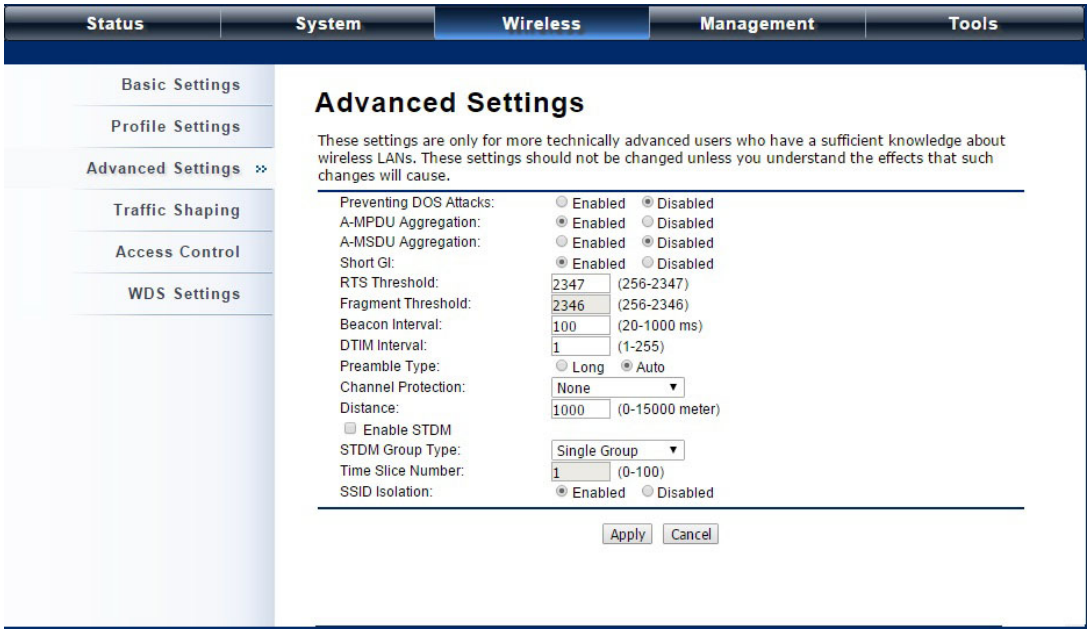


Figure 4.1 Advanced Wireless Settings

- **MPDU/A-MSDU Aggregation:**
  The data rate of your AP except wireless client mode could be enhanced greatly with this option enabled; however, if your wireless clients don’t support A-MPDU/A-MSDU aggregation, it is not recommended to enable it.
- **Short GI:**
  Under 802.11n mode, enable it to obtain better data rate if there is no negative compatibility issue.
- **RTS Threshold:**
  EKI-6332GN-AE/EKI-6331AN-BE sends RTS (Request to Send) frames to certain receiving station and negotiates the sending of a data frame. After receiving an RTS, that STA responds with a CTS (Clear to Send) frame to acknowledge the right to start transmission. The setting range is 0 to 2346 in byte. Setting it too low may result in poor network performance. Leave it at its default of 2346 is recommended.
- **Fragmentation Length:**
  Specify the maximum size in byte for a packet before data is fragmented into multiple packets. Setting it too low may result in poor network performance. Leave it at its default of 2346 is recommended.
- **Beacon Interval:**
  Specify the frequency interval to broadcast packets. Enter a value between 20 and 1024.
- **DTIM Interval:**
  DTIM, which stands for Delivery Traffic Indication Message, is contained in the data packets. It is for enhancing the wireless transmission efficiency. The default is set to 1. Enter a value between 1 and 255.
- **Preamble Type:**
  It defines some details on the 802.11 physical layer. “Long” and “Auto” are available.
- **Distance**
  To decrease the chances of data retransmission at long distance, EKI-6332GN-

AE/EKI-6331AN-BE can automatically adjust proper ACK timeout value by specifying distance of the two nodes.

- **SSID isolation**
  To isolate the communication among STA which link to the AP with different SSID.
- **Enable STDM**
  To enable time division for multiple clients, this could reduce networking jam by multiple clients transmitting simultaneously.
- **STDM Group Type**
  To choose time division allocate type by average, homogeneous, or inhomogeneous depends on distance recipe.
- **Time Slice Number**
  To define the time frame size(ms) for each client, this function only works when AP and Client are at the same protocol.

4.2 Traffic Shaping

It allows the administrator to manage the traffic flow to ensure optimal performance.

Figure 4.2 Traffic Shaping

- **Enable Traffic Shaping:**
  Check this box to control the overall bandwidth for a specific VAP network.
- **Interface Selection:**
  Select the VAP network you would like to enable traffic shaping.
- **Outgoing Traffic Rate:**
  To specify maximum outgoing bandwidth to a certain rate in kbit/s.
- **Outgoing Traffic Burst:**
  To specify the buffer size for outgoing traffic that can be sent within a given unit of time. The suggested value is 20KBytes. You may just leave the default value there, and then the connection will be bound to the traffic shaping rule at all times. You may decrease it to smaller value if the incoming traffic limit is smaller.

4.3 Wireless Security Settings

To prevent unauthorized radios from accessing data transmitting over the connectivity, EKI-6332GN-AE/EKI-6331AN-BE provides you with rock solid security settings.

Open “Profile Setting” in “Wireless” and enter “VAP Profile 1 Settings” as below.

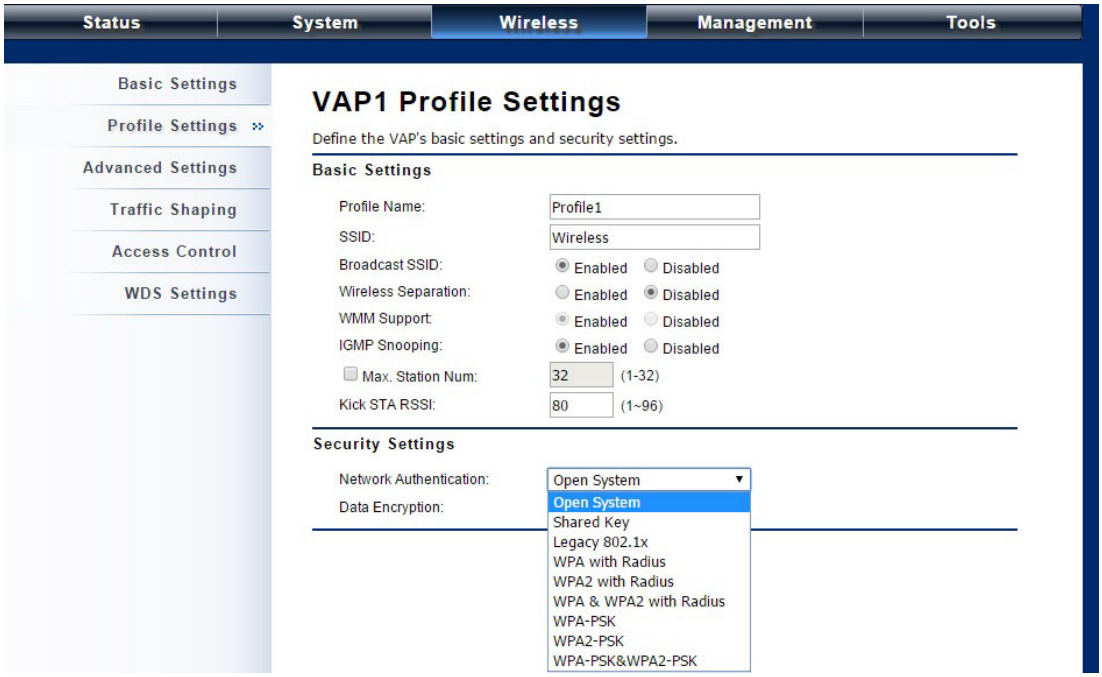


Figure 4.3 Security Settings

- **Network Authentication**
  - **Open System:** It allows any device to join the network without performing any security check.
  - **Shared Key:** Data encryption and key are required for wireless authentication (Not available in Bridge/AP Repeater mode).
  - **Legacy 802.1x:** Available in AP/Wireless Client mode, it provides the rights to access the wireless network and wired Ethernet. With User and PC identity, centralized authentication as well as dynamic key management, it controls the security risk of wireless network to the lowest. To serve the 802.1x, at least one EAP type should be supported by the RADIUS Server, AP and wireless client.

Note! *For first time users, if EAP type “TLS” is selected, you need to import valid user certificate given by CA in prior. To import user certificates, please refer to Chapter 5 Management/Certificate Settings for more details.*

  - **WPA with RADIUS:** Available in AP/Wireless Client mode, with warrant (username, password and etc.) offered by user, this kind of authentication can be realized with specific RADIUS server. This is the common way to be adopted in large enterprise network.
  - **WPA2 with RADIUS:** Available in AP/Wireless Client mode, as a new version of WPA, only all the clients support WPA2, can it be available. If it is selected, AES encryption and RADIUS server is required. It is only available in AP/Wireless Client mode.

- **WPA&WPA2 with RADIUS:** Available in AP mode, it provides options of WPA (TKIP) or WPA2 (AES) for the client. If it is selected, the data encryption type must be TKIP + AES and the RADIUS server must be set.
- **WPA-PSK:** It is a simplified WPA mode with no need for specific authentication server. In this so-called WPA Pre-Shared Key, all you have to do is just pre-enter a key in each WLAN node and this is the common way to be adopted in large and middle enterprise as well as residential network.
- **WPA2-PSK:** As a new version of WPA, only all the clients support WPA2, can it be available. If it is selected, the data encryption can only be AES and the passphrase is required.
- **WPA-PSK&WPA2-PSK:** Available in AP mode, it provides options of WPA (TKIP) or WPA2 (AES) encryption for the client. If it is selected, the data encryption can only be TKIP + AES and the passphrase is required.

■ **Data Encryption**

If data encryption is enabled, the key is required and only sharing the same key with other wireless devices can the communication be established.

- **None:** Available only when the authentication type is open system.
- **64 bits WEP:** It is made up of 10 hexadecimal numbers.
- **128 bits WEP:** It is made up of 26 hexadecimal numbers.
- **152 bits WEP:** It is made up of 32 hexadecimal numbers.
- **TKIP:** Temporal Key Integrity Protocol, which is a kind of dynamic encryption, is co-used with WPA-PSK, etc.
- **AES:** Advanced Encryption Standard, it is usually co-used with WPA2-PSK, WPA, WPA2, etc.
- **TKIP + AES:** It allows for backwards compatibility with devices using TKIP.

Note! *We strongly recommend you enable wireless security on your network!*

Only setting the same Authentication, Data Encryption and Key in EKI-6332GN-AE/EKI-6331AN-BE and other associated wireless devices, can the communication be established!

4.4 Access Control

The Access Control appoints the authority to wireless client on accessing EKI-6332GN-AE/EKI-6331AN-BE, thus a further security mechanism is provided. This function is available only under AP mode.

Open “Access Control” in “Wireless” as below.

Figure 4.4 Access Control

- **Profile Selection**
  Select the VAP profile you would like to enable Access Control
- **Access Control Mode**
  If you select “Allow Listed”, only those clients whose wireless MAC addresses are in the access control list will be able to connect to your AP. While when “Deny Listed” is selected, those wireless clients on the list will not be able to connect the AP.
- **MAC Address**
  Enter the MAC address of the wireless client that you would like to list into the access control list, click “Apply” then it will be added into the table at the bottom.
- **Delete/Clear**
  Check the box before one or more MAC addresses of wireless client(s) that you would like to cancel, and click “Delete” or “Clear” to cancel that access control rule.

4.5 WDS Settings

Bridge mode extends the range of your network without having to use cables to link the Access Points by using the Wireless Distribution System (WDS): Simply put, you can link the Access Points wirelessly. To enable Bridge mode, please go to Wireless > Basic Settings and choose “Bridge” in Operation Mode. Then go to “WDS Settings” in “Wireless” as below:

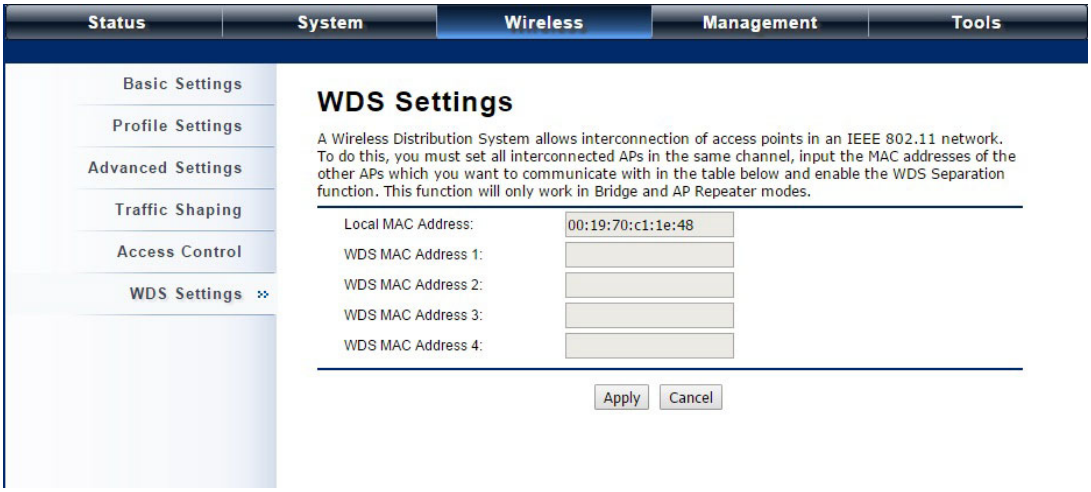


Figure 4.5 WDS Settings

Enter the MAC address of another AP you wirelessly want to connect to into the appropriate field and click “Apply” to save settings.

Note!

- *WDS Settings is available only under Bridge and AP Repeater Mode.*
- *Bridge uses the WDS protocol that is not defined as the standard thus compatibility issues between equipment from different vendors may arise. Moreover, Tree or Star shape network topology should be used in all WDS use-cases (i.e. if AP2 and AP3 are specified as the WDS peers of AP1, AP2 should not be specified as the WDS peer of AP3 and AP3 should not be specified as the WDS peer of AP2 in any case). Mesh and Ring network topologies are not supported by WDS and should be avoided in all the use cases.*

Chapter 5

Management

5.1 Password

From “Password Settings” in “Management”, you can change the password to manage your IEEE 802.11n VAC Access Point.

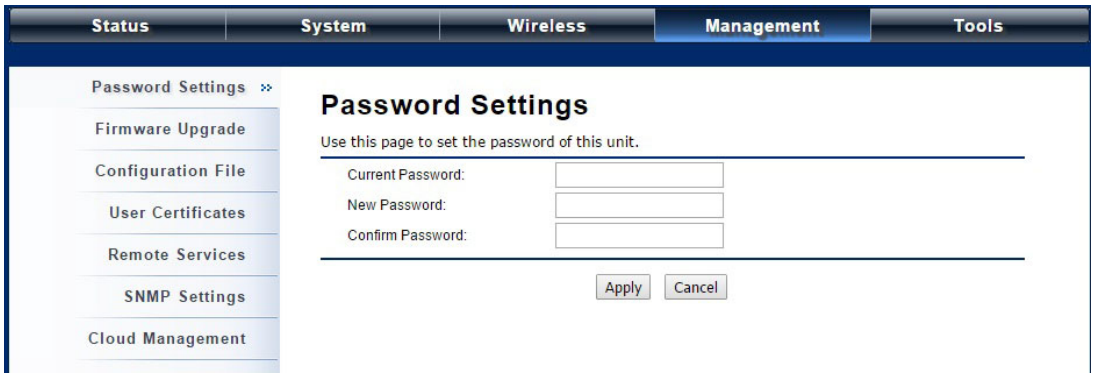


Figure 5.1 Password Settings

- **Current Password:**
  Enter the current password.
- **New Password:**
  Enter the new password.
- **Confirm Password:**
  Enter the new password again for confirmation.

Note! *The password is case-sensitive and its length cannot exceed 19 characters!*

5.2 Upgrade Firmware

Open “Firmware Upload” in “Management” and follow the steps below to upgrade firmware locally or remotely through IEEE 802.11n VAC Access Point’s Web:

Figure 5.2 Firmware Upgrade

- Click “Browse” to select the firmware file you would like to load;
- Click “Upload” to start the upload process;
- Wait a few minutes, the VAC Access Point will reboot after successful upgrade.

Note! *Do NOT cut the power off during upgrade, otherwise the system may crash!*

5.3 Backup/ Retrieve Settings

It is strongly recommended you back up configuration information in case of something unexpected. If tragedy hits your device, you may have an access to restore the important files by the backup. All these can be done by the local or remote computer.

Open “Configuration File” in “Management” as below:

Figure 5.3 Backup/Retrieve Settings

- **Save Setting to File:**
  By clicking “Save”, a dialog box will pop up. Save it, then the configuration file ap.cfg will be generated and saved to your local computer.
- **Load Settings from File:**
  By clicking “Browse”, a file selection menu will appear, select the file you want to load, like ap.cfg; Click “Upload” to load the file. After automatically rebooting, new settings are applied.

5.4 Restore Factory Default Settings

The IEEE 802.11n VAC Access Point provides two ways to restore the factory default settings:

- **Restore factory default settings via Web**
  From “Configuration File”, clicking “Reset” will eliminate all current settings and reboot your device, then default settings are applied.

Figure 5.4 Restore to Default Settings

- **Restore factory default settings via Reset Button**
  If software in IEEE 802.11n VAC Access Point is unexpectedly crashed and no longer reset the unit via Web, you may do hardware reset via the reset button. Press and hold the button for at least 5 seconds and then release it until the PWR LED gives a blink.

5.5 Reboot

You can reboot your IEEE 802.11n VAC Access Point from “Configuration File” in “Management” as below:

Click “Reboot” and hit “Yes” upon the appeared prompt to start reboot process. This takes a few minutes.

Figure 5.5 Reboot

5.6 User Certificate

Under Wireless Client mode, when EAP-TLS is used, the RADIUS server must know which user certificates to trust. The Server can trust all certificates issued by a given CA.

To import a user certificate, from Import User Certificates, click “Browse” and specify the location where the user certificate is placed. Click “Import”.

Figure 5.6 User Certificate

- **Delete User Certificate:**
- Delete the selected user certificate.
- **Import User Certificates:**
  Imported the user certificate

5.7 Remote Management

The IEEE 802.11n VAC Access Point provides a variety of remotes managements including Telnet, SNMP, FTP, SSH, HTTPS and exclusive WISE tool, making configuration more convenient and secure.

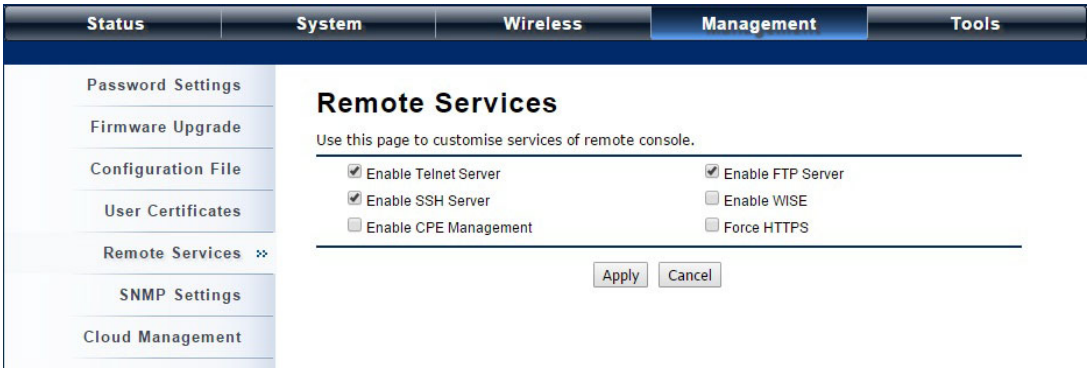


Figure 5.7 Remote Management

5.8 SNMP Management

The IEEE 802.11n VAC Access Point supports SNMP for convenient remote management. Open “SNMP Settings” in “Management” shown below. Set the SNMP parameters and obtain MIB file before remote management.

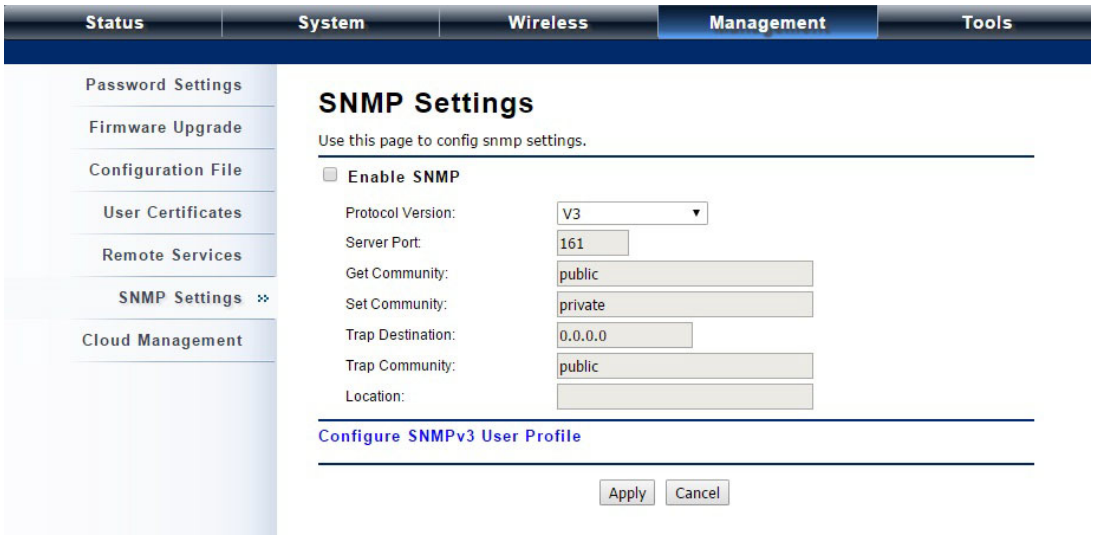


Figure 5.8 SNMP Management

- Protocol Version:
  Select the SNMP version, and keep it identical on the IEEE 802.11n VAC Access Point and the SNMP manager. The IEEE 802.11n VAC Access Point supports SNMP v2/v3.
- Server Port:
  Change the server port for a service if needed; however you have to use the same port to use that service for remote management.
- Get Community:
  Specify the password for the incoming Get and GetNext requests from the management station. By default, it is set to public and allows all requests.
- Set Community:
  Specify the password for the incoming Set requests from the management station. By default, it is set to private.
- Trap Destination:
  Specify the IP address of the station to send the SNMP traps to.
- Trap Community:
  Specify the password sent with each trap to the manager. By default, it is set to public and allows all requests.
- Configure SNMPv3 User Profile
  For SNMP protocol version 3, you can click “Configure SNMPv3 User Profile” in blue to set the details of SNMPv3 user. Check “Enable SNMPv3 Admin/User” in advance and make further configuration.
  - **User Name:** Specify a user name for the SNMPv3 administrator or user. Only the SNMP commands carrying this user name are allowed to access the IEEE 802.11n VAC Access Point.
  - **Password:** Specify a password for the SNMPv3 administrator or user. Only the SNMP commands carrying this password are allowed to access the IEEE 802.11n Wireless VAC Access Point.
  - **Confirm Password:** Input that password again to make sure it is your desired one.

- **Access Type:** Select “Read Only” or “Read and Write” accordingly.
- **Authentication Protocol:** Select an authentication algorithm. SHA authentication is stronger than MD5 but is slower.
- **Privacy Protocol:** Specify the encryption method for SNMP communication. None and DES are available. None means no encryption is applied. DES is a Data Encryption Standard that applies a 58-bit key to each 64-bit block of data.

Chapter 6

Monitoring Tools

6.1 System Log

System log is used for recording events occurred on the IEEE 802.11n VAC Access Point, including station connection, disconnection, system reboot and etc.

Open “System Log” in “Tools” as below.

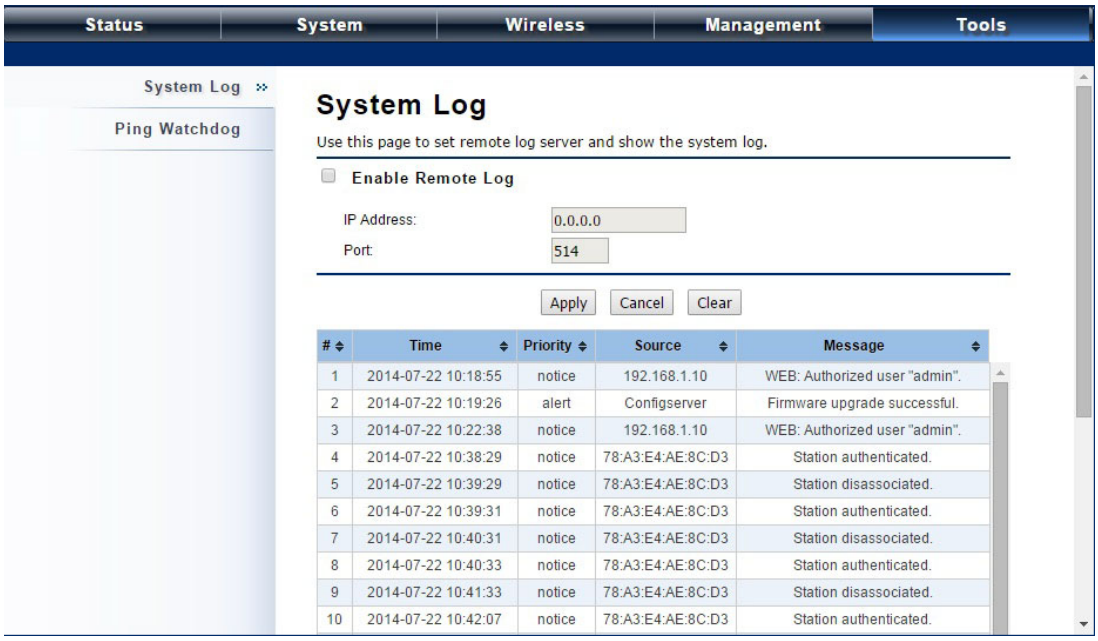


Figure 6.1 Syslog

- **Remote Syslog Server:**
  Enable System log to alert remote server.
  - **IP Address:** Specify the IP address of the remote server.
  - **Port:** Specify the port number of the remote server.

6.2 Ping Watch Dog

If you mess your connection up and cut off your ability the log in to the unit, the ping watchdog has a chance to reboot due to loss of connectivity.

Figure 6.2 Ping Watchdog

- **Enable Ping Watchdog:**
  To activate ping watchdog, check this checkbox.
- **IP Address to Ping:**
  Specify the IP address of the remote unit to ping.

- **Ping Interval:**
  Specify the interval time to ping the remote unit.
- **Startup Delay:**
  Specify the startup delay time to prevent reboot before the IEEE 802.11n VAC Access Point is fully initialized.
- **Failure Count To Reboot:**
  If the ping timeout packets reached the value, the IEEE 802.11n VAC Access Point will reboot automatically.

Chapter 7

Status

7.1 View Basic Information

Open "Information" in "Status" to check the basic information of the Access Point, which is read only. Information includes system information, LAN settings, wireless setting and interface status. Click "Refresh" at the bottom to have the real-time information.

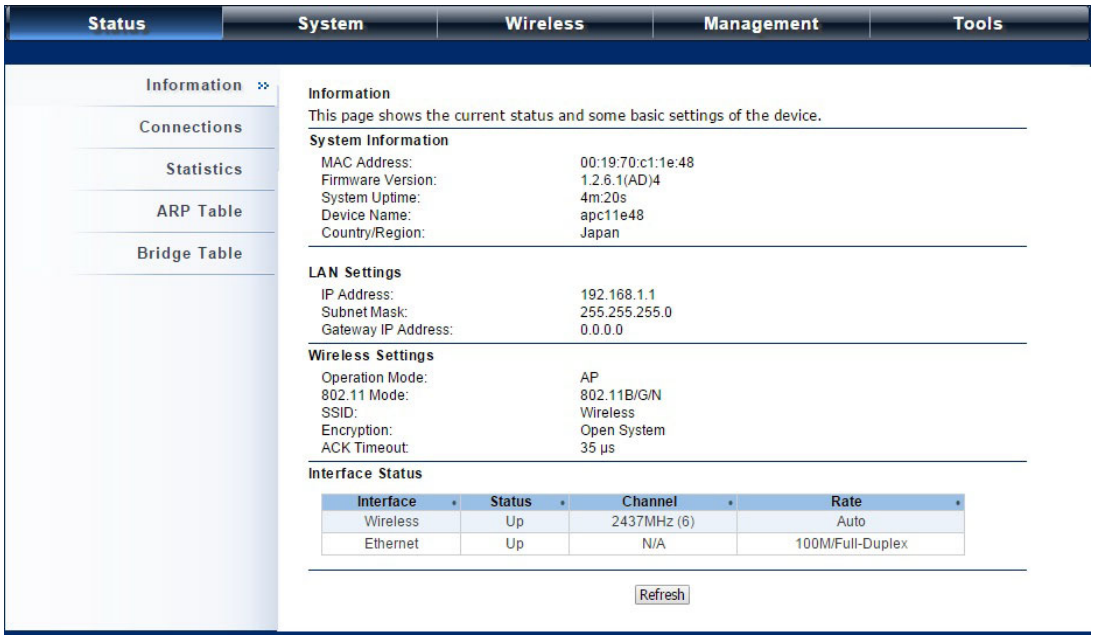


Figure 7.1 Basic Information

7.2 View Association List

Open "Connections" in "Status" to check the information of associated wireless devices such as MAC address, signal strength, connection time, IP address, etc. All is read only. Click "Refresh" at the bottom to update the current association list.

Figure 7.2 Connection

By clicking on the MAC address of the selected device on the web you may see more details including device name, connection time, signal strength, noise floor, ACK timeout, link quality, IP information, current data rate, current TX/RX packets.

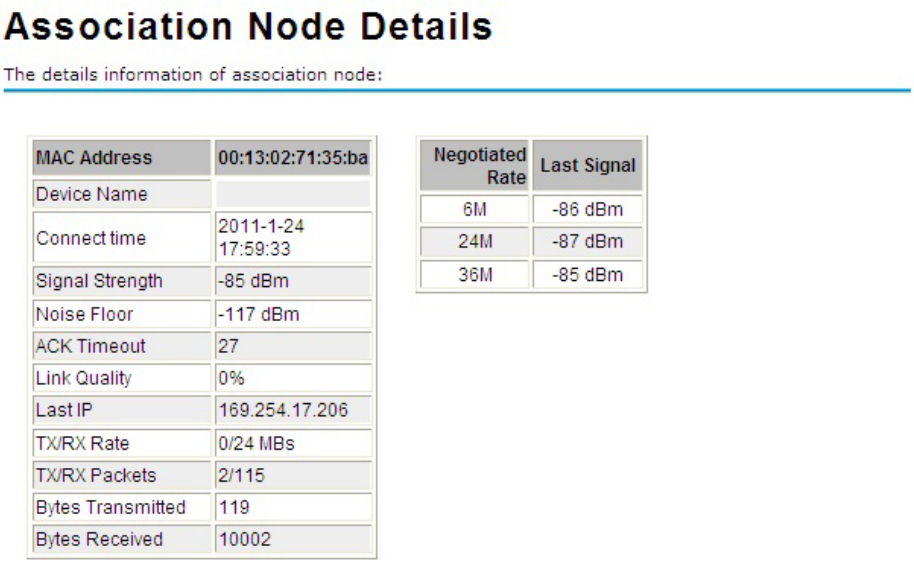


Figure 7.3 Association Node Details

7.3 View Network Flow Statistics

Open "Statistics" in "Status" to check the data packets received on and transmitted from the wireless and Ethernet ports. Click "Refresh" to view current statistics.

Figure 7.4 Network Flow Statistics

- **Poll Interval**
  Specify the refresh time interval in the box beside "Poll Interval" and click "Set Interval" to save settings. "Stop" helps to stop the auto refresh of network flow statistics.

7.4 View ARP Table

Open "ARP Table" in "Status" as below. Click "Refresh" to view current table.

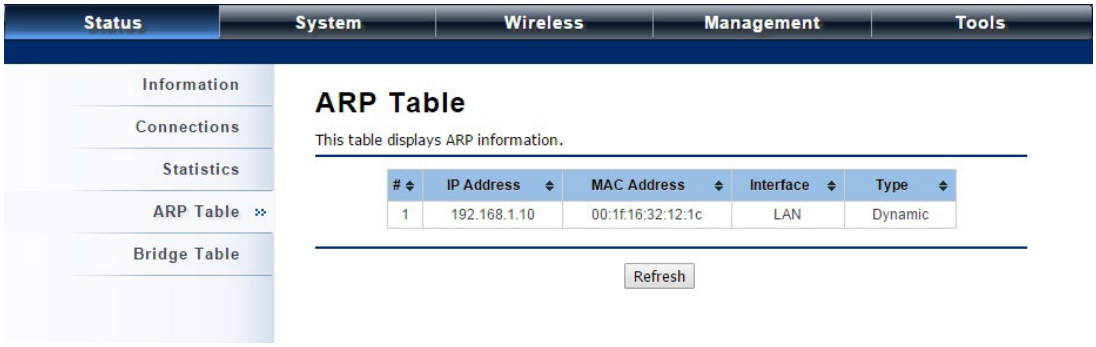


Figure 7.5 ARP Table

7.5 View Bridge Table

Open "Bridge Table" in "Status" as below. Click "Refresh" to view current connected status..

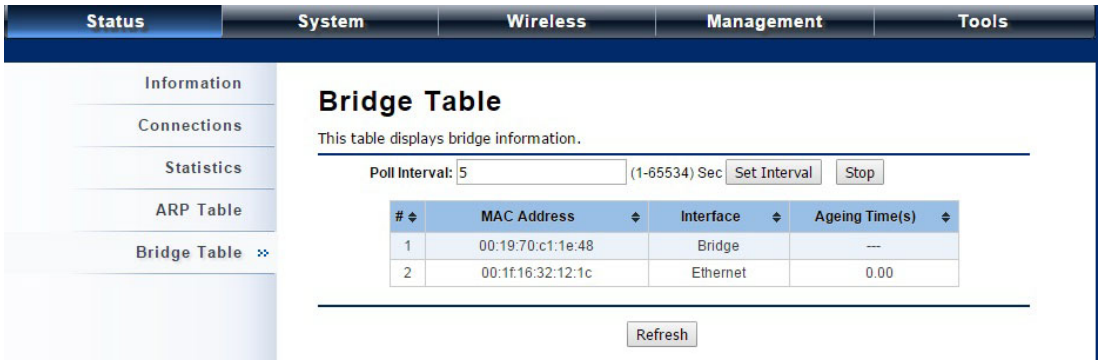


Figure 7.6 Bridge Table

7.6 View Routing Table

Available in Router mode, the routing table shows the current route information.

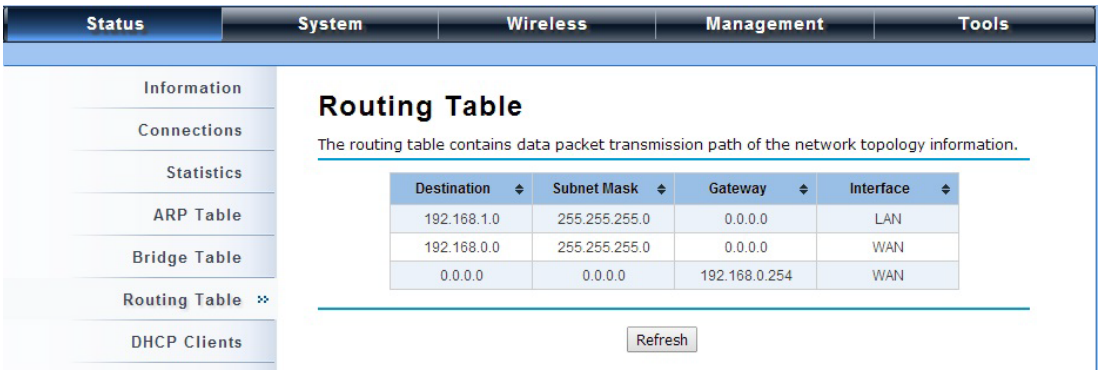


Figure 7.7 Routing Table

7.7 View Active DHCP Client Table

Available in Router mode, the DHCP allows to check the assigned IP address, MAC address and time expired for each DHCP leased client. Click "Refresh" to view current table.

Figure 7.8 DHCP Client Table

Chapter 8

Troubleshooting

This chapter provides troubleshooting procedures for basic problems with EKI-6332GN-AE/EKI-6331AN-BE. For warranty assistance, contact your service provider or distributor for the process.

Q1. How to know the MAC address of EKI-6332GN-AE/EKI-6331AN-BE?

MAC Address distinguishes itself by the unique identity among network devices. There are two ways available to know it.

- Each device has a label posted with the MAC address. Please refer below.

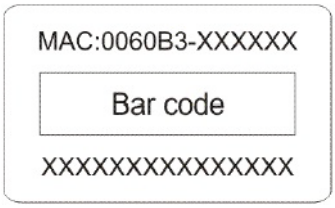


Figure 8.1 MAC Address

- On EKI-6332GN-AE/EKI-6331AN-BE Web-based management interface, you can view the MAC Address from “View Basic Information”.

Q2. What if I would like to reset the unit to default settings?

You may restore factory default settings in “Configuration File” from “Management”.

Q3. What if I would like to backup and retrieve my configuration settings?

You may do the backup by generating a configuration file or retrieve the settings you have backed up previously in “Configuration File” from “Management”.

Q4. What if I can not access the Web-based management interface?

Please check the followings:

- Check whether the power supply is OK; Try to power on the unit again.
- Check whether the IP address of PC is correct (in the same network segment as the unit);
- Login the unit via other browsers such as Firefox.
- Hardware reset the unit.

Q 5. What if the wireless connection is not stable after associating with an AP under wireless client mode?

- Since EKI-6332GN-AE/EKI-6331AN-BE comes with a built-in directional antenna, it is recommended make EKI-6332GN-AE/EKI-6331AN-BE face to the direction where the AP is to get the best connection quality.
- In addition, you can start “Site Survey” in “Wireless Basic Settings” to check the signal strength. If it is weak or unstable (The smaller the number is, the weaker the signal strength is.), please join other available AP for better connection.

Appendix A

ASCII

A.1 ASCII

WEP can be configured with a 64-bit, 128-bit or 152-bit Shared Key (hexadecimal number or ACSII). As defined, hexadecimal number is represented by 0-9, A-F or a-f; ACSII is represented by 0-9, A-F, a-f or punctuation. Each one consists of two-digit hexadecimal.

Table A.1: ASCII

ASCII Character	Hex Equivalent	ASCII Character	Hex Equivalent	ASCII Character	Hex Equivalent	ASCII Character	Hex Equivalent
!	21	9	39	Q	51	i	69
"	22	:	3A	R	52	j	6A
#	23	;	3B	S	53	k	6B
$	24	<	3C	T	54	l	6C
%	25	=	3D	U	55	m	6D
&	26	>	3E	V	56	n	6E
‘	27	?	3F	W	57	o	6F
(	28	@	40	X	58	p	70
)	29	A	41	Y	59	q	71
*	2A	B	42	Z	5A	r	72
+	2B	C	43	[	5B	s	73
,	2C	D	44	\	5C	t	74
-	2D	E	45	]	5D	u	75
.	2E	F	46	^	5E	v	76
/	2F	G	47	_	5F	w	77
0	30	H	48	`	60	x	78
1	31	I	49	a	61	y	79
2	32	J	4A	b	62	z	7A
3	33	K	4B	c	63	{	7B
4	34	L	4C	d	64	|	7C
5	35	M	4D	e	65	}	7D
6	36	N	4E	f	66	~	7E
7	37	O	4F	g	67		
8	38	P	50	h	68		

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