TELETRONICS INTERNATIONAL INC.

TT™4900
User Manual

802.11a 200mW

Table of Contents

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Electronic Emission Notices

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.

(2)This device must accept any interference received, including interference that may cause undesired operation.

FCC INFORMATION

The Federal Communication Commission Radio Frequency Interference Statement includes the following paragraph:

The 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 usage generates radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no grantee 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.

The equipment is for home or office use.

IMPORTANT NOTE

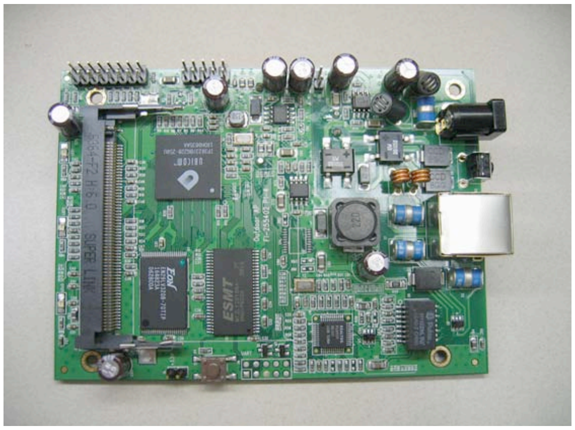
FCC RF Radiation Exposure Statement: This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the antenna and your body and must not be co-located or operating in conjunction with any other antenna or transmitter.

Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Introduction

The TT™4900 is Teletronics's answer to the ever growing demand for higher bandwidth and security in a wireless network environment. It is based on a brand new redesigned platform that not only offers faster performance and capacity but also supports all current pre IEEE 802.11i wireless security standards. The TT™4900 is the IEEE 802.11a version of the platform that directly targets the need for the more secure, less crowded 4.9GHz frequency spectrum.

TT™4900 Product Photos



TT™4900 PCB

IEEE 802.11a miniPCI Card

TT™4900 Enclosure (Die Cast Aluminum NEMA 4 Box)

Product Features

- Compact size for small enterprise or system integrate service market
- Compliant with IEEE 802.11a specifications
- Supports 64/128-bit WEP, WPA and IEEE802.1x
- Supports Atheros Super A (up to 108Mbps)
- Intelligent firmware upgrade via Web browser
- Built-in Web-based utility for easy configuration from any Web browser
- Support POE (IEEE 802.3af) function
- Supports wireless bridging and MAC address filtering
- Super bright LED indicating status and signal level (RSSI)
- Provide 10/100M, auto sensing MDI/MDI-X Ethernet port
- EzManager Support

**Atheros Super G (Proprietary technology of Atheros Communication Inc.) would only work in situations where both ends of the communication link are using the Atheros radio chipset.*

Product Specifications

Main Chips

- CPU: Ubicom IP3023
- Radio: Supports 802.11a Atheros AR5213+AR5112

Mechanical

- Chassis Dimension (W x D x L): 161mm x 30mm x 119mm

Board Specifications

Specification	Description
Network Standard	IEEE 802.11 a, IEEE 802.3, IEEE802.3x
Ethernet	10/100BaseT Ethernet, Auto MDI/MDI-X
Network Architecture	Infrastructure; Ad-Hoc
MAC	CSMA/CA
Status Indicators	POWER, Wireless LAN(RF),Ethernet LAN, Receives Signal Strength(RSS)
Push Button	Reset to Default Button

Radio Specifications

- IEEE 802.11a 5 GHz mini-PCI card

Specification	Description
Chipset	MAC/BB Processor Atheros AR5213 RF Chip Atheros AR5112
Power Consumption	IEEE 802.11a TX: ~1000 mA RX: ~400 mA
Antenna Connector	N-type Female
Output Power	• 16dBm (± 2dB) @ 54Mbps • 17dBm (± 2dB) @ 48Mbps • 18dBm (± 2dB) @ 36Mbps • 19dBm (± 2dB) @ 6 Mbps
Receiver Sensitivity	IEEE 802.11a Sensitivity @ 10% Packet Error Rate • 54Mbps: -70dBm • 48Mbps: -71dBm • 36Mbps: -75dBm • 24Mbps: -79dBm • 18Mbps: -82dBm • 12Mbps: -84dBm • 9Mbps: -86dBm • 6Mbps: -87dBm
Modulation	IEEE 802.11a (OFDM) • 48/54 Mbps (QAM-64) • 24/36 Mbps (QAM-16) • 12/18 Mbps (QPSK) • 6/9 Mbps (BPSK)
Operating Frequency	• USA: 4.950, 4.960, 4.970 GHz (FCC): 5.15GHz ~ 5.25GHz, 5.25GHz ~ 5.35GHz, 5.47 GHz ~ 5.725 GHz, 5.725 GHz ~ 5.825 GHz • Europe(ETSI): 5.15 GHz ~ 5.35 GHz, 5.47 GHz ~ 5.725 GHz • Japan(TELEC): 5.15 GHz ~ 5.25 GHz

LED Definition

Item	Specification	
Power	ON (Red)	Power on
	Off	No power
RF(WLAN)	On (Yellow)	Connected
	Off	Not connected
	Blinking(Green)	Connected and transmitting
LAN	On (Green)	Connected
	Off	Not connected
	Blinking(Green)	Connected and transmitting
Received Signal Strength Indicator (RSSI)	Blinking left to right	Not connected (Scanning for AP)

	On	Connected, indicating Received Signal Strength. 5 LEDs: > 80%(-68dBm) 4 LEDs: > 60%(-75dBm) 3 LEDs: > 40%(-82dBm) 2 LEDs: > 20%(-88dBm) 1 LED: > 3%(-94dBm) 0 LED: No Signal(-95dBm)

Software Specification

Item	Specification
Bridge Features	• Universal Bridging • MAC Address Cloning • RTS Threshold/Fragmentation Threshold • Infrastructure or Ad-Hoc Mode • Non-IP Traffic Bridging
Security Features	• 64-Bit/128-Bit WEP Encryption • WPA Personal Using TKIP or AES • WPA Enterprise Using TKIP or AES • 802.1x Authenticator • Cisco LEAP Support • MAC Address Filter
Management Features	• Web Access (Username/Password Protected) • Static IP • Automatic Device Discovery & Configuration • SNMP v1, DHCP and PPPoE (Ethernet or Wireless) • Firmware Upgrade via Web Browser • Transmit Power Adjustment

External AC Power Adapter

Item	Specification
Input Voltage	110-240VAC
Line Frequency	50/60Hz
Power Output to M/B	48VDC, 1A

Environmental

Item	Specification
Operating Temperature	-20 C to 40 C (-4 F to 104 F), 10 to 90% (non-condensing)
Storage Temperature	-25 C to 70 C (-13 F to 158 F), 10 to 90% (non-condensing)

Standards / Regulatory Compliance

- CE, FCC

Product Kit Part Listing

1. TT™4900 802.11a PCBA
2. IEEE 802.11a mini-PCI radio card (1)
3. Power over Ethernet Injector (1)
4. 48VDC Power Adapter (1)
5. Ethernet Cable (2)
6. Waterproof RJ-45 Connector (1)
7. Mounting Hardware (1)
8. User Manual

Note: If any item listed above is damaged or missing, please contact your dealer immediately.

System Requirements

- Any desktop or laptop with an Ethernet interface
- TCP/IP protocol suite installed
- Standard CAT5 Ethernet cables with RJ45 connectors
- Internet Explorer 5.0 or later / Firefox 1.0 or higher

Installation

Preparation for Installation

Always double check for any missing parts from the kit you received before deployment.

The next step is to set up the computer Ethernet interface for configuring the TT™4900. Since the default IP Address of the unit is on the 192.168.10.x IP range in both Client Bridge and AP mode you will need to set the Ethernet interface within the same IP range, where x will have to be a free IP address number from 1-254.

Check the following section - “Hardware Installation” and the next chapter - “Configuring Windows for IP Networking” to obtain complete details.

Hardware Installation

Follow the procedure below to install your TT™4900 device:

1. Select a suitable place on the network to install the TT™4900. For best wireless reception and performance the external antenna should be positioned within Line of Sight from the AP with proper alignment.

2. Connect the TT™4900 to the ODU side of the PoE Injector, via a straight Ethernet cable (Cat-5), and then connect the NET side of the PoE Injector to either a computer or an Ethernet Switch. *Note: The TT™4900 now fully supports the MDI/MDI-X standard and no longer requires the use of a cross over cable to connect directly with a computer.*

3. Connect the 48VDC power adapter to the power jack on the PoE injector to power on the TT™4900.

4. Check the LEDs on the TT™4900 to confirm if the status is okay. At this point the Power (PWR) LED indicator should be red and Ethernet (LAN) LED should be green. The RF light should light up once the unit is associated wirelessly with another wireless device. However at this point the unit is still in factory default setting so do not be alarmed that the WLAN light doesn’t light up.

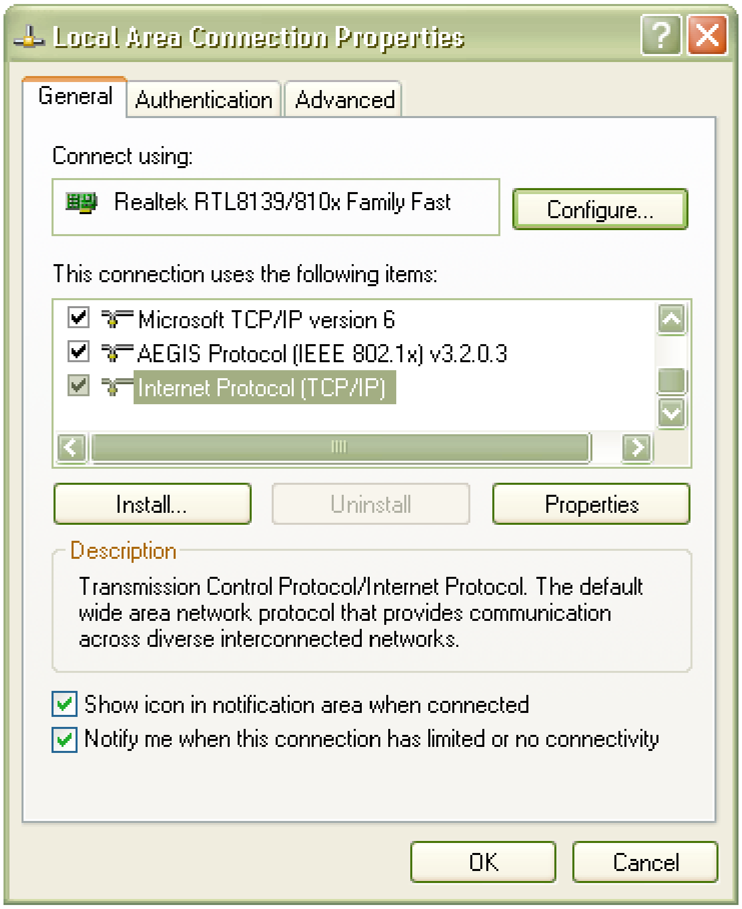
5. Now the hardware installation is complete and you may proceed to the next chapter –“Configuring Windows for IP Networking” for instructions on setting up network configurations.

Configuring Windows for IP Networking

To establish a communication link between your PC and TT™4900, you will need to set up a static IP address for your computer first. This section helps you configure the network settings for your operating system. Please follow the procedures below to complete the settings:

Windows XP

1. Click **Start** on the taskbar and from the **Control Panel** choose **Network Connections**. Right-click the **Local Area Connection** icon and then choose **Properties** from the menu. You should see the **Local Area Connection Properties** dialog box shown below.



Connect using:

Realtek RTL8139/810x Family Fast

This connection uses the following items:

- ☑ Microsoft TCP/IP version 6
- ☑ AEGIS Protocol (IEEE 802.1x) v3.2.0.3
- ☑ Internet Protocol (TCP/IP)

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

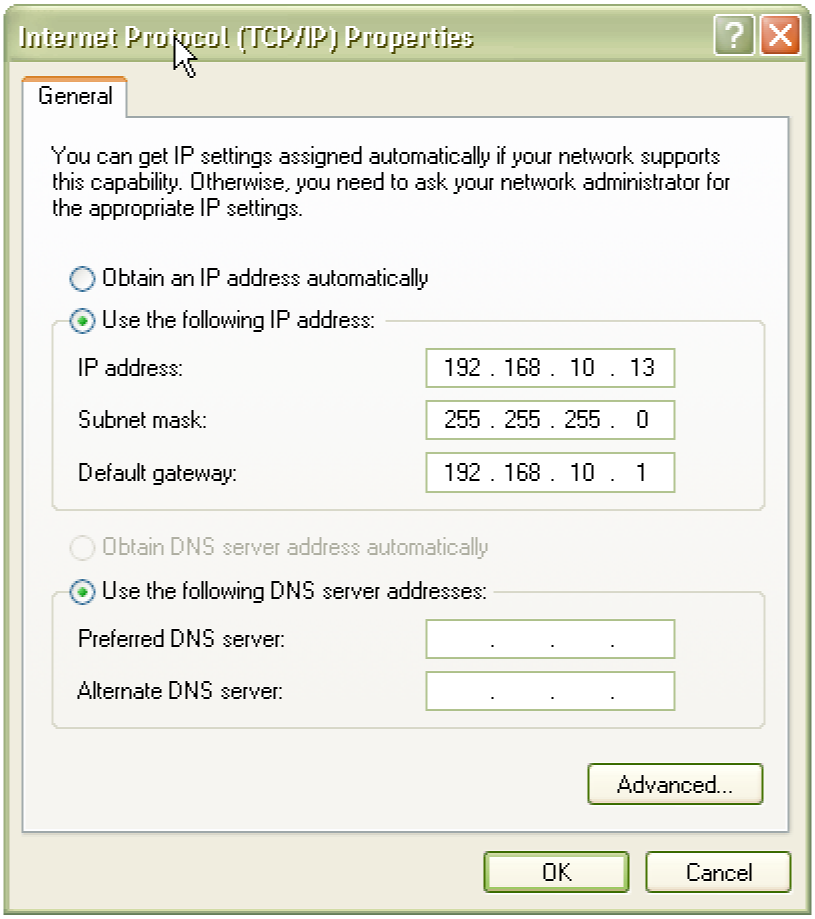
☑ Show icon in notification area when connected

☑ Notify me when this connection has limited or no connectivity

2. Select the **Internet Protocol (TCP/IP)** for your network card, and then click **Properties**.

3. In the opened dialog box, choose **Use the following IP address**

4. Under the **General** tab, choose **Use the following IP address**, and then specify an IP address. For example, type in **192.168.10.X** in the **IP Address** (where X is any free IP number from 1-254, excluding 241) area and **255.255.255.0** in the **Subnet Mask** area.



You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address:	192 . 168 . 10 . 13
Subnet mask:	255 . 255 . 255 . 0
Default gateway:	192 . 168 . 10 . 1

○ Obtain DNS server address automatically

● Use the following DNS server addresses:

Preferred DNS server:	. . .
Alternate DNS server:	. . .

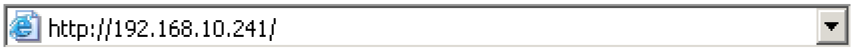
5. Click **OK** to finish configuration.

Web Configuration Interface

Client Bridge Mode

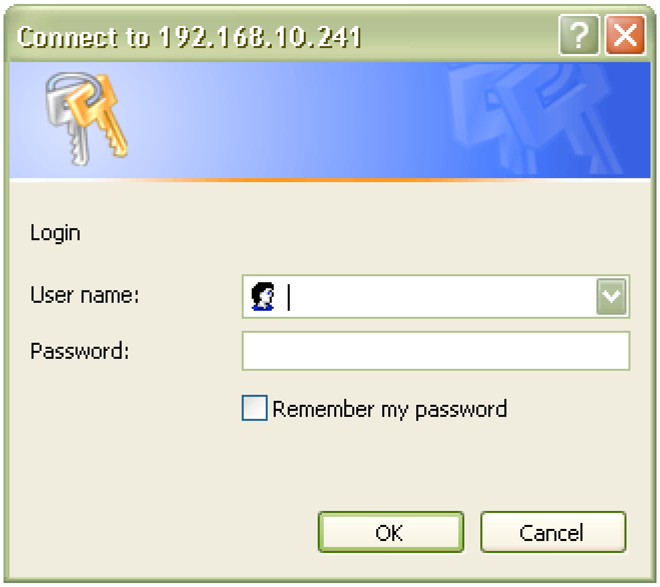
Default IP Address in Client Bridge Mode: **192.168.10.241**

To access the web control interface please open up a browser window and type in the factory default IP address in the URL.



http://192.168.10.241/

Press Enter on your keyboard and a login prompt window similar to the one shown below will appear.



Connect to 192.168.10.241

Login

User name:

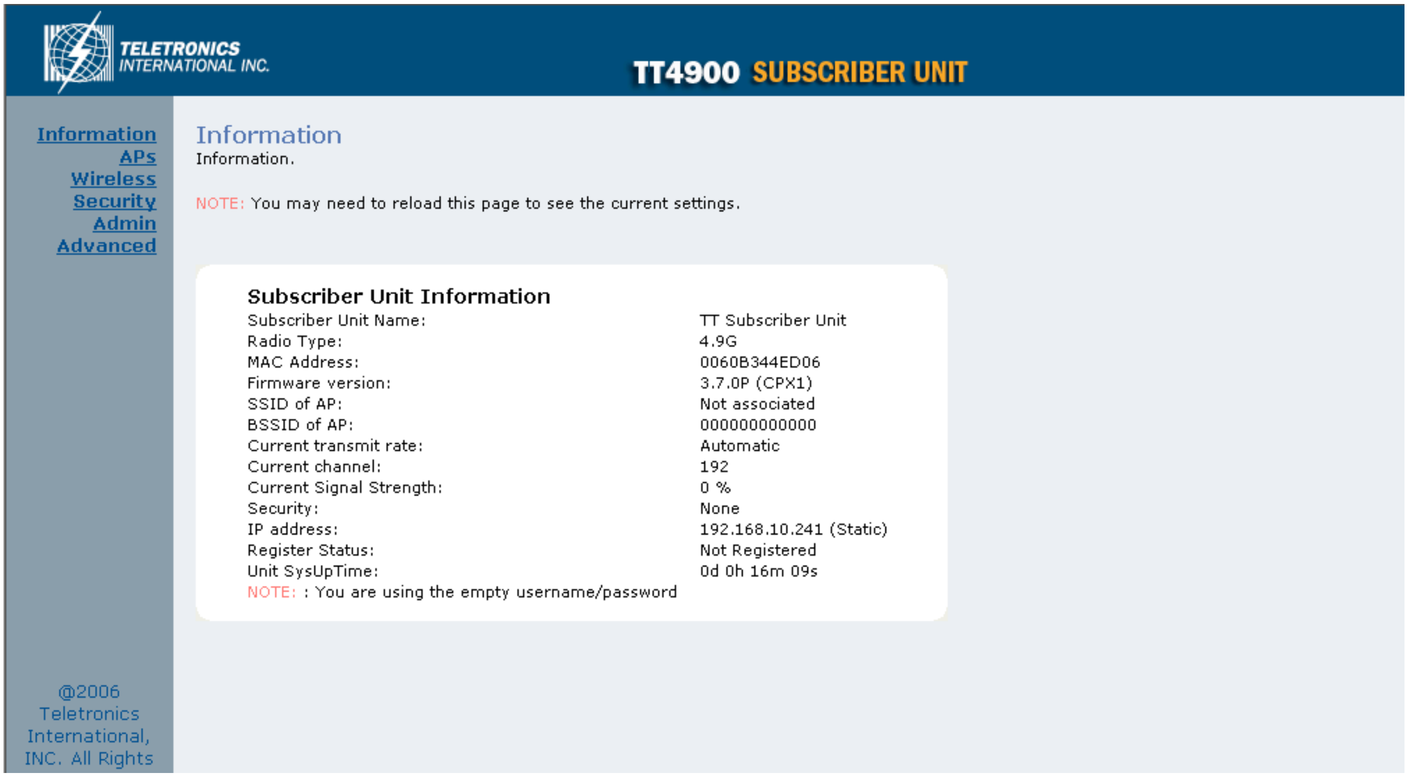
Password:

□ Remember my password

There is no default User name or Password. Leave User name and Password field blank and click OK.

Note: You may set a new password by clicking the Admin tab after you enter the Web Configuration page.

Information


TELETRONICS INTERNATIONAL INC.
TT4900 SUBSCRIBER UNIT
Information
APs
Wireless
Security
Admin
Advanced
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Information

Information.

NOTE: You may need to reload this page to see the current settings.

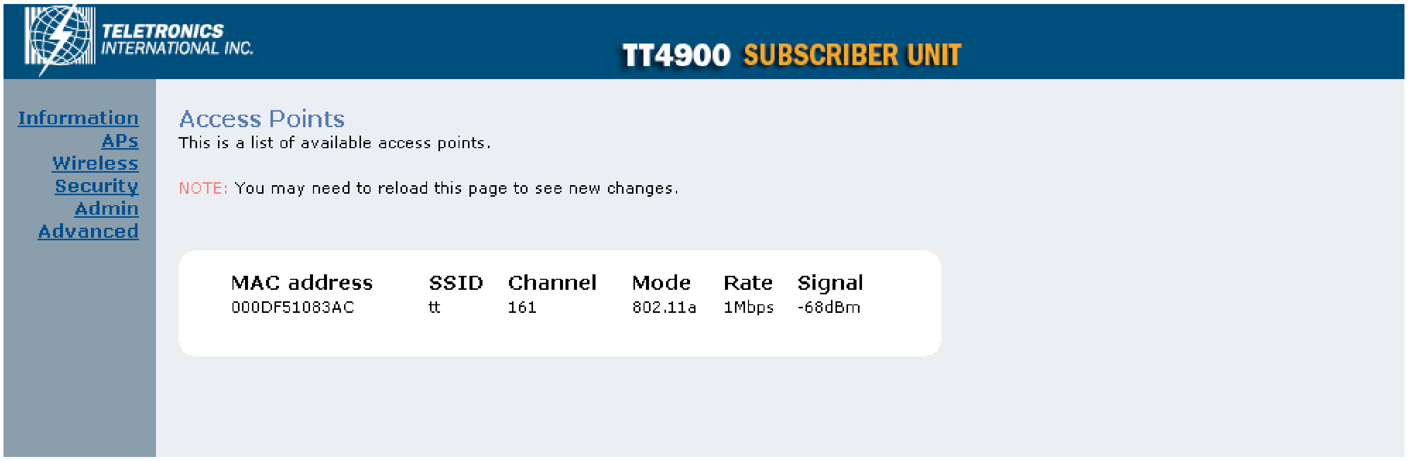
Subscriber Unit Information

Subscriber Unit Name:	TT Subscriber Unit
Radio Type:	4.9G
MAC Address:	0060B344ED06
Firmware version:	3.7.0P (CPX1)
SSID of AP:	Not associated
BSSID of AP:	000000000000
Current transmit rate:	Automatic
Current channel:	192
Current Signal Strength:	0 %
Security:	None
IP address:	192.168.10.241 (Static)
Register Status:	Not Registered
Unit SysUpTime:	0d 0h 16m 09s

NOTE: : You are using the empty username/password

Under the main web interface home page you will see the following configuration menu pages: **Information, APs, Wireless, Security, Admin** and **Advanced.** Detailed information for each section is provided below:

Access Points (APs)



Access Points

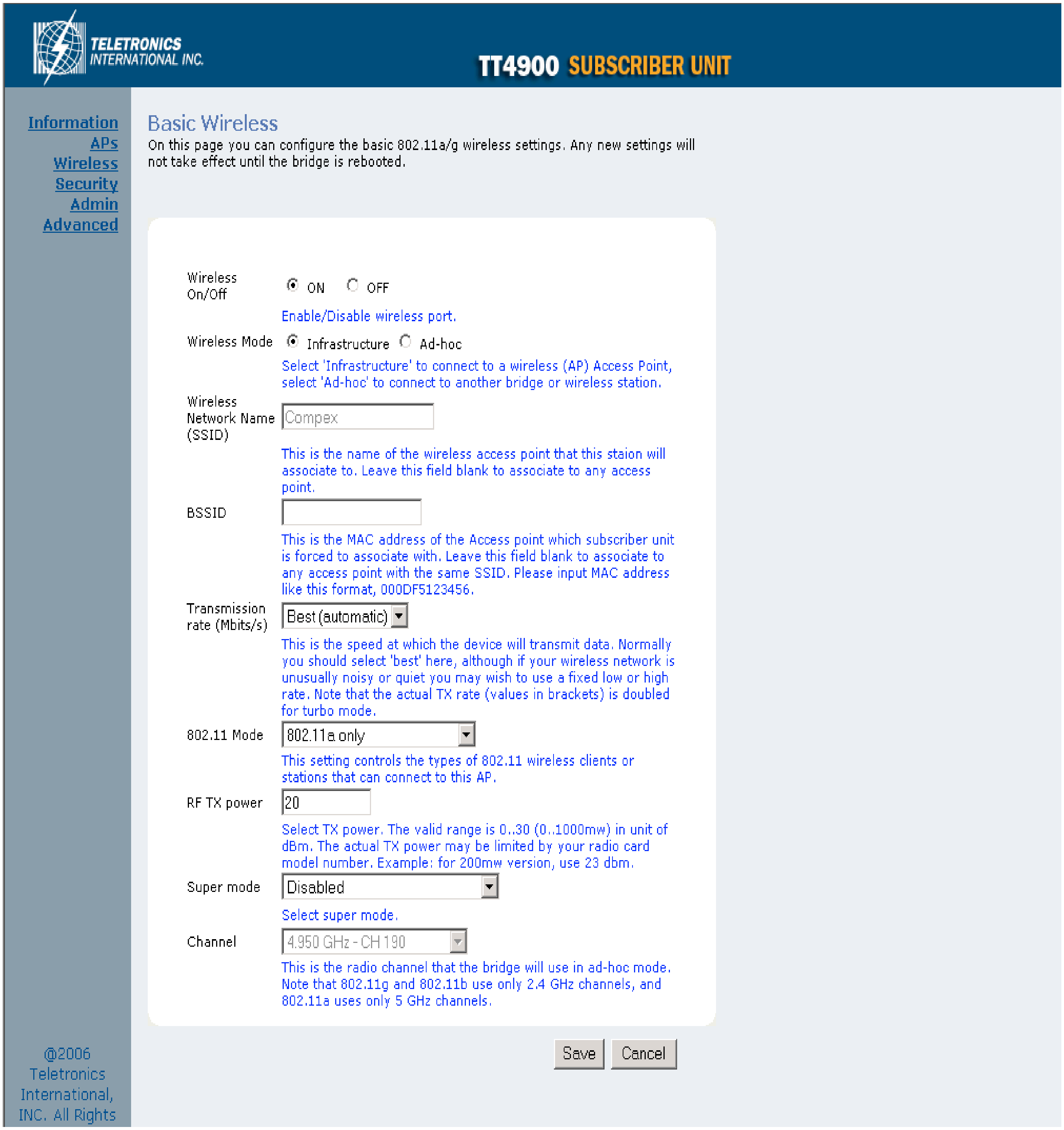
This is a list of available access points.

NOTE: You may need to reload this page to see new changes.

MAC address	SSID	Channel	Mode	Rate	Signal
000DF51083AC	tt	161	802.11a	1Mbps	-68dBm

The APs section displays available hotspots in the area along with the MAC address, SSID, Channel, Wireless mode, signal strength and transmission rate for each access point.

Wireless



Basic Wireless

On this page you can configure the basic 802.11a/g wireless settings. Any new settings will not take effect until the bridge is rebooted.

Wireless On/Off ● ON ○ OFF

Enable/Disable wireless port.

Wireless Mode ● Infrastructure ○ Ad-hoc

Select 'Infrastructure' to connect to a wireless (AP) Access Point, select 'Ad-hoc' to connect to another bridge or wireless station.

Wireless Network Name (SSID) Compex

This is the name of the wireless access point that this staion will associate to. Leave this field blank to associate to any access point.

BSSID

This is the MAC address of the Access point which subscriber unit is forced to associate with. Leave this field blank to associate to any access point with the same SSID. Please input MAC address like this format, 000DF5123456.

Transmission rate (Mbits/s) Best (automatic)

This is the speed at which the device will transmit data. Normally you should select 'best' here, although if your wireless network is unusually noisy or quiet you may wish to use a fixed low or high rate. Note that the actual TX rate (values in brackets) is doubled for turbo mode.

802.11 Mode 802.11a only

This setting controls the types of 802.11 wireless clients or stations that can connect to this AP.

RF TX power 20

Select TX power. The valid range is 0..30 (0..1000mw) in unit of dBm. The actual TX power may be limited by your radio card model number. Example: for 200mw version, use 23 dbm.

Super mode Disabled

Select super mode.

Channel 4.950 GHz - CH 190

This is the radio channel that the bridge will use in ad-hoc mode. Note that 802.11g and 802.11b use only 2.4 GHz channels, and 802.11a uses only 5 GHz channels.

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Wireless On/Off

This is the on/off switch of the radio card.

Wireless Mode

Infrastructure: An 802.11 networking framework in which devices communicate with each other by first going through an Access Point (AP).

Ad-hoc: An 802.11 networking framework in which devices or stations communicate directly with each other, without the use of an access point (AP). Use this mode if there is no wireless infrastructure or where services are not required.

Wireless Network Name (SSID)

Network Name is also known as SSID, which stands for Service Set Identifier. Any client in Infrastructure mode has to indicate the SSID of an Access Point to access a service such as internet access through the Access point.

Access Point Identifier (BSSID)

The Basic Service Set Identifier is the unique identifier (MAC address) of an access point in a Basic Service Set (BSS) network. The subscriber unit is forced to associate with this particular unit if there are multiple access points in the network.

Transmission rate (Mbits/s)

This option indicates the transmission rate of the bridge. Specify the rate according to the speed of your wireless network from the list. Most of the time the default setting, Best (automatic), should be selected for best performance. The setting can be adjusted manually if the link quality and signal strength are unusually low or high to get the best performance.

802.11 Mode

Wireless mode allows the user to select whether this subscriber unit will connect to an 802.11b only network, an 802.11g only network, an 802.11a only network or both b/g networks. For b or g only wireless devices on the network, selecting 802.11b or 802.11g only mode will provide better performance than mixed mode. In the case of TT™4900 only 802.11a mode is allowed.

RF Transmit Power

This section controls the power output for the mini-PCI radio card. The valid input range for this section is in the range of 0-30 in dBm units or (1mw – 1000mw). The default value is 23 dBm or 200mW.

Super Mode

Super Mode is only supported if both the client and the AP are using compatible Atheros radio chipsets

- Disabled
- Super A/G without Turbo
- Super A/G with Static Turbo
- Super A/G with Dynamic Turbo (AR enabled)

Country and Region

This option selects the country and region of operation. Every device should be configured to use the proper regional settings which comply with and do NOT violate the radio regulatory laws at the installed location.

Channel

Channels are important to understand because they affect the overall capacity of your Wireless LAN. A channel represents a narrow band of radio frequency. A radio frequency modulates within a band of frequencies; as a result there is a limited amount of bandwidth within any given range to carry data. It is important that the frequencies do not overlap or else the throughput would be significantly reduced as the network sorts and reassembles the data packets sent over the air.

For the TT2400: 2.4 GHz – 2.497 GHz frequency range, there are only 3 channels out of the 11 available that do not overlap with one another. To avoid interference within a network with multiple APs, set each AP to use one of the 3 channels (e.g. Channel 1) and then the other AP to be one of the other 2 channels (i.e. Channel 6 or Channel 11) within the range of the wireless radio. This simple method will reduce interference and improve network reliability.

802.11b/g Wireless Channel Frequency Range: 2.4 GHz – 2.497 GHz
802.11b/g Non-overlapping Channel Frequency Ranges

- Channel 1 = 2.401 GHz – 2.423 GHz
- Channel 6 = 2.426 GHz – 2.448 GHz
- Channel 11 = 2.451 GHz – 2.473 GHz

Americas: Wireless Channels 1 – 11
Asia: Wireless Channels 1 – 14
Europe: Wireless Channels 1 – 13

802.11a Wireless Channel Frequency Range: 5.15 GHz – 5.35 GHz, 5.725 – 5.825

802.11a is an extension to 802.11 that applies to wireless LANs and provides up to 54 Mbps in the 5GHz band. 802.11a uses an orthogonal frequency division multiplexing encoding scheme rather than FHSS or DSSS. Unlike that of 802.11b/g, 802.11a standard separates its channels into 3-100MHz segments in the US.

The lower and middle band accommodates 8 channels in a total bandwidth of 200 MHz and the upper band accommodates 4 channels in a 100 MHz bandwidth. The frequency channel center frequencies are spaced 20 MHz apart. The outermost channels of the lower and middle bands are centered 30 MHz from the outer edges. In the upper band the outermost channel centers are 20 MHz from the outer edges.

In addition to the frequency and channel allocations, transmit power is a key parameter regulated in the 5 GHz U-NII band. Three transmit power levels are specified: 40 mW, 200 mW and 800 mW. The upper band defines RF transmit power levels suitable for bridging applications while the lower band specifies a transmit power level suitable for short-range indoor home and small office environments.

802.11a Non-overlapping Channel Frequency Ranges

Lower Band (5.15 - 5.25 GHz) – Maximum Output Power 40mW

- Channel 36 = 5.15 – 5.18
- Channel 40 = 5.18 – 5.20
- Channel 44 = 5.20 – 5.22
- Channel 48 = 5.22 – 5.25

Middle Band (5.25 - 5.35 GHz) – Maximum Output Power 200mW

- Channel 52 = 5.25 – 5.28
- Channel 56 = 5.28 – 5.30
- Channel 60 = 5.30 – 5.32
- Channel 64 = 5.32 – 5.35

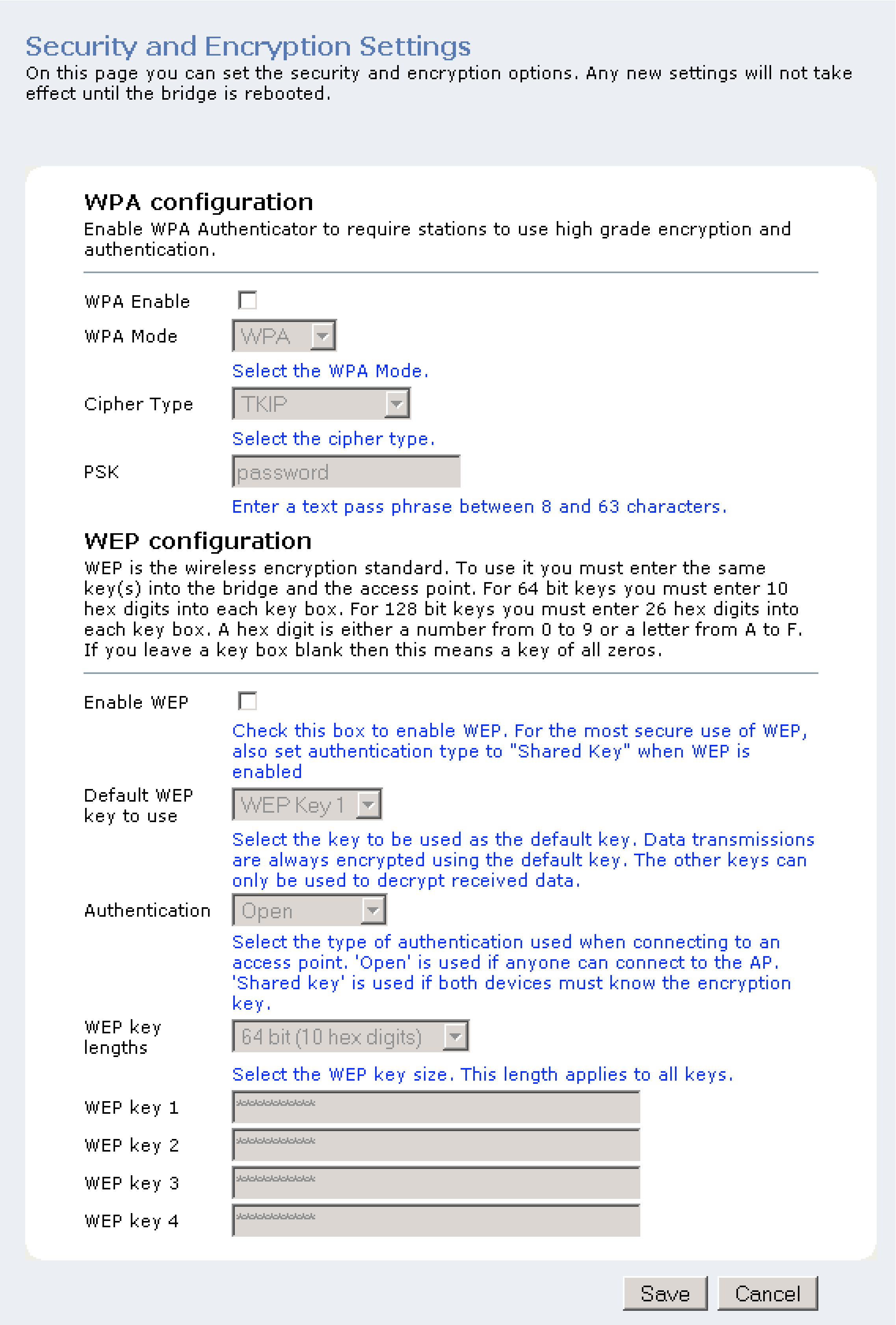
Upper Band (5.725 - 5.825 GHz) – Maximum Output Power 800mW

- Channel 149 = 5.725 – 5.745
- Channel 153 = 5.745 – 5.765
- Channel 157 = 5.765 – 5.785
- Channel 161 = 5.785 – 5.805
- Channel 165 = 5.805 – 5.825

Special Atheros Turbo Mode Channels
**Use this setting only when both side of the wireless connection is using the Atheros chipset. The radio will combine 2 free channels for the wireless transmission to double the bandwidth.*

- Channel 42 = 5.210
- Channel 50 = 5.250
- Channel 58 = 5.290
- Channel 152 = 5.760
- Channel 160 = 5.800

Security



Security and Encryption Settings

On this page you can set the security and encryption options. Any new settings will not take effect until the bridge is rebooted.

WPA configuration

Enable WPA Authenticator to require stations to use high grade encryption and authentication.

WPA Enable ☐

WPA Mode: WPA

Select the WPA Mode.

Cipher Type: TKIP

Select the cipher type.

PSK: password

Enter a text pass phrase between 8 and 63 characters.

WEP configuration

WEP is the wireless encryption standard. To use it you must enter the same key(s) into the bridge and the access point. For 64 bit keys you must enter 10 hex digits into each key box. For 128 bit keys you must enter 26 hex digits into each key box. A hex digit is either a number from 0 to 9 or a letter from A to F. If you leave a key box blank then this means a key of all zeros.

Enable WEP ☐

Check this box to enable WEP. For the most secure use of WEP, also set authentication type to "Shared Key" when WEP is enabled

Default WEP key to use: WEP Key 1

Select the key to be used as the default key. Data transmissions are always encrypted using the default key. The other keys can only be used to decrypt received data.

Authentication: Open

Select the type of authentication used when connecting to an access point. 'Open' is used if anyone can connect to the AP. 'Shared key' is used if both devices must know the encryption key.

WEP key lengths: 64 bit (10 hex digits)

Select the WEP key size. This length applies to all keys.

WEP key 1: **********

WEP key 2: **********

WEP key 3: **********

WEP key 4: **********

WPA Configuration

Short for Wi-Fi Protected Access, WPA is a Wi-Fi standard that was designed to improve upon the security features of WEP. WPA has the following improvements over WEP:

- Improved data encryption through temporal key integrity protocol (TKIP). TKIP scrambles the keys using a hashing algorithm. By adding an integrity-checking feature, TKIP ensures that keys have not been tampered with.

- User authentication through the Extensible Authentication Protocol (EAP). WEP regulates access to a wireless network based on a computer's hardware-specific MAC address, which is relatively simple to be sniffed out and stolen. EAP is built on a more secure public-key encryption system to ensure that only authorized network users can access the network.

WPA Enable

This option enables the WPA Authenticator. Note that any client that does not support the WPA standard will not be able to handshake / authenticate with a WPA enabled device.

WPA Mode

- WPA
  - Designed to secure present and future versions of IEEE 802.11 devices, WPA is a subset of the IEEE 802.11i specification. WPA addresses all known vulnerabilities in WEP. WPA also provides user authentication, since WEP lacks any means of authentication. WPA replaces WEP with a strong new encryption technology called Temporal Key Integrity Protocol (TKIP) with Message Integrity Check (MIC). It also provides a scheme of mutual authentication using IEEE 802.1X/Extensible Authentication Protocol (EAP) authentication or pre-shared key (PSK) technology. WPA was designed and has been scrutinized by well-known cryptographers. It can be implemented immediately and inexpensively as a software or firmware upgrade to most existing Wi-Fi CERTIFIED™ access points and client devices with minimal degradation in network performance. WPA offers standards-based, Wi-Fi CERTIFIED security. It assures users that the Wi-Fi CERTIFIED devices they buy will be cross-vendor compatible. When properly installed, WPA provides a high level of assurance to enterprises, small businesses and home users that data will remain protected and that only authorized users may access their networks. For enterprises that have already deployed IEEE 802.1X authentication, WPA offers the advantage of leveraging existing authentication databases and infrastructure.
- WPA2
  - WPA2 is the second generation of WPA security; providing enterprise and consumer Wi-Fi® users with a high level of assurance that only authorized users can access their wireless networks. Launched in September 2004 by the Wi-Fi Alliance, WPA2 is the certified interoperable version of the full IEEE 802.11i specification which was ratified in June 2004. Like WPA, WPA2 supports IEEE 802.1X/EAP authentication or PSK technology. It also includes a new advanced encryption mechanism using the Counter-Mode/CBC-MAC Protocol (CCMP) called the Advanced Encryption Standard (AES). AES satisfies U.S. government security requirements. It has been adopted as an official government standard by the U.S. Department of Commerce and the National Institute of Standards and Technology (NIST). Organizations that require the AES encryption available in WPA2 should be aware that upgrading to it may require new hardware. Section II of this document offers a roadmap for organizations planning to upgrade to WPA2. Considerations for its deployment are outlined in Section III.

Cipher Type

- TKIP
  - Temporal Key Integrity Protocol is an upgrade to the WEP known as WEP 1.1 that fixes known security problems in WEP's implementation of the RC4 stream cipher. TKIP scrambles the keys using a hashing algorithm and by adding an integrity-checking feature, ensures that the keys haven't been tampered with.

- AES
  - Advanced Encryption Standard (Rijndael Cypher) is the U.S. government's next-generation cryptography algorithm, which will replace DES and 3DES. AES works at multiple network layers simultaneously. AES Supports 128, 192 and 256 bit keys. Unlike the older standard, AES and 802.11i (WEP version 2) are based on 32bit processing.

- TKIP and AES
  - If clients support both the TKIP and AES standards then this would be the strongest cipher type to use that combines both TKIP and AES security.

PSK

PSK stands for Pre-Shared-Key and serves as a password. User may key in 8 to 63 characters string to set the password and activate 802.1x Authentication. Note that the same password must be used at both ends of the communication link (access point and client end).

WEP Configuration

Short for Wired Equivalent Privacy, a security protocol for wireless local area networks (WLANs) defined in the 802.11b standard. WEP is designed to provide the same level of security as that of a wired LAN.

Enable WEP

To enable the WEP Authenticator

Default WEP key to use

- WEP Key 1-4

Select the key to be used as the default key. Data transmissions are always encrypted using the default key. The other keys can only be used to decrypt received data.

Authentication

- Open - Open system authentication involves a two-step authentication transaction sequence. The first step in the sequence is the identity assertion and request for authentication. The second step in the sequence is the authentication result. If it is "successful", the station shall be mutually authenticated. Open system authentication does not provide authentication. It provides identification using the wireless adapter's MAC address. Open system authentication is used when no authentication is required. It is the default authentication algorithm.

Open system authentication uses the following process:

1. The authentication-initiating wireless client sends an IEEE 802.11 authentication management frame that contains its identity.

2. The receiving wireless AP checks the initiating station's identity and sends back an authentication verification frame.

3. With some wireless APs, you can configure the MAC addresses of allowed wireless clients. However, configuring the MAC address does not provide sufficient security because the MAC address of a wireless client can be spoofed.

- Shared Key - Shared key authentication supports authentication of stations as either a member of those who know a shared secret key or a member of those who do not. Shared key authentication is not secure and is not recommended for use. It verifies that an authentication-initiating station has knowledge of a shared secret. This is similar to pre-shared key authentication for Internet Protocol security (IPSec). The 802.11 standard currently assumes that the shared secret is delivered to the participating wireless clients by means of a more secure channel that is independent of IEEE 802.11. In practice, a user manually types this secret for the wireless AP and the wireless client.

Shared key authentication uses the following process:

1. The authentication-initiating wireless client sends a frame consisting of an identity assertion and a request for authentication.

2. The authenticating wireless node responds to the authentication-initiating wireless node with challenge text.

3. The authentication-initiating wireless node replies to the authenticating wireless node with the challenge text that is encrypted using WEP and an encryption key that is derived from the shared key authentication secret.

4. The authentication result is positive if the authenticating wireless node determines that the decrypted challenge text matches the challenge text originally sent in the second frame. The authenticating wireless node sends the authentication result.

5. Because the shared key authentication secret must be manually distributed and typed, this method of authentication does not scale appropriately in large infrastructure network mode, such as corporate campuses.

WEP key lengths

64 bit (10 Hex Digit)

WEP Key type	Example

64-bit WEP with 5 characters	Key1= 2e3f4
	Key2= 5y7js
	Key3= 24fg7
	Key4= 98jui

64-bit WEP with 10 hexadecimal digits ('0-9', 'A-F')	Key1= 123456789A
	Key2= 23456789AB
	Key3= 3456789ABC
	Key4= 456789ABCD

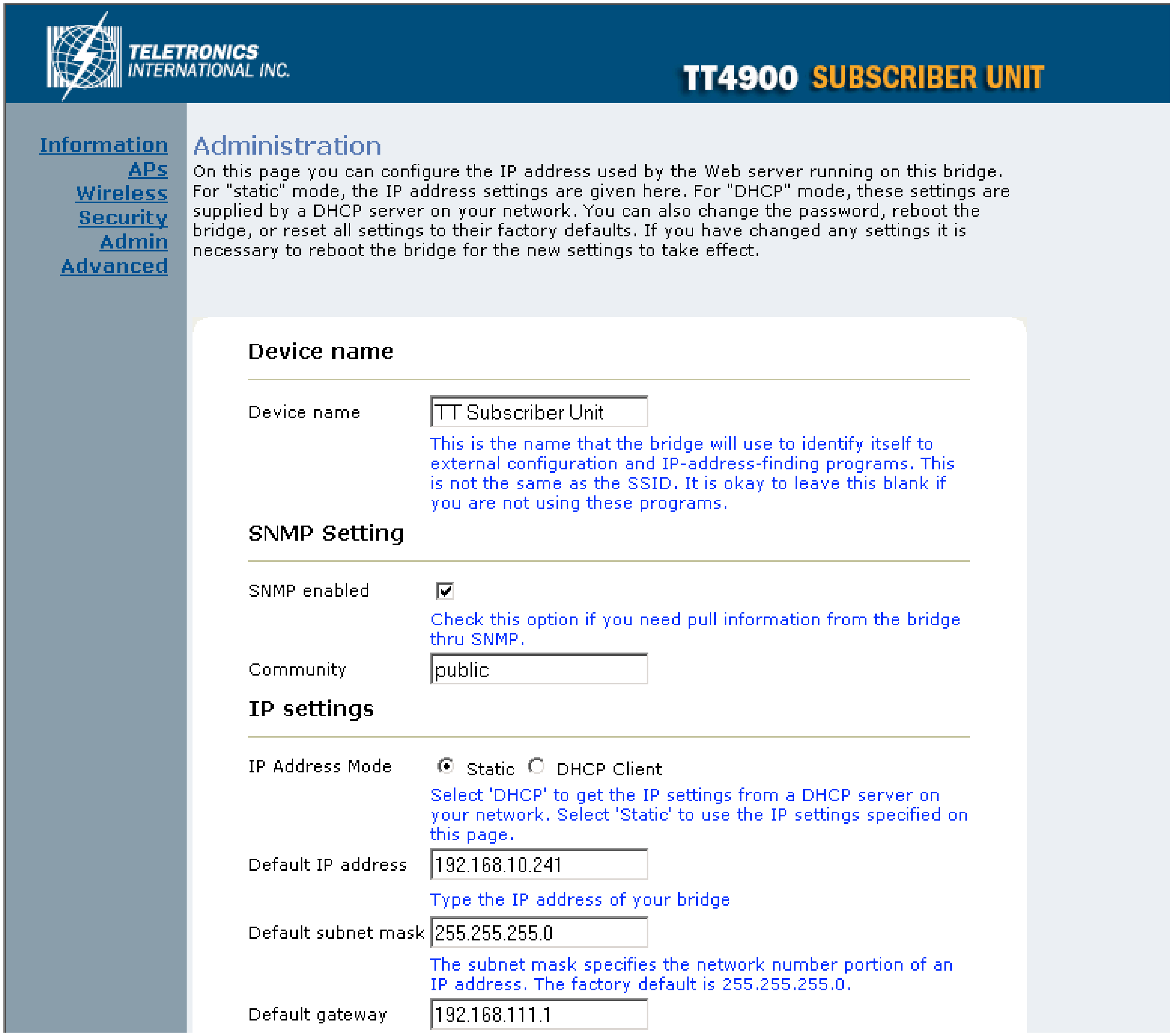
128 bit (26 Hex Digit)

WEP Key type	Example

128-bit WEP with 13 characters	Key1= 2e3f4w345ytre
	Key2= 5y7jse8r4i038
	Key3= 24fg70okx3fr7
	Key4= 98jui2wss35u4

128-bit WEP with 26 hexadecimal digits ('0-9', 'A-F')	Key1= 112233445566778899AABBCDEF
	Key2= 2233445566778899AABBCCDDEE
	Key3= 3344556677889900AABBCCDDFF
	Key4= 44556677889900AABBCCDDEEFF

Admin



Administration

On this page you can configure the IP address used by the Web server running on this bridge. For "static" mode, the IP address settings are given here. For "DHCP" mode, these settings are supplied by a DHCP server on your network. You can also change the password, reboot the bridge, or reset all settings to their factory defaults. If you have changed any settings it is necessary to reboot the bridge for the new settings to take effect.

Device name

Device name: TT Subscriber Unit

This is the name that the bridge will use to identify itself to external configuration and IP-address-finding programs. This is not the same as the SSID. It is okay to leave this blank if you are not using these programs.

SNMP Setting

SNMP enabled ☑

Check this option if you need pull information from the bridge thru SNMP.

Community: public

IP settings

IP Address Mode ● Static ○ DHCP Client

Select 'DHCP' to get the IP settings from a DHCP server on your network. Select 'Static' to use the IP settings specified on this page.

Default IP address: 192.168.10.241

Type the IP address of your bridge

Default subnet mask: 255.255.255.0

The subnet mask specifies the network number portion of an IP address. The factory default is 255.255.255.0.

Default gateway: 192.168.111.1

Device Name

This is the name that the bridge will use to identify itself to external configuration and IP address programs. This is not the same as the SSID. It is okay to leave this blank if you are not using these programs.

SNMP Setting

SNMP enable

Option to enable or disable SNMP support.

Community

The SNMP Read-only Community string is like a user id or password that allows access to a router's or other device's statistics or management information. InterMapper sends the community string along with all SNMP requests. If the community string is correct, the device responds with the requested information. If the community string is incorrect, the device simply discards the request and does not respond.

Factory default setting for the read-only community string is set to "public". It is standard practice to change all the community strings so that outsiders cannot see information about the internal network. (In addition, the administrator may also employ firewalls to block any SNMP traffic to ports 161 and 162 on the internal network.)

Change this value to have InterMapper use the new string when querying SNMP devices.

IP Settings

IP Address Mode

- **Static**
  - Manually setup an IP address for this device.
- **DHCP**
  - Set up the bridge as a DHCP client which will pick up an IP address from a DHCP server.

Default IP address

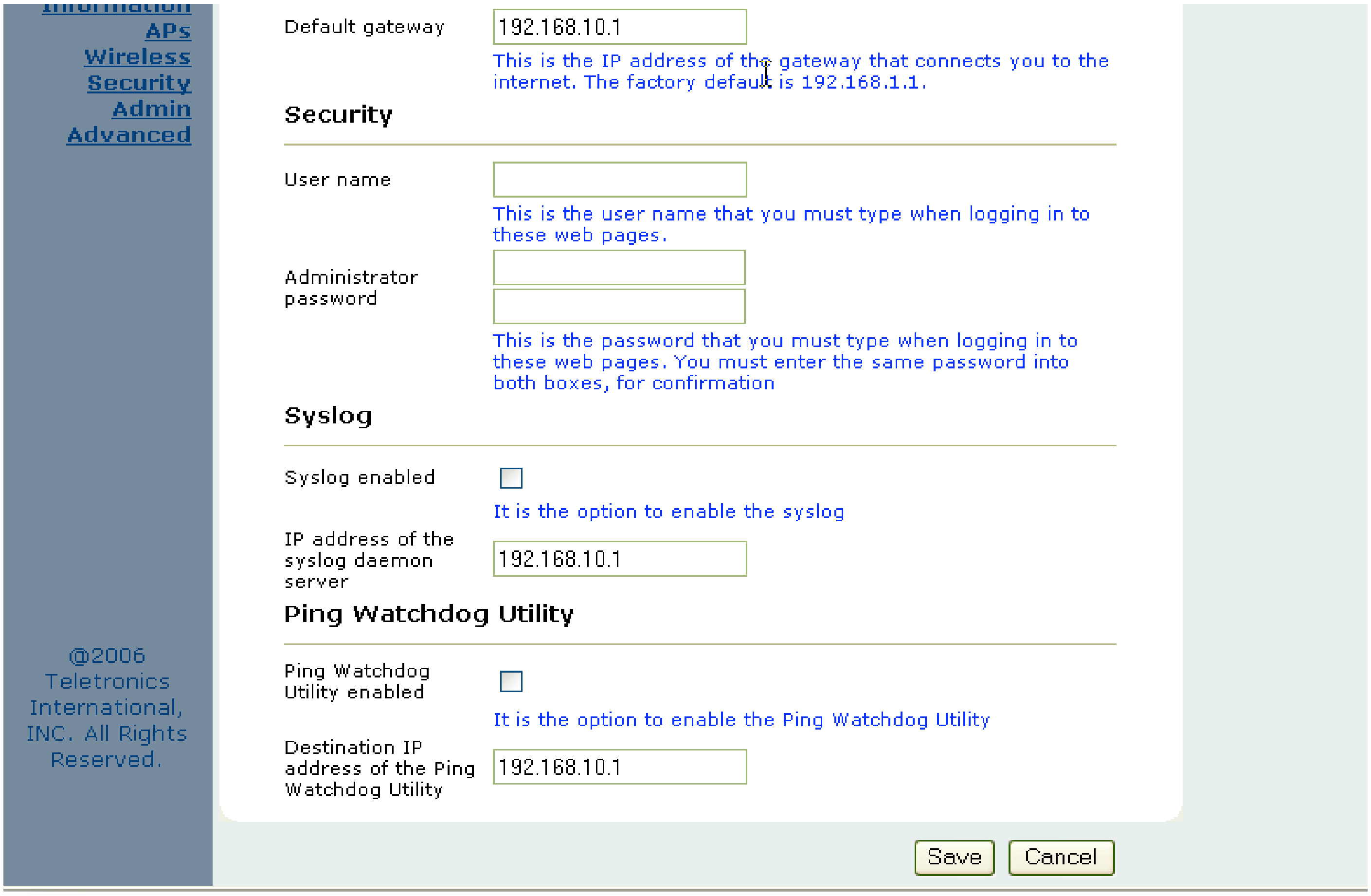
The default Client Bridge Mode IP address: 192.168.10.241

Default subnet mask

The factory subnet default value is 255.255.255.0

Default gateway

The factory gateway default address is 192.168.10.1



Default gateway 192.168.10.1

This is the IP address of the gateway that connects you to the internet. The factory default is 192.168.1.1.

Security

User name

This is the user name that you must type when logging in to these web pages.

Administrator password

This is the password that you must type when logging in to these web pages. You must enter the same password into both boxes, for confirmation

Syslog

Syslog enabled □

It is the option to enable the syslog

IP address of the syslog daemon server 192.168.10.1

Ping Watchdog Utility

Ping Watchdog Utility enabled □

It is the option to enable the Ping Watchdog Utility

Destination IP address of the Ping Watchdog Utility 192.168.10.1

Security

This section is used to set up the administrative login name and password.

User name

This is the user name that you must type when logging into the web interface.

Administrator Password

This is the password that you must type when logging into the web interface. You must enter the same password into both boxes for confirmation.

Syslog

Syslog Enabled

Option to enable or disable Syslog support.

Syslog Daemon Server

The Syslog server IP address input box.

Ping Watchdog Utility

Ping Watchdog Utility Enabled

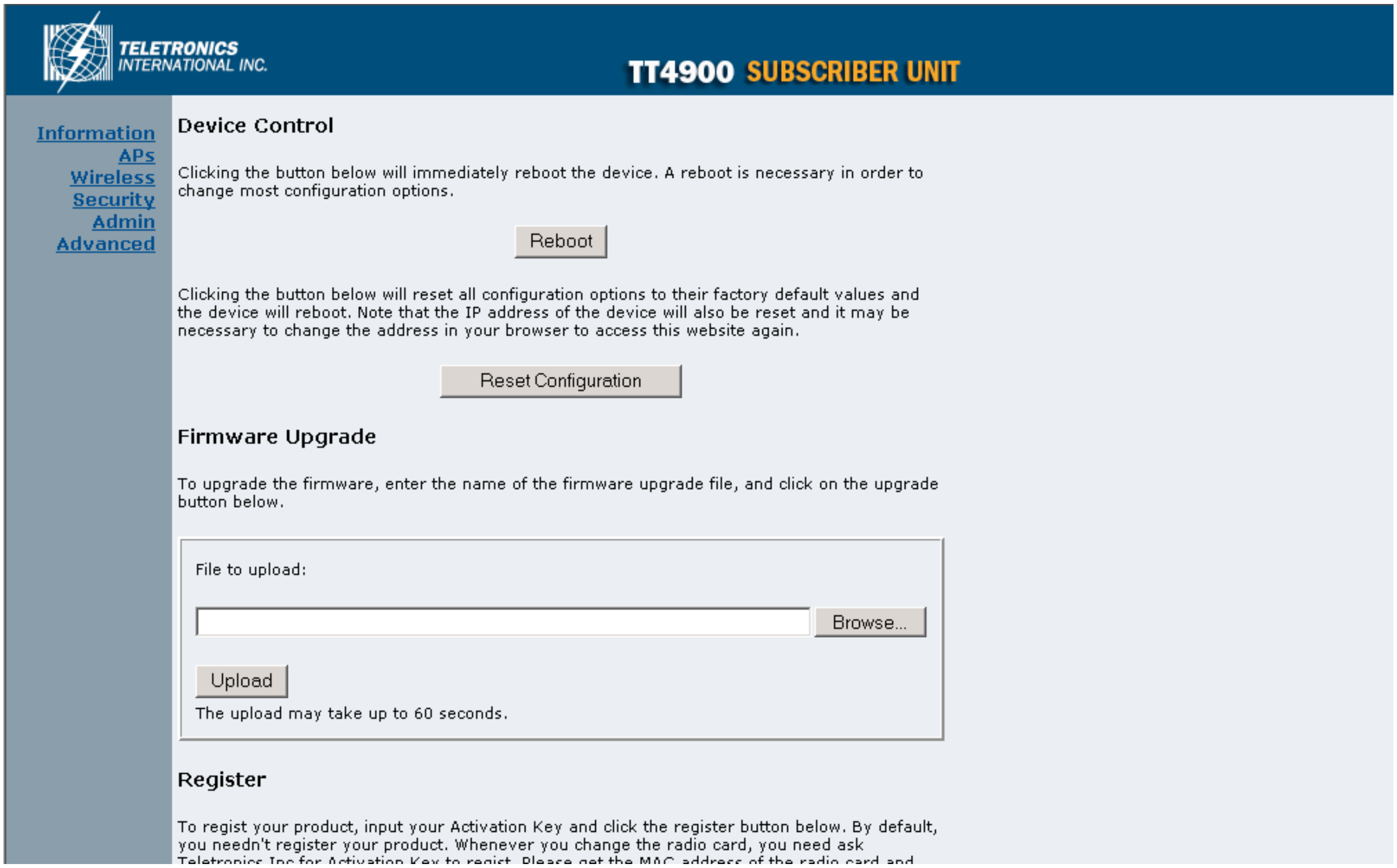
If enabled, the Ping Watchdog utility tracks the TCP/IP link between this device and another remote destination at the other end of the wireless link. When the remote destination is unreachable (loss of connection) the Ping Watchdog Utility will reboot the unit in an attempt to re-establish the connection. When the TT is up for 2 minutes, the ping watchdog utility will start to ping the remote network device every 20 seconds, if there is no icmp response for 3 times in a row then the ping watchdog will kick off the reboot action.

Destination IP address of the Ping Watchdog Utility

This is the IP address of the remote destination.

Device Control

This section has functions that will allow the TT™4900 to Reboot and Reset the system configuration to factory defaults.



Device Control

Clicking the button below will immediately reboot the device. A reboot is necessary in order to change most configuration options.

Clicking the button below will reset all configuration options to their factory default values and the device will reboot. Note that the IP address of the device will also be reset and it may be necessary to change the address in your browser to access this website again.

Firmware Upgrade

To upgrade the firmware, enter the name of the firmware upgrade file, and click on the upgrade button below.

File to upload:

The upload may take up to 60 seconds.

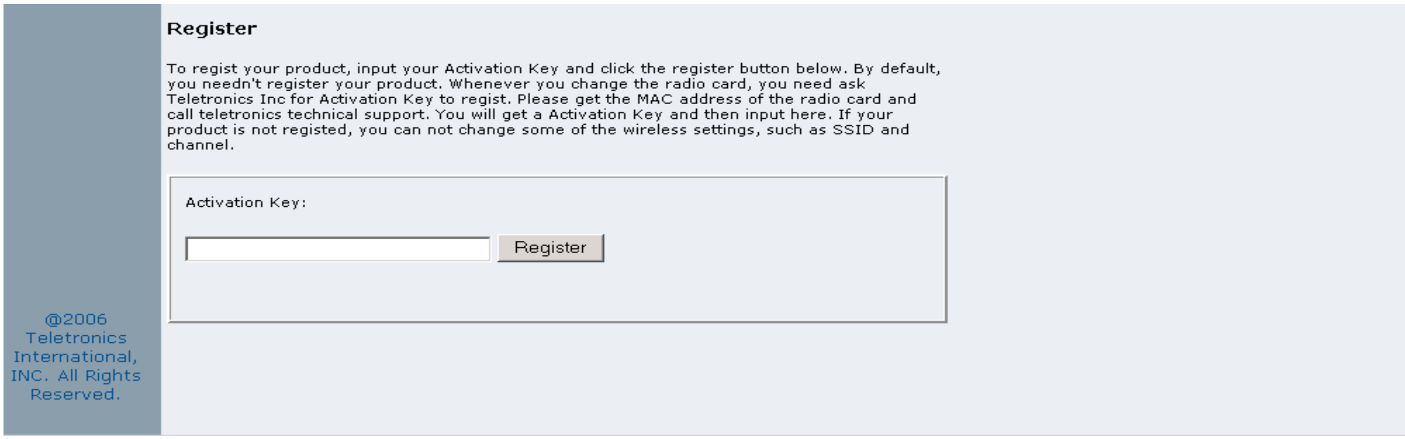
Register

To regist your product, input your Activation Key and click the register button below. By default, you needn't register your product. Whenever you change the radio card, you need ask Teletronics Inc for Activation Key to regist. Please get the MAC address of the radio card and

Firmware Upgrade

This section allows the TT™4900 firmware to be upgraded or changed directly from the web interface. Click on the Browse button to select a file from the host machine.

Register



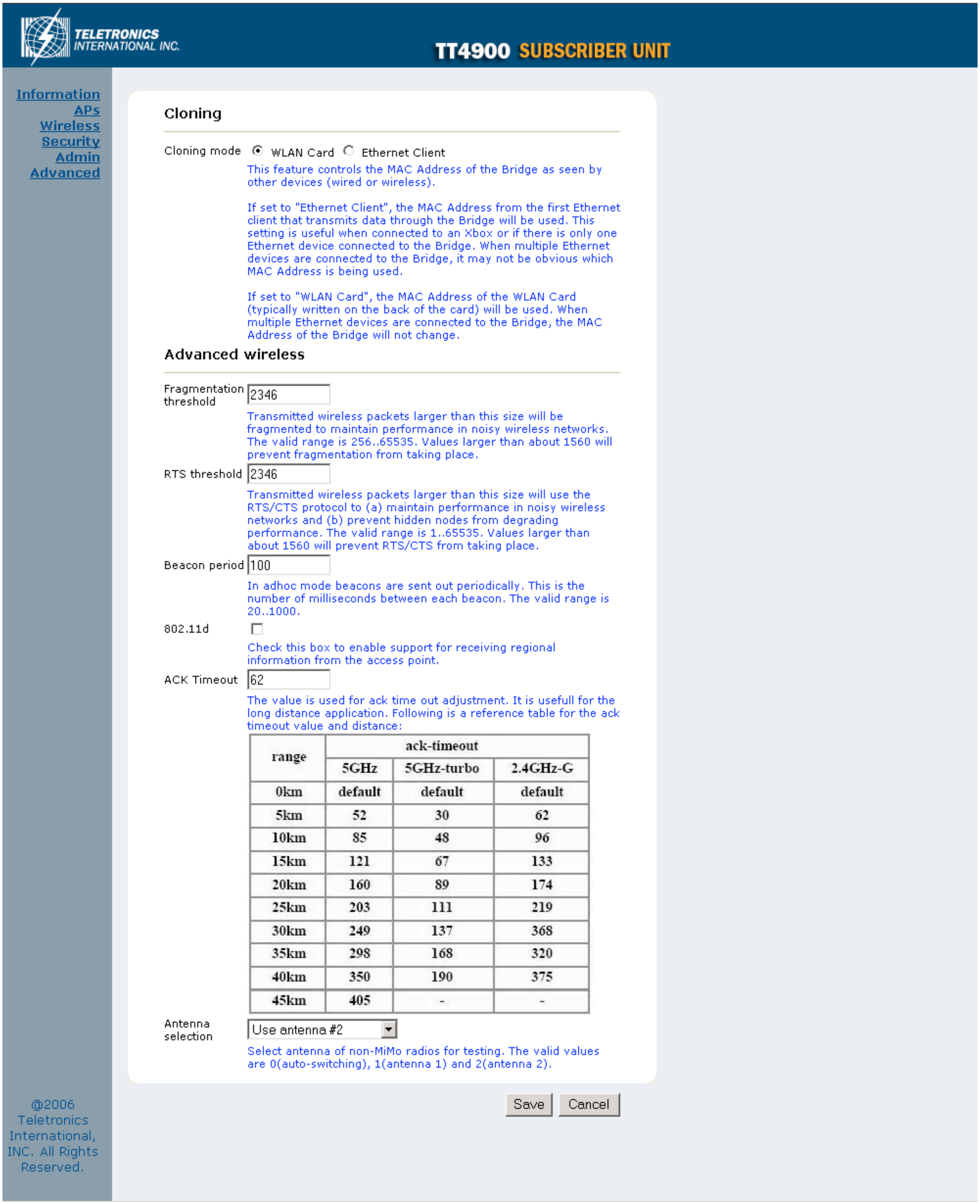
Register

To regist your product, input your Activation Key and click the register button below. By default, you needn't register your product. Whenever you change the radio card, you need ask Teletronics Inc for Activation Key to regist. Please get the MAC address of the radio card and call teletronics technical support. You will get a Activation Key and then input here. If your product is not registed, you can not change some of the wireless settings, such as SSID and channel.

Activation Key:

The TT™4900 has implemented a hardware modification authorization process to prevent use by fraudulent hardware from other manufacturers. This will require any hardware change on the radio card used on the TT™4900 to input a serial code generated based on each unique MAC address. Please contact Teletronics Support to a pickup a valid serial number to deactivate the pre-registration protection after a radio card swap. If the unit is not registered some features such as SSID and Wireless Channel selection will be disabled.

Advanced


TELETRONICS INTERNATIONAL INC.
TT4900 SUBSCRIBER UNIT
Information
APs
Wireless
Security
Admin
Advanced
Save
Cancel
@2006 Teletronics International, INC. All Rights Reserved.

Cloning

Cloning mode ● WLAN Card ○ Ethernet Client

This feature controls the MAC Address of the Bridge as seen by other devices (wired or wireless).

If set to "Ethernet Client", the MAC Address from the first Ethernet client that transmits data through the Bridge will be used. This setting is useful when connected to an Xbox or if there is only one Ethernet device connected to the Bridge. When multiple Ethernet devices are connected to the Bridge, it may not be obvious which MAC Address is being used.

If set to "WLAN Card", the MAC Address of the WLAN Card (typically written on the back of the card) will be used. When multiple Ethernet devices are connected to the Bridge, the MAC Address of the Bridge will not change.

Advanced wireless

Fragmentation threshold 2346

Transmitted wireless packets larger than this size will be fragmented to maintain performance in noisy wireless networks. The valid range is 256..65535. Values larger than about 1560 will prevent fragmentation from taking place.

RTS threshold 2346

Transmitted wireless packets larger than this size will use the RTS/CTS protocol to (a) maintain performance in noisy wireless networks and (b) prevent hidden nodes from degrading performance. The valid range is 1..65535. Values larger than about 1560 will prevent RTS/CTS from taking place.

Beacon period 100

In adhoc mode beacons are sent out periodically. This is the number of milliseconds between each beacon. The valid range is 20..1000.

802.11d □

Check this box to enable support for receiving regional information from the access point.

ACK Timeout 62

The value is used for ack time out adjustment. It is usefull for the long distance application. Following is a reference table for the ack timeout value and distance:

range	ack-timeout		
	5GHz	5GHz-turbo	2.4GHz-G
0km	default	default	default
5km	52	30	62
10km	85	48	96
15km	121	67	133
20km	160	89	174
25km	203	111	219
30km	249	137	368
35km	298	168	320
40km	350	190	375
45km	405	-	-

Antenna selection Use antenna #2

Select antenna of non-MiMo radios for testing. The valid values are 0(auto-switching), 1(antenna 1) and 2(antenna 2).

Cloning

Cloning Mode

- WLAN Card
  - If set to "WLAN Card", the MAC Address of the WLAN Card will be used. When multiple Ethernet devices are connected to the Bridge, the MAC Address of the Bridge will not change.
- Ethernet Client
  - If set to "Ethernet Client", the MAC Address from the first Ethernet client that transmits data through the Bridge will be used. This means the client MAC address will become the alias address to the Bridge.

Advanced Wireless

Fragmentation threshold

Fragmentation Threshold is the maximum length of the frame beyond which payload must be broken up (fragmented) into two or more frames. Collisions occur more often for long frames because sending them occupies the channel for a longer period of time, increasing the chance that another station will transmit and cause collision. Reducing Fragmentation Threshold results in shorter frames that "busy" the channel for shorter periods, reducing packet error rate and resulting retransmissions. However, shorter frames also increase overhead, degrading maximum possible throughput, so adjusting this parameter means striking a good balance between error rate and throughput.

RTS threshold

RTS Threshold is the frame size above which an RTS/CTS handshake will be performed before attempting to transmit. RTS/CTS asks for permission to transmit to reduce collisions but adds considerable overhead. Disabling RTS/CTS can reduce overhead and latency in WLANs where all stations are close together but can increase collisions and degrade performance in WLANs where stations are far apart and unable to sense each other to avoid collisions (aka Hidden Nodes). If you are experiencing excessive collisions you can try turning RTS/CTS on or (if already on) reduce RTS/CTS Threshold on the affected stations.

Burst time

Maximum burst time is a feature based on the PRISM Nitro; a new WLAN software solution that more than triples 802.11g throughput in a mixed-mode environment and offers up to 50 percent greater throughput performance in 802.11g-only networks. PRISM Nitro is fully IEEE 802.11 compliant and uses prioritization algorithms and enhanced protection mechanisms to significantly increase wireless networking performance.

The recommended value for the maximum burst time for 11b or the mixed 11b/g environment is 650. The 11g only mode uses the value 1400.

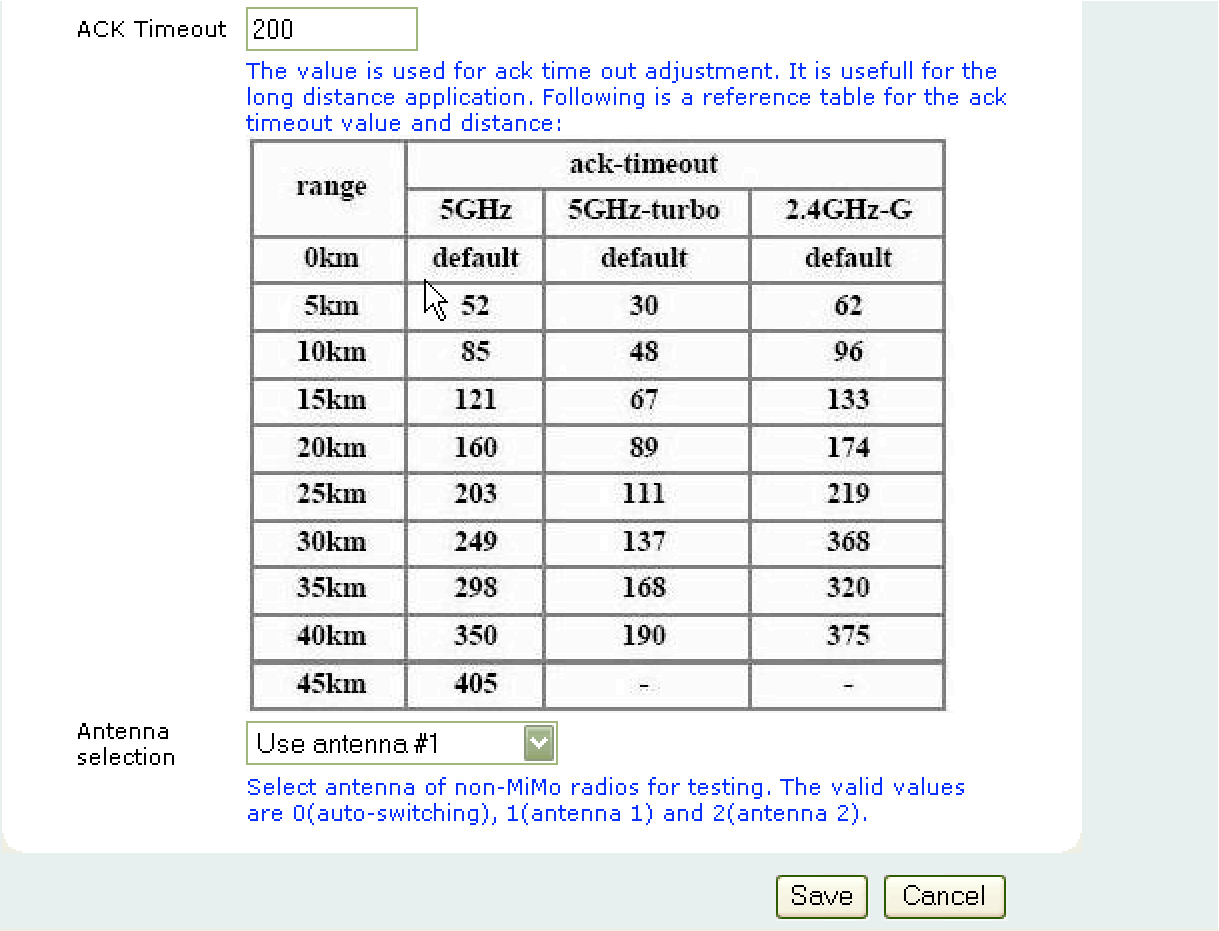
Beacon Period

In wireless networking, a beacon is a packet sent by a connected device to inform other devices of its presence and readiness. When a wirelessly networked device sends a beacon, it includes with it a beacon interval which specifies the period of time before it will send the beacon again. The interval tells receiving devices on the network how long they can wait in low-power mode before waking up to handle the beacon. Network managers can adjust the beacon interval, usually measured in milliseconds (ms) or its equivalent, kilo microseconds (K_sec).

802.11d

802.11d is a wireless network communications specification for use in countries where systems using other standards in the 802.11 family are not allowed to operate. The 802.11d specification is well suited for systems that want to provide global Roaming.

ACK Timeout



ACK Timeout: 200

The value is used for ack time out adjustment. It is usefull for the long distance application. Following is a reference table for the ack timeout value and distance:

range	ack-timeout		
	5GHz	5GHz-turbo	2.4GHz-G
0km	default	default	default
5km	52	30	62
10km	85	48	96
15km	121	67	133
20km	160	89	174
25km	203	111	219
30km	249	137	368
35km	298	168	320
40km	350	190	375
45km	405	-	-

Antenna selection: Use antenna #1

Select antenna of non-MiMo radios for testing. The valid values are 0(auto-switching), 1(antenna 1) and 2(antenna 2).

When a packet is sent out from 802.11 Station A it will wait for an 'ACKnowledgement frame' from 802.11 Station B. Station A will only wait for a certain amount of time (ACK timeout) or ACK window. If the ACK is NOT received within that timeout period then the packet will be re-transmitted from Station A resulting in reduced throughput. When sending LOTS of packets as in 802.11g and 802.11a the constant re-transmission could cost severe performance degradation due to the ACK frame not making it back to 802.11 Station A in time. This will have a dramatic impact on the throughput of the link regardless of the quantity of signal strength and good receiver sensitivity.

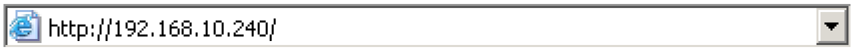
Antenna Selection

** Please refer to Appendix G on page 58 for further information.*

Access Point Mode

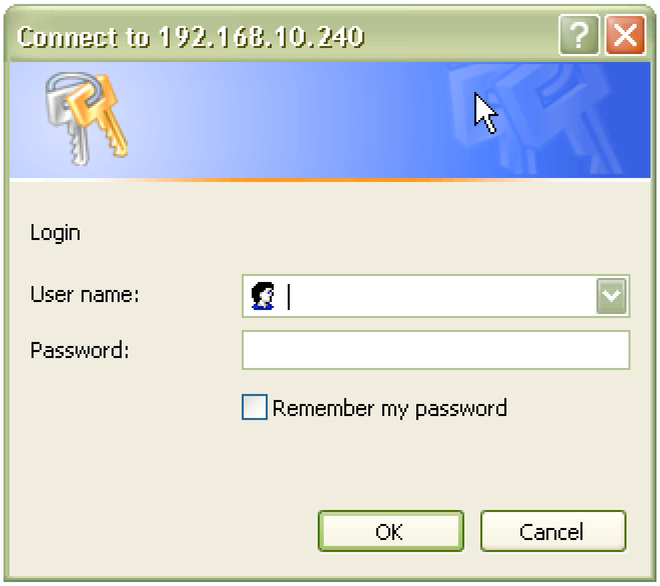
Default IP Address in Access Point Mode: **192.168.10.240**

To access the web control interface please open up a browser window and type in the factory default IP address in the URL.



http://192.168.10.240/

Press Enter on your keyboard and a login prompt window similar to the one shown below will appear.



Connect to 192.168.10.240

Login

User name:

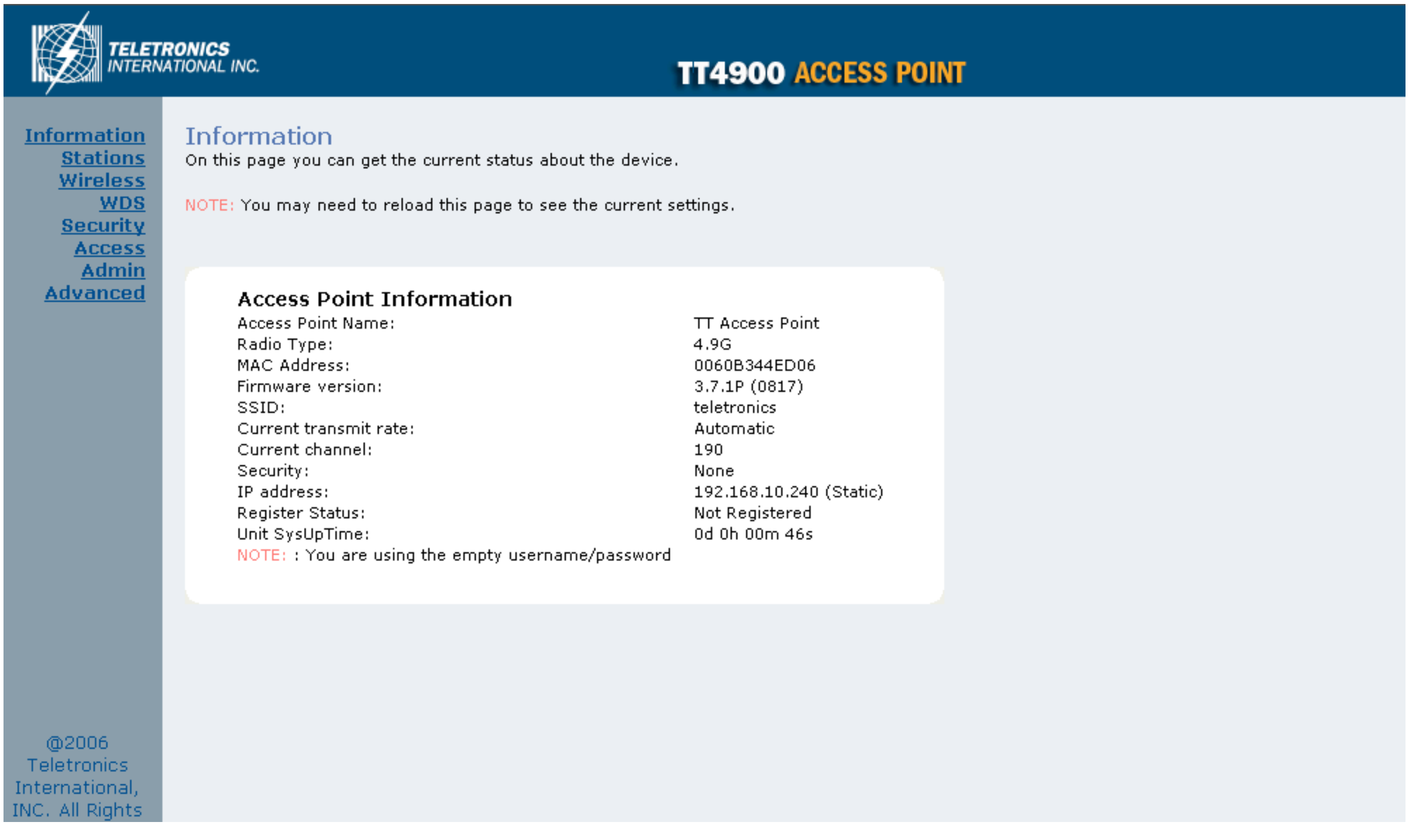
Password:

□ Remember my password

There is no default User name or Password. Leave User Name and Password field blank and then click OK.

Note: You may set a new password by clicking the Admin tab after you enter the Web Configuration page

Information



Information

On this page you can get the current status about the device.

NOTE: You may need to reload this page to see the current settings.

Access Point Information

Access Point Name:	TT Access Point
Radio Type:	4.9G
MAC Address:	0060B344ED06
Firmware version:	3.7.1P (0817)
SSID:	teletronics
Current transmit rate:	Automatic
Current channel:	190
Security:	None
IP address:	192.168.10.240 (Static)
Register Status:	Not Registered
Unit SysUpTime:	0d 0h 00m 46s

NOTE: : You are using the empty username/password

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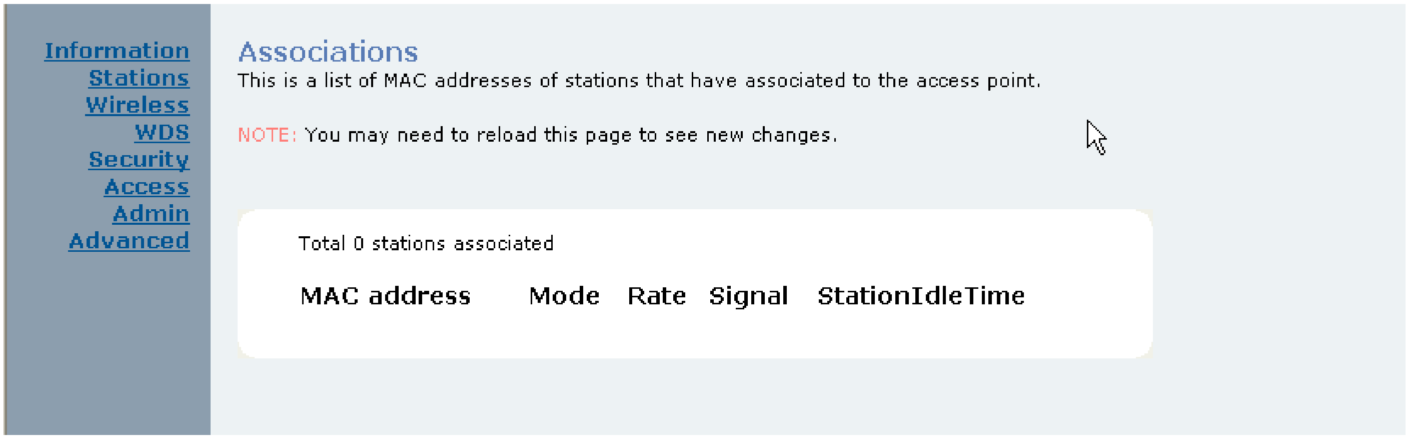
Under the main web interface home page you will see the following configuration menu pages:

Information, Stations, Wireless, WDS, Security, Access, Admin, Advanced. Detailed information on each section is provided below.

Stations



Associations

This is a list of MAC addresses of stations that have associated to the access point.

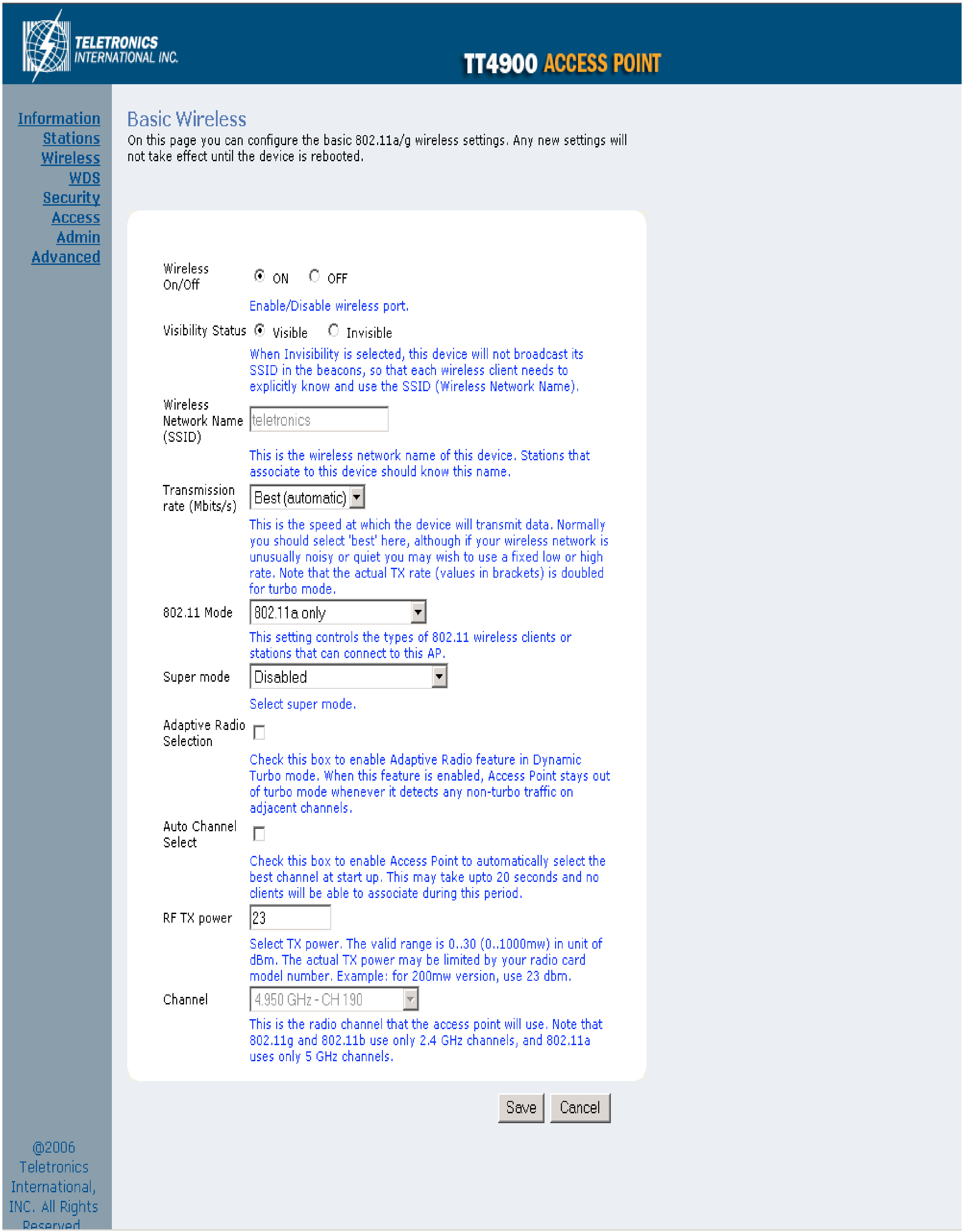
NOTE: You may need to reload this page to see new changes.

Total 0 stations associated

MAC address	Mode	Rate	Signal	StationIdleTime

The Stations section will display all the associated clients along with the MAC address and basic RF related information on the Mode, Rate, Signal and StationIdleTime for each associated client.

Wireless



Basic Wireless

On this page you can configure the basic 802.11a/g wireless settings. Any new settings will not take effect until the device is rebooted.

Wireless On/Off ● ON ○ OFF

Enable/Disable wireless port.

Visibility Status ● Visible ○ Invisible

When Invisibility is selected, this device will not broadcast its SSID in the beacons, so that each wireless client needs to explicitly know and use the SSID (Wireless Network Name).

Wireless Network Name (SSID) teletronics

This is the wireless network name of this device. Stations that associate to this device should know this name.

Transmission rate (Mbits/s) Best (automatic)

This is the speed at which the device will transmit data. Normally you should select 'best' here, although if your wireless network is unusually noisy or quiet you may wish to use a fixed low or high rate. Note that the actual TX rate (values in brackets) is doubled for turbo mode.

802.11 Mode 802.11a only

This setting controls the types of 802.11 wireless clients or stations that can connect to this AP.

Super mode Disabled

Select super mode.

Adaptive Radio Selection □

Check this box to enable Adaptive Radio feature in Dynamic Turbo mode. When this feature is enabled, Access Point stays out of turbo mode whenever it detects any non-turbo traffic on adjacent channels.

Auto Channel Select □

Check this box to enable Access Point to automatically select the best channel at start up. This may take upto 20 seconds and no clients will be able to associate during this period.

RF TX power 23

Select TX power. The valid range is 0..30 (0..1000mw) in unit of dBm. The actual TX power may be limited by your radio card model number. Example: for 200mw version, use 23 dbm.

Channel 4.950 GHz - CH 190

This is the radio channel that the access point will use. Note that 802.11g and 802.11b use only 2.4 GHz channels, and 802.11a uses only 5 GHz channels.

Wireless On/Off

Enable or disable the wireless port.

Wireless Network Name (SSID)

Network Name is also known as SSID, which stands for Service Set Identifier. This is where you're going to setup the Service Set Identifier name for this AP. Remember that the SSID is cap sensitive just like the password.

Visibility Status

This controls the SSID broadcasting function. If enabled, the SSID will be broadcasted to all wireless clients in the area. If disabled, wireless clients will not be able to pickup the SSID but must explicitly know the SSID of the unit in order to associate. The recommended practice is to set the visibility status to invisible after setting up the wireless network.

Transmission rate (Mbits/s)

This option indicates the transmission rate of the bridge. Specify the rate according to the speed of your wireless network from the list. Most of the time the default setting, Best (automatic), should be selected for best performance. The setting can be adjusted manually if the link quality and signal strength are unusually low or high to get the best performance.

802.11 Mode

Wireless mode allows the user to select whether this Access Point will connect to an 802.11b only network, an 802.11g only network, an 802.11a only network or both b/g networks. For b or g only wireless devices on the network, selecting 802.11b or 802.11g only mode will provide better performance than mixed mode. In the case of TT™4900 only 802.11a mode is allowed.

Adaptive Radio Selection

When using dynamic turbo mode with a compatible Atheros radio chipset, this option allows the Access point to switch to non-turbo mode when non-turbo traffic is detected and vice versa.

Super Mode

Super Mode is only supported if both the client and the AP are using compatible Atheros radio chipsets.

- Disabled
- Super A/G without Turbo
- Super A/G with Static Turbo
- Super A/G with Dynamic Turbo (AR enabled)

Auto Channel Select

Check this box to enable the Access Point to automatically select the best channel at start up. This may take up to 20 seconds and during this period no clients will be able to associate.

RF Transmit Power

This section controls the power output for the mini-PCI radio card. The valid input range for this section is in the range of 0-30 in dBm units. The default value is 23 dBm or 200mW.

Channel

Channels are important to understand because they affect the overall capacity of your Wireless LAN. A channel represents a narrow band of radio frequency. A radio frequency modulates within a band of frequencies; as a result there is a limited amount of bandwidth within any given range to carry data. It is important that the frequencies do not overlap or else the throughput would be significantly reduced as the network sorts and reassembles the data packets sent over the air.

For the TT™4900: 2.4 GHz – 2.497 GHz frequency range, there are only 3 channels out of the 11 available that do not overlap with one another. To avoid interference within a network with multiple APs, set each AP to use one of the 3 channels (e.g. Channel 1) and then the other AP to be one of the other 2 channels (i.e. Channel 6 or Channel 11) within the range of the wireless radio. This simple method will reduce interference and improve network reliability.

802.11b/g Wireless Channel Frequency Range: 2.4 GHz – 2.497 GHz
<u>802.11b/g Non-overlapping Channel Frequency Ranges</u>

- Channel 1 = 2.401 GHz – 2.423 GHz
- Channel 6 = 2.426 GHz – 2.448 GHz
- Channel 11 = 2.451 GHz – 2.473 GHz

Americas: Wireless Channels 1 – 11
Asia: Wireless Channels 1 – 14
Europe: Wireless Channels 1 – 13

802.11a Wireless Channel Frequency Range: 5.15 GHz – 5.35 GHz, 5.725 – 5.825

802.11a is an extension to 802.11 that applies to wireless LANs and provides up to 54 Mbps in the 5GHz band. 802.11a uses an orthogonal frequency division multiplexing encoding scheme rather than FHSS or DSSS. Unlike that of 802.11b/g, 802.11a standard separates its channels into 3-100MHz segments in the US.

The lower and middle band accommodates 8 channels in a total bandwidth of 200 MHz and the upper band accommodates 4 channels in a 100 MHz bandwidth. The frequency channel center frequencies are spaced 20 MHz apart. The outermost channels of the lower and middle bands are centered 30 MHz from the outer edges. In the upper band the outermost channel centers are 20 MHz from the outer edges.

In addition to the frequency and channel allocations, transmit power is a key parameter regulated in the 5 GHz U-NII band. Three transmit power levels are specified: 40 mW, 200 mW and 800 mW. The upper band defines RF transmit power levels suitable for bridging applications while the lower band specifies a transmit power level suitable for short-range indoor home and small office environments.

<u>802.11a Non-overlapping Channel Frequency Ranges</u>

Lower Band (5.15 - 5.25 GHz) – Maximum Output Power 40mW

- Channel 36 = 5.15 – 5.18
- Channel 40 = 5.18 – 5.20
- Channel 44 = 5.20 – 5.22
- Channel 48 = 5.22 – 5.25

Middle Band (5.25 - 5.35 GHz) – Maximum Output Power 200mW

- Channel 52 = 5.25 – 5.28
- Channel 56 = 5.28 – 5.30
- Channel 60 = 5.30 – 5.32
- Channel 64 = 5.32 – 5.35

Upper Band (5.725 - 5.825 GHz) – Maximum Output Power 800mW

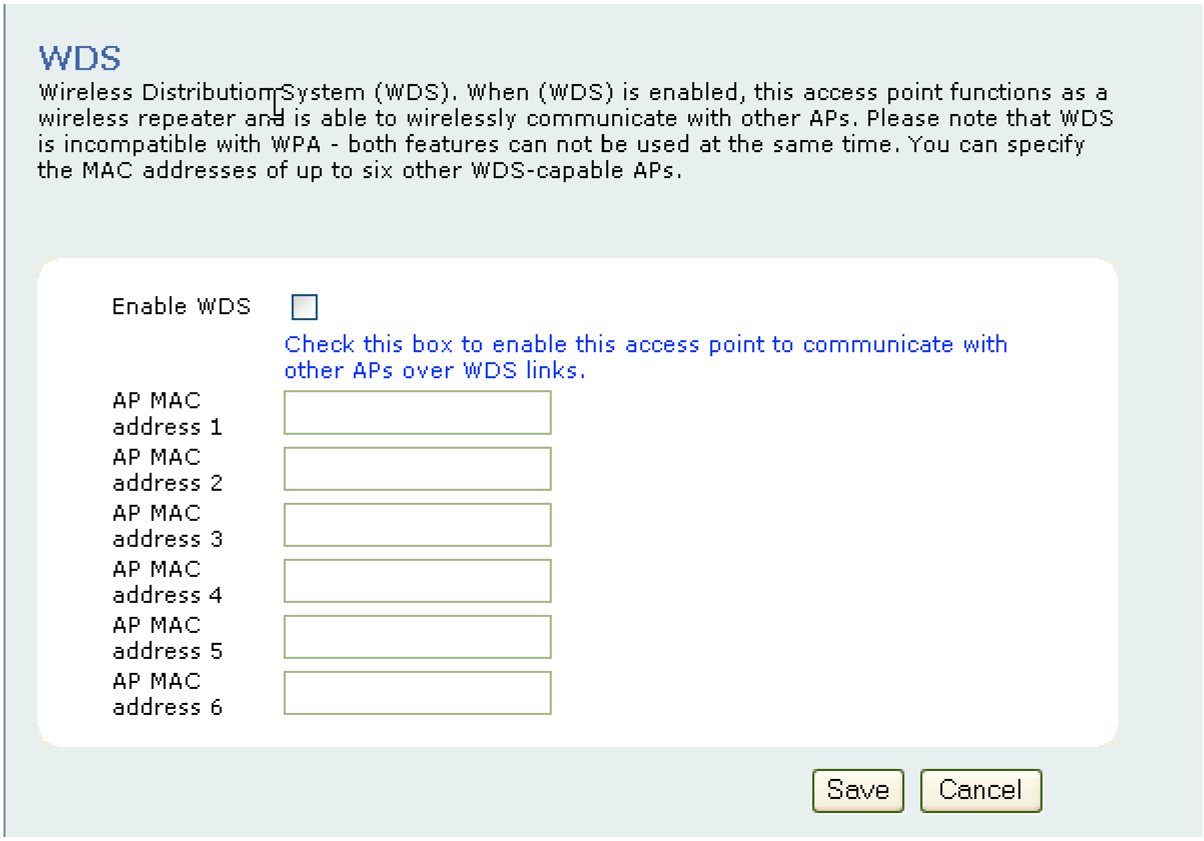
- Channel 149 = 5.725 – 5.745

- Channel 153 = 5.745 – 5.765
- Channel 157 = 5.765 – 5.785
- Channel 161 = 5.785 – 5.805
- Channel 165 = 5.805 – 5.825

Special Atheros Turbo Mode Channels
**Use this setting only when both side of the wireless connection is using the Atheros chipset. The radio will combine 2 free channels for the wireless transmission to double the bandwidth.*

- Channel 42 = 5.210
- Channel 50 = 5.250
- Channel 58 = 5.290
- Channel 152 = 5.760
- Channel 160 = 5.800

WDS (Wireless Distribution System)



WDS

Wireless Distribution System (WDS). When (WDS) is enabled, this access point functions as a wireless repeater and is able to wirelessly communicate with other APs. Please note that WDS is incompatible with WPA - both features can not be used at the same time. You can specify the MAC addresses of up to six other WDS-capable APs.

Enable WDS □

Check this box to enable this access point to communicate with other APs over WDS links.

AP MAC address 1

AP MAC address 2

AP MAC address 3

AP MAC address 4

AP MAC address 5

AP MAC address 6

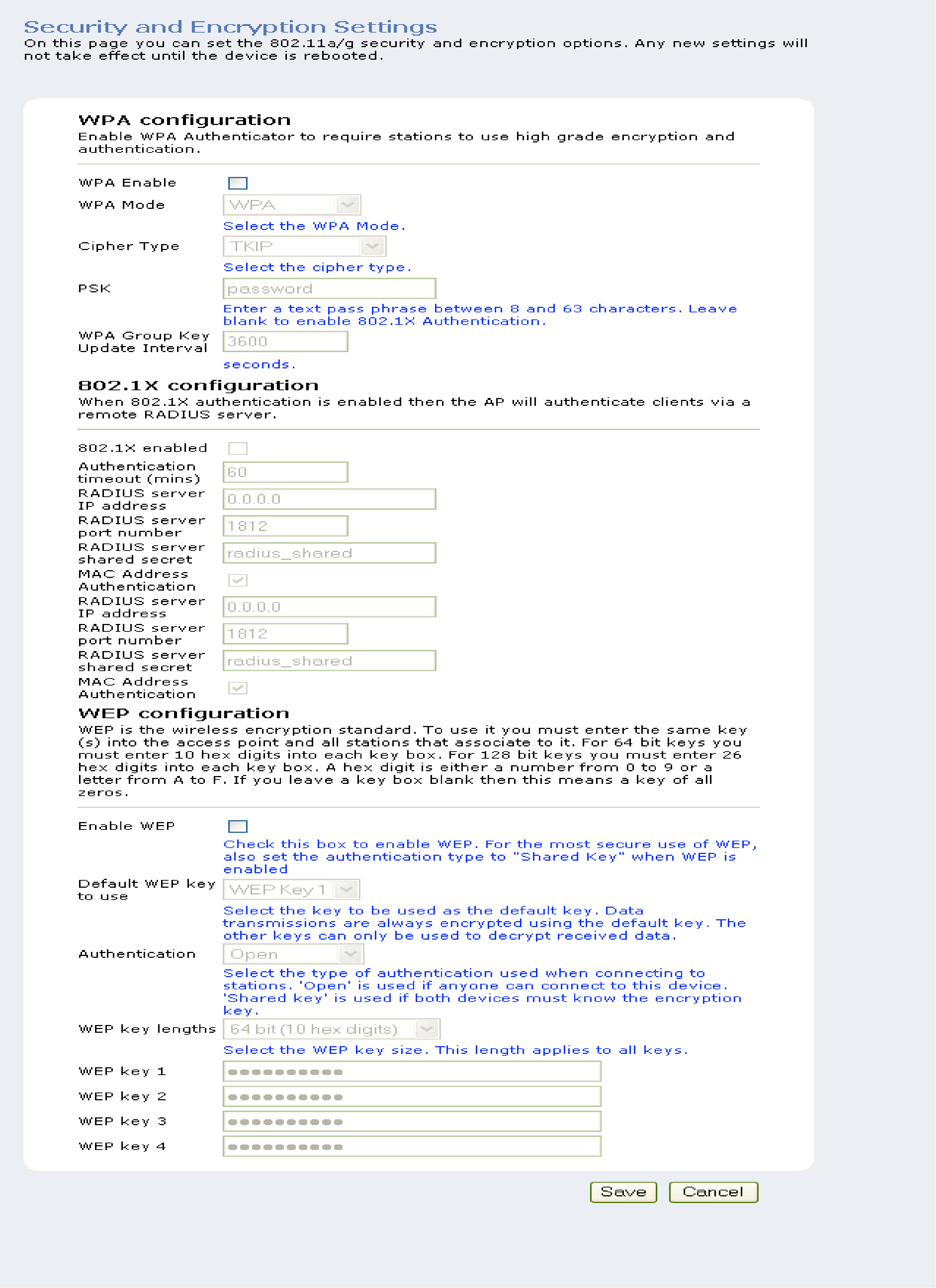
Enable WDS

The Wireless Distribution System (Repeater) functionality enables this AP to support wireless traffic to other WDS relay Access Points. In other words it is like bridging between the 2 access points in order to extend the reach of the wireless network beyond that of a single AP. By enabling the WDS feature the coverage area of the wireless network is thus extended for authenticated client devices that can roam from this Access Point to another. WDS can extend the reach of your network into areas where cabling might be difficult. The TT™4900 in Access Point mode can support up to 6 other Access Points for WDS communication.

Enter the MAC Address of other Access Points in the area that you want to add to the WDS. The MAC Address of this Access Point should be also be added to other access points in the same WDS network to enable intra-AP communication.

**** Please Consult Appendix E on page 54 for further information.***

Security



Security and Encryption Settings

On this page you can set the 802.11a/g security and encryption options. Any new settings will not take effect until the device is rebooted.

WPA configuration

Enable WPA Authenticator to require stations to use high grade encryption and authentication.

WPA Enable	□
WPA Mode	WPA Select the WPA Mode.
Cipher Type	TKIP Select the cipher type.
PSK	password Enter a text pass phrase between 8 and 63 characters. Leave blank to enable 802.1X Authentication.
WPA Group Key Update Interval	3600 seconds.

802.1X configuration

When 802.1X authentication is enabled then the AP will authenticate clients via a remote RADIUS server.

802.1X enabled	□
Authentication timeout (mins)	60
RADIUS server IP address	0.0.0.0
RADIUS server port number	1812
RADIUS server shared secret	radius_shared
MAC Address Authentication	☑
RADIUS server IP address	0.0.0.0
RADIUS server port number	1812
RADIUS server shared secret	radius_shared
MAC Address Authentication	☑

WEP configuration

WEP is the wireless encryption standard. To use it you must enter the same key (s) into the access point and all stations that associate to it. For 64 bit keys you must enter 10 hex digits into each key box. For 128 bit keys you must enter 26 hex digits into each key box. A hex digit is either a number from 0 to 9 or a letter from A to F. If you leave a key box blank then this means a key of all zeros.

Enable WEP	□ Check this box to enable WEP. For the most secure use of WEP, also set the authentication type to "Shared Key" when WEP is enabled
Default WEP key to use	WEP Key 1 Select the key to be used as the default key. Data transmissions are always encrypted using the default key. The other keys can only be used to decrypt received data.
Authentication	Open Select the type of authentication used when connecting to stations. 'Open' is used if anyone can connect to this device. 'Shared key' is used if both devices must know the encryption key.
WEP key lengths	64 bit (10 hex digits) Select the WEP key size. This length applies to all keys.
WEP key 1	••••••••••
WEP key 2	••••••••••
WEP key 3	••••••••••
WEP key 4	••••••••••

WPA Configuration

Short for Wi-Fi Protected Access, WPA is a Wi-Fi standard that was designed to improve upon the security features of WEP. WPA has the following improvements over WEP:

- Improved data encryption through temporal key integrity protocol (TKIP). TKIP scrambles the keys using a hashing algorithm. By adding an integrity-checking feature, TKIP ensures that keys have not been tampered with.

- User authentication through the Extensible Authentication Protocol (EAP). WEP regulates access to a wireless network based on a computer's hardware-specific MAC address, which is relatively simple to be sniffed out and stolen. EAP is built on a more secure public-key encryption system to ensure that only authorized network users can access the network.

WPA Enable

This option enables the WPA Authenticator. Note that any client that does not support the WPA standard will not be able to handshake / authenticate with a WPA enabled device.

WPA Mode

- WPA
  - Designed to secure present and future versions of IEEE 802.11 devices, WPA is a subset of the IEEE 802.11i specification. WPA addresses all known vulnerabilities in WEP. WPA also provides user authentication, since WEP lacks any means of authentication. WPA replaces WEP with a strong new encryption technology called Temporal Key Integrity Protocol (TKIP) with Message Integrity Check (MIC). It also provides a scheme of mutual authentication using IEEE 802.1X/Extensible Authentication Protocol (EAP) authentication or pre-shared key (PSK) technology. WPA was designed and has been scrutinized by well-known cryptographers. It can be implemented immediately and inexpensively as a software or firmware upgrade to most existing Wi-Fi CERTIFIED™ access points and client devices with minimal degradation in network performance. WPA offers standards-based, Wi-Fi CERTIFIED security. It assures users that the Wi-Fi CERTIFIED devices they buy will be cross-vendor compatible. When properly installed, WPA provides a high level of assurance to enterprises, small businesses and home users that data will remain protected and that only authorized users may access their networks. For enterprises that have already deployed IEEE 802.1X authentication, WPA offers the advantage of leveraging existing authentication databases and infrastructure.
- WPA2
  - WPA2 is the second generation of WPA security; providing enterprise and consumer Wi-Fi® users with a high level of assurance that only authorized users can access their wireless networks. Launched in September 2004 by the Wi-Fi Alliance, WPA2 is the certified interoperable version of the full IEEE 802.11i specification which was ratified in June 2004. Like WPA, WPA2 supports IEEE 802.1X/EAP authentication or PSK technology. It also includes a new advanced encryption mechanism using the Counter-Mode/CBC-MAC Protocol (CCMP) called the Advanced Encryption Standard (AES). AES satisfies U.S. government security requirements. It has been adopted as an official government standard by the U.S. Department of Commerce and the National Institute of Standards and Technology (NIST). Organizations that require the AES encryption available in WPA2 should be aware that upgrading to it may require new hardware. Section II of this document offers a roadmap for organizations planning to upgrade to WPA2. Considerations for its deployment are outlined in Section III.

Cipher Type

- TKIP
  - Temporal Key Integrity Protocol is an upgrade to the WEP known as WEP 1.1 that fixes known security problems in WEP's implementation of the RC4 stream cipher. TKIP scrambles the keys using a hashing algorithm and by adding an integrity-checking feature, ensures that the keys haven't been tampered with.

- AES
  - Advanced Encryption Standard (Rijndael Cypher) is the U.S. government's next-generation cryptography algorithm, which will replace DES and 3DES. AES works at multiple network layers simultaneously. AES Supports 128, 192 and 256 bit keys. Unlike the older standard, AES and 802.11i (WEP version 2) are based on 32bit processing.

- TKIP and AES
  - If clients support both the TKIP and AES standards then this would be the strongest cipher type to use that combines both TKIP and AES security.

PSK

PSK stands for Pre-Shared-Key and serves as a password. User may key in 8 to 63 characters string to set the password and activate 802.1x Authentication. Note that the same password must be used at both ends of the communication link (access point and client end).

WPA Group Key Update Interval

The Group Key (Group Transient Key) is a shared key among all Supplicants connected to the same AP, and is used to secure multicast/broadcast traffic. It is not used for normal unicast traffic. A pair wise Transient Key secures the unicast traffic. Group Key renewal controls how often the Group Transient Key is changed. The Group Key renewal does not control the update period for the pair wise Transient Key. The pair wise Transient Key is changed each time the Supplicant authenticates or re-authenticates.

802.1X Configuration

Remote RADIUS server configuration settings. There are two sections to setup 2 RADIUS servers for the TT™4900 to connect to. At any given time the TT™4900 will connect to one RADIUS server for authentication and will use the other one as a backup if that option is configured.

802.1X enabled

Option that enables or disables remote RADIUS authentication.

Authentication timeout (mins)

The default value is 60(minutes). When the time expires, the device will re-authenticate with RADIUS server.

RADIUS server IP address

Enter the RADIUS server IP address.

RADIUS server port number

Port used for RADIUS, the port number must be the same as the RADIUS server's, normally the port is 1812.

RADIUS server shared secret

When registered with a RADIUS server, a password will be assigned. This would be the RADIUS server shared secret.

MAC Address Authentication

Use client MAC address for authentication with RAIDUS server.

WEP Configuration

Short for Wired Equivalent Privacy, a security protocol for wireless local area networks (WLANs) defined in the 802.11b standard. WEP is designed to provide the same level of security as that of a wired LAN.

Enable WEP

To enable the WEP Authenticator

Default WEP key to use

- WEP Key 1-4

Select the key to be used as the default key. Data transmissions are always encrypted using the default key. The other keys can only be used to decrypt received data.

Authentication

- Open - Open system authentication involves a two-step authentication transaction sequence. The first step in the sequence is the identity assertion and request for authentication. The second step in the sequence is the authentication result. If it is “successful”, the station shall be mutually authenticated. Open system authentication does not provide authentication. It provides identification using the wireless adapter's MAC address. Open system authentication is used when no authentication is required. It is the default authentication algorithm.

Open system authentication uses the following process:

1. The authentication-initiating wireless client sends an IEEE 802.11 authentication management frame that contains its identity.

2. The receiving wireless AP checks the initiating station's identity and sends back an authentication verification frame.

3. With some wireless APs, you can configure the MAC addresses of allowed wireless clients. However, configuring the MAC address does not provide sufficient security because the MAC address of a wireless client can be spoofed.

- Shared Key - Shared key authentication supports authentication of stations as either a member of those who know a shared secret key or a member of those who do not. Shared key authentication is not secure and is not recommended for use. It verifies that an authentication-initiating station has knowledge of a shared secret. This is similar to pre-shared key authentication for Internet Protocol security (IPSec). The 802.11 standard currently assumes that the shared secret is delivered to the participating wireless clients by means of a more secure channel that is independent of IEEE 802.11. In practice, a user manually types this secret for the wireless AP and the wireless client.

Shared key authentication uses the following process:

6. The authentication-initiating wireless client sends a frame consisting of an identity assertion and a request for authentication.
7. The authenticating wireless node responds to the authentication-initiating wireless node with challenge text.
8. The authentication-initiating wireless node replies to the authenticating wireless node with the challenge text that is encrypted using WEP and an encryption key that is derived from the shared key authentication secret.
9. The authentication result is positive if the authenticating wireless node determines that the decrypted challenge text matches the challenge text originally sent in the second frame. The authenticating wireless node sends the authentication result.
10. Because the shared key authentication secret must be manually distributed and typed, this method of authentication does not scale appropriately in large infrastructure network mode, such as corporate campuses.

WEP key lengths

64 bit (10 Hex Digit)

WEP Key type	Example

64-bit WEP with 5 characters	Key1= 2e3f4
	Key2= 5y7js
	Key3= 24fg7
	Key4= 98jui

64-bit WEP with 10 hexadecimal digits ('0-9', 'A-F')	Key1= 123456789A
	Key2= 23456789AB
	Key3= 3456789ABC
	Key4= 456789ABCD

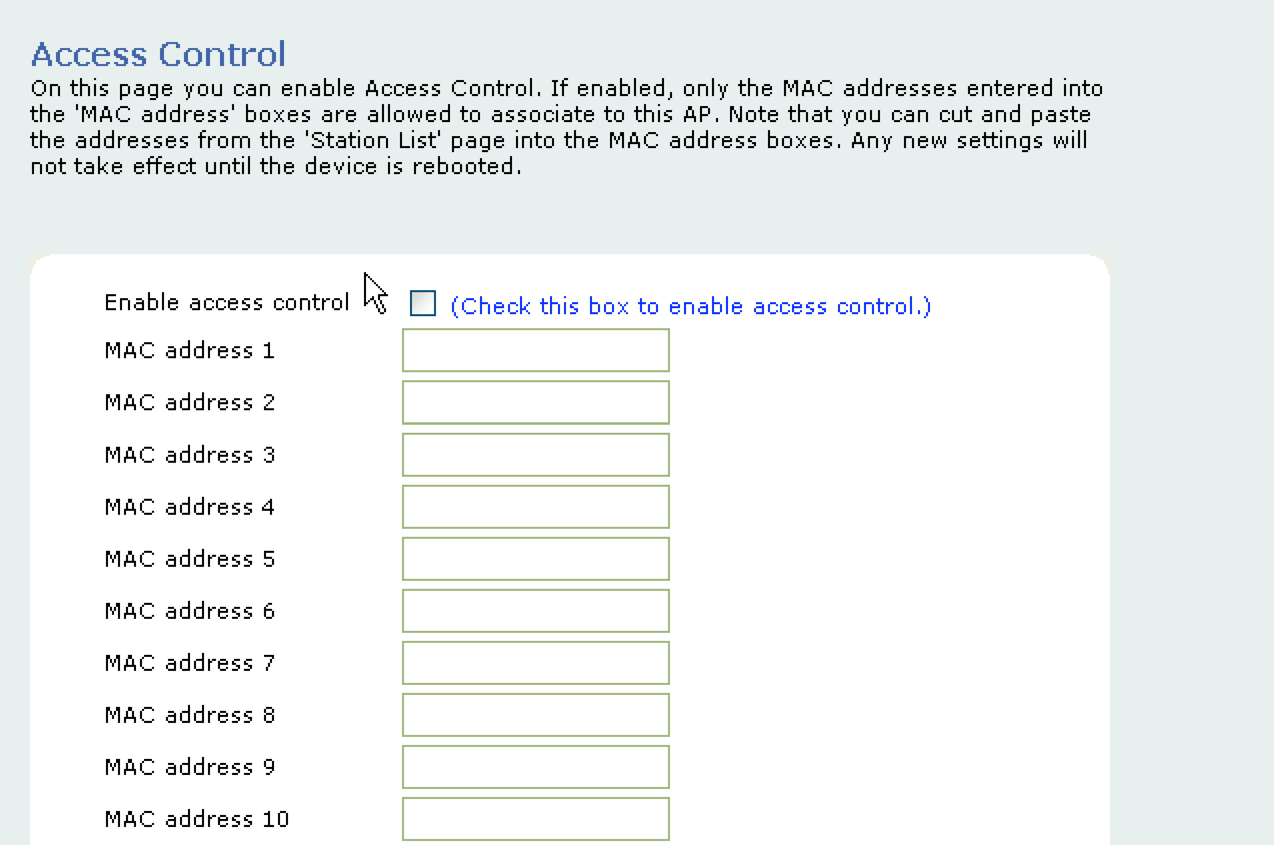
128 bit (26 Hex Digit)

WEP Key type	Example

128-bit WEP with 13 characters	Key1= 2e3f4w345ytre
	Key2= 5y7jse8r4i038
	Key3= 24fg70okx3fr7
	Key4= 98jui2wss35u4

128-bit WEP with 26 hexadecimal digits ('0-9', 'A-F')	Key1= 112233445566778899AABBCDEF
	Key2= 2233445566778899AABBCCDDEE
	Key3= 3344556677889900AABBCCDDFF
	Key4= 44556677889900AABBCCDDEEFF

Access



Access Control

On this page you can enable Access Control. If enabled, only the MAC addresses entered into the 'MAC address' boxes are allowed to associate to this AP. Note that you can cut and paste the addresses from the 'Station List' page into the MAC address boxes. Any new settings will not take effect until the device is rebooted.

Enable access control □ (Check this box to enable access control.)

MAC address 1

MAC address 2

MAC address 3

MAC address 4

MAC address 5

MAC address 6

MAC address 7

MAC address 8

MAC address 9

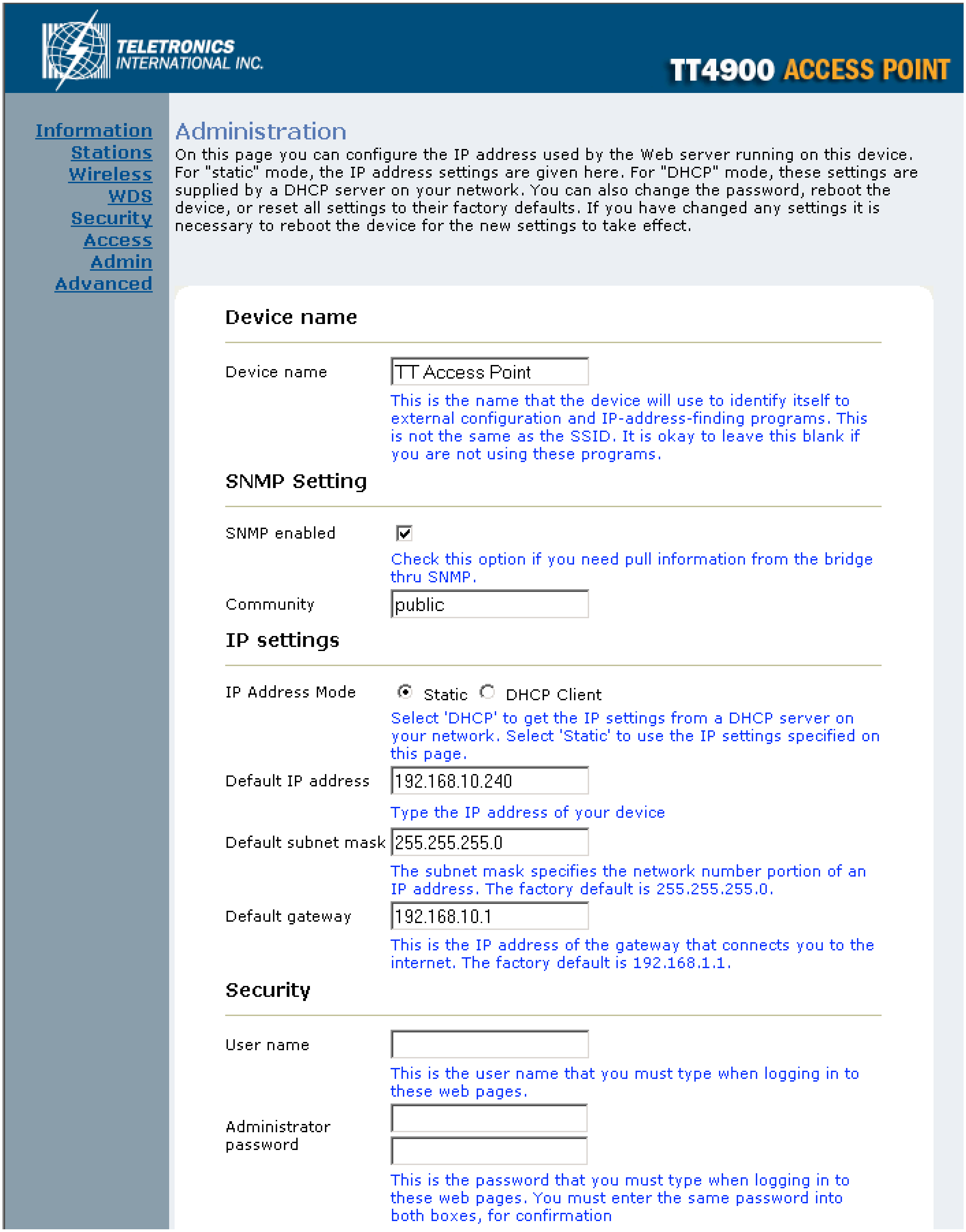
MAC address 10

Access Control

Enable access control

If enabled, this feature allows you to associate up to 64 different units/devices by MAC addresses. Any MAC addresses not programmed into the list will be prohibited from associating with this unit.

Admin



Administration

On this page you can configure the IP address used by the Web server running on this device. For "static" mode, the IP address settings are given here. For "DHCP" mode, these settings are supplied by a DHCP server on your network. You can also change the password, reboot the device, or reset all settings to their factory defaults. If you have changed any settings it is necessary to reboot the device for the new settings to take effect.

Device name

Device name: TT Access Point

This is the name that the device will use to identify itself to external configuration and IP-address-finding programs. This is not the same as the SSID. It is okay to leave this blank if you are not using these programs.

SNMP Setting

SNMP enabled ☑

Check this option if you need pull information from the bridge thru SNMP.

Community: public

IP settings

IP Address Mode ● Static ○ DHCP Client

Select 'DHCP' to get the IP settings from a DHCP server on your network. Select 'Static' to use the IP settings specified on this page.

Default IP address: 192.168.10.240

Type the IP address of your device

Default subnet mask: 255.255.255.0

The subnet mask specifies the network number portion of an IP address. The factory default is 255.255.255.0.

Default gateway: 192.168.10.1

This is the IP address of the gateway that connects you to the internet. The factory default is 192.168.1.1.

Security

User name:

This is the user name that you must type when logging in to these web pages.

Administrator password:

This is the password that you must type when logging in to these web pages. You must enter the same password into both boxes, for confirmation

Device Name

Device Name

This is the name that the Access Point will use to identify itself to external configuration and IP address programs. This is not the same as the SSID. It is okay to leave this blank if you are not using these programs.

SNMP Setting

SNMP enabled

Option to enable or disable SNMP support

Community

The SNMP Read-only Community string is like a user id or password that allows access to a router's or other device's statistics. InterMapper sends the community string along with all SNMP requests. If the community string is correct, the device responds with the requested information. If the community string is incorrect, the device simply discards the request and does not respond.

Factory default setting for the read-only community string is set to "public". It is standard practice to change all the community strings so that outsiders cannot access/read information about the internal network. (In addition, the administrator may also employ firewalls to block any SNMP traffic to ports 161 and 162 on the internal network.)

Change this value to have InterMapper use the new string when querying SNMP devices.

IP Settings

IP Address Mode

- **Static**
  - Manually setup a static IP address for this device.
- **DHCP**
  - Set up the access point as a DHCP client which will pick up an IP from a DHCP server.

Default IP address

The default Access Point Mode IP address: 192.168.10.240

Default subnet mask

The factory subnet default value is 255.255.255.0

Default gateway

The factory gateway default address is 192.168.10.1

Security

This section is used to set up the administrative login name and password.

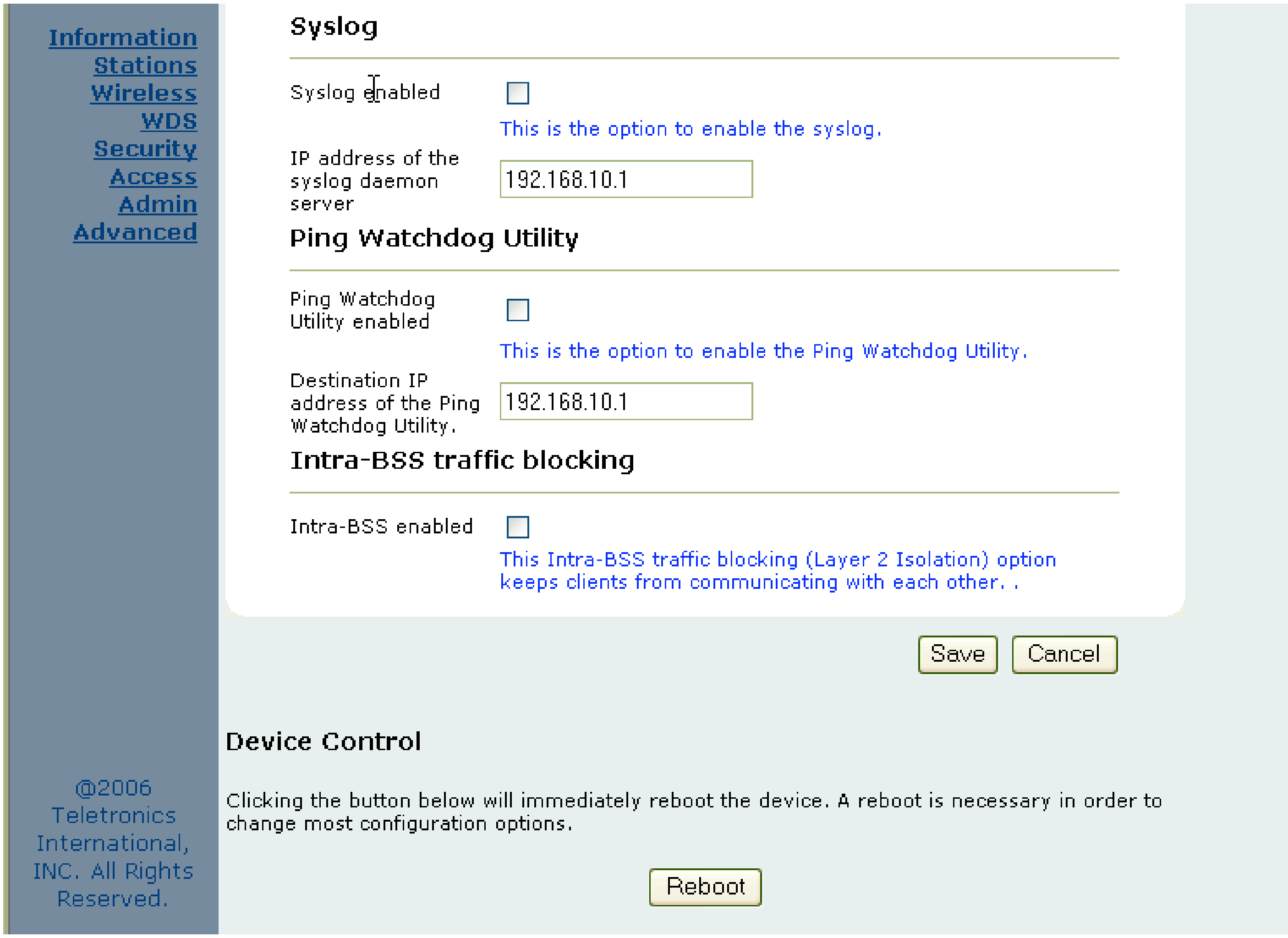
User name

This is the user name that you must type when logging into the web interface.

Administrator Password

This is the password that you must type when logging into the web interface. You must enter the same password into both boxes for confirmation.

Syslog



Syslog

Syslog enabled □

This is the option to enable the syslog.

IP address of the syslog daemon server: 192.168.10.1

Ping Watchdog Utility

Ping Watchdog Utility enabled □

This is the option to enable the Ping Watchdog Utility.

Destination IP address of the Ping Watchdog Utility.: 192.168.10.1

Intra-BSS traffic blocking

Intra-BSS enabled □

This Intra-BSS traffic blocking (Layer 2 Isolation) option keeps clients from communicating with each other. .

Device Control

Clicking the button below will immediately reboot the device. A reboot is necessary in order to change most configuration options.

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Syslog Enabled

Option to enable or disable Syslog support.

Syslog Daemon Server

The Syslog server IP address input box.

Ping Watchdog Utility

Ping Watchdog Utility Enabled

If enabled, the Ping Watchdog utility tracks the TCP/IP link between this device and another remote destination at the other end of the wireless link. When the remote destination is unreachable (loss of connection) the Ping Watchdog Utility will reboot the unit in an attempt to re-establish the connection.

Destination IP address of the Ping Watchdog Utility

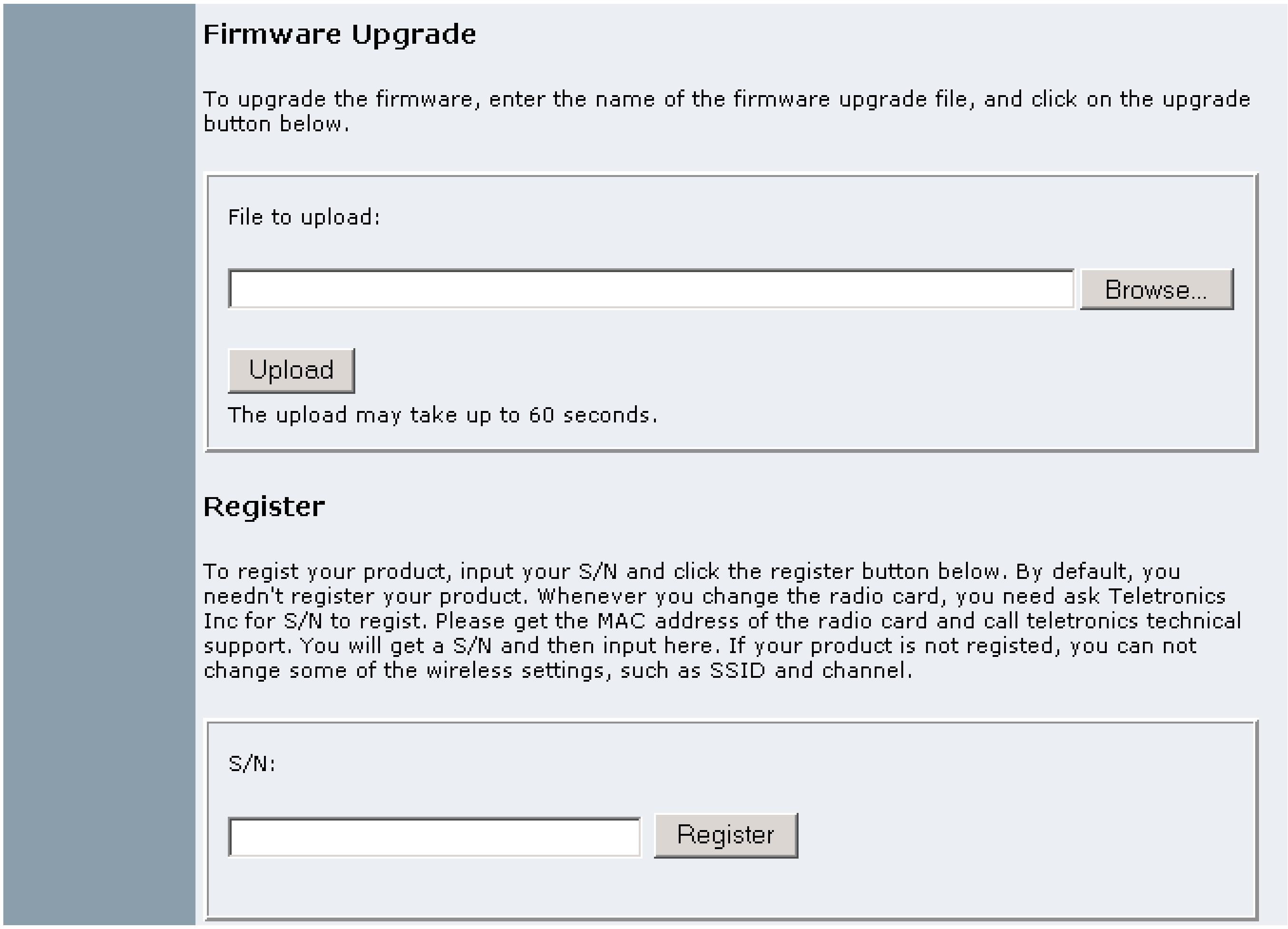
This is the IP address of the remote destination.

Intra-BSS traffic blocking

This option blocks clients in the same BSS from communicating with each other. (Layer 2 Isolation)

Device Control

This section has functions that will allow the TT™4900 to Reboot and Reset the system configuration to factory defaults.



Firmware Upgrade

To upgrade the firmware, enter the name of the firmware upgrade file, and click on the upgrade button below.

File to upload:

The upload may take up to 60 seconds.

Register

To regist your product, input your S/N and click the register button below. By default, you needn't register your product. Whenever you change the radio card, you need ask Teletronics Inc for S/N to regist. Please get the MAC address of the radio card and call teletronics technical support. You will get a S/N and then input here. If your product is not registed, you can not change some of the wireless settings, such as SSID and channel.

S/N:

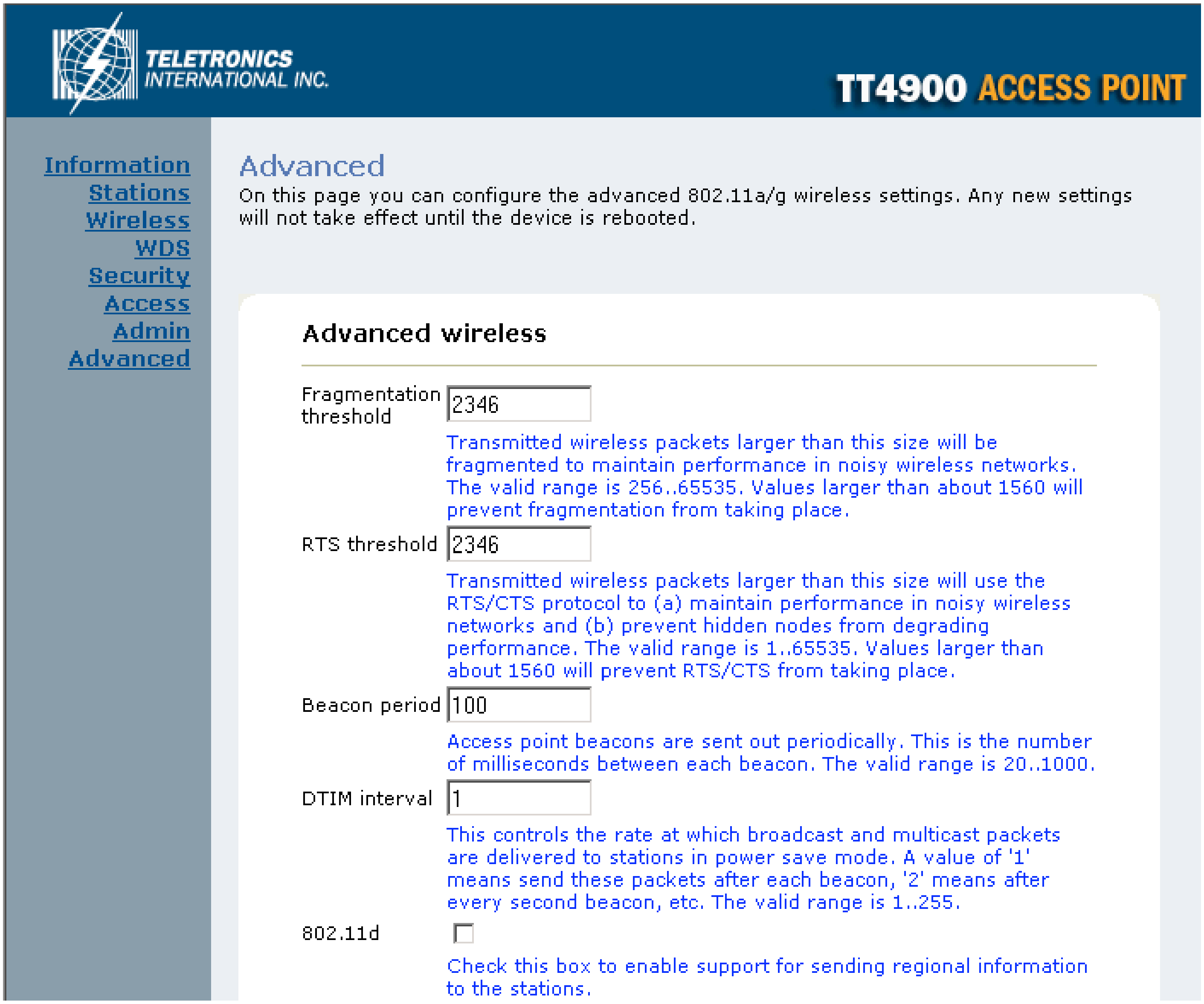
Firmware Upgrade

This section allows the TT™4900 firmware to be upgraded or changed directly from the web interface. Click on the Browse button to select a file from the host machine.

Register

The TT™4900 has implemented a hardware modification authorization process to prevent use by fraudulent hardware from other manufacturers. This will require any hardware change on the radio card used on the TT™4900 to input a serial code generated based on each unique MAC address. Please contact Teletronics Support to a pickup a valid serial number to deactivate the pre-registration protection after a radio card swap. If the unit is not registered some features such as SSID and Wireless Channel selection will be disabled.

Advanced



Advanced

On this page you can configure the advanced 802.11a/g wireless settings. Any new settings will not take effect until the device is rebooted.

Advanced wireless

Fragmentation threshold: 2346

Transmitted wireless packets larger than this size will be fragmented to maintain performance in noisy wireless networks. The valid range is 256..65535. Values larger than about 1560 will prevent fragmentation from taking place.

RTS threshold: 2346

Transmitted wireless packets larger than this size will use the RTS/CTS protocol to (a) maintain performance in noisy wireless networks and (b) prevent hidden nodes from degrading performance. The valid range is 1..65535. Values larger than about 1560 will prevent RTS/CTS from taking place.

Beacon period: 100

Access point beacons are sent out periodically. This is the number of milliseconds between each beacon. The valid range is 20..1000.

DTIM interval: 1

This controls the rate at which broadcast and multicast packets are delivered to stations in power save mode. A value of '1' means send these packets after each beacon, '2' means after every second beacon, etc. The valid range is 1..255.

802.11d ☐

Check this box to enable support for sending regional information to the stations.

Advanced Wireless

Fragmentation threshold

Fragmentation Threshold is the maximum length of the frame beyond which payload must be broken up (fragmented) into two or more frames. Collisions occur more often for long frames because sending them occupies the channel for a longer period of time, increasing the chance that another station will transmit and cause collision. Reducing Fragmentation Threshold results in shorter frames that "busy" the channel for shorter periods, reducing packet error rate and resulting retransmissions. However, shorter frames also increase overhead, degrading maximum possible throughput, so adjusting this parameter means striking a good balance between error rate and throughput.

RTS threshold

RTS Threshold is the frame size above which an RTS/CTS handshake will be performed before attempting to transmit. RTS/CTS asks for permission to transmit to reduce collisions but adds considerable overhead. Disabling RTS/CTS can reduce overhead and latency in WLANs where all stations are close together but can increase collisions and degrade performance in WLANs where stations are far apart and unable to sense each other to avoid collisions (aka Hidden Nodes). If you are experiencing excessive collisions you can try turning RTS/CTS on or (if already on) reduce RTS/CTS Threshold on the affected stations.

Burst time

Maximum burst time is a feature based on the PRISM Nitro; a new WLAN software solution that more than triples 802.11g throughput in a mixed-mode environment and offers up to 50 percent greater throughput performance in 802.11g-only networks. PRISM Nitro is fully IEEE 802.11 compliant and uses prioritization algorithms and enhanced protection mechanisms to significantly increase wireless networking performance.The recommended value for the maximum burst time for 11b or the mixed 11b/g environment is 650. The 11g only mode uses the value 1400.

Beacon Period

In wireless networking, a beacon is a packet sent by a connected device to inform other devices of its presence and readiness. When a wirelessly networked device sends a beacon, it includes with it a beacon interval which specifies the period of time before it will send the beacon again. The interval tells receiving devices on the network how long they can wait in low-power mode before waking up to handle the beacon. Network managers can adjust the beacon interval, usually measured in milliseconds (ms) or its equivalent, kilo microseconds (K_sec).

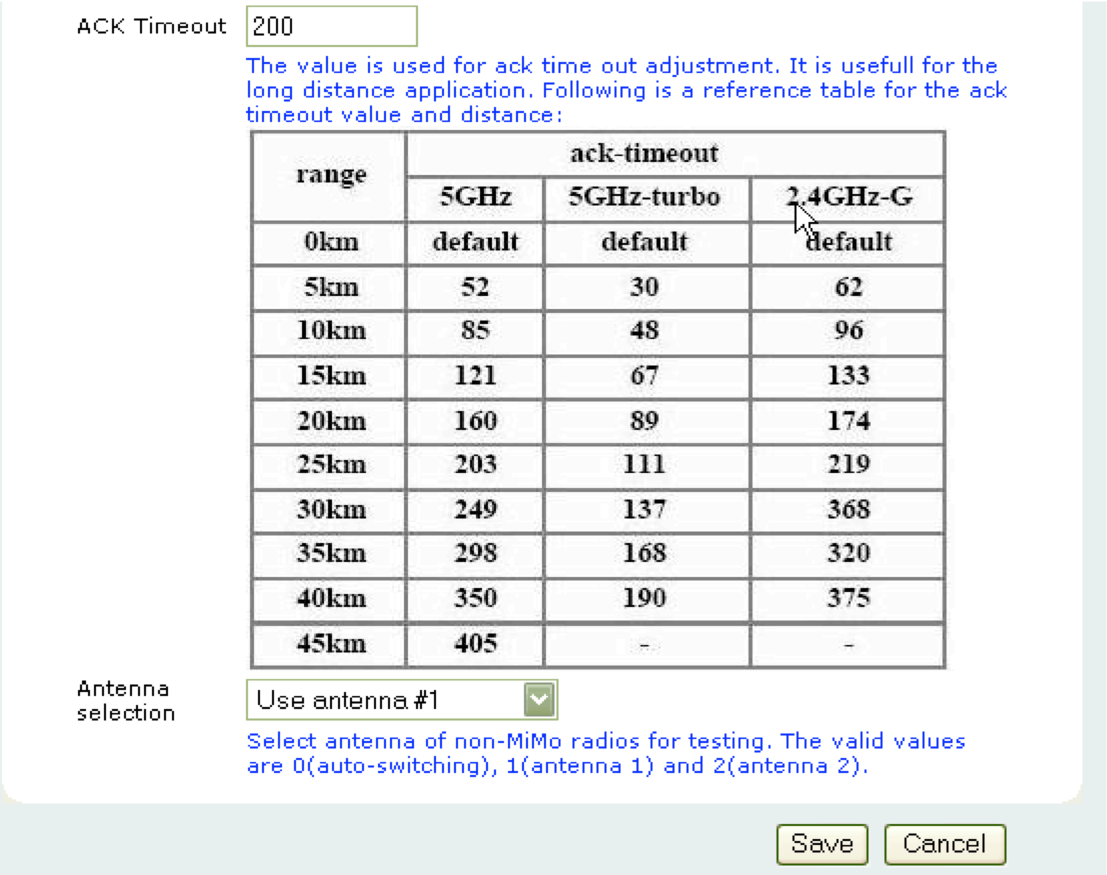
DTIM interval

A Delivery Traffic Indication Message (DTIM) is a signal sent as part of a beacon by an access point to a client device in sleep mode, alerting the device to a packet awaiting delivery. A DTIM interval, also known as a Data Beacon Rate, is the frequency at which an access point's beacon will include a DTIM. This frequency is usually measured in milliseconds (ms) or its equivalent, kilo microseconds (K_sec).

802.11d

802.11d is a wireless network communications specification for use in countries where systems using other standards in the 802.11 family are not allowed to operate. The 802.11d specification is well suited for systems that want to provide global roaming.

ACK Timeout



ACK Timeout: 200

The value is used for ack time out adjustment. It is usefull for the long distance application. Following is a reference table for the ack timeout value and distance:

range	ack-timeout		
	5GHz	5GHz-turbo	2.4GHz-G
0km	default	default	default
5km	52	30	62
10km	85	48	96
15km	121	67	133
20km	160	89	174
25km	203	111	219
30km	249	137	368
35km	298	168	320
40km	350	190	375
45km	405	-	-

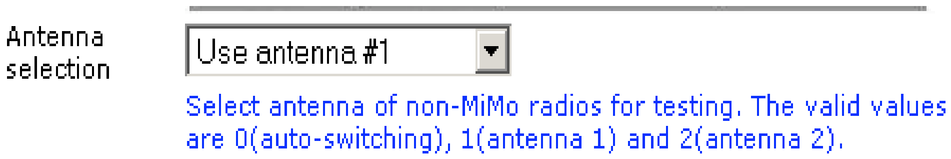
Antenna selection: Use antenna #1

Select antenna of non-MiMo radios for testing. The valid values are 0(auto-switching), 1(antenna 1) and 2(antenna 2).

When a packet is sent out from 802.11 Station A it will then wait for an 'ACKnowledgement frame' from 802.11 Station

B. Station A will only wait for a certain amount of time (ACK timeout) or ACK window. If the ACK is NOT received within that timeout period then the packet will be re-transmitted from Station A resulting in reduced throughput. When sending lots of packets as in 802.11g and 802.11a the constant re-transmission could cost severe performance degradation due to the ACK frame not making it back to 802.11 Station A in time. This will have a dramatic impact on the throughput of the link regardless of signal strength or good receiver sensitivity.

Antenna Selection



Antenna selection: Use antenna #1

Select antenna of non-MiMo radios for testing. The valid values are 0(auto-switching), 1(antenna 1) and 2(antenna 2).

**** Please refer to Appendix G on page 58 for further information.***

Appendix A: Warranty Policy

Limited Warranty

All Teletronics' products are warranted to the original purchaser to be free from defects in materials and workmanship under normal installation, use, and service for a period of one (1) year from the date of purchase.

Under this warranty, Teletronics International Inc. shall repair or replace (at its discretion) during the warranty period, any part that proves to be defective in material of workmanship under normal installation, use and service, provided the product is returned to Teletronics International Inc. or to one of its distributors with transportation charges prepaid. Returned products must include a copy of the purchase receipt. In the absence of a purchase receipt, the warranty period shall be one (1) year from the date of manufacture.

This warranty shall be voided if the product is damaged as a result of defacement, misuse, abuse, neglect, accident, destruction or alteration of the serial number, improper electrical voltages or currents, repair, alteration or maintenance by any person or party other than a Teletronics International, Inc. employee or authorized service facility, or any use in violation of instructions furnished by Teletronics International, Inc.

This warranty is also rendered invalid if this product is removed from the country in which it was purchased, if it is used in a country in which it is not registered for use, or if it is used in a country for which it was not designed. Due to variations in communications laws, this product may be illegal for use in some countries. Teletronics International, Inc. assumes no responsibility for damages or penalties incurred resulting from the use of this product in a manner or location other than that for which it is intended.

IN NO EVENT SHALL TELETRONICS INTERNATIONAL, INC. BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF THIS OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, WHATSOEVER.

Some states do not allow the exclusion or limitation of special, incidental or consequential damages, so the above exclusion or limitation may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

Appendix B: RMA Policy

Product Return Policy

It is important to us that all Teletronics' products are bought with full confidence. If you are not 100% satisfied with any product purchased from Teletronics you may receive a prompt replacement or refund subject to the terms and conditions outlined below.

IMPORTANT: Before returning any item for credit or under warranty repair, you must obtain a Return Merchandise Authorization (RMA) number by filling out the RMA form. Products will not be accepted without an RMA number. All products being shipped to Teletronics for repair / refund / exchange must be freight prepaid (customer pays for shipping). For all under warranty repair/replacement, Teletronics standard warranty applies.

30-Day full refund or credit policy:

1. Product was purchased from Teletronics no more than 30 day prior to the return request.
2. All shipping charges associated with returned items are non-refundable.
3. Products are returned in their original condition along with any associated packaging, accessories, mounting hardware and manuals. Any discrepancy could result in a delay or partial forfeiture of your credit.

Unfortunately Teletronics cannot issue credits for:

1. Products not purchased from Teletronics directly. If you purchased from a reseller or distributor you must contact them directly for return instructions.
2. Damaged items as a result of misuse, neglect or improper environmental conditions.
3. Products purchased directly from Teletronics more than 30 days prior to a product return request.

To return any product under 1 year warranty for repair/replacement, follow the RMA procedure.

Appendix C: Regulatory Information

Statement of Conditions

We may make improvements or changes in the product described in this documentation at any time. The information regarding the product in this manual are subject to change without notice.
We assume no responsibility for errors contained herein or for direct, indirect, special, incidental, or consequential damages with the furnishing, performance or use of this manual or equipment supplied with it, even if the suppliers have been advised of the possibility of such damages.

Electronic Emission Notices

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.
(2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Information

The Federal Communication Commission Radio Frequency Interference Statement includes the following paragraph: The 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 instructions, may cause harmful interference to radio communication. 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 overcome 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.
- The equipment is for home or office use.

Important Note

FCC RF Radiation Exposure Statement: This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the antenna and your body and must not be co-located or operated in conjunction with any other antenna or transmitter.
Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

R&TTE Compliance Statement

This equipment complies with all the requirements of the Directive 1999/5/EC of the European Parliament and the Council of 9 March 1999 on radio equipment and telecommunication terminal equipment (R&TTE)and the mutual recognition of their conformity. The R&TTE Directive repeals and replaces in the directive 98/13/EEC. As of April 8, 2000.

European Union CE Marking and Compliance Notices

Products intended for sale within the European Union are marked, which indicates compliance with the applicable directives identified below. This equipment also carries the Class 2 identifier.

With the Conformité Europééne (CE) and European standards and amendments, we declare that the equipment described in this document is in conformance with the essential requirements of the European Council Directives, standards and other normative documents listed below:

73/23/EEC Safety of the User (article 3.1.a)
89/336/EEC Electromagnetic Compatibility (article 3.1.b)
1999/5/EC (R&TTE) Radio and Telecommunications Terminal Equipment Directive.

EN 60950 2000 Safety of Information Technology Equipment, Including Electrical Business Equipment.

EN 300 328 V1.4.1(2003) Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems;Data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques;Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive.

EN 301 489-1, V1.4.1(2002); EN 301 489-17, V1.2.1(2002) – Electromagnetic compatibility and radio spectrum matters (ERM); electromagnetic compatibility (EMC) standard for radio equipment and services: Part 1: Common technical requirements; Part 17: Part 17: Specific conditions for 2,4 GHz wideband transmission systems and5 GHz high performance RLAN equipment

Warning: According to ERC/REC 70-30 appendix 3 National Restrictions, annex 3 Band A “RLANs and HIPERLANs.” See list of 802.11b/g restrictions for specific countries under the heading “European Economic Area Restrictions” as below.

English
This product follows the provisions of the European Directive 1999/5/EC.

Danish
Dette produkt er i overensstemmelse med det europæiske direktiv 1999/5/EF

Dutch
Dit product is in navolging van de bepalingen van Europees Directief 1999/5/EC.

Finnish
Tämä tuote noudattaa EU-direktiivin 1999/5/EY määräyksiä.

French
Ce produit est conforme aux exigences de la Directive Européenne 1999/5/CE.

Appendix D: Contact Information

Need to contact Teletronics?

Visit us online for information on the latest products and updates to your existing products at:
http://www.teletronics.com

Can't find information about a product you want to buy on the web? Do you want to know more about networking with Teletronics products?

Give us a call at: 301-309-8500 or fax your request to: 301-309-8551

For technical support issues you can e-mail us at: support@teletronics.com

If any Teletronics product proves defective during its warranty period, you can email the Teletronics Return Merchandise Authorization department to obtain a Return Authorization Number at: rma@teletronics.com

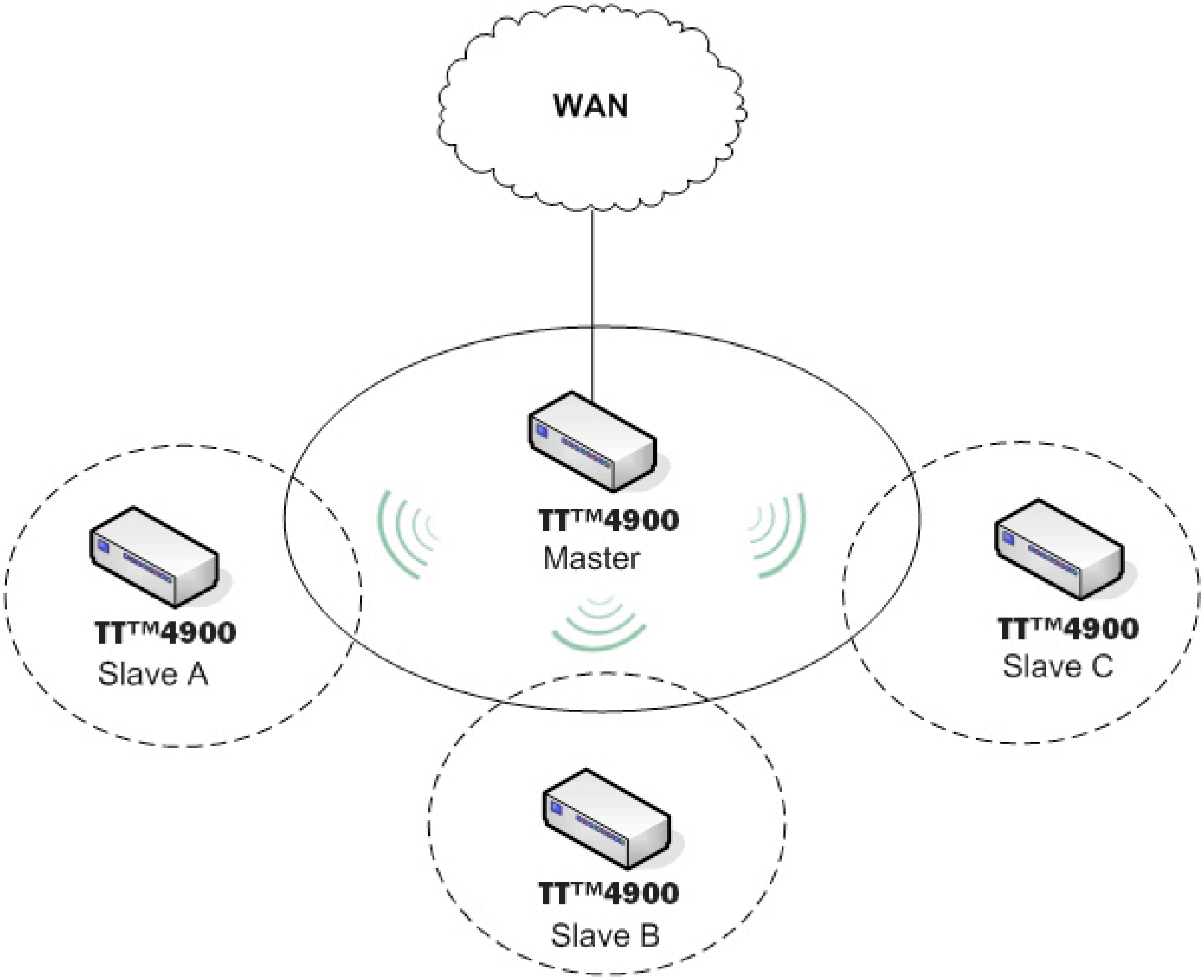
(Details on Warranty and RMA issues can be found in Appendix A and B)

Appendix E: WDS Explained

One of the requirements for a WDS network is that the operational frequency channel on all the APs must be the same. This is one of the reasons why there is a huge bandwidth penalty when setting up a wireless network in WDS mode.

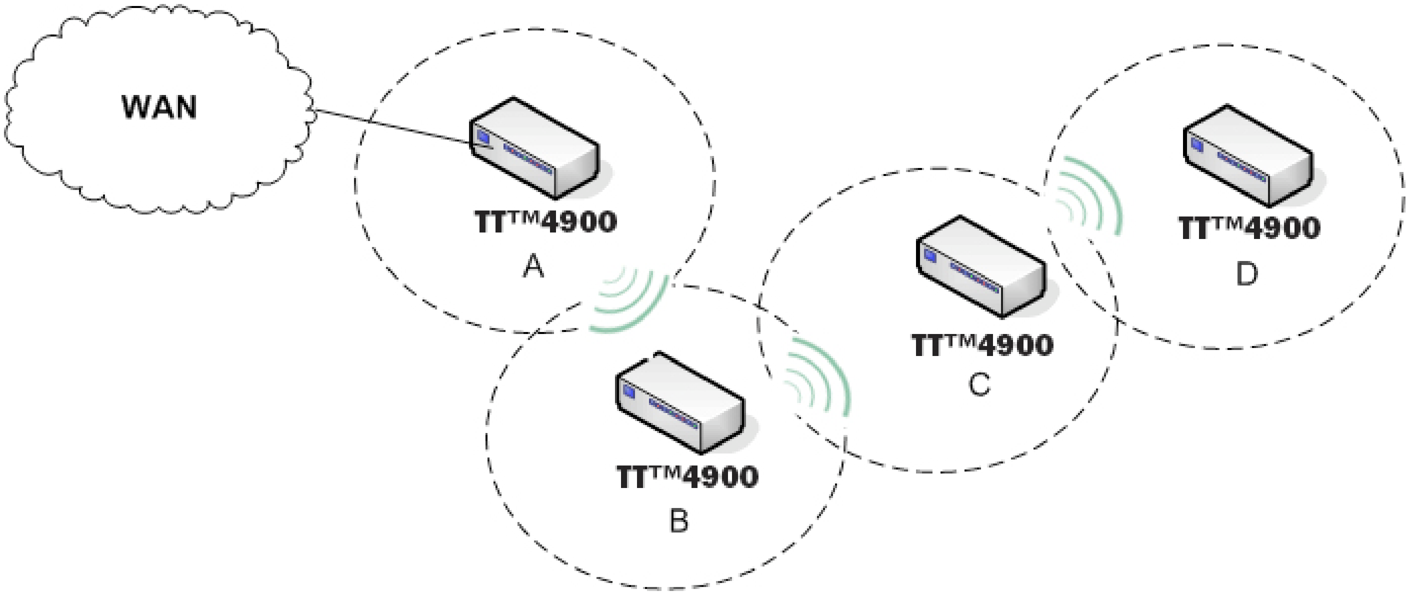
How to properly configure your APs in a WDS network will foremost depend on the locations of your wireless hotspots. Please take a look at the following two WDS topology examples:

WDS in a Star Configuration:



This is the mode to use if you're expanding the hotspots in the area around your master AP that is connected to the WAN. What you'll need to do is enable WDS and ACL on all the APs. Then input each of the MAC addresses of Slave A,B,C into the Master AP under both the WDS and ACL section. For the Slave APs A,B,C you'll input only the MAC address of the Master AP into the WDS and ACL list to limit them to direct their traffic through the Master AP only.

WDS in Chain Configuration:



In this configuration setup example you'll be expanding your wireless network coverage that will span an area in length.

- AP A will have only AP B's MAC address in its WDS and ACL configuration setting.
- AP B will have AP A and C's MAC address in its WDS and ACL configuration setting.
- AP C will have AP B and D's MAC address in its WDS and ACL configuration setting.
- AP D will have only AP C's MAC address in its WDS and ACL configuration setting.

Appendix F: TT™4900 Upgrade FAQ

How to upgrade?
The TT™4900 could be upgraded either through the web interface or from EZ-Manager. Please check Web Configuration Interface and Installation sections of this manual for detailed instructions.

Do I need an Activation Key after flashing with a newer firmware, 3.7.x or higher?
No. All the TT™4900 units shipped from Teletronics are already activated. Since Firmware 3.1.7X and 3.7.X or higher, Teletronics has now removed the necessary step to provide an activation key to change from SU to AP and vice versa in our TT™4900 product line. For example, if you have a TT™4900 in SU mode with 3.6.0 firmware, the activation key is not required if you upgrade to either 3.7.0 (SU mode) or 3.7.1 (AP mode), or later.

Do I need an Activation Key after flashing with an older firmware, 3.6.x or lower?
You might need an activation key for older firmware. Please check the upgrade guide released with the older firmware.

Do I need an Activation Key after swapping out with another radio card?
Yes, if the radio card is swapped out with another card an activation key will still be required. This rule will apply to all radio cards swapped out with a different MAC address from the original card.

Which firmware to upgrade?
Currently there are two PCB Hardware revisions V3.0 and V5.0.0, both have 4MB Flash on the board. However the old firmware 3.1.x released for our first batch back in year 2005 utilized 2MB flash only, while the firmware 3.2.x (or above) utilized the whole 4MB flash.

The firmware revision 3.1.X and 3.2.X (or above) are not interchangeable due to the different flash size utilization. If you received boards by default with firmware 3.1.X then you have the 2M version. If you received boards by default with firmware 3.2.X or above then you have the 4M version. If you were to upgrade a 4M unit with a 2M firmware the unit will show no change after the flashing process.

For each release, we publish 2 series of firmware, one for 2M version and one for 4M version. Function and performance wise, there's no difference between these two. So the customer with 2M version will continue to enjoy the latest feature upgrades and bug fixes. For instance, 3.1.70 is the 2M version, while the counterpart 4M version is 3.7.0.

What does the prefixed Alphabet mean from version 3.9.x or later?
You probably notice the new version name changed to Cx.x.x since C3.9.0 and C3.9.1. The prefix "C" means the firmware is to be upgraded on hardware revisions V3.0 and V5.0.0. In the future, we'll use prefix "D" for our next hardware revision to distinguish between hardware revisions.

Important: Activation Key might be needed when upgrading to a higher firmware version. Check the key requirement chart below and get the activation key first before proceeding with the firmware upgrade.

Do I need an Activation Key for new firmware?
Please check the key requirement chart.

How to get the activation key?

Please use our online help desk to submit a key request ticket. You may need to include the following information:

1. Purchase Number
2. Purchase Date
3. Serial No
4. MAC Address
5. Current Firmware version
6. Firmware version to be upgraded

Or you may send all activation key requests to: keyrequest@teletronics.com. All you have to provide in the email will be the model of the unit and the MAC address.

Is there a fee for the activation key?
Right now, we don’t charge our customer for firmware upgrade, or switching between AP and SU/Bridge mode.

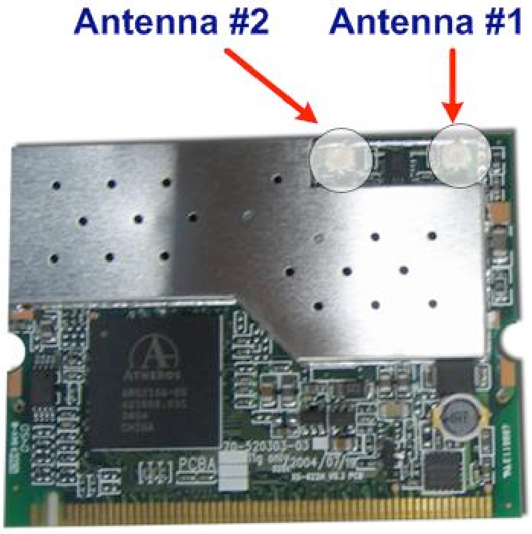
Will upgrade keep my previous configuration?
Although the upgrade might keep your previous configuration, we suggest customer to reset the unit to factory default located in “admin” section and configure it again.

Appendix G: Antenna Diversity

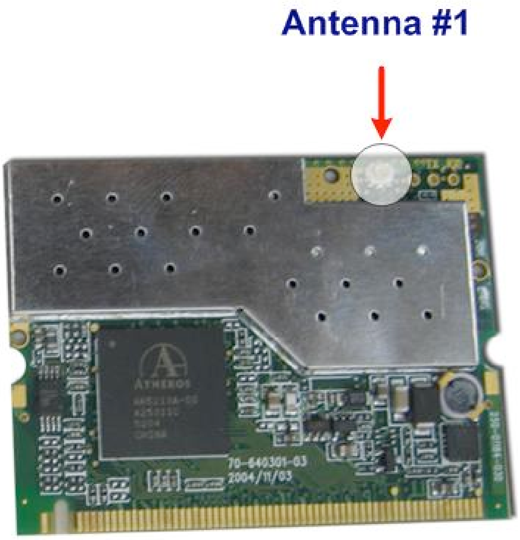
Latest firmware provides “Choose Antenna” option.

This new feature has been incorporated into versions 3.1.4x and 3.4.x. There are 3 options: “Diversity”, “Use Antenna#1” and “Use Antenna #2”. If the wireless frequency in the area is very crowded there will be lots of interference. Using the default “Diversity” option might not be the best option to achieve optimal performance. Please configure “Use Antenna #2” for TT2400 and “Use Antenna #1” for TT5800 to force the cards to use only those ports at all times for both RX and TX operations. This will under most cases give you extra output power and receive sensitivity.

Ensure that the U.FL cable adapter for the MiniPCI radio card is connected properly matching the antenna number you selected. Please use the following pictures to identify antenna port numbers:



TT2400 802.11G MiniPCI Card



TT5800 802.11A MiniPCI Card

Teletronics TT2400/TT5800	Antenna Selection
TT2400 shipped with 3.4.x firmware or earlier	“Use Antenna #2”
TT2400 shipped with 3.5.x firmware or later	“Use Antenna #1”
TT5800	“Use Antenna #1 only”

How to identify the physical radio port?

Make sure also that U.FL cable adapter for the MiniPCI radio card is connected properly matching the antenna number you selected. Please use the following picture to identify antenna port number:

Note: Using the wrong antenna port on the TT2400 will drastically lower your radio output power sometimes by as much as 20dBm.

Appendix H: Troubleshooting

Symptom: Can not access the TT™4900 through the web browser

Resolution:

- Check that the IP address in the URL field is correct.
- Check your host computer IP address. If the IP address of the TT™4900 is 192.168.10.241 then the host computer IP must set to the 192.168.1.X subnet.
- If using the PoE make sure that you're using the provided 48V power adapter. Make sure that the TT™4900 is connected to the ODU side of the PoE. The computer should be connected to the NET side of the PoE.
- Clear out all internet cache and cookies.
- Clear the ARP table by going into the dos prompt and type in the following: arp –d
- Reset unit back to factory default by holding down the reset bottom for 10 seconds while the unit is powered on.

Symptom: Forgot IP address

Resolution:

If you forgot the IP address of the TT™4900 you can press reset button to restore the default factory settings by holding down the reset button for 10 seconds. The factory default IP for Client Bridge mode is 192.168.10.241, and Access Point mode is 192.168.10.240.

Symptom: The web control interface graphics isn't showing up properly

Resolution:

Due to many anti-malware software on the market some features of these programs may disable certain IE functions which can then lead to pictures not being displayed correctly. If this happens try turning off some of the more restrictive features of these anti-malware software or try accessing the web control interface with a different browser such as the firefox.

Symptom: Can not connect to the TT™4900 with a wireless client

Resolution:

- Make sure that the client supports the wireless mode that the TT™4900 is set to.
- Make sure that the Mode, SSID (Cap Sensitive), Channel and encryption settings are set the same on both sides.
- Make sure that your computer is within range and free from any strong electrical devices that may cause interference.
- Double check that the wireless client is set to the appropriate transmission speed under the advanced tab of the wireless connection property.
- Temporary disable all securities and encryption settings.
- Try it on a different client.
- If DHCP is enabled make sure that the client is set to obtain an IP automatically.

Appendix I: Key Requirement Chart

Key Requirement Chart

Key Required? Y: Yes, N: No

2M Version	To: Latest Version	
From:	C3.1.90SU	C3.1.91AP
3.1.2SU	Y	Y
3.1.3AP	Y	Y
3.1.4SU	Y	Y
3.1.5AP	Y	Y
3.1.40SU	N	N
3.1.41AP	N	N
3.1.50SU	N	N
3.1.51AP	N	N
3.1.60SU	N	N
3.1.61AP	N	N
3.1.70SU	N	N
3.1.71AP	N	N
3.1.80SU	N	N
3.1.81AP	N	N
C3.1.90SU	N	N
C3.1.91AP	N	N

4M Version	To: Latest Version	
From:	C3.9.0SU	C3.9.1AP
3.2.0SU	Y	Y
3.2.1AP	Y	Y
3.3.0SU	N	N
3.3.1AP	N	N
3.4.0SU	N	N
3.4.1AP	N	N
3.5.0SU	N	N
3.5.1AP	N	N
3.6.0SU	N	N
3.6.1AP	N	N
3.7.0SU	N	N
3.7.1AP	N	N
3.8.0SU	N	N
3.8.1AP	N	N
C3.9.0SU	N	N

C3.9.1AP	N	N

Appendix J: Glossary

802.1x - The standard for wireless LAN authentication used between an AP and a client. 802.1x with EAP will initiate key handling.

Ad-Hoc Network - The wireless network based on a peer-to-peer communications session. Also referred to as AdHoc.

Access Point - Access points are stations in a wireless LAN that are connected to an Ethernet hub or server. Users can roam within the range of access points and their wireless device connections are passed from one access point to the next.

Authentication - Authentication refers to the verification of a transmitted message's integrity.

Beacon - In wireless networking, a beacon is a packet sent by a connected device to inform other devices of its presence and readiness.

Beacon interval - When a wirelessly networked device sends a beacon, it includes with it a beacon interval, which specifies the period of time before it will send the beacon again. The interval tells receiving devices on the network how long they can wait in low-power mode before waking up to handle the beacon. Network managers can adjust the beacon interval, usually measured in milliseconds (ms) or its equivalent, kilo microseconds (Kmsec).

BSS - Basic Service Set. When a WLAN is operating in infrastructure mode, each access point and its connected devices are called the Basic Service Set.

BSSID - The unique identifier for an access point in a BSS network. See SSID for more details.

DHCP - DHCP (Dynamic Host Configuration Protocol) software automatically assigns IP addresses to client stations logging onto a TCP/IP network, which eliminates the need to manually assign permanent IP addresses.

DSSS (Direct Sequence Spread Spectrum) - Method of spreading a wireless signal into wide frequency bandwidth.

Dynamic IP Address - An IP address that is automatically assigned to a client station in a TCP/IP network, typically by a DHCP server.
DNS (Domain Name System): System used to map readable machine names into IP addresses

DTIM - DTIM (Delivery Traffic Indication Message) provides client stations with information on the next opportunity to monitor for broadcast or multicast messages.

DTIM interval - A DTIM interval, also known as a Data Beacon Rate, is the frequency at which an access point's beacon will include a DTIM. This frequency is usually measured in milliseconds (ms) or its equivalent, kilo microseconds (Kmsec).

ESS - Extended Service Set. ESS is the collective term for two or more BSSs that use the same switch in a LAN.

ESSID - Extended Service Set Identifier. An ESSID is the unique identifier for an ESS. See SSID for more details.

Filter - Filters are schemes, which only allow specified data to be transmitted. For example, the router can filter specific IP addresses so that users cannot connect to those addresses.
Firmware: Programming inserted into programmable read-only memory, thus becoming a permanent part of a computing device.

Fragmentation - Refers to the breaking up of data packets during transmission.

Gateway – Is the place where two or more networks connect

IBSS - Independent Basic Service Set. See ad-hoc network

Infrastructure Mode - When a wireless network functions in infrastructure mode, every user communicates with the network and other users through an access point; this is the typical way corporate WLANs work. An alternative is ad-hoc mode, but users would have to switch to infrastructure mode to access a network's printers and servers.

ISP - An ISP is an organization providing Internet access service via modems, ISDN (Integrated Services Digital Network), and private lines.
LAN(Local Area Network): A group of computers and peripheral devices connected to share resources.
MAC (Medium Access Control) Address: A unique number that distinguishes network cards.

MTU - MTU (Maximum Transmission/Transfer Unit) is the largest packet size that can be sent over a network. Messages larger than the MTU are divided into smaller packets.

NAT - NAT (Network Address Translation - also known as IP masquerading) enables an organization to present itself to the Internet with one address. NAT converts the address of each LAN node into one IP address for the Internet (and vice versa). NAT also provides a certain amount of security by acting as a firewall by keeping individual IP addresses hidden from the WAN.

Preamble - Preamble refers to the length of a CRC (Cyclic Redundancy Check) block that monitors' communications between roaming wireless enabled devices and access points.

Protocol - A standard way of exchanging information between computers.
RADIUS (Remote Authentication Dial In User Service): A server that issues authentication key to clients.
RAM (Random Access Memory): Non-permanent memory.

RIP - RIP (Routing Information Protocol) is a routing protocol that is integrated in the TCP/IP protocol. RIP finds a route that is based on the smallest number of hops between the source of a packet and its destination.

Router - A router is a device that forwards data packets along networks. The device is connected to at least two networks, commonly two LANs or WANs or a LAN and an ISP. Routers are located at gateways, the places where two or more networks connect and use headers and forwarding tables to determine the best path for forwarding the packets. And they use protocols such as ICMP to communicate with each other and configure the best route between any two hosts. Very little filtering of data is done through routers.

Roaming - The ability to use a wireless device while moving from one access point to another without losing the connection.

RTS - RTS (Request To Send) is a signal sent from the transmitting station to the receiving station requesting permission to transmit data.

Server - Servers are typically powerful and fast machines that store programs and data. The programs and data are shared by client machines (workstations) on the network.

Static IP Address - A permanent IP address is assigned to a node in a TCP/IP network. Also known as global IP.

Subnet Mask - Subnet Masks (SUBNET work masks) are used by IP protocol to direct messages into a specified network segment (i.e., subnet). A subnet mask is stored in the client machine, server or router and is compared with an incoming IP ad-dress to determine whether to accept or reject the packet.

SSID - SSID (Service Set Identifier) is a security measure used in WLANs. The SSID is a unique identifier attached to packets sent over WLANs. This identifier emulates a password when a wireless device attempts communication on the WLAN. Because an SSID distinguishes WLANS from each other, access points and wireless devices trying to connect to a WLAN must use the same SSID.

TCP/IP - TCP/IP (Transmission Control Protocol/Internet Protocol) is the main Internet communications protocol. The TCP part ensures that data is completely sent and received at the other end. Another part of the TCP/IP protocol set is UDP, which is used to send data when accuracy and guaranteed packet delivery are not as important (for example, in real-time video and audio transmission).

TFTP (Trivial File Transfer Protocol) - Simple form of FTP (File Transfer Protocol), which Uses UDP (User Datagram Protocol), rather than TCP/IP for data transport and provides no security features.

TKIP (Temporal Key Integrity Protocol): An encryption method replacing WEP.TKIP uses random IV and frequent key exchanges.

UDP (User Datagram Protocol) - A communication method (protocol) that offers a limited amount of service when messages are exchanged between computers in a network. UDP is used as an alternative to TCP/IP.

Uplink: Link to the next level up in a communication hierarchy.

UTP (Unshielded Twisted Pair) cable - Two or more unshielded wires twisted together to form a cable.

Virtual Servers - Virtual servers are client servers (such as Web servers) that share resources with other virtual servers (i.e., it is not a dedicated server).

WEP (Wired Equivalent Privacy) - An encryption method based on 64 or 128bit algorithm.

WLAN - WLANs (Wireless LANs) are local area networks that use wireless communications for transmitting data. Transmissions are usually in the 2.4 GHz band. WLAN devices do not need to be lined up for communications like infrared devices. WLAN devices use access points, which are connected to the wired LAN and provide connectivity to the LAN. The radio frequency of WLAN devices is strong enough to be transmitted through non-metal walls and objects, and can cover an area up to a thousand feet. Laptops and notebooks use wireless LAN PCMCIA cards while PCs use plug-in cards to access the WLAN.