Wireless PC Card (CardBus)

DRIVER
&
SOFTWARE UTILITY

USER MANUAL

FCC Information to User

Model: Wireless PC Card

FCC ID: RC6AWP-914W

FCC Caution: To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Guidelines for Human Exposure

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This EUT is incompliance with SAR for general population /uncontrolled exposure limits in ANSI/IEEE C95.1-1999 and had been tested in accordance with the measurement methods and procedures specified in OET Bulletin 65 Supplement C.

Regulatory Compliance Information

This section includes user requirements for operating this product in accordance with National laws for usage of radio spectrum and operation of radio devices. Failure of the end-user to comply with the applicable requirements may result in unlawful operation and adverse action against the end-user by the applicable National regulatory authority.

FCC Requirements for Operation in the United States

Radio Frequency Interference Warnings & Instructions

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

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

Modifications made to the product could void the user's right to operate the equipment.

Europe

This device is a 2.4 GHz low power RF device intended for home and office use in EU and EFTA member states. In some EU / EFTA member states some restrictions may apply. Please contact local spectrum management authorities for further details before putting this device into operation.

Marking by the above symbol indicates compliance with the Essential Requirements of the R&TTE Directive of the European Union (1999/5/EC). This equipment meets the following conformance standards:
EN300 328, EN301 489-1/17, EN60950

Requirements For Operation in the European Community

Countries of Operation and Conditions of Use in the European Community

The user should run the client utility program provided with this product to check the current channel of operation and confirm that the device is operating in conformance with the spectrum usage rules for European Community countries as described in this section.

This device is intended to be operated in all countries of the European Community.

Operation Using 2.4 GHz Channels in France

The following radio channel usage limitations apply in France.

The radio spectrum regulator in France, Autorité de regulation des telecommunications (ART), enforces the following rules with respect to use of 2.4GHz spectrum in various locations in France. Please check ART's web site for latest requirements for use of the 2.4GHz band in France: http://www.art-telecom.fr/eng/index.htm. When operating in the following metropolitan regions (départements) in France, this device may be operated under the following conditions:

Indoors using any channel in the 2.4-2.4835 GHz band (Channels 1-13)

Outdoors using channels in the 2.4-2.454 GHz band (Channels 1-7)

When operating outside of the following regions (départements) in France (see table below), this product must be operated under the following conditions:

• Indoors using channels in the 2.4465-2.4835 GHz band (Channels 10-13).

• Outdoor operation not permitted.

Please refer to the ART web site for further details.

Metropolitan Regions with Eased Restrictions in 2.4GHz Band

01	Ain	36	Indre	69	Rhône
02	Aisne	37	Indre et Loire	70	Haute Saône
03	Allier	39	Jura	71	Saône et Loire
05	Hautes Alpes	41	Loir et Cher	72	Sarthe
08	Ardennes	42	Loire	75	Paris
09	Ariège	45	Loiret	77	Seine et Marne
10	Aube	50	Manche	78	Yvelines
11	Aude	54	Meurthe et Moselle	79	Deux Sèvres
12	Aveyron	55	Meuse	82	Tarn et Garonne
16	Charente	57	Moselle	84	Vaucluse
19	Corrèze	58	Nièvre	86	Vienne
2A	Corse Sud	59	Nord	88	Vosges
2B	Haute Corse	60	Oise	89	Yonne
21	Côte d'Or	61	Orne	90	Territoire de Belfort
24	Dordogne	63	Puy de Dôme	91	Essonne
25	Doubs	64	Pyrénées Atlantique	92	Hauts de Seine
26	Drôme	65	Hautes Pyrénées	93	Seine St Denis
27	Eure	66	Pyrénées Orientales	94	Val de Marne
32	Gers	67	Bas Rhin		
35	Ille et Vilaine	68	Haut Rhin		

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1 Introduction

The Wireless PC Card is a Wireless LAN device working under unlicensed 2.4GHz radio band. It complies with IEEE 802.11g and 802.11b standards. Just sliding into a notebook PC's card slot allows you to connect to the network wirelessly at super-fast 54Mbps. It is your best choice to cooperate with a notebook PC with no cabling hassle.

Its auto-sensing capability allows high packet transfer at up to 54 Mbps for maximum throughput or dynamic range shifting to lower speeds due to distance or operating limitations in an environment with a lot of electromagnetic interference.

The Wireless PC Card complies to IEEE 802.11b/g standards and provides 54 Mbps WLAN connectivity. It can protect data integrity with enterprise-level WPA security.

1.1 Key Features

- Operate at 2.4GHz unlicensed frequency with data transmission rate up to 54Mbps
- IEEE standards support: IEEE 802.11b, 802.11g
- Advanced security features including WEP, WPA and WPA2
- 32-bit CardBus interface
- Advanced power saving technology
- Full-featured WLAN management utility
- Additional software Access Point function (WinXP only)
- Compatible with Windows 98SE, ME, 2000 and XP

1.2 Kit Contents

- Wireless PC Card
- Set-up CD with User Manual & Software Utility

1.3 System Requirements

A PC must be at least equipped with the following requirements.

- available PCI card slot
- CD-ROM drive
- Microsoft® Windows® 98SE, ME, 2000 or XP operating system
- Pentium® II 450MHz or faster processor

- 64 Mbytes RAM
- 50 Mbytes free hard disk space

1.4 LED Definition

- Ready: lit when the PC Card is plugged in and ready to transmit or receive
- Link/Act: lit when the PC Card is wirelessly connected and flash when it is transmitting or receiving

1.5 Connection Diagram

1.6 Observing Location and Range Guidelines

Computers can connect over wireless networks indoors at a range which vary significantly based on the physical location of the computer with the Wireless PC Card. For best results, avoid potential sources of interference, such as:

• Large metal surfaces

• Microwaves ovens

• 2.4GHz Cordless phones

In general, wireless devices can communicate through walls. However, if the walls are constructed with concrete, or have metal, or metal mesh, the effective range will decrease between the devices.

2 Installing Hardware

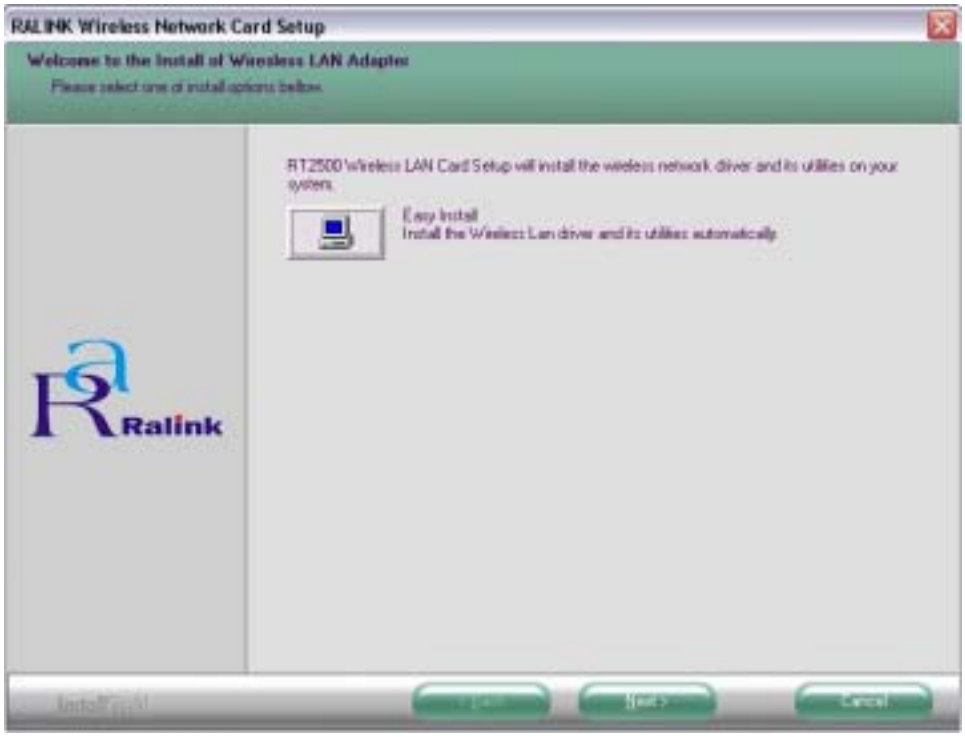
1. Locate an available PC card slot on the notebook. Check with your computer manufacture for more instructions.
2. Slide the PC Card into the PC card slot. (The LEDs should be on top of the PC Card.) Make sure that all of its pins are touching the slot's contacts.

3 Installing WLAN Client Driver and Software Utility

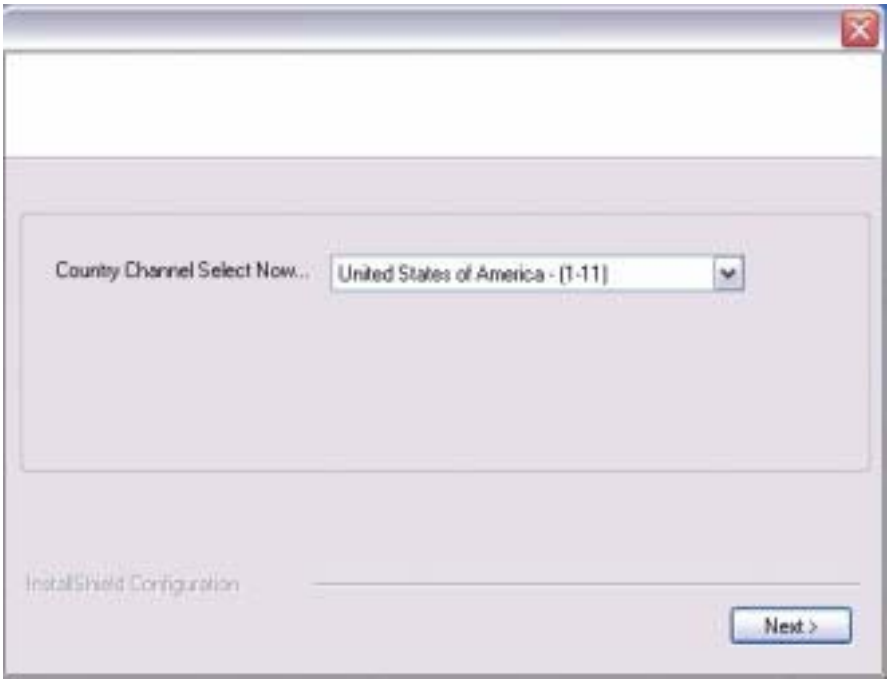
1. Windows will automatically detect this Wireless PC Card and the "Found New Hardware Wizard" window will appear. Click *Cancel*.

2. Insert the CD-ROM into your CD-ROM drive, browse to the Client folder, select the file *setup.exe*, and double click it.

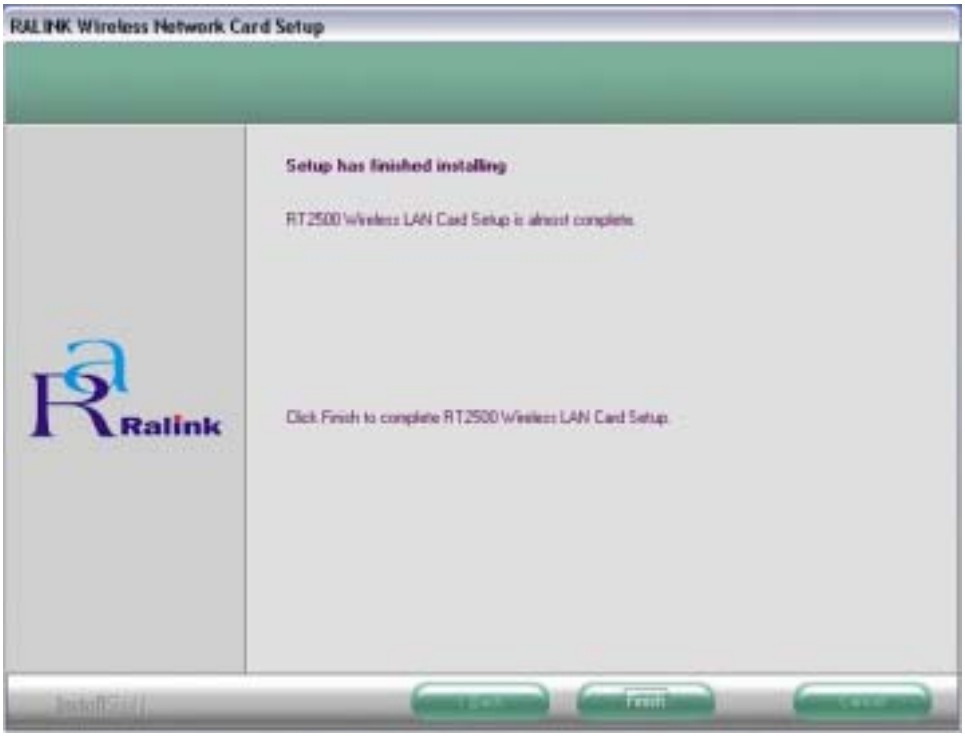
3. Click *Next* >.



4. Select the *Country Channel* from the drop-down menu and click *Next* >.



5. Click *Finish*.

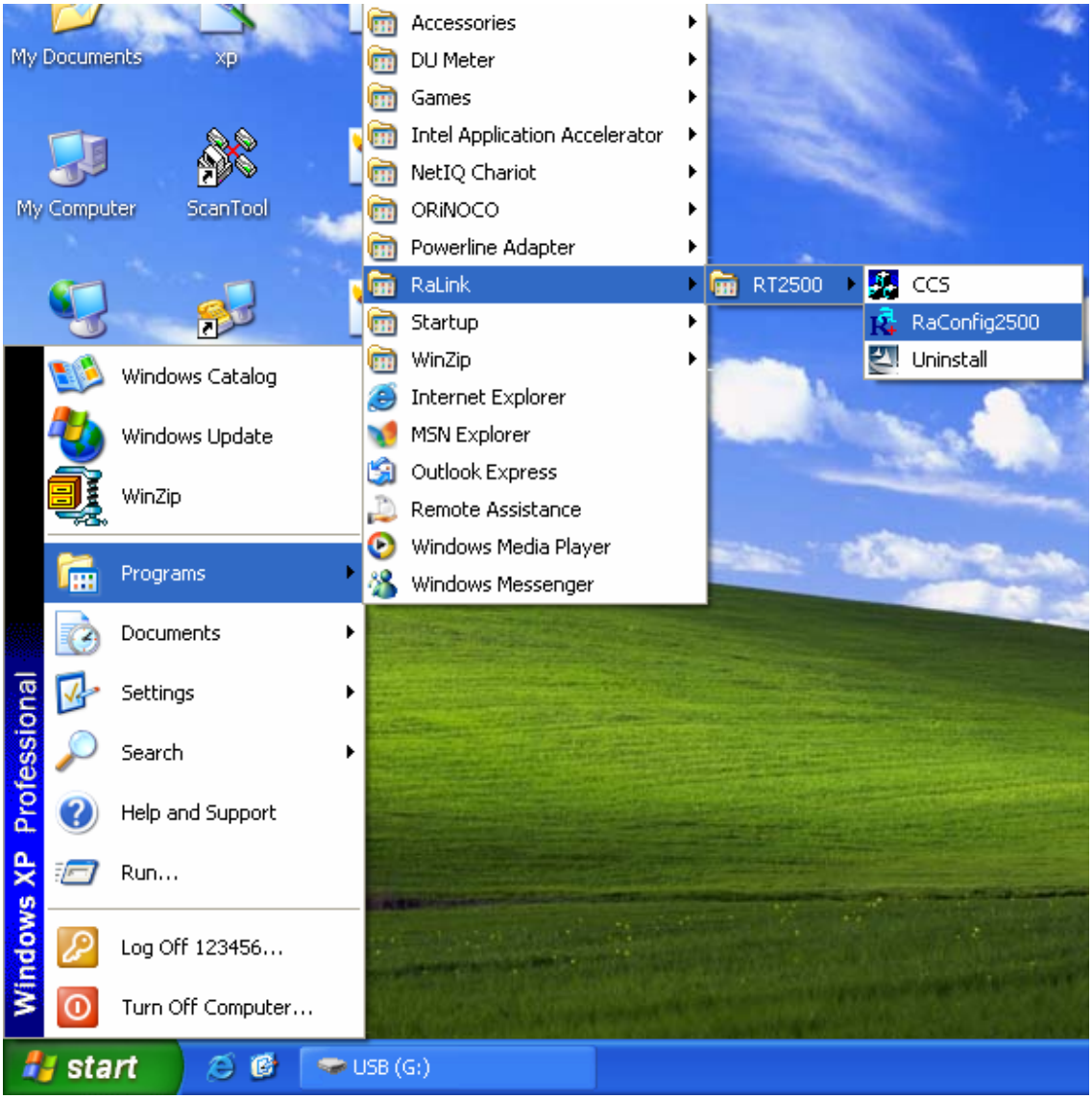


3.1 Invoking the Utility

After installing the driver and software utility, you will see the utility appear. You can also invoke the utility in one of two ways:

3.1.1 Invoking via the Start Menu

In order to invoke the utility via the Start Menu:
Select *Start, All Programs, Ralink, RT2500* and *RAConfig2500* in the Quick Launch area of the start menu. The Configuration Utility RT2500 Dialog Box appears.



3.1.2 Invoking via the Task Bar:

In order to invoke the utility via the Task Bar:
Double click the *utility icon* in the notification area of the task bar. The Configuration Utility RT2500 Dialog Box will appear.

The icon's color represents the Adapter's signal strength or status.

 Signal strength is good.

 Signal strength is normal.

 Signal strength is week.

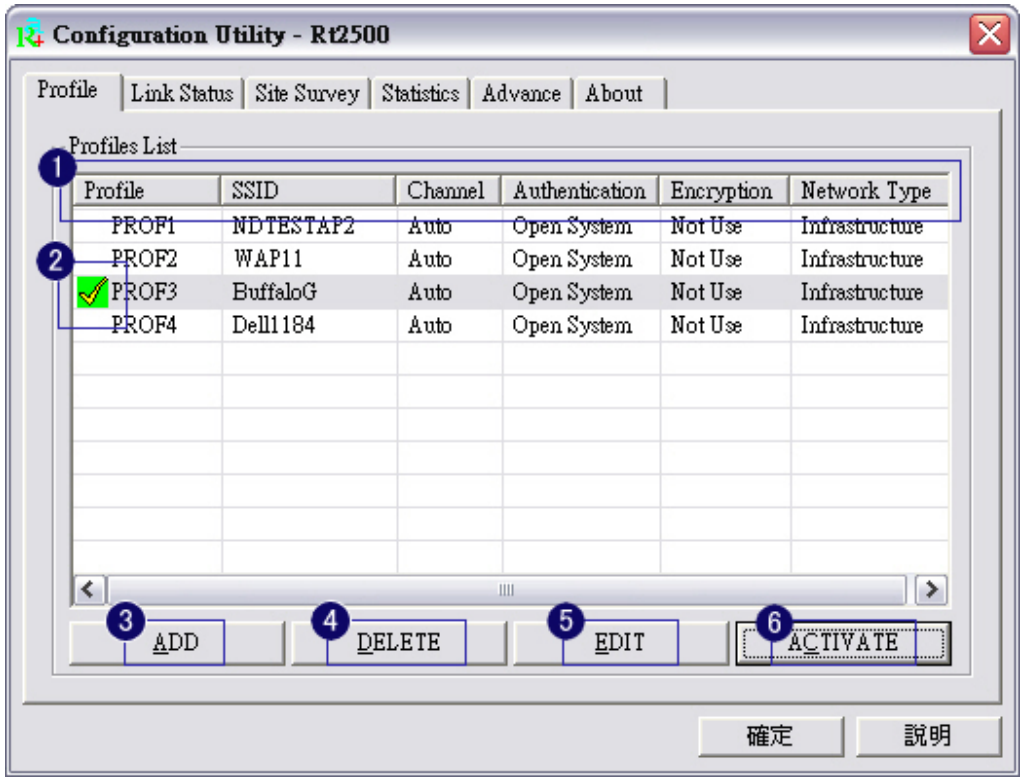
 No wireless connection.

 The Adapter is disable or unplugged.

4 WLAN Client Configuration Utility – Description

4.1 Profile

Profiles are a set of preset system parameters, or “snapshots”, of the available APs (Access Points) within a wireless network. You can record these “snapshots”. They are manually created (new/duplicate) by connecting to an AP (refer to Site Survey introduction), and then saving the system parameters as a specific profile.



A profile consists of the following three main parameters:

1. **Profile** — A name provided by the user (for example, Airport, Home) (the default is PROF*)

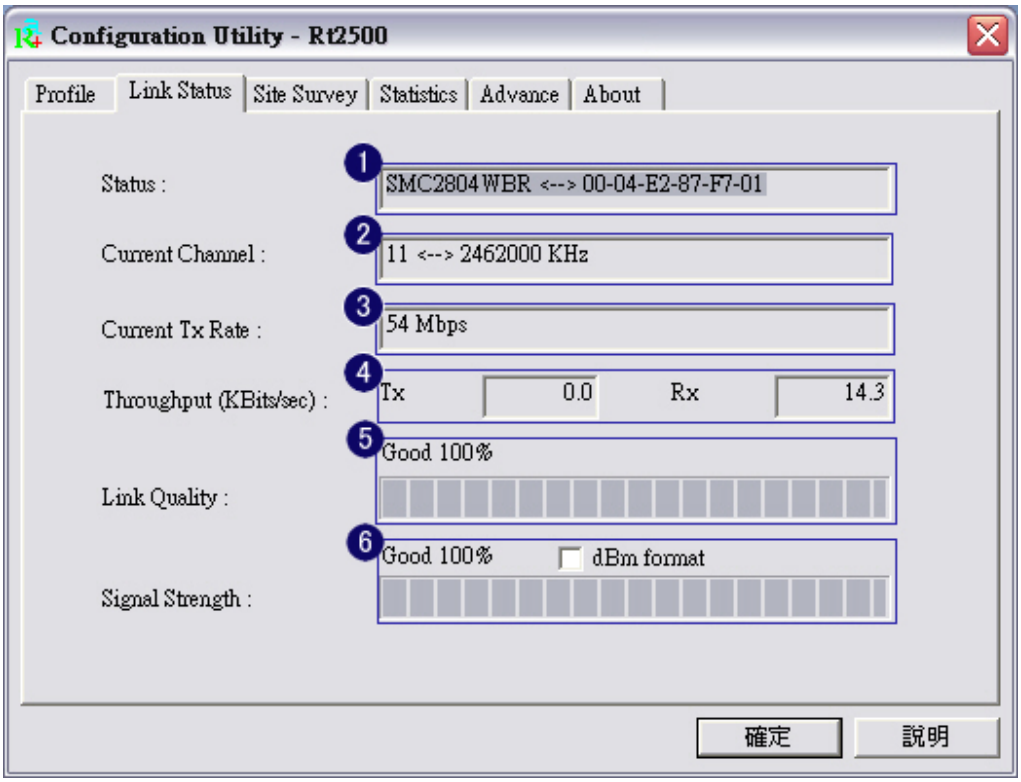
2. **SSID** — The character string of the wireless network identifier to which you want to connect.

3. **Authentication** — Use Open System(No WEP key), Shared Key(WEP key) or WPA-PSA to authenticate the peer side when association was initiated.

4 **Encryption**	AP's encryption type including WEP、AES、TKIP and NOT USE
5 **Channel**	This is the radio channel through which the access point communicates to stations in its BSS. A Basic Service Set (BSS) consists of a group of wireless stations, and an access point that is directly connected to the wired LAN. To establish an adhoc network, make sure the [Channel] is set to the same radio channel as that used by the other wireless clients in your group. However, if you are connecting to a network via an access point, the adapter will automatically synchronize up to the same channel as that used by the access point. Note: The available channel settings are limited to local regulations, which determine the number of channels that are available. FCC: 11 channels MKK: 14 channels
6 **Network Type**	Set the station operation mode to "802.11 Ad Hoc" for network configurations that do not have an access point, or to "Infrastructure" for configurations with an access point.
	Establish wireless connection with the AP
	Fail to establish wireless connection with the AP
	Add a new AP profile (for example, SSID, channel, etc)
	Delete an existing AP profile
	Edit an existing AP profile
	Activate the profile with which the Access point or station you want to associate. The activated profile is the default profile that this Wireless PC Card firstly applies to when this utility program starts running.

4.2 Link Status

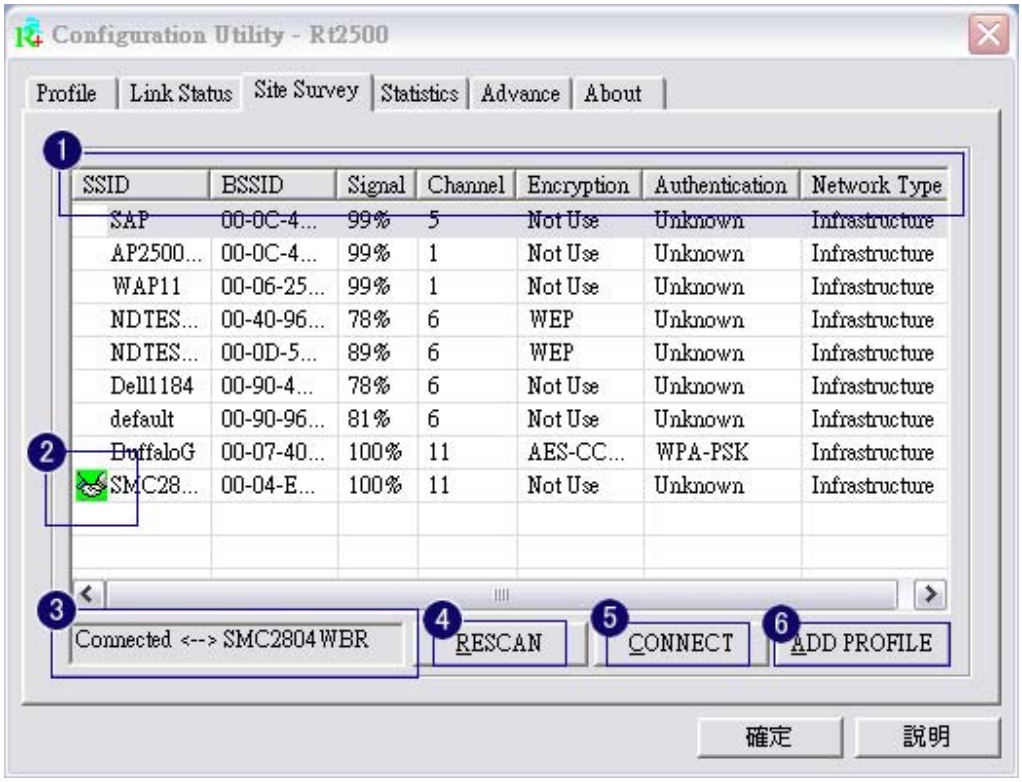
The Link Status tab indicates the wireless network information of the Wireless PC Card.



1	**Status**	Disconnected or SSID <-->BSSID
2	**Current Channel**	Show the using channel
3	**Current Tx Rate**	Show the current bit rate between 1-54Mbps
4	**Throughout**	Show the current Rx/Tx baud rate (measured in KBits/sec)
5	**Link Quality**	Show the percentage of the radio link quality while communicates with the associated Access Point or peer station.
6	**Signal Strength**	Show the sensitivity level of received signal strength (measured in percentage or dBm)

4.3 Site Survey

When the utility is activated, it will automatically detect all the access points within the wireless network and connect to one access point of the strongest signal and without any encryption.



1 A profile consists of the following three main parameters:

SSID The AP's ID which is designated by the local network administrator

BSSID A 6-byte hexadecimal ID number of the AP or based station whose traffic the data belongs to.
End-points communicating together should associate with the same BSSID.

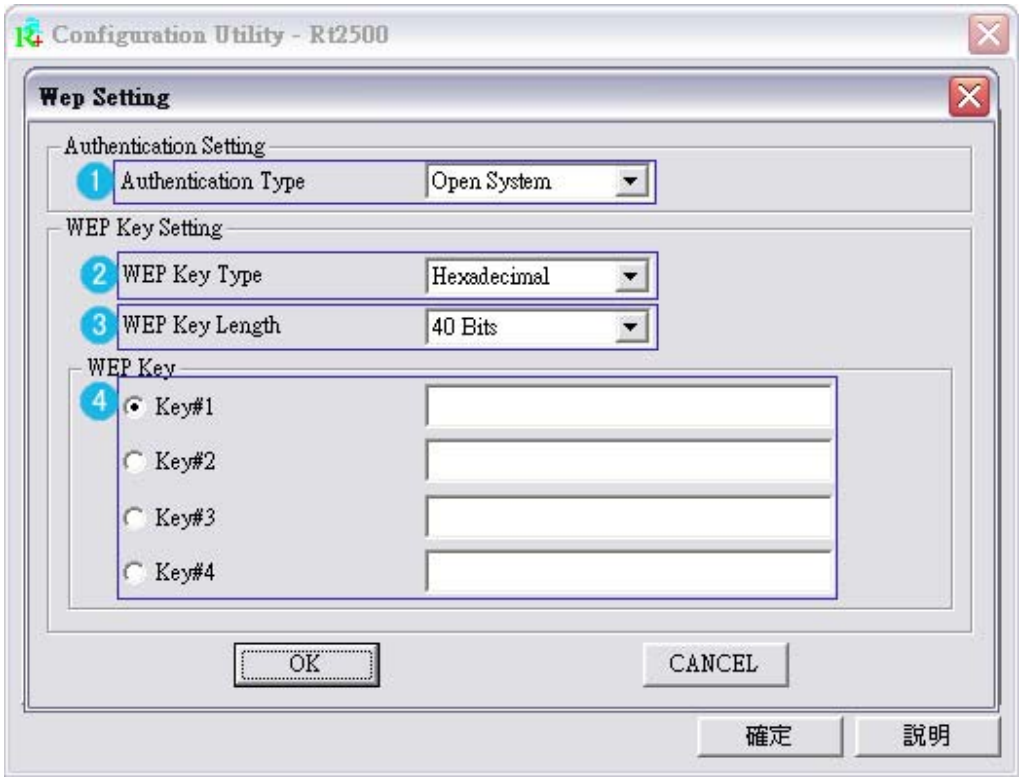
Signal Indicates signal strength detected in the station site for each Access Point or peer station (in %).

Authentication Use Open System(No WEP key), Shared Key(WEP key) or WPA-PSA to authenticate the peer side when association was initiated.

	Encryption	AP's encryption type including WEP、AES、TKIP and NOT USE
	Cannel	This is the radio channel through which the access point communicates to stations in its BSS. A Basic Service Set (BSS) consists of a group of wireless stations, and an access point that is directly connected to the wired LAN. To establish an adhoc network, make sure the [Channel] is set to the same radio channel as that used by the other wireless clients in your group. However, if you are connecting to a network via an access point, the adapter will automatically synchronize up to the same channel as that used by the access point. Note: The available channel settings are limited to local regulations, which determine the number of channels that are available. FCC: 11 channels MKK: 14 channels
	Network Type	AP's network topology including Infrastructure and Ad Hoc
2		Connection is established
3		Show the status of wireless network connection and the SSID
4	RESCAN	Update all APs' information
5	CONNECT	Connect with an AP
6	ADD PROFILE	Add an new AP's profile

4.4 Change AP Connection

Double click other AP if you want to change current wireless connection. If you connect with an AP that is using data encryption such as WEP, you will see the following window.



1 **Authentication Type** To configure this, you have to know the AP's setting first. Only when you connect to a 802.11g wireless network can you get the information of the AP's authentication type.

2 **WEP Key Type** Hexadecimal or ASCII

3 **WEP Key Length** 40bits or 104bits

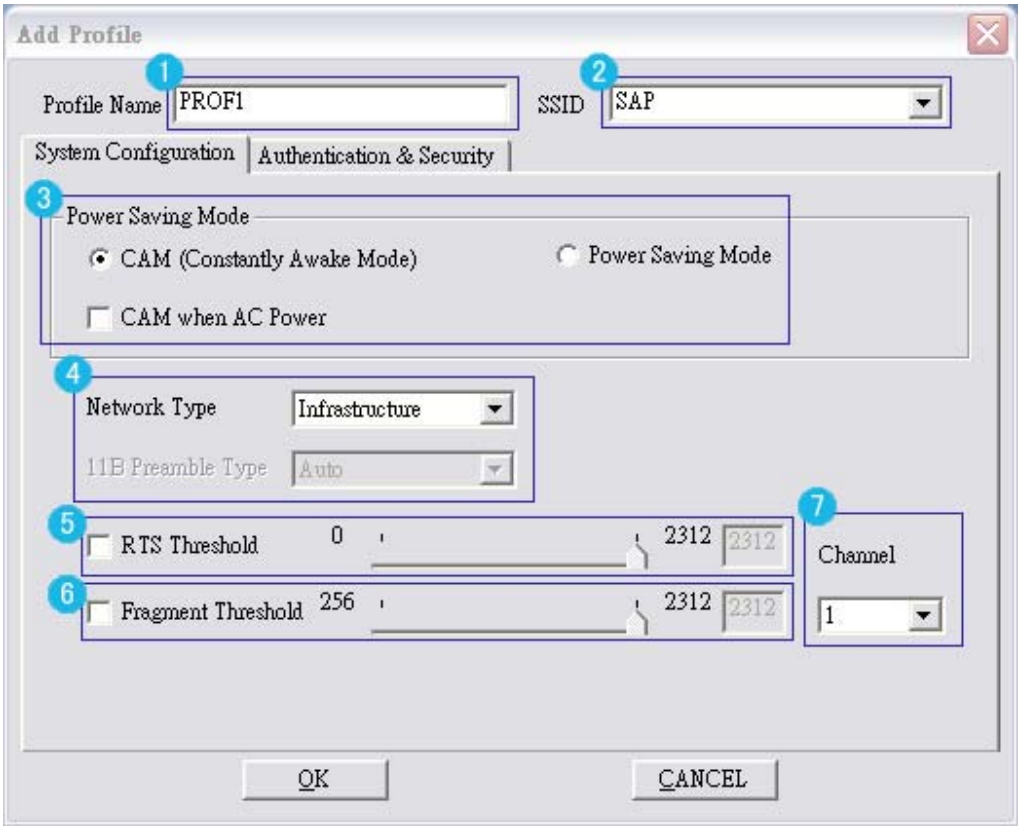
4 **WEP Key** There are four WEP Key settings based on the AP's settings. No WEP Key record will be left unless you use Profile to configure.

(1) Hexadecimal、40bits：10 hexadecimal letters
(2) Hexadecimal、128bits：32 hexadecimal letters
(3) ASCII、40bits：5 ASCII letters
(4) ASCII、128bits：16ASCII letters

4.5 Add Profile

4.5.1 System Configuration

A System Configuration window will appear when you add an AP's profile.



1 **Profile Name** This field is used to name your profile.

2 **SSID** This field is used to define the profile's SSID from the drop-down menu.

3 **Power Save Mode** CAM（Constantly Awake Mode）or (Power Saving Mode)
That the "CAM When AC Power" is clicked represents the Adapter will automatically switch to CAM mode as long as your PC uses external power supply. The Power Saving Mode is only supported in Infrastructure network.

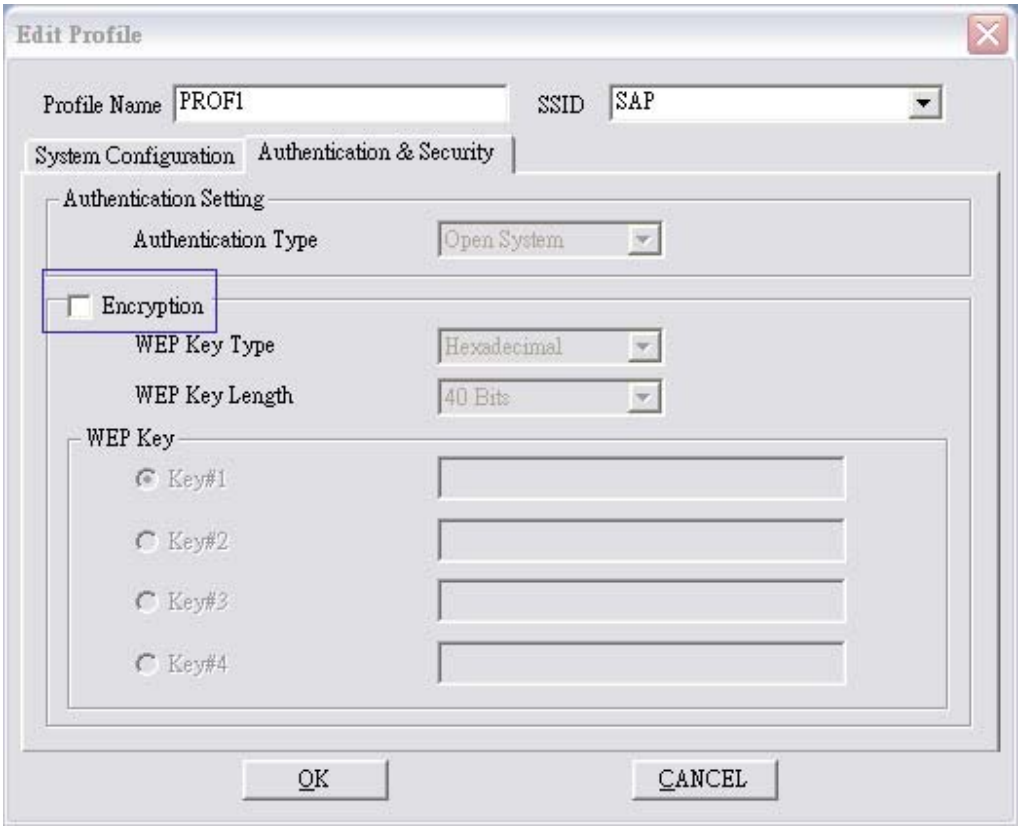
4 **Network Type** Infrastructure or 802.11 Ad Hoc
In Infrastructure network, the Power Saving Mode works instead of 11B Preamble Type. In 802.11 Ad Hoc network, Power Saving Mode will not work and 11B

Preamble Type as well as the Channel options will work.

5 **RTS Threshold**	RTS Threshold is a wireless network mechanism designed to prevent the Hidden Node issue , a problem happens in the wireless network when two wireless adapters served by the same AP can't communicate each other or have collision. Normally, the value of RTS Threshold is needless to change. The default value is 2312.
6 **Fragment Threshold**	Enable to increase the transmission efficiency by split mechanism. The value of Fragment Threshold is 2312.
7 **Channel**	This is the radio channel through which the access point communicates to stations in its BSS. A Basic Service Set (BSS) consists of a group of wireless stations, and an access point that is directly connected to the wired LAN. To establish an adhoc network, make sure the [Channel] is set to the same radio channel as that used by the other wireless clients in your group. However, if you are connecting to a network via an access point, the adapter will automatically synchronize up to the same channel as that used by the access point. Note: The available channel settings are limited to local regulations, which determine the number of channels that are available. FCC: 11 channels MKK: 14 channels

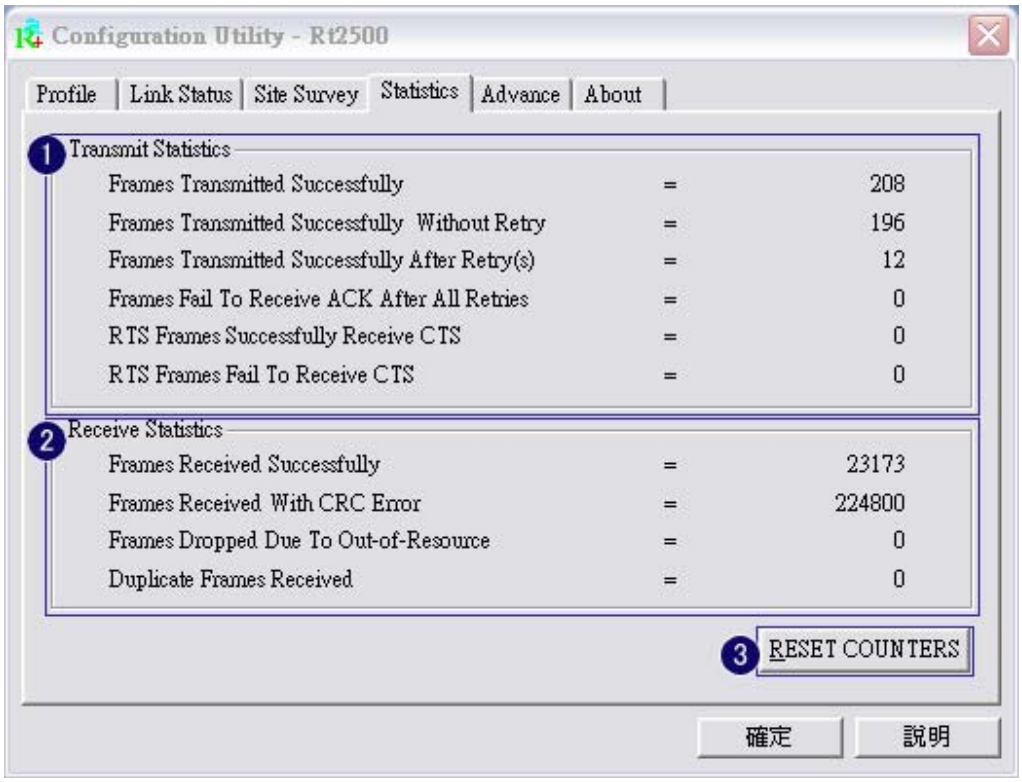
4.5.2 Authentication & Security

When the Encryption is enabled, the WEP Setting is the same as mentioned previously.



4.6 Statistics

It shows information on the Wireless PC Card's current traffic activity and its signal quality.



1 Transmit Statistics

Frames Transmitted Successfully	The field shows the successfully transmitted frame numbers.
Frames Transmitted Successfully Without Retry	This field shows the numbers of the successfully transmitted frame without retry.
Frames Transmitted Successfully After Retry	This field shows the numbers of the successfully transmitted frame with retry.
Frames Fail To Receive ACK After All Retries	This field shows the numbers of the unsuccessfully transmitted frame with many retries.
RTS Frames Successfully Receive CTS	This field shows the numbers of the successfully received the CTS（Clear To Send）after the Adapter sends out the RTS

	（Request To Send）to the AP.
RTS Frames Fail To Receive CTS	This field shows the numbers of the unsuccessfully received the CTS（Clear To Send）after the Adapter sends out the RTS（Request To Send）to the AP.

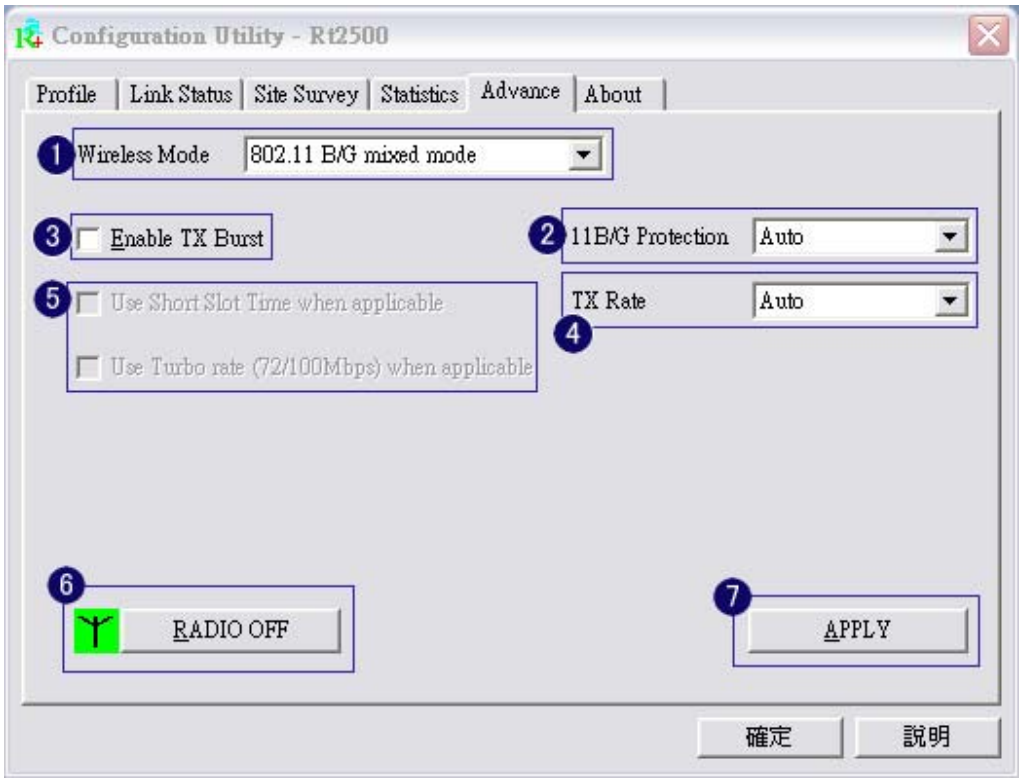
2 **Receive Statistics**

Frames Received Successfully	The field shows the successfully received frame numbers.
Frames Received With CRC Error	This field shows the numbers of the received frame with CRC error.
Frames Dropped Due To Out-of-Resource	This field shows the numbers of the received frame due to out-of-resource.
Duplicate Frames Received	The field shows the duplicate received frame numbers.

3 RESET COUNTERS — Recount all the information above.

4.7 Advance

The Advance tab allows you to configure the Wireless PC Card with some advanced settings.



1	**Wireless Mode**	802.11 B Only or 802.11 B/G mixed mode
2	**11B/G Protection**	802.11b uses CCK modulation and 802.11g uses CCK–compatible OFDM modulation. To prevent the data collision in the concurrent 802.11b and 802.11g network, it's necessary to enable 11B/G Protection in 802.11 B/G mixed mode.
	Auto	AP will automatically detect any 802.11b stations in the network environment.
	On	Protection is always on.
	Off	Protection is always off.
3	**Enable Tx Burst**	The field is to enable the Adapter to transmit more data in a frame interval, SIFS. Normally the frame interval is DIFS.

4	**TX Rate**	The field allows you to choose the transmission speed according to your Wireless Mode. In 802.11 B Only mode, the settings includes Auto, 1Mbps, 2Mbps, 5.5Mbps and 11Mbps；In 802.11 B/G mixed mode, the settings includes extra 6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps and 54Mbps.
5		This field is disabled currently.
6		This field is to control Radio power.
		Radio is on.
		Radio is off.
7		Apply to your new settings.

4.8 About

The About tab shows some information including wireless chipset vendor, utility version, driver version, EEPROM version and MAC address of this Wireless PC Card.

5 Installing WLAN Software AP Driver and Software Utility (WinXP only)

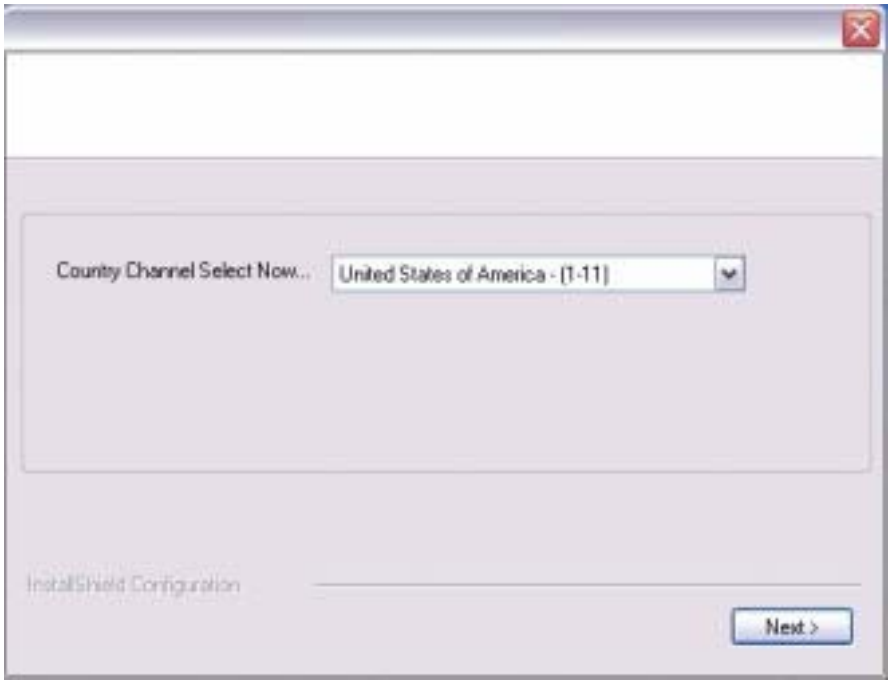
1. Windows will automatically detect this Wireless PC Card and the "Found New Hardware Wizard" window will appear. Click *Cancel*.

2. Insert the CD-ROM into your CD-ROM drive, browse to the SW AP folder, select the file *setup.exe*, and double click it.

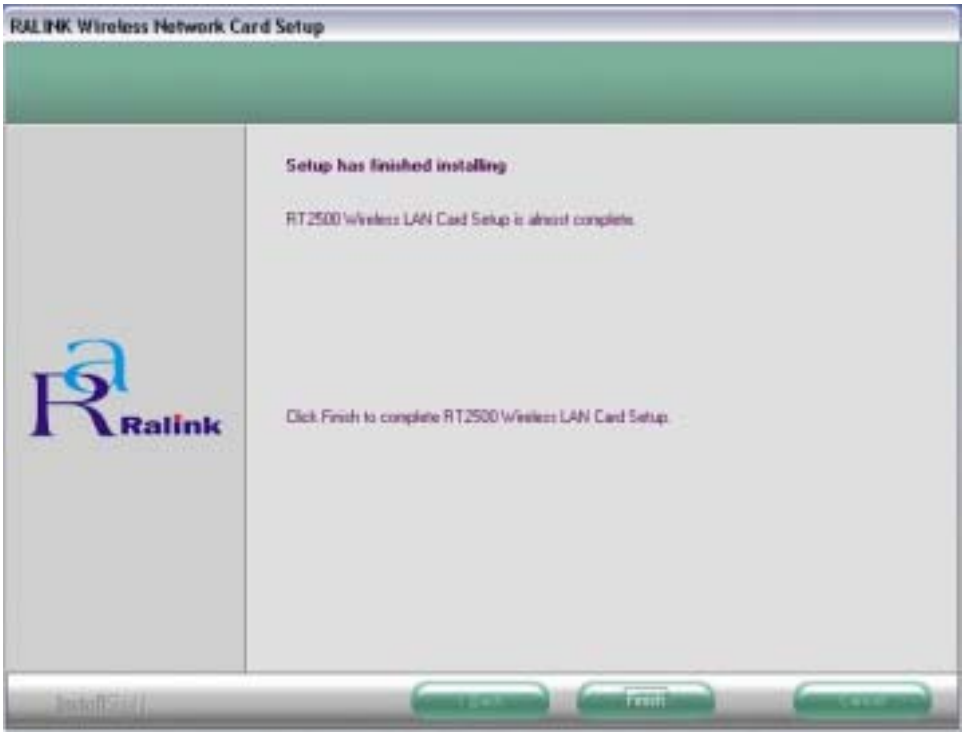
3. Click *Next* >.

4. Click *Continue Anyway*.

5. Select the *Country Channel* from the drop-down menu and click *Next* >.

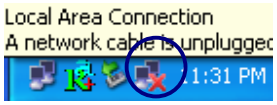


6. Click *Finish.*

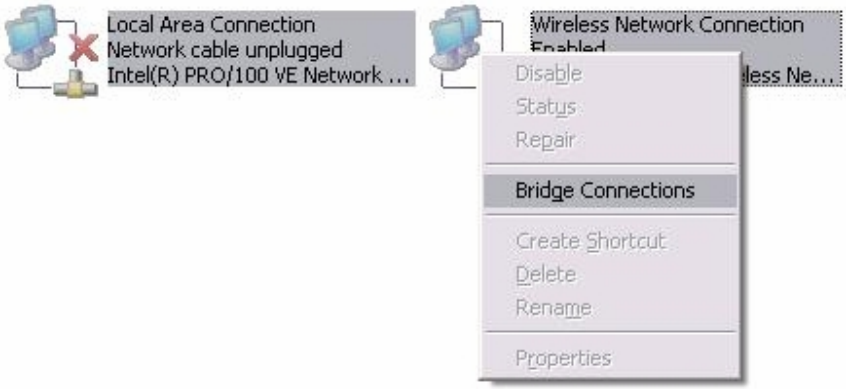


5.1 Bridge Connections

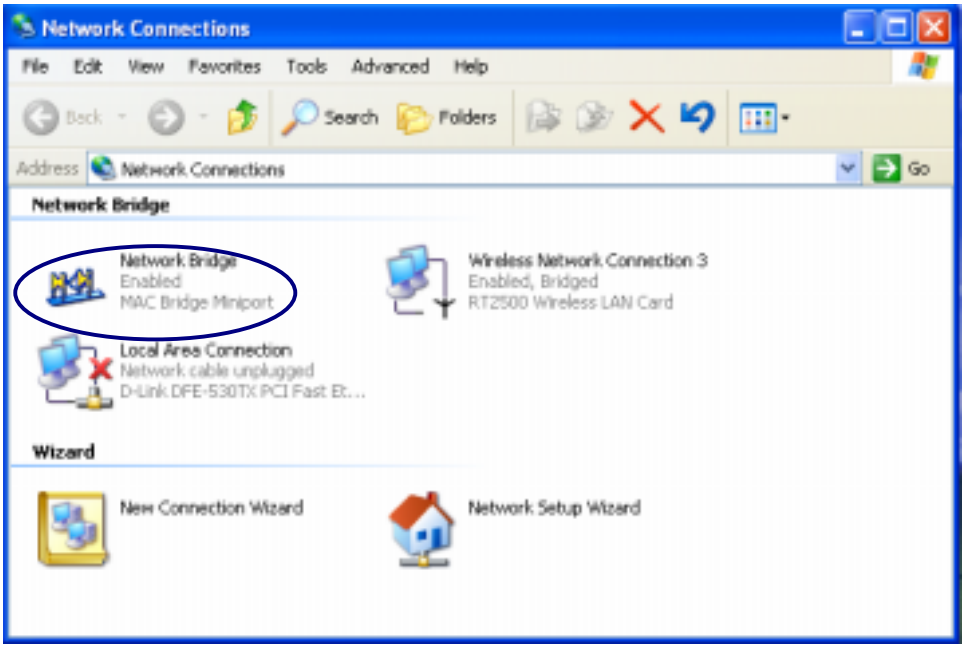
1. Make sure that your PC has equipped with an Ethernet Network Adapter. Double click the *network icon* on your system tray.



2. Make sure that either the Ethernet Network Adapter or the Wireless PC Card is not disabled. Select both and click *Bridge Connections*.



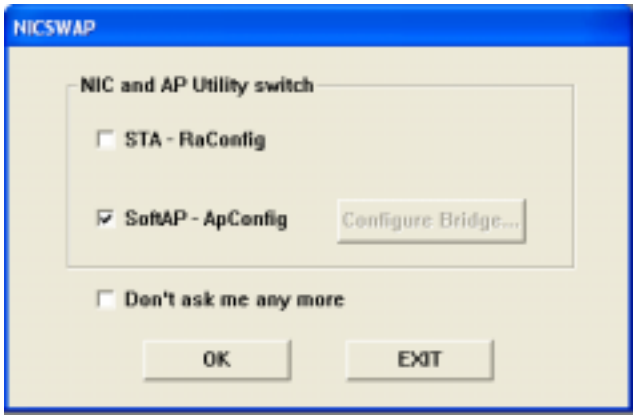
3. A new Network Bridge will appear.



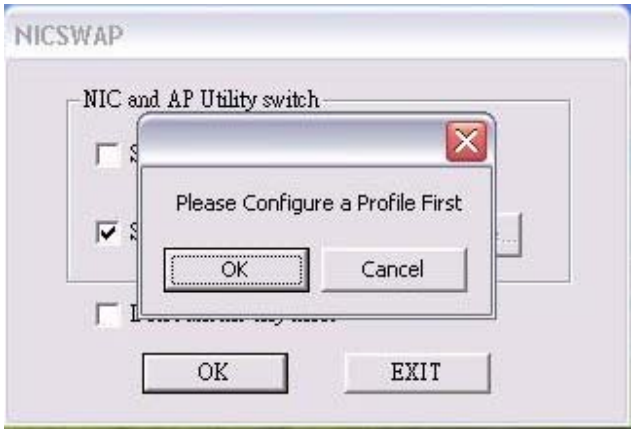
5.2 Invoking the Utility

1. Select *Start*, *All Programs*, *Ralink*, *RT2500* and *STA - AP* in the Quick Launch area of the start menu.

2. A “NICSWAP” dialog window will appear, select *SoftAP – AP Config*, and click *OK*.

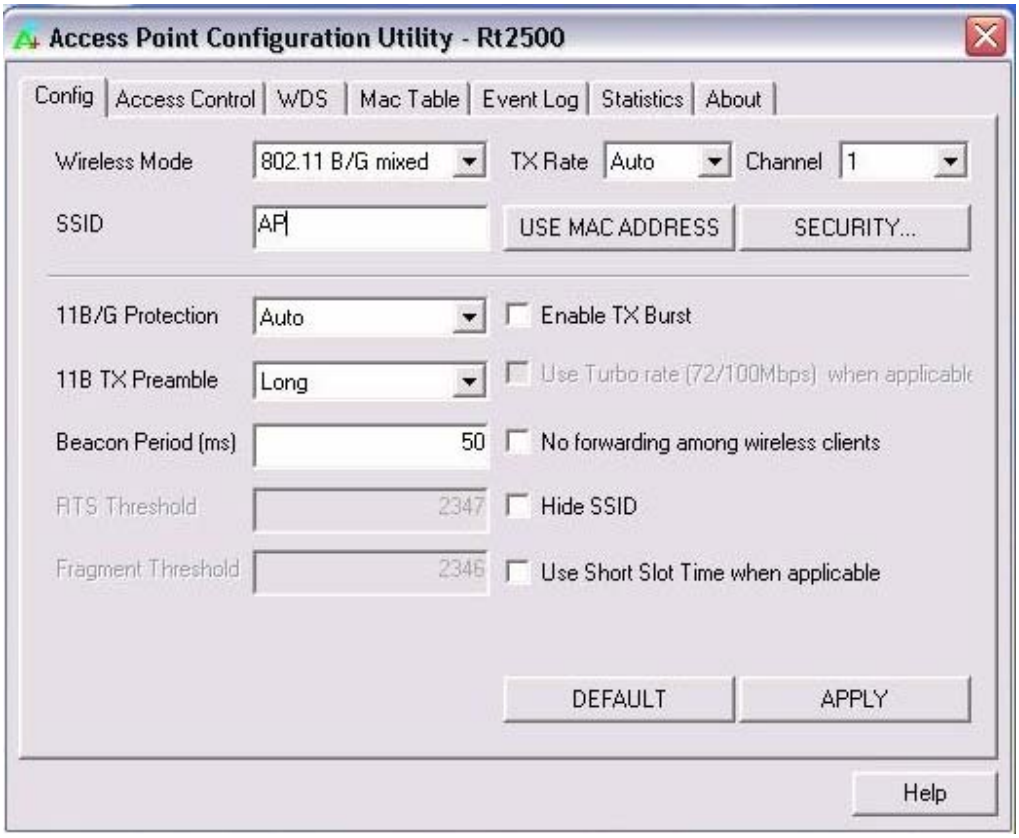


3. You will be asked to configure a profile first. Click *OK*.



6 WLAN Software AP Configuration Utility – Description

6.1 Config



Wireless Mode 802.11 B Only or 802.11 B/G mixed mode

TX Rate The field allows you to choose the transmission speed according to your Wireless Mode. In 802.11 B Only mode, the settings includes Auto, 1Mbps, 2Mbps, 5.5Mbps and 11Mbps；In 802.11 B/G mixed mode, the settings includes extra 6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps and 54Mbps.

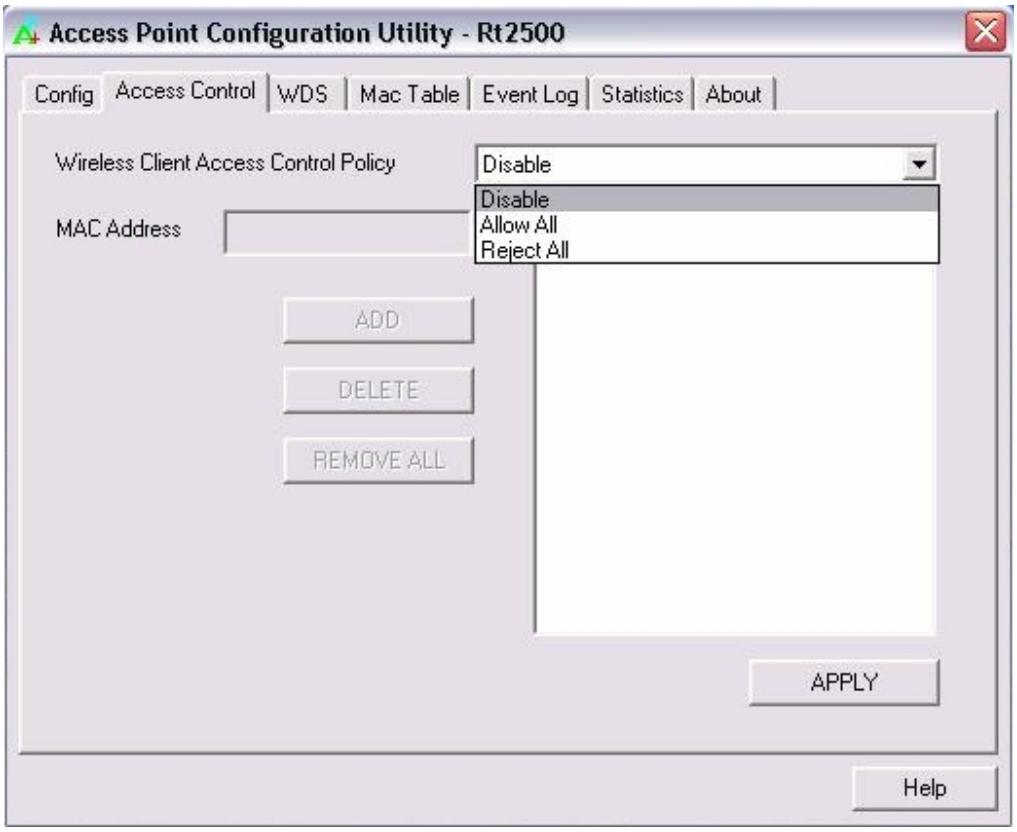
Channel	This is the radio channel through which the access point communicates to stations in its BSS. A Basic Service Set (BSS) consists of a group of wireless stations, and an access point that is directly connected to the wired LAN. To establish an Ad Hoc network, make sure the [Channel] is set to the same radio channel as that used by the other wireless clients in your group. However, if you are connecting to a network via an access point, the adapter will automatically synchronize up to the same channel as that used by the access point. Note: The available channel settings are limited to local regulations, which determine the number of channels that are available. FCC: 11 channels MKK: 14 channels
SSID	The character string of the wireless network identifier to which you want to connect.
11B/G Protection	802.11b uses CCK modulation and 802.11g uses CCK–compatible OFDM modulation. To prevent the data collision in the concurrent 802.11b and 802.11g network, it's necessary to enable 11B/G Protection in 802.11 B/G mixed mode.
11B TX Preamble	Long or Short preamble key type in the physical layer of packet
Beacon Period (ms)	Set a value here to define the duration between beacon packets.
Enable TX Burst	This field is to enable the Adapter to transmit more data in a frame interval, SIFS. Normally the frame interval is DIFS.
Use Turbo rate (72/100Mbps) when applicable	This field is disabled currently.
No forwarding among wireless clients	Click to prevent packet from looping among wireless clients.
Hide SSID	Do not show SSID in the public network.
Use Short Slot Time when applicable	This field enhances the maximum transmission power.
DEFAULT	Return to the default settings.

APPLY	Apply to your new settings.
SECURITY	This settings includes Authentication type selection, Encryption key input type & length of the encrypted/decrypted payload information, and WEP key index selection.

6.2 Security

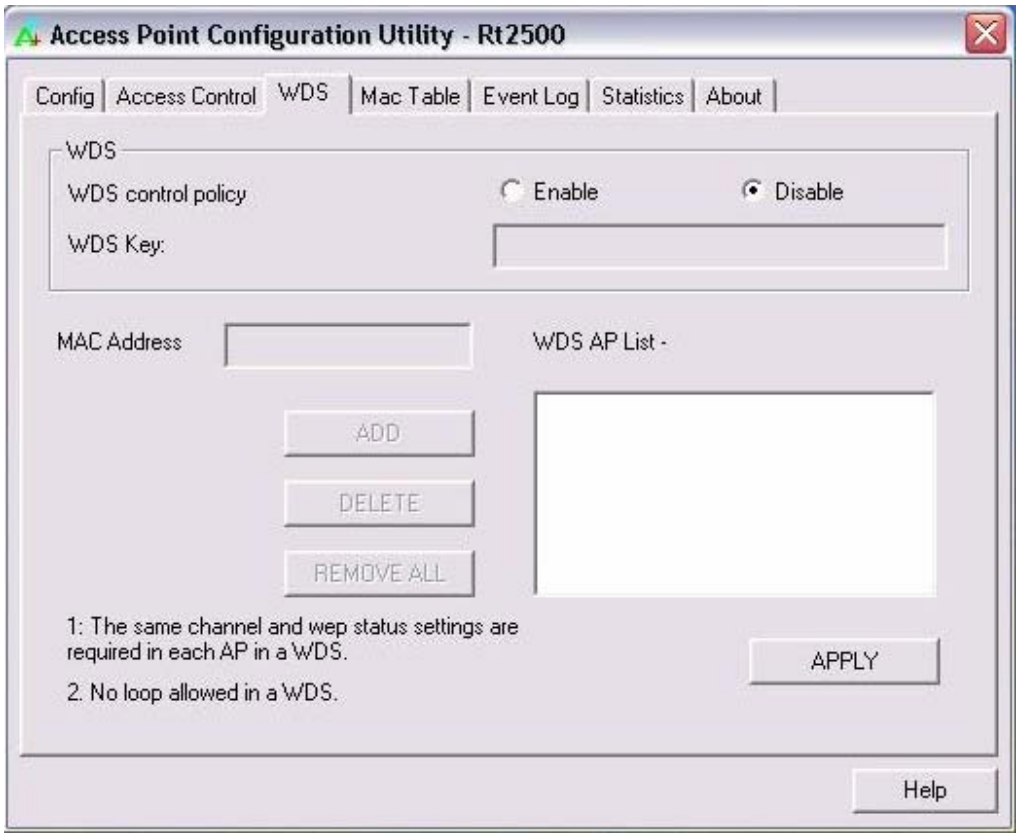
Authentication Type	To configure this, you have to know the AP's setting first. Only when you connect to a 802.11g wireless network can you get the information of the AP's authentication type.
Encryption Type	AP's encryption type including WEP、AES、TKIP and NOT USE
WPA Pre-Shared Key	A password between 8 and 63 characters long which is also used to configure other wireless client adapters
WPA Group Rekey Interval	The time to regenerate a new PSK key
WEP Key	There are four WEP Key settings based on the AP's settings. No WEP Key record will be left unless you use Profile to configure.

6.3 Access Control



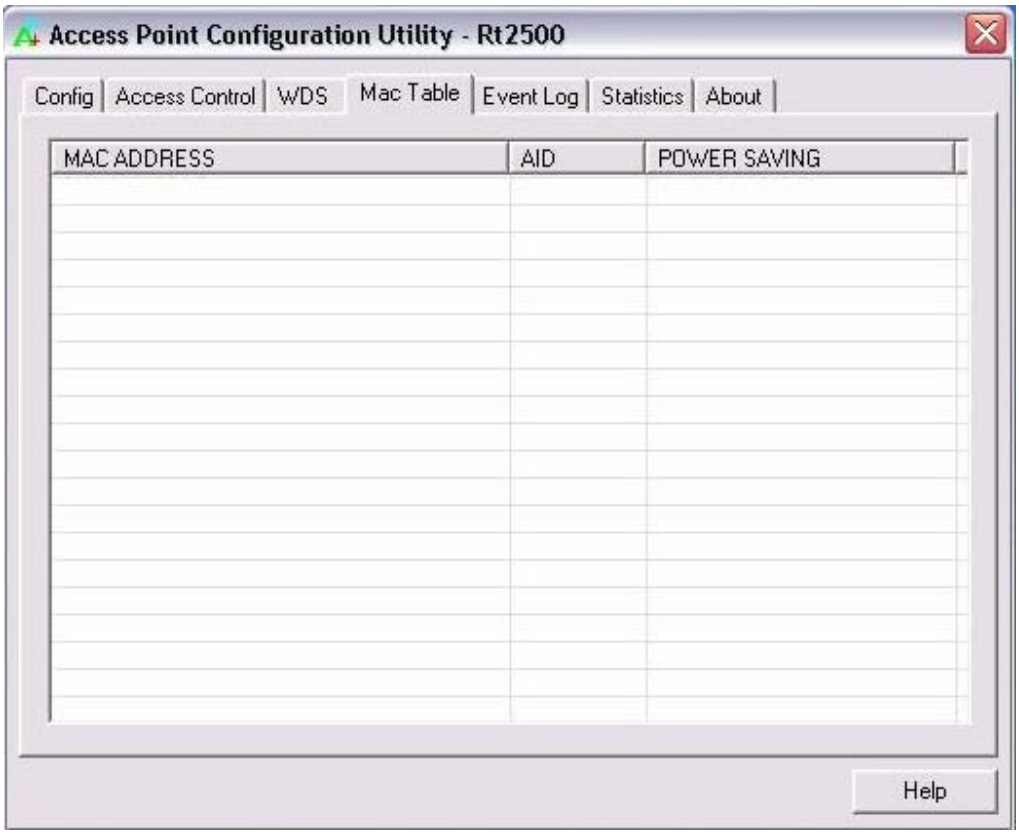
Wireless Client Access Control Policy	This field allows you to control wireless station's access.
MAC Address	The MAC address of wireless station
APPLY	Apply to your new settings.

6.4 WDS



WDS control policy	This field enables to wirelessly connect Access Points to extend a wireless network.
WDS Key	This key used to communicate among the WDS (Wireless Distribution System)
MAC Address	The MAC address of each AP
WDS AP List -	All Access Points in the WDS
APPLY	Apply to your new settings.

6.5 Mac Table

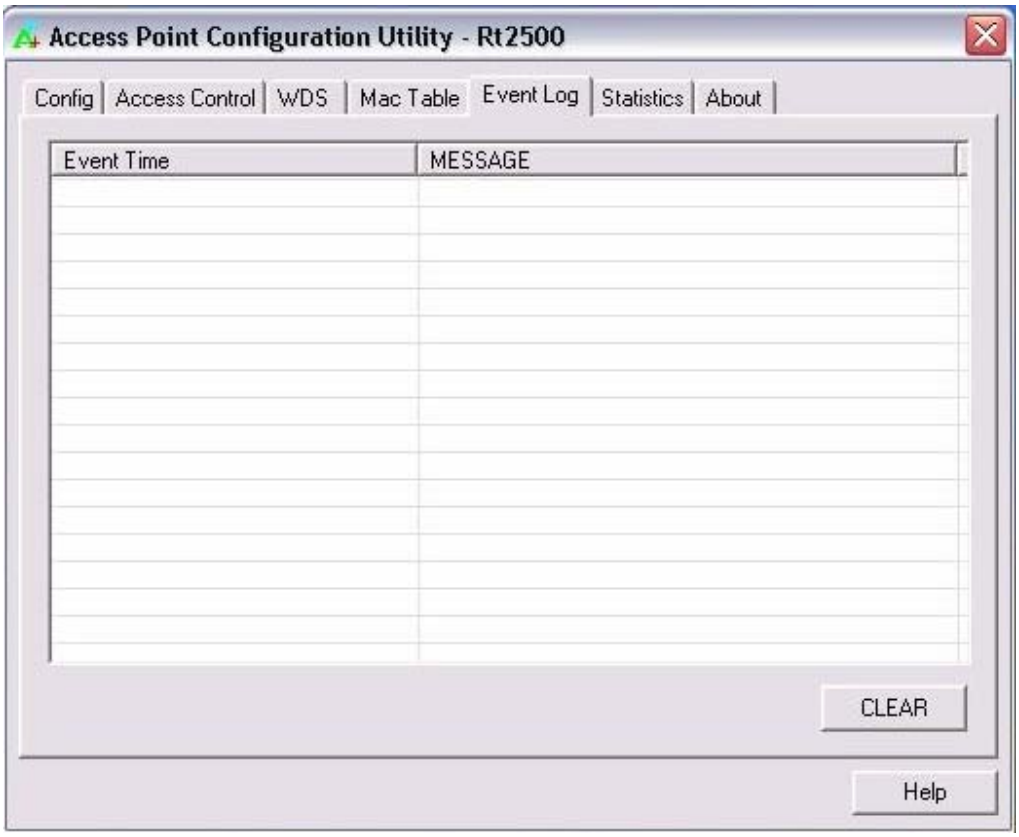


MAC ADDRESS Show the MAC address of each associated station

AID Show the identified code issued to each associated station

POWER SAVING Show the power saving status of each station

6.6 Event Log

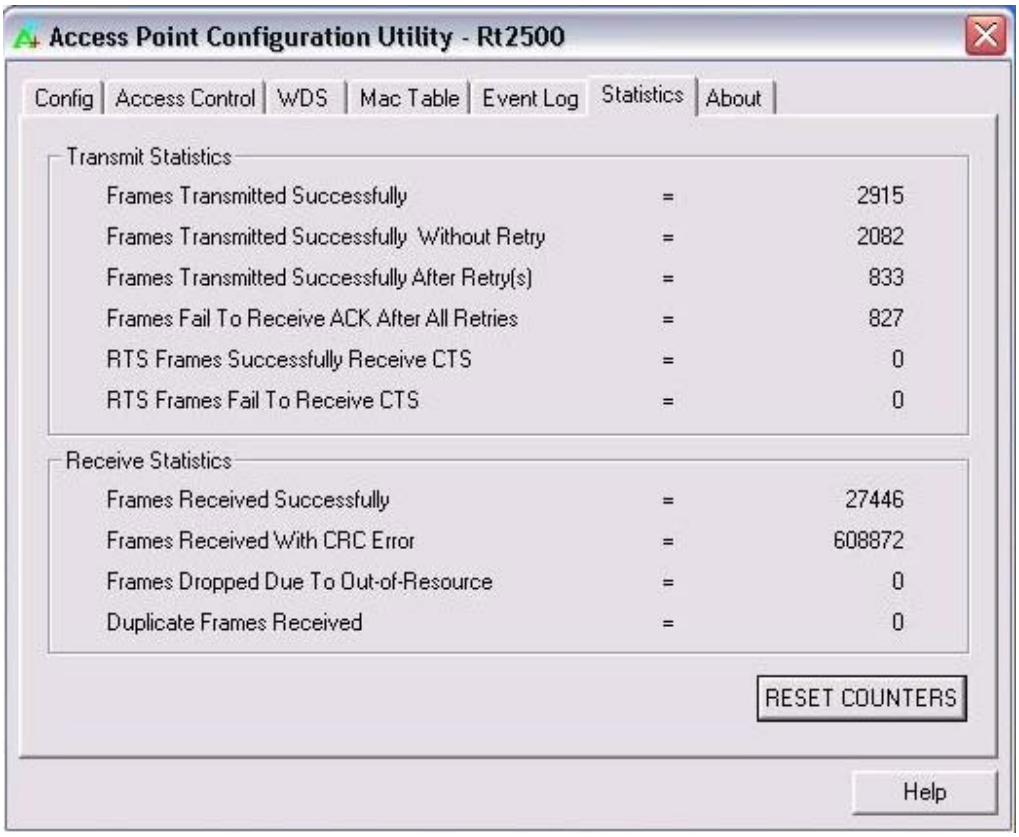


Event Time Show the recorded time of every event

MESSAGE Show the message of every event

CLEAR Clear all information in the event log

6.7 Statistics



❶ Transmit Statistics

Frames Transmitted Successfully	The field shows the successfully transmitted frame numbers.
Frames Transmitted Successfully Without Retry	This field shows the numbers of the successfully transmitted frame without retry.
Frames Transmitted Successfully After Retry	This field shows the numbers of the successfully transmitted frame with retry.
Frames Fail To Receive ACK After All Retries	This field shows the numbers of the unsuccessfully transmitted frame with many retries.
RTS Frames Successfully Receive CTS	This field shows the numbers of the successfully received the CTS （Clear To Send） after the Adapter sends out the RTS（Request To Send）to the AP.

RTS Frames Fail To Receive CTS	This field shows the numbers of the unsuccessfully received the CTS（Clear To Send）after the Adapter sends out the RTS（Request To Send）to the AP.

2 **Receive Statistics**

Frames Received Successfully	The field shows the successfully received frame numbers.
Frames Received With CRC Error	This field shows the numbers of the received frame with CRC error.
Frames Dropped Due To Out-of-Resource	This field shows the numbers of the received frame due to out-of-resource.
Duplicate Frames Received	The field shows the duplicate received frame numbers.

3 RESET COUNTERS — Recount all the information above.

6.8 About

The About tab shows some information including wireless chipset vendor, utility version, driver version, and MAC address of this Wireless PC Card.

7 Troubeshooting

1. *Question : The product literature says this Wireless PC Card can operate at 54Mbps. Why do I see no more than 11Mbps speed on my WLAN Configuration Utility status?*

   Answer: While you are connecting to an 802.11b network, the maximum 802.11b speed is 11Mbps. Moreover, the wireless connection quality between this Adapter and other stations will be limited to the space layout and thus the connection speed can't reach to 54Mbps.

2. *Question : I cannot connect to the Access Point or the wireless Router?*

   Answer: Make sure the same SSID/Channel/Security on the Wireless PC Card is the same as on the Access Point or the wireless Router. Move closer and try again.

3. *Question : I can connect to the Access Point, but I cannot connect to other computers on the network or the Internet?*

   Answer: Check to make sure that the Access Point is physically connected to the Ethernet network. Make sure that the IP addresses and the Windows networking parameters are all configured correctly. Restart your cable/DSL modem, router and access point.

4. *Question : The product literature says this Wireless PC Card can operate far to 328 feet (100 meters). Why can't it reach that range when working?*

   Answer: In optimal condition, this device can reach the maximum range. However, environmental factors such as other electric equipments and layout of building may adversely affect the effective range.