# USER'S MANUAL

# T60H563

MiniPCI WLAN/Bluetooth Combo Module

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#### Section One: Introduction

AMBIT MINIPCI 3B WLAN/Bluetooth Combo Module complied with IEEE 802.11b 11Mbps Standard. The WLAN/Bluetooth application is implemented via a Intersil Prism 2.5 RF circuit. This RF circuit is developed for Wireless LAN application complied with IEEE 802.11b 11Mbps standard in ISM band. It can be used to provide a variety of low-cost wireless network interfaces to build your wireless connection via simply SMT procedure to speed the time to market. Three Intersil's chips are implemented including ISL3984, ISL3685, HFA3783. With Bluetooth technology, the Bluetooth part can achieve internet connection rates up to 721 kbits/s. The Notebook communicate with Bluetooth by MiniPCI Interface Reserve pin. The WLAN/Bluetooth combo card mechanical complies with MINIPCI 3B from factor.

#### 1.1 Features

Form Factor & Bus Interface	MiniPCI Type IIIB, compliant to MiniPCI 1.0
Wireless LAN Compliance	IEEE 802.11b
Radio Technology	Direct Sequence Spread Spectrum
<b>Operating Frequency</b>	$2.4 \sim 2.4835 GHz$ ISM band
Modulation Schemes	DQPSK, DBPSK and CCK
Channel Numbers	IEEE 802.11b compliant
	$1 \sim 11$ channels for United States
WLAN Data Rate	11Mbps with fall back rates of 5.5, 2, and 1Mbps
Spreading	11-chip Barker Sequence
Media Access Protocol	CSMA/CA with ACK
Transmitter Output Power	Typ. 15 dBm (ERP)
<b>Receiver Sensitivity</b>	Typ. –82 dBm for 11Mbps @ 8% PER
	Typ. –85 dBm for 1Mbps @ 8% PER
Antenna Type	Integrated diversity switch with Hirose compliant connectors(U-FL) for connecting dual diversity antennas

#### 1.1.1 WLAN Hardware Specification

1.1.2 Bluetooth Hardware Specifications

**Bluetooth Module Chip Set** 

CSR BlueCore 02

Supply Voltage	2.7V to 3.3V
Power Features	Host wake-up on the module
	Detach the module from host
Frequency Range	2.400-2.497 GHz
Antenna Load	50 Ohm
Receive Sensitivity	-80 dBm@0.1% BER
Maximum Receiver Signal	-20 dBm
TX Power (ERP)	4 dBm maximum (class 2 and class 3)
<b>RF Power Control Step Size</b>	2 dB
Range	10 meters at 0 dBm TX power (class 2)
Radio	Compliant with Bluetooth standard version 1.1
Pico Net	1 master to 7 slaves
Operating Channels	79 channels of 1 MHz BW
Security	Full support of Bluetooth security provisions including hardware support for full length 128 bit encryption keys.
Host Interface (USB)	USB specification 1.1 compliant
1.1.3 Software Specification	
OS	- Supports Windows 98SE, ME, 2000, XP
Configuration	- User interface for configuration and status
	monitoring
WLAN Standard Compliance	- 802.11b,- 802.1X for Windows XP
Bluetooth Standard	- Bluetooth Specification 1.1
Site Survey	- Auto scan to find APs nearby and show signal strength for each channel (for WLAN only)

### 1.2 Package Contents

Make sure you have received the following items in your package:

One Mini-PCI Type IIIB WLAN/Bluetooth Module One Phone Cable (Bluetooth) User Manual

#### Section Two: Bluetooth Installation

The following steps provide instructions for installing Bluetooth.

- 1. Make sure your MiniPCI WLAN/BT Combo card already insert into the slot.
- 2. Insert the connector of Antenna cable into the antenna connector of MiniPCI Module .

The antenna connector assembly need to be performed by well trained engineer to cause antenna connector mismatch then degrade Bluetooth connection performance. Please find your vendor to help this connector assembly.

#### 2.1 Driver Installation

Your Bluetooth is using the Plug and Play (PnP) capabilities of you computer. PnP is a set of specifications that define the ability for the computer hardware and operating system to automatically configure all compliant devices that are installed, relieving the user of the need to determine which addresses and interrupts to user for each device.

Proceed to the following section.

#### Install Bluetooth (Windows 98/2K/ME/XP)

1Execute the program 'Setup.exe' in the CD. Windows displays the dialog as below. Press

景 Widcomm Bluetooth Software 1.2.2.9 - InstallShield 精畫 🛛 🔀		
	<b>歡迎使用 Widcomm Bluetooth Software</b> 1.2.2.9 InstallShield Wizard	
	InstallShield(R) Wizard 將要在您的電腦中安裝 Widcomm Bluetooth Software 1.2.2.9 。要繼續,諸按一下「下一步」 。	
	警告:本程式受版權法和國際條約的保護。	
<上一步(B) 下一步(M) > 取消		

'Next' button to continue.

2. Select the "Device name" and "Device Type" that you want to Install.

🙀 Widcomm Bluetooth S	oftware 1.2.2.9 - InstallShield 精靈	
<b>裝置資訊</b> 請輸入您希望 Bluetooth	Neighborhood 中其他人看到、您電腦的相關資訊	
裝置名稱:		
ASUS		
裝置類型:		
桌上型	~	
InstallShield		
THRAIDHEID	<上一步(B) 下一步(N) >	取消
		-4X/H

#### 3. Wait for the install program to do the installation.

	装您選擇的程式功能。 InstallShield Wizard 正在安裝 Widcomm Bluetooth Software 1.2.2.9,諸稍
17	installaned wizard 正在安裝 widcomm bidetooth bottware 1.2.2.9 · ann 候。這需要幾分鐘的時間。
	狀態:

## 4. Select "OK" to avoid Microsoft Digital Signature message

devices. As a result, at this time Bluetooth devices. In the event	ave a certification program in place for Bluetooth it is not possible to provide certified drivers for t that Microsoft implements a Windows Logo oth devices, signed drivers will be made available.
select OK to disable unsigned d default warning option will be r Bluetooth drivers. This option i while using this product. If you	mpts for signed drivers during the installation proces river warnings, and proceed with the installation. The re-enabled at the completion of the installation of the is an effort to provide the best customer experience a select Cancel, the installation will continue without a will be required to select Continue at each prompt to will be required to select Continue at each prompt to
	OK Cancel

5. Congratulations! Bluetooth has been installed successfully.

Please click 'Finish' to go to the next step.

🤯 Widcomm Bluetooth Software 1.2.2.9 - InstallShield 精靈 🛛 🔀				
	完成 InstallShield Wizard			
	InstallShield Wizard 已成功地安裝了 Widcomm Bluetooth Software 1.2.2.9。按一下「完成」退出精靈。			
<上一步( <u>B</u> ) <b>完成(F)</b> 取消				

6.Select the Application that you want to use.

💆 My Bluetooth Places\我的装置			
檔案(F) 編輯(E) 檢視(V) Bluetoo	oth(B) 我的最愛(A) 工具(T)	說明(出)	A.
3上一頁 • 🔘 • 🏂 🔎	搜尋 🌔 資料夾 🛄 🔻		
網址 🛛 🛃 My Bluetooth Places 我的裝	<b>꼽</b>		🖌 🏹 移至
Bluetooth 工作 余 砂 檢視或修改組態	Bluetooth 序列連接埠 自動	停填目動	
警路用「資訊同步處理」服務 重新命名服務連線。 资 檢視此連線的狀態	資訊交換 自動	資訊同步處理	
■ 顯示這項服務的內容 其他位置	網路連線 自動	<b>接號網路</b> 自動	
<ul> <li>健康</li> <li>健康</li> <li>● 我的電腦</li> <li>● 共用文件</li> </ul>	<b>ビデ 檔案轉送</b> 自動		
8 My Bluetooth Places			
詳細資料			
<b>資訊同步處理</b> 已停用			

#### Uninstall Bluetooth (Windows 98/2K/ME/XP)

One can remove the Bluetooth via the 'Add/Remove Programs' in the 'Control Panel'. Select '**Bluetooth**' and click 'Add/Remove' button, the dialog as below displays.

目前安装的程式	排序方式(3):名利	Ħ	~
😹 Adobe Acrobat 4.0		大小	8.75ME
쮛 BlueStation Demo Software	5	大小	0.38ME
わ Dr.eye 2001 譯典通	3	大小	112.00ME
👩 Dupro CD Toolkit 4.0		大小	2.22ME
🐵 Lotus Notes		大小	1,859.00ME
Microsoft Office XP Professional		大小	433.00ME
🁹 Nero - Burning Rom	3	大小	34.55ME
🌋 TestTrack Pro		大小	6.22ME
Widcomm Bluetooth Software 1.2.2.9   按這裡取得支援資訊。			<u>16.07ME</u> 很少
要從您的電腦移除這個程式,請按 [移除]。			移除
🀑 Windows XP HCT 10.0	;	大小	223.00ME
		-	關閉(())
	<ul> <li>Adobe Acrobat 4.0</li> <li>BlueStation Demo Software</li> <li>Dr.eye 2001 譯典通</li> <li>Dupro CD Toolkit 4.0</li> <li>Lotus Notes</li> <li>Microsoft Office XP Professional</li> <li>Nero - Burning Rom</li> <li>TestTrack Pro</li> <li>Widcomm Bluetooth Software 1.2.2.9 按這裡取得支援資訊。</li> <li>要從您的電腦移除這個程式,請按 [移除]。</li> </ul>	Adobe Acrobat 4.0	Adobe Acrobat 4.0       大小            BlueStation Demo Software       大小            Dr.eye 2001 詳典通       大小            Dupro CD Toolkit 4.0       大小            Dupro CD Toolkit 4.0       大小            Microsoft Office XP Professional       大小            Widcomm Bluetooth Software 1.2.2.9        大小            Widcomm Bluetooth Software 1.2.2.9        大小            Widcomm Bluetooth Software 1.2.9               Widcomm Bluetooth Software 1.2.9               Widcomm Bluetooth Software 1.2.9               Widcomm Bluetooth Software 1.2               Widcomm Bluetooth Software 1.2               Widcomm Bluetooth Software 1.2

2. Wait for the un-installation to do its work.

5 新碧或卷	徐程式			
	目前安装的程式:	排序方式(③):	名稱	~
變更或	🛃 Adobe Acrobat 4.0		大小	8.75MB
移除 程式(出)	쮛 BlueStation Demo Software		大小	0.38MB
1	🇞 Dr.eye 2001 譯典通		大小	112.00MB
100 C	🞯 Dupro CD Toolkit 4.0		大小	2.22ME
新增 程式(N)	🐵 Lotus Notes		大小	1,859.00ME
	Microsoft Off WD D		大小	433.00ME
6	👹 Nero - Bumi Widcomm Bluetooth Softw	are 1.2.2.9	大小	34.55ME
新增移除	🎼 TestTrack Pr 🚽 🗾 正在準備移除		大小	6.22ME
Windows 元件( <u>A</u> )	👸 Widcomm		大小	16.07ME
	按這裡取得 正在蒐集必要的資訊		已使用	很少
	要從您的電	■■■ 取消		移除
	🀑 Windows XF		大小	223.00ME
	~			
				關閉⊙)

3. Then Complete the un-Installation.

#### Section Three: Wireless Lan Installation

#### **3-1 System Requirements**

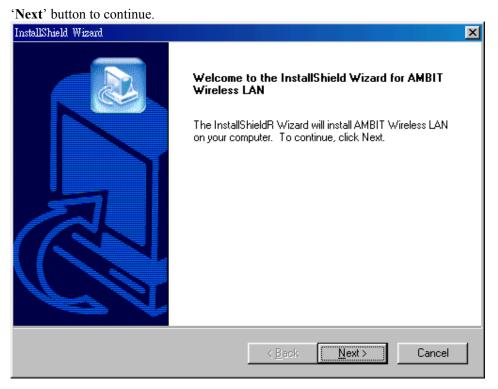
In order to install Wireless LAN and use the Wireless LAN/Bluetooth combo card in your notebook computer. Your notebook system must meet the following requirements:

- A Mini-PCI Type III Slot that already insert in WLAN/BT Combo module
- Windows 98SE,2K,ME,XP Support

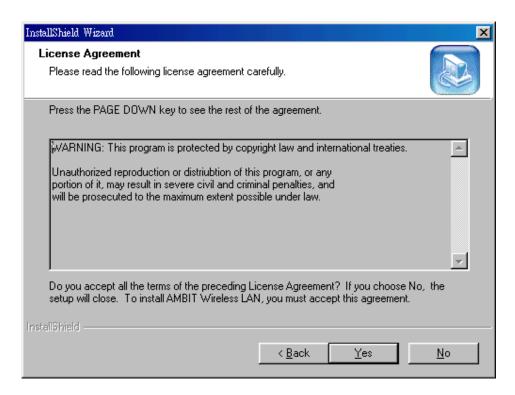
#### **3-2 Installation and Uninstall Process**

#### Install Wireless LAN (Windows 98/2K/ME/XP)

1. Execute the program 'Setup.exe' in the CD. Windows displays the dialog as below. Press



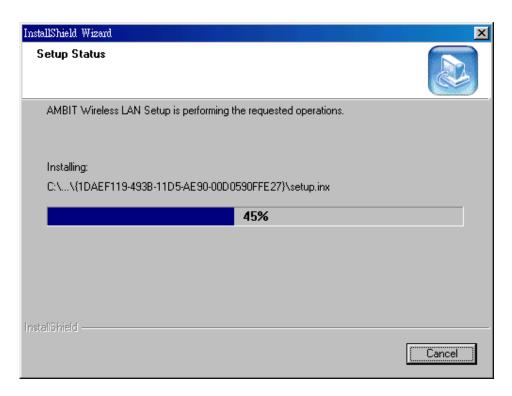
2. It displays a License Agreement dialog. Press 'Next' to continue.



3. Select the destination folder that you want to place the files.

InstallShield Wizard	×
Choose Destination Location Select folder where Setup will install files.	
Setup will install AMBIT Wireless LAN in the fol	lowing folder.
To install to this folder, click Next. To install to a another folder.	a different folder, click Browse and select
Destination Folder C:\Program Files\AMBIT\Wireless	Bīowse
	< <u>B</u> ack <u>Next</u> Cancel

4. Wait for the install program to do the installation.



5. Congratulations! Wireless LAN has been installed successfully.

Please click 'Finish' to go to the next step.

InstallShield Wizard	
	InstallShield Wizard Complete Setup has finished installing AMBIT Wireless LAN on your computer.
	< Back Finish Cancel

 Please remove any disks from any drives before your click 'Finish'. Then click 'Finish' to complete setup.

InstallShield Wizard	
	InstallShield Wizard Complete The InstallShield Wizard has successfully installed AMBIT Wireless LAN. Before you can use the program, you must restart your computer. (•) Yes, I want to restart my computer now) (•) No, I will restart my computer later. Remove any disks from their drives, and then click Finish to complete setup.
	< <u>B</u> ack <b>Finish</b> Cancel

### Uninstall Wireless LAN (Windows 98/2K/ME/XP)

1. One can remove the AMBIT Wireless LAN via the 'Add/Remove Programs' in the 'Control Panel'. Select 'AMBIT Wireless LAN' and click 'Add/Remove' button, the dialog as below displays.

InstallShield Wizar	d 🗙
Welcome Modify, repair	r, or remove the program.
	the AMBIT Wireless LAN Setup Maintenance program. This program lets you irrent installation. Click one of the options below.
⊙ <u>M</u> odify	Select new program components to add or select currently installed components to remove.
C R <u>e</u> pair	Reinstall all program components installed by the previous setup.
Eemove     Eemove     InstaliShield	Remove all installed components.
	< <u>B</u> ack. <u>N</u> ext > Cancel

2. Select 'Remove' and then click the 'Next' button to perform the un-installation. Click 'OK' button if you really want to remove the AMBIT Wireless LAN.

Confirm File Deletion					×
Do you want to comp	letely remove	e the selected	application a	und all of it	s components?
[	確定		取消		

3. Wait for the un-installation to do its work.

InstallShield Wizard	×
Setup Status	
AMBIT Wireless LAN Setup is performing the requested operations.	
Uninstalling:	
C:\WINDOWS\INF\	
13%	
InstallShield	
	Cancel

4. Click 'Finish' to complete the un-Installation.

InstallShield Wizard	
	Maintenance Complete InstallShield Wizard has finished performing maintenance operations on AMBIT Wireless LAN.
	< Back Finish Cancel

#### Section 4 Wireless Utility and Configuration

The following sections describe the Wireless Network Configuration Utility. This utility provides quick access and friendly interface to configure the card setup.

#### 4-1 Windows 98/ME/2000 Wireless Utility

After installation is completed, a Wireless LAN Utility icon will appear in Desktop screen. Click it, then you will see the screen below. If you cannot find the icon, you can select "Start" ->"Program"->"Wireless LAN Configuration Utility" Icon.

#### **Card Status**

Ambit Wireless LAN Configuration Utility				×
AMBI	Wireless LAN	Adapter (0).LAN-Express IE	EE 802.11 PCI A	dapter 💌
Card Status Site Sur	vey Profile			
ESSID	١	MIS	Resca	n
(ESSID)		r Throughput (byte	e/sec)	
BSSID :	00:D0:59:04:60:01	Tx: 64	Rx: 6	500
Current Channe	t: 8	Current Tx Rate:	11	Mbps
Card Information MAC Address:	00:D0	:59:FF:12:34		
Frequency Dom	ain: Telec	Firmware Version:	1.04.03	
			Radio On	Radio On/Off
Link Quality:	50%			Hide
Signal Stren	gth: 46%			Exit

You can see the AP information that your card connected. In this page you also can find Firmware Version, MAC Address and Frequency Domain.

**ESSID:** An acronym for Extended Service Set Identifier, ESSID is the unique name shared among all clients and Access Points in a wireless network. The ESSID must be

identical for all clients or Access Points participating in the same network. The ESSID is case sensitive and must not exceed 32 characters. Press 'Rescan' it will scan the specific ESSID that your profile set. If your profile set the ESSID to be ANY, then while you press 'Rescan', it will scan AP in the nearby area and choose the stronger one. From Link Quality and Signal Strength, you can tell the wireless transmission quality.

Profile	
Ambit Wireless LAN Configuration Utility	×
Card Status Site Survey Profile	LAN-Express IEEE 802.11 PCI Adapter
Profile name : DEFAULT  Transmission Rate : Fully Auto ESSID ANY Scan Power Save O Disable C Enable C Ad.Hoc Channel 4	WEP Key Entry         WEP Key       Disable         Key format       ASCII mode         Default Key       Key 1         Key 1       Image: Compare the second se
	Delete Undo Apply
	Radio On Radio On/Off
Link Quality: 60%	Hide
Signal Strength: 55%	Exit

There are two network types:

**Ad-Hoc:** This mode is used for a simple peer-to-peer network. It offers file sharing between wireless clients without a wireless Access Point (AP).

**Infrastructure**: This mode allows a wireless LAN to be integrated into an existing wired network through an AP. Infrastructure type networks also permit roaming between Access Points while maintaining connection to all network resources.

Infrastructure mode provides additional features, such as WEP security, power saving and extended range.

ESSID: You can either choose specific AP or connect to any AP in the nearby area.

**Power Save:** enable it, so it will be triggered when your computer system is inactive. **WEP Key:** Wired Equivalent Privacy, WEP is an encryption scheme used to protect your wireless data communications. WEP uses a combination of 40-bit keys, 128-bit keys to provide data encryption for your wireless network. AP and wireless card should use the same WEP key in order to communication. KEY Format: You can choose to enter ASCII Characters (0~9, a~z, A~Z) or

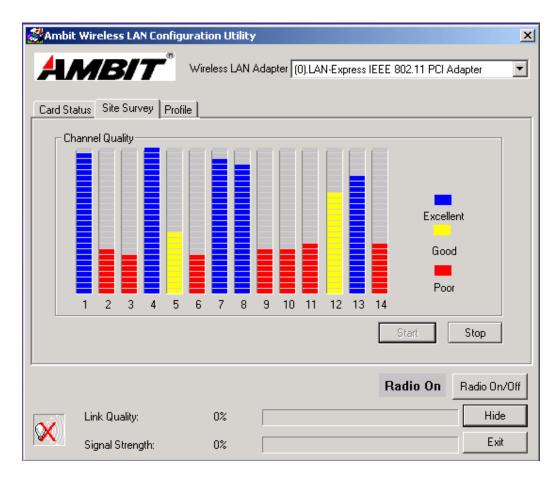
Hexadecimal number  $(0 \sim 9, a \sim f, A \sim F)$ 

Default Key: The current KEY you choose.

KEY1~4: If you choose 40-bit keys, then you must enter 5 ASCII Characters or 10 Hexadecimal numbers. If you choose 128-bit keys, then you must enter 13 ASCII Characters or 26 Hexadecimal numbers.

#### **Site Survey**

Use the Site Survey Tool. You can identify each channel transmission quality.



#### 4-2 Windows XP Wireless Utility

1. To configure the wireless card setting, you can select Start\Settings\Network Connection in the Windows XP. Choose the wireless network connection, then you will see below screen. From this screen, you can see wireless connection status and wireless signal level.

	k Connection Status	? 🗙
General Support		
Connection		
Status:		Connected
Duration:		00:07:43
Speed:		11.0 Mbps
Signal Strength:		☜∎000
Activity	Sent — 획 —	Received
Packets:	72	20
Properties	<u>D</u> isable	
		<u>C</u> lose

2. Select 'Properties' in the above screen. The following windows will show up.

In 'General' page, Wireless LAN card information and networking protocol have been displayed. Extra networking protocol can be installed in this page.

🗕 Wireless Network Connection Properties 🛛 🔹 💽
General Wireless Networks Authentication Advanced
Connect using:
■ LAN-Express IEEE 802.11 PC Card Adapter(425v)
<u>C</u> onfigure
This connection uses the following items:
Client for Microsoft Networks   File and Printer Sharing for Microsoft Networks   GoS Packet Scheduler   WLAN Transport   Install Install Properties Description Allows your computer to access resources on a Microsoft network.
Show icon in notification area when connected
OK Cancel

3. Select Wireless Networks page, you can see available wireless networks in your nearby area. You can add your preferred wireless Access Point to your list, so your wireless card will search for specific wireless networks.

🕹 Wireless Network Connection Properties 👘 🛛 🛛				
General Wireless Networks Authentication Advanced				
Use Windows to configure my wireless network settings  Available networks:  To connect to an available network, click Configure.				
MIS Configure				
AP13				
Preferred networks: Automatically connect to available networks in the order listed below: Move up				
Move <u>d</u> own				
Add <u>R</u> emove Properties				
Learn about <u>setting up wireless network</u> <u>configuration.</u> Ad <u>v</u> anced				
OK Cancel				

#### Configure

To connect to an existing access point (infrastructure) network, under Available networks, click the network name, and then click 'Configure' to setup wireless security and data encryption.

#### Reflesh

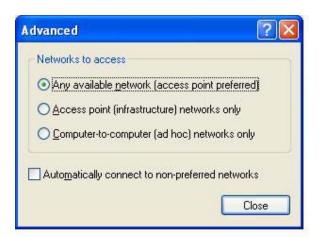
To update the list of available networks that are within range of your computer, click Refresh.

#### Add

To connect to an access point (infrastructure) network that you know is available but that does not appear under Available networks, under Preferred networks, click Add. In Wireless Network Properties, specify the network name (Service Set Identifier).

#### Remove

To remove a wireless network from the list of preferred networks.



#### Advanced

\*If your network are configuring to a computer-to-computer (ad hoc) network, select 'Computer-to-computer (ad hoc) network only'.

\*If you want to connect to a computer-to-computer and access point (infrastructure) networks are within range of your computer, click 'Access point (infrastructure)network only'.

\*If you want to connect to a computer-to-computer (ad hoc) network and both computer-to-computer and access point (infrastructure) networks are within range of your computer, click 'Any available network (access point preferred)'.

To automatically connect to available networks that do not appear in the Preferred networks list, click Advanced, and then select the Automatically connect to nonpreferred networks check box. Define your network name (SSID) in the following windows, so your can join a specific wireless network. Check AP has WEP on or not. You wireless network will need to have same WEP setting with AP in order to communicate. If your wireless network don't have any AP, check the **'This is computer-to computer (ad-hoc) network; wireless access points are not used'** 

Wireless Network Properties				
Network <u>n</u> ame (SSID):	MIS			
Wireless network key (WE	:P)			
This network requires a ke	ey for the following:			
Data encryption [WEP enabled]				
Network <u>A</u> uthentica	tion (Shared mode)			
Network <u>k</u> ey:				
Key format:	ASCII characters 💉			
Key length:	104 bits (13 characters) 💌			
Key inde <u>x</u> (advanced):	0			
The key is provided for me automatically				
This is a <u>computer-to-computer</u> (ad hoc) network; wireless access points are not used				
	OK Cancel			

This window provides authentication via 802.1X. 802.1X, an IEEE standard that provides an authentication framework for 802-based LANs. 802.1X takes advantage of an existing authentication protocol known as the Extensible Authentication Protocol. 802.1x, giving someone secure, encrypted, wireless access on a Microsoft network will be as easy as setting a flag on the users domain account.

#### What does this mean for the Home Network user?

802.1x will ensure that if and when you make the change over to Wireless Ethernet, your neighbor will not be able to access your wireless LAN!

🕂 Wireless Network Connection Properties 🛛 🔹 🔀
General Wireless Networks Authentication Advanced
Select this option to provide authenticated network access for wired and wireless Ethernet networks.
EAP type: Smart Card or other Certificate
P <u>r</u> operties
Authenticate as computer when computer information is available
Authenticate as guest when user or computer information is unavailable
OK Cancel

The 'Advanced' window offers Firewall and Internet Connection Sharing functions. Depends on your networking environment, you can select below functions.

🔟 Wireless Network Connection Properties 🛛 🔹 💽
General Wireless Networks Authentication Advanced
Internet Connection Firewall
Protect my computer and network by limiting or preventing access to this computer from the Internet
Learn more about Internet Connection Firewall.
Internet Connection Sharing
Allow other <u>n</u> etwork users to connect through this computer's Internet connection
Allow other network users to control or disable the shared Internet connection
Learn more about Internet Connection Sharing.
If you're not sure how to set these properties, use the <u>Network Setup Wizard</u> instead.
OK Cancel

#### **Appendix A Glossary**

Access Point - An internetworking device that seamlessly connects wired and wireless networks together.

**Ad-Hoc** - Ad-Hoc is a peer- to-peer wireless network without Access Point. A group of wireless clients consistent an independent wireless LAN.

**Backbone** - The core infrastructure of a network, the portion of the network that transports information from one central location to another central location. The information is then off-loaded onto a local system.

**BSS** - Stands for "Basic Service Set." An Access Point associated with several wireless stations.

**ESS** - Stands for "Extended Service Set." More than one BSS can be configured as an Extended Service Set. An ESS is basically a roaming domain.

**Ethernet** - A popular local area data communications network, originally developed by Xerox Corp., which accepts transmission from computers and terminals. Ethernet operates on 10/100 Mbps transmission rate over shielded coaxial cable or over shielded twisted pair telephone wire.

**Infrastructure** - An integrated wireless and wired LAN is called an Infrastructure configuration.

**MINI-PCI TYPE III** - Personal Computer Memory Card International Association, which develops standards for PC cards, formerly known as MINI-PCI TYPE III cards, are available in three "types" which are about the same length and width as credit cards, but range in thickness from 3.3 mm (Type I) to 5.0 mm (Type II) to 10.5 mm (Type III). These cards can be used for many functions, including memory storage, as landline Bluetooths and as wireless LAN.

**Roaming** - A function that allows one to travel with a mobile end system (wireless LAN mobile station, for example) through the territory of a domain (an ESS, for example) while continuously connecting to the infrastructure.

Throughput TX RX Link Quality Signal Strength Channel Quality