

# **TwinMOS**

## **Octopus G Series**

**802.11b/g  
Wireless LAN Card**

***User's Manual***

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## **PACKAGE CONTENTS**

Unpack your **Octopus WLAN Card** kit and verify that all items are present.

- **Octopus** Wireless LAN card
- User's Manual (on CD)
- Driver (on CD)

If any of the items described appear to be damaged or missing, please contact your reseller.

## INTRODUCTION

The **Octopus WLAN Card** is a wireless network client that complies with the IEEE 802.11b standard on wireless LANs. The IEEE 802.11b standards compliance means this adapter gives you the flexibility to connect it to any 802.11b network. The IEEE 802.11b Ethernet standard allows you to connect computers and devices at speeds up to 11Mbps, dependent upon the distance between wireless adapters, the configuration of your working environment, or the capabilities or limitations of your computer systems.

This **Octopus WLAN Card** supports following WLAN features :

- Support for 54,48,36,24,18,12,9,and 6 Mbps OFDM,11 and 5.5Mbps CCK and legacy 2 and 1 Mbps data rates.
- Center frequency channel selection (2.4 GHz)
- Fully compliant with the IEEE 802.11g WLAN standards
- Roaming over multiple channels.
- Supports power save mode
- 64/128-bit Wired Equivalent Privacy (WEP) data encryption.

This **Octopus WLAN card** comes with software drivers for the most popular Microsoft Windows operating systems and can be integrated into a larger network, running Windows XP, Windows 2000, Windows ME, or Windows 98 in either Ad-Hoc mode or infrastructure mode. This manual provides a quick introduction to wireless technology and its application as it relates to networking. Take a moment to read through this manual and familiarize you with wireless technology. You should also give yourself some time to become familiar with your new wireless network.

## WIRELESS NETWORK OVERVIEW

A wireless local area network (LAN) is a flexible data communications system implemented as an extension to, or as an alternative for, a wired LAN. Using radio frequency (RF) technology, wireless LANs transmit and receive data over the air, minimizing the need for wired connections. Thus, wireless LANs combine data connectivity with user mobility.

A local area network that transmit and receive over the air typically in an unlicensed frequency such as the 2.4GHz band. A wireless LAN does not require lining up devices for line of sight transmission like IrDA. Wireless access points (base stations) are connected to an Ethernet hub or server and transmit a radio frequency over an area of several hundred to a thousand feet which can penetrate walls and other nonmetal barriers. Roaming users can be handed off from one access point to another like a cellular phone system. Laptops use wireless modems that plug into an existing Ethernet port or that are self contained on PC cards, while stand-alone desktops and servers use plug-in cards (ISA, PCI, etc.).

Wireless LANs offer the following productivity, convenience, and cost advantages over traditional wired networks :

**Mobility** - WLAN provide LAN users to access data in any location within the operating range of the WLAN. Ad-hoc management decisions based on real-time information can significantly improve worker efficiency.

**Installation Speed and Simplicity** - Installing a wireless LAN system can be fast and easy and can eliminate the need to pull cable through walls and ceilings.

**Installation Flexibility** - Wireless technology allows the network to go where wire cannot go.

**Reduced Cost-of-Ownership** - While the initial investment required for wireless LAN hardware can be higher than the cost of wired LAN hardware, overall installation expenses and life-cycle costs can be significantly lower. Long-term cost benefits are greatest in dynamic environments requiring frequent moves and changes.

**Scalability** - Wireless LAN systems can be configured in a variety of topologies to meet the needs of specific applications and installations. Configurations are easily changed and range from peer-to-peer networks suitable for a small number of users to full infrastructure networks of thousands of users that enable roaming over a broad area.

### Installation Considerations

Designed to go up to 300 feet (100 meters) indoors and up to 900 feet (273 meters) outdoors, **Octopus WLAN card** lets you access your network from virtually anywhere you want. Keep in mind, however, that the number and thickness of walls, ceilings or other objects that the wireless signals must pass thru may limit range. Typical ranges vary depending on the types of materials and background RF noise in your home or business. The key to maximizing range is to follow these basic principles:

*Keep the number of walls and ceilings between the access point and your receiving device to a minimum* - Each wall or ceiling can reduce your TwinMOS **Octopus** Wireless product's range from 3-90 feet (1-30 meters.) For some businesses or for a large residential home deployment, it may be more beneficial to have more than one access point with overlapping coverage.

1. *Be aware of the direct line between Access Points, Residential Gateways, and Computers* - A wall that is 1.5 feet thick (.5 meters), at a 45-degree angle appears to be almost 3 feet (1 meter) thick. At a 2-degree angle it looks over 42 feet (14 meters) thick! Try to make sure that the Access Points and Adapters are positioned so that the signal will travel straight through a wall or ceiling for better reception.
2. *Building Materials make a difference* - A solid metal door or aluminum studs may have a negative effect on range. Try to position Access Points, Residential Gateways, and Computers so that the signal passes through drywall or open doorways and not other materials.
3. Make sure that the antenna is positioned for best reception by using the software signal strength tools included with your product.
4. Keep your product away (at least 3-6 feet or 1-2 meters) from electrical devices that generate RF noise, like microwaves, monitors, electric motors, etc.

For the average residence, range should not be a problem. If you experience low or no signal strength in areas of your home that you wish to access, consider positioning the Access Point in a location directly between the Residential Gateways and/or Computers that will be connected. Additional Access Points can be connected to provide better coverage in rooms where the signal does not appear as strong as desired.

Using radio frequency (RF) technology, WLANs transmit and receive data over the air, minimizing the need for wired connections. Thus, WLANs combine data connectivity with user mobility, and, through simplified configuration, enable movable LANs.

## Octopus WIRELESS NETWORK SCENARIOS

The **Octopus WLAN Card** enables you to:

- Connect your computer to a Ad-Hoc workgroup of wireless computing devices (see Figure 1-1 on page 7).
- Connect your computer to a Small Office/Home Office (SOHO) network that includes a Residential Gateway (RG) access point (see Figure 1-2 on page 8).
- Connect your computer to a Local Area Network (LAN) Infrastructure that includes Access Points, or other IEEE 802.11 compliant LAN systems (see Figure 1-3 and Figure 1-4).
- Expand the capabilities of your Access Points, to support wireless devices that have been equipped with **Octopus WLAN Card**.

### Ad-Hoc Workgroup

The Ad-Hoc workgroup configuration enables you to quickly set up a small wireless workgroup, where the workgroup participants can exchange files using features like “Files and Printer Sharing” as supported by Microsoft Networking.

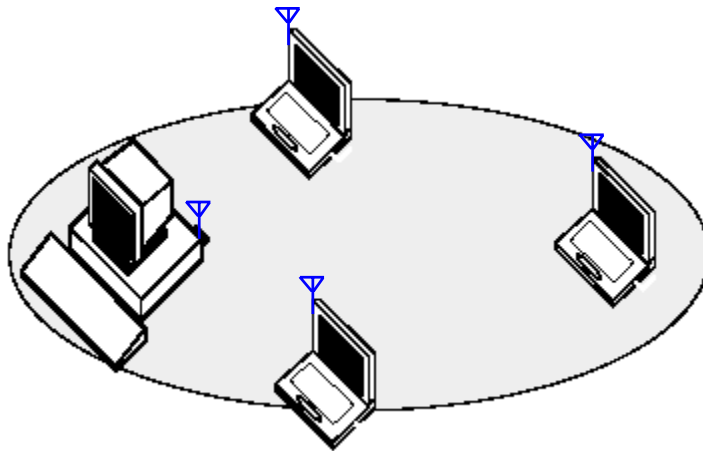


Figure 1-1 Ad-Hoc Wireless Workgroup

You can use this option to setup a temporary or ad-hoc network in environments where no access points are available (for example in Small Office/Home Office (SOHO) environments). As long as the stations are within range of one another, this is the easiest and least expensive way to set up a wireless network.

## Home Networking

With the TwinMOS **Octopus WLAN card**, wireless access to the Internet or other computers is at your fingertips. All you need to do is connect the wireless computers to an external cable, an xDSL or a ISDN modem and you are ready to :

- Share files and printers, and
- Access the Internet

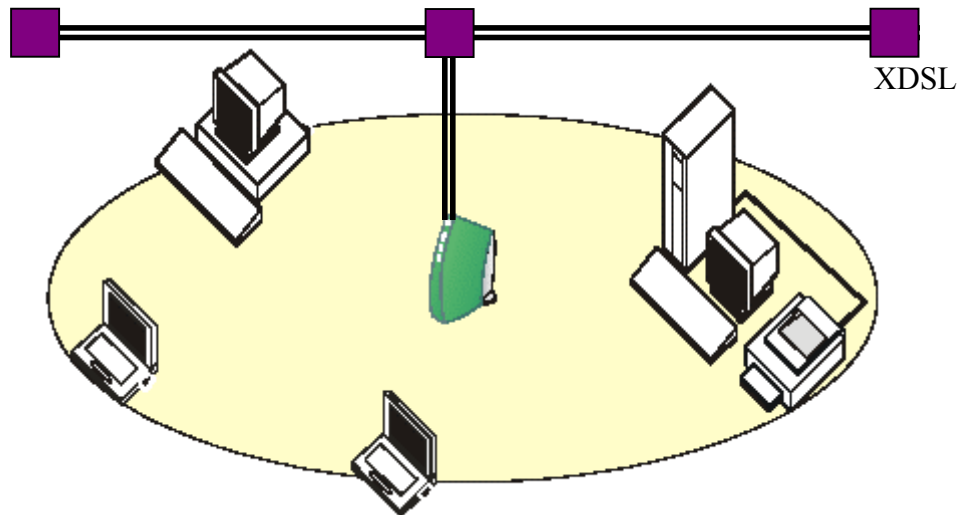


Figure 1-2 Connect to a Residential Gateway (RG)

## Enterprise Networking

With the 11 Mbps Wireless LAN access point you can connect to a corporate Local Area Network (LAN) infrastructure to have wireless access to all network facilities. LAN Infrastructures may either be:

- Stand-alone wireless LANs (Figure 1-3).
- Wireless network infrastructures connected to an existing Ethernet network (Figure 1-4).

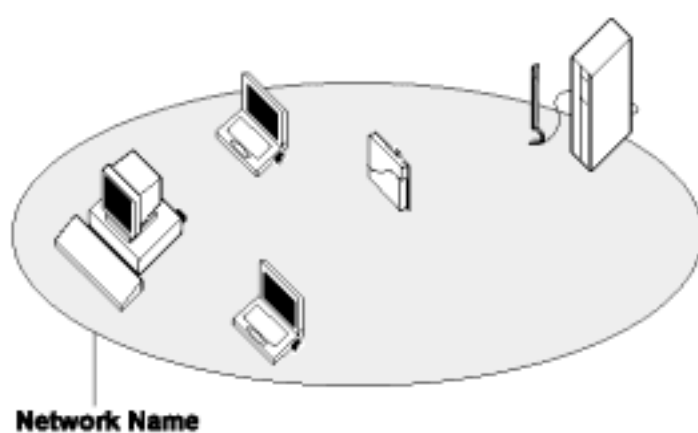


Figure 1-3 Stand Alone Wireless LAN

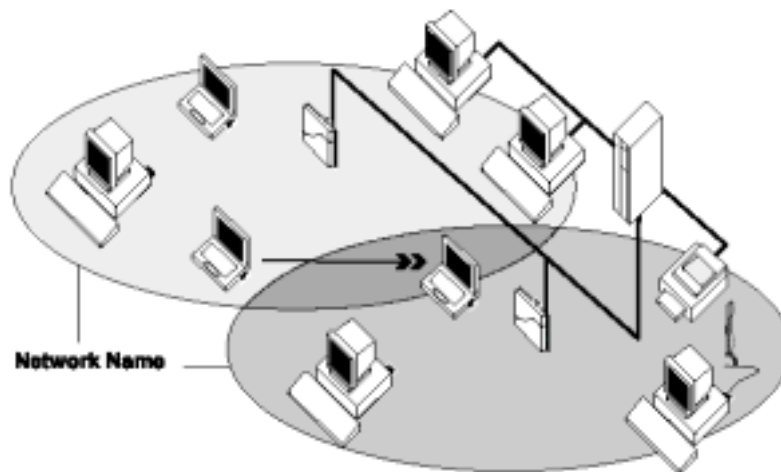


Figure 1-4 LAN Infrastructure

### ***It's Easy***

The **Octopus WLAN Card** functions like any standard wired Ethernet card, but **Octopus WLAN Card** does not need any wires!

Where an Ethernet card requires a cable connection to a hub and/or patch panel, the cable physically ties you down to the location of the wired connection.

**Octopus WLAN Card** allows you to connect your computer to a Local Area Network (LAN) system from anywhere within the wireless coverage area. Expanding or re-designing your network is easy: Add or relocate access point, power-up your (new) wireless computers, and you're done!

Unlike Ethernet, TwinMOS **Octopus WLAN Card** will enable you to roam throughout the network while remaining connected to the LAN.

**Note :** The Octopus WLAN Card is a radio product. Refer to the flyer "Information to the User" for regulatory information that may apply in your country.

## INSTALLATION FOR WINDOWS

The following section will assist you to install **Octopus WLAN Card** successfully. You will plug in the **Octopus** WLAN card and then install driver firstly, and finally set the network properties to accommodate resource sharing and select the type of wireless network that you want to install.

In order to establish your wireless network connection, make sure some steps below will be performed.

- Install the Access Point (AP) at first if you use Access Point network mode.
- Plug in the **Octopus** wireless LAN card.
- Install the driver using the Installation CD.
- Install the network protocol(s) required to communicate on your network. Most likely you will need the TCP/IP protocol.

The **Octopus** Wireless LAN Configuration Utility is installed by executing the “**PRISMSTA.exe**” file. Note also that some versions of Microsoft Windows operating systems require administrator to install software. If this is the case for your operating system, be sure that you have such privileges before executing the Setup.exe file. To upgrade an existing driver, it is not necessary to remove your **Octopus** driver from your computer. Simply run the Setup.exe file to replace the existing driver with the latest version. After the new driver is installed, maybe you must restart the operating system (depend on the Windows' OS).

Please follow the following steps one by one in order to install the **Octopus WLAN Card** successfully.

## For Windows XP

Before you proceed with the installation, please notice following descriptions.

**Note:** *The following installation was operated under Windows XP. (Procedures will be the same for Windows 98SE/Me/2000.)*

### ● Install the Driver

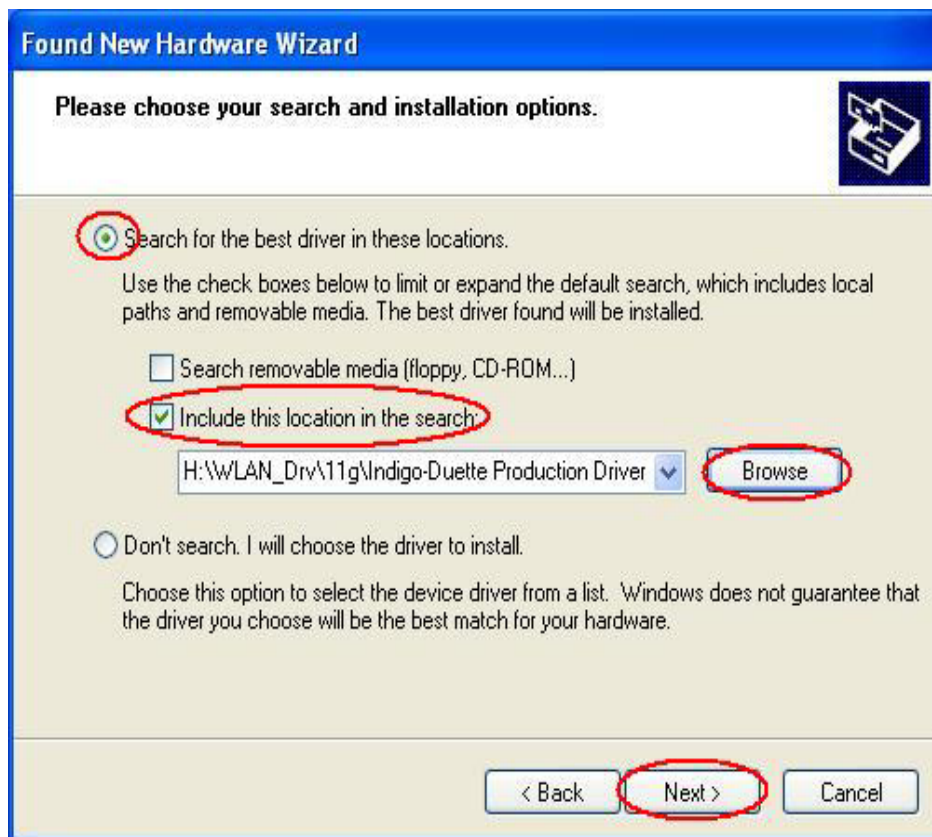
1. Insert the driver disk in your CD-ROM.
2. Insert the **Octopus WLAN Card** into the slot of your computer, the system will automatically find the device and search for its driver.

### CAUTION:

*This assembly is designed to operate with a supply voltage of 3.3V in laptop computers supporting the CARDBUS32 standard.*



3. Please select the “Driver” folder (select the folder based on your computer’s OS system) and the system will complete the driver installation automatically.



4. Click "Finish" to complete the installation.



5. After drivers are installed, restart windows

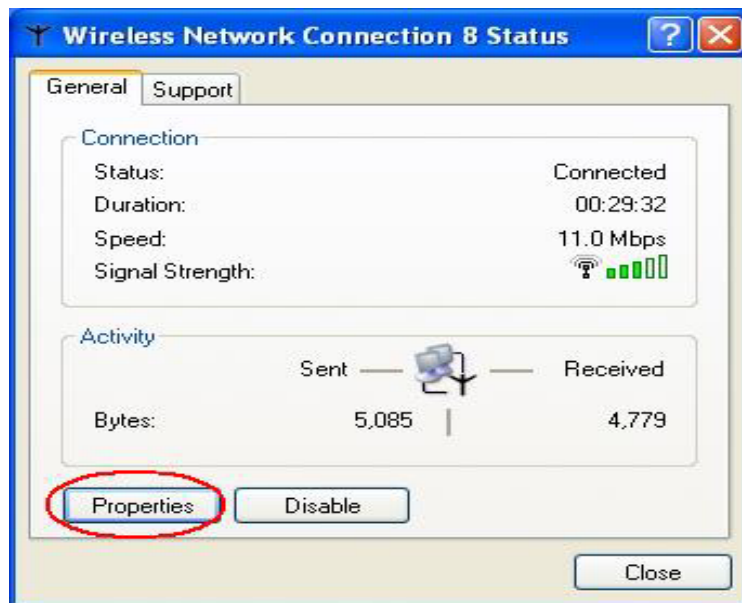
6. When you complete the driver installation, a new icon will be displayed in the taskbar at the bottom of the screen.



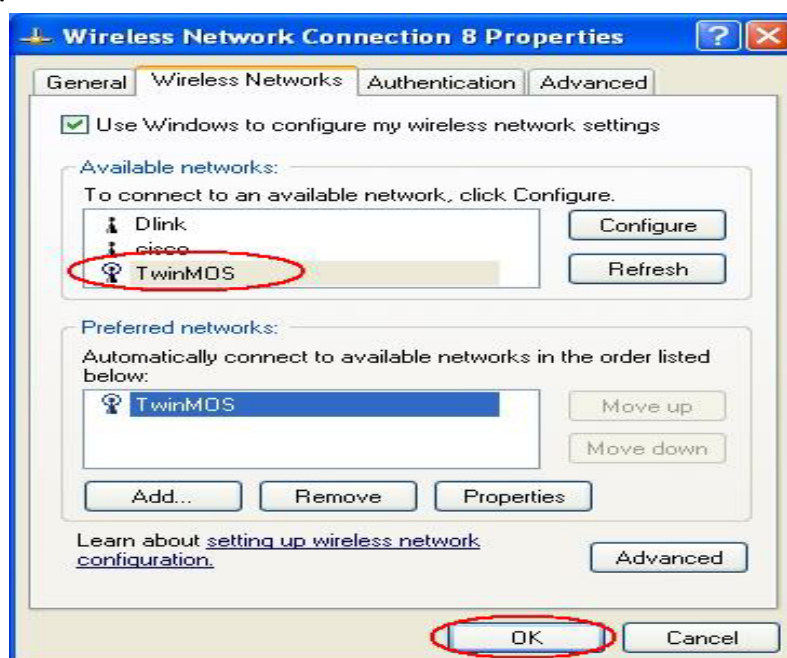
## Using the Windows XP's Utility

To connect to your wireless network, please do the following:

© Double-click the icon marked in red in the taskbar and you may start using the Windows XP's wireless utility



© The “Connect to Wireless Network” window will contain a list of all the available Wireless Networks. Select the proper network for your needs. In this example, “TwinMOS” network was selected as shown.

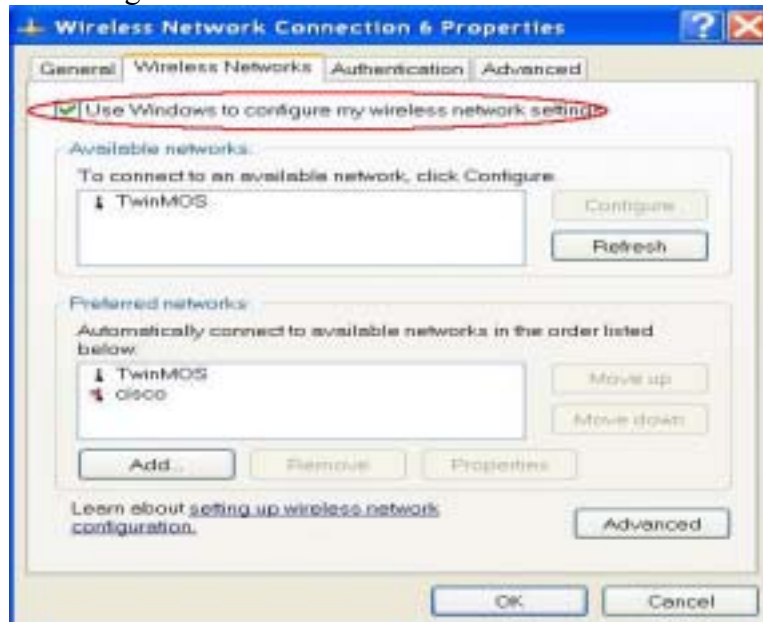


## Using the Utility of Octopus WLAN Card

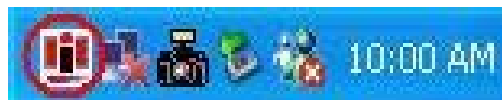
© Get into Windows XP's utility, click "Advanced" button.



© In "Wireless Network Connection Properties" screen, **uncheck** the setting "Use Windows to configure my wireless network settings". Note that if you want to change back to the Windows XP built-in utility, check the item again.

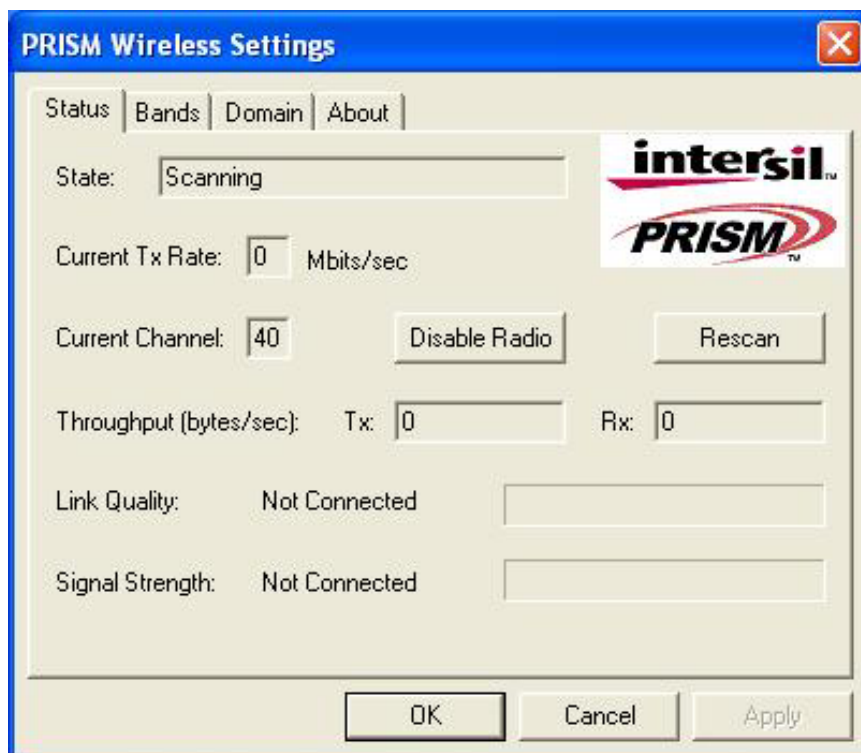


© Double click the icon and start using the WLAN Card .





**Note:** If you don't disable the XP's Utility, you can still see the status, bands, domain and about during communication process from the adapter's utility.



## CONFIGURATION UTILITY

**TwinMOS Octopus WLAN Card** uses the Configuration Utility as the management software. The utility provides the user an easy interface to change any settings related to the wireless adapter. When the computer is started, the Configuration Utility starts automatically and the system tray icon is loaded in the toolbar (see illustration below.) Clicking on the utility icon will start the Configuration Utility.



Double-click on the icon shown above. The screen below will be displayed.



## Status Tab

The Status menu displays information on the current status of your connection to the wireless LAN. You can display this menu by choosing the **Wireless Network Status...** command from the pop-up menu, or by clicking on the **Status** tab when the Configuration Utility is displayed on your desktop.



The fields in this menu provide the following information:

- **State:** shows the association state of your computer with the wireless LAN. Possible values for this field are:
  - **AdHoc:** The adapter is operating in Peer-to-Peer mode. This field also shows the virtual MAC address used by computers participating in the AdHoc network.
  - **Associated:** The adapter is operating in Infrastructure mode. This field also shows the MAC address of the Access Point with which you are communicating.
  - **Listening:** Indicates that the adapter is listening on all allowed channels, but has not yet found a peer-to-peer or infrastructure network with which to associate.
  - **Stopped:** The radio has been stopped by the Disable Radio Button.
  - **Scanning:** The adapter is scanning for transmissions by other wireless adapters on all channels.
  - **Associating:** The adapter is in the process of associating with a network
  - **Not Associated:** The adapter has not found any network with which to associate.
  - **Hardware Radio Switch OFF:** The radio has been disabled by moving the hardware radio switch to the off position. Note that not all adapters have a hardware switch.
- **Current Tx Rate:** shows the current transmit rate of the current association.

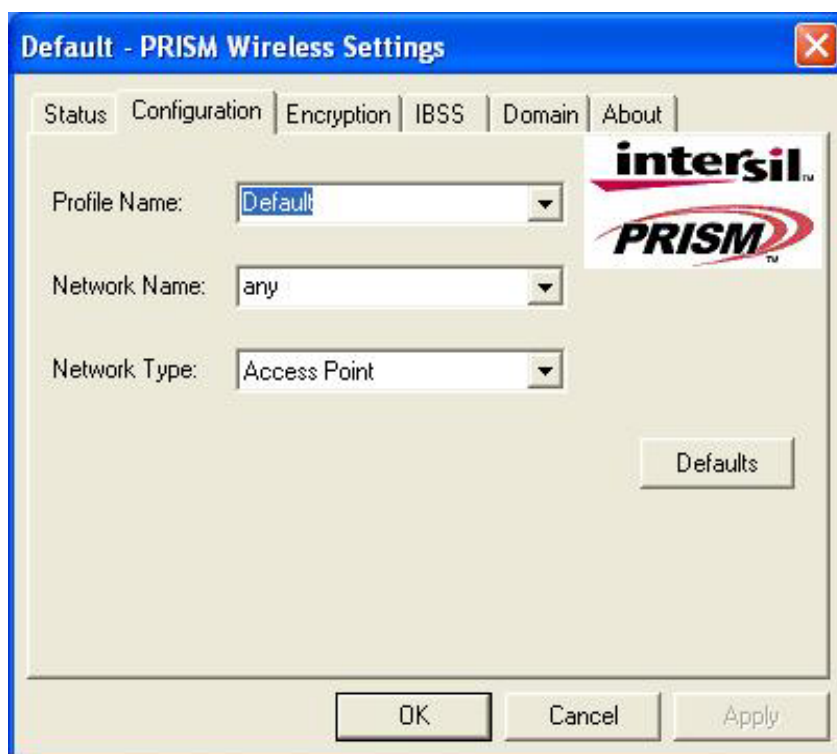
- **Current Channel:** shows the channel on which the connection is made. In Infrastructure mode, this number changes as the radio scans the available channels.
- **Throughput:** shows the short term transmit and receive throughput in bytes/second, and is continuously updated.
- **Link Quality:** is based on the quality of the received signal of the Access Point beacon.
- **Signal Strength:** is based on the received signal strength measurement of the baseband processor of the Beacon signal.

You can click the **Disable Radio** button to turn off the wireless radio. When you click this button, the **State** field indicates that the radio has been stopped and the remaining fields in this window display either a zero or **Not Applicable**. Click this button again to turn the radio back on. However, if the radio has been disabled by the hardware switch on the adapter, clicking this button displays a popup message telling you that the radio cannot be enabled.

You can click the **Rescan** button to force the radio to rescan all available channels. If your link quality or signal strength is poor, rescanning can be used to push the radio off a weak Access Point and search for a better link with another Access Point.

## Configuration Tab

The Configuration menu lets you specify the operating parameters for your Octopus WLAN Interface adapter. You can display this menu by choosing the **Advanced Configuration ...** command from the pop-up menu, or by clicking on the **Configuration** tab when the Configuration Utility is displayed on your desktop.



## ● Profile Name

A profile is a named set of operating parameters for your Octopus WLAN adapter. The **Profile Name:** field lets you set values for all parameters by selecting a previously defined profile. Click the down arrow at the right of this field to display the available profiles for your PRISM WLAN Interface adapter.

You will always have at least one profile, named **Default**. Initially, this profile contains the parameters configured at installation. You can modify this profile at any time after the installation. After changing parameters, you can save them in the profile named in this field by clicking the **Apply** button in the Configuration Utility panel.

You can also create additional profiles by typing a name in the **Profile Name:** field. When you change the name in this field and then click the **Apply** button, the Configuration Utility uses the current parameters for your adapter to create a separate profile. You can then switch between profiles by clicking the down arrow at the right of the **Profile Name:** field, selecting a profile from the drop-down list, and clicking the **Apply** button.

The following example describes a situation in which you would want to create multiple profiles. Suppose that you use the wireless LAN at your work, but you also have a network in your home (with a wireless Access Point) for sharing an internet connection and a printer between several computers. Suppose also that you have another office within your business which also has WLAN capability, but which is configured differently than your main office.

In this situation, you can create a different profile for each of these three environments. Each profile specifies the parameters used on a single network. Moving from one location to another, you need only apply the appropriate profile to be able to participate in the local network.

## ● Network Name

Officially, in wireless networks the network name is known as the SSID (Service Set Identifier), and is used by Access Points and stations to identify a wireless LAN. Your PRISM WLAN Interface adapter scans the available channels looking for an Access Point or another station which has specified this same SSID. It then attempts to associate with these Access Points or stations to form a wireless LAN.

To change the SSID, simply highlight it, type the new SSID, and click the **Apply** button.

In typical infrastructure applications a company will use a single SSID for all Access Points. If the radio is scanning and cannot find a channel when an Access Point is known to be in range, verify that the Network Name is set correctly.

## ● Network Type

The Octopus WLAN adapter can operate in one of two types of networks, which are specified in the **Network Type:** field of the Configuration menu. Clicking the down arrow at the right of this field displays the available types.

### Peer-to-Peer

IEEE 802.11, the standard on which the WLAN protocol is based, defines two modes to handle two separate needs. The first, called AdHoc (or IBSS) mode, is used when two or more wirelessly-enabled PCs exchange data directly, without an Access Point. In this case the PCs can establish a peer-to-peer

network in which they are the only members and over which they can exchange data. To exchange data, each computer participating in the AdHoc network must specify the same Network Name in this menu.

Peer-to-Peer networks operate on a single communications channel. You specify the channel on which your adapter communicates in an IBSS network either in this menu or through either the Bands Menu or the IBSS Menu.

Note also that IBSS operation is incompatible with the 802.11d standard. If your adapter supports 802.11d operation, you must disable 802.11d support through the [Domain Menu](#)

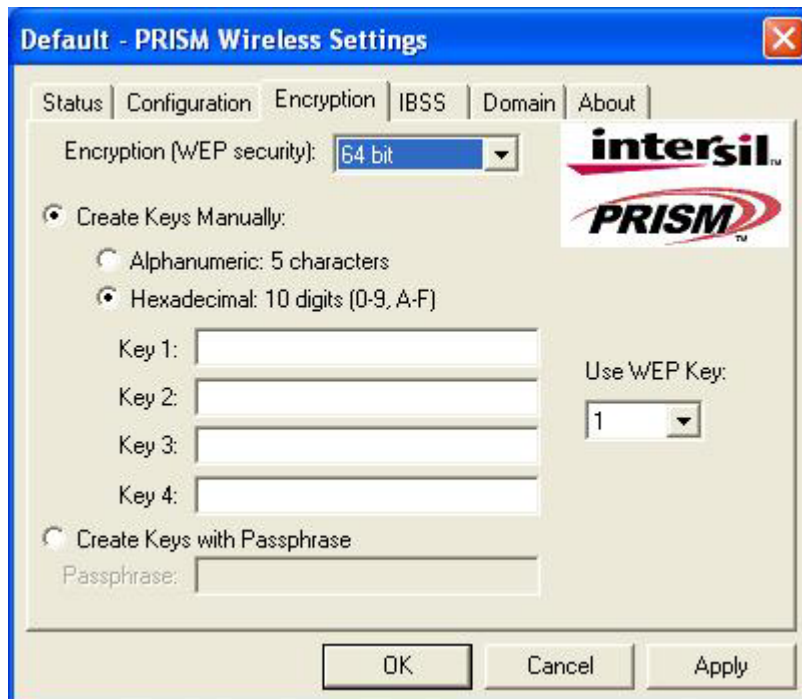
## Access Point

The second mode defined by the IEEE 802.11 standard is called infrastructure mode, and is the primary application for WLAN operation. In this mode all data on the wireless network is directed to an Access Point, which then routes the data to the appropriate wireless station. The Access Point may also be configured to allow data to be bridged from the wireless network to wired networks.

To participate in a wireless LAN in infrastructure mode, every station and Access Point must specify the same Network Name. In infrastructure mode, all available channels are scanned for traffic, so there is no need to specify a channel.

## Encryption Tab

The Encryption menu lets you enable encryption and set the encryption keys. To see the available encryption methods, click the down arrow at the right of the Encryption (WEP security) field.



There are two encryption methods available. The IEEE 802.11 specification defines Wired Equivalent Privacy (WEP) using a 64-bit key. This capability was extended by the industry to allow a 128-bit key.

If you specify an encryption method, you will only be able to communicate with Access Points and stations that use the same encryption method and keys.

### **Disabling encryption**

To disable encryption, click the down arrow at the right of the Encryption field, select Disabled, and click the Apply button.

### **Enabling encryption**

To enable encryption, click the down arrow at the right of the Encryption field, select either 64 bit or 128 bit, and click the Apply button. After enabling an encryption method, you must then specify encryption keys, as described in the following sections.

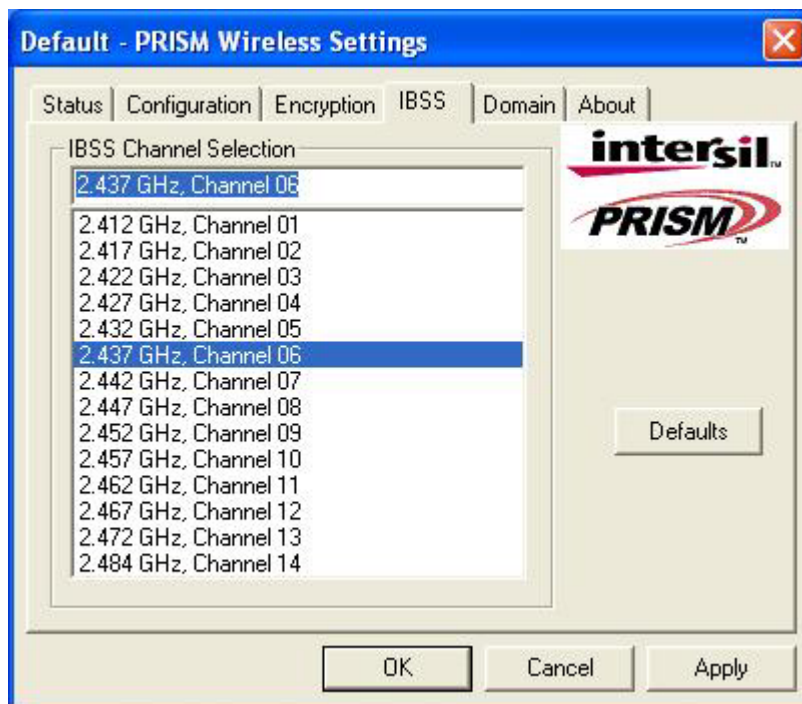
### **Creating Encryption Keys Manually**

When you specify either 64-bit or 128-bit encryption, the Configuration Utility selects **Create Keys Manually**, and allows you to enter keys as either alphanumeric or hexadecimal characters. When you click one of these buttons, the cursor appears in the field for Key 1. For 64-bit encryption, you must type exactly 5 alphanumeric or 10 hexadecimal characters in each of the four key fields; for 128-bit encryption, you must type exactly 13 alphanumeric or 26 hexadecimal characters. You then click the **Apply** button to create your encryption keys. After you click the **Apply** button, the Configuration Utility uses asterisks to mask your keys.

The **Use WEP Key** field lets you specify which of the four encryption keys you use to transmit data on your wireless LAN. You can change the default key by clicking on the down arrow at the right of this field, selecting the number of the key you want to use, and then clicking the **Apply** button. As long as the Access Point or station with which you are communicating has the same key in the same position, you can use any of the keys as the default.

### **Creating Encryption Keys Using a Passphrase**

To create encryption keys using a passphrase, click the radio button next to **Create Key with Passphrase** and type a character string in the Passphrase field. As you type, the Configuration Utility displays asterisks to mask your passphrase and uses an algorithm to generate four keys used for encryption. Using a passphrase to generate the four keys makes it easy to set the same keys for all members of your wireless LAN.

**IBSS Tab**

When communicating in a peer-to-peer network, you may specify a channel on which you prefer communications to take place. To specify a channel, click on the channel to select it, and then click the **Apply** button.

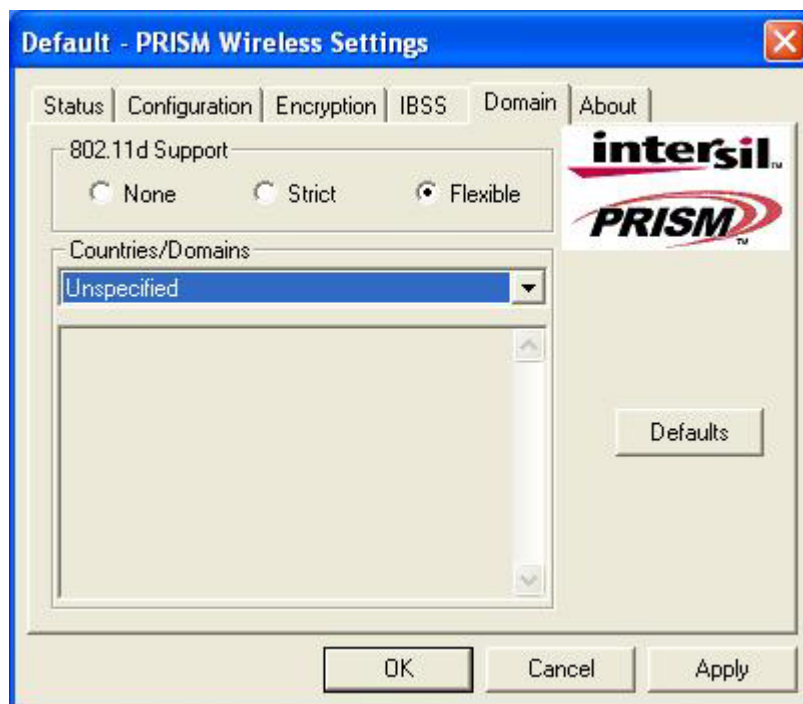
Note that this is not necessarily the channel on which peer-to-peer communications will be established. If the IBSS network names (SSID) are the same for nodes in the peer-to-peer network but they have different preferred channels, a network can still be established. In this case, if it cannot find a network with the specified network name on the preferred channel, a station will scan other channels until it finds a peer-to-peer network with the specified network name on which to communicate.

If you specified **Access Point** as the network type (in the **Configuration** Tab), choosing a channel in this field has no effect until you change the network type to **Peer-to-Peer**.

## Domain Tab

A *domain* refers to a territory in which radio frequency transmissions must conform to the standards set by a single regulatory agency. For example, in the United States, the allowed frequencies and channels for wireless data communications are set by the FCC. Every country is free to set its own standards, although in practice many countries may use the same standards.

The IEEE 802.11d standard provides a means for a wireless LAN adapter to detect the domain in which it is located and conform its transmissions to the standards set by the controlling regulatory agency. Not all PRISM adapters include this mechanism, however, so the version of the **Domain** menu displayed by the Configuration Utility depends on the versions of driver and firmware for your adapter.



### 802.11d Not Supported

If your Octopus adapter does not support 802.11d operation, the **Domain** menu simply provides a list of the domains established throughout the world for radio frequency transmissions. In most cases, these domains correspond to a single country.

To see a list of the domains supported by your adapter, click on the arrow to the right of the **Countries/Domains** field. Use the arrows or the scroll bar to the right of the list to see the complete list of domains. Choose the appropriate domain for your location by clicking on its name in the list, and then click the **Apply** button.

When you specify a domain, the Domain menu then displays information about the domain you chose. Use the arrows or the scroll bar to the right of the display to see the complete information, such as country code, domain name, and transmission standards (channels, frequencies, etc.) for the domain.

### **802.11d Supported**

If your PRISM adapter supports 802.11d operation, the **Domain** menu lets you specify one of three levels of 802.11d support.

If you specify **None** in the **802.11d support** field, you must then choose the country in the **Countries/Domains** field which corresponds to your location. In this case your adapter operates according to the standards set by the appropriate regulatory agency.

**Note:** If you specify **Peer-to-Peer** as the network type, you must specify **None** in the **802.11d support** field.

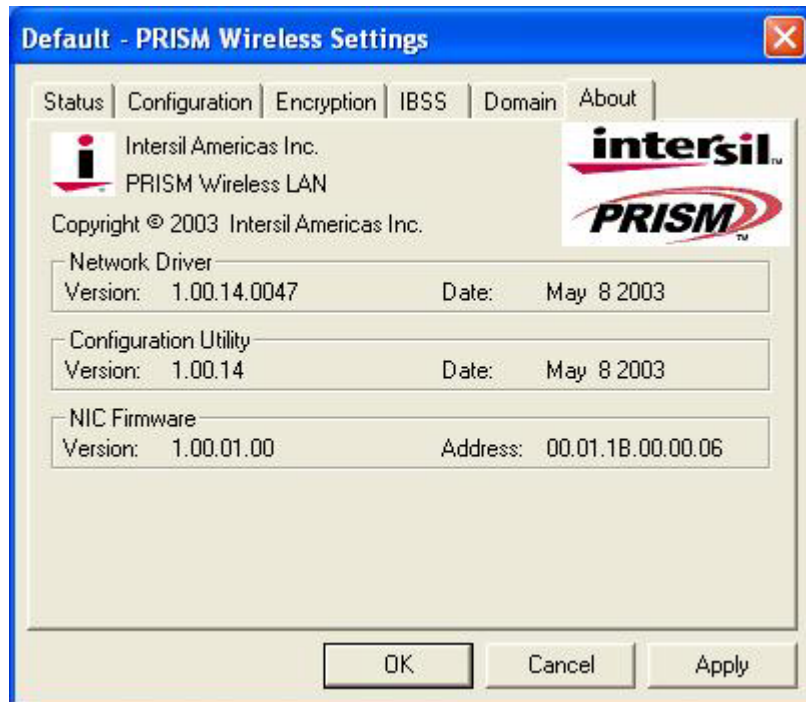
If you choose **Strict** in the **802.11d support** field, your adapter will only communicate with Access Points which provide 802.11d support. In this case, the adapter scans all communications channels for an Access Point which provides information on the channels, frequencies, and power levels permitted in your location. Once it finds such an Access Point, the adapter conforms its operations to these standards. The adapter will not communicate with an Access Point that does not provide this information, nor will it join or create a peer-to-peer network if Strict 802.11d support is specified in this field.

If you choose **Flexible** in this field, your adapter can communicate with any Access Point it finds. In this case, you must also choose the country in the **Countries/Domains** field which corresponds to your location. Your adapter then searches for an Access Point which provides information on the channels, frequencies, and power levels permitted in your location. If it finds such an Access Point, the adapter conforms its operations to these standards.

If it does not find an Access Point which provides this information, it then will establish communications with any Access Point it finds.

## About Tab

The About menu provides information on the version of the Network Driver, the Configuration Utility, and the firmware in the Octopus WLAN adapter. You can display this menu by choosing the **Version Information...** command from the pop-up menu, or by clicking on the **About** tab when the Configuration Utility is displayed on your desktop.



## TROUBLESHOOTING

If you encounter some problems while installing the **Octopus** WLAN card or you want to confirm whether your adapter is installed properly or not, we have listed the procedure for checking the various components after you have installed the adapter. In first part of Troubleshooting, we have suggested the users to check the various properties of the card to check the proper installation. In second section, we have listed the various problems that you may encounter during the installation and have also listed the possible solution. Check the first part to guess the probable reason of unsuccessful installation.

Please check the followings if you encounter some problem while installing the **Octopus WLAN Card** or yours **Octopus WLAN Card** are non-functional.

### **In Windows 2000:**

To check that the **Octopus WLAN Card** is installed properly, please do the following:

1. Check the Windows 2000 Diagnostics. See if there is any conflict in the Resource allocation or the I/O Address, IRQ allocations. If you find that the IRQ or I/O Addresses are already assigned to some other devices, you must change that value.
2. Go to the Control Panel. Double click on the Network Adapter; you will see **Octopus WLAN Card**. Double clicking on that will show you the status of the **Octopus WLAN Card**. If there are no error signs, the adapter has been installed properly.

### **In Windows XP:**

To check that the **Octopus WLAN Card** is installed properly, please do the following:

1. Go to START>CONTROL PANEL. Double-click on Network Connections. Right-click on LAN. Click Properties.
2. The **Octopus WLAN Card** will appear, indicating proper installation.

## TECHNICAL SPECIFICATIONS

### Physical Specification

|                        |                                   |
|------------------------|-----------------------------------|
| Dimensions             | mm (118x54x7)                     |
| Weight                 | 36 g                              |
| Host Interface         | 32-bit Cardbus                    |
| Temperature & Humidity |                                   |
| Operation              | 0°C to 55°C maximum humidity 95%  |
| Transit                | -20°C to 65°C humidity 15% to 95% |
| Storage                | -20°C to 65°C humidity 10% to 95% |

### Power Characteristics

|                     |                            |
|---------------------|----------------------------|
| Operating Voltage   | 3.3V±5%                    |
| Current Consumption | Nominal 240mA , Max. 300mA |

### Networking Characteristics

|                       |                                                                                                                                     |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Compatibility         | <ul style="list-style-type: none"> <li>● IEEE 802.11b/g Standard for WLAN</li> <li>● Internal Wi-Fi certified by TwinMOS</li> </ul> |
| Host OS               | Windows 98/98SE/ME/2000/XP                                                                                                          |
| Media Access Protocol | CSMA/CA with ACK                                                                                                                    |
| Network Protocol      | TCP/IP, IPX, NetBEUI                                                                                                                |

### RF Characteristics

|                      |                                                                                                                                                                                               |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency Range      | 2.400-2.4835 GHz, Direct Sequence Spread Spectrum (DSSS)                                                                                                                                      |
| Operating Channels   | <ul style="list-style-type: none"> <li>● 1-11 United States (FCC)</li> <li>● 1-11 Canada (DOC)</li> <li>● 1-14 Japan (MKK)</li> <li>● 1-13 Europe (Except Spain and France) (ETSI)</li> </ul> |
| Modulation Technique | <ul style="list-style-type: none"> <li>● 54 /48/36/24/18/12/9/6 Mbps: OFDM</li> <li>● 11/5.5 Mbps: CCK</li> <li>● 2 Mbps: DQPSK</li> <li>● 1 Mbps: DBPSK</li> </ul>                           |
| Spreading            | 11-chip Barker Sequence                                                                                                                                                                       |
| Transmit Power       | 13 dBm @ Nominal Temp Range                                                                                                                                                                   |
| Receive Sensitivity  | 54 Mbps OFDM, 10% PER, -68 dBm<br>36 Mbps OFDM ,10% PER, -75 dBm,<br>24 Mbps OFDM ,10% PER ,-79 dBm<br>18 Mbps OFDM, 10% PER ,-82 dBm<br>11 Mbps CCK, 8% PER ,-82 dBm                         |
| Security             | 64/128-bit WEP Encryption                                                                                                                                                                     |
| Operating Range      | Open Space : 100 ~ 300m; Indoor: 30m ~ 100m<br>The transmission speed varies in the surrounding environment.                                                                                  |
| Antenna              | Internal antenna integrated on the PCB (1 dBi rated gain)                                                                                                                                     |
| EMC Certification    | FCC Class B part 15B, 15C; R&TTE                                                                                                                                                              |

**NOTE**

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

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

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

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.