WLAN b/g/n mini-PCI Module

Version: 1.0

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Federal Communication Commission Interference Statement

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

FCC Caution: 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.

For product available in the USA/Canada market, only channel 1~11 can be operated. Selection of other channels is not possible.

This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna,
3) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further <u>transmitter</u> test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions <u>can not be met</u> (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID <u>can not</u> be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

<u>End Product Labeling</u>

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: NKR-DNMA91".

<u>Manual Information To the End User</u>

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Table of Contents

1. Introduction

Thank you for purchasing the WLAN b/g/n mini-PCI Module that provides the easiest way to wireless networking. This User Manual contains detailed instructions in the operation of this product.   Please keep this manual for future reference.

System Requirements
- A laptop PC contains:
  - 32 MB memory or greater
  - 300 MHz processor or higher
- Microsoft® Win™2000/ME/98 Second Edition/XP

# 2. Driver/Utility Installation / Uninstallation

2.1 Installation

Note! The Installation Section in this User Manual describes the first-time installation for Windows. To re-install the driver, please first uninstall the previously installed driver. See Chapter 2.3 "Uninstallation" in this User Manual.

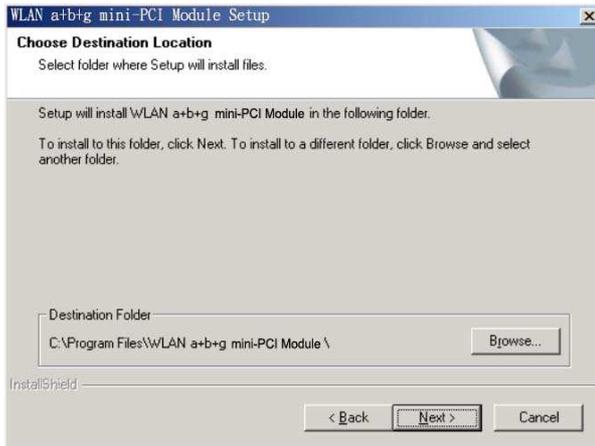Follow the steps below to complete the driver/utility installation:

1. Insert the **Installation Software CD** into the CD-Rom Drive.
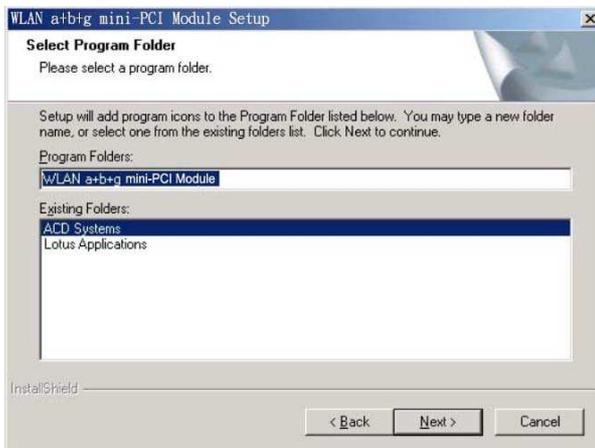
2. Click **"Next"**.
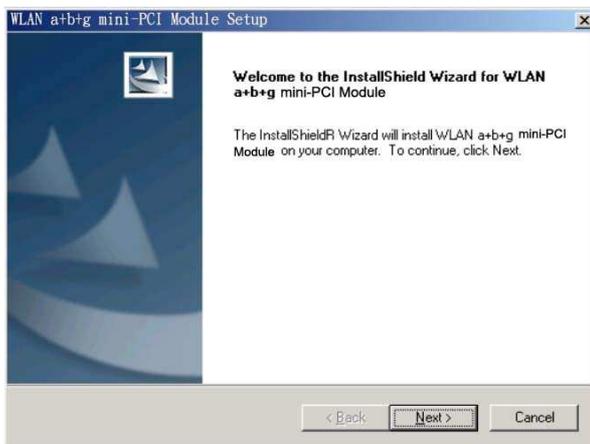
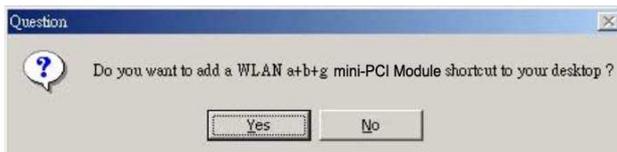3. Read the **License Agreement** and click **"Yes"**.
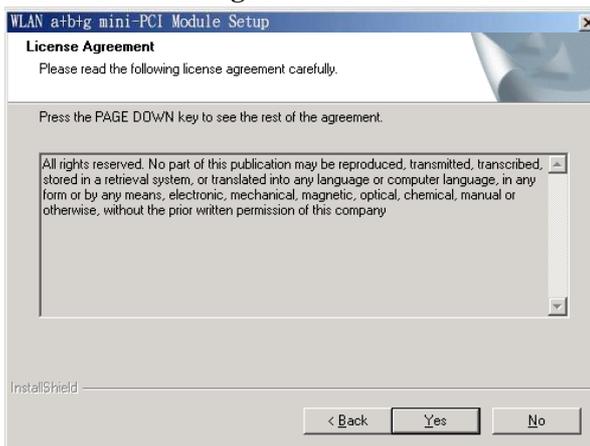
4. Click **"Next"** to continue or click **"Browse"** to choose a destination folder.

5. Click **"Next"**.

6. Click **"Yes"** to create a shortcut icon on your desktop.

7. Click **"Finish"**.
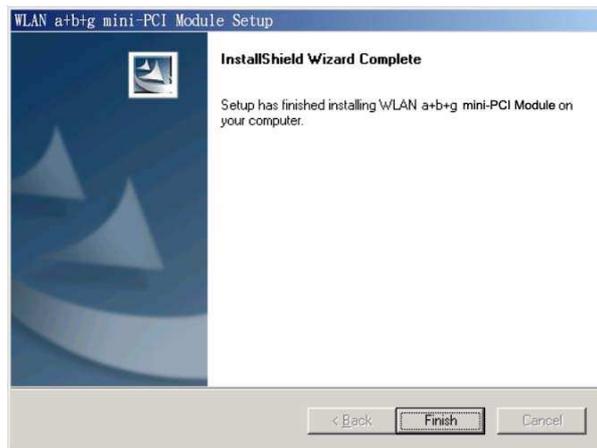
8. You should now see a shortcut icon on your desktop.

2.2 Additional Setup Processes

During software installation procedure, each operating system may prompt different specific options:

1. **Windows 98SE:** The system will request the original Windows CD during the installation process.   When the installation is finished, you'll have to restart your computer.

2. **Windows Me:** Please restart your computer when the installation is finished.

3. **Windows 2000/XP:** Select "Install the software automatically" when the window with this option appears, and then click "Next" to continue installation.

2.3 Uninstallation

Note!   Before uninstallation, please close all running programs.

1.   Click <u>Start>Programs>WLAN b+g mini-PCI Module >UnInstall WLAN b+g mini-PCI Module</u>.

2.   Choose **"Remove"**. Click **"Next"**.
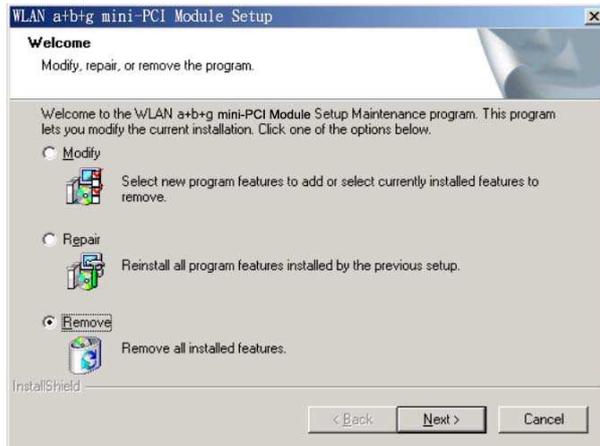
3.   Click **"OK"** to start **Uninstall**.
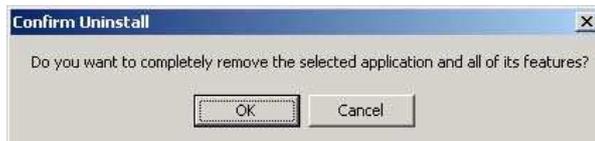
4.   Click **"Finish"**.   **Uninstall** is now completed.
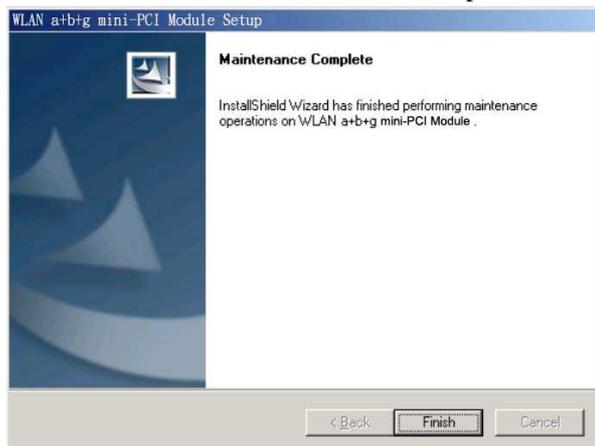
3. Connecting to an Existing Network

1. Double click the shortcut icon of WLAN b+g mini-PCI Module on the desktop, and the Configuration window appears.
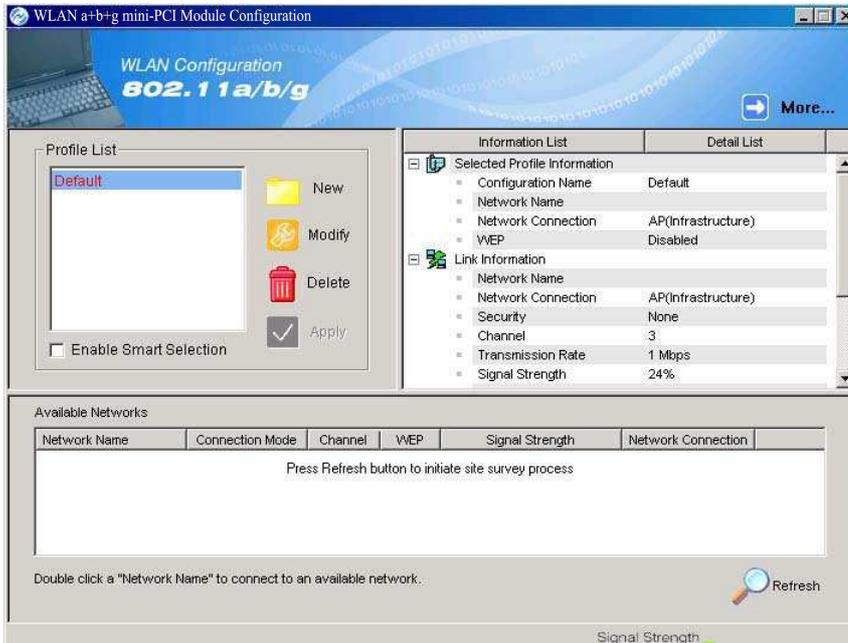
2. Click on the **Refresh** button ![Refresh] to list all available networks.
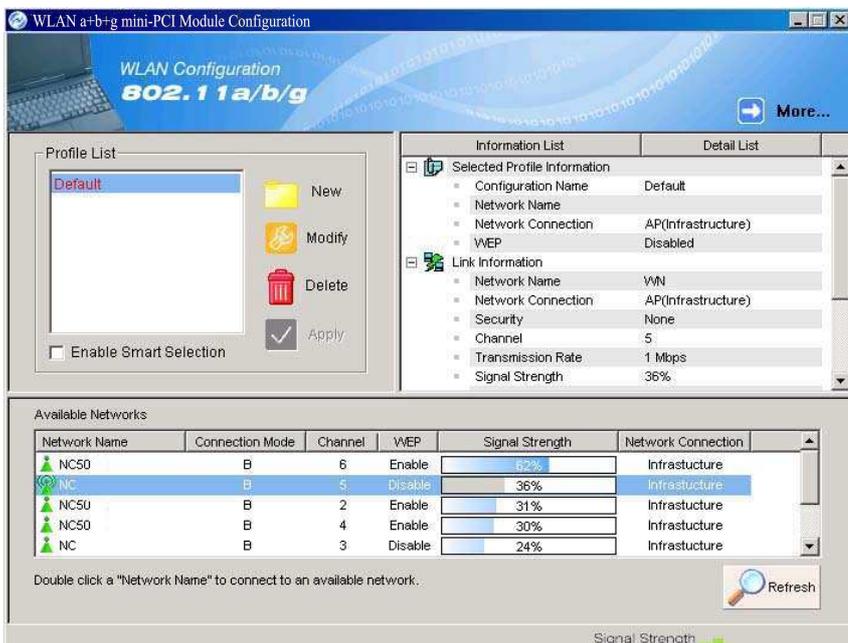
Note! To automatically connect to the network with the strongest signal, select **Enable Smart Selection**. **Any** displays in Profile List.

3. From the list of "Available Networks", choose one network by double clicking the **Network Name**.   One of the following dialog boxes appears.   Click **"Yes"** to continue.

4. If the chosen network has security enabled, the **Security** tab displays. Select the security option used by the network. Contact the network administrator for the correct settings.

5. If selecting **WPA** or **802.1X**, select the EAP type, then click on the **Configure** button to select the certificate.
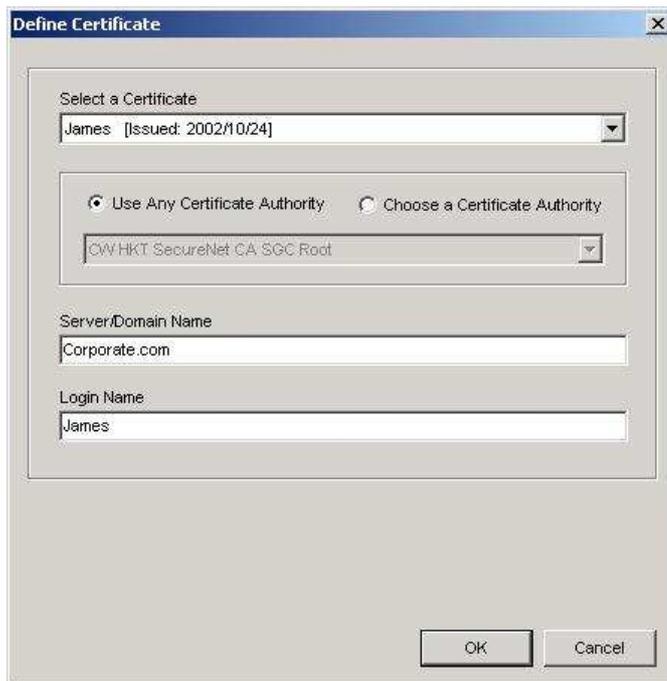
6. If selecting **WPA-PSK**, click on the **Configure** button to enter the PassPhrase.
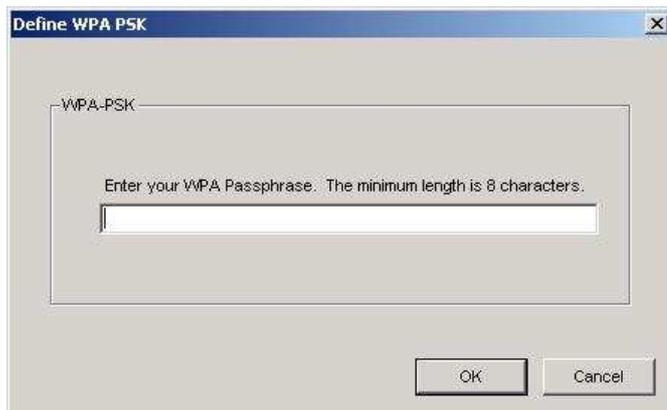
7. If selecting **Pre-Shared Key**, click on the **Configure** button to enter the correct
   Encryption Keys**.**

   Key entry method:

   a.10hex digits: User must enter 10 hexadecimal digits.

   The hexadecimal define is "0-9" and "A-F".

   ex: 123456abc

   b.5 chars: User must enter 5 characters. ex: ab3#@

   c.13 chars: User must enter 13 characters.

   ex: ab3#@kf08&kdk

   d.16 chars: User must enter 16 characters.

   ex: ab3#@kf08&kdk456

   For WEP key, please contact with MIS administrator.

8. Click on **OK** (or **Apply** if using the other tabs) when done to save the settings.

9. Once connected (the icon or in front of the name of the Connected
   Network), you can check the signal strength from the icon in the Windows
   System Tray.

Additional Note for Windows XP

In Windows XP, it is recommended that you use the WLAN b+g mini-PCI Module
Configuration Utility.   Before using the Utility, please follow the steps below to
disable the Windows XP Zero Configuration:

Option 1:
1. Double click the shortcut icon to open the Utility.
2. From the Windows System Tray, you should see the signal icon.   Right-click it
   and select "Disable Zero-Configuration".
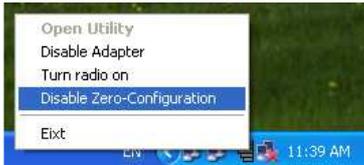
Option 2:
1. Go to "Control Panel" and double click "Network Connections".

2. Right-click "Wireless Network Connection" of "WLAN b+g mini-PCI Module",
   and select "Properties".

3. Select "Wireless Networks" tab, and uncheck the check box of "Use Windows to
   configure my wireless network settings", and then click "OK".
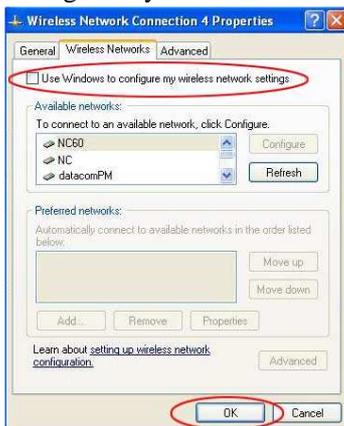
4. Creating an Ad Hoc New Network

NOTE! Ad-hoc mode is available only for 802.11b/g.

1. In the Configuration window, click **New**
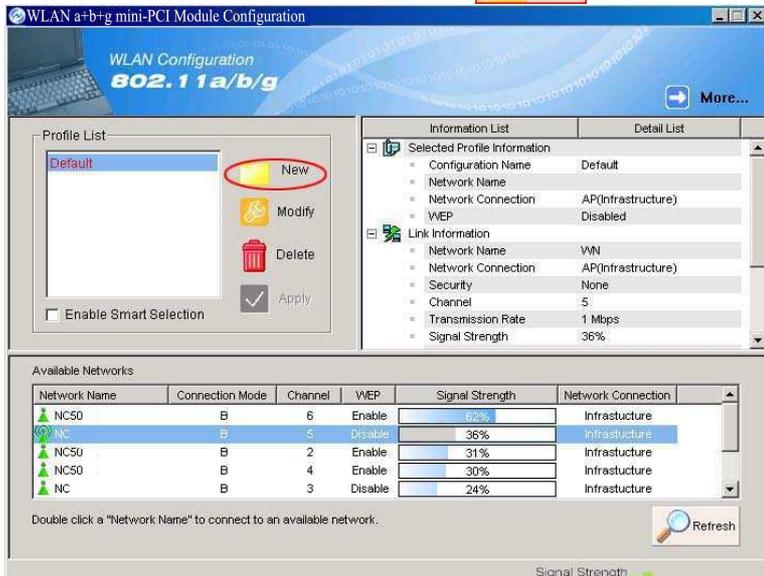
2. Select the "Profile Editor" tab.
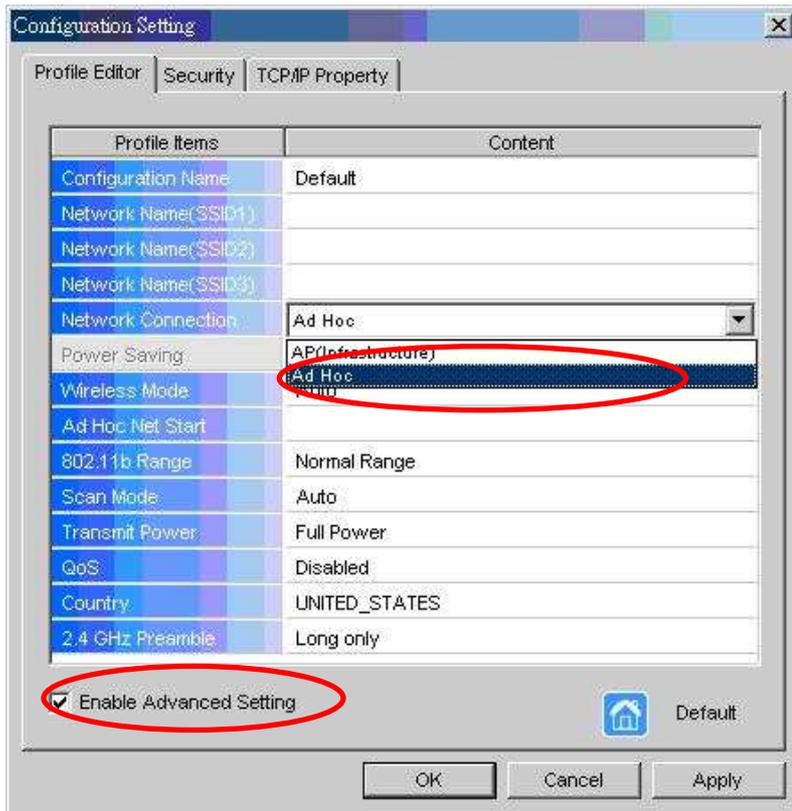
3. Choose the check box of **Enable Advanced Setting** to edit all settings.
4. If joining or creating an Ad-Hoc network, choose **Ad Hoc**.
5. Click **OK** (or **Apply** if using the other tabs) to save the settings.
   For details of each setting, refer to **Modifying a Wireless Network on page 20**.
6. Click the **Security** tab. If not using security, select **None**.
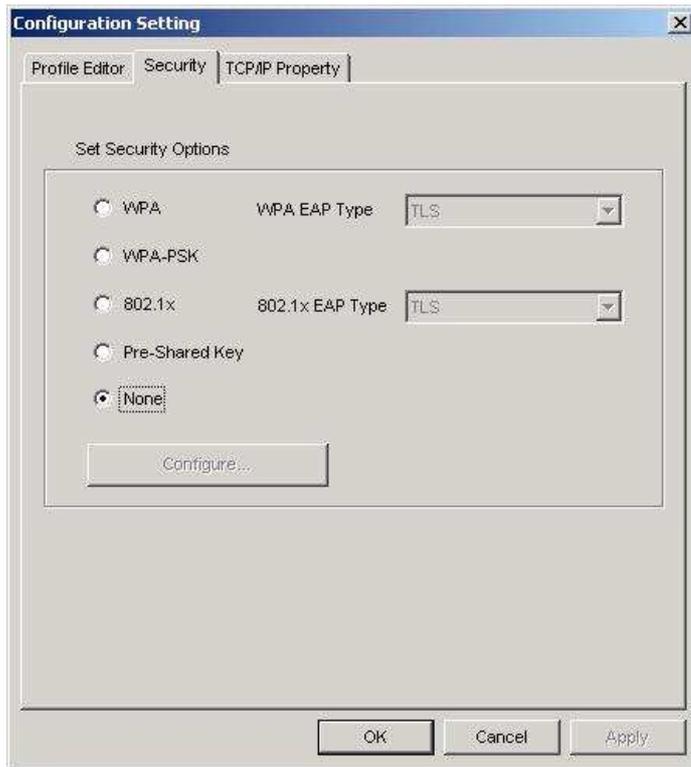
7. If security is used, select **Pre-Shared Key** and click on the **Configure** button.

8. Enter an encryption key in the **Shared: First** field.

9. Click **OK** (or **Apply** if using the other tabs) to save the settings. The new **Network Name** is listed in the **Profile List**.

The driver does not allow channel selection in Ad-Hoc mode. Instead, the driver starts with an initial channel then checks channel status. If the channel is busy, the driver automatically uses a different channel.

For details of each setting, please see chapter 5.

5. Modifying a Wireless Network

5.1 Infrastructure Mode and Ad Hoc Mode

You can set the Wireless Network Adapter to work in either **Infrastructure mode** or **Ad Hoc mode**.

NOTE! Ad-hoc mode is available only for 802.11b/g.

Infrastructure Mode

In infrastructure mode, devices communicate with each other by first going through an Access Point (AP).   Wireless devices can communicate with each other or can communicate with a wired network.   When one AP is connected to wired network and a set of wireless stations, it is referred to as a BSS (Basic Service Set).
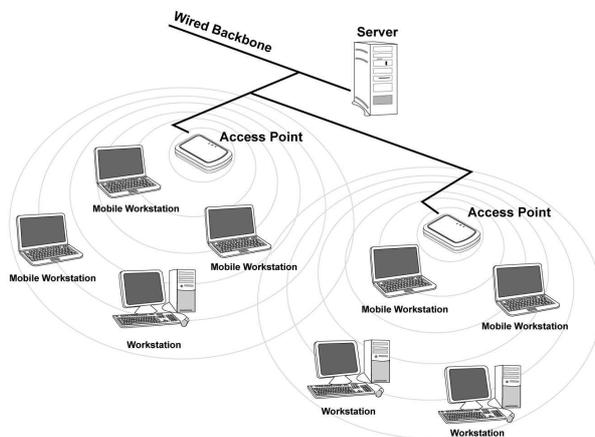
Ad Hoc Mode

Ad-hoc mode is also called "peer-to-peer mode" or "Independent Basic Service Set (IBSS)".   In ad hoc mode, devices communicate directly with each other without using an Access Point (AP).

NOTE! Ad-hoc mode is available only for 802.11b/g.

5.2 Modifying a Wireless Network

1. Open "WLAN b+g mini-PCI Module Configuration" by double clicking the shortcut icon on the desktop.

   Note! If there's no network name listed in the "Profile List", click **Refresh** button and double click a Network Name from **Available Networks**. The chosen Network Name is listed in the Profile List.

2. From the Profile List, select one Profile and click **Modify** button .

3. Select **Profile Editor** tab and edit the settings. Click **OK** to save the modifications.
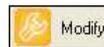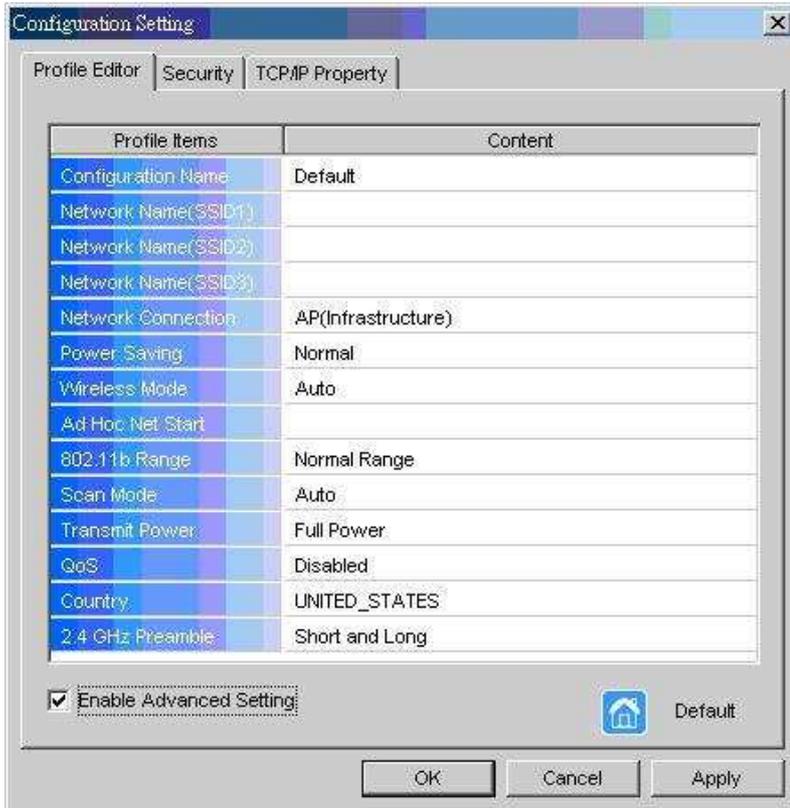
- **Configuration Name:** This name identifies the configuration. This name should be unique.
- **Network Name (SSID1) (SSID2) (SSID3):** The name of the wireless network.   This name cannot be longer than 32 characters.   If the field is set to be "ANY" or is left blank, your computer will connect to an AP with the best signal strength.
- **Network Connection:** Specifies the mode of the network.   Two options are "Infrastructure" and "Ad Hoc".
- **Power Saving:** Minimizes power consumption while maintaining network connectivity and high data transfer performance. In **Ad Hoc** mode, **Power Savings** function cannot be enabled. The power management options are:
  - **Off**: PC Card is powered up at all times.
  - **Normal**: PC Card sleeps less often and stays asleep for a shorter period.
  - **Maximum**: PC Card sleeps more frequently and stays asleep as much as possible.
- **Wireless Mode:** Three options are "802.11b", "802.11g", "Super G" or

"Auto". "Auto" allows the use of either, 802.11g or 802.11b mode.

NOTE! Ad-hoc mode is available only for 802.11b/g.

Ad Hoc Net Start: Specifies a band to establish an Ad Hoc network if no matching SSID is found.   Options available are the following: 802.11b and 802.11g.

NOTE! Ad-hoc mode is available only for 802.11b/g.   This is a client product and do not have radar detection function specified by FCC. **802.11b Range:** Options are **Normal Range** and **Extended Range**. This function can let user to determine the transfer range in 802.11b mode. Extended Range can prolong the transfer range with a lower data transmitting rate.

- **Scan Mode:** Options are **Active Scan**, **Passive Scan** and **Auto**. In Active Scan, the driver sends out the probe request frames from each channel and collects the response frames from the responding. In Passive Scan, the driver scan each requested channel, listening the beacons on each channel.

- **Transmit Power:** This setting allows you to change the output power of the PC Card to increase or decrease the coverage area.

- **QoS:** Disables or enables the PC Card to cooperate in a network using QoS (Quality of Service).

- **2.4 GHz Preamble:** Allows Ad-Hoc compatibility with other 2.4 GHz devices. Two options are **Short and Long** and **Long only**. Use **Long Only** when configuring the client for an 802.11b RoamAbout AP wireless network.

4. Select **Security** tab and choose the security mode.
   Note! *Check with your Network Administrator for the security features supported by your AP.*

- **WPA:** Enables the use of WiFi protected Access (WPA). This option requires IT administration.
  a) Select **WPA** to open the WPA EAP drop-down menu. The options includes TLS and PEAP.
  b) Click on the **Configure** button and complete the configuration information in the Define Certificate dialog.

- **WPA-PSK:** Enables the WPA-Pre Shared Key (PSK). Click on the **Configure** button and complete the configuration information in the WPA Passphrase dialog.

- **802.1x:** Enables 802.1x security. This option requires IT administration.
  a) Select **802.1x** to open the 802.1x EAP drop-down menu. The options include TLS and PEAP.
  b) Click on the **Configure** button and complete the configuration information in the Define Certificate dialog.

- ◼ **Pre-Shared Key:** Enables the use of pre-shared keys that are defined on the AP and the station.

  a) Select the **Pre-Shared Key** radio button.

  b) Click on the **Configure** button and complete the configuration information in the Define Certificate dialog.

- ◼ **None:** No security.

5. Define the Certificate.
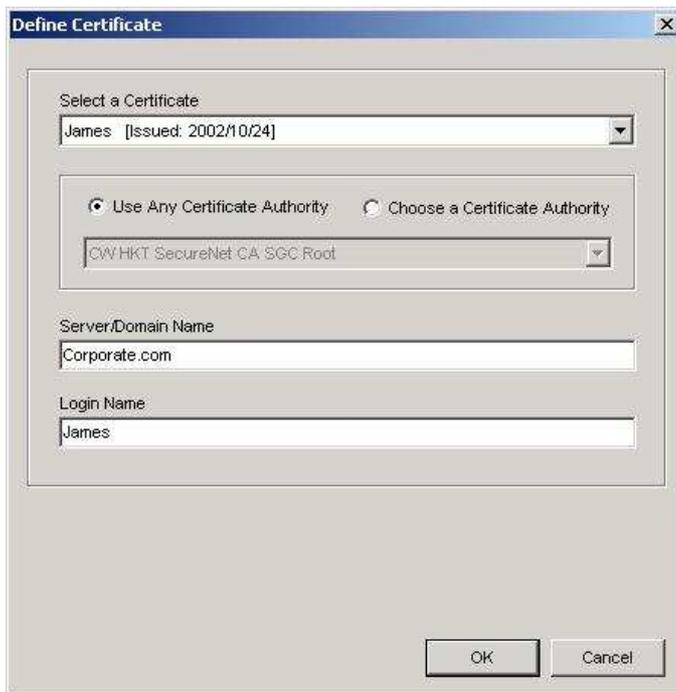
- ◼ **Select a Certificate:** Select the Certificate to Authenticate to the RADIUS server from the drop-down menu.
- ◼ **Use any Certificate Authority:** The Default Setting. Select this radio button to use any Certificate Authority (CA) for authentication.
- ◼ **Choose a Certificate Authority:** Select this radio button to choose the desired Certificate Authority for authentication from the drop-down menu.
- ◼ **Server/Domain Name:** The the RADIUS server name or the domain name used for the network access.
- ◼ **Login Name:** The username used to log into the server or domain.
- ◼ **Define User Information (PEAP)**: Click on the **Define User Information** button and complete the configuration information in the Define User Information dialog.

6. If selecting **WPA-PSK**, click on the **Configure** button to enter the PassPhrase. The PassPhrase must be a minimum of 8 printable ASCII characters. The PassPhrase   should be at least 20 characters to make it more difficult for an attacker to decipher the key.
7. If selecting **Pre-Shared Key**, click on the **Configure** button to enter the Encryption Keys.When finished, click **OK**. For WEP key, please contact with MIS administrator.

■ **Key Entry Method:** Determines the entry method for the key. Hexadecimal (0-9, A-F) or ASCII text (all keyboard characters).

■ **Default Encryption Key:** Allows you to choose one encryption key (First, Second, Third, or Fourth) as the transmit key, which encrypts transmissions from the PC Card.

■ **Unique Key:** Defines the per-session encryption key for the current network configuration. Not used in Ad-Hoc mode.

■ **Shared Keys:** Use these fields to enter the wireless network's encryption keys. The keys must be in the correct position (First, Second, Third, or Fourth).

■ **Key Length:** Defines the length of each encryption key.
  o For 40/64 bit (enter 10 digits for hexadecimal or 5 characters for ASCII)
  o For 104/128 bit (Enter 26 digits for hexadecimal or 13 characters for ASCII)

When the length is changed, the number of available characters in the field automatically changes. If a previously entered key is too long, the key is automatically truncated to fit. If the key length is increased again, the key does not update to the previous value.

8. Click **OK** to save the settings.

9. Select "TCP/IP Property" tab.   Enter the settings and click "OK" to save the settings.
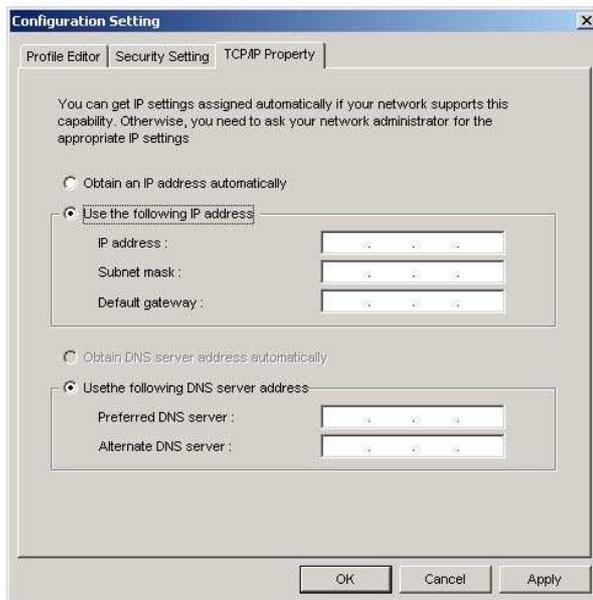
■ If the network uses DHCP server, choose **Obtain an IP address automatically**.
■ If the network does not use DHCP server, choose **Use the following IP address** to set the relative settings.   For the IP configuration information, please contact the network administrator.

5.3 Default Settings Windows XP Zero-Configuration

You may also choose the default parameters and directly proceed to Windows XP zero-configuration through the steps below:

1. Go to "Control Panel" and open "Network Connections".
2. Right-click the Wireless Network Connection of "WLAN b+g mini-PCI Module", and make sure this connection is **Enabled**.
3. Right-click the Wireless Network Connection of "WLAN b+g mini-PCI Module", and then click "Properties".
4. Select "Wireless Networks" tab and select "Use Windows to configure my wireless network settings" check box.

Note! Clear the check box of "Use Windows to configure my wireless network settings" will disable automatic wireless network configuration.

Appendix A: FAQ about WLAN

1. Can I run an application from a remote computer over the wireless network?

This will depend on whether or not the application is designed to be used over a network. Consult the application's user guide to determine whether it supports operation over a network.

2. Can I play computer games with other members of the wireless network?

Yes, as long as the game supports multiple players over a LAN (local area network). Refer to the game's user guide for more information.

3. What is Spread Spectrum?

Spread Spectrum technology is a wideband radio frequency technique developed by the military for use in reliable, secure, mission-critical communications systems. It is designed to trade off bandwidth efficiency for reliability, integrity, and security. In other words, more bandwidth is consumed than in the case of narrowband transmission, but the trade-off produces a signal that is, in effect, louder and thus easier to detect, provided that the receiver knows the parameters of the spread-spectrum signal being broadcast. If a receiver is not tuned to the right frequency, a spread-spectrum signal looks like background noise. There are two main alternatives, Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum (FHSS).

4. What is DSSS? What is FHSS? And what are their differences?

Frequency-Hopping Spread-Spectrum (FHSS) uses a narrowband carrier that changes frequency in a pattern that is known to both transmitter and receiver. Properly synchronized, the net effect is to maintain a single logical channel. To an unintended receiver, FHSS appears to be short-duration impulse noise. Direct-Sequence Spread-Spectrum (DSSS) generates a redundant bit pattern for each bit to be transmitted. This bit pattern is called a chip (or chipping code). The longer the chip, the greater the probability that the original data can be recovered. Even if one or more bits in the chip are damaged during transmission, statistical techniques embedded in the radio can recover the original data without the need for retransmission. To an unintended receiver, DSSS appears as low power wideband noise and is rejected (ignored) by most narrowband receivers.

5. Would the information be intercepted while transmitting on air?

WLAN features two-fold protection in security. On the hardware side, as with Direct Sequence Spread Spectrum technology, it has the inherent security feature of scrambling. On the software side, WLAN offers the encryption function (WEP) to enhance security and access control.

6. What is WEP?

WEP is Wired Equivalent Privacy, a data privacy mechanism based on a 64-bit or 128-bit shared key algorithm, as described in the IEEE 802.11 standard.

7. What is infrastructure mode?

When a wireless network is set to infrastructure mode, the wireless network is configured to communicate with a wired network through a wireless access point.

8. What is roaming?

Roaming is the ability of a portable computer user to communicate continuously while moving freely throughout an area greater than that covered by a single access point. Before using the roaming function, the workstation must make sure that it is the same channel number with the access point of dedicated coverage area.

To achieve true seamless connectivity, the wireless LAN must incorporate a number of different functions. Each node and access point, for example, must always acknowledge receipt of each message. Each node must maintain contact with the wireless network even when not actually transmitting data. Achieving these functions simultaneously requires a dynamic RF networking technology that links access points and nodes. In such a system, the user's end node undertakes a search for the best possible access to the system. First, it evaluates such factors as signal strength and quality, as well as the message load currently being carried by each access point and the distance of each access point to the wired backbone. Based on that information, the node next selects the right access point and registers its address. Communications between end node and host computer can then be transmitted up and down the backbone. As the user moves on, the end node's RF transmitter regularly checks the system to determine whether it is in touch with the original access point or whether it should seek a new one. When a node no longer receives acknowledgment from its original access point, it undertakes a new search. Upon finding a new access point, it then re-registers, and the communication process continues.

Appendix B: Specification

Electric Characteristics:

Category	▪ Key Specifications
Main Chipset	▪ Atheros® Communication AR9220 dual band configurable radio
Frequency Range	▪ USA: 2.400 ~ 2.483 GHz ▪ Europe: 2.400 ~ 2.483 GHz ▪ Japan: 2.400 ~ 2.497 GHz ▪ China: 2.400 ~ 2.483 GHz
Host Interface	▪ Mini-PCI form factor; Mini-PCI Version 1.0 type 3A

Channels support	▪ 802.11 b/g/n
	
	  o US/Canada: 11 (1 ~ 11)
	
	  o Major European country: 13 (1 ~ 13)
	
	  o France: 4 (10 ~ 13)
	
	  o Japan: 11b: 14 (1~13 or 14th), 11g/n: 13 (1 ~ 13)
	
	  o China: 13 (1 ~ 13)

Operation Voltage	▪ 3.3V +/-5%
Typical Current Consumption	<table><tr><td></td><td>802.11b Avg/Max (mA)</td><td>802.11g Avg/Max (mA)</td><td>802.11n(2.4GHz) Avg/Max (mA)</td></tr><tr><td>Continue Tx</td><td>566/691</td><td>706/859</td><td>579/712</td></tr><tr><td>FTP Tx</td><td>363/700</td><td>271/743</td><td>358/741</td></tr><tr><td>FTP Rx</td><td>156/685</td><td>165/721</td><td>184/726</td></tr><tr><td>Standby mode</td><td>142/254</td><td>143/259</td><td>142/256</td></tr></table>The maximum current consumption would be impacted by radiation environment and the driver mechanism. **Condition: 2T2R @25º C (with +15 /-15% tolerance)**

RF Output Power (dB) (Typical composite power) Tolerance: +2/-2 dB @ 25 ℃ +3/-3 dB @ 0 & 60 ℃	**802.11b** **802.11g** **802.11gn**

802.11b

Frequency	1_Target	2_Target	5.5_Target	11_Target
2412	18	18	18	18
2462	18	18	18	18

802.11g

Frequency	6-24_Target	36_Target	48_Target	54_Target
2412	23	22	21	19
2442	23	22	21	19
2472	23	22	21	19

802.11gn

Freq Ranger 2.4GHz/HT20

Frequency	MCS 0/8	MCS 1/9	MCS 2/10	MCS3/11	MCS4/12	MCS5/13	MCS6/14	MCS7/15
2412	21	21	21	21	21	21	19	17
2442	21	21	21	21	21	21	19	17
2472	21	21	21	21	21	21	19	17

Freq Ranger 2.4GHz/HT40

Frequency	MCS 0/8	MCS 1/9	MCS 2/10	MCS3/11	MCS4/12	MCS5/13	MCS6/14	MCS7/15
2412	21	21	21	21	20	20	18	16
2442	20	20	20	20	20	20	18	16
2472	20	20	20	20	19	19	18	16

EVM	**802.11b**			
		Data Rate	**Relative constellation error (dB)** **IEEE Spec (1Tx)**	**Relative constellation error (dB)** **Typical/Maximum (2Tx)**
		1M	-10	-18/-15
		5.5M	-10	-18/-15
		11M	-10	-18/-15
	802.11g			
		Data Rate	**Relative constellation error (dB)** **IEEE Spec (1Tx)**	**Relative constellation error (dB)** **Typical/Maximum (2Tx)**
		6M	-5	-24/-16
		9M	-8	-25/-16
		12M	-10	-25/-16
		18M	-13	-26/-16
		24M	-16	-23/-19
		36M	-19	-29/-22
		48M	-22	-31/-23
		54M	-25	-31/-25
	802.11ng			
		Data Rate	**Relative constellation error (dB)** **IEEE Spec (1Tx)**	**Relative constellation error (dB)** **Typical/Maximum (2Tx)**
	HT20			
		MCS0	-5	-30/-16
		MCS1	-10	-30/-16
		MCS2	-13	-30/-16
		MCS3	-16	-30/-19
		MCS4	-19	-30/-22
		MCS5	-22	-31/-23
		MCS6	-25	-31/-25
		MCS7	-28	-31/-27
		MCS8	-5	-30/-16
		MCS9	-10	-30/-16
		MCS10	-13	-30/-16
		MCS11	-16	-30/-19
		MCS12	-19	-30/-22
		MCS13	-22	-30/-23
		MCS14	-25	-30/-25
		MCS15	-28	-30/-27
	HT40			
		MCS0	-5	-30/-16
		MCS1	-10	-30/-16
		MCS2	-13	-30/-16
		MCS3	-16	-30/-19
		MCS4	-19	-30/-22
		MCS5	-22	-30/-23
		MCS6	-25	-30/-25
		MCS7	-28	-30/-27
		MCS8	-5	-30/-16
		MCS9	-10	-30/-16
		MCS10	-13	-30/-16
		MCS11	-16	-30/-19
		MCS12	-19	-30/-22
		MCS13	-22	-30/-23
		MCS14	-25	-30/-25
		MCS15	-28	-30/-27

Sensitivity	**802.11b**		
	Data Rate	IEEE Spec (1 Rx dBm)	Typical/Maximum (2 Rx dBm)
	1M	-82	-95/-91
	5.5M	-80	-95/-91
	11M	-76	-91/-87
	802.11g		
	Data Rate	IEEE Spec (1 Rx dBm)	Typical/Maximum (2 Rx dBm)
	6M	-82	-95/-91
	9M	-81	-95/-91
	12M	-79	-94/-90
	18M	-77	-93/-89
	24M	-74	-90/-86
	36M	-70	-86/-82
	48M	-66	-82/-78
	54M	-65	-80/-76
	802.11ng		
	Data Rate	IEEE Spec (1 Rx dBm)	Typical/Maximum (2 Rx dBm)
	HT20		
	MCS0	-82	-95/-91
	MCS1	-79	-94/-90
	MCS2	-77	-92/-88
	MCS3	-74	-88/-84
	MCS4	-70	-85/-81
	MCS5	-66	-80/-76
	MCS6	-65	-79/-75
	MCS7	-64	-77/-73
	HT40		
	MCS0	-79	-90/-86
	MCS1	-76	-90/-86
	MCS2	-74	-89/-85
	MCS3	-71	-85/-81
	MCS4	-67	-82/-78
	MCS5	-63	-78/-74
	MCS6	-62	-77/-73
	MCS7	-61	-74/-71

Operation Distance	802.11b - Outdoor: 150 m @11Mbps, 300 m @1Mbps - Indoor: 30 m @11Mbps, 100 m @1Mbps 802.11g - Outdoor: 50 m @54Mbps, 300 m @6Mbps - Indoor: 30 m @54Mbps, 100 m @6Mbps 802.11n - Outdoor: 250 m @6.5Mbps (MCS0: 1 Nss/20MHz BW) 30m @130Mbps (MCS15: 2 Nss/20MHz BW) 30m @300Mbps (MCS15: 2 Nss/40MHz BW) - Indoor: 100 m @6.5Mbps (MCS0: 1 Nss/20MHz BW) 20m @130Mbps (MCS15: 2 Nss/20MHz BW)

	○ 20m @300Mbps (MCS15: 2 Nss/40MHz BW) *(Notes :Estimated range are based on 2dB dipole antenna. The real operational distance is depending on (Access Point) system efficiency and antenna performance.)*
PCB Dimension	▪ 50.8mm (L/H) x 59.6mm (W) x 1.0mm (T)

Data Rate	▪ 802.11b: 1, 2, 5.5, 11Mbps
	 ▪ 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps
	 ▪ 802.11n: @800GI(400GI)
	     ○ 20MHz BW
	        ▪ 1 Nss: 65(72.2)Mbps maximal
	        ▪ 2 Nss: 130(144.4)Mbps maximal
	     ○ 40MHz BW
	        ▪ 1 Nss: 135(150)Mbps maximal
	        ▪ 2 Nss: 270(300)Mbps maximal

Operation Temperature	▪ $0^o \sim 60^o$ C
Storage Temperature	▪ $-20^o \sim 80^o$ C
Wi-Fi® Alliance®	▪ WECA Compliant
Radio & EMC Certificate	▪ US: 47 CFR 15, FCC Part 15 401~ Part 15. 407 (5150 ~ 5350 MHz & 5725~5825 MHz), Part 15.247 (5725~5850 MHz); FCC Part 15.247 (2400~2483.5 MHz), 47CFR 15, FCC-Class B, FCC Part 15.107 & Part 15.109; ▪ Limited Module Level Approval, ▪ Industry Canada: IC RSS210, RSS139-1, ICES-003; Limited Module Level Approval ▪ ETSI, EN301893, EN60950 (Europe); EN 301.893, EN 300.328, & EN 301489-1/17 EN 55022 & EN 55024;
Antenna connector	▪ 2 x SMT ultra-miniature coaxial connectors (Hirose® U.FL connector)

Industry Canada statement:

This device complies with RSS-210 of the Industry Canada 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.

French translation:

Ce dispositif est conforme à la norme CNR-210 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna,

3) For all products market in Canada, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

French translation :

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes:

1) L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et

2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne,

3) Pour tous les produits vendus au Canada, OEM doit limiter les fréquences de fonctionnement CH1 à CH11 pour bandes de fréquences 2.4G grâce aux outils de microprogrammation fournis. OEM ne doit pas fournir d'outil ou d'informations à l'utilisateur final en ce qui concerne le changement de réglementation de domaine.

Tant que les 3 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours

responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

French translation:

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

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End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC: 4441A-DNMA91".

French translation:

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 4441A-DNMA91".

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as

show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.