

# **NWH-650/660 Access Point (AP) NWH-2210 Wireless Ethernet Client (WEC) NWH-6110 Bridge User's Manual**

## **Warranty**

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

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# 1. Introduction

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The NWH-2210 and NWH-650/660 are wireless network solutions for the 7188E/8000 series. Coupled with our 7188E/8000 series, they are very easy to set up and use on the Internet/Intranet. Once the connection between the WEC and the 7188E/8000 series has been set up, the NWH-2210 is similar to an Ethernet NIC. On the programming side, there is no need to take precautions for the WEC or AP in your program.

Both the NWH series and 7188E/8000 series have specially designed firmware. Any NWH series product shipped from ICPDAS will have an "ICPDAS" sticker on the case.

The NWH-650 is similar to the NWH-660. The most important difference is that the NWH-660 can be changed the antenna for increased transmission distances.

In order to add a wireless transmission range, we have some accessories for collocation such as a Bridge and an antenna.

## More Information

- Refer to the "I-7188E Series Hardware User's Manual" for more information about the 7188E series.
- Refer to the "8000 Series Hardware User's Manual" for more information about the 8000 series

# Package List

The package includes the following items:

## **NWH-2210**

- One NWH-2210 InstantWave Wireless Network Client (WEC).
- One power adaptor.
- One companion CD (containing WEC Utility and a PDF-file user manual)
- One printable User's Manual.

## **NWH-650/660**

- One NWH-650 InstantWave High Rate Access Point (AP).
- One RS-232 cable.
- One power adaptor.
- One companion CD (contains driver, AP Tools, user manual on a PDF file....)
- One printable User's Manual

## **NWH-6110**

- One NWH-6110 InstantWave Bridge.
- One power adaptor.
- One companion CD (containing Bridge Utility and a PDF-file user manual)
- One printable User's Manual.

## **Note**

If any of the items are missing or damaged, contact the local distributor for more information. Save the shipping materials and cartons in case you want to reship in the future.

## 2. Specifications

---

### NWH-650(AP)



### General

|                                |   |
|--------------------------------|---|
| <b>Regulatory Compliance</b>   | FCC Part 15 Class B.<br>ETS 300 328 and ETS 300 826, CE Mark.<br>ARIB STD-T66   |
| <b>Standards Compliance</b>    | <b>Wireless:</b> IEEE 802.11b, Wi-Fi compliant<br><b>Ethernet:</b> IEEE 802.3   |
| <b>Transmission Rate</b>       | 11Mbps (Max.)<br>11/5.5/2/1Mbps auto fallback   |
| <b>Communication method</b>    | Half-Duplex   |
| <b>Security Systems</b>        | SSID; 40-bit/128-bit WEP encryption; MAC Access Control;<br>SNMP authentication for authorized access   |
| <b>LED Indicators</b>          | Power/Status, Ethernet Link, Ethernet TX/RX, Wireless Link,<br>Wireless TX/RX   |
| <b>Access Point Interfaces</b> | <b>10Base-T:</b> RJ-45<br><b>RS-232:</b> D-SUB 9 pin  |
| <b>Power</b>                   | <b>Power Voltage:</b> DC 5.1 Volt $\pm$ 5%; 2A (Max.);<br><b>AC Adapter:</b> AC 100V ~ 240V;<br><b>Power Consumption:</b> 5.1Volt, 1.0A (Typical) |
| <b>Dimensions</b>              | 138 x 114 x 37mm (5.43 x 4.49 x 1.46in.)  |

### Wireless

|                             |   |
|-----------------------------|---|
| <b>Radio Frequency Type</b> | <b>Direct Sequence Spread Spectrum</b> (DSSS)   |
| <b>Frequency Band</b>       | 2.4GHz  |
| <b>RF Frequency Range</b>   | 2471MHz ~ 2497MHz – <b>Japan Band</b><br>2400MHz ~ 2483.5MHz – <b>North American, Europe,<br/>Extended Japan Band</b> |

|                           |  |
|---------------------------|--|
|                           | 2445MHz ~ 2475MHz – <b>Spain</b><br>2446.5MHz ~ 2483.5MHz – <b>France</b>  |
| <b>Transmitter</b>        | <b>RF Output Power:</b> 20dBm (For North American and Extended Japan). 18dBm (Europe).<br><b>Frequency Stability:</b> Within $\pm 25$ ppm<br><b>Data Modulation Type:</b> BPSK (1Mbps)/QPSK(2/5.5/11Mbps)<br><b>Data Modulation Speed:</b> 11/5.5/2/1Mbps with auto fallback |
| <b>Receive</b>            | <b>Sensitivity:</b> (Less than 8% of FER packet size is 1024 bytes) – 80dBm (11Mbps@25 $\pm$ 5 $\square$ )   |
| <b>Transmission Range</b> | Up to <b>300m</b> (984ft) <b>outdoors</b> (depends on the interference conditions and environment)<br>Up to <b>100m</b> (328ft) <b>indoors</b> (depends on the interference conditions and environment)  |
| <b>Antenna Type</b>       | Dual dipole diversity  |

## Software

|                         |  |
|-------------------------|--|
| <b>Configuration</b>    | AP COMFIG Tools program via COM port;<br>AP Management System via Ethernet   |
| <b>Security</b>         | 40-bit/128-bit WEP encryption;<br>Configuration settings password  |
| <b>Software Support</b> | SNMP for MIB I and MIB II; 40-bit/128-bit WEP encryption;<br>Dynamic rate shifting from 11/5.5/2/1Mbps; Network Configuration profile; Access Control; Protocol Filtering; Trap Management; Self-Diagnostic Test; Upgradeable Firmware |
| <b>Firmware Upgrade</b> | Via COM port   |
| <b>OS Support</b>       | Windows 95/98/Me/NT4.0/2000/XP   |

## Environment

|                              |   |
|------------------------------|---|
| <b>Operating Environment</b> | <b>Operating Temperature:</b> 0 ~ 55 $\square$ (32 ~ 131 $^{\circ}$ F)<br><b>Storage Temperature:</b> -30 ~ 70 $\square$ (-22 ~ 158 $^{\circ}$ F)<br><b>Humidity:</b> Maximum 85% at 40 $\square$ (104 $^{\circ}$ F) non-condensing |
| <b>System Requirements</b>   | One IEEE 802.11b compliant wireless adapter; An Ethernet drop (UTP)<br>One PC and a supplied RS-232 cable (only used when configuration of the AP is required)  |
| <b>Warranty</b>              | One year limited  |

# NWH-660(AP)



## General

|                                |  |
|--------------------------------|--|
| <b>Regulatory Compliance</b>   | FCC Part 15 Class B.<br>ETS 300 328 and ETS 300 826, CE Mark.<br>ARIB STD-T33  |
| <b>Standards Compliance</b>    | <b>Wireless:</b> IEEE 802.11b, Wi-Fi compliant<br><b>Ethernet:</b> IEEE 802.3  |
| <b>Transmission Rate</b>       | 11/5.5/2/1Mbps auto fallback   |
| <b>Communication method</b>    | Half-Duplex  |
| <b>Security Systems</b>        | SSID; 40-bit/128-bit WEP encryption; MAC Access Control;<br>SNMP authentication for authorized access  |
| <b>LED Indicators</b>          | Power/Status, Ethernet Link, Ethernet Activity, Wireless Link,<br>Wireless Activity  |
| <b>Access Point Interfaces</b> | <b>10Base-T:</b> RJ-45<br><b>RS-232:</b> D-SUB 9 pin<br><b>Reverse Type SMA Antenna Connector</b>  |
| <b>Power</b>                   | <b>Power Voltage:</b> DC 5.1 Volt $\pm$ 5%; 2A (Max.);<br><b>AC Adapter:</b> AC 100V ~ 240V;<br><b>Power Consumption:</b> 5.1Volt,1.0A (Typical) |
| <b>Dimensions</b>              | 220 x 145 x 33mm (8.66 x 5.71 x 1.30in.)   |

## Wireless

|                             |  |
|-----------------------------|--|
| <b>Radio Frequency Type</b> | <b>Direct Sequence Spread Spectrum (DSSS)</b>  |
| <b>Frequency Band</b>       | 2.4GHz   |
| <b>RF Frequency Range</b>   | 2471MHz ~ 2497MHz – <b>Japan Band</b><br>2400MHz ~ 2483.5MHz – <b>North American, Europe,</b><br><b>Extended Japan Band</b><br>2445MHz ~ 2475MHz – <b>Spain</b><br>2446.5MHz ~ 2483.5MHz – <b>France</b> |
| <b>Transmitter</b>          | <b>RF Output Power:</b> 13 dBm.  |

|                           |  |
|---------------------------|--|
|                           | <b>Frequency Stability:</b> Winthin $\pm 25$ ppm<br><b>Data Modulation Type:</b> BPSK<br>(1Mbps)/QPSK(2/5.5/11Mbps)<br><b>Data Modulation Speed:</b> 11/5.5/2/1Mbps with auto fallback |
| <b>Receive</b>            | <b>Sensitivity:</b> (Less than 8% of FER packet size is 1024 bytes) – 80dBm(11Mbps@25 $\pm$ 5 $\square$ )  |
| <b>Transmission Range</b> | <b>Typical Range:</b> Up to 500 ft (150m) radius indoors,<br>1000ft (300m) radius outdoors   |
| <b>Antenna Type</b>       | Dual dipole diversity( <b>Fixed type or External type</b> )  |

### Software

|                         |  |
|-------------------------|--|
| <b>Configuration</b>    | AP COMFIG Tools program via COM port;<br>AP Management System via Ethernet   |
| <b>Security</b>         | 40-bit/128-bit WEP encryption;<br>Configuration settings password<br>Access control  |
| <b>Software Support</b> | SNMP for MIB I and MIB II; 40-bit/128-bit WEP encryption;<br>Dynamic rate shifting from 11/5.5/2/1Mbps; Network<br>Configuration profile; Access Control; Protocol Filtering; Trap<br>Management; Self-Diagnostic Test; Upgradeable Firmware |
| <b>Firmware Upgrade</b> | Via COM port   |
| <b>OS Support</b>       | Windows 95/98/Me/NT4.0/2000/XP   |

### Environment

|                              |  |
|------------------------------|--|
| <b>Operating Environment</b> | <b>Operating Temperature:</b> 0 ~ 50 $\square$ (Except RF output power and sensitivity)<br><b>Storage Temperature:</b> -30 ~ 70 $\square$ (-22 ~ 158 $^{\circ}$ F)<br><b>Humidity:</b> Maximum 85% at 40 $\square$ (104 $^{\circ}$ F) non-condensing |
| <b>System Requirements</b>   | One IEEE 802.11b compliant wireless adapter; An Ethernet drop (UTP)<br>One PC and a supplied RS-232 cable (only used when configuration of the AP is required)   |
| <b>Warranty</b>              | One year limited   |



# NWH-2210(WEC)



## General

|                              |  |
|------------------------------|--|
| <b>Regulatory Compliance</b> | FCC Part 15 Class B.<br>ETS 300 328 and ETS 300 826, CE Mark.<br>ARIB STD-T66  |
| <b>Standards Compliance</b>  | <b>Wireless:</b> IEEE 802.11b, Wi-Fi compliant<br><b>Ethernet:</b> IEEE 802.3  |
| <b>Transmission Rate</b>     | 11Mbps (Max.)<br>11/5.5/2/1Mbps auto fallback  |
| <b>Communication method</b>  | Half-Duplex  |
| <b>Security Systems</b>      | SSID; 40-bit/128-bit WEP encryption;   |
| <b>LED Indicators</b>        | Power, Activity  |
| <b>Interfaces/Connectors</b> | <b>10Base-T:</b> RJ-45   |
| <b>Power</b>                 | <b>Power Voltage:</b> DC 5.1 Volt + 5%; 2A (Max.);<br><b>AC Adapter:</b> AC 100V ~ 240V;<br><b>Power Consumption:</b> 5.1Volt,1.0A (Typical) |
| <b>Dimensions</b>            | 103 x 116 x 66mm (4.05 x 4.56 x 2.60in.)   |

## Wireless

|                             |   |
|-----------------------------|---|
| <b>Radio Frequency Type</b> | <b>Direct Sequence Spread Spectrum (DSSS)</b>   |
| <b>Frequency Band</b>       | 2.4GHz  |
| <b>RF Frequency Range</b>   | 2471MHz ~ 2497MHz – <b>Japan Band</b><br>2400MHz ~ 2483.5MHz – <b>North American, Europe, Extended Japan Band</b><br>2445MHz ~ 2475MHz – <b>Spain</b><br>2446.5MHz ~ 2483.5MHz – <b>France</b>  |
| <b>Transmitter</b>          | <b>RF Output Power:</b> 20dBm (For North American and Extended Japan).18dBm (Europe).<br><b>Frequency Stability:</b> Winthin ± 25ppm<br><b>Data Modulation Type:</b> BPSK (1Mbps)/QPSK(2/5.5/11Mbps)<br><b>Data Modulation Speed:</b> 11/5.5/2/1Mbps with auto fallback |
| <b>Receive</b>              | <b>Sensitivity:</b> (Lass than 8% of FER packet size is 1024 bytes) –   |

|                           |   |
|---------------------------|---|
|                           | 80dBm(11Mbps@25±5□)   |
| <b>Transmission Range</b> | Up to <b>300m</b> (984ft) <b>outdoors</b> (depends on the interference conditions and environment)<br>Up to <b>100m</b> (328ft) <b>indoors</b> (depends on the interference conditions and environment) |
| <b>Antenna Type</b>       | Integrated built-in dual dipole antenna with diversity  |

## Software

|                         |   |
|-------------------------|---|
| <b>Configuration</b>    | WEC Utility program via Ethernet port   |
| <b>Security</b>         | 40-bit/128-bit WEP encryption;  |
| <b>Software Support</b> | <b>Dynamic rate shifting:</b> 11/5.5/2/1Mbps; Channel Setting; Roaming; RF Signal Quality Monitor |
| <b>Firmware Upgrade</b> | Via Ethernet port   |
| <b>OS Support</b>       | Supports any operating system   |

## Environment

|                              |   |
|------------------------------|---|
| <b>Operating Environment</b> | <b>Operating Temperature:</b> 0 ~ 50□ (32 ~ 122°F) (Except RF output power and sensitivity)<br><b>Storage Temperature:</b> -30 ~ 70□ (-22 ~ 158°F)<br><b>Humidity:</b> Maximum 85% at 40□ (104°F) |
| <b>System Requirements</b>   | One IEEE 802.11b compliant wireless adapter; An Ethernet drop (UTP)<br>One PC and a supplied RS-232 cable (only used when configuration of the AP is required)                                    |
| <b>Warranty</b>              | One year limited  |

## Accessories

(Add the transmission range, For NWN-660 & NWH-6110)

### **I.** 6dBi Indoor High-Gain Directional Antenna (NWA0106)

#### Electrical Specifications

|                     |                   |
|---------------------|-------------------|
| Frequency Range     | 2400MHz ÷ 2500MHz |
| Gain                | 6dBi              |
| VSWR                | 1.5:1 Max.        |
| Polarization        | Linear, Vertical  |
| HPBW/Horizontal     | 80°               |
| HPBW/Vertical       | 80°               |
| Front to Back Ratio | 12dBi             |
| Power Handling      | 20W (cw)          |
| Impedance           | 50 Ohms           |
| Connector           | MMCX plug         |
| Cable               | ULA-316; 100cm    |
| Warranty            | One year limited  |



#### Environmental & Mechanical Characteristics

|             |                                   |
|-------------|-----------------------------------|
| Temperature | -10°C to + 55°C                   |
| Humidity    | 95% @ 25°C                        |
| Dimensions  | 115 x 76 x 76mm (4.53 x 3 x 3in.) |
| Weight      | 110g (3.88oz)                     |

## **II. 8.5dBi Outdoor High-Gain Directional Antenna(NWA0208)**

### **Electrical Specifications**

|                            |                   |
|----------------------------|-------------------|
| <b>Frequency Range</b>     | 2400MHz ÷ 2500MHz |
| <b>Gain</b>                | 8.5dBi            |
| <b>VSWR</b>                | 1.5:1 Max.        |
| <b>Polarization</b>        | Linear, Vertical  |
| <b>HPBW/Horizontal</b>     | 70°               |
| <b>HPBW/Vertical</b>       | 65°               |
| <b>Front to Back Ratio</b> | 15dB              |
| <b>Power Handling</b>      | 50W (cw)          |
| <b>Impedance</b>           | 50 Ohms           |
| <b>Connector</b>           | N female          |
| <b>Cable</b>               | ULA-168; 6m       |
| <b>Warranty</b>            | One year limited  |



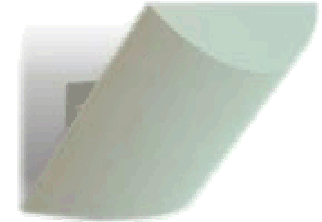
### **Environmental & Mechanical Characteristics**

|                              |  |
|------------------------------|--|
| <b>Temperature</b>           | -40° to + 80°                            |
| <b>Humidity</b>              | 100% @ 25°                               |
| <b>Lightening Protection</b> | DC ground                                |
| <b>Dimensions</b>            | 125 x 120 x 42mm (4.92 x 4.72 x 1.65in.) |
| <b>Weight</b>                | 300g (10.58oz)                           |

### **III. 14dBi Outdoor High-Gain Directional Antenna(nwa0214)**

#### **Electrical Specifications**

|                            |                   |
|----------------------------|-------------------|
| <b>Frequency Range</b>     | 2400MHz ÷ 2500MHz |
| <b>Gain</b>                | 14dBi             |
| <b>VSWR</b>                | 1.5:1 Max.        |
| <b>Polarization</b>        | Linear, Vertical  |
| <b>HPBW/Horizontal</b>     | 30°               |
| <b>HPBW/Vertical</b>       | 30°               |
| <b>Front to Back Ratio</b> | 15dB              |
| <b>Power Handling</b>      | 50W (cw)          |
| <b>Impedance</b>           | 50 Ohms           |
| <b>Connector</b>           | N female          |
| <b>Cable</b>               | ULA-168; 9m       |
| <b>Warranty</b>            | One year limited  |



#### **Environmental & Mechanical Characteristics**

|                              |  |
|------------------------------|--|
| <b>Temperature</b>           | -40° to + 80°                            |
| <b>Humidity</b>              | 100% @ 25°                               |
| <b>Lightening Protection</b> | DC ground                                |
| <b>Dimensions</b>            | 240 x 240 x 60mm (9.45 x 9.45 x 2.36in.) |
| <b>Weight</b>                | 825g (29.10oz)                           |

## IV. Wireless Building-to-Building Bridge (NWH6110)



|   |  |
|---|--|
| <b>Standards Compliance</b>                 | IEEE 802.11b   |
| <b>Radio Frequency Type</b>                 | <b>Direct Sequence Spread Spectrum</b> (DSSS)  |
| <b>Frequency Band</b>                       | 2.4GHz   |
| <b>Transmission Power</b>                   | 100mW (Max.)   |
| <b>Transmission Rate</b>                    | 11Mbps/5.5Mbps/2Mbps/1Mbps auto fallback   |
| <b>Transmitter</b>                          | <b>RF output power:</b> 20dBm (Max.)<br><b>Frequency stability:</b> Within $\pm 25$ ppm  |
| <b>Receiver</b>                             | <b>Sensitivity:</b> -80dBm (Typical) 11Mbps @ 25 $\square$ $\pm 5$ $\square$   |
| <b>Interfaces</b>                           | One RJ-45 port   |
| <b>Security</b>                             | 40-bit/128-bit WEP encryption;<br>SNMP authentication for authorized access  |
| <b>Software Support</b>                     | SNMP for MIB I and MIB II; SNMP-based network management tools; Protocol Filtering; Trap Management; Upgradeable Firmware; Bridge Discovery  |
| <b>Operating Environment</b>                | <b>Operating Temperature:</b> 0 ~ 50 $\square$ (32 ~ 122 $\square$ F)<br><b>Storage Temperature:</b> -30 ~ 70 $\square$ (-22 ~ 158 $\square$ F)<br><b>Humidity:</b> Maximum 85% at 40 $\square$ (104 $\square$ F) non-condensing |
| <b>Dimensions</b>                           | 220 x 145 x 33mm (8.66 x 5.71 x 1.30 in)   |
| <b>Power</b>                                | <b>Voltage:</b> DC 5.1 Volt +5%; 2A (Max.);<br>AC adapter AC 100V ~ 240V<br><b>Power Consumption:</b> 5.1 Volt. 1.0A (Typical)   |
| <b>Regulatory Approval</b>                  | FCC Part 15 B (US); CE   |
| <b>Network Management System OS Support</b> | Windows 98/Me/NT4.0(SP4 or above)/2000/XP  |
| <b>Transmission Range</b>                   | Up to <b>30 km (18 miles)</b> at 11Mbps transmission speed*  |
| <b>Warranty</b>                             | One Year Limited   |

## Selection Guide

This following table shows how to choose the wireless modules in term of distance. For example: If you want to create a connection between a **PC** and a **7188E** series which connects some **7000 modules** via RS-485 network. Use **2 NWH-2210** to connect the **PC** and **7188E** series separately. In term of the distance, add the extra wireless devices such as NWA-0214 or NWH-6110. Refer to **page 15~27** for more notes and applications.

| Mode<br>Distance               | Ad-hoc  | Infrastructure   |
|--------------------------------|---|--|
| 0~100M<br><i>(indoor)</i>      | NWH-2210 * 2<br><i>(Refer to page 16<br/>Picture 2)</i> | <u>NWH-650 * 1 + NWH-2210 * 2</u><br><i>(Refer to page 17 Picture 3)</i>                                       |
| 100~300M<br><i>(indoor)</i>    |   | <u>NWH-650 * 1 + NWH-2210 * 2</u><br><i>(Refer to page 17 Picture 3)</i>                                       |
| 300~1000M<br><i>(indoor)</i>   |   | <u>NWH-660 * 2 + NWA-0106 * 2</u><br>+ <u>NWH-2210 * 2</u><br><i>(Refer to page 26)</i>                        |
| 1000~2000M<br><i>(outdoor)</i> |   | <u>NWH-660 * 2 + NWA-0208 * 2 +</u><br><u>NWH-2210 * 2</u><br><i>(Refer to page 27)</i>                        |
| 2000~4000M<br><i>(outdoor)</i> |   | <u>NWH-660 * 2 + NWA-0214 * 2 +</u><br><u>NWH-2210 * 2</u><br><i>(Refer to page 17 Picture 4)</i>              |
| 4000~8000M<br><i>(outdoor)</i> |   | <u>NWH-660 * 2 + NWH-6110 * 2 +</u><br><u>NWA-0214 * 2 + NWH-2210 * 2</u><br><i>(Refer to page 24)</i>         |
| > 8000M                        |   | { <u>NWH-660 * 2 + NWH-6110 * 2 +</u><br><u>NWA-0214 * 2 + NWH-2210 * 2</u> } * n<br><i>(Refer to page 28)</i> |

### 3. Product Descriptions

#### WEC

The WEC is a Wire to Wireless converter used to connect your devices (such as PC, 7188E, 8000 series....). The maximum radius of your WEC is 100m. Another WEC must be at the maximum usage distance for support. However, WEC only features point-to-point transmission devices. Notice the figure below: WEC2 is between WEC1 and WEC3, so WEC2 can access both WEC1 and WEC3. Since WEC1 and WEC3 are out of each other's range, they cannot access each other.

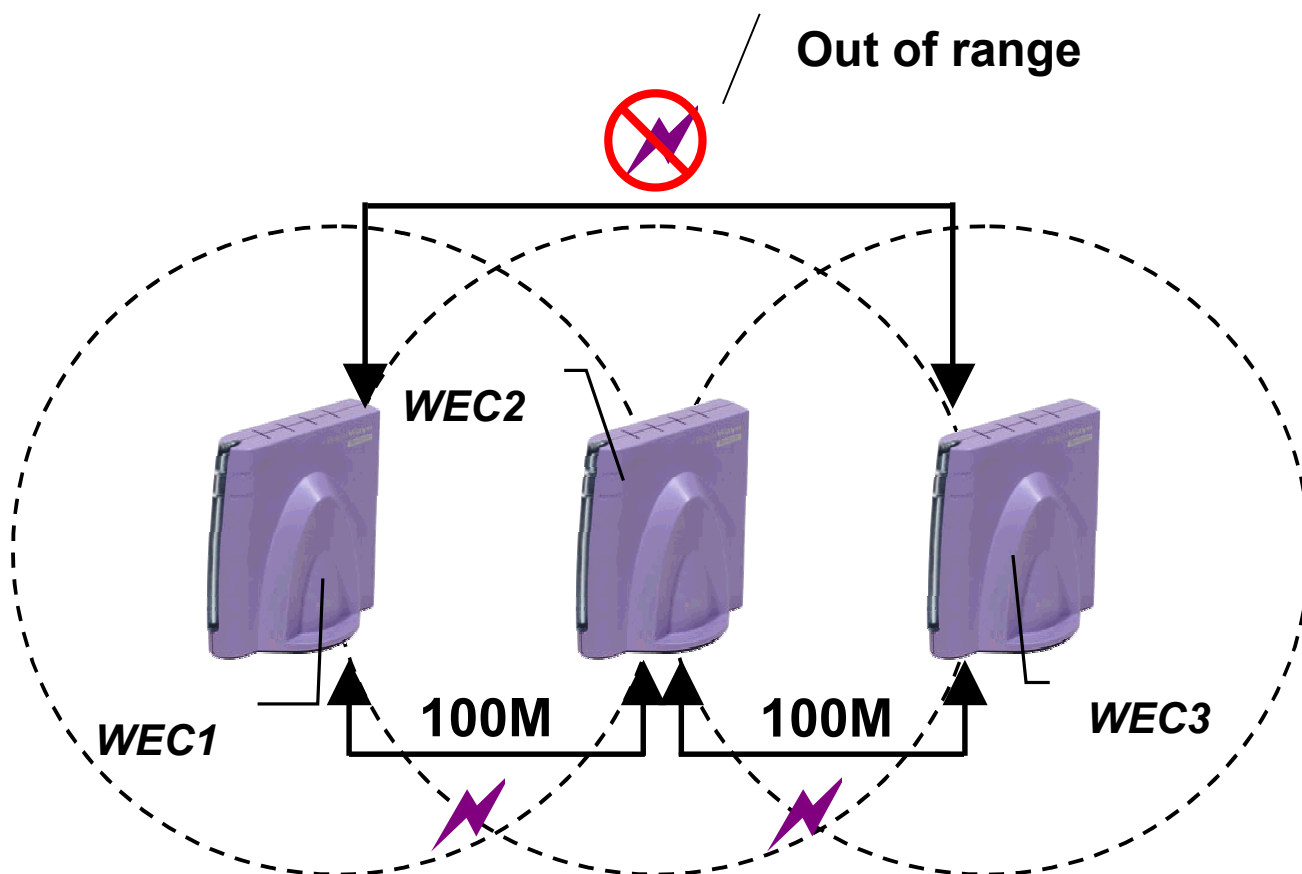
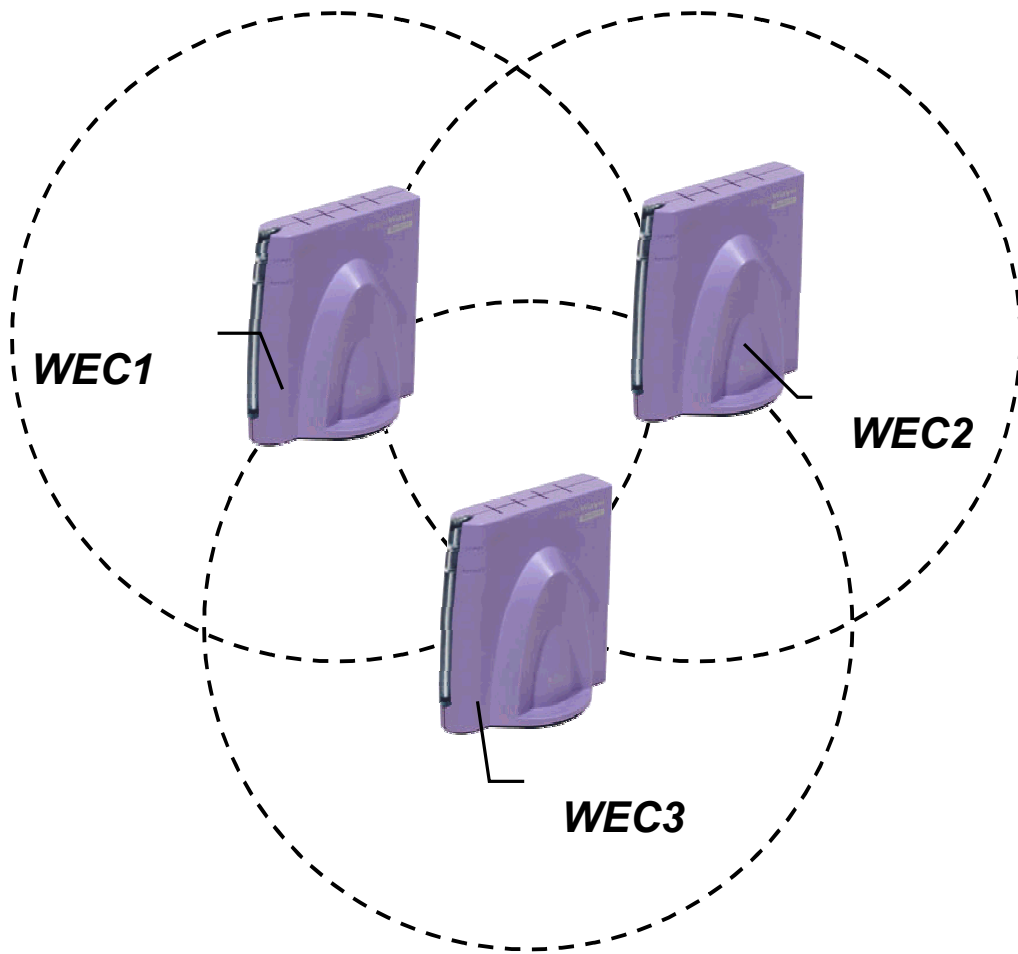


Figure 3.1



If all WEC are positioned with transmission range (see the following figure), WEC1, WEC2 and WEC3 can access each other.

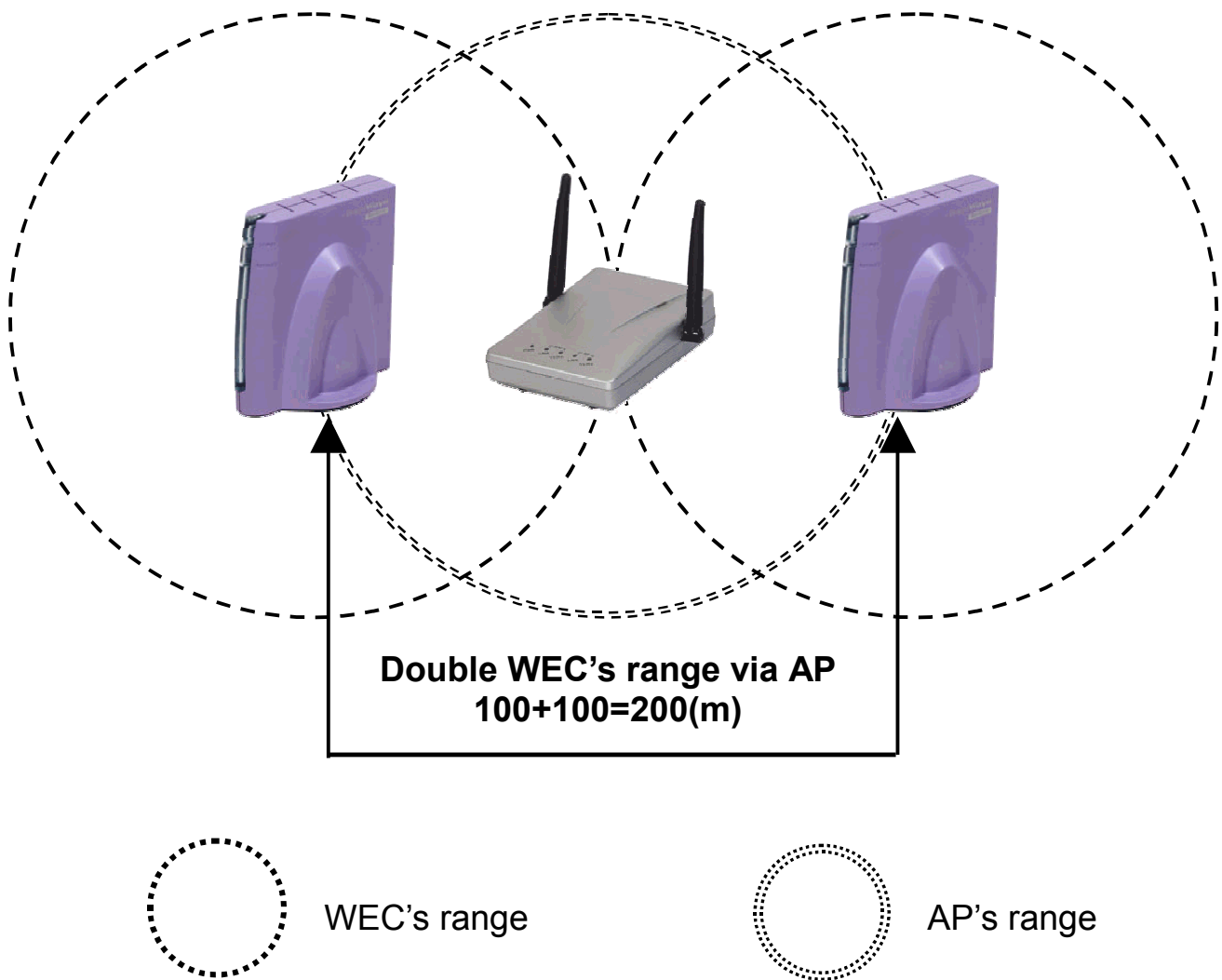


**Figure 3.2**

Connecting to the WEC without the assistance of an AP is referred to as Ad-hoc mode.

## AP

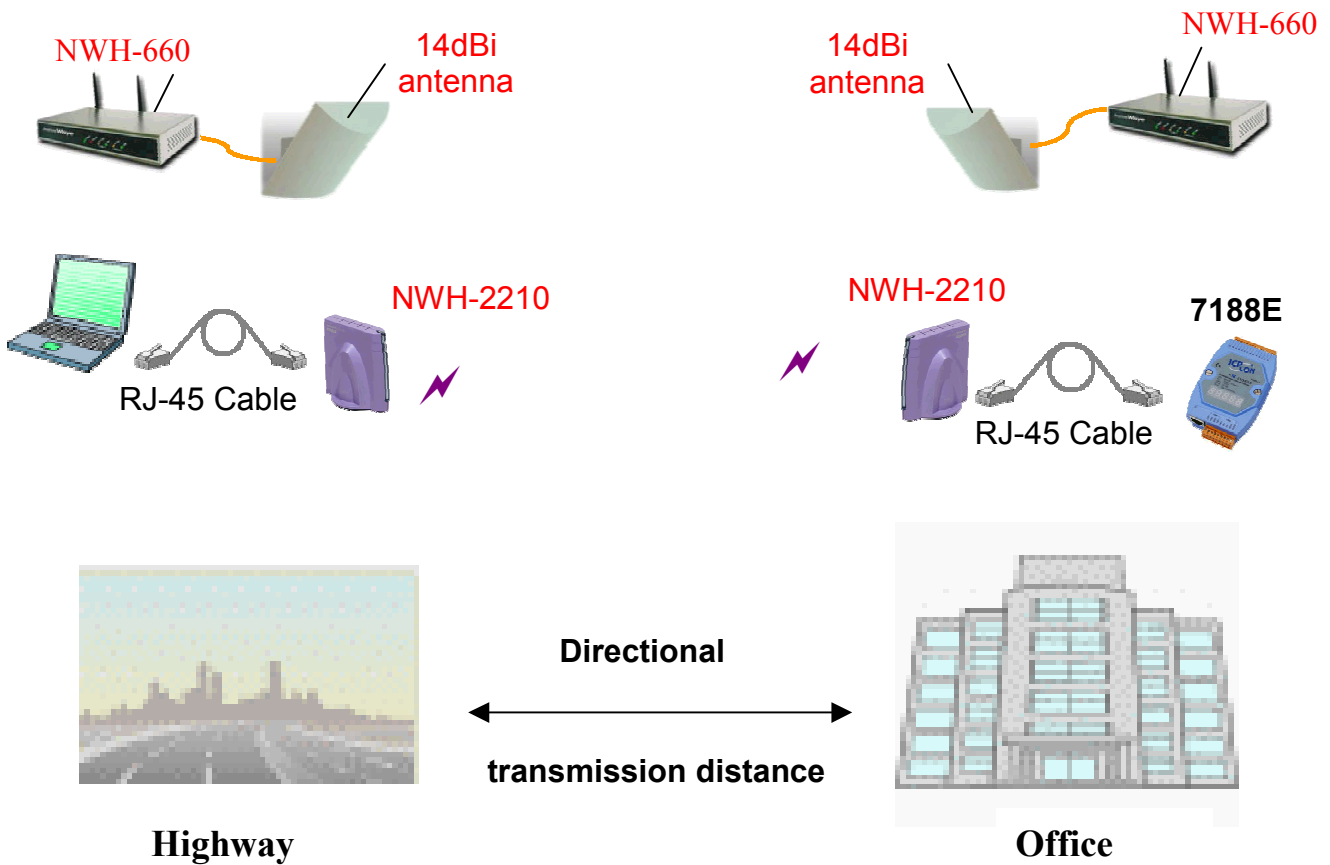
The AP is an amplifier repeater for WEC, with a maximum usage radius of 100m. All WEC in the maximum range of AP can access each other. The AP must connect to the hub. Other devices connecting to the WEC can access each other via the AP.



**Figure 3.3**

For long distance solutions, change your AP's antenna to add to the transmission range. Please see page 10 for the antenna's specifications.

The antenna can only be changed on the NWH-660. Possibilities include 4/6/8.5/14dBi antennas. In general, every 6dBi doubles the maximum usage transmission distance of your device. For example:



The maximum usage distance is  $\rightarrow (300+300) * 2^{[(14+14)/6]} = 4200(m)$

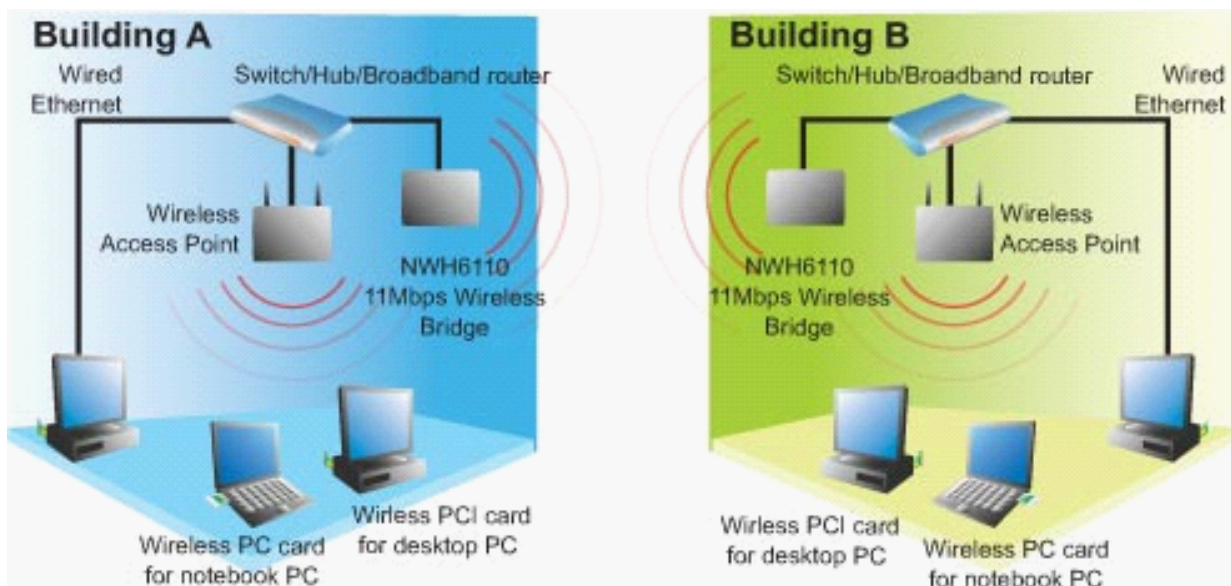
## Bridge

The Bridge links two or more separate networks into one single LAN environment; it may be used as a repeater to extend the coverage range or to overcome an obstacle that blocks radio communication, boost antenna power either for higher transmission quality over a wider coverage area up to 30 km (18 miles), or in a radio frequency hostile environment. When using directional antennas to communicate among bridges, manually aligning the antennas for proper bridge operation is a must. The NWH6110's intelligent antenna alignment monitoring features a fast and simple alignment at a glance.

See the following pictures for more information:

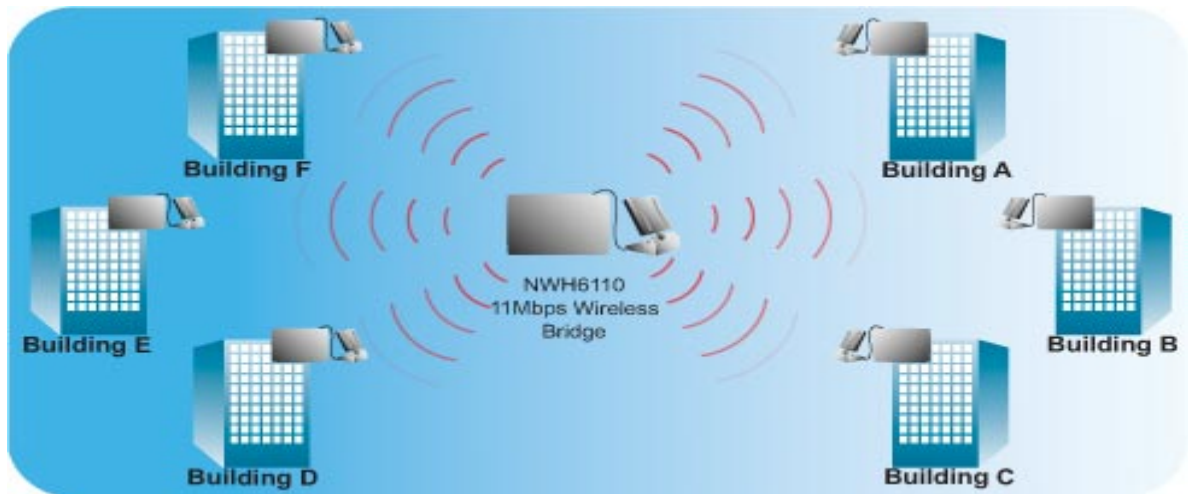
### **I. Point-to-Point Mode:**

The point-to-point bridge mode connects two networks in different locations through a wireless connection. This capability allows a single high-speed connection to the Internet to be shared across separate sites.



## **II. Point-to-Multipoint Bridge Mode:**

Point-to-multipoint bridge mode connects more than two networks in separate buildings through a wireless connection. This capability allows a single high-speed connection to the Internet to be shared across multiple sites.



## **III. Repeater Mode:**

Use a bridge as a repeater to extend the coverage range or to overcome an obstacle that blocks radio communication.

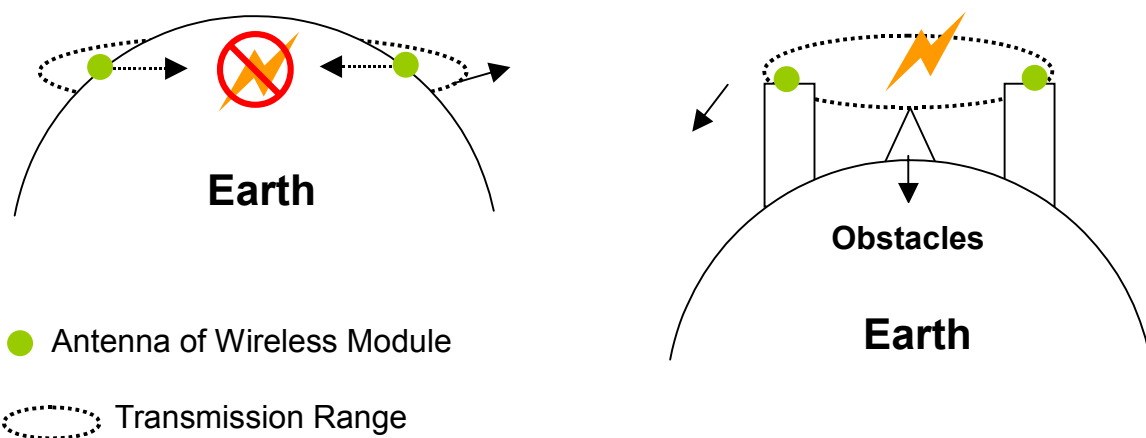


## A Few Notes

All of our wireless modules are designed for indoor applications. Though we also provide an outdoor application, you only can put the outdoor antenna outside of the building. However, if you must place the wireless module outside, please put it in a waterproof case.

Many factors influence the transmission range. The landscape, buildings...etc. All wireless transmission ranges listed in the manual are for ideal, unimpeded conditions.

Of course wireless waves cannot go through obstacles such as buildings, mountains ...etc. We suggest mounting the antenna in the highest possible place. Refer to the following picture:



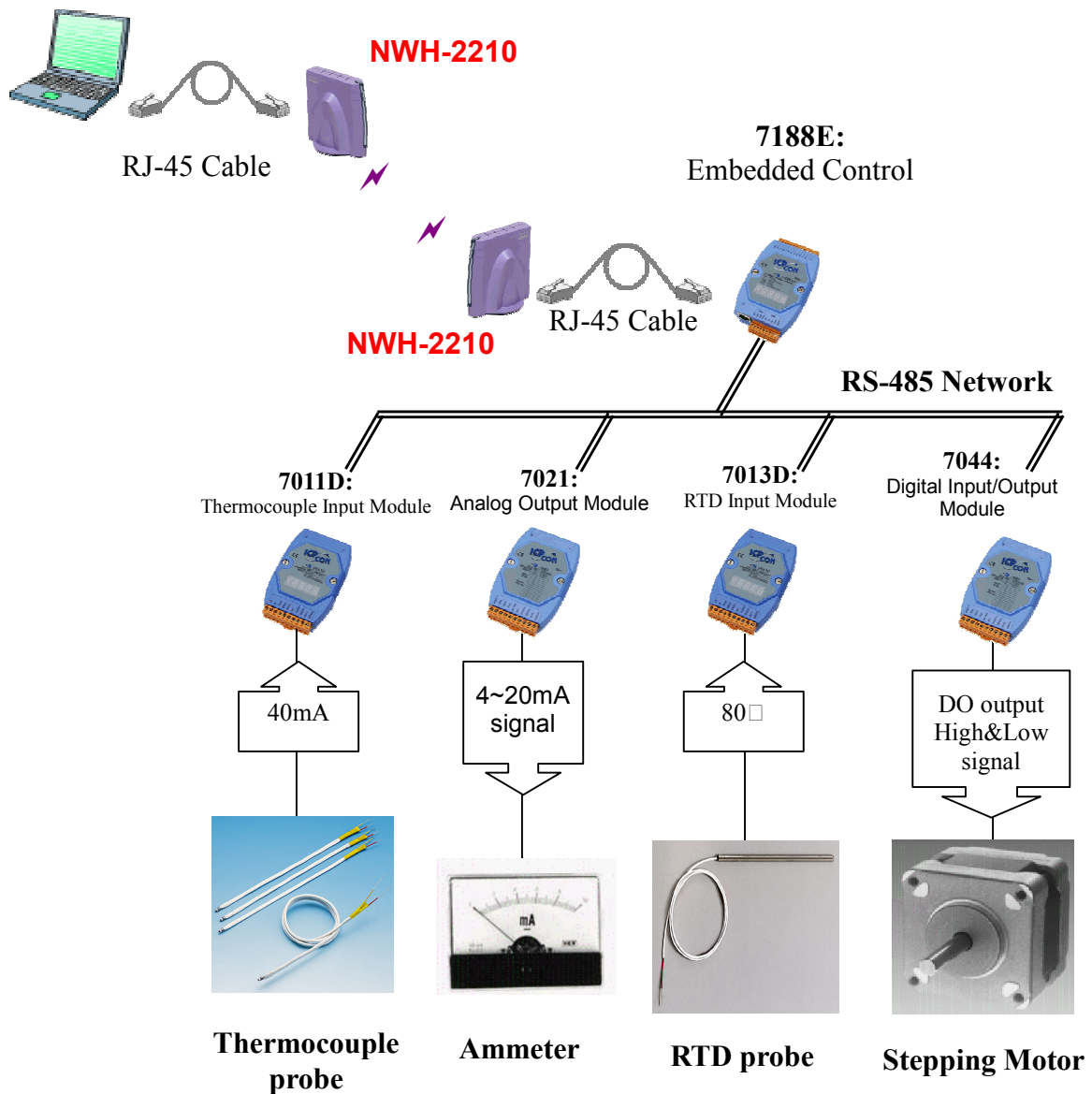
# 4. Applications

## 4.1 Ad-hoc Mode

An Ad-hoc network is formed by a number of wireless stations (without an Access Point) communicating via radio waves. For the user, the shared resources on the wireless network appear exactly as they would on a regular wired network. The wireless operation of the network is totally transparent.

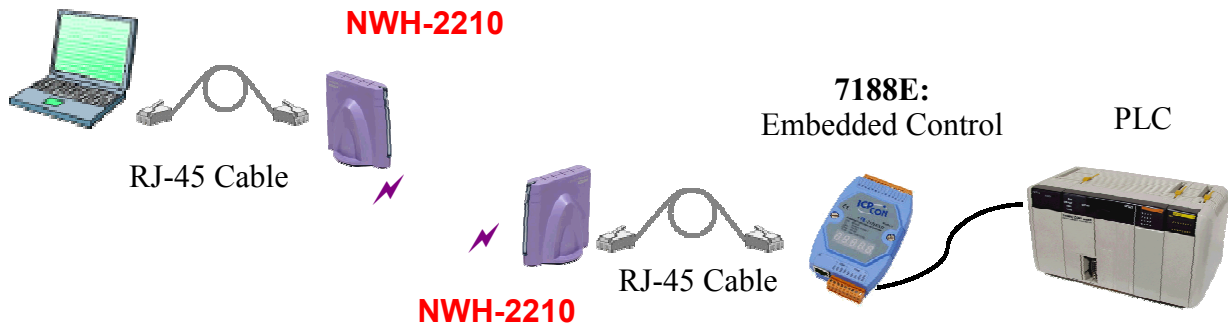
### 4.1.5 Application 1

Communication between PC and 7188E



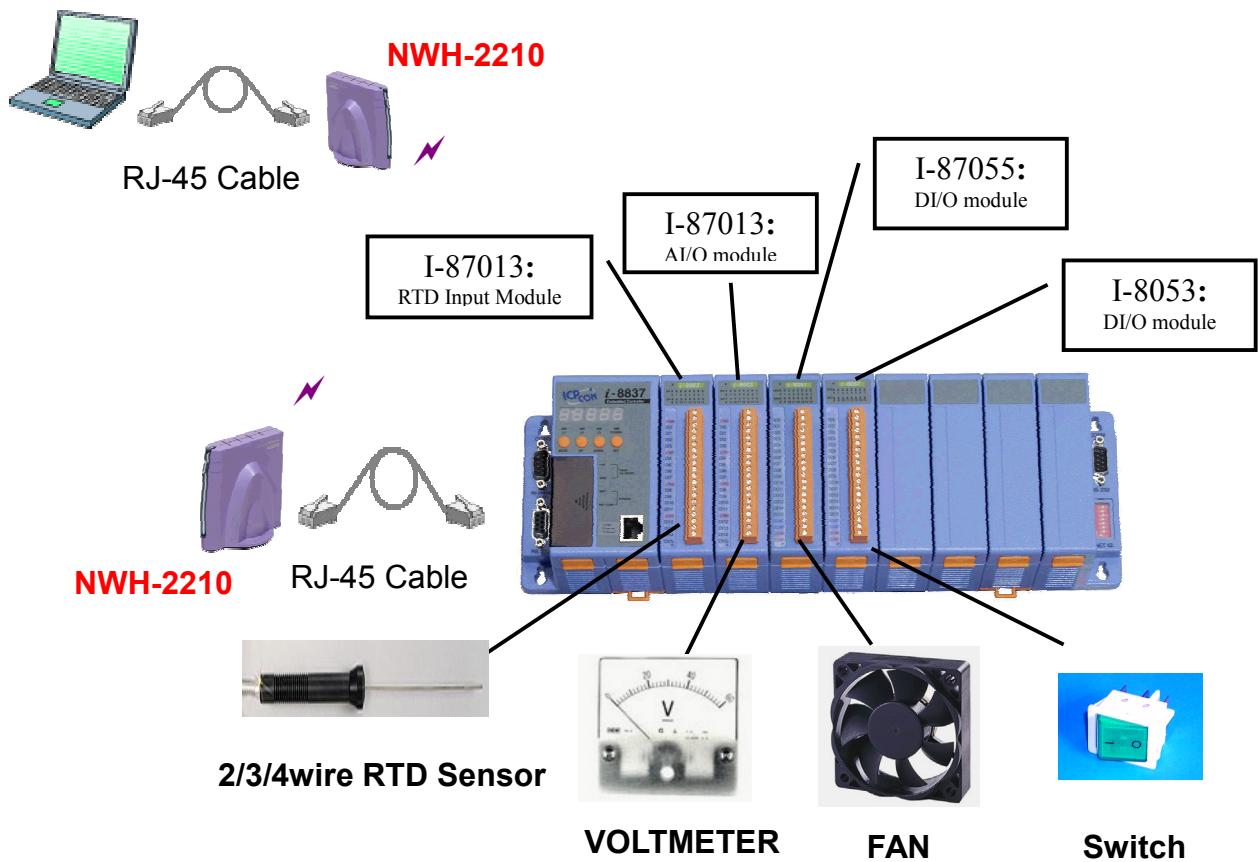
## 4.1.2 Application 2

Communication between PC and PLC



## 4.1.3 Application 3

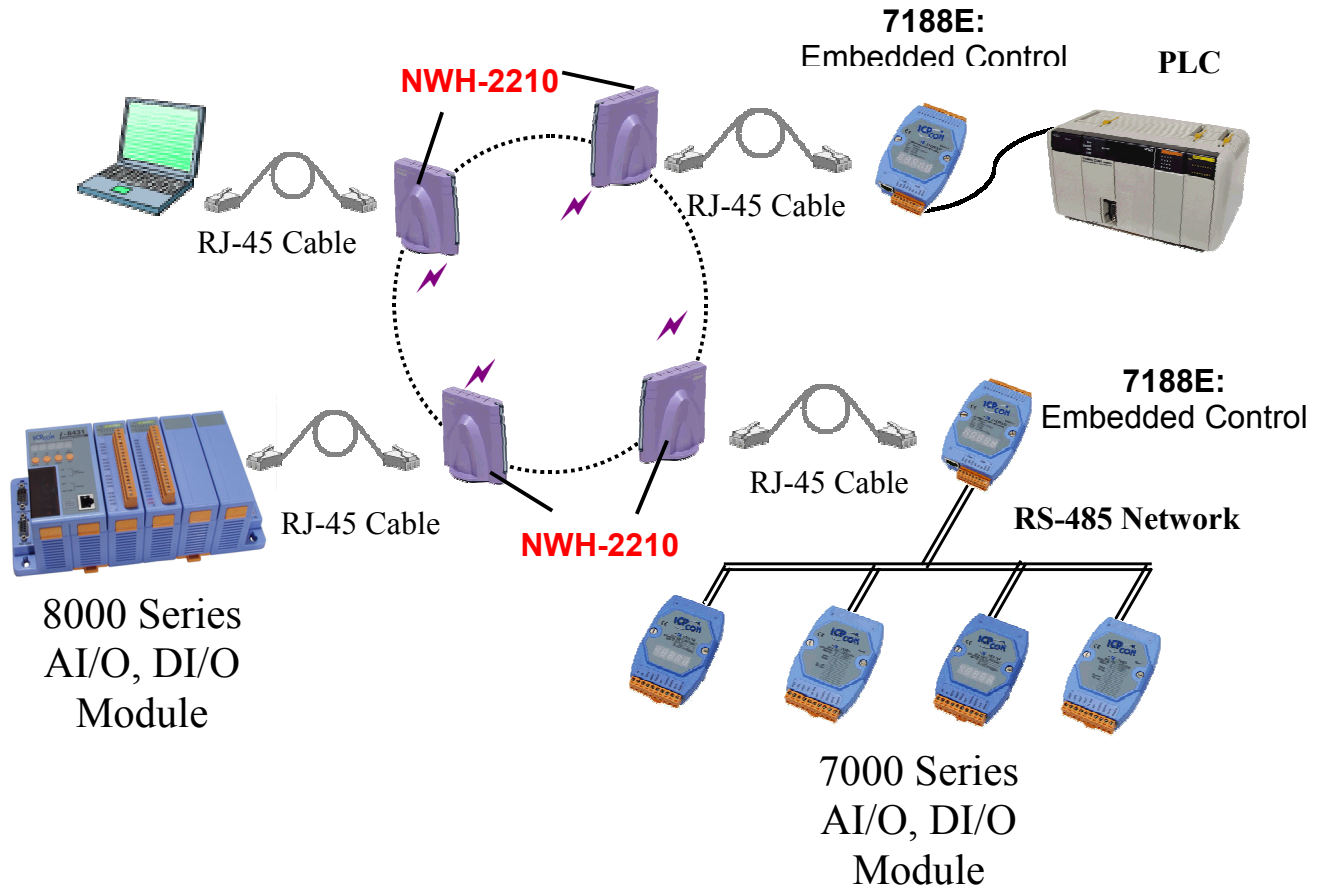
Communication between PC and 8000 series





## 4.1.4 Application 4

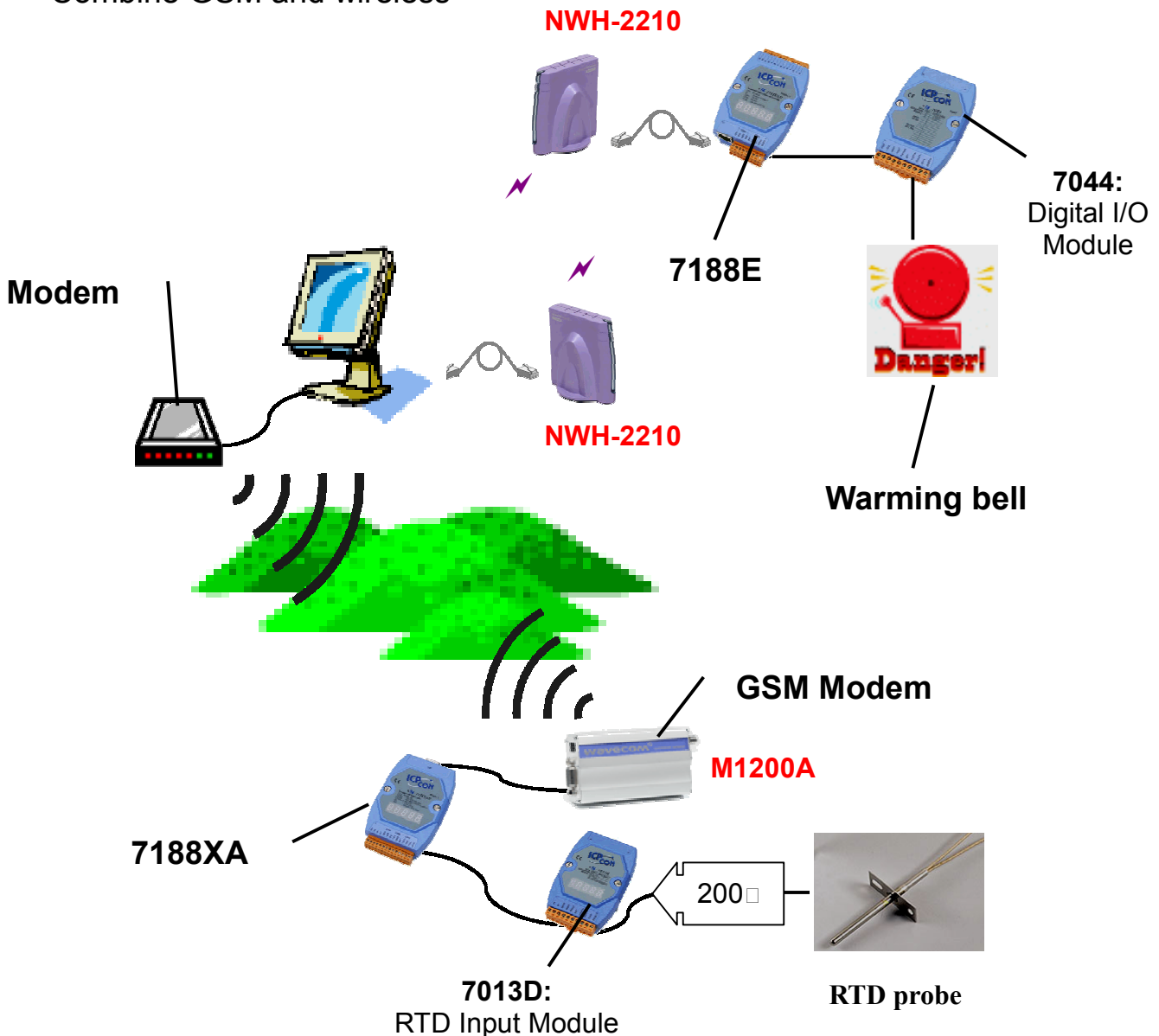
Multipoint wireless network of a short distance



The Ad-hoc mode does not support long distances transmissions. The Transmission Range between WECs is 100m (328ft) indoor (depending on the interference conditions and environment). If you require long distance transmissions, please use the Infrastructure mode and refer to the next chapter for clear description.

## 4.1.5 Application 5

Combine GSM and wireless



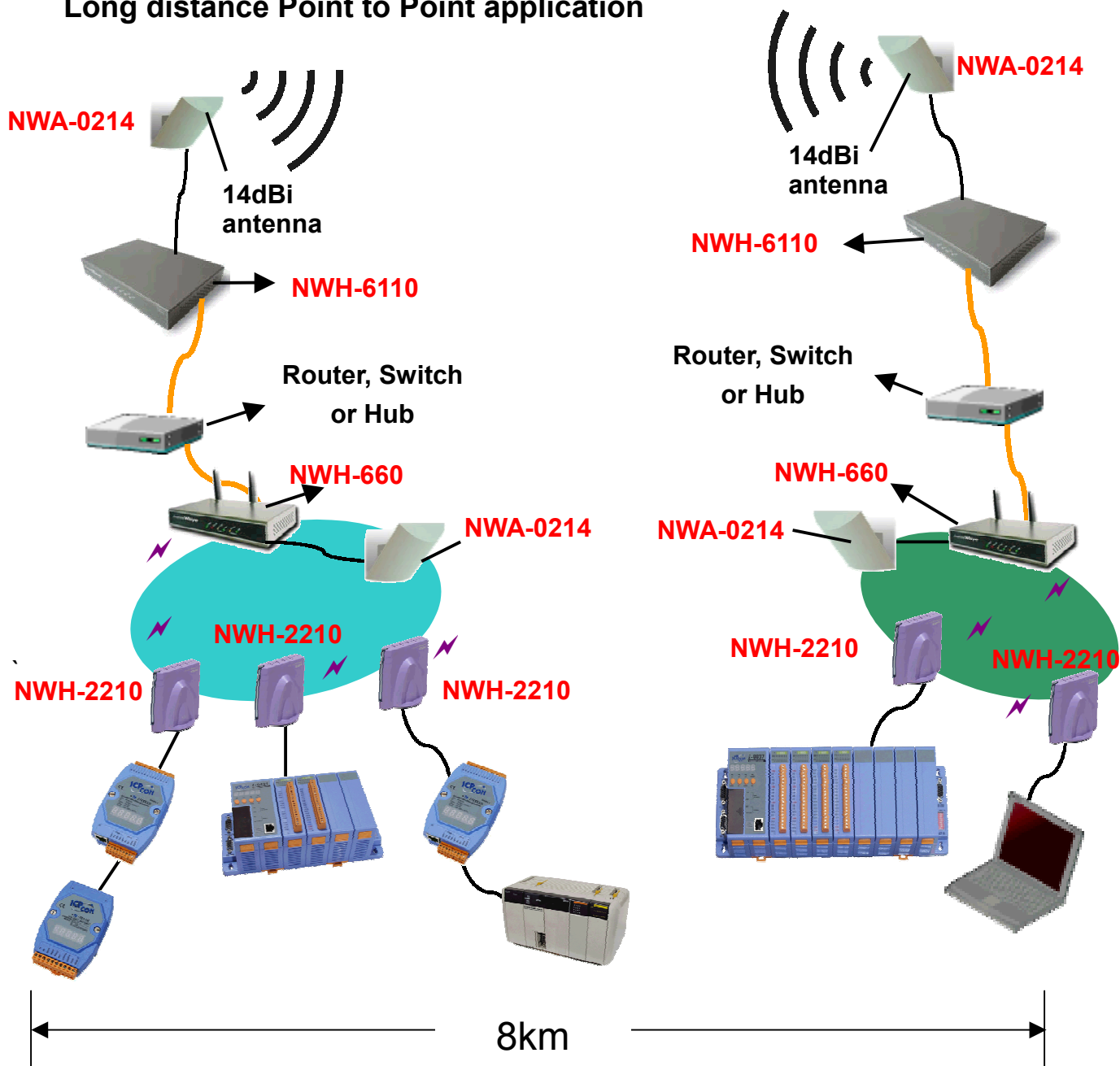
In this application, the 7188XA reads the values of the RTD sensor continuously. If the temperatures are out of the safe range, the 7188XA will send a message to the remote host through GSM modem. The host notes the emergency service for a distant location by WEC. Under normal conditions, the host also reads and sends the values of the remote device to 7188E by WEC.

## 4.2 Infrastructure Mode

An Infrastructure network is formed by stations and one or more Access Points (APs), with the stations within a set distance from the AP. This mode supports long distance transmissions.

### 4.2.1 Application 1

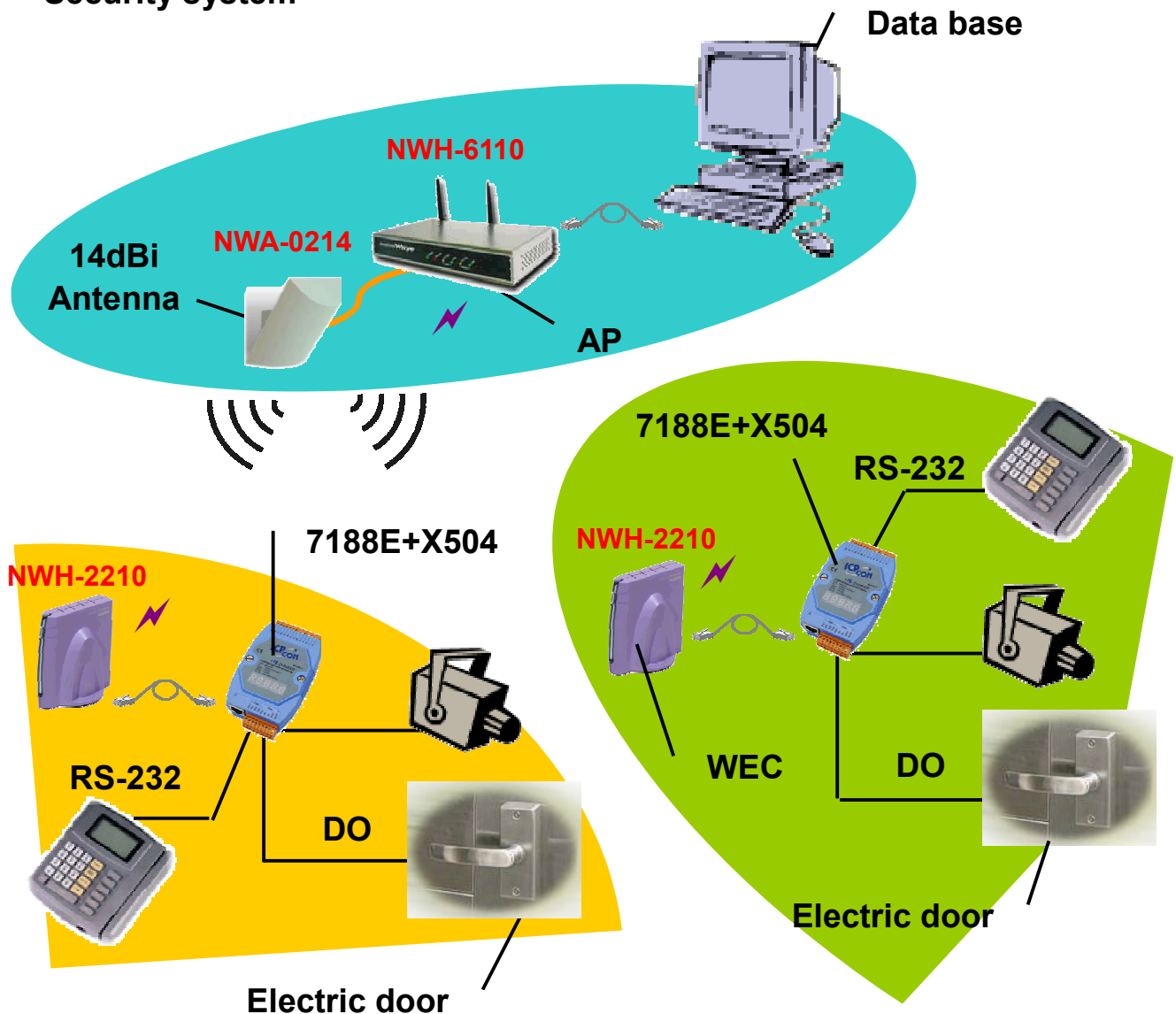
#### Long distance Point to Point application



Two bridges with 14dBi antennas can increase the transmission range to 8km.

## 4.2.2 Application 2

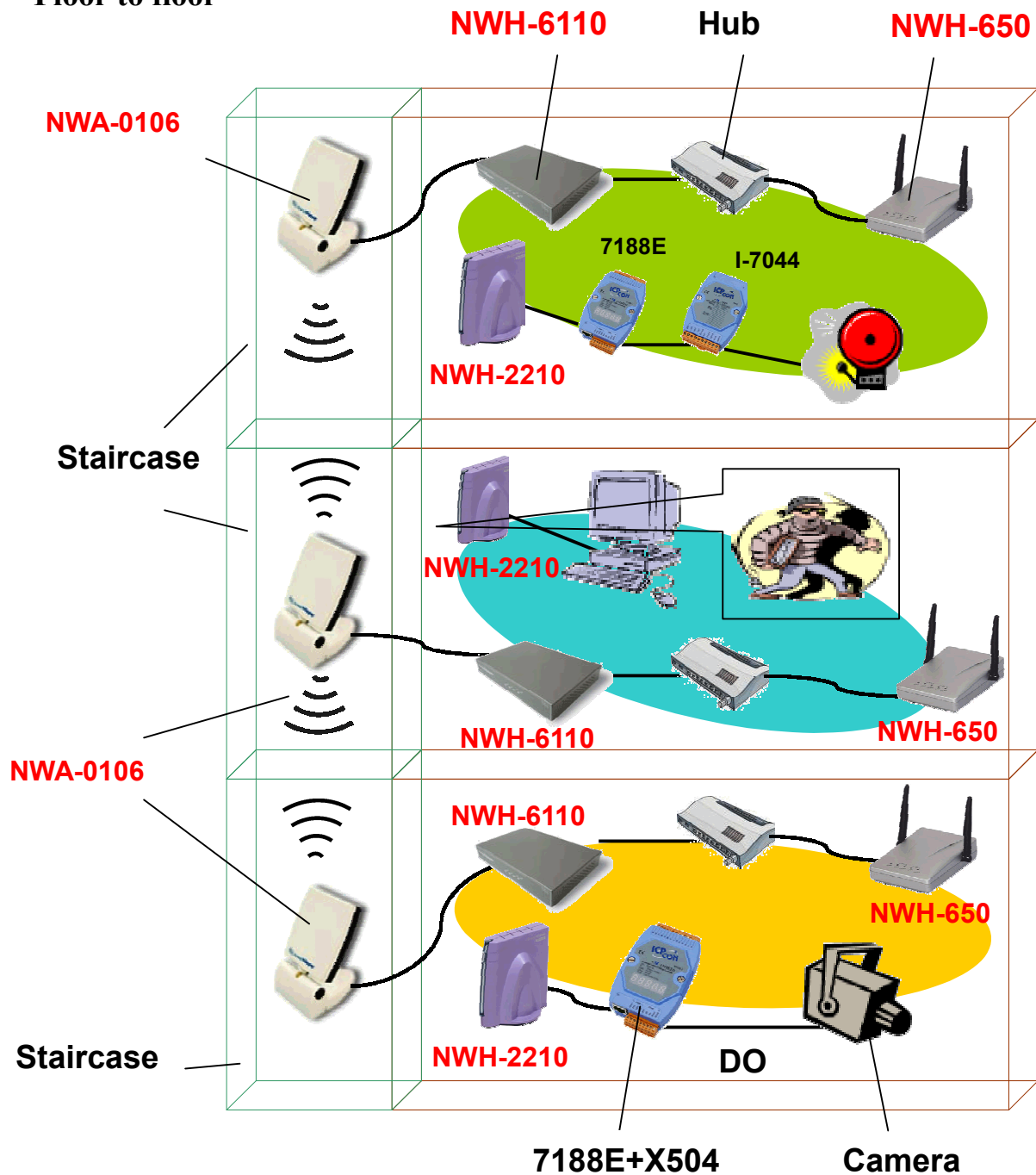
### Security system



In this application, the card-reader sends messages to 7188E via RS-232. If the ID is legal, the 7188E will send a DO signal to open the door and to rotate the direction of the camera. The cameras must connect to another device to send Image-data to remote host. The host can save any data going in and out from a remote place.

## 4.2.3 Application 3

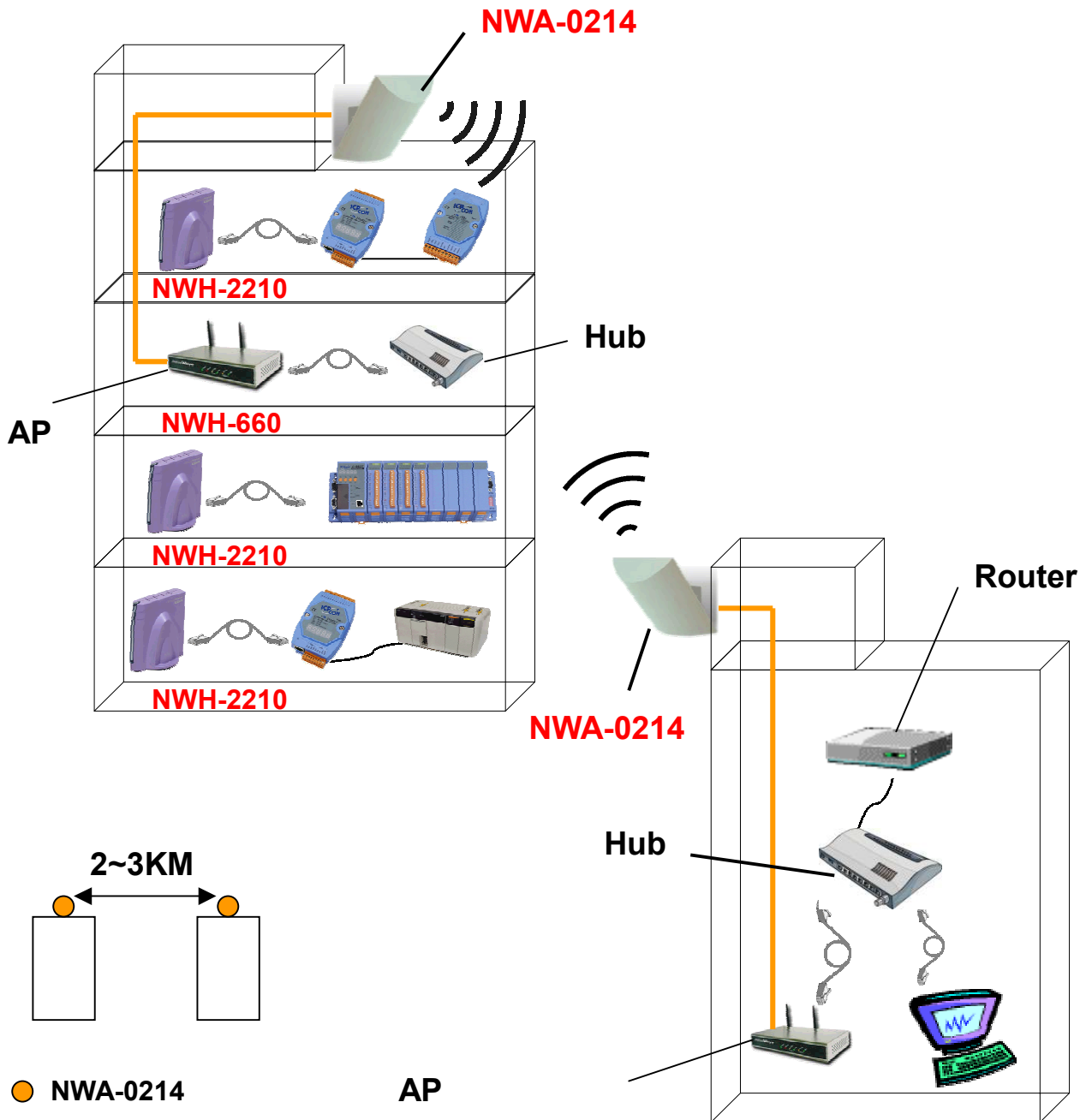
### Floor to floor



In this application, the 7188E+X504 can control the angle of camera. If there is something wrong, a security officer can turn on the alarm. The image-data of the camera must be sent to host through another device. The antennas must be placed in the staircase, face-to-face.

## 4.2.4 Application 4

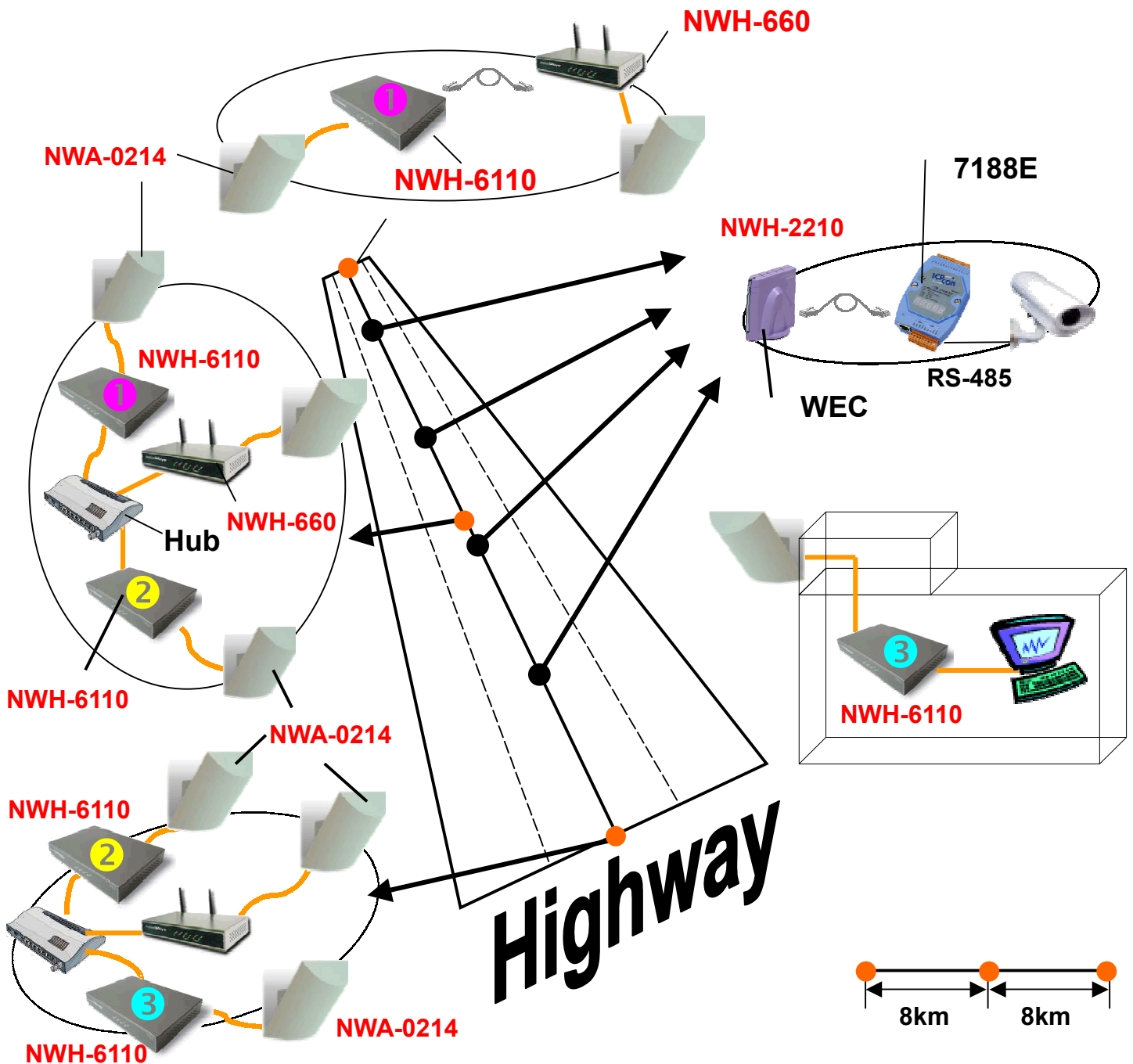
### Building to Building application (outdoor)



In the above application, the maximum usage range is 2~3km without obstacles between the two buildings.

## 4.2.4 Application 4

### Long distance Main-Line (outdoor)



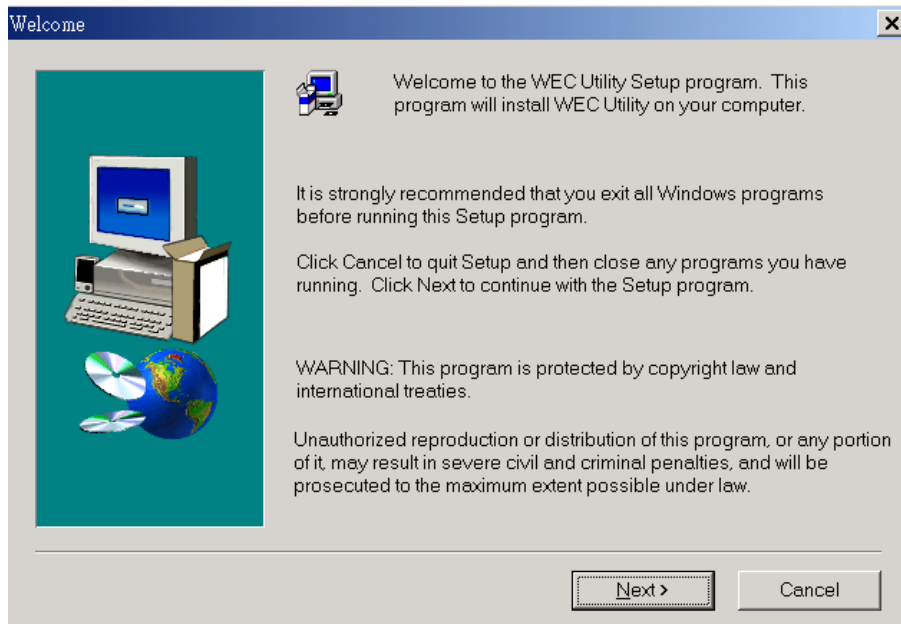
Occasionally you will need to place your device at fixed intervals to establish a longer connection. In this situation, link 3 or 4 pair of Bridges to add to your transmission distance. At each interval, place a WEC to connect to your device. If you are within transmission distance, you will be able to access the device directly. If you are out of the transmission range, access the device by adding a Bridge along with the antenna.

# Quick Start for NWH-2210 (WEC)

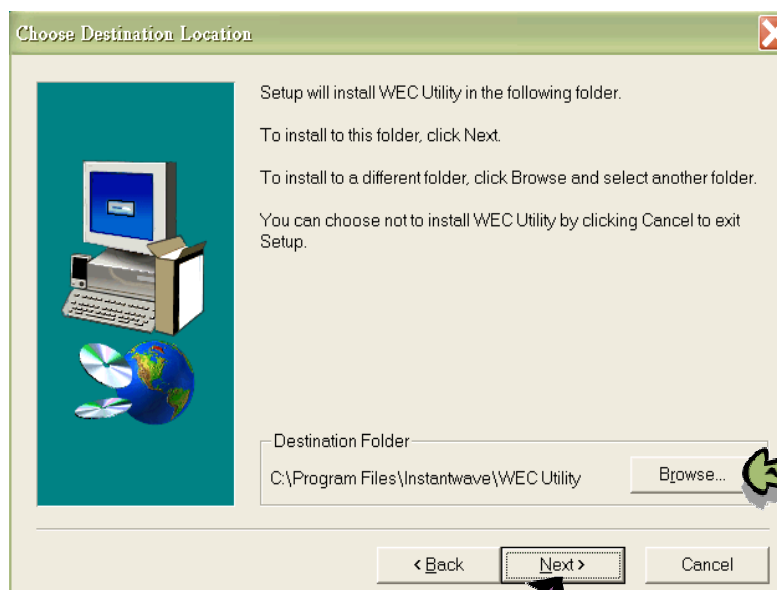
## 5.1 Install WEC Utility

Installing you WEC-setting software is easy! Follow these steps:

**Step1.** Put the companion CD in your CD-ROM. Execute the Setup.exe file which is located in the **napdos\Wireless\WEC\Utility** of the CD. Setup will prepare the InstallShield Wizard and then open the *Welcome* screen

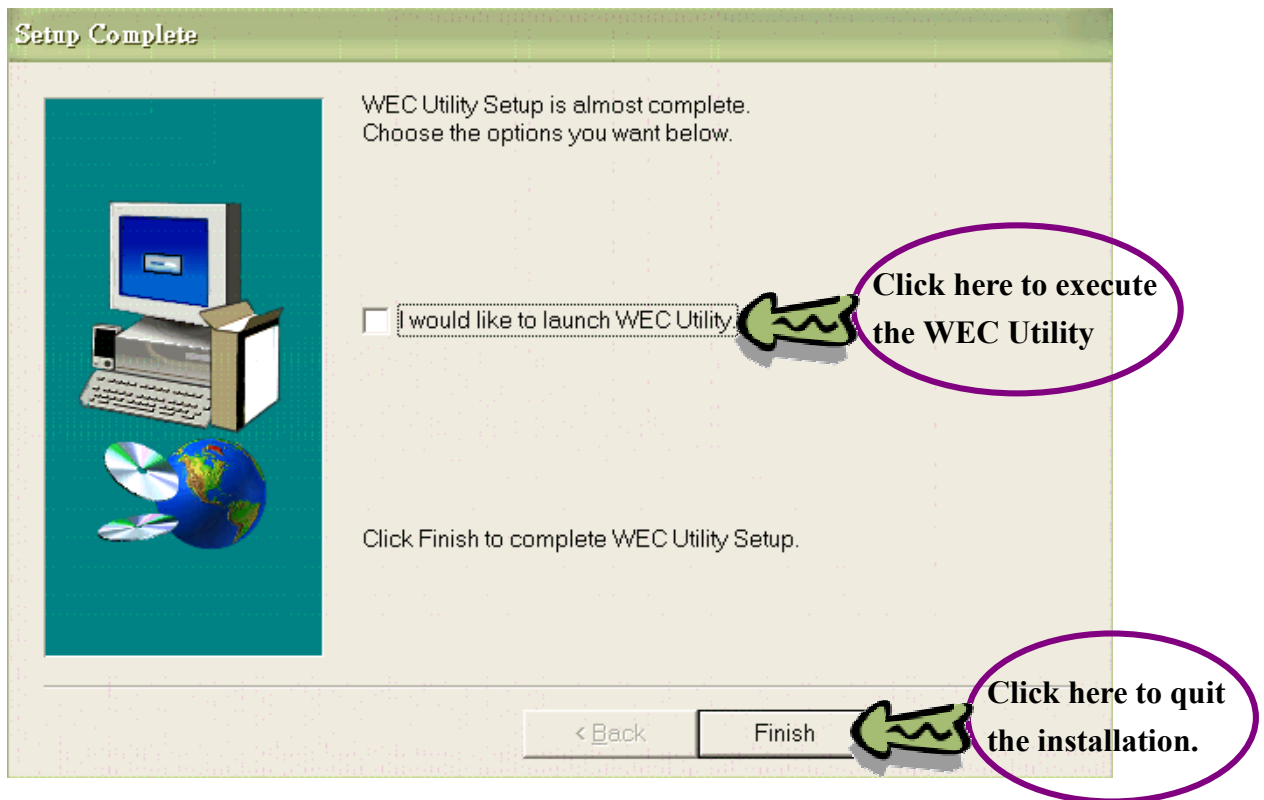


**Step2.** Select the directory where you want to install and click the "**Next**" button to continue the installation.

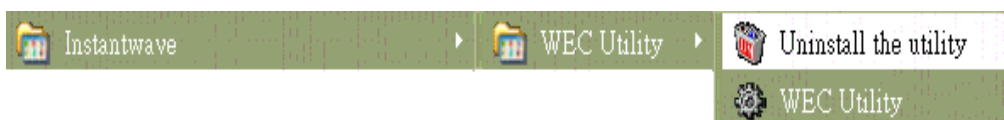




**Step3.** When the Utility has finished the installation, immediately click the selection to set the WEC.

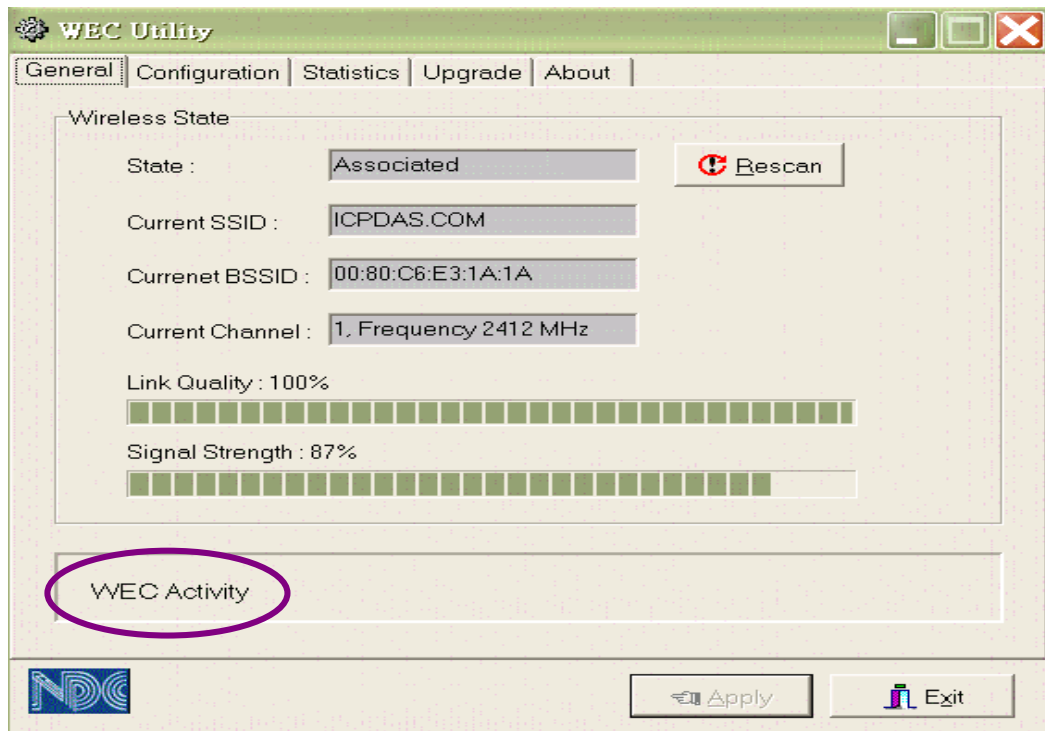


If you want to set the WEC later or reconfigure your WEC in the future, execute the WEC Utility to set WEC as follows:  
Click on the “**Start**” menu and “**Programs**” under Windows system. Find the “**Instant wave**” icon. Execute the “**WEC Utility**”



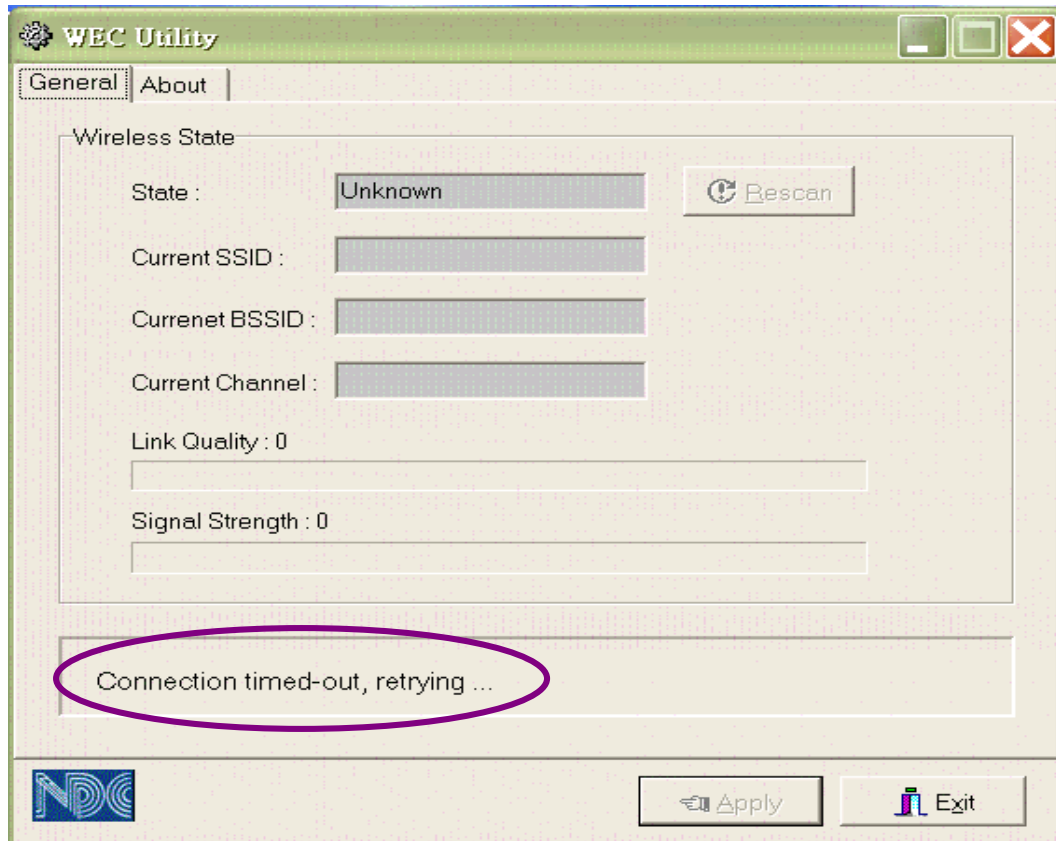
## 5.2 Setting the WEC with Utility

Before using the WEC with our 7188E/8000 series, please set the WEC from PC. After excusing the WEC Utility in the PC, The Utility shows the status of the WEC as follows:



- ✘ If the connection between WEC and PC is fine, the Utility will show "WEC Activity". See the above picture.

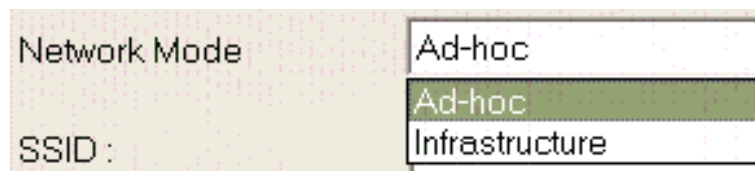
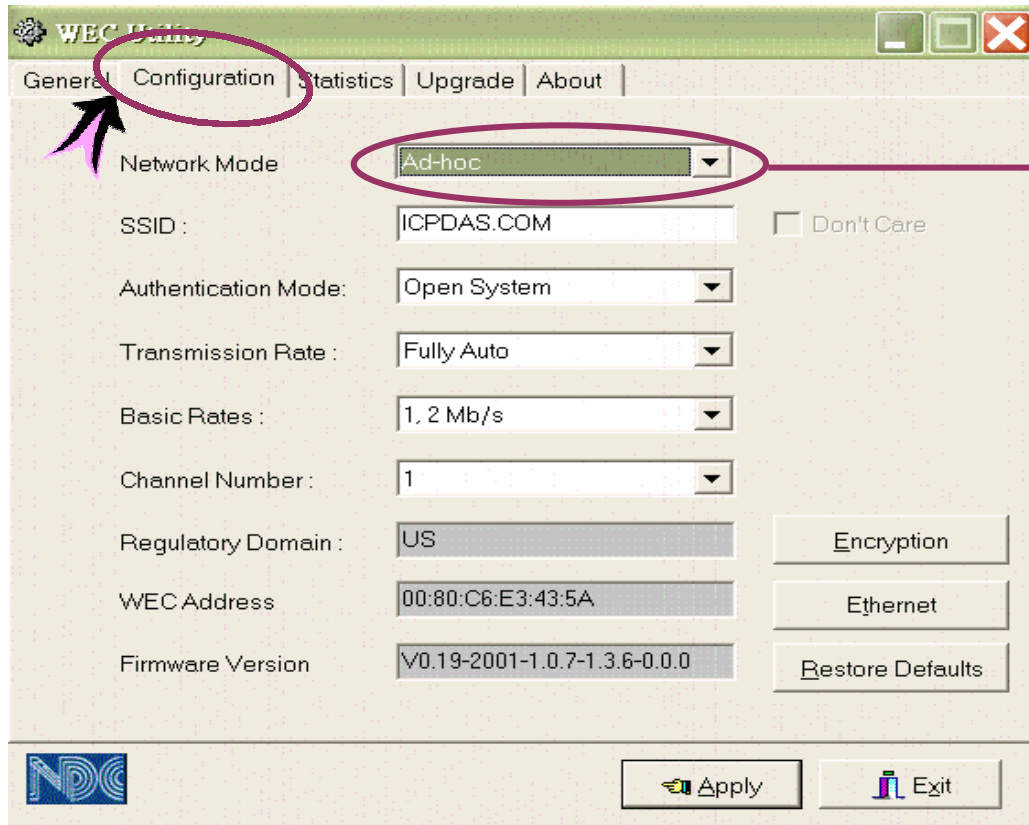
- ✘ The WEC reconnects automatically when the connection is faulty between the PC and the WEC. This happens until either you get a successful connection or click the “Exit” button to end the application. See the following picture:



- ✘ There is no need to re-launch the Utility when you check the hardware.

## λ Setting the WEC in the “Configuration” Menu

**Set the Network Mode:** Two Network Modes can be selected. One is Ad-hoc and other is Infrastructure. Refer to the “NWH650 man-SB1.pdf” file in the companion CD of NWH-650 for more details about these two modes.

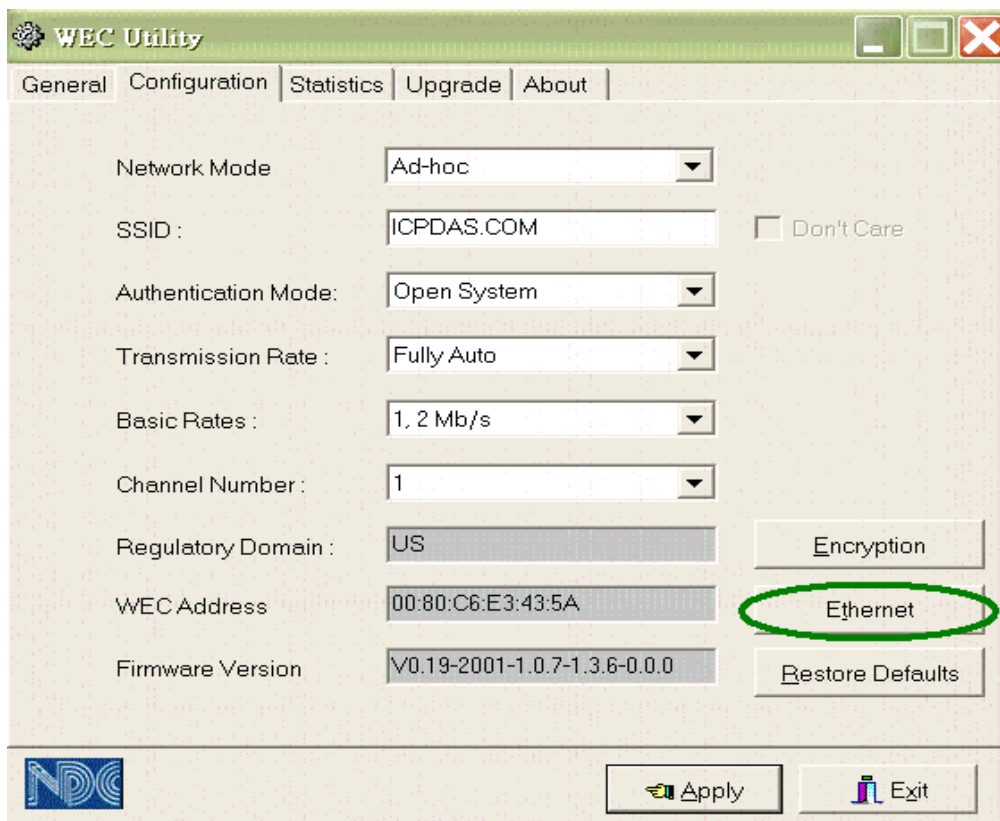


- λ **Set the SSID:** The SSID is the name of your Wireless Network. The SSID must be set, and all SSID within your WEC have to be identical. For example:

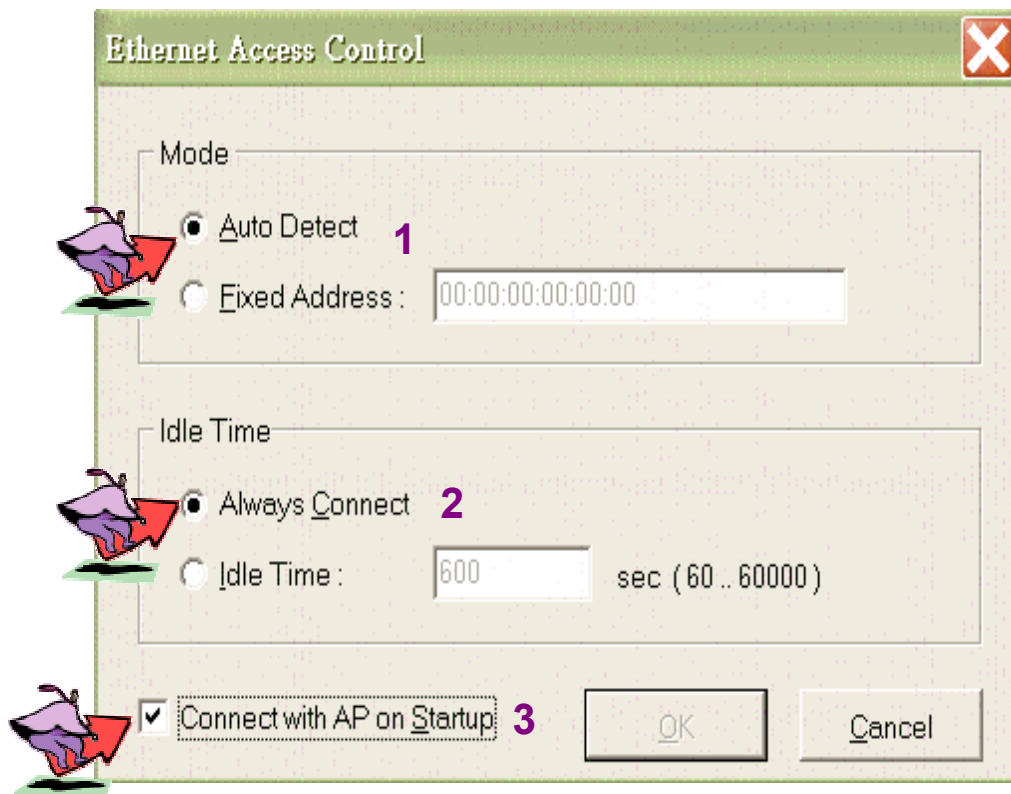


If you use a wireless network with an AP in the “Infrastructure” Mode, all SSID’s must be identical to the AP. Note that there is an extra “Don’t care” item that can be selected when you are in the “Infrastructure” Mode. If two signals overlap, the “Don’t care” mode will direct the WEC to seek the AP with the strongest signal. If you set the SSID to WEC, the WEC can only be accessed by an AP with the same SSID.

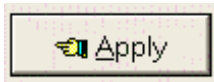
- λ **Set Ethernet:** This button shows the three ports that need to be set. First, click the “Ethernet” button.



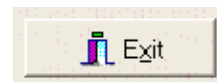
Make sure the three items have been selected as follows:



Click the “OK” button to return to the “Configuration” Menu. Now click the



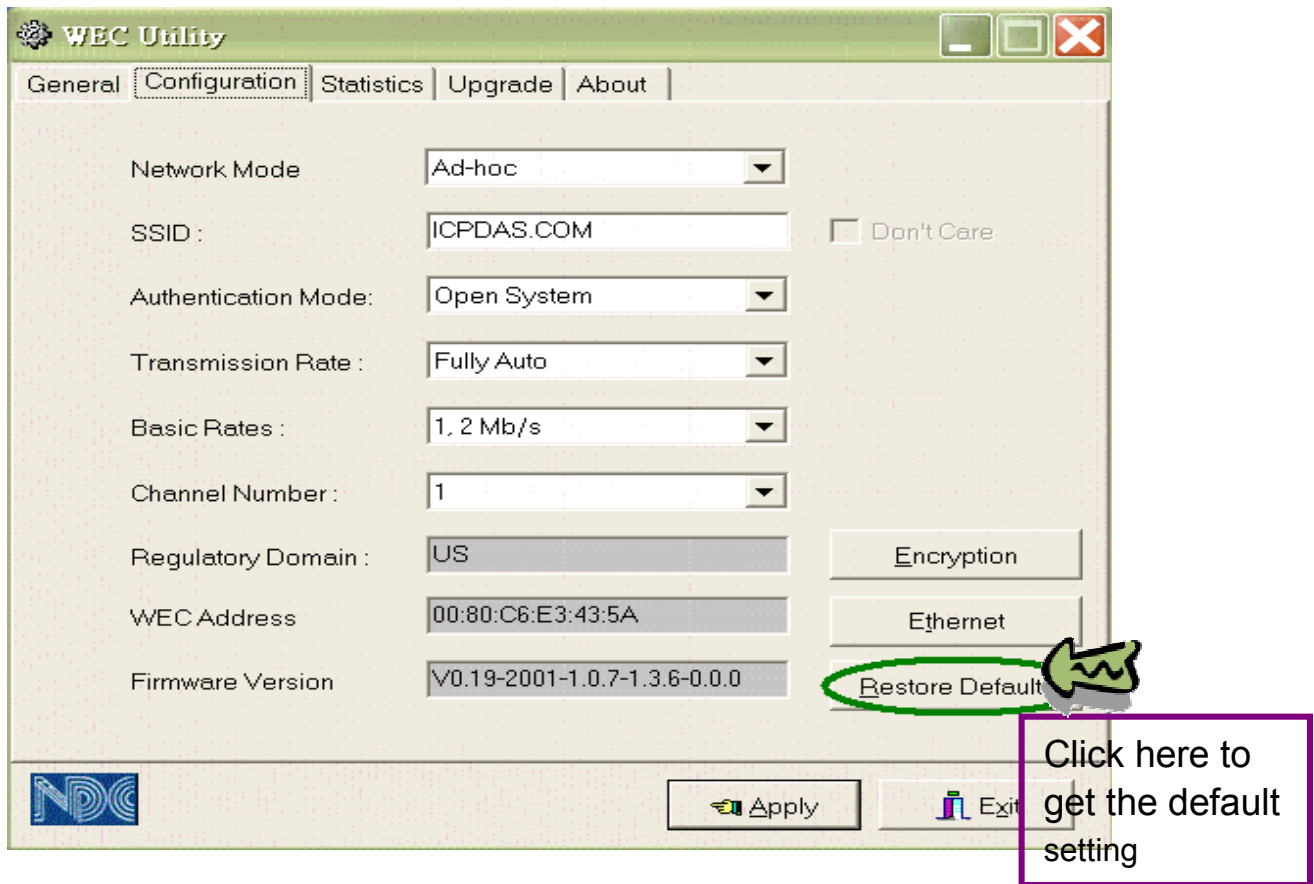
button to save the setting and the



button to exit

the WEC Utility.

- λ **Restore Default:** The WEC has a default setting. If the 7188E/8000 series and WEC don't connect, select this item to return to the default settings. Then follow steps on the previous page.



## Other setting descriptions:

|                          |   |
|--------------------------|---|
| <b>Transmission Rate</b> | Sets the transmission rate at which the data packets are transmitted by the WEC   |
| <b>Basic Rates</b>       | This value determines the basic rates used and reported for this BSS by the WEC. The highest rate specified is the rate that the WEC will use when transmitting broadcast/multicast and management frames.<br>Available options are: <ul style="list-style-type: none"> <li>• 1 and 2Mbps</li> <li>• All (1, 2, 5.5, and 11Mbps)</li> </ul> |
| <b>Channel Number</b>    | You can change the channel number from here. Refer to the Appendix, page 101  |
| <b>Secure SSID</b>       | Click to enable the Secure <b>SSID</b> option. <ul style="list-style-type: none"> <li>• Blocks a connection request from a station without the correct SSID</li> <li>• Hides the SSID in outgoing beacon frames. A site-survey will not find the SSID.</li> </ul>   |
| <b>Regulatory Domain</b> | Identifies the country where the WEC is used. Each country has pre-defined available channel numbers and transmission power. Refer to the Appendix, page 78.  |
| <b>AP Address</b>        | This is the MAC ID of the WEC.  |
| <b>Firmware version</b>  | The current WEC firmware version.   |
| <b>Encryption</b>        | Data Encryption provides more secure wireless data communication.   |

### **Important:**

In a multiple cell network topology, overlapping and/or adjacent cells using different channels can operate simultaneously without interference if the frequency distance between the center frequencies is at least 30MHz. For example, channels 1, 7, and 13 are non-overlapping frequency channels.

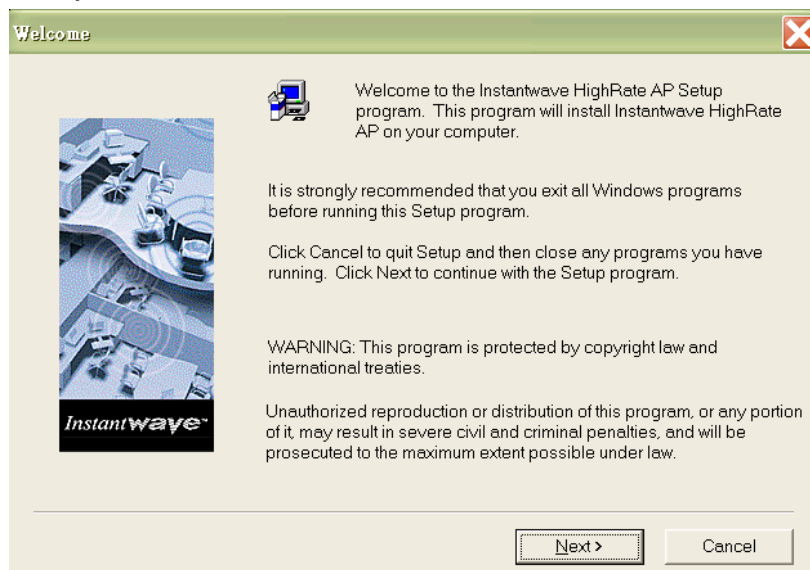


# 5. Quick Start for NWH-650/660 (AP)

## 6.1 Install AP Tools

The AP tool is the application for setting the AP. Again, installation is very simple.

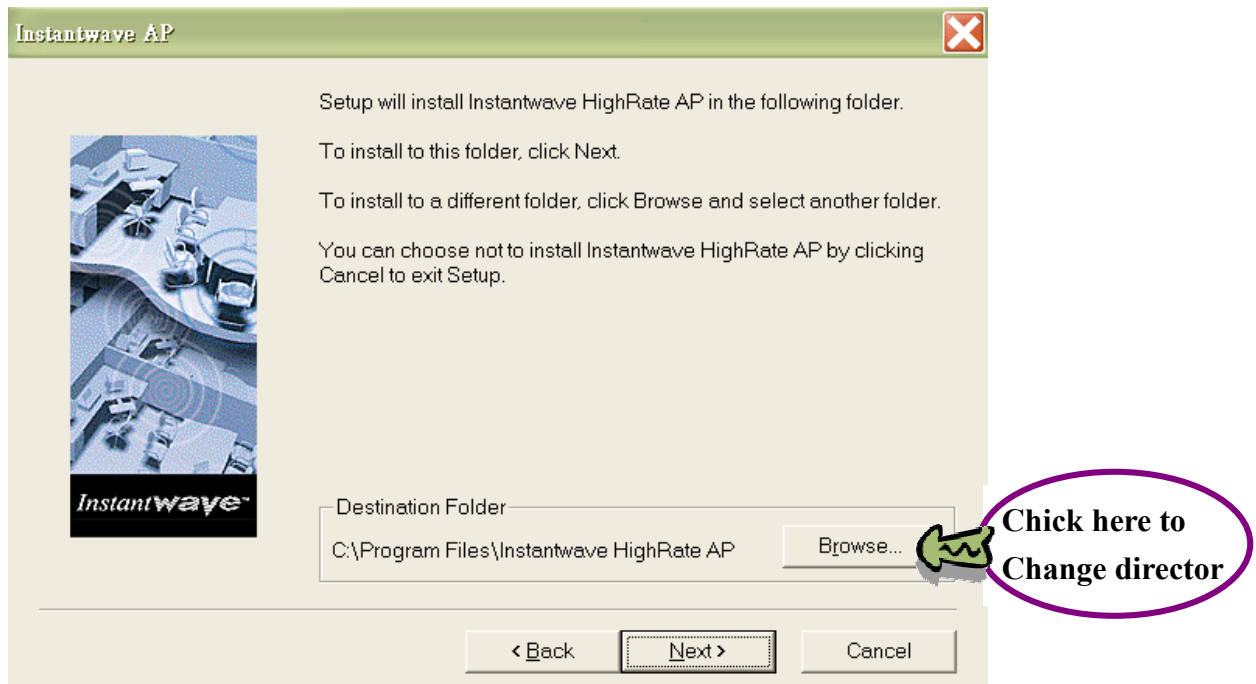
Put the companion CD in your CD-ROM. Execute the Setup.exe file which is located in the **napdos\Wireless\AP\AP Tools** of the CD. Setup will prepare the InstallShield Wizard and then open the *Welcome* screen



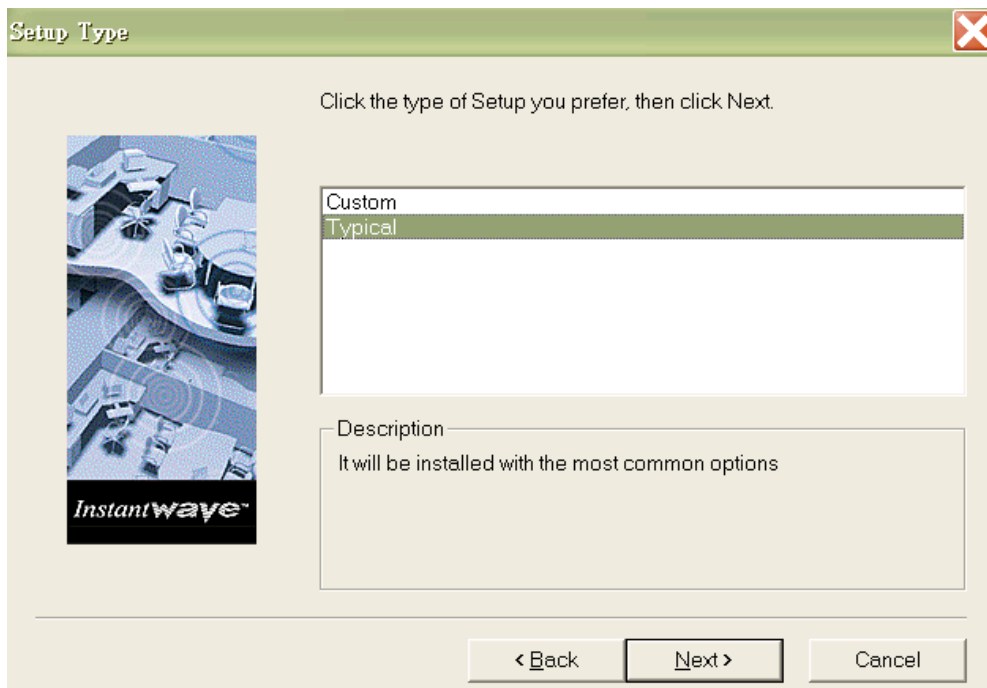
λ Here is how the installation screen looks on your monitor. Click the “Next” button to continue the AP installation.



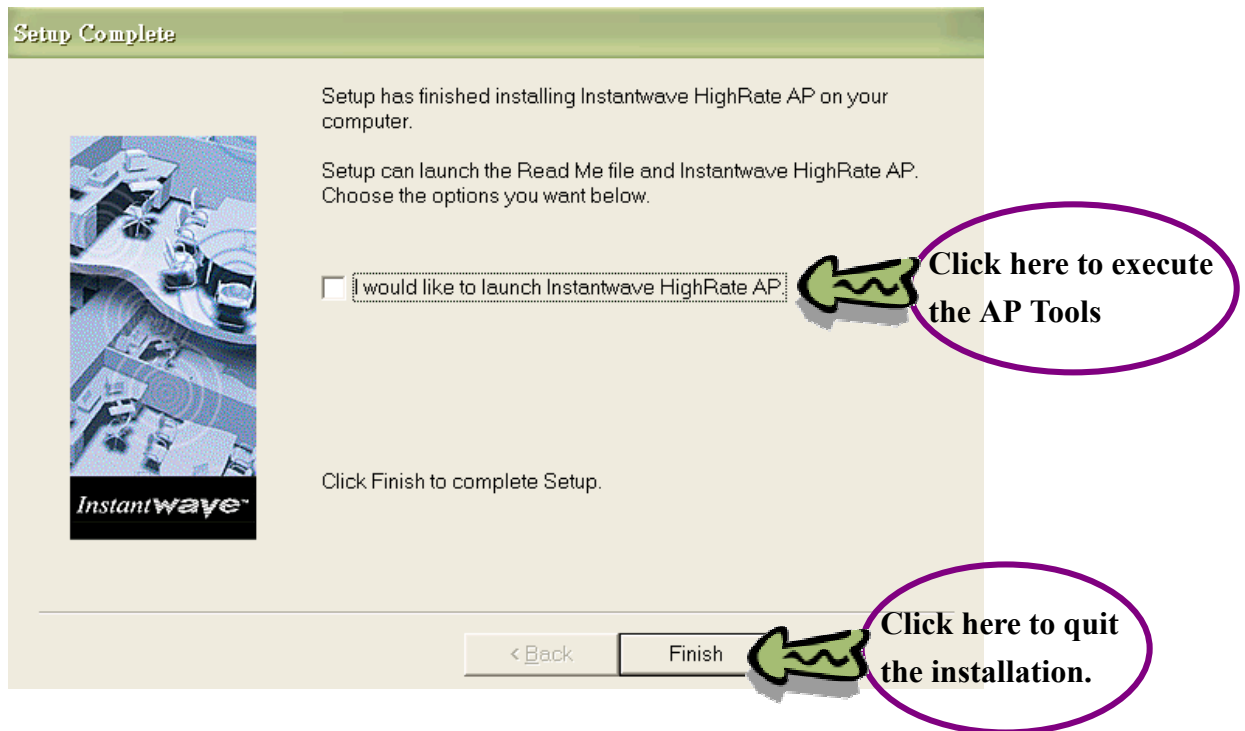
- λ Select the location of the directory where you want to install and click the “Next” button to continue the installation.



- λ At this point, two options are available to you. Select “Typical” for installing all options or “Custom” for installing the options that you selected. Then click the “Next” button to continue.



- λ When the Utility has finished the installation, click the selection to set the WEC immediately.



If you want to set WEC later or reconfigure your WEC in the future, you also can execute the WEC Utility to set WEC by following:

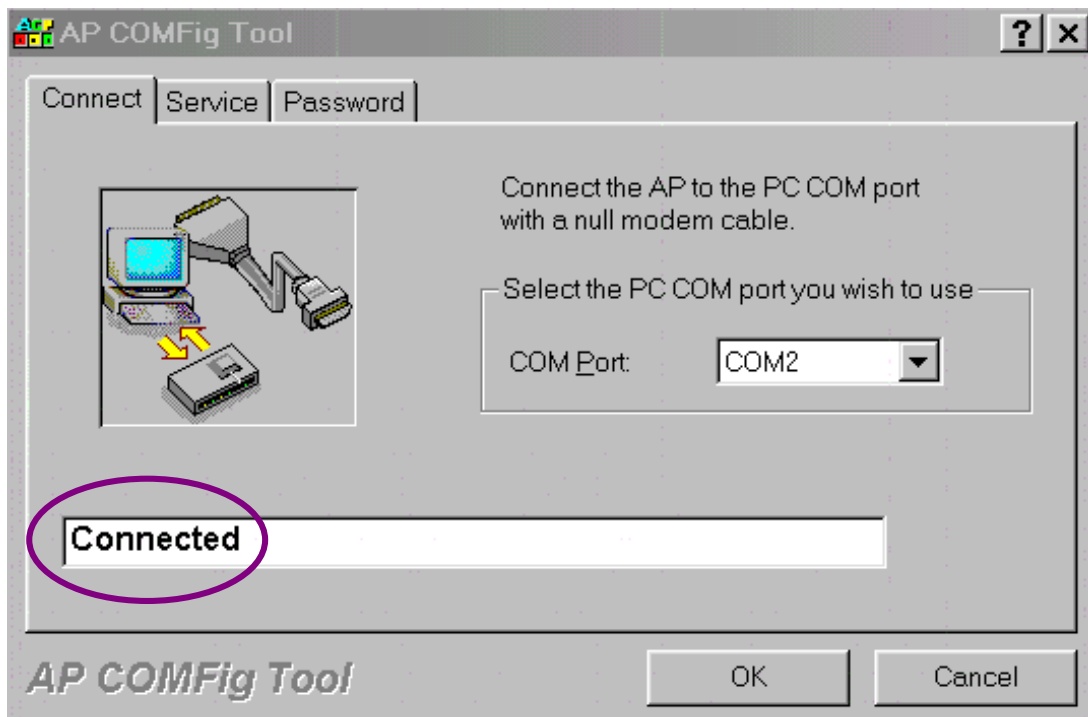
- λ Click the “Start” menu and “Programs” under Windows system. Execute the “AP COMFig Tool”



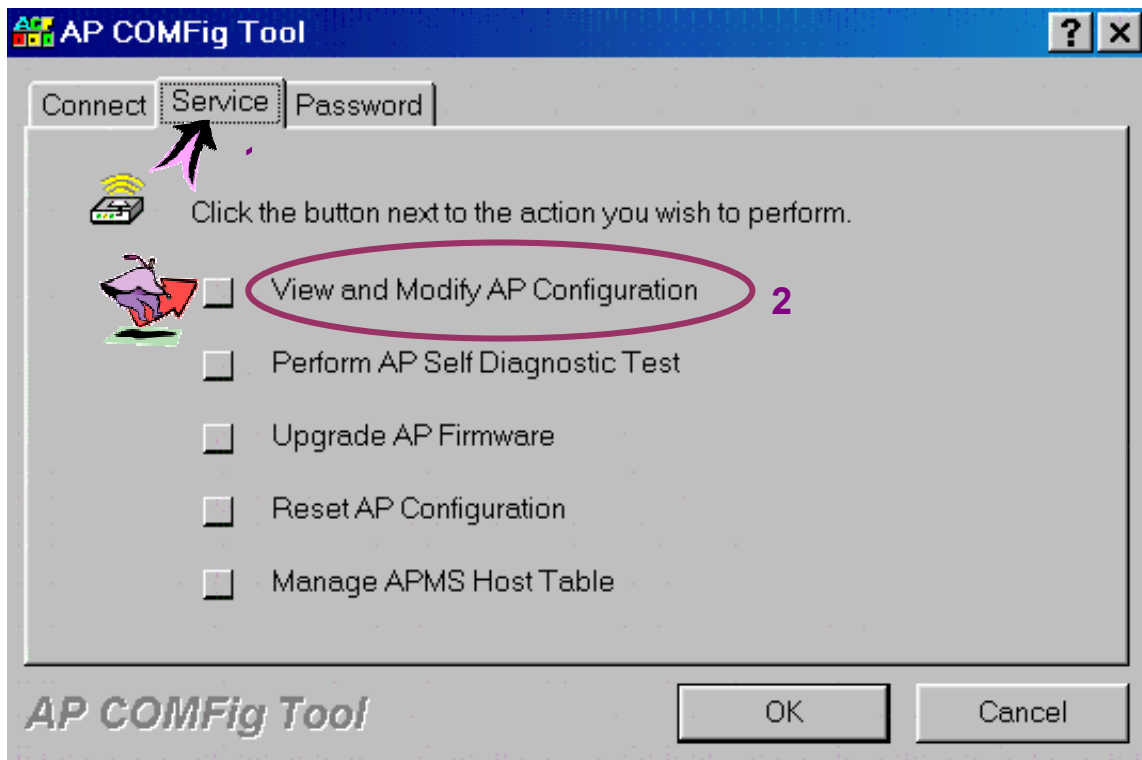
## 6.2 Setting the AP

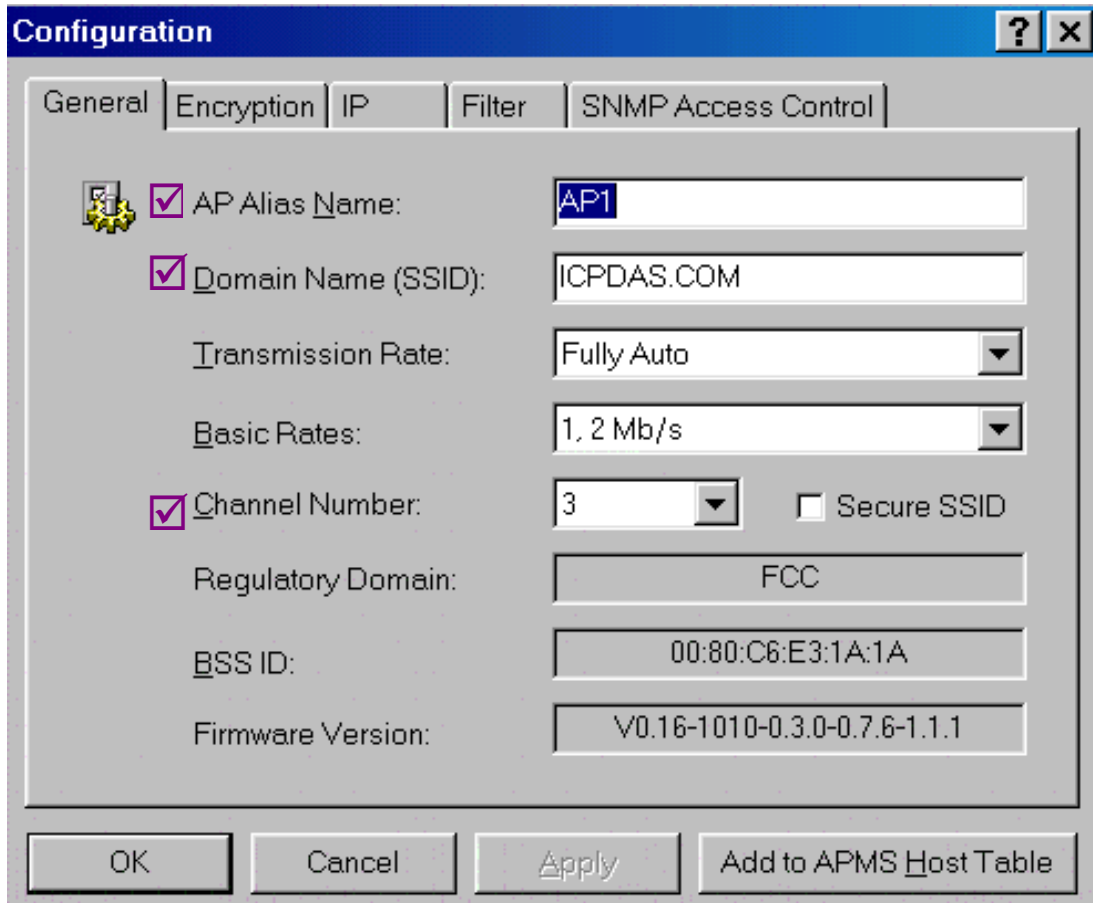
Before you use the AP, set the AP with the following steps:

**Step1.** Click the “Start” menu and “Programs” under Windows system. Find the “Instantwave High...” and click the “AP COMFig Tool “. Use the COM port to connect the AP in order to set the configuration. When the connection between AP and PC is ready, the box below will read “connected”.



**Step2.** Select the “Service” item. Click the first item to set the configuration of AP.

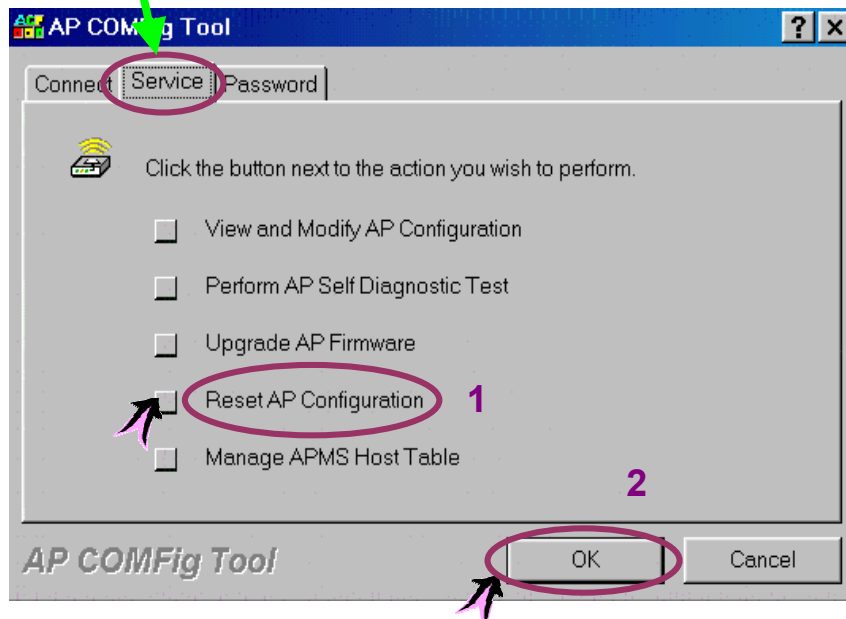
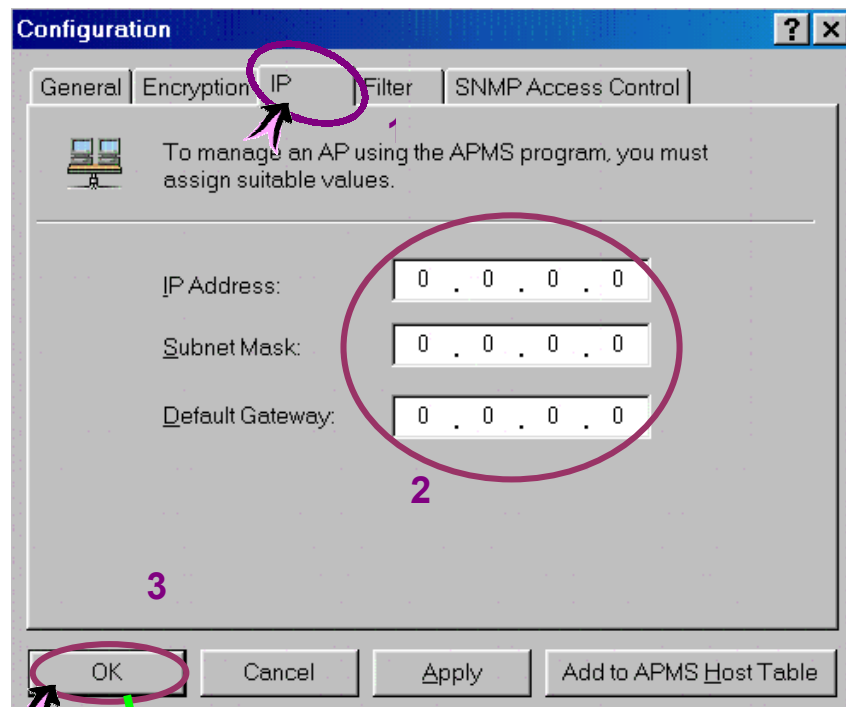




On the "configuration" screen, the most important items to set for a successful connection with our 7188E/8000 series are as follows:

- λ **AP Alias Name:** Assign your own name to your AP to designate your network.
- λ **Domain Name (SSID):** Only wireless devices with the same SSID as the AP can associate with each other in the "Infrastructure" mode.
- λ **Channel Number:** The AP automatically sets its' own channel to the WEC.

Select “**IP**” item to set the IP address, subnet Mask, and Gateway to your AP. Then click the “**OK**” to return to “Service”



**Step3.** “**Reset AP Configuration**” sets all AP values to the default values. If you have a problem with your wireless network, use this item and set AP’s configurations again.

## Other setting descriptions:

|                          |   |
|--------------------------|---|
| <b>Transmission Rate</b> | Sets the transmission rate at which the data packets are transmitted by the AP  |
| <b>Basic Rates</b>       | This value determines the basic rates used and reported for this BSS by the AP. The highest rate specified is the rate that the AP will use when transmitting broadcast/multicast and management frames.<br>Available options are: <ul style="list-style-type: none"> <li>• 1 and 2Mbps</li> <li>• All (1, 2, 5.5, and 11Mbps)</li> </ul> |
| <b>Channel Number</b>    | You can change the channel number from here. Refer to the Appendix, page 101.   |
| <b>Secure SSID</b>       | Click to enable the Secure <b>SSID</b> option. <ul style="list-style-type: none"> <li>• Blocks a connection request from a station without the correct SSID</li> <li>• Hides the SSID in outgoing beacon frames. A site-survey will not find the SSID.</li> </ul>   |
| <b>Regulatory Domain</b> | Identifies the country where the AP is used. Each country has defined its available channel numbers and transmission power. Refer to the Appdix, page 78.   |
| <b>AP Address</b>        | This is the MAC ID of the AP.   |
| <b>Firmware version</b>  | The current AP firmware version.  |
| <b>Encryption</b>        | Data Encryption provides more secure wireless data communication.   |

### **Important:**

In a multiple cell network topology, overlapping and/or adjacent cells using different channels can operate simultaneously without interference if the frequency distance between the center frequencies is at least 30MHz.

For example; channels 1, 7, and 13 are non-overlapping frequency channels.



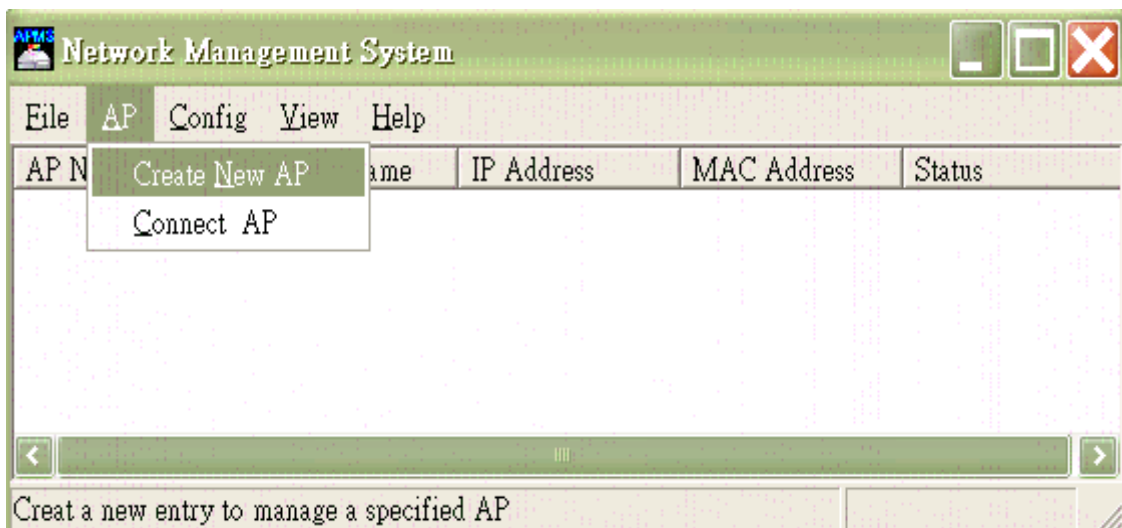
## 6.3 Set the AP via Ethernet

You can set the configurations of AP by using Ethernet, once the wireless network has been set up. The steps are as follows:

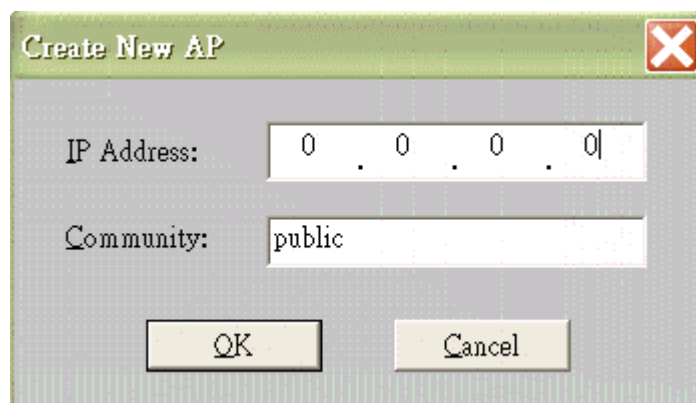
**Step1.** Click the “**Start**” menu and “**Programs**” under Windows system.  
Execute the “**AP Management System**”



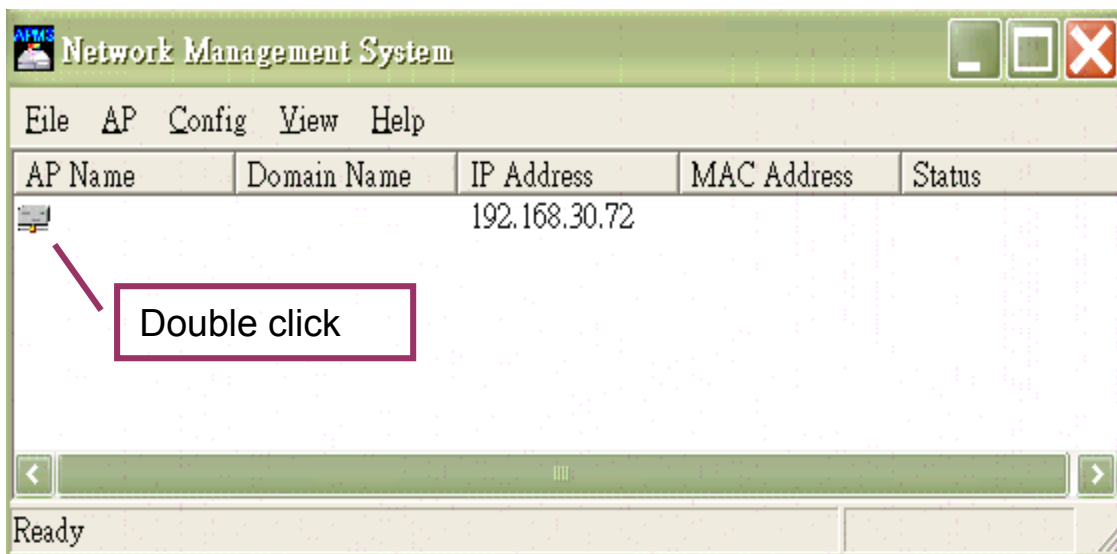
**Step2.** When you first execute the application, there is no knowledge of any AP. First, create an AP.



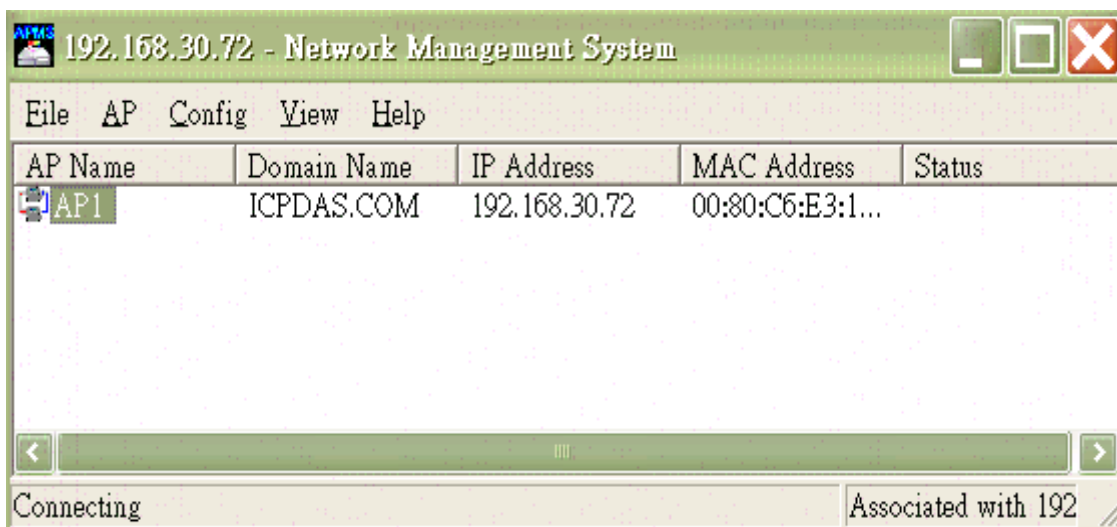
**Step3.** Key-in the IP that you set with “**AP COMFig Tool**”.



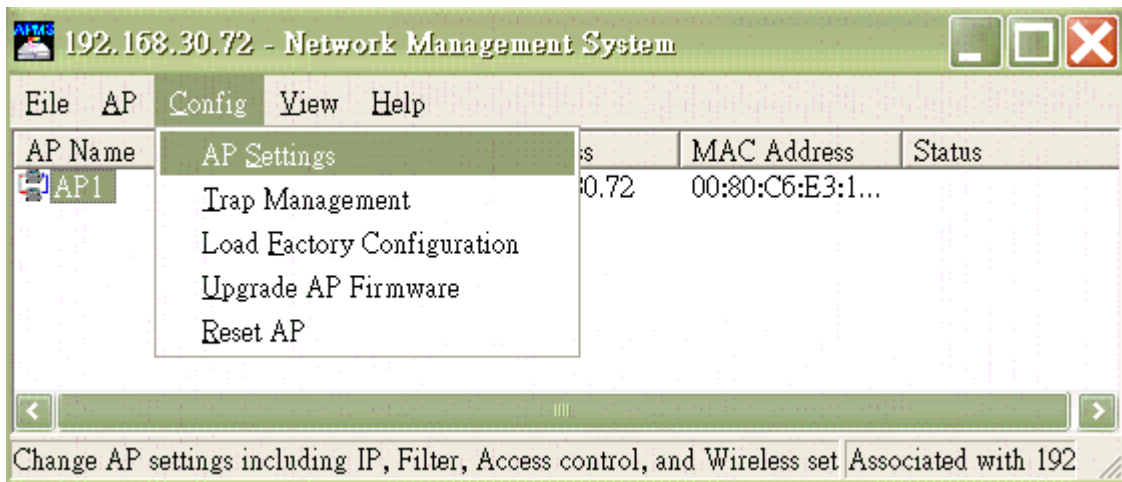
**Step4.** Now you can see that the IP is shown on the screen. **Double click** the icon.



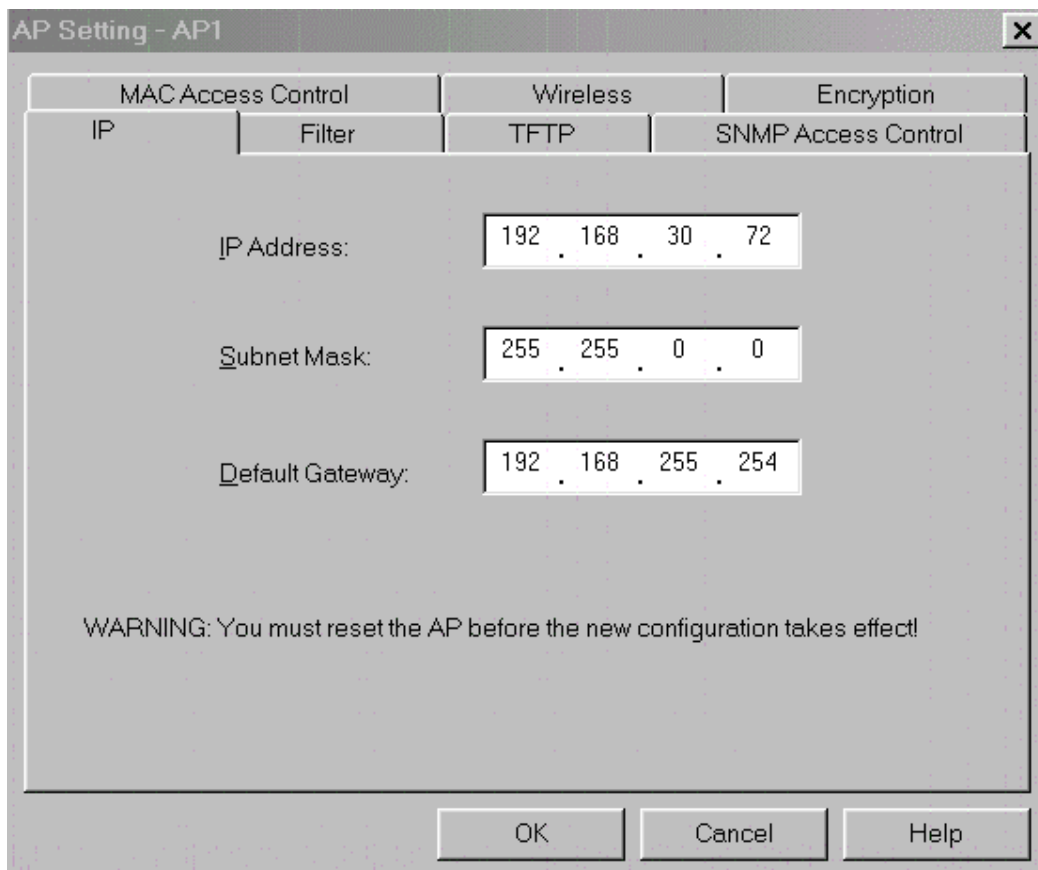
**Step5.** Double-clicking the icon shows the information that you're entered.



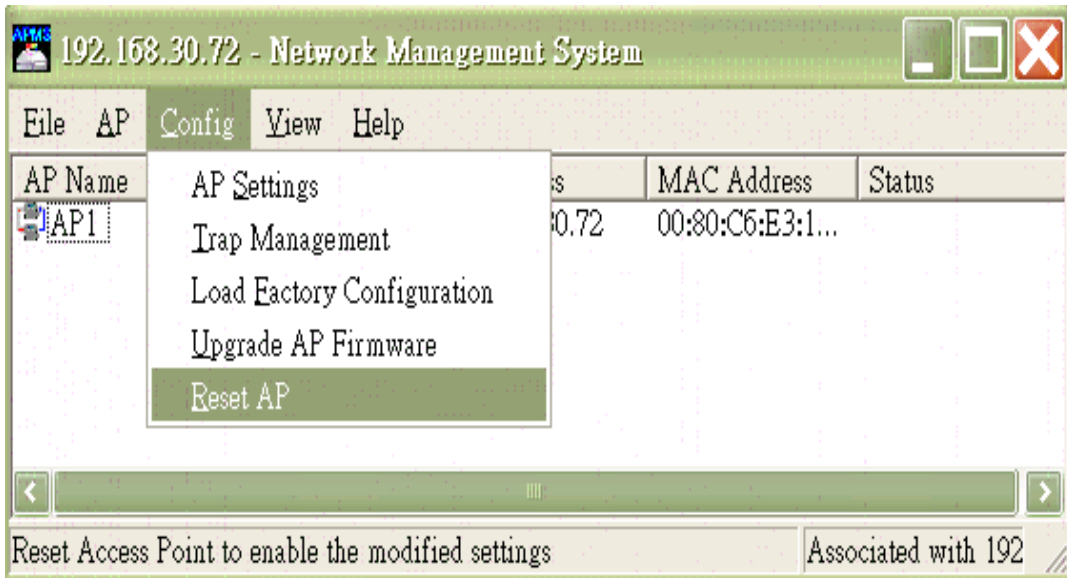
**Step6.** You can see the settable items in the ***Config*** menu.



**Step7.** Reset any part of the configuration which you need to change. After resetting, click the ***OK*** button.



**Step8. *Reset the AP:*** Note the configuration has been changed. If you want to re-change the AP, just re-create an AP and enter the changed IP which you changed. Then, follow the above steps.



# 6. Quick Start for NWH-6110 (Bridge)

## 7.1 Install the InstantWave Management Tools

**Step1.** Put the companion CD in your CD-ROM. Execute the Setup.exe file from the **napdos\Wireless\Bridge\Utility** of the CD. Setup will prepare the InstallShield Wizard and then open the **Welcome** screen

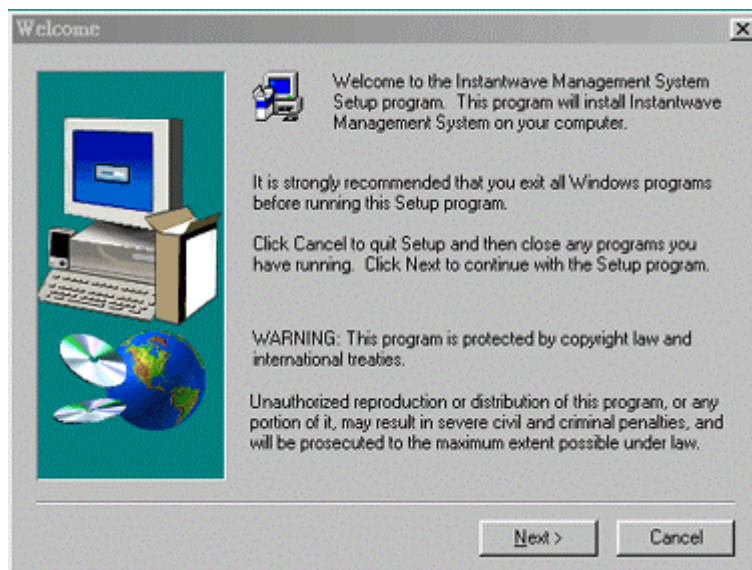


Figure 1. Welcome

**Step2.** Click **Next**

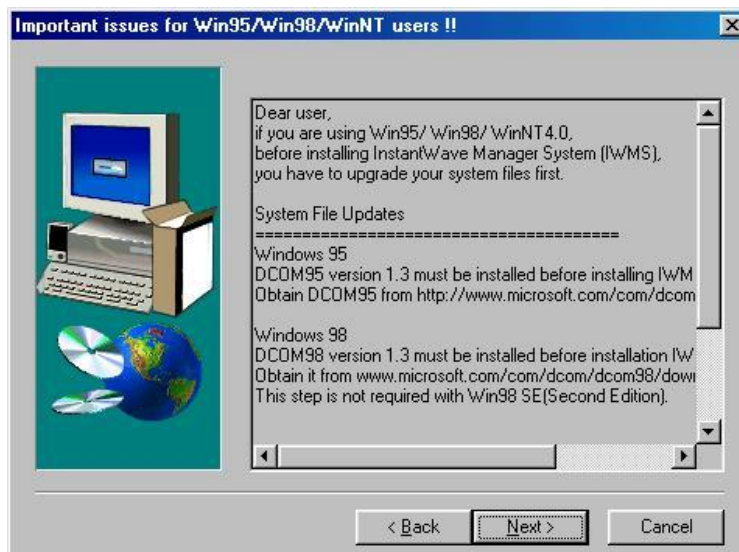
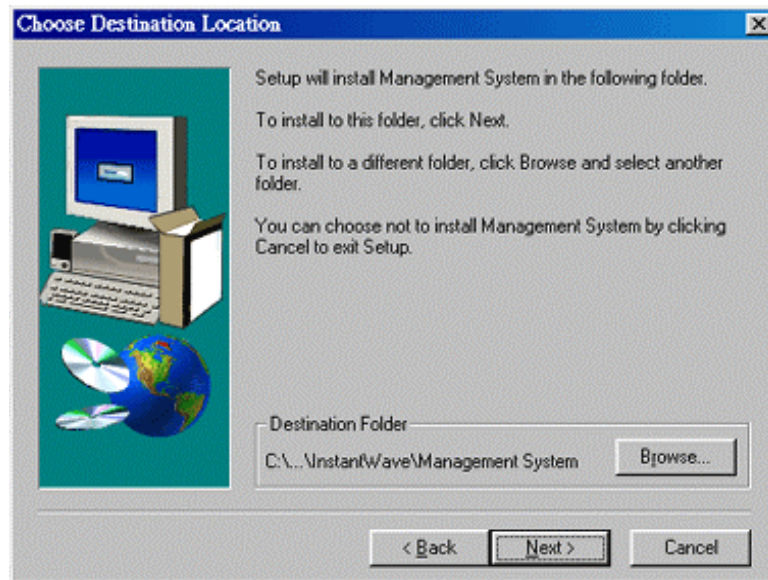


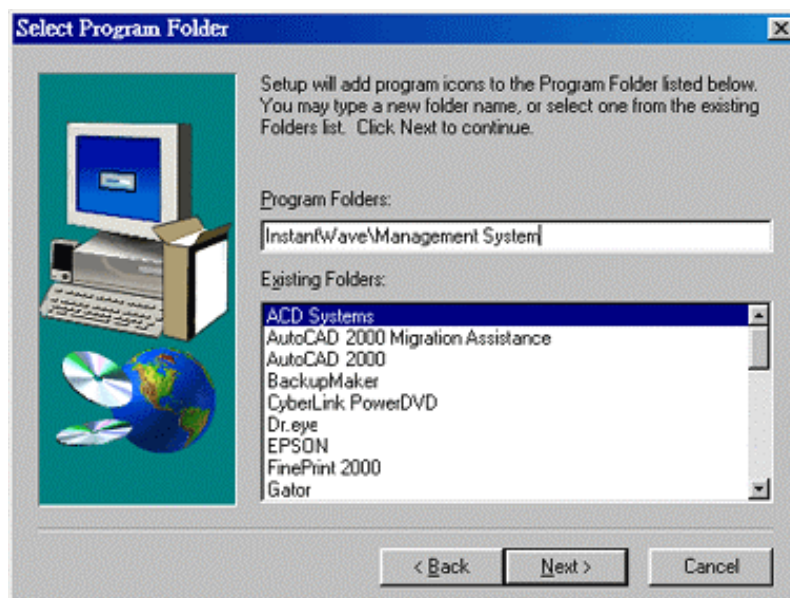
Figure 2. Important Issues

**Step3.** Older operating systems may need to update some system files to function correctly with the InstantWave Management System. If required, follow the on-screen instructions to download the required file (Figure 2). Click **Next** to open the **Choose Destination Location** screen (Figure 3)



**Figure 3. Choose Destination Location**

**Step4.** Click **Next**



**Figure 4. Select Program Folder**

**Step5.** Click **Next** again (Figure 4)



**Figure 5. Setup Complete**

**Step6.** Check *I would like to launch InstantWave Management System* and click **Finish**

## 7.2 Using the InstantWave Management Utility

Once the NWH6110 is connected to an Ethernet network, a network administrator can connect to it from any PC on the same network via the InstantWave Management System (IWMS) utility.

The IWMS utility is a Windows-based SNMP management tool, allowing network administrators to remotely configure and monitor the NWH6110 through both an Ethernet and a wireless connection. To launch the IWMS utility:

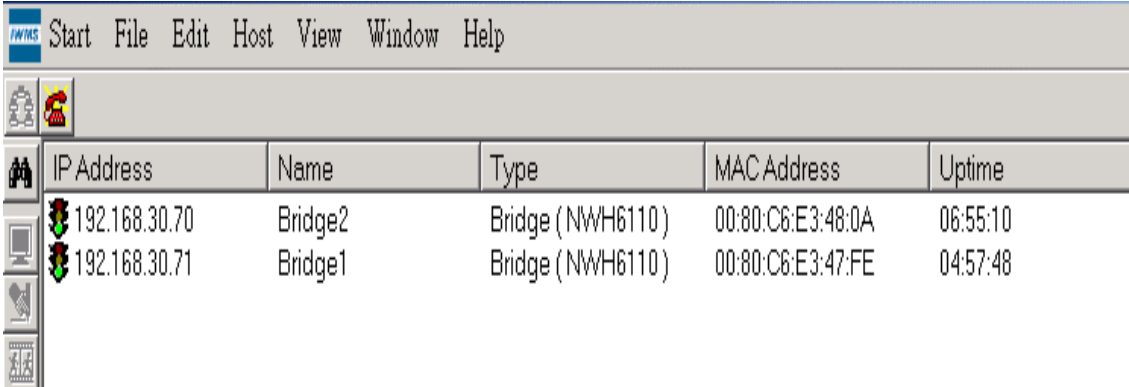
**step1.** Click **Start/Programs/InstantWave/Management System/InstantWave Management System**. The main IWMS window will open

**step2.** Click **Start/Start Hosts View**

### Auto-Discovery

The Discovery Protocol will discover all InstantWave Wireless operating devices connected to the Ethernet LAN within the same subnet.

**Step1.** Click the “Auto Discovery” icon on the left toolbar (binoculars). All InstantWave operating devices will be automatically discovered (Figure 6)



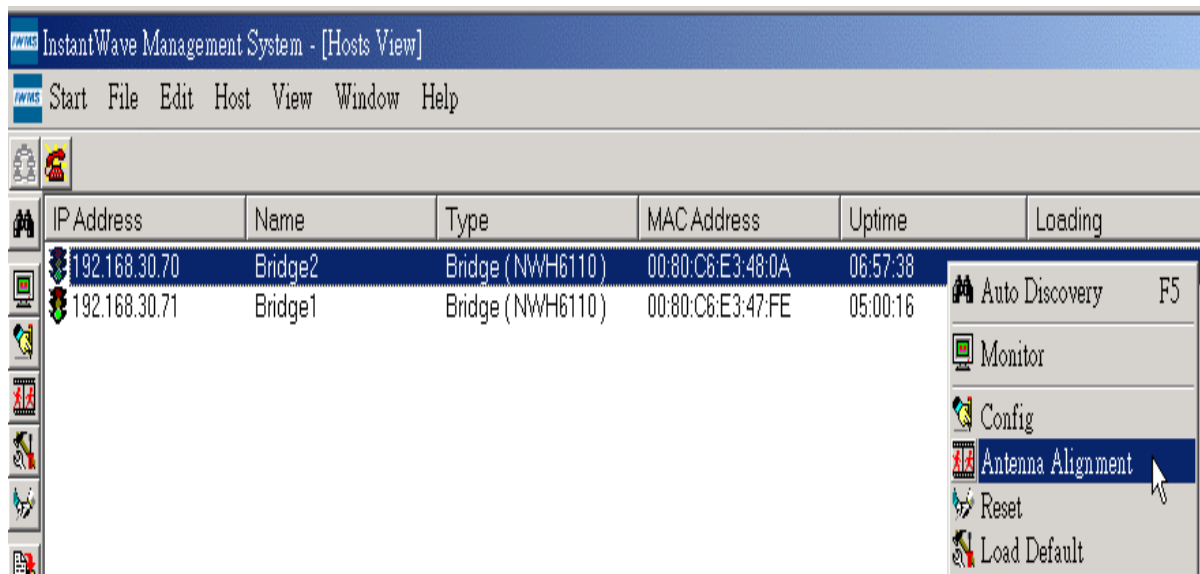
The screenshot shows the IWMS application window with a menu bar (Start, File, Edit, Host, View, Window, Help) and a toolbar on the left containing icons for Start, Hosts View, and Auto Discovery. The main area displays a table of discovered devices.

| IP Address    | Name    | Type             | MAC Address       | Uptime   |
|---------------|---------|------------------|-------------------|----------|
| 192.168.30.70 | Bridge2 | Bridge (NWH6110) | 00:80:C6:E3:48:0A | 06:55:10 |
| 192.168.30.71 | Bridge1 | Bridge (NWH6110) | 00:80:C6:E3:47:FE | 04:57:48 |

**Figure 6. InstantWave Management System**



**Step2.** Select one of the wireless devices in the list. The utility buttons on the left toolbar will become enabled (Figure 7)

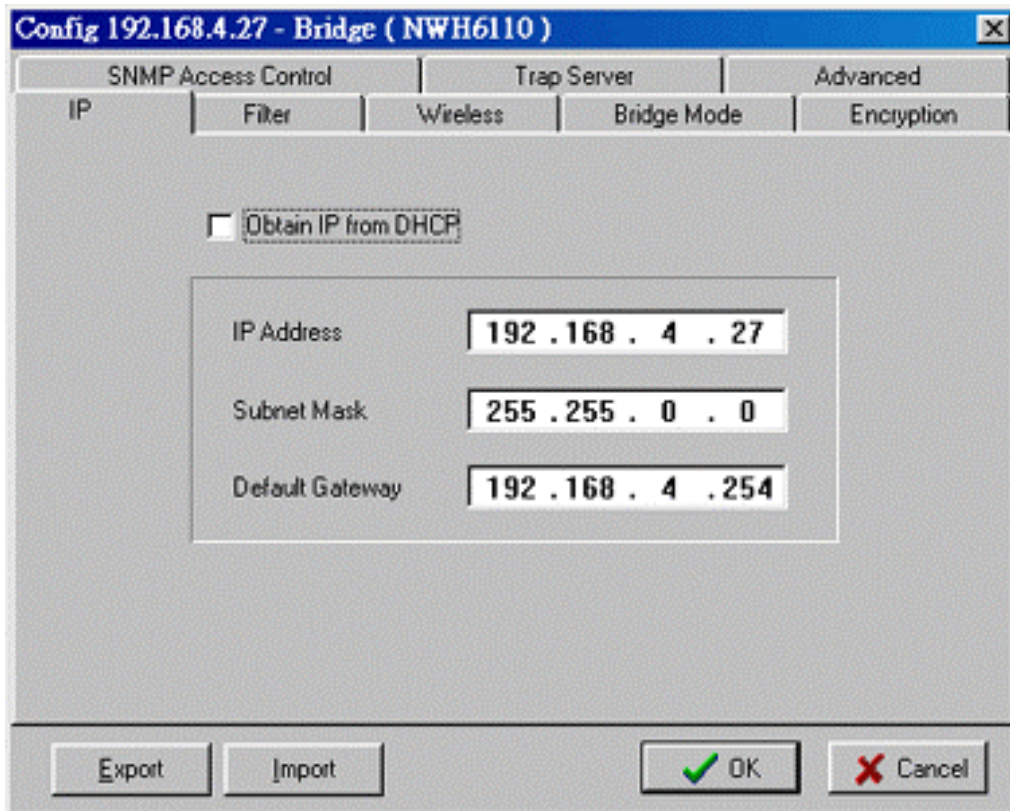


**Figure 7. Host View**

**Step3.** Right-clicking on a particular device will open a popup menu offering the same functions as the toolbar (Figure 7)

## Configuration

- step1.** For configuration, select the Bridge (NWH6110) on the *Hosts View* screen (Figure 7)
- step2.** Right-click the NWH6110 to open the popup menu
- step3.** Click **Config** to go to the configuration pages (Figure 8)



**Figure 8. Configuration**

## IP

**IP Address Setting:** The InstantWave NWH6110 is a DHCP Client. It will automatically ask a DHCP Server to assign it an IP address. An administrator can assign a fixed IP to an NWH6110 by un-checking the *Obtain IP from DHCP* box (Figure 8). You may also configure a subnet mask and add a default gateway.

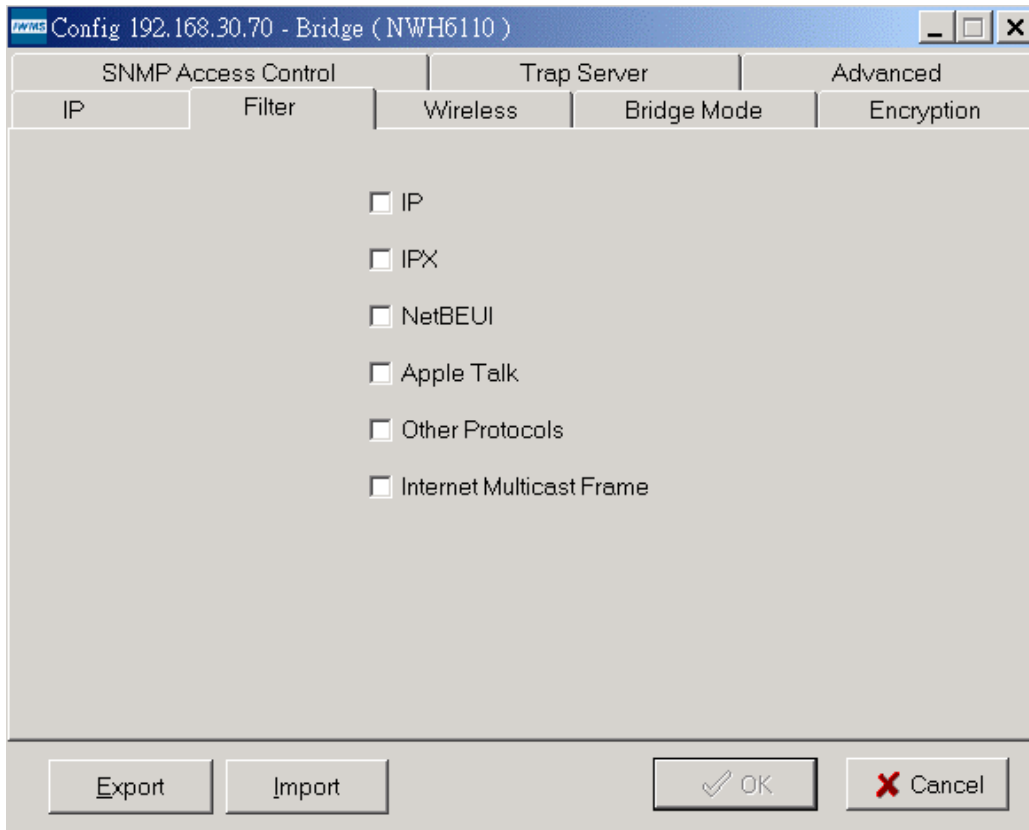
If you assign a fixed IP address to an NWH6110, make sure that all NWH6110s within the same network have the same TCP/IP subnet address.

|                            |  |
|----------------------------|--|
| <b>Obtain IP from DHCP</b> | Automatically retrieves an IP address for the NWH6110 from a Dynamic Host Configuration Protocol (DHCP) server.<br>This option is enabled by default |
| <b>IP Address</b>          | Manually assigns an IP address to the NWH6110  |
| <b>Subnet Mask</b>         | Manually assigns a subnet mask to the NWH6110  |
| <b>Default Gateway</b>     | Specifies a default gateway IP address (if required)   |

**Note:** An NWH6110 will directly transfer SNMP response packets (confirmation packets) to an IWMS PC if it is within the same LAN (the same subnet mask). If an SNMP response packet from an NWH6110 is destined for an IWMS PC on another LAN, the SNMP response packet needs to be forwarded by routers. The default gateway is the closest router to the NWH6110. If the correct default gateway is set, you can use an IWMS manager (i.e. a PC running IWMS) physically located in a different subnet to manage this NWH6110.

## Filter

The next sheet on the dialog box is *Filter* (Figure 9).



**Figure 9. Filter**

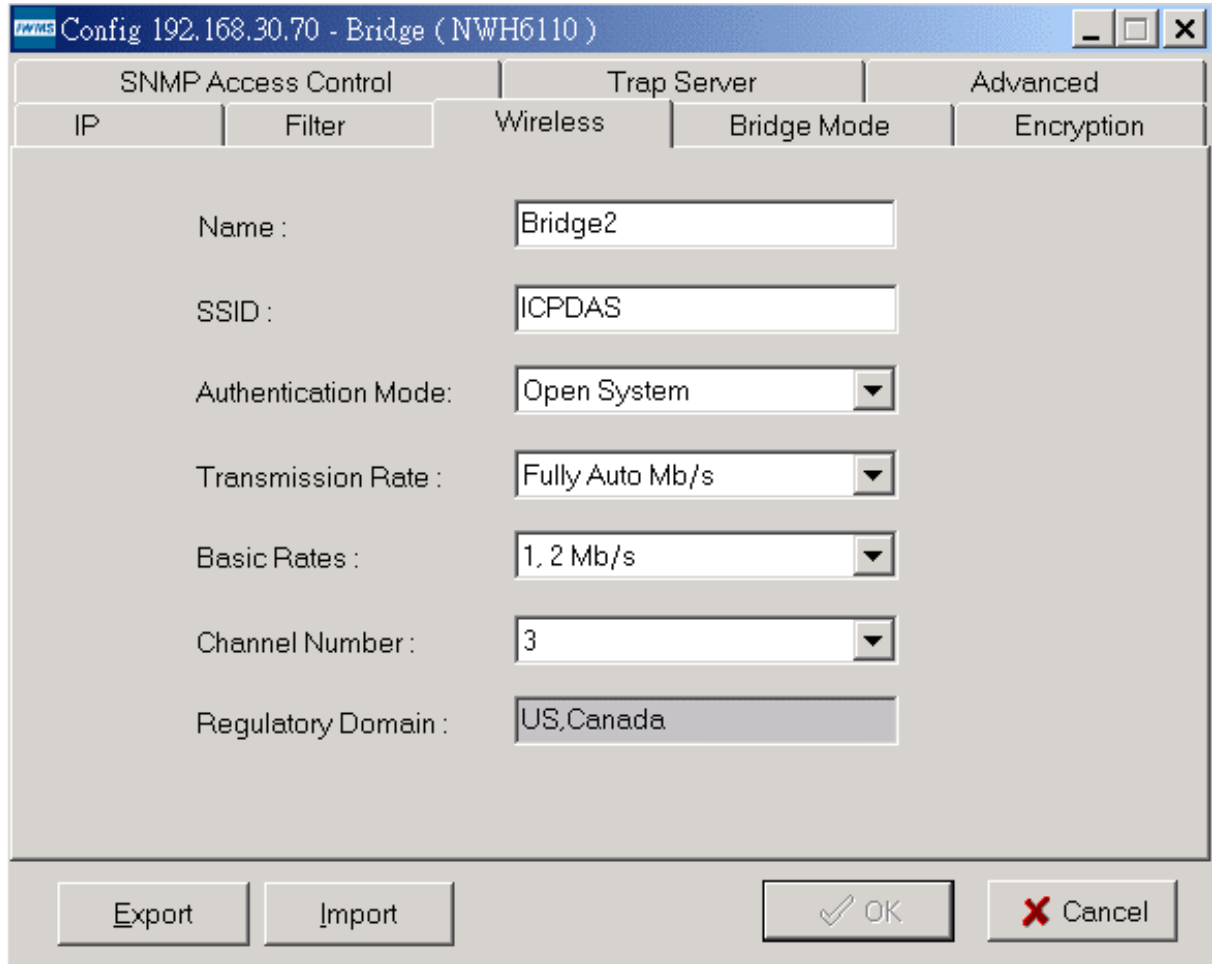
This is a one-way protocol filtering mechanism that prevents the NWH6110 from transmitting specified protocol packets from a wired Ethernet LAN into the wireless LAN. If you do not require particular protocols on the wireless part of your network, you can save bandwidth by enabling the protocol filter.

From the *Filter* sheet, some, all, or none of the protocols listed may be selected for filtering out:

- IP Protocol
- IPX Protocol
- NetBEUI Protocol
- AppleTalk Protocol
- Other Protocols
- Internet Multicast Frames

# Wireless

The *Wireless* page ( Figure 10) provides access to the Wireless settings.



The screenshot shows a configuration window titled "NWS Config 192.168.30.70 - Bridge (NWH6110)". The window has a tabbed interface with three tabs: "SNMP Access Control", "Trap Server", and "Advanced". The "Advanced" tab is selected and contains sub-tabs for "IP", "Filter", "Wireless", "Bridge Mode", and "Encryption". The "Wireless" sub-tab is active, displaying the following settings:

|                      |                 |
|----------------------|-----------------|
| Name :               | Bridge2         |
| SSID :               | ICPDAS          |
| Authentication Mode: | Open System     |
| Transmission Rate :  | Fully Auto Mb/s |
| Basic Rates :        | 1, 2 Mb/s       |
| Channel Number :     | 3               |
| Regulatory Domain :  | US,Canada       |

At the bottom of the window, there are buttons for "Export", "Import", "OK", and "Cancel".

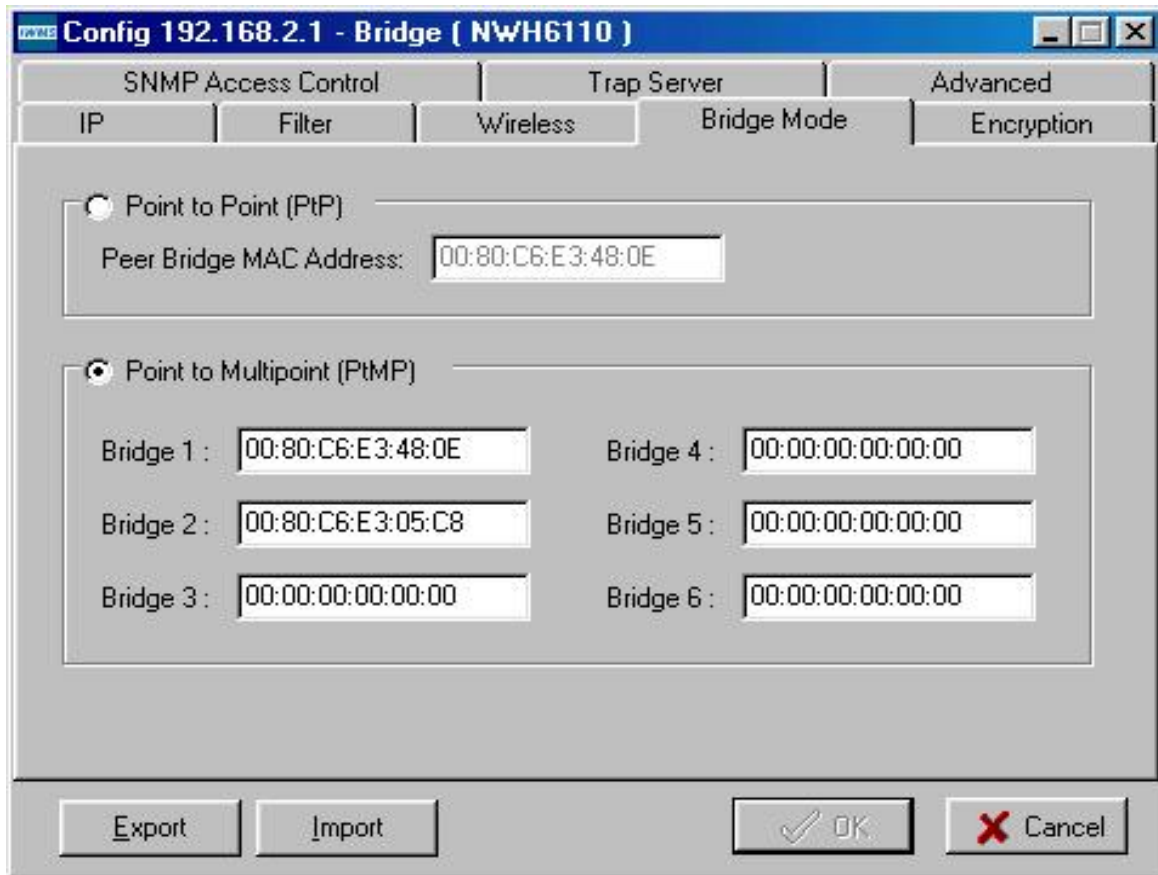
**Figure 10. Wireless**

|                            |  |
|----------------------------|--|
| <b>Name</b>                | Assigns the NWH6110 a unique name that allows the Bridge to be easily identified on the network.   |
| <b>SSID</b>                | Identifies the wireless LAN domain that this Bridge is in. A domain is generally composed of wireless Bridges you are most likely to communicate with. You can type an existing domain name or create a new one that contains up to 32 characters.   |
| <b>Authentication Mode</b> | From the dropdown list select: <b>Open system</b> , <b>Shared key</b> , or <b>Both</b> .<br><b>Open System</b> : no authentication required for connecting to other wireless devices<br><b>Shared Key</b> : uses the same shared key (automatically generated by the system) for all connecting wireless devices<br><b>Both</b> : the system will try shared key mode first. If that fails it will switch to open system |
| <b>Transmission Rate</b>   | Sets the transmission rate at which the data packets are transmitted by the NWH6110. In high interference environments a lower rate can increase overall transmission speed by reducing resends of lost packets  |
| <b>Basic Rates</b>         | This value determines the basic rates used and reported for this BSS by the NWH6110. The highest rate specified is the rate that the NWH6110 will use when transmitting broadcast/multicast and management frames.<br>Available options are:<br><ul style="list-style-type: none"> <li>• 1 and 2Mbps</li> </ul> All (1, 2, 5.5, and 11Mbps)  |
| <b>Channel Number</b>      | You can change the channel number from here.   |
| <b>Regulatory Domain</b>   | Identifies the country where the NWH6110 is used. Each country has pre-defined available channel numbers and transmission power.   |

**Important:**

In a multiple cell network topology, overlapping and/or adjacent cells using different channels can operate simultaneously without interference if the frequency distance between the center frequencies is at least 30MHz. For example, channels 1, 7, and 13 are non-overlapping frequency channels.

## Bridge Mode



**Figure 11. Bridge Mode**

The NWH6110 has two operating modes: Point-to-Point and Point-to-MultiPoint.

### **Point-to-Point**

Two separated LANs are connected using two NWH6110 units.

Each Bridge has to know its peer bridge's MAC address. For example; if Bridge A wants to connect with Bridge B, then Bridge A has to enter Bridge B's Mac address on this page. Likewise, Bridge B needs to enter Bridge A's MAC address.

## Point-to-MultiPoint

**If a large wireless network using more than two NWH6110 units is to be constructed, at least one of the NWH6110 units must be set to Point-to-MultiPoint. Other NWH6110 units can be set to either Point-to-Point or Point-to-MultiPoint.**

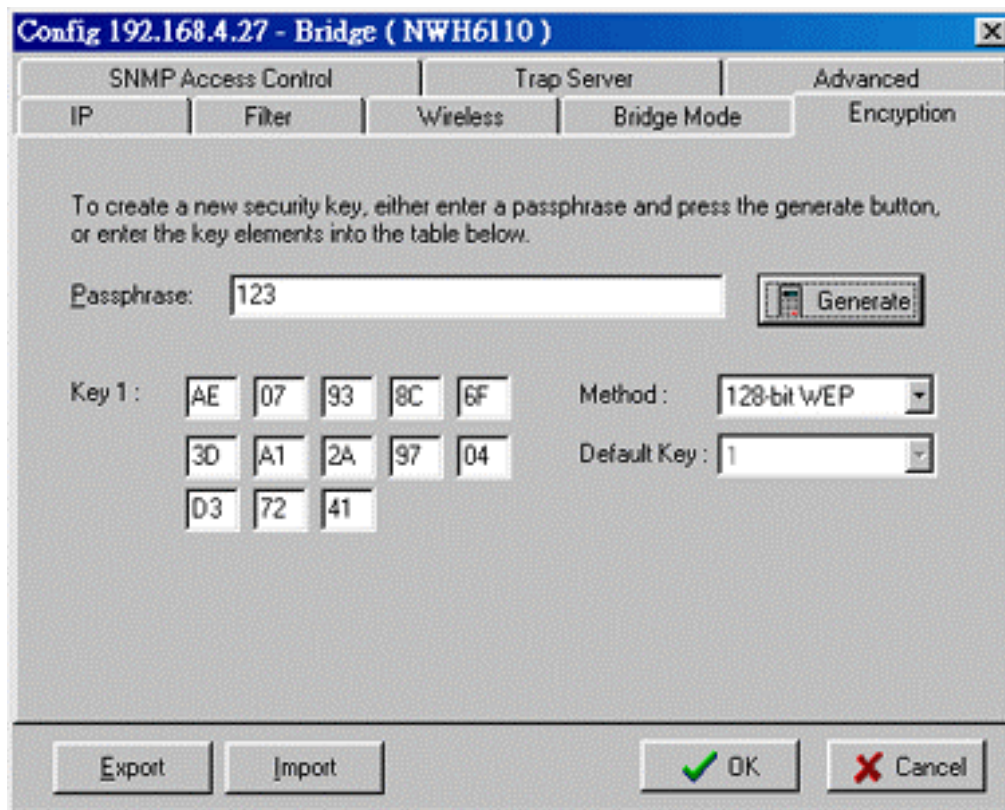
In this mode, up to six other NWH6110 units can be connected. Their MAC addresses must be entered here. Do not use Point-to-MultiPoint mode, which is more complex and slower than Point-to-Point mode, unless it is definitely required.



## Encryption

Click the *Encryption* tab (

Figure 12) to setup the security options.



**Figure 12. Encryption**

The default setting is *Disabled* and initially the key sections will be blank.

The pull-down *Method* box lists three options:

- Disabled (default) - Disables data encryption
- 40-bit WEP - Enables use of 40-bit WEP
- 128-bit WEP - Enables use of 128-bit WEP

**Key Generation** - There are two ways to generate a security key. The first is by entering any text in the *Passphrase* field. Click the **Generate** button. For 40-bit WEP, it will generate four keys, Key 1, Key 2, Key 3, and Key 4. Select a key number from the dropdown list of the *Default Key* box. If you do not manually select a key, key 1 will be selected. For 128-bit WEP, only one key will be generated. Click **OK**.

Another WEP key generation method is to insert the key values directly from the keyboard. Enter your own key into one of the *Key 1~4* fields. Select

that field number in the *Default Key* field.

## SNMP Access Control

The Bridge contains an SNMP access table to limit configuration access. By default there is no restriction on accessing the Bridge. To avoid chaos on the network, access to the NWH6110 configuration should be restricted to only those who require access.

When you select SNMP Access Control, the system will display four blank wireless devices for setting (a maximum of 4 IP addresses are allowed to access the Bridge via SNMP protocol).

Right-click on a device in the list and click **Edit Address** (Figure 13).

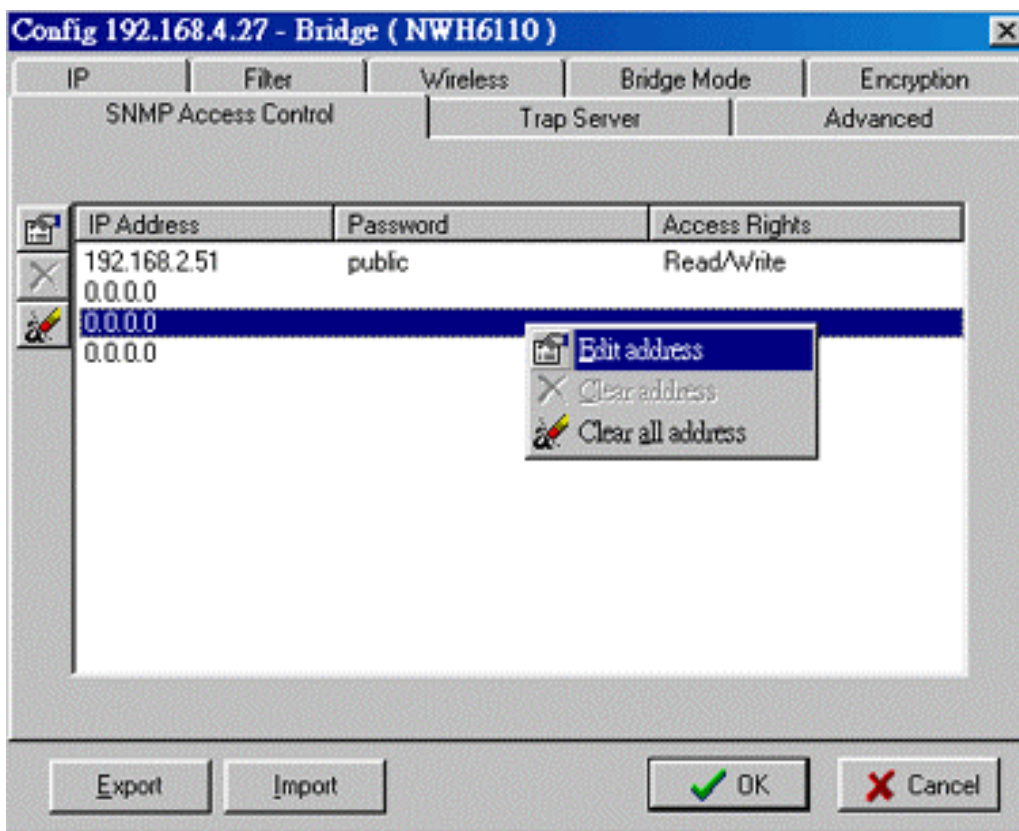
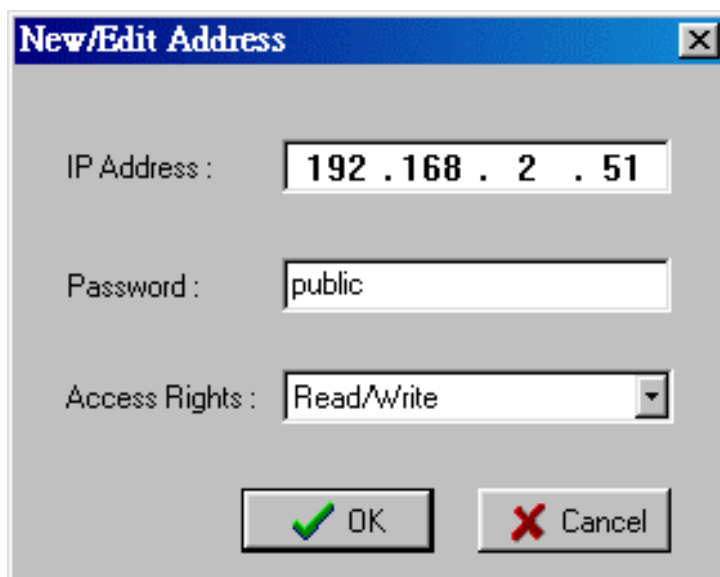


Figure 13. SNMP Access Control

The *New/Edit Address* screen will open (Figure 14).



**Figure 14. New/Edit Address**

Two levels of access may be assigned.

|                   |   |
|-------------------|---|
| <b>Read</b>       | Read-only rights. Users may read everything except the Access Control settings, but are not allowed to alter anything |
| <b>Read/Write</b> | Users may read and alter all settings   |

Enter your PC's IP address and then set your own access rights to Read/Write (see the following note).

**Note:** Do not set all the stations in the Access Control table to Read only. Once this is set and enabled, it will be impossible to modify the NWH6110. Should this situation occur, press the Reset button on the rear of the NWH6110 to restore the factory configuration.

To set access rights for one station, enter a station's IP address and password (the community string is used as a password to access the NWH6110) and choose *Read* or *Read/Write*.

When a setting is made, click **OK**. Repeat the procedure for the next PC. When all settings are made, click **OK** on the *SNMP Access Control* sheet to

put the changes into effect.

## Trap Server

When the NWH6110 is powered on, or an Ethernet port becomes active, an event log will be generated indicating the time, the IP address of the reporting NWH6110, and the event. You may save, open, and delete log files from the *File* menu.

To assign a trap server, click *Trap Server* (Figure 15).

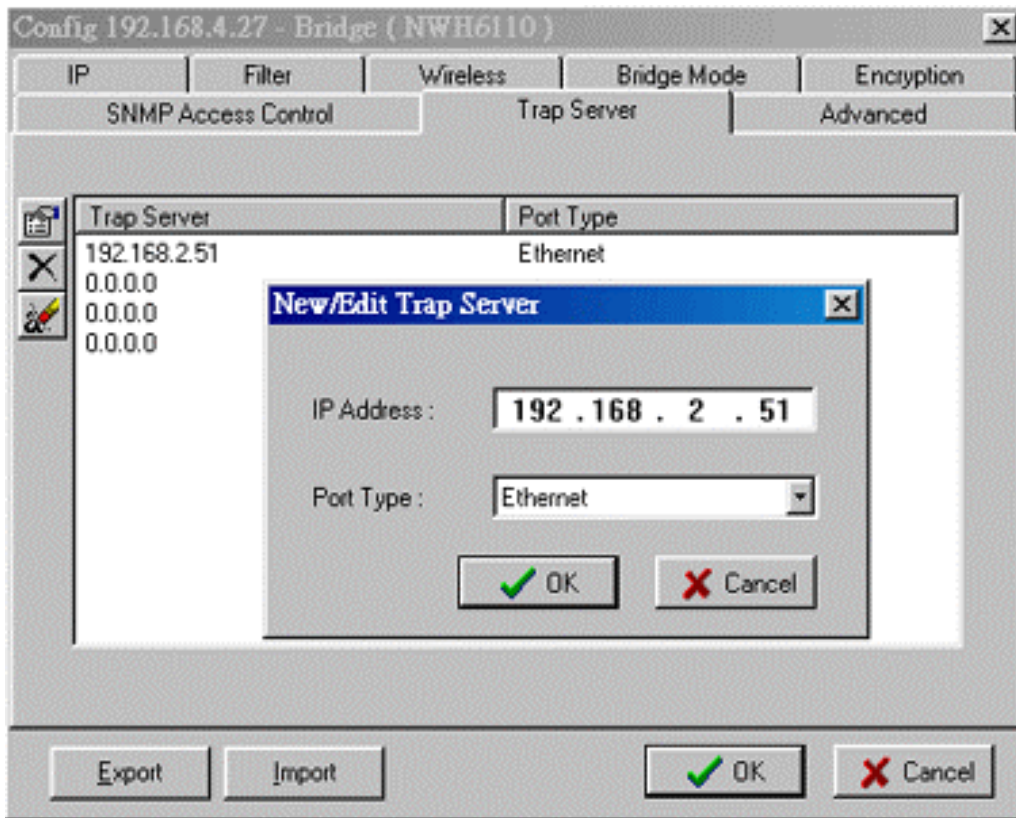


Figure 15. Trap Server

Assign a station as a trap server by entering its IP address and network port type. Click *Edit address*.

To remove a trap server from the list, highlight it and click **Clear address**. Click **Clear all address** to remove all assigned trap servers from the list ( Figure 16).

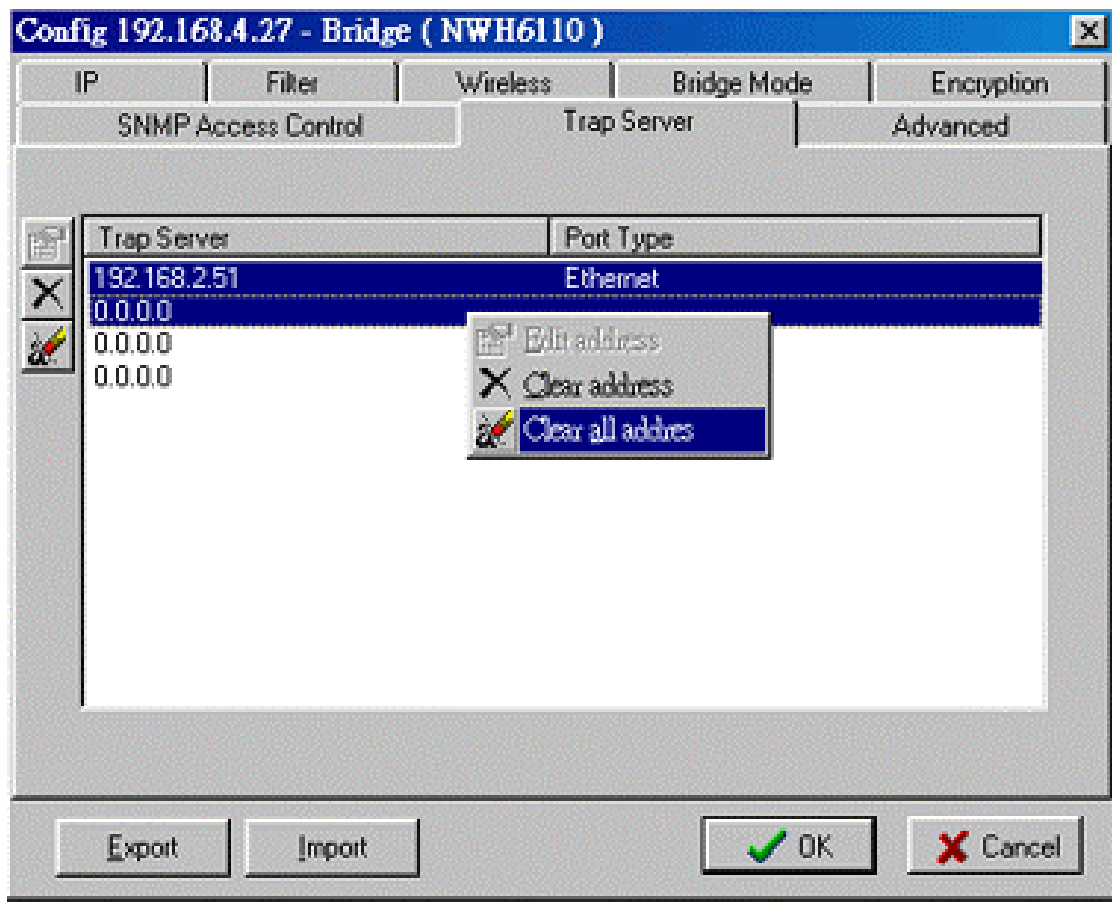
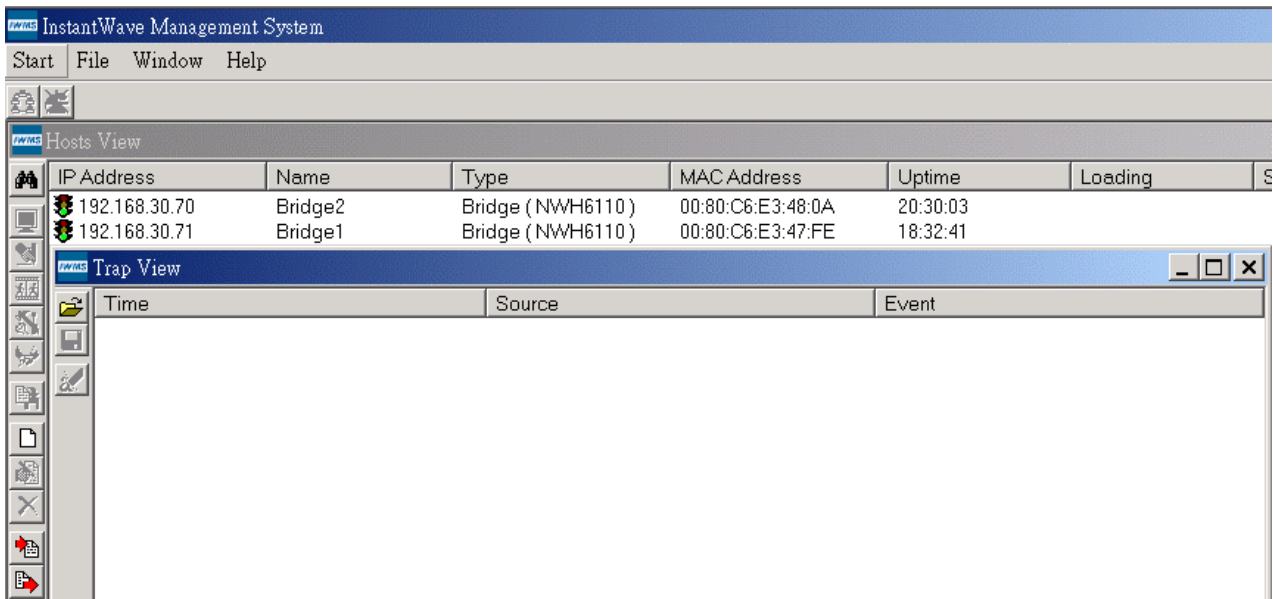


Figure 16. Clear all Addresses

To view trap log information, click the icon (telephone set at the upper left corner on the main user interface) to open the following screen ( Figure 17).



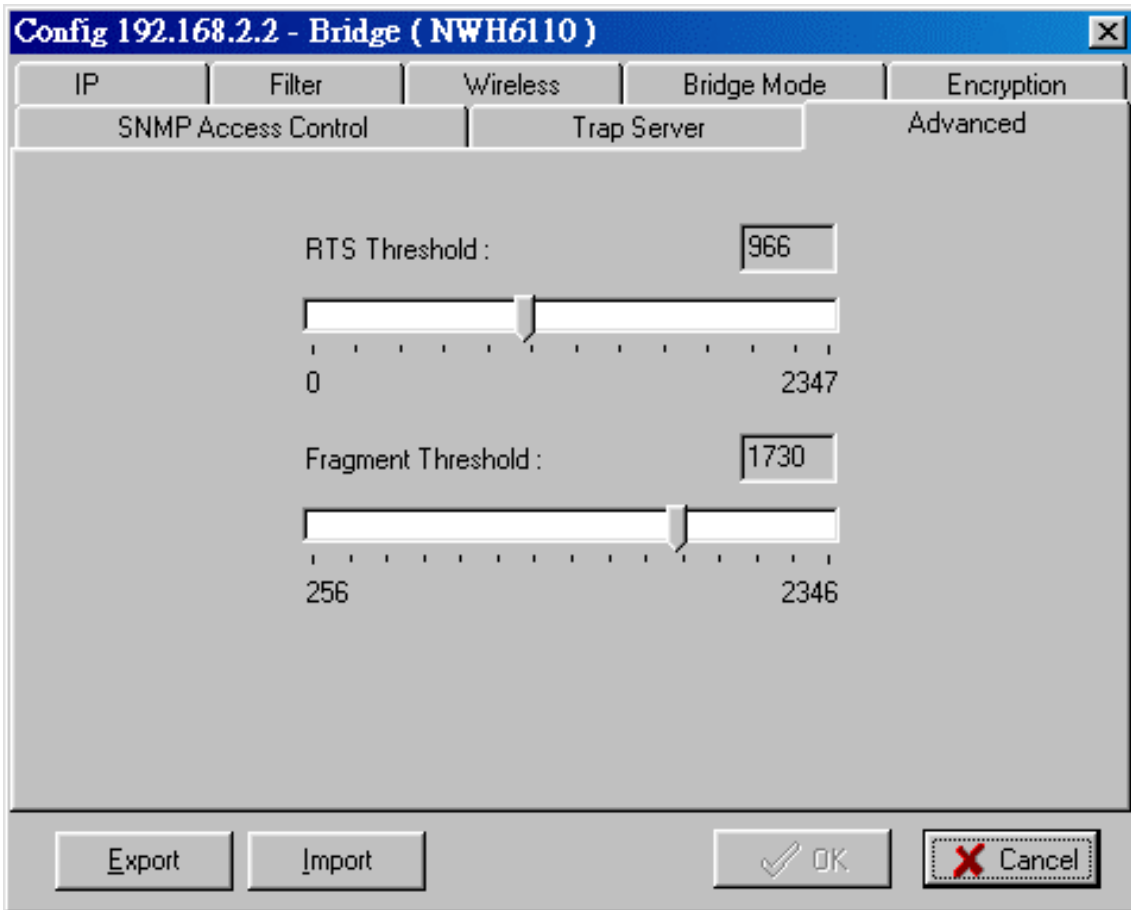
**Figure 17. Trap View**

The log shows when an NWH6110 was powered on, or an Ethernet port became active, and the IP address of the reporting NWH6110. You may save, open, and delete log files from the *File* menu.



## Advanced

You may set packet size thresholds in the **Advanced** section.



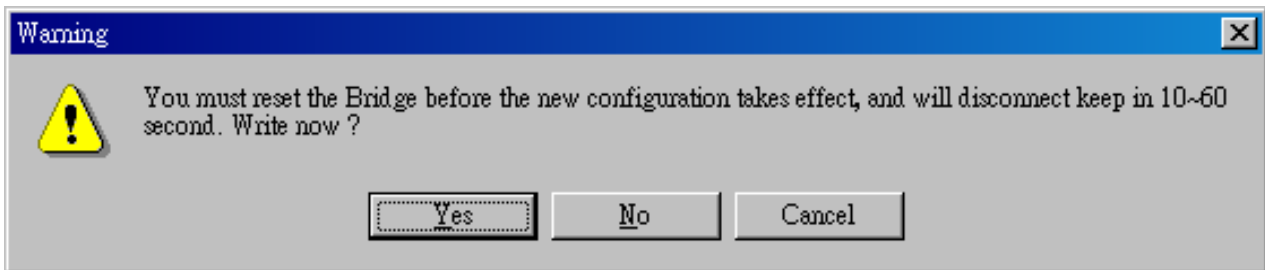
**Figure 18. Advanced**

**RTS Threshold:** Transmitters contending for the medium may not be aware of each other. The RTS (Request to Send) mechanism can solve this “Hidden Node Problem”. If the packet size is smaller than the preset RTS Threshold size, the RTS mechanism will NOT be enabled

**Fragment Threshold:** In the 802.11 Standard, the MAC Layer may fragment and reassemble directed data units. The fragmentation and defragmentation mechanisms allow for fragment re-transmission.

**Important:**

Once all configurations have been completed, click **OK**. You will be reminded that a reset is required to make the changes effective. Click **Yes**.



**Figure 19. Warning**

## Antenna Alignment Utility

The wireless Bridge is usually used to connect two separate LANs via a radio link, with a directional antenna to extend the maximum distance between the two wireless bridges. Sometimes the distance between two LANs might be several kilometers. Owing to the nature of a directional antenna, the higher the antenna gain is, the narrower the angle of the wave propagation will be. In order to achieve the best radio performance from an InstantWave NWH6110 Wireless Bridge, the Antenna Alignment Utility was developed. It helps installation as well as achieving the best radio performance.

## Features

The InstantWave Antenna Alignment Utility features:

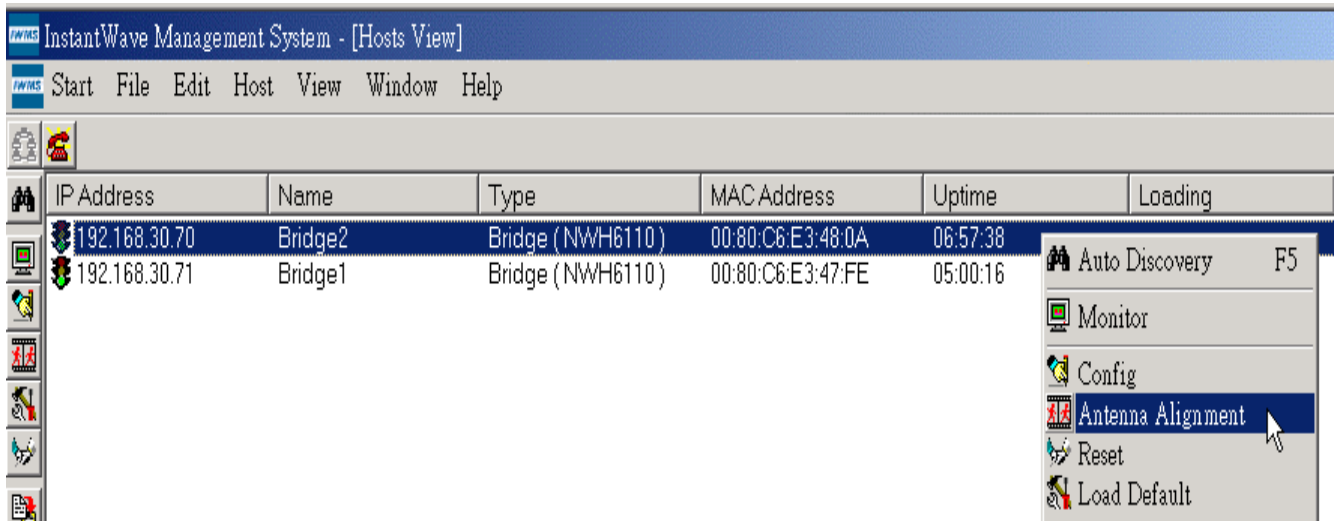
- Integrated operation within the IWMS (InstantWave Management System)
- Easy to use
- Real-time display of radio performance
- Two or three dimension graphic user interface result presentation
- Historical test data and set up conditions may be stored and retrieved to correlate with the latest test result.

## Before Aligning

- Find a suitable location for the directional antenna and NWH6110 wireless bridge.
- Use the IWMS to configure two NWH6110 Bridges with their peer Bridge's MAC address respectively. For example; on Bridge-A enter Bridge-B's MAC address as the peer Bridge, and vice versa (
- Figure 11, page 63)

## Aligning

**Step1:** After the NWH6110 wireless Bridge and the antenna have been successfully installed, connect a Notebook PC to an NWH6110 bridge via a crossover UTP cable. Run the IWMS (InstantWave Management System) on the Notebook PC. Click the Auto-discover icon.



**Figure 20. Antenna Alignment**

**Step2:** Select the NWH6110 and click the right mouse button. The available tools for the wireless bridge will be shown (Figure 20). Click ***Antenna Alignment***.

**Step3:** Setup the parameters for testing. Calculation of antenna alignment is conducted via the following procedure:

- Bridge-A sends a packet to Bridge-B
- When Bridge-B successfully receives the packet from Bridge-A, it automatically echoes the packet back
- When Bridge A receives the pack echoed back by Bridge-B, it calculates the throughput and presents it in PPS (packets per second) and KBPS (kilobytes per second). The higher the throughput is, the better the alignment.

Since every installation is different (for example, the difference in distance, temperature, humidity, and alignment angle) there is no pre-determined reference for minimum acceptable signal levels.

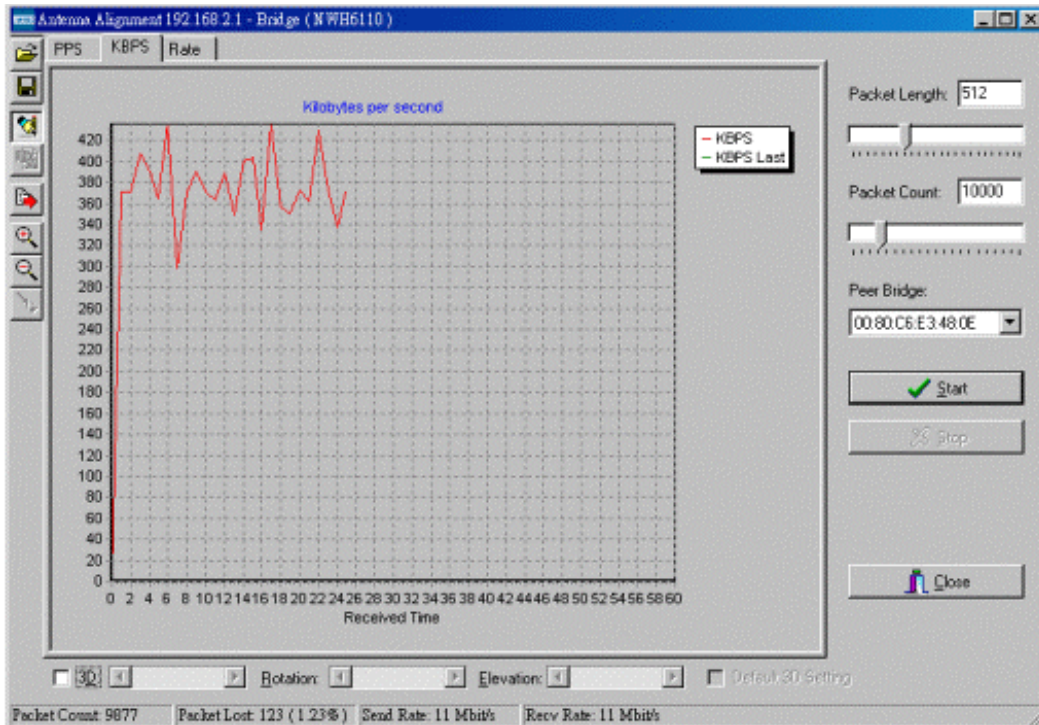
The user may specify the following parameters for each test.

- **Packet Length:** Ranges from a minimum of 64 bytes to a maximum of 1514 bytes, as Ethernet does. The larger the packet size is, the higher the likely error rate.
- **Packet Count:** The packet number to be sent during the test. The larger the packet count is, the longer the test will take.
- **Peer Bridge:** Under a Point to Multi-Point application environment, all wireless bridges that are configured to communicate with each other are shown on the screen. The peer bridge has to be specified via its MAC address before starting the antenna alignment test. The selected bridge must be set up to communicate with the bridge initializing the alignment test.

#### **Tips in setting the parameters:**

1. **Rough alignment:** When the bridge is first set up, the antennas of the bridge are not yet aligned to an optimum condition. It is suggested to use a shorter size and a smaller packet count to perform the test so that a test result can be obtained quickly.
2. **Fine Alignment:** Once the test reveals that the antenna is just about aligned, enter a longer packet size and larger packet count for fine adjustment.

**Step4:** Execute the test and evaluate the performance. Click **Start** on the right side of the screen. The test result is presented in a two-dimensional graph (**Step5:Figure 21**).



**Figure 21. Throughput-1**

**PPS:** Packets per Second  
**KBPS:** Kilobytes per Second  
**RATE:** Rate count per Second

During the antenna alignment test, the bridge may suffer interference. Under such circumstance the wireless communication data rate will automatically fall. The packets being sent or received at different data rates are summarized on the following chart ( Figure 22).

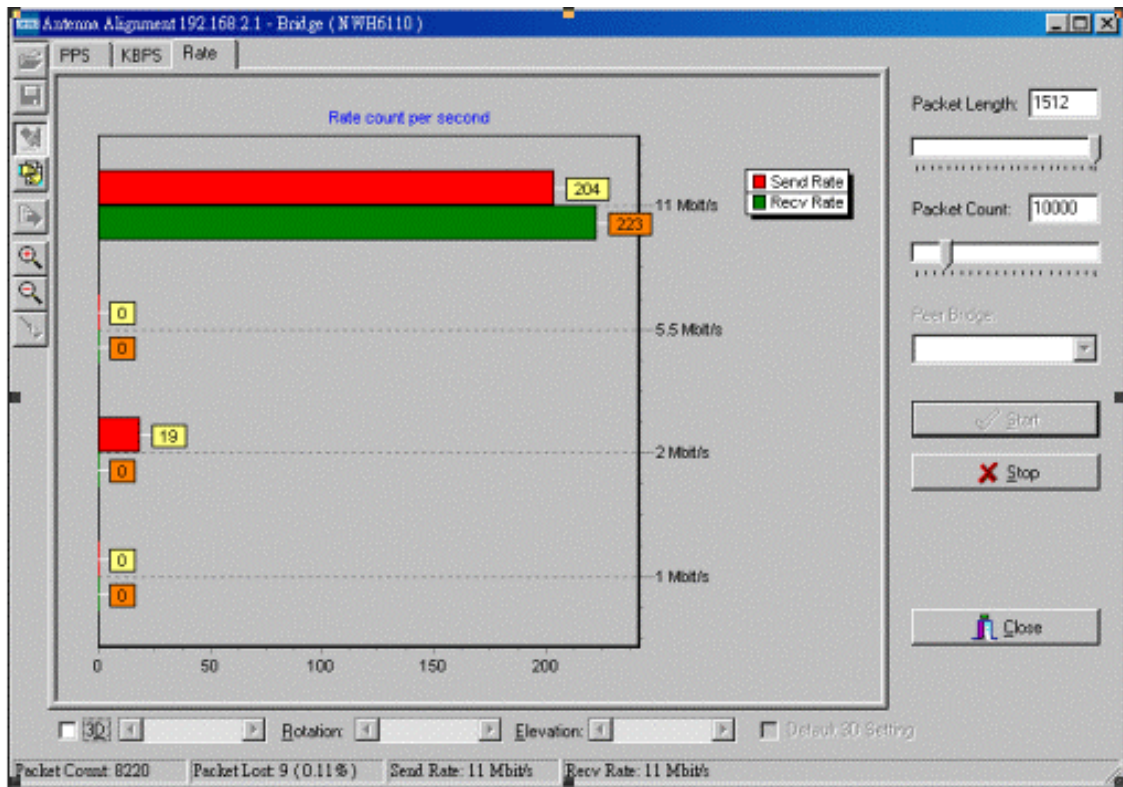
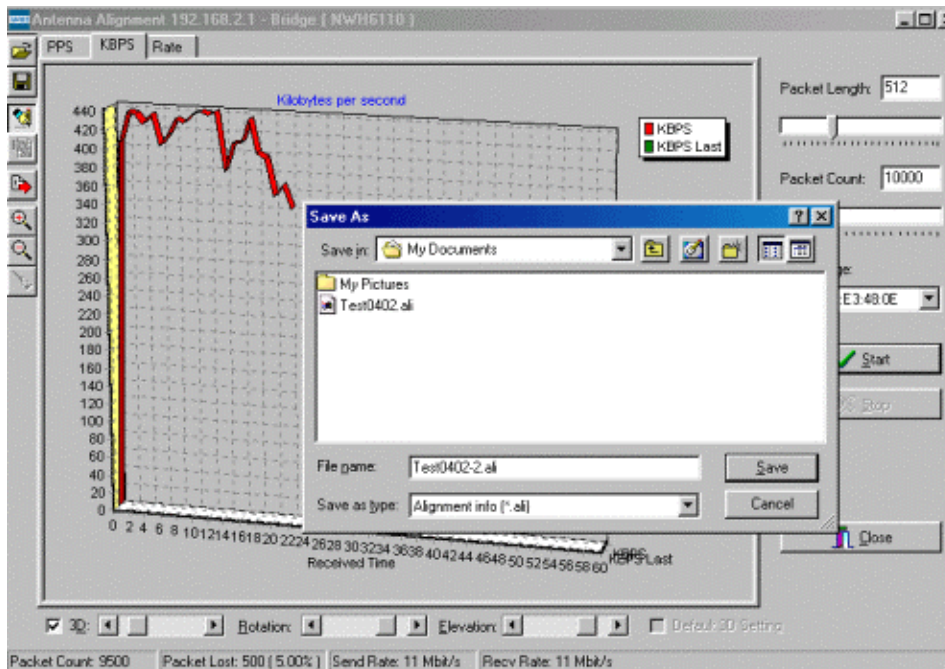


Figure 22. Throughput-2

**Step6:** Save the test result to a file. The tests may be repeated as described in Step 4 until the antenna is aligned at the optimum position. Then store the test configuration and test result into a file for later use. Click the second icon (floppy disk) on the toolbar to open the Save As box ( **Step7:**Figure 23).



**Figure 23. Save Test Results**



Save the file to a location of your choice.

A previously saved test data file can also be restored and displayed by clicking the first icon on the left toolbar.

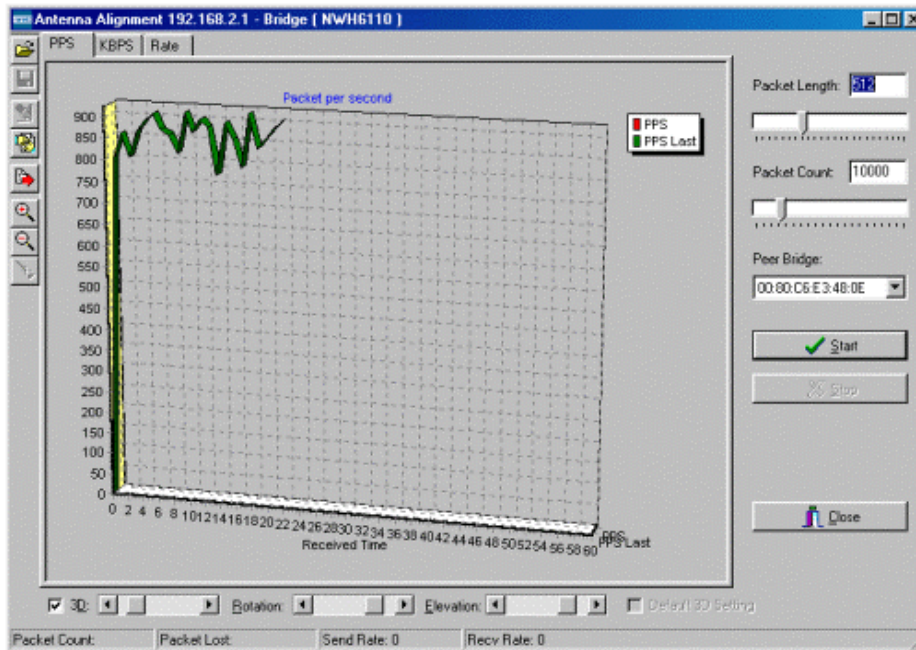
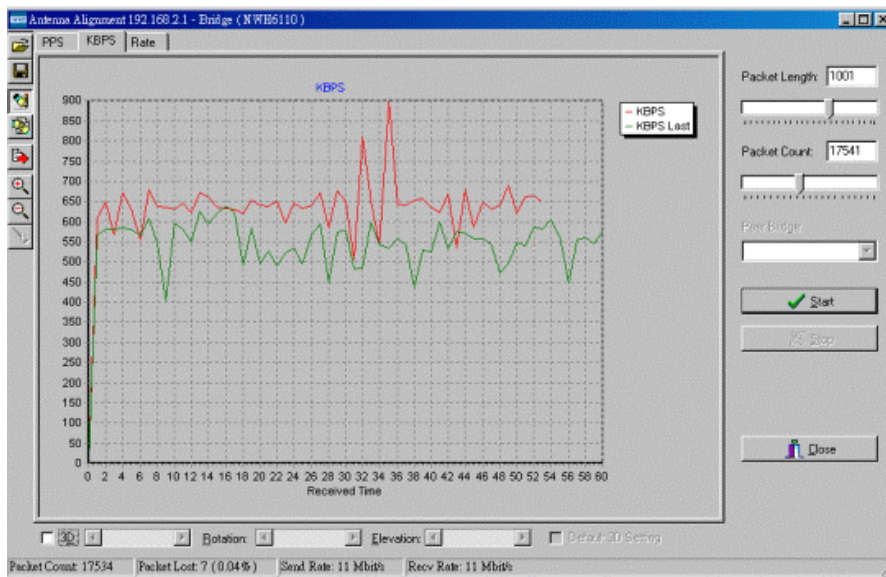


Figure 24. Load A Previous Test Result

Use a stored file as a reference to compare with the latest test result and evaluate differences between them. Click the **Start** button and run the test. The following screen will open (Figure 25).



**Figure 25. Compare Test Data**

On the figure above, the **Red-line** represents the **latest** test result and the **Green-line** represents the **previous** test result. Only the latest test will be shown and the system will automatically delete the previous ones.

## Viewing Test Results

The Antenna Alignment utility allows the user to view the test results in multiple ways.

- 2D (Two Dimension) or 3D (Three Dimension)
- Zoom in for a magnified view or zoom out for a smaller view
- **Rotation:** Rotate the view angle to the side
- **Elevation:** Rotate the view angle from the top

**3D and zoom in for a magnified view:** Check the 3D check box on the bottom-left of the screen, and click the magnifying glass '+' icon.

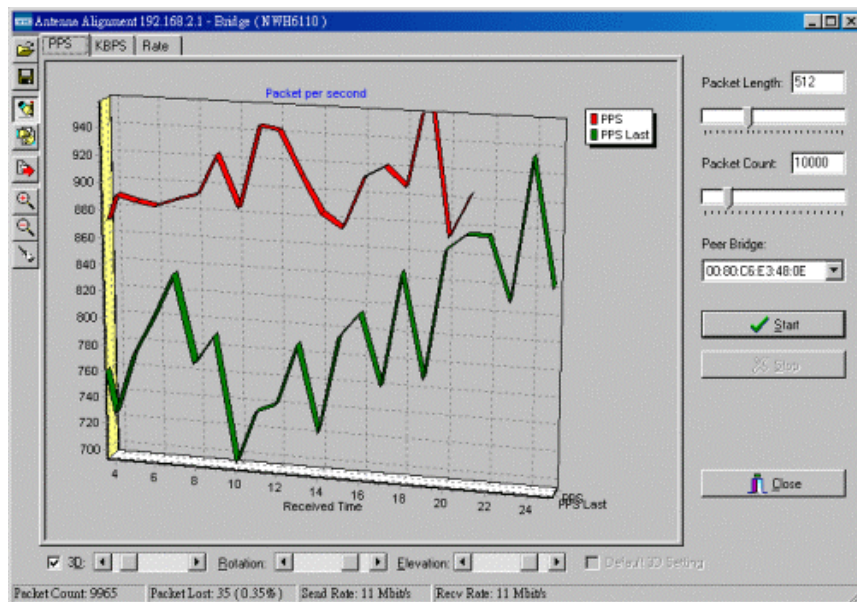
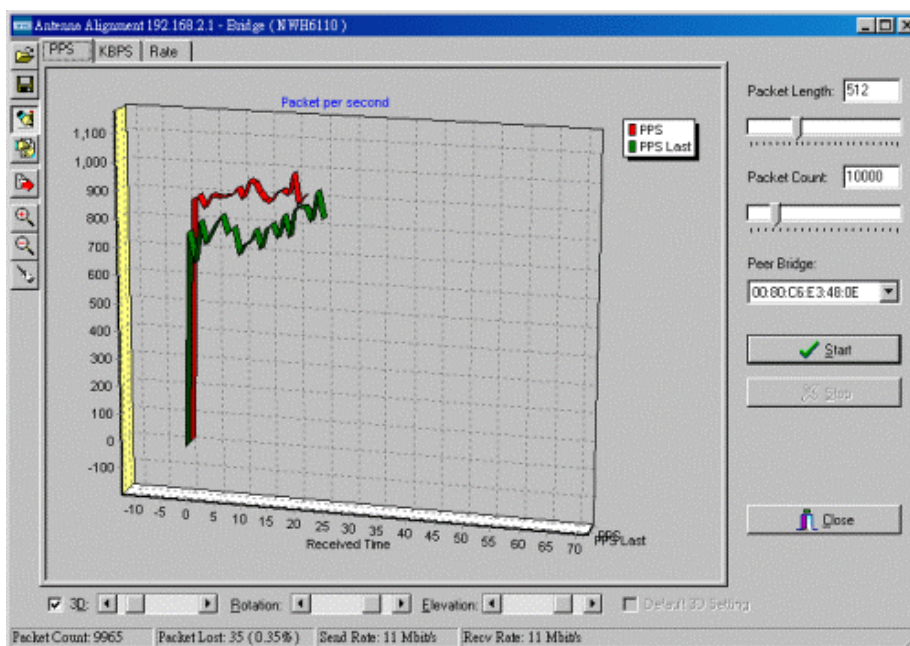


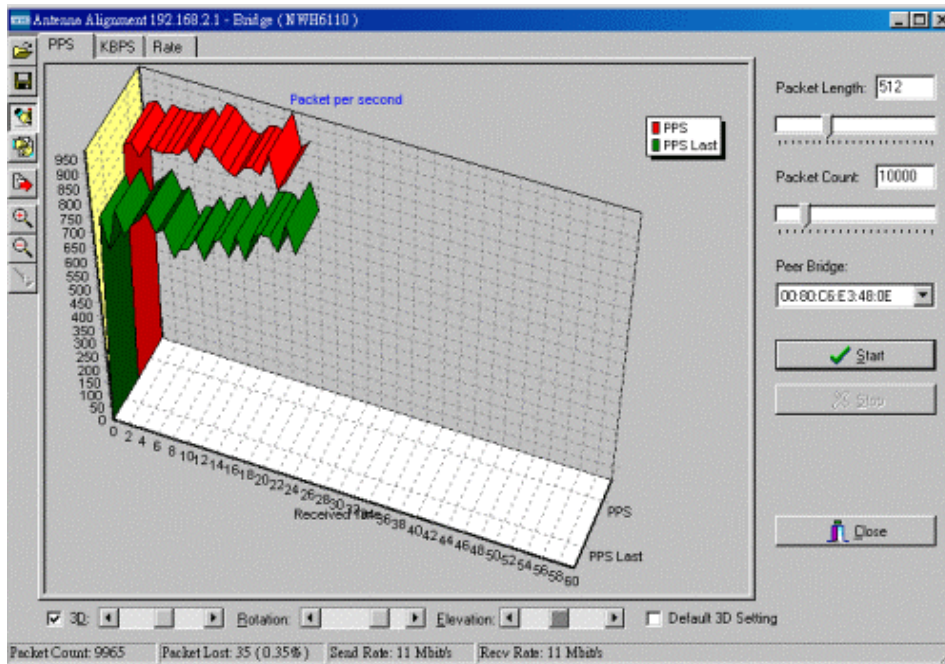
Figure 26. 3D and Zoom In

**3D and zoom out for a smaller view: Check the 3D check box on the bottom-left of the screen, and click the magnifying glass '-' icon.**

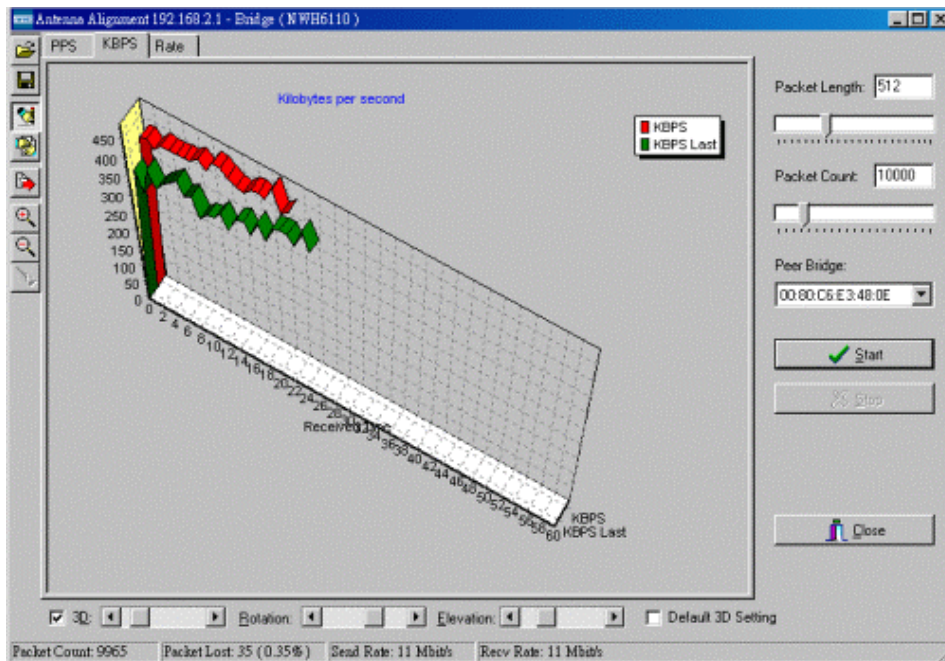


**Figure 27. 3D and Zoom Out**

**3D Rotation and Elevation for X, Y, and Z axis:** Check the 3D box and adjust the sliders on the bottom of the screen (see Figure 28 and Figure 29).



**Figure 28. 3D with Enhanced Effect**



**Figure 29. 3D with Rotation and Elevation**

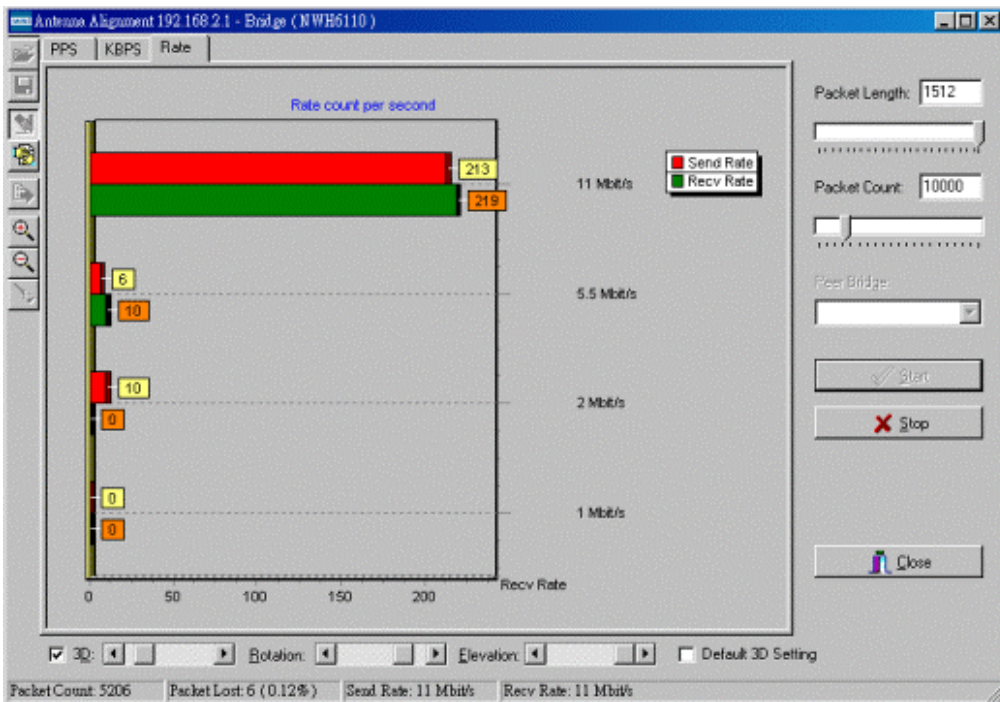


Figure 30. 3D View of Data Rate Distribution

**Step8:** Export the chart to a file or the clipboard. Click the fifth icon on the left side tool bar. The *Export Chart* box will appear (**Step9:**Figure 31)

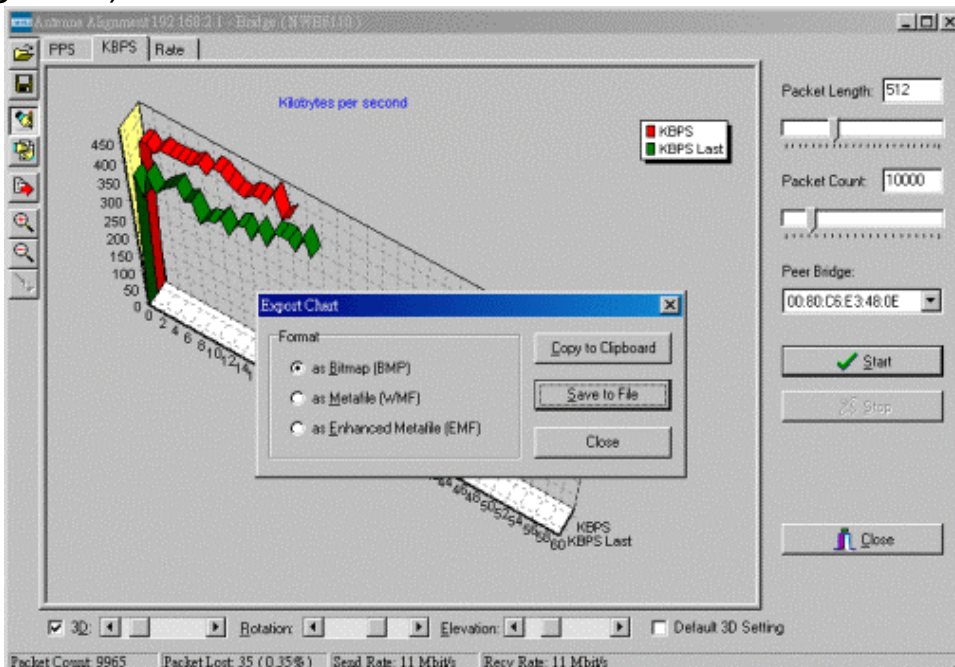


Figure 31. Export Chart

Save to a file or copy to the clipboard as required.

## Monitor

The Monitor tool allows the NWH6110's status, Ethernet statistics, Wireless statistics, and other configuration information to be viewed/monitored.

On the *Hosts View* screen (Figure 32), select a device and click the **Monitor** button on the toolbar or on the popup menu.

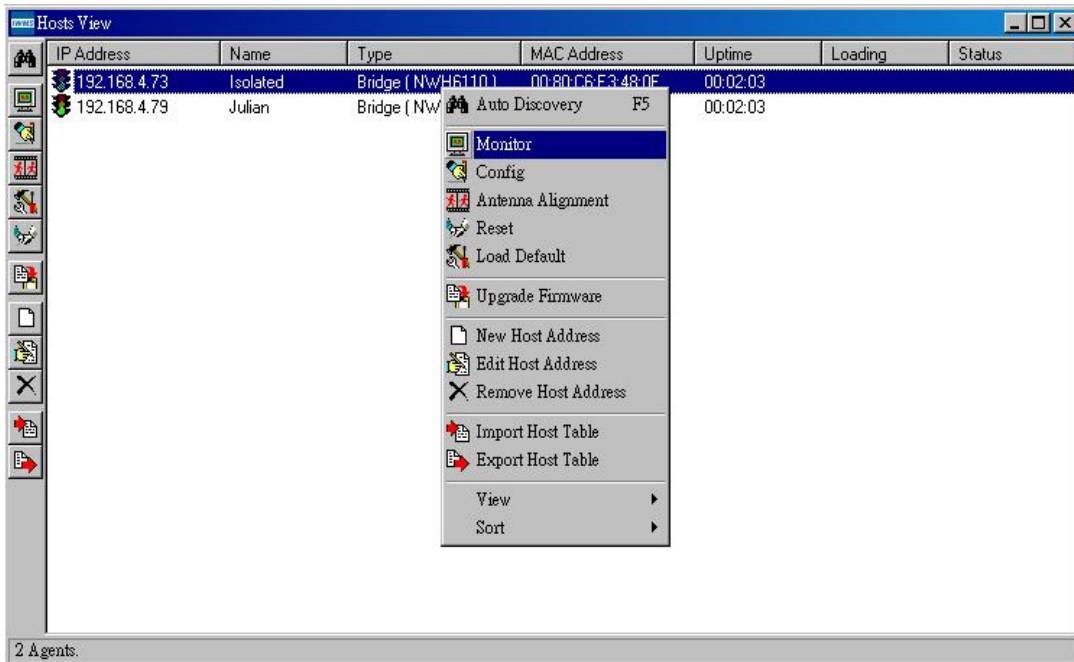


Figure 32. Monitor

The information screen will open (Figure 33).



Figure 33. Summary Information

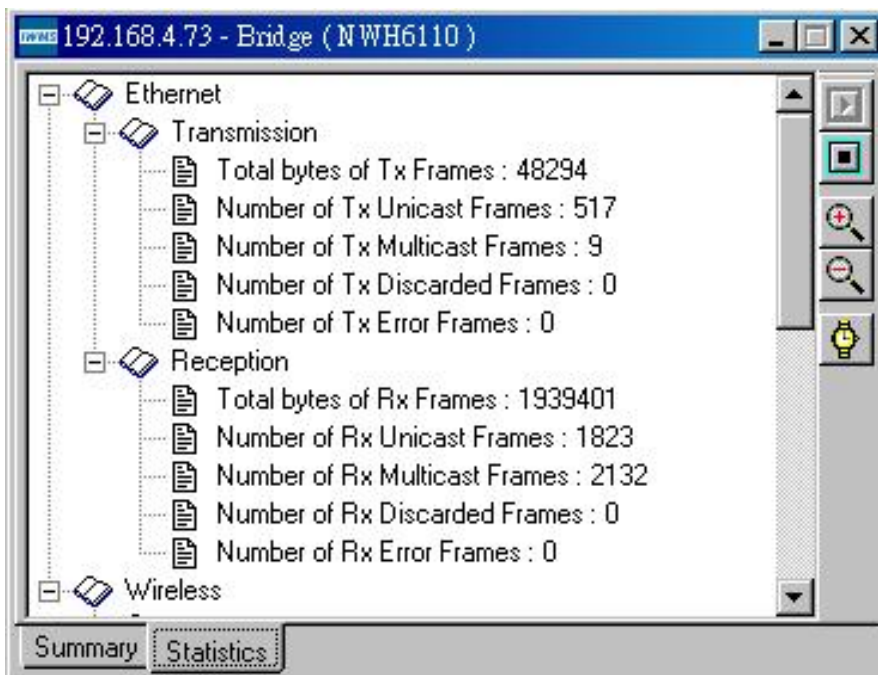
## Summary Information

The information shown is read-only.

|                      |  |
|----------------------|--|
| <b>Device Name</b>   | IWMS system default category name                                  |
| <b>Name</b>          | Human-friendly name assigned by the user for easier identification |
| <b>S/W Version</b>   | Shows the device software version number                           |
| <b>H/W Version</b>   | Shows the device hardware version number                           |
| <b>Channel</b>       | Shows the wireless channel currently in use on the device          |
| <b>Current BSSID</b> | Shows the BSSID of the device (same as the device MAC address)     |

## Statistics

The Statistics page shows both the Ethernet and Wireless transmission/reception statistics. To refresh the statistics, click on the ▶ button to continually refresh information. Click on the ■ button to stop update information.

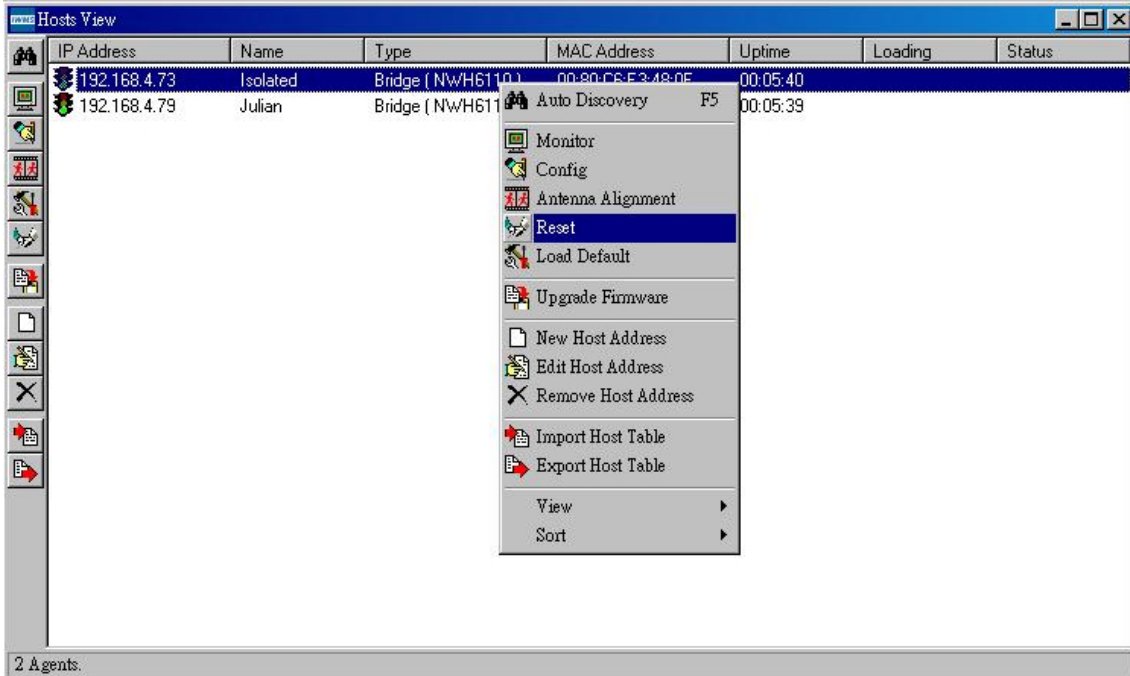


**Figure 34. Statistics**



# Reset

Resetting the NWH6110 will take about 30 seconds (Figure 35).



**Figure 35. Reset-1**

During this period, the IWMS program will not be able to query the NWH6110 via the SNMP protocol and the NWH6110 will not be available to its peer Bridge.



**Figure 36. Reset-2**

If you try to access it, the IWMS program will display a “Timeout! No response from agent...” message.

## Load Default

Click *Load Default* if you want to return the device to its factory default settings.

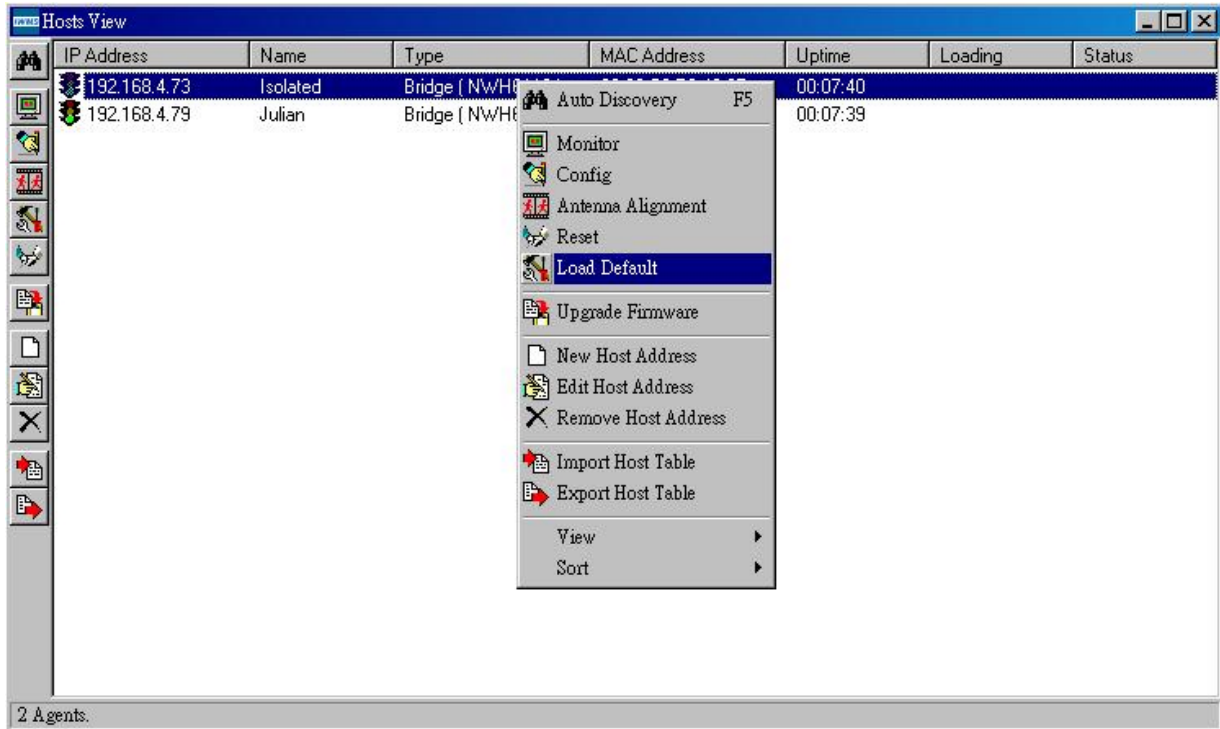


Figure 37. Load Default

A warning dialog box will open ( Figure 38).

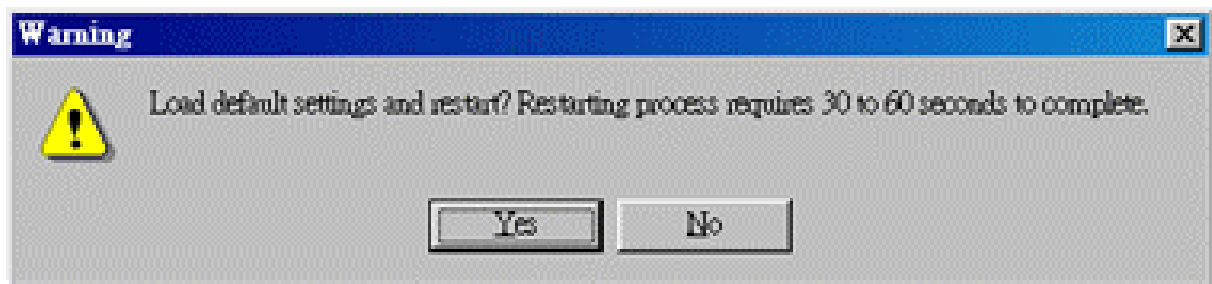


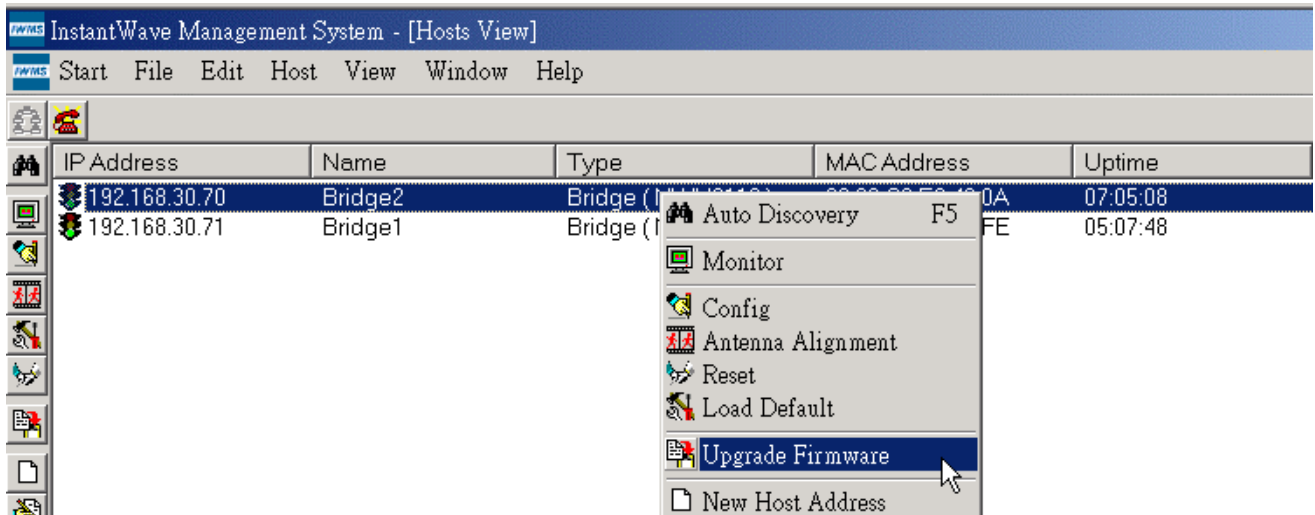
Figure 38. Warning

Click **Yes** to return the selected device to the factory default settings.

Note: The NWH6110 will be reset to complete the 'Load Default' operation.

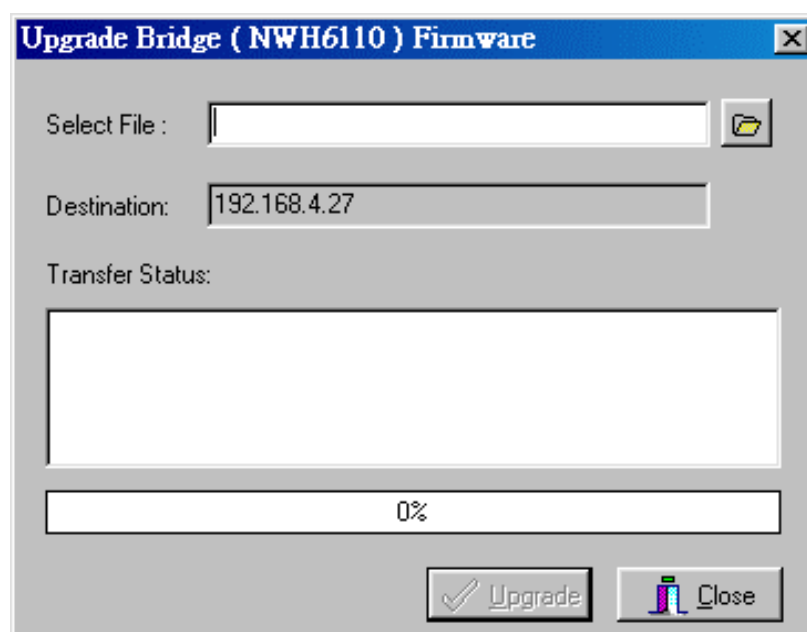
## Upgrade Firmware

The NWH6110's embedded software is burned into the flash ROM. However, an updated NWH6110 code can be installed over your LAN via the IWMS program. Click on *Upgrade Firmware* (Figure 39).



**Figure 39. Upgrade Firmware**

The *Upgrade Firmware* dialog box will open (Figure 40).



**Figure 40. Upgrade Bridge Firmware**

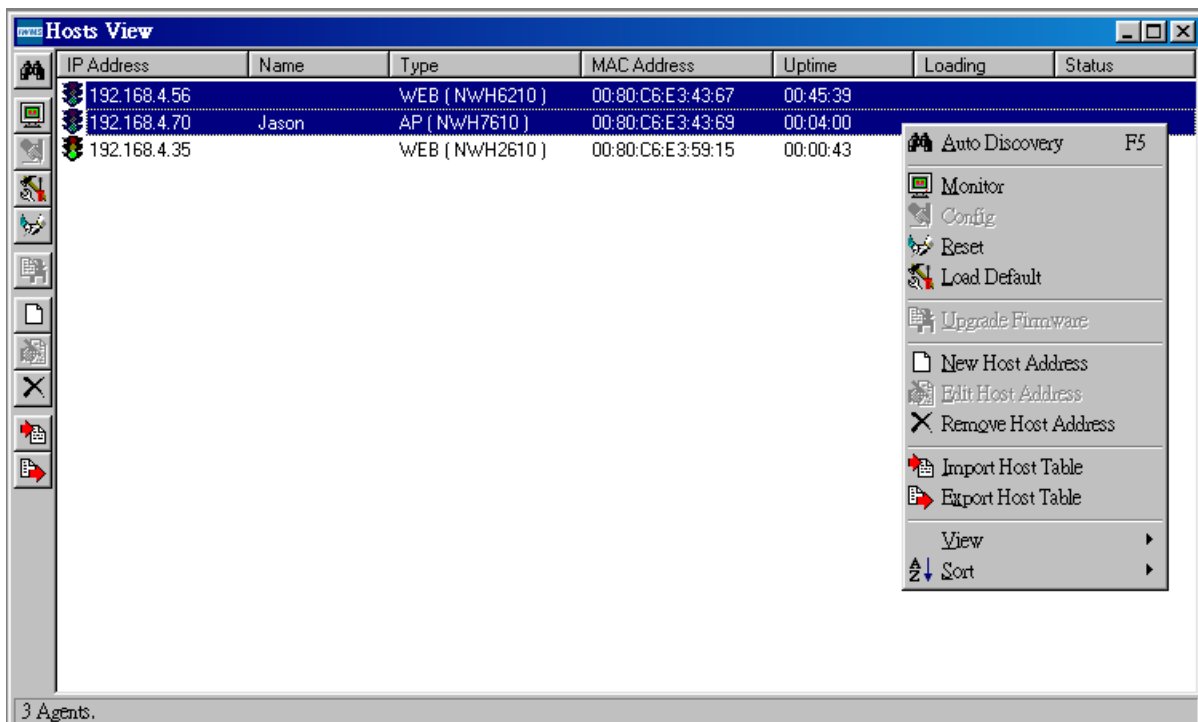
Browse for the file to be uploaded to the NWH6110, or type the file name and path in the *Select File* field.

The *Upgrade* button will then become enabled. Click **Upgrade** to start uploading the file to the NWH6110. The IWMS and the NWH6110's built-in Trivial File Transfer Protocol (TFTP) client/server will load the new executable into the NWH6110's flash ROM area. If the upload activity fails, an error message will be shown on the message box. Once the file transfer is complete, click **Close** to close the window.

## Advanced Management

### Batch Mode Operation

In order to maximize the efficiency of wireless LAN management, the user may apply a batch mode operation to manage the Bridge. First sort the InstantWave devices by device type. Then select the Bridges. Click the right mouse button to open the popup menu and choose the tool you would like to work on the Bridges with.



**Figure 41. Batch Mode Operation List**

## Manage the IWMS Host Table

### **Partition the Network According to the Physical Location**

The Host Table is a powerful tool that helps support a mass deployment of InstantWave products. You may combine several Access Points, Wireless Workgroup Bridges, or Wireless Ethernet Clients together to form a group with a specific Host Table name so that you can divide the wireless network into many small groups.

### **Create a Host Table via Automatic Discovery**

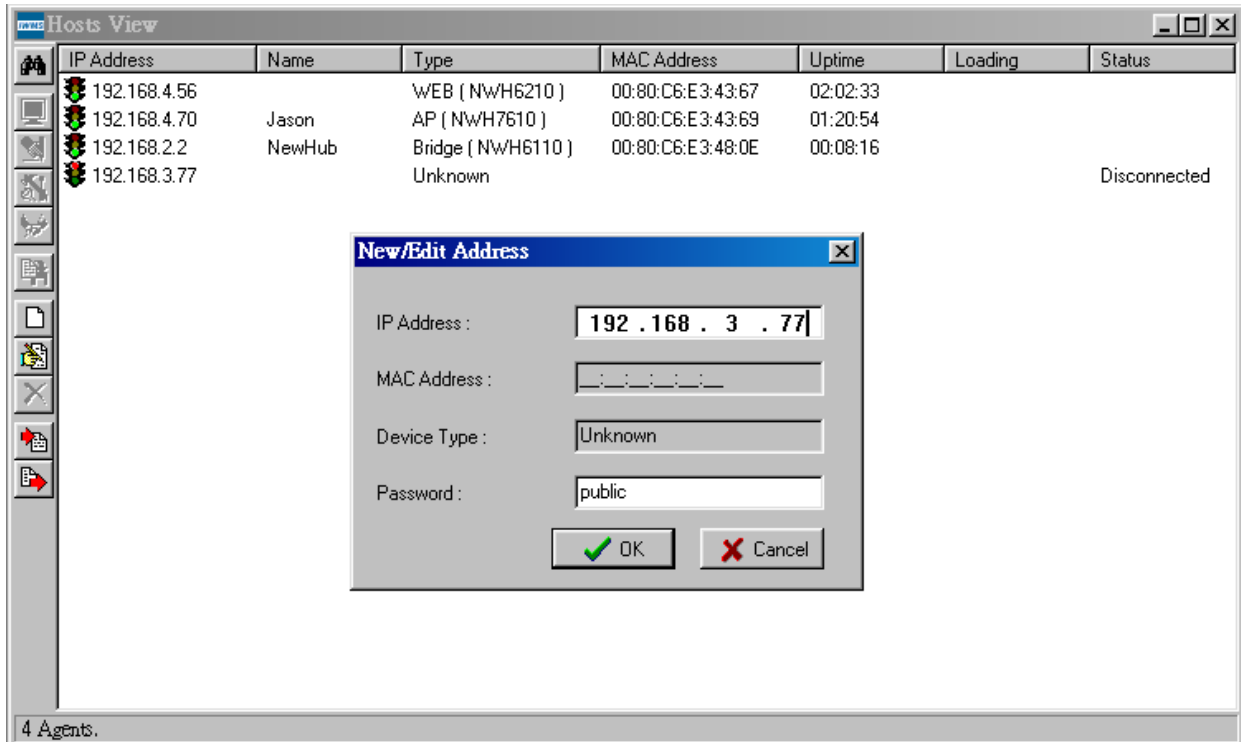
Click the 'Automatic Discovery' tool to find all InstantWave devices. Select the desired Bridges (for example; located in building A). Click the right mouse button to open the popup menu. Choose **Export Host table** to save the Host Table to a file (for convenience you could save the Host table on a network disk for ease of access). **Import Host Table to**

### **Check Device's Availability**

Import the Host Table from a file (for convenience you could retrieve the Host table from a network disk for ease of access). Once the Host Table has been imported, the IWMS will automatically check the availability of Bridges listed in the Host Table. This is an extremely powerful feature as Auto-Discovery can only find InstantWave devices when they are active. The devices listed in the Host Table should be available and provide a service. If they do not exist, the IWMS can report their absence immediately so that the system administrator can take immediate action.

## New/Edit/Delete a Host Address in the Host Table

Click the *Add New Address* button to open the New/Edit Address dialog box (Figure 42). You only need enter an IP address; the IWMS will automatically find the device's hardware address and type.



**Figure 42. New/Edit/Delete a Host Address**

From here you can also select any Bridge on the table. Edit it or delete the device as necessary. This table can be saved and retrieved from the IWMS utility so you don't need to create it again.

## Export a Configuration Profile to a File

The configuration file can be saved to a text file and safely stored. To do this, first click the **Export** button on the *Configuration* screen. Enter a file name for the configuration profile to be saved to (Figure 43). Click **Export** again

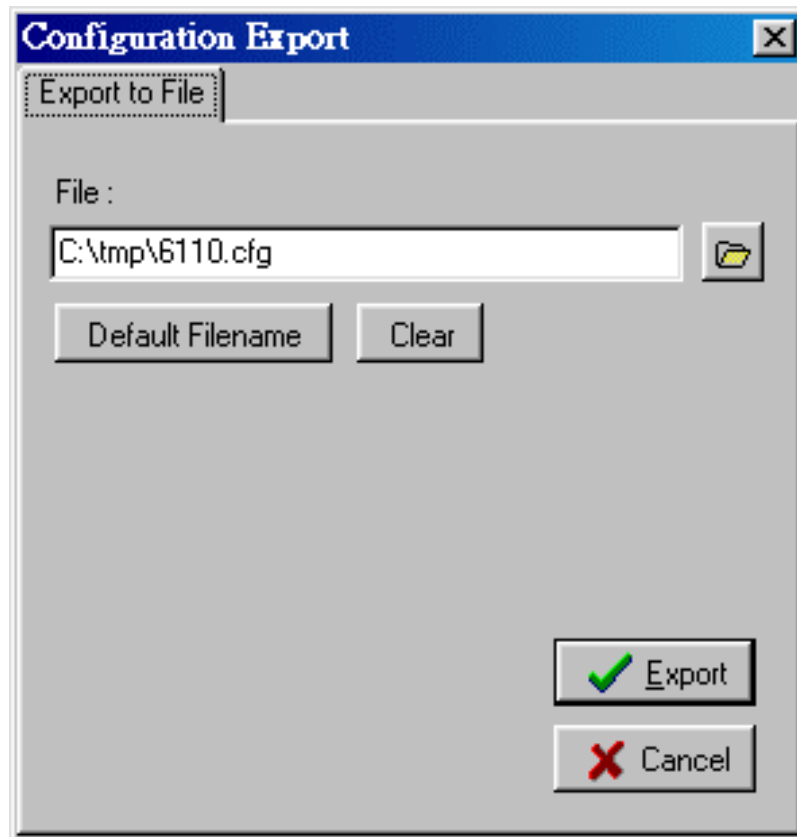


Figure 43. Export a Configuration Profile to a File

## Import a Configuration Profile from a File

A configuration file may be imported to recover an InstantWave device's original settings. To do this, first click the **Import** button on the *Configuration* screen. Enter the file name for the configuration profile to be imported from. Select the section of the network profile to be imported before clicking the **Import** button.



Figure 44. Import a Configuration Profile from a File

### Encryption

The configuration file does not contain the security key settings. The attributes of security keys are externally **write-only** and cannot be saved into the configuration file. See Figure 12, page 65, to setup the security keys manually.



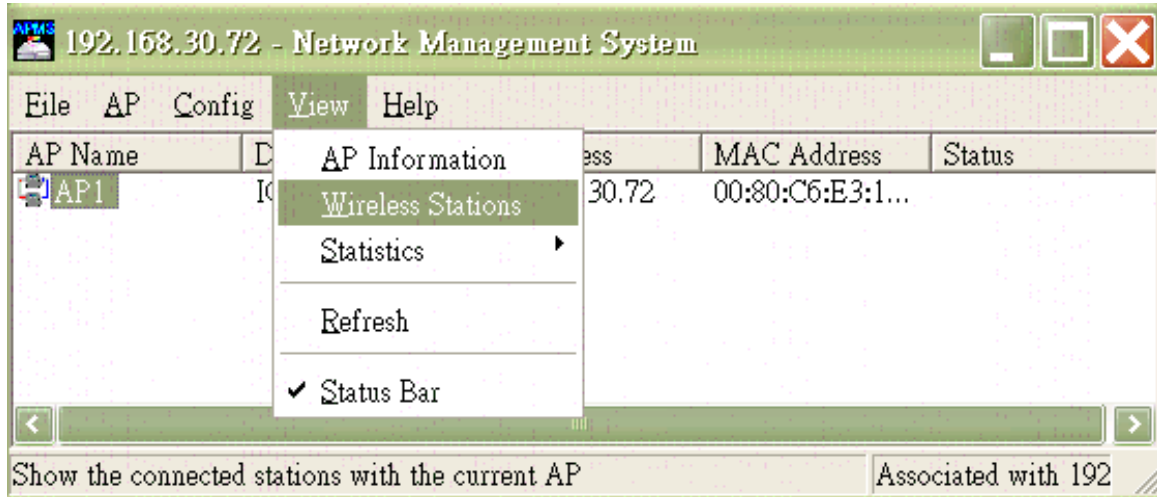
## 7. Troubleshooting for Hardware

AP Management System not only can set the AP (refer to page 19) but also can be a tool for troubleshooting if problems occur between WEC and 7188E/8000.

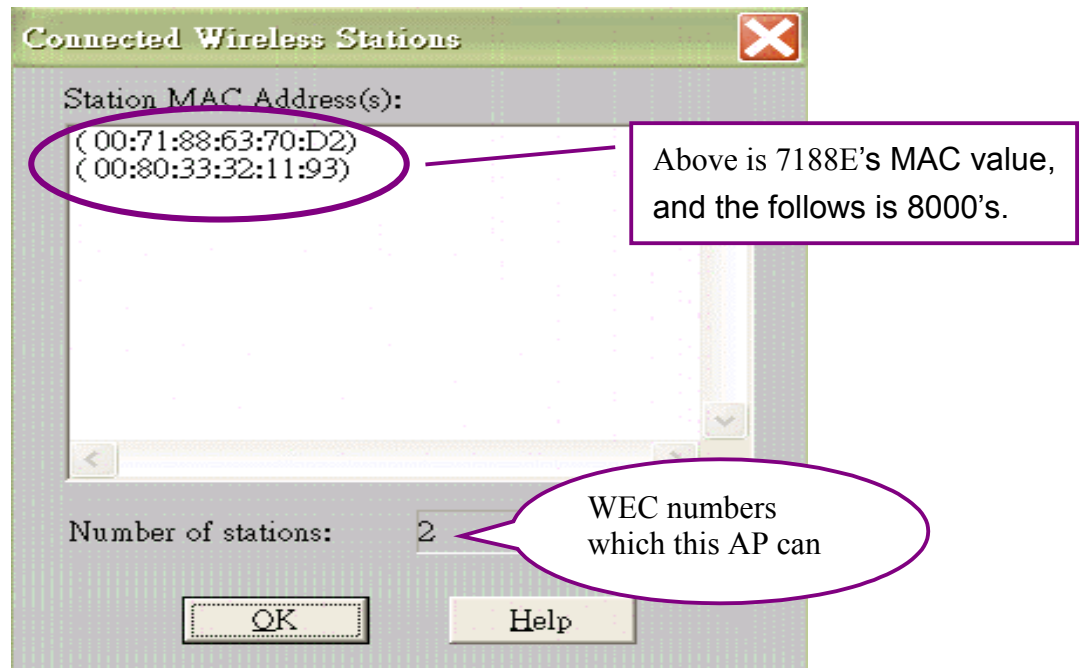
- λ Click on the “Start” menu and “Programs” under Windows system. Find the “Instantwave HighRate AP”. Execute the “AP Management System”.




- λ Connect to AP (refer to page 19 for more details), and click the “**Wireless Stations**” (see following picture):

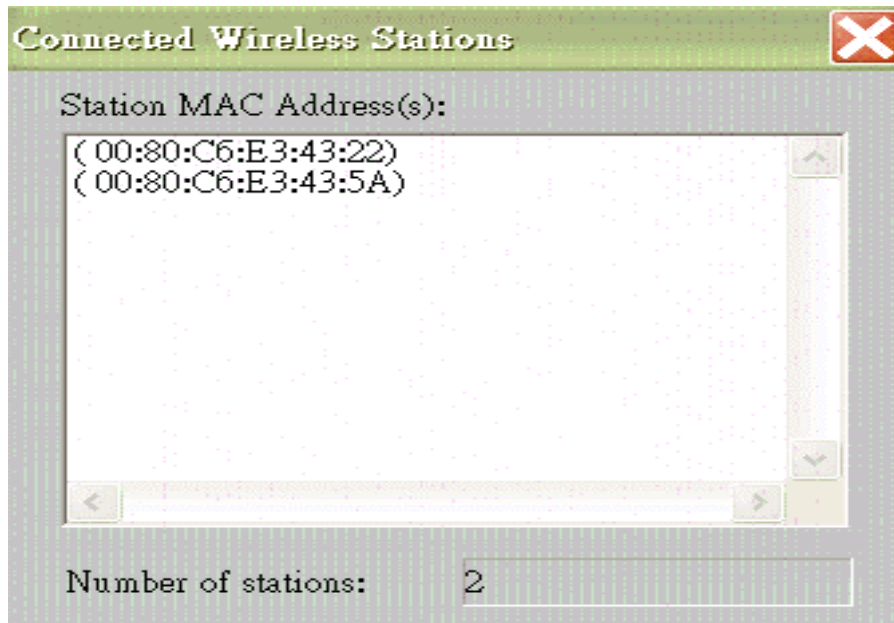



- λ After the above step, the following screen will pop-up. It detects and shows the device's (for example: 7188E/8000) MAC values, and also can detect WEC numbers which this AP can access.

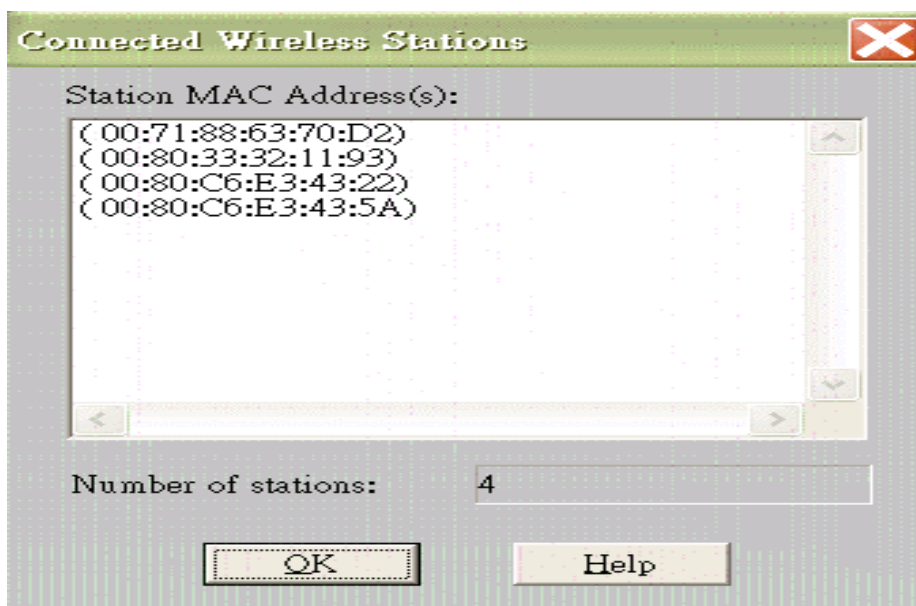


- In the correct situation, it should show the device's MAC values instead of the WECs.

 If the shown values are not device's MAC values, it means that the connection between WEC and device is faulty. You may reset the AP (see page 21), power off then power on the WEC and power off then power on the device.



 When WEC is powered on and powered off, you will find it will show the MAC values of WEC and the device at the same time. See the following picture:



To clear the arp table of PC, refer to the following steps:

Open the DOS box under the windows system, and key-in `arp -d X.X.X.X` (device's IP), or you can also wait several minutes until the PC cleans the arp table automatically.



If it shows nothing, it means the connection between AP and WEC is faulty. Please check the following items:

λ **Cable**

Use normal a RJ-45 cable to connect the 7188E/8000 series and WEC. The WEC doesn't support cross RJ-45 cable.

λ **WEC configuration**

The WEC configuration, such as IP, SSID...etc, is very important for WEC network. Check the configuration with the WEC Utility, especially the SSID and your IP settings. Refer to SEC 4.2 for more information.

# Appendix

This appendix lists the channels supported by the world's regulation domains.

The channel numbers, channel center frequencies, and regulation domains are shown in the table.

| <b>Channel Number</b> | <b>Center Frequency (MHz)</b> | <b>FCC/ Canada</b> | <b>ETSI</b> | <b>Spain</b> | <b>France</b> | <b>Japan</b> |
|-----------------------|-------------------------------|--------------------|-------------|--------------|---------------|--------------|
| 1                     | 2412                          | ○                  | ○           |              |               | ○            |
| 2                     | 2417                          | ○                  | ○           |              |               | ○            |
| 3                     | 2422                          | ○                  | ○           |              |               | ○            |
| 4                     | 2427                          | ○                  | ○           |              |               | ○            |
| 5                     | 2432                          | ○                  | ○           |              |               | ○            |
| 6                     | 2437                          | ○                  | ○           |              |               | ○            |
| 7                     | 2442                          | ○                  | ○           |              |               | ○            |
| 8                     | 2447                          | ○                  | ○           |              |               | ○            |
| 9                     | 2452                          | ○                  | ○           |              |               | ○            |
| 10                    | 2457                          | ○                  | ○           | ○            | ○             | ○            |
| 11                    | 2462                          | ○                  | ○           | ○            | ○             | ○            |
| 12                    | 2467                          |                    | ○           |              | ○             | ○            |
| 13                    | 2472                          |                    | ○           |              | ○             | ○            |
| 14                    | 2484                          |                    |             |              |               | ○            |

# Glossary

-- 0~9 --

## **10BASE-T –**

IEEE 802.3 standard for a twisted-pair Ethernet network. 10 Mbps transmission rate over baseband using unshielded, twisted-pair cable.

-- A --

## **Access Point (AP) –**

A wireless LAN transceiver that acts as a center point of an all-wireless network or as a connection point between wireless and wired networks.

## **Ad-Hoc Mode –**

A client setting that provides independent peer-to-peer connectivity in a wireless LAN. An alternative setup is where PCs communicate with each other through an AP. See Infrastructure Mode.

## **Ad Hoc Network –**

A wireless network composed only of network clients in peer-to-peer mode (without access points).

## **Antenna –**

A device for transmitting or receiving a radio frequency (RF). Antennas are designed for specific and relatively tightly defined frequencies and are quite varied in design. An antenna designed for 2.4-GHz 802.11b devices will not work with 2.5-GHz devices.

## **Antenna Gain –**

The measure of antenna performance relative to a theoretical antenna called an isotropic antenna. Certain antenna designs feature higher performance relative to beamwidth and frequencies.

## **Address Resolution Protocol (ARP) –**

TCP/IP networks use 32-bit Internet addresses while Ethernet networks use 48-bit Ethernet addresses: ARP translates an IP address to an Ethernet address (or MAC address) so that TCP/IP protocols can operate over an Ethernet network.

-- B --

**Baseband –**

A transmission system in which the signals are broadcast one at a time at their original frequency (not modulated).

**Baud rate –**

The rate at which data are transferred.

-- C --

**Client/Server –**

A networking system in which one or more file servers (Server) provide services; such as network management, application and centralized data storage for workstations (Clients).

**Channel –**

A communications path wide enough to permit a single RF transmission.

**Carrier Sense Multiple Access with Collision Detection**

**(CSMA/CD) –**

The LAN access method used in Ethernet. When a device wants to gain access to the network, it checks to see if the network is free. If the network is not free, the device waits a random amount of time before retrying. If the network is free and two devices access the line at exactly the same time, their signals collide. When the collision is detected, they both back off and wait a random amount of time before retrying.

-- D --

**dB –**

Decibel – a measure of relative power. For example, it may be used to describe the power of antenna 1, relative to antenna 2 and equal to  $0.1 * \log ((\text{power of antenna 1})/(\text{power of antenna 2}))$ .

**dBi –**

Measure of antenna gain – referenced to the zero dB gain of an isotropic radiator

**dBm –**

Absolute measure of signal power, where zero dBm equals a milliwatt.

**Dipole –**

A type of low-gain (2.2 dBi) antenna consisting of two (often internal) elements.

**Direct Sequence Spread Spectrum (DSSS) –**

A type of spread spectrum that spreads its signal continuously over a wide frequency band.

**Directional Antenna –**

An antenna that concentrates transmission power into a direction such that coverage distance increases at the expense of coverage angle. Directional antenna types include yagi, patch, and parabolic dish.

**Dynamic Host Configuration Protocol (DHCP) –**

A protocol available with many operating systems that automatically issues IP addresses within a specified range to devices on a network. The device retains the assigned address for a specific administrator-defined period.

-- E --

**Encryption –**

The application of a specific algorithm to data so as to alter the appearance of the data. This alteration of the data will appear incomprehensible to those who are not authorized to see the information.

**EIA –**

Electronic Industry Association (formerly RMA or RETMA). An association of manufacturers and users that establishes standards and publishes test methodologies.

**Ethernet –**

A network protocol invented by Xerox Corporation and developed jointly by Xerox, Intel and Digital Equipment Corporation. Ethernet networks use CSMA/CD and run over a variety of cable types at 10 Mbps (megabits per second).

-- F --

**FCC –**

Federal Communications Commission. US government agency (established 1934) that regulates communications via radio, television, wire, satellite, and cable. For more information, see [www.fcc.gov](http://www.fcc.gov).



## **Frequency Bands –**

A range of frequencies.

-- G --

## **Gateway –**

A node on a network that serves as a common access point for other nodes. The Internet addresses for all nodes accessed through a particular gateway have the same network portion but different node portions. For example, a node on Internet network 192.1.2 must go through a gateway to communicate with a node on Internet network 192.3.4.

## **Gain –**

The ratio of the output amplitude of a signal to the input amplitude of a signal. This ratio is typically expressed in decibels (dB).

Gigahertz (GHz) –

One billion cycles per second (hertz). Measurement of electromagnetic energy and transmission rates.

## **GSM (Global Standard for Mobile) –**

A digital communication technology used by some carriers to provide PCS service. Other technologies used are CDMA and TDMA.

-- H --

## **Hertz (Hz) Frequency –**

The international unit for measuring frequency, equivalent to the older unit of cycles per second. One megahertz (MHz) is one million hertz. One gigahertz (GHz) is one billion hertz. The standard U.S. electrical power frequency is 60 Hz, the AM broadcast radio frequency band is 0.551.6 MHz, the FM broadcast radio frequency band is 88108 MHz, and wireless LANs operate at 2.4 GHz.

## **Hub –**

A device at the center of a star topology network. Hubs can be active (where they repeat signals sent to them) or passive (where they do not repeat but merely split signals sent through them). Hub may refer to a repeater, bridge, switch, router, or any combination of these.

-- I --

## **IEEE 802.11b –**

A revision to the IEEE standard for direct sequence wireless LANs. Most 802.11b products have data rates of up to 11 Mbps, even though the standard does not specify the techniques for achieving these data rates.

### **IEEE 802.3 –**

The IEEE standards committee defining Ethernet networks.

### **Infrastructure Mode –**

A client setting that provides connectivity to an AP. As compared to Ad-Hoc Mode, where PCs or other client devices communicate directly with each other, clients set in Infrastructure Mode all pass data through a central AP. The AP not only mediates wireless network traffic in the immediate neighborhood, but also provides communication with the wired network. See AD-Hoc and AP.

### **Infrastructure Network –**

A wireless network centered about an access point. In this environment, the access point not only provides communication with the wired network but also mediates wireless network traffic in the immediate neighborhood.

### **Internet –**

A global network of networks used to exchange information using the TCP/IP protocol. It allows for electronic mail and the accessing and retrieval of information from remote sources.

-- L --

### **Local Area Network (LAN) –**

A network interconnecting devices in the same office, floor or building, or areas inside buildings with areas just outside.

-- M --

### **Megabits per second (Mbps) –**

One million bits per second.

### **Media Access Control (MAC) –**

In a wireless LAN (WLAN) network card, the MAC is radio controller protocol. It corresponds to the ISO Network Model Layer 2 data link layer. The IEEE 802.11 standard specifies the MAC protocol for medium sharing, packet formats and addressing, and error detection.

### **Management Information Base (MIB) –**

A collection of network operational information residing in a virtual store that may be accessed, typically through a Simple Network Management Protocol (SNMP)-compliant system, for analysis.

**Modem (Modulator/Demodulator) –**

Devices that convert digital and analog signals. Modems allow computer data (digital) to be transmitted over voice-grade telephone lines (analog).

-- O --

**Ohm –**

The electrical unit of resistance. The value of resistance through which a potential of one volt will maintain a current of one ampere.

**Omni-directional Antenna –**

An antenna that provides a 360-degree transmission pattern. This type of antenna is used when coverage in all directions is required.

**Open Systems Interconnection (OSI) model –**

A seven-layer protocol model developed to facilitate interconnection of disparate computer networks.

-- R --

**Radio Frequency (RF) –**

A generic term for radio-based technology.

**Range –**

A linear measure of the distance that a transmitter can send a signal.

**Receiver Sensitivity –**

A measurement of the weakest signal a receiver can receive and still correctly translate it into data.

**Repeater –**

A device used to extend cabling distances by regenerating signals.

**RJ-45 –**

Standard connectors used for unshielded twisted-pair cable.

**Router –**

On the Internet, a router is a device or, in some cases, software in a computer, that determines the next network point to which a packet should be forwarded toward its destination. The router is connected to at least two networks and decides which way to send each information packet based on its current understanding of the state the networks it is connected to.

## **RS-232C –**

RS-232C is a standard for serial transmission of data between computers and other devices. It describes both the physical interface and the transmission protocol.

## **RX –**

RX is an abbreviation for "receiver" or "receive".

## **-- S --**

## **Simple Network Management Protocol (SNMP) –**

The network management protocol that defines the transfer of LAN operational data between Management Information Bases (MIBs).

## **Spread Spectrum –**

A radio transmission technology that "spreads" the user information over a much wider bandwidth than otherwise required in order to gain benefits such as improved interference tolerance and unlicensed operation.

## **Wireless Service Set Identifier (SSID) –**

Network security name or ID used by wireless LAN hardware. The wireless devices must be configured for the same identifier in order to communicate. May also be referred to as "Network Name" or "Domain" by some wireless LAN hardware vendors.

## **Switch –**

A switch is a multi-port bridge. Each port on the switch is in its own collision domain.

## **-- T --**

## **Transmission control protocol/Internet protocol(TCP/IP) –**

A communications protocol developed under contract from the U.S. Department of Defense to network dissimilar systems. Invented by Vinton Cerf and Bob Kahn, this de facto Unix standard is the protocol of the Internet and has become the global standard for communications.

**TCP** provides transport functions, which ensures that the total amount of bytes sent is received correctly at the other end. UDP is an alternate transport that does not guarantee delivery. It is widely used for real-time voice and video transmissions where erroneous packets are not retransmitted.

**IP** provides the routing mechanism. TCP/IP is a routable protocol, which

means that all messages contain not only the address of the destination station, but the address of a destination network. This allows TCP/IP messages to be sent to multiple networks within an organization or around the world, hence its use in the worldwide Internet. Every client and server in a TCP/IP network requires an IP address, which is either permanently assigned or dynamically assigned at startup.

### **TIA –**

Telecommunications Industry Association. Body which authored the TIA/EIA 568-A "Commercial Building Telecommunications Wiring Standard" in conjunction with EIA.

### **TX –**

TX is an abbreviation for "transmitter" or "transmit".

### **-- U--**

### **Unshielded Twisted Pair (UTP) –**

Twisted pair cabling that includes no shielding. UTP most often refers to the 100 ohm Category 3, 4, & 5 cables specified in the TIA/EIA 568-A standard.

### **User Datagram Protocol (UDP) –**

A transport layer in TCP/IP networks. UDP is a low-overhead protocol that uses IP to deliver its packets.

### **-- W --**

### **Wide-Area Network (WAN) –**

A wide-area network connects local-area networks together. Typical WAN interfaces include plain old telephone service (POTS) lines, digital subscriber lines (DSL), cable, T1/T3, and ISDN.

### **Wireless Access Protocol (WAP) –**

A language used for writing Web pages that uses far less overhead, making it more preferable for wireless access to the Internet by personal digital assistants (PDAs) and Web-enabled cellular phones.

### **Wired Equivalent Privacy (WEP) –**

Optional security mechanism defined within the 802.11 standard designed to make the link integrity of the wireless medium equal to that of a cable.

**Wi-Fi –**

Wireless Fidelity; Wireless Ethernet Compatibility Alliance's (WECA) brand identity for the IEEE 802.11b standard; WECA certification that ensures products' compatibility.

**Wireless –**

Describes any computing device that can access a network without a wired connection.

**Wireless LAN –**

It uses radio frequency technology to transmit network messages through the air for relatively short distances, like across an office building or college campus. A wireless LAN can serve as a replacement for or extension to a wired LAN.