NOKIA

Nokia RoofTop™ Wireless Router (R240/ R240A) Hardware Installation Guide

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IMPORTANT NOTE TO USERS

This device has been certified as an intentional radiator (transmitter) which requires that it is installed and/or moved by a trained professional.

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COMPLIANCE STATEMENTS
This hardware complies with the standards listed in this section.

Compliance in the United States

Emission Standards

UNINTENTIONAL EMISSIONS: FCC Part 15 CLASS B
INTENTIONAL EMISSIONS: FCC Part 15, Section 15.247

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

—Reorient or locate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

Any modifications made to the unit, unless expressly approved by Nokia could void the user's authority to operate the equipment.

FCC Rules and Regulations - Part 68

This equipment complies with Part 68 of the FCC Rules. The FCC Part 68 Label is located on the rear panel of the Network/ Power Unit. This label contains, among other information, the FCC Registration Number and Ringer Equivalency Number (REN) for this equipment. You must, upon request, provide this information to your telephone company. The REN is useful to determine the quantity of devices you may connect to your telephone line and still have all those devices ring when your telephone number is called. In most but not all areas, the sum of the RENs of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should contact your local telephone company to determine the maximum REN for your calling area.

Connection to the telephone network should be made by using standard modular telephone jacks, type RJ11. The plug and/or jacks used must comply with FCC Part 68 rules. If your telephone equipment causes harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance, but if advance notice is not practical, you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC.

Your telephone company may make changes in its facilities, equipment, operations or procedures that could affect the proper functioning of your equipment, If they do, you will be notified' in advance to give you an opportunity to maintain uninterrupted telephone service.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to tariffs.

If trouble is experienced with this unit, for repair or warranty information, please contact customer service at the address and phone listed below. If the equipment is causing harm to the network, the telephone company may request that you disconnect the equipment until the problem is resolved.

DO NOT DISASSEMBLE THIS EQUIPMENT. It does not contain any user serviceable components.

Compliance in Canada

Canadian compliance (Industry Canada) When tested with at least one intended host: This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the interference-causing equipment entitled "Digital Apparatus", ICES-003 of the Canadian Department of Communications.

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Class B prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques", NMB-003 édictée par le Ministre Canadien des Communications.

Notice: The Industry Canada (IC) label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical document(s). The department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations

made by a user to this equipment, or equipment malfunctions, may give the telephone communications company cause to request the user to disconnect the equipment.

The installer should ensure that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

Notice: The Ringer Equivalent Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exeed 5.

REN: See the equipment for REN information.

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CHAPTER 1

About this document

1.1 Introduction

This document explains the procedures necessary to install the Nokia Rooftop Wireless Router. It also covers important information about the router, from selecting its installation site to connecting it to the computer.

This chapter gives you an overview of the installation process.

1.1.1 Components of the Wireless Router

The Nokia Rooftop Wireless Router consists of the following components:

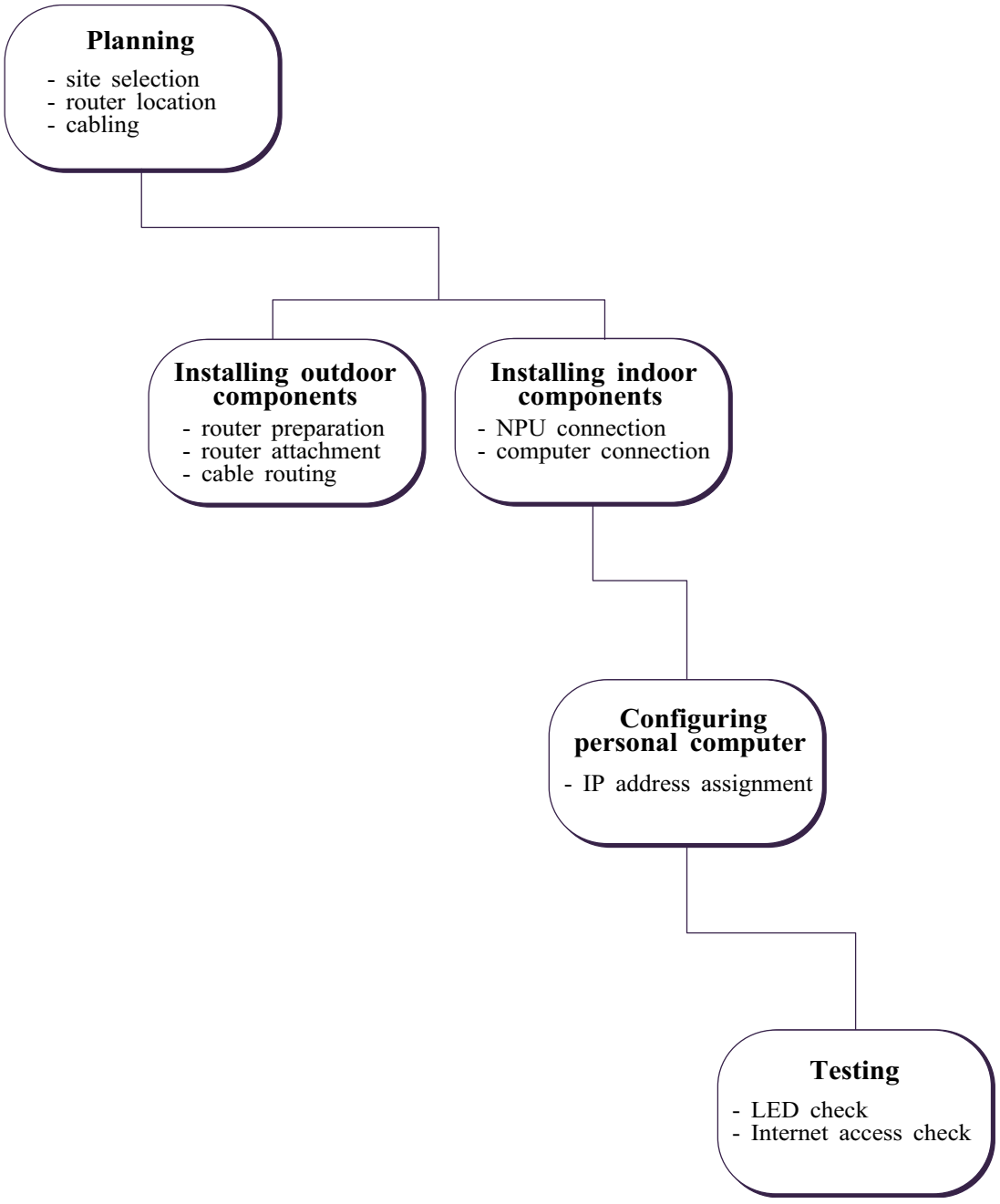
- a router with integral antenna
- router mounting hardware
- a Network/Power Unit (NPU)

- a multiwire cable which is necessary for connection between the router and the NPU. The cable is not included in the package because its length must be specified. Nokia provides numerous lengths of cable.

1.1.2 Overview of the installation

The following flowchart shows an overview of the tasks you will complete during installation. Follow the chart sequence and the instructions provided in the chapters to complete the installation.

NOTE: The Nokia RoofTop Wireless Router has to be preconfigured by an Internet Service Provider prior to installation. If the router has not been preconfigured, it will not work properly.


Planning
- site selection
- router location
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Installing outdoor components
- router preparation
- router attachment
- cable routing
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- NPU connection
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Configuring personal computer
- IP address assignment
Testing
- LED check
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CHAPTER 2

Safety issues

2.1 Introduction

When installing the Nokia Wireless Router, it is important that the unit is not installed where it could be damaged by the environment or pose a hazard to the user. Be aware of the safety regulations described in this chapter.

This chapter lists safety considerations you should understand before you move on to installation.

2.1.1 Hazard warnings

- **Environment** - The Network/Power Unit (NPU) is an electrical device. Place it away from all heat sources such as radiators, heat registers, stoves, amplifiers and other heat producing appliances. It should also be kept out of cold, dusty, wet, or high humidity areas.
- **Fire or electric shock** - Keep the NPU away from moisture or water-related environments such as sinks, bathtubs, laundry areas, spas, swimming pools, or wet basements. Take care not to spill any liquid on the unit.
- **Installation** - Outdoor antennas and their supporting masts, wires, and cables are electrical conductors. Use extreme caution when installing antennas in areas with overhead power lines. Contact with high-voltage electrical wires can cause serious injury or death.
- **Medical devices** - If you have a pacemaker do not go close to the router on the roof. If you have any discomfort, switch off the router immediately.
- **Lightning** - Routers are elevated metal objects and they attract lightning and are subject to voltage surges and built-up static charges. Make sure the router and antenna are attached to a grounding wire to to provide a safe path to the ground.
- **Interference** - The router can cause electrical interference. Do not install the router near medical equipment or in a hospital or medical environment without first ensuring that there will be no interference with such equipment.
- **Co-located antennas** - Up to six sector antennas or three omni-directional antennas may be co-located provided that they are permanently mounted on a rooftop or antenna tower where access to the general public is restricted. In order to comply with FCC RF safety regulations, antennas shall be placed at least 1 meter (3 feet) apart. The warning sticker provided with the equipment has to be attached on the co-located devices.
- **RF Exposure** - The system shall be permanently mounted on a rooftop or antenna tower. To comply with FCC RF safety requirements , always disconnect power from the wireless router whenever working within 20cm of the antenna. When the RF adapter is used, only Nokia approved antennas may be used.

CHAPTER 3

Site survey

3.1 Introduction

The goals of a site survey are to determine the feasibility of RF links at each site and to determine the antenna and cable requirements. While a survey is performed by the Internet Service Provider (ISP) prior to installation, it is helpful to understand how a site and antenna are selected.

This chapter discusses issues that are considered while choosing a site and type of antenna.

3.2 Determining the RF links to other sites

The feasibility of an RF link can be estimated based on:

- Distances between potential sites
- Line of sight for RF paths
- Antenna RF gains
- Cable and connector losses

If the site has good links to other sites, it can be used as a forwarding system for other wireless routers in the network. If the router can link to one other router, it will be able to access the internet, but it will be unable to forward signals to other wireless routers. If it can link to more than one router, it can share many more signals in many directions. Nokia recommends that each router has three hops or less to the AirHead.

Determine the RF path between the antenna at the site and the antennas at other, adjacent sites. For a directional link with a single antenna, there is only one RF path. For an omnidirectional antenna, determine all RF paths. The RF path can be determined by knowing the relative bearing from the current site to adjacent sites.

3.3 Surveying potential sites

Wherever possible, find a site that is unobstructed for some distance. This ensures maximum connectivity and allows the system to forward “packets” of information for existing and future needs.

3.3.1 Line of sight analysis

In order for the Nokia Wireless Router network to operate correctly, there must be line of sight paths for each link.

Determine that there is a visual line of sight and a radio line of sight between the router to be installed and its neighboring routers.

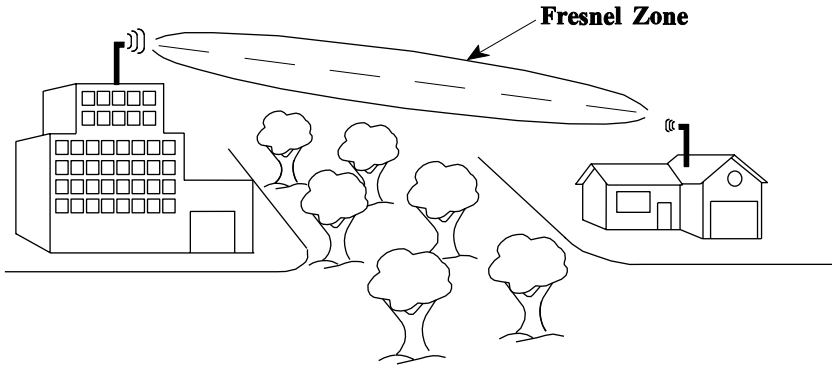
It is recommended that each router has a line of sight to at least **2** other routers to enable several options to route internet traffic to the AirHead.

Visual line of sight

Visual line of sight exists when an imaginary straight line can be drawn between two antennas without passing through any physical obstructions. Verifying visual line of sight is the first step in planning the Nokia Wireless Router System installation. Observation points must be high enough to allow the viewer to see over ground based obstructions.

Radio line of sight

A radio wave is not like a laser with a narrow, pointed beam. RF waves fan out from a single source and are diffracted or absorbed by objects that are near the visual line of sight. This area is called the Fresnel Zone. Clear radio line of sight exists when there are no physical obstructions in the Fresnel Zone. It is therefore essential that there is a clear radio path by raising the antenna as high as possible and away from objects near the radio path.



NOTE: An example of the Fresnel Zone dimensions is, for a one quarter mile link, the Fresnel Zone is approximately $7^{1}/_{2}$ feet above and below the line of site. Therefore the height of the antenna must clear the Fresnel Zone. For very short distances, wooden structures and non metallic objects have little effect on the RF signal. For long distance paths, there should be no obstacles close to the RF path.

To determine line of sight

1. Access the rooftop using a safe ladder, either tied or held by another surveyor.
2. Scan the other rooftops in the location. Ensure line of sight ensuring that other routers can be seen from the selected vantage point.

NOTE: The router being installed may be the first in the area. If this is the case, ensure that the other rooftops in the area can be seen from the selected vantage point.

3. If it is not possible to see other routers/rooftops, it may be necessary to install the router on an adjoining tall structure, or to install a mast.

3.4 Selecting the antenna type

The Nokia Rooftop Wireless Router is supplied with an omnidirectional antenna. For very specific cases, however, it may be necessary to use a directional antenna. The following explanations describe the two types of antenna and the special circumstances in which the directional antenna may be used.

3.4.1 Omnidirectional antennas

Omnidirectional antennas radiate their RF pattern spherically, providing coverage in all directions. These are best suited for multipoint links and are used at all forwarding sites.

Omnidirectional antennas are the preferred solution to most installations.

Omnidirectional Antenna - RF Radiation Pattern

3.4.2 Directional antennas

Directional antennas focus the RF beam in narrow patterns in one direction and provide communication over greater distances than omnidirectional antennas, but they are limited in the areas they cover.

Directional antennas are useful for long distance or point-to-point contacts, but prevent future growth of the network, by preventing the wireless router from repeating signals to other units. They should be used only when an omnidirectional antenna will not work.

Directional antennas - radiation pattern side view

In Nokia Wireless Router Networks, use a directional antenna only if:

- There are numerous obstructions in the area
- The nearest router is a considerable distance away
- The router is in a location where it does not need to route traffic for other subscribers and itself requires a maximum link distance to the neighboring router.
- There are more than two AirHeads co-located at one site

CHAPTER 4

Planning the installation

4.1 Introduction

Before you begin the installation, spend some time planning the process.You need to consider your outdoor environment and your indoor computer space. This chapter offers suggestions for your planning.

4.2 Planning

Consider the following things in your planning:

- Make sure you have the necessary tools.
- Find a safe location for the router, away from power lines and near a ground.
- Find a safe and optimal location for the NPU, either near the computer if you are connecting to only one system, or in an out-of-the-way place if you are connecting several systems.
- Plan the cable routing to minimize the length of cable and environmental problems. (See chapter 2, “Safety issues” for more information).
- Find a location for the grounding.
- Review the rest of this guide.
- Ensure that co-located antennas will be placed at least 1 meter (3 feet) apart.

4.2.1 Gathering the tools

You will find a list of tools in Appendix D. In addition you will need either a RJ-11 phone cable (if HomePNA is used), patch cable or Ethernet cross-over cable.

4.2.2 Finding a location for the router

When looking for the location of the router, consider the following things:

- Use an existing structure on the top of the house, for example, a chimney, vent, or television antenna.
- Use a mounting pole only if there is no other existing high point.
- Wherever you position the router, place it as high as you can. In all cases, be sure the router is higher than the roof line.

4.2.3 Finding a location for the NPU

The Network/ Power Unit is plugged into a grounded AC outlet. When locating the AC outlet consider the following:

- Try to find a place in close proximity to the place where the multiwire cable enters the house.

4.2.4 Planning the cable routing

The multiwire cable runs from the outside of the house to the inside so be aware that outside weather plays a factor. The maximum length of the multiwire cable that Nokia provides is 150ft. In any case the cable should be routed so that the length of the cable is minimized.

- Where possible, route the cable inside wall or roof spaces. Try to avoid drilling holes through the wall.
- Avoid air ducts, water, and gas pipes.
- Where wires have to be routed outside the building, make sure they are supported with cable clips at 18 to 24 inch intervals.
- Seal any drill holes in the wall using silicone sealant.
- If HomePNA is used, the cable can enter the house anywhere, where it is close to a phone jack. This will allow you to shorten the distance you have to route the cable. HomePNA uses the existing phone lines in the house, so when considering the entrance of the cable or the location of the NPU, you only need to make sure that they are close to a phone jack.

4.2.5 Finding a location for the grounding

Test the existing grounding at the property.

- Try to find an electrical ground close to the cable entrance.

CHAPTER 5

Installing the outdoor components

5.1 Introduction

The first step in the wireless router installation is setting up, placing, and grounding the router. If you have not already reviewed the information in chapter 2, “Safety issues” and chapter 4, “Planning the installation”, it is a good idea to do so.

This chapter provides step-by-step instructions for assembling the router with an integral antenna and a router with a directional antenna. It also describes how to ground them.

NOTE: The sequence of steps presented below shows one way of doing the installation. The actual sequence in which the installation is done may vary in each installation.

5.1.1 Components to be installed

The Outdoor portion of the Nokia RoofTop Wireless Router system includes:

- a wireless router with integral (omnidirectional) antenna
- a grounding kit for router (if required)
- router mounting hardware
- a shielded multiwire cable. Nokia provides several different lengths of cable with D-Connectors already installed to the end of the cable.

5.1.1.1 Components for the non-integral antenna

If you are installing a router system with a non-integral (directional) antenna, you need:

- a sector antenna kit, Nokia code WRTT38587.00

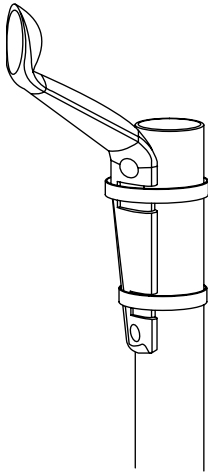
5.2 Installing the wireless router with an integral antenna

There are two basic steps to installing the outdoor components:

- constructing the mounting and
- assembling the router and antenna.

To construct the mounting:

1. Mount the wireless router bracket to the mounting point (it can be a pole, chimney, vent pipe, etc.), ensuring that the bracket is fixed securely.



Router bracket fixed to mast

To assemble the router and integral antenna:

The wireless router is packaged with its cover on. To be able to mount it and to connect the D-connector, you need to remove the cover. To remove the cover, place your fingers inside the router where the D-connector connection is located. You can feel the latch that is holding the cover. Release the latch and lift up the cover.

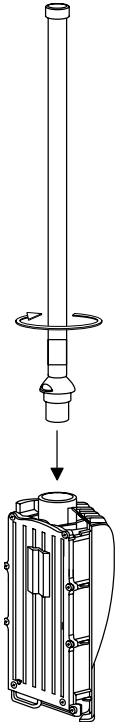
Now you can go on to assembling the router and antenna.

1. First apply silicone lubricant on the threads of the antenna to keep it from getting jammed. The recommended lubricant is: Dry Lubricant PRF Tefsol.
   - Spray silicone on a rag.
   - Wipe the threads of the antenna with the rag.

NOTE: Do not spray silicone directly on the threads. Only a thin coating of silicone on the threads is needed and spraying them directly would result in too much silicone on the threads.

2. Attach the omnidirectional antenna by screwing it into the top of the wireless router.

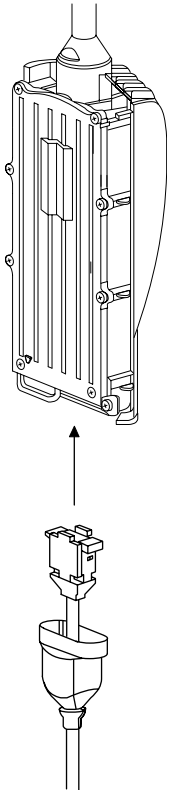
Ensure secure connection by hand-tightening metal-to-metal. The tightening torque should not exceed 13 ft./lb. (18Nm).



Attach the omni-directional antenna

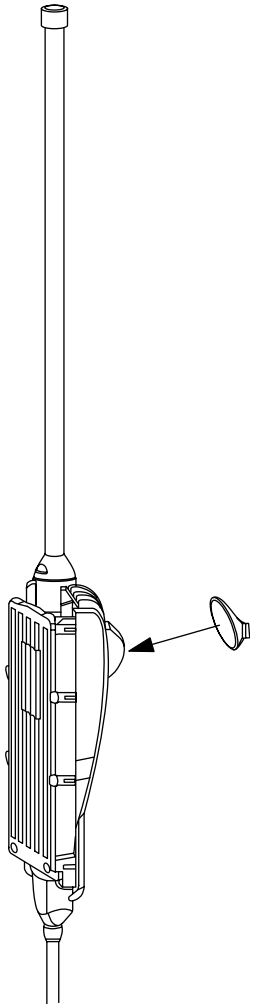
3. Plug the D-connector into the bottom of the wireless router. Guide the connector very carefully onto the pins on the router. Using too much force may damage the pins.
   Before attaching the D-connector, make sure that the cover of the wireless router is off. Attach the cover only after you have secured all the connections on the router.

4. Tighten the two screws on the sides of the connector and slide the rubber sleeve over the connections to keep them dry.
   Be careful not to overtighten the screws as you can damage the router case.



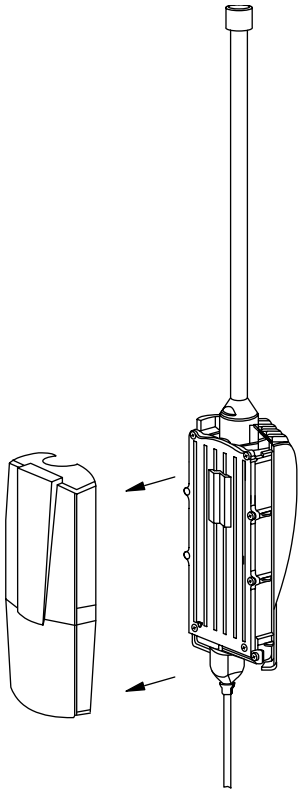
Attach multiwire connection

5. Attach the bolt and washer to the back of the router.
Do not tighten the bolt at this time as some flexibility is required to attach the router to the mast mounting bracket.



Attach mounting bolt to router

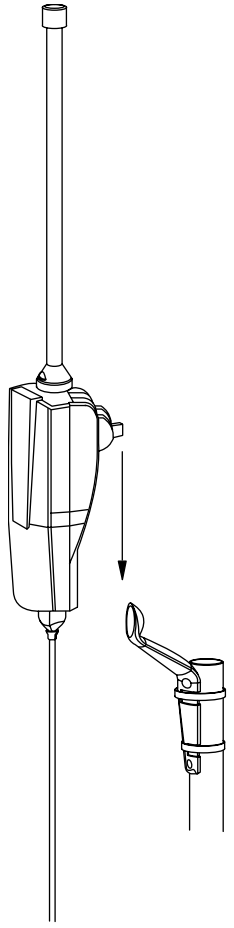
6. Attach the front panel to the wireless router.



Attach front panel to wireless router

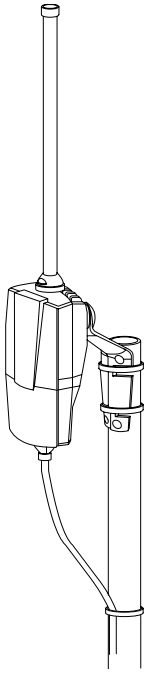
If you need to remove the wireless router cover after the D-connector is already installed, pull it open by holding tightly onto the top of the cover.

7. Attach the router to the mounting bracket.
Make sure the router is mounted vertical on the mount, using a level as necessary, and tighten the bolt in the back of the router to torque of 9 ft./lb. (12 Nm). Be careful not to overtighten the bolt, you could crack the plastic washer.



Slide the router mount onto the mast bracket

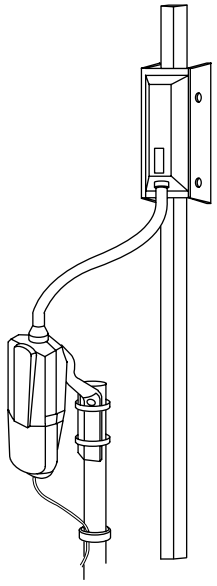
8. Using cable ties or adhesive tape, secure the multiwire cable to the mast.
Take care to avoid placing strain on the connectors when securing the cable to the mast. Use ties or tape about every two feet down the length of the mast.



Secure the cable and ground wire

5.3 Installing the directional antenna

Assembling the directional antenna is slightly different from the integral antenna. You use an RF cable between the antenna and the router. In addition you need an RF cable adaptor which fits on top of the router and connects the cable to the router. When you finish, the assembly looks like this.



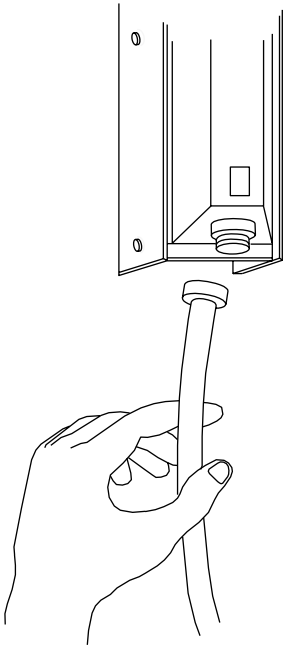
Installed router with directional antenna

To mount the antenna:

1. Attach the antenna to the mounting on the rooftop using the mounting clamp. Tighten the nuts to fasten the antenna securely.

To assemble the antenna and router:

1. Connect an RF cable to the directional antenna ensuring that the connections are properly tight, but do not overtighten.



Connect the wireless router to the directional antenna with the jumper cable

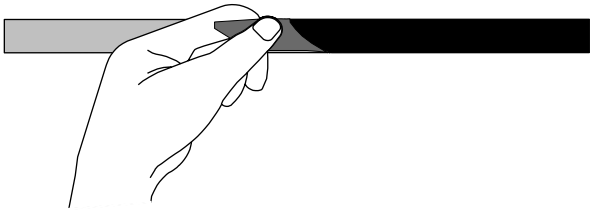
2. Apply silicone lubricant on the threads of the RF cable adapter to keep it from getting jammed. The recommended lubricant is: Dry Lubricant PRF Tefsol.

- Spray a small amount of lubricant on the threads of the RF cable adapter. Make sure not to spray any lubricant inside the connector.
- Keep the RF cable adapter upside down for a few seconds until the lubricant has dried up.

3. Attach the other end of the RF cable to the RF cable adaptor on the top of the router.
   This completes the connection between the antenna and the router. Make sure the connections are tight but not overly so.

To weatherproof the antenna connection:

1. Cut an 8” strip of weatherproofing tape and remove the plastic backing from the tape.

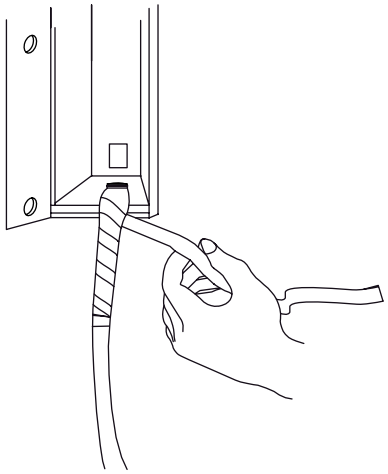


Remove plastic backing from the tape

2. Stretch the tape and apply the tape in the direction of the connector thread to ensure that the connector does not come loose during the weatherproofing process.

Stretching tape

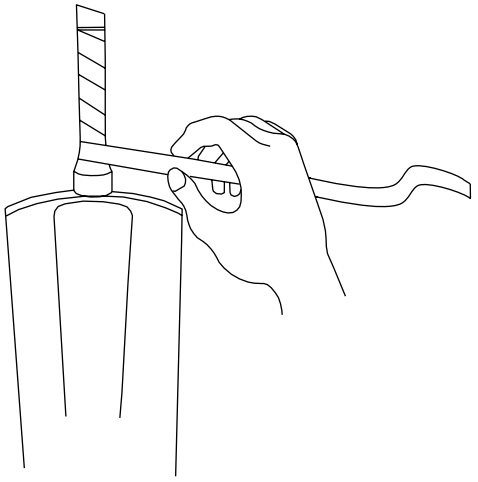
3. Apply the tape *tightly* in a counter clockwise direction starting at least 2 inches from the connector.
Move along the cable towards the connector so the tape covers the bottom of the antenna and the top of the connector without gaps and with a layer of overlapping.



Covering the directional antenna connection with weatherproof tape

To weatherproof the router connection:

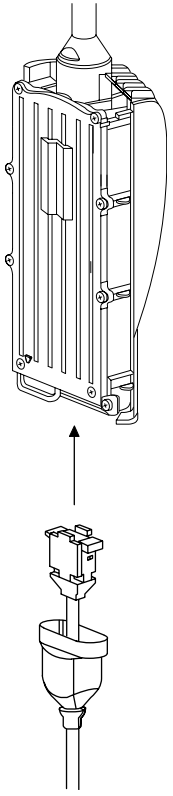
1. Apply tape *tightly* starting at least 2 inches from the connector. *Move along the cable toward the connector so that it covers the connection completely.*



Covering the Router connection with weatherproof tape

NOTE: Take care when weatherproofing RF connectors. Do not stress or bend the cable during the weatherproofing process.

2. Plug the D-connector into the bottom of the wireless router. Guide the connector very carefully onto the pins on the router. Using too much force may damage the pins.
Before attaching the D-connector, make sure that the cover of the wireless router is off. Attach the cover only after you have secured all the connections on the router.



Attaching D-connector to router

3. Assemble the router with the front cover.

Refer to the instructions in the previous section, “Installing the wireless router with an integral antenna” for mounting the router.

5.4 Grounding the router

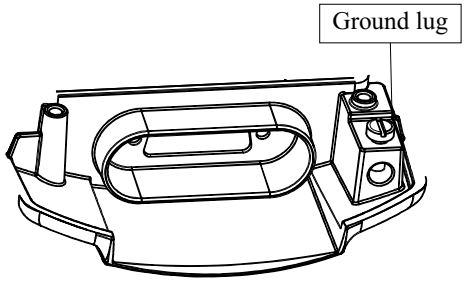
Because antennas are elevated metal objects with connections to ground, they attract lightning.

The Nokia RoofTop Wireless Router has a grounding lug in it. A ground wire can be attached to it to provide an appropriate and safe path to ground for the lightning. Additional grounding is only required if the existing grounding system within the property is insufficient for router grounding purposes.

Section 810 of the National Electrical Code ANSINFPA No 70-1984 provides information about proper grounding of the mast and supporting structure, grounding of the lead-in wire to an antenna discharge unit, connection to grounding electrodes and requirements for the grounding electrode.

To ground the router:

1. Connect a ground wire to the grounding lug at the bottom of the router. The picture below shows the location of the grounding lug at the bottom of the wireless router.



2. Run the ground wire from the router to the appropriate electrical ground.

If a grounding kit is required:

Attach the grounding kit to the multiwire cable according to the instructions that come with the kit before running the multiwire cable into the house.

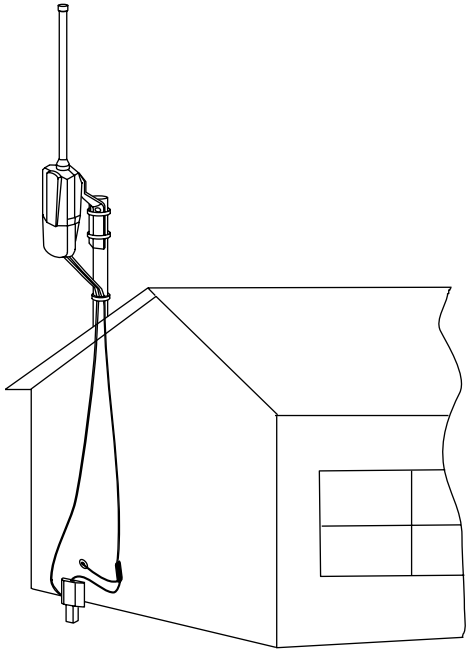


Illustration of complete installation (integral antenna)

CHAPTER 6

Installing the indoor components

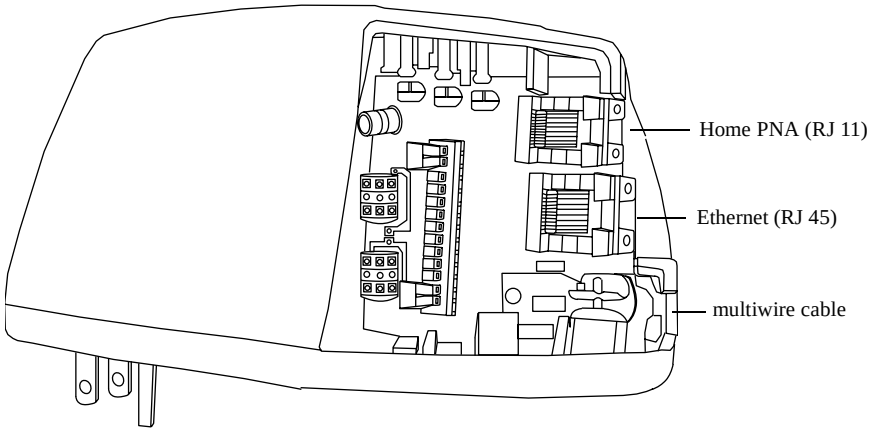
6.1 Introduction

The second step in the wireless router installation is connecting the router to the Network/Power Unit (NPU) and setting up the connection to the computer.

6.1.1 The Network/ Power Unit (NPU)

The NPU provides three cable connections.

- HomePNA 2.0 interface, a standard phone jack connection (RJ-11)
- Ethernet interface, a standard 10/100 BaseT Ethernet jack (RJ-45)
- Router outdoor unit connection, a multiwire cable connection



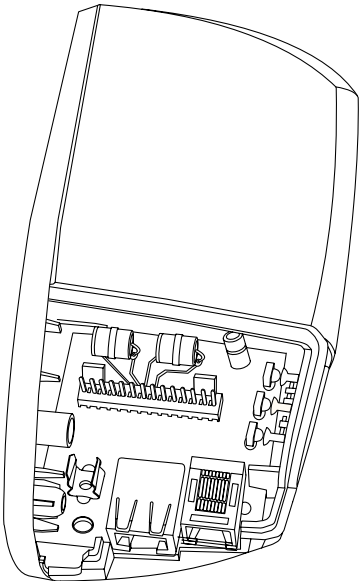
Three cable connections in the NPU

6.2 Connecting the multiwire cable

To enable the NPU's operation you must connect the multiwire cable wires to pin connections inside the NPU.

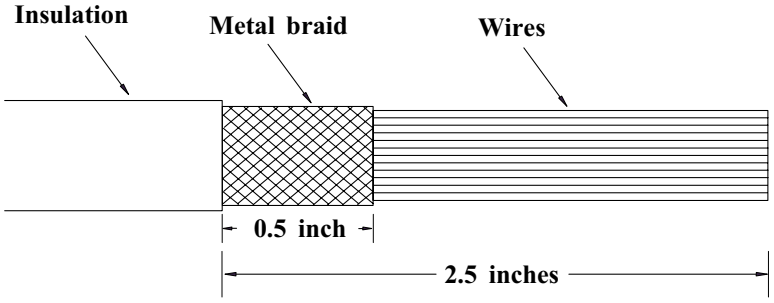
To prepare the NPU:

1. Remove the Network/Power Unit from its packaging.



Inside view of the NPU

2. Holding the multiwire cable, trim back the insulation about 2.5 inches. Make sure not to cut the metal braid and the foil. Slide the insulation off (see picture below).
3. Cut the metal braid, foil and plastic coating about half an inch above the insulation and carefully peel it off (see picture below).



4. Separate the pairs of wires from one another keeping each pair twisted together.
5. Separate the two wires in the brown and white pair and cut the brown wire off. It is not used by the NPU.
6. Before starting to punch down the wires, hold the multiwire cable over the NPU to measure at which point each wire should be punched down. The metal braid should fit into the ground clip. You can trim off excess wire after you have punched down all the wires.

To connect the wires and install the NPU:

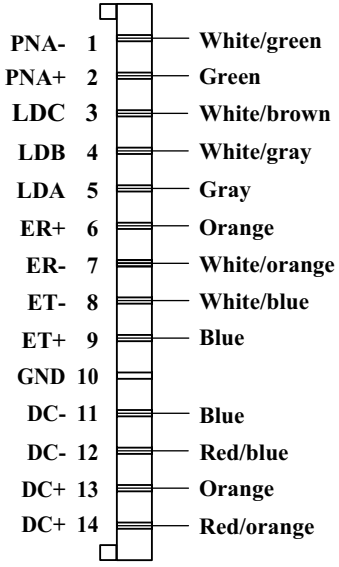
NOTE: Do not push the pin connector down onto the pins inside the NPU before all the wires have been punched down.

1. Connect the wires into the pin connector slots according to the following chart.

NOTE: To punch down the wires, use the Molex punchdown tool (see Appendix C for details). Standard punc-down tools are too small for the NPU.

The numbering in the below diagram only indicates the order of pins in the NPU.

NPU Wiring

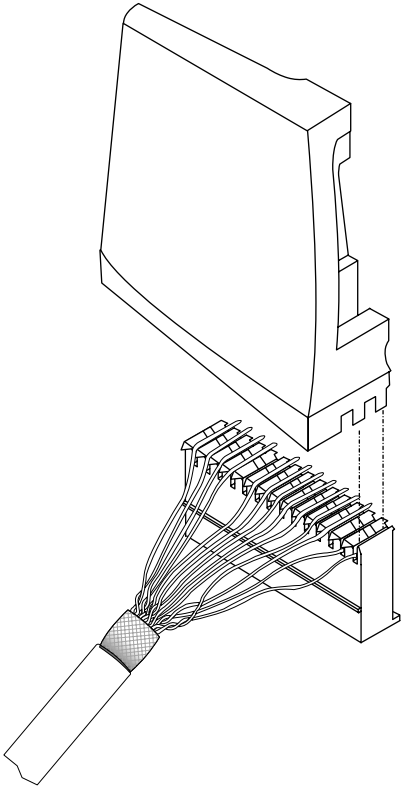


Note: The brown wire is not connected and is cut off

2. Keep the pairs twisted until the wires need to be separated for pin connection.
   This ensures a more consistent signal through the cable.

NOTE: It is especially important to keep the pairs with the blue wire twisted together. Because there are two blue wires in the cable, you might get them mixed up unless you keep them twisted with their pair up until you punch them down into the connector.

3. Secure the wires tightly into the pin connector using either a punch down tool or the integrated tool on the side of the NPU cover (see picture below).



Using the NPU integrated punch down tool to connect the wires

4. When all wires are connected securely, push the pin connector down onto the pins inside the NPU (see picture below).
5. Place the part of the cable with the metal braid into the ground clip (see picture below)

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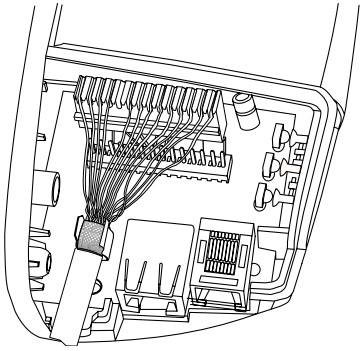
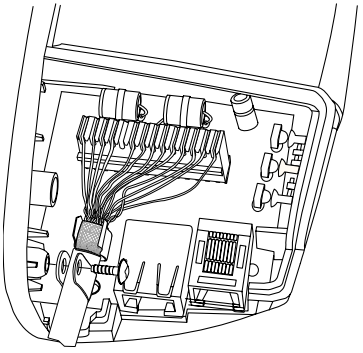


6. Connect the strain relief clamp in the NPU with the screw. This prevents the multiwire cable from being pulled out.

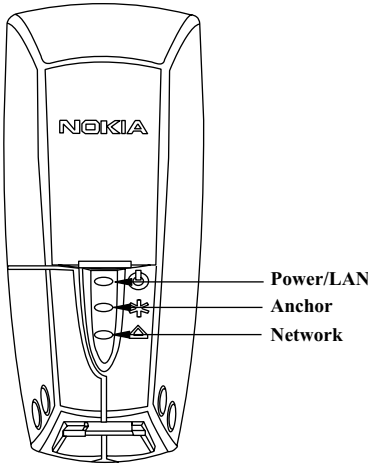


7. Fit the NPU cover onto the NPU and attach it with the screw. Make sure you use the correct size screwdriver (Pz1 or Ph1). Also press the screwdriver hard enough to avoid damaging the screwhead. Do not overtighten the screw.

8. Plug the NPU into the wall AC outlet. The LEDs on the unit should flash three times to indicate that the NPU is connected to the router.

6.3 Identifying LED status

Each of the three LEDs on the face of the NPU serves a specific purpose and can assume different states.



LEDs on face of Network/Power Unit

After the installation is finished, ideally the LEDs should indicate the following:

- Anchor and network LED solid “ON”

You can also leave the LEDs in the following two states:

- Anchor and network LED “slow flashing” (the light flashes appr. three times in five seconds) or
- Network LED “fast flashing” (the light flashes appr. six times in five seconds). This state is not recommended and you should leave the installation at this state only if absolutely necessary.

You should never leave the installation, if the Anchor LED is “fast flashing”. If this is the case and you are not able to fix it, contact the internet service provider.

The following charts indicate the status of information flow for each LED in each state.

LED	Description
Power/ LAN	**Solid On** Power on **Slow Flash (the light flashes appr. three times in five seconds)** Waiting for the router to complete its startup cycle **Intermittent Flash** Flashes when transmitting or receiving wireless network packets **Off** Not receiving power, or the router is not functioning

LED	Description
Anchor	**Solid On** The data speed is 2Mb in at least one link and the AirHead is 3 or fewer hops away from the router **Slow Flash (the light flashes appr. three times in five seconds)** The data speed is 1Mb and the AirHead is 3 or fewer hops away from the router **Fast Flash (the light flashes appr. six times in five seconds)** The unit is more than 3 hops away from the Airhead or there is no path to the Air Head **Off** The Router has no neighbors and no connection to the AirHead
Network	**Solid On** There are at least 2 independent neighbors and at least one 2Mbps path to the Air-Head. Also the path to the AirHead is 3 or fewer hops away **Slow Flash (the light flashes appr. three times in five seconds)** There are at least 2 independent neighbors and at least one 1Mbps path to the Air-Head. Also the path to the AirHead is 3 or fewer hops away **Fast Flash (the light flashes appr. six times in five seconds)** There is at least 1 neighbor and a 2 Mbps path to the AirHead. Also the path to the AirHead is 3 or fewer hops away **Off** None of the above

6.4 Connecting to the computer

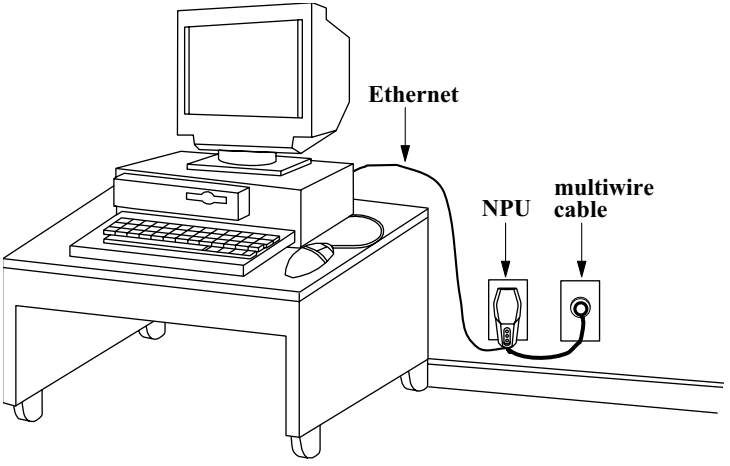
There are three ways to connect the wireless router to the computer system.

- Direct Personal Computer Connection, using 10/100 Base-T Ethernet crossover cable.
- Phoneline Networking Connection.
- Network Hub Connection, using 10/100 Base-T Ethernet interface

The router automatically activates the Ethernet or HomePNA, depending upon which connector is used. If a cable is connected to both connectors, the Ethernet port is activated.

6.4.1 Direct personal computer connection

Connect an Ethernet crossover cable between the Network/Power Unit and the personal computer Ethernet connection. Use an RJ-45 connector at the NPU end, and the appropriate connector at the personal computer end and connect the cables as shown below.



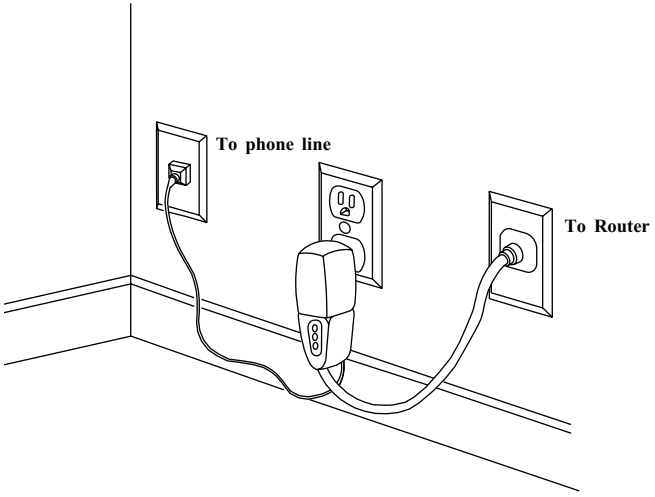
Attach NPU to computer through Ethernet cable

Use one crossover cable whenever a network hub is not being used.

NOTE: Changing the Ethernet configuration from a LAN connection to a direct PC connection requires changing from a standard Ethernet cable to a crossover cable.

6.4.2 Phoneline networking connection

Connect a phone cable between the NPU's phoneline networking connection and the RJ-11 phone jack on the wall. You can make this connection in any room, the most likely being near the place where the multiwire cable enters the home.



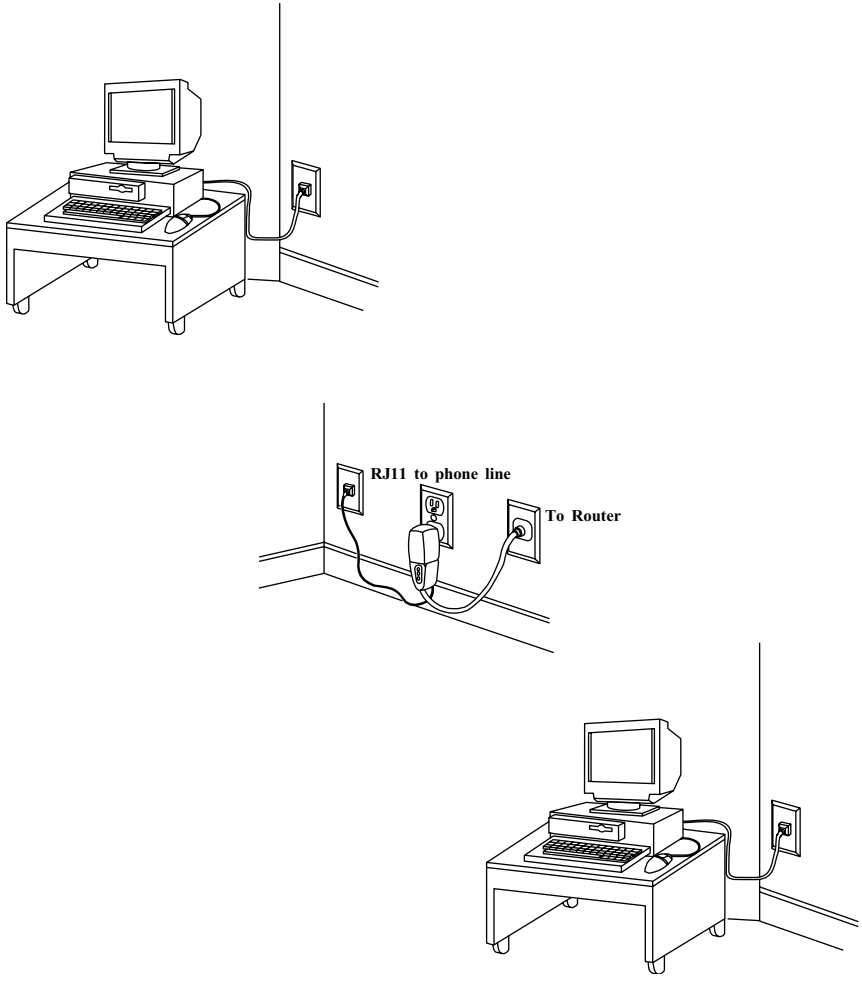
Connect the NPU to the phone jack and multiwire cable

Once the NPU has been connected to a phone jack in the house, you can connect PC's to the phoneline network through phoneline networking adapters.

The phoneline networking adapters come in three varieties:

- USB adapter
- PCI card
- Ethernet/Phoneline networking gateway (if the computer already has an Ethernet card)

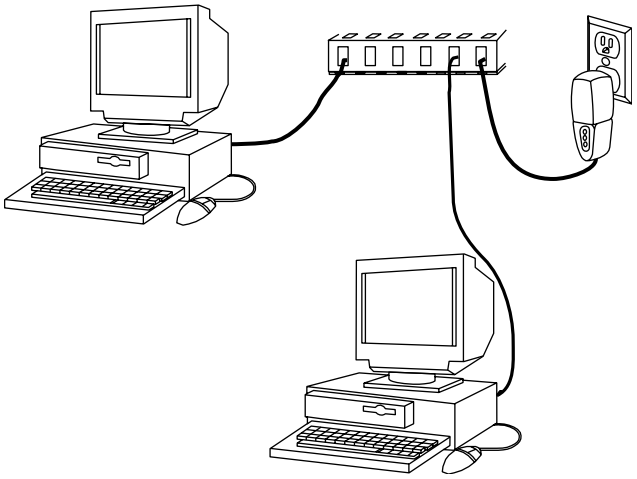
PCI cards are used in desktop PC's and USB adapters can be used for either desktop or portable PC's. Once these adapters have been installed in or connected to a PC, the adapter must be connected to a RJ-11 phone jack. Ensure that both the NPU and the phoneline networking adapters are connected to the same phoneline in the house. Refer to the installation manuals of phoneline networking adapters for more details.



Attach multiple computers to phone jacks

6.4.3 Network connection

Use a standard Ethernet Cable with an RJ-45 connector at the wireless router and the appropriate connector at the LAN Ethernet connection.



Attach computers and NPU to network hub

CHAPTER 7

Configuring the PC

7.1 Introduction

After the router installation is complete, the PC needs to be configured for use with the Nokia Rooftop Wireless Router system. Anyone may do this but it requires a good knowledge of the computer. The ISP provides all the required information prior to installation.

This chapter gives brief instructions for configuring the PC with Windows.

7.1.1 Configuring the personal computer

These instructions presume a knowledge of IP addresses.

1. Check that the PC has a network interface card (either HomePNA or Ethernet).
   If the PC does not have an interface card, install it.
2. Define the TCP/IP Properties.
   In the IP Address field, either select the "Obtain IP Address Automatically" or enter the IP Address and Subnet Mask in accordance with information provided by the ISP.
3. In the Default Gateway field, enter the IP address of the default gateway, provided by the ISP.

CHAPTER 8

Post installation testing

8.1 Introduction

After the router and NPU installation and PC configuration procedures have been accomplished, you'll want to test the system.

This chapter gives instructions for performing a few simple tests.

8.1.1 Testing

Ensure that the router functions correctly by carrying out the following few steps.

To check out the system:

1. Ensure that the NPU is inserted properly into the AC outlet. The LEDs flash three times to indicate that the router is functioning correctly.
2. Turn on the PC. Wait for 3-5 minutes to allow the router to anchor to the network.
3. Check the LEDs to indicate an active internet connection.
4. Open the web-browser and browse a few Internet pages to ensure that the system downloads web sites.

NOTE: AOL customers will need to use dial-up connections for the AOL browser to perform correctly. The router supports only Netscape and Internet Explorer browsers.

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5. Perform baseline testing according to the ISP's instructions and note the results. It is very important to know the download speeds of the router.
6. Where there are problems with download or speed of connection, check the installation first. If this does not solve the problem, then contact the ISP.

APPENDIX A

Cables

Ethernet crossover cable

The wiring for an Ethernet Crossover cable for 10Base-T is as follows:

RJ45 Plug

Pin 1 (Tx+) to Pin 3 (Rx+)

Pin 2 (Tx-) to Pin 6 (Rx-)

Pin 3 (Rx+) to Pin 1 (Tx+)

Pin 6 (Rx-) to Pin 2 (Tx-)

APPENDIX B

Technical specifications

This appendix describes technical specifications for Nokia RoofTop™ Wireless Router Models R240 & 240A Outdoor-Mounted Unit.

Specifications

Data Capacity per Cell	12 Mbps (6x2 Mbps per channel)
AirHeads per Cell **Routers per Cell** **Routers per AirHead**	Up to 6 Up to 240 Up to 40
Antenna Type (typical)	8 dBi Omnidirectional (integrated)
Maximum Link Range (typical)* **1 Mbps Data Rate** **2 Mbps Data Rate**	 1.75 Miles 0.50 Miles
Radio/ Modem Specifications **Frequency Band (GHz)** **Radio Type** **Modulation**	 2.4000 - 2.4835 Frequency Hopping Spread Spectrum 2 and 4 level GF SK

Transmit Power (typical)	12 dBm - 27.5 dBm (Dynamically adjusts in 1dB steps)
Receiver Sensitivity(10^{-5} BER) **1Mbps Data Rate** **2 Mbps Data Rate**	 - 82 dBm (typical) -72 dBm (typical)
Interfaces and Connectors **Ethernet** **Phoneline Networking** **RF**	 10/100 Base -TX, autosensing, RJ-45 Home PNA 2.0/ 1.0, RJ-11 N-Female (optional)
Router Environment **Operational Temperature** **Relative Humidity**	 - 40° C to 55° C (-40° to 131° F) 100%
Weight **Router**	 3.3 lbs (including antenna and mount)
Dimensions **Router** **NPU** **Antenna (8dBi)**	 4"W x $2\frac{3}{8}$"D x $8\frac{1}{4}$"H $1\frac{3}{4}$"W x $2\frac{3}{4}$"D x $5\frac{1}{2}$"H $21\frac{1}{2}$"H x $\frac{3}{4}$" Diameter
Power Consumption	16 Watts @ 120 VAC
Electrical Current Draw	100-120VAC 420mA, max AC current 21V / 1A, max DC current consumption during normal operation
External Power Supply	NA
Management	Nokia Wireless Router Manager, SNMP MIB II, Telnet
Maximum length of multiwire cable	150ft

Internet Protocols	IP, TCP, UDP, ICMP, RIPv1, RIPv2, SNMP, TFTP, IGMP, ARP, Proxy-ARP, Telnet, DHCP Relay, DHCP Server, NAT.
Agency Compliance	FCC Class B, FCC CFR 47 Part 15, FCC Part 68 ICES-003, RSS-210, CS-03

* Refer to "Planning a Nokia RoofTop Wireless Network"

APPENDIX C

Tool requirements

Tools list

There follows a list of tools required for the correct installation of the Nokia Wireless Router System.

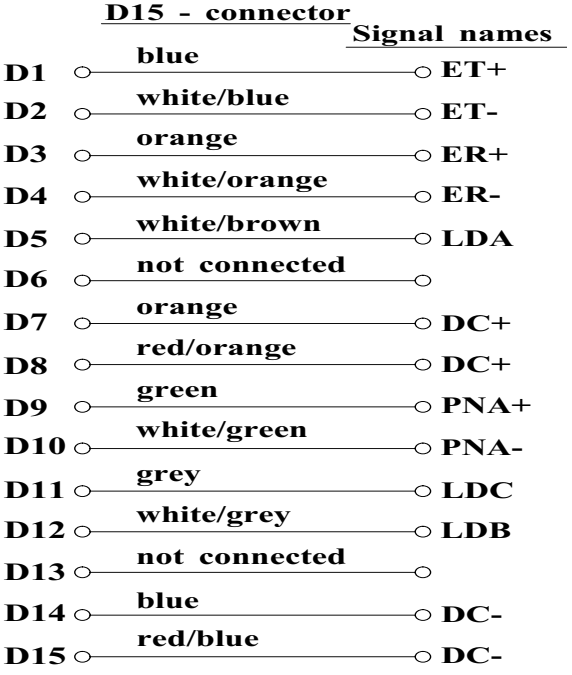
Nokia shall not endorse, recommend or warrant the third party products listed below or be under any liability whatsoever for any loss, damage, injury or expense caused by them.

Tool Description	Quantity required	To be provided by
50 feet extension Cord - 15Amps	1	Installer
Flashlight	1	Installer
$^1/_4$" Socket set 14 piece	1	Installer
$^3/_8$" Socket set 14 piece	1	Installer
Metric combination wrench set 8mm to 19mm	1	Installer

Tool Description	Quantity required	To be provided by
Adjustable wrench 8"	1	Installer
Ratcheting screwdriver with bits (PFS 5400)	1	Installer
Screwdriver $^{5}/_{16}$" x 6"	1	Installer
Screwdriver $^{1}/_{4}$" x 1.5"	1	Installer
Screwdriver $^{1}/_{4}$" x 4"	1	Installer
Screwdriver $^{3}/_{16}$" x 4"	1	Installer
Screwdriver $^{3}/_{8}$" x 8"	1	Installer
Screwdriver #1 CG	1	Installer
Screwdriver #2 CG	1	Installer
Screwdriver #3 CG	1	Installer
Diagonal cutters - large and small	1	Installer
Channel locks 10"	1	Installer
Cable cutter 8"	1	Installer
Utility Knife	1	Installer
Claw hammer 16oz (fiberglass)	1	Installer
Tape measure 26’ (english/ metric)	1	Installer
Utility pliers 10"	1	Installer
Safety glasses - clear	1	Installer
Leather work gloves	1	Installer
Tool box	1	Installer
Multimeter	1	Installer
Heat gun	1	Installer
Wrist strap ESD	1	Installer
Rubber mallet 2lbs	1	Installer
Power screwdriver and bit set	1	Installer
Power drills - corded and cordless	1	Installer
Drill bit set	1	Installer
Cable snake	1	Installer
Molex punchdown tool, ordering number 11-02-0016 for connector type 7720	1	Installer

Tool Description	Quantity required	To be provided by
RJ-45 Connector crimp tool	1	Installer
Cordless hand vacuum	1	Installer
Keyhole saw	1	Installer
Stud finder	1	Installer
Small wire strippers	1	Installer
Large wire strippers	1	Installer
Scissors	1	Installer
Small needlenose pliers	1	Installer

APPENDIX D

D-connector specifications

Nokia provides different lenghts of multiwire cable with the D-connector installed. Should you need to connect the multiwire cable to the D-connector for testing or other purposes, the diagram below tells you how to connect the wires.When connecting the wires, keep the pairs twisted until the wires need to be separated for pin connection.This ensures a more consistent signal through the cable.