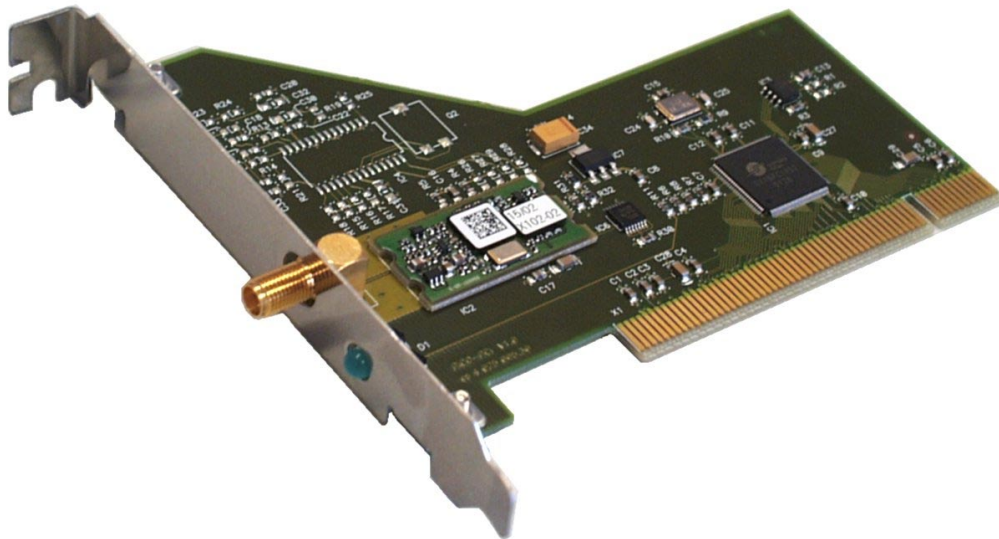


## Bluetooth PCI Adapter



## Users Manual

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## 1 Introduction

This User Manual describes the installation procedure and usage of your Bluetooth PCI Adapter. Please take some time to read this manual. If you don't want to read the whole manual, at minimum read the sections marked **important**.

If you are not familiar with the operation of Bluetooth technology, we encourage you to read the chapter *Bluetooth Basics* before you start to use the Bluetooth PCI adapter.

## 2 Installation

### 2.1 Software Installation

#### 2.1.1 Installation on Windows 95/98/ME/2000/XP

**Important:** Please install the software **before** you install the Bluetooth PCI Adapter in your PC.

If you install the software on Windows 2000/XP you need administrator rights on your PC.

- Insert the Bluetooth PCI Adapter Setup CD. Usually the Setup program launches automatically. In the case that Setup does not start automatically, open the CD-ROM in the Windows Explorer and double click on Setup.exe.
- The Setup program automatically detects the operating systems version and your current language settings. If you wish to install the Bluetooth PCI Adapter software in a different language, select that language in the upper right corner of the Setup program.
- To start the installation click on install.
- If the Setup detects an older version of the software on your system, this software will be uninstalled first. Depending on your system configuration, it may be necessary to reboot your PC after uninstallation and start the Setup program again.
- Follow the instructions of the Setup program.

After the Setup program has finished, you can continue with physically installing your Bluetooth PCI Adapter into your PC. Please follow the instructions in section 2.2.

After you have completed the hardware installation, the Bluetooth PCI Adapter will be detected by the system when you start your PC. The necessary device drivers will be installed automatically. To install Bluetooth services now please continue with section *Installing Bluetooth Devices*.

### Information for installation on Windows 95

Under Windows 95, installation is only completed after a restart of the system. If you install the Bluetooth PCI Adapter in a Windows 95 system you must subsequently restart your computer!

### 2.1.2 Installation on Windows NT

To install your Bluetooth PCI Adapter on Windows NT, please install the hardware **first** as described in section 2.2. Then continue with the steps below. Please note that you need administrator rights to install the software on Windows NT.

- Insert the Bluetooth PCI Adapter setup CD. Usually the Setup program is launched automatically. In the case that the Setup program does not start open the CD-ROM in the windows explorer and double click on Setup.exe.
- To start the installation click on install button.
- Follow the instructions of the Setup program.

On Windows NT, the Bluetooth Monitor will not start automatically. To start the Bluetooth Monitor click on **Start → Programs → Bluetooth → Bluetooth Monitor**.

If you like to start the Bluetooth Monitor automatically you can copy the start menu shortcut to your autostart folder.

### 2.1.3 Installation on Linux

Please visit <http://bluez.sourceforge.net/> to get the newest drivers and installation instructions to use your Bluetooth PCI Adapter on Linux.

## 2.2 Bluetooth PCI Adapter Hardware Installation

**Important:** Never open you PC while it is connected to an electrical outlet.

- Shutdown your PC.
- Disconnect your PC from all electrical outlets.
- Remove the computer casing (you may need to read your users manual that came with your computer).
- Remove the metal plate from a free PCI slot.
- Insert the Bluetooth PCI Adapter into the free PCI slot; and secure the card firmly, with a case screw, into place.
- Close the computer casing.
- Connect the antenna to the Bluetooth PCI Adapter. Place the antenna in such a way, that it is not covered by any metal, e.g. on top of your computer case or on the edge of your desk.
- Reconnect your PC and turn it on.

### 3 Installing Bluetooth Devices

Please note that the instructions given in this chapter are only valid if you use a Microsoft Windows operating system. If you are using Linux please refer to the documentation available on the BlueZ web site.

#### 3.1 System Integration of Bluetooth Services

Remote and local Bluetooth services are integrated into the system by virtual ports. For each service a virtual serial (COM) or parallel (LPT) port is installed. The type of port depends on the service used.

System services like the Dial Up Networking (e.g. Modems) or the Fax service can use these virtual ports. They will work like using a direct cable connection to the device you want to use.

There are two types of Bluetooth services: local and remote. Remote services are those you want to use on a remote device, e.g. the DUN service of a modem or the LPT service of a printer. A connection to a remote service is created whenever your application wants to use the service (e.g. printing a document on a Bluetooth printer).

By installing local services you allow other Bluetooth devices to connect to your PC. The remote device must create the connection to your computer. Examples for local services are incoming network connections or a Hot-Sync connection to a PDA or Cell phone.

The software, which comes with the Bluetooth PCI Adapter, currently supports the following services:

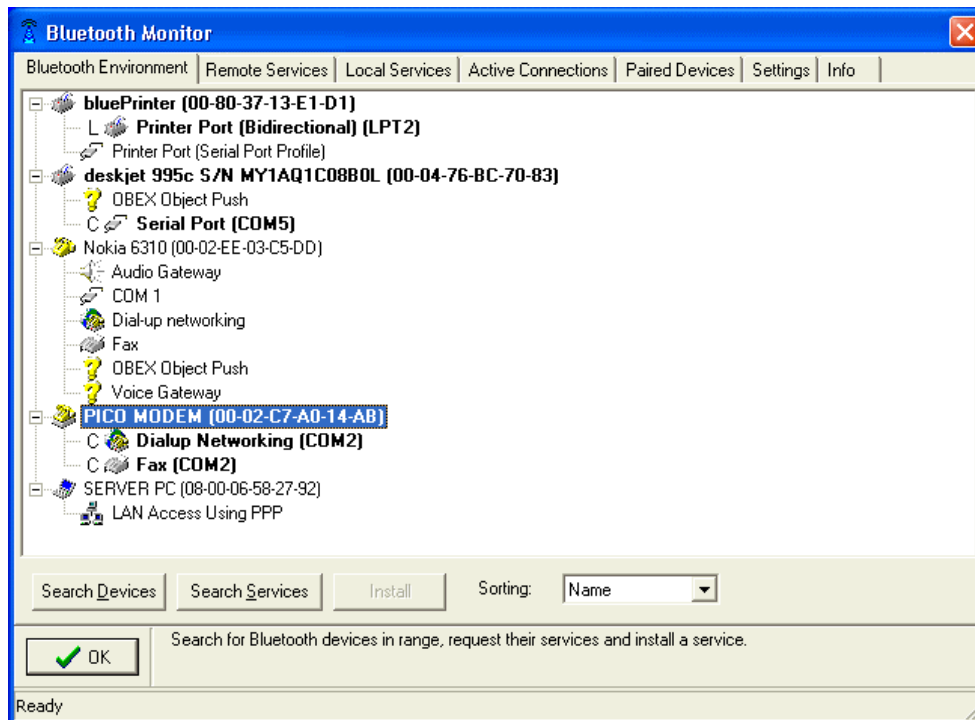
Service	Bluetooth Profile	As remote Service (Application)	As local Service (Application)
Serial Port	Serial Port	Yes (universal, printing)	Yes (universal, Hot-Sync)
Network	LAN Access	Yes (Dial Up Network, RAS, PC Direct Connection)	Yes (Dial Up Network, RAS, PC Direct Connection)
Modem	Dial Up Networking	Yes (Dial Up Network, RAS)	No
Fax	Fax	Yes (Windows Fax Service)	No

## 3.2 Using the Bluetooth Monitors

After successful installation you will find an blue antenna symbol in the system tray. You can open the Bluetooth Monitor by clicking on this antenna symbol. The Bluetooth Monitor is used to install and configure Bluetooth services. It also shows you the state of active Bluetooth connections.



### 3.2.1 Bluetooth Environment

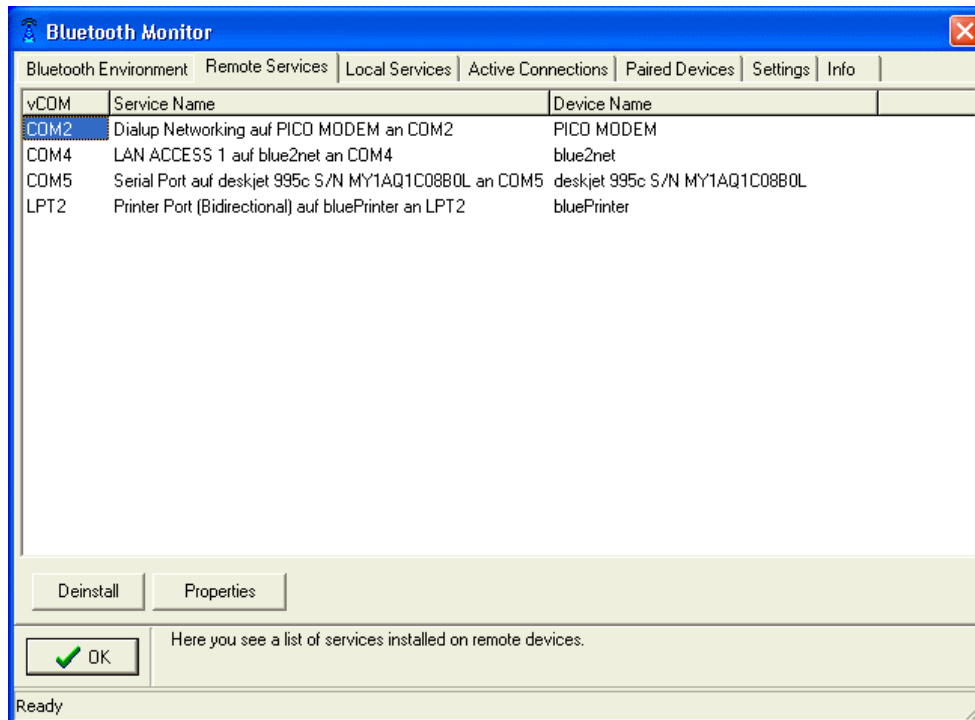


The Bluetooth Environment shows all Bluetooth devices currently in range. The services offered by these devices are also displayed. If you use the default settings, devices will be searched and their services retrieved automatically. You can search for devices and search for services manually by clicking the appropriate button. For services you have already installed, the service and device name are shown in bold and the virtual port used is shown behind the service name.

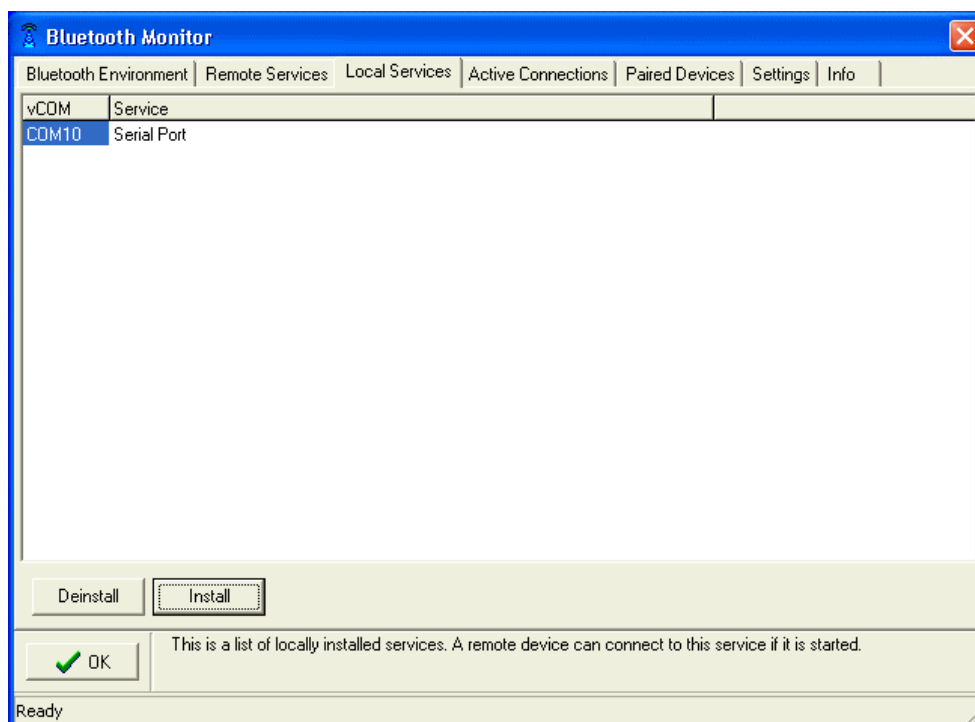
To install a service, mark it by clicking on the service name and then click the install button (or simply double click the service name). Further instructions on how to install Bluetooth Services you will find in section *Application Examples*.

### 3.2.2 Services and Connections

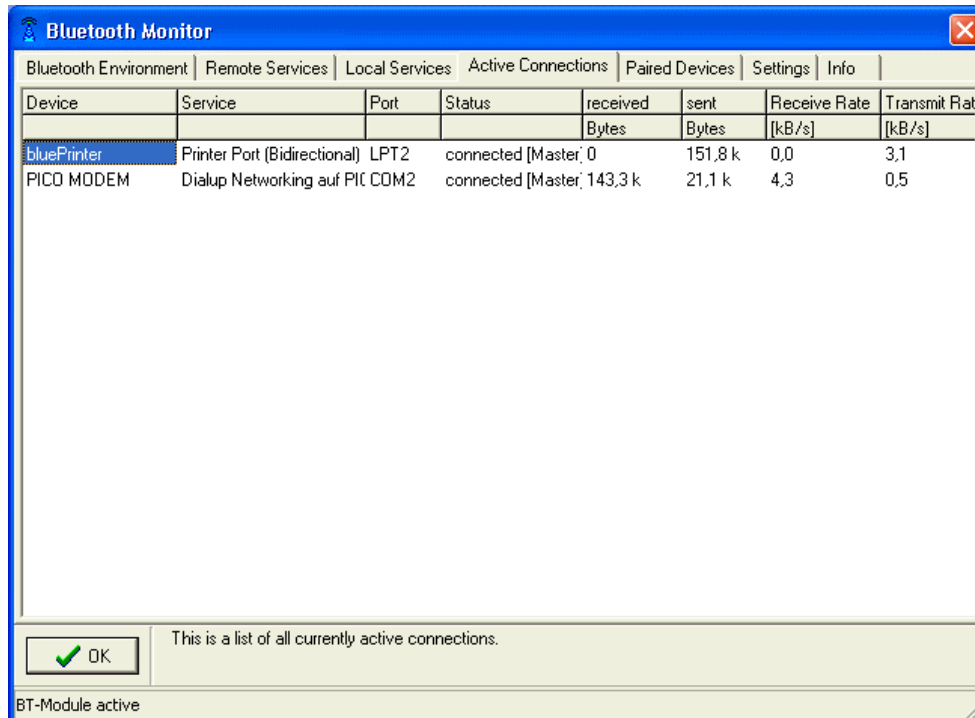
On the tab sheet *Remote Services* you will see a list of all currently installed remote services. This list shows the installed services regardless of whether the device is in range or not. You can change settings for the services or you can remove services not needed anymore.



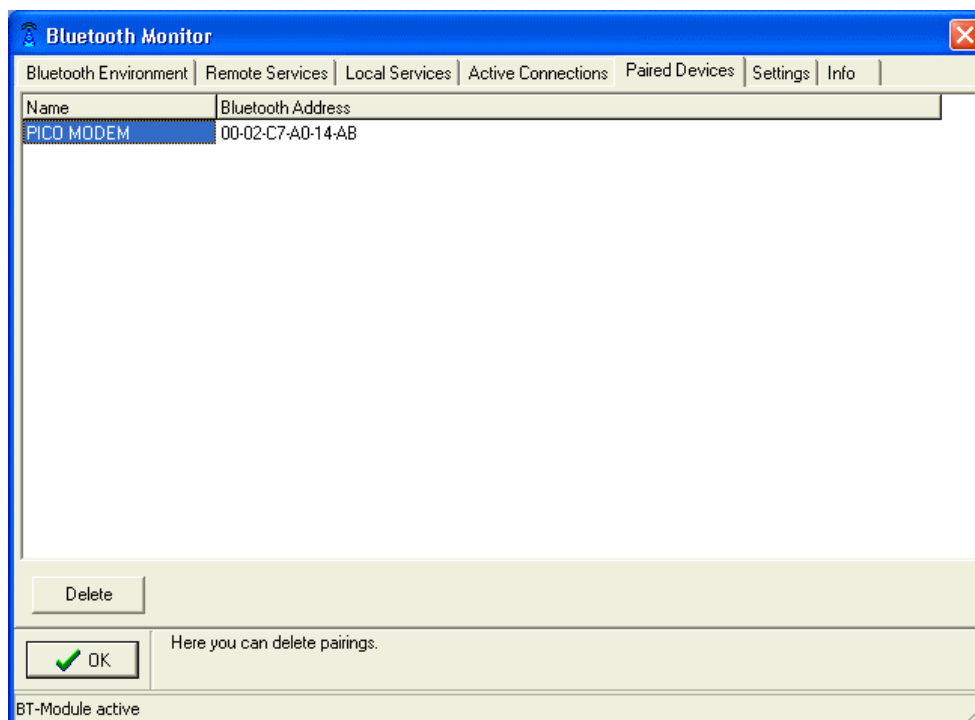
On the tab sheet *Local Services* you can see a list of all installed local services. You can install new services or remove existing ones. For further instructions on how to install local services please refer to section *Application Examples*.



The *Active Connections* tab sheet shows a list with the state of all currently active Bluetooth connections.



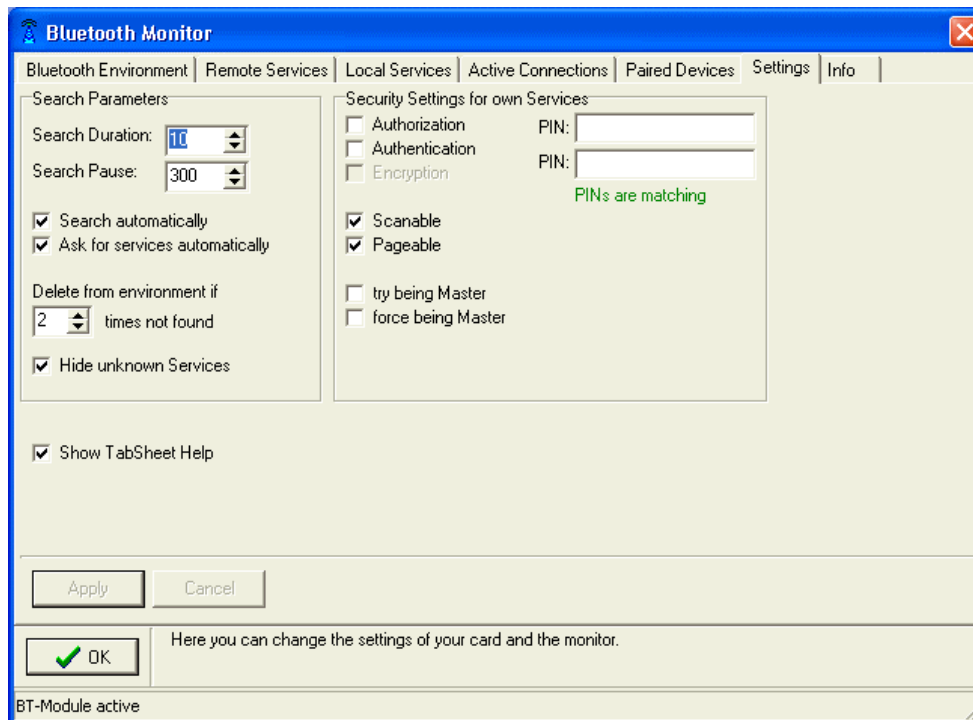
The *Paired Devices* tab sheet shows a list of all currently paired devices. You can delete pairings here.





### 3.2.3 Settings

On the *Settings* tab sheet you can change the basic settings for your Bluetooth PCI Adapter.



In the section *Bluetooth Environment* you can change the behaviour of the Bluetooth device search and service requests. You can also set the duration and the time between two device searches (in seconds). You can also disable the automatic device search and the automatic service requests.

In the section *Security Settings for own Services* you can set the security options for local services. If you switch off the "scannable" option, your Bluetooth PCI Adapter is invisible to other Bluetooth devices, but devices that already know its Bluetooth Address, can still be connected. If you deselect the "pageable" option, other devices cannot connect to your Bluetooth PCI Adapter.

Please don't modify the settings for the Bluetooth Role switch if not required. These options have the following meanings:

#### *Try being Master*

When this option is enabled and a remote device connects to a local service, a role switch is initiated. This means that the Bluetooth PCI Adapter tries to switch from Bluetooth slave mode to master mode and consequently the remote device has to switch from master mode to slave mode. In practice, if the role switch is successful, this has the consequence that the Bluetooth PCI Adapter still can connect to other devices or is able to accept additional connection request.

On the other hand, if the role switch is not successful (either because the remote device does not support or allow role switching), the Bluetooth PCI Adapter can not connect to other devices or accept additional connection while the current connection is active.

### *Force being Master*

This option is very similar to *try being master* with the addition, that a connection request from a remote device is rejected when the role switch fails.

You should activate one of these options if you want to:

- Allow multiple connections to local services from remote devices, e.g. for a LAN access point.
- Use remote services from your PC while a remote device is connected, e.g. if you want to print to a Bluetooth printer while a Hot-Sync connection from a PDA is active.

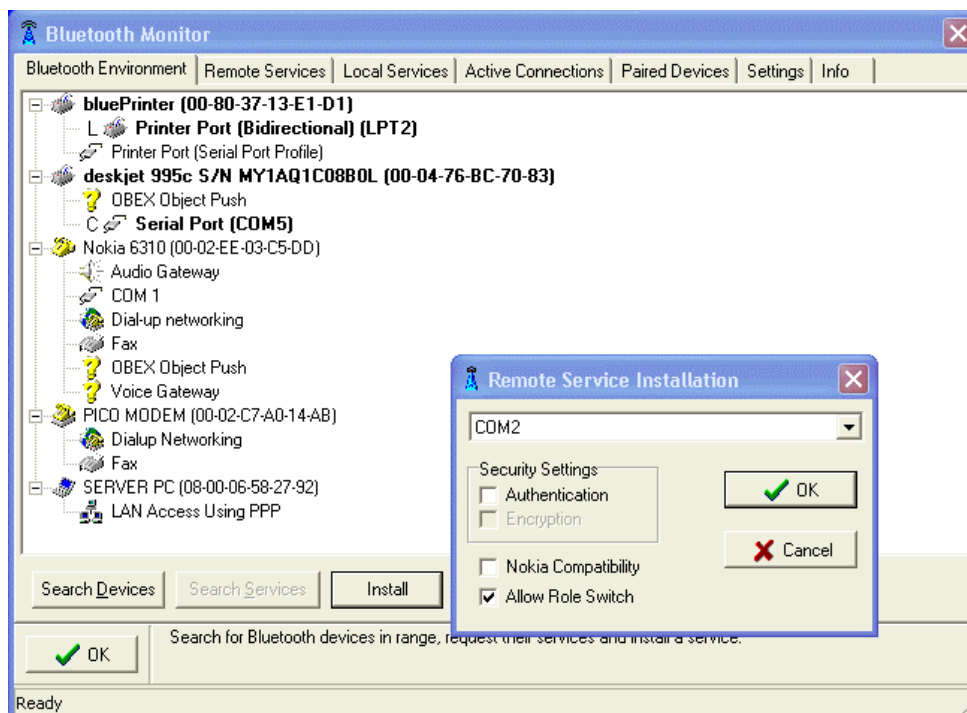
## 3.3 Application Examples

In the following sections the installation of some typical Bluetooth applications is described. Some steps to install a particular device may vary depending on your device or the operating system you are using.

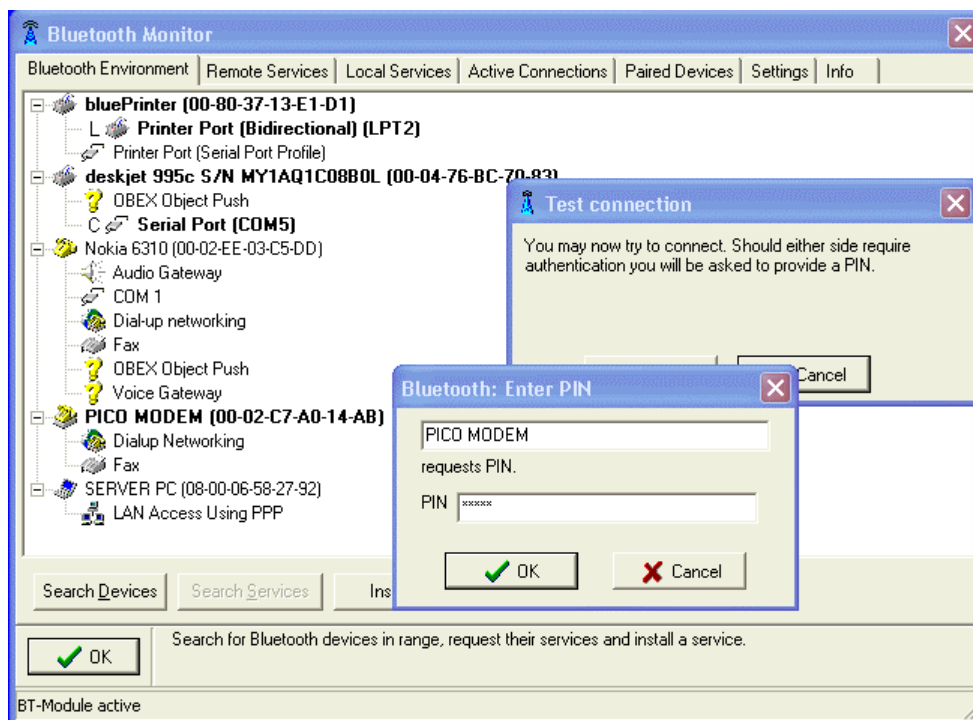
### 3.3.1 Using a Bluetooth Modem

The installation steps described here will be basically the same for all devices supporting the DUN (Dial up Networking) profile. This may even be a modem (analogue or ISDN) or a mobile phone.

- Open the Bluetooth Monitor by clicking on the blue antenna symbol in the system tray.
- If the modem you want to install is not shown in the Bluetooth environment make sure that the modem is switched on and Bluetooth is activated. Some devices, especially mobile phones, require that you make them visible. Click on *Search Devices* to update the Bluetooth environment view.
- Mark the service for the modem (for the Pico Modem in the example this is Dialup Networking) and click on *Install*.



- The next dialog allows you to select a virtual port number and to enable security settings. Because modems usually request secure connections it is often not necessary to enable security here. Click *OK*.
- You are now requested to start a test connection. This test connection is required to pair the modem with your Bluetooth PCI Adapter. Before clicking *Test*, make sure your modem is in a pairable mode. Most modems and mobile phones are not in a pairable mode during normal operation for security reasons. For instructions how to make your modem pairable please refer to its user manual. You should also look up the modems PIN code (on mobile phones you usually enter the PIN during pairing later).
- Click *Test*. The pairing process will be started now. When using a modem with a fixed PIN you will be requested to enter its PIN code. If you are using a mobile phone you will be requested to enter a PIN on the phone first. Enter a code on the phone first and the same code when requested by the Bluetooth monitor. The value of the code you enter is not important. The only thing that is important is that you enter the same code on both devices.



- When the pairing was successful you will get a success message. If you get an error message, you can retry the pairing. Possible causes for an error are:
  - Your Bluetooth device wasn't in a pairable mode.
  - You entered a wrong PIN.
  - You waited too long to enter the PIN and the pairing timed out.

After having successfully paired your modem you need to install a modem driver. How this is done depends on your modem:

- The modem (or mobile phone) manufacturer supplies a special modem installation program.  
(e.g. PICO ISDN, Nokia mobile phone)

- b) Use the Windows modem installation wizard.  
(e.g. PICO Modem, Ericsson mobile phone)

In case a) please follow the instructions given by the modem supplier. The modem Setup programs often try to detect the port the modem is connected to. If this detection fails you can select the port in the Windows control panel under modem options later. The port used by the modem is displayed in the Bluetooth Monitor in the *Bluetooth Environment* (if the modem is visible) or under *Remote Services*.

In case b) you need a so-called INF file, which tells Windows how to use your modem. This file (ending *.inf*) is usually supplied with your modem. When installing the modem from the Windows control panel you must specify this file.

### 3.3.2 Sending a Fax over Bluetooth

To send Faxes over Bluetooth you need a Bluetooth modem which also supports the fax profile. Most Bluetooth modems support the FAX profile, too. In the examples given you can see that the PICO Modem and the Nokia 6310 offer a fax service.

If you already have installed the modem function, as described in the previous section, you can use the same modem for sending faxes. No additional installation is necessary. If you have not installed a modem, you can install the fax service the same way as described in the previous section.

### 3.3.3 Using a Bluetooth Printer

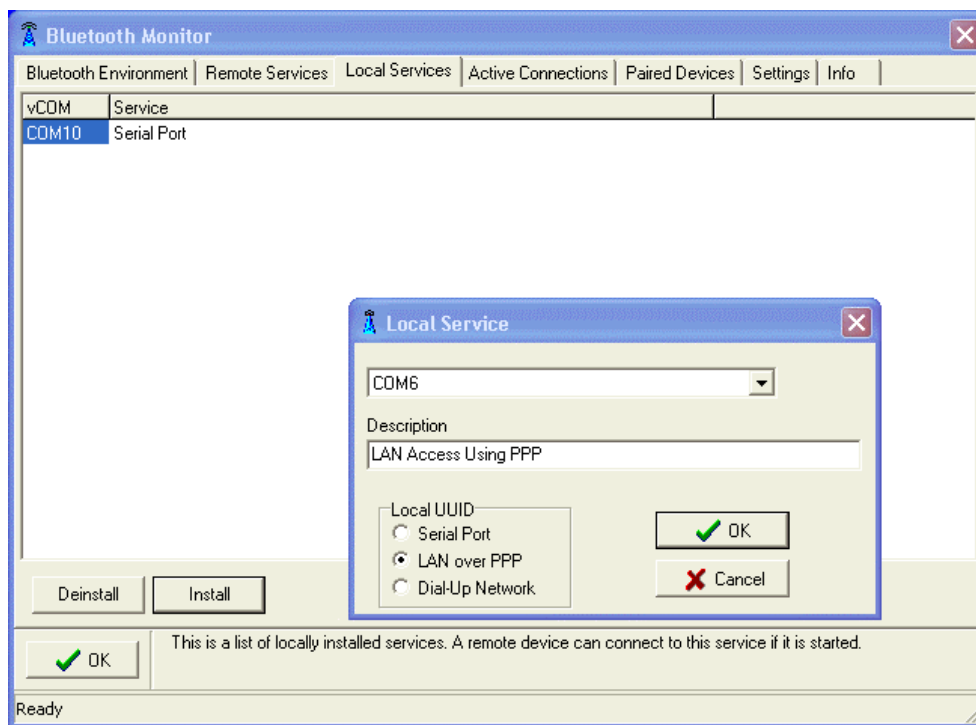
To install a Bluetooth printer you first install a virtual port for the printer as described for a modem. In the example you can see that the service *Serial Port* on the device *HP Deskjet 995* is installed on COM5. On some Bluetooth printers, the installation of a virtual parallel port (LPT) may be offered. This option enables additional features like automatic printer detection and more verbose error messages like "printer out of paper".

After this you can install the printer driver software, using the virtual port you assigned. When asked for the communication port to use, select the one you have the printer service installed to in the previous step (COM5 in the example given).

### 3.3.4 Setting up a Bluetooth LAN Access Points

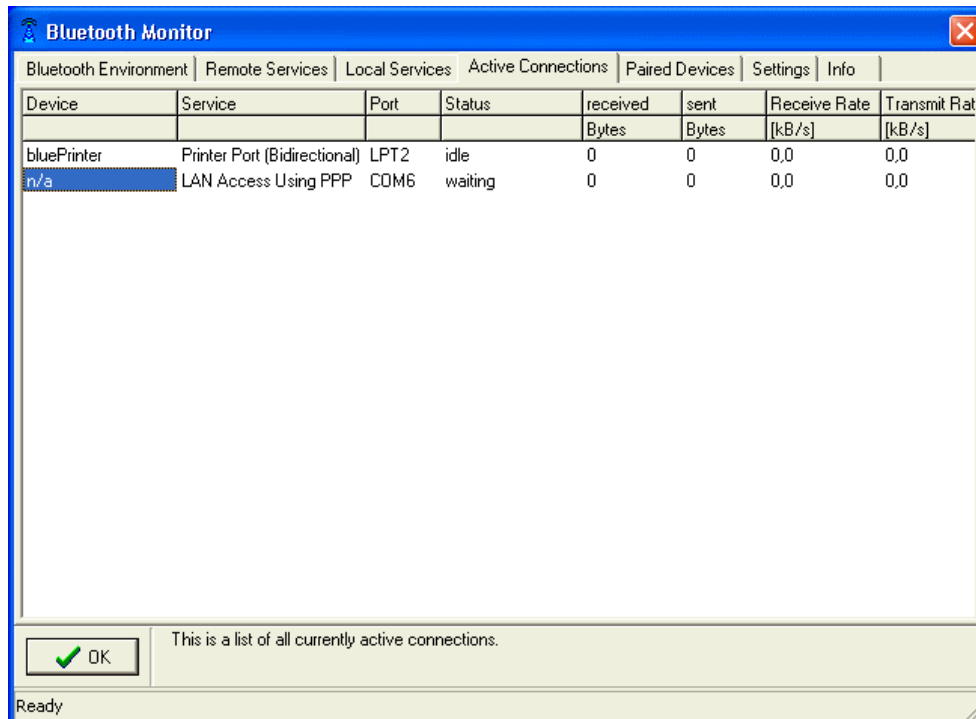
The set up steps described here assume that you are using Windows XP. For other Windows versions they are quiet similar but may vary in details.

- 1. Open the Bluetooth Monitor and select *Local Services*.
- 2. Click the *Install* button and select a free COM port (for a free port no additional text beside COMX is displayed, where X is the port number). Select *LAN over PPP* and click OK to install the port.



- **3. Only for Windows XP (.NET) Server:**  
If you like to allow more than one user to connect to the access point at the same time, repeat step 2. as often as many users you like to allow to connect simultaneously. Please note that the limit set by Bluetooth is seven concurrent connections. The home and professional editions of Windows XP only support one connection.
- 4. Open the Windows XP "Network Connections" window by clicking:  
**Start → Connect to → Show all connections.**
- 5. Start the **New Connection Wizard** and click **Next**.  
Select **Set up an advanced connection** and click **Next**.  
Select **Connect directly to another Computer** and click **Next**.  
Leave **Host** selected and click **Next**.  
Select the port installed in the previous step (COM6 in the example) and click **Next**.  
Select the users you want allow access to your computer and click **Next**.  
Click **Finish**.

If you select the Bluetooth Monitor tab sheet *Active Connection* now, you will find a new entry for the service you just created with state waiting.



Other devices that support the Bluetooth LAN access profile can now connect to the service you just created. If your computer is connected to a LAN and/or to the Internet, a device connected to this service can use the LAN or Internet connection, too.

## 4 Bluetooth Basics

Bluetooth is a manufacturer independent standard for the wireless connection of various electronic devices. It supports data transfer for applications like wireless printing or Internet access as well as voice for applications like headsets or phones.

Bluetooth supports connections between just two or between multiple devices. In the latter case, the master device can connect to multiple other slave devices at the same time. Such a configuration is called a "PICO-Net".

### 4.1 Radio Transmission

Bluetooth utilises the license free 2,4 GHz ISM radio band. Other devices like wireless LAN or wireless Video transmission devices also use this frequency range. Bluetooth implements sophisticated techniques for error free operation:

- A frequency-hopping scheme with 1600 frequency changes per second.
- Utilisation of state of the art coding techniques with forward error correction.
- Low transmission power with automatic power control.

The low transmission power (about 1/1000 of a mobile phone) limits the range of Bluetooth devices. For the lowest power class (class 3) a range of about 10 meters outside buildings can be expected. Inside buildings the range is usually smaller.

For the highest power class (class 1) a range of up to 100 meters outside and about 30 meters inside buildings is achievable in practice.

### 4.2 Device Properties

All Bluetooth Devices have a unique identification, the Bluetooth Device Address. This is a twelve digit hexadecimal number usually displayed in a notation like 01-23-45-67-89-AB.

Because this device address isn't very practical, Bluetooth devices also have a name and a device code, which identifies their main function (e.g. printer, modem, mobile phone or computer).

These properties can be discovered from other Bluetooth devices and are used to identify a particular Bluetooth device and its services. However, the device code and the device name are only used for informational purposes. To connect to another Bluetooth device, the only thing that is needed is its device address.

Further, all Bluetooth devices have an internal database, which describes all services offered by a particular device. Other devices can query this database. The protocol used to query this database is specified as SDP (Service Discovery Protocol) within the Bluetooth standard.

### 4.3 Protocols and Profiles

The Bluetooth standard defines various protocols and profiles that specify how Bluetooth devices can communicate. In general the protocols define how information is to be exchanged and the profiles define the type of data to be exchanged. For normal users the protocols used are of little interest. Much more important is knowledge about the profiles, because they are

visible at the user interface level. The following table gives an overview of the Bluetooth profiles. Because new profiles are added to the Bluetooth standard from time to time there may be profiles not listed here. Also, some rarely used profiles have been omitted.

<b>Profile</b>	<b>Applications</b>
Generic Access (GAP)	Describe device discovery and general security aspects. This profile is not related to a special service but is used by all services.
Service Discovery Application (SDAP)	Describes the access to the service database. Like the GAP profile it is used by other services.
Serial Port(SPP)	Basic profile which describes the emulation of a serial port over Bluetooth . Is used by a number of other profiles for data communication.
Headset Hands Free (*)	Used for wireless headsets
Dial Up Networking (DUN)	Used for modems. Analogue or ISDN, as well as mobile phones. Uses the SPP for data communication.
Fax	Used to send and receive Faxes. Often found in combination with DUN. Uses the SPP for data communication.
LAN Access (LAN)	Used for network access over a PPP connection. Uses the SPP for data communication.
Generic Object Exchange (GOEP)	Base profile for OBEX based services. Uses the SPP for data communication.
Object Push	OBEX service used to exchange address book information and business cards, e.g. between a mobile phone and a PC.
File Transfer	OBEX service used to exchange general files.
Synchronisation	OBEX service to synchronise address book information, notes, calendar information and messages between, for example, between a PDA and a PC. Often realised by special software supplied by the PDA manufacturer which directly uses the SPP and that will also function over a cable connection.
Hardcopy Cable Replacement (HCRP) (*)	Parallel port emulation over Bluetooth. Mainly intended for printers and scanners.
Personal Area Network (PAN) (*)	Direct (TCP/IP based) network connection over Bluetooth. More flexible than the LAN profile.
Common ISDN Access (*)	Used for ISDN applications over Bluetooth. More flexible than the DUN and FAX profiles.
Human Interface Device (HID) (*)	Used to connect mice, keyboards, joysticks and similar devices.

The profiles marked with a (\*) are not part of the original Bluetooth 1.1 specification and partly not finally standardised.

#### 4.4 Establishment of a Bluetooth Connection

Even though Bluetooth has a lot of different applications, the basic steps to establish a Bluetooth connection the first time are more or less the same:



- Searching for the device to connect to. This inquiry discovers the Bluetooth address, the device code (class), and the name of the device you want connect to.
- Searching for available services and selection of the service to use.
- Pairing of the devices. This step is optional and not required if no security options are enabled. During this step the entry of a PIN code (or passkey) on one or both devices is required. Using this PIN code a Link Key is generated. This Link Key is stored in both devices and used to authenticate the devices on subsequent connections.

The information collected during these three steps are now stored within the devices and used whenever a connection is to be created between them. In most cases, the initial establishment of a Bluetooth connection, will be initiated by the device that will create the connection later. This device will be the master of the Bluetooth connection.

Devices, which communicate over Bluetooth, will always have one of two roles: master or slave.

A master

- Creates a connection (paging).
- Controls which slave is allowed to send data.
- Can create additional connections while others are active.

A slave

- Waits for the connection request from a master.
- Cannot create or accept additional connection while a connection is active.

Depending on the application the device roles can be

- a) Fixed
- b) Fixed for the duration of a single connection,
- c) Dynamically change while a connection is active.

An example for case a) is the connection between a computer and a printer. The computer always creates a connection when some document is to be printed.

An example for case b) is the connection between a mobile phone and a headset. If there is an incoming call, the phone will connect to the headset as master. If the user wants to make a call, he will press some button on the headset, which will connect to the phone and allow the user to voice dial a number.

An example for case c) is a network access point for multiple users. The first device connects to the access point as a master. However, if it keeps its master role, no further connections to the access point (now a slave) are possible. To allow other devices to connect to the access point, the devices will change the roles. Now the access point is a master and can accept additional connections.

#### 4.5 Security Aspects

The Bluetooth standard defines various security options. There are options to prevent unauthorised usage of a device and options to prevent monitoring a connection.

The options to prevent unauthorised usage may not be all implemented in a given device. Possible options are:

- Bluetooth devices may be made invisible. This makes it impossible for other devices to get their Bluetooth address. Only devices, which already know the Bluetooth address of an invisible device, can connect to this device.
- Paring can be disallowed.
- The user must authorise every connection.
- A connection is only accepted from paired devices (authentication).

To prevent monitoring a connection it is also possible to enable encryption for a connection. This is only possible if authentication is enabled, too.

## 5 System Requirements

A standard PC running one of the operating systems supported by the Bluetooth PCI Adapter software. Currently there is software support for Windows 98, Windows ME, Windows NT, Windows 2000, Windows XP and Linux.

The hardware requirements mainly depend on the operating system used. At a minimum an I386 compatible CPU, 16 Mbytes main memory, 4 Mbytes free hard-disk space, a CD-ROM drive and a free PCI slot are required.

## 6 Technical Specifications

<b>Radio Transmission</b>	
Frequency Range	2,402 - 2,480 GHz
Transmit Power	+ 3dBm maximal (Bluetooth Class 2) (+20 dBm Bluetooth Class 1 available soon)
Receiver Sensitivity	-85 dBm
Modulation	GFSK Modulation with frequency hopping.
<b>Compatibility</b>	
Standards	Bluetooth 1.1 PCI Bus Specification 2.2
Operating Systems	Windows 98/ME/NT/2000/XP Linux
Interfaces	Bluetooth HCI H4
<b>Data Transfer</b>	
Speed	up to 723 kBit / second asymmetrical up to 433 kBit / second symmetrical
Bluetooth Protocols	Bluetooth HCI L2CAP, SDP, RFCOMM
Bluetooth Profiles	Generic Access, Service Discovery Serial Port, LAN Access Dial Up Networking, FAX (others under development)
<b>General</b>	
Dimensions	130 x 120 mm
Power Supply	5 Volt through PCI Bus 250 mA maximum (300 mA maximum for Class 1)