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# AirLancer™ MC-54
# AirLancer™ PCI-54

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110156/0803

# Preface

**Thank you for placing your trust in this *LANCOM* product.**

Radio networks by LANCOM Systems are low-priced alternatives and complements of local, cable-bound networks (LANs). Thanks to the mobile network adapters, notebooks and PCs are able to communicate together or gain access over base stations to cable-bound networks and even to ISDN, DSL and Internet.

This documention is addressed to users of the network adapters *AirLancer MC-54* and *AirLancer PCI-54*. We will first introduce you to the devices and their features, we will help you to install the devices and drivers, and we will show you the connection to a base station at first.

**This documentation was created by …**

… several members of our staff from a variety of departments in order to ensure you the best possible support when using your *LANCOM* product.

In case you encounter any errors, or just want to issue critics or enhancements, please do not hesitate to send an email directly to:

info@lancom.de

*Our online services www.lancom.de are available to you around the clock should you have any queries regarding the topics discussed in this manual or require any further support. Current drivers, firmware, tools and manuals can be downloaded at any time. The knowledge database (KnowledgeBase) offers an additional large pool of information.*

*In addition, LANCOM Systems support is available. For telephone numbers and contact addresses of the LANCOM Systems support, please see the enclosed leaflet or the LANCOM Systems website.*

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| Information symbols | |
|---|---|
|  | Very important instructions. Failure to observe this may result in damage. |
|  | Important instruction that should be observed. |
|  | Additional information that may be helpful but which is not required. |

| Special formatting in body text | |
|---|---|
| **Bold** | Menu commands, command buttons, or input fields |
| `Code` | Inputs and outputs in command-line mode |
| <Value> | Placeholder for a specific value |
| *Italic* | Notes and product names |

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# Contents

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# 1 Introduction

The advantages of a radio network (Wireless LAN) are obvious: notebooks and PCs can be set up where they are needed. Due to Wireless LANs, problems with missing connections or structural alterations belong to the past.

Network access in conferences or during presentations, access to resources in neighbouring buildings or data exchange with portable terminals are only some possible applications of Wireless LANs.

## 1.1 What is a Wireless LAN?

A Wireless LAN connects single terminals (e.g. PCs, notebooks and PDAs) to a local network (also LAN – **L**ocal **A**rea **N**etwork). In contrast to a conventional LAN, communication takes place via radio links rather than via network cables. This is the reason why a Wireless LAN is also called **W**ireless **L**ocal **A**rea **N**etwork (WLAN).

All functions of a cable-bound network are also available in a Wireless LAN: access to files, servers, printers etc. is as possible as the connection of individual stations to an internal mail system or to the Internet access.

## 1.2 What do you need for a Wireless LAN?

The obvious advantages of the Wireless LANs raise questions about the required hardware equipment.

### 1.2.1 Radio interfaces to the network

Each device within a Wireless LAN needs a radio interface to be able to access the Wireless LAN. Many devices, which do not have a radio interface as standard, can be upgraded with an extension card or an adapter. With an *AirLancer* client adapter you upgrade a device for access to the Wireless LAN.

A Wireless LAN is made of at least two devices having each a radio interface. In this case, these two devices are able to communicate directly via radio.

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### 1.2.2 Central collecting point – the base station

With an additional base station, a Wireless LAN becomes more comfortable and more efficient. The base station (access point) enables a central administration of the Wireless LAN. Furthermore, with a base station you can also connect an entire cable-bound LAN to a Wireless LAN. If the base station contains a router, too, it can make available a ISDN or DSL a connection to the Internet as well.

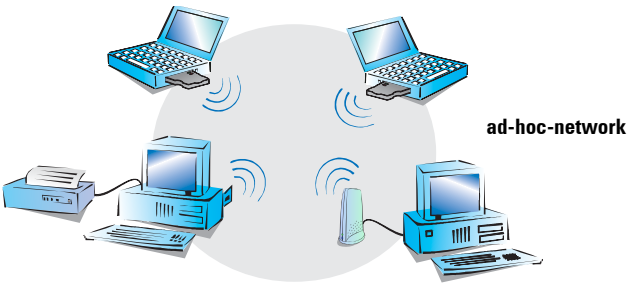
According to whether a base station is used or not in the Wireless LAN, two different operation modes arise for a Wireless LAN: on the one hand the ad-hoc-network (peer-to-peer), on the other the infrastructure-network (access point).

## 1.3 Operation modes

We take now a separate look at both operation modes.

### 1.3.1 Ad-hoc network

In ad-hoc networks you connect two or more PCs with own wireless interfaces directly together to build a Wireless LAN. All stations in this wireless LAN are able to communicate between each other without any further equipment.




*Ad-hoc-network*

This operation mode is generally called peer-to-peer network (spontaneous network). PCs can immediately get in touch and exchange data.

*Ad-hoc-networks are only possible in the 2,4 GHz frequency band with radion-LANs according to IEEE 802.11g and IEEE 802.11b. Ad-hoc-networks are not possible in the 5 GHz frequency band according to the IEEE 802.11a standard.*

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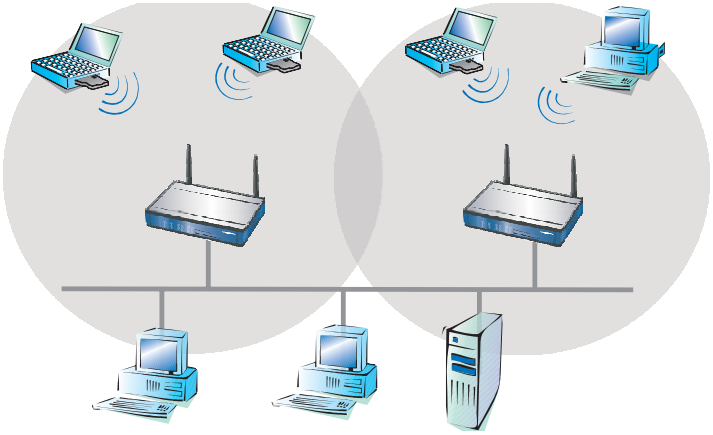
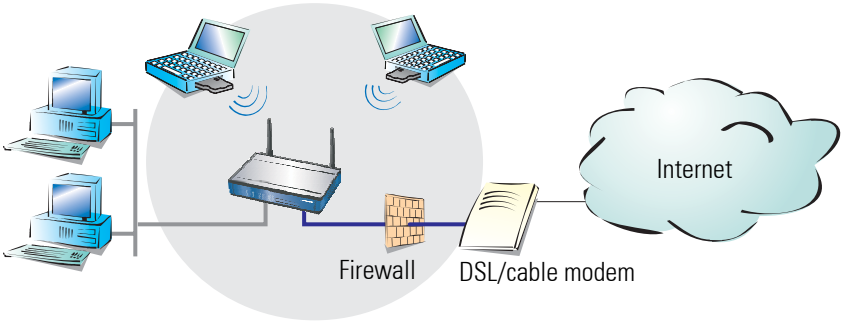
## 1.3.2 Infrastructure network

A base station (access point) is needed for connection to an existing network. The base station forms the control center for data exchange within the WLAN. The base station additionally can offer - depending on its product type - access to a cable-based LAN, as well as to the Internet.



*Infrastructure-network*

A Wireless LAN with one or more base stations is generally called a peer-to-LAN-network. In Wireless LAN terminology this network topology is referred to as an infrastructure-network. Depending on its product type, LANCOM Wireless base stations contain integrated routers for the connection with ISDN or DSL. Via the integrated routing function the linked stations get thus access to Internet and ISDN. Simultaneously, the router's integrated Firewall ensures an optimal security of the network.



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An infrastructure-network is excellently suitable as an extension to existing wired LANs. For extension of a LAN in areas, where a wiring is not possible or uneconomical, the infrastructure-network represents an ideal alternative.

## 1.4 Standardized radio transmission by IEEE

*IEEE 802.11*

*AirLancer* client adapters work with the IEEE 802.11 standard. This standard family represents an extension of the already existing IEEE standards for LANs, of which IEEE 802.3 for Ethernet is the most popular one. Within the IEEE 802.11 family there exist different standards for the radio transmission in different frequency ranges and with different speeds. *AirLancer* client adapters support according to their respective type the IEEE 802.11b standard with up to 11Mbps transfer rate into 2,4 GHz frequency band, the IEEE 802.11g standard with up to 54 Mbps transfer rate in the 2,4 GHz frequency band, and the 802.11a standard with up to 54 Mbps transfer rate in the 5 GHz frequency band.

*IEEE 802.11a 54 Mbps*

IEEE 802.11a describes the operation of Wireless LANs in the 5 GHz frequency band (5,15 GHz to 5,75 GHz) with up to 54 Mbps maximum transfer rate. The real throughput depends however on the distance and/or on the quality of the connection. With increasing distance and diminishing connecting quality, the transmission rate lowers to 48 Mbps, afterwards to 36 Mbps etc., up to a minimum of 6 Mbps. The distance of transmission ranges from up to 125 m in open expanses, in buildings typically up to 25 m. The IEEE 802.11a standard uses OFDM (**O**rthogonal **F**requency **D**ivision **M**ultiplexing) as modulation scheme.

*Please notice that not all frequencies are permitted in each country! You will find a table with the allotted frequencies and the permission regulations in the appendix.*

*OFDM*

In the 5 GHz frequency band, the OFDM modulation scheme is used for IEEE 802.11a. OFDM is a modulation scheme, which utilizes multiple independent carrier frequencies for the signal transmission, and which modulates these multiple carriers each with a reduced data transfer rate. Thus the OFDM modulation scheme is very insensitive in particular to echoes and other impairments and enables high data transfer rates.

*IEEE 802.11b 11 Mbps*

IEEE 802.11b describes the operation of local Wireless LANs in the ISM frequency band (**I**ndustrial, **S**cientific, **M**edical: 2.4 up to 2.483 GHz). The maximum transfer rate is up to 11 Mbps. The real throughput depends however on

the distance and/or on the quality of the connection. With increasing distance and diminishing connecting quality the transmission rate lowers to 5,5 Mbps, afterwards to 2 and finally to 1 Mbps. The range of the transmission distances is between up to 150 m in open expanses and in buildings typically up to 30 m. Due to different frequency bands in use, IEEE 802.11b is not compatible to IEEE 802.11a.

*Please notice that not all frequencies are permitted in each country! You will find a table with the allotted frequencies and the permission regulations in the appendix.*

*DSSS*

For shielding against interferences by other transmitters, which have possibly the same frequency band, the DSSS procedure (**D**irect **S**equence **S**pread **S**pectrum) is used for IEEE 802.11b in the 2,4 GHz frequency band. A transmitter normally uses only a very narrow range of the available frequency band for transmission. If exactly this range is used by another transmitter, interferences in transmission would be the result. With the DSSS procedure the transmitter uses a broader spread of the possible frequencies and becomes more insensitive to narrow-band disturbances then. This procedure is also used in military range for increasing tap-proof security.

*IEEE 802.11g*

*54 Mbps*

The IEEE 802.11g standard works likewise with up to 54 Mbps data transmission rate in the 2,4 GHz frequency band. Contrary to IEEE 802.11b, the OFDM modulation is used for IEEE 802.11g like already introduced for IEEE 802.11a. IEEE 802.11g contains a special compatibility mode that ensures a downward compatibility to the popular IEEE 802.11b standard . However, in this compatibility mode you encounter reduced transmission speeds. Due to the different frequency bands, IEEE 802.11g can not be compatible to IEEE 802.11a. The transmission distances of IEEE 802.11g products are comparable with those of IEEE 802.11b products.

*Transfer rates*

The indicated transfer rates are always to interpret as gross data rates, i.e. that the entire protocol overhead - as for example the complex protocols to secure the radio transmission - are included in the indicated transfer rates. The net data transfer rate can be thus lower than the indicated gross data rates, typically over up to the half for all IEEE 802.11 standards mentioned above.

*Ranges*

The actually obtained distances for radio transfers depend strongly on the individual spatial environment. In particular influences of noise and obstacles

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have an effect on the range. Decisive is frequently an optimal placement of the radio stations (both network adapters and base stations).

## 1.5 The *AirLancer 54 models*

The *AirLancer* series with 54 Mbps data transfer rate features several models. You have the possibilty to extend standard PCs and a multitude of mobile computers for access to the Wireless LAN:

- ***AirLancer MC-54ag***
  Dual band PC card (Cardbus) according either to IEEE 802.11a (up to 54 Mbps data tranfer rate in the 5 GHz band) or to IEEE 802.11g (up to 54 Mbps data transfer rate in 2,4 GHz, backward-compatible to IEEE 802.11b) for operation with mobile devices
- ***AirLancer MC-54g***
  PC card (Cardbus) according to IEEE 802.11g (up to 54 Mbps data tranfer rate in 2,4 GHz, backward-compatible to IEEE 802.11b) for operation with mobile devices
- ***AirLancer PCI-54ag***
  Dual band PCI adapter according to IEEE 802.11a (up to 54 Mbps data tranfer rate into 5 GHz frequency band) or IEEE 802.11g (up to 54 Mbps data tranfer rate into 2,4 GHz frequency band, backward-compatible to IEEE 802.11b) for installation in a stationary desktop PC. You find an external dual band antenna enclosed with the product.

### 1.5.1 Encryption in three security steps

Several countries regulate the operation of encryption technologies. *AirLancer* 54 Mbps Wireless LAN adapters support three different variants of encryption:

- WEP64 – for encryption in accordance with **W**ired **E**quivalent **P**rivacy (WEP), encryption keys are used with an effective length of 40 bit.
- WEP128 – encryption keys with a length of 104 bit.
- WEP152 – operate with keys with a length of 128 bit (only applicable with *AirLancer* 54 Mbps cards).

*Please inform yourself about the valid legal regulations for employment of encryption technology in the country you want to use a AirLancer Wireless LAN adapter. Pay attention to use no devices which support inadmissible encryption technologies.*

For detailed information about the operation of WEP encryption please see 'Encryption of the data transfer (WEP)' on page 38.

## 1.6 The next chapters

In the following two chapters you will find detailed descriptions and installation instructions for the *AirLancer* variants. Each *AirLancer* type has got its own chapter. You may advance straight forward to your model's chapter.

- *AirLancer MC-54*: chapter 2 on page 15.
- *AirLancer PCI-54*: chapter 3 on page 19.

The remaining parts of the documentation from chapter 4 upwards are valid for all *AirLancer* again.

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# 2 *AirLancer MC-54*

In this chapter you will find a description of the *AirLancer MC-54* and a step-by-step instruction for starting the card. After installation of hardware, drivers and the *AirLancer* software, you have to set up the access to a Wireless LAN. The description of this configuration step can be found for both *AirLancer*s in chapter 5.

## 2.1 Properties

*AirLancer MC-54ag* is compliant to the IEEE 802.11a, IEEE 802.11g and IEEE 802.11b standards, and is thus excellent suitable for notebook users who need a maximum of flexibility and performance. The switch between the radio standards can be made as desired automatically, and enables at any time the fastest possible connection. So for example the connection to a company network with up to 54 Mbps can be made with the IEEE 802.11g or IEEE 802.11a standard, while on journeys the compatibility to public hot spots is ensured with up to 11 Mbps transfer rate according to IEEE 802.11b.

*AirLancer MC-54g* complies to the IEEE 802.11g standard with up to 54 Mbps data transfer rate, as well as to the 11 Mbps IEEE 802.11b standard.

## 2.2 Package contents

Please check the package contents for completeness before starting. The package should contain the following components:

- *AirLancer MC-54ag* or *AirLancer MC-54g*
- *AirLancer 54 MBit*-CD with drivers, the *Client Manager* and electronical documentation

If anything is missing, please contact your retailer directly.

## 2.3 Have a look at the card

The radio network card *AirLancer MC-54* is a PC card for notebooks and mobile devices with Cardbus interface. It is a little bit longer than other PC cards. The internal radio antenna of the *AirLancer MC-54* is located inside the part jutting out of the casing.

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1 Cardbus receptacle

2 LEDs for sending and receiving status:
- Off – no radio activity
- Blinking alternately – searching for base station
- Blinking simultaneously – sending or receiving of radio data
- Flickering – card is in power save mode

3 Integrated antenna

## 2.4 Installation

The installation of *AirLancer MC-54* takes place in four steps:

a Check the system preconditions

b Put the *AirLancer MC-54* into your PC

c Driver installation

d Setting up for accessing the Wireless LAN – you will find the instruction for this configuration step in chapter 4 'The AirLancer Client Manager' on page 23.

### 2.4.1 Checking the system preconditions

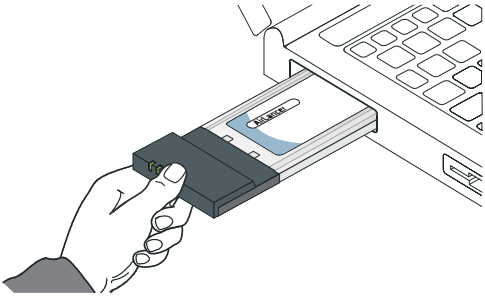
You should check before installing, whether your device fulfills all necessary system preconditions:

- PC with a free PC card interface (Cardbus, type II or type III), 300 MHz processor or faster, at least 32 MByte RAM.
- CD ROM drive

- One of the following operating systems:
  - Windows 98 SE (Second Edition)
  - Windows ME (Millennium Edition)
  - Windows 2000
  - Windows XP

## 2.4.2 Putting the card into your PC

Slip the card into a free PC card slot of your computer while running. Ensure that the side with the product label points upwards and the side with the series number label downwards.



## 2.4.3 Driver installation for *AirLancer MC-54*

In the course of the plug&play hardware identification of Windows ME, Windows 98 SE, Windows XP and Windows 2000, you will see that your computer identifies the new hardware automatically, just a short time after insertion of the card.

Please follow the instructions of the hardware installation wizard, and point to the *AirLancer 54 MBit*-CD when searching for drivers.

You find the appropriate drivers in the root folder of your *AirLancer 54 MBit*-CD.

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# 3 *AirLancer PCI-54*

In this chapter you will find a description of the radio network card *AirLancer PCI-54* and a step-by-step instruction for starting it. This chapter will end with the successful installation of hardware and drivers. The following configuration of the access to a Wireless LAN is described in chapter 5.

## 3.1 Properties

*AirLancer PCI-54ag* is intended for operating in a stationary desktop PC. It is working compliant to the IEEE 802.11a standard with up to 54 Mbps in the 5 GHz frequency band, and compliant to the IEEE 802.11g standard with up to 54 Mbps in the 2,4 GHz frequency band. *AirLancer PCI-54ag* is additionally backward-compatible to the IEEE 802.11b standard. Optimum transfer results are achieved due to the enclosed external antenna, which is suitable for operation in 2,4 GHz as well as in 5 GHz bands.

## 3.2 Package contents

Please check the package contents for completeness before starting. The package should contain the following components:

- PCI-radio network card *AirLancer PCI-54ag*
- *AirLancer 54 MBit*-CD with drivers, the *Client Manager* and electronical documentation
- External dual-band antenna

If anything is missing, please contact your retailer directly.

## 3.3 Have a look at the card

*AirLancer PCI-54* is intended for the installation in a desktop PC. An external antenna is part of the package contents.

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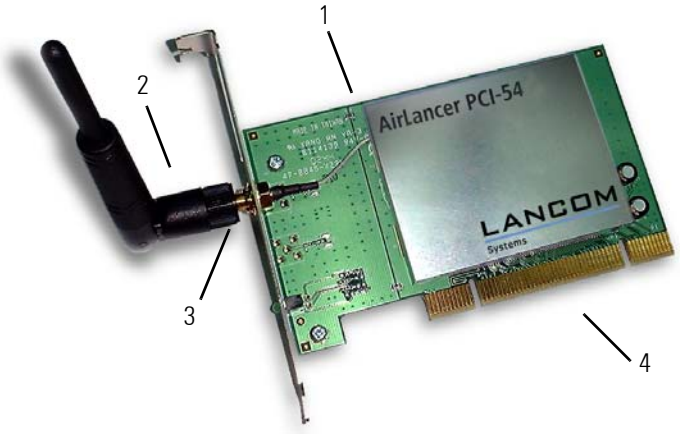



1 *AirLancer PCI-54*

2 External antenna (The kind of the external antenna may vary from the illustation above.)

3 Connection for external antenna

4 Plug-in socket for PCI bus

## 3.4 Installation

The installation of *AirLancer PCI-54* takes place in five steps:

a Checking the system preconditions

b Hardware installation of the *AirLancer PCI-54*

c Connection of the external antenna

d Driver installation

e Settings for access to the Wireless LAN – you will find the instruction for this configuration in chapter 4 'The AirLancer Client Manager' on page 23.

### 3.4.1 Checking the system preconditions

You should check before installing, whether your device fulfills all necessary system preconditions:

- PC with at least one free PCI slot (PCI specification 2.1 or better), at least 300 MHz processor, at least 32 MByte of RAM.
- CD ROM disk drive
- One of the following operating systems:
  - Windows 98 SE (Second Edition)
  - Windows ME (Millennium Edition)
  - Windows 2000
  - Windows XP

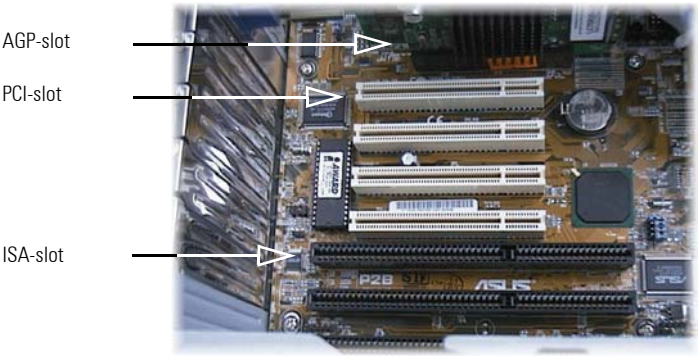
### 3.4.2 Installing *AirLancer PCI-54*

a Switch off your PC.

b In order to divert electrostatic loadings, you should touch the metal casing of the computer briefly. Then pull out the power plug on the back of the PC casing.

c Loose the screws and lockings of the computer casing and remove the casing cover.

d One free PCI slot is needed for the *AirLancer PCI-54* . Remove the assembly sheet of the slot before installing the card.




*Avoid if possible installing the PCI card into the first PCI slot in case your PC is equipped with an AGP graphics board. The first PCI slot is the one, which is located nearest towards the graphic card. In this case, interrupt conflicts could arise between the AGP graphic board and the PCI card.*

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e Insert carefully the *AirLancer PCI-54* into the free slot. Make sure that the card has got a clean seat and screw up the assembly sheet on the casing.

f Put on the PC casing and screw it up.

g Screw up the external antenna onto the antenna connection of the *AirLancer PCI-54*.

h Switch on your PC. Windows operating systems will install automatically the necessary drivers for *AirLancer PCI-54* after starting.

### 3.4.3 Driver installation for *AirLancer PCI-54*

In the course of the plug&play hardware identification of Windows ME, Windows 98 SE, Windows XP and Windows 2000, you will see that your computer identifies the new hardware automatically.

Please follow the instructions of the hardware installation wizard, and point to the *AirLancer 54 MBit*-CD when searching for drivers.

You find the appropriate drivers in the root folder of your *AirLancer 54 MBit*-CD.

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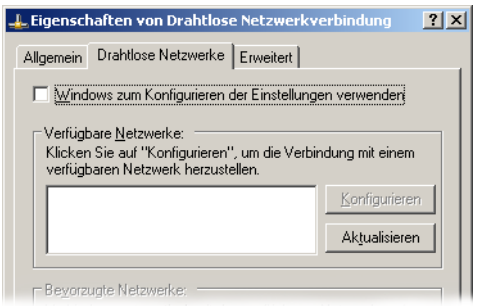
# 4 The *AirLancer Client Manager*

The *AirLancer AirLancer Client Manager* is the main program for configuration and management of *AirLancer* radio adapters. It is available for the following operating systems:

- Windows 98 SE (Second Edition)
- Windows ME (Millenium Edition)
- Windows 2000
- Windows XP

The *AirLancer* Client Manager has been installed likewise during the installation of *AirLancer* drivers.

*For configuration of the AirLancer card under Windows XP, it is possible to use the integrated configuration tools of Windows XP, as well as the AirLancer Client Manager. When running the AirLancer Client Manager under Windows XP, the integrated configuration software of the operating system has to be deactivated in any case. To do so, open under* **Settings / Control Panel** *the* **Network connections.** *Click with your right mouse button on* **Wireless network connection** *and select* **Properties**. *Deactivate the software on the index card* **Wireless networks**..




*Under Windows 98 SE the WMI Interface (Windows Management Instrumentation) is needed for operating the AirLancer Client Manager. The WMI Interface is automatically installed from the AirLancer CD during the installation of the AirLancer drivers. If the installation should not happen automatically, select from the CD within the folder WMI98SE the file with the language of your operating system, and add the installation of the WMI Interface.*

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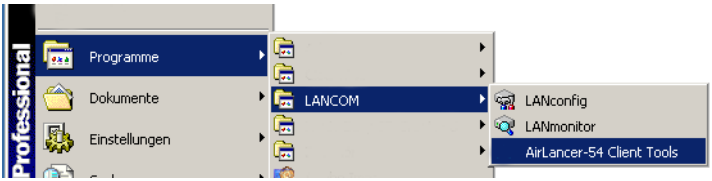
## 4.1 Starting the *AirLancer AirLancer Client Manager*

The *AirLancer Client Manager* will be activated automatically after finishing the installation. You find it in the right corner of the Windows task bar also.


*If the AirLancer Client Manager should not appear in the task bar, you can start it manually out of the menu* **Programs** */* **LANCOM / AirLancer-54 Client Tools**. *The AirLancer Client Manager will appear on the task bar then.*




To launch the *AirLancer Client Manager* or its help function, just click with the right mouse botton on the *AirLancer Client Manager* quickstart icon and select the desired function.


## 4.2 Basic configuration

The basic configuration will demonstrate you how to connect your *AirLancer* client adapter to your base station. The required parameters such as SSID and WEP settings must match exactly the according settings of your base station.

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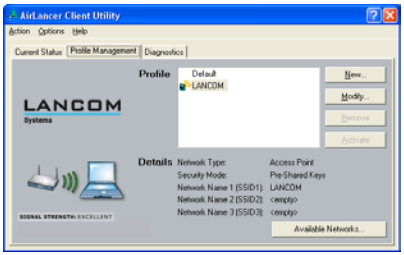
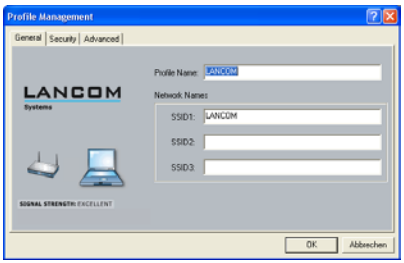
a Change in *AirLancer Client Manager* to the index card **Profile Management**. Here you can adjust the standard profile for *AirLancer* or add a new profile.




b Select the command **New** to add a new configuration profile.

Assign a name to the new profile under **Profile Name** and specify one or more wanted network names **(SSID)**.




*The network name must correspond to all other devices of the same network (base stations or radio cards). You can enter **ANY** as network name if you have a base station in reach with the 'Closed Network' function switched off. As a result, the radio station will join the next available Wireless LAN. You can find further information in section 'Closed network' on page 37 and in the documentation of your base station.*

c Change now to the register card **Advanced** and select a network type under **Network Type**. Here you can specify whether you want to access

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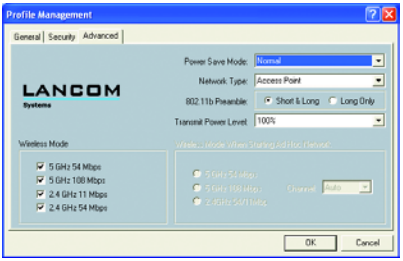
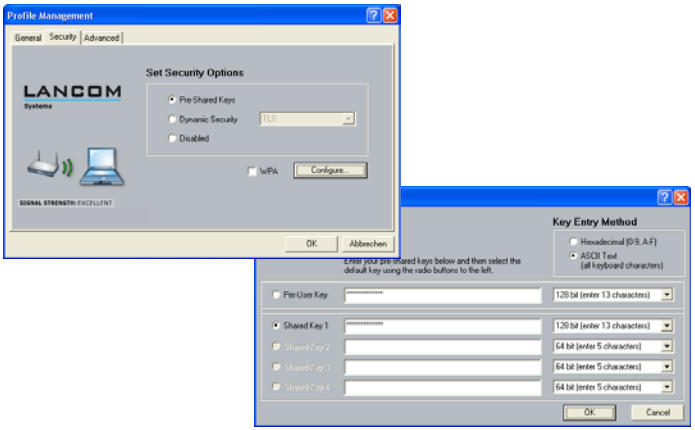
a base station (access point), or whether you want to establish ad-hoc-connections (peer-to-peer-group).




*Ad-hoc networks are only possible in the 2,4 GHz frequency band using IEEE 802.11g and IEEE 802.11b. Ad-hoc networks are not available with IEEE 802.11a in the 5 GHz band.*

d Change now to register card **Security** to activate the WEP encryption. Select **Pre-Shared Keys** for static WEP keys. To define one or more keys select **Configure**. Define first the entry method of the keys (**Key Entry Method**). Enter now one or more keys in your selected method (ASCII or hexadecimal), and select the kind of WEP (WEP64, WEP128 or WEP152) in the field behind. Select the key to use via the radio button in front. Please notice that only one key at a time can be activated. Confirm your selection with **OK**.




*You will find detailed information about WEP in section 'Encryption settings' on page 28 and 'Encryption of the data transfer (WEP)' on page 38.*

e Complete the profile configuration with **OK** and activate the new profile by clicking on the profile and then **Activate**.

f Check your country settings in the menu **Action** under **Country Select** .

*Please notice that for a legal operation of your AirLancer radio card a correct country setting is mandatory, since the regulations for operating a radio network may differ in different countries. Pay also attention to chapter 'Radio channels' on page 42 and the specific regulations for operating with radio networks in different countries!*

g Now close the *AirLancer Client Manager*.

## 4.3 Overview of the functions

### 4.3.1 Administration of profiles

- Installing profiles
- Changing to another profile

### 4.3.2 Configuration

You can configure installed profiles in the *AirLancer Client Manager* under **Profile Management** and activate them with the command **Activate**.

- For ad-hoc networks you have to enter network name, radio channel and WEP key.

*Ad-hoc networks are only possible in the 2,4 GHz frequency band using IEEE 802.11g and IEEE 802.11b. Ad-hoc networks are not available with IEEE 802.11a in the 5 GHz band.*

- When using base stations you can scan (open) Wireless LANs within reach. The available radio networks within reach are listed on the register card **Profile Management** under **Available Networks**. You can easily select the desired one by cklicking on and activating it via **Activate**.

### 4.3.3 Analysis, diagnosis and information

The page **Link Status** of your *AirLancer Client Manager* lists information about the status of the Wireless LAN and the your own radio LAN interface,

as well as the currently selected frequency band, the signal strength, the name of the selected profile and your own IP address.

Information about sent and received data can be found under **Diagnostics**, under the **Advanced** tab there are statistics and further information about transfered frames and potential transmission errors shown.

You may deactivate the radio connection uder **Action / Disable Radio**, change the country setting (**Country Select**) and disable the indication of the tray icons (**Disable Tray Icon**).

## 4.4 Encryption settings

You have to enter the keys in the settings for encryption which should secure the connection into the whole Wireless LAN.

### 4.4.1 General rules for WEP keys

When using WEP keys, please pay particular attention to the following general information:

- You have to use exactly matching keys between all involved devices. All devices use a common key within ad-hoc-networks. In infrastructure networks, the key between base station and its radio stations must match .
- Different key lengths cannot be used simultaneously on a base station. In order to giving users with WEP64 devices encrypted access to a base station, the encryption for this base station must be set to WEP64.
- Wireless LAN interfaces with WEP128 always contain also WEP64, too. At the same time, WEP128 is downward compatible to WEP64. A WEP128 device will register automatically with the short key at a WEP64 encrypted base station.

### 4.4.2 Valid key characters

One can enter WEP keys either as alpha-numeric strings (ASCII, consisting of numbers '0'–'9', small letters 'a'–'z' and capitals 'A'–'Z'), or as hexadecimal values (consisting of '0'–'9' and 'a'–'f').

*All kinds of special characters, e.g. special regional characters ('ä', 'ö', 'ü', 'ß') are no valid entries.*

When entering hexadecimal values, the number of required characters for a key will double. For a WEP64 key, 10 hexadecimal numbers have to be entered, 26 for WEP128, and 32 characters for WEP152. With alpha-numeric input (ASCII), the WEP keys consist accordingly of 5, 13 or 16 characters.

Numerous Wireless LAN devices of other manufacturers only accept hexadecimal values as WEP keys or may generate even special characters from arbitrary passwords.

Therefore if may happen that that you cannot enter a WEP key into a device of another manufacturer, which your *AirLancer* accepts without any problem. In such a case it is advisable to use the key of the more inflexible device for the connection.

### 4.4.3 Sliding key change

For infrastructure networks you can enter up to four keys into the key list of a base station. A simple exchange of the keys is facilitated this way. In this case, the base station accepts each one of the up to four entered keys. As soon as all stations are changed, the old keys can be deleted from the list.

*The sliding key change of a base station must not be mixed up with the four possible WEP key entries of an AirLancer client adapter. Concerning the AirLancer, always only one key is active, i.e. the currently selected one.*

*One of the base station's keys must be present in all involved clients.*

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# 5 Configuration example

This chapter exemplifies the use of *AirLancer* radio network cards with the following example:

## 5.1 Connecting to a company network

The main advantage of radio networks beside the establishing of independent networks is the possibility to extend existing, cable-bound networks. It does not matter whether the existing LAN has to be extended, the wiring of new workstations is however uneconomic or impossible, or whether e.g. field sales representatives need to be integrated mobilely for their office work time into the corporate LAN.

*Example: sales departement*

As example for an infrastructure network we look at the sales department of a mid-sized company. The sales representatives will move to another floor. Since they are out of the office most time anyway, their new workplaces are not wired anymore. Instead, a Wireless LAN access point enables to access the corporate Intranet services (e.g. *LANCOM 3550 Wireless)*. Since the sales representatives with their notebooks must have access to the network also in other departments of the company, further base stations will be installed. These ensure that a sales representative has access to the network within the company building at any time. When changing to another radio cell, the stations are disconnected automatically from the previous base station and connected to the new base station. This procedure is called roaming.

Each sales representative gets a radio network card *AirLancer MC-54g* for his notebook, with which he is able to log into the network of the company in his office. For also being able to print locally, the sales representatives have still got a network printer in their office, which is attached to the cable-bound

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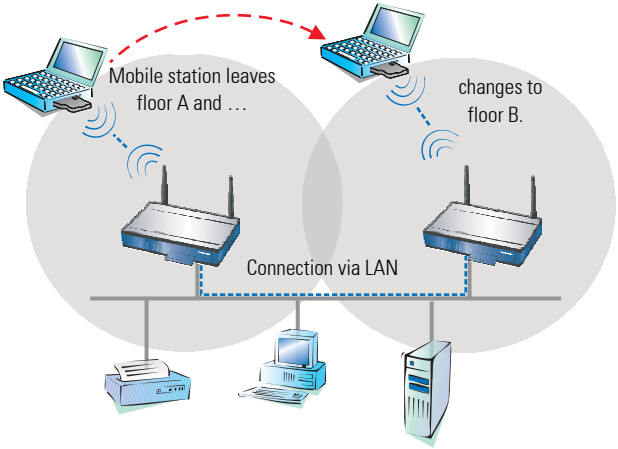
LAN. *LANCOM 3550 Wireless* serve as Wireless LAN base stations and enable a fast LAN connectivity at up to 54 Mbps.




To be able to join the WLAN base station and exchange data with the LAN, the WLAN cards of the notebooks as well as the base stations must have the matching settings in different parameters. To be able to make a first network contact, you must specify only the network name.

### Defining a network name (SSID)

You must make this specification in any case. The network name must be entered identically for all stations of the radio network. It is registered in the *AirLancer Client Manager*.

You have the possibility to store own profiles for different Wireless LANs in the *AirLancer Client Manager*.

If you use your notebook both in the office and at home, you could create two profiles: a profile 'Work' for the office and a profile 'Home' for at home. If you want to work in the evenings or during the weekend at home, then just switch to the according profile.

### Encryption of radio data

*Encryption with WEP*

Activate the WEP encryption of your radio connection in the *Client Manager* to secure the transmission over the radio link data so that it cannot be read by others. Up to four different alphanumeric (5, 13 or 16 characters) or

hexadecimal (10, 26 or 32 characters) keys are supported by base stations in parallel.

### Controll of network protocols

Check under **Start** / **Settings** / **Control Panel** / **Network and Dial-up Connections** the properties of your *AirLancer* client adapter. Under 'Bindings', the TCP/IP protocol should be selected in any case, whereas e.g. IPX/SPX protocols are additionally needed in Novell networks only.

*Information regarding configuration of base stations can be found in the documentation of your LANCOM Wireless base station and in the electronical documentation of your CD.*

*Access to LAN*

After installing the radio network cards, all functions and services are available for the sales representatives with their notebooks, which were also offered to the desktop PCs in the cabel-bound network. Being part among others:

- File server (Novell, NT or other)
- Network printer of sales departement
- Internal mailing system of the company
- Internet via LAN

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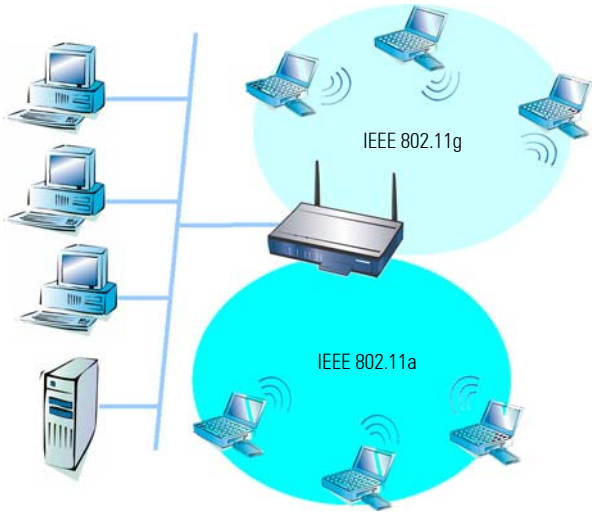
# 6 Extension of the *LANCOM 3000 Wireless* base station

The WLAN base stations of the *LANCOM 3000 Wireless* series have numerous possibilities of extension, especially the flexibility to use the extensive *LANCOM* accessories.

Due to a second, from outside accessible cardbus slot, it is possible to upgrade base stations of the *LANCOM 3000 Wireless* series with a second radio card of the *LANCOM AirLancer* series, and to extend it this way with a second radio cell, for example with new radio standards.

*Dual band operation of two radio cells*

It is possible to install a second radio cell for extension of the wireless network for parallel operation of different radio standards simply by inserting a *AirLancer MC-54* into the cardbus slot of a base station of the *LANCOM 3000 Wireless* series. For example, a single device can serve radio network clients with different standards simultaneously then.




*Please ensure that your LANCOM 3000 Wireless base station has got an up-to-date firmware image to support AirLancer MC-54 prior to installing the AirLancer MC-54. The latest firmware version for your LANCOM 3000 Wireless base station is available on the LANCOM website* www.lancom.de.

Befor installing the *AirLancer MC-54* onto your *LANCOM 3000 Wireless* ensure to turn off the base station by pulling the power supply cable out of

the it. Remove now carefully the blind slide-in module of the external cardbus slot. Slip-in now the *AirLancer MC-54* card into the cardbus slot and restart your device by plugging the power supply cable in again.

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# 7 Security within the Wireless LAN

Reflecting on Wireless LANs often entails substantial doubts concerning securtity. Many people suppose that abuse of data transmitted via radio links is relatively simple.

Wireless LAN devices by *LANCOM Systems* permit the employment of modern security technologies:

- Closed network
- Access Control (via MAC-addresses)
- Encryption of data transfer (WEP)
- 802.1x / EAP
- optional IPSec over WLAN (VPN)

## 7.1 Closed network

Each Wireless LAN according to IEEE 802.11 has its own network name (SSID). This network name serves as identification and enables administration of Wireless LANs.

A Wireless LAN can be established in such a way that any user gets access to this network. Such networks are called open networks. Any user can access an open network also without knowledge of its network name. Only requirement is the input of the network name 'ANY'.

In a closed network the access via 'ANY' is not possible. User have to specify the correct network name. Unknown networks stay hidden to them.

Ad-hoc-networks are automatically installed as closed networks and cannot be opened. Infrastructure networks can be run either in open or closed condition. You make the settings for this at the respective base station.

## 7.2 Access control via MAC address

Each network device has an special identification number. This identification number is the so-called MAC address (**M**edia **A**ccess **C**ontrol), which is world-wide unique per device.

The MAC address is programmed into the hardware and cannot be changed. Wireless LAN devices by *LANCOM Systems* have got a MAC address label on the casing.

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The access to an infrastructure network can be restricted to known MAC addresses for certain Wireless LAN devices solely. To do so, Access Control lists are available within the LANCOM base stations, in which the granted MAC addresses can be deposited.

This method of access control is not available for ad-hoc networks.

## 7.3 Encryption of the data transfer (WEP)

A special role comes up to the encryption of data transfer for Wireless LANs. For IEEE 802.11 radio transfer the supplementing encryption standard is WEP, which means **W**ired **E**quivalent **P**rivacy. The function of WEP is to ensure the security level of cable-bound LANs also in Wireless LANs.

The WEP protocol encrypts the radio data with a typical key length of 40, 104 or 128 bit.

### 7.3.1 WEP functionality

WEP encrypts data frames on level 2 of the OSI model. Thus data frames of higher protocols (in particular IP packets) are automatically protected by WEP.

WEP uses the well-known RC4 algorithm of the american cryptography specialist RSA Data Security for encryption. Several variants with different key lengths are available:

- **WEP64**
  The nominal key length is 64 bit, with 40 bit (5 characters, each 8 bit) freely selectable.
- **WEP128**
  The nominal key length is 128 bit, with 104 bit (13 characters, each 8 bit) freely selectable.
- **WEP152**
  The nominal key length is 152 bit, with keys of 128 bit length, whereof 128 bit (16 characters, each 8 bit) are freely selectable. WEP152 is only available for 54 Mbps devices.

*The shorter effective key lengths result from the encryption method of the RC4 algorithm. RC4 uses the remaining 24 bits in order to produce a unique key for each encrypted block. These 24 bits are the so-called 'initialization vector'.*

WEP encryption requires calculating time in the Wireless LAN devices and can slightly impair the data transfer rate.

### 7.3.2 Tipps for handling keys

The security of encryption procedures can be substantially increased the by paying attention to some important rules for handling keys.

- **Keep keys as secret as possible.**
  Never note a key. Popular, but completely unsuitable are for example: notebooks, wallets and text files in PCs. Do not share a key unnecessarily.
- **Select a random key.**
  Use randomized keys of character and number sequences. Keys from the general linguistic usage are insecure.
- **Change your key regularly.**
  Keys are to be exchanged as frequently as possible. That is a laborious task but you increase the security in a considerable way. In infrastructure networks you have the possibility to change keys smoothly (see 'Sliding key change' on page 29).
- **Change a key immediately in case of suspicion.**
  It is time to change the key of the Wireless LAN if an employee with access to a key leaves your company. The key should also be renewed in case of smallest suspicion of a leak.

### 7.3.3 The ways you can increase the security additionally

With WEP it will be difficult for external persons without knowledge of the keys to receive access to transferred data. Although WEP offers in the very most cases a sufficient level of data security, in practice there is a limit for each technology.

Therefore it may be useful to take additional security technologies on higher protocol level. Modern IPSec products (on level 3 of the OSI model) make possible a separate protection of users within the Wireless LAN and facilitate the administration by an automatic key management. Something similar applies to SSL, PGP and S/MIME for example, products which work on application level.

All these technologies can be added on top of a WEP-secured radio connection, just like they use in a conventional network the 'naturally' protected cable as their communication basis.

## 7.4 802.1x / EAP

The international industry standard IEEE 802.1x and the **E**xtensible **A**uthentication **P**rotocol (EAP) enables the realization of reliable and secure access controls for base stations. The access data is centrally administered on a RADIUS server then, and can be retrieved by the base station if required.

Moreover, this technology makes enables a secured dispatch and a regular automatic change of WEP keys. In this way IEEE 802.1x improves the protection efforts of WEP.

In Windows XP the IEEE-802.1x technology is already integrated by default. For other operating systems 802.1x client software is available.

## 7.5 IPSec over WLAN

By means of IPSec over WLAN a radio network can be optimally secured in addition to the already introduced securing mechanisms.

In order to run IPSec over WLAN you have to upgrade the base stations of the *LANCOM 3000 Wireless* series with the *LANCOM VPN* option. Thereafter the *LANCOM 3000 Wireless* base station serves as a VPN gateway also.

Thereby, in addition to WEP encryption, a *LANCOM 3000 Wireless* base station offers optionally the possibility to encrypt the radio-link via an IPSec-based VPN. Required components are the *LANCOM VPN option* and the *LANCOM VPN Client* software for Windows 2000 and XP. For other operating systems client software from other manufacturers is available.

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# 8 Appendix

## 8.1 Technical data

| | AirLancer MC-54ag / MC-54g | AirLancer PCI-54ag |
|---|---|---|
| interface | PC Card (Cardbus) | PCI (Spec. 2.1) |
| WLAN connection | 54 Mbps, IEEE 802.11g<br>11 Mbps, IEEE 802.11b<br>54 Mbps, IEEE 802.11a (only MC-54ag) | 54 Mbps, IEEE 802.11g<br>11 Mbps, IEEE 802.11b<br>54 Mbps, IEEE 802.11a |
| Antenna connection | - | yes (external antenna included) |
| Frequency range* | 2400-2483,5 MHz (ISM) or 5150-5750 MHz (5 GHz MC-54ag only) | 2400-2483,5 MHz (ISM) or 5150-5750 MHz |
| WLAN standards | IEEE 802.11g, OFDM<br>IEEE 802.11b, DSSS<br>or IEEE 802.11a, OFDM (MC-54ag) | IEEE 802.11g, OFDM<br>IEEE 802.11b, DSSS<br>or IEEE 802.11a, OFDM |
| WLAN transfer rate | 54 Mbps (fallback to 48, 36,24,18,12, 9, 6 Mbps), or 11 Mbps (fallback to 5.5, 2, 1 Mbps) | 54 Mbps (fallback to 48, 36,24,18,12, 9, 6 Mbps), or 11 Mbps (fallback to 5.5, 2, 1 Mbps) |
| Transmission power | up to 16 dBm with TPC (Transmission Power Control) | |
| Range** | Up to 25m in closed areas, up to 125m with direct sight connection | |
| Transfer channels* | Up to 11 channels, max. 3 non-overlapping (2,4 GHz band), or up to 19 non-overlapping channels (5 GHz band with DFS, MC-54ag only) | Up to 11 channels, max. 3 non-overlapping (2,4 GHz band), or up to 19 non-overlapping channels (5 GHz band with DFS) |
| Driver support | Windows 98 SE / ME / 2000 / XP | |
| WLAN Security | WEP64 / WEP128 / WEP152 | |
| Package contents | CD with documentation in English and German, PC driver, management and diagnostics software, external antenna (AirLancer PCI-54 only) | |
| Licences | CE compliant, conforming to ETSI ETS 300 328-2, EN 301 893, EN 301 489-17, EN 60950 | |

*) Dependent on national regulations.

**)The effective range and data transfer rate depend on site conditions and possible disturbances.

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## 8.2 Radio channels

### 8.2.1 Radio channels in the 2,4 GHz frequency band

In the frequency range from 2400 to 2483 MHz are up to 13 channels available, from which maximally 3 are non-overlapping. The following overview shows which channels are supported by the different regions (EU/WORLD).

| Frequency range | 2400–2500 MHz | |
|---|---|---|
| **Channel-No.** | **EU (ETSI)** | **WORLD (ETSI + FCC)** |
| 1 | 2412 | 2412 |
| 2 | 2417 | 2417 |
| 3 | 2422 | 2422 |
| 4 | 2427 | 2427 |
| 5 | 2432 | 2432 |
| 6 | 2437 | 2437 |
| 7 | 2442 | 2442 |
| 8 | 2447 | 2447 |
| 9 | 2452 | 2452 |
| 10 | 2457 | 2457 |
| 11 | **2462** | **2462** |
| 12 | 2467 | – |
| 13 | 2472 | – |

Bold values indicate the default setting of the *AirLancer* radio adapters when utilized in a base station.

## 8.2.2 Radio channels in the 5 GHz frequency band

In the frequency range from 5,13 to 5,805 GHz up to 19 non-overlapping channels are available in Europe. The following overview shows which channels are allowed in different regions.

| Channel-No. | Frequency | ETSI (EU) | FCC (US) |
|---|---|---|---|
| 36 | 5,180 GHz | yes | yes |
| 40 | 5,200 GHz | yes | yes |
| 44 | 5,220 GHz | yes | yes |
| 48 | 5,240 GHz | yes | yes |
| 52 | 5,260 GHz | yes | yes |
| 56 | 5,280 GHz | yes | yes |
| 60 | 5,300 GHz | yes | yes |
| 64 | 5,320 GHz | yes | yes |
| 100 | 5,500 GHz | yes | no |
| 104 | 5,520 GHz | yes | no |
| 108 | 5,540 GHz | yes | no |
| 112 | 5,560 GHz | yes | no |
| 116 | 5,580 GHz | yes | no |
| 120 | 5,600 GHz | yes | no |
| 124 | 5,620 GHz | yes | no |
| 128 | 5,640 GHz | yes | no |
| 132 | 5,660 GHz | yes | no |
| 136 | 5,680 GHz | yes | no |
| 140 | 5,700 GHz | yes | no |
| 149 | 5,745 GHz | no | yes |
| 153 | 5,765 GHz | no | yes |
| 157 | 5,785 GHz | no | yes |
| 161 | 5,805 GHz | no | yes |

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## 8.3 Restrictions of use within EU

In European countries the 5 GHz frequency band is divided into three sub-bands, to which different use conditions can apply. The three sub-bands are defined as follows:

- Lower frequency range from 5,15 to 5,25 GHz (Channels 36, 40, 44 and 48)
- Middle frequency range from 5,25 to 5,35 GHz (Channels 52, 56, 60 and 64)
- Upper frequency range from 5,470 to 5,725 GHz (Channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136 and 140)

When creating this documentation, the following national restrictions of use for Wireless LAN devices were in force:

| Country | Restrictions |
|---|---|
| Great Britain | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. For use however a test radio license is necessary. Detailed information under: http://www.radio.gov.uk/topics/mobiledata/mobiledata-index.htm |
| France | In the 2,4 GHz frequency band only the channels 10,11, 12 and 13 may be used. When using TPC and DFS only the lower and the middle frequency range may be used in the 5 GHz band. The use in open terrain is forbidden in both frequency bands. The use in the 2,4 GHz frequency band is subject to authorization. Detailed information under: http://www.art-telecom.fr/eng/index.htm |
| Germany | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. Detailed information under: http://www.regtp.de/schriften/start/fs_08.html |
| Austria | Only the lower frequency range may be used in the 5 GHz band. An opening of of the middle and upper frequency band when using TPC and DFS is expected. Detailed information under: http://www.bmvit.gv.at/sixcms_upload/media/70/news15_2002rev2_1.pdf |
| Belgium | When using TPC and DFS only the lower and the middle frequency range may be used in the 5 GHz band. Detailed information under: http://www.bipt.be/bipt_e.htm |
| Denmark | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. Detailed information under: http://www.itst.dk |
| Finland | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. Detailed information under: http://www.ficora.fi/englanti/radio/RLANnotice.htm |

| Country | Restrictions |
|---|---|
| Greece | The use in the 5 GHz frequency band is actually forbidden! The use in the 2,4 GHz frequency band is permitted in closed environments, but forbidden in free areas. |
| Iceland | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. Detailed information under: http://www.pta.is/english/estart.htm |
| Ireland | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. Detailed information under: http://www.odtr.ie |
| Italy | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. The use in closed environments is subject to authorization in 2,4 and 5 GHz frequency range. The use in free areas is forbidden. Detailed information under: http://www.comunicazioni.it/en/index.php |
| Luxembourg | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. Detailed information under: http://www.etat.lu/ILR/content.html |
| Netherlands | In the 5 GHz band all three frequency ranges may be used. The use in the 2,4 GHz frequency band is permitted in closed environments, but forbidden in free areas. Detailed information under: http://www.egentschaptelekom.nl |
| Norway | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. Detailed information under: http://www.npt.no/eng/system/html/index.html |
| Portugal | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. Detailed information under: http://www.anacom.pt |
| Spain | The use in the 5 GHz frequency band is actually forbidden! The use in the 2,4 GHz frequency band is permitted in closed environments, but forbidden in free areas. Detailed information under: http://www.setsi.mcyt.es |
| Sweden | When using TPC and DFS all three frequency ranges may be used in the 5 GHz band. Detailed information under: http://www.pts.se/index_eng.asp?avdelning=hem_english&language=eng |
| Switzerland and Liech-tenstein | When using TPC and DFS only the lower frequency range may be used in the 5 GHz band. Detailed information under: http://www.bakom.ch/en/index.html |

*Please inform yourself about the current radio regulations of the country you want to operate a Wireless LAN device.*

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## 8.4 Declaration of conformity

### 8.4.1 European Union (CE)

The CE declarations of conformity for *AirLancer MC-54* and *AirLancer PCI-54* are available for download on the LANCOM Systems web site (www.lancom.de).