WIMAN Star
WIMAN Access
WIMAN Line

DRAFT

Operation Manual
Software Version: T0.7

- Version E 17 -
August 18th, 2000

Distribution and/or duplication of any materials belonging to this product is prohibited except with explicit written permission from Airdata WIMAN Systems, Inc. All information was generated after careful research and testing.

Subjects to change without notice.

Bad Rappenau, July 2000

The actual version of this operation manual can be found at http://www.wiman.net.

Windows is a registered trademark of **Microsoft Corporation**. **Cisco** is a registered trademark of **Cisco Systems Inc**. Other products mentioned in this manual might be registered trademarks of the respective manufacturer.

FCC-Information:

FCC ID: NB9WIMAN2A24

This Device complies with Part 15 of the FCC-Rules.

Operation is subject to the following two conditions:

(1)   This device may not cause harmful interference, and

(2)   This device must accept any interference received, including interference that may cause undesired operation.

Caution !

Exposure to Radio Frequency Radiation

The radiated output power of the equipment is below the FCC radio exposure limits. Nevertheless, it is advised to use the equipment in such manner that the potential for human contact during normal operation is minimized.

Any changes or modifications not in accordance with the instructions may void the user's authority to operate the equipment.

The WIMAN unit does not contain any user serviceable parts inside and should not be opened by anyone other than authorized service personnel.

Configuration and installation shall be performed by personnel being familiar with the WIMAN system only. Improper configuration may void the right to operate WIMAN units. For more information, please refer to chapter 2.5.1 of this manual.

Conventions

This operation manual uses the following conventions:

Symbols:

Danger!

This symbol is intended to warn the user that improper use of the instruments could result in injury.

Information

This symbol is intended to draw the user's attention to useful information.

Note

This symbol is intended to alert the user to information that may save time or simplify a task.

Attention

This symbol is intended to indicate specific directions and methods necessary for proper operation.

Checklist

This symbol is intended to inform the user of the required steps to complete a task.

Texts:

Commands are shown in *italics and bold* typeface.

Parameters are shown in *italics*.

Display outputs are shown in `Courier`.

Keys and names of Menu windows are shown in **bold** typeface.

Table of Contents

Table of Contents

1   <u>Introduction to WIMAN technology</u>

The WIMAN product series provides a powerful new technology for the design of flexible data networks. Integrating a multitude of innovative and optimized methods and communication protocols, we've created a wireless network technology, which is available for various applications such as campus networking, high speed access for Internet users, and cellular data networks in conurbation areas, etc.

In contrast to other available wireless products, the WIMAN product line integrates the demand for an economic system with high data rates, a high range and efficient utilization of the frequency-spectrum. The WIMAN System utilizes the most modern spread spectrum technology without using any further encoding algorithm, and features higher security and noise immunity than other existing systems. Applying the frequency hopping technique in combination with an intelligent transmission control algorithm, the ISM frequency range between 2.4 and 2.4835 GHz is optimally used.

The interfaces provided by the WIMAN unit to attach to the customer's terminal equipment complies with the international X.21 and V.24/RS232/RJ45 standards allowing a direct connection to any standard personal computer, workstation or mainframe system. For hooking up wired networks (LAN, MAN, WAN), there are various routers available in the form of hardware or software solutions.

The WIMAN product line provides users with the benefits of high performance and speed in a wireless modem. WIMAN is easily distinguished from other transmission systems through several remarkable features:

1.1 <u>Transmission Speeds / Frequency Range</u>

At present, wireless data network technology can be divided into two categories: The first category consists of wireless modems with a small transmission bandwidth. These products are used for company networks, cellular networks, CDPD (Cellular Digital Packed Data) or GSM (Global System for Mobile communication) networks. The second category consists of wireless modems with large bandwidth in the ISM range (Industrial Scientific Media, frequency range around 2,4 GHz), such as wireless LAN products.

It is possible to cover a large area with the narrow band systems. Some systems are even able to cover a complete country. The other LAN products specified above operate with substantially higher data transmission rates; however, the range of these systems is limited to approx. 300m/900ft. Therefore, the area of application is strongly reduced.

The WIMAN technology offers the advantages of both the narrow band systems and the broadband systems. With a clear line of sight between the antennas, data can be transmitted between two WIMAN radio modems with a rate of up to 2048 KBit/s (at the data interface) / 512KBit/sec at the wireless interface in duplex operation over a distance of up to approx. 40km/25miles (FCC version) or up to approx. 5km/3.2miles (ETSI version).

Furthermore, WIMAN systems are deployed in a highly scalable manner similar in nature to a cellular structure. Therefore, it can overcome some of the need for direct line-of-sight.

1.2 <u>Frequency Hopping Procedure</u>

All WIMAN radio modems operate with the modern frequency hopping procedure. With this procedure, the RF-channel is changed in very short intervals (all 8 ms). A total of 80 non-overlapping radio channels are available.

WIMAN takes advantage of these 80 channels, each with 1 MHz of bandwidth, by use of spread spectrum technology (frequency hopping).

The WIMAN radio modem transmits information packages that hop from one frequency to another, not staying longer than 8 ms in a frequency range.

As data packets are transmitted and received, the ISP selects the order of the channels, producing a truly secured line of data.

This remarkable feature yields the following important advantages:

- High security against eavesdropping due to fast changes of the channel,

- Resistance to jamming,

- Protection against other RF-systems in the same frequency band,

- High performance with high efficiency,

- Possibility of parallel operation of WIMAN connections by use of different frequency-hopping patterns.

1.3 <u>WIMAN Network Topology</u>

With the WIMAN technology, bonding can be structured in a simple point-to-point connection, but it is also possible to set up various other network topologies. The WIMAN product series consists of three different wireless WIMAN radio-modems:

WIMAN STAR: wireless base station for public and private point-to-multi-point networks.

WIMAN ACCESS: wireless access node for public and private point-to-multi-point networks,

WIMAN LINE: wireless point-to-point connection between two computers or computer networks.

1.4 <u>Basic WIMAN Topologies</u>

As previously mentioned, the WIMAN technology is not limited to point-to-point connections. Different network topologies can be structured. The following chapter introduces some simple network configurations using the WIMAN units to illustrate some of the features of each configuration.

1.4.1 <u>Point-to-Point connections with WIMAN LINE</u>

WIMAN LINE radio modems enable point-to-point connections between local area networks, data terminals or individual personal computers. In general, the WIMAN LINE can replace a wire communication or a zero-modem cable. At present the WIMAN LINE supports duplex data transmission rates of 256 kBit/s at 2FSK

Router   WIMAN Line   WIMAN Line   Router
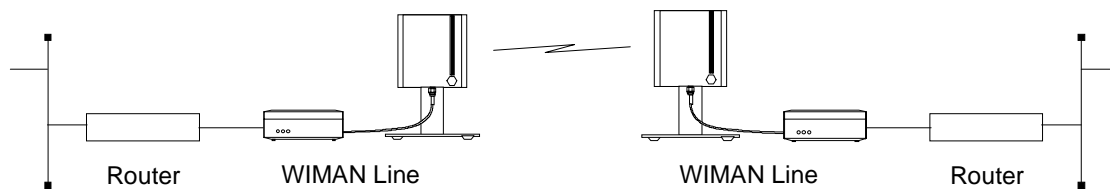
Figure 1   ***Point-to-Point connection using WIMAN LINE***

1.4.2 Cellular Networks using WIMAN STAR and WIMAN ACCESS

One of the outstanding features of the WIMAN series is its ability to support point-to-multi-point networks with technically matured distribution of load between the individual ACCESS devices (load balancing).

Figure 2 shows a typical network environment.
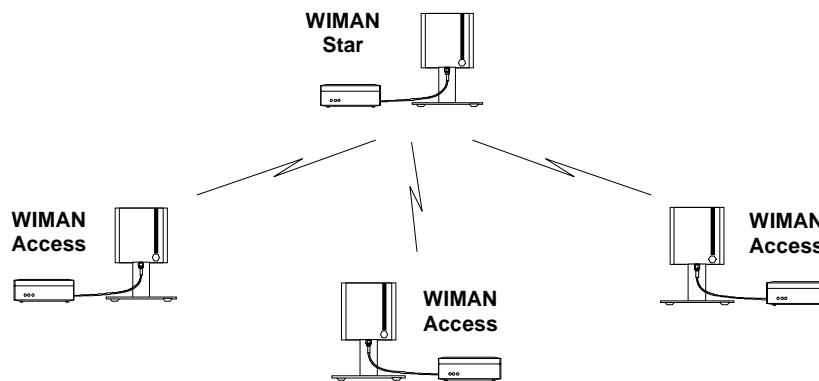
Figure 2   *wireless access networks with WIMAN STAR and WIMAN ACCESS*

This network configuration can be used as a wireless connection to the Internet.

The current software-Version supports up to 9 WIMAN ACCESS per WIMAN STAR. They can be configured to meet higher density of traffic in the networks by use of several synchronized parallel WIMAN radio modems.

Avoid errors by synchronization of the WIMAN units (see chapter 4.5 on page 53).

1.5 <u>Transmission Protocols</u>

1.5.1 <u>Frame Relay</u>

The WIMAN system supports the Frame Relay protocol widely used at many Telephony companies.

It operates smoothly in Frame Relay networks and enables the application of commercial Frame Relay compatible Router as switches on the STAR- and the ACCESS side.

Except for the supply of an Internet access, it is additionally possible to use the WIMAN Frame Relay system for telephony uses. Therefore, commercial Frame Relay multiplexers from companies such as RAD, NUERA, CISCO, etc. can be used.

The Frame Relay support is a software-configurable feature and is starting from the software-Version T.05. This software version does also support leased line functionality.
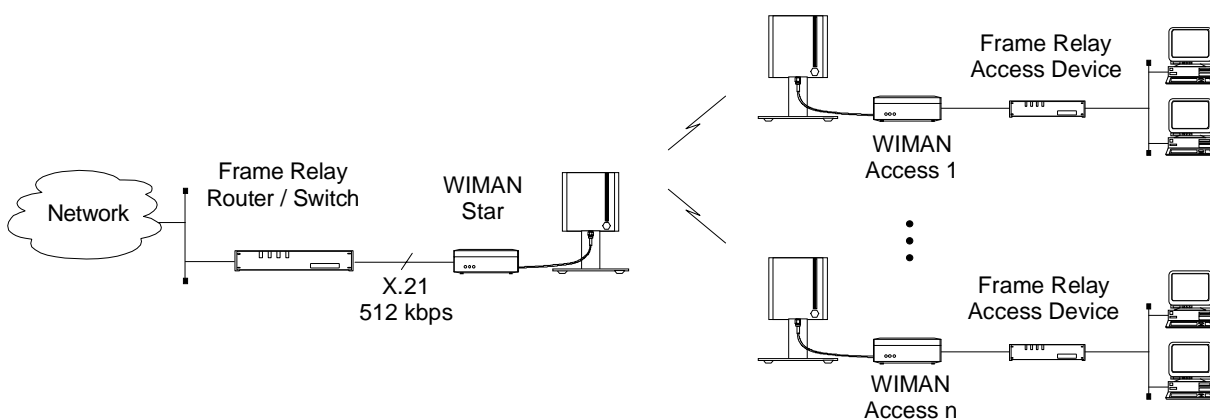
Figure 3   Standard Frame Relay applications

Router *: Any Frame Relay-Router or Switch with Synchronous X.21-port (128 kBit/s), RFC 1490-Standard

- LMI has to be switched off, DLCI is configured statically.

Router **: Any Frame Relay-Router or Switch with synchronous X.21-port (128 kBit/s), RFC 1490-Standard

- LMI has to be switched off, DLCI is configured statically.

2 The WIMAN Command Line Level

The operating system of the WIMAN radio modem has an integrated command line interpreter ("Shell") for configuration of the WIMAN. Input and output is visible on the input or output-window of a PC terminal program (e.g. TELIX, ZOC).

So that communication between the terminal program and the WIMAN can take place, the communication parameters of the terminal program and the WIMAN must correspond.

The configuration of the WIMAN radio modem is executed with instructions on the command line level ("Shell"). There is no distinction between upper- and lower case characters (except for passwords).

The command line level can be accessed via different interfaces. Successful locking on the command line level is acknowledged by display of the command line prompt. The factory setting of the command line prompt is `WIMAN II >.`

The user may personalize the command line prompt (e.g. `DEVICE 1:`).

2.1 Authorization Levels

The command line level has two different authorization levels that differ in the number of changeable parameters. Therefore, the WIMAN radio modem may be configured by diversely qualified and permitted persons (e.g. user, Provider).

The last character of the command line prompt displays the authorization level you are in at that time.

The authorization levels are represented as follows:

- Authorization level 1 WIMAN II >

- Authorization level 2 WIMAN II #

Each authorization level can be protected with a different password. However, a password for authorization level 2 is always needed.

2.2 <u>**Passwords**</u>

Passwords serve to protect the WIMAN from unauthorized access to the command line level in the different authorization levels. All passwords must have a length from four to eight characters. For the passwords the following characters may be used:

" a... z ", " A... z ", " 0... 9 ", " - ", " @ ", "?", " \ ", " [", "] ", " < ", " > ".

NOTE:

The WIMAN <u>DOES</u> acknowledge case sensitivity characters for passwords.

Attention

Typing in of any other characters than the ones mentioned above may lead to a reset of the WIMAN shell.

If no password is assigned for the authorization level one, the command line appears when the WIMAN is switched on. Otherwise you are asked to enter a password to access the command line level one.

A password for authorization level two is always required. This password cannot be deleted, however it is possible to modify this password.

In case of a false configuration or a forgotten password in the lowest authorization level (e.g. user authorization level) qualified personnel are needed to access the unit (e.g. Provider). It is possible to gain access directly to level two by entering the designated password for that level.

With suitable instruction (see chapter 3.5.1, on page 40) you can reset the password for authorization level one.

If, for any reason, you are unable to arrive at the necessary authorization level any longer and you are thus closed out of the device, it is possible to gain access with a master password. The master password can only be used after the third unsuccessful access attempt and can only be made via the serial interface. Further information on this issue can be obtained from your WIMAN Distributor.

Attention:

The input of the master password can be executed exclusively over the RS-232 port and results in resetting of all parameters to their factory settings. A reconfiguration of the device will be necessary afterwards.

2.3 <u>Operation Modes</u>

On the command line level, the following operating modes are differentiated with respect to each authorization level:

- Command mode and

- Configuration mode.

In command mode you can view the accepted parameters of the present configuration (current config) as well as give the accepted commands for this mode and authorization level (see Chapter 2.6.1 on page 25).

In configuration mode you may change only the parameters allowed for that specific authorization level.

The system software indicates these parameters as "new configuration" (new config). You may render certified instructions for this level and this mode.

Figure 4 shows how to switch between the different authorization levels and operation modes.

	serial connection / Telnet	

Reset pw
↓

	←	↓ [pw] ↑ exit	↑ exit
Reset Config	← pw →	Command Mode (1)	→ en pw	Command Mode (2)

↓ config ↑ exit   ↓ config ↑ exit

Config Mode		Config Mode

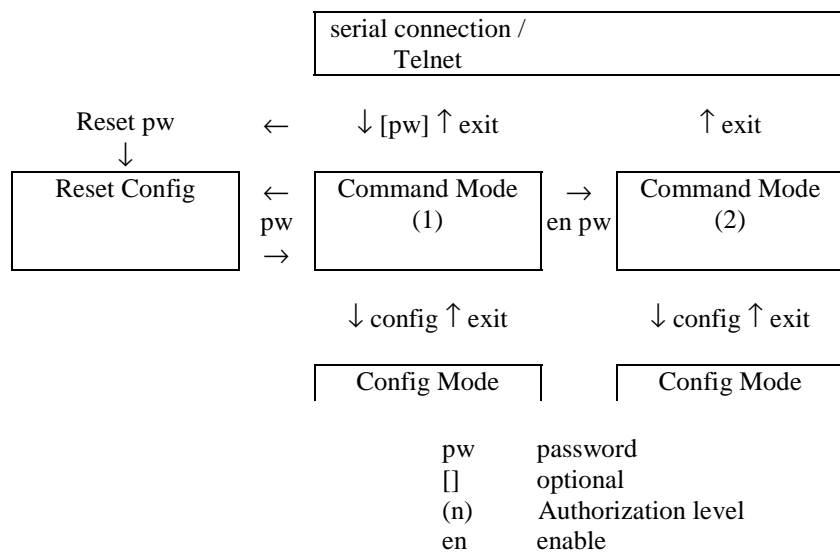| pw	password
[]	optional
(n)	Authorization level
en	enable

Figure 4   *Diagram of the different operating modes*

2.4 <u>Configuration Data</u>

The configuration data (values of the adjustable parameters) is classified into the following three types:

- New configuration (new config),

- Present configuration (current config) and

- Non-volatile configuration (boot config).

Figure 5 shows the connections of the three different types of configuration data.
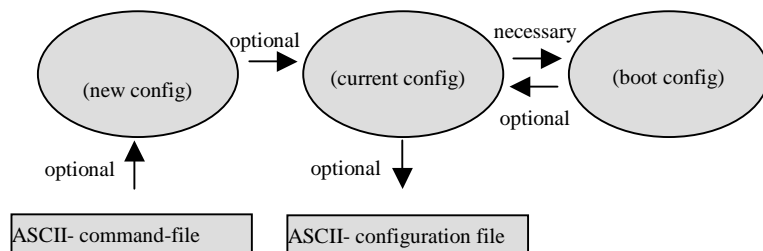
Figure 5   *Configuration data*

The **new configuration** is created by modification of the parameters in the configuration mode (see Chapter 2). This has no effect on the current operation. It is possible to produce a new configuration by manually changing the parameters or by reading-in a parameter text file. In the parameter text file comments may be inserted at the start of a line or after an instruction (See Chapter xxx on page xxx).

The **present configuration** consists of the parameters used by the system at that time. This configuration can be saved as a text file.

The **non-volatile configuration** consists of the parameters called on and made the present configuration at a strat or restart of the device. Modified parameters (new configuration) can either be taken over (transfer for present configuration) or rejected by a query when leaving the configuration mode.

The up-to-date parameters (present configuration) can be permanently taken over by a further query when leaving the command mode (transfer into the non-volatile configuration) or maintained only up to the next restart.

2.5 <u>Configuration Parameters</u>

The WIMAN radio modems are delivered with a factory-installed standard setup. To adjust the WIMAN to your specific requirements you can modify different parameters (depending on the authorization level).

The configurable Parameters are classified into the following groups:

- Parameter for the wireless interface,

- Parameter for the serial interface,

- Parameter for the network,

- Other parameters.

All parameter can only be changed in the configuration mode of the appropriate level.

2.5.1 <u>Parameter for the Wireless Interface</u>

The following parameters affect the wireless interface and serve to set up the network configuration. These parametersalso set up countermeasures against possible disturbances in the operating frequency band.

Destination

The parameter *destination* determines the destination address of the WIMAN, to which all data will be sent.

Note:

This setting is only available on WIMAN LINE units and is not used on WIMAN STAR and ACCESS units.

Authorization Level:	2
Preset value:	1
Scope:	0 ... 250

FTab

The parameter *FTab* determines the frequency-hopping pattern between the 80 channels. Each WIMAN radio-modem comes with a factory installed frequency-hopping pattern that cannot be changed. However, it is possible to create a second frequency-hopping pattern to be used in place of the standard one. In this case the new pattern can be set *with FTab*.

Authorization Level: 2

FTabMode

The user-defined hopping pattern must be switched on with *FtabMode* set to USER.

Authorization Level:	2
Preset value:	System
Scope:	System, User

LoopData

The parameter *LoopData* sets the hexadecimal value to be sent in a *LoopTest*.

Authorization Level:	2
Preset value:	FFFFFFFF
Scope:	00000000 … FFFFFFFF

LoopMode

The parameter *LoopMode* determines, which bit pattern and frame lengths are to be used with the independent back loop test (see loop test below). This parameter is not available on STAR devices.

It is possible to set the values **normal**, **load**, **long** and **high**. The values function as follows:

- Normal

  Pseudo coincidental data is transmitted. All 256 byte values occur equivalently. A break is inserted between two packages. This type of test is to simulate the "normal" data communication in a network.

- Load

  Pseudo coincidental data is transmitted. However, in this type of test it is transmitted with highest possible transfer rate.

- Long

  "Stress" data (bit pattern, which lead to a high utilization) is transmitted at a normal transfer rate.

- High

  "Stress" data is transmitted with high transfer rate.

Attention:

If the looptest is executed in an operating radio net, all values except **normal** should be avoided for the parameter LoopMode. Use of any other value may result in malfunction.

Authorization Level:	2
Preset value:	long
Scope:	normal, load, long, high

LoopTest

The parameter *LoopTest* yields a back loop test. If loop test is set to **True**, the WIMAN begins to transmit test data in back loop operation. Therefore, it is possible to check procedure statistics during the test. This parameter is not available on STAR devices.

Authorization Level:	2
Preset value:	False
Scope:	True, False

MaxRetry

The parameter *MaxRetry* determines the maximum number of a repeated package dispatching. A package is dispatched again only in the case of a failed checksum test. If a package fails the checksum test, the WIMAN tries to send the package again. The number of attempts to resend the package can be determined in *MaxRetry*.

Authorization Level:	2
Preset Value:	9
Scope:	0 ... 9

NetId

The parameter *NetId* determines the network address of the WIMAN. The WIMAN analyses only the data communication that is addressed to the network address configured on it. NetID also determines which frequency-hopping table is used.

Attention:

Please note that if several WIMAN networks are situated in close geographical location identical NetIds may not be used.

Authorization Level:	2
Preset value:	255
Scope:	0 ... 255

NodeID

The parameter *NodeId* determines the non-standard address of a WIMAN radio modem within a network. A NodeID with the value 0 automatically changes the WIMAN radio modem to **MASTER** operation. NodeIDs of 1... 250 automatically switch a WIMAN radio modem into the **SLAVE** operation with appropriate NodeIDs from 1... 250. Two WIMAN radio modems in the same network (same NetId) may not possess identical NodeIDs. Disturbance would occur and communication would be lost until one of the devices is switched off.

This effect does not occur, if a serial number for this NodeID is set with the instruction *peer* (see *peer* below). In this configuration, the WIMAN radio modem with the adjusted serial number

would function perfectly and all other devices with the same NetId and NodeId would be ignored.

Authorization Level:	1
Preset value:	0 (WIMAN Star)
Scope:	0 ... 250

RadioPower

The parameter *RadioPower* activates the normal operation or switches into a low power mode (around 0 dBm, regardless of the *Region* or *Antenna* setting). When there is only a small distance between a STAR and ACCESS the transmitting power can be scaled down to avoid overriding of the input-stage.

Authorization Level:	2
Preset value:	Normal
Scope:	Normal, Low

Antenna

The parameter *Antenna* specifies the type of antenna used with the WIMAN and thus determines the specific settings (e.g. transmit power) required for that type of antenna.

Authorization Level:	2
Preset value:	8mn360
Scope:	2mn360, 8mn360, 85pl76, 16pl27, 24pf20

Region

In addition to the parameter *Antenna*, the parameter *Region* sets the WIMAN radio to the specific settings required in that specific region (output power, frequency-range, etc.).

Authorization Level:	2	
Preset value:	depending on region	
Scope:	1	valid for ETSI-compliant operation
	2	valid for FCC-compliant operation

Note:

Incorret setting of the parameters 'Antenna' and 'Region' may lead to non-permitted behaviour of the unit and will void the right of operation !

If you are not sure which operation mode the WIMAN unit must comply with, please refer to your local distributor or manufacturer of this system.