

Wireless LAN Mini PCI Type IIIA Card

Introduction

The Mini PCI Type IIIA Card is an 11 Mbps/s wireless networking card with a range of up to 550 m (1750 ft).

With its small size, light weight, and low power consumption, it is ideally suited to integration in a wide range of OEM devices.

The Mini PCI Card uses direct sequence spread spectrum (DSSS) technology, and implements DBPSK, DQPSK, and CCK modulation, as defined in the *IEEE*® 802.11b standard. This gives a very robust radio channel, which is made even better by the excellent receiver sensitivity and delay spread robustness.

In environments with radio interference, the Mini PCI Card, because of its acknowledgment protocol and its option to be tuned to another frequency channel, continues to run.

Superior echo path management makes it suitable for areas with a large delay spread, for example, warehouses. This reduces the number of cells required and, therefore, reduces the total cost of ownership.

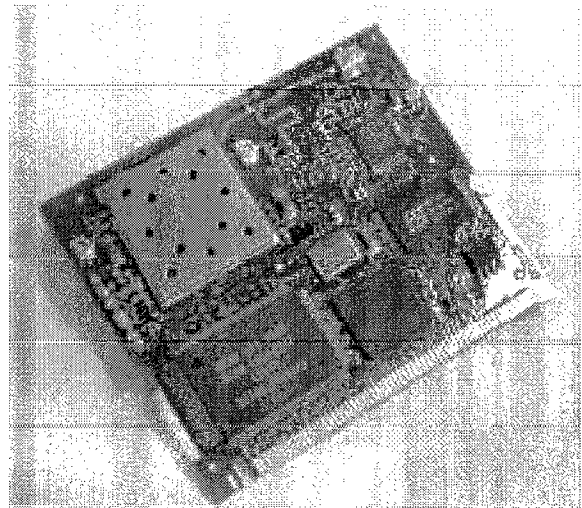
Security against eavesdropping is provided for by WEP using a 64-bit or 128-bit key. WEPplus prevents attacks that exploit weak keys. The 802.1x standard is also supported.

The Mini PCI Card is complemented by drivers and networking tools for various versions of the *Windows*® operating system and for *Linux*™.

Agere provides extensive technical documentation on integration issues such as antenna design, customizing drivers, and management software.

Features

- Automatic fallback: 11 Mbps/s, 5.5 Mbps/s, 2 Mbps/s, or 1 Mbit/s
- Low power consumption



- Automatic power management to reduce battery use
- Firmware image downloaded to card each time driver is loaded
- Easy integration into mobile and hand-held platforms, with freedom of design and antenna placement
- External antenna diversity
- WEPplus—fully compatible with WEP, but avoiding the weaknesses
- Conforms to *IEEE* 802.11 and *IEEE* 802.11b specification
- Can be used in platform with multiple wireless LAN cards
- Interoperable with other *IEEE* 802.11b compliant systems
- Conforms to industry-standard mini PCI Card Type IIIA specification
- Compatible with *Windows* and *Linux* operating systems
- *Microsoft*® OIDs on all *Windows* drivers
- WHQL certification for all supported *Windows* operating systems

Physical Dimensions/Packaging

The Mini PCI Card has been designed to conform to the Mini PCI specification, as defined in *Mini PCI Specification Rev 1.0*.

All dimensions in this section have a tolerance as permitted in the *Mini PCI Specification*.

Dimensions: 59.75 mm x 50.95 mm x 5.0 mm

Weight: 15 g

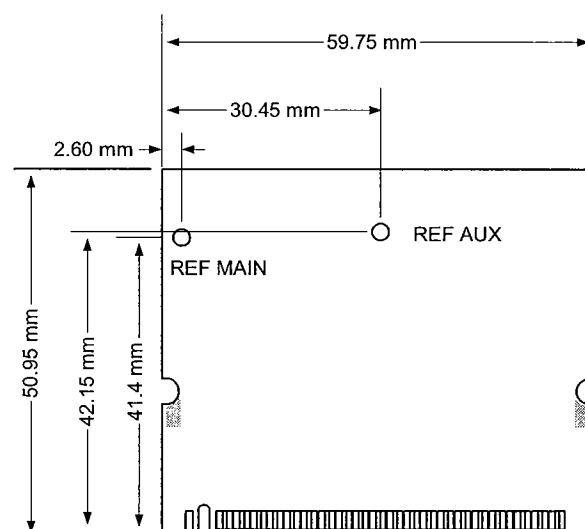


Figure 1. Mini PCI Card Dimensions

Mechanically unique coax connectors for two external antennas.

Shock and Vibration Resilience

The Mini PCI Card has been developed for incorporation in other devices, and, as such, no shock and vibration tests for the card in isolation have been performed.

Reliability

MTTF 150,000 hours, based on workload of 2040 hours/year within operating conditions.

Operating Conditions

Operating Temperature Range	0 °C to 60 °C ambient temperature
Relative Humidity When Operational	95% maximum (noncondensing)
Barometric Pressure	740 hPa to 1050 hPa

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Description
Storage Temperature Range	–20 °C to +75 °C ambient temperature
Relative Humidity During Storage	95% maximum (noncondensing)
Barometric Pressure	740 hPa to 1050 hPa

Electrical Specification

Parameter	Description		
Supply Voltage	3.3 Vdc from host (± 0.2 V).		
Ripple Tolerance of Supply Voltage	120 mV ripple (measured peak-to-peak) with fundamental frequency ≤ 150 kHz.		
Load Capacitance of Supply Voltage	≤ 150 μ F.		
Power-on Start-up time	≤ 600 ms after switching power supply on. (This includes a delay of max 500 ms for the Flash ROM power up sequence.)		
Doze to Receive Mode Start-up Time	≤ 75 ms. Transmissions are not allowed during this period.		
Power Consumption	Doze mode	Receive mode	Transmit mode
Typical for Mini PCI Card	16 mA	185 mA	285 mA
Max for Mini PCI Card	45 mA	250 mA	350 mA

RF Specification

Parameter	Description	
Frequency Range	2400 MHz to 2484 MHz	
Frequency Stability	Within 25 kHz of nominal value	
Transmitter Output Power	15 dBm $\pm$ 2 dB	
Over-driving Levels	Tolerated up to +17 dBm at the antenna connector	
Nominal Antenna Port Impedance	50 Ω	
Media Access Protocol	CSMA/CA with ACK	
Modulation Technique	Direct-sequence spread spectrum	
	CCK (11 Mbits/s and 5.5 Mbit/s)	
	DQPSK (2 Mbits/s)	
	DBPSK (1 Mbit/s)	
Spreading	11-chip Barker sequence	
Data Rate	Receiver Sensitivity (Bit Error Rate $<10^{-5}$)	Delay spread robustness (FER $<1\%$)
11 Mbits/s	-82 dBm	65 ns
5.5 Mbits/s	-87 dBm	225 ns
2 Mbits/s	-91 dBm	400 ns
1 Mbit/s	-94 dBm	500 ns

Antenna Specification

The Mini PCI Card is available in two variants as regards antenna diversity: on-board diversity switch, and external diversity switch.

On-Board Diversity Switch

This variant of the Mini PCI Card has connectors for two external passive antennas: MAIN and AUX. One of the antennas is used for transmission, and the DSP selects which of the two to use for reception, based on signal strength.

The coax connectors for the antennas are mechanically unique, such that no off-the-shelf connector will fit (FCC requirement).

Switch electronics for selection between the two antennas for reception of the stronger receive signal is provided onboard.

External Diversity Switch

This variant of the Mini PCI Card has one active connector (MAIN), which is designed to take an external antenna diversity unit. Nothing must be connected to the AUX connector. The coax connectors for the antennas are mechanically unique, such that no off-the-shelf connector will fit (FCC requirement).

The MAIN antenna select signal is a bias voltage that has 3.3 V CMOS levels; high for selecting the transmit/receive antenna and low for selecting the second receive antenna.

- High ($V_{CC} = 3\text{ V}$ nominal): transmit/receive mode using main antenna of external diversity antenna
- Low ($V_{CC} = 0\text{ V}$ nominal): receive mode using auxiliary antenna of external diversity antenna

Security

At the physical layer, transmissions are encrypted using WEP; two levels of encryption are possible:

- 40-bit key plus 24-bit initialization vector
- 104-bit key plus 24-bit initialization vector

Attacks have been made on WEP by exploiting various weaknesses. The Mini PCI Card implements random setting of the initialization vector and utilizes WEPplus, which prevents initialization vectors that result in weak keys being used. WEPplus is completely compatible with WEP.

For those operating systems that support it either natively or with an add-on supplement (i.e., *Windows 98*, *Windows 98SE*, *Windows Me™*, *Windows 2000*, *Windows XP™*, and *Windows NT4®*), the 802.1x security standard is implemented. This offers port-based network access control, and automatic key distribution.

Performance

Table 1. Characteristics at Different Rates

The typical ranges are given for a bit error rate better than 10^{-5} and assume an adequate antenna design by the OEM.

Parameter	11 Mbits/s	5.5 Mbits/s	2 Mbits/s	1 Mbit/s
Typical Range in Open Environment	160 m (525 ft)	270 m (885 ft)	400 m (1300 ft)	550 m (1750 ft)
Typical Range in Semi-open Environment	50 m (165 ft)	70 m (230 ft)	90 m (300 ft)	115 m (375 ft)
Typical Range in Closed Environment	25 m (80 ft)	35 m (115 ft)	40 m (130 ft)	50 m (165 ft)
Typical Throughput (excluding headers, etc.) Using TCP/IP	5.04 Mbits/s	3.44 Mbits/s	1.59 Mbits/s	0.82 Mbit/s

Mini PCI Card Pinout

The Mini PCI Card connects to a host through the Mini PCI interface bus. The connector pinout is defined in the *Mini PCI Specification*.

The following implementation-specific aspects for the Mini PCI Card should be noted:

- The AC97-link bus, the system audio bus and the LAN bus are not supported, with the exception of LED signals.
- Pins 3 to 8 are used for the DSP's test interface; pins 9 and 10 are used for programming the EEPROM that holds the configuration information; pins 11 and 12 are used for LED signals; and pin 13 is used as a hardware radio on/off switch.

Mini PCI Card Pinout (continued)**Table 2. Pin Uses**

Name (Mini PCI Pin Number)	Use	
ETD0 (#3) Mapped to LAN Bus (8PMJ-3)	DSP test interface signals	
ETCK (#4) Mapped to LAN Bus (8PMJ-1)		
ETD1 (#5) Mapped to LAN Bus (8PMJ-6)		
ETSYN (#6) Mapped to LAN Bus (8PMJ-2)		
ETD2 (#7) Mapped to LAN Bus (8PMJ-7)		
ENGTEST (#8) Mapped to LAN Bus (8PMJ-4)		
SDA (#9) Mapped to LAN Bus (8PMJ-8)	Used for programming EEPROM with configuration information	
SCL (#10) Mapped to LAN Bus (8PMJ-5)		
LED1_GRNP (#11)	Network activity LED	LED control signals (active when high)
LED2_YELP (#12)	Power/network connection LED	
LED1_GRNN (#13)	Radio on/off switch. When tied to ground, the radio is disabled. This can be compared to an out-of-range situation.	
Ground (#101)	Used as open signal.	

Function Configuration Register

The configuration option register (COR) is located in the attribute memory space at address 3E0h. The host software should obtain this address from CISTPL_CONFIG.

b7	b6	b5	b4	b3	b2	b1	b0
CRESET	LevIREQ	Configuration Index					

CRESET

COR reset bit. Setting this bit places the card in reset state. This is equivalent to the host asserting HRESET, except that this bit is not cleared. The host clears this bit by writing 00h to the COR register in order to assure that the card continues as a memory-only card after the software reset.

LevIREQ

When set, level-mode interrupts are generated: when cleared, pulse-mode interrupts are generated. Level-mode interrupts are generated by default.

Configuration Index

The card is configured as a memory-only card if the configuration index is 00h. The card is configured as I/O card by writing 01h to the configuration index. By default, the card is configured as I/O card by writing 41h to the COR register.

International Channel Frequencies

The Mini PCI Card uses frequencies in the 2.4 GHz to 2.5 GHz ISM band, as defined by *IEEE* 802.11.

The channels available in the regional variants of the Mini PCI Card are:

- FCC: 1 to 11
- ETSI: 1 to 13
- Japan: 1 to 14

System Requirements

The system in which the card is integrated must have a BIOS that is compatible with the TI1410 PCI controller.

Operating System Compatibility

Drivers are available for the following operating systems:

- *Windows* 98, *Windows* 98SE™, *Windows* Me™. For these versions of *Windows*, the NDIS 5 miniport driver is used. *Windows* built-in networking software provides network support. Hot swapping is supported, although the removal of the network connection could affect *Windows*.
- *Windows* 2000 (Service Pack 1). For *Windows* 2000, the NDIS 5 miniport driver is used. *Windows* built-in networking software provides network support. Hot swapping is supported, although the removal of the network connection could affect *Windows*.
- *Windows* XP™. For *Windows* XP, the NDIS 5.1 miniport driver is used. *Windows* built-in networking software provides network support. Hot swapping is supported, although the removal of the network connection could affect *Windows*.
- *Linux*™. The driver sources and a support library are supplied, which are compatible with *Linux* kernel versions 2.0.x, 2.2.x and 2.4.x for the *Intel*® architecture. This includes the following *Linux* distributions, for example:
 - *Red Hat*™ versions 5.2, 6.0, 6.1, 6.2, 7.0 and 7.1
 - *SuSE*® versions 6.1, 6.3, 6.4, 7.0 and 7.1

Hot swapping is supported under *Linux*.

Regulatory Body Approvals/Compliance

Agere provides a device that complies with international regulations: approval is a matter for the OEM once the device is integrated into a host platform.

Description	Country	Compliance
Electromagnetic Compatibility	USA	FCC CFR47 Part 15
	Europe	ETS 300 826 (1999/5/EC R&TTE Directive)
	Japan	Not applicable—covered by radio regulations
Product Safety	USA	IEC® 60950, UL1950, CB
	Europe	EN 60950
	International	IEC 60950, CB
Radio Regulations	USA	FCC CFR47 part 15 C, para 15.247
	Europe	EN 300-328 (1999/5/EC R&TTE directive)
	Japan	ARIB STD-T66
	Canada	IC RSS 210

Contact Agere Systems Inc. for the current position regarding certification worldwide.

Related Products

None.

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