agere systems

**Data Sheet**
**June 2002**

# Wireless LAN Mini PCI Type IIIA Card

## Introduction

The Mini PCI Type IIIA Card is an 11 Mbits/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 Mbits/s, 5.5 Mbits/s, 2 Mbits/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

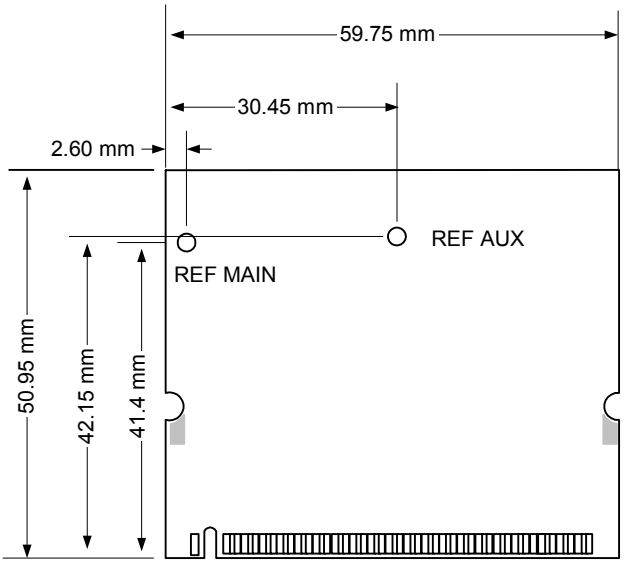


**Figure 1. Mini PCI Card Dimensions**

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 µF. | | |
| 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 ± 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 $<0^{-5}$) | 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 V nominal): transmit/receive mode using main antenna of external diversity antenna
- Low ($V_{CC}$ = 0 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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DS02-113WCNC-1 (Replaces DS02-113WCNC)