

## PRISM<sup>®</sup> 2.5 11Mbps Wireless Local Area Network miniPCI



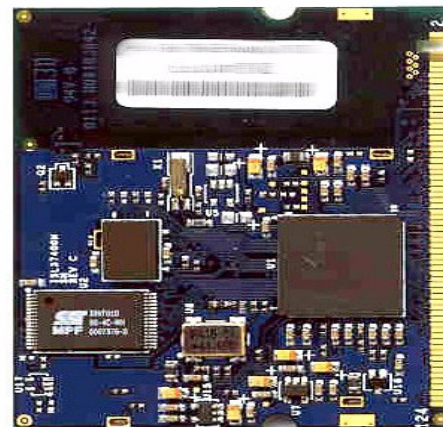
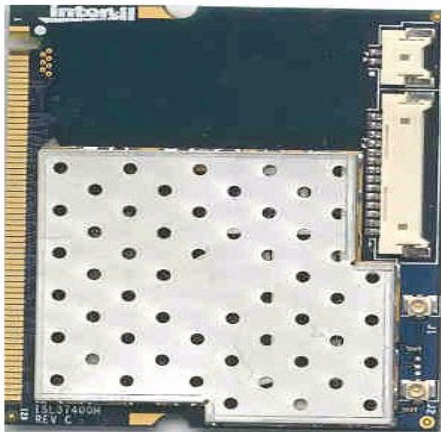
The Intersil ISL37400M WLAN miniPCI (Note 1) is a complete wireless high speed network interface card (NIC) utilizing the Intersil PRISM 2.5 Direct

Sequence Spread Spectrum (DSSS) Wireless Transceiver chip set. It provides a complete PRISM 2.5 reference design evaluation platform of hardware and software to system providers or integrators requiring wireless data communications capability and is ideal for integration into computer platforms.

Evaluation kits include a WLAN miniPCI and a WLAN PCMCIA designed to Intersil's PRISM reference design, Microsoft<sup>®</sup> Windows<sup>®</sup> driver, LAN evaluation software, PRISM Transmitter Test Utilities (PTTU) software (Note 3) and documentation to get your evaluation started quickly. It supports the IEEE802.11 network specification for DSSS signaling, providing data rates of 1, 2, 5.5 and 11Mbps. Access points are available from a number of suppliers, enabling a total wireless network solution. Typical operating ranges are shown in Table 1.

A complete PRISM chipset WLAN reference design package (ISL37400M-CD) is also available. The reference design package contains all the documentation needed for the manufacture of the PRISM 2.5 miniPCI WLAN card including Cadence/Allegro Layout, Gerber files, Concept Schematic, Bill of Materials, Assembly and Mechanical Drawings, Test Plan, and a copy of the application for FCC equipment authorization. Customers who license the reference design also receive password access to Intersil's Premier Web Site for up-to-the-minute updates on hardware and software.

### Packaging



### Features

- FCC-certified under Part 15 to operate in 2.4GHz ISM band
- Support for 11, 5.5, 2 and 1 Mbps data rates
- Supports the IEEE 802.11 direct sequence specification
- Driver supports Microsoft Windows 95, 98, 98SE, 2000, CE, ME and Microsoft Windows NT<sup>®</sup>4
- Supports dual diversity antennas
- Advanced RAKE receiver design with Decision Feedback Equalizer
- Provides wireless data communications at full ethernet speed
- Designed to fully support miniPCI Type 3A-defined mechanical and environmental stress conditions
- Intelligent power control, including IEEE802.11 power save mode
- Complete reference design; the ISL37400M-CD is available to ensure minimum time-to-market

### Ordering Information

PART NUMBER	DESCRIPTION	CARDS/SET
ISL37400M-EVAL	WLAN Evaluation Kit	1 miniPCI 1 PCMCIA
ISL37400M-CD	Reference Design	n/a

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TABLE 1. TYPICAL OPERATING RANGE (Notes 2, 4)

DATA RATE (Mbps)	INDOOR RANGE	OUTDOOR RANGE
11	120 feet (37 meters)	500 feet (152 meters)
5.5	200 feet (61 meters)	800 feet (243 meters)
2	240 feet (73 meters)	1300 feet (396 meters)
1	300 feet (91 meters)	1750 feet (533 meters)

## NOTES:

1. Throughout this document, all references to 'miniPCI', 'WLAN adapter', 'adapter', or 'card' refer to a card assembly conforming to the mechanical size specifications of the miniPCI Type 3A.
2. The range will vary in different operating environments due to effects such as building construction.
3. At present, PTTU supports Windows 95, 98, NT, 2000 and ME
4. Data taken using custom proprietary antennas in a custom proprietary laptop computer.

### Functional Overview

The WLAN miniPCI is designed to operate in the 2.4GHz ISM frequency band, channels 1 to 11, as specified by the FCC in the USA. The card will also operate on channels 12 through 14, where permitted by local regulatory authorities. Radio equipment must be certified in a country prior to use. Refer to Table 4 for a list of countries and agencies that have approved the ISL37400M-EVAL for operation.

The Intersil PRISM Chip Set allows for high level integration for reduced size, increased throughput, improved radio performance and faster time to market. The WLAN miniPCI implements DSSS technology providing superior noise and signal jamming immunity, including less severe impact from unintentional radiators such as microwave ovens. The user can connect the miniPCI in an ad-hoc peer-to-peer networking scheme, allowing for instant network setup in any office environment. By using an access point, the wireless LAN can be set up to allow for a greater number of users to interconnect, and to increase the coverage area. With a portal (i.e., Access Point), the wireless LAN can be easily connected into an existing wired LAN, allowing for easy expansion of the service.

Compared to the PRISM II chip set, the PRISM 2.5 generation offers:

- Low-loss front end designed for maximum range
- Higher level of chip integration and less peripheral components, reducing material costs
- Support of optional IEEE802.11 Short Preamble for significantly increased data throughput with room for additional user-defined functions
- Has a miniPCI interface/Type 3A form factor

A complete reference design for the ISL37400M is available to ensure minimum time-to-market. This information contains details for manufacturing a miniPCI WLAN assembly, including Gerber PC board files, an accurate bill of material with component sourcing and complete mechanical drawings and a complete radio description and test plan.

### Related Literature

- Tech Brief TB337, Intersil Corporation, *A Brief Tutorial on Spread Spectrum and Packet Radio* [1].
- Tech Brief TB382, Intersil Corporation, *Measurement of WLAN Receiver Sensitivity* [2].
- Application Note AN9850, Intersil Corporation, *Complementary Code Keying Made Simple* [3].
- Application Note AN9829, Intersil Corporation, *Brief Tutorial on IEEE802.11 Wireless LANs* [4].
- Application Note AN9820, Intersil Corporation, *A Condensed Review of Spread Spectrum Techniques for ISM Band Systems* [5].

### The ISL3874 Media Access Controller (MAC) Protocol Handler

The ISL3874 MAC/Baseband Processor and its firmware are responsible for running the IEEE802.11 protocol in the WLAN card. This section describes the features of IEEE802.11 that are implemented.

The functions supported by the STA (station) Firmware are:

- CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) with random backoff
- WEP security
- Short/long preamble with multirate
- RTS/CTS handshake (ready to send/clear to send) and NAV management (network allocation vector)
- MAC level acknowledgments
- Retransmission of unacknowledged frames
- Duplicate detection and rejection
- Broadcast and multicast frames
- Fragmentation and re-assembly
- Power management (planned)
- Timestamp synchronization
- DCF (distributed coordination function)
- PCF (point coordination function)
- Beacon generation in an ad-hoc network
- Probe response generation in an ad-hoc network

### Card Information Structure

The standard Intersil WLAN miniPCI will be supplied with information embedded in the Plug and Play (PnP) shown in Table 2. It should be noted that in most systems this information is displayed when the card is inserted. Customization of the PnP for specific customer requirements is available upon request, to enable customer information to be displayed when the card is inserted.

TABLE 2. CIS PLUG AND PLAY (PnP)

FUNCTION NAME	CONTENT
Manufacturer's ID	00
Function ID	Network Adapter
Product Revision	1
Manufacturer	Intersil Corporation
Product	12603873
PROG	
LOT	

**IEEE802.11 International Agreement and Frequency Assignments**

The IEEE802 LAN committee has forged an international agreement providing for wireless data communication standards for the frequency range of 2.4GHz to 2.4835GHz, as allocated by the FCC in the USA, and in the 2.471GHz to 2.497GHz frequency range, as specified by the regulatory authority in Japan. These standards are designed to focus the industry to develop highly integrated, low cost, interoperable WLAN equipment, of which the ISL37400M-EVAL is a prime example.

In the USA, there are 11 channels specified by the FCC in the 2.412GHz to 2.462GHz range. In Japan, channel 14 at 2.484GHz is authorized under ARIB STD-33 and channels 1-13 are authorized under ARIB STD-T66. The ETSI (European) regulatory body conforms to the USA (FCC) channel assignments with the exception that channels 12 and 13 are also allowed. Some countries in Europe, notably France and Spain have unique channel restrictions.

Although information contained in Table 3 is deemed to be accurate, local regulatory authorities should be consulted before using such equipment.

The available channels of operation in the 2.4GHz to 2.4835GHz and 2.471GHz to 2.497GHz ranges are as follows:

TABLE 3. IEEE802.11 CHANNELS

CHANNEL NUMBER	CHANNEL FREQUENCY	GEOGRAPHIC USAGE
1	2412MHz	US, CA, ETSI, MKK
2	2417MHz	US, CA, ETSI, MKK
3	2422MHz	US, CA, ETSI, MKK
4	2427MHz	US, CA, ETSI, MKK
5	2432MHz	US, CA, ETSI, MKK
6	2437MHz	US, CA, ETSI, MKK
7	2442MHz	US, CA, ETSI, MKK

TABLE 3. IEEE802.11 CHANNELS (Continued)

CHANNEL NUMBER	CHANNEL FREQUENCY	GEOGRAPHIC USAGE
8	2447MHz	US, CA, ETSI, MKK
9	2452MHz	US, CA, ETSI, MKK
10	2457MHz	US, CA, ETSI, MKK, FR, SP
11	2462MHz	US, CA, ETSI, MKK, FR, SP
12	2467MHz	ETSI, FR, MKK
13	2472MHz	ETSI, FR, MKK
14	2484MHz	MKK

**KEY:**

US = United States, CA = Canada, ETSI = European countries (except France and Spain), FR = France, SP = Spain, MKK = Japan

The ISL37400M is shipped with FCC-compliant firmware. In order to ensure regulatory-compliant channel usage in a particular country, special geographic-specific firmware is available for customer production assemblies which restricts channel usage. Examples include ETSI-compliant firmware, etc. Since the end user does not have the ability to alter this firmware, regulatory compliance is ensured.

**Agency and Regulatory Body Approvals**

The WLAN miniPCI will comply to the standards shown in Table 4:

TABLE 4. COMPLIANCE STANDARDS

COUNTRY	APPROVAL	NOTES
USA	FCC part 15, Sec. 15.247, Sec. 15.107 and 15.109	Approved for Intentional Radiators & Computer Peripheral
Canada	ICAN RSS-210	Designed for compliance
Europe	EN 60950 EN 301 489-1 V1.2.1 (2000-08) EN 301 489-17 V1.1.1 (2000-09) EN 300 328 Part 1 V1.2.2 (2000-07) EN 300 328 Part 2 V1.1.1 (2000-07)	Designed for compliance
Japan	ARIB STD-T66 ARIB STD-33	Designed for compliance

## FCC Information to User

This product does not contain any user serviceable components and is to be used with approved antennas only. Any product changes or modifications will invalidate all applicable regulatory certifications and approvals.

### FCC Electronic Emission Notices

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

### FCC Radio Frequency Interference statement

The wireless LAN card is subject to the rules of the Federal Communications Commission (FCC). This card is considered an intentional radiator as per the FCC guidelines.

NOTE: This equipment has been tested and found to comply with the limits for Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**WARNING** Any changes or modifications of equipment not expressly approved by Intersil could void the user's authority to operate the equipment.

### FCC Guidelines for Human Exposure

The EIRP was measured for the lower, middle and highest frequencies used by the transmitter. The results in Table 5 are based on a safe distance between antenna and operator of eight inches. The equipment therefore fulfills the requirements on power density for general population / uncontrolled exposure of  $1.0\text{mW}/\text{cm}^2$  and therefore

complies with the requirements of FCC part 15.247 (b) (4) and FCC OET Bulletin 65 including supplements A, B and C.

TABLE 5. POWER DENSITY CALCULATION

	Ch.1	Ch.6	Ch.11
Measured EIRP (mW)	66.1	67.6	64.6
Calculated Power Density ( $\text{mW}/\text{cm}^2$ )	0.052	0.053	0.051

**CAUTION:** This assembly is designed to operate with a supply voltage of 3.3V in laptop computers supporting the miniPCI standard.

**CAUTION:** Do not force engagement of the card in the miniPCI slot. It is mechanically designed to prevent improper insertion.

Permanent damage may occur if operated outside of the specified operating limits listed in this document.

## References

For Intersil documents available on the internet, see web site <http://www.intersil.com/>

- [1] TB337 Tech Brief, Intersil Corporation, *A Brief Tutorial on Spread Spectrum and Packet Radio*.
- [2] TB382 Tech Brief, Intersil Corporation, *Measurement of WLAN Receiver Sensitivity*.
- [3] AN9850 Application Note, Intersil Corporation, *Complementary Code Keying Made Simple*.
- [4] AN9829 Application Note, Intersil Corporation, *Brief Tutorial on IEEE802.11 Wireless LANs*.
- [5] AN9820 Application Note, Intersil Corporation, *A Condensed Review of Spread Spectrum Techniques for ISM Band Systems*.
- [6] AN9895 Application Note, Intersil Corporation, *Multipath Measurement in Wireless LANs*.
- [7] FN8006 File Note, Intersil Corporation, *PRISM 2.5, 11Mbps Chip Set Overview for miniPCI*.

Further information can be found in the following:

- Intersil PRISM 2.5 Chip Set data sheets, web home page, <http://www.intersil.com/design/prism/ser-p25-11mbps.asp>
- IEEE802.11 Standards Project (available from the IEEE, New York, USA).

# ISL37400M-EVAL

## Absolute Maximum Ratings

Supply Voltage . . . . . -0.3V to 4.0V (Max)  
 Storage Temperature (Note 5) . . . . . -20°C to 85°C

## Operating Conditions

Temperature Range . . . . . 0°C ≤ T<sub>A</sub> ≤ 70°C  
 Supply Voltage Range . . . . . 3.0V to 3.6V

Caution: These are the absolute maximum ratings for the miniPCI product. Exceeding these limits could cause permanent damage to the card.

NOTE:

5. All temperature references refer to ambient conditions.

## Electrical Specifications

Test Conditions: Supply Voltage (V<sub>CC</sub>) = 3.3V, Ambient Temperature (T<sub>A</sub>) = 25°C,  
 Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
<b>CURRENT CONSUMPTION</b>						
Initialization Current	I <sub>CC</sub>		-	145	180	mA
Average Current (2% TX; 8% RX; 90% Standby) (With Power Saving Mode)	I <sub>CC</sub>		-	140	-	mA
Continuous Transmit Mode	I <sub>CC</sub>		-	325	380	mA
Continuous Receive Mode	I <sub>CC</sub>	Receiving Valid Packets	-	200	225	mA
802.11 Power Save Mode	I <sub>CC</sub>		-	63	-	mA
<b>miniPCI LOGIC LEVELS</b>						
Input HIGH Voltage	V <sub>IH</sub>	V <sub>CC</sub> =Max, Min	0.7V <sub>CC</sub>	-	-	V
Input LOW Voltage	V <sub>IL</sub>	V <sub>CC</sub> =Min, Max	-	-	0.3V <sub>CC</sub>	V
Output HIGH Voltage	V <sub>OH</sub>	I <sub>OL</sub> = 2mA, V <sub>CC</sub> =Min	0.9V <sub>CC</sub>	2.6	-	V
Output LOW Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 2mA, V <sub>CC</sub> =Min	-	0.05	0.1V <sub>CC</sub>	V
Input Leakage Current	I <sub>I</sub>	V <sub>CC</sub> =Max, Input=0V or V <sub>CC</sub>		0.100	1.0	μA
<b>miniPCI LOADING CAPACITANCE</b>						
Input Capacitance	C <sub>IN</sub>		-	5	10	pF
Output Capacitance	C <sub>OUT</sub>		-	5	10	pF
<b>RF SYSTEM SPECIFICATIONS</b>						
Transmitter Power Output	P <sub>out</sub>		-	16	-	dBm
Receive Sensitivity	RX_S	1Mbps, 8% PER	-	-93.2	-	dBm
		2Mbps, 8% PER	-	-90.9	-	dBm
		5.5Mbps, 8% PER	-	-89.4	-	dBm
		11Mbps, 8% PER	-	-85.8	-	dBm
Multipath Delay Spread using IEEE802.11b Naftali Model	T <sub>DELAY</sub>	2Mbps, 8% PER	-	>290	-	ns
		5.5Mbps, 8% PER	-	200	-	ns
		11Mbps, 8% PER	-	105	-	ns

## ISL37400M-EVAL

**Electrical Specifications** Test Conditions: Supply Voltage ( $V_{CC}$ ) = 3.3V, Ambient Temperature ( $T_A$ ) = 25°C,  
Unless Otherwise Specified **(Continued)**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Multipath Receive Sensitivity using JTC models (Note 7)	RX_SJTC	1Mbps, 8% PER Office C Delay Spread = 450ns	-	-77.2	-	dBm
		2Mbps, 8% PER Commercial B Delay spread = 150ns	-	-82.9	-	dBm
		5.5Mbps, 8% PER JTC Commercial B Delay spread = 150ns	-	-79.5	-	dBm
		11Mbps, 8% PER JTC Commercial B Delay spread = 150ns	-	-69.2	-	dBm
Maximum Receive Level	RX_MAX	PER <8%	-3	+3	-	dBm
Carrier Suppression	TX_sup	Test Mode	-	-42.5	-	dB
Image Rejection	IR	PER 8%	-	60	-	dB
IF Rejection	IFR	PER 8%	60	66.5	-	dB
Adjacent Channel Rejection	ACR	PER <8%	-	47	-	dB
Data Rate (Physical Layer)	Rate		-	1, 2, 5.5 and 11	-	Mbps

**NOTES:**

- The adjacent channel measurement is carried out on two channels separated by 25MHz (five channels). The -70 dBm signal and variable strength jammer are both 11Mbps data transmissions. The jammer is a continuous signal with -40dBc 1<sup>st</sup> side lobes.
- For more information on JTC Models, refer to Application Note AN9895, *Multipath Measurement in Wireless LANs* [7].

All Intersil U.S. products are manufactured, assembled and tested utilizing ISO9000 quality systems.  
Intersil Corporation's quality certifications can be viewed at [www.intersil.com/design/quality](http://www.intersil.com/design/quality)

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