

PRISM 2.5 11Mbps Wireless Local Area Network miniUSB



The Intersil ISL37300U WLAN miniUSB (Note 1) is a complete wireless high speed Network Interface

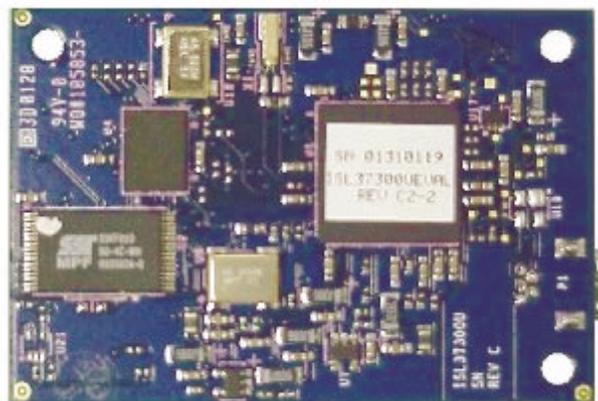
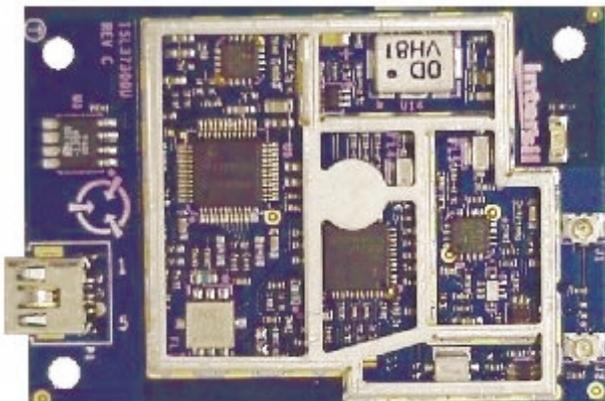
Card (NIC) utilizing the Intersil PRISM® 2.5 Direct Sequence Spread Spectrum Wireless Transceiver chip set. It provides a complete PRISM 2.5 reference design evaluation platform of hardware and software to system providers or integrators requiring wireless data communications capability and is ideal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

The USB interface implemented in the ISL37300U complies with the Universal Serial Bus Specification Revision 1.1 dated September 23, 1998, which is available from the USB Implementers' forum at <http://www.usb.org/>.

A complete PRISM chipset WLAN reference design package (ISL37300U-CD) or evaluation kit (ISL37300U-EVAL) are available. The reference design package contains all the documentation needed for the manufacture of the PRISM 2.5 USB Wireless Local Area Network card including: Cadence/Allegro Layout, Gerber files, Concept Schematic, Bill of Material, Assembly and Mechanical Drawings, Test Plan, and even 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.

Evaluation kits include 2 WLAN miniUSB radios designed to Intersil's PRISM reference design, Microsoft® Windows® Driver, Local Area Network evaluation software, PRISM Test Utilities (PTU) software (Note 3) and documentation to get your evaluation started quickly. It supports the IEEE 802.11b network specification for Direct Sequence Spread Spectrum 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.

Packaging



Features

- FCC Certified Under Part 15 to Operate in the 2.4GHz ISM Band
- Support for 11, 5.5, 2 and 1 Megabit Per Second (Mbps) Data Rates
- Supports the IEEE 802.11b Direct Sequence Specification
- Driver Supports Microsoft® Windows® 98, 98SE, 2000, CE, and ME
- Supports Dual Diversity Antennas. Eval kit supplied with left and right PCB mounted Dipole antennas
- Advanced RAKE Receiver Design with Decision Feedback Equalizer combats multipath fading.
- Provides Wireless Data Communications at Full Ethernet Speed
- Designed to Fully Support the USB 1.1 Specification.
- Intelligent Power Control, Including IEEE802.11 Power Save Mode when operating in the "infrastructure" mode.
- Complete Reference Design, the ISL37300U-CD is Available to Ensure Minimum Time-to-Market..

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)

Ordering Information

PART NUMBER	DESCRIPTION	CARDS/SET
ISL37300U-EVAL	WLAN Evaluation Kit	2
ISL37300U-CD	Reference Design	NA

NOTES:

1. Throughout this document, all references to 'miniUSB', 'WLAN adapter', 'adapter', or 'card' refer to a card assembly conforming to the USB 1.1 Specification
2. The range will vary in different operating environments due to effects such as building construction.
3. At present, PTU supports Windows 98, NT, 2000 and ME only.
4. Data taken using PCB mounted dipole antenna's.

ISL37300U-EVAL

Absolute Maximum Ratings

Supply Voltage -0.3V to 5.5V (Max)
 Storage Temperature (Note 5) -20°C to 85°C

Operating Conditions

Temperature Range $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$
 Supply Voltage Range 4.5V to 5.5V

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

NOTE:

- All temperature references refer to ambient conditions.

Electrical Specifications Test Conditions: Supply Voltage (V_{CC}) = 5.0V, Ambient Temperature (T_A) = 25°C,
 Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
CURRENT CONSUMPTION						
Initialization Current	I_{CC}		-	82	95	mA
Average Current (2% TX; 8% RX; 90% Standby)	I_{CC}		-	98	-	mA
Continuous Transmit Mode	I_{CC}		-	280	320	mA
Continuous Receive Mode	I_{CC}	Receiving Valid Packets	-	200	225	mA
IEEE 802.11 Power Save Mode	I_{CC}		-	85	-	mA
USB suspend current	I_{CC}		-	3.1	-	mA
miniUSB LOGIC LEVELS Required at target connector input						
Differential "1"		(D+) - (D-) > 200mV and D+ > Vih	-	3.3	-	V
Differential "0"		(D-) - (D+) > 200 mV and D- > Vih	-	3.3	-	V
RF SYSTEM SPECIFICATIONS						
Transmitter Power Output (std Filter)	P_{out}		-	17	-	dBm
EIRP - dipole antenna	mW		-	180		mW
Receive Sensitivity (J2)	RX_S	1Mbps, 8% PER	-	-92	-	dBm
		2Mbps, 8% PER	-	-90	-	dBm
		5.5Mbps, 8% PER	-	-87	-	dBm
		11Mbps, 8% PER	-	-84	-	dBm
Multipath Delay Spread Using Naftali Model	T_{DELAY}	2Mbps, 8% PER	-	>290	-	nSec
		5.5Mbps, 8% PER	-	200	-	nSec
		11Mbps, 8% PER	-	105	-	nSec
Multipath Receive Sensitivity Using JTC Model	RX_SJTC	1Mbps, 8% PER, Office C Delay Spread = 450nsec	-	-81	-	dBm
		2Mbps, 8% PER, Commercial B Delay Spread = 150nsec	-	-86	-	dBm
		5.5Mbps, 8% PER, Commercial B Delay Spread = 150nsec	-	-82	-	dBm
		11Mbps, 8% PER, Commercial B	-	-77	-	dBm
Maximum Receive Level	RX_MAX	PER <8%	-3	+3	-	dBm
Third Order Intercept Point (Input)	IIP3_90	-100 dBm input - max gain	-	-65	-	dBm
	IIP3_25	+2 dBm input - min gain	-	25	-	dBm
Carrier Suppression	TX_sup	Test Mode	-	-47	-	dB
Image Rejection	IR	PER <8%	-	50	-	dB
IF Rejection	IFR	PER <8%		56	-	dB
Adjacent Channel Rejection	ACR	PER <8% (Note 7)	-	43	-	dB
Data Rate (Physical Layer)	Rate		-	1, 2, 5.5 and 11	-	Mbps

NOTES:

- For more information on JTC models refer to AN9895 "Multipath Measurement in wireless LANs"
- The adjacent channel measurement is carried out on two channels separated by 25MHz (5 channels)

Functional Overview

The WLAN miniUSB 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 to14, 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 ISL37300U-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 miniUSB implements Direct Sequence Spread Spectrum 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 miniUSB 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 to reduce material costs
- Support of optional IEEE 802.11 Short Preamble for significantly increased data throughput with room for additional user defined functions.

A complete Reference Design for the ISL37300U is available to ensure minimum time-to-market. This information contains details for manufacturing a miniUSB 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.

The ISL3873 Media Access Controller (MAC) Protocol Handler

The ISL3873 MAC/Baseband Processor and its firmware are responsible for running the IEEE 802.11 protocol in the WLAN card. This section describes the features of IEEE 802.11 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 (Media Access Control)
- Re-Transmission 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 miniUSB will be supplied with information embedded in the PDA for use in enumeration. Table 2 shows the Plug Record and the default information. Customization of the enumeration values can be performed by modifying the PDA plug records and reflashing the PDA, Primary, and Secondary. Please refer to the PRISM Driver Programmers Manual for more information.

TABLE 2.

PLUG RECORD CONTENTS	USAGE	DEFAULT
401	Vendor/Product ID	09AA 3642
407	Bus/Self Powered	Bus Powered (value 8000)

IEEE 802.11 International Agreement and Frequency Assignments

The IEEE 802 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 ISL37300U-EVAL is a prime example.

In the U.S., 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 Channel 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. IEEE 802.11 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
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 ISL37300U 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 miniUSB will comply with 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

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

Operation of this equipment in a residential area may cause harmful interference in which case the user will be required to correct the interference at his own expense.

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.

FCC Guidelines for Human Exposure

CAUTION: To comply with FCC RF exposure compliance, a separation distance of at least 20cm (8 inches) must be maintained between the antenna of this device and all persons

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 8 inches. The equipment therefore fulfills the requirements on power density for general population / uncontrolled exposure of 1.0 mW/cm² and therefore complies with the requirements of FCC part 15.247 (b) (4) and FCC OET Bulletin 65 incl. supplements A, B and C.

TABLE 5. POWER DENSITY CALCULATION

	CH.1	CH.6	CH.11
Measured EIRP (mW)	169.8	186.2	186.2
Calculated Power Density (mW/cm ²)	0.135	0.148	0.148

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

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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 IEEE 802.11 Wireless LANs”
- [5] *AN9820 Application Note*, Intersil Corporation, “A Condensed Review of Spread Spectrum Techniques for ISM Band Systems”
- [6] *FN4983 Data Sheet*, “Chipset Overview PRISM 2.5 with ISL3873”
- [7] *AN9895 Application Note*, Intersil Corporation, “Multipath Measurement in wireless LANs”

Further information can be found in the following:

- Intersil PRISM 2.5 chipset datasheets, web home page, <http://www.intersil.com/design/prism/ser-p25-11mbps.asp>

IEEE 802.11 Standards Project (available from the IEEE, New York, USA).