

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.

Evaluation kits include a WLAN miniUSB designed to Intersil's PRISM reference design, Microsoft Windows® Driver, Local Area Network evaluation software, PRISM Transmitter Test Utilities (PTTU) software (Note 3) and documentation to get your evaluation started quickly. Information on the WLAN USB card may be found in the ISL37300U-EVAL data sheet. 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.

TABLE 1. TYPICAL OPERATING RANGE (NOTE 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 |

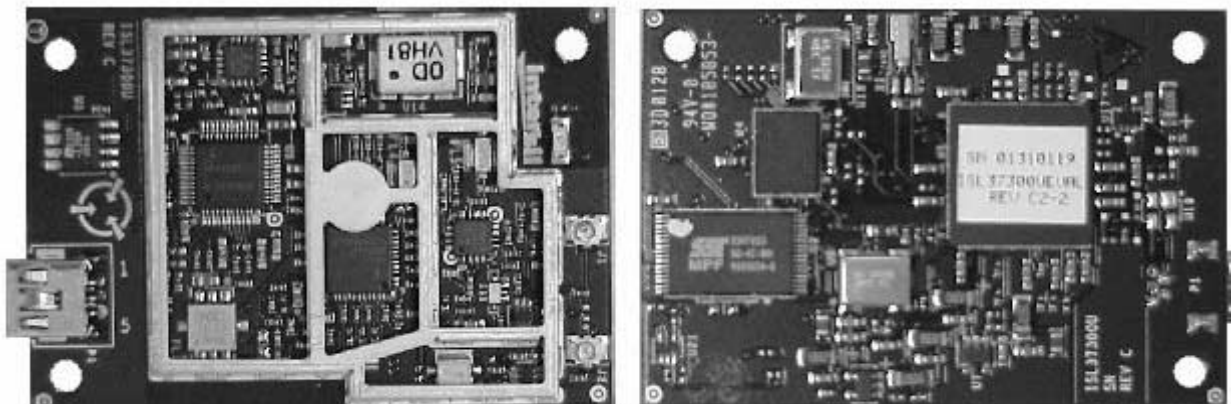
Features

- FCC Certified Under Part 15 to Operate in 2.4GHz ISM Band
- Support for 11, 5.5, 2 and 1 Megabit Per Second (Mbps) Data Rates
- Supports the IEEE 802.11 Direct Sequence Specification
- Driver Supports Microsoft® Windows® 95, 98, 2000, NT, CE and LINUX®
- Supports Dual Diversity Antennas
- Advanced RAKE Receiver Design with Decision Feedback Equalizer.
- Provides Wireless Data Communications at Full Ethernet Speed
- Designed to Fully Support the USB 1.1 Specification.
- Intelligent Power Control, Including Low Power Standby Mode
- Complete Reference Design, the ISL37300U-CD is Available to Ensure Minimum Time-to-Market

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, PTTU supports Windows 95, 98, NT, 2000 and ME.
4. Data taken using custom proprietary antenna's in a laptop computer.

Packaging



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 to 14, where permitted by local regulatory authorities. Radio equipment must be certified in a country prior to use. Refer to Table 3 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.

Related Literature

- Tech Brief TB337, Intersil Corporation, “A Brief Tutorial on Spread Spectrum and Packet Radio” [1].
- Application Note ANxxxx, Intersil Corporation, “ISL37300U-EVAL PRISM 2.5 11 Mb miniUSB Wireless LAN Radio Description” [2]
- Tech Brief TB337, Intersil Corporation, “A Brief Tutorial on Spread Spectrum and Packet Radio” [3]
- Tech Brief TB382, Intersil Corporation, “Measurement of WLAN Receiver Sensitivity” [4]
- Application Note AN9850, Intersil Corporation, “Complementary Code Keying Made Simple” [5]
- Application Note AN9829, Intersil Corporation, “Brief Tutorial on IEEE 802.11 Wireless LANs” [6]
- Application Note AN9820, Intersil Corporation, “A Condensed Review of Spread Spectrum Techniques for ISM Band Systems” [7]

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 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. PnP EMBEDDED INFORMATION

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

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 USA-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 | Approval pending 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.

Export restrictions

This product or software contains encryption code which may not be exported or transferred from the US or Canada without an approved US Department of Commerce export license.

FCC Guidelines for Human Exposure

CAUTION: To comply with FCC RF exposure compliance, a separation distance of at least 20 cm 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.

[1] *TB337 Tech Brief*, Intersil Corporation, "A Brief Tutorial on Spread Spectrum and Packet Radio", AnswerFAX document No. 82337.

[2] *AN9951 Application Note*, Intersil Corporation, "ISL37400M-EVAL PRISM 2.5 11 Mb miniUSB Wireless LAN Radio Description"

[3] *TB337 Tech Brief*, Intersil Corporation, "A Brief Tutorial on Spread Spectrum and Packet Radio"

[4] *TB382 Tech Brief*, Intersil Corporation, "Measurement of WLAN Receiver Sensitivity"

[5] *AN9850 Application Note*, Intersil Corporation, "Complementary Code Keying Made Simple"

[6] *AN9829 Application Note*, Intersil Corporation, "Brief Tutorial on IEEE 802.11 Wireless LANs"

[7] *AN9820 Application Note*, Intersil Corporation, "A Condensed Review of Spread Spectrum Techniques for ISM Band Systems"

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).

References

For Intersil documents available on the internet, see web site [http://www.intersil.com/Intersil AnswerFAX \(321\) 724-7800](http://www.intersil.com/Intersil AnswerFAX (321) 724-7800).

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_A ≤ 70°C
 Supply Voltage Range 3.0V to 3.6V

Caution: These are the absolute maximum ratings for the miniUSB 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_{CC}) = 3.3V, Ambient Temperature (T_A) = 25°C,
 Unless Otherwise Specified

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---------------------|-------------------------------|-----|-------|-----|-------|
| CURRENT CONSUMPTION | | | | | | |
| Initializatoin Current | I _{CC} | | - | 145 | 180 | mA |
| Average Current (2% TX; 8% RX; 90% Standby) (With Power Saving Mode) (Note 6) | I _{CC} | | - | TBD | - | mA |
| Continuous Transmit Mode | I _{CC} | | - | 325 | 380 | mA |
| Continuous Receive Mode | I _{CC} | Receiving Valid Packets | - | 200 | 225 | mA |
| Standby (Note 6) | I _{CC} | | - | TBD | - | mA |
| miniUSB LOGIC LEVELS | | | | | | |
| Meets all electrical USB 1.1 electrical specifications | | | | | | |
| RF SYSTEM SPECIFICATIONS | | | | | | |
| Transmitter Power Output | P _{out} | | - | 16 | - | dBm |
| Receive Sensitivity | RX_S | 1Mbps, 8% PER | - | -90 | - | dBm |
| | | 2Mbps, 8% PER | | -88 | | dBm |
| | | 5.5Mbps, 8% PER | | -85 | | dBm |
| | | 11Mbps, 8% PER | - | -83.5 | - | dBm |
| Multipath Delay Spread | T _{DELAY} | 2Mbps, 8% PER | - | >290 | - | nSec |
| | | 5.5Mbps, 8% PER | | 200 | | nSec |
| | | 11Mbps, 8% PER | | 105 | | nSec |
| Multipath Receive Sensitivity | RX_S _{JTC} | 1Mbps, 8% PER, Office B | - | -82 | - | dBm |
| | | 2Mbps, 8% PER, Office B | | -80 | | dBm |
| | | 5.5Mbps, 8% PER, Office A | | -75.4 | | dBm |
| | | 11Mbps, 8% PER, Residential A | - | -71 | - | dBm |
| Maximum Receive Level | RX_MAX | PER <8% | -3 | +3 | - | dBm |
| Third Order Intercept Point (Input) | IIP3_90 | -90 dBm input | - | TBD | - | dBm |
| | IIP3_25 | -25 dBm input | - | TBD | - | dBm |
| Carrier Supression | 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% (Note 7) | - | 44.5 | - | dB |

FN8022

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 |
|----------------------------|--------|-----------------|-----|---------------------|-----|-------|
| Data Rate (Physical Layer) | Rate | | - | 1, 2, 5.5 and 11 | - | Mbps |

NOTES:

6. Refer to Application Note “PRISM Power Management Modes” AN9665 [5].
7. The adjacent channel measurement is carried out on two channels separated by 25MHz (5 channels).

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Intersil Corporation's quality certifications can be viewed at website www.intersil.com/design/quality

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