EZURiO

# 802.11b/g Wireless LAN – SLIP 802.3 (50 way Hirose Connector)

## Part Number: WISMC02BI

# 1. General Description

EZURiO's Wireless LAN Module is a fully integrated and qualified solution Unlike other modules all the drivers and antenna are integrated. This makes certain the module is designed for lowest cost of integration and ownership for designers wishing to incorporate Wireless LAN functionality into their products.

The Wireless LAN module is one of the most compact complete Wireless LAN solutions, incorporating all the required 802.11b/g drivers directly into the module, making it ideal to integrate into handheld devices.

The EZURiO Wireless LAN module contains all of the hardware, firmware and embedded drivers for a complete Wireless LAN solution, requiring no further components. The Module has an integrated, high performance antenna which is matched with the Wireless LAN RF and baseband circuitry. The firmware integrated into the module interfaces with the host via a UART which carries control and data frames. Frames transferred across this interface are encapsulated in a simple SLIP protocol. Data frames consist of 802.3 packets and control frames contain simple commands used to configure and monitor the module operation. The module has been designed to ensure the best co-existence with other devices operating within the same frequency spectrum and has hardware support designed into the module for true Bluetooth co-existence.

The feature rich command set abstracts the Wireless LAN protocol from the host application, saving many months of programming and integration time. A low cost development system is available for fast product evaluation and development.

The Wireless LAN module is supplied in a form factor PCB (32.5 mm x 35 mm x 5.05 mm), with a 50 way Hirose connector with an industrial standard pin configuration. The module includes a high sensitivity, high gain antenna which provides excellent range. Typical open field performance provides ranges of over 100 metres.

Support is provided for low power modes that make the Wireless LAN module particularly applicable to battery powered installations.

The Wireless LAN module is Lead-free and is RoHS compliant and supports an industrial temperature range of -40°C to +85°C.

## 1.1 Applications

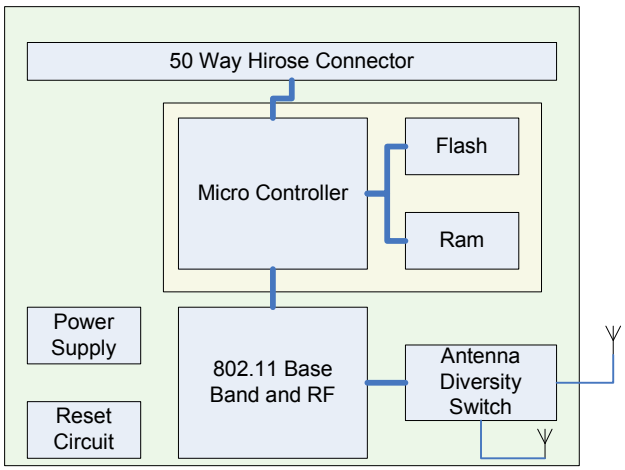
- POS Equipment
- Medical Equipment
- Telematics
- Industrial Automation
- Automotive Applications
- Street furniture
- Metering applications

# 2. Specification

| Feature | Implementation |
|---|---|
| Wireless LAN Transmission | Complete stand alone device with on board flash |
| Drivers | Embedded 802.11b/g |
| Protocol | SLIP for Wireless Ethernet 802.3 |
| Range | 100 meters typical |
| Frequency | 2.4 – 2.484 GHz |
| Channels | 11 channels – USA<br>13 channels – Europe (excl France)<br>14 channels – Japan |
| Max Transmit Power (Programmable) | +15 dBm @ antenna connector.<br>+17dBm from integrated antenna<br>+10 dBm limit for France and Hungary |
| Receive Sensitivity | -84dBm @ 2Mbps |
| Interface | UART Interface |
| Data Transfer rate | Up to 2 Mbps min (determined by UART) |
| Serial Interface | RS-232 bi-directional for commands and data.<br>16550 compatible. |
| Serial parameters | Default 115200,n,8,1<br>Configurable from 9,600 bps. Default 115,200 bps<br>/DTR, /DSR, /DCD, /RING, /RTS, /CTS supported |
| Security | WEP encryption 64 and 128 bit options. Built in hardware accelerators for WPA and WPA2 encryption. |
| Network support | Support for access point and ad-hoc mode |
| Current consumption | Less than 250mA during data transfer with a configurable low power mode less than 10mA. Powersave mode 5 as default. |
| Temperature Range | Low Power Mode: -40°C to +85°C<br>Continuous transmission: -40°C to +60°C |
| Bluetooth Co-existence | GPIO designated for hardware Bluetooth co-existence signalling |
| Supply Voltage | 3.3V – 5.0V |
| Interface Levels | 3.0V Logic |
| Connection | 50 way Hirose Connector with industrial standard pin configuration |
| Lead free | Lead-free and RoHS compliant |
| Warranty | 2 Years |

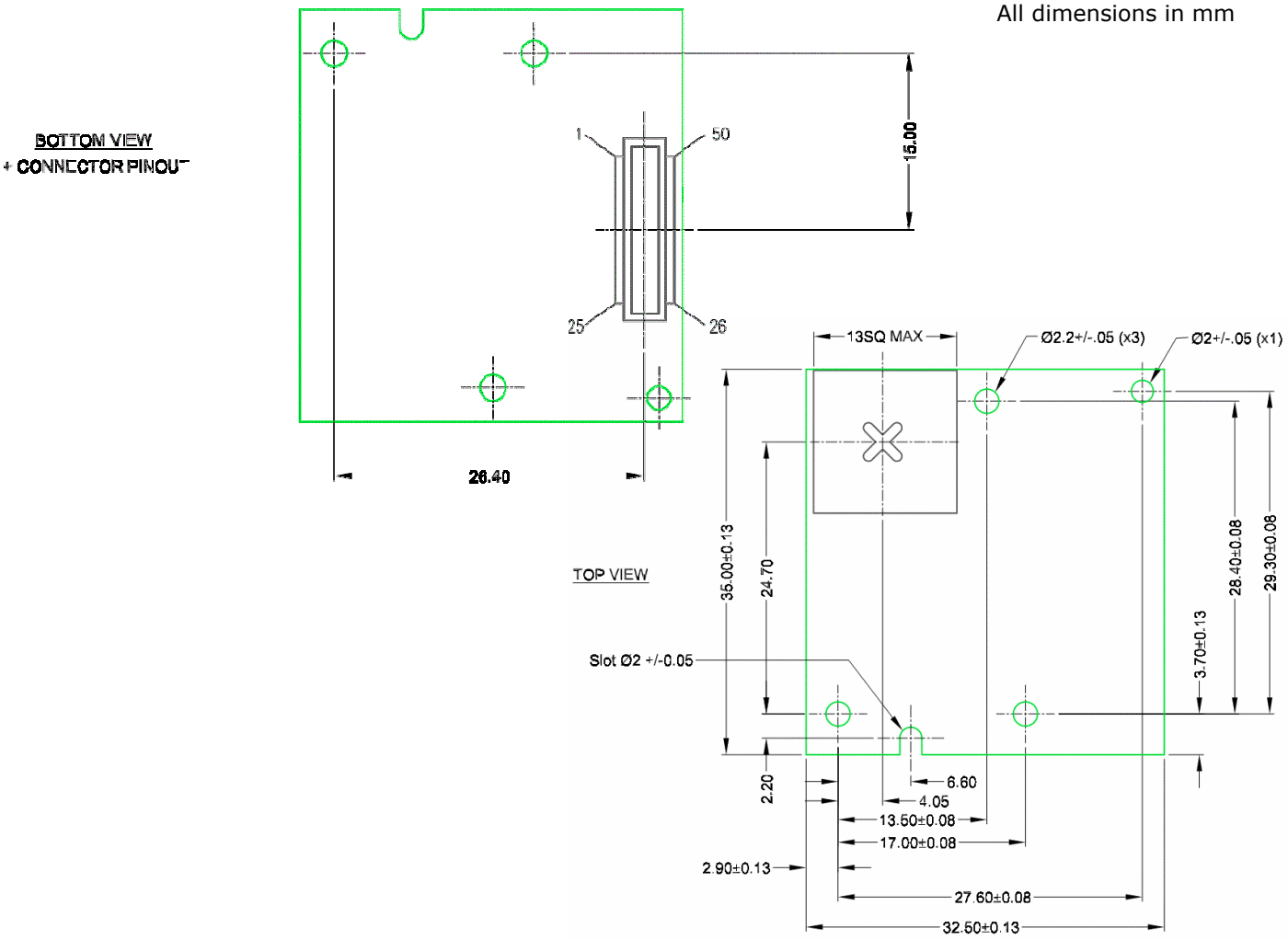
## 2.1 Block Diagram

The module has a 50 way Hirose connector with an industrial standard pin out configuration.




# 3. Mechanical

All dimensions in mm



## 3.1 50 way Hirose Connector Pin Descriptions

The WISM module is connected to a motherboard via a 50 way Hirose DF12C board-to-board connector. The table below defines the pin functions.

Note that this pin-out is as viewed from the underside of the Module.

| Pin No. | | Description |
|---|---|---|
| 26 | I | VCC |
| 27 | I | VCC |
| 28 | I | VCC |
| 29 | I | VCC |
| 30 | I | VCC |
| 31 | O | 3VOUT (monitor only) |
| 32 | O | /RING |
| 33 | O | /DSR |
| 34 | I | /RTS |
| 35 | I | /DTR |
| 36 | | Not Used |
| 37 | O | /CTS |
| 38 | | Not Used |
| 39 | O | /DCD |
| 40 | I | /RESET |
| 41 | | Not Used |
| 42 | | GND |
| 43 | | Not Used |
| 44 | | Not Used |
| 45 | | Not Used |
| 46 | | Not Used |
| 47 | | Not Used |
| 48 | | Not Used |
| 49 | | Not Used |
| 50 | | Not Used |

| Pin No. | | Description |
|---|---|---|
| 25 | | GND |
| 24 | | GND |
| 23 | | GND |
| 22 | | GND |
| 21 | | GND |
| 20 | | Not Used |
| 19 | | Not Used |
| 18 | | Not Used |
| 17 | I | /TXD |
| 16 | | Not Used |
| 15 | O | /RXD |
| 14 | | Not Used |
| 13 | | Not Used |
| 12 | | Not Used |
| 11 | | Not Used |
| 10 | | Not Used |
| 9 | | Not Used |
| 8 | | Not Used |
| 7 | | Not Used |
| 6 | | Not Used |
| 5 | | Not Used |
| 4 | | Not Used |
| 3 | | Not Used |
| 2 | | Not Used |
| 1 | | Not Used |

## 3.2 Electrical Specifications

### 3.2.1 Absolute Maximum ratings

Absolute maximum ratings for supply voltage and voltages on digital and analogue pins of the Module are listed below; exceeding these values will cause permanent damage.

| Parameter | Min | Max | Unit |
|---|---|---|---|
| Peak current of power supply | 0 | 550 | mA |
| Voltage at digital pins | -0.3 | 3.3 | V |
| Voltage at POWER pin | 3.3 | 5.0 | V |

### 3.2.2 Recommended Operating Parameters

#### 3.2.2.1 Power Supply

| Signal Name | Pin No | I/O | Voltage level | Comments |
|---|---|---|---|---|
| VCC | 26, 27, 28, 29, 30 | I | 3.3V to 5.0V | $I_{typ}$ = 250mA[1] |
| GND | 21, 22, 23, 24, 25, 42 | | | |

[1] Total current consumption assuming power saving is disabled.
All VCC and GND pins should be connected

#### 3.2.2.2 RS-232 Interface

| Signal Name | Pin No | I/O | Signal level | Comments |
|---|---|---|---|---|
| /RXD | 15 | O | $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V | |
| /TXD | 17 | I | $V_{IL}$max=0.8V<br>$V_{IH}$min=2.1V<br>$V_{IH}$max=3.3V | |
| /RTS | 34 | O | $V_{IL}$max=0.8V<br>$V_{IH}$min=2.1V<br>$V_{IH}$max=3.3V | |
| /CTS | 37 | I | $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V | |
| /DSR | 33 | O | $V_{IL}$max=0.8V<br>$V_{IH}$min=2.1V<br>$V_{IH}$max=3.3V | |
| /DTR | 35 | I | $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V | |
| /RING | 32 | O | $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V | |
| /DCD | 39 | O | $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V | |

UART nomenclature refers to the use of the module in a DCE (modem) mode.

#### 3.2.2.3 Other Functions

| Signal Name | Pin No | I/O | Comments |
|---|---|---|---|
| /RESET | 40 | I | Active LOW reset |
| 3VOUT | 31 | O | Used to monitor the state of the regulated supply within the module. THIS PIN MUST NOT BE USED TO POWER AN EXTERNAL CIRCUITRY. |

# 4. DC Characteristics

## 4.1 RF Performance

### 4.1.1 Transmit Power (802.11g)

| | |
|---|---|
| **Conducted Transmit Power** | Typ: +13 dBm |
| **Antenna Gain (Integrated Antenna)** | +2dBi typ. |
| **Effective Transmit Power** | Typ:+15dBm |

### 4.1.2 Transmit Power (802.11b)

| | |
|---|---|
| **Conducted Transmit Power** | Typ: +15 dBm |
| **Antenna Gain (Integrated Antenna)** | +2dBi typ. |
| **Effective Transmit Power** | Typ:+17dBm |

### 4.1.3 Receive Sensitivity (802.11b)

| | |
|---|---|
| **Receive Sensitivity (11Mbps)** | Typ: -84dBm |
| **Antenna Gain (Integrated Antenna)** | +2dBi typ |
| **Effective Receive Sensitivity** | -86dBm |

### 4.1.4 Receive Sensitivity (802.11g)

| | |
|---|---|
| **Receive Sensitivity (6Mbps)** | Typ: -82dBm |
| **Antenna Gain (Integrated Antenna)** | +2dBi typ |
| **Effective Receive Sensitivity** | -84dBm |

# 5. Functional Description

The Wireless LAN module is a self-contained product requiring only power to implement full communication. The integrated, high performance antenna together with the RF and Base-band circuitry provides the Wireless LAN connectivity and the UART interface provides a connection to the host system.

The complexity and flexibility of configuration are made simple for the design engineer by the integration of a simple command set that abstracts the details of the Wireless LAN functionality.

# 5.1 Interfaces

## 5.1.1 UART interface

**Modem signal nomenclature can be a source of great confusion, particularly on devices which can be configured in either DCE or DTE formats. For the purpose of this data sheet all UART signals are defined on the assumption that the module is being used as a conventional DCE. I.e it is behaving like a serial modem.**

/TXD, /RXD, /RTS and /CTS form a conventional asynchronous serial data port with handshaking, conforming to the ITU-T v.24 standard for DCE signalling. The interface is designed to operate correctly when connected to other UART devices such as the 16550A. Note that the signalling levels are a nominal 0V and 3.0V and are inverted with respect to the signalling on an RS232 cable. The interface is programmable over a variety of bit rates; no, even or odd parity; stop bit and hardware flow control.

The default condition on power-up is pre-assigned as 11520,n,8,1.

In DCE mode Port /TXD receives data from the application's /TX output.

In DCE mode Port /RXD transmits data to the application's /RX input.

Two-way hardware flow control is implemented by /RTS and /CTS. In DCE mode, /RTS is an input and is active low. /CTS is an output and is active low. These signals operate according to normal industry convention.

In a DCE mode, where the module is being driven as a peripheral by a host processor, the UART signals should be connected according to the following scheme:

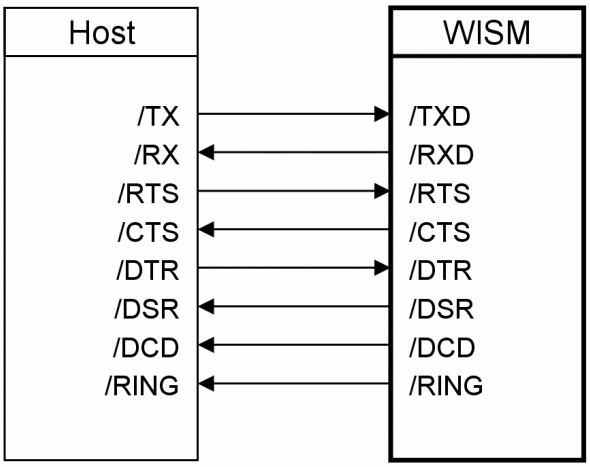



Figure 6.1 : UART interfaces

Some serial implementations link /CTS and /RTS to remove the need for handshaking. EZURiO do not recommend linking /CTS and /RTS other than for testing and prototyping. If these pins are linked and the host sends data at the point that the Wireless Module deasserts its /RTS signal, then there is a significant risk that internal receive buffers will overflow which could lead to an internal processor crash. This will lead to a drop in connection and may require a power cycle to reset the module.

EZURiO recommend that the correct /CTS to /RTS handshaking protocol be adhered to for proper operation.

Note that the serial module output is at 3.0V CMOS logic level, which is inverted with respect to a standard RS-232 signal. Level conversion must be added to interface with an RS-232 level compliant interface.

# 6. Firmware Features

## 6.1 Command Set

The module supports the following commands. Details of these commands are provided in the Programming Guide.

| Command | Parameters | Operation |
|---|---|---|
| UARTMODIFY | Baud: Baud rate (9600, 19200, 38400, 57600, 115200, 230400,921600)<br>Length: 8 bits (only allowed option)<br>Parity: Even / Odd<br>Stop: 1, 2 | Configures the UART parameters. |
| SECURITY | Flag: none, WEP | Selects use of WEP security |
| KEY | Keystring: 10 or 26 Hex digits setting 64 or 128 bit encryption key | Sets the WEP encryption key |
| AUTHENTICATE | Flag: Open or closed | Selects authentication strategy to use in combination with WEP |
| SEARCH | | Performs a search for local APs |
| ATTACH | Name: Alphanumeric AP SSID name to attach to | Attaches the module to the specified AP |
| DETACH | | Detaches the module from the current AP |
| CHANNEL | Channel: 1-11 (Europe), 1-13 (US) and 1-14 (Japan) | Sets the operating channel for ad-hoc network |
| MACADDRESS | | Reads back the macaddress of the |
| POWERSAVE | Flag: Powersave mode (01,2,5) | Selects the power save mode (described in greater detail in Section 6.1) |
| GETRSSI | | Reports signal strength information for the current AP connection. |

## 6.2 Power Saving

The module supports the Wireless LAN IEEE power saving function. When this power saving mode is enabled, the wireless LAN chipset goes to sleep when it is not actively receiving from the access point. The chipset wakes up on a regular basis to receive broadcast messages from the AP or to transmit or receive unicast messages. By using this technique the average power consumption of the chipset is reduced from around 250mA in active receive to <10mA (TBC) when IEEE power save is in use. The EZURiO module offers IEEE power save operation in two different modes:

- Powersave mode 1: The wireless LAN chipset operates in IEEE powersave mode and the module microcontroller remains fully awake and ready to receive commands and data from

the host. This mode of power saving reduces the average consumption of the module to <35mA (TBC).

- Powersave mode 2: The wireless LAN module operates in IEEE powersave mode and the module microcontroller is put into a very low power standby mode. The average current consumption in this mode is reduced to <10mA (TBC). In power save mode 2, /DTR is used by the host to indicate that the module can enter the low power state. When /DTR is de-asserted, the module microcontroller enters low power standby. The microcontroller will re-start when either a packet is received from the AP or the host requests it by asserting /DTR.
- Powersave mode 5: The modules default mode of start up is in powersave mode5. At start up the module automatically enters Power Save 5 mode. The average current consumption in this mode is reduced to <25mA (TBC). In this mode the module powers down the WLAN chipset, and awaits commands from the host. The host may only send the following commands:
    - UARTMODIFY
    - POWERSAVE
    - MACADDRESS
    - VER

In powersave mode 5 no other commands will be accepted by the module until it has entered either Power Save 1 or Power Save 0 mode.

# 7. Application Information

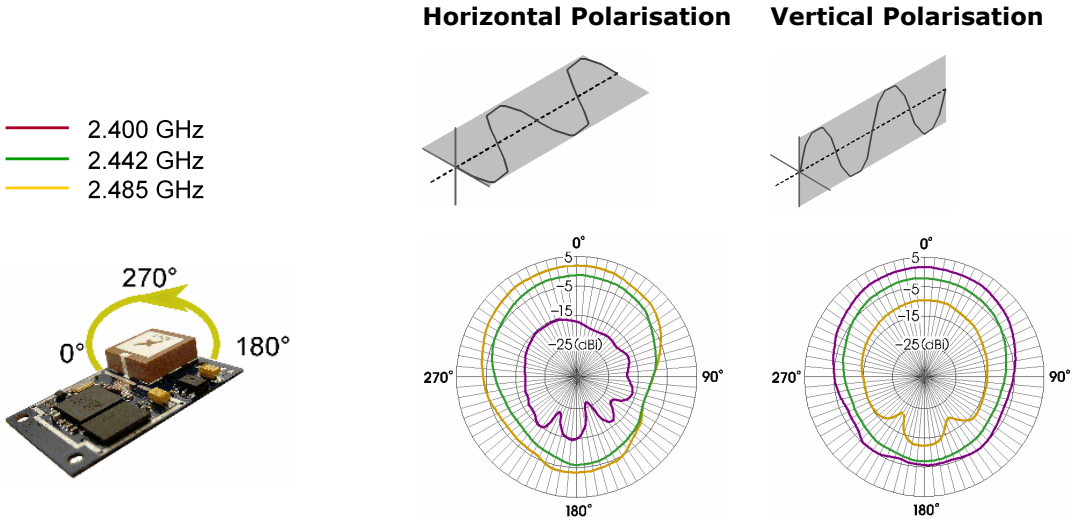
## 7.1 Antenna Position

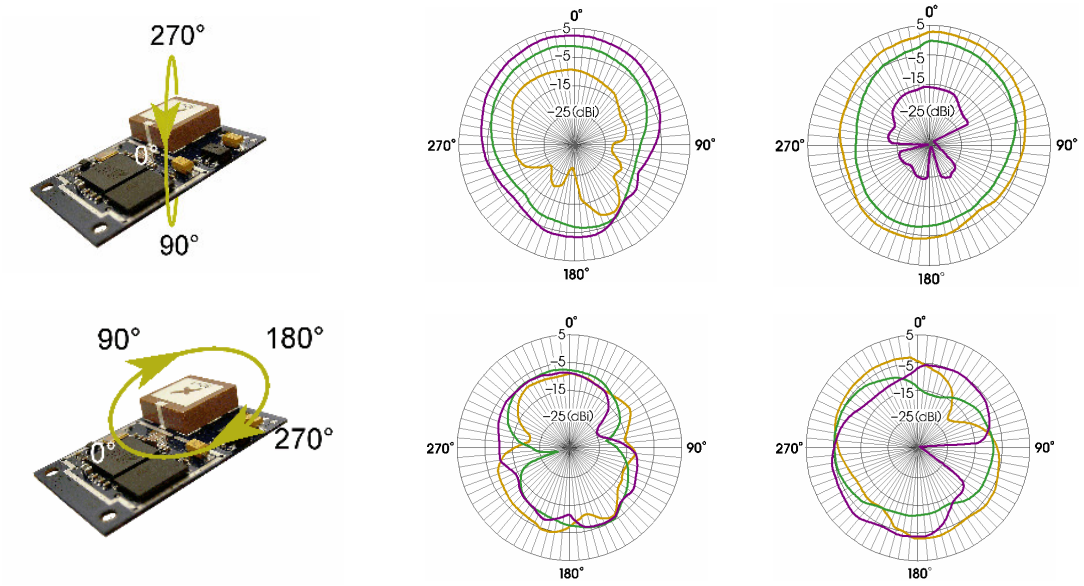
The antenna used on the Wireless LAN module is designed to be largely immune from the effects of proximity detuning. Normally, antennas operating at 2.4GHz are affected by their surroundings, so that great care is needed in their placement and orientation.

The Wireless LAN module can be used in most locations and orientations and is only marginally affected by the presence of a significant ground plane in close proximity.

The antenna distribution is close to isotropic, which means that the orientation of mounting has only a limited effect on the overall range. However the optimum range is achieved when the two antennae are directly facing each other

**Example of Radiation Characteristics**






*Typical Radiation Characteristics. Measured at 2.5metres from a standard dipole.*

The module should not be located in a sealed metal enclosure, as this will act as a Faraday cage and severely attenuate the radio signal.

The antenna finish may tarnish as a result of environmental effects and handling. This is a cosmetic effect and does not affect the RF performance.

## 7.2 Power Supply Considerations

The power supply for the Module has to be a single voltage source of Vcc within the range of 3.3 V to 5.0 V. It must be able to provide sufficient current in a transmit burst, this could rise to a peak 550mA.

The Module includes regulators to provide local 3.0V. This rail is accessible on connector Pin 31 for monitoring purposes only. Under no circumstances should this pin be used to source current.

Power (Vcc) can be provided via the board-to-board connector Pin 29 on Pin 31 and it is recommended that power is tracked to all PSU pins and all GND pins are connected.

## 7.3 External Antenna

A variety of manufacturers can supply external antennae suitable for use with the WISM module as a diversity or prime antenna. Users should be aware that the choice of antenna will affect the qualification of the module.

To ensure that the qualification is not affected, the TOTAL GAIN of the external antenna, including insertion loss of the connectors and cable must be less than 3dBi. If a higher gain is employed, then the pre-qualified status of the module will be lost. It is the customer's responsibility to ensure that an external antenna does not negate the qualification.

## 7.4 Power-On-Reset

The Module is provided with an active low reset pin (Hirose 50way connector pin 40) however, on the application of power, the Power On Reset circuit built into the Module will ensure that the unit starts correctly. The external reset signal allows the module to be reset under software control from the host. After a power on or reset operation, the module will de-assert the /RTS output and re-assert it when it is ready to receive commands.

## 7.5 Operational Temperature

The Wireless LAN module is designed to meet an operational temperature of -40°C to +85°C in the standard mode where it is running in IEEE power save mode.

If the module is run in a mode that results in more frequent receive and transmit activity the operating temperature will need to be derated to ensure that overall module power dissipation limits are not exceeded. When the ambient temperature rises above 60°C the module should only be operated in powersave mode 1 or higher.

## 7.6 Mounting the Module onto the application platform

There are many ways to properly install the Module in the host device. An efficient approach is to mount the PCB to a frame, plate, rack or chassis. Fasteners can be M1.8 or M2 screws plus suitable washers, circuit board spacers, or customized screws, clamps, or brackets in 2.2mm diameter holes. Note that care should be taken to ensure the head of the fixing does not interfere with the circuit. Nylon fixings are recommended. In addition, the board-to-board connection can also be utilized to achieve better support.

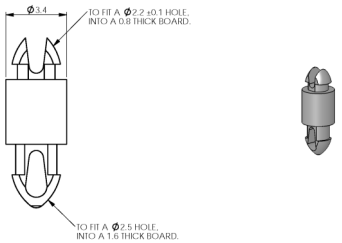
The antenna (Brown square component on top side of PCB) must not be influenced by any other PCBs, components or by the housing of the host device. The proximity of the antenna to large metallic objects can affect the range and performance of the system. Designers should carefully consider the location of the Module and the type of enclosure material that is used.

To prevent mechanical damage, be careful not to force, bend or twist the Module. Be sure it is positioned flat against the host device.

### 7.6.1 Fixing Pillars

EZURiO in conjunction with Richco has designed a mounting pillar for use with the Wireless LAN Module. This allows the module to be securely held to a primary pcb using snap fit details. A variety of different heights are available to accommodate different variants of Hirose stacked connectors. Pillars supporting a 3.5mm stacked board height can be supplied by EZURiO. These and alternative spacings can also be ordered directly from Richco.

Customer designs using these pillars should use 2.5mm diameter holes on a 1.6mm thick PCB. in conjunction with the 3.6 mm stacked height Hirose if they are to take advantage of this.




See http://www.hirose.co.jp/cataloge_hp/e53700036.pdf for detail information on the PCB socket.

## 7.7 Stacking Height

Mating headers from Hirose are available in different stacking heights, allowing the spacing between the Wireless LAN Module and carrier pcb to be changed from 3.5mm to 5.0mm.

| Item | Part number | Stacking height | HRS number |
|---|---|---|---|
| Receptacle on Module | DF12C-50DS-0.5V(86) | 3.5 mm – 5 mm | CL537-0009-2-86 |
| Headers DF12 series | DF12(3.5)-50DP-0.5V(86) | 3.5 mm | CL537-0034-0-86 |
| | DF12(4.0)-50DP-0.5V(86) | 4.0 mm | CL537-0059-0-86 |
| | DF12(5.0)-50DP-0.5V(86) | 5.0 mm | CL537-0159-5-86 |

Notes: The headers listed above are with boss and metal fitting.
Suffix -86 denotes RoHS compliance.

## 7.8 Hirose Connector general specification

| Parameter | Specification (50 pin Board to Board connector) |
|---|---|
| Number of Contacts | 50 |
| Quantity delivered | 2000 Connectors per Tape & Reel |
| Voltage | 50V |
| Current Rating | 0.5A max per contact |
| Resistance | 0.05 Ohm per contact |
| Dielectric Withstanding Voltage | 500V RMS min |
| Operating Temperature | -45°C...+125°C |
| Contact Material | phosphor bronze (surface: gold plated) |
| Insulator | Material PA , beige natural |
| Stacking height | 3.0 mm ; 3.5 mm ; 4.0 mm ; 5.0 mm |
| Insertion force | 21.8N |
| Withdrawal force 1st | 10N |
| Withdrawal force 50th | 10N |
| Maximum connection cycles | 50 |

# 8. Certification

## 8.1 FCC and Industry Canada Statements

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, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment marketed in USA is restricted by firmware to only operate on 2.4 GHz channel 1-11.

### 8.1.1 FCC Labelling requirement

If the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: PI405W" or "Contains FCC ID: PI405W." Any similar wording that expresses the same meaning may be used.

### 8.1.2 RF Exposure

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

# Regulatory Information

## Declaration of Conformity

EZURiO Ltd,

Saturn House

Mercury Park,

Wooburn Green,

Bucks

HP10 0HH

ENGLAND

declare under our responsibility that the following products:

**WISMC02BI, WISMC04BI**

conform to the following product specifications:

**R&TTE Directive 1999/5/EC** EN 300 328 V1.6.1 (2004-11)

**EMC Directive: 89/336/EEC**

EN 301 489-1 V1.4.1 (2002-08) EN 301 489-17 V1.2.1 (2002-08)

**Safety Compliance**

EN 60950-1:2001 and/or IEC 60950-1:2001 (1st Edition)

# 9. Disclaimers

EZURIO'S WIRELESS PRODUCTS ARE NOT AUTHORISED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE MANAGING DIRECTOR OF EZURIO LTD.

The definitions used herein are:

a) Life support devices or systems are devices which (1) are intended for surgical implant into the body, or (2) support or sustain life and whose failure to perform when properly used in accordance with the instructions for use provided in the labelling can reasonably be expected to result in a significant injury to the user.

b) A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

EZURiO does not assume responsibility for use of any of the circuitry described, no circuit patent licenses are implied and EZURiO reserves the right at any time to change without notice said circuitry and specifications.

## 9.1 Data Sheet Status

This data sheet contains preliminary data for use with Engineering Samples. Supplementary data will be published at a later date. EZURiO Ltd reserve the right to change the specification without prior notice in order to improve the design and supply the best possible product.

Please check with EZURiO Ltd for the most recent data before initiating or completing a design.