



**Preliminary Product Specifications**  
**Wireless LAN /Bluetooth Combo Mini-PCI Card**  
**IEEE 802.11g + Bluetooth 1.1**  
**MWL-41G2**

**Delta Mobile Software, Inc.**

## Revision History

VERSION	REASON FOR REVISION	ISSUE DATE	APPROVED BY
0.1	Initial Spec	Feb 25 <sup>th</sup> , 2003	Jamie Chu
0.2	Adopted Prism Frisbee	Mar 28, 2003	Jamie Chu
0.9	Draft proposal	Apr 1, 2003	Jamie Chu
1.0	802.11g draft 6.1->8.1	May 20, 2003	Jamie Chu
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## Scope

This document describes the hardware architecture for the wireless mini-PCI module MWL-41G1 and its software specifications.

## 1. Introduction

This document is to specify the product requirements for **MWL-41GB1**, 802.11g compliant mini-PCI module based on Intersil Prism Frisbee and Bluetooth 1.1 Enable USB interface based on MBT4101M Class 2 CSR based module.

This Bluetooth USB module (MBT4101M) is used to transmit/receive messages to/from other Bluetooth devices. Based on Bluetooth connection, the messages can be directed at a specific device, or can be broadcasted to all devices.

The design of the Bluetooth module will closely adapt the Bluetooth module (MBT4101). That is connected to the host processor via a Bluetooth HCI link. As an effort to the interface connection to the whole notebook systems, it can be directly soldered on the Notebook motherboard and routed to the interface of the main board in the notebook systems.

This Bluetooth module is Bluetooth BQB qualified, power level of the class 2/3 and consists of either a connector connecting to the external high gain antenna, or a on-board chip antenna.

### **IEEE802.11g mini PCI :**

Following standard 32-bit PCI standard, plus Microsoft Windows compliant device driver and installation utility, this product is an ideal for notebook computer system integration. Built-in security mechanism includes WEP 64/128, AES engine and WPA. Hardware-based WEP provides good performance and secure communications.

### **Bluetooth USB module:**

Because Bluetooth enable products provide much more flexible applications than Wireless Lan did. Next generation design of the Laptop mini-PCI would be possible to combine Bluetooth enable function .. The benefit it would bring is mechanical design flexibility. Design team would not worry about what BT daughter card dimension is, just because there is no industrial mechanical standard for BT module.

### **Bluetooth and Wireless Lan Coexistence (AFH-Adaptive Frequency Hopping)**

Adaptive Frequency Hopping goes a long way to solving the Bluetooth and Wi-Fi co-existence problem. To deliver simultaneous operation of Bluetooth and Wi-Fi wireless technologies in PCs, CSR and Intersil has developed Coexistence Technology, a unique collaborative real-time communications interface at the MAC layer that is transparent to the user. Data can be transmitted without interference while optimizing throughput, range and responsiveness. This enables Bluetooth applications such as mouse, keyboard, printing, file transfer and portable device synchronization to run at the same time the user is connected to the network over Wi-Fi.

## **1.1 Product Features**

### **WLAN IEEE802.11g**

- Compatible with IEEE 802.11g high rate standard to provide wireless speeds of 54Mbps data rate with OFDM modulation.
- Backward compatible with IEEE 802.11b high rate standard to provide wireless speeds of 11Mbps data rate with CCK modulation.
- Dynamic data rate scaling at 54, 48, 36, 24, 18, 12, 9 Mbps in OFDM mode
- Dynamic data rate scaling at 11, 5.5 Mbps in CCK mode; 2 and 1Mbps in DQPSK and DBPSK mode.
- 32-bit mini-PCI Interface, Type 3B
- Maximum reliability, throughput and connectivity with automatic fallback, auto-switch between OFDM and CCK.
- Supports wireless data encryption with 128-bit WEP and WPA standard for security
- Reserved on-board dual Hirose RF connector for antenna extension

- Drivers support Windows 98SE, 2000, ME, XP
- Driver support for embedded RTOS like uCLinux
- Simple user setup & diagnostics utilities
- Type approval compliant with FCC Part 15.247 for US, EN 300-328 for Europe, and RCR STD-33A and ARIB STD-T66 for Japan

## Bluetooth

- CSR BC02 Single Chip solution
- Bluetooth Specification 1.1 compliant
- Pico-net support
- Support up to 7 slaves
- *WLAN IEEE802.11g coexist with Bluetooth Specifications* 5Company Confidential
- Class 2 Transmitter Power 0 dBm
- Excellent receiver sensitivity –80 dBm
- Up to 30 meters Peer-to-peer range with external antenna
- Provide UART, PCM, USB Interface
- Full Bluetooth Rate UART: with programmable baud rate up to 921.6 KBPS and a 128-byte TX and RX FIFO.
- PCM Codec Interface
- On-module USB transceiver conforms to full-speed 12 Mbps speed of USB spec.1.1
- On-module Flash containing Bluetooth software stack.
- DC Supply from 5 V
- Low current consumption 60 mA @HV5
- Four Low power mode: Park, Sniff, Hold and Sleep.
- Small size: 22 mm \* 14 mm \* 3.0 mm

## Coexistence:

Adaptive hopping Bluetooth devices will move into that mode based on one or more of several possible interference-detection mechanisms. Among the technical approaches:

- The Bluetooth device gradually adapts its normal operation hop pattern based on observed packet loss.
- The Bluetooth device detects and assesses received signal strength across its wireless environment before commencing operation.

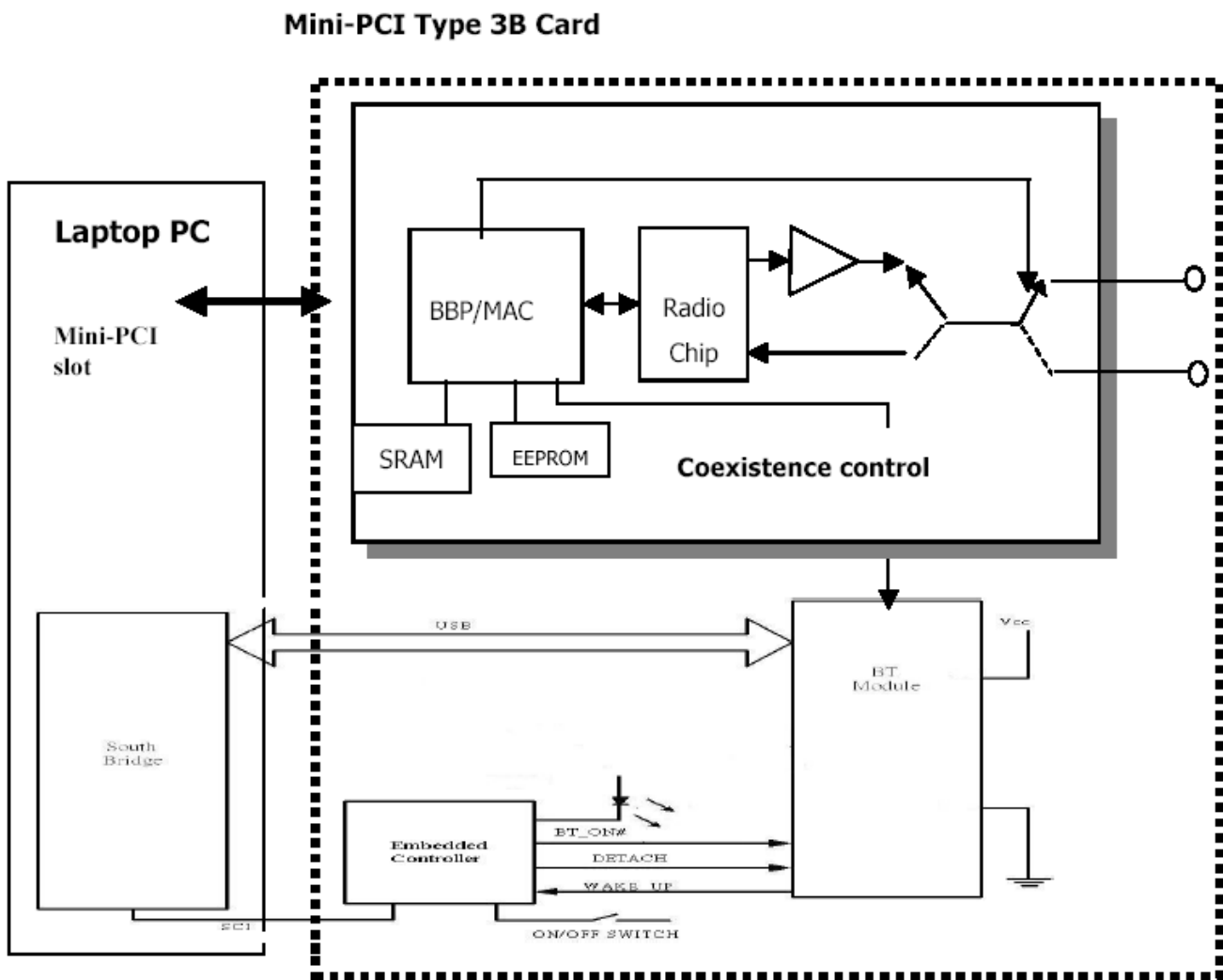
Company Confidential

- The Bluetooth device transmits a "test" pattern of packets across the entire spectrum, observes the ratio of lost packets across available channels and locates its adapted piconet in the least active or interference-prone channel.
- If the Bluetooth device is co-located with a Wi-Fi device and can receive the Wi-Fi passband location from the Wi-Fi device, it simply avoids operating within the Wi-Fi passband. (To be continued with CSR's implementation update)

## 2. Hardware Platform

Based on Intersil Frisbee 11g-only low cost solution

### 2.1 Hardware Architecture

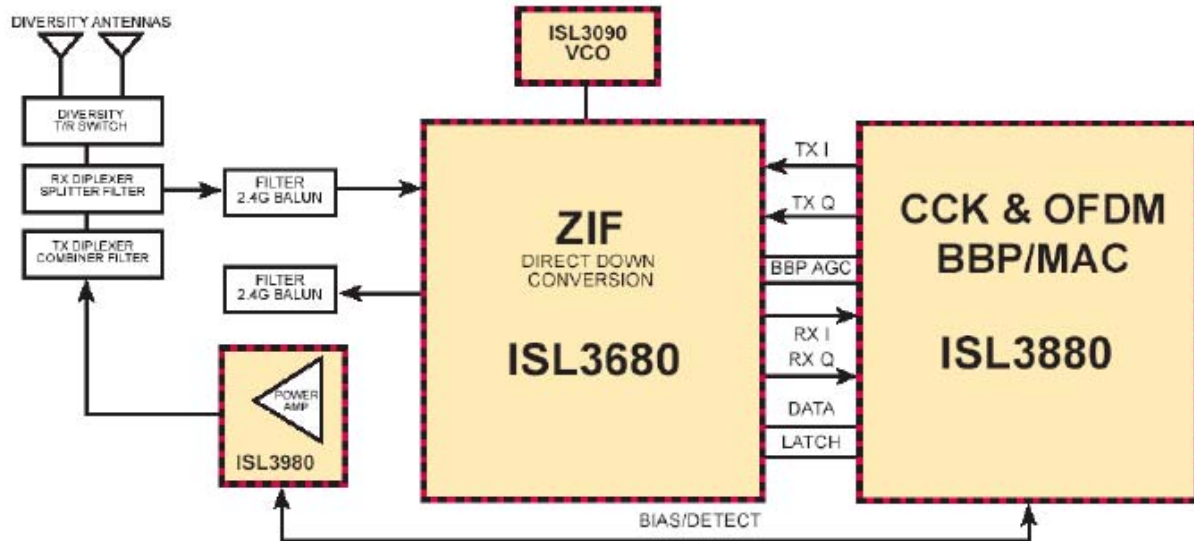


### 2.2 The major internal components and external interfaces



## 2.2.1 WLAN

Functions	Vendor and Part Number
MAC/BBP 802.11g	Intersil ISL3880
RF Transceiver	Intersil ISL3680(*ISL3686)
2.4 GHz Power Amplifier	Intersil ISL3980
VCO	Intersil ISL3090(*ISL3084)
* : Intersil 11G Frisbee Chipset cost down version	



### MAC/Baseband Processor Intersil 3880

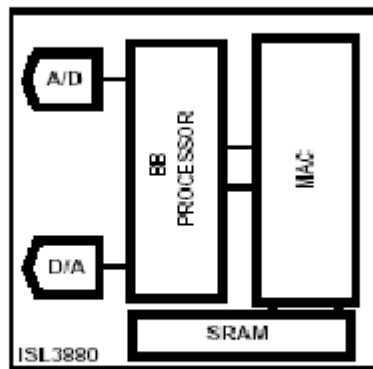
The Intersil ISL3880 Wireless LAN Integrated Media Access Controller with Baseband Processor is part of the PRISM® GTI radio chipset. The ISL3880 directly interfaces with the Intersil's ISL3680/ISL3686 Direct Transceiver with AGC and synthesizer. Adding Intersil's ISL3090 10GHz VCO and Intersil's ISL3980 Power Amp completes an end-to-end WLAN Chipset solution for the 2.4GHz 802.11b/g standards.

Protocol and PHY support are implemented in firmware to provide for custom WLAN solutions. Firmware implements the full IEEE 802.11 Wireless LAN MAC protocol. It supports BSS and IBSS operation under DCF, and operation under the optional Point Coordination Function (PCF). Low-level protocol functions such as RTS/CTS generation and acknowledgment, fragmentation and de-fragmentation, and automatic beacon monitoring are handled without host intervention. Active scanning is performed autonomously once initiated by host command.

Host interface command and status handshakes allow concurrent operations from multi-threaded I/O drivers. Orthogonal Frequency Division Multiplex (OFDM) combined with BPSK through 64 QAM modulation of the individual carriers and a variety of convolutional coding rates provides 8 selectable data rates. Differential phase shift keying modulation schemes, DBPSK and DQPSK with data scrambling capability along with Complementary Code Keying provide 4 selectable data rates or DSSS mode. Built-in flexibility allows the ISL3880 to be configured for a range of applications. The MAC is based on the ARM 946E processor core that offers a wide variety of code development support tools.

The ISL3880 is housed in a thin plastic BGA package suitable for CardBus or Mini-PCI circuit card applications.

### ***Simplified Block Diagram***



### **Block Diagram of Intersil ISL3880**

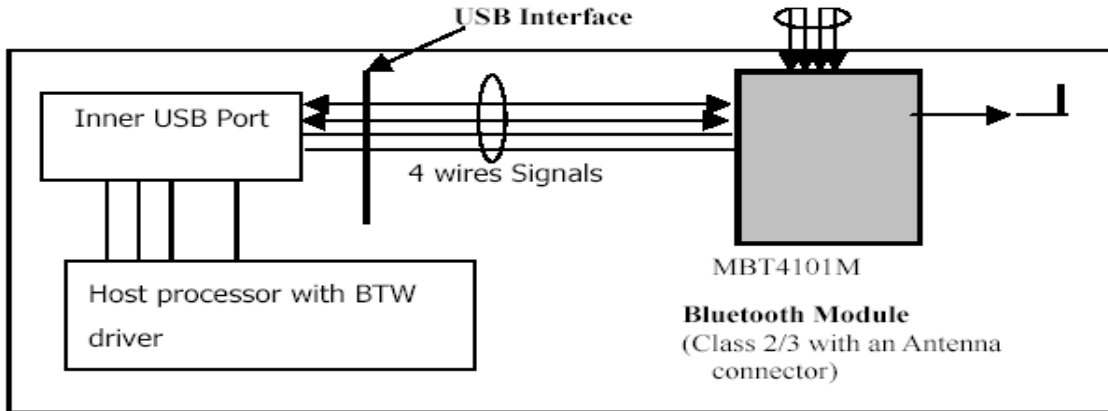
## **RF Transceiver and Power Amplifier Intersil ISL3680**

The Intersil ISL3680A is a highly integrated SiGe process, direct down conversion transceiver and is part of the PRISM GT , 2.4GHz, 54Mbps, IEEE802.11b/g compliant radio chipset. The ISL3680 directly interfaces with Intersil's Baseband Processor (BBP) and ISL3880 Integrated Medium Access Controller (MAC) with BBP. The addition of the ISL3984/85 Intersil power amplifier, and the ISL3090 10 GHz VCO completes the LAN radio.

### **2.2.2 The major internal components and external interfaces**

#### **Control of Bluetooth**

The following diagram shows the design with 's Bluetooth module solution. In this configuration, the board of the module will perform LINK and Baseband/RF tasks. And most of the application functions and protocols are done by the Software BTW provided by Widcomm.



■ **USB 4 signals:**

Item	Feature	Detailed Description	Level
1	USB _ D+	<ul style="list-style-type: none"> <li>USB Differential Data –NRZI differential Data Positive Input/Output</li> </ul>	CMOS
2	USB _ D-	<ul style="list-style-type: none"> <li>USB Differential Data –NRZI differential Data Negative Input/Output</li> </ul>	CMOS
3	VCC	<ul style="list-style-type: none"> <li>Module DC Power Supply</li> </ul>	3.3V
4	Ground	<ul style="list-style-type: none"> <li>Module Ground.</li> </ul>	--

■ **Bluetooth USB Module Feature**

Item	Feature	Detailed Description	✓/✗
1	PCB	<ul style="list-style-type: none"> <li>22 mm * 14 mm * 3.0 mm ,6 Layers , Single side of components.</li> </ul>	Y
2	Weight	<ul style="list-style-type: none"> <li>N/A</li> </ul>	N
3	LED Indicator	<ul style="list-style-type: none"> <li>TBD</li> </ul>	N
4	Antenna	<ul style="list-style-type: none"> <li>Hiroset connector mounted on Board(TBD)</li> </ul>	-

■ **WiFi and Bluetooth Coexistence Control Feature**

Item	Feature	Detailed Description	✓/✗
1	GPIO 3	<ul style="list-style-type: none"> <li>TBD.</li> </ul>	-
2	GPOI 4	<ul style="list-style-type: none"> <li>TBD</li> </ul>	-
3	GPIO 6	<ul style="list-style-type: none"> <li>TBD</li> </ul>	-
4	GPIO 7	<ul style="list-style-type: none"> <li>TBD</li> </ul>	-

■ **Bluetooth USB Host Control Feature**

Item	Feature	Detailed Description	✓/✗
1	DETACH	<ul style="list-style-type: none"> <li>Signal for signals the module that it must</li> </ul>	-

Item	Feature	Detailed Description	U/D
		disconnect from the USB.	
2	WAKE_UP	<ul style="list-style-type: none"> <li>Signal for signals the system that the module has received a wakeup event and the system must resume</li> </ul>	-
3	BT_ON#	<ul style="list-style-type: none"> <li>Signal for signals to the FET to control Vcc and optionally Vcc_IO of the module</li> </ul>	-
4	SCI interfaces	<ul style="list-style-type: none"> <li>With the chipset to indicate a wake up or power change event has occurred</li> </ul>	-

## Device Drivers

### Bluetooth for Windows Support

Windows XP

Windows 2000

Windows 98SE (Second Edition)

Windows Me (Millennium Edition).

Bluetooth for Windows will function in the same way, no matter what version of Windows is running

## 2.3 Feature and Requirement

### 2.3.1 General Requirement - WLAN

Feature	Detailed Description
RF Technology	Direct Sequence Spread Spectrum (DSSS)
Spreading	11-chip Barker Sequence
Modulation Schemes	DQPSK, DBPSK, CCK and OFDM
Operating Frequency	ISM band Japan: 2402 ~ 2497MHz N. America: 2402~2472MHz Europe: 2402~2483.5 France: 2446.5~2483.5
Channel Numbers	IEEE 802.11g/b compliant 11 channels for United States 13 channels for Europe Countries

14 channels for Japan	
Data Rate	11Mbps(CCK) with fall back rates of 5.5, 2, and 1Mbps 54Mbps with fall back rates of 48/36/24/18/12/9 Mbps (OFDM)
Range	Typical range at open space: 1300 ft at 1Mbps 300 ft at 11Mbps 100 ft at 54Mbps Typical range at indoor 300 ft at 1Mbps 50 ft at 54Mbps
Media Access Protocol	CSMA/CA with ACK
Transmitter Output Power	Typical 16dBm
Receiver Sensitivity	54 Mbps OFDM, 10% PER, -68 dBm 48 Mbps OFDM, 10% PER, -68 dBm 36 Mbps OFDM, 10% PER, -75 dBm 24 Mbps OFDM, 10% PER, -79 dBm 18 Mbps OFDM, 10% PER, -82 dBm 12 Mbps OFDM, 10% PER, -84 dBm 11 Mbps CCK, 8% PER, -82 dBm 9 Mbps OFDM, 10% PER, -87 dBm 6 Mbps OFDM, 10% PER, -88 dBm 5.5 Mbps CCK, 8% PER, -85 dBm 2 Mbps QPSK, 8% PER, -86 dBm 1 Mbps BPSK, 8% PER, -89 dBm
Antenna Type	Dipole antenna, on-board Hirose U.FL-R-SMT mates with cable connector U.FL-LP-066
Operating Voltage	3.3VDC +/- 10%
Current Consumption	Max. 250mA at transmit mode (TBD) Max. 200mA at receive mode (TBD) Max 30mA at power save mode Max. 5mA at sleep mode (TBD)
Form Factor and Interface	Mini-PCI type 3B
Host Interface	124-pin SO-DIMM edge connector

### 2.3.2 Engineering Requirement

Feature	Detailed Description
Transmit Power Level	<p>The maximum allowable RF power level is subject to specified regulation                      Typical 16dBm at EIRP</p>

Transmit Center Frequency Tolerance	<p>Refer to sub-clause 15.4.7.1, IEEE 802.11                      The transmitted center frequency tolerance is +/- 25ppm maximum</p>
Transmit Modulation Accuracy	<p>Refer to sub-clause 15.4.7.9, IEEE 802.11                      The requirements of transmit modulation accuracy is based on difference between the actual transmitted waveform and the ideal signal waveform. The modulation accuracy is determined by measuring peak EVM (error vector magnitude) of complex I/Q constellation points.                      The normalized EVM value can not exceed 0.35</p>
TX-to-RX Turnaround	<p>Refer to sub-clause 15.4.6.6, IEEE 802.11                      The TX-to-RX turnaround time is less than 10usec, including power down ramp</p>
RX-to-TX Turnaround	<p>Refer to sub-clause 15.4.6.7, IEEE 802.11                      The RX-to-TX turnaround time is less than 5usec, including power up ramp</p>
Transmit Power-on and Power-down Ramp	<p>Refer to sub-clause 15.4.7.7, IEEE 802.11                      Transmit power-on and power-down ramp are the difference times between 10% and 90% of maximum RF power.                      The maximum power-on and power-down ramp is no greater than 2usec.</p>

<p>Transmit Spectrum Mask</p>	<p>Refer to sub-clause 15.4.7.4, IEEE 802.11</p> <p>The transmit spectrum mask for requirements is subject to applicable regulations</p> <p>The transmitted spectral products are less than <math>-30\text{dBc}</math> for <math>f_c - 22\text{MHz} &lt; f &lt; f_c - 11\text{MHz}</math>, <math>f_c + 11\text{MHz} &lt; f &lt; f_c + 22\text{MHz}</math>, <math>-50\text{dBc}</math> for <math>f &lt; f_c - 22\text{MHz}</math>, and <math>f &gt; f_c + 22\text{MHz}</math>, where <math>f_c</math> is the channel center frequency</p>
<p>Spurious Emission (Image)</p>	<p>The spurious emission for requirements is subject to applicable regulations</p>
<p>Spurious Emission (Harmonics)</p>	<p>The spurious emission for requirements is subject to applicable regulations</p>
<p>Receiver Sensitivity at 2Mbps</p>	<p>Refer to sub-clause 15.4.8.1, IEEE802.11</p> <p>According to IEEE802.11 specification, the packet error rate (PER) is less than <math>8\text{E}-2</math> for a minimum input level of <math>-80\text{dBm}</math> measured at antenna connector for 2Mbps DQPSK modulation</p> <p>Sensitivity is typical <math>-90\text{dBm}</math> at 2Mbps</p>
<p>Receiver Sensitivity at 11Mbps</p>	<p>Refer to sub-clause 18.4.8.1, IEEE802.11b</p> <p>According to IEEE802.11 specification, the packet error rate (PER) is less than <math>8\text{E}-2</math> for a minimum input level of <math>-76\text{dBm}</math> measured at antenna connector for 2Mbps DQPSK modulation</p> <p>Sensitivity is typical <math>-84\text{dBm}</math> at 11Mbps</p>



<p>Receiver Sensitivity at 54Mbps</p>	<p>Refer to sub-clause 18.4.8.1, IEEE802.11g          According to IEEE802.11 specification, the packet error rate (PER) is less than 8E-2 for a minimum input level of –76dBm measured at antenna connector for 54Mbps OFDM modulation          Sensitivity is typical –84dBm at 54Mbps</p>
<p>CCA Energy Detection</p>	<p>Refer to sub-clause 15.4.8.4, IEEE 802.11          CCA function is implemented according to at least one of the three methods: Energy Detection, DSSS Carrier Sense, and both.          The energy detection threshold is less than or equal to –76dBm.</p>
<p>Processing Gain</p>	<p>According to the FCC regulations, the DSSS system provides a processing gain of at least 10 dB.          This is accomplished by chipping the baseband signal at 11 MHz with an 11-chip PN code.</p>

### 2.3.3 Antenna

On-board dual Hirose connector for attaching antenna

On-board dual diversity switch

### 2.3.4 LEDs:

LED signal will go through PCI bus and being able to be used through proper embedded system design, only reserve one LED on-board indicating system power on-off

## 2.4 Bluetooth Performance

### 2.4.1 Range

This Bluetooth module will be able to transmit/receive messages to/from the other within 10 meters reliability through walls typically at home or at the office. The range in clear light-of-sight should be over 25 meters.

## 2.4.2 Frequency

Following the Bluetooth standard, the bluetooth module will use the unlicensed ISM Band(2400 to 2483.5 MHz).

## 2.4.3 Power consumption

Power consumption (while active) will be average 60 mA. This board support 4 power saving modes defined in the Bluetooth standard.

## 2.4.4 RF Output power

The output power will be about 1 mW

## 2.4.5 Receiver sensitivity

The receiver sensitivity will be about -80 dBm.

## 2.5 IEEE Compliance Requirements

Feature	Detailed Description
IEEE 802.11g	54Mbps high rate WLAN
IEEE 802.11b	11Mbps WLAN
IEEE 802.11	1/2 Mbps WLAN
IEEE802.15.2	WiFi and Bluetooth Coexistence Conformance

## 2.6 EMI Requirement

Feature	Detailed Description
USA	FCC part 15.247, 15.205, 15.209 and certified by FCC before marketing in USA
European Countries	EN 300-328-2 (ETSI EN 301 489-1, -17, EN60950, CE-Mark) and certified by ETSI before marketing in European countries

Japan	ARIB STD-T66 and RCR STD-33A, and certified by MPT before marketing in Japan Telec ready VCCI ready
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## 2.7 Compatibility Requirement

Feature	Detailed Description
Wi-Fi	Meet Wi-Fi certification of WECA (Wireless Ethernet Compatibility Alliance) Before Wi-Fi ready for certification, conduct interoperability test with the following product D-link AirPlus Xtreme Linksys Wireless G Buffalo 54g
Bluetooth	Bluetooth SIG UnPlugFest
Physical Layer and Functionality	Meet Engineering Test Plan and Test Report

## 2.8 Requirements of Reliability, Maintainability and Quality

Feature	Detailed Description
MTBF	Mean Time Between Failure > 30,000 hours
Maintainability	There is no scheduled preventive maintenance required
Quality	The product quality follows factory quality control system

## 2.9 Mechanical Design Requirement

### 2.9.1 Device Outlook (preliminary)

### 2.9.2 Dimension

59.45 mm x 44.45 mm x 5 mm

## 2.10 Power Consumption

Mini-PCI bus power, 3.3V only

## 2.11 Environmental Specifications

Feature	Detailed Description
Operating Temperature Conditions	The product is capable of continuous reliable operation when operating in ambient temperature of 0 °C to 70 °C.
Non-Operating Temperature Conditions	Neither subassemblies is damaged nor the operational performance is degraded when restored to the operating temperature after exposing to storage temperature in the range of -20 °C to +75 °C.
Operating Humidity conditions	The product is capable of continuous reliable operation when subjected to relative humidity in the range of 10% and 90% non-condensing.
Non-Operating Humidity Conditions	The product is not damaged nor the performance is degraded after exposure to relative humidity ranging from 5% to 95% non-condensing

## 2.12 Product Deliverable

Basic Requirement:

Device Unit

Resource CD

Items above will be packaged in generic white box without printing

Others requested by customers

Printed user's manual

Quick installation Guide

Attractive box

## 3. Software Features

### 3.1 Overview

The MWL-41G1 featured Configuration Software supports the following operating system:

NDIS 4.0 LAN driver for Win98SE

NDIS 5.0 LAN driver for Win2000, Win ME

NDIS 5.1 LAN driver for Win XP

This configuration software includes the following functions:

**Information** Information allows you to monitor network status.

**Configuration** Configuration allows you to configure parameters for wireless networking.

**Encryption** Encryption provides RC4 security control

**Diagnosis** Diagnosis allows you to display all channel status and search neighboring access points

### 3.2 Information

Feature	Detailed Description
General Information	General Information shows the name of Wireless Adapter, Adapter MAC Address, Regulatory Domain, Firmware Version, and Utility Version.
Current Link Information	Current Link Information shows the following: Current Setting ESSID, Network Type (infrastructure or Ad-hoc network) Channel Number, , WEP Status (enable or disable), Link Status (Connect or Disconnect) Transmit Speed, Modulation Scheme, Signal Strength, and Link Quality.

### 3.3 Configuration

Feature	Detailed Description
ESS ID	Input an SSID number if the roaming feature is enabled Supports for ASCII printable characters.
Network Type	Ad-hoc Mode and 802.11 Ad-hoc Mode for network configurations that do not have any access points Infrastructure Mode for network configurations with access points
Power Save	Extend the battery life of clients by allowing the client to sleep for short periods of time while the Access Point buffers the messages.
RTS Threshold	Set the number of bytes used for fragmentation boundary for messages

Fragment Threshold	Set the number of bytes used for RTS/CTS boundary
Transmission Speed	This indicates the communication rates. Select appropriate transmission speed to match your wireless LAN settings
Roaming	Support Automatic or Manual Rescan to associate with access point.

### 3.4 Security

Feature	Detailed Description
Encryption	RC4 encryption algorithm Supports 128-bit encryption Backward compatible with 40-bit WEP Support open system (OSA) and shared key authentication (SKA)
WEP Management	Four WEP keys can be selected STA with WEP off will never associate any AP with WEP enabled WEP Key Format: Option for both Hex and ASCII
WPA	802.1x for PC-based OSs and Linux-based embedded system TKIP, MIC, IV Expansion, Shared Key Authentication

AES engine	With hardware encryption engine on chip, proper software implementation is required
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### 3.5 Diagnostics

Feature	Detailed Description
Channel Status	To display the interference status of all channels.
Access Point Status	To search the neighboring access points and display the information of all access points.

### 4. Development Schedule

Hardware Platform working sample: 2003/04/30

Software Integration started: 2003/05/01

RTOS-based Software integration finished and Release for Pilot Run: 2003/05/31

Pilot run release date: TBD