

WiFi and Ethernet Shield With WiFi Audio

User Manual

Rev 1.0

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Doc Title	WiiMu-A02 WIFI Audio Specification	Number	WMB20130110
		Version	1.2

HISTORY

Version	Date	Description	Author
K8			

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Features

- Support 802.11 b/g/n networks
- Support 10/100Mbps Ethernet
- Standard WiFi and Ethernet Shield two in one
- Support Internet audio streaming via Apple Airplay or DLNA
- Support TCP/IP/UDP protocol
- Support STA/AP/AP Client mode
- Support UART and Ethernet Interface
- Support audio output via 3.5mm audio jack
- Built-in web server to easily configure the module
- Support WiFi UART via AT command

Applications

- WiFi speaker
- WiFi audio docking station for smartphones
- WiFi remote control
- Portable WiFi base station with Airplay
- WiFi/Ethernet shield two in one for Arduino

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1. Overview

WiiMu-A02 module is developed by Wiimu Information Technology Inc. It could be used in wireless speaker, wireless docking station, WiFi base station and WiFi remote control. It supports 802.11b/g/n standard with up to 150Mbps bandwidth. It could work at AP, AP client or station modes. It is fully compatible with Apple Airplay and digital living network alliance (DLNA) streaming standards. With this module, you can play the music on your speaker wirelessly from iPhone, iPad , iPod touch, Android devices or PC devices.

1.1. Parameters

	Items	Performance
Wireless	Certification	FCC/CE
	Standard	802.11 b/g/n
	Frequency	2.412GHz-2.484GHz
	Transmit	802.11b: +20dBm(Max.)
		802.11g: +18dBm(Max.)
		802.11n: +15dBm(Max.)
	Receive sensitivity	802.11b: -89dBm
		802.11g: -81dBm
802.11n: -71dBm		
Antenna options	External: I-PEX	
	Internal: on board antenna	
Hardware	Work voltage	5.0V (+/-5%)
	Work current	170mA~300mA
	Work temperature	-25°C - 85°C
	Storage temperature	-40°C - 135°C
	Size	33×48×3mm 28-pin SMT
Software	WiFi working mode	AP Client (by default)/AP/STA
	Security	WEP/WPA-PSK/WPA2-PSK/WAPI
	Encryption	WEP64/WEP128/TKIP/AES
	User Configuration	Web server
	Software Update	Web server
	Audio streaming protocol	AirPlay
DLNA		

Table 0-1 WiiMu-A02 parameters

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2. Hardware Description

2.1. Description of hardware interface

WiiMu-A02 module provides two options to connect with customer board either through its 28-pins DIP or SMT pads.

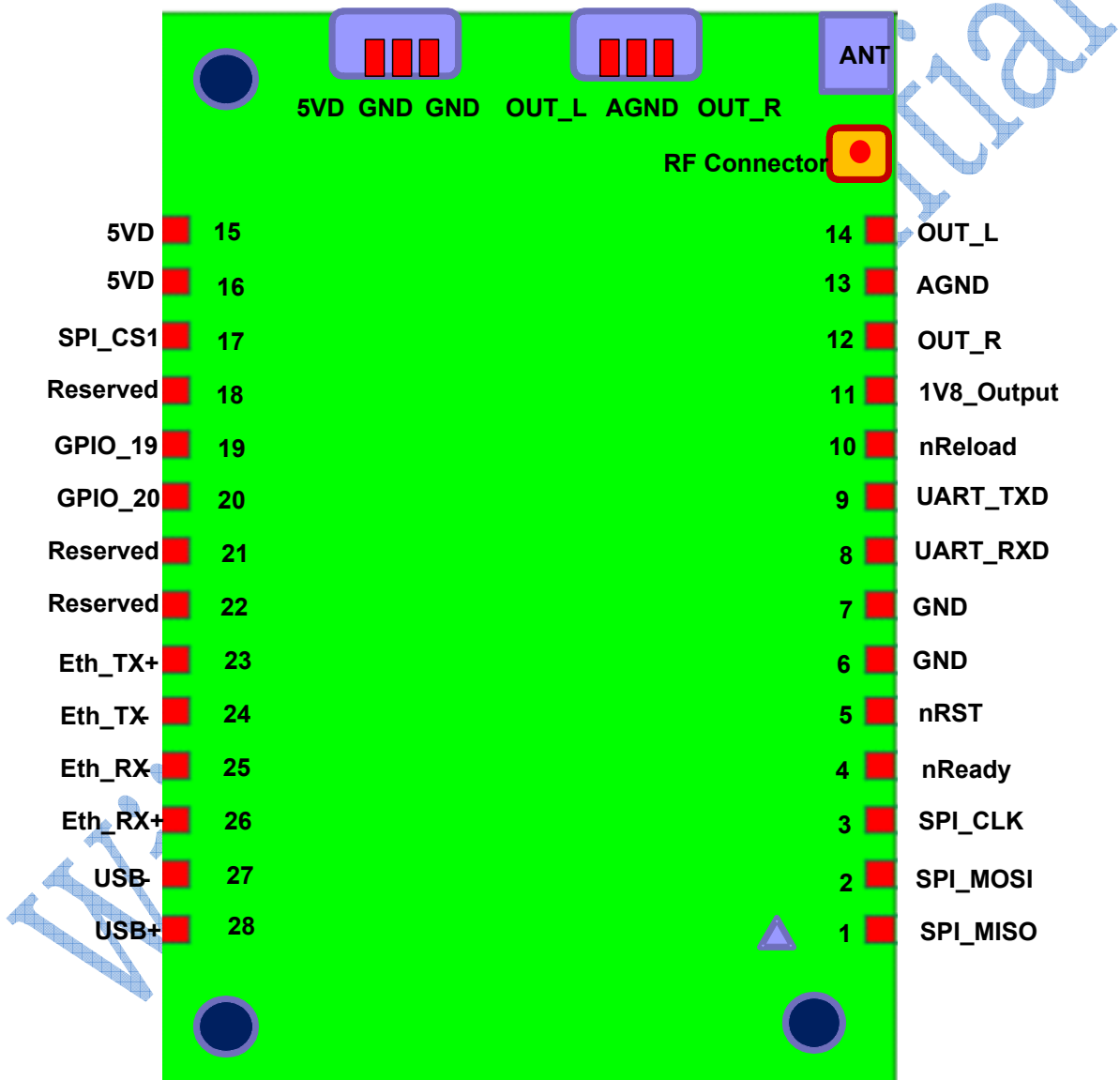


Figure 2-1 WiiMu-A02 interface pins

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Pin description:

Pin	Description	Net	Type	Comments
6,7	GND	GND	Power	Ground
15,16	5VD	5VD	Power	+5V@ 350mA
1	SPI data	SPI_MISO	I/O	SPI interface is configured to work in master mode, can be used to connect SD card or other SPI slave devices
2	SPI data	SPI_MOSI	I/O	
3	SPI clock	SPI_CLK	I/O	
17	SPI chip select	SPI_CS1	I/O	
4	Module ready signal	nReady	O,IPU	Module finishes the boot-up and is ready to work, output "0"; Otherwise, output "1".
5	Module reset	nRST	I,IPU	Reset with pull down, reset time >300ms
8	UART data receive	UART_RXD	I,IPD	UART
9	UART data send	UART_TXD	O,IPD	
10	Reset factory setting	nReload	I,IPU	Pull down for more than 5 seconds then pull up, reset the module with factory setting.
11	Output 1.8V	1V8_Output	O	1.8V@300mA, used for Ethernet interface
12	Audio output-R	OUT_R	A	Audio output ports
13	AGND	AGND	Power	
14	Audio output-L	OUT_L	A	
18	Reserved pin	Reserved	I/O, IPD	Reserved, keep float
19	GPIO	GPIO_19	I/O, IPD	
20	GPIO	GPIO_20	I/O, IPD	
21	Reserved pin	Reserved	I/O, IPD	Reserved, keep float
22	Reserved pin	Reserved	I/O, IPD	Reserved, keep float
23	Ethernet Output+	PHY_TX+	O	1.8V TTL interface (module provides 1.8V reference voltage via Pin11)
24	Ethernet Output-	PHY_TX-	O	
25	Ethernet Input-	PHY_RX-	I	
26	Ethernet Input+	PHY_RX+	I	
27	USB input-	USB-	I	USB 2.0 host interface
28	USB input+	USB+	I	

Table 2-1 WiiMu-A02 module pin description

Notes:

1. I: Input, O: Output, P: Power, IPU: Internal Pull Up, IPD: Internal Pull Down, A: Analog.

Meanwhile, WiiMu-A02 module could work in standalone mode. There are two three pin breakouts that could connect with 5V voltage input and stereo audio output.

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2.2. Mechanical dimension

WiiMu-A02 module has the physical dimension of 33 x 48mm. The detailed layout shows below. The unit is in mm.

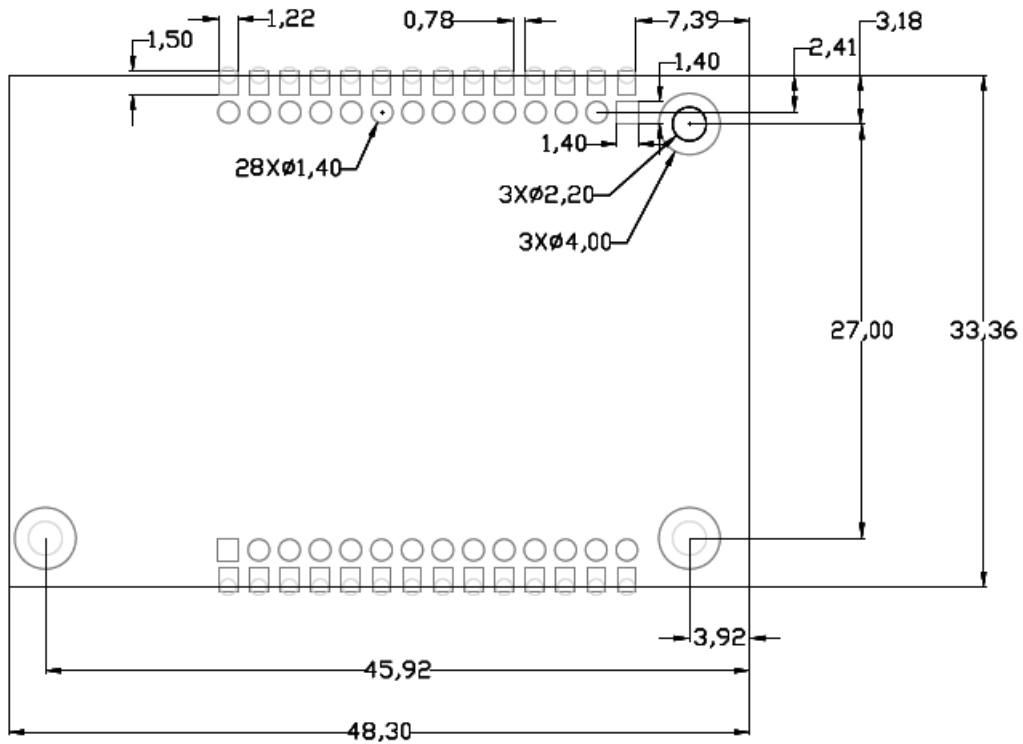


Figure 2-2: WiiMu-A02 physical dimension

2.3. Audio output

WiiMu_A02 module has integrated a high quality audio codec IC with the following performance parameters:

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PARAMETER	MIN	TYP	MAX	UNIT
<i>DAC Performance</i>				
Dynamic Range (Note 1)	83	96	98	dB
THD+N	-85	-83	-75	dB
Channel Separation (1KHz)	80	85	90	dB
Signal to Noise ratio	83	96	98	dB
Interchannel Gain Mismatch		0.05		dB
<i>Filter Frequency Response – Single Speed</i>				
Passband	0		0.4535	Fs
Stopband	0.5465			Fs
Passband Ripple			±0.05	dB
Stopband Attenuation	40			dB
<i>Filter Frequency Response – Double Speed</i>				
Passband	0		0.4167	Fs
Stopband	0.5833			Fs
Passband Ripple			±0.005	dB
Stopband Attenuation	40			dB
<i>De-emphasis Error at 1 KHz (Single Speed Mode Only)</i>				
Fs = 32KHz			0.002	dB
Fs = 44.1KHz			0.013	
Fs = 48KHz			0.0009	
<i>Analog Output</i>				
Full Scale Output Level		AVDD/3.3		Vrms

Note

1. The value is measured used A-weighted filter.

Table 2-3 Audio output parameters

2.4. External antenna

WiiMu-A02 provides two antenna options for different customer applications. The user could use either internal or external antenna. To use external antenna, please choose the antenna type that meets the requirement of IEEE 802 b/g/n WiFi standard running at 2.4GHz frequency. The detailed parameters are shown in the table below.

Items	Parameters
Frequency range	2.4~2.5GHz
Impedance	50 Ohm
VSWR	2 (Max)
Reflection loss	-10dB (Max)
Connector	I-PEX or populate directly

Table 2-5 WiiMu-A02 external antenna parameters

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2.5. 10/100M Ethernet Port

WiiMu-A02 module provides 10/100Mbps Ethernet interface pins that could be used to connect with Ethernet RJ45 socket via transformer. On the other hand, it could be used to transfer data from the module to the customer base board directly via PHY-to-PHY connection. Moreover, the module also provides the 1.8V reference voltage for the Ethernet transformer.

2.5.1. Connect the module with RJ45 with transformer

To provide 10/100Mbps Ethernet functionality, you could connect the module with the RJ45 socket via a Ethernet transformer. The detailed diagram is as follows:

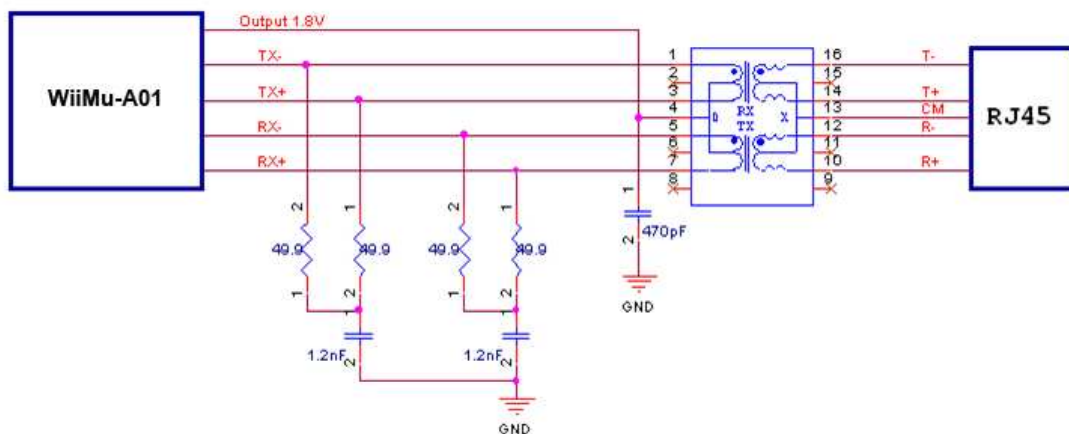


Figure 2-4 The reference design of Ethernet via transformer

2.5.2. Transfer the data from the module to user board via Ethernet interface directly

The Ethernet interface could be used to transfer data from the module to customer board through Ethernet interface. It could save one transformer, one the RJ45 socket and PCB space. The reference circuit diagram is shown below. The voltage (VCC_PHY) in the figure depends on the PHY chip in the customer board, usually it requires 2.5V power input.

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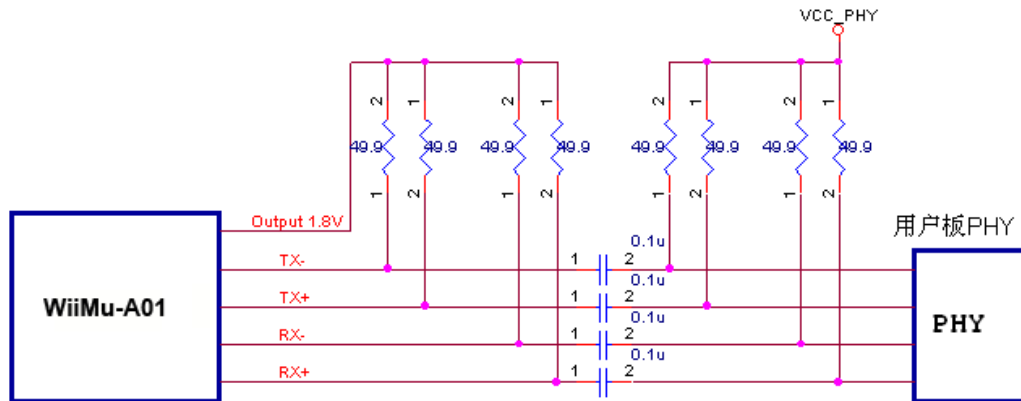


Table 2-5 The reference design of Ethernet

2.6. USB host port

WiiMu_A02 module provides high speed USB2.0 host interface. To connect with USB port, the reference design is shown below.

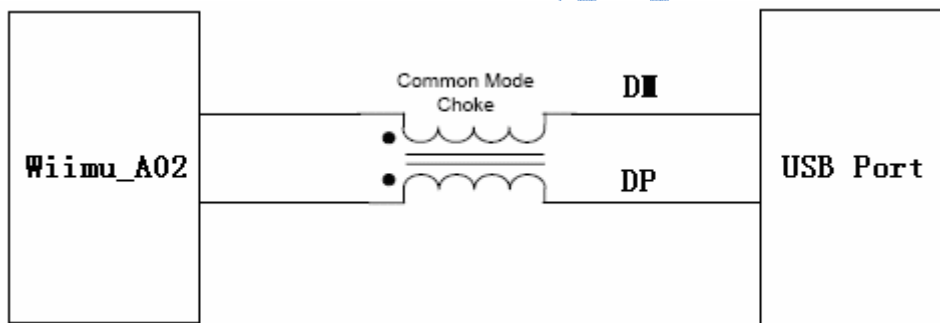


Figure 2-6 USB host interface

Please follows the following design rule to populate the USB host interface:

Item	Parameter
Signal Group	USB
Topology	Differential Pair Point-to-Point
Reference Plane	Ground Referenced
Characteristic Trace Impedance (Zo)	90 Ω ±10%
Trace Width	4 mils
Serpentine Spacing(center to center)	8.5 mils
Minimum Isolation Spacing to Clock Signals	50 mils

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Minimum Isolation Spacing to Low-Speed Signals	20 mils
Minimum Isolation Spacing to other USB Pair	20 mils
Total Length (with package length)	Max = 8000 mils
Maximum Recommended Via Count	2 (per side)
DM to DP Length Matching(with package length)	Match total length to within ±10 mils

Table 2-6 WiiMu-A02 USB design rule

2.7. Power supply

WiiMu-A02 module is powered with single 5V power supply. The peak current is around 350mA, the normal working current is 200mA. In sleep mode (when WiFi is off), the current is 100mA.

The power supply is important for system stability and WiFi performance. It is recommended to use 100uF and 10uF decoupling capacitor in parallel to reduce the ripple of power supply.

2.8. Status LED

WiiMu-A02 module provides four status LEDs as the follows:

1. Power supply status
2. WiFi AP status
3. WiFi station status
4. WiFi data transfer status

Status LED of the WiiMu-A02 module:

LED status	Description
AP LED off	WiFi AP is waiting for connection
AP LED on	WiFi AP has the device that connected to the module
Client LED off	WiFi AP Client is not connected to any router
Client LED on	WiFi AP Client is connected to router, however, it is not connected to Internet yet
Client LED blinking	WiFi AP Client is connected to router and connected to Internet too
Power LED on	WiFi is in boot-up procedure
Power LED blinking slowly (on: 1 second, off: 1 second)	WiFi is running normally
Power LED blinking fast (on: 0.3 second, off: 0.3 second)	The system is in the process of updating firmware. Please don't disconnect the power. Otherwise, the system may be corrupt.

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WiFi data LED on	The WiFi data transfer is ongoing
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Table 2-7 WiiMu-A02 status LEDs

3. Software

WiiMu-A02 supports Airplay and DLNA functionality:

Items	Description
iOS version	<ul style="list-style-type: none"> ● iOS 4.2 and above ● iPhone, iPad, iPod Touch, iPad Mini
iTune version	<ul style="list-style-type: none"> ● iTunes 10.2 and above ● PC, iMac
Network setup	<ul style="list-style-type: none"> ● WiiMu-A02 work in AP Client mode ● Support WPS
Support Airplay mode	<ul style="list-style-type: none"> ● Play, Pause, Seek, Volume, Prev, Next
Support Airplay applications	<ul style="list-style-type: none"> ● Apple Music App. ● QQ Music ● iTunes ● Many music applications ...
Support DLNA operations	<ul style="list-style-type: none"> ● Play, Pause, Seek, Volume, Prev, Next
Support DLNA applications	<ul style="list-style-type: none"> ● Compatible with DLNA certified player, i.e., <ul style="list-style-type: none"> ■ Skifta ■ BubbleUPnP
Supported browser	<ul style="list-style-type: none"> ● PC: IE9/10, Chrome, Firefox ● iOS/MAC OS: Safari
Supported language of Web server	<ul style="list-style-type: none"> ● Chinese ● English
Setup with web server	<ul style="list-style-type: none"> ● Setup WiiMu-A02 network ● Setup WiiMu-A02device name, add password protection ● Update WiiMu-A02firmware and restore factory setting

Table 3-1 WiiMu-A02 Software description

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3.1. Airplay introduction

AirPlay is the streaming standard developed by Apple Inc. It lets you wirelessly stream what's on your iOS device to your HDTV or speaker. It is supported starting from iOS4.2 and OS X Mountain Lion. It can also stream the music in PC or Mac via iTunes 10.1 or above.


When the user devices (including iMac, PC, iPod touch, iPhone, iPad) are in the same WiFi LAN with the speaker that supports Airplay, when the user device launches the applications such as iTunes or iOS music applications, the



Airplay button appears. When click the Airplay button, please choose the speaker that you want to stream to.

3.2. DLNA introduction

Digital Living Network Alliance (DLNA) is an organization formed by companies in consumer electronics, cellphone and PC fields. The device with DLNA certification could seamlessly works with other DLNA devices

without compatibility issue. The device has  logo.

3.3. WiFi mode

WiiMu-A02 module is working at WiFi AP Client mode. To setup AP client mode, please setup with web server.

3.3.1. AP Client mode

Device working under AP Client could serve as AP and client simultaneously. When it is used as AP, other wireless device could connect with it directly. Meanwhile, it could connect to other wireless AP as a wireless station. In this mode, device could connect with WiiMu-A02 and playback music to this device with airplay or DLNA. Meanwhile, if WiiMu-A02 is connected with main wireless AP that is connected to Internet, the device that is connected with WiiMu-A02 has access to Internet too.

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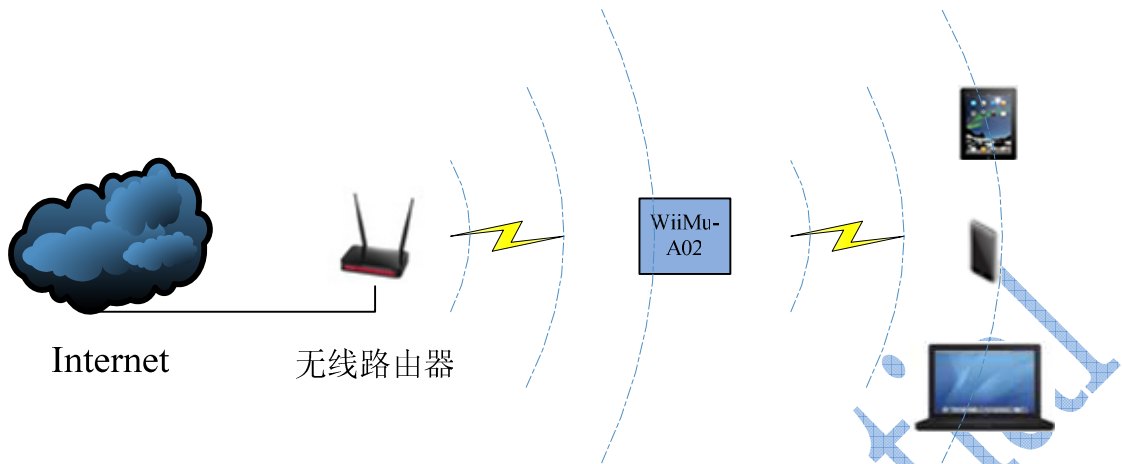


Figure 3-1 WiiMu-A02 AP Client mode

3.4. Web Server setup

WiiMu-A02 module provides Web server to let user configure the module via the browser.

In the factory mode, the SSID of WiiMu-A02's AP port is in the form of WiiMu _AP_ xxxx. The xxxx represent 4 digital numbers. The IP address, user name and password are shown below:

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Parameters	Default setting
SSID	WiiMu _AP_ xxxx
IP address	10.10.10.254
Mask	255.255.255.0
DNS	WiiMu.com
User name	admin
Password	admin

Table 3-2 WiiMu-A02 AP default parameters

You could use PC, iOS or Android device connect the WiiMu-A02 first as wireless AP, then launch the browser and login to web server and configure the module.