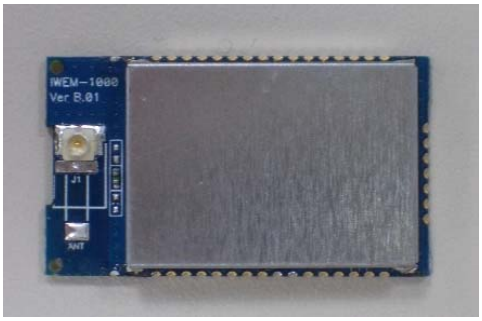
iWEM-1000

Ultra Low Power Consumption WiFi Module

User Manual



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Technical Support Contact Information

If you encounter any technical issues while using iWEM-1000, do not hesitate to contact us @Atech. Our technical staff will help you resolve the technical issues. You can contact us by email or phone. The following is our technical contact:

- Hours: 9:30AM to 5:30PM (GMT+08:00)
- Email: wifi.support@atechtpe.com.tw
- Phone: +886.2.6629.6667

Atech Technology Co., Ltd.
7F, AAEON Building, No.43, Sec. 4, Keelung Rd, Taipei City 10607, Taiwan (R.O.C.) Tel: +886-2-2377-0282 Fax: +886-2-2377-0283
http://www.atechoem.com/

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Atech Technology Co., Ltd.
7F, AAEON Building, No.43, Sec. 4, Keelung Rd, Taipei City 10607, Taiwan (R.O.C.) Tel: +886-2-2377-0282 Fax: +886-2-2377-0283
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1. Overview

iWEM-1000 is a complete 802.11b/g Wi-Fi and networking solution and includes an antenna, a 32-bit CPU, operating system, network stack, crypto accelerator, power management subsystem, real-time clock and a versatile sensor interface, allowing it to serve as a WiFi client data communication module or, with custom software, as a standalone host.

For typical WiFi data communication applications, iWEM-1000 has TCP/IP stack and applications running on the module. It does not require the host system to run any TCP/IP stack. iWEM-1000 requires only 4 pins (POWER, TX, RX, GND) to connect to the host system. The iWEM-1000 is configured by simple ASCii configuration commands through the UART port in command mode. Once network configuration is set, the radio can automatically connect to the WiFi network upon reset and send/receive serial data over UART.

Since all networking functions are managed by the iWEM-1000, internet connectivity can be added to devices with 8- or 16-bit processors, eliminating the need to port existing applications and resulting in fastest time to market and reduced development costs.

This user manual focuses on how to use iWEM-1000 module with Atech firmware. This manual shows how to connect the hardware, how to configure through serial interface and how to use iWEM-1000. The custom software development with iWEM-1000 is not covered in this manual.

2. Hardware

iWEM-1000 is a surface-mount module designed to be integrated to a system board as a wireless subsystem or standalone system. The hardware interface is grouped into the following functional blocks:

- Power supplies: 2.4 to 3.3VDC and 3.0 to 3.7VDC power input blocks. The user picks one of the power supply circuits to use. Only one power supply circuit needs to be connected.
- GPIOs: The GPIO interface includes UART TX, UART RX, 8mA drive GPIOs and 24mA drive GPIOs. The 24mA GPIOs can be use to drive LEDs. See more information about GPIOs in the pin description section.
- Debug: Reset, DMA-TX and DMA-RX pins for software programming and debugging
- SPI Master: This interface to for the user to connect to external SPI devices. Special software support is required.
- Sensors: This interface is to connect to external sensors. It can be configured to support few different sensors types. Special software support is required.
- RF: There are two RF interfaces on the module. One is the WLAN interface and the other one is RFID interface. The WLAN interface has a choice of three antenna types: chip antenna, UFL and

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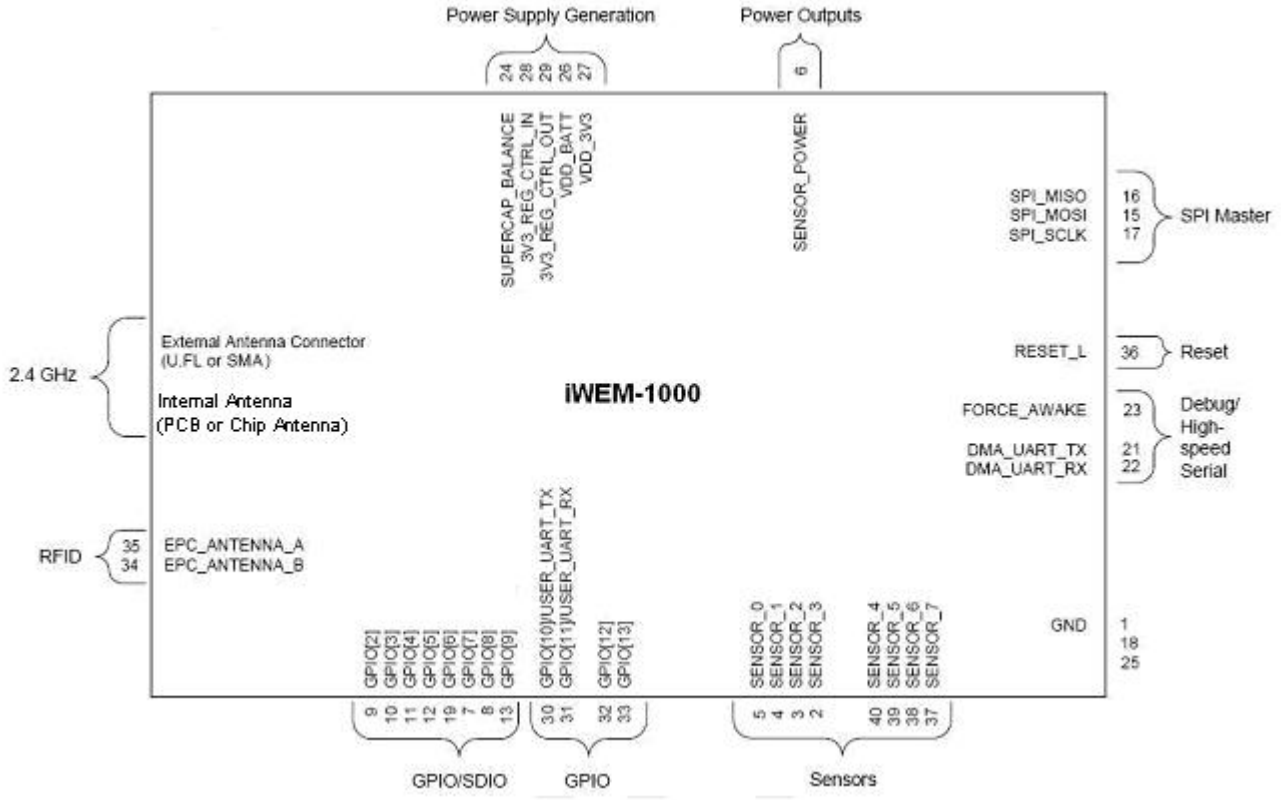
reverse SMA connector. The selection of the antenna path is user configurable through command line interface. The second RF interface is the RF ID interface. To use the RFID interface, special software support is required.

The following picture shows how the interfaces are grouped.



2.1. iWEM-1000 Quick Connection Guide

In the simplest configuration the hardware only requires a few connections (PWR, UART-TX, UART-RX, GND) to create a wireless data connection. The user selects a power supply voltage (2.4-3.3V or 3.0-3.7V) to use and configure the external power supply circuits according to the power supply section in this manual. The user connects UART-TX, UART-RX and ground pins to the host controller. The host controller can control the iWEM-1000 module and transmit data through the WLAN network.

The user can also use other functional blocks like SPI, GPIO, and sensor interfaces. Special software support is required to use these interfaces. The Atech default software does not support those function blocks. The following picture shows the simplest way to hook up iWEM-1000.

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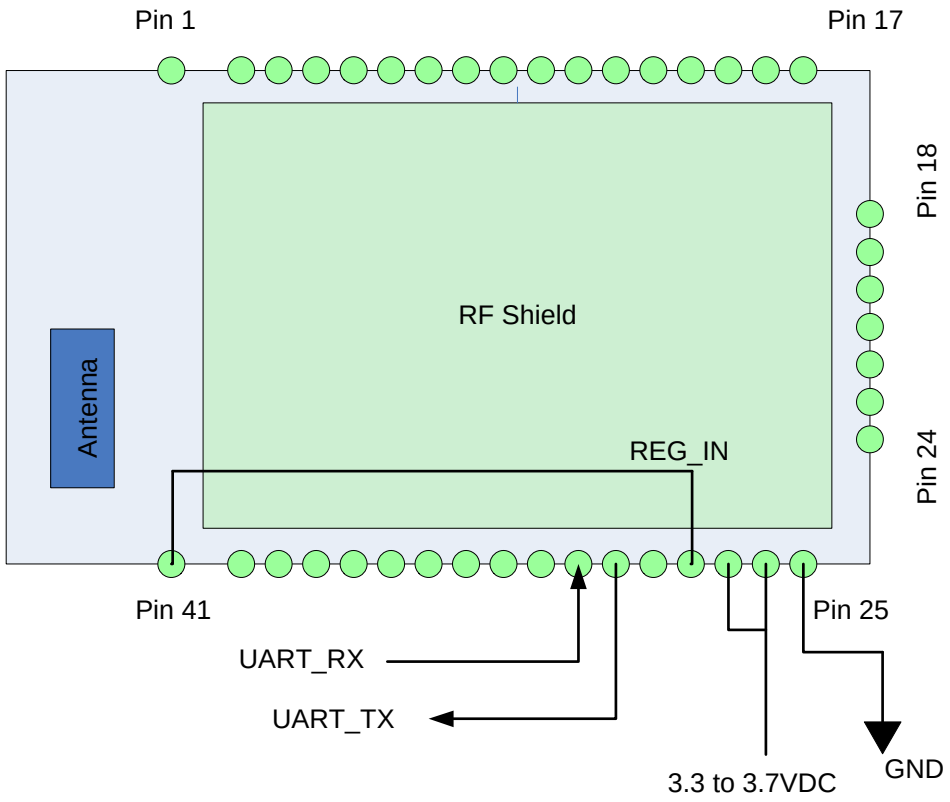

Connection	Direction
Ground	Connect pin 25 to ground
3.3 to 3.7VDC	Short pin 26 VDD_BATT and pin 27 VDD_3V3 together. Connect to 3.3 to 3.7VDC regulated power source.
REG_IN	Short pin 28 REG_IN to ground.
UART_TX	Connect pin 30 UART_TX to host UART receive pin
UART_RX	Connect pin 31 UART_RX to host UART transmit pin

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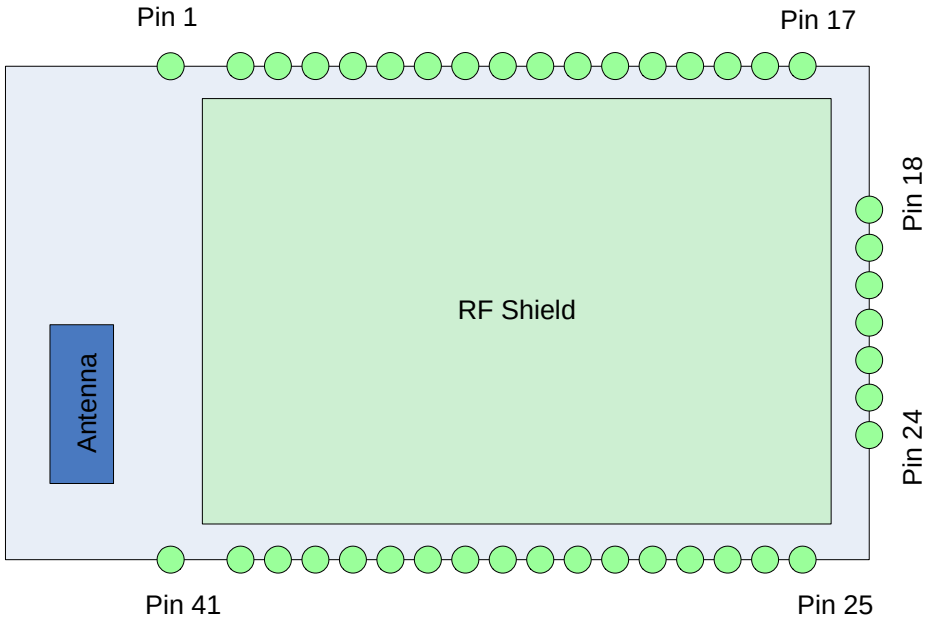
2.2. Pin description

The following picture and table show how the I/O pins are arranged for iWEM-1000.



Pin	Name	Description	Pin Type	Default Configuration
1	GND2	Ground. Must be connected for proper antenna performance		
2	SENSOR-3	Sensor interface, Analog input to module	Analog, 1.2V tolerant	
3	SENSOR-2	Sensor interface, Analog input to module	Analog, 1.2V tolerant	
4	SENSOR-1	Sensor interface, Analog input to module	Analog, 1.2V tolerant	
5	SENSOR-0	Wakeup from external condition		
6	SENSE-PWR	Voltage output from module to power external sensors, 3.3V	Analog 3.3V	
7	GPIO-7	GPIO	24mA drive, 3.3V tolerant	
8	GPIO-8	GPIO	24mA drive, 3.3V tolerant	
9	GPIO-2	GPIO	24mA drive, 3.3V tolerant	
10	GPIO-3	GPIO	24mA drive, 3.3V tolerant	
11	GPIO-4	GPIO	24mA drive, 3.3V tolerant	
12	GPIO-5	GPIO	24mA drive, 3.3V tolerant	
13	GPIO-9	GPIO	8mA drive, 3.3V tolerant	

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14	SPI-CS	SPI Chip Select		No connect
15	SPI-MOSI	SPI master data out		No connect
16	SPI-MISO	SPI master data in		No connect
17	SPI-CLK	SPI clock		No connect
18	GND1	Ground		
19	GPIO-6	GPIO	24mA drive, 3.3V tolerant	
20	GPIO-14	GPIO	8mA drive, 3.3V tolerant	
21	DMA-RX	Debug port		No connect
22	DMA-TX	Debug port *(apply 100K pull-down if ultra low sleep power required)		HIGH Z
23	FORCE_AWAKE	Force the module to wakeup, input to module, 31us min pulse		
24	SUPERCAP	Balance center pin voltage on stacked super capacitors	Analog 3.3V	No connect
25	GND	Ground		
26	VDD-BATT	Battery input, 2.4-3.3V with boost regulator in use, 3.0-3.7V otherwise		
27	VDD-IN	3.3 to 3.7 voltage, do not connect when boost regulator is in use		
28	3.3V-REG-IN	Boost regulator control input, connect to 3.3V-REG-OUT to enable		GND to disable
29	3.3V-REG-OUT	Boost regulator control output, connect to 3.3V-REG-IN to enable		No connect
30	UART-TX	TX from the module	8mA drive, 3.3V tolerant	
31	UART-RX	RX to the module	8mA drive, 3.3V tolerant	
32	GPIO-12	UART CTS flow control	8mA drive, 3.3V tolerant	
33	GPIO-13	UART RTS flow control	8mA drive, 3.3V tolerant	
34	EPC-ANT-B	EPC port, RFID antenna B		No connect
35	EPC-ANT-A	EPC port, RFID antenna A		No connect
36	RESET	Module reset, Active Low, reference to VDD-BATT, 160 usec pulse		Pull up
37	SENSOR-7	Sensor interface, Analog input to module	Analog, 1.2V tolerant	No connect
38	SENSOR-6	Sensor interface, Analog input to module	Analog, 1.2V tolerant	No connect
39	SENSOR-5	Sensor interface, Analog input to module	Analog, 1.2V tolerant	No connect
40	SENSOR-4	Sensor interface, Analog input to module	Analog, 1.2V tolerant	No connect

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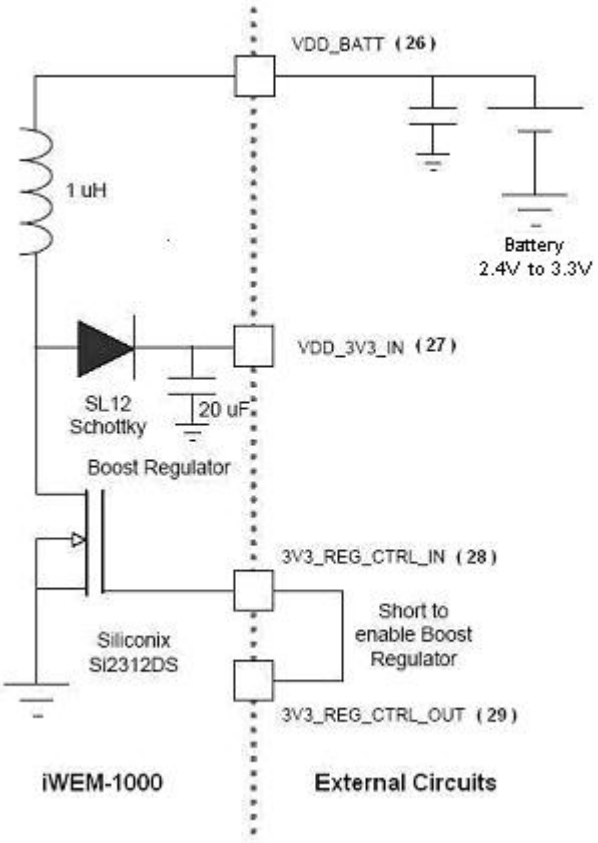
2.3. Power

There are 2 ways to power iWEM-1000 up. One is to use the 2.4V to 3.3VDC input circuit. The other one is to use 3.0 to 3.7VDC input circuit. Only one power input circuit needs to be connected.

2.3.1. 2.4-3.3VDC Input Circuit

2.4 to 3.3VDC power supply circuits are designed to power iWEM-1000 with 2 standard Ni-Cd or Ni-MH batteries. To use this configuration, apply battery = 2.4 to 3.3VDC to VBATT (pin 20). Let V3.3IN (pin 21) floating. Tie pin 17 to pin 18. (This enables the on board battery boost 3.3V switcher). There is a built in voltage brownout monitor which will shut down the chip when the voltage drops below 2.4 VDC. The following picture shows the application circuits to use the 2.4 to 3.3VDC power supply.



2.3.2. 3.0-3.7VDC input Circuit

3.0 to 3.7VDC power supply circuits are designed to power iWEM-1000 with standard 3.3VDC power or a rechargeable Lithium battery. To use this configuration, apply 3.3 VDC power to VBATT (pin 20), and V3.3IN (pin 21). Tie 3.3VREG-IN (pin 18) to GROUND. Let 3.3V-REG-OUT (Pin 17) floating. Do NOT exceed the voltage ratings on the 3.3V pins, damage to the module will result. The following picture shows the application circuits to use the 3.0 to 3.7VDC power supply.

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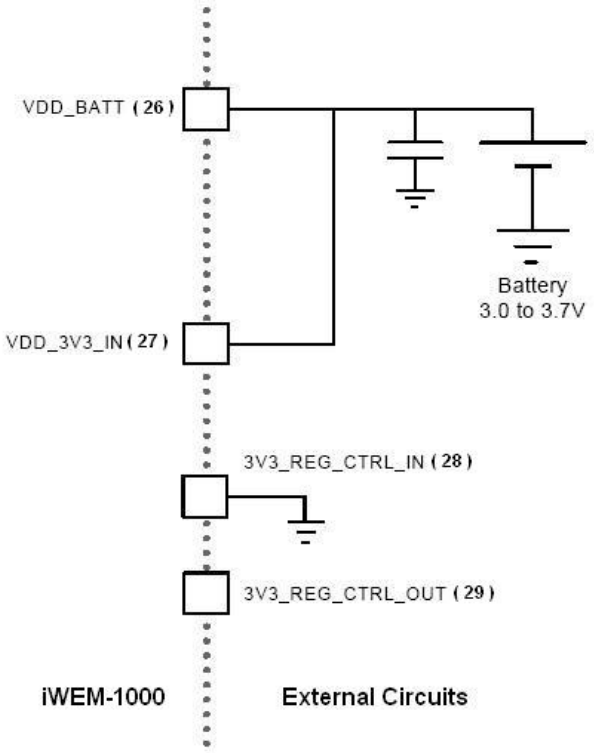

2.4. Reset

The Reset pin is required to be used only when the programming the flash memory on the module. Reset is active LOW and is optional/does not need to be connected. The Reset pin is 3.3V tolerant and has an internal pull up of 100K to the VDD_BATT. Leave the reset pin floating for typical applications.

2.5. UART

iWEM-1000 supports 3-wire and 5-wire UART configuration. The 3-wire configuration is standard TX, RX, and ground connection. The 5-wire configuration is with CTS/RTS flow control. When the 3-wire interface is used, connect only UART-TX, UART-RX and ground to external UART port. When the 5-wire UART configuration is used, connect 2 extra CTS/RTS lines.

The UART configuration is set in command interface. The user can set baud rate, flow control and other UART parameters in the command interface. The default UART setting is 9600bps, 8 data bits, 1 start/stop bit, and no flow control.

2.6. Integrated-on-board Antenna / Antenna Connectors

iWEM-1000 can be built with the choice of integrated-on-board antenna or UFL/SMA antenna connector. The user specifies the choice of antenna when the iWEM-1000 is built. The integrated-on-board antenna is

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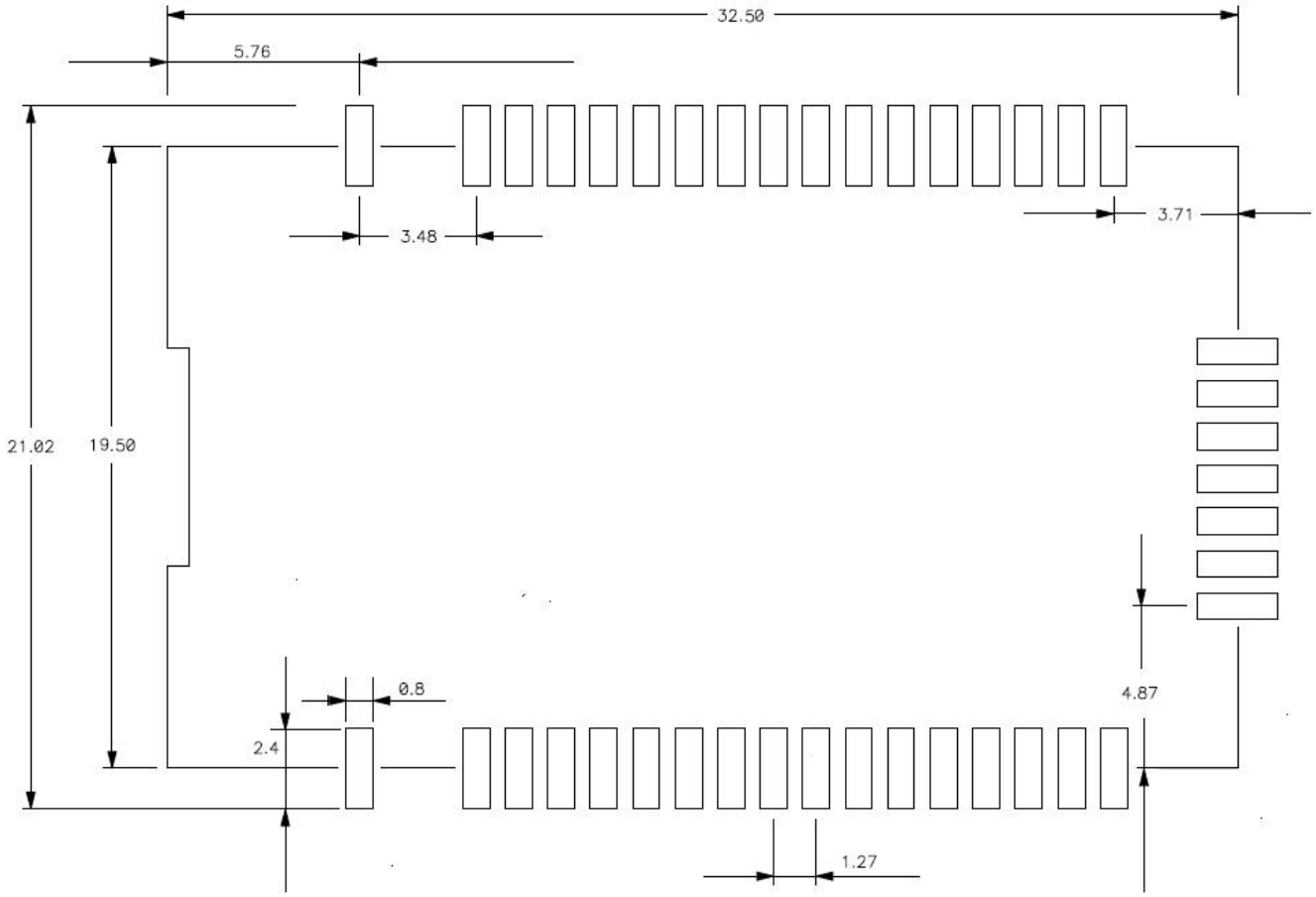
the most convenient selection. (two types of option to be available – PCB & Chip Antenna)
The UFL/SMA antenna provides more flexibility and better performance if the proper antennas are matched.

2.7. Layout Dimensions

Use the dimensions shown in the picture below to do the PCB layout for the host system or carrier board that will use iWEM-1000.



3. Operation Modes

iWEM-1000 has two operations modes: data mode and command mode. The data mode is for the user to transmit and receive data in user specified modes. The command mode is for the user to set or check configuration of the module.

3.1. Data Mode

When iWEM-1000 is powered up, the default operation mode is data mode. The module is ready to transmit and receive data as soon as the module boots up and associates to a WLAN network.

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7F, AAEON Building, No.43, Sec. 4, Keelung Rd, Taipei City 10607, Taiwan (R.O.C.) Tel: +886-2-2377-0282 Fax: +886-2-2377-0283
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3.2. Command Mode

When iWEM-1000 is powered up, the default operation mode is data mode. To enter command mode, send escape characters "+++" to iWEM-1000 through the UART port. iWEM-1000 will respond with the command prompt characters ">". The user sets and checks the configuration of iWEM-1000 in command mode. The user can use a host controller or a terminal emulator to send ascii commands to iWEM-1000 UART port to set communication parameters or view them. The response is also in readable ascii format.

When iWEM-1000 in command mode, iWEM-1000 takes defined ascii command sets. To exit command mode, send exit<cr> to the UART port. iWEM-1000 will respond with "exit" to the data terminal and switch to data mode.

The UART setting of the host controller or data terminal must match the iWEM-1000 UART setting in order to communicate. iWEM-1000 default UART setting is 115200bps, 8 data bits, 1 start/stop bit, and no flow control.

The user can use any preferred terminal program like Teraterm, or Hyperterm to connect to the iWEM-1000 through COM port. Teraterm is recommended because of its popularity and user friendliness. You can go to the official Teraterm site to download the latest Teraterm application: http://en.sourceforge.jp/projects/ttssh2/releases/.

3.3. Save Updated Configuration

After the user updates the configuration in command mode, the user must save the new configuration into the flash memory. Send "save" command to iWEM-1000 after the new configuration is set. The new configuration will be saved into the flash memory. The new setting will take effect after the user reboots iWEM-1000.

4. Command Interface

This section describes syntax and commands used in command interface for the user to set and check the iWEM-1000 configuration.

4.1. Escape Characters to Enter Command Mode

In order to get into command from default data mode, the user must send time-guarded escape characters to the UART port. The format is: **<500ms guard time>+++<500ms guard time>**. If the guard time is less than 500ms, the escape characters will be discarded and iWEM-1000 will not get into command mode.

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4.2. Command Type

There are three types of commands:

- Action Commands – Perform action such as scan, connect, disconnect, etc.
- Config Commands – Set the iWEM-1000 configuration. The user needs to issue a save command to save the updated configuration to the flash memory. The new configuration will take effect after reboot.
- Status Commands – See what is going on with the interface, IP status, etc.

The user can issue **?** command to list all available commands. All available commands will be printed to the terminal emulator in ascii format.

All commands issued to iWEM-1000 must be followed by **<CR>** character as a command terminator.

4.3. Action Commands

The action commands are the commands to have the iWEM-1000 doing various actions other than changing the configuration of the module.

Command	Response	Action and Notes
exit	**Data mode<CR>**	Exit command mode
ls	**<List of files><CR>**	List all files in flash
scan [<ssid>]	**<List of APs><CR>**	Scan for infrastructure BSSs to join
ping <ping_IP_addr>	**<ping response from the pinged host><CR>**	Send an ICMP echo request to the specified IP address. Ping the default gateway if no IP_address is specified
set_factory_defaults	**OK<CR>**	Restore the configuration to factory default settings. The settings take effect after the module is restarted.
tcp_connect	**TCP Connecting... <CR>**	Create a connection to the TCP server
tcp_disconnect	**TCP Disconnected<CR>**	Drop the TCP connection. If the setting is TCP server, disconnect the TCP client connected to iWEM-1000. If the setting is TCP client, disconnect from the TCP server.
restart	**OK: Restarting application now<CR>**	Restart the current application
save	**OK<CR>**	Save the configuration to the EEPROM memory. The settings take effect after the module is restarted.
sleep	**Power down...<CR>**	Put iWEM-1000 module into sleep mode. Ground pin 5 to wake up module.

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tftp_get <tftp_server> <file_name>	**OK<CR>**	Get a image from the TFTP server to upgrade firmware.
boot_image <handle> <file_name>	**OK<CR>**	Set the boot image. The settings take effect after the module is restarted.

4.4. Config Commands

Config commands are to set different types of parameters in iWEM-1000. The typical response of a Config command is **OK<CR>**. The user must issue **save<CR>** to store the updated configurations into the flash memory. The new configuration will take effect after reboot.

4.4.1. WLAN

WLAN commands are for the users to configure the WLAN interface. The WLAN parameters can be set with the WLAN commands.

Command	Response	Action and Notes
set_antenna <ant#>	**OK<CR>**	Select antenna configuration: Ant# = 0, antenna used = UFL or SMA connector. Ant# = 1, antenna used = chip antenna. Default = 0
set_ssid <ssid_string>	**OK<CR>**	Set the SSID of the BSSID with which we'll associate Default = Atech
set_channel <channel>	**OK<CR>**	Set the 802.11b/g channel to use. channel = 1 to 13. Default = 1
set_wlan_mode <wlan_mode>	**OK<CR>**	Set WLAN mode, 0:Infrastructure, 1:Ad-Hoc wlan_mode = 0:Infrastructure, 1:Ad-Hoc Default = 0
set_preferred_rates <r1> <r2> <r3> <r4>	**OK<CR>**	Set the 802.11b/g channel to use. r1, r2, r3, r4 = {54, 48, 36, 24, 12, 6, 11, 5, 2, 1} Default = 24 12 5 1 The four data rate set should be a descendant series or equal numbers. The rates must be selected from the defined set shown above.
set_passwd wep40	**set_passwd wep40**	Select WEP40 key number, and set WEP keys.

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<key#> <password>	**<key#> <password>**	key# = 1 to 4. password = xx xx xx xx xx; x=0 to f.
set_passwd wep104 <key#> <password>	**set_passwd wep104 <key#> <password>**	Select WEP40 key number, and set WEP keys. key# = 1 to 4. password = xx xx xx xx xx xx xx xx xx xx xx xx xx; x=0 to f.
set_passwd wpa <password>	**WPAv1 & WPAv2 Key: <password> <CR>**	Set the WPA passwords. The length of the WPA password must be shorter than 64.
set_passwd key <key#>	**WEP40 key <key#> active<CR> or WEP104 key <key#> active<CR>**	Set key number used for WEP40 or WEP104. The response depends on the selected WEP mode. key# = 1 to 4. Default = 1

4.4.2. Network

Network commands are for the users to set the DHCP mode, IP address and all essential IP network parameters. The Network commands also cover serial port device server settings.

Command	Response	Action and Notes
set_dhcp <state>	**OK<CR>**	Enable/Disable DHCP state = 0, disable state = 1, enable Default = 1
set_host <host_IP_addr>	**OK<CR>**	Set remote TCP server host IP address Default = 192.168.0.100
set_remote_port <remote_port>	**OK<CR>**	Set remote TCP server listening port remote_port = 0 to 65535 Default = 2000
set_local_port <local_port>	**OK<CR>**	Set local TCP server listening port. This setting local_port = 0 to 65535 Default = 1000
set_ip <local_IP_addr>	**OK<CR>**	Set local IP address Default = 0.0.0.0
set_netmask <netmask>	**OK<CR>**	Set local netmask Default = 255.255.255.0

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set_gateway <GW_IP_addr>	**OK<CR>**	Set Gateway IP address Default = 0.0.0.0
set_dns <dns_IP_addr>	**OK<CR>**	Set DNS address Default = 0.0.0.0
set_protocol <protocol>	**OK<CR>**	Set the protocol to use protocol = 0, UDP protocol = 1, TCP client protocol = 2, TCP server Default = 1

4.4.3. UART

The UART commands are for the user to set the UART parameters like baudrate and flow control. The UART commands set the UART to WiFi forward packet size and flush timeout.

Command	Response	Action and Notes
set_baud_rate <baud_rate>	**OK<CR>**	Set UART port baudrate baudrate = {2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600} Default = 115200 Please do not use undefined baudrate. The baudrate will not be set if undefined a baudrate are selected.
set_mtu <mtu>	**OK<CR>**	Set forward packet sizein bytes. mtu = 1 to 1400 Default = 1400
set_flush_timeout <flush_timeout>	**OK<CR>**	Set UART buffer flush timeout in mS. flush_timeout = 0 to 50 Default = 10

4.5. Status Commands

Status commands are for the users to get current device state and settings. The get_state command gets the current status of the module. The rest of commands get the setting stored in the flash memory. The setting stored in the flash memory will take effect after a system restart. The setting may not reflect the current setting. It reflects the setting after system reboot.

Command	Response	Action and Notes
get_state	**<current_state><CR>**	Get current device state. The output reflects the current

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		device setting. **Example output:** Baud rate: 115200 MTU: 1400 Flush Timeout: 10 MAC Address: 00:12:34:56:78:9a WLAN mode: 0 (Join an existing network) SSID: Atech525A3 Channel:6 - Auth'ed, Assoc'ed 12 transmits 0 retries Tx rate is 24Mbit/s. Autorate 1 Retries per rate: 4 Retry limit 12 802.11 interface is UP IP: 192.168.0.103 NM: 255.255.255.0 GW: 192.168.0.1 Local Port: 1000 Host IP: 192.168.0.100 Remote port: 2000 Protocol: 1 (TCP client / Connected)
get_uart	**<uart_setting><CR>**	Get UART port setting. The output reflects the setting stored in the flash memory, The setting will take effect after reboot. **Example:** Baud rate: 9600 MTU: 1400 Flush Timeout: 10
get_wlan	**<wlan_setting><CR>**	Get WLAN setting. The output reflects the setting stored in the flash memory, The setting will take effect after reboot. **Example:** ANT: 0 WLAN Mode: 0 (Infrastructure) SSID: Atech Channel: 1 Preferred Rates: 24M 12M 5M 1M
get_ip	**<network_setting><CR>**	Get Network setting. The output reflects the setting stored in the flash memory, The setting will take effect after reboot. **Example:** DHCP is OFF IP: 192.168.2.138 NM: 255.43.255.0 GW: 192.168.2.253

Atech Technology Co., Ltd.
7F, AAEON Building, No.43, Sec. 4, Keelung Rd, Taipei City 10607, Taiwan (R.O.C.) Tel: +886-2-2377-0282 Fax: +886-2-2377-0283
http://www.atechoem.com/

		DNS: 168.95.192.1 Local Port: 1000 Host IP: 192.168.2.254 Remote port: 2000 Protocol: 1 (TCP client)

5. Default Setting

The following sections describe the default settings when iWEM-1000 is out of Atech factory. The user can issue set_factory_defaults to put the module back to factory default settings. The user can also toggle the factory default pin in specified sequence to put iWEM-1000 into factory default settings.

5.1. WLAN

SSID: Atech

802.11 Channel: 1

Mode: Infrastructure

Antenna: 0

Security: open

Preferred Data Rates: 24M, 12M, 5M, 1Mbps

5.2. Network

DHCP: ON

Remote TCP server: 192.168.0.100

Remote TCP server port to connect: 2000

Local IP address: 0.0.0.0

Local port: 1000

Netmask: 255.255.255.0

Gateway: 0.0.0.0

Protocol: TCP client

5.3. UART

Baudrate: 115200

Flow control: No flow control

MTU: 1400 bytes

Flush Timeout: 10 ms

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