Waspmote
Product information

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Documento Confidencial

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ÍNDICE DE CONTENIDO

1 PRODUCT INFORMATION

1.1 GENERAL PROJECT INFORMATION

Waspmote is a wireless sensor mote developed by Libelium.
Waspmote is a board with radio modules and others componentes such as GPS integrated.
Waspmote works this way:

1º- Read the data from the sensors attached (if any)
2º- Send the information using the 2.4GHz or 900MHz radio and/or the GSM/GPRS module
3º- Sleep until the alarm wakes it up again

- **Energy efficient architecture:**
  Waspmote can control separately the different modules and components which takes the most part of the power. It lets sleep the microprocessor, the sensors, the communication modules choosing in each case which via we want to set on or off.
- **Short, Medium and Long Range Communications Radios: (ZigBee/802.15.4 and GSM/GPRS protocols)**
  - 2.4GHz (1mW) is used to perform short range (300m) and low power communications.
  - 2.4GHz (100mW) is used to perform medium range (1300m) communications.
  - 900MHz (50mW and 100mW models) are used to perform medium range (up to several km) communications.
  - GSM/GPRS is used to connect to the mobile cells and to set communications up to Km's, when alarm messages are generated. It works in the GSM bands: 850 - 900 - 1800 - 1900MHz.

  IMPORTANT: all the radio modules have both the FCC tests passed.

- **Large Data Storage: Each mote can store up to GB's of data due to the SD flash memory it takes. The information is stored as files, as it would be done in a common computer.**
- **Ready for Emergency Events:**
  Waspmote has an accelerometer which can wake the mote up when an event happens. Some of this events are: a fall, a crash, a linear movement. (We can detect also is someone is stealing the device).
- **Sensors Integration: The mote is ready to connect 7 analog and 10 digital sensors.**
- **Actuator: Waspmote can also behave as an actuator due to its 10 different output signals.**
- **Geolocation: the GPS module let to know where the mote is located.**
- **Time Synchronization: Each mote has its own clock timer which is powered by an independent battery. This lets the mote to be always synchronized despite being slept. This time can be adjusted with the GPS time.**
- **Programming API: Waspmote comes with a complete library which lets easily program and manage each of the modules.**
- **Battery Powered: A rechargeable lithium battery is used to power the mote.**
- **Socket for Solar Power Module: the mote comes with an special connection to let a solar panel power the mote and recharge the lithium battery.**
- **USB: The device lets communicate with a computer using the USB port. This connector lets the mote to be powered and the battery recharged.**

Among its features it counts with two basic communication modes:XBee and GSM/GPRS that allows the board to communicate under any circunstances. The design has been carefully crafted to be adapted to many different situations without compromising size or power consumption.

It can be powered from any standard 3V3 to 3V7 source, as well as through its mini-USB connector. It contains an intelligent battery charger and monitors its own charge through a resistor bridge. Data coming from analog or digital sensors can be stored into the on-board flash memory chip or a FAT-16 formatted micro SD card. These storage capabilities allow for (optional) wireless reconfiguration of the mote's firmware in a two steps process: load of the new firmware in memory and update of the software into the chip through the execution

of the embedded bootloader. The bootloader software allows reprogramming the firmware directly over the USB port when unplugging the protection jumper and is casted into only a 4KB memory space. The configuration of the mote is stored inside the processor's EEPROM avoiding any risks to lose relevant configuration variables when rebooting the mote.

1.2 WASPMOTE MODELS

Depending on the XBee module it has, there are 6l Waspmote models:

Model 1 = XBee 2.4GHz series 1 (1mW) + GSM/GPRS
Model 2 = XBee 2.4GHz series 1 (100mW) + GSM/GPRS

Model 3 = XBee 2.4GHz series 2 (2mW) + GSM/GPRS
Model 4 = XBee 2.4GHz series 2 (50mW) + GSM/GPRS

Model 5 = XBee 900MHz (50mW) + GSM/GPRS
Model 6 = XBee 900MHz (100mW) + GSM/GPRS

You can find any of the modules in the delivered pack.

1.3 WASPMOTE ANTENNAS

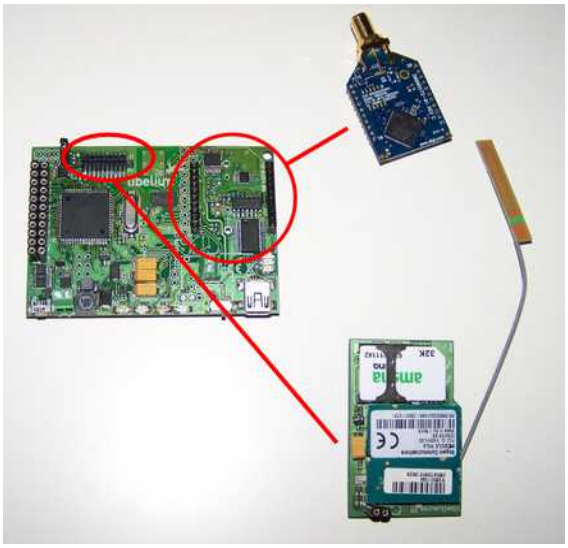
There are three different antennas included in the Waspmote pack:
1º-XBee SMA antenna (datasheet attached)
2º-GSM/GPRS UFL antenna (datasheet attached)
3º-GPS UFL antenna (datasheet attached)

1.4 HOW TO SET THE MODULES

First of all for each module connect its antenna.
(the GPS module is soldered on the bottom of the board so you can plug its antenna from the beginning)
As Wasp can use different modules for communicating, they can be exchanged easily, just be careful with these:

- Switch the WASP OFF.
- Unplug the battery and the USB cable.
- Now you can take the modules out and plug them in again.

See pictures below.



1.5 SIMPLIFIED OPERATING INSTRUCTIONS TO TEST THE BOARD

IMPORTANT: Read ALL the operating instructions before using Wasp.

Powering Wasp

The WASP can be powered from different sources: USB, and battery are the most common ones. The board doesn't include any connectors that would make possible power it from the mains or from a standard AC-DC converter. On the board there is a battery charge monitor. This configuration makes possible to use different means to recharge the battery supplied with the mote. The single-cell Li-Ion battery can be charged from the USB, a solar cell, and potentially AC adapter sources (we do NOT support this last configuration, though). The circuitry allows battery-to-input power switchover, so the system can be powered directly from the power source (USB in this case) rather than from the battery. The voltage at the input of the circuit can be as low as 3.7V and should never be over 6.5V.

Other features include an indicating charging led when the battery is being charged.
Battery charge can also be monitored from the WASP through a resistor bridge connection.

Power from battery

To test the board:

1º- We are going to choose its working mode connecting the device through the USB. (see instructions below)

2º- Once the mode is set and saved, we can disconnect the device from the USB and power it using the battery.

3º- We can test the device is working on the proper mode looking at the led blinking for each case (see table below).

For making the different tests in WASP we'll use the USB communication feature, we'll set the test we want sending a character from a computer to WASP via USB.

1 – Switch the Wasp off and take the battery out. Connect WASP to a free USB connection on the computer using a USB – mini USB cable

Once WASP is connected we should be able to see a new communication port in the computer (COM0/COM1... in windows, ttyUSB0/ttyUSB1... in linux). Maybe FTDI drivers need to be installed (http://www.ftdichip.com/FTDrivers.htm).

2 – Open a serial port terminal

Set the serial port to 9600 baud, no parity, 8 data bits, 1 stop bit and no flow control. Set the right port to communicate with the device (COM0/COM1/.. in windows, ttyUSB0/ttyUSB1/... in linux).

In Windows you can use Hyperterminal.

In Linux you can use: gtkterm or cutecom.

3 – Reset WASP

Reset WASP pressing the reset button on the board and WASP will show the *ABOUT* message on the terminal screen.

4 – Launch a test

Sending a test command to WASP, it immedtely will go to that test mode until you send another test command.

For changing the test mode you have to send to WASP via USB the test command (0, A, B, C, D, E) you want to go. If you are in B mode (sleep – ON) and you want to change the mode, you have to wait until WASP is ON (led green ON) and send the command in this mode, later WASP will finish the cycle, it'll be 8 seconds in sleep mode and then WASP will start the new mode.

The commands for the tests are in the next table.

Testing Wasp modes

Test	Name	Expected successful outcome
0	About	About text is shown on the terminal screen
A	ON mode	Led green is ON
B	Sleep mode – ON mode	ON mode (led green ON) – 5 seconds Sleep mode (led's OFF) – 8 seconds **(Note: To leave the B mode, the command has to be sent when WASP is ON (led green ON)**
C	XBee ON	Led green is blinking
D	GPRS ON	Led red is blinking
E	XBee and GPRS ON	Led's green and red are blinking

(Commands in CAPITAL letter, no *Carriage Return (CR)* or *End of Line (LF)* are needed after the command)

Now you can plug the battery and test the device wherever. To plug the battery:

We are going to use a 3.7V battery plugged directly to the board on its battery connector. With the switch at its OFF position, plug in the battery connecting the power cable from it (colored red) to the positive connector (+) and the ground cable (colored black) to the negative connector (-).

BE CAREFUL SINCE CONNECTING THE WIRES WRONG MAY DAMAGE THE WASP.

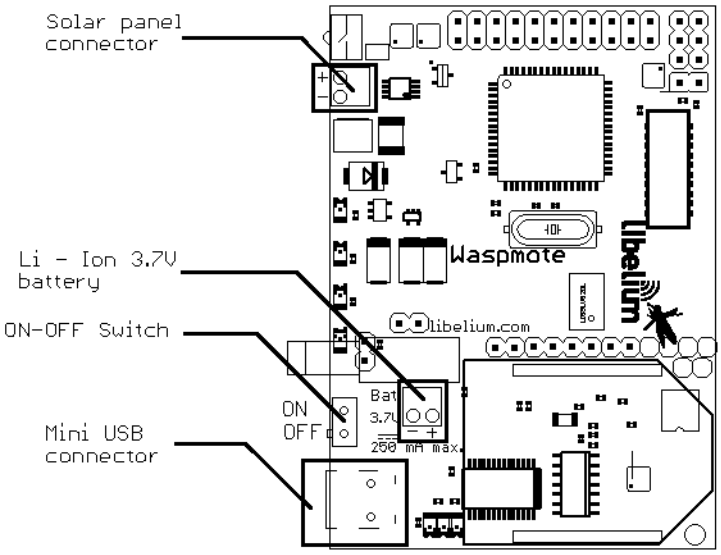
Once the battery is connected, you can turn ON the board what should make one of the LED blinks briefly. If you press the reset button, you will see this behaviour again.

Power from the USB

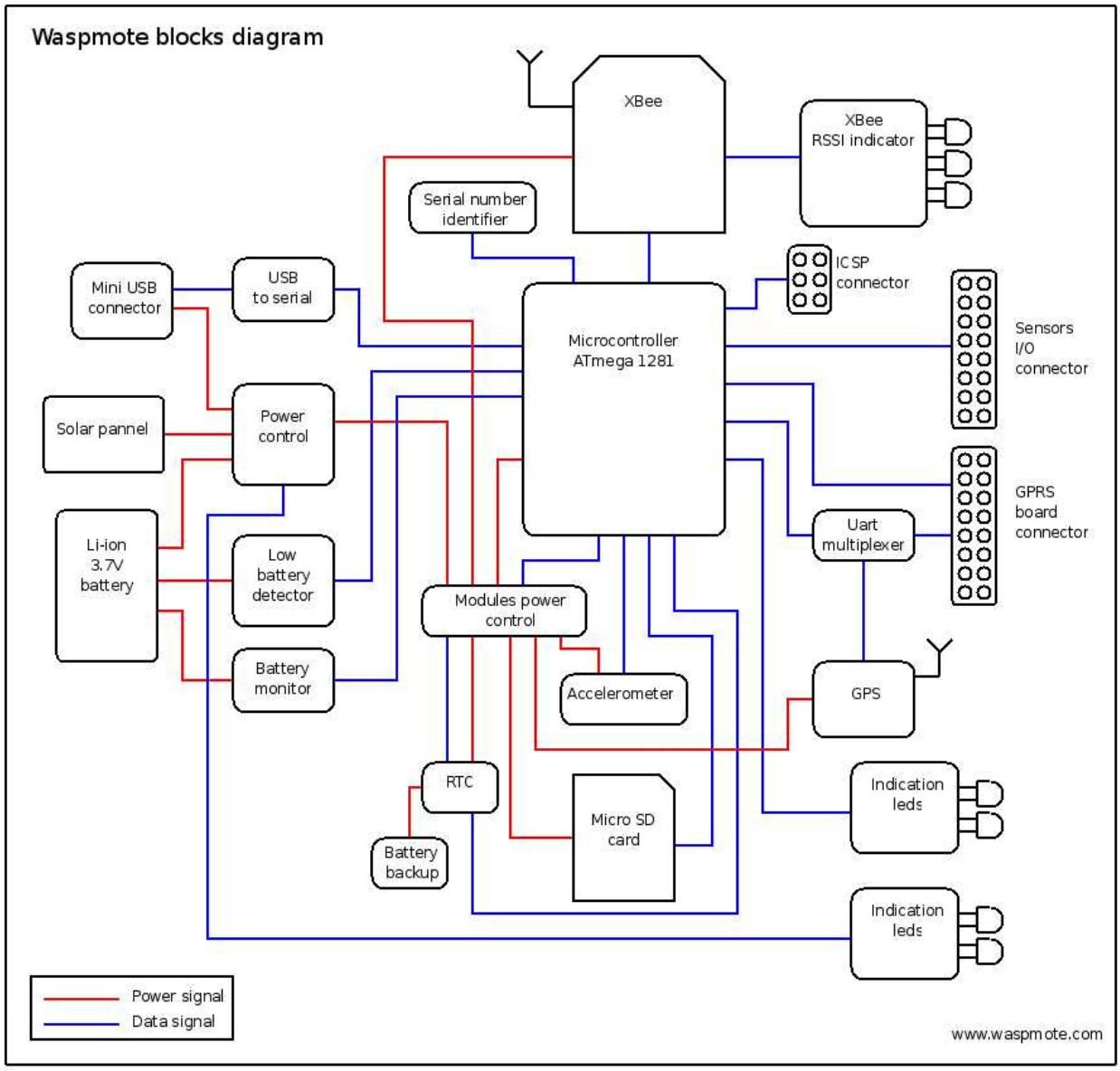
It is possible to power WASP from the USB port and, in this case, omit the battery. When the USB cable is connected to the board, a green LED located by the USB connector will light up, indicating that the connection has been made. It should be possible to make use of an AC-USB power converters, as the ones sold to be used with portable devices like digital cameras, mobile phones, etc. However this has not been tested with WASP and we don't recommend it unless you have made sure it will fulfill the power limitations mentioned above.

1.6 ELECTRICAL RATING OF THE PRODUCT

The main power supply for WASP is a Li-Ion battery (3.7V – 1130 mAh). The battery can be charged with a standard mini USB connection or with a solar panel (6V – 12V). Wasp includes the circuitry necessary for the battery charge control.



1.7 SYSTEM CONFIGURATION



1.8 WORST CASE CONSUPTION

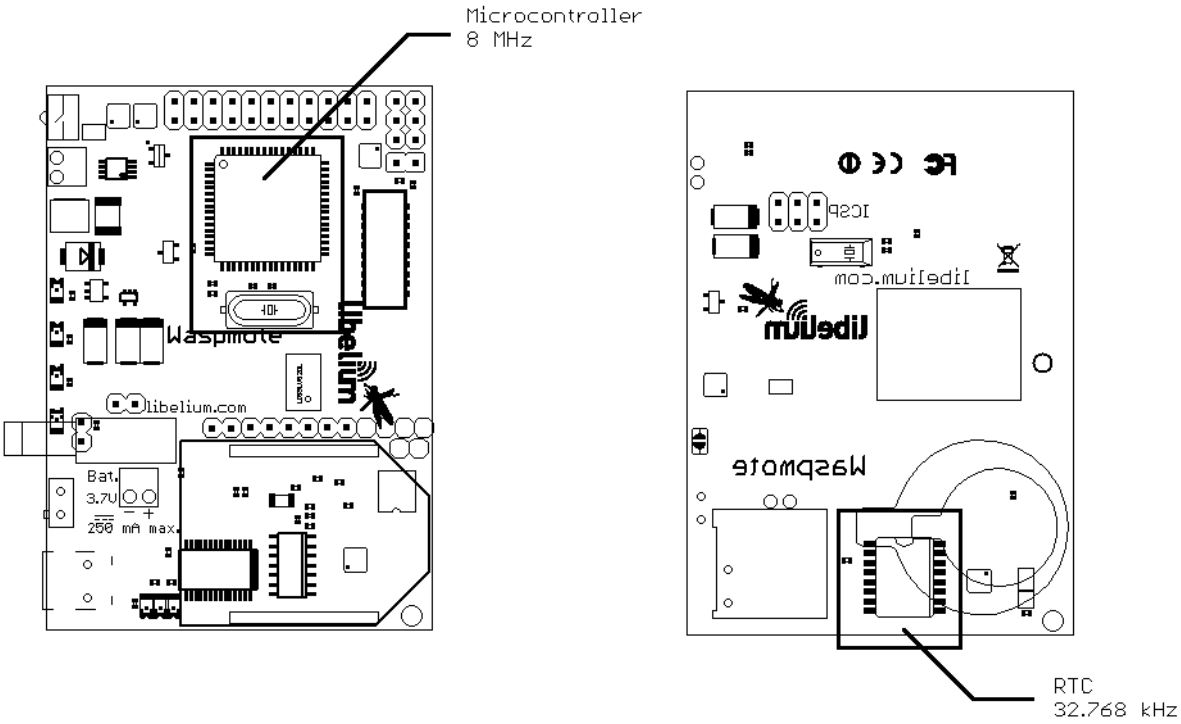
The worst case is the mode where the 2.4GHz 100mW XBee module and the GSM/GPRS are both on (case E). See test modes above.

It is about 200mA.

2 ADDITIONAL REQUIREMENTS NECESSARY FOR ALL EMC EVALUATIONS

2.1 LIST OF CLOCK FREQUENCIES

The microcontroller in WASP is operating in a frequency of 8 MHz and the RTC module is operating in a frequency of 32.768 kHz.

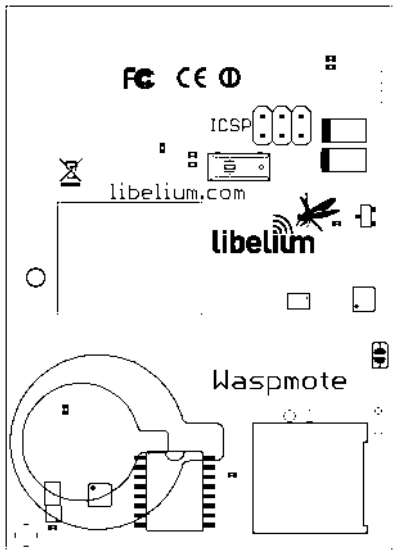


3 ADDITIONAL REQUIREMENTS NECESSARY FOR ALL PRODUCT SAFETY EVALUATIONS

3.1 MANUFACTURING LOCATIONS

Waspmote has been manufactured in Zaragoza (Spain).

3.2 PRODUCT MARKINGS



See documentation attached to find the FCC documents of all the modules used in Waspmote.

3.3 INTERNAL BATTERIES

WASP uses two different batteries for powering.

- **The main battery is a Li – Ion battery, voltage = 3.7V, capacity is 1130 mAh**
- **The second battery is a Lithium Coin Battery (1620 size), voltage = 3V, capacity = 75 mAh**

4 CERTIFICATIONS

4.1 FCC

Waspmote models:

Model 1- FCC (XBee PRO series 1 OEM + GPRS Hilo)
FCC ID: XKM-WASP01 comprising
- FCC ID: OUR-XBEEPRO
- FCC ID: VW3HILOC

Model 2- FCC (XBee PRO ZB series 2 + GPRS Hilo)
FCC ID: XKM-WASP02 comprising
- FCC ID: MCQ-XBEEPRO2*
- FCC ID: VW3HILOC

Model 3 - FCC (XBee 900MHz + GPRS Hilo)
FCC ID: XKM-WASP03 comprising
- FCC ID: MCQ-XBEE09P
- FCC ID: VW3HILOC

Model 4 - FCC (XBee 900MHz XSC + GPRS Hilo)
FCC ID: XKM-WASP04 comprising
- FCC ID: MCQ-XBEEXSC
- FCC ID: VW3HILOC

Usage Restrictions:

- **Installation and operation of any Waspmote model must assure a separation distance of 20 cm from all persons, to comply with RF exposure restrictions.**

4.2 IC

Waspmote models:

Model 1- IC (XBee PRO series 1 OEM + GPRS Hilo)
IC: 8472A-WASP01 comprising
- IC: 4214A-XBEEPRO
- IC: 2599H-HILOC

Model 2- IC (XBee PRO ZB series 2 + GPRS Hilo)
IC: 8472A-WASP02 comprising
- IC: 1846A-XBEEPRO2
- IC: 2599H-HILOC

Model 3- IC (XBee 900MHz + GPRS Hilo)
IC: 8472A-WASP03 comprising
- IC: 1846A-XBEE09P
- IC: 2599H-HILOC

Model 4 - IC (XBee 900MHz XSC + GPRS Hilo)
IC: 8472A-WASP04 comprising
- IC: 1846A-XBEEXSC
- IC: 2599H-HILOC

Usage Restrictions:

- **Installation and operation of any Waspmote model must assure a separation distance of 20 cm from all persons, to comply with RF exposure restrictions.**

4.3 ANTENNAS

Waspmote: XKM-WASP01 - 8472A-WASP01
RF exposure limits are met for the antenna gain combinations listed below:
If the GPRS antenna gain is 0dBi the 2.4GHz antenna is valid for values below 16dBi.
If the GPRS antenna gain is 2.5dBi the 2.4GHz antenna is valid for values below 16dBi.
If the 2.4GHz antenna gain is 2.2dBi the GPRS antenna is valid for values below 8dBi.
If the 2.4GHz antenna gain is 5dBi the GPRS antenna is valid for values below 8dBi.

Waspmote: XKM-WASP02 - 8472A-WASP02
RF exposure limits are met for the antenna gain combinations listed below:
If the GPRS antenna gain is 0dBi the 2.4GHz antenna is valid for values below 16dBi.
If the GPRS antenna gain is 2.5dBi the 2.4GHz antenna is valid for values below 16dBi.
If the 2.4GHz antenna gain is 2.2dBi the GPRS antenna is valid for values below 8dBi.
If the 2.4GHz antenna gain is 5dBi the GPRS antenna is valid for values below 8dBi.

Waspmote: XKM-WASP03 - 8472A-WASP03
RF exposure limits are met for the antenna gain combinations listed below:
If the GPRS antenna gain is 0dBi the 900MHz antenna is valid for values below 13dBi.
If the GPRS antenna gain is 2.4dBi the 900MHz antenna is valid for values below 13dBi.
If the 900MHz antenna gain is 0dBi the GPRS antenna is valid for values below 8dBi.
If the 900MHz antenna gain is 4.5dBi the GPRS antenna is valid for values below 7dBi.

Waspmote: XKM-WASP04 - 8472A-WASP04
RF exposure limits are met for the antenna gain combinations listed below:
If the GPRS antenna gain is 0dBi the 900MHz antenna is valid for values below 13dBi.
If the GPRS antenna gain is 2.4dBi the 900MHz antenna is valid for values below 13dBi.
If the 900MHz antenna gain is 0dBi the GPRS antenna is valid for values below 8dBi.
If the 900MHz antenna gain is 4.5dBi the GPRS antenna is valid for values below 7dBi.