



# ■ MAMBO2

## ■ HARDWARE MANUAL



**VERSION HISTORY:**

*This table provides a summary of the document revisions.*

Number	Author	Changes	Modified
		-	
1.0.1	F. Beqiri	- Added power consumption for different power modes.	24/07/2009
1.0.0	F. Beqiri	- Initial version.	30/05/2008

## CAUTIONS

Information furnished herein by FALCOM is believed to be accurate and reliable. However, no responsibility is assumed for its use. It is necessary to read this manual before you start using the device.

Please, read carefully the safety precautions.

If you have any technical questions regarding this document or the product described in it, please contact your vendor.

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## NOTE

Specifications and information given in this document are subject to change by FALCOM without notice.

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# 1 INTRODUCTION

This product manual is only addressed to qualified personnel which is well skilled in electrical/electronic installation and not addressed to private consumers/end user. The installation, implementing or setting into operation of the product can only be performed by this qualified personnel.

*The status of the product described in the data sheet may have changed since publication of the data sheet and therefore information in this data sheet on product status may be outdated. The latest information of the product is available on the download area of the FALCOM website.*

## 1.1 General

**MAMBO2** is an advanced personal tracker and personal tracking system that uses a quad-band GSM/GPRS technology for two way communication and the latest GPS technology for positioning. It has a high sensitivity GPS Helix antenna that receives GPS signals from all direction and helps the GPS engine to get a fix more quickly. MAMBO2 as an all-in-one handheld product and equipped with a sophisticated software allows system integrators and developers the possibility to develop their own cost efficient and flexible applications in both SMS and TCP communication modes. This gives MAMBO2 the ability to transmit its position not only to your cell phone by SMS, but also to an internet server by GPRS using the inside TCP/IP stack. MAMBO2 can be used as a cell phone with the standard features such as data call and SMS, all through a simple menu-guided operation. It can be carried along in a pocket, backpack or fixed in a vehicle. Emergency alarms can be done by pressing a specific key and reporting current location, date and time. This option should be pre-configured by the system integrators. Therefore, you can quickly and easily track the position of the MAMBO2 device. This product has a unique geo-fence feature used to report if the device (e.g. *the person who is carrying it*) moves from a particular location or deviates from a pre-defined route. Additional applications include fleet management tracking, personal security for independent workers, safety locator devices for police officers and fire/rescue personnel, and so much more.

MAMBO2 offers an OLED display, two-soft keys and a navigation key that allow users to easily navigate menus, send SMS, release alarms or graphically view all your GPS information with detailed statistics on a large and brilliant screen. The MAMBO2's firmware can be upgraded remotely (over-the-air over Internet).

The MAMBO2 connects the PC USB port and allows device programming, debugging and battery charging from the same port.

The device functions are software configuration dependant. In order to insert your device in your application you need to configure it. For more details, have a look in the software documentation called "***Mambo2PFALCommandsReferenceGuide.pdf***".

MAMBO2 can be used in a variety of applications such as:

- ✓ *Personal safety and security,*
- ✓ *Remote tracking (Locating people),*
- ✓ *Fleet tracking and management,*
- ✓ *Real-time Navigation and Positioning,*
- ✓ *Trip management and many others ...*

## 1.2 Audience

This document is intended for system integrators and application developers.

## 1.3 Circuit concept

The MAMBO2 architecture includes the following major functional components (a block diagram **Fig.1** is available below):

### ❖ ARCHITECTURE INTEGRATES:

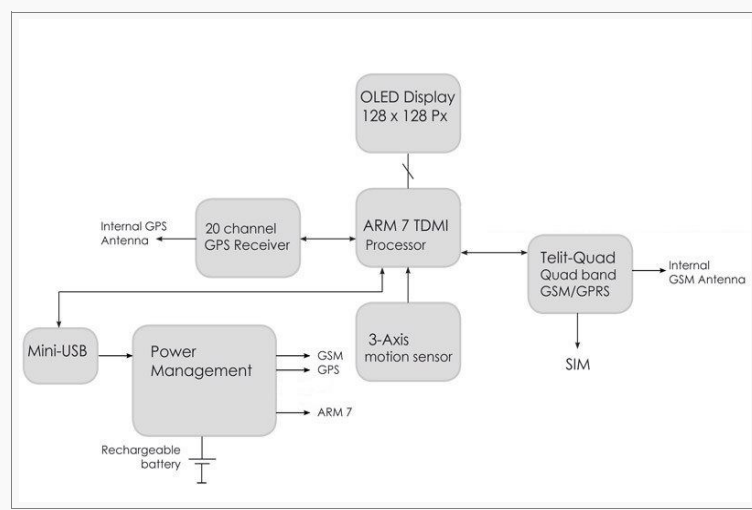
- ↳ High-performance Quad-Band GSM/GPRS core (operating at 26MHz),
- ↳ 20 parallel channel low-power GPS core (operating at L1 1575.42 MHz and C/A code 1,023 MHz chip rate),
- ↳ ARM7TDMI Processor (operating at 25MHz) that controls all functions of the system,
- ↳ Internal SIM card reader (**1.8/3V SIM cards**),
- ↳ Li-Polymer internal battery
- ↳ Two-way communication
- ↳ Internal GSM antenna,
- ↳ Helix GPS antenna.

### ❖ OPTIONS TO MAMBO2

- ↳ **3D motion** sensor (available in basic version),
- ↳ **Micro-SD-Card** reader.

### ❖ PHYSICAL INTERFACES:

- ↳ Full color OLED display (128x128)
- ↳ 2 x Soft keys, 1 x Navigation key,
- ↳ Mini-USB port for battery charging and data transfer.
- ↳ 1 x LED free programmable (in OFF mode indicates battery charging process)



**Figure 1:** MAMBO2 block diagram

## 1.4 Related documents

Some others PDF documents such as FCC approval, application notes, Certificate of Conformity R&TTE etc. are available on the Web at: <http://www.falcom.de/> in the published download area.

In addition to this document, the following files comprise the full set of FALCOM MAMBO2 product manuals which are also available on the Web at: <http://www.falcom.de/> in the protected download area.

NR	PDF file name	Description
[1]	MAMBO2PFALConfigurationReferenceGuide.pdf	Contains the description of the internal firmware and the supported Configuration Commands Set for the MAMBO2.
[2]	MAMBO2EvalKitGettingStarted.pdf	Contains an introduction how to get started with MAMBO2 EVALKIT, how do the software and hardware operate, factory preloaded configuration settings etc.
[3]	AppNoteMAMBO2SoftwareUpdate.pdf	Contains information how to upgrade the MAMBO2 device to a new firmware version locally via USB.
[4]	AppNotesRemoteUpdateWithWorkbench.pdf	Contains information how to upgrade the MAMBO2 device to a new firmware version remotely via TCP.
[5]	MAMBO2GettingStartedWithSimpleGUI.pdf	Contains information how to get started with Simple GUI.
[6]	MAMBO2GettingStartedWithStandardSportGUI.pdf	Contains information how to get started with Standard(+Sport) GUI.
[7]	AppNoteMAMBO2SerialConnectionOnLINUX.pdf	Contains information how to perform a serial connection with MAMBO2 on LINUX operating system.
[8]	AppNotes_Transform_history_data.pdf	Contains information of how to transform history data that are being transmitted from MAMBO2 via TCP connection.
[9]	AppNote_Remote_update.pdf	Contains information of how to upgrade the MAMBO2 device to a new firmware revision remotely via TCP.

*These PDF files are viewable and printable from Adobe Reader. If you do not have the Adobe Reader installed, you can download it from <http://www.adobe.com>.*

## 2 SECURITY

IMPORTANT FOR THE EFFICIENT AND SAFE OPERATION OF YOUR GSM-MODEM, READ THIS INFORMATION BEFORE USE!

Your cellular engine MAMBO2 is one of the most exciting and innovative electronic products ever developed. With it, you can stay in contact with your office, your home, emergency services and others, wherever service is provided.

This chapter contains important information for the safe and reliable use of the MAMBO2 device. Please read this chapter carefully before starting to use the cellular engine MAMBO2.

### 2.1 General information

Your MAMBO2 device utilizes the GSM standard for cellular technology. GSM is a newer radio frequency („RF“) technology than the current FM technology that has been used for radio communications for decades. The GSM standard has been established for use in the European community and elsewhere. Your MAMBO2 is actually a low power radio transmitter and receiver. It sends out and receives radio frequency energy. When you use your modem, the cellular system handling your calls controls both the radio frequency and the power level of your cellular modem.

*For the use of the acquired devices SIM cards are needed, which are not included in the scope of delivery of the device. The SIM cards can be acquired e.g. by specific providers. From the use of the SIM cards can result additional costs, which are to be borne by the purchaser (client) of the devices. The seller does not cover the extra costs for the use of the devices. The seller gives no recommendation for the use of specific SIM cards and does not liable also for the fact that the devices are usable with all available SIM cards. The seller also covers no other costs, that are needed for the application of the customer in connection with this device.*

### 2.2 Exposure to RF energy

There has been some public concern about possible health effects of using a GSM modem. Although research on health effects from RF energy has focused for many years on the current RF technology, scientists have begun research regarding newer radio technologies, such as GSM. After existing research had been reviewed, and after compliance to all applicable safety standards had been tested, it has been concluded that the product is fit for use.

If you are concerned about exposure to RF energy, there are things you can do to minimize exposure. Obviously, limiting the duration of your calls will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your cellular modem efficiently by following the guidelines below.



## 2.3 Driving

Check the laws and regulations on the use of cellular devices in the area where you drive. Always obey them. Also, when using your MAMBO2 while driving, please pay full attention to driving, pull off the road and park before making or answering a call if driving conditions so require. When applications are prepared for mobile use, they should fulfil road-safety instructions of the current law!

## 2.4 Electronic devices

Most electronic equipment, for example in hospitals and motor vehicles is shielded from RF energy. However, RF energy may affect some malfunctioning or improperly shielded electronic equipment.

## 2.5 Vehicle electronic equipment

Check your vehicle manufacturer's representative to determine if any on board electronic equipment is adequately shielded from RF energy.

## 2.6 Medical electronic equipment

Consult the manufacturer of any personal medical devices (*such as pacemakers, hearing aids, etc.*) to determine if they are adequately shielded from external RF energy.

Turn your MAMBO2 device OFF in health care facilities when any regulations posted in the area instruct you to do so. Hospitals or health care facilities may be using RF monitoring equipment.

## 2.7 Aircraft

Turn your MAMBO2 OFF before boarding any aircraft. Use it on the ground only with crew permission. Do not use it in the air.

To prevent possible interference with aircraft systems, Federal Aviation Administration (FAA) regulations require you to have permission from a crew-member to use your modem while the plane is on the ground. To prevent interference with cellular systems, local RF regulations prohibit using your modem whilst airborne.

## 2.8 Children

Do not allow children to play with your MAMBO2 device. It is not a toy. Children could hurt themselves or others (by poking themselves or others in the eye with the antenna, for example). Children could damage the modem or make calls that increase your modem bills.

## 2.9 Blasting areas

To avoid interfering with blasting operations, turn your device OFF when in a "blasting area" or in areas posted: „*turn off two-way radio*". Construction crew often uses remote control RF devices to set off explosives.

## 2.10 Potentially explosive atmospheres

Turn your MAMBO2 device **OFF** when in any area with a potentially explosive atmosphere. It is rare, but your modems or their accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas such as petrol stations; below decks on boats; fuel or chemical transfer or storage facilities; and areas where the air contains chemicals or particles, such as grain, dust or metal powders.

Do not transport or store flammable gas, liquid or explosives, in the compartment of your vehicle, which contains your modem or accessories.

Before using your modem in a vehicle powered by liquefied petroleum gas (such as propane or butane) ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is to be used.

## 2.11 Battery safety

The safety rules below are applied for the internal battery. Mistreating the battery may cause the battery to get hot, crack, or inflame and cause serious injury. In order to avoid any damage and extend the life expectancy of battery, please follow the safety rules listed below before using the **MAMBO2** device:

- *Do not place the battery on, in or near fires, apparatus that provide heat, or other high-temperature locations. Do not place the battery in direct sunshine, or use or store the battery inside cars in hot weather. Doing so may cause the battery to generate heat, crack, or inflame. Using the battery in this manner may also result in a loss of performance.*
- *Do not attach the battery to a power supply plug or directly to a car's cigarette lighter.*
- *Do not pierce the battery with nails, strike the battery with a hammer, step on the battery, or otherwise subject it to strong impacts or shocks.*
- *Do not solder onto the battery contacts.*
- *Do not allow the battery to get wet.*
- *Do not disassemble or modify the battery.*
- *Immediately discontinue use of the battery if, while using, charging, or storing the battery, the battery emits an unusual smell, feels hot, or appears abnormal in any other way.*
- *Do not place the batteries in microwave ovens, high-pressure containers, or on induction cookware.*
- *In case the battery drips and the fluid gets into one's eye, do not rub the eye. Rinse well with water and immediately look for medical care. If left untreated the battery fluid could cause damage to the eye.*

### 2.11.1 Safety precautions while charging the battery

Be sure to follow the rules listed below while charging the battery. Failure to do so may cause the battery to become hot, rupture, or ignite and cause serious injury.

- *When charging the battery insure that the battery charging conditions specified are met. The temperature range over which the battery can be*

*charged is 0°C to 40°C. Charging is interrupted, if the ambient temperature is outside of this range.*

### **2.11.2 Safety precautions while discharging the battery**

The temperature range over which the battery can be discharged is -20°C to 60°C. Use of the battery outside of this temperature range may damage the performance of the battery or may reduce its life expectancy.

### 3 SAFETY STANDARDS

Your GSM/GPRS/GPS device complies with all applicable RF safety standards.

MAMBO2 meets the safety standards for RF receivers and the standards and recommendations for the protection of public exposure to RF electromagnetic energy established by government bodies and professional organizations, such as directives of the European Community, Directorate General V in matters of radio frequency electromagnetic energy.

## 4 TECHNICAL DATA

### 4.1 Product features

#### ↵ **Input voltage:**

- USB port voltage level: +5.0 V ± 10 % (max. 0,5A).

#### ↵ **Battery:**

- Device is powered by a rechargeable 1300 mAh Li-Polymer battery.
- Default operating time is user-application dependant.

#### ↵ **Power saving:**

- 4 different power-saving modes - programmable with PFAL commands.

#### ↵ **Operating temperature range:**

- -20 °C to + 60 °C (for more details, see chapter 4.1.2)

#### ↵ **Physical characteristics:**

- Size: 54.0 ± 0.1 mm x 103.0 ± 0.1 mm x 26.0 ± 0.1 mm
- Weight: ca. 108 gr.

#### ↵ **Physical Interfaces:**

- OLED color display 128x128
- 1 x Mini-USB port for battery charging and data transfer,
- 1 x SIM Card interface (for 1.8 and 3 V SIM cards),
- 1 x LED indicator (shows battery charging status when the device is turned off; free-programmable by the software while the device is running.)
- 1 x Micro-SD card reader for a Micro SD-Card.
- 2 X Soft keys (Left and right soft key buttons),
- 1 x 5-way navigation key,
- 1 x Hardware reset button.

#### ↵ **Operating Software:**

- Embedded TCP/IP stack, including TCP, IP and SMTP protocols. TCP/IP allows SMTP protocol allows the sending of E-Mail via an internet mail server.
- Accessible via PFAL commands,
- Upgrade via USB and over the air (GPRS/TCP).

#### ↵ **Data access/download:**

- Direct **USB** connection e.g. laptop, PC:
  - ✓ Bi-directional serial interface,
  - ✓ 5-wires (VCC, Data-, Data+, NC, GND),
  - ✓ Selectable baud rate (default 57600 bps),
  - ✓ 8 data bits, no parity, 1 stop bit, no flow control.
- SMS for two-way communication messages,

- CSD dial-up data link,
- TCP communication by GPRS - IP based packet transfer,
- SMTP - Receive device location via Email.

#### ↪ **Hardware options:**

- **3D motion** sensor - already available in the standard hardware version,
- **Micro-SD-Card Reader** - for additional memory (up to 1GB Mini-SD cards support).

#### ↪ **Casing:**

- Fully shielded in a plastic case.

#### ↪ **Antennas:**

- Internal.

#### ↪ **Certifications:**

- Fully type approved confirming with R&TTE directive,
- FCC / CE.

#### ↪ **Directive:**

- RoHS compliant.

#### ↪ **Memory:**

- FLASH: 8 MBytes (for configuration, data-logging/history and firmware storage). Approx. 4 Mbytes of memory is available for history data/data logging.
- RAM: 4 Mbytes.

#### ↪ **EVALKIT:**

- Designed to test and evaluate separately all Graphical User Interfaces (GUIs) such as Simple GUI, Sport + Standard GUI with the same MAMBO2 device. All of them provide a sample configuration that can be used a starting point for developing your application.

### 4.1.1 Power consumption for MAMBO2

AVERAGE POWER CONSUMPTION (@ T <sub>AMB</sub> = 25 °C)					
Internal battery voltage between 3.9V to 4.0V					
MODES by PFAL commands	STATE				mA
	GSM	GPS	DISPLAY	CPU	
PFAL,Sys.Power.Mode=auto,30	OFF	OFF	OFF	ON	52
PFAL,Cnf.Set,DISP.SAVER=1,1	ON	ON	OFF	ON	140
PFAL,Cnf.Set,DISP.SAVER=2,1	ON	ON	OFF	ON	132
PFAL,Sys.Device.Shutdown	OFF	OFF	OFF	OFF	700 µA
PFAL,Sys.Device.Sleep=Ign+Ring+Motion+Timer=1:20:00	SLEEP	OFF	OFF	OFF	18
PFAL,Sys.GSM.Disable	OFF	ON	OFF	ON	85
PFAL,Sys.GSM.PowerMode=enable	SLEEP	ON	OFF	ON	117
PFAL,Sys.GPS.Disable	ON	OFF	OFF	ON	99
PFAL,Sys.GPS.Sleep	ON	HN	OFF	ON	99
Full operational	ON	ON	ON	ON	210

HN = Hibernate; TP = TricklePower; SLEEP = Device remains registered on the network and reachable.

**Note:** The values in this table are measured at FALCOM's laboratory and can vary depending upon Hardware/Software configurations and environmental conditions. Therefore, there is no guarantee that the average values given above will be the same in your scenario.

Table 1: MAMBO2 power consumption in different operation modes

### 4.1.2 Operating temperatures

Parameter	Min.	Typ.	Max.	Unit
Storage temperature	-5	+20	+35	°C
Operating temperature*	-20	+20	+60	°C
Charging temperature	0	+20	+40	°C

\* Recommended discharging temperature range is 0-40°C, beyond which it will result in decadence of the battery performance and shortness of its life.

Table 2: Operating temperature

### 4.1.3 Battery Technical Data (1300 mA/h)

#### ↳ Electrical characteristics and operating conditions

- Nominal voltage (V) 3.70
- Typical capacity 20°C (mA/h) 1300 mAh @ 4.2 V
- Charging method Constant Current / Constant Voltage
- Charging voltage 4.2V ±0.05V
- Charging Time 4 Hours (approx.)
- Charging current 450 mA (approx.)
- Charging temperature range 0°C to + 40°C
- Max. discharge current 1C
- Discharge temperature range -20°C to +60°C

#### 4.1.4 GSM/GPRS features

##### ↪ **GSM/GPRS core:**

- Telit GE864-Quad module
- Quad-Band: *GSM 850, 900, DCS 1800, PCS 1900.*
- Compliant to GSM Phase 2/2+

##### ↪ **Output power:**

- Class 4 (2 W) at EGSM900/850
- Class 1 (1 W) at GSM1800 and GSM 1900

##### ↪ **GPRS connectivity:**

- GPRS multi-slot class 10
- GPRS mobile station class B

##### ↪ **DATA:**

###### **GPRS ⇒**

- GPRS data downlink transfer: max. 85.6 kbps (see table 3).
- GPRS data uplink transfer: max. 42.8 kbps (see table 3).
- Coding scheme: CS-1, CS-2, CS-3 and CS-4.

###### **CSD ⇒**

- Direct dial-up connection - Automatic answer of a data call from any modem with live NMEA GPS data.
- CSD transmission rates: 2.4, 4.8, 9.6, 14.4 kbps, non-transparent, V.110. .

##### ↪ **SMS:**

- SMS based reporting in text mode;
- Continuous minute-by-minute tracking.
- Automatic reply to a polling SMS from any mobile phone or GSM modem with contents NMEA data).

##### ↪ **GPRS Coding scheme:**

Coding scheme	1 Timeslot	2 Timeslots	4 Timeslots
CS-1:	9.05 kbps	18.1 kbps	36.2 kbps
CS-2:	13.4 kbps	26.8 kbps	53.6 kbps
CS-3:	15.6 kbps	31.2 kbps	62.4 kbps
CS-4:	21.4 kbps	42.8 kbps	85.6 kbps

**Table 3:** Coding schemes and maximum net data rates over air interface

Please note that, the values listed above are the maximum ratings which, in practice, are influenced by a great variety of factors, primarily, for example, traffic variations and network coverage.



### 4.1.5 GPS features

#### ↳ **GPS engine:**

- JP18 FALCOM GPS receiver with the latest SiRFstarIII chip set.
- High sensitive 20 channel, L1 1575.42 MHz, C/A code 1,023 MHz chip rate.
- SiRF GSW3

#### ↳ **Accuracy:**

- Position accuracy: < 10 m

#### ↳ **Datum:**

- WGS-84.

#### ↳ **Time to First Fix (TTFF):**

- Hot start < 1 sec., average
- Cold start \* < 42 sec, average

#### ↳ **Sensitivity:**

- Tracking -159 dBm

#### ↳ **Dynamic Conditions:**

- Altitude 18,000 meters (60,000 feet) max.
- Velocity < 515 m/s (1000 knots) max.
- Max. update rate 1 Hz

#### ↳ **Protocol Output (see chapter 4.2):**

- NMEA (Msg.: **GLL, GGA, RMC, VTG, GSV, GSA**) – For SMS/Data call/TCP/SMTP applications.
- FALCOM (Msg.: **IOP, GSM, AREA, 3DP, BIN**) - for SMS/Data call/TCP/SMTP applications.

#### ↳ **GPS antenna:**

- Built-in GPS Helix antenna.

\* Capable of cold starts of -144dBm.

## 4.2 NMEA & FALCOM data message

MAMBO2 delivers data in the NMEA-0183 format. Table 4 lists each of the NMEA and FALCOM output messages supported by the MAMBO2 terminal and a brief description. For further description about NMEA, see related documents [1].

The running firmware inside the device offers the possibility to switch on and off each protocol that is listed in table below. As mentioned above, the firmware inside the device supports a lot of PFAL commands enabling full control of the device. There are also PFAL commands which allow sending of these protocols via SMS, TCP, Data call and e-mail. For example, the PFAL commands "PFAL,GSM.SMS.Send..." and "PFAL,GSM.Send.TCP..." allow you to send an SMS message to a user or a TCP packet to a TCP server to let him know the current location, GPS state, UTC time, Date, Speed and Course over ground of the device. The received SMS contents or TCP packet can then be forwarded to a map software for graphically representation of the device location.

<b>NMEA</b>	<b>Description</b>
GGA	<i>Time, position and fix type data.</i>
GLL	<i>Latitude, longitude, UTC time of position fix and status.</i>
GSA	<i>GPS receiver operating mode, satellites used in the position solution and DOP values.</i>
VTG	<i>The number of GPS satellites in view satellite ID numbers, elevation, azimuth and SNR values.</i>
GSV	<i>The number of GPS satellites in view satellite ID numbers, elevation, azimuth and SNR values.</i>
RMC	<i>Time, date, position, course and speed data.</i>
<b>FALCOM</b>	<b>Description</b>
IOP	<i>The voltage level of the internal battery.</i>
GSM	<i>The GSM operator, reception, registration status, GSM field strength, area code and cell ID.</i>
AREA	<i>The state of 32 areas.</i>
3DP	<i>The state of the Motion Sensor.</i>
BIN	<i>User protocol including time, date, position, course and speed data.</i>

**Table 4:** NMEA Output Messages

## 5 MAMBO2 APPLICATION INTERFACE

### 5.1 Power supply

Your MAMBO is powered by a rechargeable Li-Polymer battery. The power supply to recharge the internal battery of the MAMBO2 unit is drawn from a valid USB port source which complies exactly with the USB standard. A compliant USB host source is specified to supply no more than 500 mA. The USB voltage is used to charge the internal battery. The current for charging the internal battery of the MAMBO2 device is limited to 450 mA.

#### 5.1.1 Automatic shutdown

Automatic shutdown takes effect if:

- *under voltage is detected when battery level runs low.*

The automatic shutdown procedure is equivalent to the initiated power-down, i.e. MAMBO2 logs off from the network and the software enters a secure state avoiding loss of data.

#### 5.1.2 Power saving

SLEEP mode reduces the functionality of the modules of the MAMBO2 device to a minimum and, thus, minimizes the current consumption to the lowest level. Settings can be made using the **\$PFAL,Sys.Device.Sleep** command. For details see examples in table below. Following SLEEP modes are supported by the MAMBO2 device:

<b>Ign</b>	<i>Device wakes up when IGN (pin 13 MOLEX, AMP) changes its digital level from Low to High (performs a rising edge).</i>
<b>Ring</b>	<i>Device wakes up when the GSM module receives an SMS message.</i>
<b>Timer=1:20:00</b>	<i>Device wakes up after the defined time has expired.</i>
<b>Motion</b>	<i>Device wakes up when motions are detected.</i>
<b>Example</b>	<b>\$PFAL,Sys.Device.Sleep=Ign+Ring+Timer=1:20:00</b>

**IMPORTANT:** The sleep and wake-up procedures are quite different depending on the selected sleep mode. Please keep in mind the power saving with "Ring" parameter works properly only when PIN authentication has been done and the device is registered to the GSM network. If you attempt to activate power saving while the SIM card is not inserted or the PIN not correctly entered, the device responds error "**ring shutdown aborted due to bad GSM coverage**" and the power saving does not take place. For more details refer to the manual "**Mambo2PFALConfigurationReferenceGuide.pdf**".

## 5.2 Function parts of device



**Figure 2:** Parts of the MAMBO2

The pinout of the 5 pin mini-USB jack connector on the MAMBO2 device:



**Figure 2.1:** 5 pin mini-USB jack connector

PIN	NAME	DESCRIPTION
1	VCC	+ 5 VDC
2	D-	Data -
3	D+	Data +
X	NC	-
4	GND	Ground

**Table 5:** The pinout of the 5 pin mini-USB jack connector

## 5.3 Getting Started

To get started with MAMBO2 device you need to have a valid SIM card and it needs to support SMS, data services. Next is the configuration of the MAMBO2. For more details how to configure your MAMBO2 and pull its current configuration, refer to the manual "[Mambo2PFALConfigurationReferenceGuide.pdf](#)". The principle of MAMBO2 operation is explained in [Chapter 5.3.1](#).

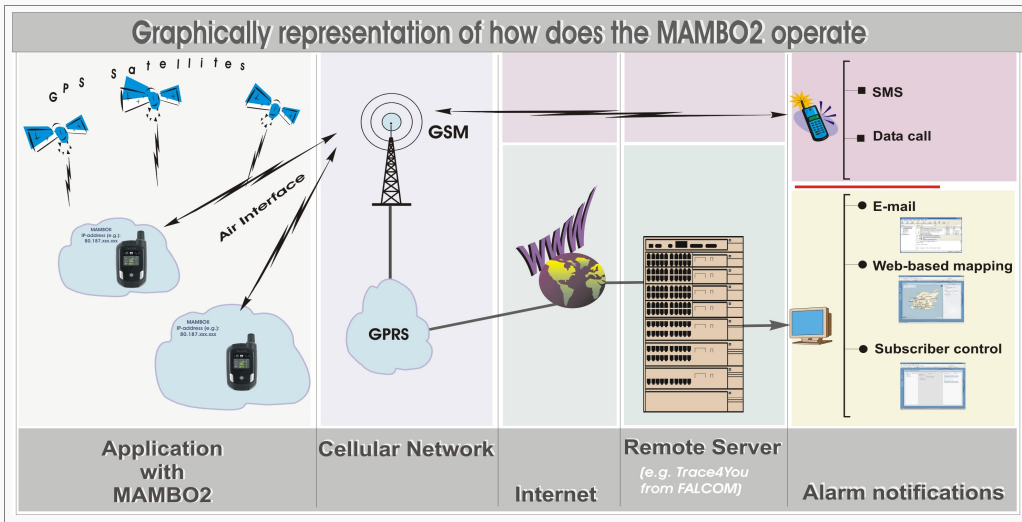
To get started with MAMBO2-EVALKIT, please refer to the manual "[Mambo2EvalKitGettingStarted.pdf](#)".

### 5.3.1 The principle of MAMBO2 operation

What is required to integrate your MAMBO2 in your application.

- MAMBO2 Unit(s),
- A valid SIM card for DATA and GPRS,
- GPRS settings (provided by your operator),
- Remote Server (for receiving TCP packets sent by the MAMBO2 – e.g. Trace4You from FALCOM),
- TCP settings (IP-address and socket to which the MAMBO2 should connect),
- Device configuration - which should locally be done by the system integrator or developer,
- Client computer with the Internet connection and an installed Web browser for accessing server services.

The illustration below represents which interfaces the MAMBO2 uses to get connected with your Remote Server. Moreover, it shows the kind of services used by the user to track and control the device remotely.



**Figure 3:** Interfaces that the firmware uses to access the Remote Server by GPRS

The principle of system operation is very simple. The integrated GPS receiver uses the satellites data to calculate its exact position. This GPS data (*device location*) can be with the software configuration either stored inside the device or pulled via SMS or over Internet to show the location of this data on a web-based mapping site (e.g. *Trace4You*).

FALCOM Workbench software helps you to configure, test and debug your MAMBO2 locally.

## 6 RF EXPOSURES

This device contains 850/900/1800/1900 MHz GSM/GPRS functions that is operational in these frequencies respectively.

The MAMBO2 device contains 1800 MHz GSM functions that are not operational and must not be used in U.S. Territories. Filing is only applicable for 850MHz GSM/1900 MHz PCS operations, whereby only these frequencies (850MHz GSM/1900 MHz PCS) are possible to be used in U.S. Territories.

This EUT has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001) and IEEE Std. 1528-2003, December 2003.

## 7 STATEMENTS ACCORDING TO FCC

### **Statement according to FCC part 15.19:**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- *this device may not cause harmful interference, and*
- *this device must accept any interference received, including interference that may cause undesired operation.*

### **Statement according to FCC part 15.21:**

Modifications not expressly approved by this company could void the user's authority to operate the equipment.

### **Statement according to FCC part 15.105:**

**NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*