# UM1579
# User manual

## STEVAL-MKI132V1- BlueMotion motherboard for MEMS adapter boards

### Introduction

The STEVAL-MKI132V1 (BlueMotion) motherboard is designed to provide the user with a complete ready-to-use platform for the demonstration of MEMS devices mounted on adapter boards.

This STEVAL-MKI132V1 demonstration board uses an STM32F103TB microcontroller and an SPBT2532C2.AT Bluetooth® module; it functions as a bridge between the sensor on the adapter board and the PC. It is possible to connect the BlueMotion to the PC using the Bluetooth module and using the Unico graphical user interface (GUI), downloadable from the ST website, or dedicated software routines for customized applications.

This user manual describes the hardware included with the demonstration board and provides the information required to install and run the demonstration board user interface.

For details regarding the features of each sensor, please refer to the datasheets available for each individual device.

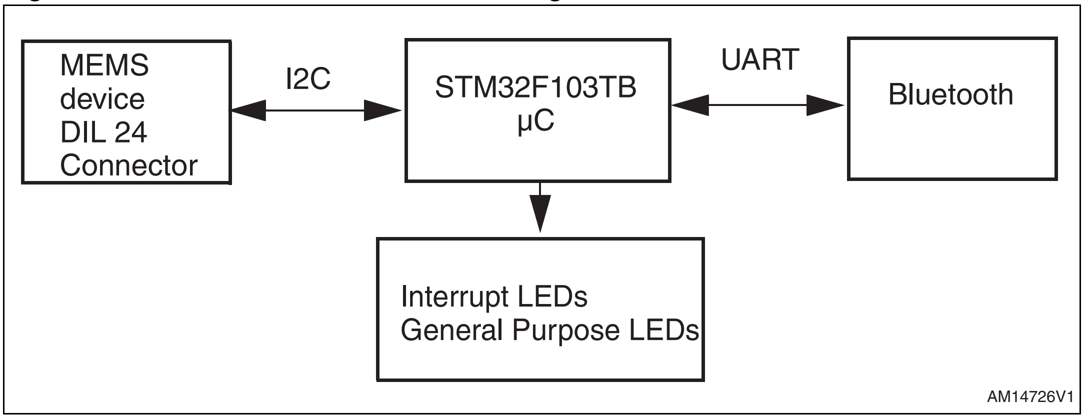
# Contents

# 1 Demonstration board description

The BlueMotion is a complete demonstration board that allows the demonstration of both digital and analog MEMS sensors. Thanks to its DIL 24 connector, a wide range of MEMS adapter boards can be used.

The block diagram of the demonstration board is shown in *Figure 1*.

**Figure 1. Demonstration board block diagram**



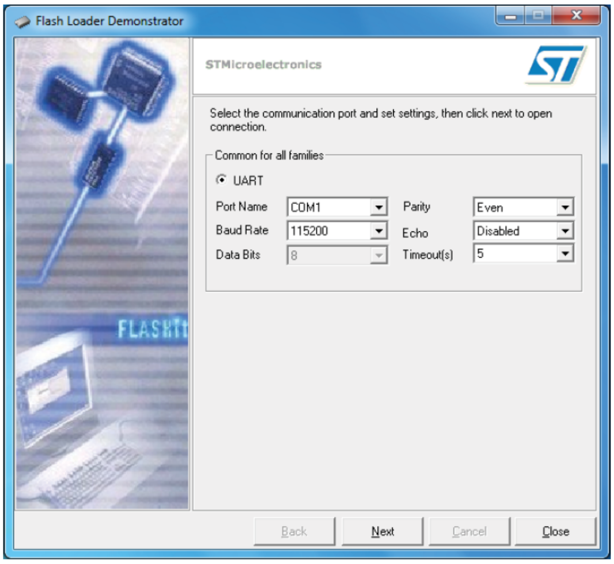

As shown in *Figure 1*, the BlueMotion demonstration board is based on the STM32F103TB microcontroller and can be connected to the PC through Bluetooth. Data coming from the MEMS sensor connected to the board can be read through the PC GUI provided with the board.

The BlueMotion can be flashed with compatible firmware using an SWD connector or a UART connector. See www.st.com/mems for new firmware releases.

The following steps are required to flash the board using UART:

1. Connect the BlueMotion to the PC using a UART connector (use the FS and ST pins of the J2 connector shown in *Figure 10*).
2. Set the BOOT0 pin of the DIL 24 device adapter high.
3. Power up the board.
4. Use the STM32 flash loader utility to establish a UART connection with the BlueMotion. The recommended settings are shown in *Figure 2*.

**Figure 2. Connecting BlueMotion using UART**

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Download the hexadecimal file of the firmware on BlueMotion using the STM32 flash loader utility. For further details, refer to the utility's user manual.

**Figure 3. Downloading firmware using UART**

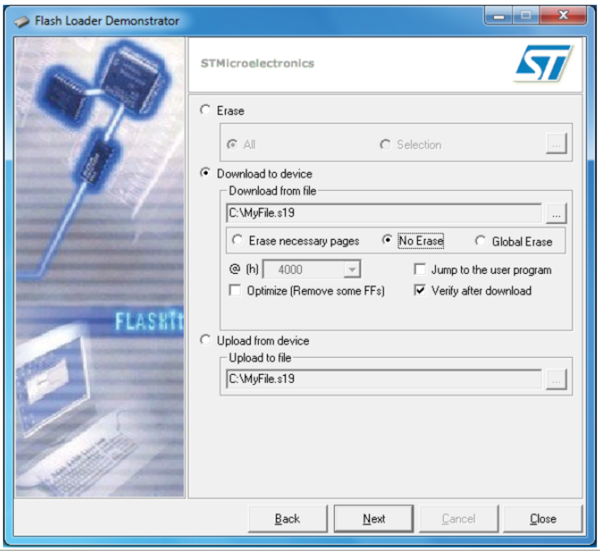


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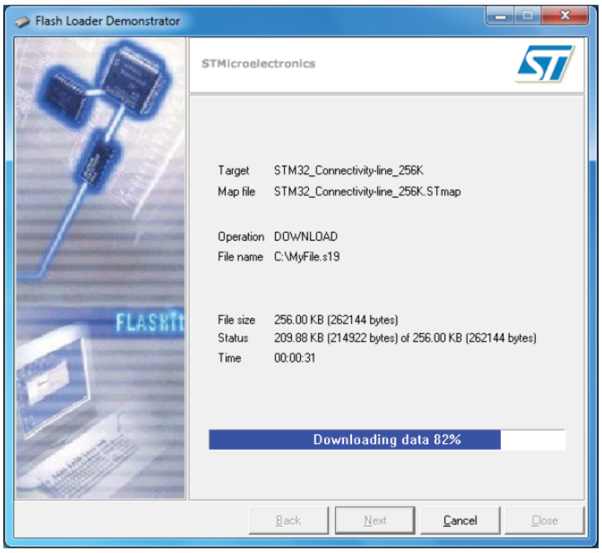
**Figure 4. Connecting BlueMotion using UART**

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The BlueMotion also integrates one general purpose LED, and two LEDs connected directly to the interrupt pins of the digital adapters.

The top view and the bottom view of the full board are shown in *Figure 5* and *Figure 6* respectively.

**Figure 5. Board top view**

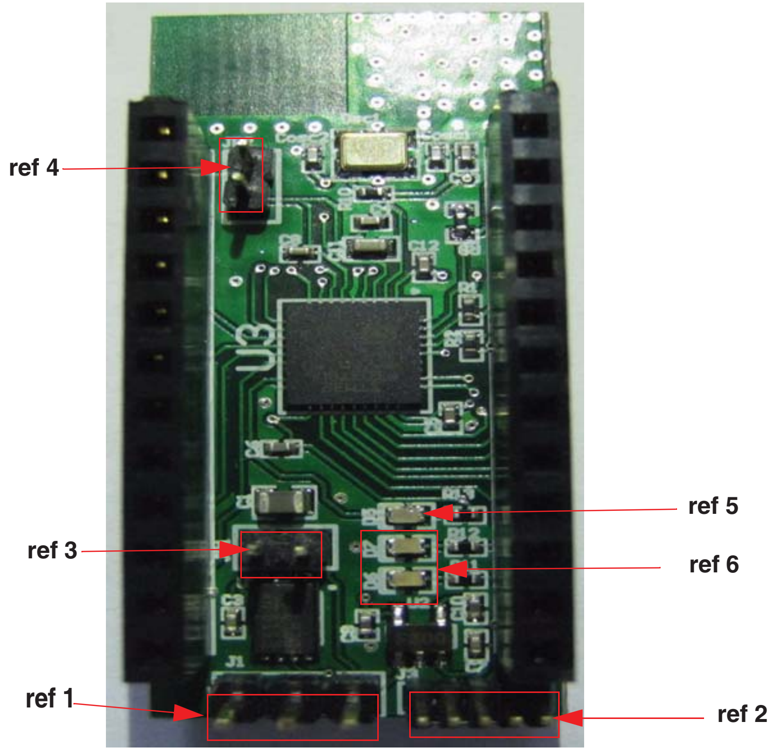
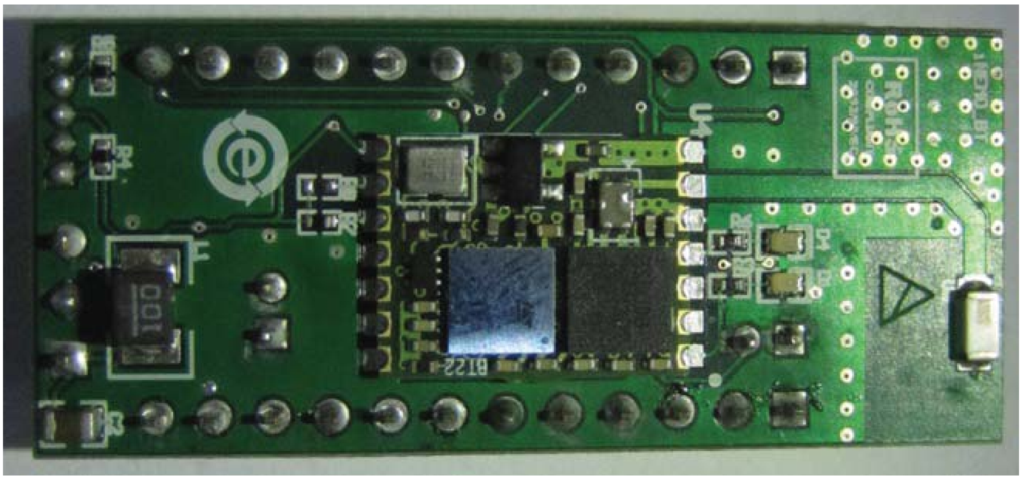



**Figure 6. Board bottom view**




The BlueMotion demonstration board can be used with the Unico GUI interface which allows simple interaction with the sensor. The steps required for establishing a Bluetooth connection with the board and accessing it are discussed in the following sections.

In *Figure 5* some of the main components placed on the top layer of the BlueMotion board are highlighted.

- The dual power supply connector J1 (*Figure 5*, ref 1) can be used to supply power in one of the two possible modes. Pin 2 on must be connected to ground. The board can be powered with either a 1.5 V supply, e.g. an AA battery, connected to Pin 1 or with a supply in the range 3.5 V - 6.0 V. connected to Pin 3.
- The SWD connector J3 can (*Figure 5*, ref 2) be used to program the BlueMotion board.
- Jumper JP1 allows the user to measure the sensor current consumption by connecting a multimeter in series with its terminals when a 1.5 V power supply is used (*Figure 5*, ref 3).
- Jumper JP2 allows the user to measure the sensor current consumption by connecting a multimeter in series with its terminals when a power supply in the range 3.5 V - 6.0 V is used (*Figure 5*, ref 4).

BlueMotion also integrates three LEDs:

- LED D5 (*Figure 5*, ref 5) is a general purpose LED and is used to indicate some firmware states.
- LEDs D6 and D7 (*Figure 5*, ref 6) are directly connected to the interrupt pins of the MEMS digital adapters (if available on the sensor mounted on the adapter board).

# 2 BlueMotion board installation

The software package can be downloaded from the st.com website and includes the following directory structure:

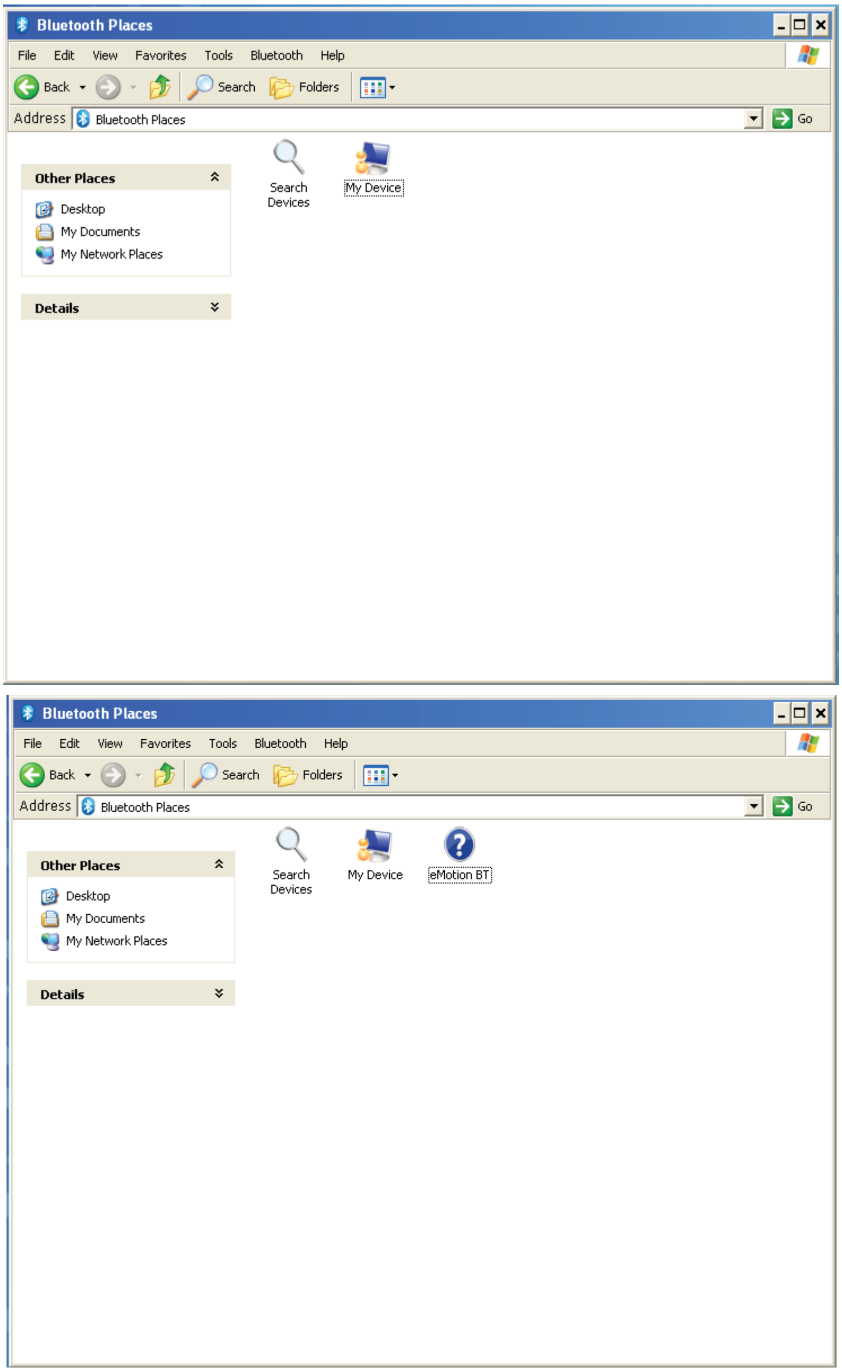
- FIRMWARE: it contains the source code of the firmware of the BlueMotion board together with the corresponding binary file that can be flashed to the board.

The section below describes the procedure for establishing a Bluetooth connection with the BlueMotion board.

## 2.1 Establishing Bluetooth connection

A Bluetooth connection to the BlueMotion board can be established in three steps: searching the BlueMotion device, pairing it and connecting to it. To search the device, open the “Bluetooth Places” using the Bluetooth software on your PC and click on “Search Devices“. The BlueMotion board should appear with the name “eMotion BT”, as shown in *Figure 7*.

**Figure 7. Searching the BlueMotion board**

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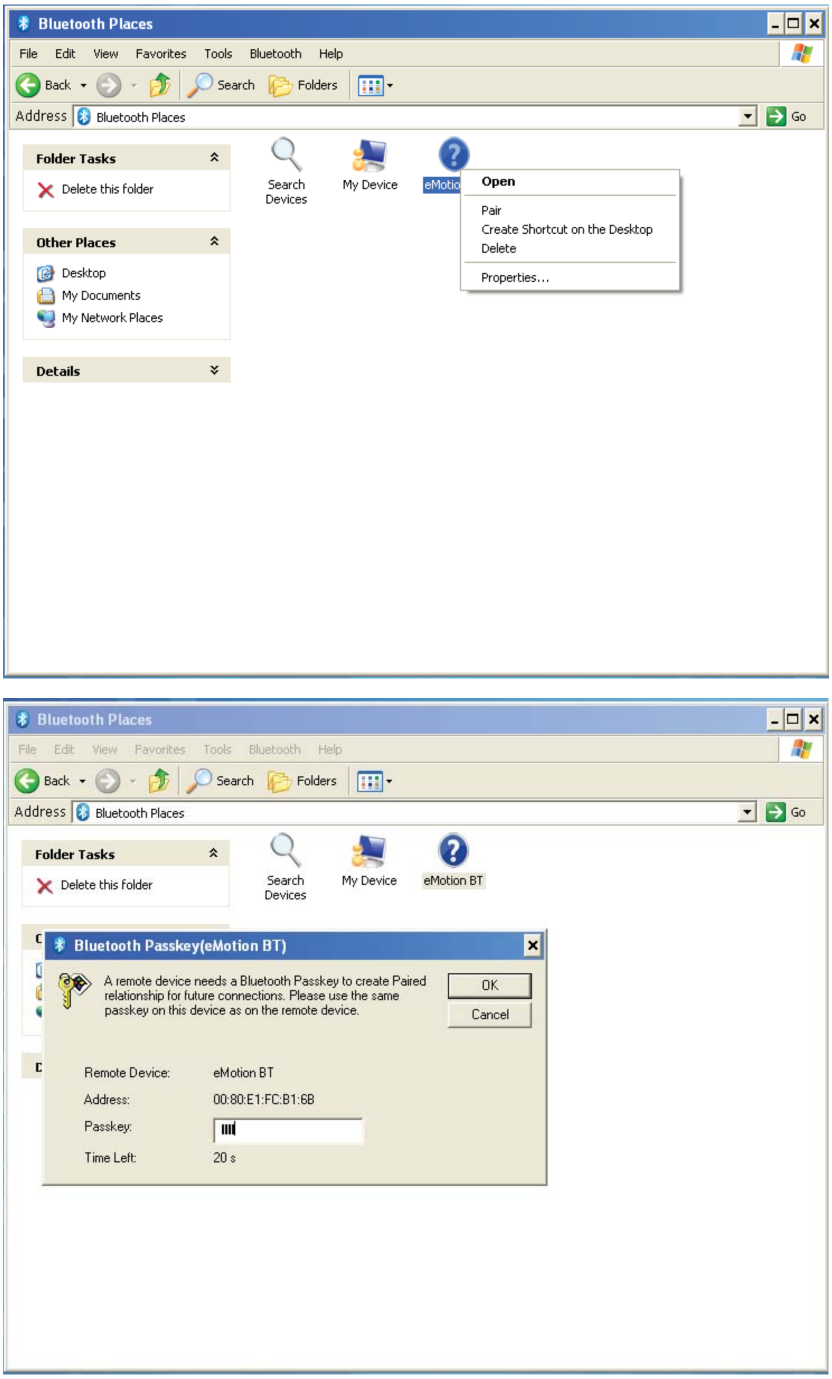
To pair the device right click on the icon “eMotion BT” and select “Pair”. Enter “1234” in the “Passkey” field in the dialogue-box (shown in *Figure 8*) and click “OK”.

**Figure 8. Pairing the BlueMotion board**

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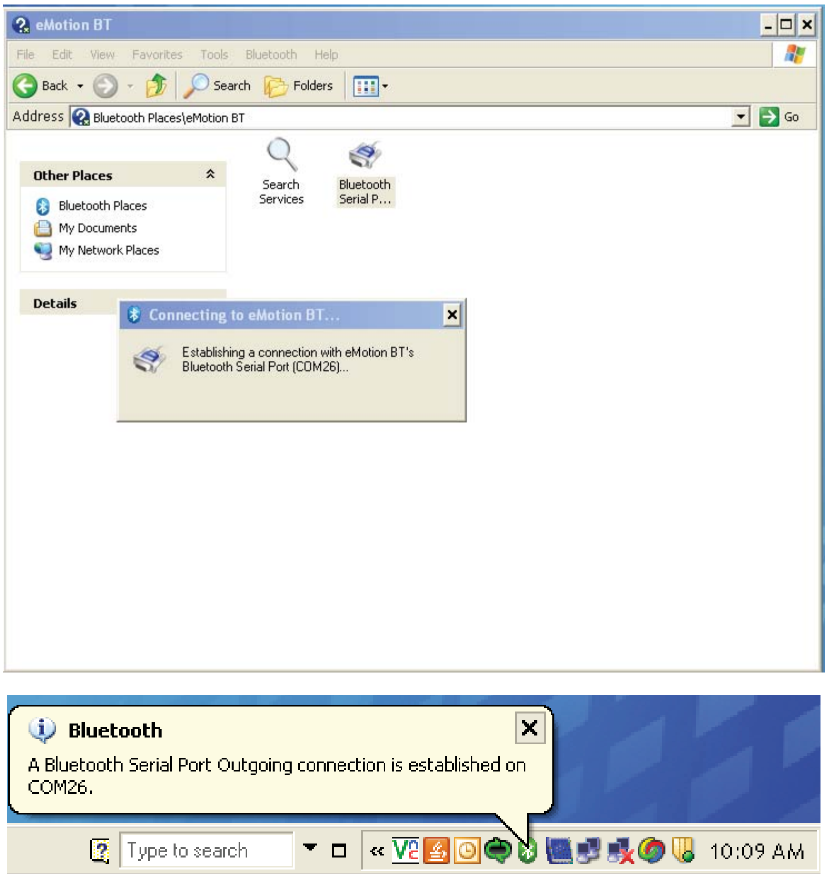
The next step is to connect to the BlueMotion board. Click on the “eMotion BT” icon and then click on the “Bluetooth Serial Port” icon, as shown in *Figure 9*. In this example the board is assigned the port “COM26”. The BlueMotion board is now connected and it can be accessed through the assigned port.

**Figure 9. Connecting to the BlueMotion board**

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# 3 Supported MEMS adapter boards

*Table 1* below provides a complete list of supported adapter boards.

**Table 1. List of supported MEMS adapter boards**

| Adapter board | Device |
|---|---|
| STEVAL-MKI089V1 | LIS331DLH |
| STEVAL-MKI105V1 | LIS3DH |
| STEVAL-MKI106V1 | LSM303DLHC |
| STEVAL-MKI107V1 | L3G4200D |
| STEVAL-MKI107V2 | L3GD20 |
| STEVAL-MKI108V1 | 9AXISMODULE v1 [LSM303DLHC + L3G4200D] |
| STEVAL-MKI108V2 | 9AXISMODULE v2 [LSM303DLHC + L3GD20] |
| STEVAL-MKI110V1 | AIS328DQ |
| STEVAL-MKI122V1 | LSM330DLC |
| STEVAL-MKI123V1 | LSM330D |
| STEVAL-MKI303V1 | LSM303D |

# 4 Supported commands

The microcontroller mounted on the BlueMotion board is equipped with dedicated firmware that supports a set of commands which allows either the digital or the analog output MEMS sensor to be controlled and permits the acquisition of the measured data. The firmware also handles the communication between the board and the PC through a Bluetooth connection. These features allow the user to easily write their own applications to exploit the capabilities of the sensor chosen.

This section describes the commands that are supported by the firmware for the microcontroller of the BlueMotion demonstration board.

## 4.1 Getting started

Before using the commands supported by the firmware, the following procedure must be performed:

1. Connect the BlueMotion to the PC using Bluetooth.
2. Launch an application which allows commands to be sent through the virtual serial port. The remainder of this document assumes the use of the “Microsoft® HyperTerminal” program available with the Windows® XP operating system.
3. Create a new connection, enter a name (e.g. “BlueMotion”), and click “OK”.
4. In the “Connect Using” field, select the Bluetooth serial COM port to which the BlueMotion has been connected, and click “OK”.
5. In port settings, set bits per second to 115200, data bits to 8, parity to none, stop bits to 1, and flow control to none. Click “OK”.
6. On the “HyperTerminal” application window choose “files” > “properties” > “settings”, then click on the “ASCII Setup” button.
7. Select “Send line ends with line feeds” and “Echo typed characters locally”.
8. Click the “OK” button to close the “ASCII Setup” window.
9. Click the “OK” button to close the “Properties” window.

Once this procedure has been completed the user can utilize the commands described in the following sections by typing them into the “HyperTerminal” window.

## 4.2 Supported commands

The firmware supports a wide range of MEMS adapters; the next section reports the complete list of supported commands (see *Table 2*) and their description.

Then, the list of commands (split into sections) available for each sensor supported by the BlueMotion firmware is reported.

### 4.2.1 Commands list and description

**Table 2. Supported commands list**

| Command | Description | Returned value |
|---|---|---|
| *setdbXXXVY | Selects firmware according to the adapter connected | |
| *start | Starts continuous data acquisition | (see Table 3) |
| *debug | Returns the output data in readable text format | (see Table 4) |
| *stop | Stops data acquisition | |
| *Zon | Forces 3-state | |
| *Zoff | Exits from 3-state | |
| *dev | Device name | e.g.: LIS3DH |
| *ver | Firmware version | e.g.: V1.0 |
| *rAA | Accelerometer register read | e.g.: RAAhDDh |
| *wAADD | Accelerometer register write | |
| *grAA | Gyroscope register read | e.g.: GRAAhDDh |
| *gwAADD | Gyroscope register write | |
| *mrAA | Magnetometer register read | e.g.: MRAAhDDh |
| *mwAADD | Magnetometer register write | |
| *single | It gets a single X, Y, and Z data acquisition | (see Table 4) |
| *list | Prints the list of MKIs supported | e.g.: MKI105V1 |
| *listdev | Prints the list of devices supported | e.g.: LIS3DH |
| *echoon | Activates the write verbose mode | e.g.: RAAhDDh |
| *echooff | Deactivates the write verbose mode | |
| *fifostr | Accelerometer “FIFO Stream” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *fifomde | Accelerometer “FIFO mode” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *fifotrg | Accelerometer “Stream-to-FIFO” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *fiforst | Accelerometer “Reset” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *gfifostr | Gyroscope “FIFO Stream” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *gfifomde | Gyroscope “FIFO mode” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *gfifotrg | Gyroscope “Stream-to-FIFO” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *gfiforst | Gyroscope “Reset” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *gfifobts | Gyroscope “Bypass-to-FIFO” enable | st 0 0 0 0 0 0 IR FC FS |

*Note: IR: interrupt byte; FC: FIFO control register; FS: FIFO source register.*

### Set demonstration board

The command *setdbxxxvy selects the part of the firmware able to handle the adapter board sensor connected to the board. e.g., in order to select the firmware for the LIS3DH the command must be: setdb105V1.

### Start command

The *start command initiates the continuous data acquisition. When this command is sent to the device, it returns a string of bytes (plus carriage return and line feed) similar to “st OUT1 OUT2 OUT3 IR BT”.

The first two bytes are always the *ASCII char “s”* and *“t”* which correspond to the hexadecimal values {73h 74h}.

OUT1, OUT2, and OUT3 are the bytes that contain the values measured at device outputs; if the output data is represented on more than 8 bits, OUT1, OUT2, and OUT3 are split into two bytes: high byte (e.g.: “XH”) and low byte (e.g.: “XL”).

IR contains the interrupt bytes and BT contains the bytes that describe the state of the buttons integrated on the board.

Specifically, bit#0 of the “BT” data corresponds to the status of the SW1 button on the demonstration board: it is set to 1 when the SW1 is pressed (otherwise 0). Bit#1 has the same behavior but is dedicated to the SW2.

Before sending the *start command, the device must be out from 3-state and some registers must be configured according to user needs, therefore, *start must be preceded by a *zoff and some “Register Write” commands.

*Table 3* shows the format of the string returned for each device when a *start command is sent.

**Table 3. Returned values for *start command**

| STEVAL # (device) | Returned value |
|---|---|
| STEVAL-MKI089V1 (LIS331DLH)<br>STEVAL-MKI105V1 (LIS3DH)<br>STEVAL-MKI107V1 (L3G4200D)<br>STEVAL-MKI107V2 (L3GD20)<br>STEVAL-MKI110V1 (AIS328DQ) | s t XH XL YH YL ZH ZL int1 int2 sw1lsw2 \r \n |
| STEVAL-MKI106V1 (LSM303DLHC)<br>STEVAL-MKI303V1 (LSM303D) | s t A_XH A_XL A_YH A_YL A_ZH A_ZL M_XH M_XL M_YH M_YL M_ZH M_ZL A_int1 A_int2 sw1lsw2 \r \n |
| STEVAL-MKI108V1 (9AXISMODULEv1)<br>STEVAL-MKI108V2 (9AXISMODULEv2) | s t A_XH A_XL A_YH A_YL A_ZH A_ZL<br>G_XH G_XL G_YH G_YL G_ZH G_ZL<br>M_XH M_XL M_YH M_YL M_ZH M_ZL<br>A_int1 A_int2 sw1lsw2 \r \n |
| STEVAL-MKI122V1 (LSM330DLC)<br>STEVAL-MKI123V1 (LSM330D) | s t A_XH A_XL A_YH A_YL A_ZH A_ZL<br>G_XH G_XL G_YH G_YL G_ZH G_ZL<br>A_int1 A_int2 G_int1 G_int2 sw1lsw2 \r \n |

*Note: XH: X axis output high byte (same for Y axis, Z axis, P pressure, and TEMP temperature).*
*XL: X axis output low byte (same for Y axis, Z axis, P pressure, and TEMP temperature).*

### Debug command

The *debug command starts the continuous data acquisition in debug mode. When this command is sent to the board, it returns the output values measured by the device formatted in a readable text format. The values shown on the screen correspond to the LSB data shown as a decimal number.

*Table 4* shows the format of the string returned for each device when a *debug command is sent.

**Table 4. Returned values for *debug command**

| STEVAL # (device) | Returned value |
|---|---|
| STEVAL-MKI089V1 (LIS331DLH)<br>STEVAL-MKI105V1 (LIS3DH)<br>STEVAL-MKI110V1 (AIS328DQ) | X=XXXXX Y=YYYYY Z=ZZZZZ |
| STEVAL-MKI106V1 (LSM303DLHC)<br>STEVAL-MKI303V1 (LSM303D) | AX=XXXXX AY=YYYYY AZ=ZZZZZ<br>MX=XXXXX MY=YYYYY MZ=ZZZZZ |
| STEVAL-MKI107V1 (L3G4200D)<br>STEVAL-MKI107V2 (L3GD20) | P=PPPPP R=RRRRR Y=YYYYY |
| STEVAL-MKI108V1 (9AXISMODULEV1)<br>STEVAL-MKI108V2 (9AXISMODULEV2) | AX=XXXXX AY=YYYYY AZ=ZZZZZ<br>MX=XXXXX MY=YYYYY MZ=ZZZZZ<br>GX=XXXXX GY=YYYYY GZ=ZZZZZ |
| STEVAL-MKI122V1 (LSM330DLC)<br>STEVAL-MKI123V1 (LSM330D) | AX=XXXXX AY=YYYYY AZ=ZZZZZ<br>GX=XXXXX GY=YYYYY GZ=ZZZZZ |

### Stop command

The *stop command interrupts any acquisition session that has been started with either the *start or *debug commands.

### Zon and Zoff

The *Zon and *Zoff commands are employed, respectively, to put into 3-state the STM32F103TB microcontroller mounted on the demonstration board. These commands allow the isolation of the sensor from the microprocessor and allow the user to interact with the sensor in a pure analog way.

By default, when the board is first turned on, the lines are in 3-state mode and the user is required to send the *Zoff command to allow communication between the sensor and the microcontroller. If Zoff has not been launched, the firmware ignores any other commands.

### Device name

The *dev command retrieves the name of the adapter connected to the demonstration board. The returned value is, for example, "LIS3DH".

### Firmware version

The *ver command queries the demonstration board and returns the version of the firmware loaded in the microprocessor, for example, "V1.0".

### Accelerometer register read

The *rAA command allows the contents of the accelerometer registers in the demonstration board to be read. AA, expressed as a hexadecimal value and written in upper case, represents the address of the register to be read.

Once the read command is issued, the board returns RAAhDDh, where AA is the address sent by the user and DD is the data present in the register.

For example, to read the register at address 0x20, the user issues the command *r20, which returns, e.g., R20hC7h.

### Accelerometer register write

The *wAADD command allows writing to the contents of the accelerometer registers of the demonstration board. AA and DD, expressed as hexadecimal values and written in upper case, represent, respectively, the address of the register and the data to be written. For example, to write 0xC7 to the register at address 0x20, the user issues the command *w20C7.

### Gyroscope register read

The *grAA command allows the contents of the gyroscope registers of the demonstration board to be read. AA, expressed as hexadecimal value and written in upper case, represents the address of the register to be read.

Once the read command is issued, the board returns GRAAhDDh, where AA is the address sent by the user and DD is the data present in the register.

For example, to read the register at address 0x20, the user issues the command *gr20, which returns, e.g., GR20hC7h.

### Gyroscope register write

The *gwAADD command allows writing to the contents of the gyroscope registers of the demonstration board. AA and DD, expressed as hexadecimal values and written in upper case, represent, respectively, the address of the register and the data to be written. To write 0xC7 to the register at address 0x20, for example, the user issues the command *gw20C7.

### Magnetometer register read

The *mrAA command allows the contents of the magnetometer registers in the demonstration board to be read. AA, expressed as a hexadecimal value and written in upper case, represents the address of the register to be read.

Once the read command is issued, the board returns MRAAhDDh, where AA is the address sent by the user and DD is the data present in the register.

For example, to read the register at address 0x00, the user issues the command *mr00, which returns, e.g., MR00h10h.

### Magnetometer register write

The *mwAADD command allows writing to the contents of the magnetometer registers of the demonstration board. AA and DD, expressed as hexadecimal values and written in upper case, represent, respectively, the address of the register and the data to be written. To write 0x20 to the register at address 0x01, for example, the user issues the command *mw0120.

### Single acquisition

The *single command may be used to read just one set of data. It requires the sensor to be well configured and once invoked, returns the read values of one data sample.

The format of the returned value is exactly the same as the *debug command (*Table 4*), in fact, the *debug command is used for continuous data acquisition purposes whereas a *single command returns just one set of data.

### List

The *list command returns the list of MKI adapters supported by the firmware, printed in ASCII format.

### Listdev

The *listdev command returns the list of devices supported by the firmware, printed in ASCII format.

### Echo on

The *echoon command is used to activate the write command verbose mode. Once this command is launched, after every write command the firmware automatically performs also a read of the register just written. This function is useful to check if the write has succeeded. For instance, if the *echoon command is launched, after a *w2027 it results R2027.

### Echo off

The *echooff command stops the write command verbose mode.

### Accelerometer FIFO Stream mode enable

The *fifostr command is used to enable the accelerometer FIFO Stream mode. For more details see the AN3308 application note.

### Accelerometer FIFO mode enable

The *fifomde command is used to enable the accelerometer FIFO mode. For more details see the AN3308 application note.

### Accelerometer Stream-to-FIFO mode enable

The *fifotrg command enables the accelerometer Stream-to-FIFO mode. For more details see the AN3308 application note.

### Accelerometer FIFO Reset enable

The *fiforst command enables the accelerometer FIFO Reset mode. For more details see the AN3308 application note.

### Gyroscope FIFO Stream mode enable

The *fifostr command is used to enable the gyroscope FIFO Stream mode.

### Gyroscope FIFO mode enable

The *gfifomde command is used to enable the gyroscope FIFO mode.

#### Gyroscope Stream-to-FIFO mode enable

The *gfifotrg command enables the gyroscope Stream-to-FIFO mode.

#### Gyroscope FIFO Reset enable

The *gfiforst command enables the gyroscope FIFO Reset mode.

#### Gyroscope FIFO Bypass-to-Stream enable

The *gfifobts command enables the gyroscope Bypass-to-Stream mode.

### 4.2.2 Digital output accelerometers: supported commands

*Table 5* below lists the commands supported by the devices/demonstration boards including a digital output accelerometer.

**Table 5. Digital output accelerometers: supported commands list**

| Command | Description | Returned value |
|---|---|---|
| *setdbXXXVY | Selects firmware according to the adapter connected | |
| *start | Starts continuous data acquisition | (see *Table 3*) |
| *debug | Returns the output data in readable text format | (see *Table 4*) |
| *stop | Stops data acquisition | |
| *Zon | Forces 3-state | |
| *Zoff | Exits from 3-state | |
| *dev | Device name | e.g.: LIS3DH |
| *ver | Firmware version | e.g.: V1.0 |
| *rAA | Accelerometer register read | e.g.: RAAhDDh |
| *wAADD | Accelerometer register write | |
| *single | It gets a single X, Y, and Z data acquisition | (see *Table 4*) |
| *list | Prints the list of MKIs supported | e.g.: MKI105V1 |
| *listdev | Prints the list of devices supported | e.g.: LIS3DH |
| *echoon | Activates the write verbose mode | e.g.: RAAhDDh |
| *echooff | Deactivates the write verbose mode | |
| *fifostr(1) | Accelerometer “FIFO Stream” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *fifomde(1) | Accelerometer “FIFO mode” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *fifotrg(1) | Accelerometer “Stream-to-FIFO” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *fiforst(1) | Accelerometer “Reset” mode enable | st 0 0 0 0 0 0 IR FC FS |

1. Available only for devices with embedded FIFO.

*Note: IR: interrupt byte; FC: FIFO control register; FS: FIFO source register.*

### 4.2.3 Digital output gyroscopes: supported commands

Table 6 below lists the commands supported by the devices/demonstration boards including a digital output gyroscope:

Table 6. Digital output gyroscopes: supported commands list

| Command | Description | Returned value |
|---|---|---|
| *setdbXXXVY | Selects firmware according to the adapter connected | |
| *start | Starts continuous data acquisition | (see Table 3) |
| *debug | Returns the output data in readable text format | (see Table 4) |
| *stop | Stops data acquisition | |
| *Zon | Forces 3-state | |
| *Zoff | Exits from 3-state | |
| *dev | Device name | e.g.: LIS3DH |
| *ver | Firmware version | e.g.: V1.0 |
| *grAA | Gyroscope register read | e.g.: GRAAhDDh |
| *gwAADD | Gyroscope register write | |
| *single | It gets a single X, Y, and Z data acquisition | (see Table 4) |
| *list | Prints the list of MKIs supported | e.g.: MKI105V1 |
| *listdev | Prints the list of devices supported | e.g.: LIS3DH |
| *echoon | Activates the write verbose mode | e.g.: RAAhDDh |
| *echooff | Deactivates the write verbose mode | |
| *gfifostr(1) | Gyroscope “FIFO Stream” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *gfifomde(1) | Gyroscope “FIFO mode” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *gfifotrg(1) | Gyroscope “Stream-to-FIFO” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *gfiforst(1) | Gyroscope “Reset” mode enable | st 0 0 0 0 0 0 IR FC FS |
| *gfifobts(1) | Gyroscope “Bypass-to-FIFO” enable | st 0 0 0 0 0 0 IR FC FS |

1. Available only for devices with embedded FIFO.

*Note: IR: interrupt byte; FC: FIFO control register; FS: FIFO source register.*

### 4.2.4 Digital output magnetometers: supported commands

Table 7 below lists the commands supported by the devices/demonstration boards including a digital output magnetometer:

Table 7. Digital output magnetometer: supported commands list

| Command | Description | Returned value |
|---|---|---|
| *setdbXXXVY | Selects firmware according to the adapter connected | |
| *start | Starts continuous data acquisition | (see *Table 3*) |
| *debug | Returns the output data in readable text format | (see *Table 4*) |
| *stop | Stops data acquisition | |
| *Zon | Forces 3-state | |
| *Zoff | Exits from 3-state | |
| *dev | Device name | e.g.: LIS3DH |
| *ver | Firmware version | e.g.: V1.0 |
| *mrAA | Pressure sensor register read | e.g.: MRAAhDDh |
| *mwAADD | Pressure sensor register write | |
| *single | It gets a single X, Y, and Z data acquisition | (see *Table 4*) |
| *list | Prints the list of MKIs supported | e.g.: MKI105V1 |
| *listdev | Prints the list of devices supported | e.g.: LIS3DH |
| *echoon | Activates the write verbose mode | e.g.: MRAAhDDh |
| *echooff | Deactivates the write verbose mode | |

## 4.3 Quick start

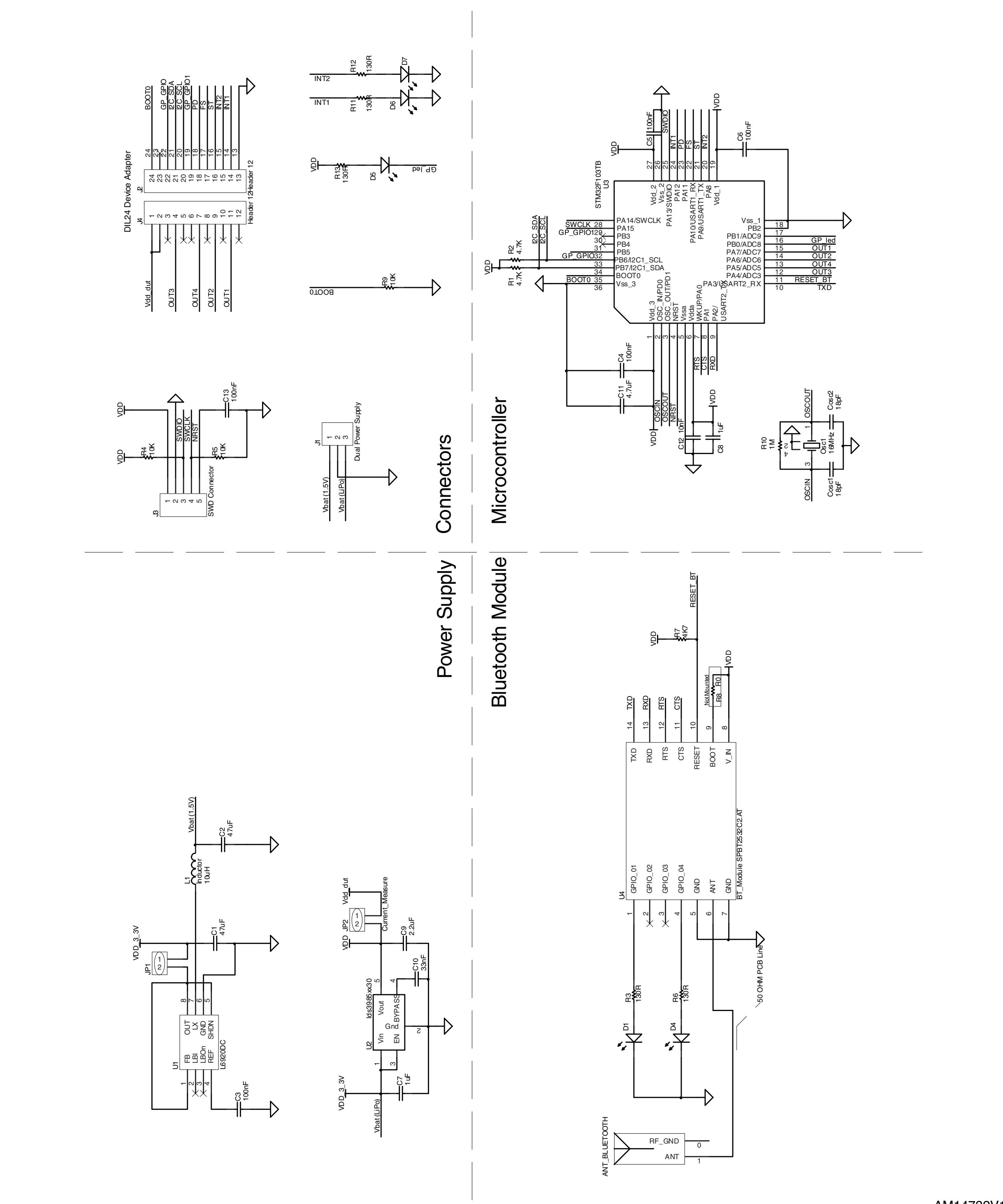
This section shows the basic sequence of commands, based on the LIS3DH accelerometer, to start a data communication session and to retrieve the X, Y, and Z acceleration data from the demonstration board:

1. Connect the BlueMotion to the PC using Bluetooth.
2. Start the “Microsoft HyperTerminal” and configure it as described in *Section 4.1*.
3. Inside the “HyperTerminal” window, enter the command *setdb105v1 (supposing the LIS3DH adapter board is used, for other adapters see the relevant datasheets to check the register configuration), enter the command *Zoff to enable the control of the device by the STM32F103TB microcontroller, and *w2047 to switch on the LIS3DH and to set the data rate to 50 Hz.
4. Send the *debug command to get the X, Y, and Z data measured by the sensor.
5. Send *stop to end the continuous acquisition and visualization.

# 5 Schematic diagrams

The schematic diagrams of the BlueMotion demonstration board are shown in *Figure 10*.

**Figure 10. BlueMotion board (power supply and USB)**




AM14732V1

# 6 Bill of materials

The bill of materials for the BlueMotion demonstration board is provided in *Table 8* below.

**Table 8. Bill of materials**

| Component | Qty. | Description | Value | Package |
|---|---|---|---|---|
| C1 | 1 | CAP | 47 $\mu$F | 0805 |
| C2 | 1 | CAP | 47 $\mu$F | 0805 |
| C3 | 1 | CAP | 100 nF | 0402 |
| C4 | 1 | CAP | 100 nF | 0402 |
| C5 | 1 | CAP | 100 nF | 0402 |
| C6 | 1 | CAP | 100 nF | 0402 |
| C7 | 1 | CAP | 1 $\mu$F | 0402 |
| C8 | 1 | CAP | 1 $\mu$F | 0402 |
| C9 | 1 | CAP | 2.2 $\mu$F | 0402 |
| C10 | 1 | CAP | 33 nF | 0402 |
| C11 | 1 | CAP | 4.7 $\mu$F | 0603 |
| C12 | 1 | CAP | 10 nF | 0402 |
| C13 | 1 | CAP | 100 nF | 0402 |
| Cosc1 | 1 | CAP | 18 pF | 0402 |
| Cosc2 | 1 | CAP | 18 pF | 0402 |
| D1 | 1 | LED_SMD | LED_SMDg | LED_SMD_0603 |
| D4 | 1 | LED_SMD | LED_SMDr | LED_SMD_0603 |
| D5 | 1 | LED_SMD | LED_SMDg | LED_SMD_0603 |
| D6 | 1 | LED_SMD | LED_SMDg | LED_SMD_0603 |
| D7 | 1 | LED_SMD | LED_SMDr | LED_SMD_0603 |
| J1 | 1 | MHDR1X3 | Dual power supply | HDR1X3 |
| J4 | 1 | Header 12 | | HDR1X12 |
| J2 | 1 | Header 12 | | Header _13_to_24 |
| J3 | 1 | Header 5 | SWD connector | MHDR1X5 |
| JP1 | 1 | CON2 | Current_measure | Header 1x2 2 mm |
| JP2 | 1 | CON2 | Current_measure | Header 1x2 2 mm |
| L1 | 1 | Inductor | Inductor | 1210(2) |
| Osc1 | 1 | Ceramic SMD crystal 3.2x2.5 mm | 16 MHz | Ceramic SMD crystal 3.2x2.5 mm |
| R1 | 1 | Res1 | 4.7 KΩ | 0402 |
| R2 | 1 | Res1 | 4.7 KΩ | 0402 |

Table 8. Bill of materials (continued)

| Component | Qty. | Description | Value | Package |
|---|---|---|---|---|
| R3 | 1 | Res1 | 130R | 0402 |
| R4 | 1 | Res1 | 10 KΩ | 0402 |
| R5 | 1 | Res1 | 10 KΩ | 0402 |
| R6 | 1 | Res1 | 130R | 0402 |
| R7 | 1 | Res1 | 4K7 | 0402 |
| R9 | 1 | Res1 | 10 KΩ | 0603 |
| R10 | 1 | Res1 | 1 MΩ | 0402 |
| R11 | 1 | Res1 | 130R | 0402 |
| R12 | 1 | Res1 | 130R | 0402 |
| R13 | 1 | Res1 | 130R | 0402 |
| U1 | 1 | L6920 | L6920DC | L6920DC |
| U2 | 1 | Component_1 | lds3985xx30 | SOT23-5 |
| U3 | 1 | STM32F103TB_VFQFPN36 | STM32F103TB | VFQFPN36 |
| U4 | 1 | Bluetooth_module | BT_module SPBT2532C2.AT | SPBT25532C2.AT |
| U5 | 1 | ANT_BLUETOOTH | ANT_BLUETOOTH | Antenna Johanson |

# 7 Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 29-Jan-2013 | 1 | Initial release. |