USB ZigBee Adapter

User Manual

1.0, Dec 2011

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Chapter 1. Introduction

ZigBee is a low power, wireless mesh network standard, largely used in the areas of home automation, medical data collection and industrial control. The USB ZigBee Adapter connects a PC or any USB capable host to a ZigBee network.

At the core of the USB ZigBee Adapter is the XBee module from Digi, which implements the ZigBee stack. Once connected to the PC, the USB ZigBee Adapter is visible as a virtual COM port. The user can interact with the ZigBee stack, by sending commands through the virtual COM port.

The USB ZigBee Adapter also doubles up as an XBee Module Programmer for firmware upgrades.

1. Features

- USB Powered
- Built in +3.3V regulator for XBee module
- XBee ZB and XBee-PRO ZB compatible
- LEDs for TX/RX and ZigBee state
- Debug LED and Key
- Local and remote loopback

2. Wireless Parameters

Parameter	XBee ZB	XBee-PRO ZB
Data rate	250Kbps	250Kbps
Indoor range	40m	90m
Line of sight	120m	1500m
Tx. Power	1.25mW / 2mW	63mW

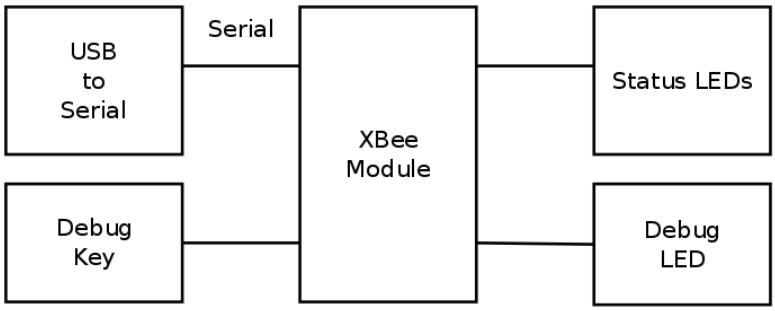
The international variant of XBee-Pro ZB are limited to 10mW Tx. Power

Chapter 2. Board Design

1. Overview

The devices available on the board, is shown in the following block diagram. Each device is described in details in the following sections.

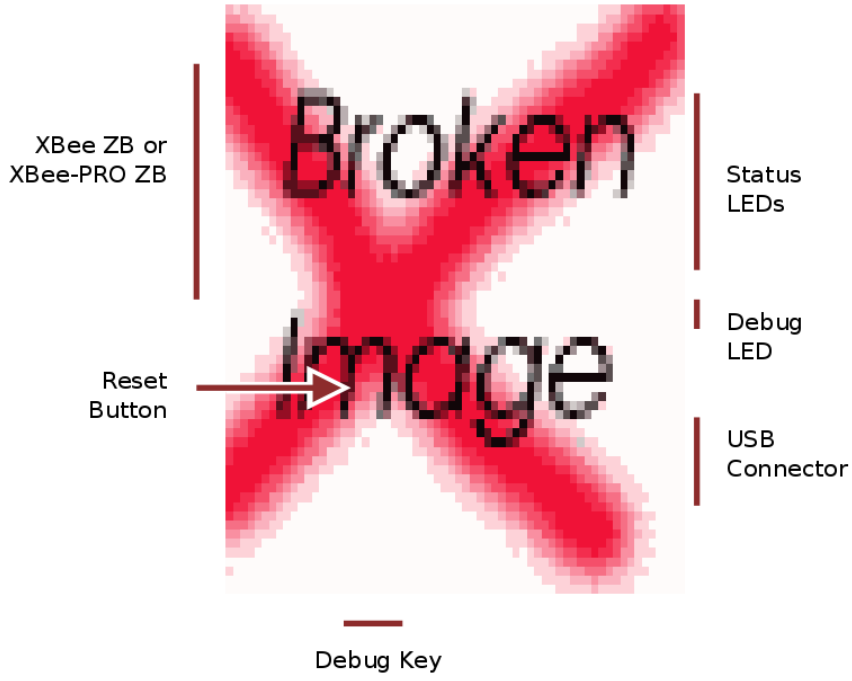
Figure 2.1. Block Diagram



2. Locating Components

The location of the components on the board is indicated in the following diagram.

Figure 2.2. Front View



3. Power Supply

The USB ZigBee Adapter is powered from a PC USB port, and does not require an external power supply.

4. XBee Module

The XBee ZB Module or XBee-PRO ZB Module can be mounted in the USB ZigBee Adapter. The module provides a UART interface through which the host PC can send and received data. The module can also be configured through the serial interface.

5. USB Serial

The USB ZigBee Adapter has a FT232R USB to serial UART converter, for communication between the host PC and the XBee module. The OS detects the USB Serial device as a Virtual COM port. Any standard serial terminal application should be able to communicate with the XBee module, using the Virtual COM port.

The RTS and CTS signals of the USB serial converter are connected to the XBee module, for optional hardware flow control. The DTR signal of the USB serial converter is also connected to the XBee module, for switching the module into firmware upgrade mode, during module power up.

6. Status LEDs

The status LEDs indicate the following information.

RXD LED	Blink indicates data has been received by the module from the host.
TXD LED	Blink indicates data has been transmitted by the module to the host.
ASC LED	Continuos blinking indicates associated with a network, in case of a router or end device. And PAN ID and radio channel has been selected in the case of coordinator.
SIG LED	Brighter LED indicates a more stable link. In other words, shows the received signal strength of the last received packet.
NAP LED	On indicates device has woken up from sleep state.

7. Debug Key & LED

A Debug Key and Debug LED is provided for testing the local and remote IOs. The Debug Key is connected to the pin `DIO11` of the XBee module. The Debug LED is connected to the pin `DIO4` of the XBee module.

Chapter 3. Board Usage

1. AT Mode and API Mode

The XBee modules can communicate using two protocols with the host.

1. AT Mode
2. API Mode

In AT mode, the module provides an AT command interface, similar to AT modem commands, for configuration. The AT mode also supports transparent mode of operation in which serial data sent to the module, is transmitted over the air to a remote ZigBee node.

In API mode, the module uses a binary packet interface for communicating with the host. The available packets and their formats is described in the module user manual.

2. Updating the Firmware

Separate firmware is available to make the XBee module operate as a coordinator, router or end device. Moreover separate firmware is available for AT mode and API mode.

The firmware is identified using a version no. Firmware version nos. have the format `ABCD`, where `A`, `B`, `C` and `D` are hexadecimal digits `0x0` - `0xF`. Each digit has the following meaning.

Digit	Value	Meaning
A	1	indicates 802.15.4 firmware
	2	indicates ZigBee firmware
B	0	indicates ZigBee Coordinator, AT Command Mode
	1	indicates ZigBee Coordinator, API Mode
	2	indicates ZigBee Router, AT Command Mode
	3	indicates ZigBee Router, API Mode
	4	indicates ZigBee End Device, AT Command Mode
	5	indicates ZigBee End Device, API Mode
C	even	indicates stable releases
	odd	indicates development releases
D	-	not clear from Digi's documentation

The firmware can be obtained from, Digi's FTP site ftp://ftp1.digi.com/support/firmware/update/xbee_zb/

2.1. Updating the firmware in Linux

The firmware can be updated from Linux using `xbfwup` on Linux. The steps to update the firmware is given below.

1. Identify the firmware version to be downloaded.
2. Download the firmware from Digi's FTP site.
3. Unzip the downloaded .ZIP file.
4. Use `xbfwup` to update the firmware.

For example to update the firmware of the module to Coordinator in AT mode.

1. The firmware version to be downloaded should look like 20xx.

2. Download the file ftp://ftp1.digi.com/support/firmware/update/xbee_zb/XB24-ZB_2070.zip

```
$ wget ftp://ftp1.digi.com/support/firmware/update/xbee_zb/XB24-ZB_2070.zip
```

3. Unzip the downloaded zip archive.

```
$ unzip XB24-ZB_2070.zip
```

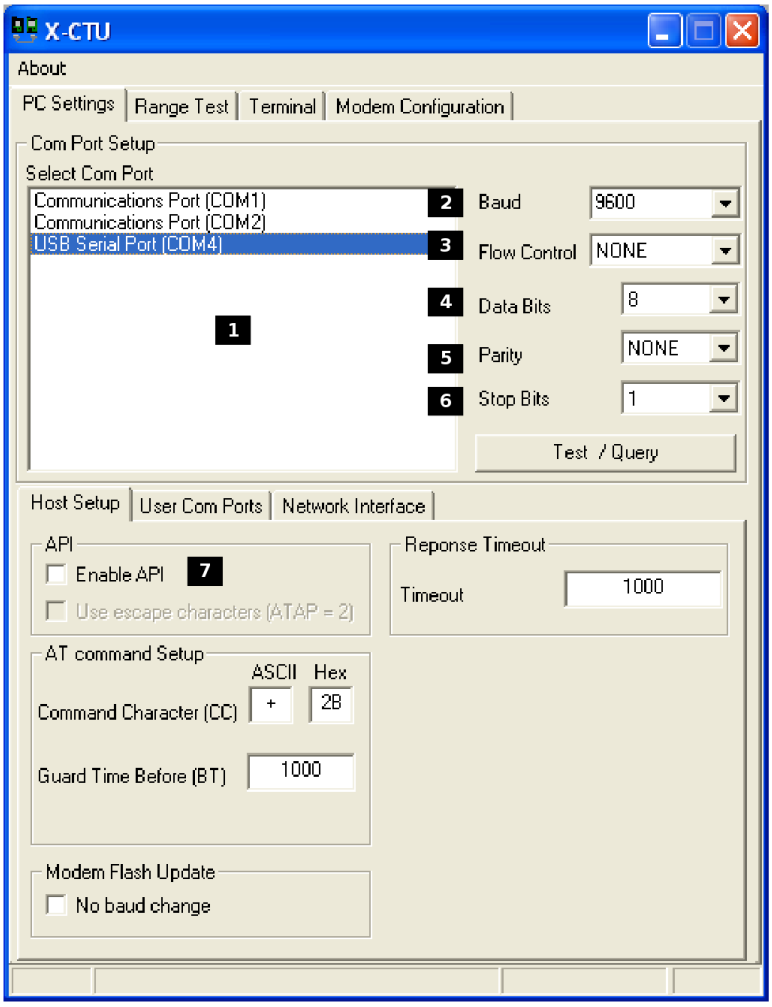
4. Update the firmware using `xbfwup`. Specify the current mode using the `-A <mode>` option. `mode` is 1 for API mode, and 0 for AT mode. Specify the serial device file using `-d <device>` option.

```
$ cd ebl_files
$ xbfwup -A 1 -d /dev/ttyUSB0 XB24-ZB_2070.ebl
```

2.2. Updating the firmware in Windows

The firmware can be updated from Windows using the `X-CTU` application from Digi. The steps to update the firmware is given below.

Figure 3.1. PC Settings



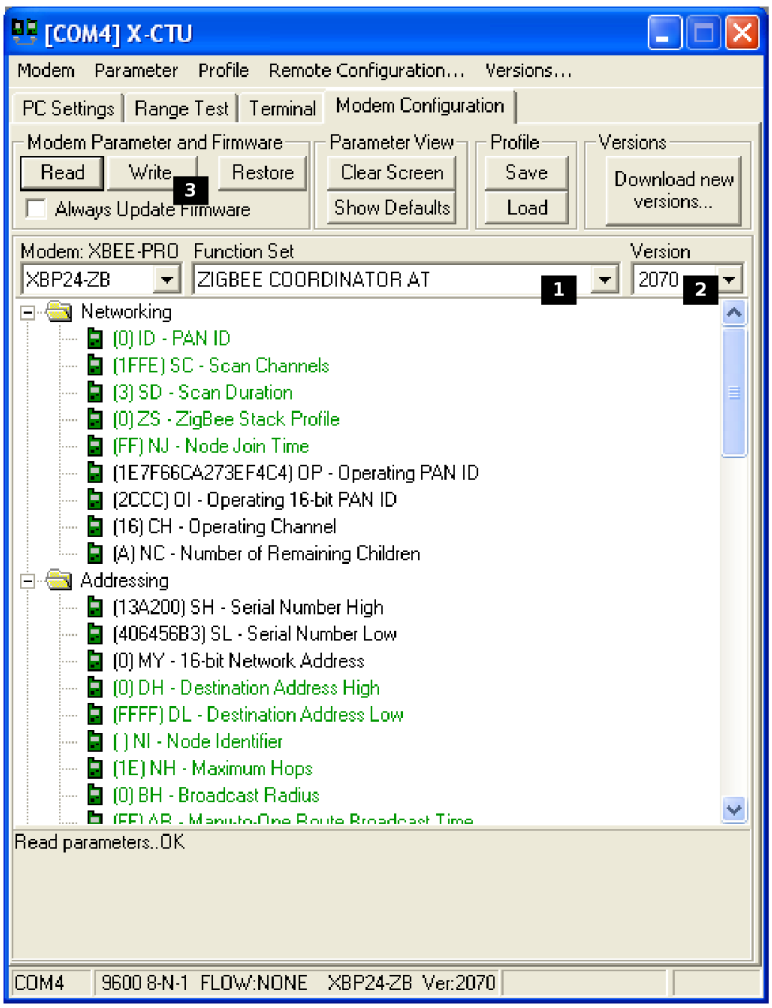
In the *PC Settings* tab, configure the following parameters.

No.	Parameter	Value
1	Select COM Port	USB Serial Port

No.	Parameter	Value
2	Baudrate	9600
3	Data Bits	8
4	Parity	NONE
5	Stop Bits	1
6	Flow Control	NONE
7	Enable API	True / False

The *Enable API* parameter depends on the current firmware within the device. If the current firmware is API firmware set this to True. If the current firmware is AT firmware set this to False.

Figure 3.2. Modem Configuration



In the *Modem Configuration* tab:

1. Select the firmware type in the *Function Set* combo box.
2. Select the required firmware version in the *Version* combo box.
3. Click the *Write* button to update the firmware.

3. Communicating in AT mode

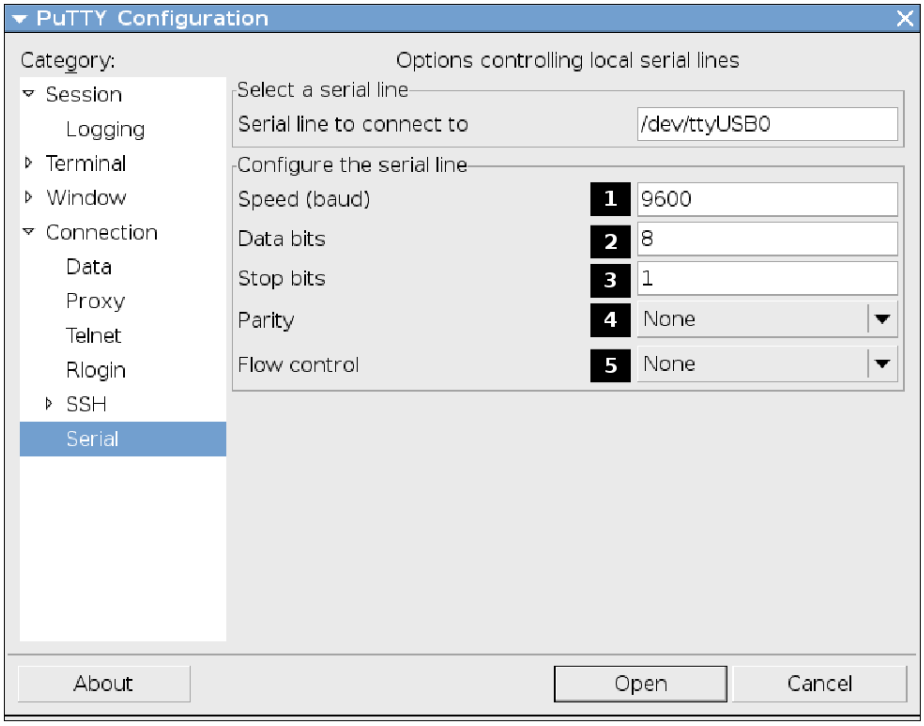
The module is first updated with an AT mode firmware. AT commands can then be sent to the device using a terminal software, like putty, hyperterminal or minicom.

When the device is connected to the host system, it is detected a Virtual COM device in Windows, and a USB serial device in Linux. The procedure to determine the COM port name in Windows, is specified in Appendix B, *Determining COM Port*.

The terminal software configuration is shown below with `putty` as an example. Open up the putty, and configure the following parameters in the *Serial* panel.

No.	Parameter	Value
1	Baudrate	9600
2	Data Bits	8
3	Stop Bits	1
4	Parity	None
5	Flow Control	None

Figure 3.3. Serial Configuration Screenshot



Configure the following parameters in the *Terminal* panel.

No.	Parameter	Value
1	Implicit LF in every CR	True
2	Local Echo	Force On

Figure 3.4. Terminal Configuration Screenshot

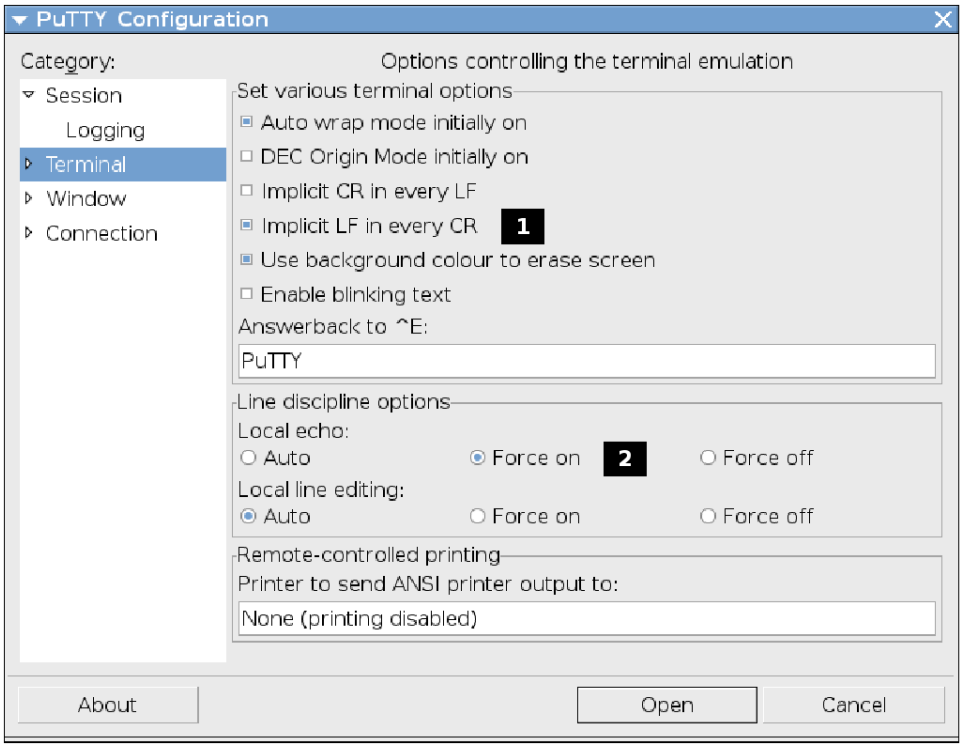
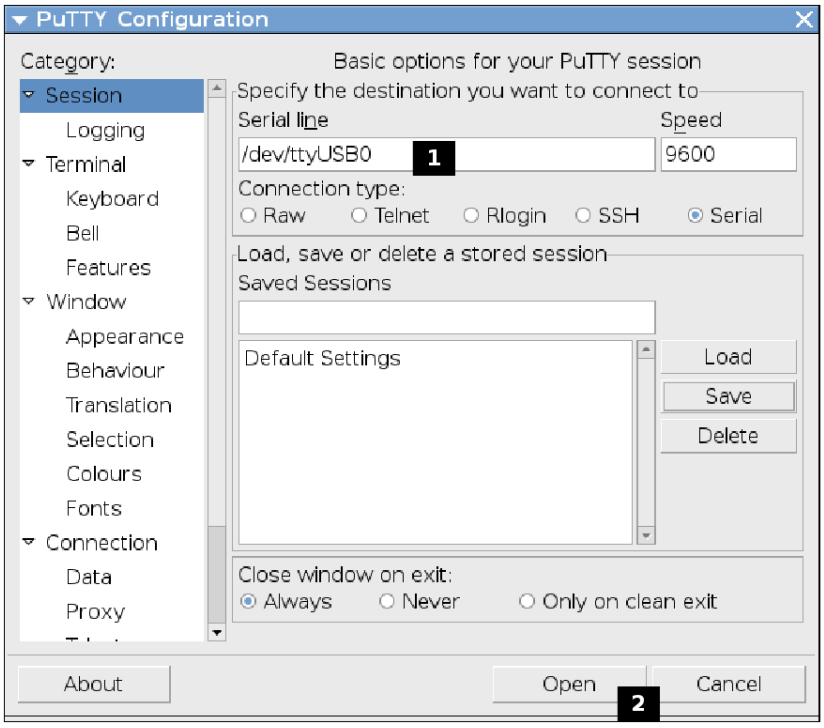


Figure 3.5. Session Screenshot



In the *Session* panel,

1. Specify the serial port device name.
2. Click the *Open* button.

By default the module will be in transparent mode of operation, to enter AT command mode type +++. A one second gap, called the guard time, should be provided before and after the +++ sequence. The

module on entry into AT command mode, responds with `OK\r`. After which AT commands can be sent to the device.

For example, to get the firmware version (VR), the following sequence of commands can be used.

```
U: +++
M: OK
U: ATVR
M: 2070
```

The character + used for entering the AT command mode, is called the Command Character. The guard time and command character is configurable using AT commands. The default is 1 second and +, respectively.

The module can be put back to transparent mode of operation manually using the CN AT command. The module also switches back to transparent mode of operation after a timeout, 10 seconds by default. The command mode timeout is also configurable using the CT AT command.

4. Sending and Receiving Data in Transparent Mode

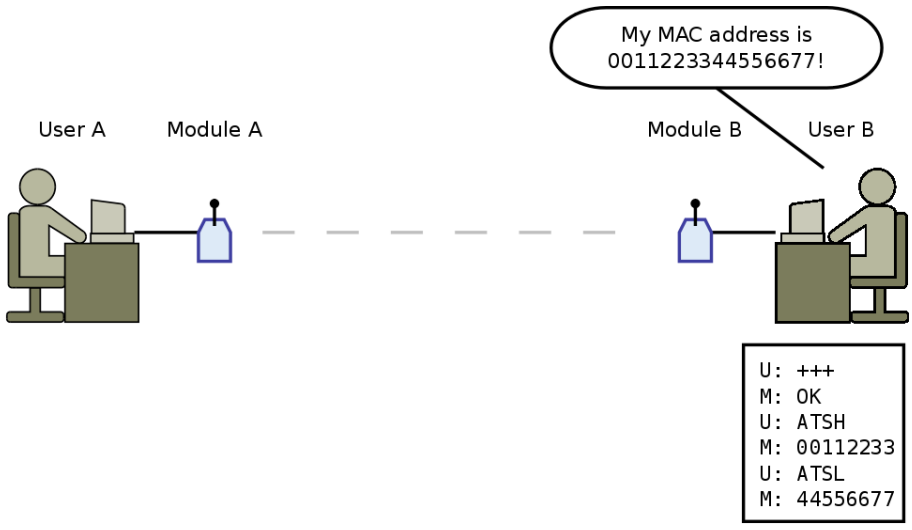
Transparent mode of operation is demonstrated using a two node network, consisting of a coordinator and router. The following sequence shows how to send a message from the coordinator to the router.

1. Update the coordinator AT firmware in module A, and router AT firmware in module B.
2. Connect the ZigBee Adapters to the host PC. Ensure the ASC LED is blinking in both the modules.

Figure 3.6. Two Node Network

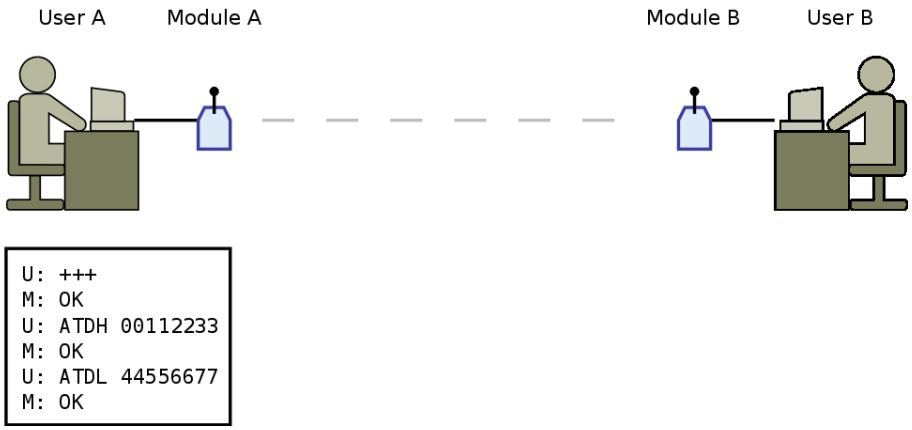
3. Note down the 64-bit MAC address specified in the module B. The 64-bit MAC of the module can be obtained from the label on the back of the module. The 64-bit MAC can also be obtained using the SH and SL AT commands.

Figure 3.7. Obtaining MAC address



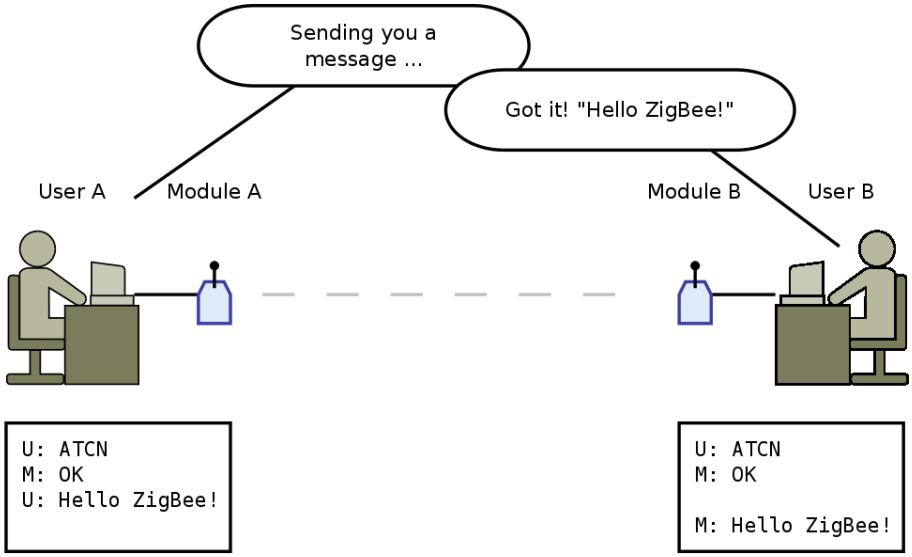
4. In module A, set the destination addressing using the DH and DL AT commands. DH is used to specify the higher order 32 bits and DL is used to specify the lower order 32 bits.

Figure 3.8. Setting the Destination



5. Switch both the module into transparent mode of operation, using the CN AT command. Type a message to be sent to module B, the message should appear on module B's serial output.

Figure 3.9. Sending and Receiving Message



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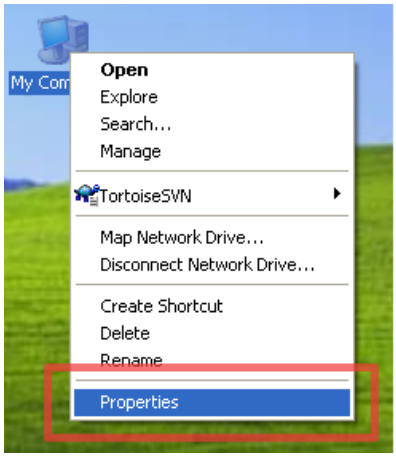
Appendix B. Determining COM Port

The USB Serial Adapter uses a USB serial interface to communicate with the PC. When the USB port of the board is connected to the PC, MS Windows assigns a COM port to the board. To determine the assigned COM port, follow the instructions given below.

Step 1. Right click on the `My Computer` icon, to get the drop down menu. Select the `Properties` from the menu.



Step 2. In the `System Properties` window that appears, select the `Hardware` tab. In the tab, click on the `Device Manager` button.

Step 3. In the `Device Manager` window, a tree of devices present in the system is shown. Expand the `Ports` node in the device tree. Look for an entry called `USB Serial Port`. The assigned COM port is specified in parenthesis, as shown in the figure below. If this does not appear make sure you have installed the driver correctly as mentioned in installation manual.