Quick Start Guide

XBee & XBee-PRO Radio Modules on CB-1 peripheral board

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1. Introduction

This Quick Start Guide provides step-by-step instruction on:

- Preparing two Zigbee nodes based on XBee Zigbee radio modules, CB-1 peripheral boards and MINI-MAX/51 single board computers
- Upgrading Xbee firmware to the latest version
- Setting up wireless links between the two nodes.



Figure 1

2. XBee/XBee-PRO OEM Radio Module Basics

The XBee and XBeePRO OEM Radio Modules are manufactured by Maxstream. These modules meet IEEE 802.15.4 standards and support wireless sensor networks. The modules operate within the ISM 2.4 GHz frequency band and are pin-for-pin compatible with each other.

Xbee Specifications:

- Indoor/Urban: up to 100 feet (30 meters)
- Outdoor line-of-sight: up to 300 feet (100 meters)
- Transmit Power: 1 mW (0 dBm)
- Receiver Sensitivity: -92 dBm

XBee-PRO Specifications:

- Indoor/Urban: up to 300 feet (100 meters)
- Outdoor line-of-sight: up to 1 mile (1500 meters)
- Transmit Power: 100 mW (20 dBm) EIRP
- Receiver Sensitivity: -100 dBm

RF Data Rate: 250,000 bps

3. Software setup

3.1) Download and install the latest release of the 8051 Development System from <u>http://www.bipom.com/8051dev.php</u>

Development software components include Micro-IDE, Micro C Compiler, Simulator and Debugger. Serial Number is 1 for DEMO version.

3.2) Download and install the FREE X-CTU utility from <u>http://www.maxstream.net/</u> For example, <u>http://ftp1.digi.com/support/utilities/40002637_A.exe</u>

4. Hardware setup

- 4.1) Required Components
- 2 pieces of OEM RF Modules (any combination of XBee & XBee-PRO Modules)
- 2 pieces of CB-1 peripheral boards
- 2 pieces of MINI-MAX/51 single board computers
- 2 pieces of special NULL-modem cables to configure the nodes using the X-CTU utility

Please read <u>http://www.bipom.com/hyperterminal.php</u> for more details.

- 2 pieces of 6VDC Adapters
- 2 PC with serial ports (One PC with two serial ports can be used for testing)

4.2) Install JP4 and JP6 jumpers on both CB-1 boards.

4.3) Install XBee/XBeePRO modules to both CB-1 boards.

4.4) Plug the CB-1 boards into Expansion connectors of MINI-MAX/51 boards.

4.5) Connect a special serial cable between COM1 serial port of first PC and first MINI-MAX/51.

4.6) Connect a special serial cable between COM1 serial port of second PC and second MINI-MAX/51 board. If the setup is based on a PC with two serial ports, then COM2 can be connected to the second MINI-MAX/51.

4.7) Power both MINI-MAX/51 boards from 6VDC adapters.

5. Firmware setup

5.1) Download the 8051 firmware project that includes HEX file from <u>http://www.bipom.com/support/Xbee.zip</u>.

The 8051 development system provides the same project under C:\bipom\devtools\MicroC\Examples\8051\medium\cb1\Xbee folder.

5.2) Unzip Xbee.zip to any folder on the hard drive; for example, C:\Xbee

5.3) Run Micro-IDE and open cb1xbee.prj project

5.4) Press "Download" icon button to download the pre-compiled firmware (cb1xbee.hex) to both MINI-MAX/51 boards.

If you face any problems downloading the firmware, please visit <u>http://www.bipom.com/mm51c2_faq.php</u> for more information.

6. How does a PC communicate with an XBee/XBeePRO module on CB-1 board ?

The XBee/XBee-PRO OEM Radio Modules interface to a host device through a logic-level (CMOS/TTL) asynchronous serial port. Through its serial port, the module can communicate with any logic and voltage compatible UART. CB-1 peripheral board provides an SC16IS762 IC that has an SPI bus interface to UART. The 8051 micro-controller on the MINI-MAX/51 board communicates with the SC16IS762 via SPI of Expansion connector. MINI-MAX/51 provides a standard RS232 port to connect to a PC. Figure 2 shows the details of the interface.



Figure 2.

7. Configure an XBee/XBeePRO module on CB-1 board

7.1) Run the X-CTU utility. Select Communications Port (COM1) and click the Test/Query button.

🕂 х-сти		
PC Settings Range Test Terminal Modem Configuration		
Com Port Setup		
Select Com Port Bluetooth Communications Po(COM8) Restarts Communications Pro(COM8)	Baud 9600 💌	
Communications Pot. (COM3) Communications Port (COM1) Communications Port (COM2)	Flow Control NONE	
	Data Bits 8 💌	
	Parity NONE -	
	Stop Bits 1	
	Test / Query	
Host Com test / Query Modem Communication with modemOK Modem type = XBP24 Modem firmware version = 10A5 Cc Gu Retry	<u>OK</u>	
Guard Time After (AT)		
No baud change		

If the hardware setup is built correctly, it will display "Communication with modem..OK"

7.2) Go To Modem Configuration and click the Read Button (the radio modules are referred to as Modem):



7.3) Edit the following critical parameters:

Channel **C** PAN ID **3332** Destination Address High **0** Destination Address Low **0** 16-bit Source Address **0**

Uncheck "Always update firmware" and click the Write Button:

🖳 х-сти [сом1]	×	
PC Settings Range Test Terminal Modem Configuration		
Modem Parameters and Firmware Parameter View Profile Versions		
Read Write Restore Clear Screen Save Download new	.1	
Always update firmware Show Defaults Load versions		
Made VDEE Evention Cat		
Modem: XBEE Function Set Version	л II	
	2	
E 🔄 Networking & Security	^	
E (C) CH - Channel		
(0) DH - Destination Address High		
 (i) DF - Destination Address Fight (ii) DL - Destination Address Low 	Ξ	
(0) MY - 16-bit Source Address		
SH - Serial Number High		
SL - Serial Number Low	-	
🔄 🖪 (0) RR - XBee Retries		
🖢 (0) RN - Random Delay Slots		
🖥 (0) MM - MAC Mode		
🖥 (19) NT - Node Discover Time		
📮 (0) CE - Coordinator Enable		
🔤 (1FFE) SC - Scan Channels		
🚽 🖬 (4) SD - Scan Duration		
U) A1 - End Device Association		
UJAZ - Coordinator Association		
Association Indication		
Getting modern ture OK		
Modem's firmware not updated		
Setting AT parametersOK		
white FalanetersComplete		
COM1 9600 8-N-1 FLOW:NONE XBP24 Ver:10A4		

7.4) Please check the version. If the newest version is present under a pull-down list, it is possible to update a modem firmware. Select the necessary version, check "Always update firmware", and click the Write button:

🖳 х-сти [сом1]			
PC Settings Range Test Terminal Modem Configuration			
Modem Parameters and Firmware Parameter View Profile Versions			
Read Write Restore Clear Screen	Save Download new		
Always update firmware Show Defaults	Load versions		
Modem: XBEE Function Set	Version		
XBP24 XBEE PRO 802.15.4	▼ 10A5 ▼		
🖃 📇 Networking & Security	~		
🔤 (C) CH - Channel			
📮 (3332) ID - PAN ID			
🔤 (0) DH - Destination Address High			
(0) DL - Destination Address Low			
U) MY - 16-bit Source Address			
SH - Serial Number High			
(0) FIN • Abeen eules			
(0) MM - MAC Mode			
19) NT - Node Discover Time			
(0) CE - Coordinator Enable			
📔 (1FFE) SC - Scan Channels			
📘 (4) SD - Scan Duration			
🔤 🖥 (0) A1 - End Device Association			
📮 (0) A2 - Coordinator Association			
Al - Association Indication			
🖬 (0) EE - AES Encryption Enable			
📮 KY - AES Encryption Key	× .		
Getting modern typeOK			
Programming modemUK Setting & Tiparameters: DK			
Write ParametersComplete			
COM1 9600 8-N-1 FLOW:NONE XBP24 Ver:10A4			

IMPORTANT NOTE1: Be careful when updating the modem firmware. If the board loses link or power during this procedure, the firmware will be corrupted and the modem will not respond anymore. To repair the modem, it will be necessary to connect an XBee/XBeePRO module to a PC's COM port using a special RS232 converter. TXD, RXD, RTS, DTR lines should be connected properly.

IMPORTANT NOTE2: X-CTU utility does not work reliably with some USB-to-Serial COM port adapters. Therefore, in some cases it will be impossible to upgrade the modem's firmware. Configuration will work in any case.

8. Establish Radio connection between 2 nodes

If the two nodes are configured properly, the radio connection will be established automatically.

Run two sessions of X-CTU and go to Terminal. Try to type any messages on two terminal windows.

Echo will appear on the opposite window through the radio link:



More information about Xbee/XBeePRO modules and the X-CTU utility can be obtained from <u>www.maxstream.net</u> site:

http://ftp1.digi.com/support/documentation/xctumanual_a.doc http://ftp1.digi.com/support/documentation/manual_xb_oem-rf-modules_802.15.4_v1.xAx.pdf http://ftp1.digi.com/support/documentation/quickstartguide_xbee_oem_developmentkit.pdf

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