



XBee RF Module Product Kit Description and Assembly

Introduction

KibaCorp (www.KibaCorp.com) is pleased to introduce a RF module based that uses the XBee Series 1 805.4 (ISM 2 band) RF unit from Digi International for building and experimenting with wireless sensor networks. The XBee is a de facto standard wireless sensor module that is easy to use, inexpensive, and readily available for the hobbyist and engineering communities. It is well supported with PC dongles as USB to XBee interfaces, and XBee modules are available from a number of vendors : check the Nuts and Volts Advertiser to get best values. The KibaCorp module is shown side by side with the Digi-International XBee in figure 1. The XBee Series 1 must be purchased separately from the RF Module kit. .The XBee (Series 1) has two major versions: XBee or XBee-Pro 802.15.4. These versions are low transmitting power (1 mW for 100 feet indoor to 300 feet outdoor) and high transmit power (63 mW for 300 feet indoor to 1 mile outdoor) units. Another variant on the XBee is antenna type. The KibaCorp Module can accommodate any of these variants depending on what range coverage you are trying to achieve with your network.



XBee and Basic Module



Figure 1 XBee and Module side by side (XBee must be purchased separately)

RF Module Wireless Sensor Network Application

A very cool thing about the XBee is that it can be used as a standalone as well as with a microcontroller. Both are required to build standalone wireless networks. The KibaCorp module allows for the XBee series 1 805.4 (ISM 2 band) RF unit from Digi International to function as a wireless sensor base station when used with the 32 Experimenter (see figure 2) or as a standalone remote sensor RF module (see figure 3) without any supporting microcontroller (except the one internal to the XBee).



Module plugged into 32 Bit Experimenter



Figure 2 Module plugged into 32 bit Experimenter for network base station



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Module standalone as battery operated remote sensor

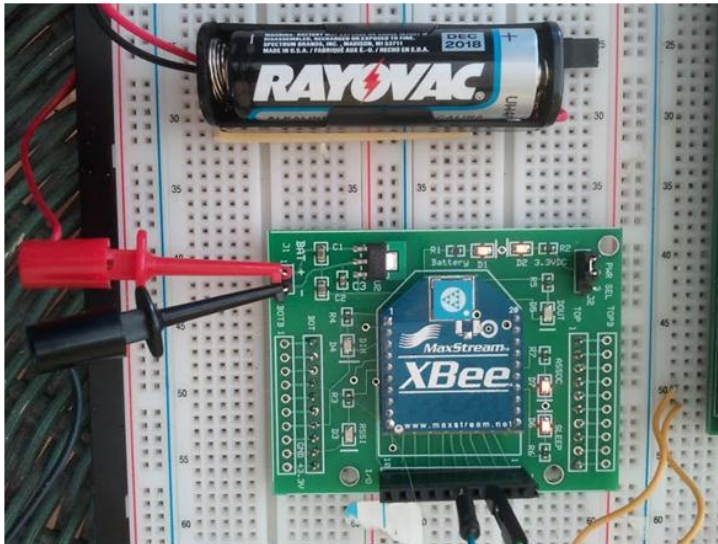


Figure 3 Standalone battery powered Module with XBee for network remote sensor

When used with the 32 bit Experimenter the XBee and KibaCorp module draw their power from the Experimenter BOT connector +3.3V (pin 10) and GND (pin 9). The power selection jumper connection is on pins 2 and 3. When used standalone battery power (approximately +4.5 to 6V DC) is supplied via connection J1. The power selection jumper connection is on pin 1 and 2.

The XBee has a pretty extensive command/control interface. . A user guide describing the XBee command types and XBee operation is freely available at http://ftp1.digi.com/support/documentation/90000991_E.pdf

It can operate in two distinct modes of operation. In mode one, “AT Command Mode”, the XBee interfaces to a host microcontroller through UART asynchronous serial interface using an ASCII (American Standard for Communication Interchange) command set. In mode two, “API Mode”, the XBee uses lower level network packets with binary data and checksum error checking. To achieve what we need to do in direct control of the remote XBee, the API mode is required. The AT mode is only used during power up of the Experimenter in order to configure it. The Experimenter in turn configures the remotes.

A simple API library for building your wireless sensor and demonstration code is available from the Nuts and Volts web site as part of the Dec 2012 article “Build your own Wireless Sensor Network Using XBee and the 32 Experimenter”. Demo 1 does a round robin of blinking LED in a single base and two remote wireless sensor configurations. Demo 2 configures has the base configure a remote for cyclic sleep and reporting an analog value every 8 seconds

Module Operational Concept

First Time Configuration of the XBee Modules

Free X-CTU software can be downloaded from Digi International (ftp://ftp1.digi.com/support/utilities/Setup_XCTU_5260.exe) and used as a serial terminal, for configuration changes, for testing RSSI (receive signal) levels, and for downloading different firmware to the XBee module. It works through a pluggable USB dongle for the XBee module (See figure 4). You must first install X-CTU, plug in the dongle with an XBee module inserted, configure the dongle USB (available from Spark fun) as a com port, and then finally select the required com port to talk to the XBee with dongle. Detailed instructions are available from any vendor who supplies the dongle.

Once a com port is selected, you can test communications with the XBee, reconfigure the module firmware with the appropriate settings, and program the module.

To run the demos, we want to configure up to two remote XBee modules with different module addresses 1, 2 and set these remote modules to API mode. The Experimenter base XBee module will be automatically configured using the PIC32 on power up.

Module Assembly

The basic SMT portions of the module come completely assembled and tested. The only assembly needs is to mount connectors.

- A. The first assembly needed is to mount the BOT and TOP ten pin .100 Male headers to board. These headers are needed for insertion into a Solderless breadboard or into the BOT/TOP female connector set on the right side of the 32 bit Experimenter as well as to be able to plug-in standalone into a Solderless breadboard. The .100 10 pin header mount from the bottom of board. Insert short part of header through the bottom holes and then apply solder from top of board. If you are not using the module with the Experimenter or with a Solderless breadboard then there are mounting hole available for custom mounting the assembly to a protective housing.
- B. The next assembly is a two pin female into J1 battery plus and minus. This connector mounts from the top and is soldered on the bottom of the board.
- C. The next assembly is the three male headers in PWR SEL (Power select). The short part of header is inserted into the top of the board and soldered from the bottom.
- D. The next assembly is the two 10 pin XBee female headers (2 mm spacing). These are mounted within the XBee Silkscreen as row inserts for the XBee. Mounted to top of the board and solder from bottom.
- E. The final assembly is the mounting of the female ten pin connector to J3 I/O Connector. This is for direction connection to the XBee I/O complement
- F. Plug in your separately purchased XBee Series 1 module. Follow the outline of board silkscreen for proper orientation.

A block diagram and schematic are shown (figure 5 and 6)

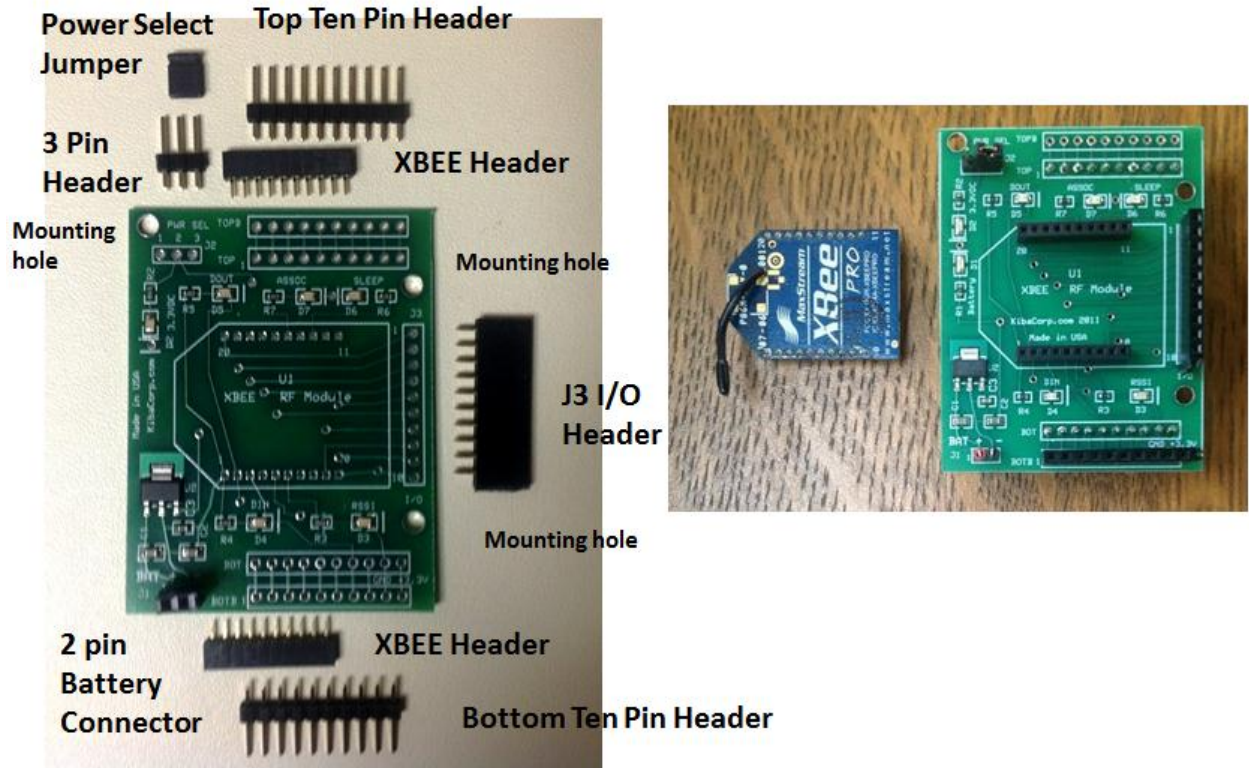


Figure 4 Module Assembly Diagram

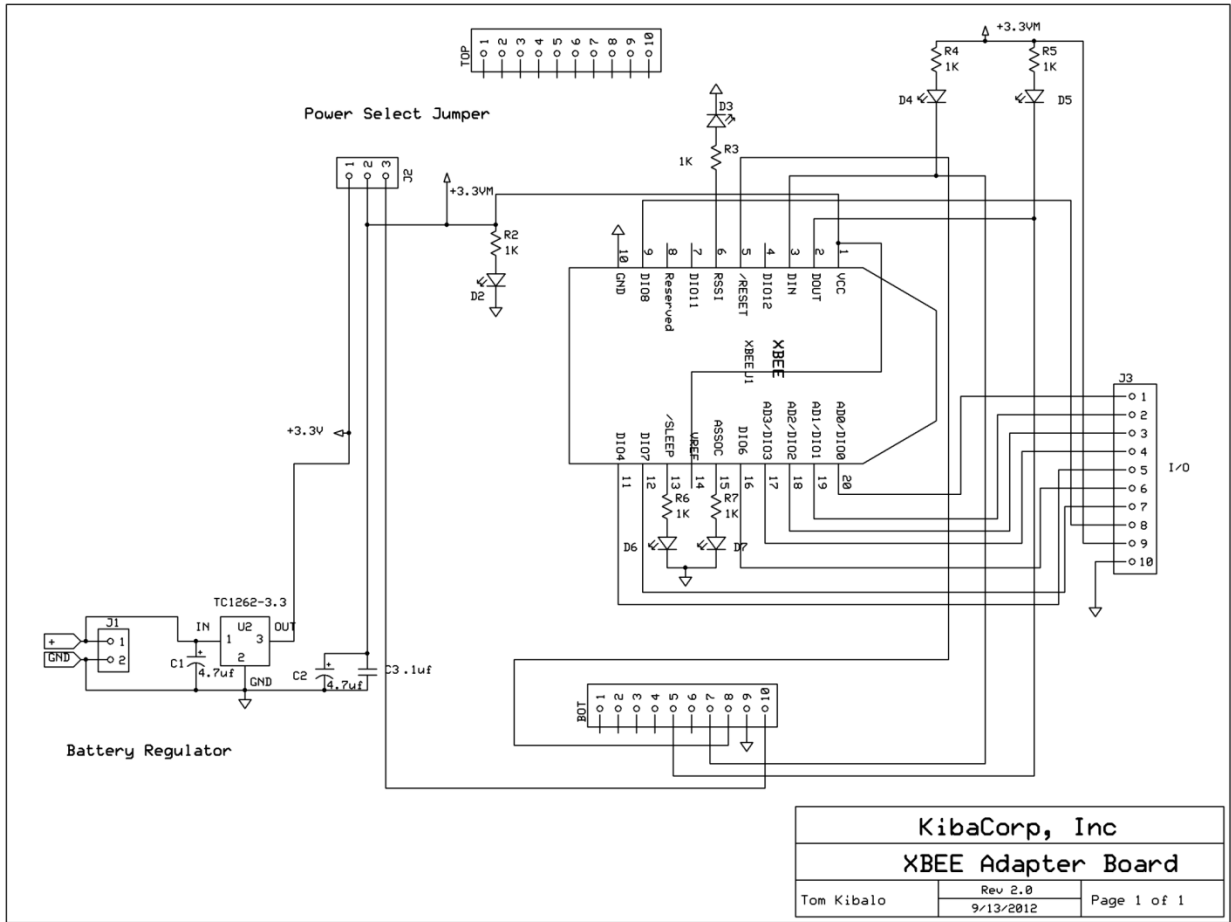


Figure 5 Module Schematic

Module Configuration

An important configuration element is the selection of power source. A shorting connector is provided where you select between battery power or Experimenter +3.3V power sources.

- PIN 1 -2 shorted Battery power Enable –battery power must be supplied via J1 (+4.5 to 6VDC)
- PIN 2-3 Experimenter +3.3V Power (Must be plugged into Experimenter)

The carrier module supports power and activity LEDs. The activity LEDs are associated with data in, data out, received signal strength (brightness varies with strength of received signal), active sleep condition, and finally, network association (normally blinks on power up). Once you plug in your XBee (series 1), you then apply power from any of the two sources the power and (default) the sleep Leds should be on and the association led should be blinking.

The module sensor I/O connector J3 is as follows:

- DIO0–DIO4 and DIO6: These are used as standard 3.3 V digital inputs and outputs. ADC is a programmable option for DIO0-DIO6. These are 10-bit Analog to Digital Converter (ADC) inputs to the XBee.
- Fixed digital input DI7 and fixed digital output DO8
- +3.3V and GND outputs

The J3 I/O pin out is as follows, all pins are +3.3VDC tolerant - (PIN 1 is marked on board):

- PIN 1 DIO0
- PIN 2 DIO1
- PIN 3 DIO 2
- PIN 4 DIO3
- PIN 5 DIO4
- PIN 6 DIO6
- PIN 7 DI7
- PIN 8 DO8
- PIN 9 +3.3VDC out
- PIN 10 GND

Again the user guide describing the XBee command types and XBee operation is freely available at http://ftp1.digi.com/support/documentation/90000991_E.pdf. This guide also contains description of all pin and their configurations.

Vendor Support

Feel free to contact us at www.Kibacorp.com (contact page) to answer questions and provide support.