Instructions for Configuring XBee modules for Communication between PC and Fire Bird V

Zigbee personnel network is setup by configuring XBee modules in three stages as explained below:

- First stage consists of reading the Source Address of two XBee modules (Step 1 to Step 8).
- Second stage consists of setting the Destination Address for two XBee modules (Step 9).
- Finally Third stage consists of testing and verification for the configuration (Step 10).

I: Reading the Source Address of two XBee modules

Step1: Inserting XBee in XBee adapter

After Installation of the X-CTU software connection (Refer to: Installation steps of X-CTU), fix the X-bee module in the X-bee adapter which will connect the X-Bee with PC. Figures below clearly explain the fixing of X-Bee to the adapter. **Caution: Connecting the X-Bee module in opposite direction can damage the XBee module.**

Figure 1: XBee Module

Figure 2: XBee Adapter

Figure 3: XBee Module in Adapter

Step2: Connecting XBee module to PC

Make the connection between laptop and XBee module using a USB cable as shown in Figure4. Figure 5 illustrates the Power LED and Associate LED on the XBee Adapter.
When the connection is established, if the connection is correct, the following will happen:

- (i) Power LED on the X-Bee Adapter will be ON and
- (ii) Associate LED on the X-Bee Adapter will blink.

If not, remove and make the connection again till the above two conditions are met.

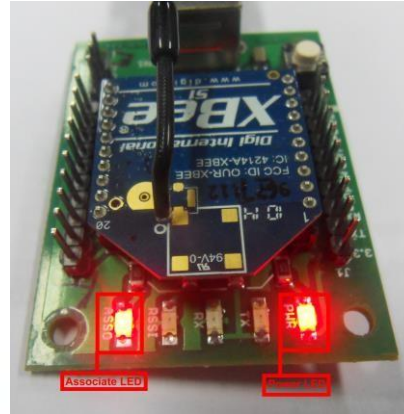**Figure 4: Connection between PC and XBee adapter**

Figure 5: Associate and Power LEDs

Step3: Serial Communication port settings

After connecting XBee to the PC, check whether the necessary communication (COM) port is assigned to the XBee. This can be done using the *Device Manager* on your PC as shown in Figure 6.If the com port is not detected in the *Device Manager*, install driver for CP2102 USB to serial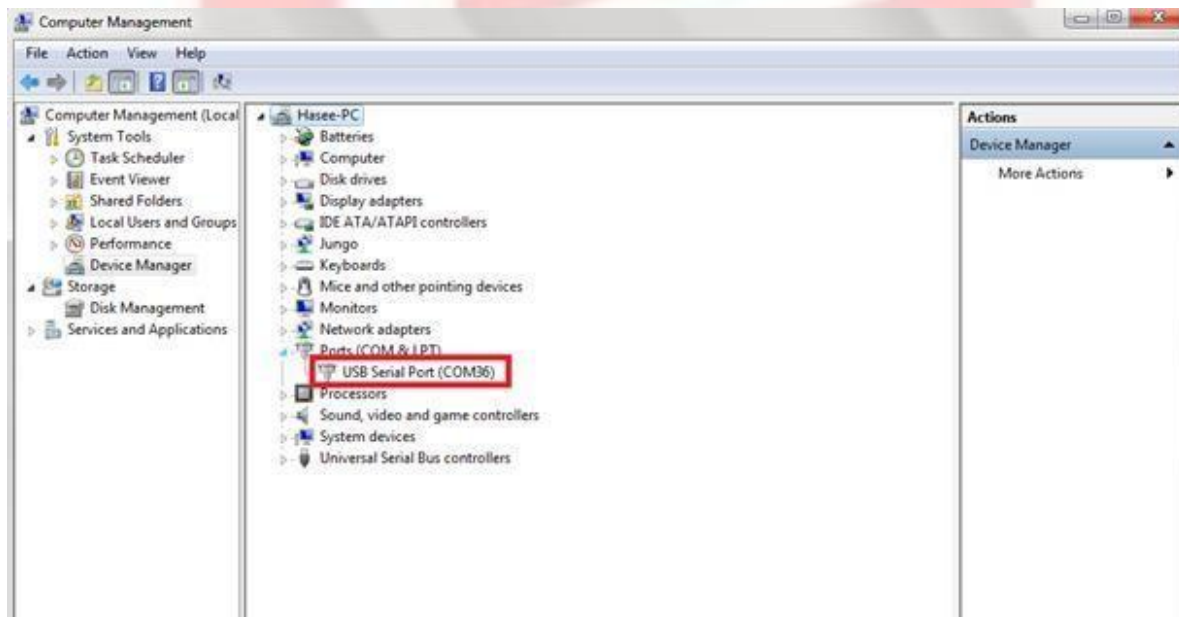 converter.(Drivers can be downloaded from following link: https://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx).

Figure 6:Device Manager

Step4: Launching X-CTU Software

Open X-CTU application that you have installed earlier. This can be done in any of the two ways, by selecting the icon from Desktop or selection from the Start menu as shown in Figure 7.

Figure 7: X-CTU icon in Desktop and in Start Menu

Step 5: X-CTU window
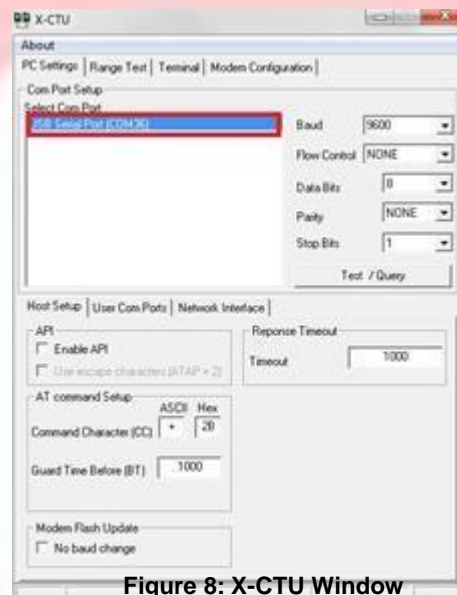
After Step 4, X-CTU window will pop up as shown in the Figure 8.

Figure 8: X-CTU Window

Step6: Testing and Querying the Network by Serial number verification

Click on the **"Test/Query"** button. A window pops with the serial number and type of the modem as shown in Figure 9.
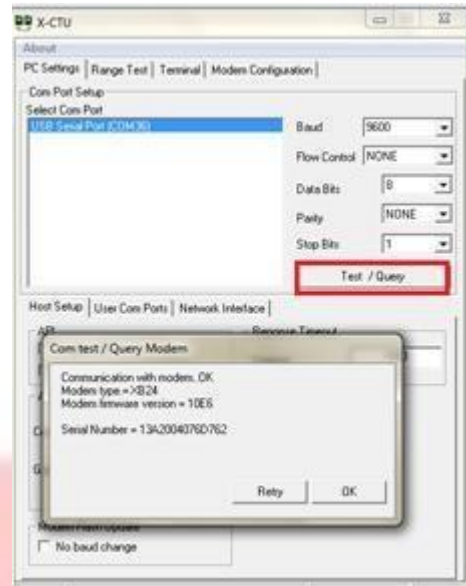
Figure 9: Test/Query XBee Modem

If this window pops up, you can infer that the XBee module is working.

Step 7: Reading the module configuration

Open **Modem Configuration** tab on the X-CTU window and read the XBee module configuration by clicking the **Read** button as shown in Figure 10.
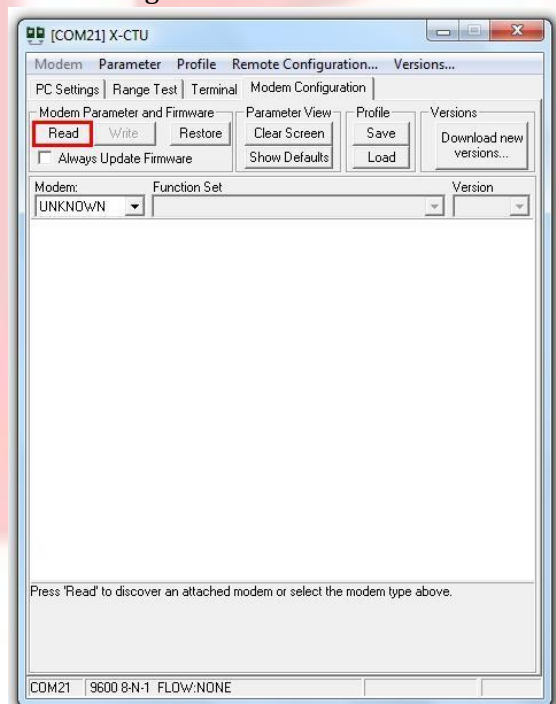

Figure 10: Reading the XBee Module Configuration

Step 8: Noting down the modem configuration.

Kit contains two XBee modules:
      (i)   One is connected to laptop with XBee adapter. This acts as **Transmitter.**
      (ii)   Other is attached to the Fire Bird V. This acts as **Receiver**.

Step 8.1: Reading the configuration for Transmitter

o Now note down the following values from the **Modem Configuration** tab:

CH-Channel
ID-PAN ID
DH-Destination Address High
DL- Destination Address Low
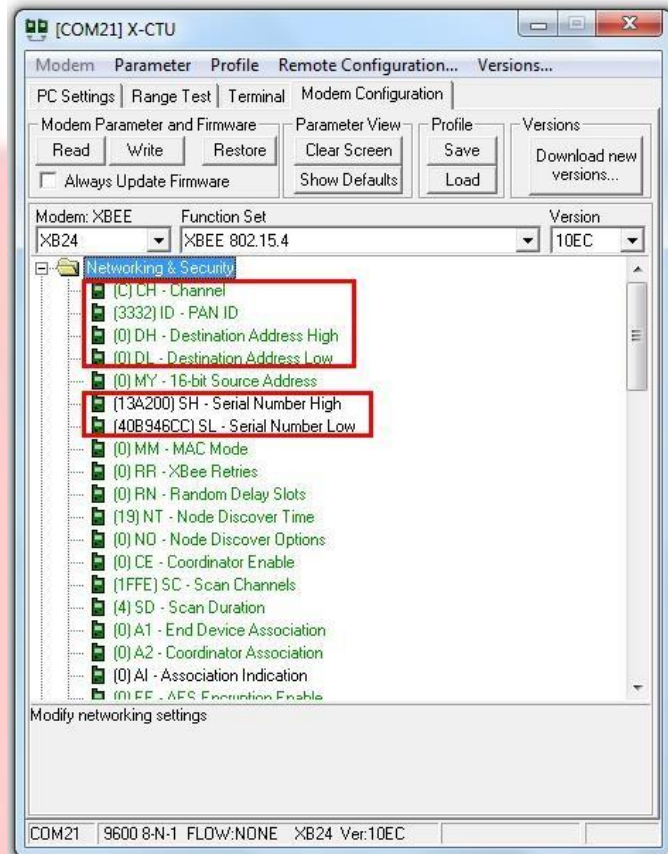SH-Serial Number High
SL-Serial Number Low

Figure 11: Transmitter Modem Configuration

For example, in above Modem Configuration settings (Refer to Figure 11), values noted down are as follows:

CH-Channel = C
ID-PAN ID = 3332
DH-Destination Address High = 0
DL- Destination Address Low = 0
SH-Serial Number High = 13A200
SL-Serial Number Low = 40B946CC
Now remove the USB cable from the PC and then remove the Transmitter XBee module from the XBee adapter.

Step 8.2: Reading the XBee module configuration for Receiver
Now repeat Step 1 to Step 12 for Receiver XBee module.
For example, in above Modem Configuration settings (Refer to Figure 12), Receiver XBee module values are as follows:
CH-Channel = C
ID-PAN ID = 3332

DH-Destination Address High = 0
DL- Destination Address Low = 0
SH-Serial Number High = 13A20
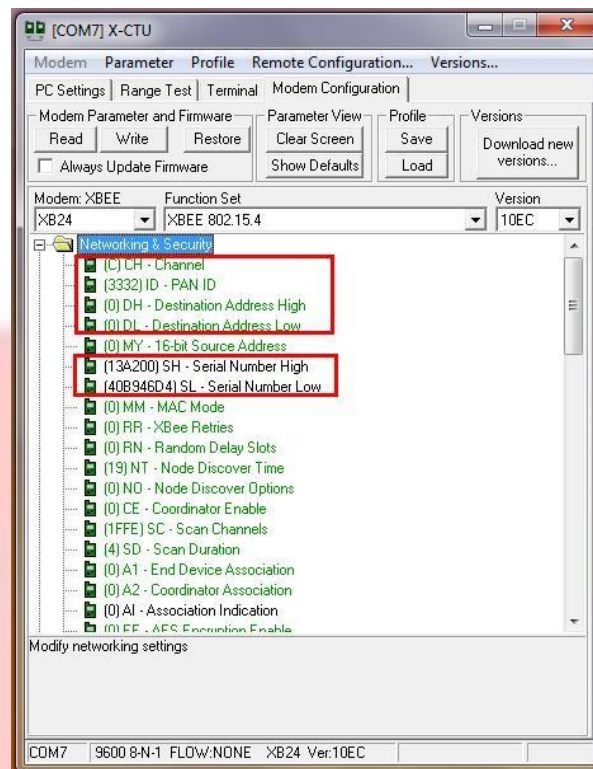SL-Serial Number Low = 40B946D4

Figure 12: Receiver Modem Configuration

XBee module Parameters In the Modem Configuration Tab:

Channel(CH): 802.15.4 and Zigbee split the 2.4Ghz band into 16 **channels**. Parameter range for XBee is 0x0B - 0x1A.

Personal Area Network(PAN): PAN is a data communication network that includes one or more *End Devices*(Receiver in Fire Bird V) and a *Coordinator*(Transmitter XBee module).

PAN ID: Each network is defined with a unique **PAN identifier** (PAN ID). This identifier is common among all devices of the same network. Zigbee devices are either preconfigured with a PAN ID to join, or they can discover nearby networks and select a PAN ID to join. If multiple Zigbee networks are operating within range of each other, each should have a unique PAN ID.

Destination Address:

- o **DH: Destination Address High**. Set/Read the upper 32 bits of the 64-bit destination address. When combined with DL, it defines the destination address used for transmission.
- o **DL: Destination Address Low**. Set/Read the lower 32 bits of the 64-bit destination address. When combined with DH, DL defines the destination address used for transmission.

Source Address:

- o **SH: Serial Number High**. Reads high 32 bits of the RF module's unique IEEE 64-bit   address.

o **SL: Serial Number Low.** Reads low 32 bits of the RF module's unique IEEE 64-bit address.

II: Setting the Destination Address of XBee modules

Step 9: Setting the Network Address.

Modem Configuration tab is used to configure the various address locations and PAN ID.

Setting the Network Address for Receiver:

Setup your XBee network by assigning a Channel number (in the range 0x0B - 0x1A) and PAN ID. For PAN ID use your team ID in 4 digit form:

　　　For example, if Team ID = 48
　　　Then setup the PAN ID as "0048"
　　　　　Set the Destination address (DH and DL) of Receiver with the Source address (SH and SL)
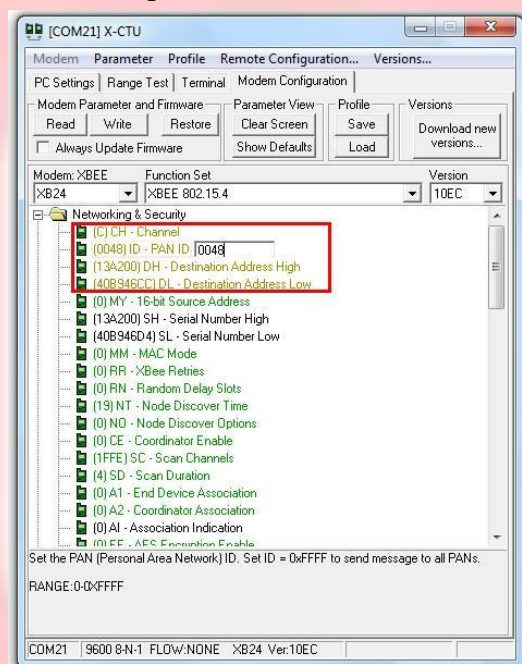　　　　　　of Transmitter as shown in Figure 13.

Figure 13: Setting the Network Address for Receiver

Now write the configuration by clicking the **Write** button in the configuration tab as shown in Figure 14.
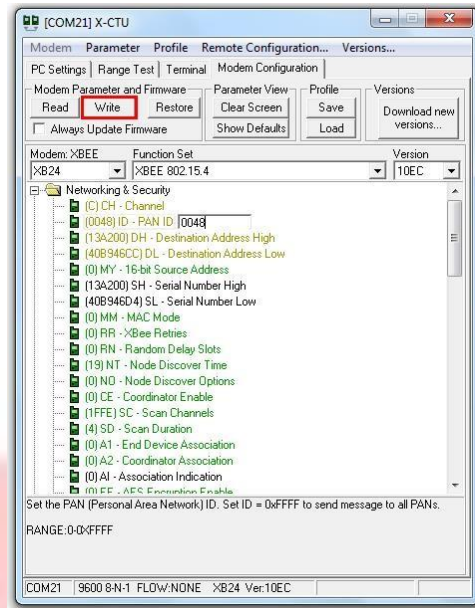
Figure 14: Writing the configuration

Remove the Receiver XBee module from adapter and keep it aside. This XBee module must be attached to the Fire Bird V XBee port.
Setting the Network Address for Transmitter:
Now attach the Transmitter XBee module again to set the network address.

Set the Channel and PAN ID; Use the same values as for the Receiver XBee module.

Set the Destination address (DH and DL) of Transmitter XBee module with the Source address (SH and SL) of Receiver XBee module as shown in Figure 15.
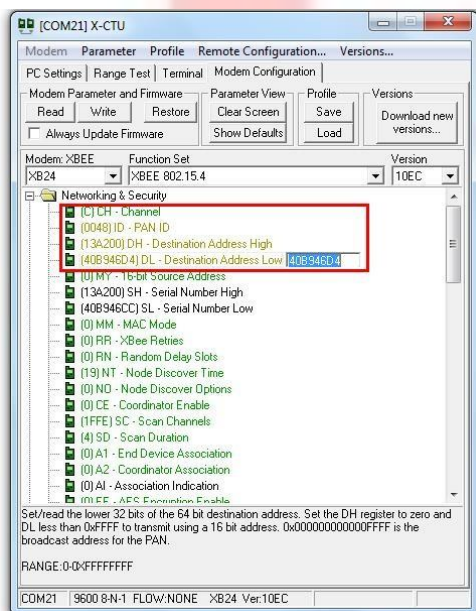

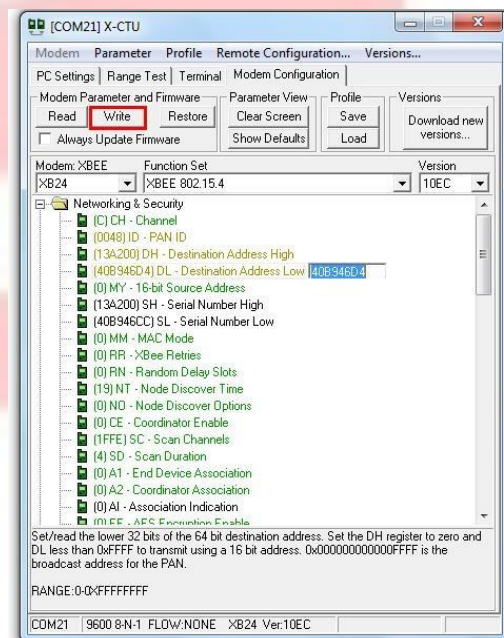
Figure 15: Setting the Network Address for Transmitter

Figure 16: Writing the configuration

Now write the configuration by clicking the **Write** button in the configuration tab as shown in Figure 16.

III: Testing and Verification of XBee modules cofigurations

Step 10: Testing and Verification of the Network Configuration

Connect the Receiver XBee module to the Fire Bird V robot as explained in Section 3.18 of
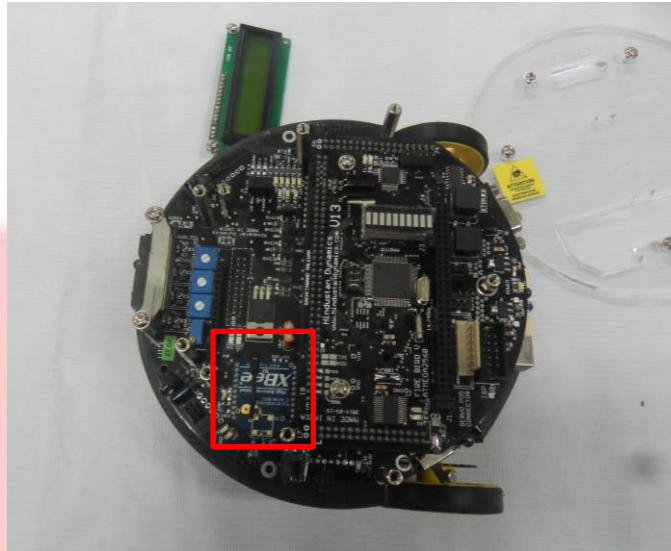Fire Bird V ATMEGA2560 Hardware Manual. (Figure 17)

Figure 17: Fire Bird V with XBee module

Load the hex file from *xbee_testing_verification_code/default* folder in *xbee_module_testing*
folder.

Connect the Transmitter XBee module to PC using XBee adapter.

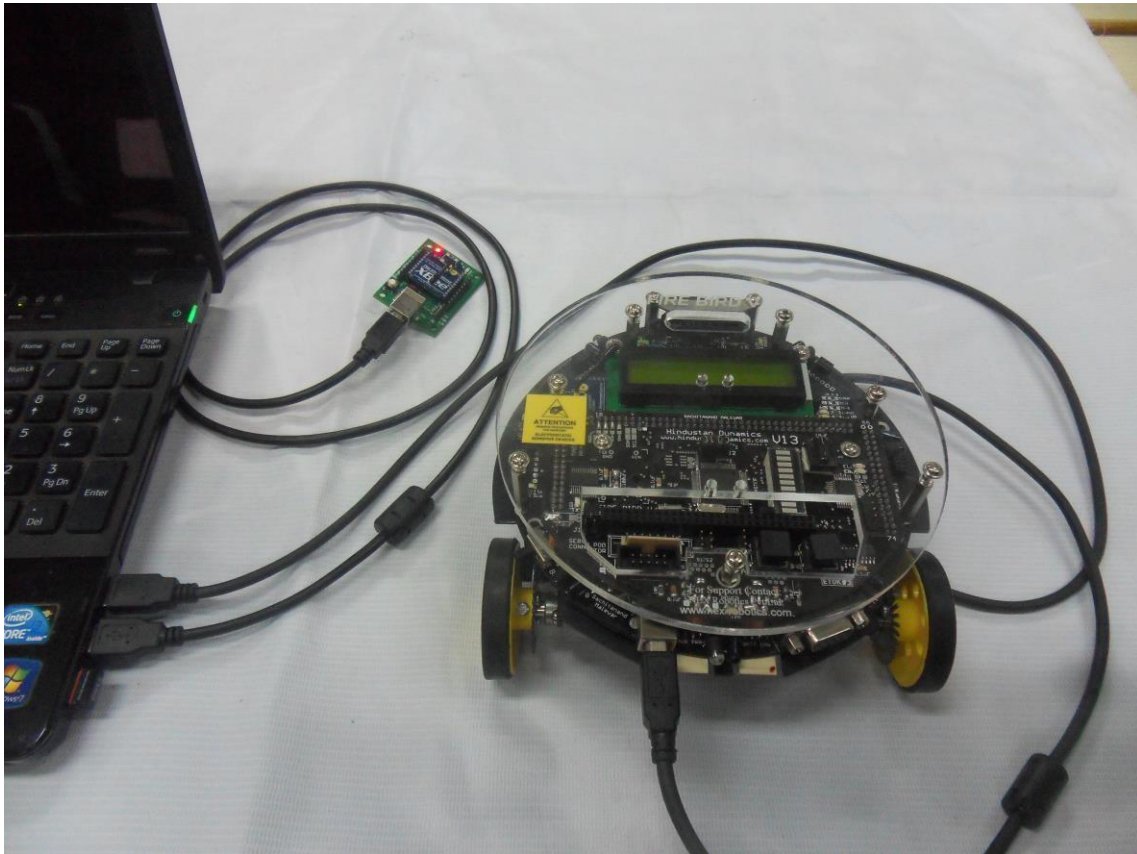Connect the Fire Bird to PC using USB cable.

Figure 18: Connection of XBee Adapter and Fire Bird V with PC

Now open two X-CTU applications. X-CTU window must show the two Serial Ports for Transmitter XBee module and Fire Bird V. For example (Refer to Figure 19):

USB Serial Port (COM1) – USB serial port for Fire Bird V
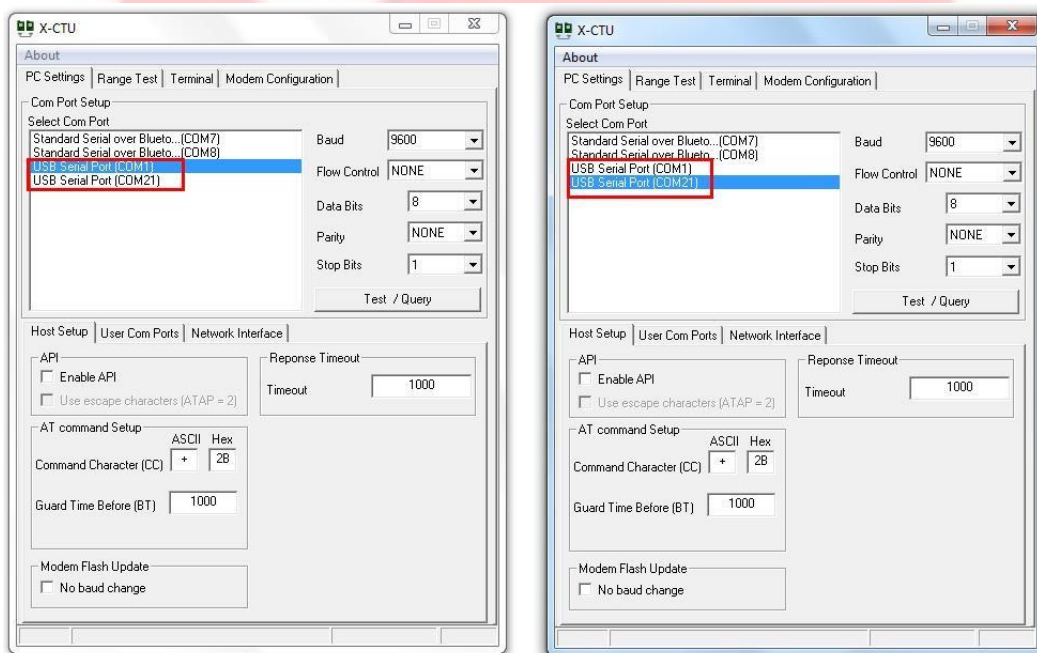USB Serial Port (COM21) – Serial port for Transmitter XBee module

Figure 19: Two XCTU Windows for Verification Step

Now to see the output, open the terminal window in both X-CTU. Type something in window, which gets reflected back in other. The transmitted data appears in blue while the received data appears in red.

As shown in Figure20, if you get the data in both the terminals, the XBee modules are configured to communicate with each other. Now you are ready to proceed with the future tasks.
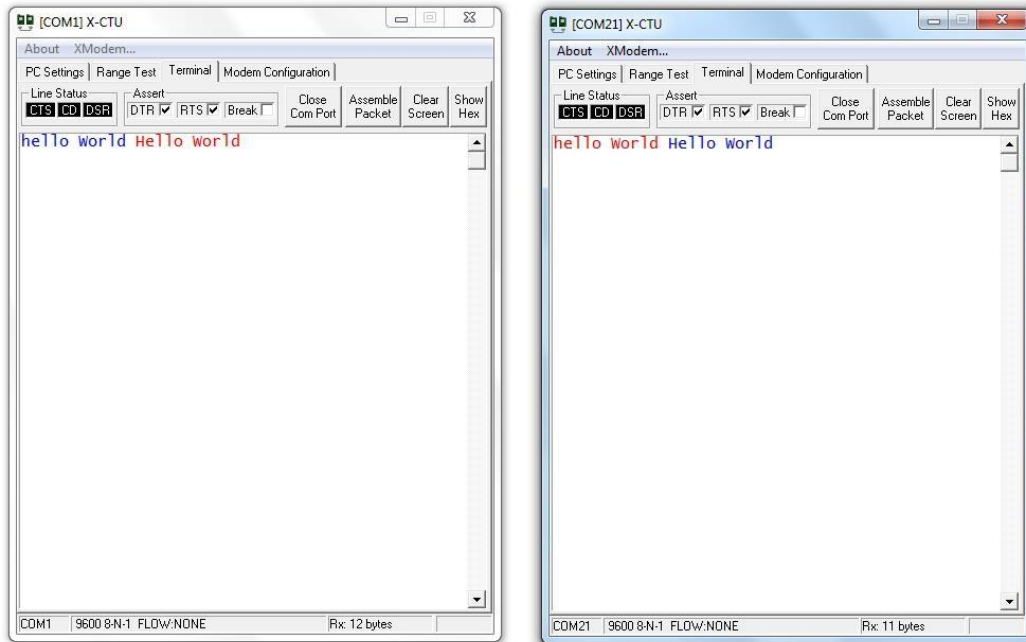

Figure 20: Sending and Receiving data in Terminal Window of X-CTU

Best of Luck!!!!