Creating a Multicast network configuration in X-CTU using XBEE S1 module

Multicast:

Block Diagram:

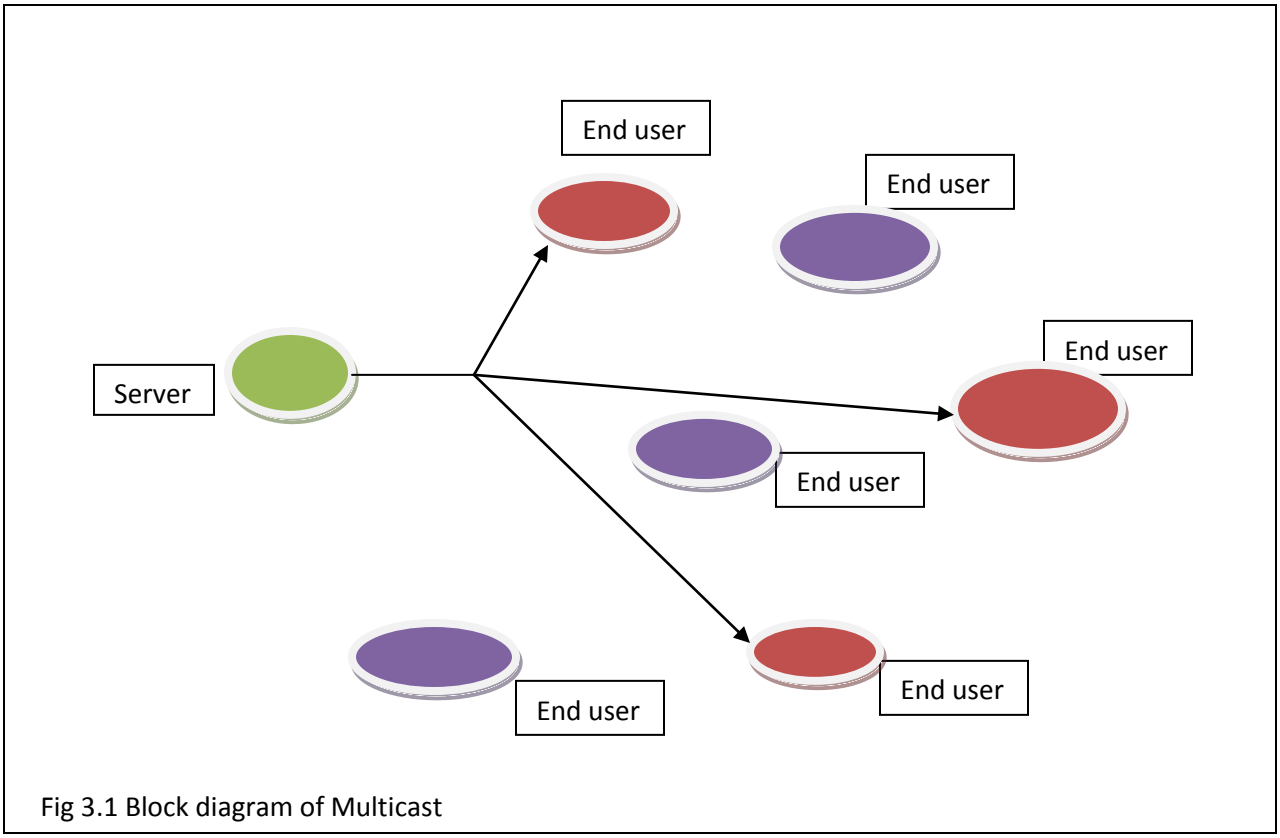


Fig 3.1 Block diagram of Multicast

. The Multicast Consists of a server who can communicate with selected end users and these end users can communicate with the server but the end users cannot between themselves and end users not connected to server are totally not in connection with either server or selected end users.

Components Required:

- Zigbee modules(XBEE S1) - 4
- Zigbee adaptor - 4
- USB cable – 4
- Computers (we need 4 USB ports, in same or different computers).

The steps to create a Multicast communication in XBEE module using 16-bit addressing are as follows:

Step 1: Connecting Zigbee to PC.

Make the connection between laptop and XBEE module using a USB cable as shown in figure.

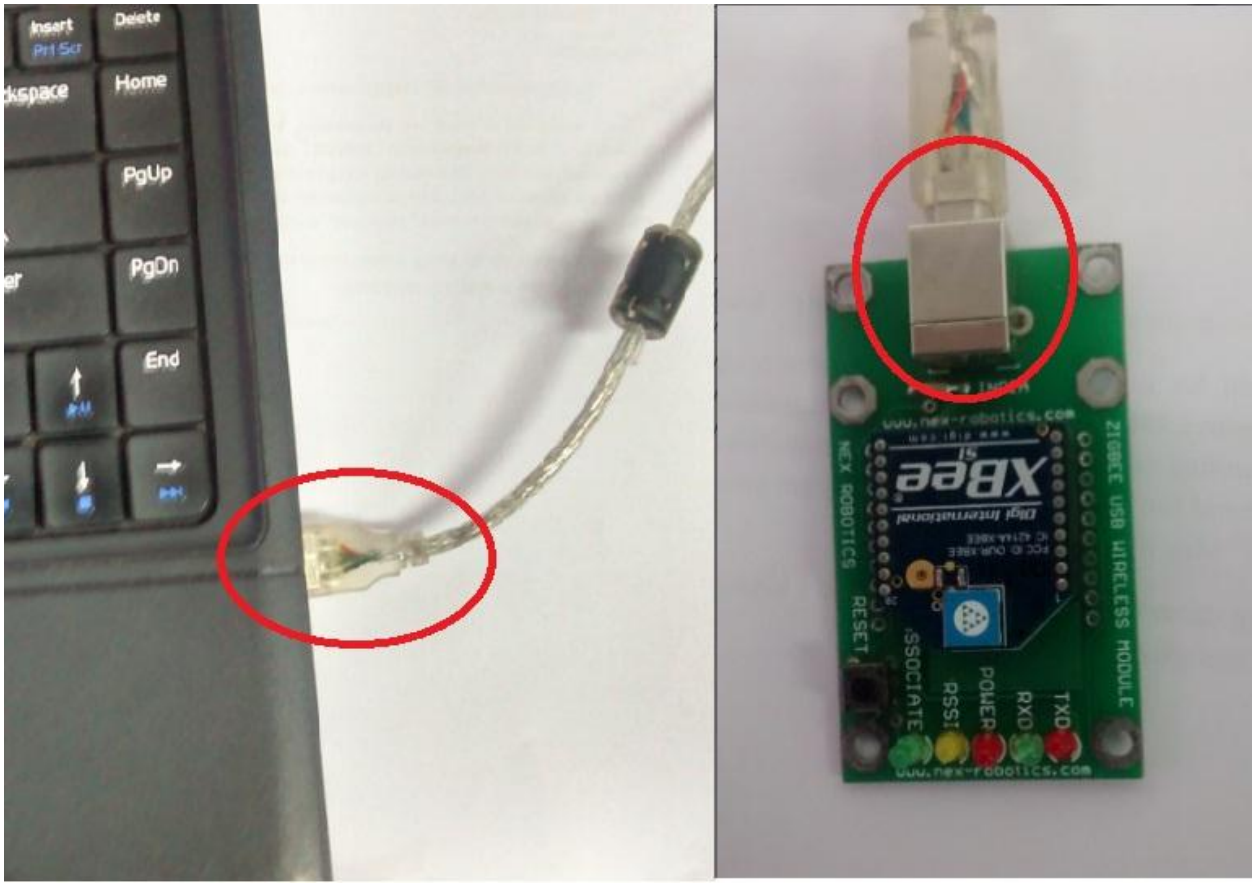


Figure 3.2 USB connections

The red Power LED in XBEE module must ON and green associate LED must start blinking.

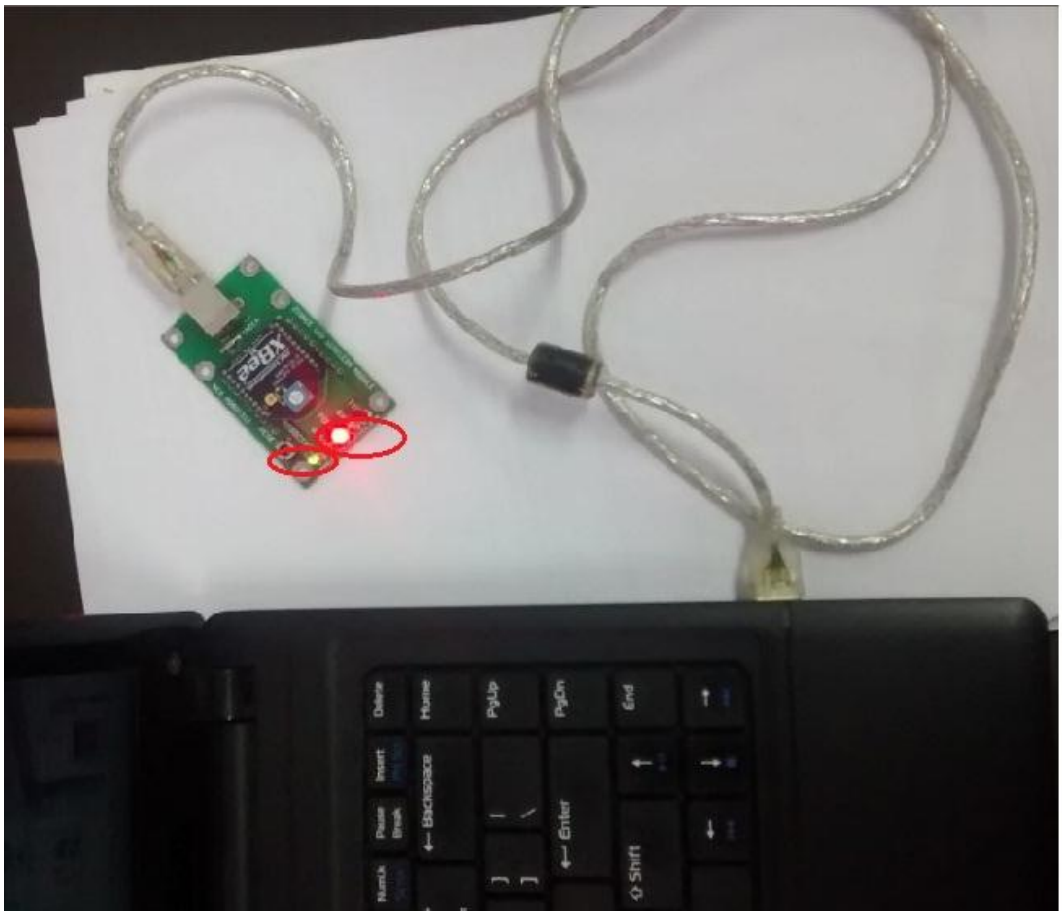


Fig 3.3 verification through LEDs

Repeat the step 1 four times for four different modules.

Step 2: Launching X-CTU Software.

Launch X-CTU windows from shortcut icon on desktop or program files in start menu.

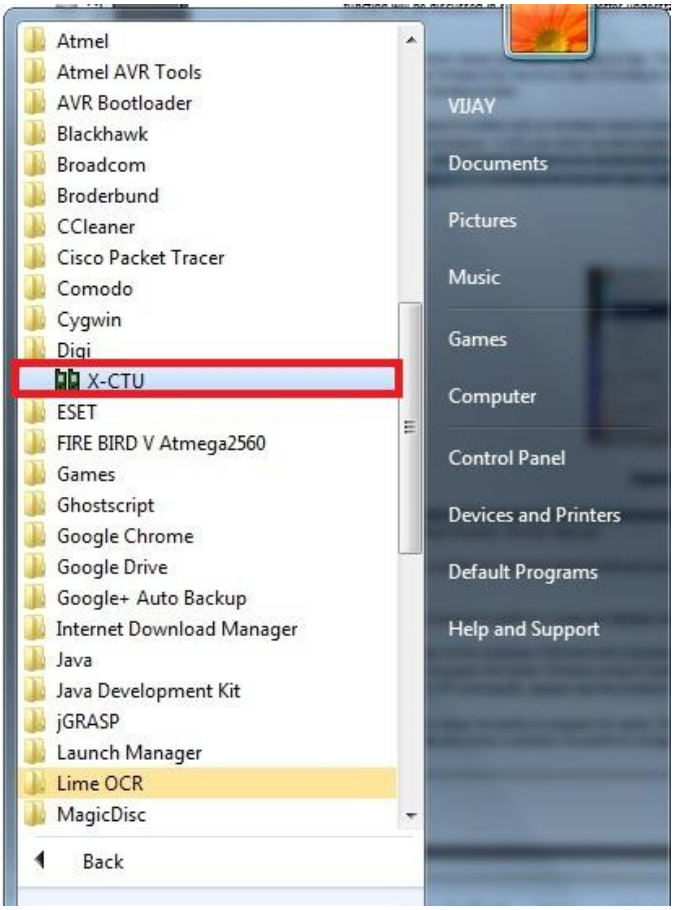


Fig 3.4 Launching of X-CTU

Do this for all four modules. Open multiple windows in same computer, one window for each module separately.

Step 3: Testing and Querying the Network by Serial number verification.

Notice the COM ports being displayed on the select COM port workspace. Test/Query each COM port individually in the windows opened previously.

The result of Test/Query must show serial numbers as shown in figure 2 if the connections are correct.

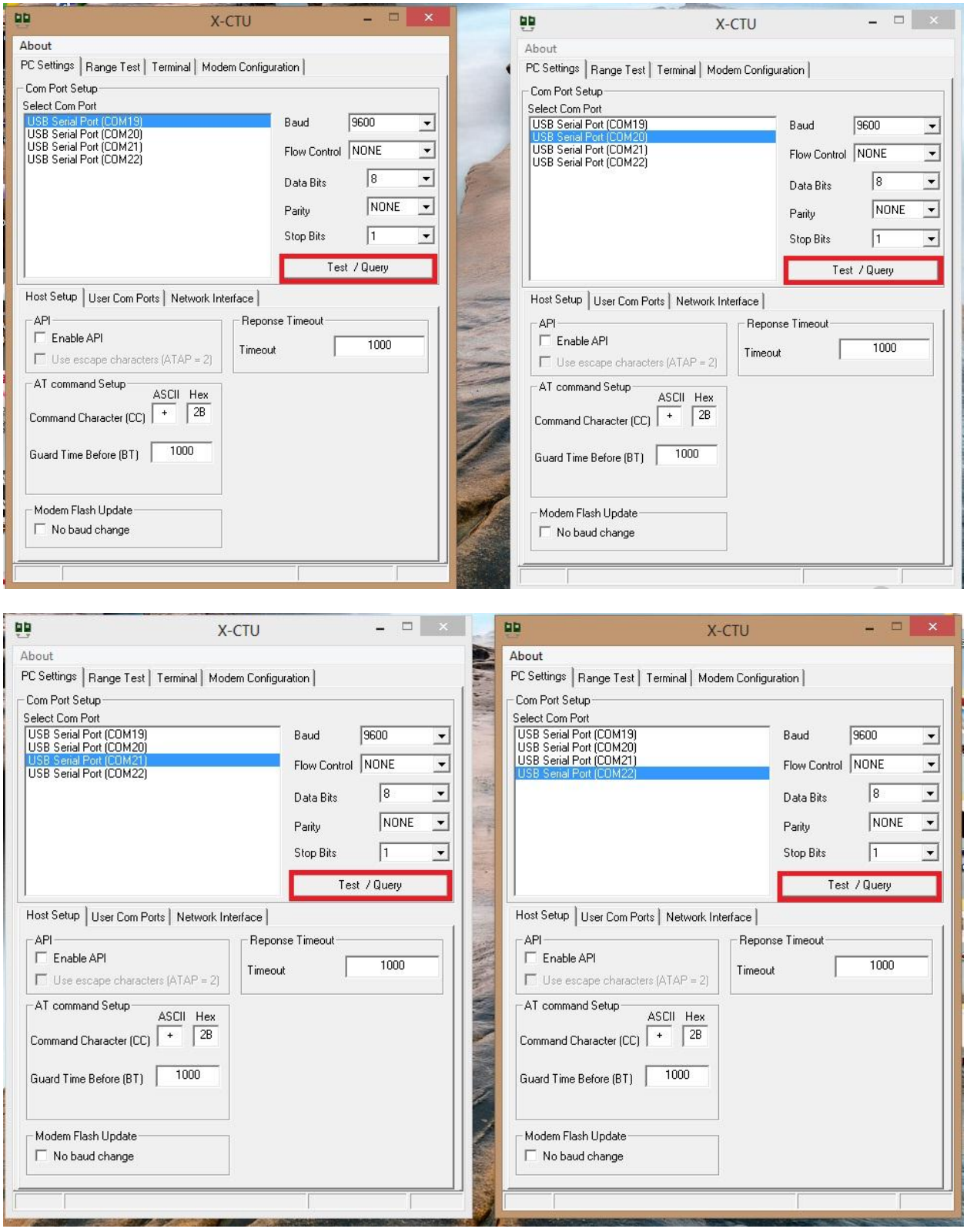
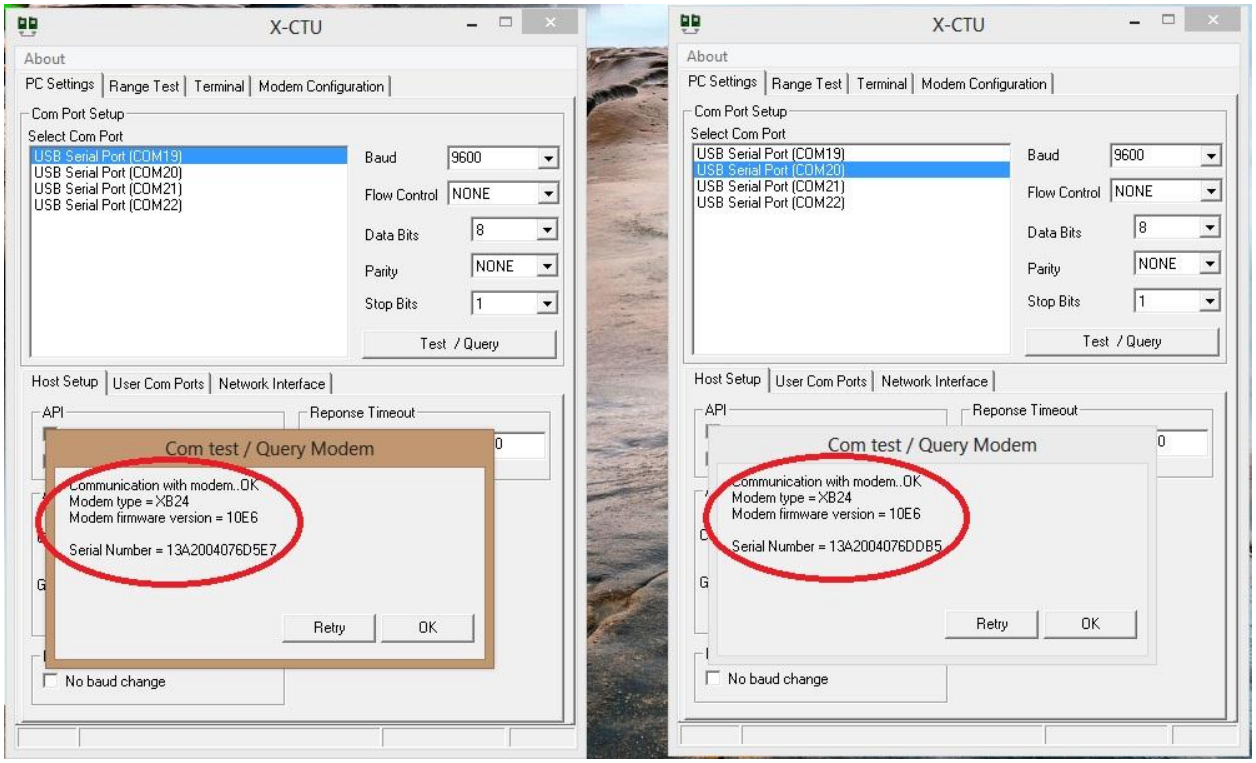


Fig 3.5 Test/Query



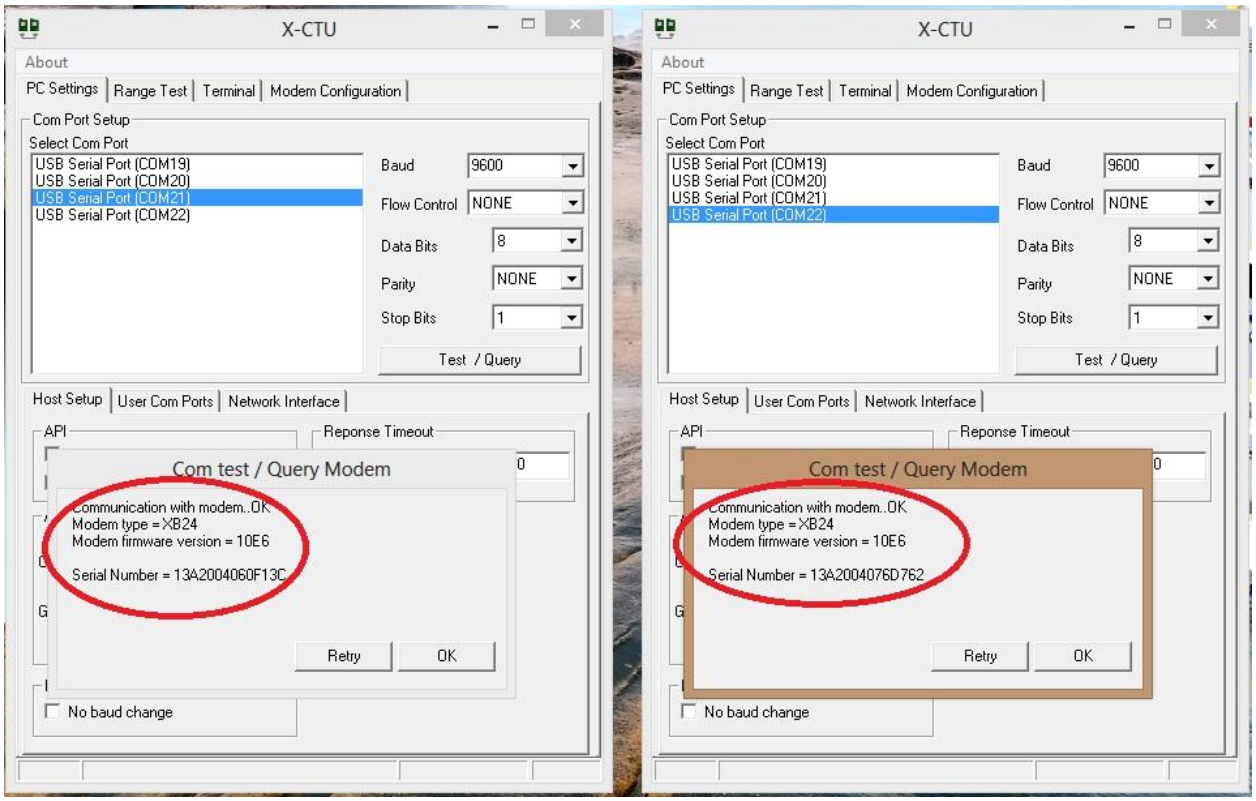


Fig 3.6 serial number verification

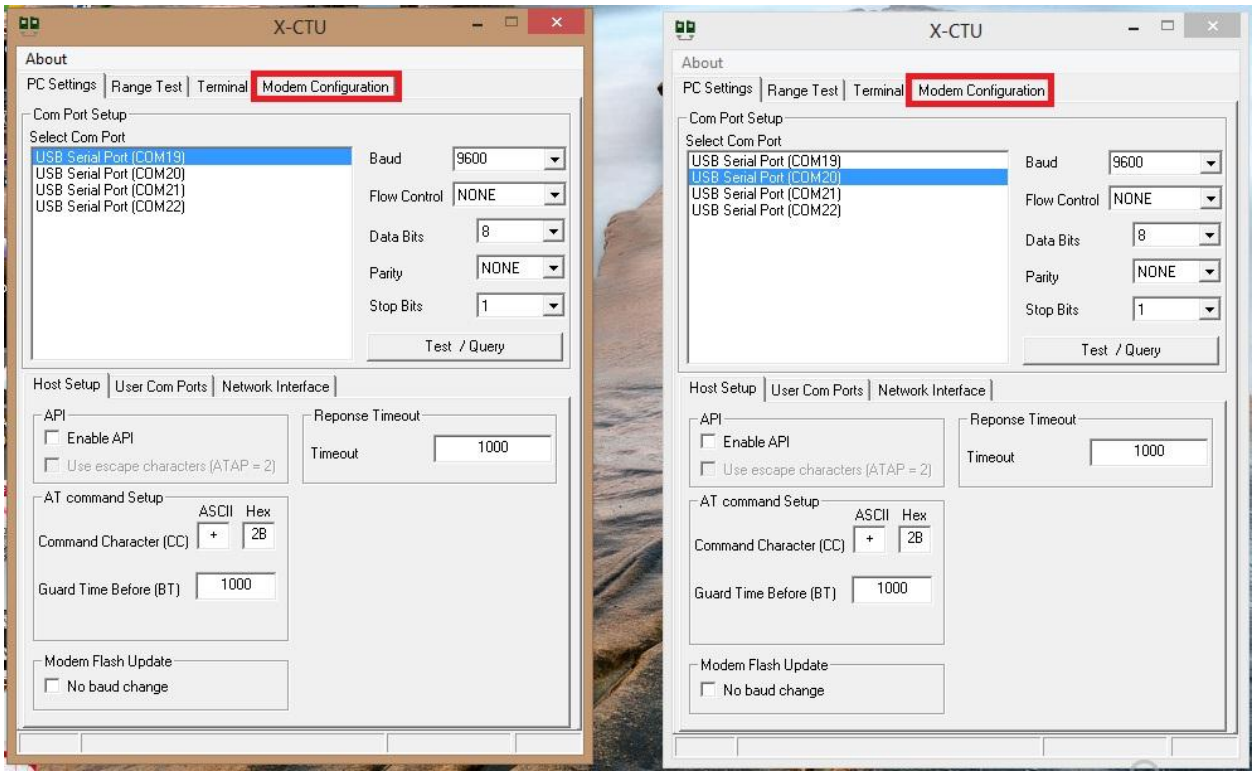
Serial Number:

A unique 64-bit IEEE source address is assigned at the factory and can be read with the SL (Serial Number Low) and SH (Serial Number High) commands. Short addressing must be configured manually. A module will use its unique 64-bit address as its Source Address if its MY (16-bit Source Address) value is “0xFFFF” or “0xFFFE”.

The above figures are for two windows, whereas you’ll have to do it for four windows One window of one module each.

Step 4: Reading the module.

Open modem configuration tab on the X-CTU window and read the modem.



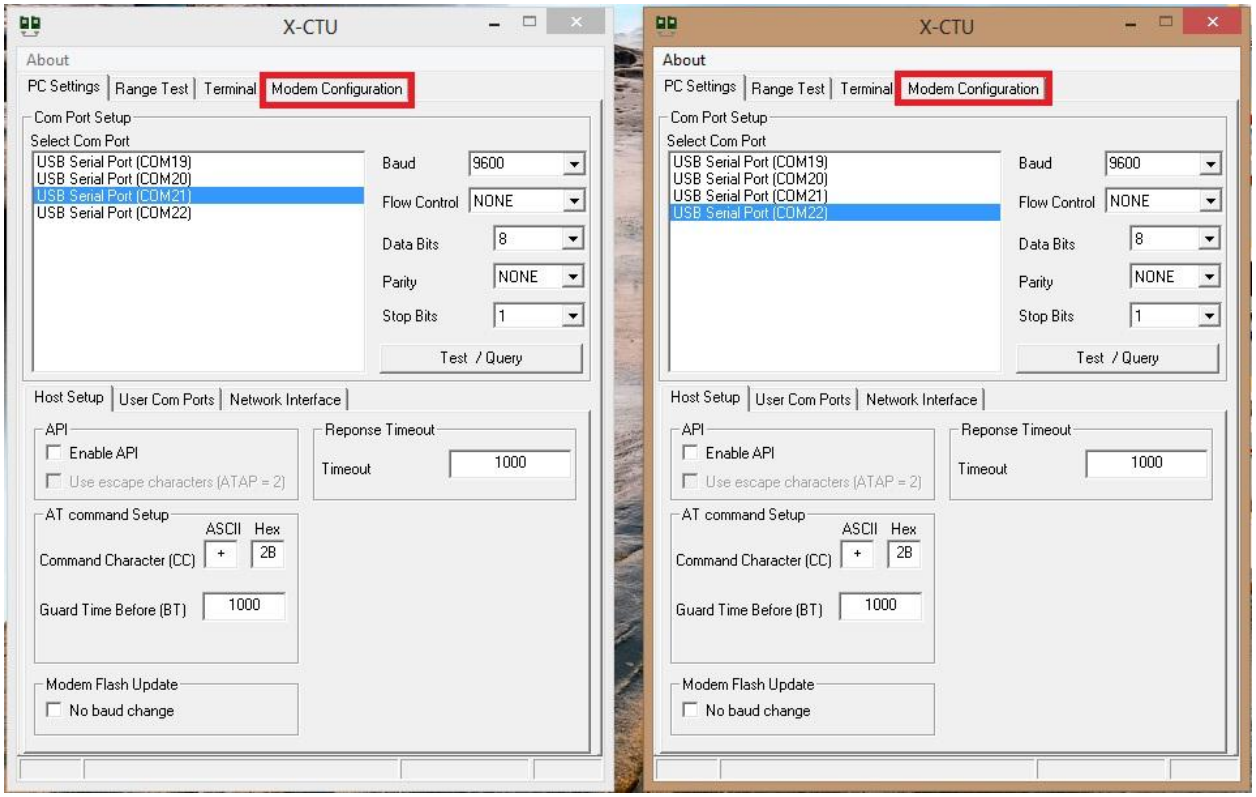
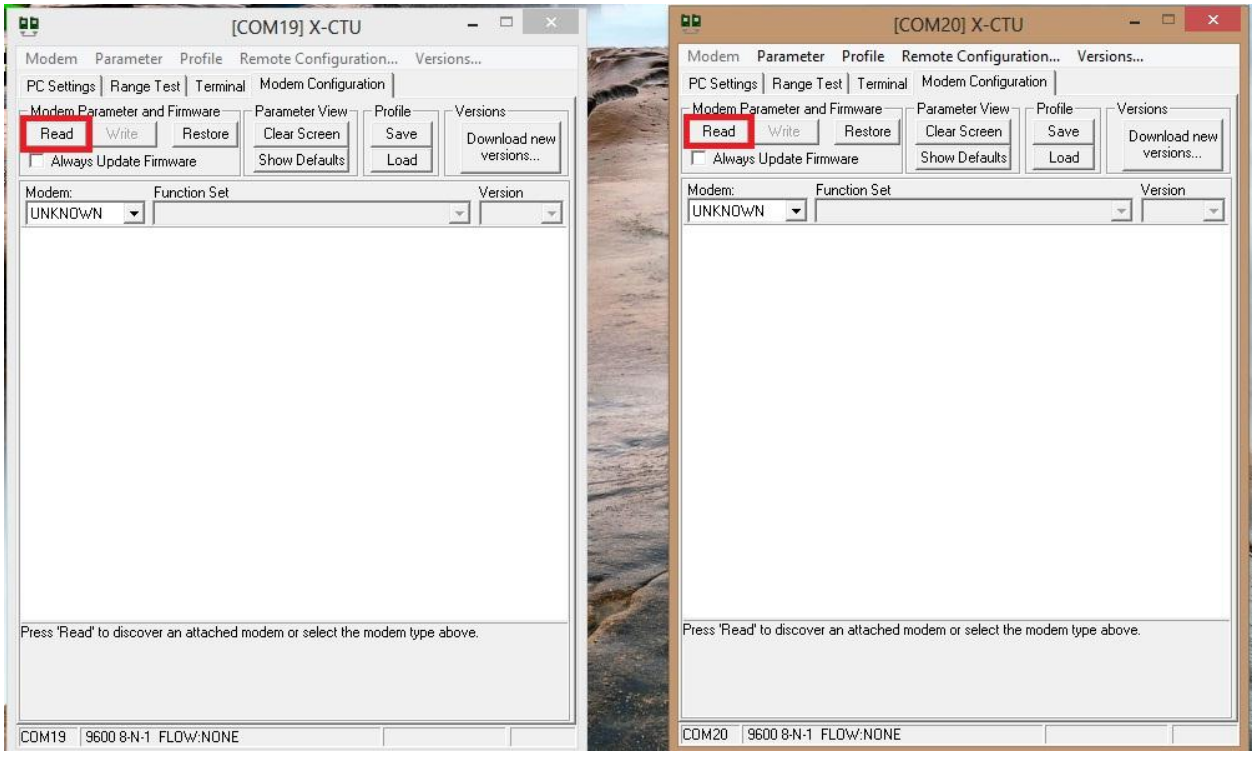


Fig 3.7 Modem Configuration



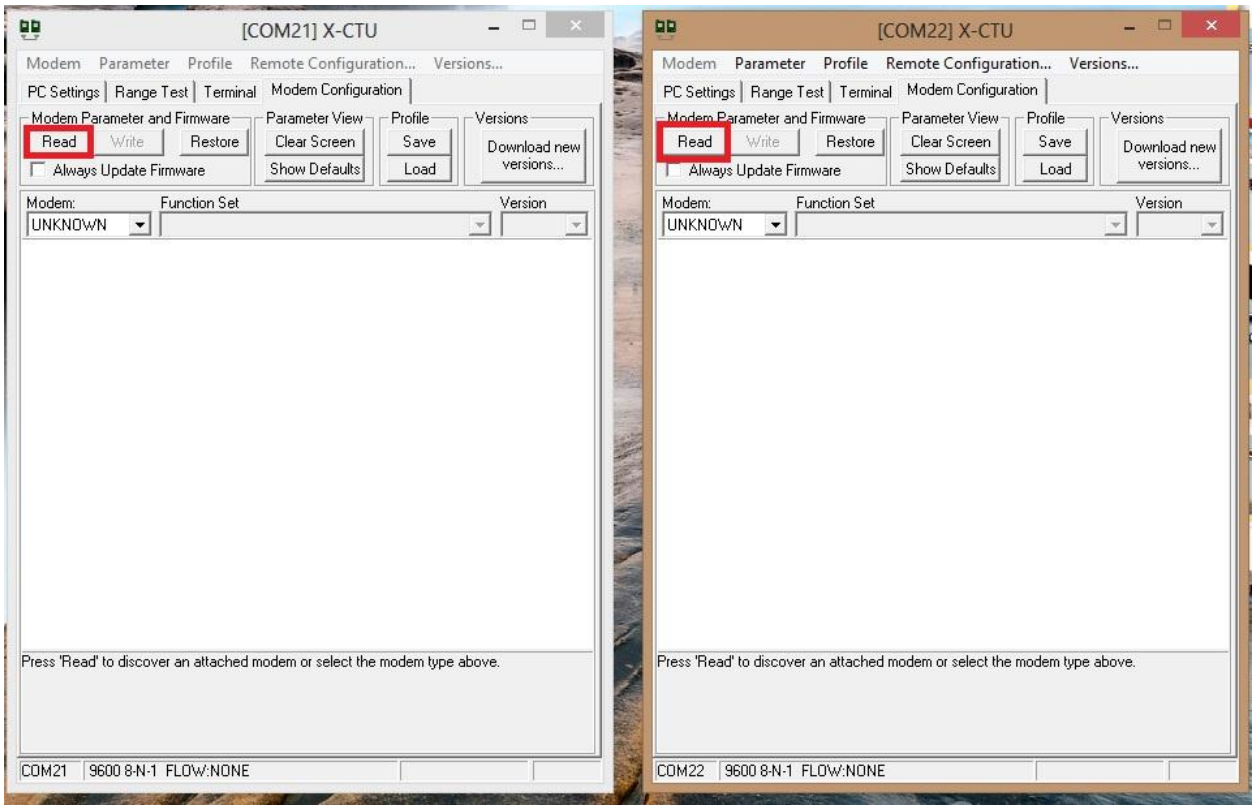


Fig 3.8 Reading the module

The X-CTU will read the pre-configuration of XBEE.

<u>Step 5</u>: <u>Setting the Network Address.</u>

In the workspace under Network & Security tab select following settings

X-CTU(window 1)	X-CTU(window 2)	X-CTU(window 3)	X-CTU(window 4)
CH-Channel = C	CH-Channel = C	CH-Channel = C	CH-Channel = C
PAN ID = 2222	PAN ID = 2222	PAN ID = 2222	PAN ID = 2222
DH = 0	DH = 0	DH = 0	DH = 0
DL = 3	DL = 2	DL = 2	DL = 4
MY = 2	MY = 3	MY = 3	MY = 5

**this is a sample address and can be varied.*

- PAN IDs and Channel (CH) of all end users and server must same since they are operating in same network.
- Since we are using 16-bit addressing mode DH of all modules must be 0.
- DL of server should be same as MY (source address) of the end users since you want them to communicate.
- DL of end user should be MY (source address) of server if you want end user to communicate back with server else it can be unique.

- MY (source address) of end users not in network should be unique since it should not be able to communicate with themselves.

Note:

- Any RF module within range will accept a packet that contains a multicast address. When configured to operate in Multicast Mode, receiving modules do not send ACKs (Acknowledgements) and transmitting modules do not automatically re-send packets as is the case in Unicast Mode. To send a broadcast packet to Selected modules regardless set the destination addresses of the Server as shown below. Sample Network Configuration (All modules in the network)
  DL (Destination Low Address) = 2 DH (Destination High Address) = 0
- In the above sample address X-CTU (window 1) will act as server and others will act as end system.
- There will be communication between window 1 and window 2 and window 3 but not in window

Key Terms:

- **Channel (CH):** 802.15.4 and Zigbee break the 2.4Ghz band into 16 channels. Parameter range for Xbee is 0x0B - 0x1A.
- **Personal Area Network (PAN)** - A data communication network that includes one or more End Devices and optionally a Coordinator.
- **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 discovery nearby networks and select a PAN ID to join.
  If multiple Zigbee networks are operating within range of each other, each should have unique PAN ID.
- **Destination Address:**
  - **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. To transmit using a 16-bit address, set DH parameter to zero and DL less than 0xFFFF. 0x000000000000FFFF is the broadcast address for the PAN.
  - **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. To transmit using a 16-bit address, set DH parameter to zero and DL less than 0xFFFF. 0x000000000000FFFF is the broadcast address for the PAN.
- **Source Address:**
  - **16-bit (MY):** Set/Read the RF module 16-bit source address. Set MY = 0xFFFF to disable reception of packets with 16-bit addresses
  - **64-bit:** 64-bit source address (serial number) and broadcast address (0x000000000000FFFF) is always enabled.
    - **SH: Serial Number High**. Read high 32 bits of the RF module's unique IEEE 64-bit address. 64-bit source address is always enabled.
    - **SL: Serial Number Low**. Read low 32 bits of the RF module's unique IEEE 64-bit address. 64-bit source address is always enabled.

X-CTU(window 1)

X-CTU(window 2)

X-CTU(window 3)

X-CTU(window 4)

Fig 3.9 Network addressing

Step 6: Writing the module.

Write this coniguration into the module by clicking on write option.

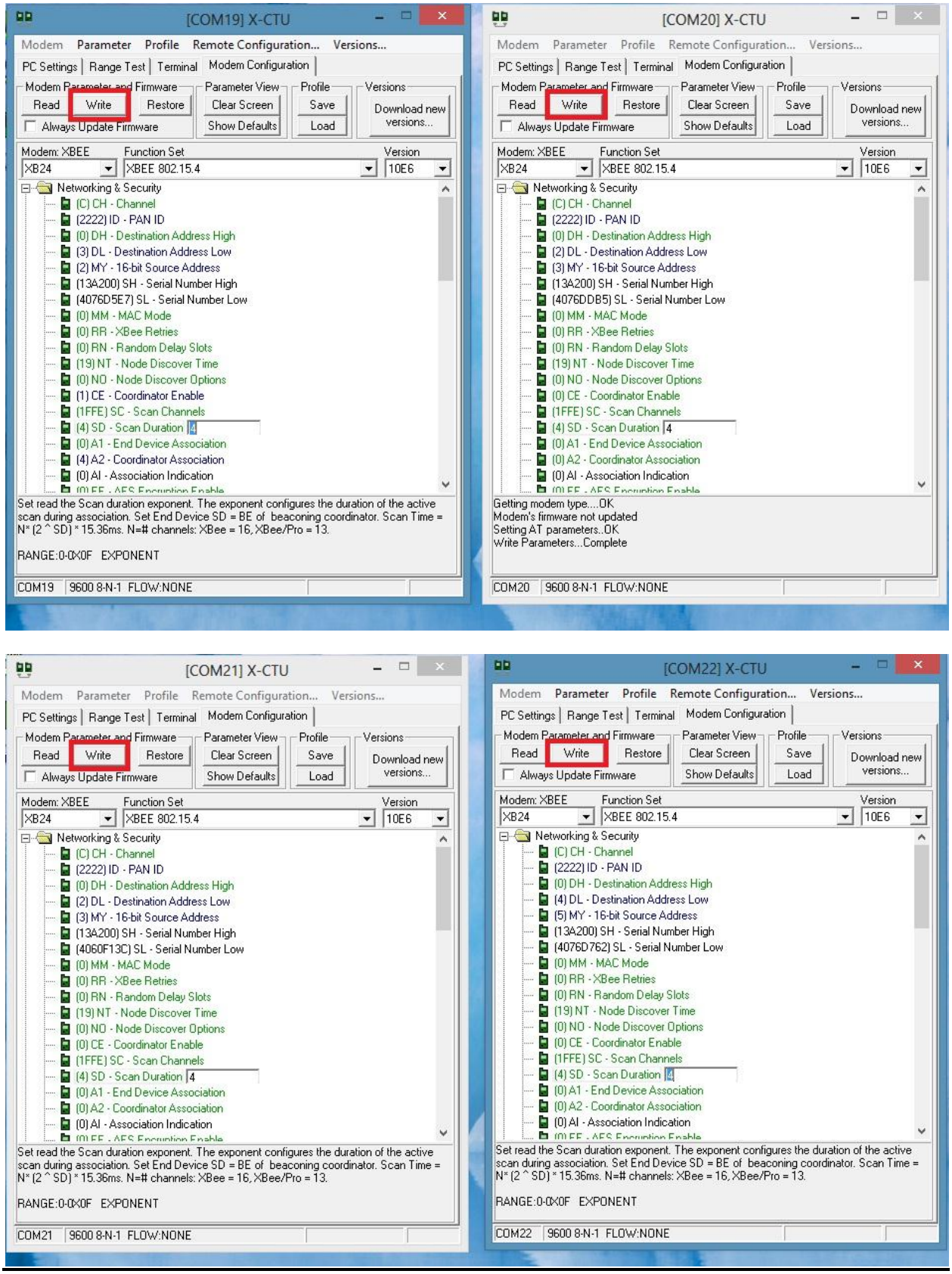


Fig 3.10 writing the module

Step 7: Verification of Multicast Network Configuration.

Go to terminal window and check if the transmission is a valid.

In Terminal Window you can transmit by typing in the workspace.

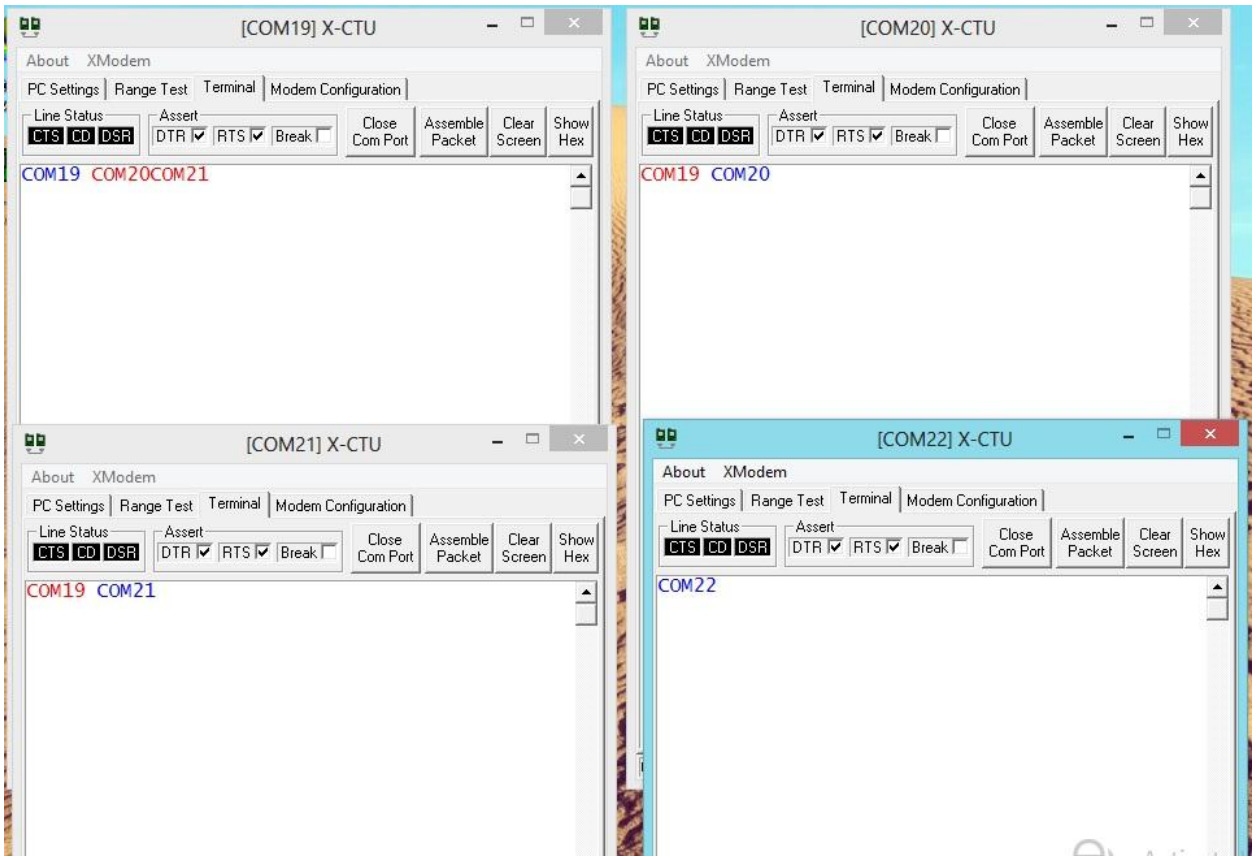


Fig 3.11 verification of Multicast from terminal window

Conclusion:

as it is as shown in fig 3.11:

- [com19] is server and [com20][com21][com22] are end user.
- Data sent by server is received at selected end user and data transmitted by same selected end users are only received by server. Data transmitted by end user outside network are not received by any module, neither do they receive data from any other module.
- Message “com19” was sent by server and is received end users [com20] and [com21]. Message “com20” “com21” was sent by selected end users and received only by server. Message “com22” was sent by end user outside network and not received by any module.
- This is called ‘Multicasting’.