Sociable Objects Workshop

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Plan for Today

- Imagined Sociable Objects: 1 last presentation
- ZigBee Addressing
- firmware updates
- basic configuration
- pair exercise
- Readings & Assignments

Imagined Sociable Objects

- 1 last presentation

Critique Exercise

- 5 minute discussion

ZigBee Addressing

ZigBee Coordinator

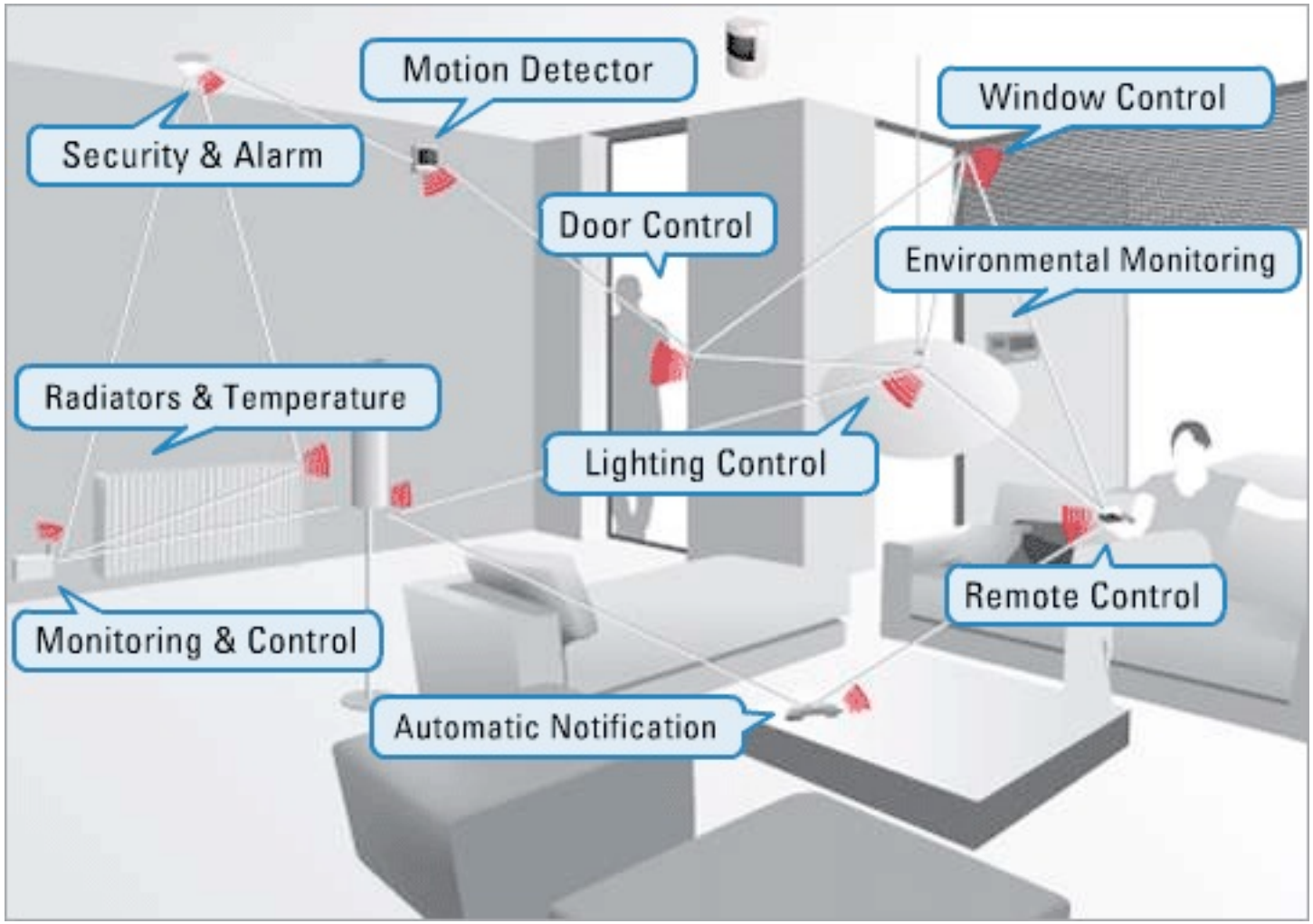
- Every ZigBee network must have a coordinator
- There can only be one coordinator
- Coordinator selects channel and PAN ID
- End devices and routers can then join the PAN
- Typically mains-powered
- Coordinator’s 16-bit address is always 0

ZigBee Router

- Non-coordinator routers are optional to ZigBee networks
- Typically mains-powered
- Many can be on each PAN
- Issues a beacon request on startup to locate channel and PAN
- Routers can communicate with any device on the network
- Stores packets for sleeping end devices
- 16-bit address assigned by coordinator

ZigBee End Device

- Optional to ZigBee networks
- Typically battery-powered
- Many can be on each PAN
- Issues a beacon request on startup to locate channel and PAN
- Automatically attempts to join a valid PAN
- End devices can only communicate directly with their parent
- 16-bit address assigned by coordinator


Motion Detector
Security & Alarm
Window Control
Door Control
Environmental Monitoring
Radiators & Temperature
Lighting Control
Remote Control
Monitoring & Control
Automatic Notification

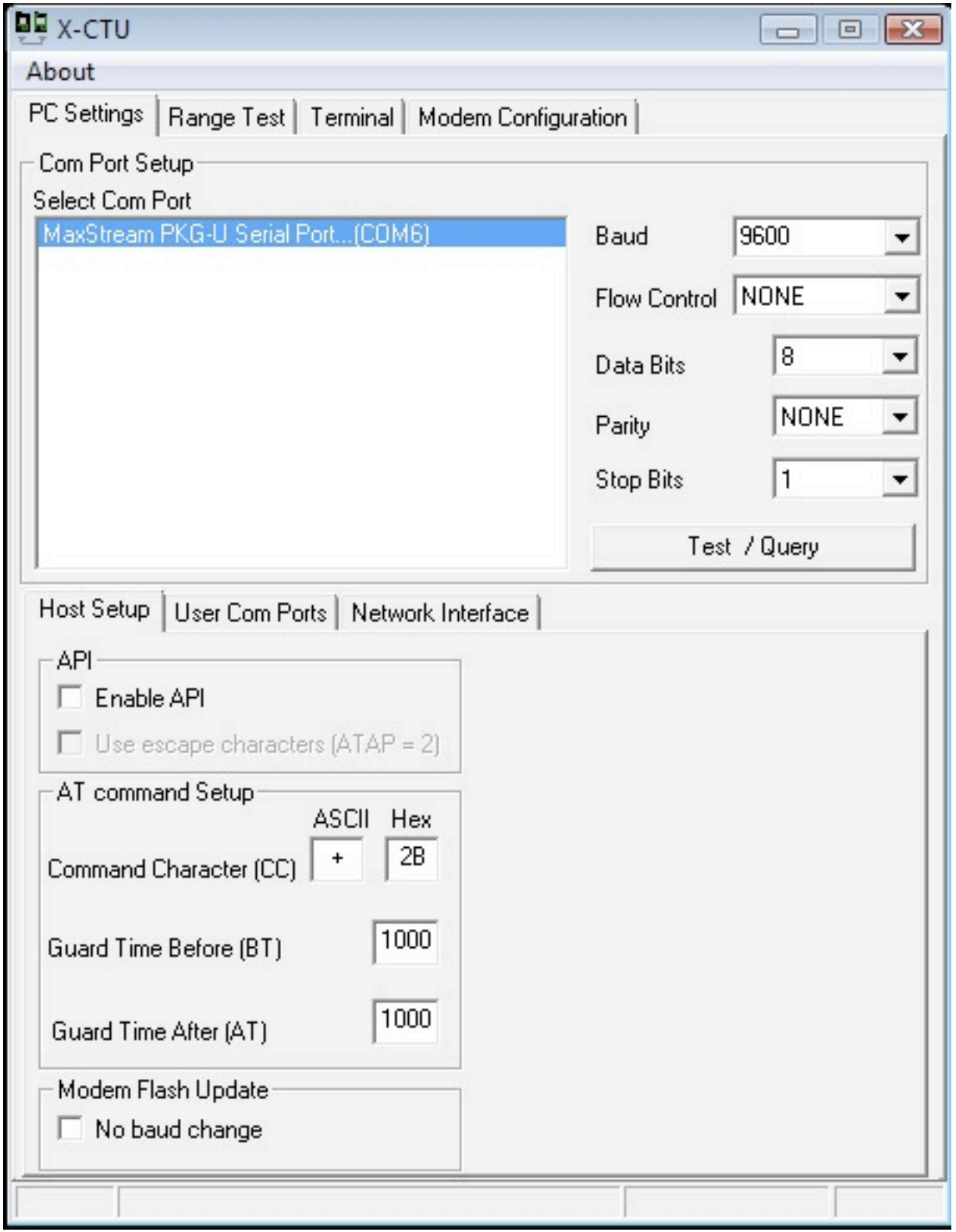
XBee ZB

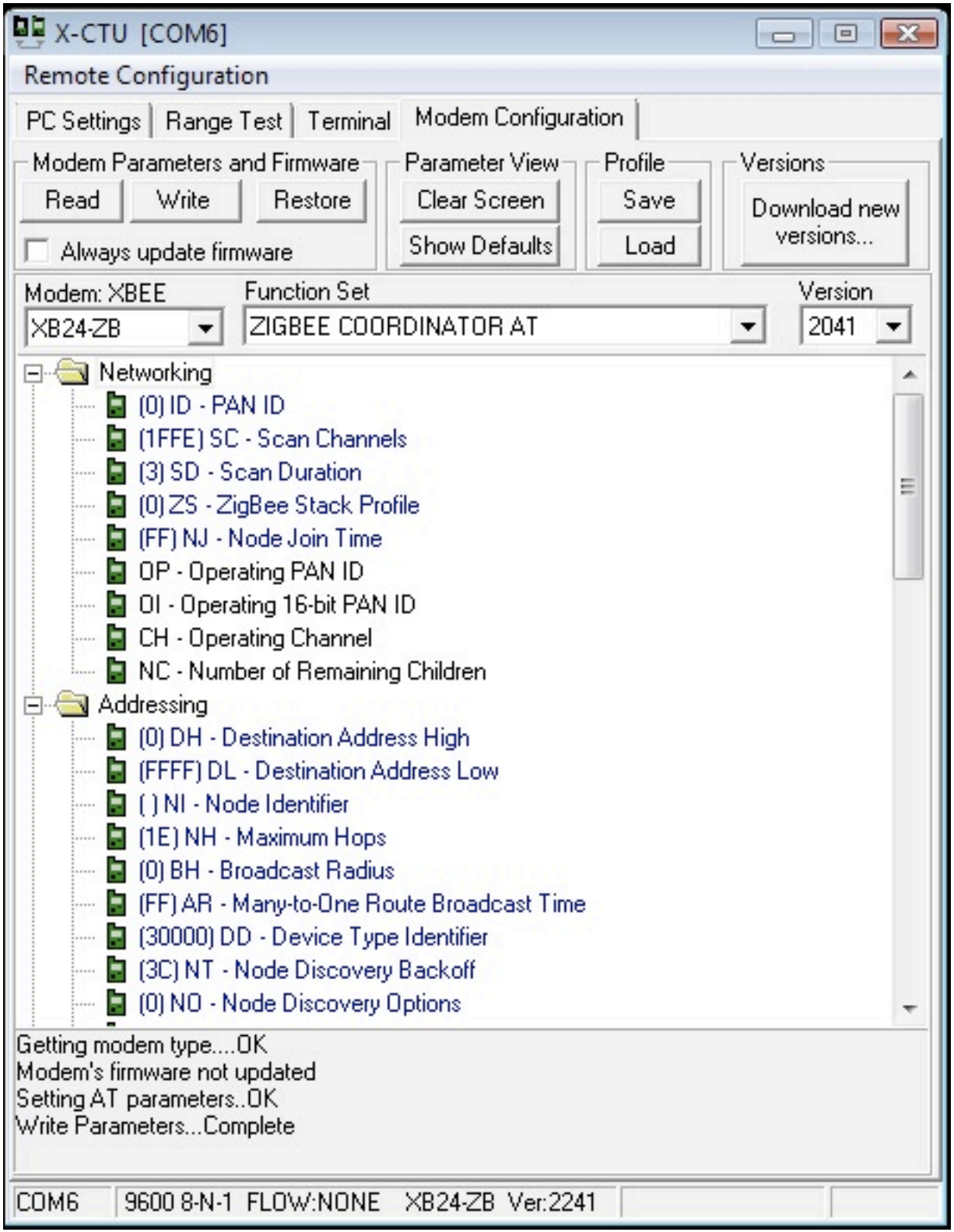
- Coordinator Firmware
  - for AT commands or API
- Router and End Device Firmware
  - for AT commands or API
- ...so 6 different firmware combinations (you'll always use 2 at the same time)
- and two power levels, regular and Pro
- and 4 antennas! whip, chip, U.FL and RPSMA.

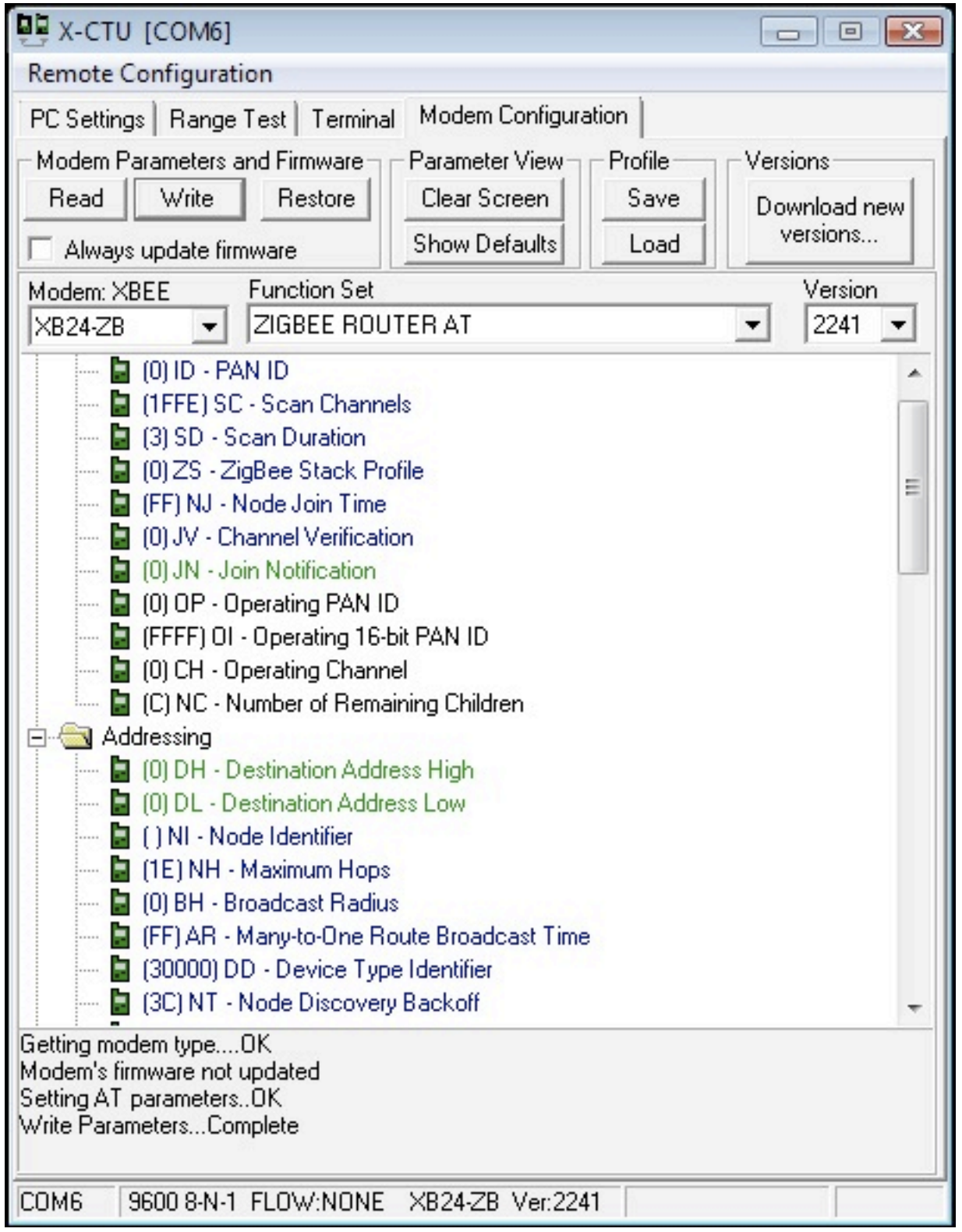
Addressing Basics

- channels
- PAN ID
- 64 bit addresses, aka serial numbers
- 16 bit addresses
- Node Identifier and Node Discovery
- endpoints and clusters

Firmware Updates


X-CTU
About
PC Settings
Range Test
Terminal
Modem Configuration
Com Port Setup
Select Com Port
MaxStream PKG-U Serial Port...(COM6)
Baud
9600
Flow Control
NONE
Data Bits
8
Parity
NONE
Stop Bits
1
Test / Query
Host Setup
User Com Ports
Network Interface
API
Enable API
Use escape characters (ATAP = 2)
AT command Setup
ASCII
Hex
Command Character (CC)
+
2B
Guard Time Before (BT)
1000
Guard Time After (AT)
1000
Modem Flash Update
No baud change


X-CTU [COM6]
Remote Configuration
PC Settings
Range Test
Terminal
Modem Configuration
Modem Parameters and Firmware
Read
Write
Restore
Always update firmware
Parameter View
Clear Screen
Show Defaults
Profile
Save
Load
Versions
Download new versions...
Modem: XBEE
XB24-ZB
Function Set
ZIGBEE COORDINATOR AT
Version
2041
Networking
(0) ID - PAN ID
(1FFE) SC - Scan Channels
(3) SD - Scan Duration
(0) ZS - ZigBee Stack Profile
(FF) NJ - Node Join Time
OP - Operating PAN ID
OI - Operating 16-bit PAN ID
CH - Operating Channel
NC - Number of Remaining Children
Addressing
(0) DH - Destination Address High
(FFFF) DL - Destination Address Low
( ) NI - Node Identifier
(1E) NH - Maximum Hops
(0) BH - Broadcast Radius
(FF) AR - Many-to-One Route Broadcast Time
(30000) DD - Device Type Identifier
(3C) NT - Node Discovery Backoff
(0) NO - Node Discovery Options
Getting modem type....OK
Modem's firmware not updated
Setting AT parameters..OK
Write Parameters...Complete
COM6
9600 8-N-1 FLOW:NONE XB24-ZB Ver:2241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(FF) NJ - Node Join Time
(0) JV - Channel Verification
(0) JN - Join Notification
(0) OP - Operating PAN ID
(FFFF) OI - Operating 16-bit PAN ID
(0) CH - Operating Channel
(C) NC - Number of Remaining Children
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9600 8-N-1 FLOW:NONE XB24-ZB Ver:2241

X-CTU

- Coordinator
- Router
- Both AT command mode
- resets
- about API configurations

Basic Configuration

Download and Install Software & Drivers

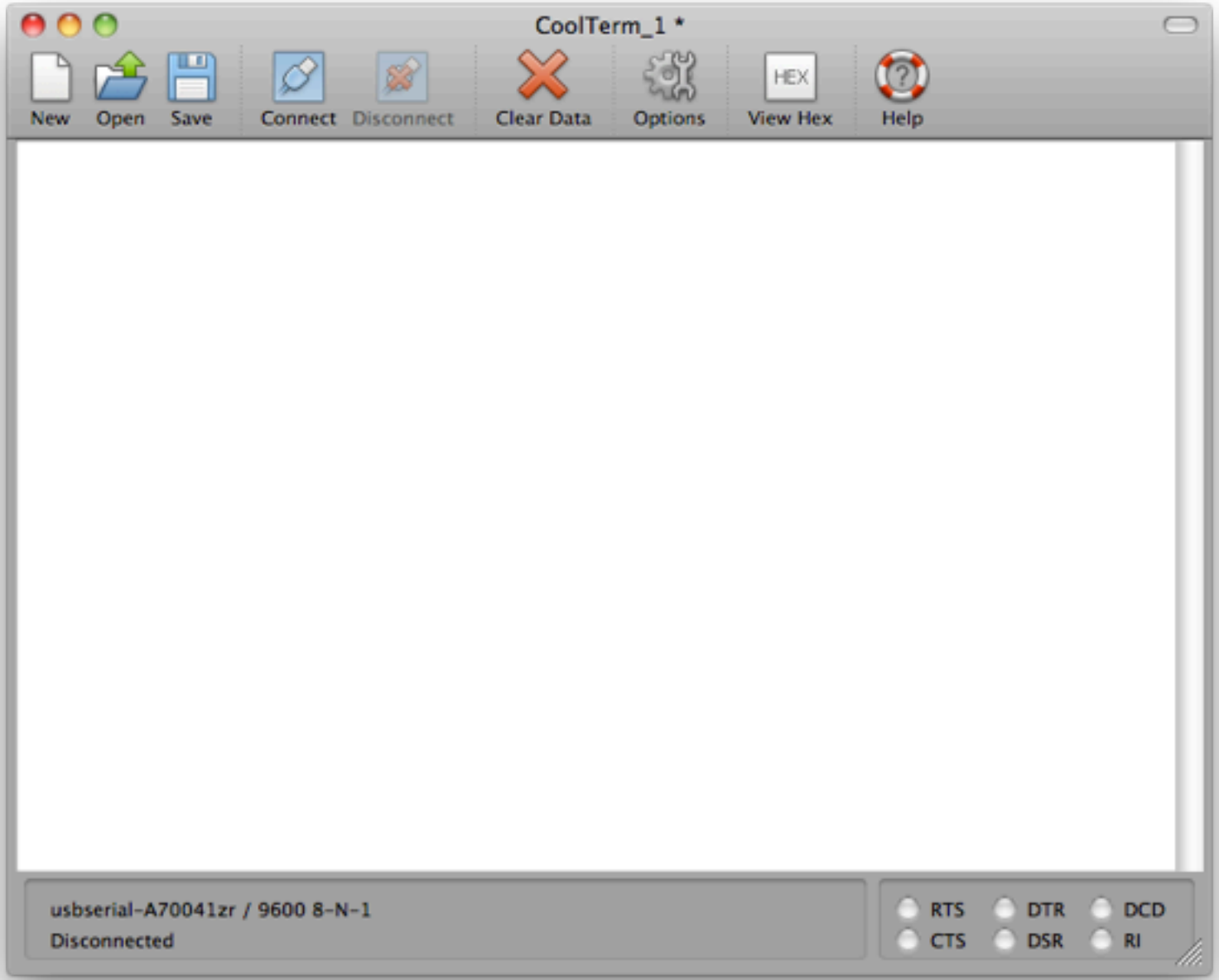
- Download & install the FTDI USB drivers:
  http://www.ftdichip.com/Drivers/VCP.htm

- Download the CoolTerm:
  http://freeware.the-meiers.org/

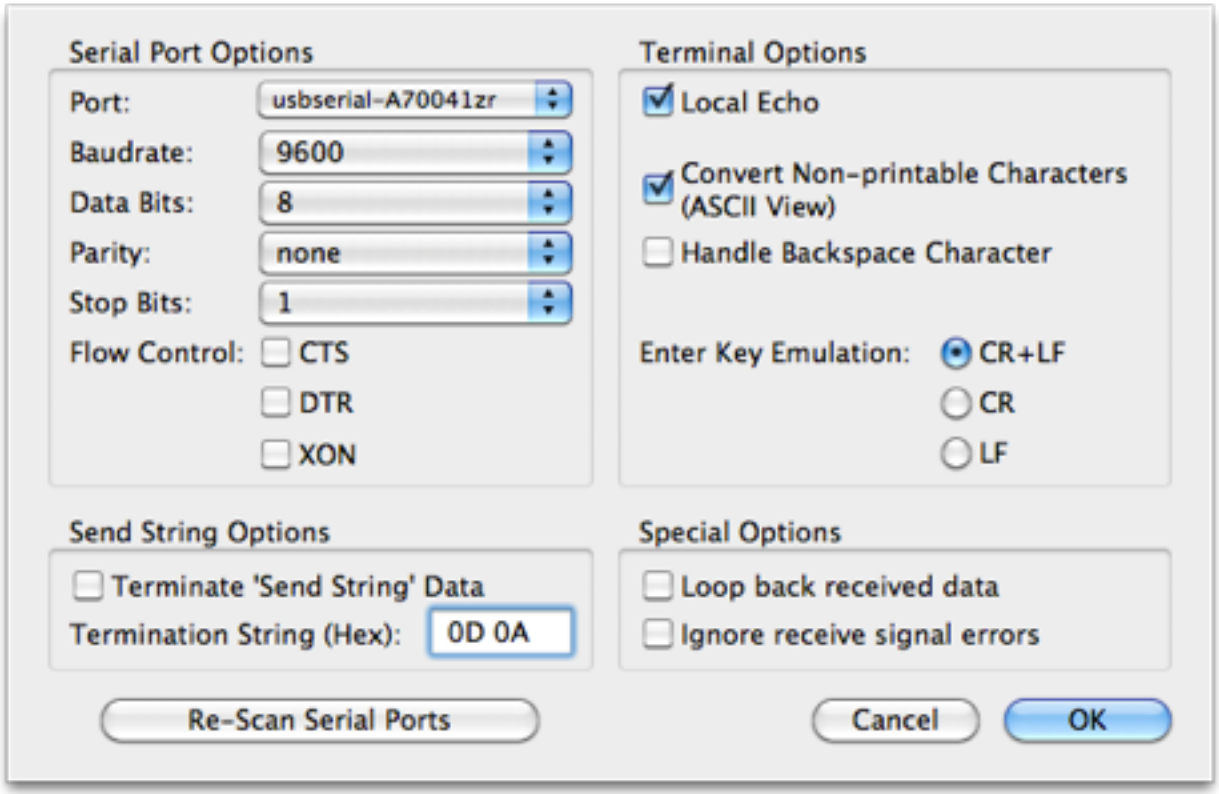
Other Serial Terminal Options:
settings: 9600 baud, 8 bits, no parity, one stop bit, no flow control

- X-CTU: http://www.digi.com/support/productdetl.jsp?pid=3352&osvid=57&tp=4&s=316
- Z-Term: http://homepage.mac.com/dalverson/zterm/
- HyperTerm: Windows Start Menu, Accessories, Communication
- Screen: Terminal program on the Mac (or Linux)

Open CoolTerm

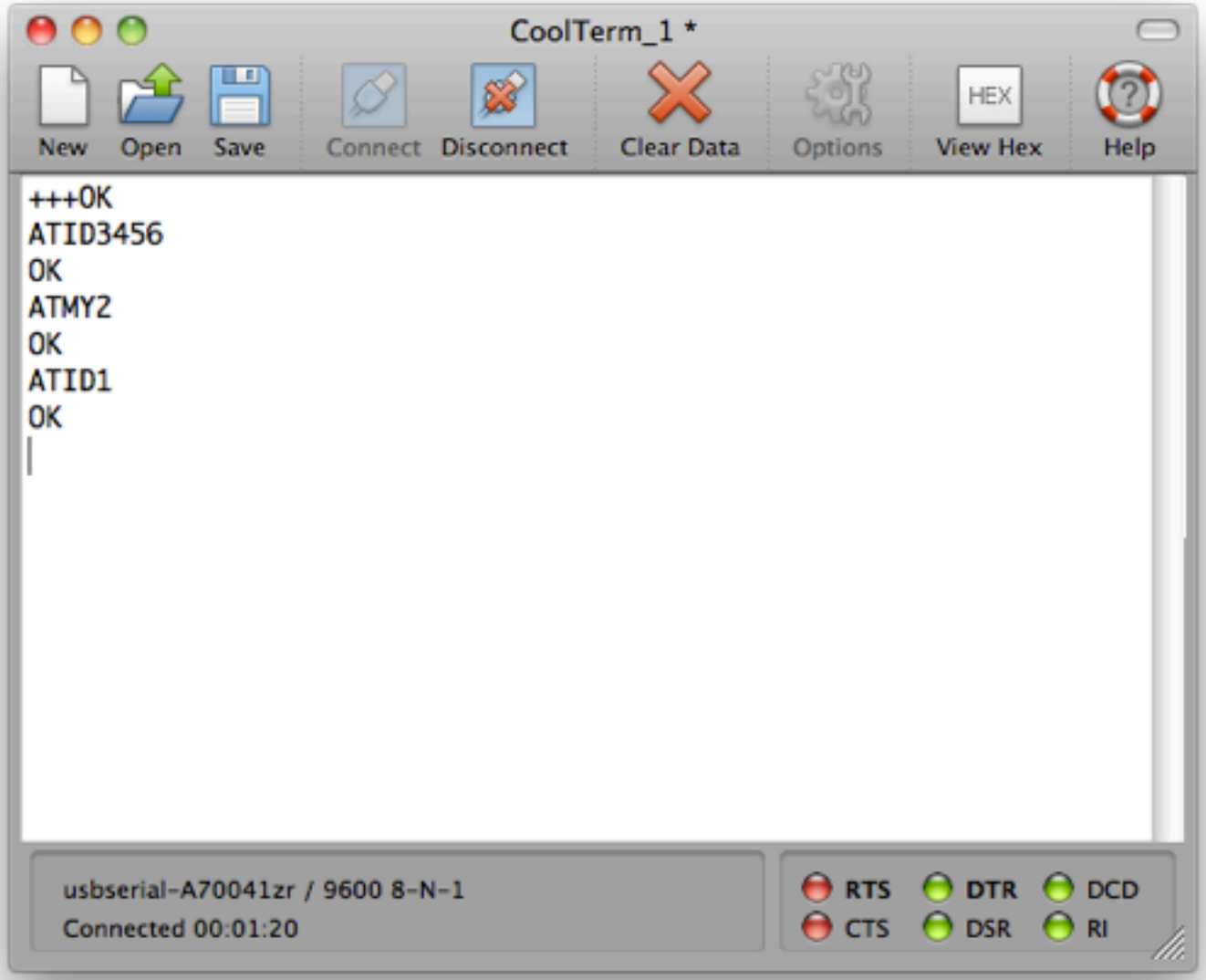


Set Connection Options



Configure your radio with AT commands

- Configure your radio



Baud, Bits and Parity

- Baud rate: 9600
- Data bits: 8
- Stop bits: 1
- Parity: None
- Flow control: none for now...

Data Mode vs. Command Mode

- Idle Mode, transmit and receive data
- Command Mode, talk to the XBee itself
  - +++ "*Yo, XBee*"
  - AT "*Attention!*" (Hayes command set)
    - always press enter after AT commands
    - *never* press enter after +++

AT Commands

Some AT Commands

- AT -> OK
- ATDH, ATDL -> destination address hi/lo
- ATID -> personal area network ID
- ATCN -> end command mode
- ATWR -> write current configuration to firmware
- *ATMY* -> ~~my address~~ NOT SETTABLE FOR ZIGBEE

Pair Exercise

Create a Basic ZigBee Pair

- One coordinator and one router
- Use the 64-bit addresses for destinations
- ATNR will reset your network layer, useful if you join the wrong ID
- Remember, the radios work reliably, troubleshooting is mostly about figuring out what they’re doing.

Readings and Assignments

- Readings
  - XBee Antenna Whitepaper
  - Zigbee vs. 802.15.4 Whitepaper
- Assignments
  - Gather parts for doorbell exercises
  - Complete pairs exercise