



# ZigBee Lab



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# Outline

- ZigBee tools
  - IAR
  - SmartRF
- ZigBee boards
  - Evaluation Board (EB)
  - Development Board (DB)
- Example and exercise

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## ZigBee tools

- **IAR (Ingenjörfirman Anders Rundgren):** is embedded systems workbench IDE for building and running applications on zigbee boards. [www.iar.com](http://www.iar.com)
- **SmartRF™ Studio:** is a Windows application that can be used to evaluate and configure Low Power RF-ICs from Texas Instruments.

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## ZigBee board #1

- **Chipcon SmartRF04EB**  
Evaluation Board with CC2430EM (RF)



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**ZigBee board #1**

The image shows a green PCB with a central LCD screen. Various components are labeled with lines pointing to them. On the left side, labels include: Power connector, DC jack, LCD, USB connector, USB MCU reset, USB MCU, and I/O-232 connector. At the bottom left are: Joystick, I/O connector A, and LEDs. On the right side, labels include: Supply selection switch, Connectors for evaluation module (EM), Fx0 debug/flash connector, GMA test connectors, USB MCU debug connector, Potentiometer, Headphone output, Mic. input, Button S1, and Volume control. At the bottom right are: I/O connector B and Volume control. A 'PRACTIC' logo with a magnifying glass is in the top right corner.

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**ZigBee board #2**

- **Chipcon CC2430DB Development Board**

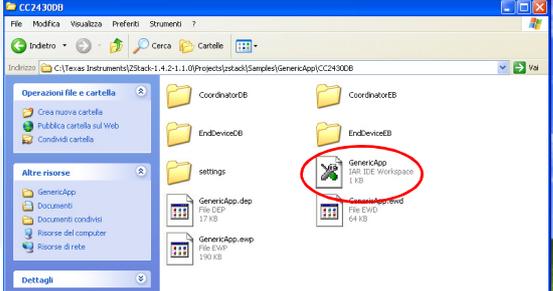
The image shows a green PCB with various components. Labels include: Joystick, I/O connector A, CC2430 Reset, LED, Button S1, CC2430 debug, DC jack (Reverse), USB connector, Battery clip (Reverse), Low current jumpers, Power switch S1, Pot., Accelerometer, EEPROM, Light sensor, I/O connector B, USB MCU, Low current jumpers, CC2430, FCD Antenna, and USB MCU debug connector. A 'PRACTIC' logo with a magnifying glass is in the top right corner.

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## Generic App (1)

- Open GenericApp example(Zstack & IRA tools) from example folder as shown bellow:
  - C:\texasInstrument\Zstack-1.4.2.1.1.0\project\Zstack\samples\GenericApp\CC2430DB\GenericApp

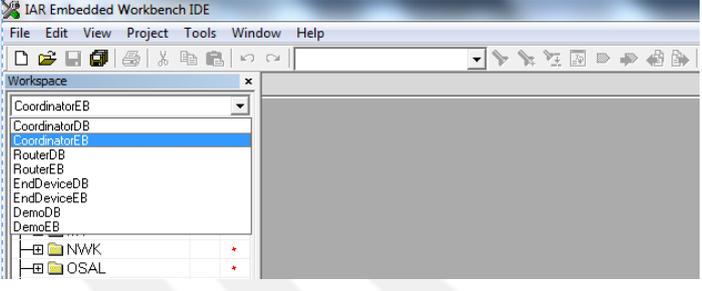


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## Generic App (2)

- Choose Coordinator or End device based on your board type (ED, DB) and ZigBee role (ZC,ZR,ZED)

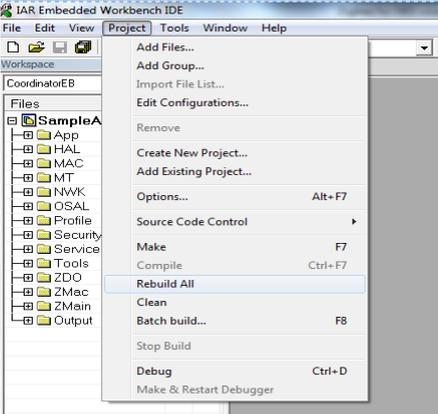


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## Generic App (3)

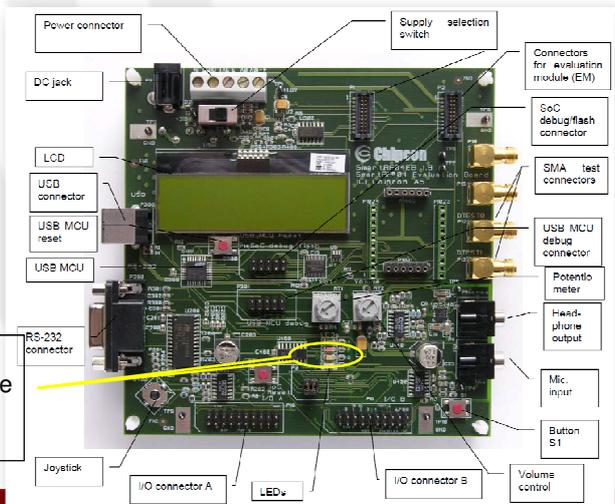
- Then
  - Project-> buildall
  - Project->Debug (for configuration)
- Reset zigBee kit from its switch.
  - S300 for EB
  - S2 for DB
- Repeat these steps to configure other devices



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## Network formation



Power connector

DC jack

LCD

JCD connector

USB MCU reset

USB MCU

RS-232 connector

Joyetick

I/O connector A

LEDv

Supply selection switch

Connectors for evaluation module (EM)

SoC debug/flash connector

SMA test connectors

USB MCU debug connector

Potentiometer

Head-phones output

Mic input

Button S1

I/O connector B

Volume control

Orange light is ON when the node formed the network

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**ESD** Elements Embedded Systems Design

## Join the network

**Red light is ON** when the node **joins** the network & **Blinks** when it disconnects from the network

Labels on the PCB include: Joystick, I/O connector A, CC2430 Reset, LED, Button S1, CC2430 debug, DC jack (Reverse), USB connector, Battery clip (Reverse), Low current jumpers, Power switch S3, Pct., Accelerometer, EEPROM, Light sensor, I/O connector B, USB MCU, Low current jumpers, FCD Antenna, CC2430, and USB MCU debug connector.

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**ESD** Elements Embedded Systems Design

## Auto scan mode

**Push the joystick to the left** to activate the auto scan mode

Labels on the PCB include: Power connector, DC jack, LCD, USB connector, USB MCU reset, USB MCU, RS-232 connector, Joystick, I/O connector A, LEDa, I/O connector B, Supply selection switch, Connectors for evaluation module (EM), SWC debug/flash connector, SMA test connectors, USB MCU debug connector, Potentiometer, Head-phone output, Mic. input, Button S1, Volume control, and I/O connector B.

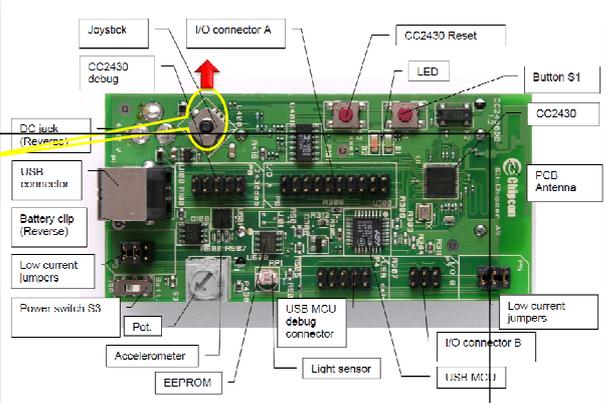
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## Send message

Push the joystick to the up  
To send **"Hello NES 2014"** message and observe the green light.  
If it is ON, it means that the message is sent.

P.S. the applicatoin will continue send the message every 15 sec



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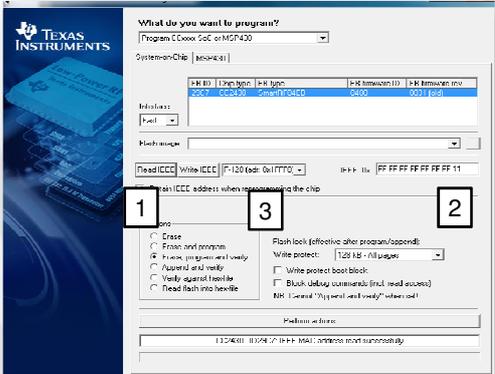

## Change IEEE address

Open SmartRF tool

- IEEE address 8 bytes (static)

Click on:

1. Read
2. Change IEEE
3. Write



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# RF sniffing

The screenshot shows the Texas Instruments SmartRF Packet Sniffer application. The title bar reads "Texas Instruments SmartRF Packet Sniffer: IEEE 802.15.4 MAC and ZigBee 2003". The interface includes a menu bar (File, Settings, Help), a toolbar with a play button circled in red and labeled with a '2' in a box, and a dropdown menu set to "ZigBee 2003". Below the toolbar is a section for "Capturing device" with a list of available devices, including "SmartRF05EB USB Device (443671-CC430)". At the bottom, status information shows "Packet count: 0", "Error count: 0", "Filter: off", "RF device: CC430", "Channel: 11 (DWR)", and "Packet broadcast: OFF".

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# RF sniffing

- Run the app

The screenshot shows the SmartRF Packet Sniffer application with captured data. The title bar reads "Texas Instruments SmartRF Packet Sniffer: IEEE 802.15.4 MAC and ZigBee 2003". The interface is filled with a table of captured packets. A red arrow points from the text "Run the app" to the play button in the toolbar. The table has columns for "Prio", "Time (ms)", "Length", "Frame control field", "Sequence number", "Seq. PAM", "Dest. Address", "Source Address", and "FCS". The table contains several rows of data, including MAC payload and MAC payload CRC. Below the table is a "PACKETS" section with a radio configuration area and a packet capture timeline. At the bottom, status information shows "Packet count: 285", "Error count: 6", and "Filter: OFF".

Prio	Time (ms)	Length	Frame control field	Sequence number	Seq. PAM	Dest. Address	Source Address	FCS
000	0.0	8	Type: 000, Src: 000, Dest: 000, PAM: 00000000	0	0000	00000000	00000000	00000000
000	0.0	25	Type: 000, Src: 000, Dest: 000, PAM: 00000000	0	0000	00000000	00000000	00000000
000	0.0	5	Type: 000, Src: 000, Dest: 000, PAM: 00000000	0	0000	00000000	00000000	00000000
000	0.0	27	Type: 000, Src: 000, Dest: 000, PAM: 00000000	0	0000	00000000	00000000	00000000
000	0.0	5	Type: 000, Src: 000, Dest: 000, PAM: 00000000	0	0000	00000000	00000000	00000000
000	0.0	10	Type: 000, Src: 000, Dest: 000, PAM: 00000000	0	0000	00000000	00000000	00000000
000	0.0	24	Type: 000, Src: 000, Dest: 000, PAM: 00000000	0	0000	00000000	00000000	00000000
000	0.0	10	Type: 000, Src: 000, Dest: 000, PAM: 00000000	0	0000	00000000	00000000	00000000

Figure 12: Packet sniffer screenshot from the IEEE802.15.4/ZigBee protocols

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## Exercise



- Configure the application based on the following requirements:
  - Change the message to “Ciao NES”.
  - Change the operating frequency to 2415 MHz
  - Change the IEEE address of the coordinator node to “00 11 22 33 44 55 66 77”
  - Run the application and sniff the data
- Raise your hand when you are done

