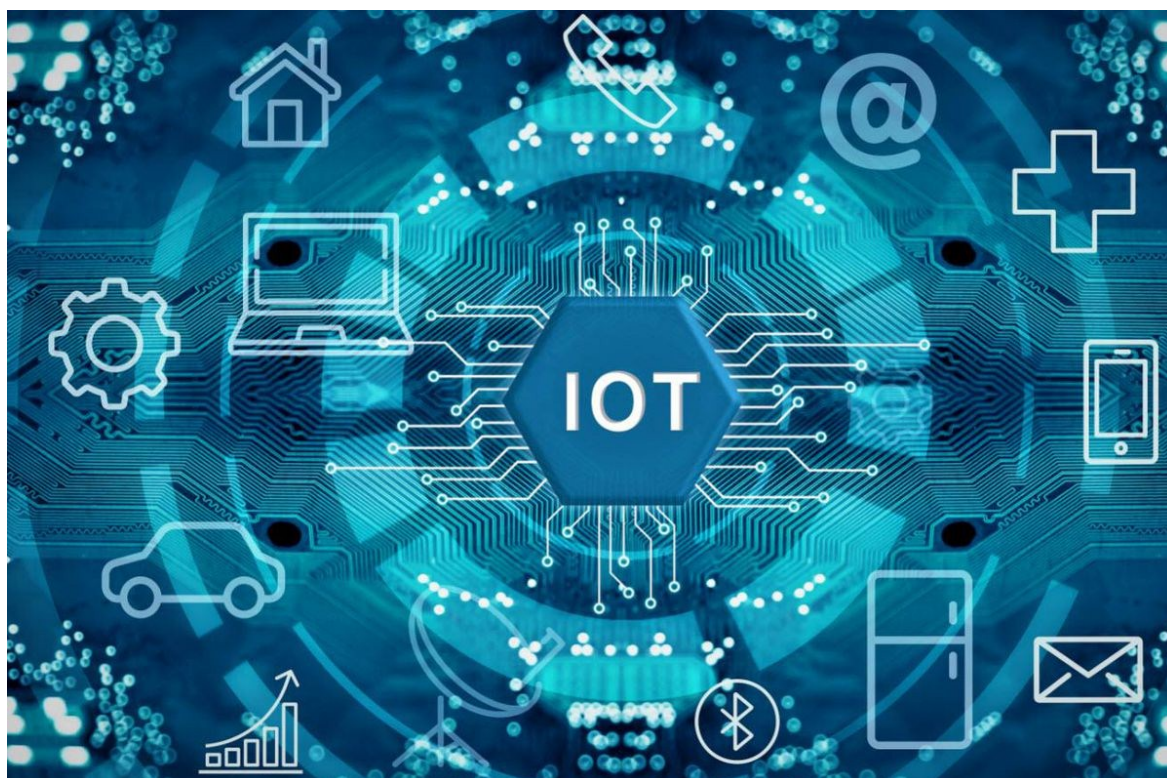


Laboratory manual

# INTERNET OF THINGS

Version 1.0



## 1. Hardware description

The course is based on programming and communicating with CC3220 development board, manufactured by Texas Instruments (see Figure 1). Key features of the board include:

- CC3220S/SF, SimpleLink Wi-Fi, Internet-on-a chip solution with integrated MCU
- 40-pin LaunchPad standard that leverages the BoosterPack ecosystem
- XDS110-based JTAG emulation with serial port for flash programming
- Two buttons and three LEDs for user interaction
- Back-channel universal asynchronous receiver/transmitter (UART) through USB to PC
- Onboard chip antenna with U.FL for conducted testing
- Onboard accelerometer and temperature sensor for Out-of-Box Experience (OOBE)
- Micro USB connector for power and debug connections

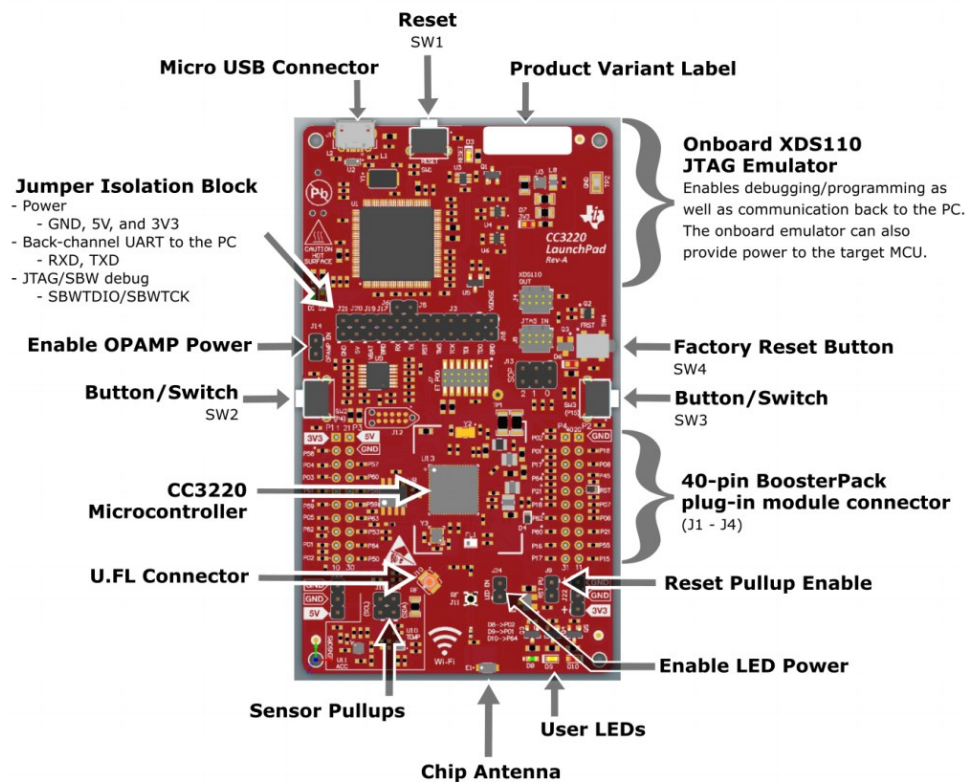


Figure 1 CC3220 Development Kit overview

For more information about the board, please refer to the CC3220 Development Kit User's Guide.

## 2. System overview

Figure 2 presents the overview of the system used during laboratory course.

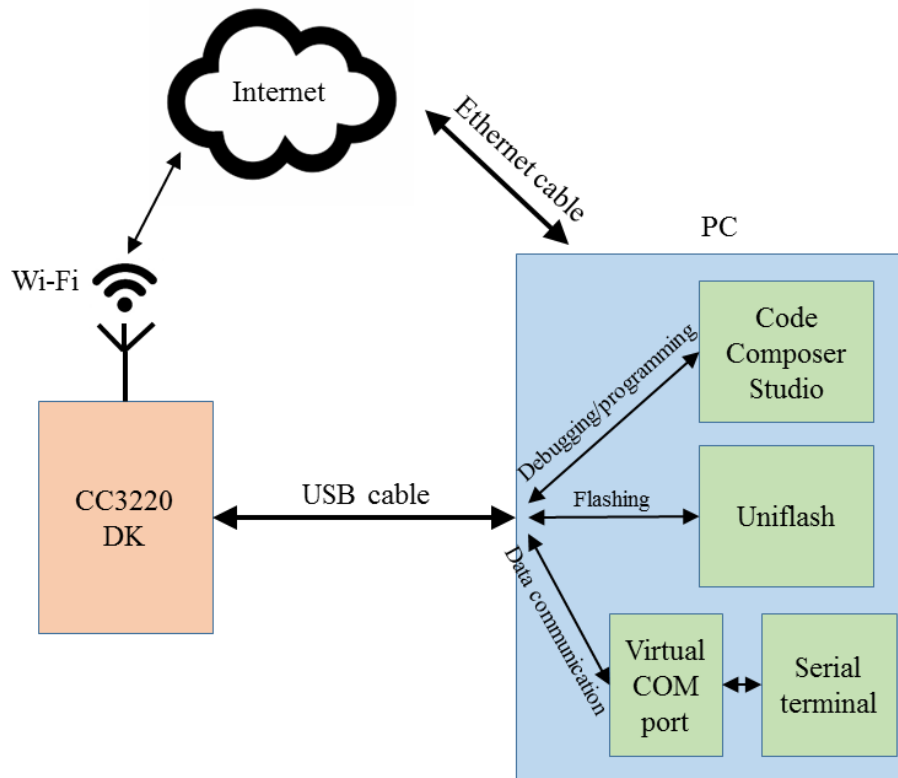


Figure 2 System overview

### 3. Software description

Debugging and programming the board can be performed directly in Code Composer Studio 10 and CC3220 Software Development Kit, which should already be installed and ready to use on laboratory computers. Additionally, directly flashing memory is possible using the application TI Uniflash. For data communication with the board, any serial port terminal can be used, for example PuTTY.

### 4. First steps

1. Connect the board with the PC using the USB cable.
2. Power up the CC3220 DK board with the provided power cable. Make sure the LEDs on board are lit.
3. Open PuTTY and launch a serial connection with the following parameters: COM xxx port, 115200 baud rate, 8-bit data, parity: none, stop: 1-bit, flow control: none. You can save the parameters of the connection for later use by specifying the session name (for example "TI serial") and clicking on "save".

4. Launch Code Composer Studio. To properly configure it, choose a folder which will be used as your workspace. Remember to choose a folder for which you have writing permissions. To import an existing project, you can click on View->Resource Explorer and browse pre-installed examples.
5. Import the project “out\_of\_box\_CC3220SF\_LAUNCHXL\_freertos\_ccs”. This is the default project programmed on the board.
6. Make sure the project is active (its name is in bold letters) and try to build it by clicking on the “hammer” icon, there shouldn’t be any errors.
7. If the project compiled successfully, start the debugging session by clicking on the “bug” icon. Wait until the compiled code is copied to the board.
8. To start the program in a debugging mode, click on the small “play” icon. You should see some messages in your serial terminal window (PuTTY), see Figure 3.

```

=====
out of box Example Ver: 1.00.00.09
=====

CHIP: 0x30000019
MAC: 2.0.0.0
PHY: 2.2.0.6
NWP: 3.13.0.3
ROM: 0
HOST: 3.0.1.55
MAC address: 98:84:e3:f6:71:a0
=====

[Provisioning task] Wake up on Power ON
[WLAN EVENT] STA Connected to the AP: DMCS-IoT ,BSSID: 74:4d:28:f1:ca:22
[NETAPP EVENT] IP Acquired: IP=192.168.88.241 , Gateway=192.168.88.1
[Provisioning task] Connection to AP succeeded
[Provisioning task] IP address is 192.168.88.241
[Provisioning task] detected device is CC3220SF

```

Figure 3 Sample output at serial terminal after resetting the board

9. Enter the board’s IP address in your browser, the board’s webpage should appear (Figure 4). Click on the button and observe how the state of the red LED changes. Move the board and observe how accelerometer data change.

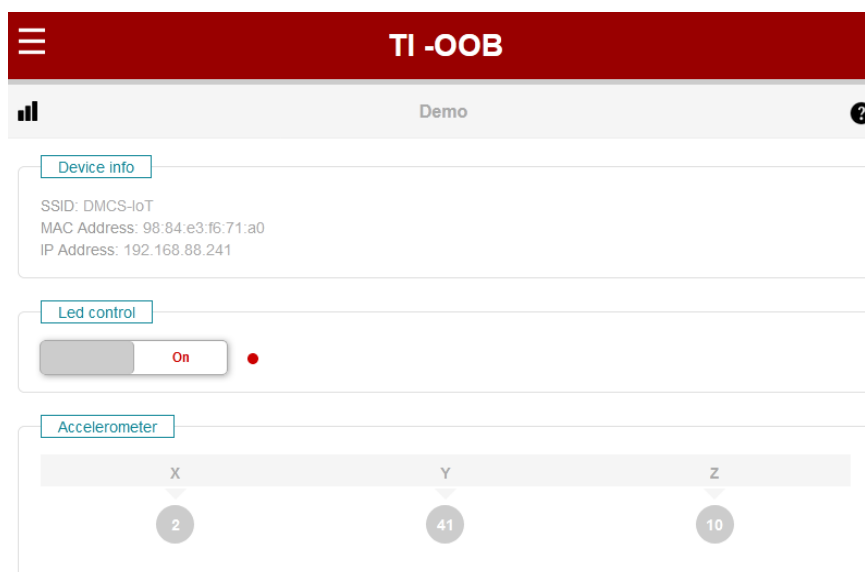


Figure 4 Board's default webpage

## 5. Help! Step 9 from section 4 does not work! (optional)

If you cannot display board's webpage in the browser, it means that cannot communicate with the board via WiFi. The usual reason is that the board enters sleep mode after 1-2 minutes of inactivity and needs to be woken up. Please follow the steps:

1. Run the console and type the command "ping -t <board\_ip\_address>". The board probably will not be responding. Keep this window open, making sure that your computer continues to ping the board.
2. Terminate the debug session in Code Composer Studio by clicking on the "stop" icon.
3. Reset the board by manually pressing the reset button (the one next to the USB connector).
4. Observe the console window. If the board still does not respond to ping command, reset the board one more time.
5. When you see the response, you can launch debug session in Code Composer Studio again.