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D2.4

Wireless and ancillary hardware BoM



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1. DOCUMENT INFORMATION

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4. ABSTRACT

Currently efficient options exist for low-power connectivity such as Zigbee and the more recent Bluetooth LE (low-energy). However, video streaming is not supported due to low bandwidth. EoT aims at being both interoperable and flexible, so video streaming must be possible (although not always desirable). EoT will use TCP/IP over Wi-Fi, since it supports video streaming and is widely deployed. Video compression (which can be performed efficiently with the video processor) and low-power features present in the latest Wi-Fi modules prepared for the Internet of Things will be leveraged, having low-power standby modes and fast wake-up times. This brief report describes EoT Wi-Fi deliverable.

5. WI-FI MODULE

MOVIDIUS-UCLM selected the WiFi module for EoT project carefully among a number of candidates. The CC3100 is a low-power (4 μ A hibernate, 115 μ A deep sleep, 50-230 μ A active), easy-to-use, and quick design WiFi module created for the Internet of Things (IoT) with all required protocols integrated. Ti CC3100 module features are as follows:

- Wi-Fi Module consisting of CC3100R11MRGC.
- Wi-Fi network processor and power-management subsystems.
- Includes all required clocks, SPI Flash, and passives.
- Modular FCC, IC, CE certifications save customer effort, time, and money.
- Completely offloads Wi-Fi and internet protocols from the external.
- Full on-board TCP/IP (IPv4, IPv6 to follow) and TLS stack
- Wi-Fi CERTIFIED modules, with ability to request certificate transfer for Wi-Fi alliance members.
- Eval modules available from TI.

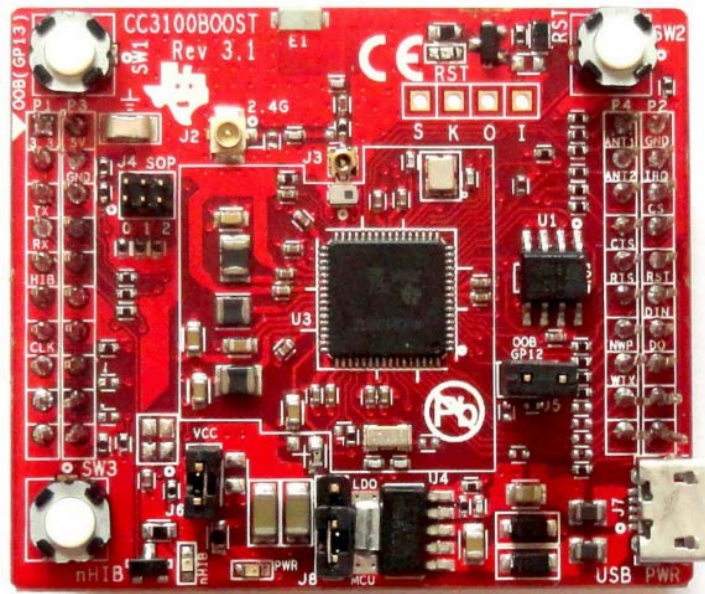


Figure 1: Wi-Fi TI CC3100BOOST.

Fig. 2 and 3 show the TI CC3100 connection and communication method and its basic SPI configuration.

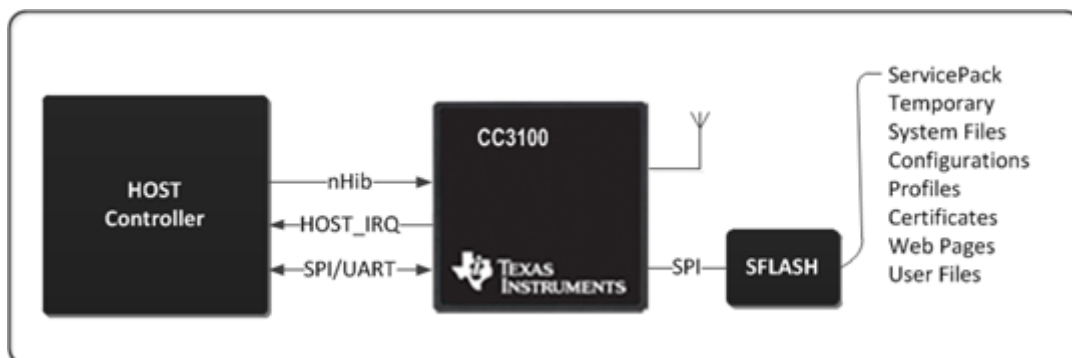


Figure 2: SimpleLink CC31xx Wi-Fi and Networking solution.

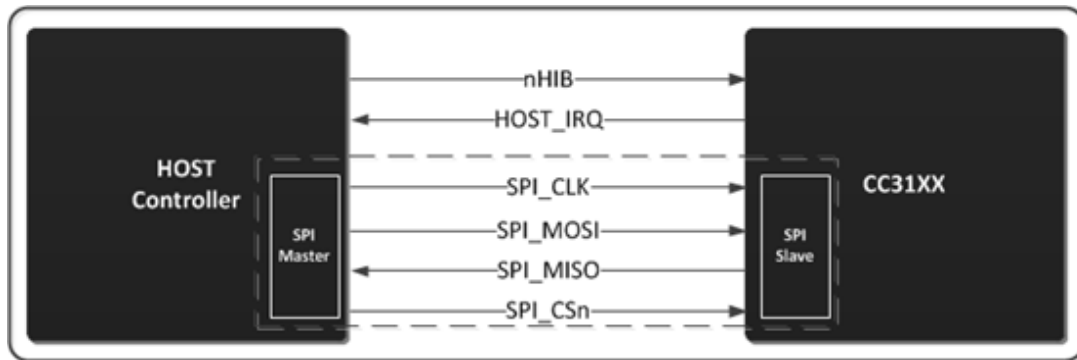


Figure 3: Basic SPI Configuration.

HW Setup and SW Configuration for 1st Development Prototype (MV0182)

This section describes the hardware setup and software configuration for using the Texas Instruments CC3100BOOST SimpleLink Wi-Fi device (Fig. 1) along with Movidius Myriad2 development platform (MV0182). Fig. 4. shows the block diagram of Wi-Fi rig connection.

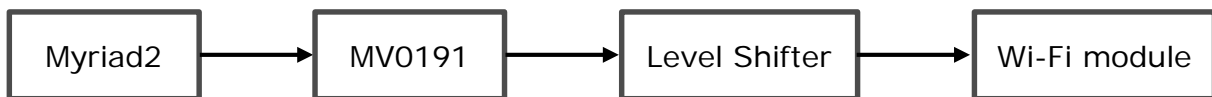


Figure 4: Block diagram of Wi-Fi rig connection.

Fig. 5 shows the assembled testing rig.



Figure 5: Wi-Fi HW rig on MV0182.

5.1.1. CC3100BOOST setting and connection

Before assembling the testing rig, it should be noted that the firmware on CC3100BOOST board should be updated to the latest ServicePack using the CC31XXEMUBOOST board and the UniFlash tool. All software and instructions can be found on the Texas Instruments website, from the links provided in the Bill of Materials. To update the ServicePack, ensure the jumper settings are those specified in the TI documentation (J6 connected, J8 connecting lower two pins, nHIB connected). When it is completed, CC3100BOOST board should be disconnected from CC31XXEMUBOOST board, reconfigured its jumper settings, and connected to level shifter as follows:

- **Jumper Settings:**
 - The J6 (VCC) jumper should be connected (left hand side).
 - The J8 jumper should have the upper two pins connected (lower center).
 - The nHIB jumper should be disconnected (right hand side).
- **Connections:** The pins used on the CC3100 are detailed below. The names in brackets are the names of the equivalent pins used on the Level Shifter board. The colours given are arbitrary and purely in reference to the Fig. 4.
 - P1.5 : nHib (SCL - Red)
 - P1.7: CLK (SCK - Yellow)
 - P2.2: HOST_IRQ (SDA - Yellow)
 - P2.3: Chip Select – CS (SS# - Red)
 - P2.6: DI[N] – MOSI (MOSI - Green)
 - P2.7: DO[UT] – MISO (MISO - Black)

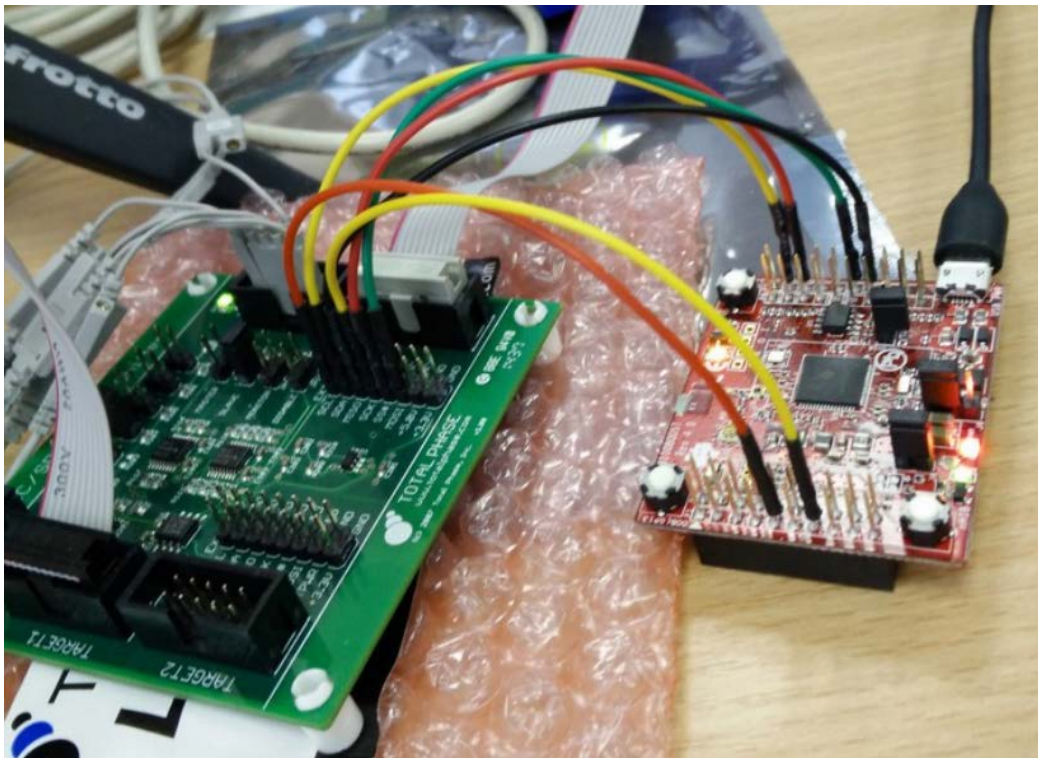


Figure 6: Wi-Fi TI CC3100BOOST to TotalPhase level shifter connection.

5.1.2. Level Shifter setting and connection

As shown in Fig. 4, the selected CC3100BOOST module is connected to MV0182 development board via the TotalPhase level shifter (Fig. 7) and MV0191 extension board (Fig. 8), which expose the SPI of Myriad2. Jumper setting and connection on level shifter would be as follows:

- **Jumper Settings:**
 - TWPR (top left) jumper connected.
 - 1.8V (center top) jumper connected.
 - SLAVE jumper connected.
- **Connections:**
 - The ribbon cable on the left is connected to a 10-pin splitter cable which is in turn
 - connected to the MV0191 board.
 - The ribbon cable on the right is connected to the Beagle I2C/SPI Protocol Analyzer.
 - The grey wires on the upper right are connected to a digital oscilloscope (optional).
 - The multi-coloured cables are connected to the CC3100BOOST board. The SPI pins are connected to their counterpart on the CC3100. The SCL and SDA pins are connected to the nHIB and HOST_IRQ pins on the CC3100, respectively.

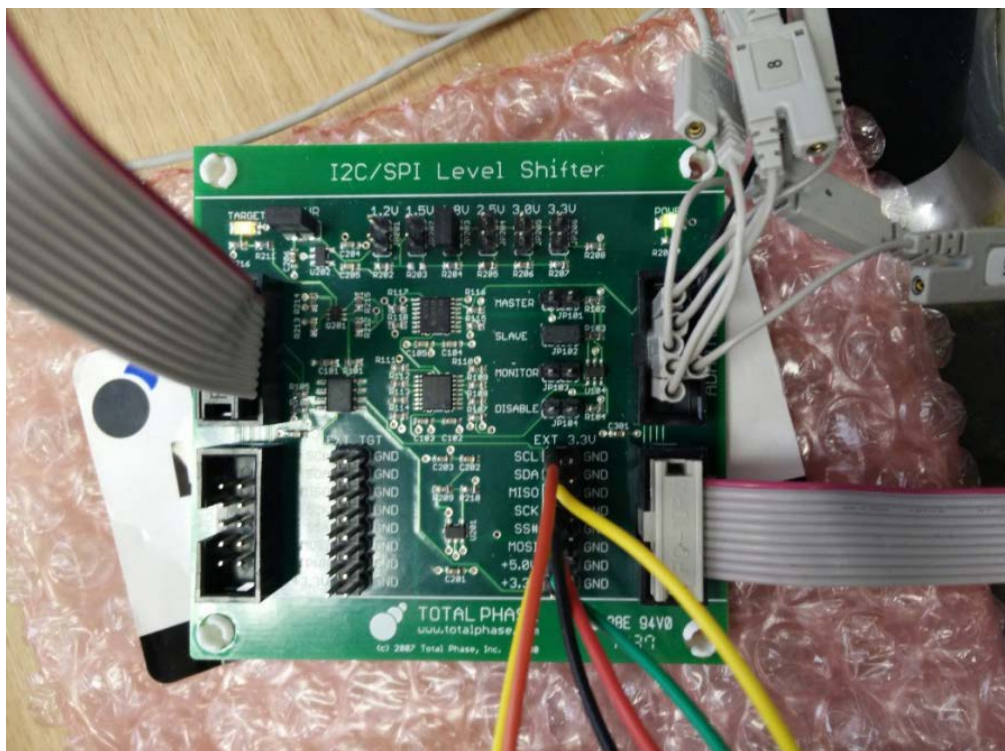


Figure 7: TotalPhase Level Shifter Board.

5.1.3. MV0191 extension board setting and connection

The level shifter is connected to the MV0191 extension board as detailed below. The colours in brackets are those of the 10-pin splitter cable wires. In addition to

the regular SPI wires, the SCL wire (Brown) is connected to the AP_IO_EXP1 pin and the SDA wire (Orange) is connected to the AP_IRQ pin.

- **J1 Connector**
 - Pin 10: Ground (Red)
 - Pin 20: SPI MOSI (gray)
 - Pin 21: SPI SCK (purple)
 - Pin 22: SPI MISO (green)
 - Pin 24: AP_IRQ pin used as HOST_IRQ from CC3100 board (orange)
- **J4 Connector**
 - Pin 1: SPI_SS1 pin used as Slave Select for CC3100 board (white)
 - Pin 2: AP_IO_EXP1 pin used as nHIB for CC3100 board (brown)
 - J5 Connector
 - Pin 13: Ground (Black)
- **J5 Connector**
 - Pin 13: Ground (Black)

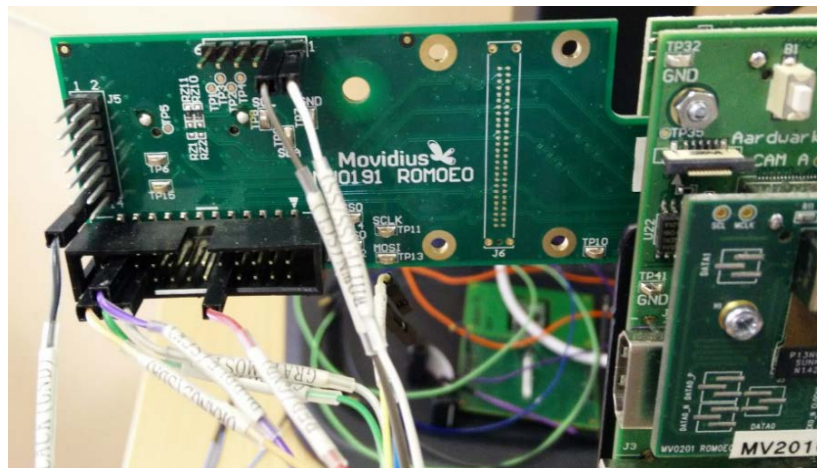


Figure 8: MV0191 extension board.

5.1.4. MV0182 Boot Settings

MV0182 boot setting is important in proper functionality of the WiFi. Accordingly, the setting on the DIP switches should read as "00001100", the factory default configuration.

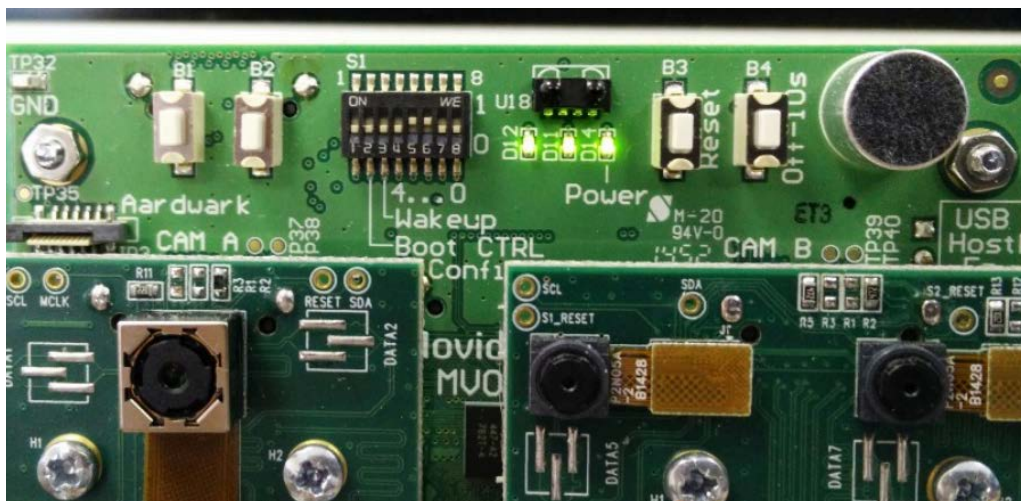


Figure 9: MV0182 Boot Settings board.

5.1.5. CC3100MOD Considerations

Although this document describes the usage of a CC3100BOOST board, it is functionally equivalent to a CC3100MOD connected to a CC3100MODBOOST board. A minor difference is that on the HOST_IRQ pin is referred to as HOST_INTR on the CC3100MOD. The CC31XXEMUBOOST board can be used with either the CC3100BOOST or CC3100MODBOOST boards, as per the TI documentation.

■ Bill Of Materials

The bill of materials, HW, SW, online resources, and deliverable software for the Wi-Fi rig is listed as follows:

5.2.1. Hardware

- Movidius Myriad2 Development Kit (MV0182 R3M0E0)
- Movidius MV0191 Extension Board (ROM0E0)
- TotalPhase Level Shifter Board
 - <http://www.totalphase.com/products/level-shifter/>
- TotalPhase Beagle I2C/SPI Protocol Analyzer
 - <http://www.totalphase.com/products/beagle-i2csapi/>
- TotalPhase Splitter Cable
 - <http://www.totalphase.com/products/split-cable/>
- Texas Instruments SimpleLink WiFi CC3100 BoosterPack
 - <http://www.ti.com/tool/cc3100boost>
- Texas Instruments CC31XXEMUBOOST Board
 - <http://www.ti.com/tool/CC31XXEMUBOOST>
- Misc cables for connecting board pins

5.2.2. Software

- Movidius MDK 15.02.0
- Total Phase Data Center
 - <http://www.totalphase.com/products/data-center/>
- Texas Instruments UniFlash Tool + Latest CC3100 ServicePack
 - http://processors.wiki.ti.com/index.php/CC31xx_%26_CC32xx_SimpleLink_Tools#UniFlash
 - http://processors.wiki.ti.com/index.php/CC31xx_Release_Notes

5.2.3. Online Resources

- Level Shifter Board Manual
 - <http://www.totalphase.com/support/articles/200397858>
- CC31XX Wiki
 - http://processors.wiki.ti.com/index.php/CC31xx_%26_CC32xx
- Movidius Developer Support <https://www.movidius.org/>
- Wi-Fi Driver Software <https://github.com/CTOmovidius/MvEoT>

■ Software Deliverables

The Myriad2 port of the SimpleLink Wi-Fi Host driver software is available on GitHub for cloning or downloading (link provided in previous section). The code is organized in the traditional manner for Myriad2 development using the MDK 15.02.0 release. The driver and example code can be found in the mdk/emdalo/wifi_driver directory, the structure of which is described below.

5.3.1. File Structure

Makefile	Top level Makefile for tests
config/	Myriad2 build scripts
doc/	Documentation
leon/	
app_config.c	Myriad2 configuration functions
app_config.h	Myriad2 configuration header
get_time.c	CC3100 get SNTP Time example (AP)
main.c	Main code entry point
sl_common.h	CC3100 common example definitions
simplelink/	Myriad2 port of CC3100 SPI Host Driver
board.c	Test Rig configuration and setup functions
board.h	Test Rig configuration and setup header
cli_uart.h	Command Line Interface macro definitions
spi.c	Myriad2 SPI Master port for SimpleLink Host driver
spi.h	Myriad2 SPI Master driver public interface
user.h	Configuration of SimpleLink Host driver definitions
include/	CC3100 SimpleLink Host Driver header files
source/	CC3100 SimpleLink Host Driver source code
output/	Output directory for build system

5.3.2. Running The Example Test

The simplest example to run is the `get_time` example from the TI CC3100 Software Development Kit (v1.1.0). This example connects to a local wireless network and then contacts an NTP server to get the current time. Before running the test, you must edit the `sl_common.h` header file and edit the `SSID_NAME`, `SEC_TYPE` and `PASSKEY` definitions to match those of your local wireless network. Once the testing rig has been assembled and powered-up (including the Myriad2 JTAG debugged), start the `moviDebugServer` by running "make start_server" in the `wifi_driver` directory. The `get_time` test can now be run via "make run" in the `wifi_driver` directory (in a different terminal/window from the `start_server` one).

Wi-Fi CC3100BOOST module on EoT DevBoard

As EoT HW work progresses, the MV0182 board is substituted by EoT DevBoard (also called Rev1). At this stage, the level shifter is integrated into the board and SPI of Myriad2 would be accessible without requiring the MV0191. So, CC3100BOOST would be the only module which is connected to DevBoard as a daughter card. Fig. 10 shows Wi-Fi to Myriad2 connection on schematic design.

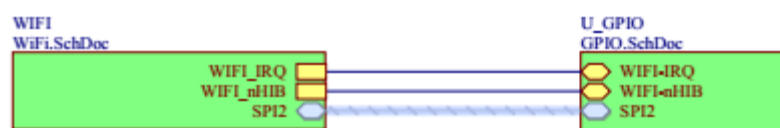


Figure 10: Wi-Fi to Myriad connection on EoT DevBoard schematic.

The schematic of Wi-Fi for EoT DevBoard is shown in Fig. 11.

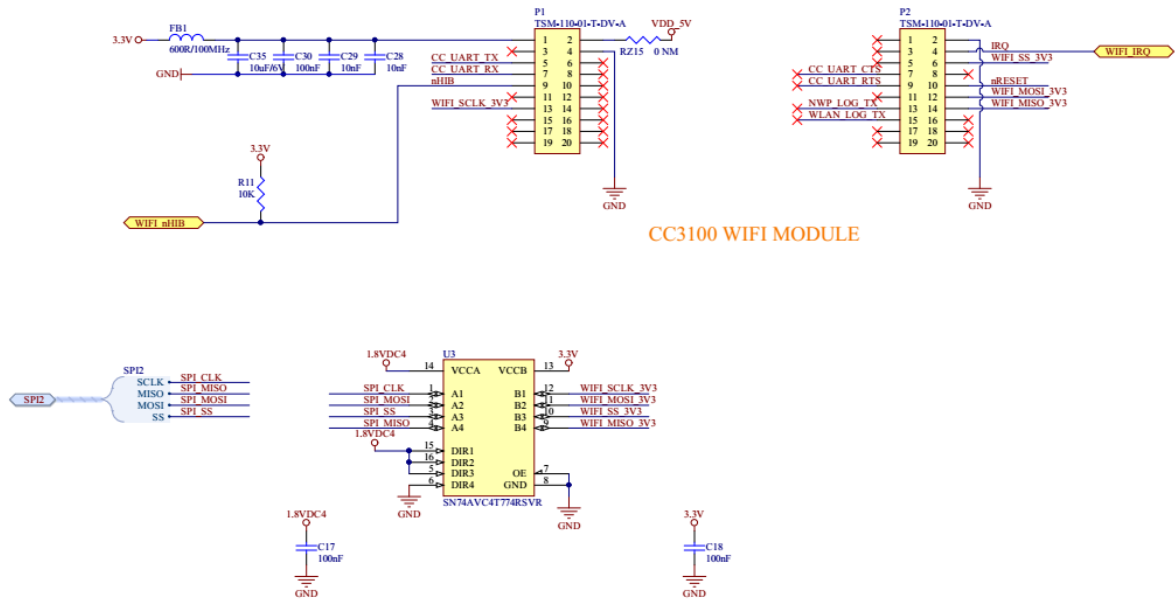


Figure 11: Wi-Fi to Myriad connection on EoT DevBoard schematic.

Fig. 12 shows the CC3100BOOST mounted on top of EoT DevBoard.



Figure 12: EoT DevBoard.

- End of document -