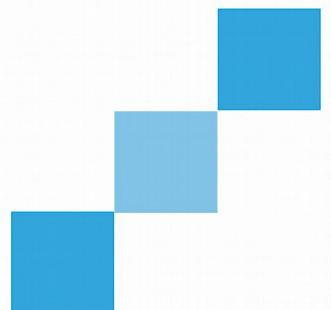


Ionos A1-SimpleLink CC2541 BLE Module

CS-P000-UM-13-Rev.B

This document contains Hardware description and connection information about Ionos A1-SimpleLink CC2541 BLE Module.



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Version Control

Version	Date	Author	Change Description
B1a	06.08.2014	Amaresh Nayak	Document Started
B1b	19.01.2016	Amaresh Nayak	<ul style="list-style-type: none">Format Changed30 pin Connector Pin diagram changed

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ABBREVIATION

UART	UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER
SPI	SERIAL PERIPHERAL INTERFACE
I2C	INTER INTEGRATED CHIP
RTC	REAL TIME CLOCK
SCL	SERIAL CLOCK LINE
SDA	SERIAL DATA LINE
MISO	MASTER IN SLAVE OUT
MOSI	MASTER OUT SLAVE IN
CS	CHIP SELECT

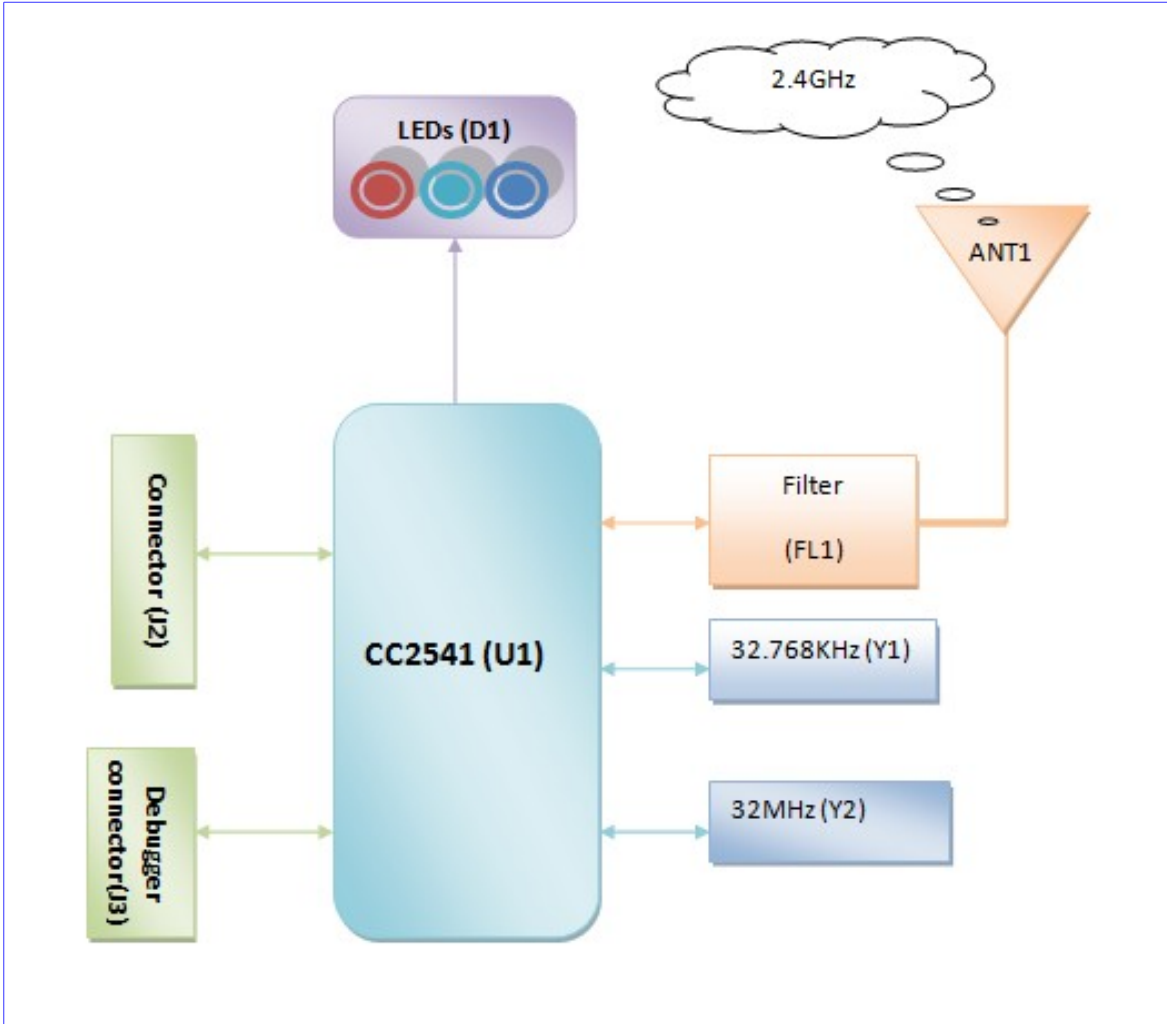
1 INTRODUCTION

The purpose of this document is to describe the hardware design and connection information about Ionos A1-SimpleLink CC2541 BLE Module as carried out by CASCADEMIC. The BLE module is with two powerful USARTs with Support for Several Serial Protocols and I2C interface for interfacing to other host module or slave module. It consists of CC2541 IC which is an 8051 MCU embedded *Bluetooth v4.0* Compliant Protocol Stack for Single-Mode BLE Solution. This module can be used either as master board or as slave board. This is the best solution for low power M2M application.

APPLICATION

- Home Automation and Security
- Connected Appliances
- Consumer Electronics
- Machine-to-Machine (M2M) Communications
- Toys
- Sports and Leisure Equipment
- Human-Interface Devices

2 BLOCK LEVEL ARCHITECTURE:



MODULE DESCRIPTION:

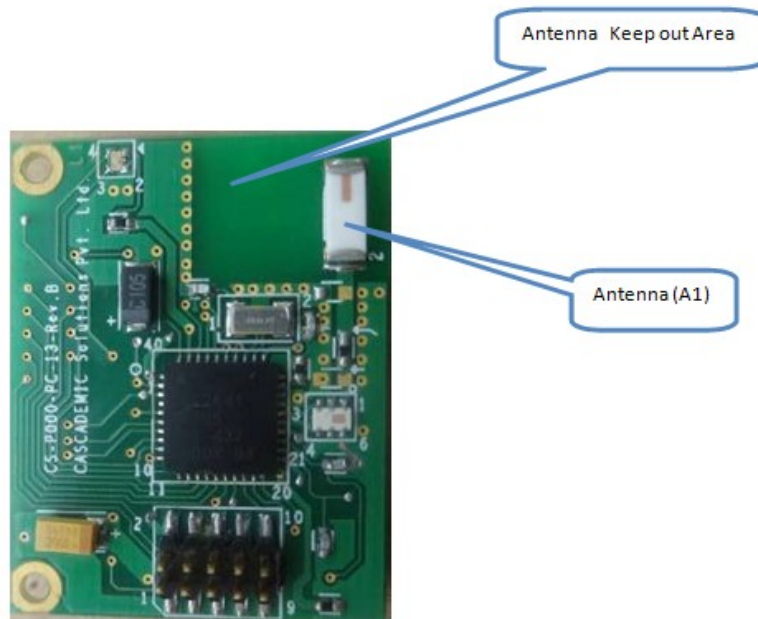
The BLE Module includes CC2541 (8051 processor, Antenna(2.4GHz antenna), Filter(Balun filter , crystal oscillators:32.768KHz and 32MHz. CC2541 acts as a mother IC which controls the BLE module.

2.1 CC2541(U1):

The CC2541 is a power-optimized true system-on-chip (SoC) solution for both *Bluetooth* low energy and proprietary 2.4-GHz applications. We can also use CC2540 instead of CC2541 as it is pin to pin compatible. It has 256 internal flash memory and 8KB RAM. It has two USART ,one SPI and an I2C to interface to external device. It supports 250-kbps, 500-kbps, 1-Mbps, 2- Mbps Data Rates.

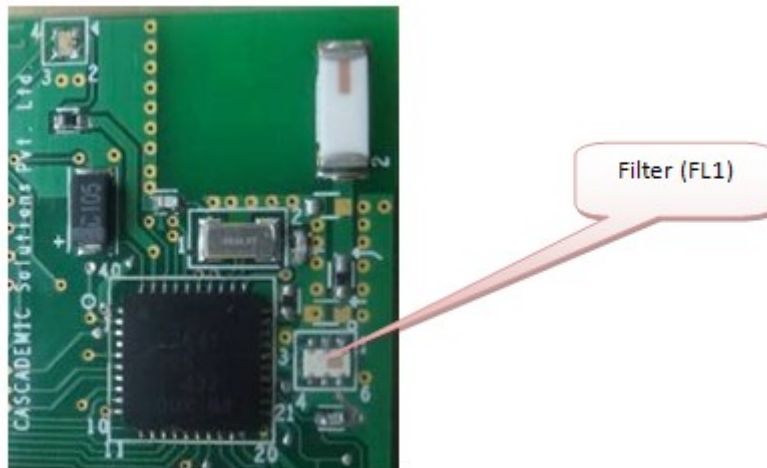
2.2 Antenna(ANT1):

Antenna is used to transmit and receive the signal. Here we are using chip antenna only .



2.3 FILTER(FLT1):

The RF signal may be affected by the noise in signal path from antenna to CC2541 IC. To avoid noise in signal, the signal path usually consists of a filter. Here the filter used is a Balun Filter which provide balanced to unbalanced signal transformation and frequency discrimination. The specification of filter given below



2.4 CRYSTAL OSCILLATOR:

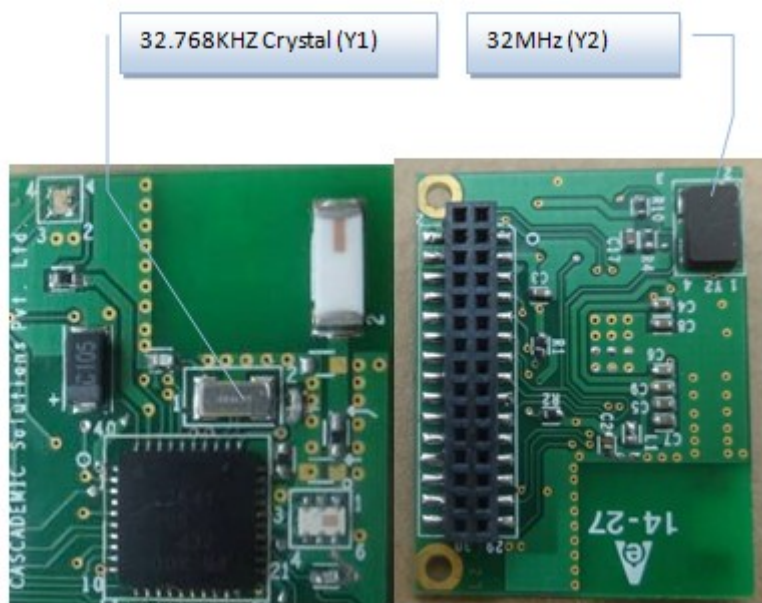
The BLE module requires two separate clocks for its operation:

- A slow clock running at 32.768 kHz.
- A fast clock running at 32MHz.

32MHz Oscillator :

The CC2541 device incorporates an internal crystal oscillator to support a crystal-based fast clock. The crystal is fed directly between the P2_4(Pin No:32) and P2_3(Pin No 33) pins of the device with suitable loading capacitors. The fast clock running at 32MHz is used by the device for the internal processor. Specification of the Crystal IC is given below.

Sl. No	PARAMETER	VALUES
1	Nominal frequency range	12 TO 48 MHz
2	Operating temperature	-40°C to +85°C
3	Frequency tolerance	$\pm 10 \times 10^{-6}$ to $\pm 30 \times 10^{-6}$
4	Load capacitance	6 pF to ∞
5	Resistance	60Ω
6	Frequency Ageing	$\pm 1 \times 10^{-6}$ to $\pm 3 \times 10^{-6}$ /year max
7	Level of Drive	0.5W (1.0W Max.)



32.768 KHZ OSCILLATOR

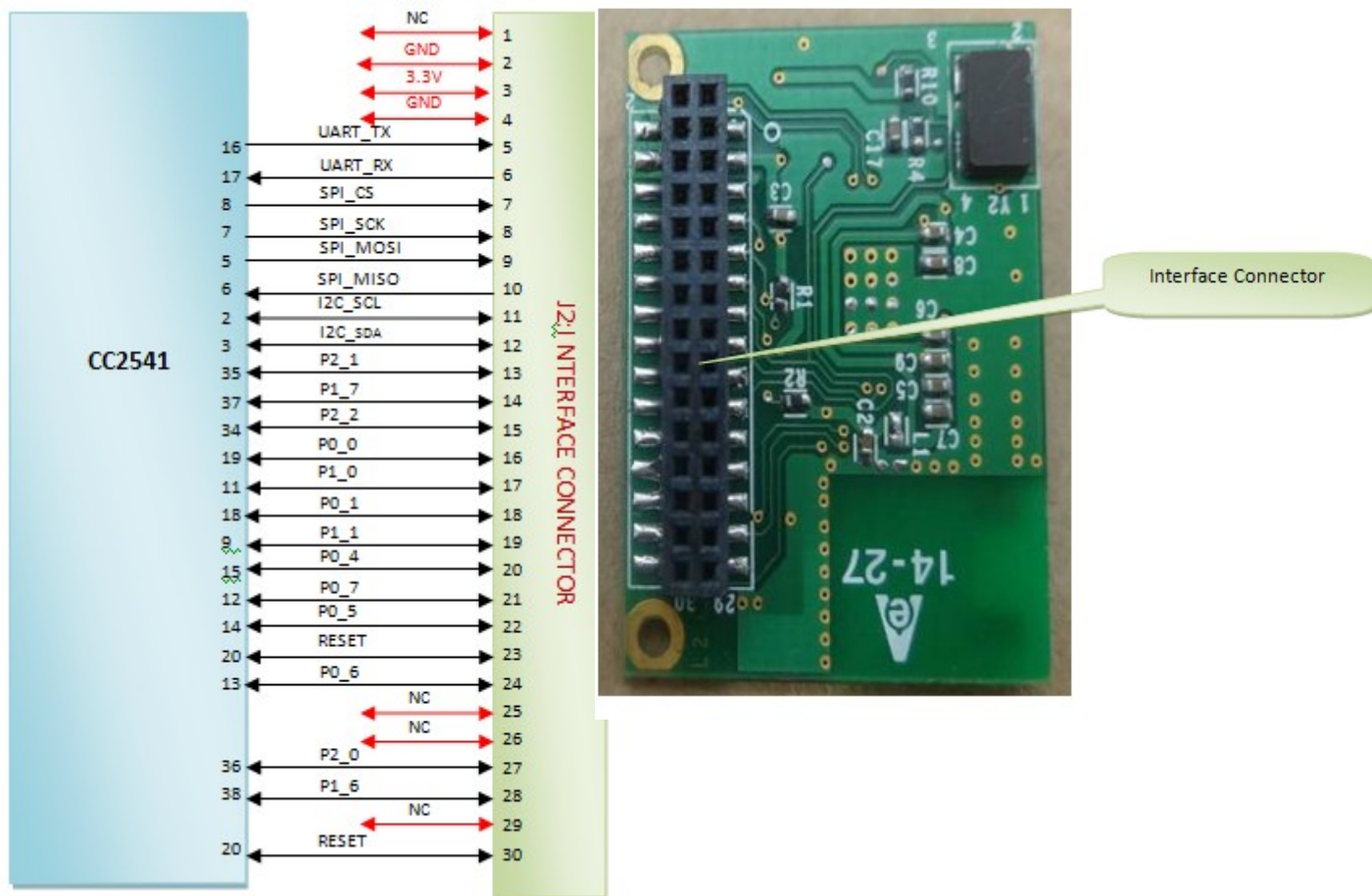
A slow clock running at 32.768 kHz is used for the RTC .The slow clock is a free-running clock supplied using the RTC crystal connected on the device. The accuracy of the slow clock frequency must be 32.768 kHz \pm 150 ppm. In this mode of operation, the crystal is tied between the XOSC_Q1(Pin No:22) and XOSC_Q2(Pin No 23) pins of the device with a suitable load capacitance. Specification of the Crystal IC is given below.

Sl. No	PARAMETER	VALUES
1	Nominal frequency range	32.768KHz
2	Operating temperature	-40°C to +85°C
3	Frequency tolerance	$\pm 20 \times 10^{-6}$.
4	Load capacitance	7pF,9pF,12.5pF.
5	Motional Resistance	70K Ω max.
6	Motional Capacitance	3.4fF
7	Shunt Capacitance	1pF
8	Frequency Ageing	6 $\pm 3 \times 10^{-6}$ /year max.
9	Level of Drive	0.5W (1.0W Max.)

2.5 CONNECTOR:

Here we used one 30 pin socket connector. This connector is used during interfacing to the external slaves or master modules. This connector can be either plug or socket type connector.

2.5.1 INTERFACE CONNECTOR 1(J2):

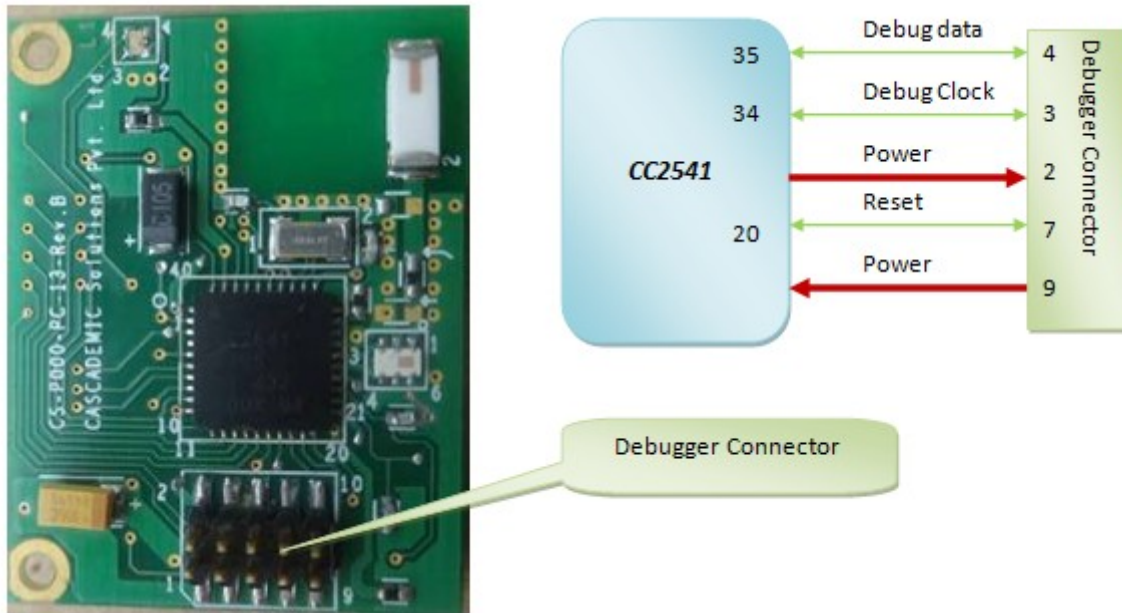


2.5.2 DEBUGGER CONNECTOR:

As a master board this BLE module can be debugged through 10 pin connector(J3).The signals required for debugging purpose are as follows

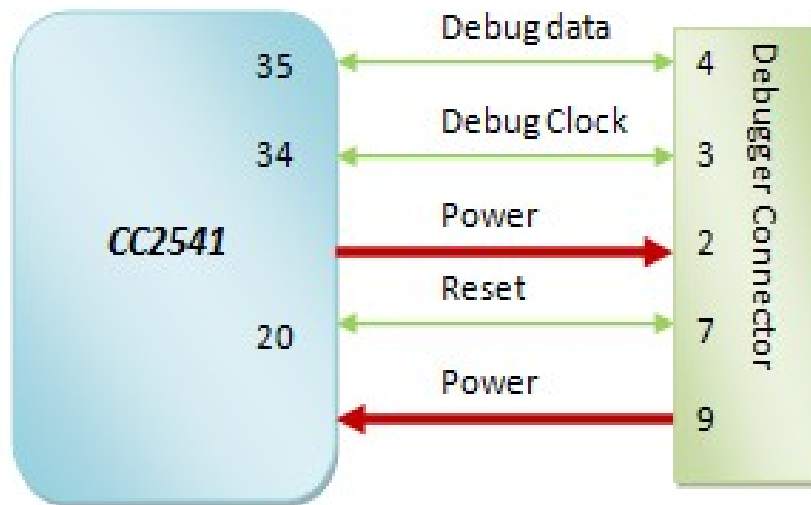
- debug data(Pin No:35)
- debug clock (Pin No:34)
- Reset

The connection of debugger connector shown in below.



3 POWER SUPPLY:

This Module requires a regulated /battery power supply of 3.3V . Pin No:3 of 30pin connector power supply pin when it is connected to external processor board. You can get power supply from pin No:9 of debugger connector(J3) during debugging as shown in below image. When you are taking power supply through connector J2(30pin Connector) remove the resistor R10.



4 LIGHT EMITTING DIODE(LED):

Here we are using a three colour **RGB LED** for indication of **power on**, **signal Transmission** and **reception**.

GREEN LED:

Green LED used for indication of signal transmission.

RED LED:

Red LED is used for indication of power..

Blue LED:

Blue LED is used for indication of signal reception.



5 PCB SIZE:

The size of BLE board is **26.50mm** X 20.50mm X 5.5mm

It is a 2 layer PCB,

Length : 20.50mm
Width : 26.5mm
Height : 5.5mm

