Time Multiplexed Central

Objective

This example demonstrates the use of PRoC BLE as a Time Multiplexed Central.

Overview

This example configures the PRoC BLE as a Time Multiplexed Central device. A Time Multiplexed Central device connects to more than one Peripheral device in a round robin fashion. This functionality can be used to implement a star connection with multiple slave devices communicating to a single master device.

The Central device connects to each Peripheral device in its bonded device list one-by-one. Each Peripheral device is allotted one second, including both its advertisement and connection time. This means that if a Peripheral device is not found in its allotted slot, it is skipped for that round. The time slot allotted to a Peripheral device is not shifted if the previous device is not found, as long as both the Peripheral devices is part of the Central's bonded device list.

New Peripheral devices (up to a maximum of four) can be added to the Time Multiplexed Central by sending 'a' or 'A from UART terminal' and then connecting to that Peripheral. Existing devices can be removed from the bonded device list by sending 'r' or 'R from the UART terminal and then select the device to be removed from bonded list.

Requirements

Tool: PSOC Creator 3.1 SP1

Programming Language: C (GCC 4.8.4)

Associated Parts: All PSoC 4 BLE, PRoC BLE parts

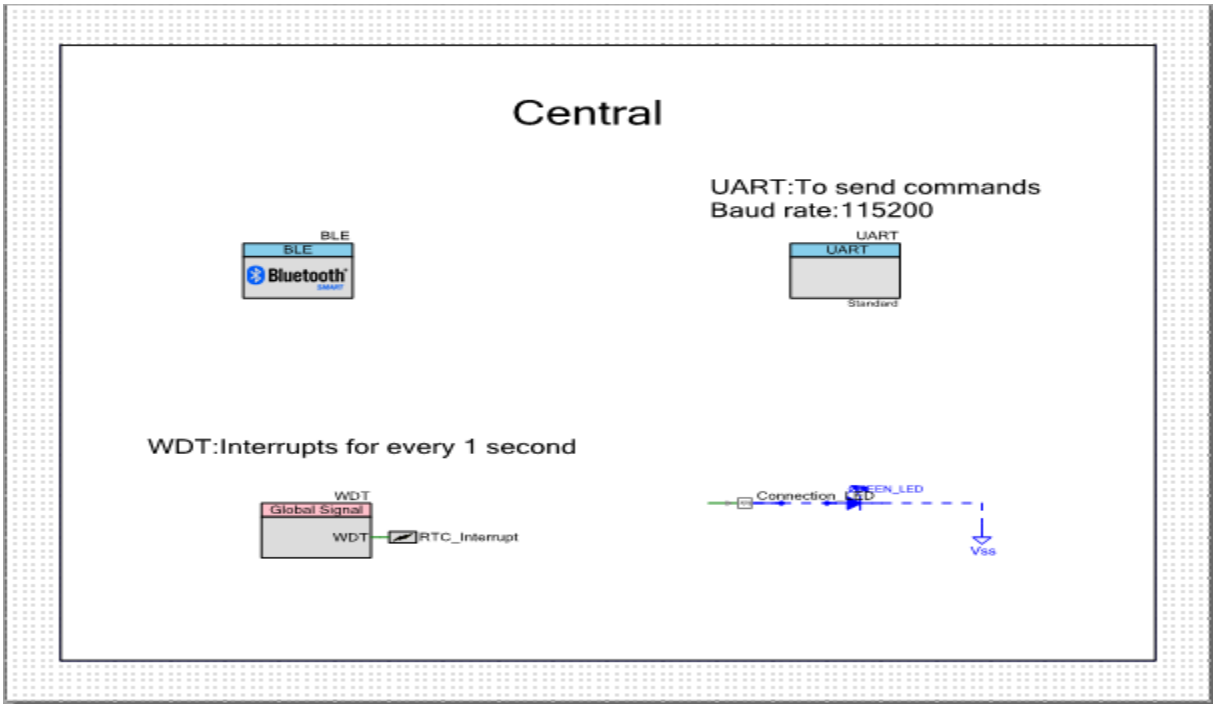
Related Hardware: CY8CKIT-042-BLE Bluetooth® Low Energy (BLE) Pioneer Kit

Hardware Setup

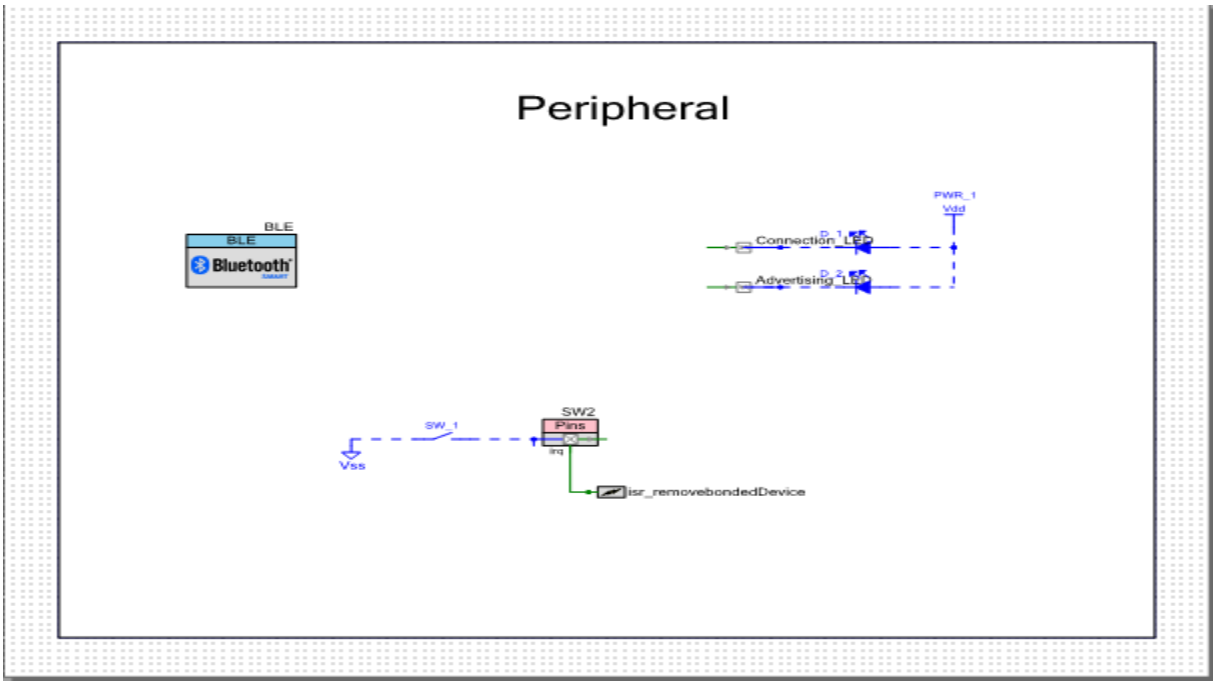
BLE Pioneer Kit has the necessary hardware connections required for this lab. If you are using your own hardware for Central, then connect BLUE LED to P3.3, UART RX to P1[4] and UART TX to P1[5] of PROC BLE. If you are using your own hardware for Peripheral connect GREEN LED to P3[6] and BLUE LED to P3[7]. You need at least two PSoC4 BLE modules and one Dongle to test this example

PSoC Creator Schematic

Error! Not **a valid bookmark self-reference.**. PSoC Creator Schematic of Central.



Error! Not a valid bookmark self-reference.. **PSoC Creator Schematic of Peripheral.**



Project Description of Central:

On the first time Central scans with white list disabled and shows the list of available Peripheral devices. It also mentions whether the particular device is in white list or not You can connect to one of the devices by sending a command ‘c’ or ‘C’ from UART terminal of Central followed by the device number. Once the device is connected it stores the bonding information and shows the bonded device list. Blue LED turns ON when it is connected. If you want to add a new device then send command ‘a’ or ‘A’ from the UART terminal and select the device number from the list of addresses to connect.

When Central is bonded with more than one device then it allots one second for each device. A counter (based on the Watchdog timer) is used to generate an interrupt every second. Whenever the interrupt is triggered, the Central tries to connect to next device in the bonded device list, in a round robin fashion. This is done by disconnecting from the current connection and scanning for the next device in the bonded list. If the Central can’t find the next Peripheral in the scheduled time slot then it mentions that “Device is missing” and starts scanning for the next device.

The Central device also checks for the commands from UART and process these commands:

I. ‘A’ or ’a’: To add new peripheral to the Central. If there is at least one bonded device the multiplexing process is stopped and a new scan is started with whitelist disabled. This command works only when there is at least one bonded device is the list.

II. ‘C’ or ‘c’: To connect to one of the devices listed in a scan.

III. ‘R’ or ‘r”: To remove a device from the bonded device list. If there is at least one bonded device then the multiplexing process is stopped and the list of bonded devices is shown. On entering a valid device number, that device is removed from the list, and multiplexing with the remaining devices in the list is started again. If the bonded device list turns empty after removal of the last device, the Central starts a fresh scan with whitelist disabled. This command works only when there is at least one bonded device present.

Project Description of Peripheral:

On the first time a Peripheral starts connectable undirected advertising. On connection to a peer device, the peer information is stored to flash (called bonding). Upon disconnect or a power cycle event, the bonded device list is checked to see if it is non-empty, and if so, directed advertising is done. Connectable undirected advertising is done otherwise.

Press SW2 to remove the bonded device information. The Peripheral then starts connectable undirected advertising.

When advertising Green LED turns ON and when connected Blue LED turns ON.

Programming the devices:

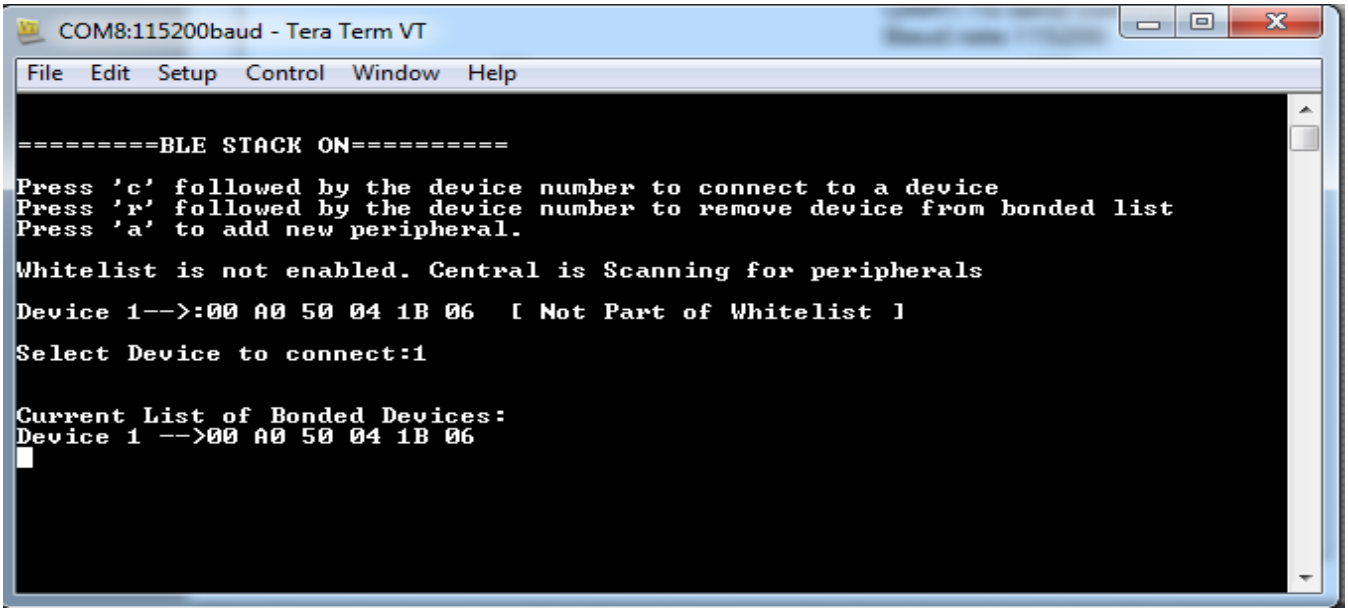
I. Program dongle with the example project **Central.**

II. Program PSoC 4 BLE with the example project **Peripheral.**

Steps to Test the project:

1. Open UART Terminal and the select the COM port (related to Central device) and use the following settings:
    I. Baud rate:115200
    II. Data rate: 8 bit
    III. Parity: none
    IV. Stop: 1 bit
    V. Flow control : none
2. Power on at least one PSoC 4 BLE which is programmed with the project **Peripheral**.
3. On the UART terminal you can see the list of peer devices which are advertising. Select one of the peer devices (programmed with project Peripheral) by sending command 'c' or 'C' from the UART terminal. After device is connected it stores the bonding information and displays the list of bonded devices.

Error! Not a valid bookmark self-reference. **Connecting to Peripheral**



4. When only one Peripheral is connected to the Time multiplexed Central, that connection is maintained until any external interaction. In case if the connection is lost due to power cycle or interference etc, Central tries to connect to the same Peripheral automatically. For every 1 second in DISCONNECTED state it displays the address of the bonded device that it is trying to connect.

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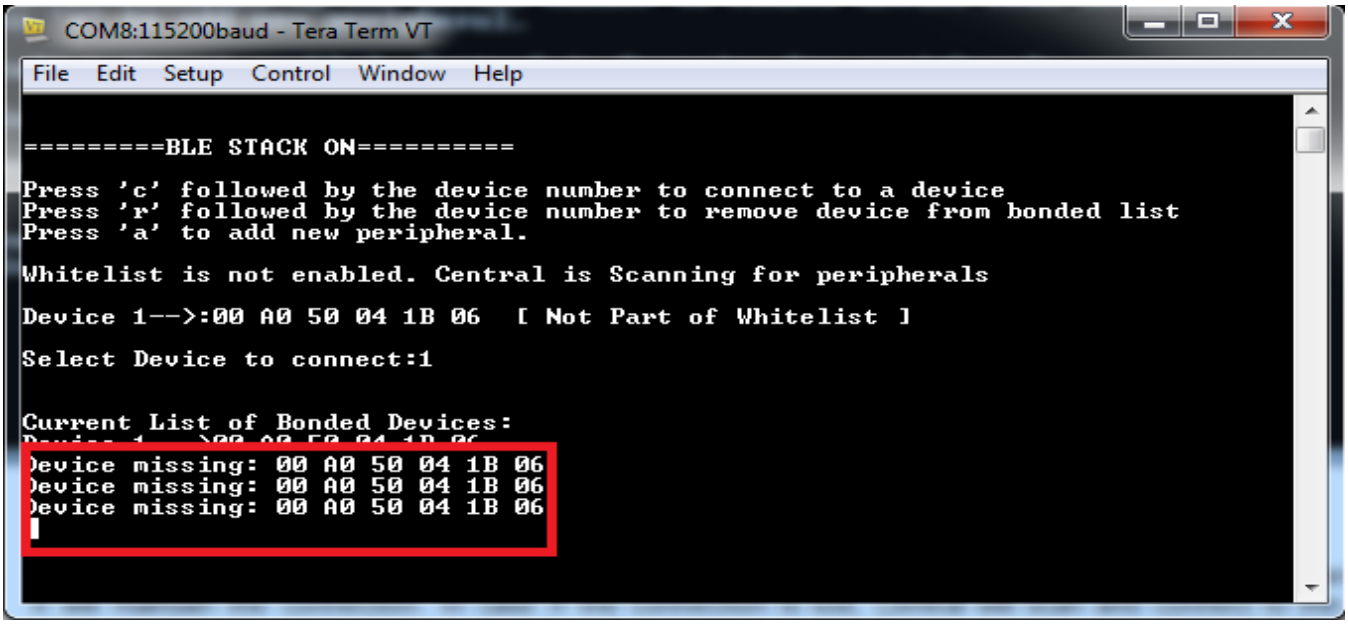
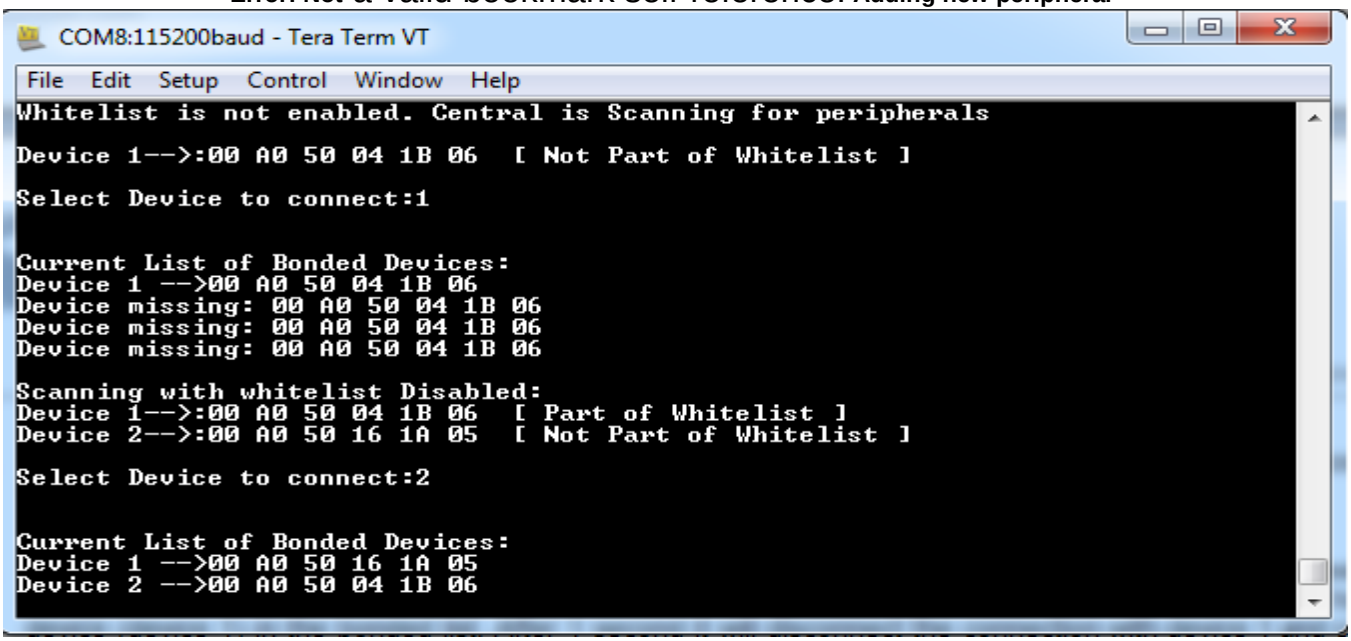


5. Send 'a' or 'A' from the UART terminal to add new peripheral. It will display the list of peripheral. Send command 'C' or 'c' followed the device number to connect to the device.

Error! Not a valid bookmark self-reference. **Adding new peripheral**



6. If one of the peripheral lost power or couldn't able to establish connection to the Central during its time slot then on the UART terminal you can see the device that is missing or couldn't able to connect in its slot.

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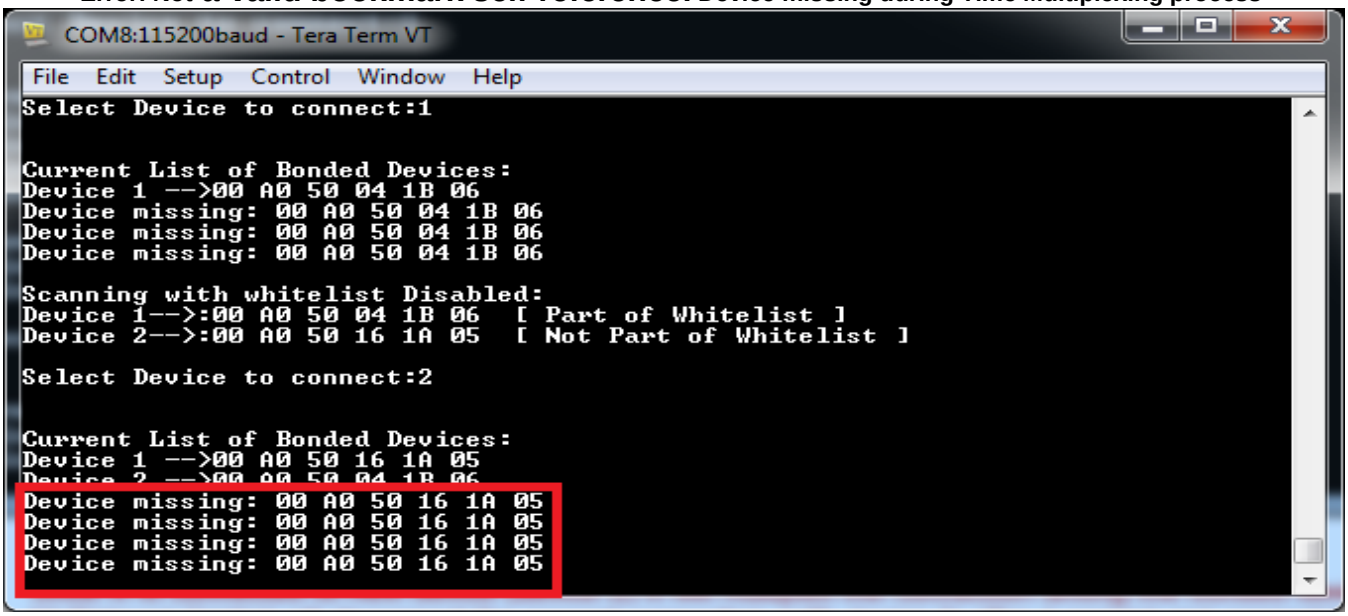

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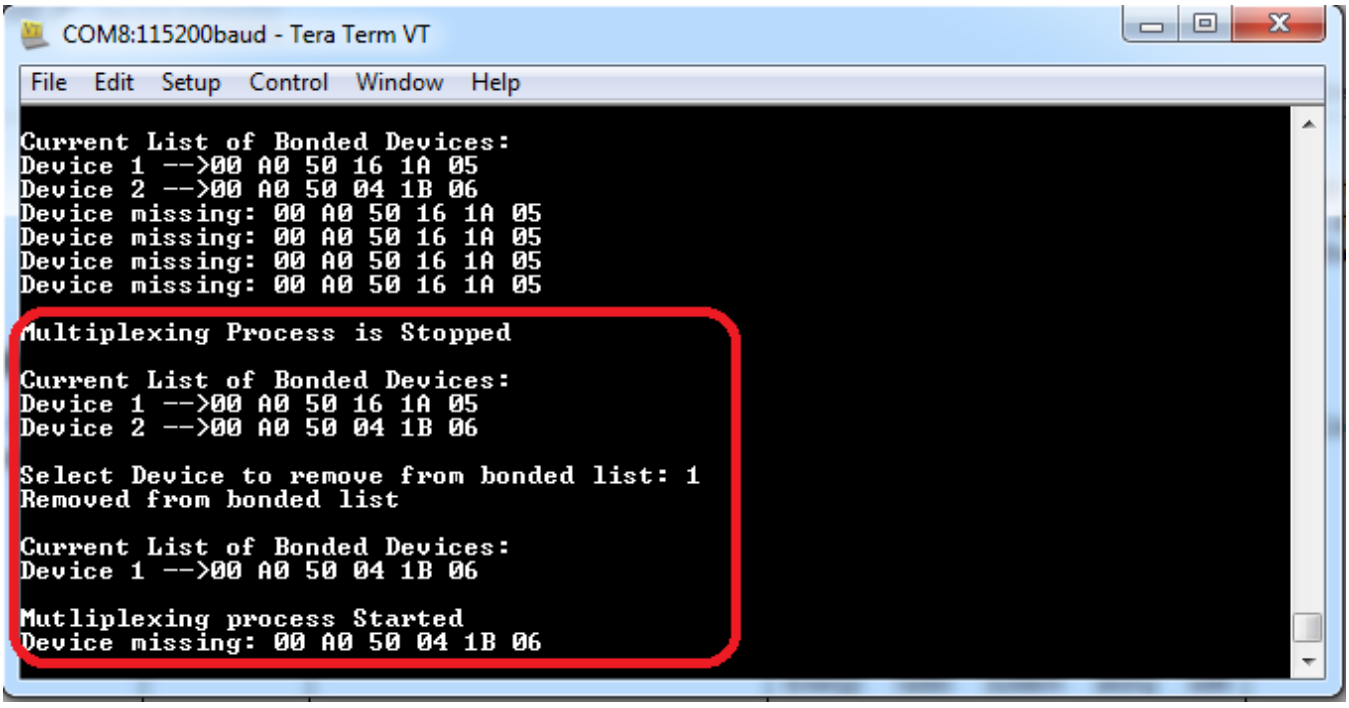
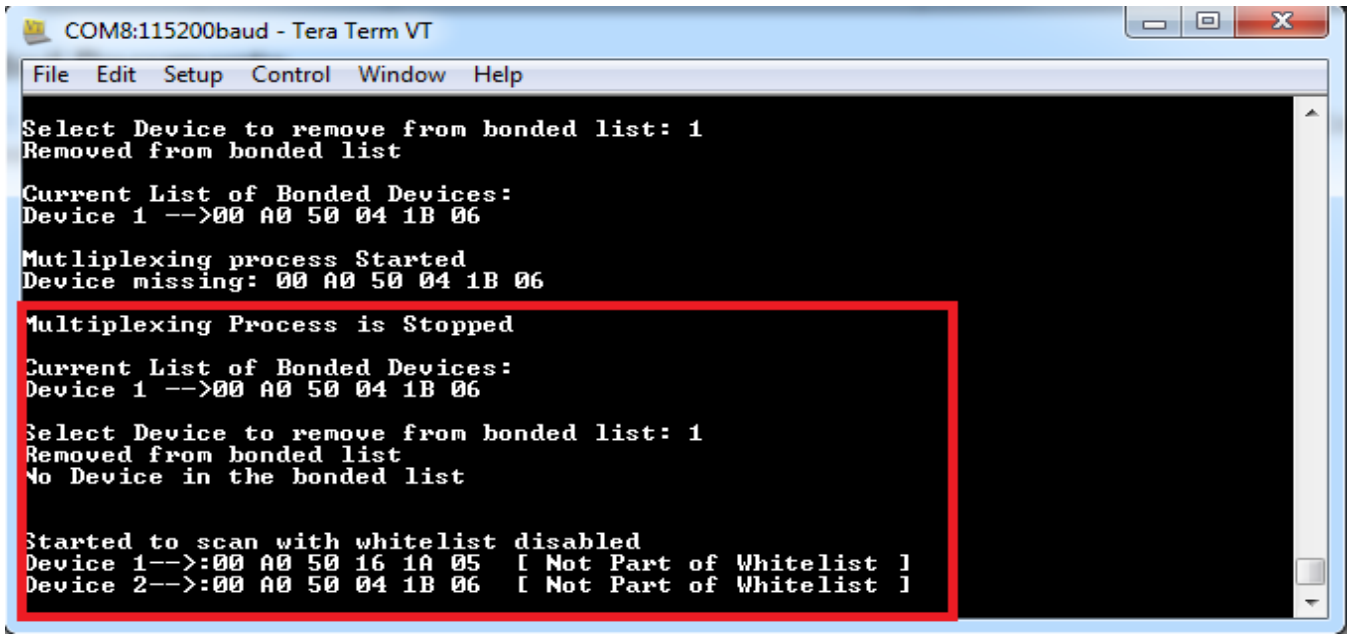
7. If you want to remove device from the bonded list, send command ‘r’ or ‘R’ from UART terminal and select the device number from the list of devices. It will remove the bonded device and start multiplexing process if there is at least one bonded devices. If there is no bonded devices after removing the device from bonded list it will disable the white list and start to scan to allow you to add new peripherals.

Error! Not a valid bookmark self-reference. Removing bonded device and starting Multiplexing process

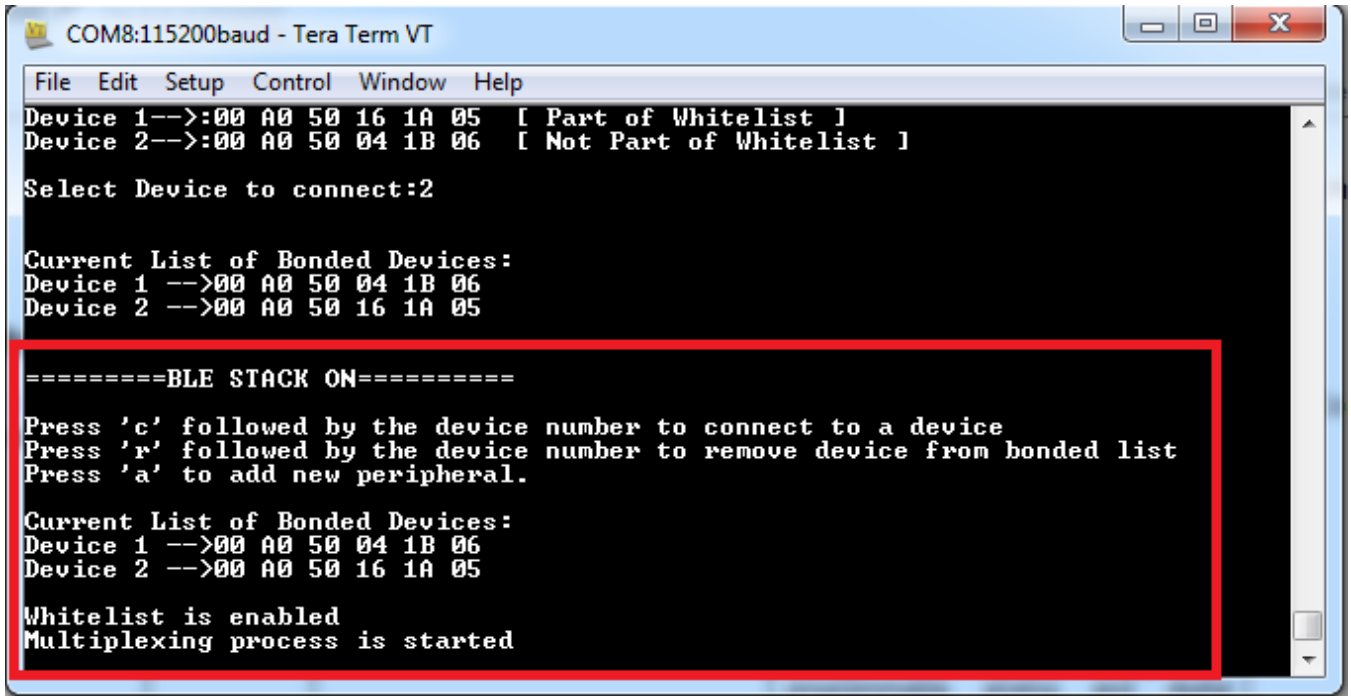


Error! Not a valid bookmark self-reference. Removing bonded device and starts to scans again with white list disabled



8. After power cycling, Central will enable white list if there is at least one bonded device and starts multiplexing process. If the peripherals are missing it will display the address of missing peripheral.

Error! Not a valid bookmark self-reference. Starting Multiplexing process after power cycle



Related Documents

Error! Not **a valid bookmark self-reference.** lists all relevant application notes, code examples, knowledge base articles, device datasheets, and Component / user module datasheets.

Error! Not a valid bookmark self-reference. Related Documents

Document	Title	Comment
AN91267	Getting Started with PSoC4 BLE	Provides an introduction to PSoC4 BLE device that integrates a Bluetooth Low Energy radio system along with programmable analog and digital resources.
AN91445	Antenna Design Guide	Provides guidelines on how to design an antenna for BLE applications.