Talaria TWO™ (INP2045)

Ultra-Low Power Multi-Protocol Wireless Platform SoC

IEEE 802.11 b/g/n, BLE 5.0

User Guide for Talaria TWO Download Tool

Release: 10-30-2023

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Revision History

Version	Date	Comments
1.0	06-23-2020	First release.
1.1	09-03-2020	Updated for SDK 2.1.1 release corresponding to Download tool version v1.8.
2.0	05-13-2021	Updated for SDK 2.2 release corresponding to Download tool version v2.0.
2.1	07-05-2021	Enhanced Write Files section of Filesystem.
3.0	08-12-2021	Updated for SDK 2.3 release.
3.1	08-27-2021	Updated for SDK 2.3.1 release.
3.2	10-13-2021	Updated with the following: - One-Click Installation of libusbk driver Help option for the Tool
3.3	11-16-2021	Updated Appendix with steps to assign a new EVK serial number to device.
3.4	02-01-2022	Updated Download Tool GUI.
3.5	02-16-2022	Updated prerequisites with the requirement of Microsoft Visual C++ Redistributable Software Package.
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4.2	08-05-2022	Updated driver installation for Windows OS.
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5.2	11-18-2022	Updated with Prerequisites to run the application in Linux.
5.3	01-20-2023	Updated to include the latest version of the Download Tool GUI.
6.0	06-20-2023	Updated to include the procedure for SSBL programming.
6.1	08-21-2023	Updated to include steps to add a new serial number to the Talaria TWO EVK manually.
6.2	10-30-2023	Updated to include the latest version of the Download Tool GUI.

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Terms & Definitions

BL	Boot Loader
ELF	Executable and Linkable Format
EVK	Evaluation Kit
FTDI	Future Technology Devices International
GUI	Graphical User Interface
SDK	Software Development Kit
SSBL	Secondary Stage Boot Loader
SSID	Service Set Identifier

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Introduction

This document describes the use of the Download Tool provided with InnoPhase Talaria TWO SDK. The download tool is provided as binaries for Windows and Linux Operating Systems.

Prerequisites

EVB-A

User must have procured the InnoPhase Talaria TWO evaluation board, and a USB cable to connect the evaluation board to the PC. Though this document specifically describes the use of the GUI on a Windows platform, the procedure is similar for Linux OS as well.

Application `T2DownloadTool_Windows.exe` is for Windows platform while `T2DownloadTool_Linux` is for the Linux OS.

Using Download Tool in Linux

There are two ways in which the `T2DownloadTool_Linux` can be used in Linux:

1. Run the `T2DownloadTool_Linux` tool from terminal with sudo command. For example:

```
sudo  /sdk_x.y/pc_tools/Download_Tool/bin/T2DownloadTool_Linux
```

   Note: x and y in sdk_x.y refers to the SDK release version. Replace x and y with the appropriate SDK release version.

2. Double click on `T2DownloadTool_Linux`.

   Add udev rules and folder access permission to enable double click feature. Execute the following steps:

   Step 1: Create `Libusb_T2.rules` file in */etc/udev/rules.d* directory.

   Step 2: Add the following rules to `Libusb_T2.rules` file.

   `Libusb_T2.rules:`

```
SUBSYSTEMS==”usb”, ATTRS{idVendor}==”0403”, ATTRS{idProduct}==”6011”,

GROUP=”users”, MODE=”0666”
```

   In case of `Permission Denied` error, execute the following step (Step 3) to extend folder access permission.

   Step 3: Run the following command in the terminal to extend permissions to the selected folder and its files.

```
sudo chmod -R a+rwxRWX /Path/to/sdk folder
```


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Microsoft Visual C++ Redistributable Software Package

Microsoft Visual C++ Redistributable software package is a prerequisite for Windows platform to run the application `T2DownloadTool_Windows.exe` successfully. Incase this software package is not installed on the Windows platform, application will not launch, leading to a fatal error message as shown in Figure 1. In such a scenario, install the Microsoft Visual C++ Redistributable software package and relaunch the application.

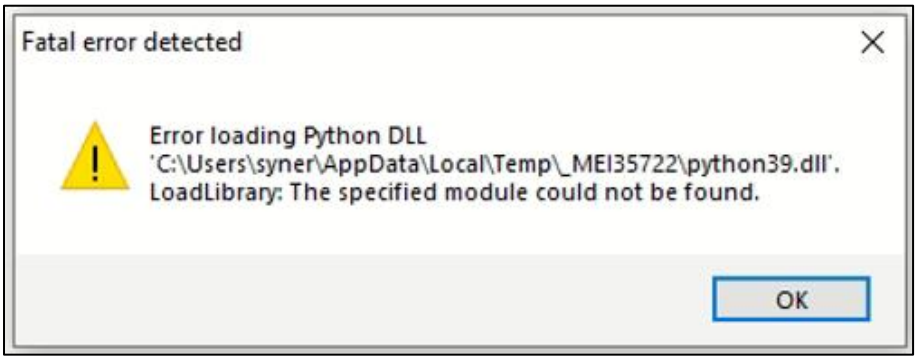

Figure 1: Error message for missing Microsoft Visual C++ Redistributable Software Package

Driver Installation for Windows OS

On Windows OS, `libusbK` driver needs to be installed to communicate and control the Talaria TWO module via the FTDI device on the evaluation board. The tools/applications provided by InnoPhase will communicate using this driver.

Download tool comes with an option of `One-Click Installation` of libusbk driver. In case the driver is not installed, the tool will ask for user confirmation to install this driver. If the user selects `yes`, various `User Account Control` authentication screens will appear to complete the driver installation (as shown in Figure 4).

Note:

1. In case of any other unwanted libusbk drivers that are already installed, tool will automatically uninstall the unwanted drivers. This action needs `User Account Control` authentication screens shown in Figure 5, in addition to Figure 4. Each unwanted drives will require a separate `User Account Control` authentication for uninstallation.

2. Talaria TWO Evaluation Board may get detected under any already installed device driver (using `libusbk` driver). In this case, the tool will follow the procedure of `One-Click Installation` of libusbk driver (as shown in Figure 4), and might get completed with a pop-up message "`Driver Installation Failed`". This will result in any one of the following two conditions:

    a. Device found: EVK serial number field in the download tool GUI is populated with appropriated EVK serial number. In this case, ignore the error message "`Driver Installation Failed`" and continue using the tool. To avoid this from happening repeatedly, update the driver for Talaria TWO Evaluation Board to "`InnoPhase T2 Evaluation Board`" driver, from device manager

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(as shown in Figure 2). Then, ensure the Talaria TWO Evaluation Board is detected under "`libusbK USB Devices`" in device manager (as shown in Figure 3).

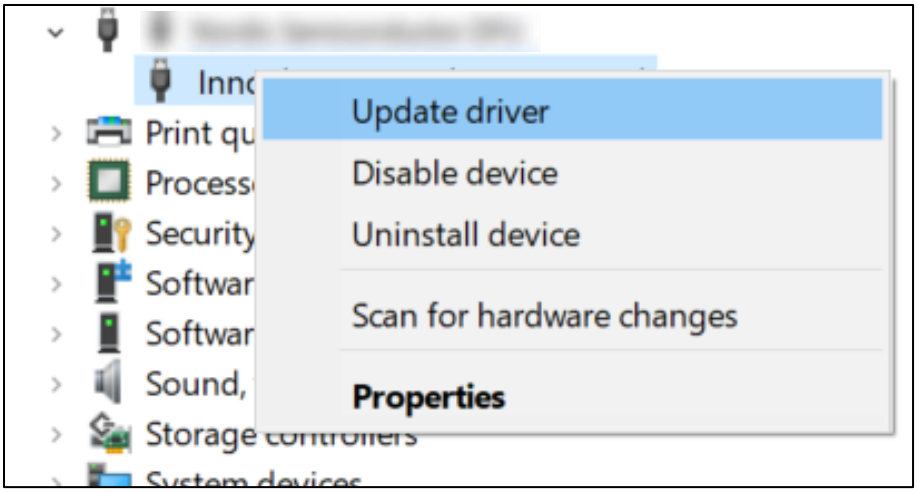

Figure 2: Update device driver for Talaria TWO Evaluation Board

b. No device found: Manually install the driver using instructions from section: Installation instructions for libusbK driver and ensure that Talaria TWO Evaluation Board is detected under `libusbK USB Devices` driver (as shown in Figure 3).

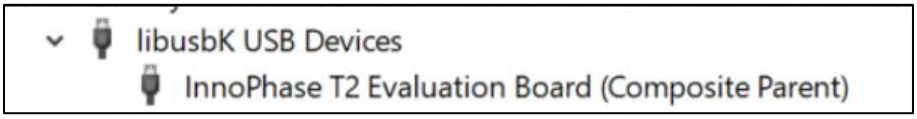

Figure 3: Talaria TWO Evaluation board under "libusbk USB Devices" driver

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3. Even after successful installation of the driver, there might be possibility of the device not being identified for the first time. In this case, close the tool and re-open it. The user is notified of the same through a pop-up message: "`No Device Connected. Please close and reopen the Tool.`".

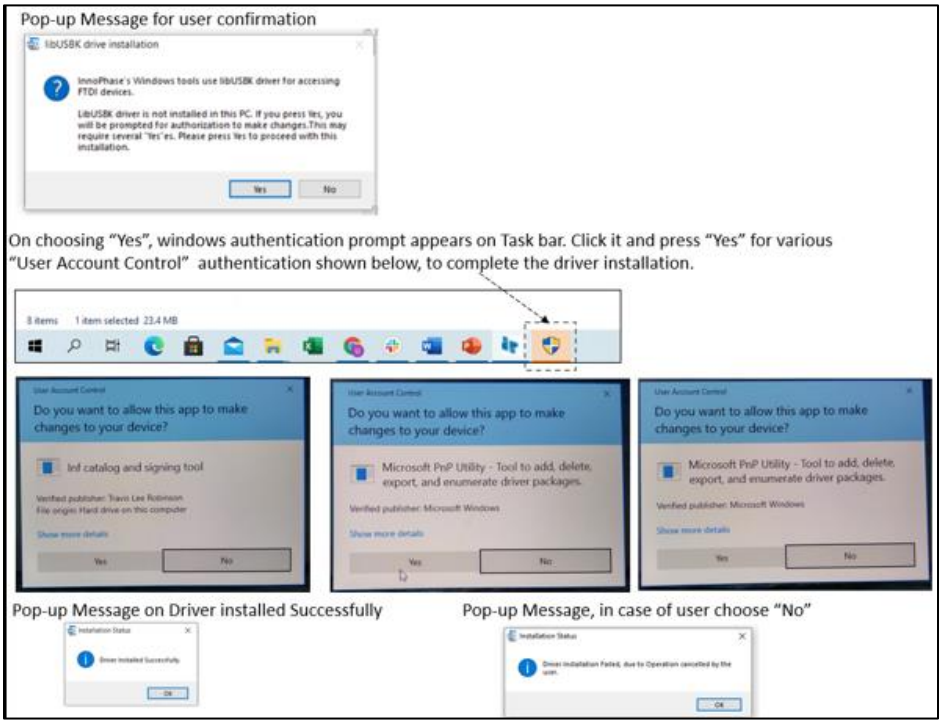

Figure 4: User Account Control authentication to complete driver installation

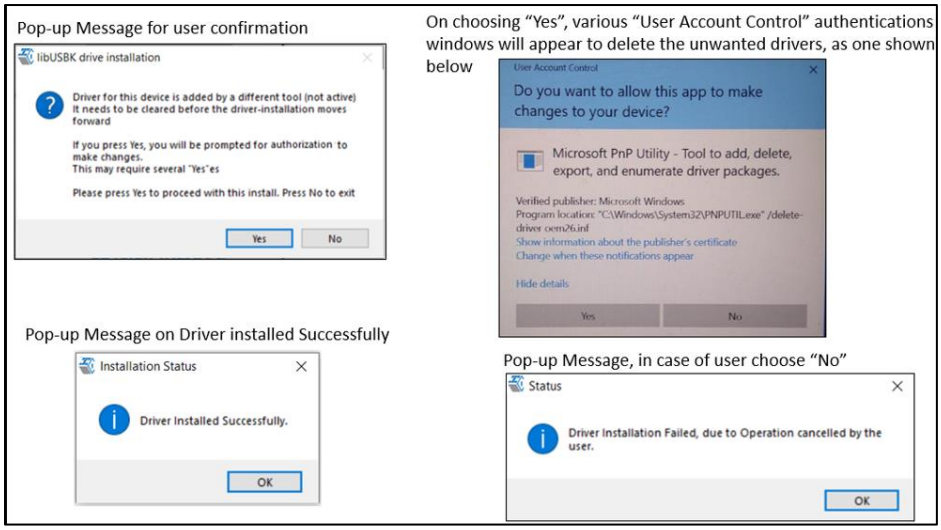

Figure 5: User Account Control authentication to delete the unwanted Libusbk drivers

In case the driver installation using the Download Tool is not successful, the user can manually install the driver by following the instructions provided in section: Installation instructions for libusbK driver. Instructions to change driver is available in section: Update Driver from libusbK to COM Port.

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Installation instructions for `libusbK` driver

Download the free software Zadig, available here: - https://zadig.akeo.ie/. Connect your Windows PC or Windows Laptop to the evaluation board using the provided USB cable.

1. Now, open Zadig
2. Click on `Options`
3. Check `List All Devices`
4. Uncheck `Ignore Hubs or Composite Parents` as shown in Figure 6.

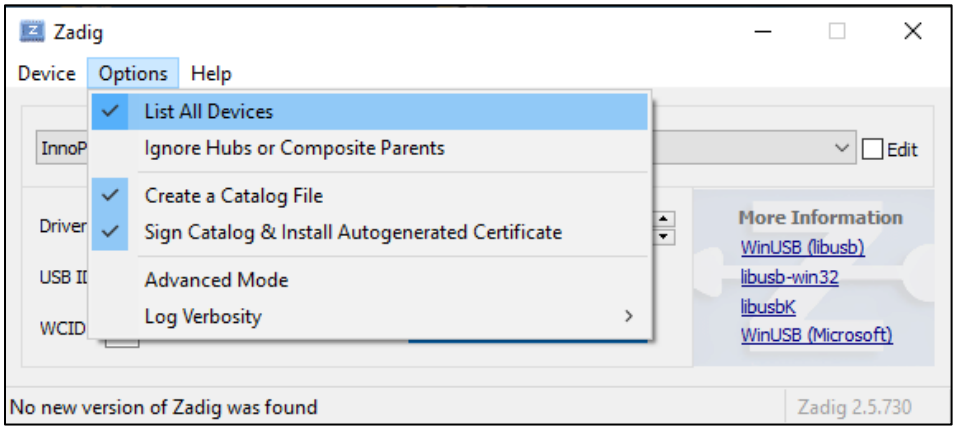

Figure 6: Listing devices in Zadig

To establish communication with Talaria TWO module via the FTDI device on the InnoPhase Evaluation Board, the Talaria TWO USB driver must be `libusbK`. In case the current driver is not `libusbK`, use the drop-down menu to select `libusbK` and click on `Replace Driver` which will update the drivers to `libusbK`.

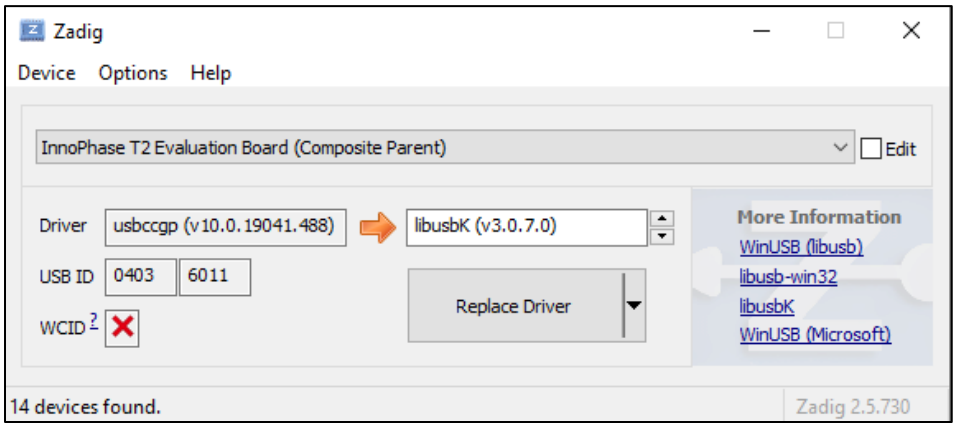

Figure 7: Updating Talaria TWO USB driver to libusbK

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Block Diagram

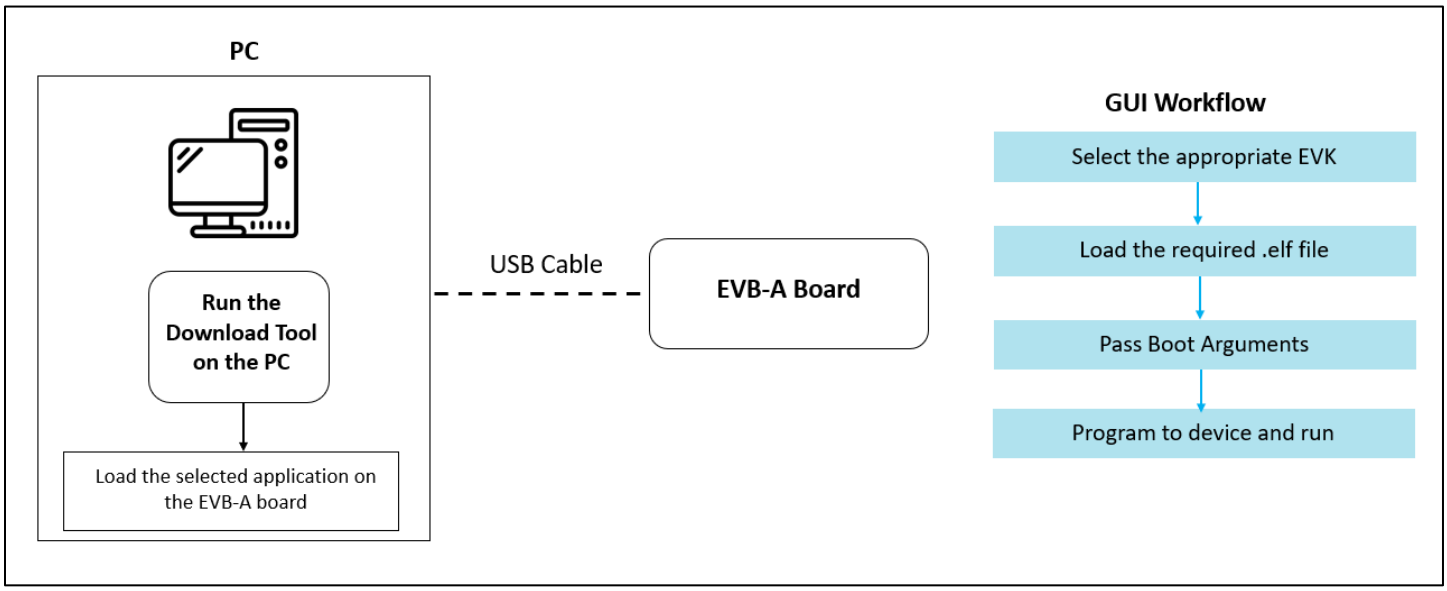

Figure 8: Block Diagram

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Download Tool GUI Overview

Download Tool supports two types of programming:

1. Standard
2. SSBL

On launching the Download Tool application, the following come into view:

1. GUI window on top for Standard (default) and SSBL programming, represented by two different tabs as shown in Figure 9 and Figure 10
2. Console window at the bottom for monitoring Talaria TWO module console output as shown in Figure 11

Note: In case of Windows display setting, if the `Scale and Layout` is more than 125%, GUI window might go out of screen.

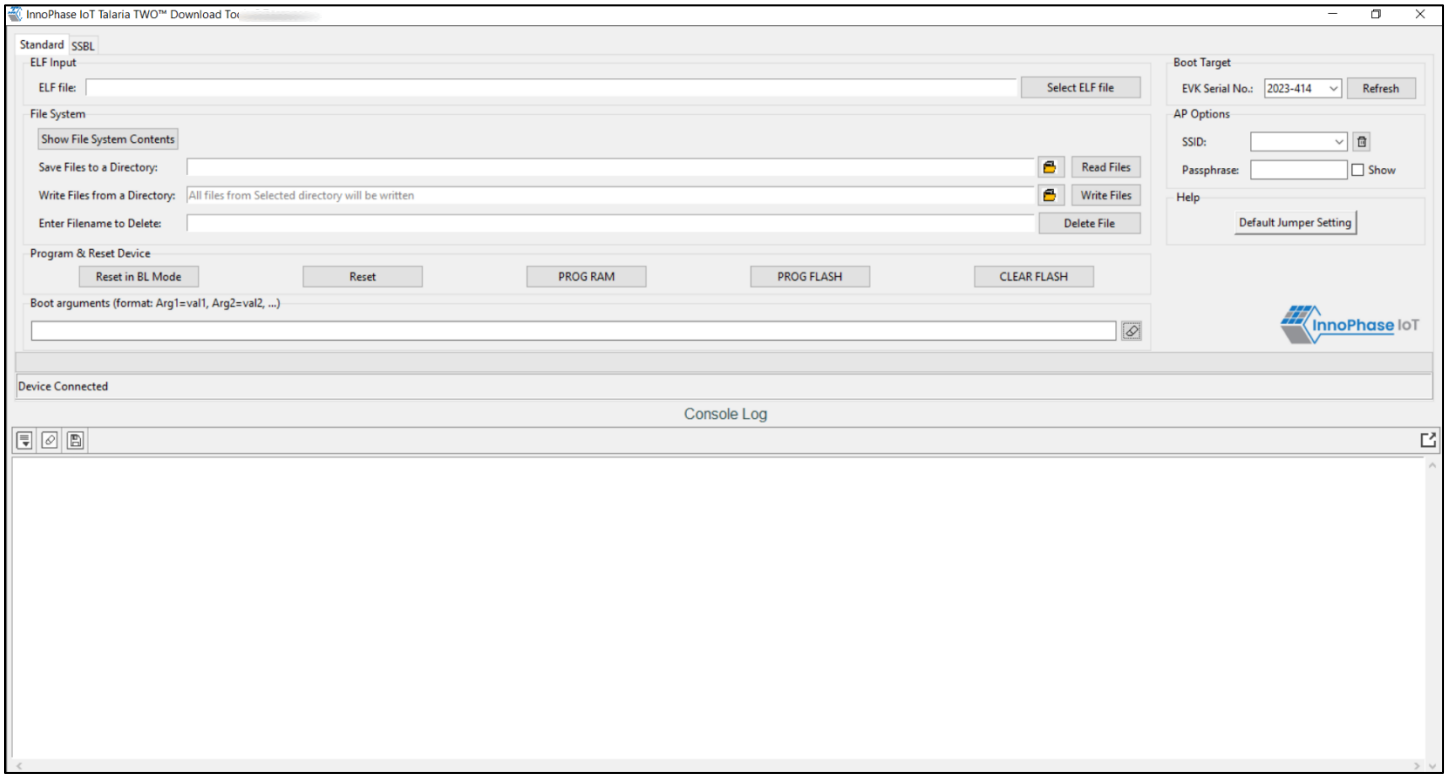

Figure 9: Download Tool GUI – Standard Programming

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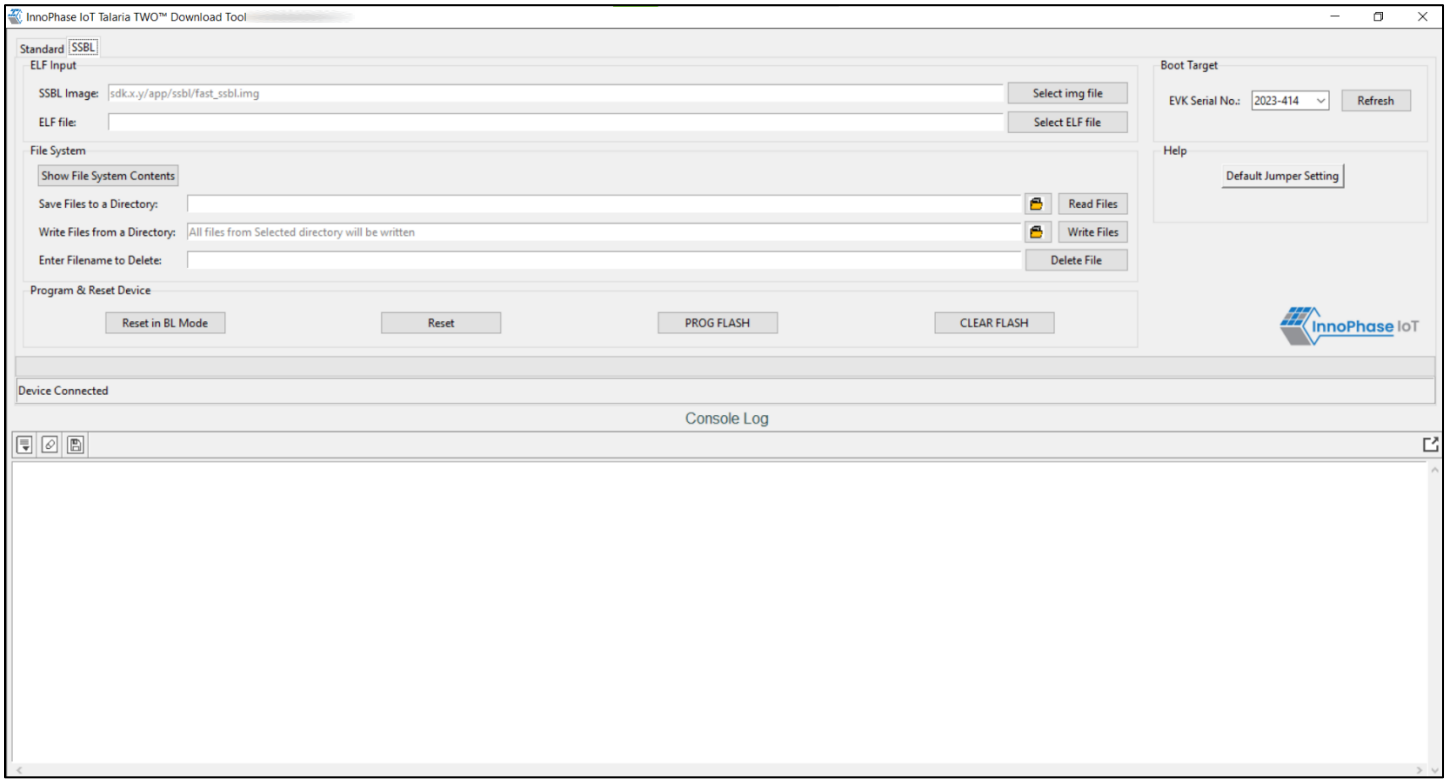

Figure 10: Download Tool GUI – SSBL Programming

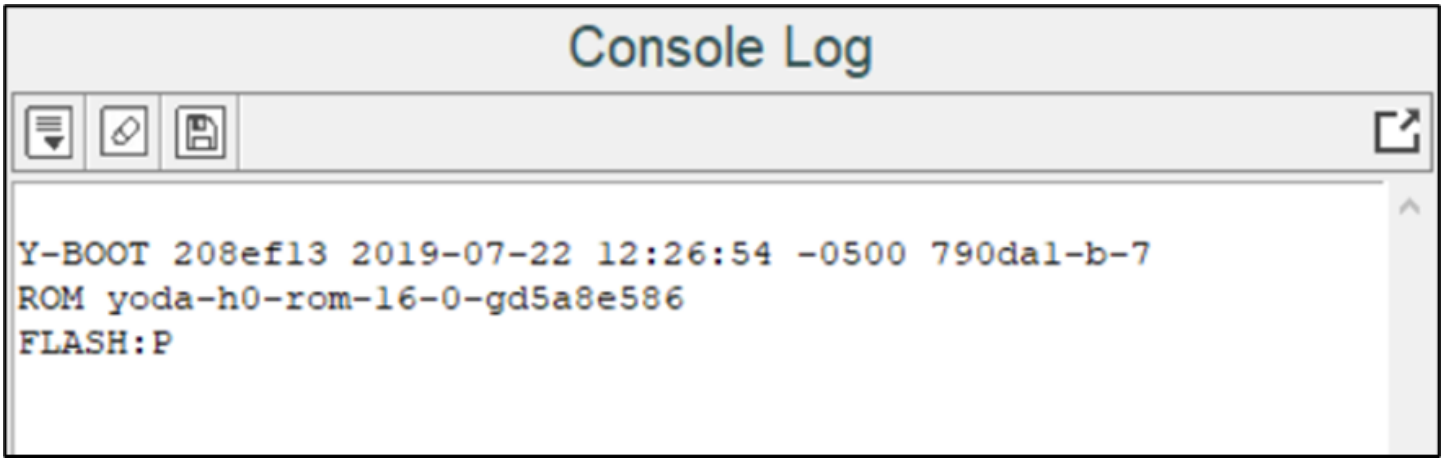

Figure 11: Download Tool Console

The console window has the following icons (with Hover Text):

1. **`Auto Scroll`** : Enables scrolling of console content till the end (default mode).
2. **`Pause Scroll`** : Turns OFF `Auto Scroll` mode.
3. **`Clear Console`** : Clears console window content.

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4. **`Save Logs`** : Opens a file dialog with `Console_Output.log` as the default file name to save the logs.

   Note: Only upcoming data after starting the `Save Logs` is saved in the file.

5. **`Stop Save Logs`** : Stops saving console logs to the file. This icon appears after `Save Logs` is started successfully.
6. **`Pop Out`** : Pops out the console window separate from the GUI window.
7. **`Pop In`** : Embeds the console and GUI window together.

Note:

1. While loading the ELF using this tool, the existing Partition table is validated as mentioned in section: Checking and Validating the Partition Table.
2. Keeping this tool idle for a while (around 2 to 3 hours), may lead to loss of communication to the EVK device. This is indicated in the console as "`Error communicating with FTDI device`", as show in Figure 12. Workaround for this is as follows:
   a. Close the tool
   b. Unplug & re-plug the EVK
   c. Re-open the tool again

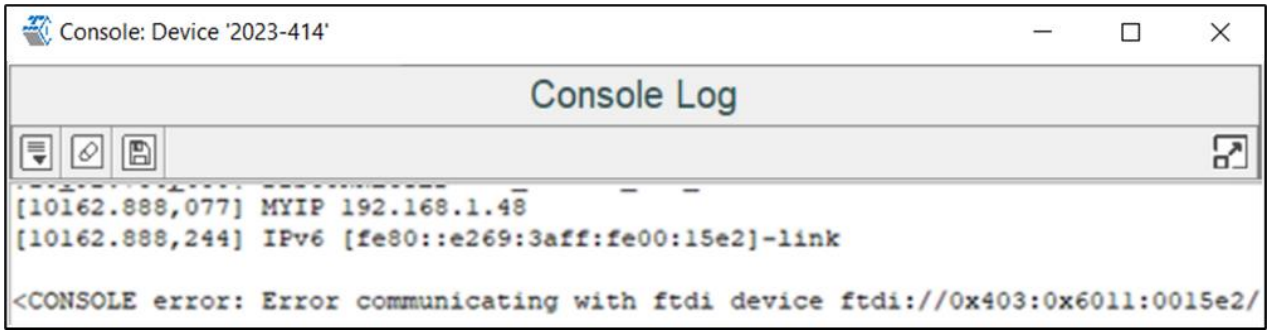

Figure 12: Error communicating with FTDI device

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Download Tool Usage

Boot Target

Connected EVKs appear in the EVK serial number drop-down and the appropriate EVK can be selected.

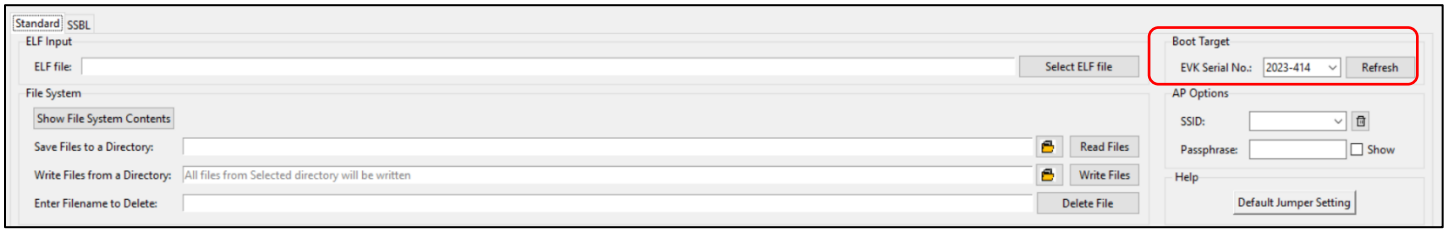

Figure 13: Boot target - EVK selection

Note:

If any connected EVK devices do not have a serial number, the Download tool will automatically handle this by generating a new serial number and update the same onto the corresponding device. During this process, the tool will indicate this in the status bar, as shown in Figure 14.

Format of the new serial number:

```
<year_stamp>-<integer>
```

where,

- <year_stamp>: Current year. For example: 2023
- <integer>: Formed from the sum of last 3 octets (in decimal) of the MAC address found in the device.

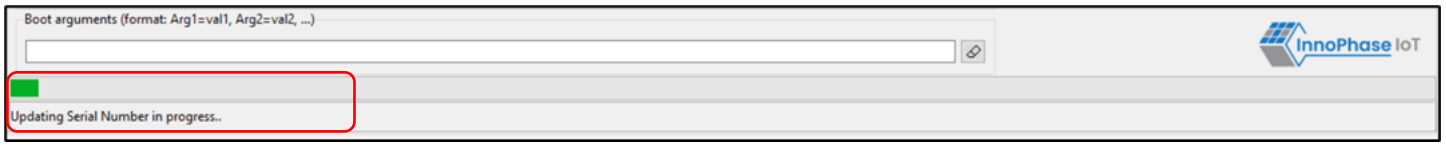

Figure 14: Boot target – Serial number update

Since a new serial number is generated from the MAC address of the device, devices with the same MAC address will get updated with the same serial number. This is an expected behavior.

User can manually update the new serial number to the device following the instructions mentioned in section: New Serial Number to Device – Manual Method.

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ELF Input

Standard Programming

Load the application as per requirement by selecting an appropriate ELF.

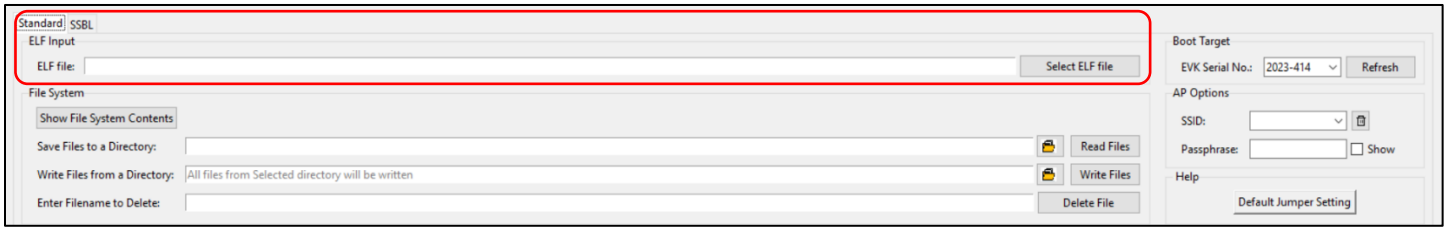

Figure 15: ELF input - Standard programming

SSBL Programming

1. SSBL Image: Select the appropriate SSBL image file to be loaded onto boot partition.
2. ELF File: Load the application as per requirement by selecting an appropriate ELF.

For more information on SSBL programming, refer: `Application_for_using_SSBL.pdf` (*sdk_x.y/apps/ssbl/doc*).

Note: x and y in sdk_x.y refer to the SDK release package version.

Before SSBL programming, write the necessary files onto Talaria TWO. For more details on writing files onto Talaria TWO, refer section: Write Files.

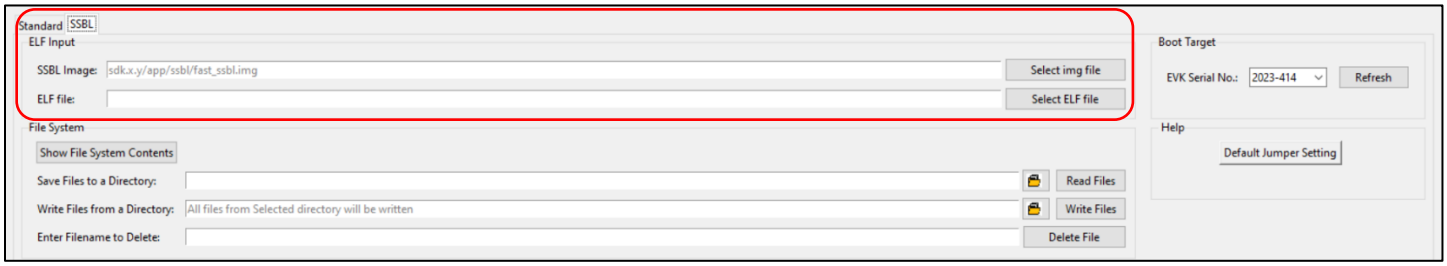

Figure 16: ELF input - SSBL programming

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File System

Show File System Contents

The `Show File System Contents` displays the current available files in the file system. On clicking the `Show File System Contents`, a new window opens displaying the files present. The file path, name and size are displayed.

In case there are no files previously mounted on Talaria TWO, a new window opens displaying: `No files mounted, please write some files using Write Files button.`

Refer section: Write Files for writing files to Talaria TWO.

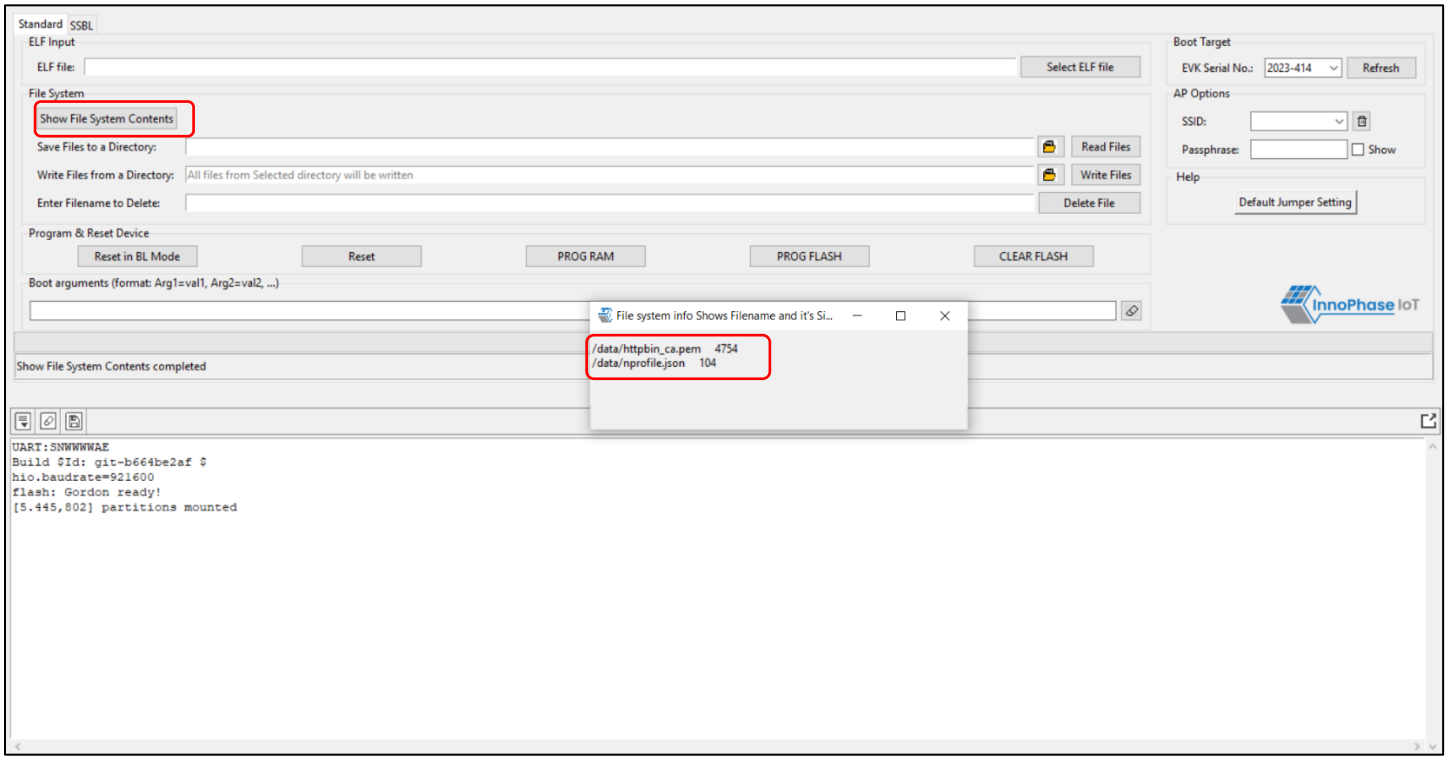

Figure 17: Show File System Contents

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Read Files

To save files to a directory, click on `folder icon before Read Files button`. This opens a new window where the appropriate folder can be selected. Once the path to read files is selected, click on `Read Files`.

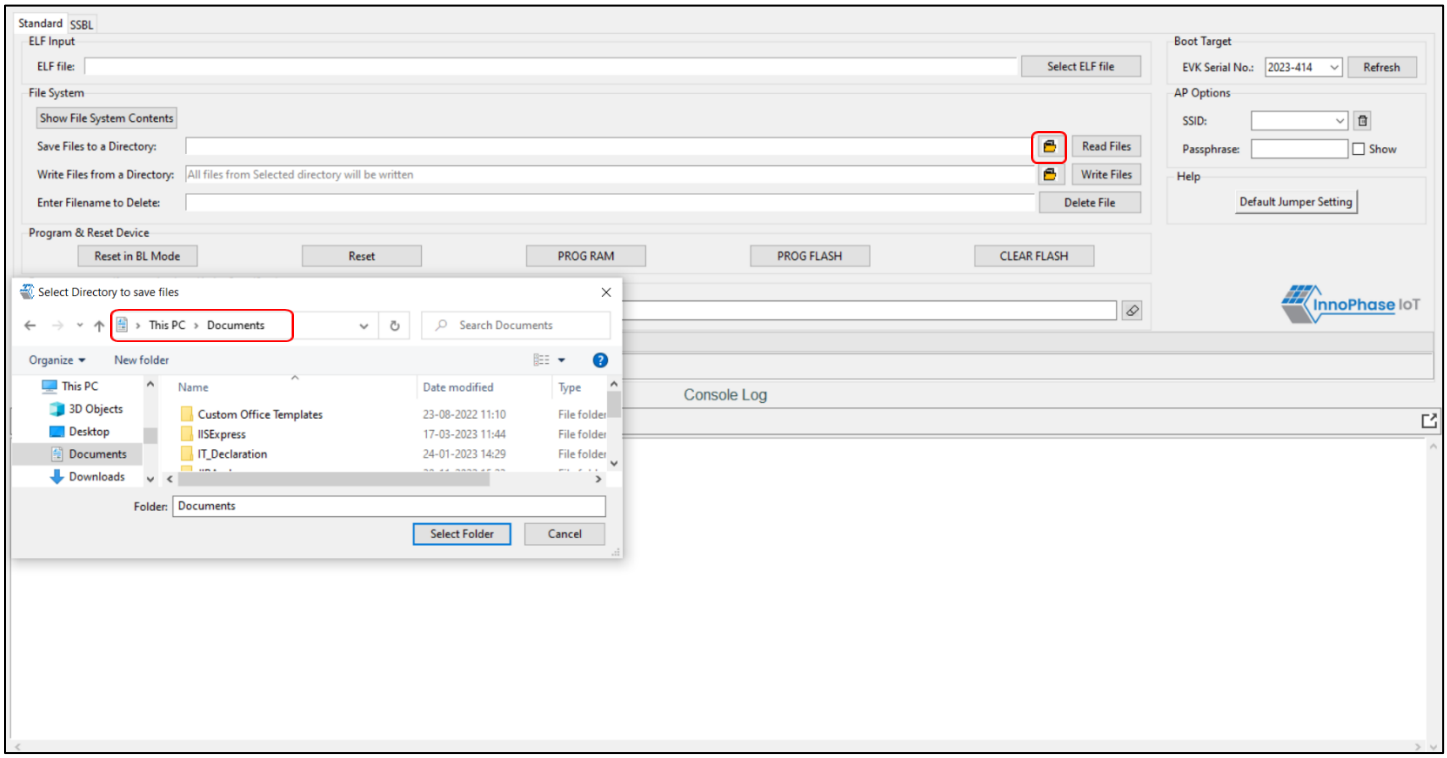

Figure 18: Select path to Read Files

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Before using the `Write Files`, user can read the file system with `Read Files` to retain a copy of the Talaria TWO file system contents.

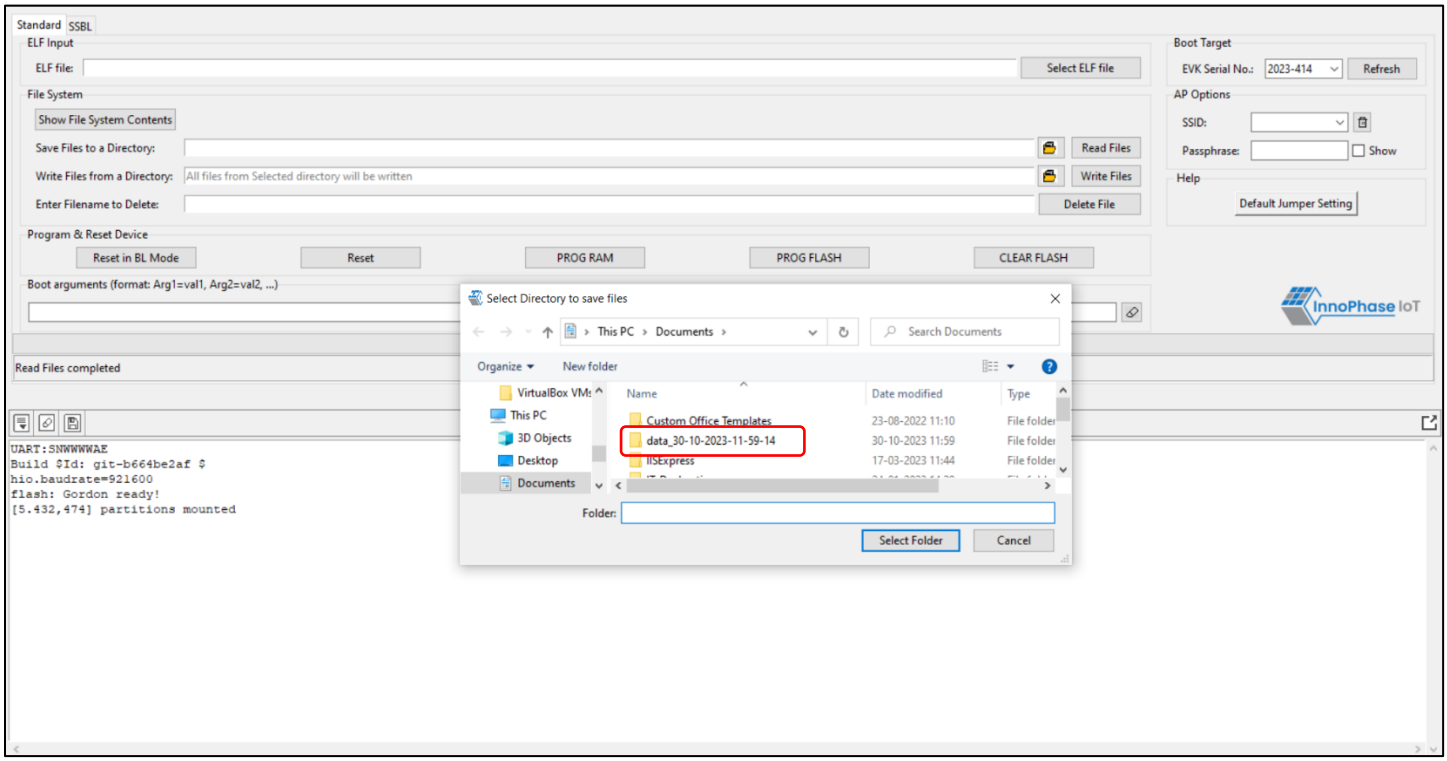

Figure 19: Read Files

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Write Files

To write files, click on the folder icon before `Write Files` button and select the folder from the where the files can be written. Click on `Write Files`. Once done, the file system contents can be confirmed by clicking on `Show File System Contents`, where the said files will be displayed.

To write files into Talaria TWO, user must create a folder with the name `data` and place all certificates either directly into data or they can create multiple subfolders (for example: `/data/certs/https_client/app`) and place the certificates inside the sub-directory and update the path as per the file system in the `.c` file.

Any number of files/folders inside `data` will be written.

On clicking the `Folder icon before Write Files button` option, a window to browse the files opens. Select the folder where the appropriate files/certificates are present and click on `Select Folder`. Though the GUI window does not display the files present in the selected folder, all the files present in selected folder will be written to Talaria TWO.

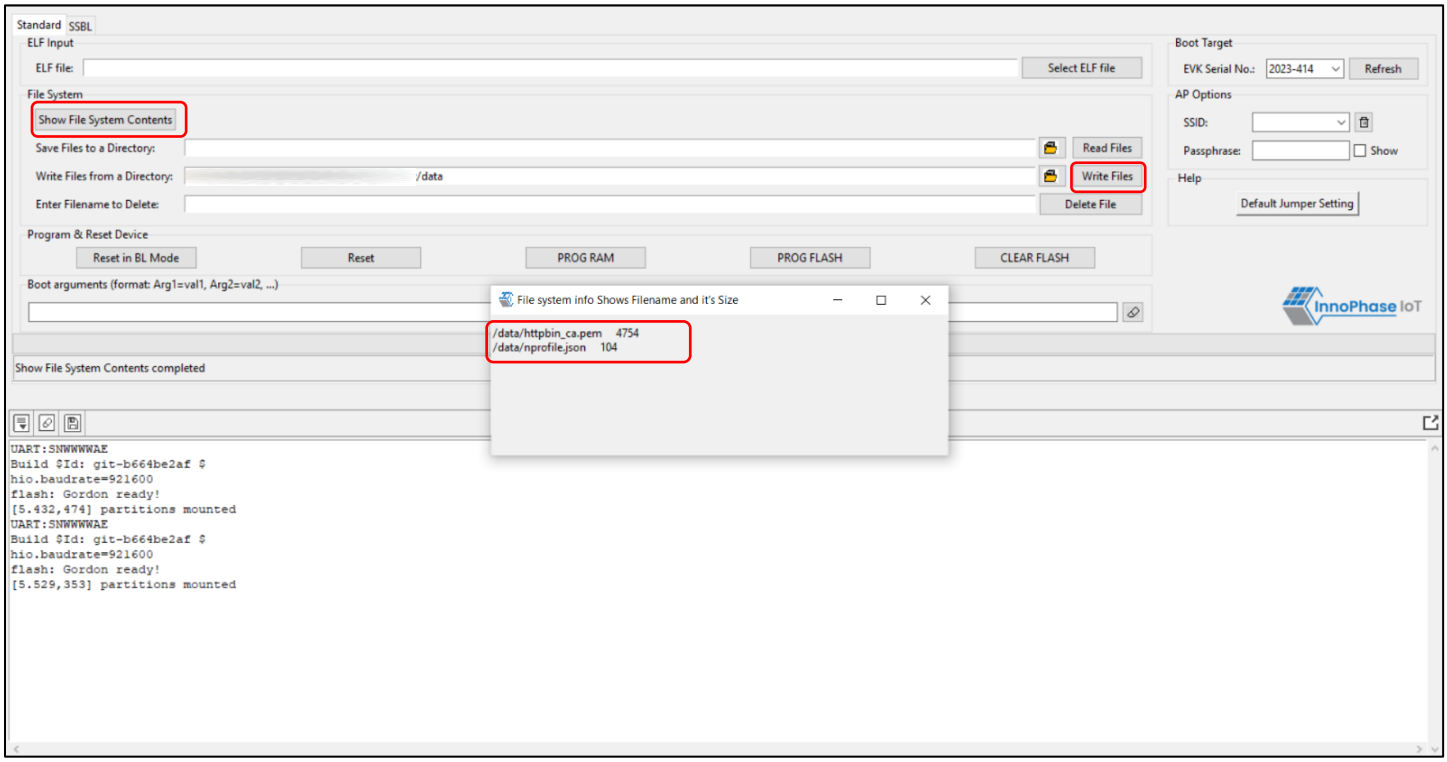

Figure 20: Write Files

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Note:

1. The maximum size limit of the directory selected using `Write Files` is equal to the size of `DATA` partition (in EVB partition table).
   If the default partition table is used, the maximum limit is `120 Kbytes`.
2. In case the user needs the existing files, the user will have to `Read Files` to retrieve the existing files before initiating `Write Files`. On taking a back-up, click `Yes` as shown in Figure 21.

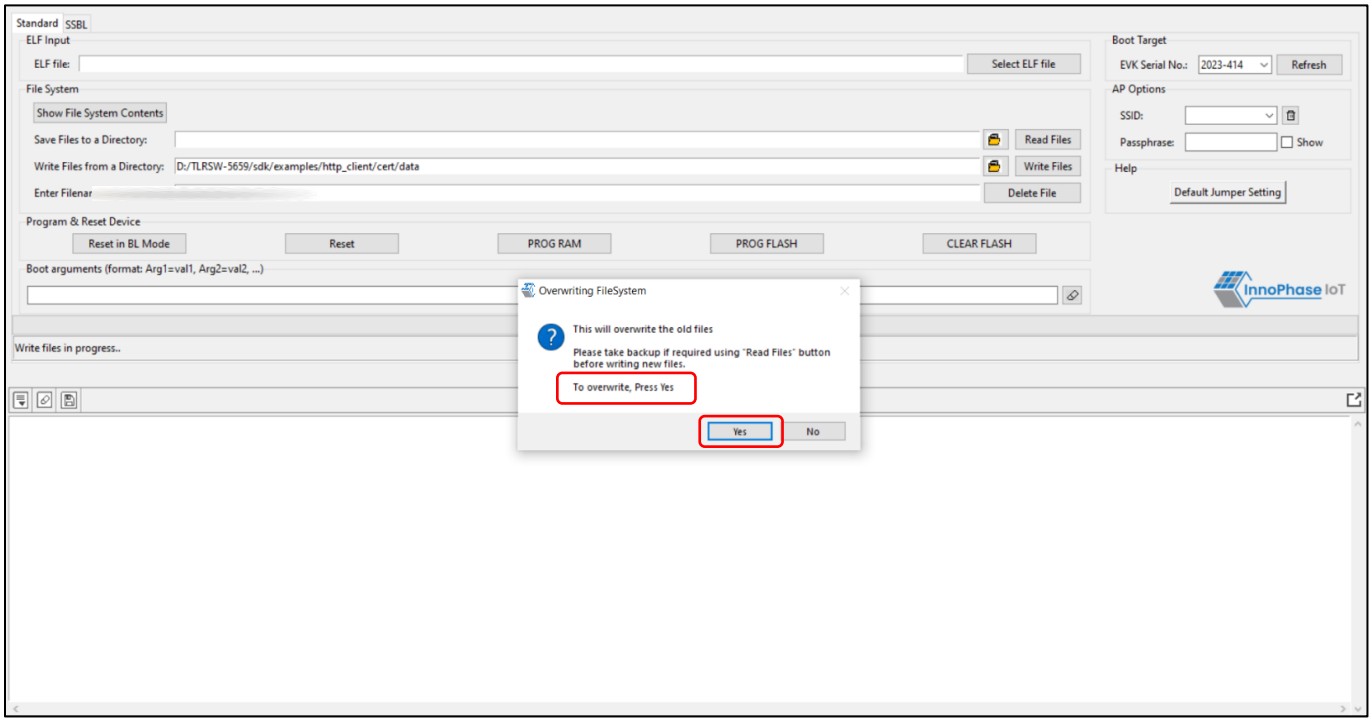

Figure 21: Overwriting old files

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Delete File

To delete a file from Talaria TWO, enter the name of the file in the field `Enter File Name to Delete` and click on `Delete File`. Files can be deleted one at a time.

After deleting, the file system contents can be confirmed by clicking on `Show File System Contents`, where the said file will be deleted from the list.

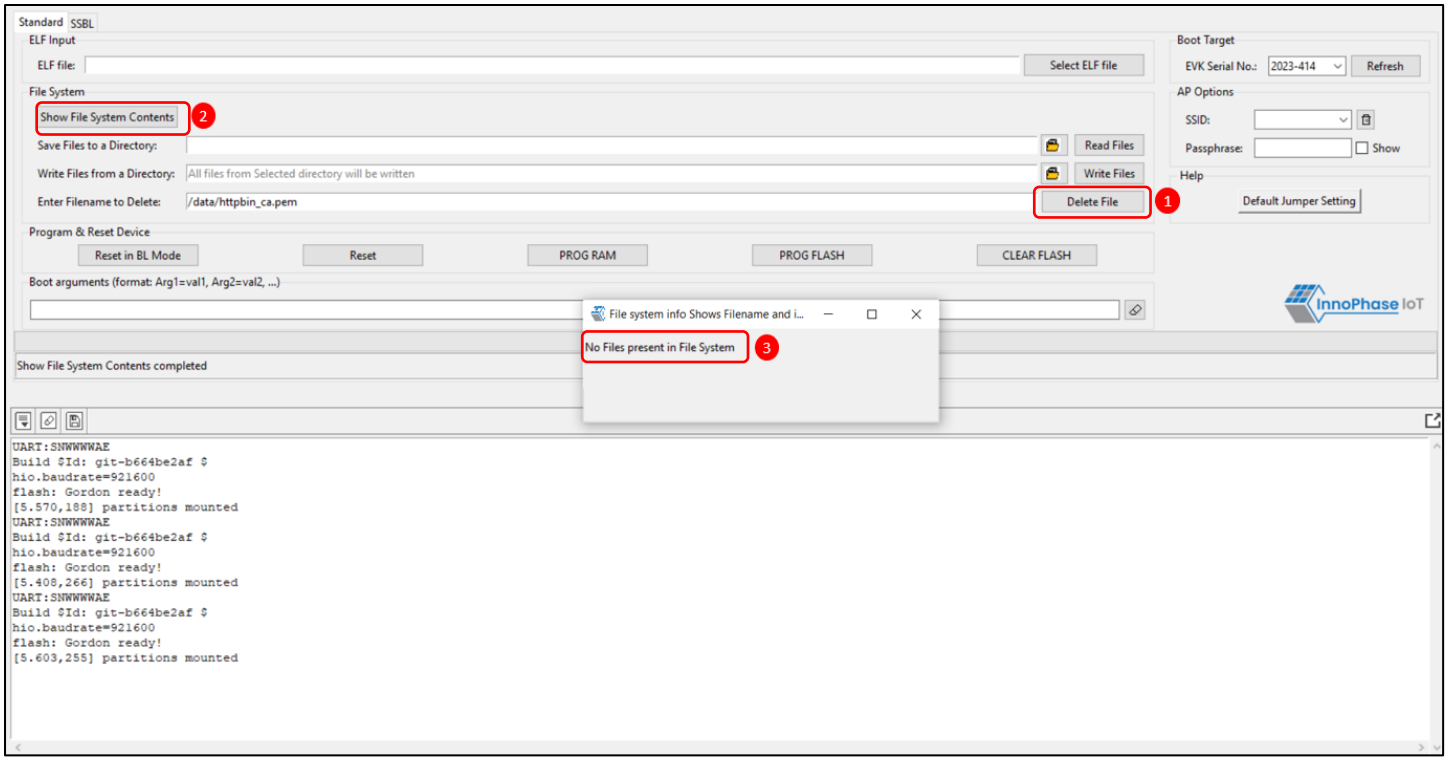

Figure 22: Delete File

Note: Clicking on `Clear Flash` will only clear the application but not the file system contents.

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AP Options

AP Options are used for connecting to an Access Point. Basic parameters are SSID and Passphrase. If SSID and Passphrase are entered, then these parameters are used while loading the ELF using PROG Ram/ PROG Flash.

Note: Tool will internally generate the network profile as JSON file, stores it in the Talaria TWO file system and passes this JSON file path as a boot argument, while loading the application.

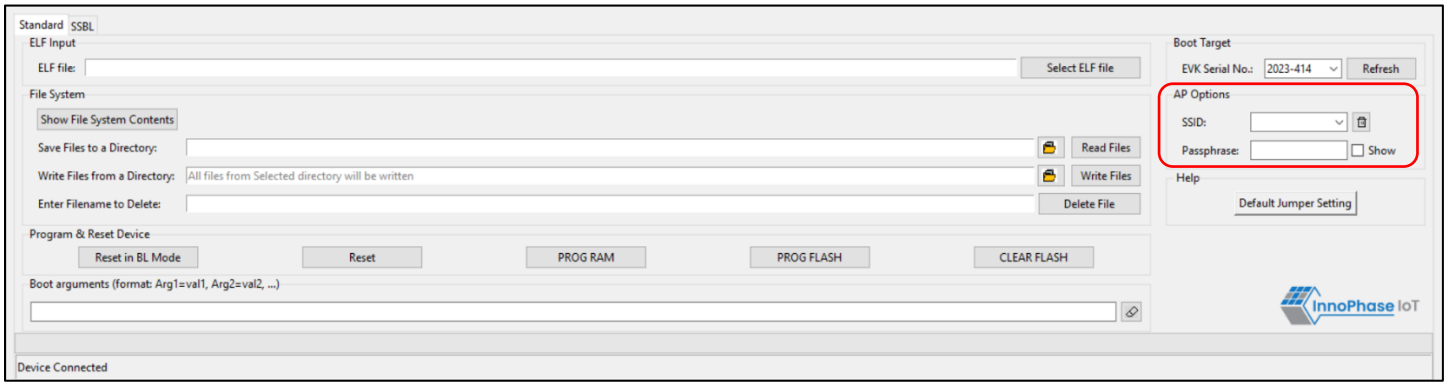

Figure 23: AP Options

Boot Arguments

Talaria TWO's software allows the user to pass boot time arguments which might be useful during the execution of the software. Users can pass boot time arguments to configure the firmware. In the current use case, the following boot arguments are passed:

```
host=httpbin.org,path=/json,port=443,secured=1,method=get,ca_cert=/data/httpbin_ca.pem
```

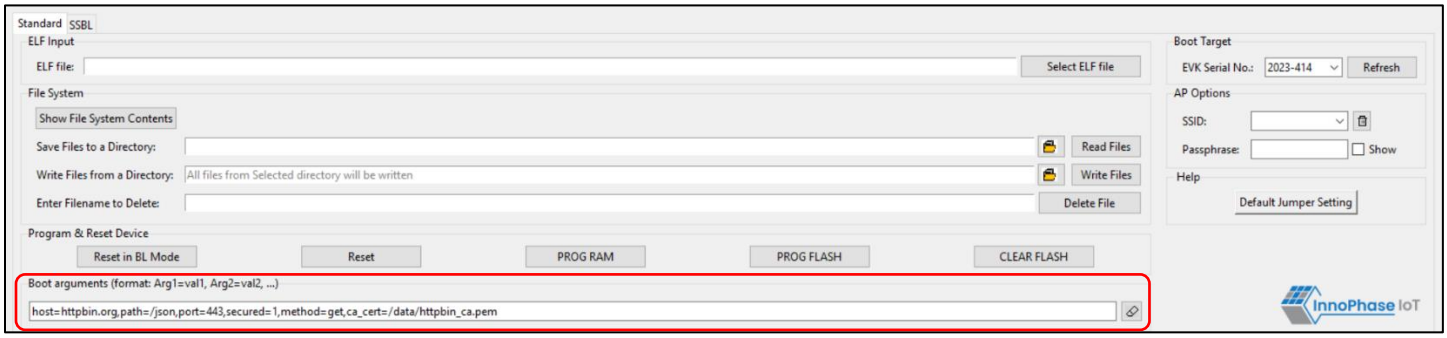

Figure 24: Passing Boot Arguments

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Resetting the EVB-A in BL Mode

To reset the EVB-A in Boot Loader mode, click on Reset in BL Mode as shown in Figure 25.

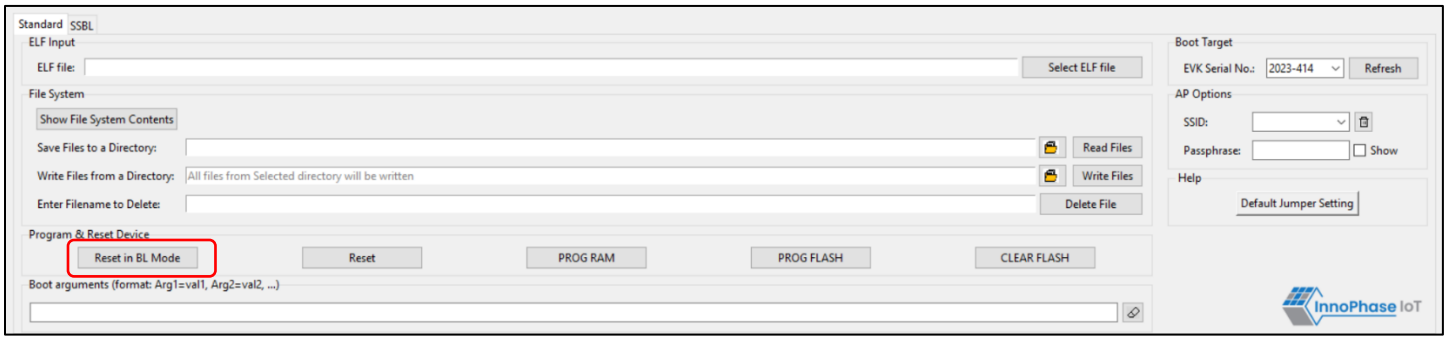

Figure 25: Reset in BL mode

When the EVB-A is reset in the Boot Loader mode, though no changes are observed in the console for this command, the board is reset.

Programming to RAM

Program Talaria TWO's ELF to RAM by clicking on `PROG RAM`.

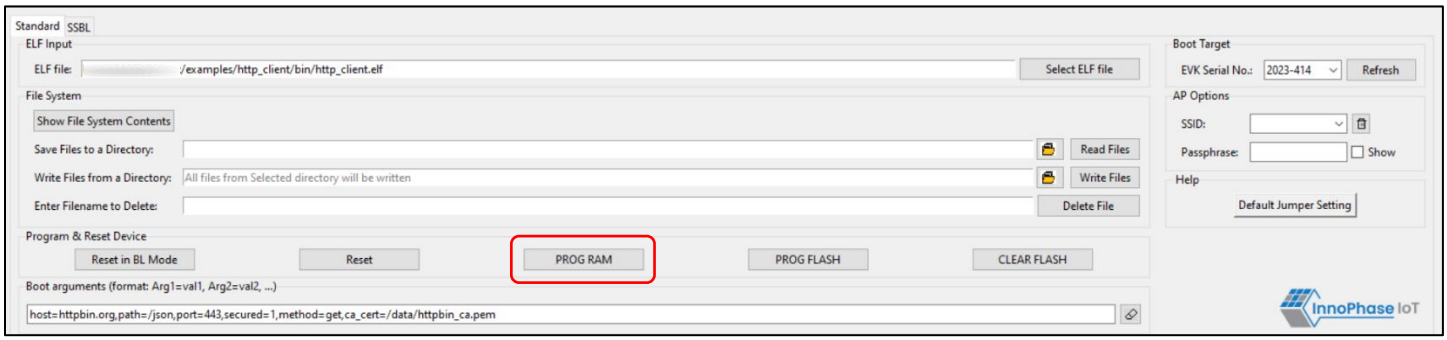

Figure 26: PROG RAM

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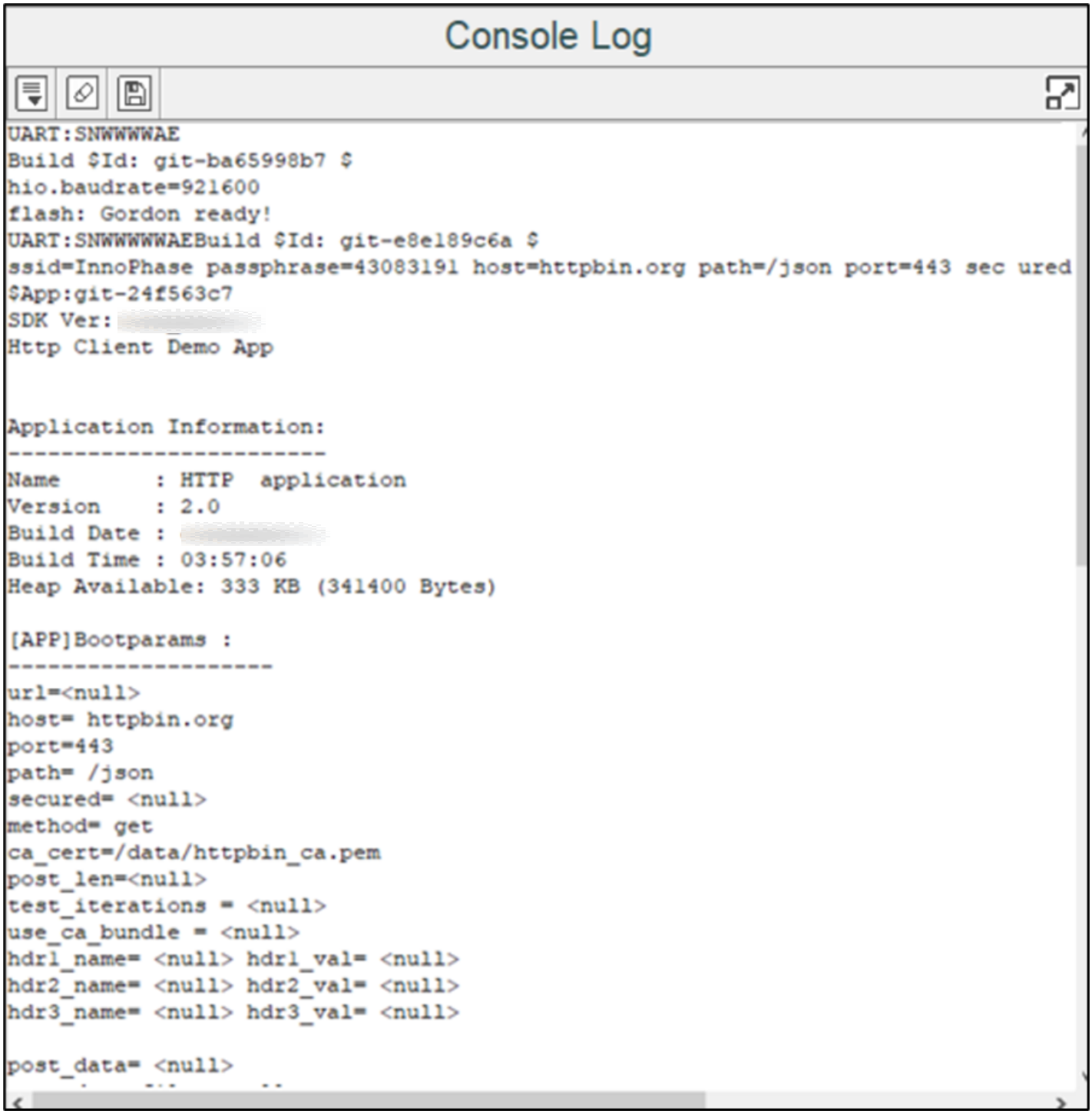

Figure 27: Console Output – PROG RAM

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`PROG RAM` will clear the application from Flash. The user is alerted of the same during `PROG RAM` through a pop-up message as shown in Figure 28. User can select the `Do not show again` checkbox to stop the pop-up message from appearing the next time.

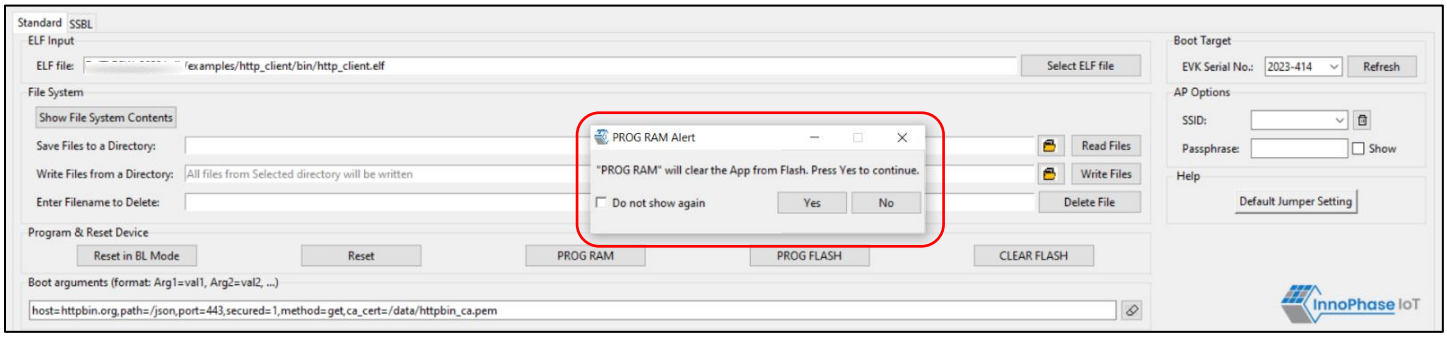

Figure 28: PROG RAM alert message

Programming to Flash

Program Talaria TWO's ELF to Flash by clicking on `PROG Flash`.

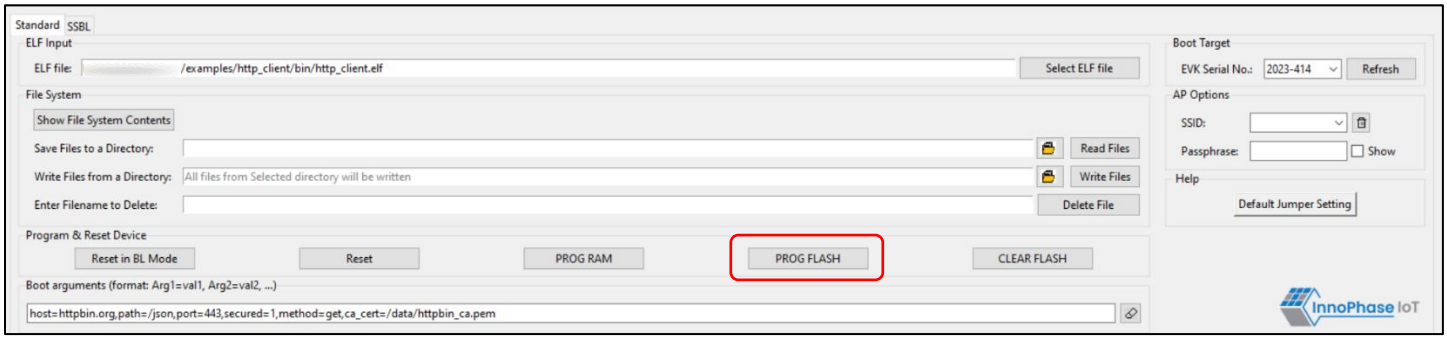

Figure 29: PROG Flash

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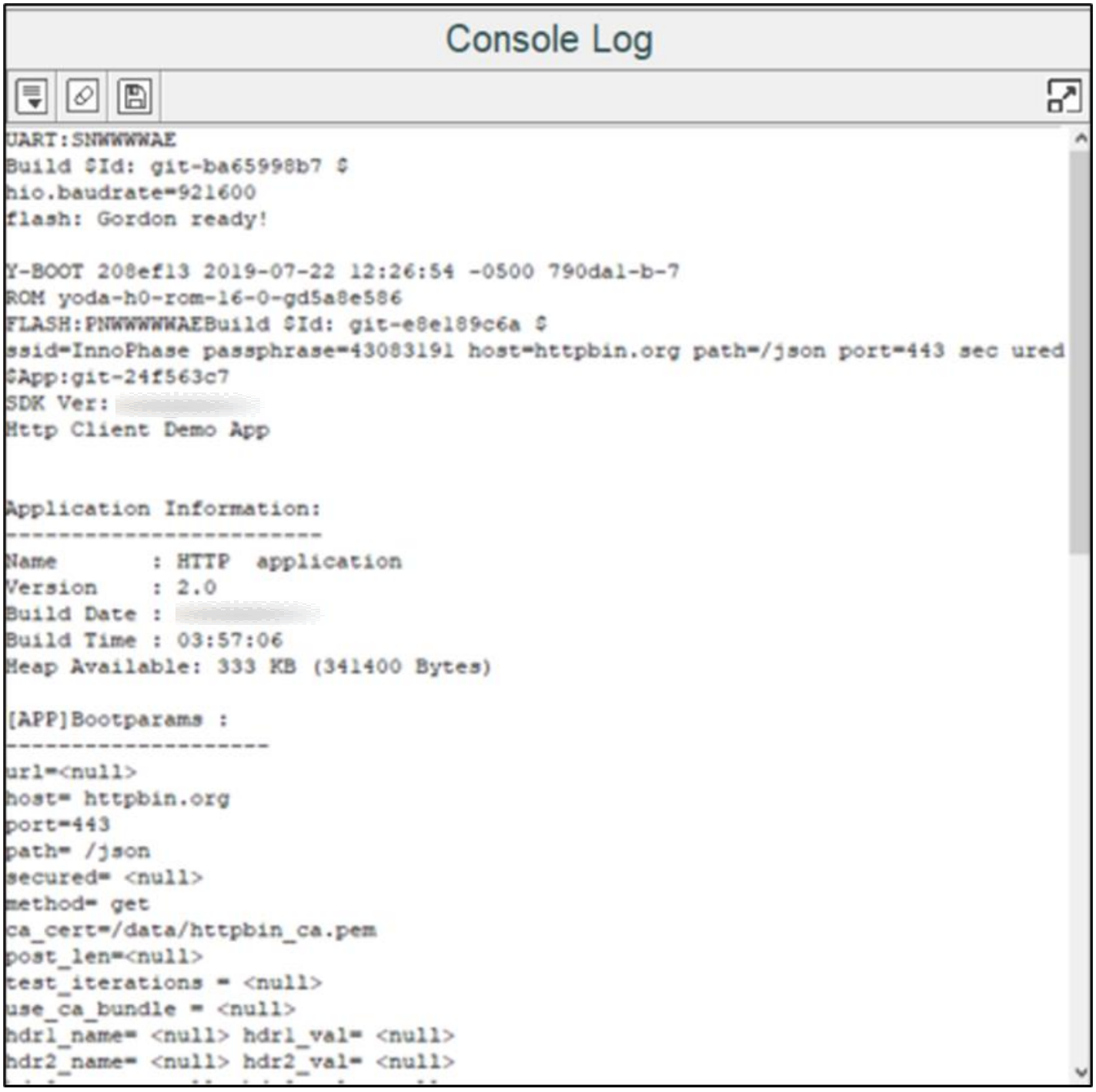

Figure 30: Console Output – PROG Flash

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Help

Help provides information about the default jumper/switch setting. Clicking on `Default Jumper Setting` as shown in Figure 31 will pop-up a new window with default jumper/switch setting information as shown in Figure 32.

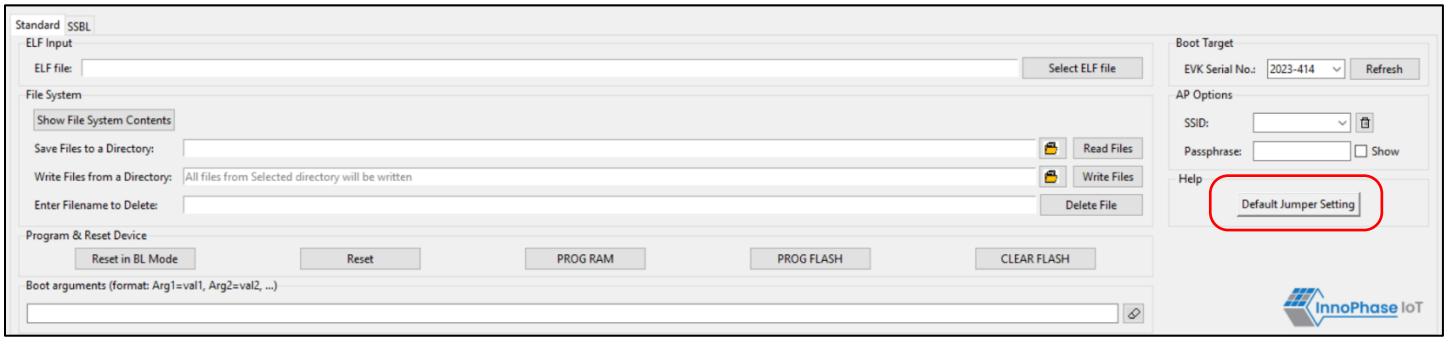

Figure 31: Help Frame

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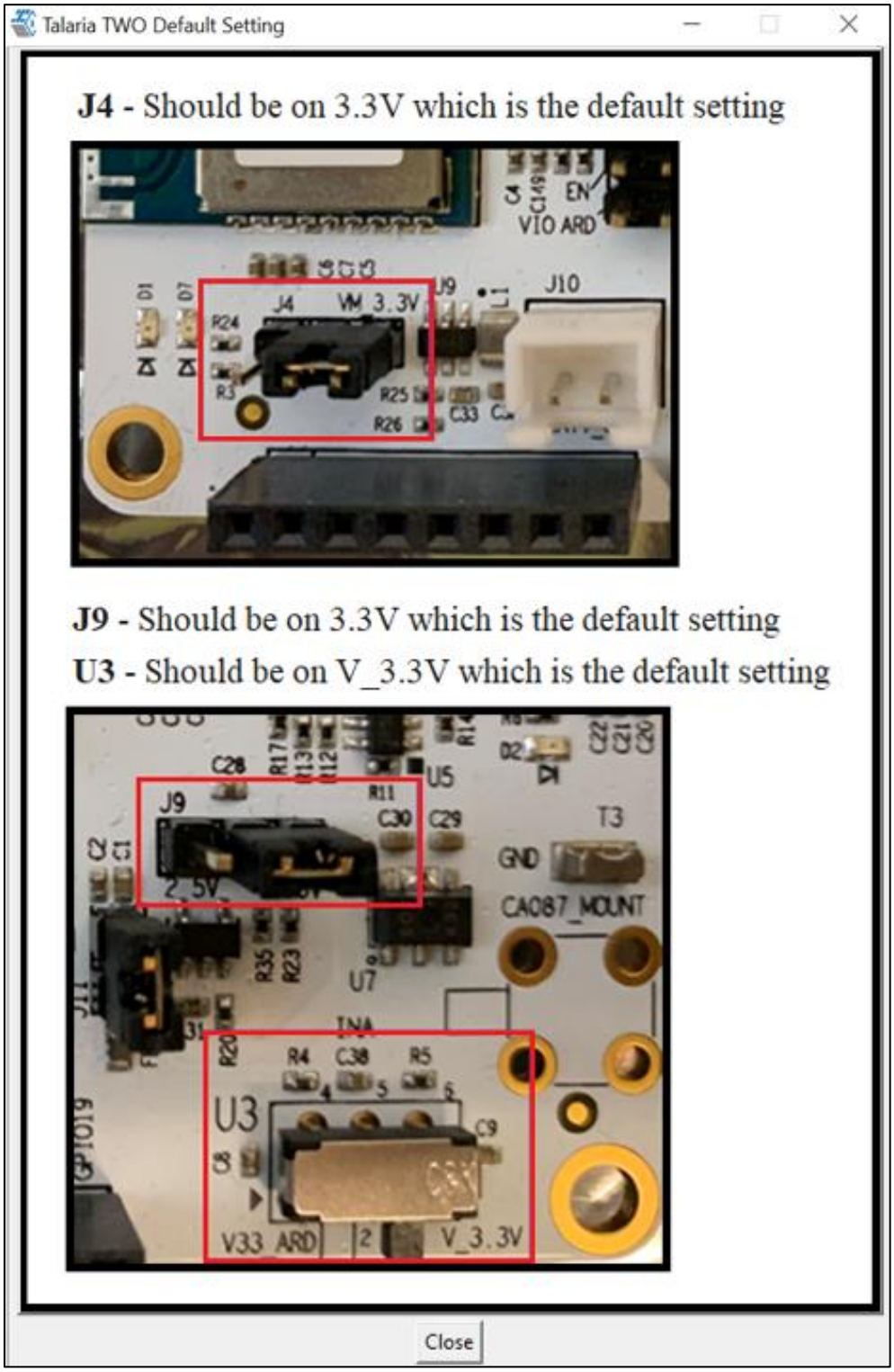

Figure 32: Default Jumper/Switch setting Window

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Note: As shown in Figure 33, default Jumper/Switch setting window will appear every time the tool is launched. To turn this feature OFF permanently, check the `Do not show again` box and close the window.

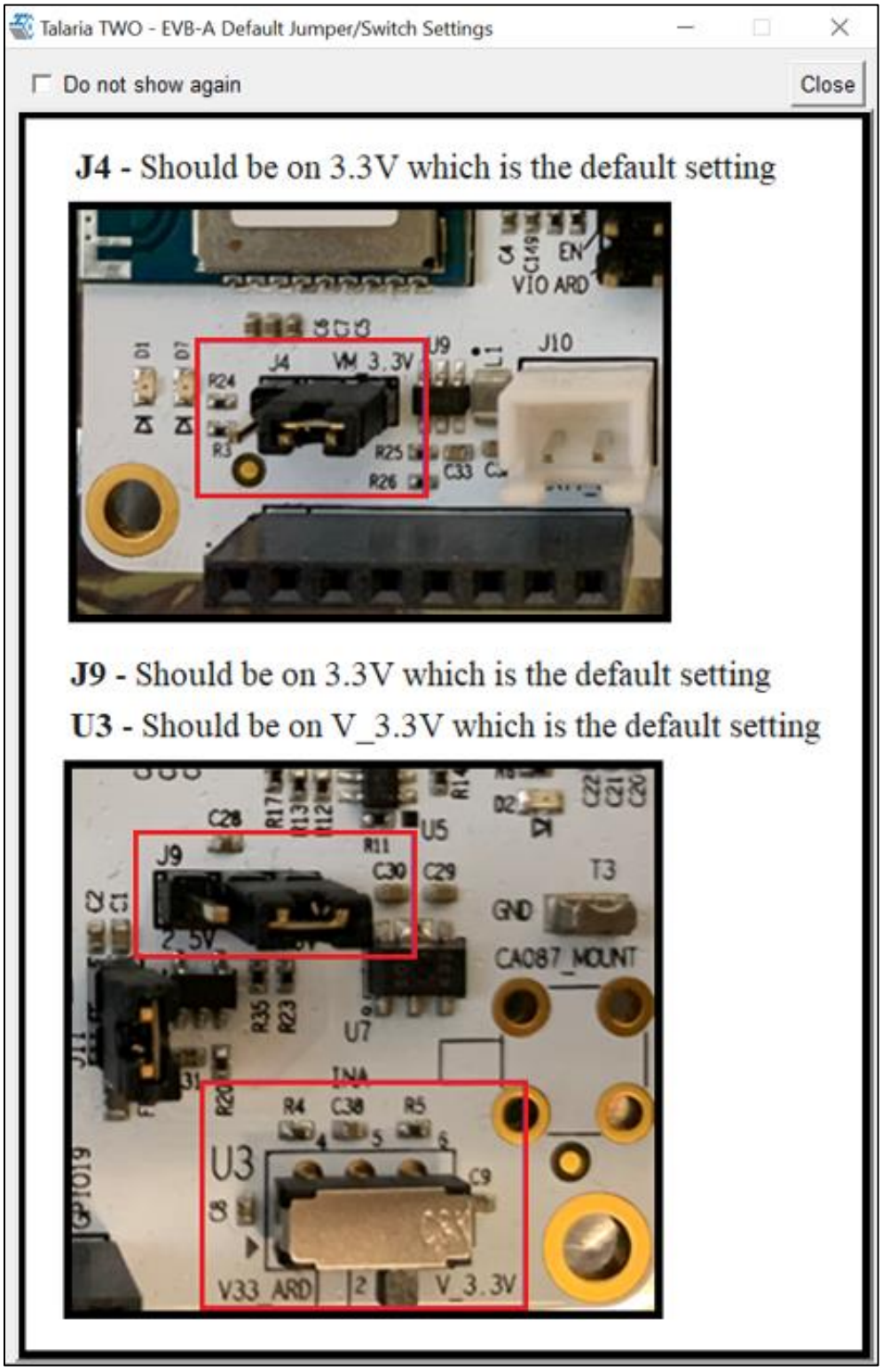

Figure 33: Default Jumper/Switch setting Window during Tool Launch

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Appendix

Checking and Validating the Partition Table

Standard Programming

Download tool will validate the existing partition table in the EVB, for the following condition:

Partition Name	Sector Start	Sector Count
BOOT	1	63
VIRT	64	>=65
SYSFS	496	16

Table 1: Standard programming: Partition Table – Condition

Case 1: Existing partition matches SSBL programming partition

If the existing partition does not satisfy the condition mentioned in Table 1, but matches with the SSBL programming partition, the user is notified by a pop-up message. The user will then have the option (Yes/No) to either flash the default partition table or terminate the action (i.e., correct the deviation manually and try again).

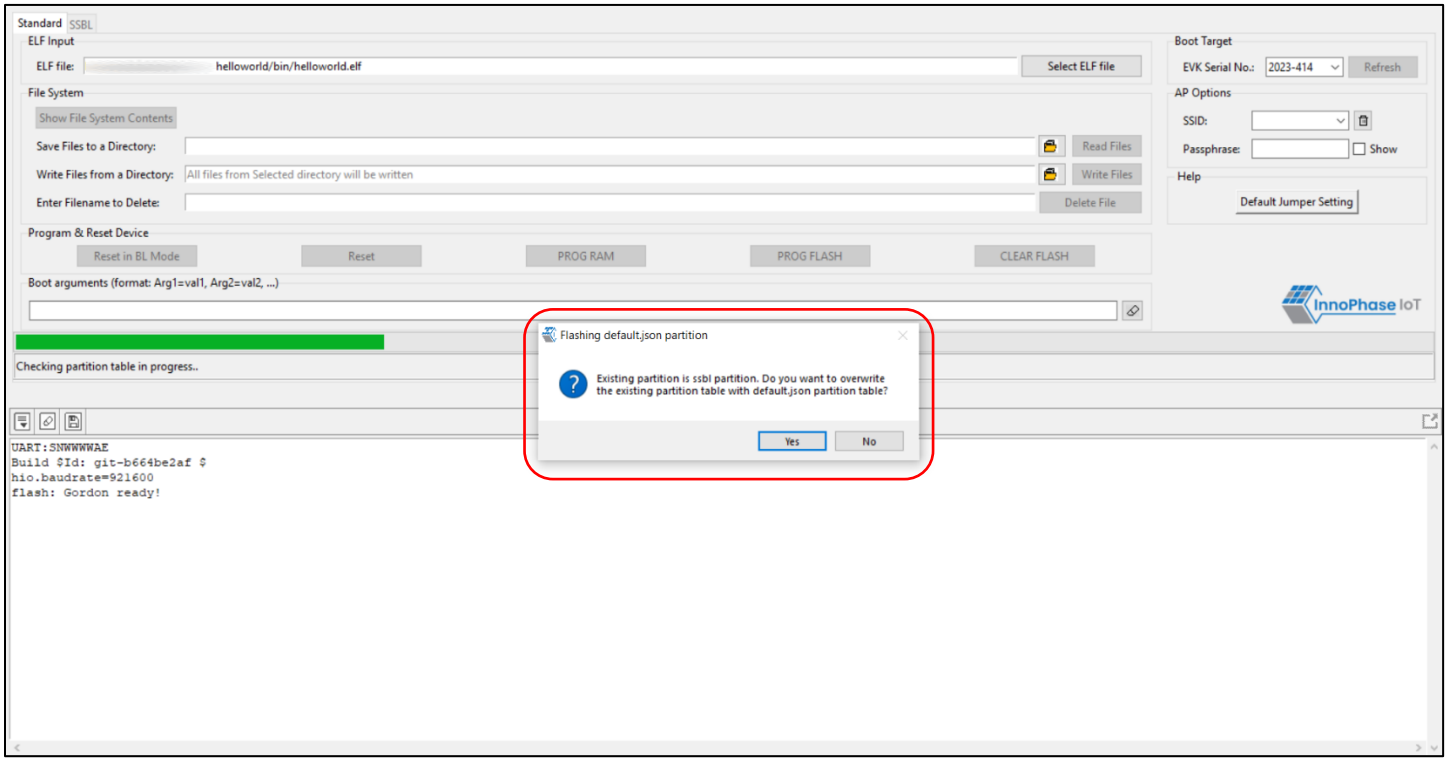

Figure 34: Deviation from the standard programming partition – matches SSBL programming partition

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If the user selects 'No' and chooses not to back-up to the local system, action is terminated requiring the user to manually correct the deviation to proceed further as shown in Figure 35.

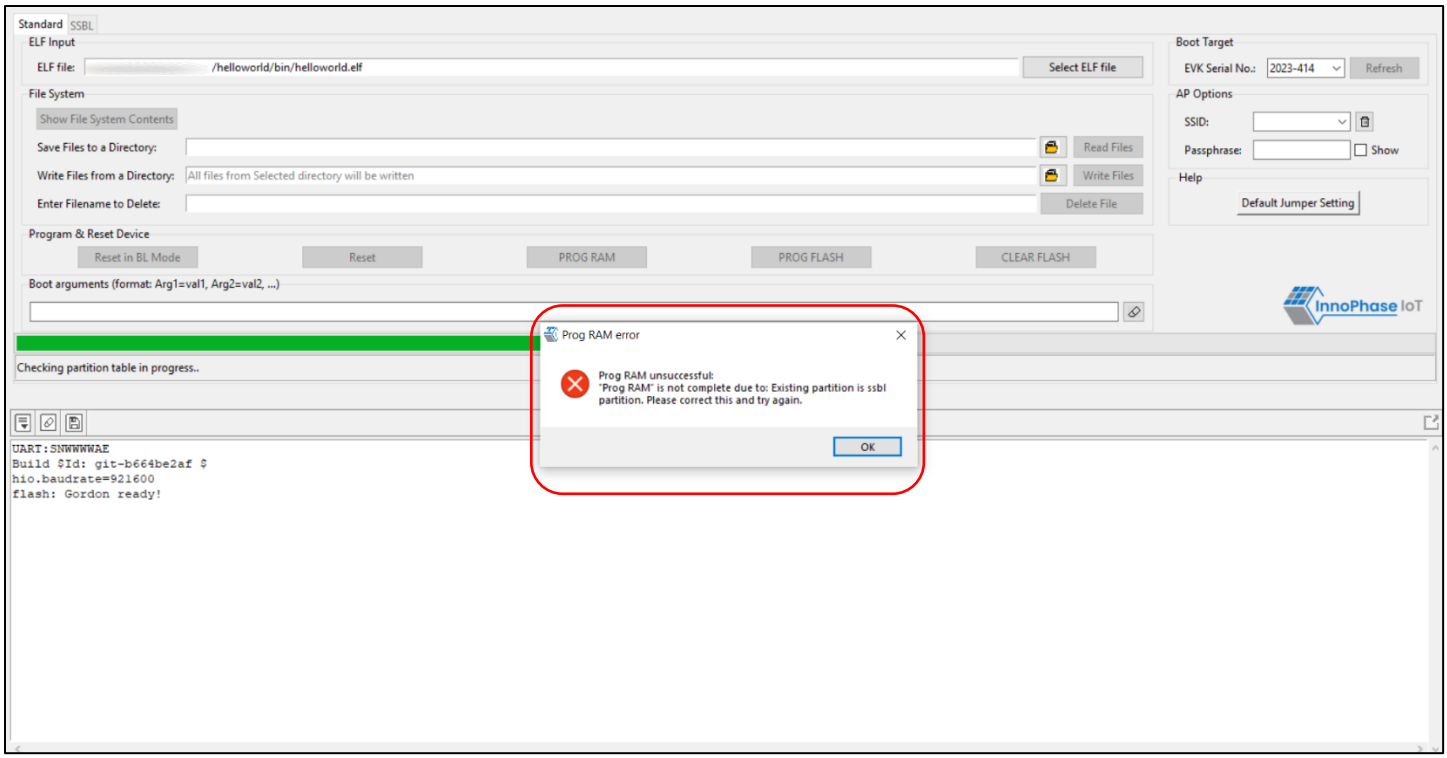

Figure 35: Standard programming - action terminated

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Case 2: Existing partition neither satisfies Standard programming partition, nor SSBL programming partition

If the existing partition neither satisfies the condition mentioned in Table 1, nor the SSBL programming partition, the user is notified by a pop-up message. The user will then have the option (Yes/No) to either flash the default partition table or terminate the action (i.e., correct the deviation manually and try again).

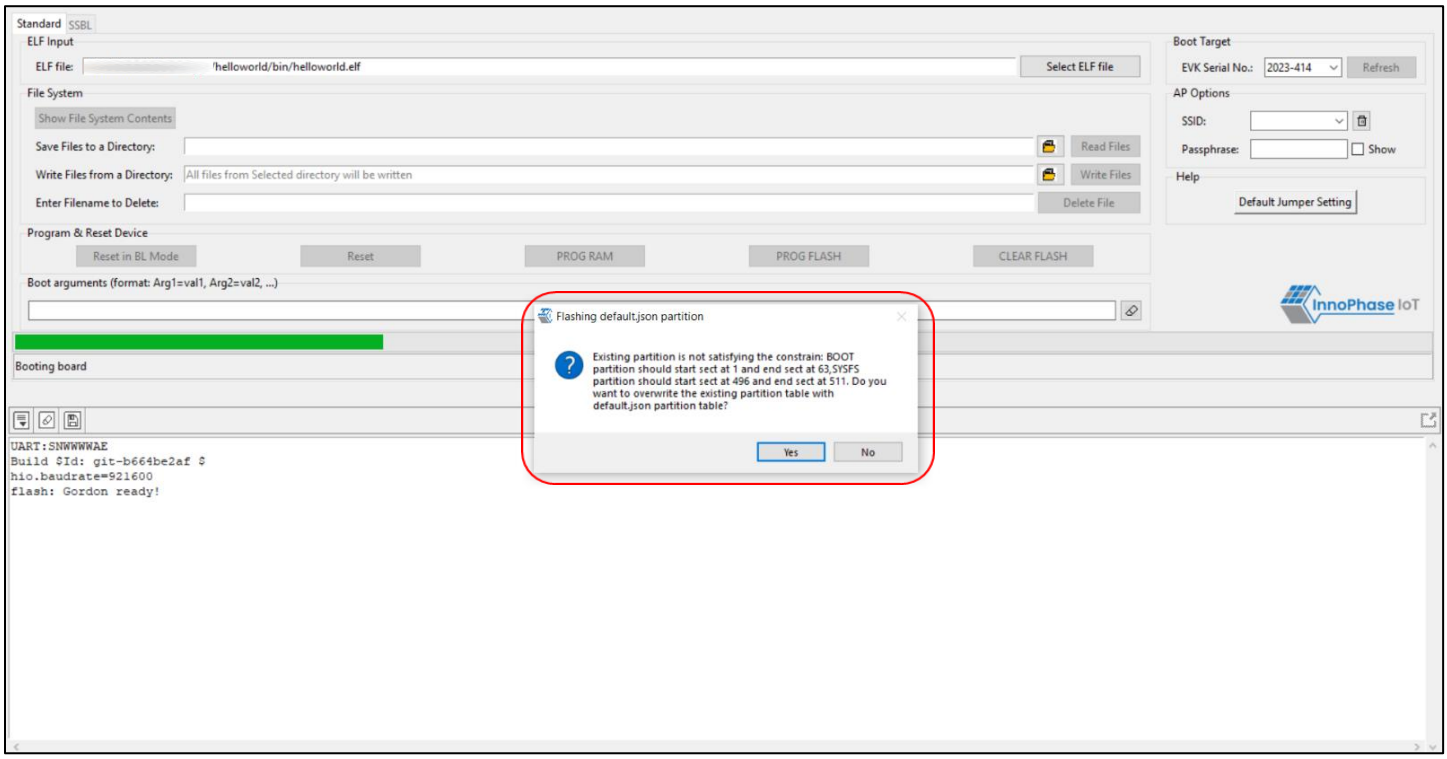

Figure 36: Deviation from the standard programming partition - no match

Note: In case the user-defined partition table meets the condition mentioned in Table 1, but with VIRT partition less than the application VM image size, a pop-up message notifies the same to the user with an option of overwriting existing partition with default partition table, as shown in Figure 37.

Figure 37: VM image does not fit in partition

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1. If the user chooses to flash the default partition (option: Yes):
   Download tool will back-up the contents of SYSFS and DATA partition of existing partition table. Once the default partition is flashed successfully, the backed-up contents of SYSFS and DATA partitions are re-flashed to the corresponding new location as per the default partition table.

   a. In case the backed-up contents of SYSFS does not fit into the corresponding new location as per the default partition table (regarding size), user will have an option (Yes/No) to either back-up the content to local system and clear the data in EVB or correct the deviation manually and try again.

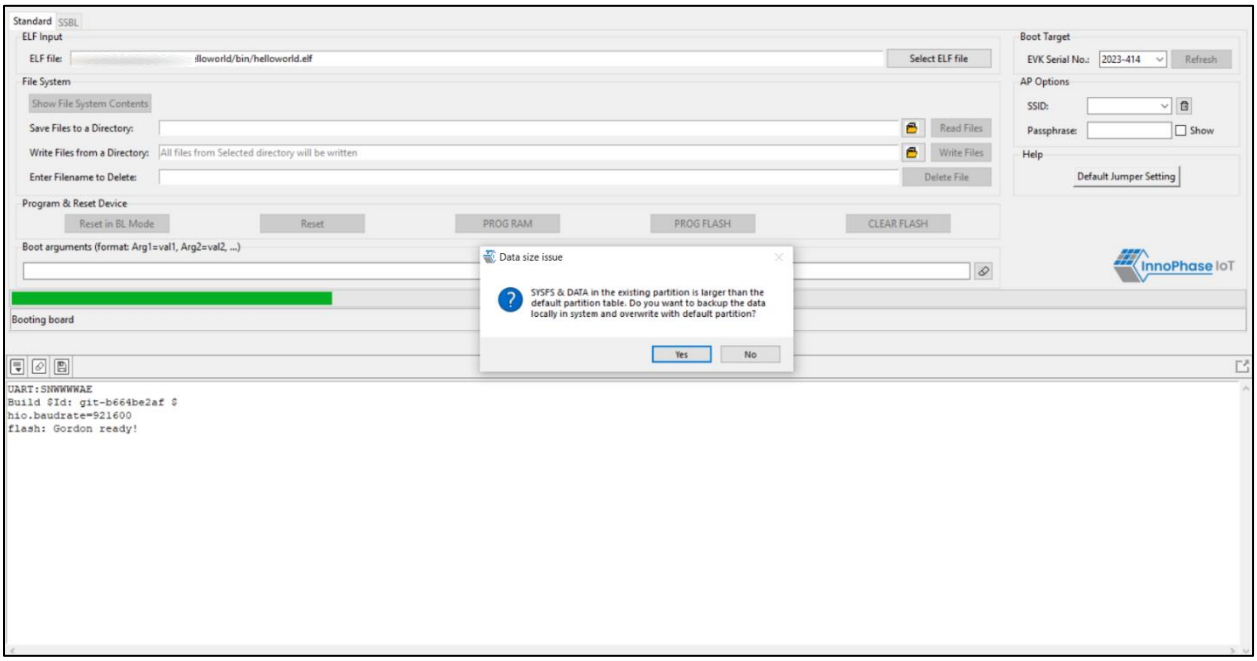

Figure 38: Backed-up contents of SYSFS

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i. If the user chooses to back-up to local system (option: Yes):
The contents will be saved in the local system and the user will be notified with the folder path through a popup message.

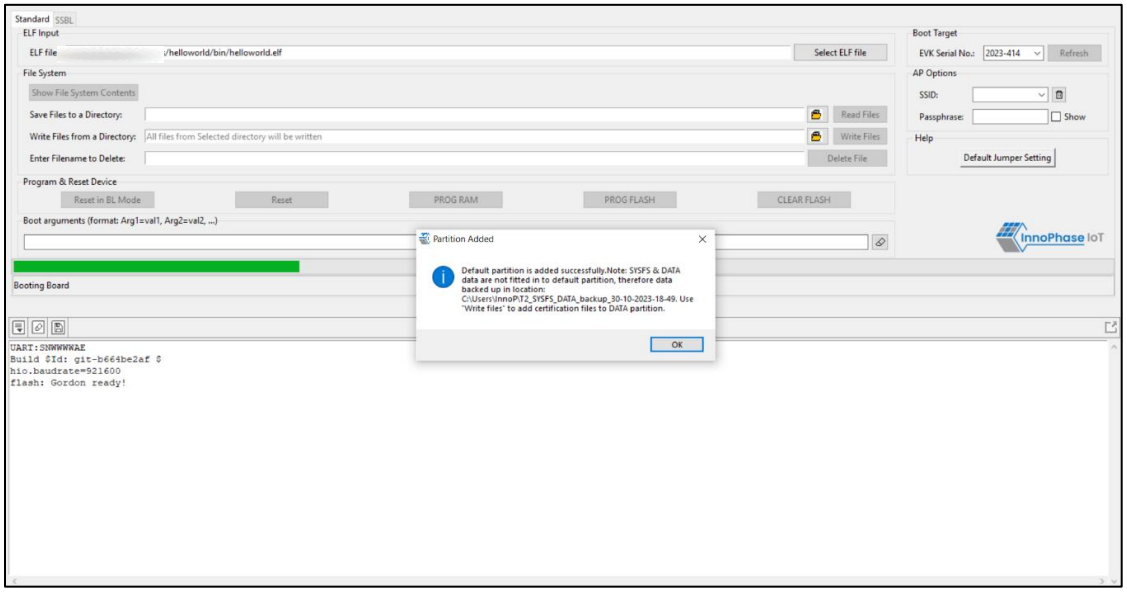

Figure 39: Contents saved in the local system

ii. If the user does not choose to back-up to local system (option: No):
The action will be terminated, and user will be required to correct the deviation manually to proceed further.

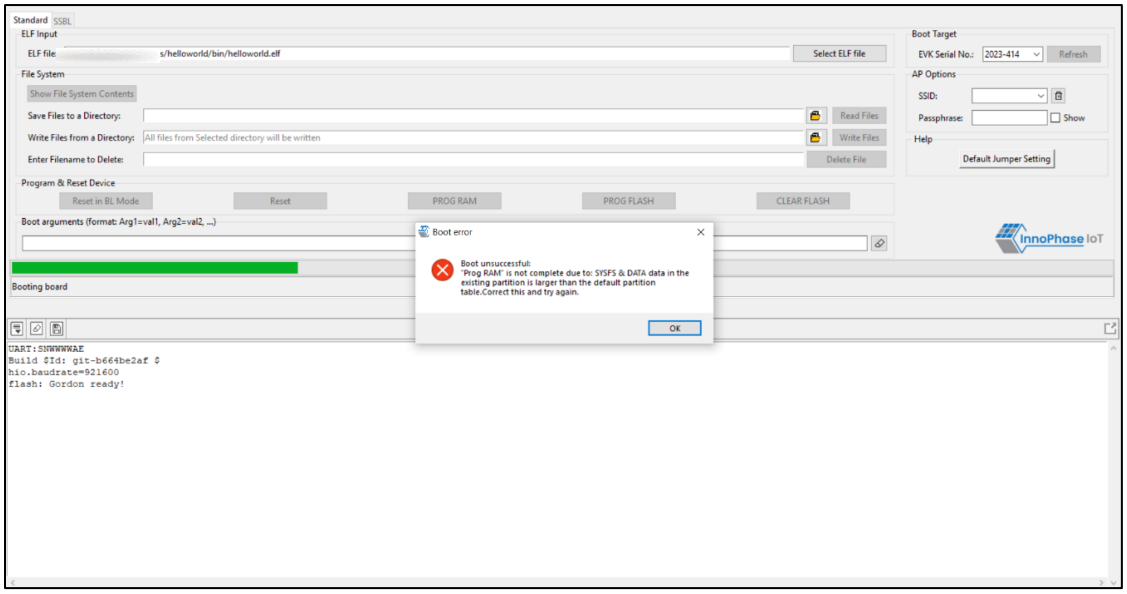

Figure 40: Action terminated requiring to correct the deviation manually

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b. In case the back-up contents of DATA partition do not fit the corresponding location in the default partition, the contents will be saved in the local system and the user will be notified with the folder path through a pop-up message. Also, the user will be intimated to write the new certification file to DATA partition using `Write Files` option.

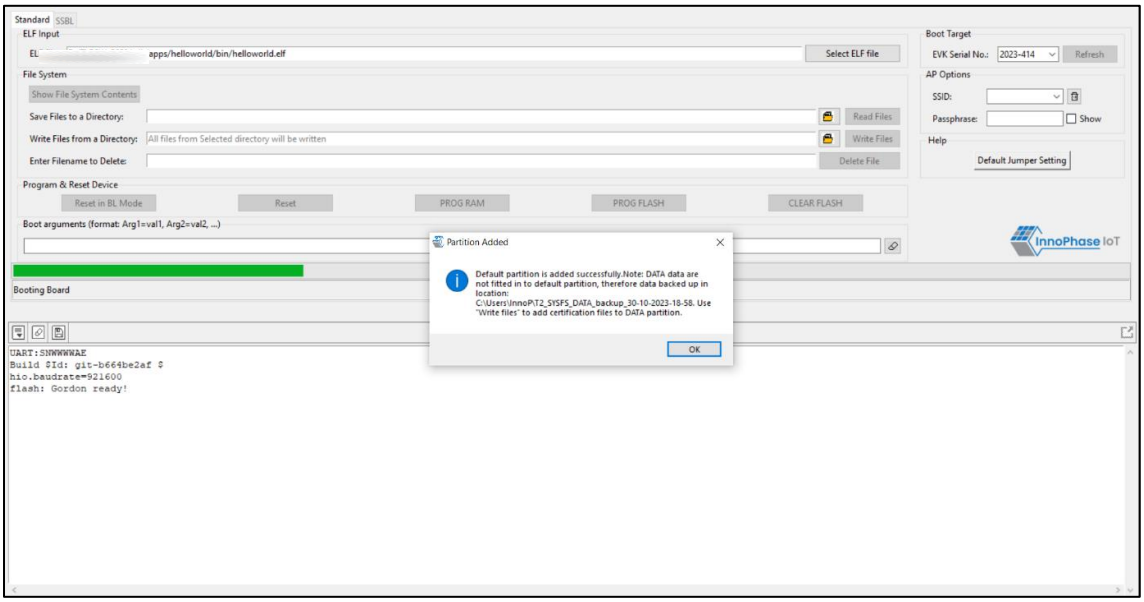

Figure 41: Back-up contents of DATA partition

c. However, if the user does not choose to flash the default partition (option: No):
The action will be terminated, and the user will be required to correct the deviation manually to proceed further.

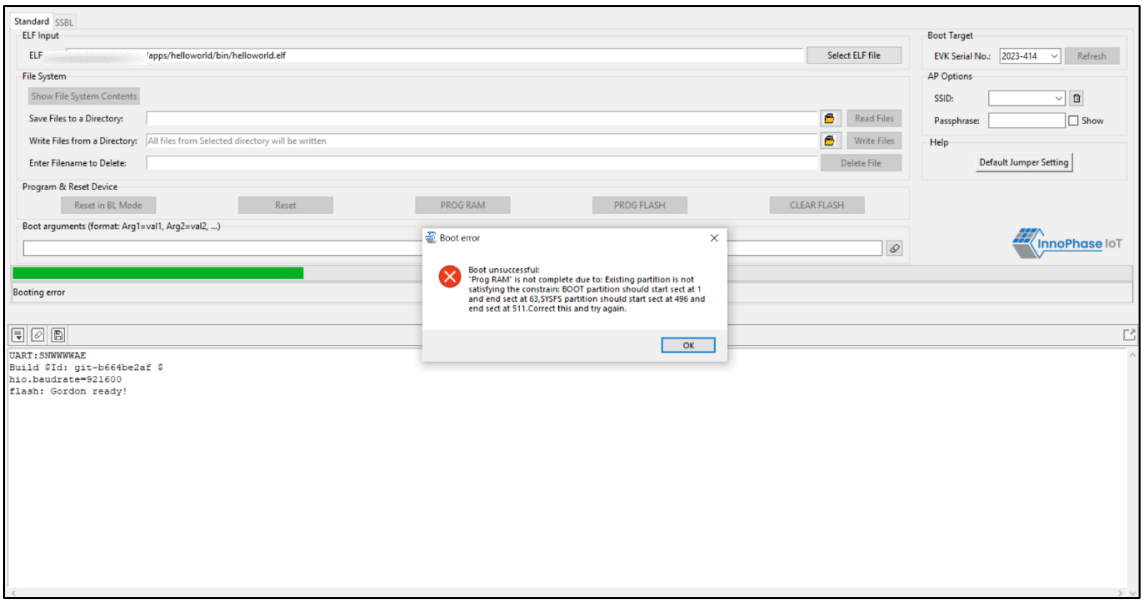

Figure 42: User does not choose to flash default partition – action terminated

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SSBL Programming

Download tool will validate the existing partition table in the EVB, for the following condition:

Partition Name	Sector Start	Sector Count
BOOT	1	31
BOOT	32	352
DATA	384	112
SYSFS	496	16

Table 2: SSBL programming: Partition Table – Condition

If the existing partition does not satisfy the condition mentioned in Table 2, but matches with the default programming partition, the user is notified by a pop-up message.

The user will then have the option (Yes/No) to either flash the default partition table or terminate the action (i.e., correct the deviation manually and try again).

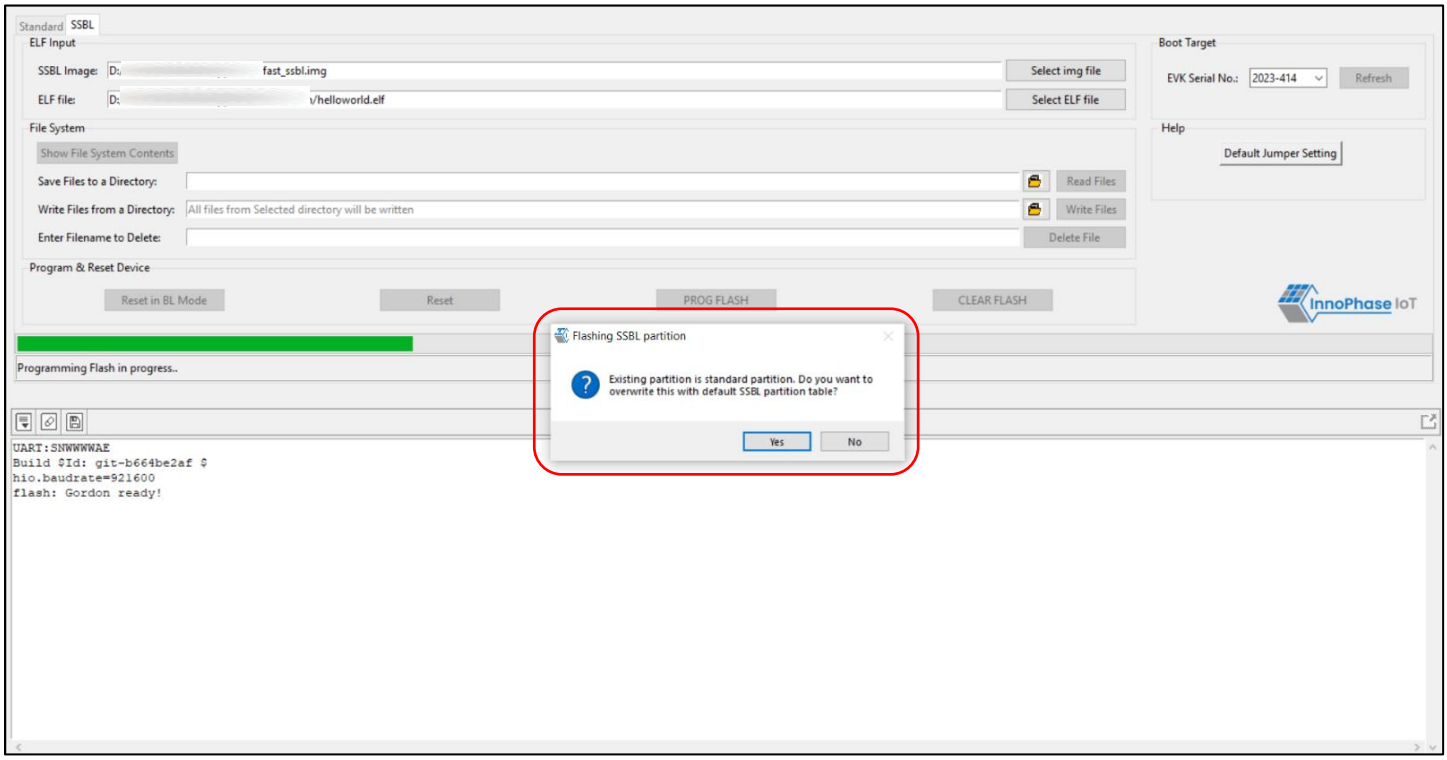

Figure 43: Deviation from the SSBL programming partition – matches default programming partition

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If the user selects 'No' and chooses not to flash the default SSBL partition table, action is terminated requiring the user to manually correct the deviation to proceed further as shown in Figure 44.

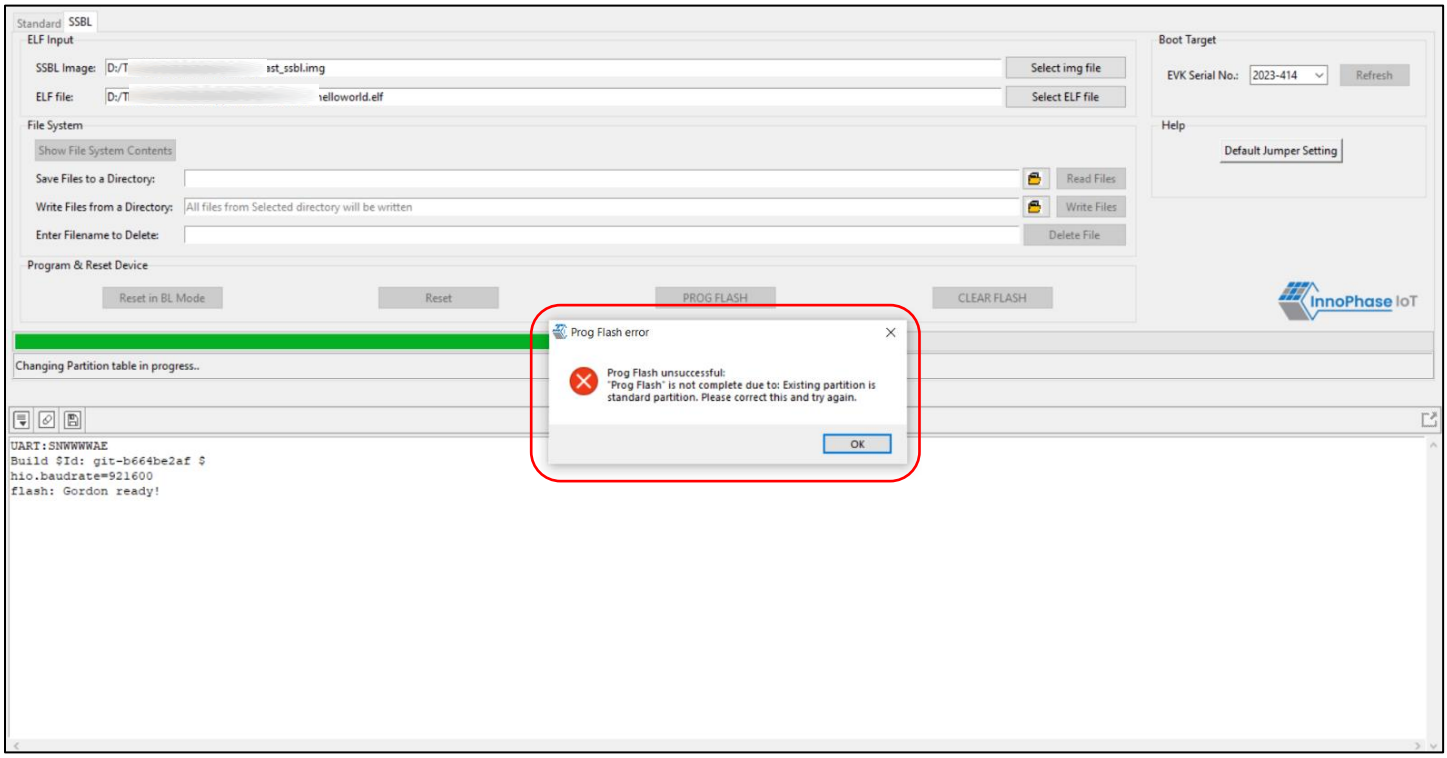

Figure 44: SSBL programming - action terminated

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Update Driver from libusbK to COM Port

To update and retrieve the COM ports, execute the following steps:

1. Go to `Device Manager`. Expand the `libusbK USB Devices` and right click on the `InnoPhase T2 Evaluation Board (Composite Parent)`. Click on `Update Driver`.

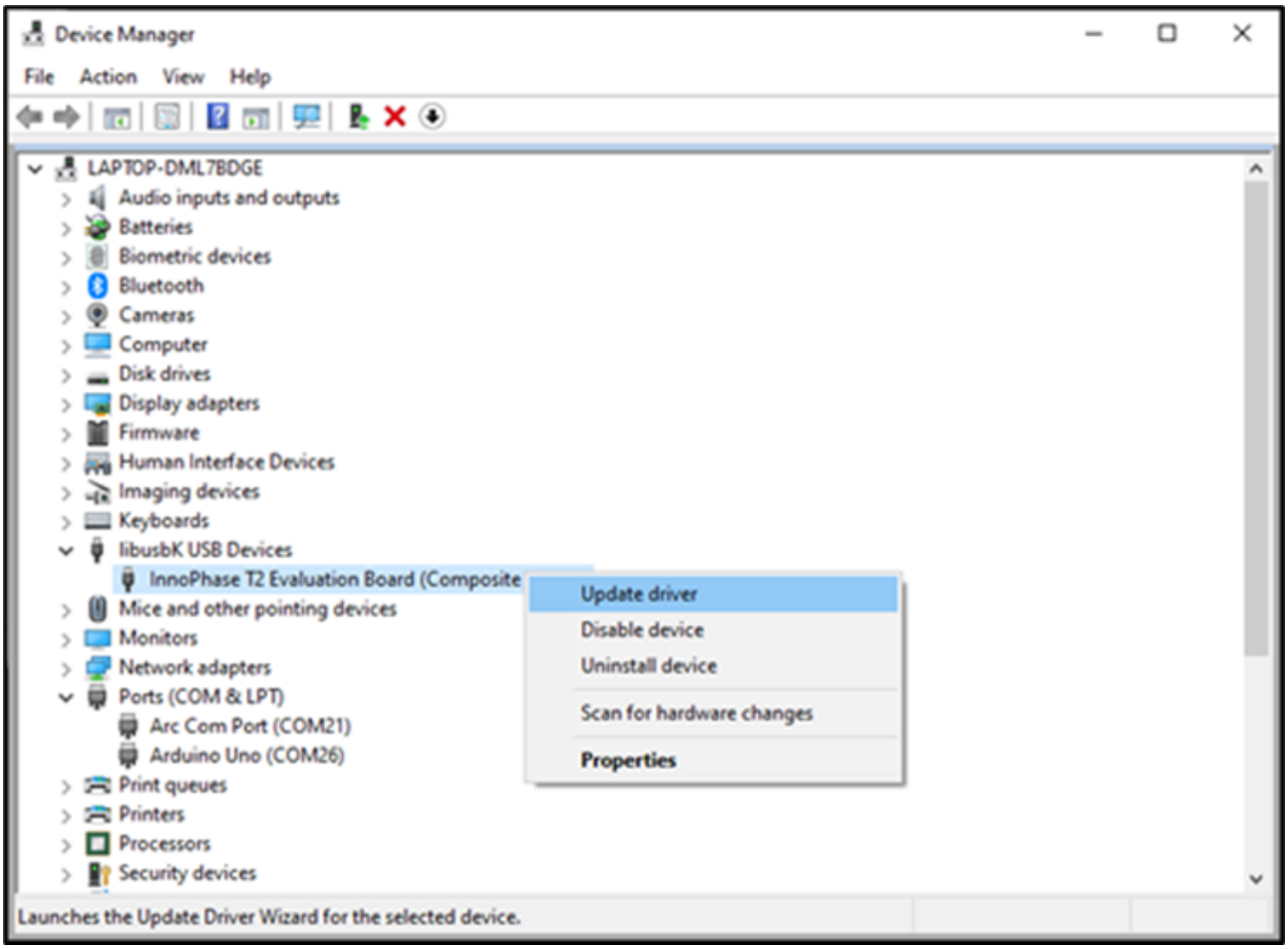

Figure 45: Device Manager – libusbK USB device

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2. On the new window, click on `Let me pick from a list of available drivers on my computer` option and click on Next.

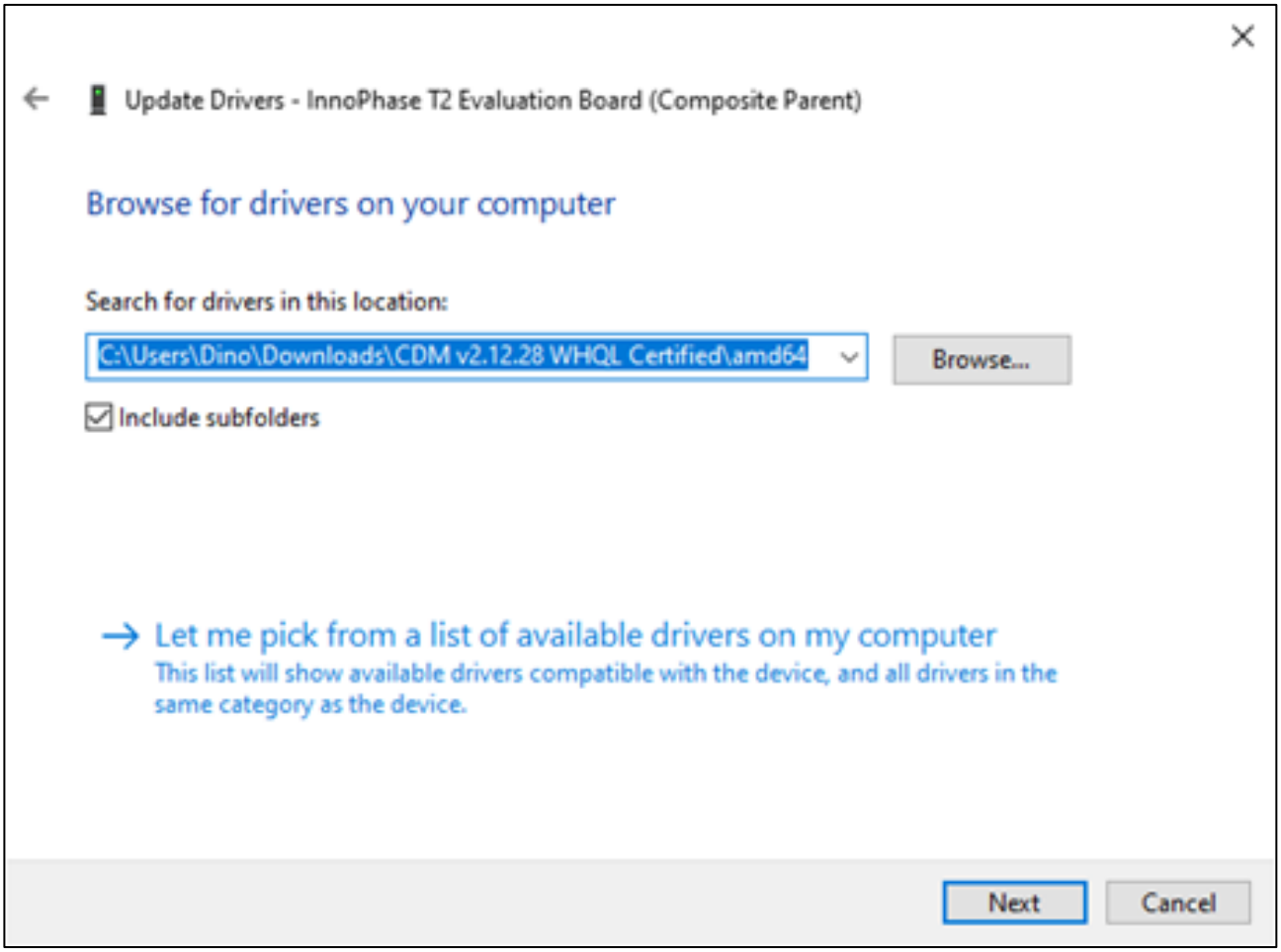

Figure 46: Update Devices

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3. Select `USB Composite Device` and install the same for reinstalling COM posts.

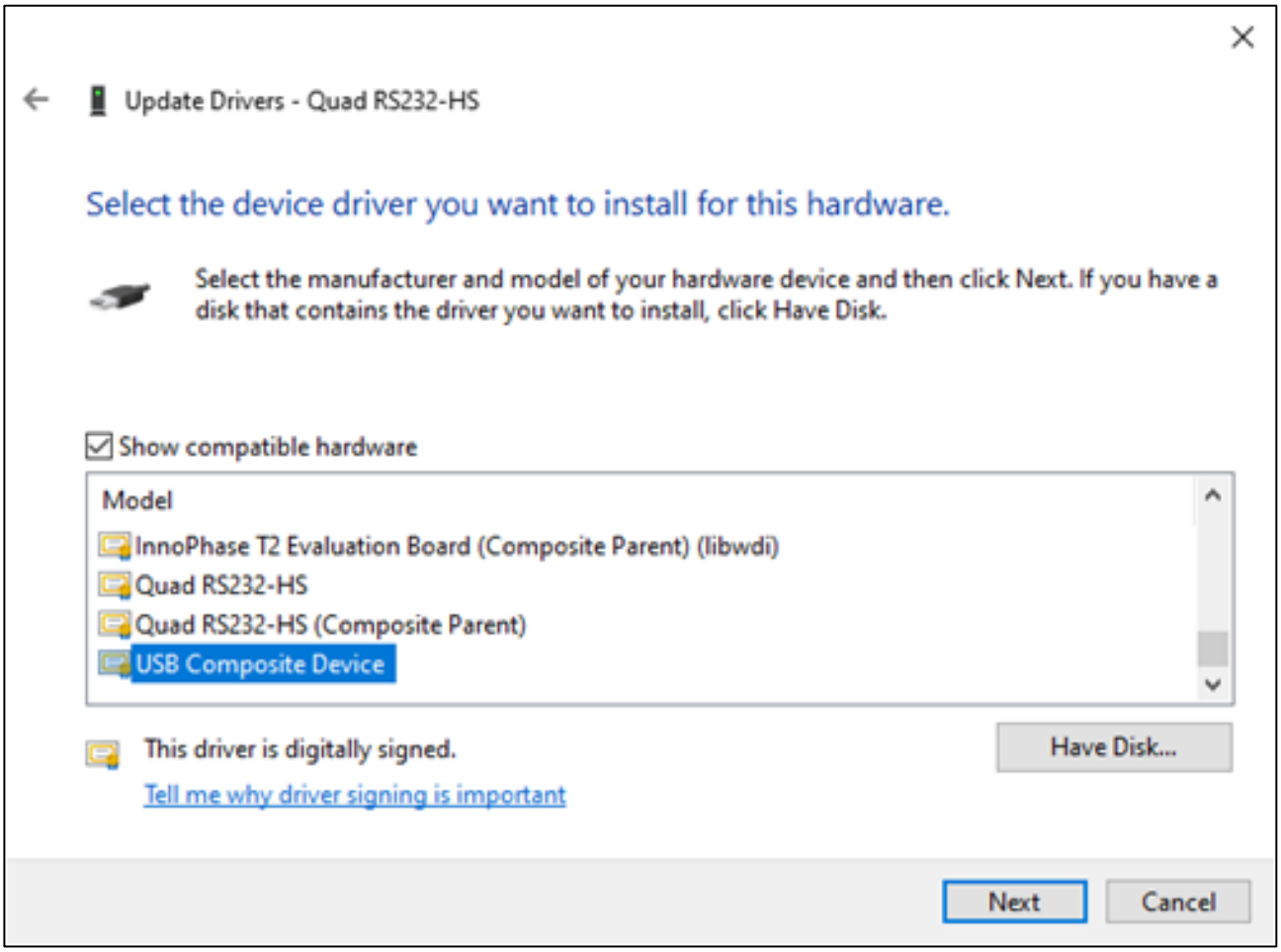

Figure 47: Select Device Driver

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New Serial Number to Device – Manual Method

There might be certain instances where the user may need to manually change/add a new EVK serial number to the Talaria TWO (T2) device.

To manually update Talaria TWO EVK's serial number, follow the subsequent steps:

1. Ensure the device connected is detected under `COM Port` as shown in Figure 48.

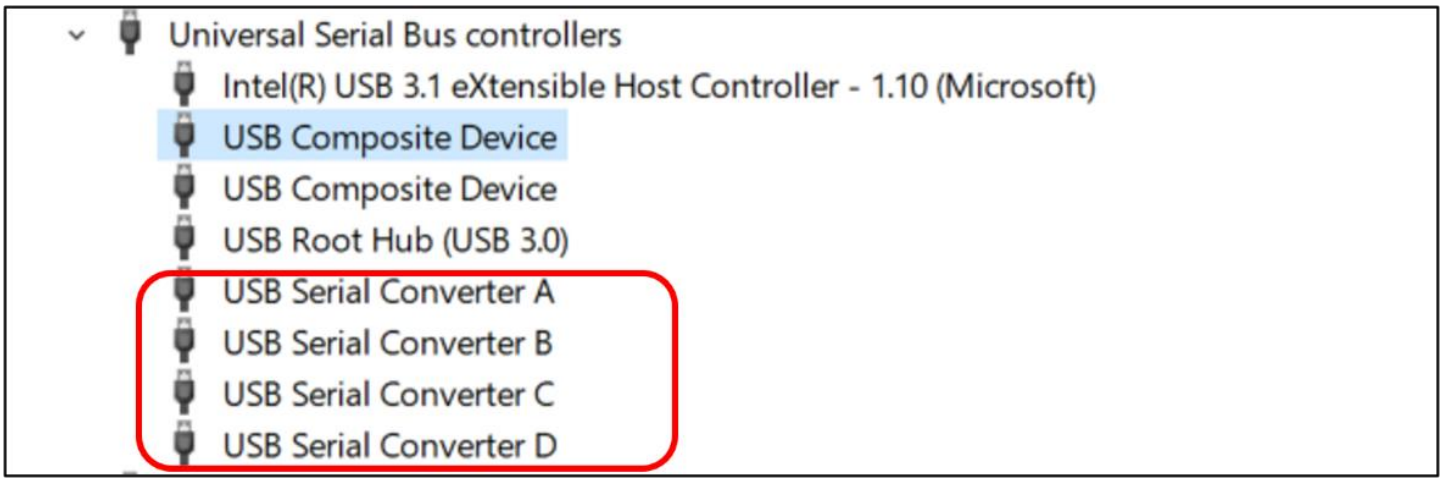

Figure 48: Device Manager – Composite Device

2. In case the device is not detected under `COM Port`, follow the instruction available in section: Update Driver from libusbK to COM Port to change the driver to `USB Composite Device`.

3. Once the device is recognized under `COM Port`, install `FT_Prog` software with the help of Utilities - FTDI (ftdichip.com) to change the FTDI device property as required.

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4. Open the FT_Prog software and click on `Scan & Parse` button to detect the COM devices. FT_Prog software shows the identified devices in tree with device properties, as shown in Figure 49.

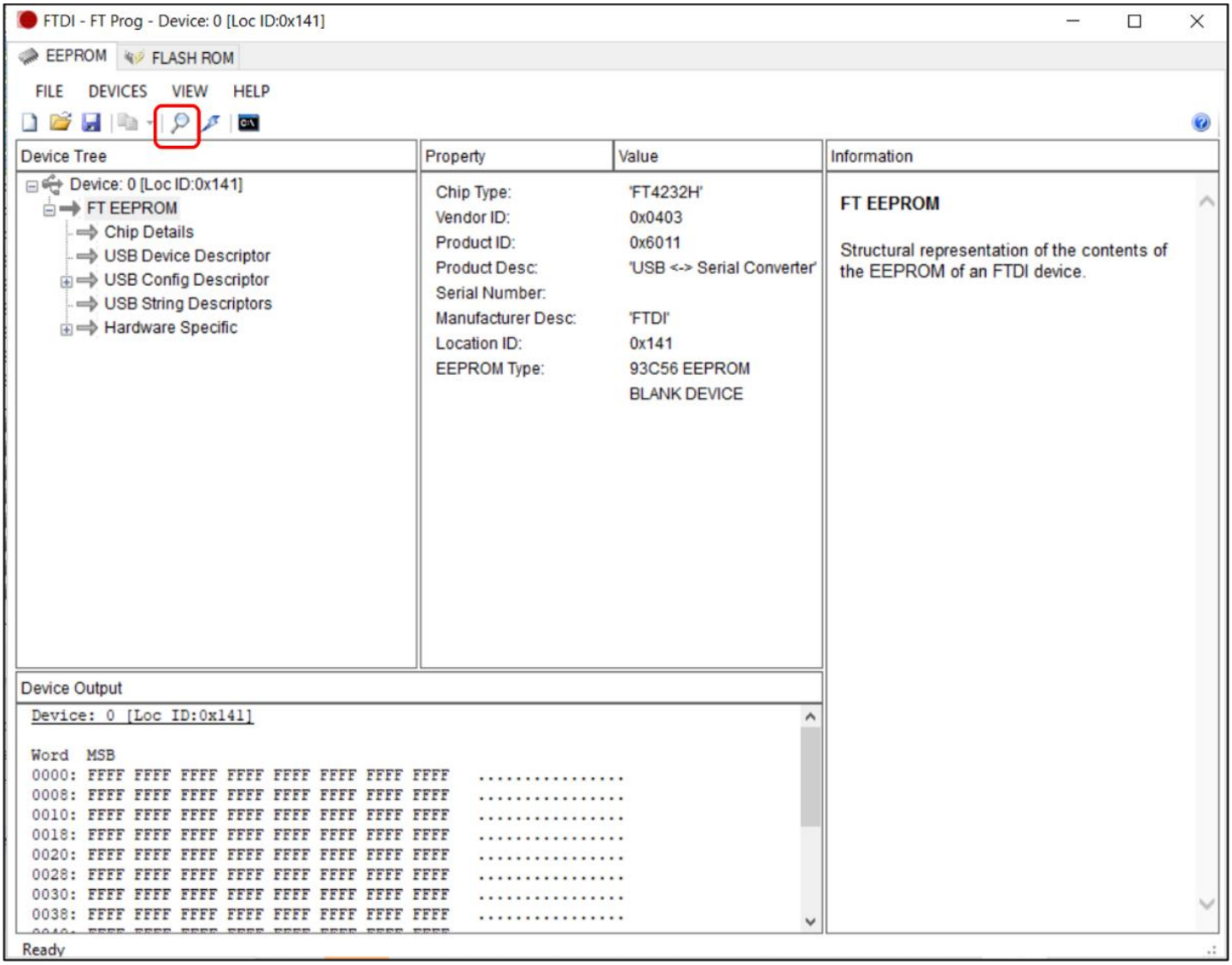

Figure 49: FT_Prog - Device detected

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5. To update the serial number, click on `USB String Descriptor`. Add the new serial number in the `Serial Number` field and change the product description as `InnoPhase T2 Evaluation Board`.

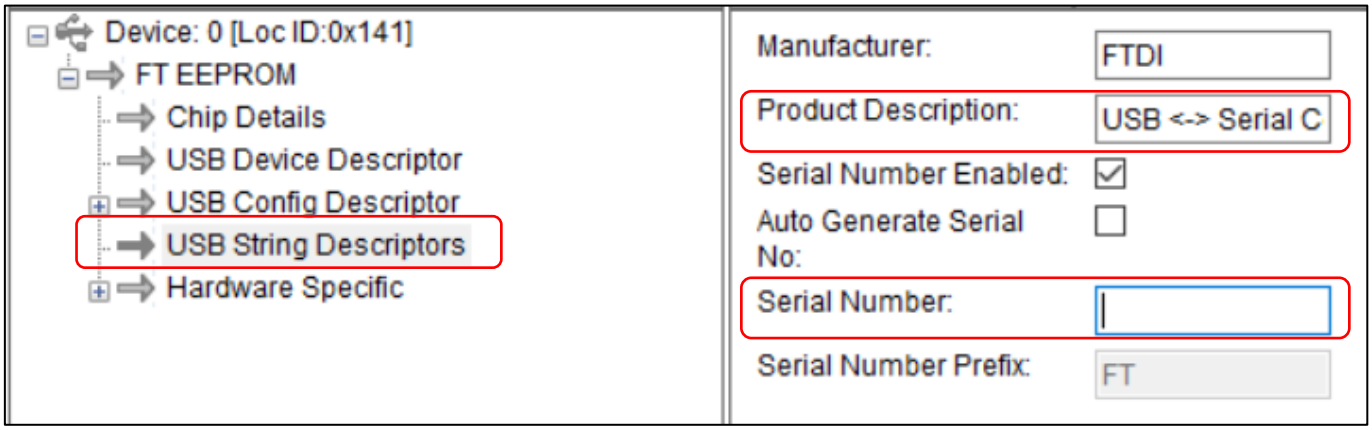

Figure 50: FT_Prog - Update Serial Number

6. To upload the changes to the device, right click on `FT EEPROM` and click on `Program Device`.

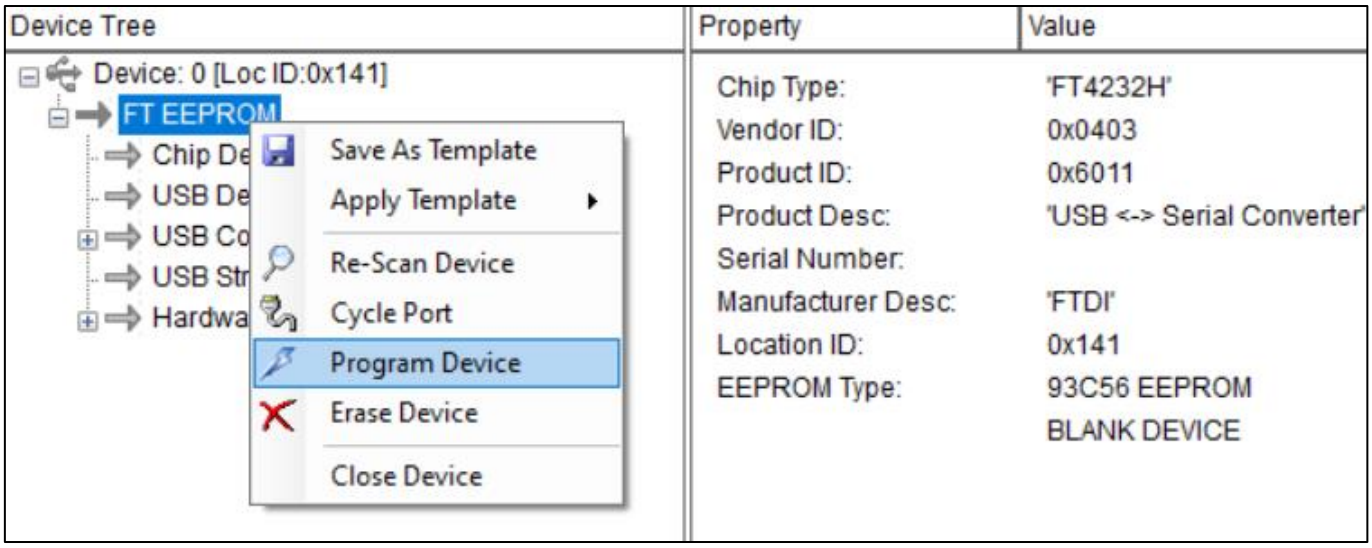

Figure 51: FT_Prog - Program Device

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7. The device will now be updated with the new serial number as shown in Figure 52.

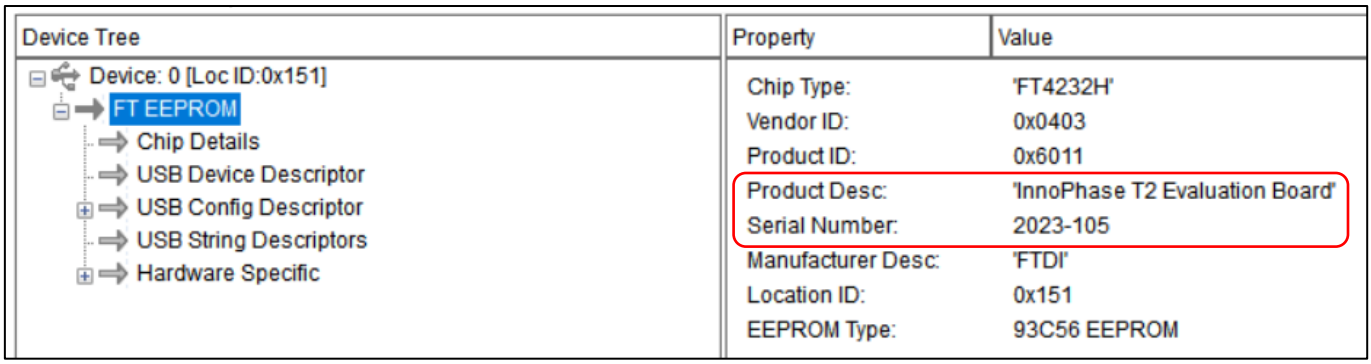

Figure 52: FT_Prog - Updated Serial Number

8. In case the new serial number is not updated in Device Manager, unplug and re-plug the device to refresh the connection.

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2. Technical Support:
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    b. Also Visit: https://innophaseiot.com/talaria-two-modules/
    c. Contact: support@innophaseiot.com

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