

MRD8550 Merlin Kit

Programming Guide





Revision History

Revision	Date	Description
0.1	July 28, 2025	Preliminary version
1.0	Aug 11, 2025	Baselined version

CONFIDENTIAL



TABLE OF CONTENTS

Privacy Information.....	5
1. Introduction	6
2. Overview.....	7
3. Programming Accessories	9
4. Platform Setup	10
5. Ubuntu Host PC Programming with Script.....	12
6. Windows Host PC Programming with PCAT Tool.....	16
7. Fastboot Programming.....	19
8. Verification of Programming with Boot Logs	21
9. Additional Assistance.....	23

CONFIDENTIAL

TABLE OF FIGURES

Figure 1: MRD8550 Merlin Kit	7
Figure 2: MRD8550 EDGE AI BOX	7
Figure 3: MRD8550 Merlin KIT LR WIFI.....	8
Figure 4: MRD8550 Merlin Kit Host PC Connectors	10
Figure 5: MRD8550 Merlin Kit Connection	10
Figure 6: MRD8550 Merlin Kit connection to Host PC.....	11
Figure 7: MRD8550 Merlin Kit FORCE-QDL SW5 Press	13
Figure 8: MRD8550 Merlin Kit SW5 Hold and Power Up.....	13
Figure 9: Ubuntu Host PC Merlin Kit QDL mode check.....	14
Figure 10: Ubuntu Host PC Flat build Package zip file extraction	14
Figure 11: Ubuntu Host PC Programming	15
Figure 12: Compressed Flatbuild Extraction	16
Figure 13: Device Connect option	17
Figure 14: Target selection	17
Figure 15: Flat build selections.....	18
Figure 16: Download flat build to target	18
Figure 17: Downloading successfull	19
Figure 18: Merlin Kit Initial Boot Logs.....	21
Figure 19: Merlin Kit Complete Boot Up and Login Prompt.....	22

Privacy Information

Mistral Solution Private Limited. and/or its affiliated companies – May Contain Trade Secrets and information sensitive to restricted audience.

The content of this document is intended solely for the use of the individual or entity to whom it is addressed and may contain privileged or confidential information. If you are not the intended recipient, you are hereby notified that any dissemination, distribution, copying, or unauthorized use of the information contained herein is strictly prohibited.

By accessing or reviewing this document, you agree to the following.

- To treat its contents with the utmost confidentiality and to take all necessary precautions to prevent unauthorized disclosure. Any unauthorized use, disclosure, or distribution of the information in this document may result in legal action and may be subject to applicable laws.
- Not to engage in or support any activities that are illegal or harmful. Any misuse of this document for purposes contrary to the law or public safety is strictly prohibited.

Mistral Solutions disclaims any responsibility for the consequences of unauthorized access or disclosure of the information contained in this document. Further to this, Mistral solutions disclaim any responsibility for the misuse or illegal distribution of this document. Individuals or entities found to be using or distributing this document for unlawful or harmful activities may be subject to legal action.

If you have received this document in error, please notify the sender immediately and delete the original message and all copies from your system.

Confidential Distribution: Use or distribution of this item, in whole or in part, is prohibited except as expressly permitted by written agreement(s) and/or terms with Mistral Solutions and/or its subsidiaries.

Not to be used, copied, reproduced, or modified in whole or in part, nor its contents revealed in any manner to others without the express written permission of Mistral Solution Private Limited.

For any further information/clarifications please contact

Mistral Solutions Private Limited,
#60 Adarsh Regent, 100 Ft. Ring Road,
Domlur Extension, Bengaluru 560071
Karnataka, India

© 2024–2025 Mistral Solutions Private Limited. and/or its subsidiaries. All rights reserved.

1. Introduction

The MRD8550 platforms (Merlin – Kit & Edge AI – Box) from Mistral are compact, high-performance edge AI Engine built around the Mistral's MRD8550 SoC, providing 48 TOPS (Trillion Operations Per Second) of artificial intelligence (AI) performance. This enables efficient processing of complex AI and deep learning workloads for on-device edge inferencing. It is designed to deliver high-speed wireless connectivity and high-accuracy AI and machine-learning inferencing technology, accelerating the development of innovative, power-efficient, high-computing robots for enterprise, professional service applications.

Packed with cutting-edge technology, this kit empowers developers to create powerful drone solutions. Experience exceptional compute performance, seamless AI integration, and precision with computer vision capabilities.

The MRD8550 platforms include MRD8550 SoM, the core of the Edge AI Box, is a high-compute, AI-enabled, low-power processor with 12GB LPDDR5X PoP memory, 128GB UFS storage, a dedicated high-performance Computer Vision Engine for video analytics, on-board wireless connectivity, and multiple PMICs for power supplies. The MRD8550 platform integrates a powerful Image Signal Processor and provides various peripheral connections such as 8 MIPI CSI cameras, an HDMI Camera, USB 3.0 ports, a Micro USB port for debugging, 2x Gigabit Ethernet ports for wired connectivity, 5G modem and LR-Wi-Fi for Wireless connectivity. It also integrates an expandable SD card slot for additional storage.

The MRD8550 Merlin Kit from Mistral is an advanced drone controller built around the Mistrals MRD8550 SoC and CubePilot's Cube Orange+. Designed with power efficiency in mind, it ensures longer flight times without compromising performance. Explore the skies and revolutionize the drone industry with our optimized development kit – your gateway to a new era of MRD8550 Merlin kit delivers high-speed wireless connectivity and high-accuracy artificial intelligence (AI) and machine-learning inferencing technology to facilitate accelerated development of innovative, power-efficient, high-computing robots and drones for enterprise, industrial, and professional service applications.

The MRD8550 Edge AI – box is highly integrated, modular form-factor design tailored for robotics developers, drone manufacturers, and system integrators, empowering users to build intelligent machines customized to their requirements. The kit is meticulously engineered for effortless integration directly into your designs!

This MRD8550 platform also includes multiple software options including support for embedded Linux and a reference Root Filesystem from Ubuntu. The kit supports Linux Kernel 5.15, Ubuntu, and ROS; and includes a suite of software packages for implementing various applications such as AI/ML, Neural Processing, Auto Pilot, Navigation, Machine Vision, Multimedia and User Interface among others.

This document provides the instructions to set up the MRD8550 platform and procedure to program the OS image into the on-board flash memory.

2. Overview

The Mistral MRD8550 SoM is based on Qualcomm's QCS8550 processor. The MRD8550 platform provides high-performance computing platform for precise artificial intelligence (AI) and machine-learning inferencing technology to facilitate the accelerated development of innovative, power-efficient, high-computing robots and drones for enterprise, industrial, and professional service applications. It offers readily deployable SDKs, Ubuntu Root-FS and tools for product development to facilitate quick prototyping and proof-of-concept evaluations. Additionally, this kit includes high performance connectivity interfaces making it an ideal platform for connected Edge device in IOT, Drones and Robotics.



Figure 1: MRD8550 Merlin Kit .

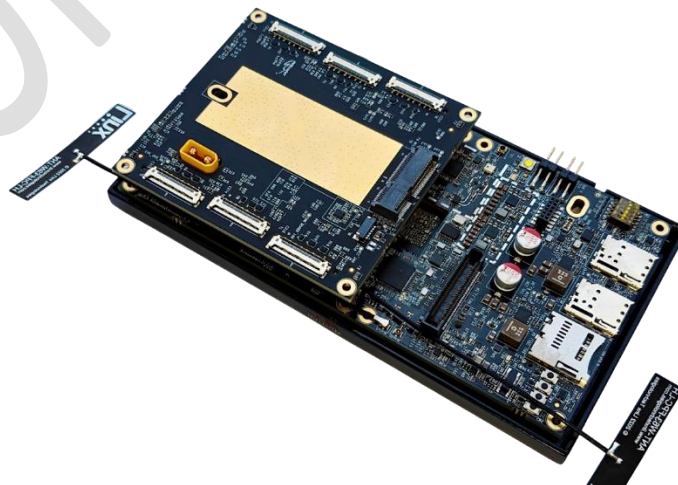


Figure 2: MRD8550 EDGE AI BOX



Figure 3: MRD8550 MERLIN KIT LR WIFI

This document provides multiple procedure for updating / programming the OS image in the embedded flash memory. Depending on the current state of the board, either of the following procedure could be adapted.

1. **For a working board that boots normally:**
 - [Follow Section 5.2: "Setting up MRD8550 Platform in QDL/EDL Mode – ADB Commands"](#). This does not require opening the device enclosure.
2. **For a board that is not booting (or no USB ADB access):**
 - [Follow Section 5.3: "Setting up MRD8550 Platform in QDL/EDL Mode – FORCE USB BOOT"](#). This requires opening the device enclosure to access the buttons.
3. **For users with PCAT tools on a Windows PC:**
 - Refer to [Section 6: "Windows Host PCAT Configuration and Programming"](#).

3. Programming Accessories

Basic Accessories required for programming MRD8550 Platforms:

Basic Accessories:

1. DC Adapter with chord
2. Custom B2B power cable with DC Jack
3. USB Type-C cable
4. Micro-B USB Cable

Note: Micro-B is not included with Basic Kit.

CONFIDENTIAL

4. Platform Setup

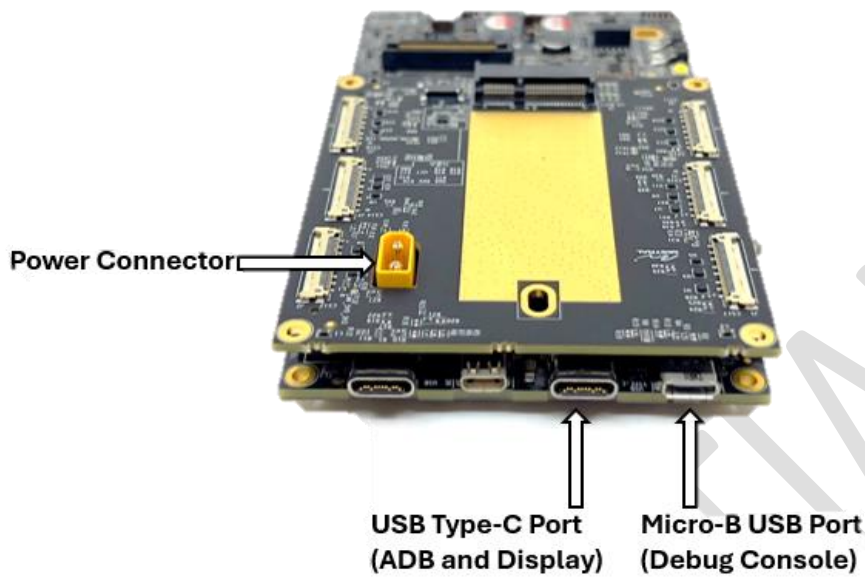


Figure 4: MRD8550 Merlin Kit Host PC Connectors

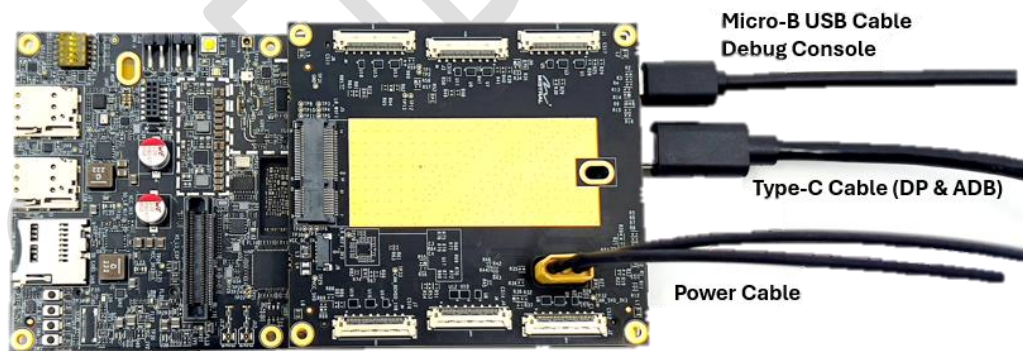


Figure 5: MRD8550 Merlin Kit Connection

1. Connect the DC adapter using Power cable to J6
2. Connect a USB Type-C cable to J2 (adb connection)
3. Connect a Micro-B cable to J1 (Debug console)



Figure 6: MRD8550 Merlin Kit connection to Host PC

5. Ubuntu Host PC Programming with Script

5.1 Ubuntu Host PC ADB and fast boot installation

To install the necessary ADB and Fastboot tools on the Ubuntu host system, execute the following commands in the terminal:

```
$ sudo apt-get update
$ sudo apt-get install android-tools-adb android-tools-
fastboot
```

5.2 Setting up MRD8550 Platform in QDL/EDL Mode – ADB commands

Note: This method is applicable only if the Merlin-Kit is booting correctly and ADB communication is functional. If the device is not booting or ADB is not responsive, please refer to section “FORCE_USB_BOOT”.

1. Connect the MRD8550 platform to the Ubuntu host PC using a **USB Type-C cable**.
2. Open a terminal on the host PC and execute the following commands:

```
$ adb root
$ adb reboot edl
```

5.3 Setting up MRD8550 Platform in QDL/EDL Mode – FORCE_USB_BOOT

Note: Use this method if the MRD8550 platform is not booting or ADB communication is not available.

1. **Disconnect** both the **USB Type-C cable** and the **Power cable** from the Merlin Kit.
2. **Press and hold** the **SW5 switch** on the main board, labelled **SDM_FORCE_USB_BOOT**.
3. While holding the switch, **reconnect the Power cable** to power up the Merlin Kit.
4. **Connect the USB Type-C cable** between the Merlin Kit and the Ubuntu host PC.
5. Verify the device has entered EDL mode using one of the following methods:

Terminal Command: Run *lsusb* and check for the following entry:

>> Qualcomm, Inc. Gobi Wireless Modem (QDL mode)

PCAT Tool: Confirm device detection with the following entry:

>> Qualcomm HS-USB QDLoader 9008 (COMxx)

6. For accessing Boot Logs, connect a **Micro-B USB cable** between the Merlin Kit and the host P

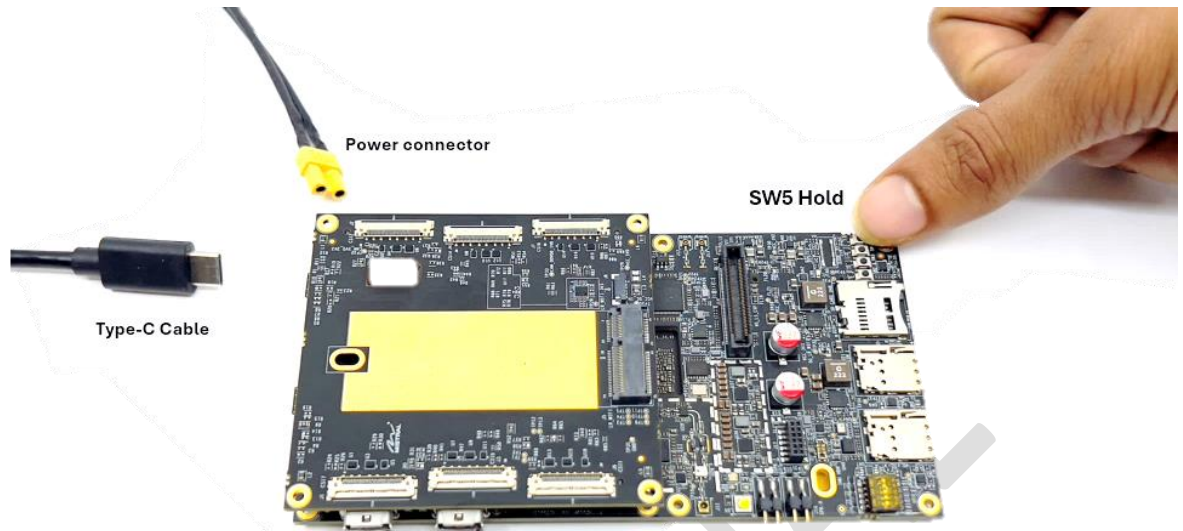


Figure 7: MRD8550 Merlin Kit FORCE-QDL SW5 Press

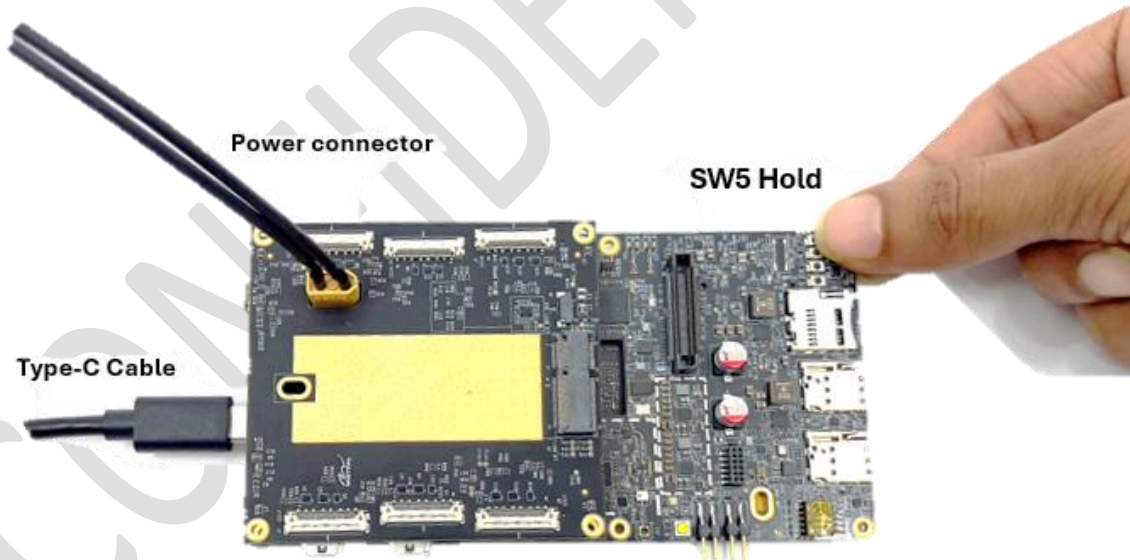


Figure 8: MRD8550 Merlin Kit SW5 Hold and Power Up

- 5.4 To confirm that the Merlin Kit has successfully entered **EDL (Emergency Download) Mode**, Run the command `lsusb` in terminal of Host PC.

Observe Qualcomm device entry mentioned with “(QDL mode)”

```
mistral@LAP666U:~$ lsusb
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 003: ID 0c45:6a09 Microdia Integrated Webcam HD
Bus 001 Device 005: ID 8087:0026 Intel Corp. AX201 Bluetooth
Bus 001 Device 006: ID 05c6:9008 Qualcomm, Inc. Gobi Wireless Modem (QDL mode)
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
mistral@LAP666U:~$
```

Figure 9: Ubuntu Host PC Merlin Kit QDL mode

check 5.5 Flat build image extraction and programming

1. To obtain the latest **Flat Build Package** for the MRD8550 platform, register to the Mistral website and download the latest flat build package for your hardware.
2. Extract the contents by running the following command in the terminal:

```
$ unzip flatbuild_package.zip
```

```
mistral@LAP666U:~$ unzip flatbuild_le1.0_20250729032707.zip
Archive: flatbuild_le1.0_20250729032707.zip
  creating: output/flatbuild/
  creating: output/flatbuild/ufs/
  inflating: output/flatbuild/ufs/rawprogram_unsparse0.xml
  inflating: output/flatbuild/ufs/patch0.xml
  inflating: output/flatbuild/ufs/rawprogram1.xml
  inflating: output/flatbuild/ufs/patch1.xml
  inflating: output/flatbuild/ufs/rawprogram2.xml
  inflating: output/flatbuild/ufs/patch2.xml
  inflating: output/flatbuild/ufs/rawprogram3.xml
  inflating: output/flatbuild/ufs/patch3.xml
  inflating: output/flatbuild/ufs/rawprogram4.xml
  inflating: output/flatbuild/ufs/patch4.xml
  inflating: output/flatbuild/ufs/rawprogram5.xml
  inflating: output/flatbuild/ufs/patch5.xml
  inflating: output/flatbuild/ufs/partition_ext.xml
  inflating: output/flatbuild/ufs/kailua_security_profile.xml
  inflating: output/flatbuild/ufs/prog_firehose_ddr.elf
  inflating: output/flatbuild/ufs/persist_1.img
  inflating: output/flatbuild/ufs/system_1.img
  inflating: output/flatbuild/ufs/system_2.img
  inflating: output/flatbuild/ufs/system_3.img
  inflating: output/flatbuild/ufs/system_4.img
  inflating: output/flatbuild/ufs/system_5.img
  inflating: output/flatbuild/ufs/system_6.img
  inflating: output/flatbuild/ufs/system_7.img
```

Figure 10: Ubuntu Host PC Flat build Package zip file extraction

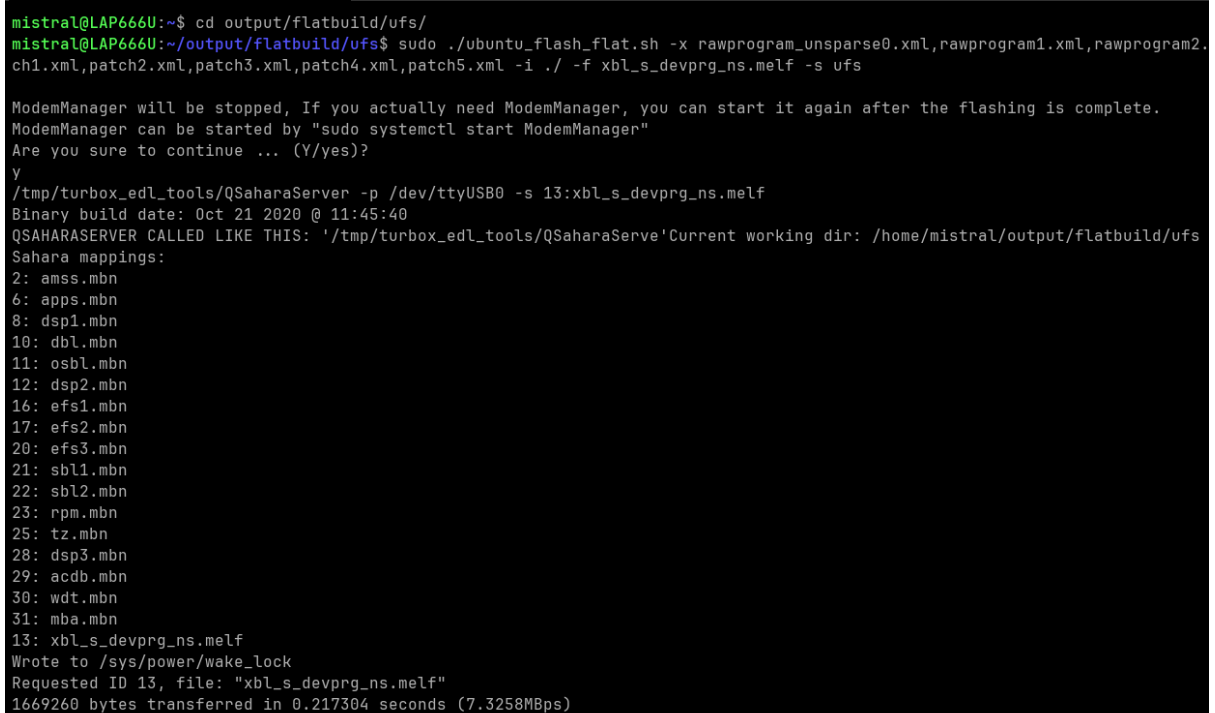
5.6 Programming the Merlin-Kit

The MRD8550 can be programmed using the provided `ubuntu_flash_flat.sh` script, which automates the flashing process.

Execute the script with the required parameters in the terminal of host pc.

```
$ sudo chmod +x ./ubuntu_flash_flat.sh

$ sudo ./ubuntu_flash_flat.sh -x
rawprogram_unsparse0.xml,rawprogram1.xml,rawprogram2.xml,rawpr
ogram3.xml,rawprogram4.xml,rawprogram5.xml,patch0.xml,patch1.x
ml,patch2.xml,patch3.xml,patch4.xml,patch5.xml -i ./ -f
xbl_s_devprg_ns.melf -s ufs
```



```
mistral@LAP666U:~$ cd output/flatbuild/ufs/
mistral@LAP666U:~/output/flatbuild/ufs$ sudo ./ubuntu_flash_flat.sh -x rawprogram_unsparse0.xml,rawprogram1.xml,rawprogram2.
ch1.xml,patch2.xml,patch3.xml,patch4.xml,patch5.xml -i ./ -f xbl_s_devprg_ns.melf -s ufs

ModemManager will be stopped, If you actually need ModemManager, you can start it again after the flashing is complete.
ModemManager can be started by "sudo systemctl start ModemManager"
Are you sure to continue ... (Y/yes)?
y
/tmp/turbox_edl_tools/QSaharaServer -p /dev/ttyUSB0 -s 13:xbl_s_devprg_ns.melf
Binary build date: Oct 21 2020 @ 11:45:40
QSAHARASERVER CALLED LIKE THIS: '/tmp/turbox_edl_tools/QSaharaServe'Current working dir: /home/mistral/output/flatbuild/ufs
Sahara mappings:
2: amss.mbn
6: apps.mbn
8: dsp1.mbn
10: dbl.mbn
11: osbl.mbn
12: dsp2.mbn
16: efs1.mbn
17: efs2.mbn
20: efs3.mbn
21: sbl1.mbn
22: sbl2.mbn
23: rpm.mbn
25: tz.mbn
28: dsp3.mbn
29: acdb.mbn
30: wdt.mbn
31: mba.mbn
13: xbl_s_devprg_ns.melf
Wrote to /sys/power/wake_lock
Requested ID 13, file: "xbl_s_devprg_ns.melf"
1669260 bytes transferred in 0.217304 seconds (7.3258MBps)
```

Figure 11: Ubuntu Host PC Programming

Once the flashing process is complete, a confirmation message **"{All Finished Successfully}"** will be displayed in the terminal, indicating that the image has been successfully programmed to the MRD8550 platform.

6. Windows Host PC Programming with PCAT Tool

1. Follow the one of the methods to set up the device in QDL/EDL mode
 - a) Setting up MRD8550Platform in QDL/EDL Mode – ADB commands
(Please refer [Section 5.2](#))
 - b) Setting up MRD8550 Platform in QDL/EDL Mode – FORCE_USB_BOOT
(Please refer [Section 5.3](#))
2. Extract the downloaded flat build zip package.

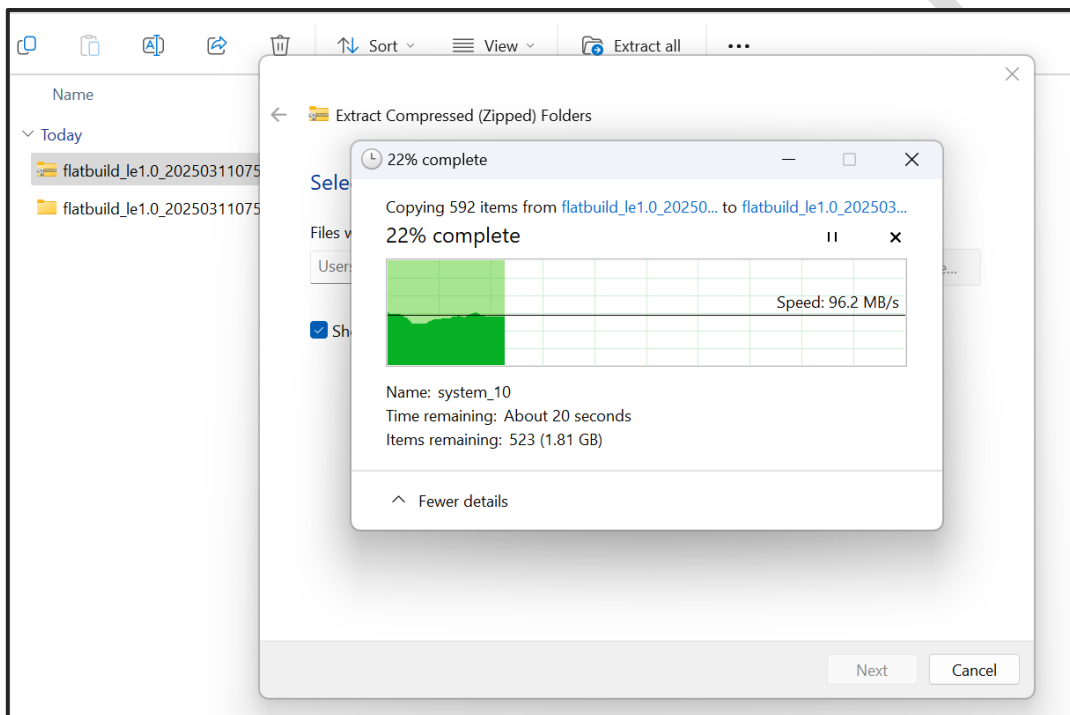


Figure 12: Compressed Flatbuild Extraction

3. Click on CONNECT A DEVICE option to select target for programming

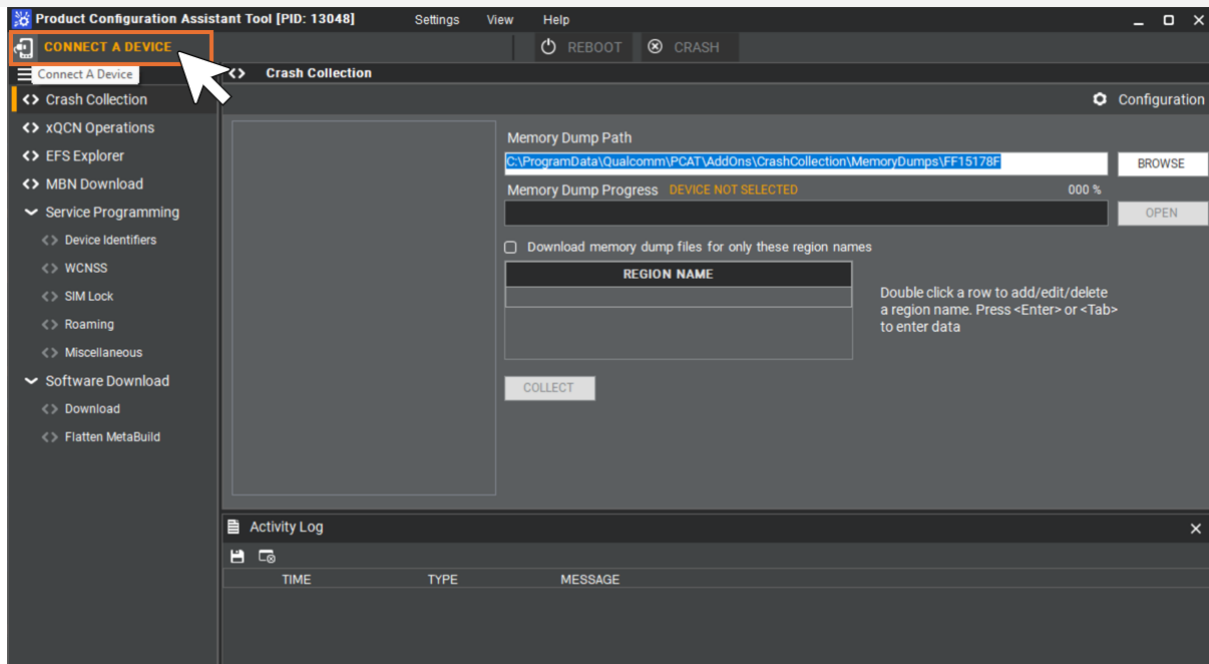


Figure 13: Device Connect option

4. Select the **Qualcomm HS-USB QDLoader 9008** port to connect to the board

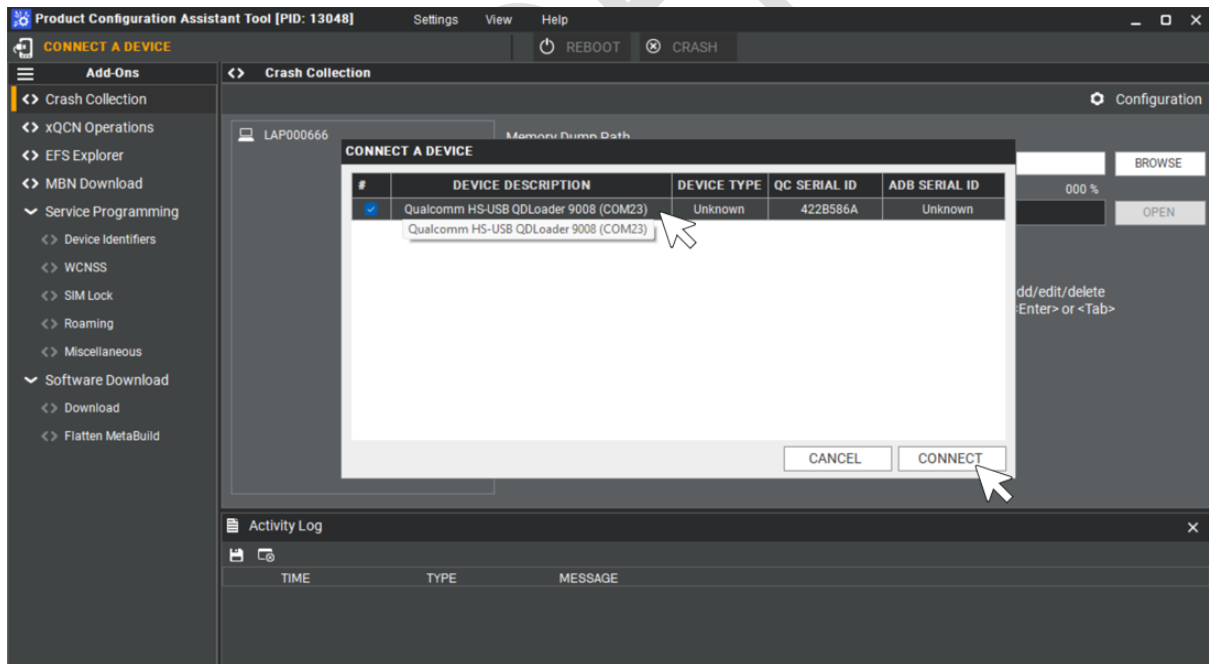


Figure 14: Target selection

5. Select the following configurations and packages as follows
 1. Meta / Flat build: select the latest extracted flatbuild folder as shown.
 2. Device programmer: select the **xbl_s_devprg_ns.melf** file in the respective flat build.
 3. Memory Type: Select the Memory Type as **MEMORY_TYPE_UFS**.

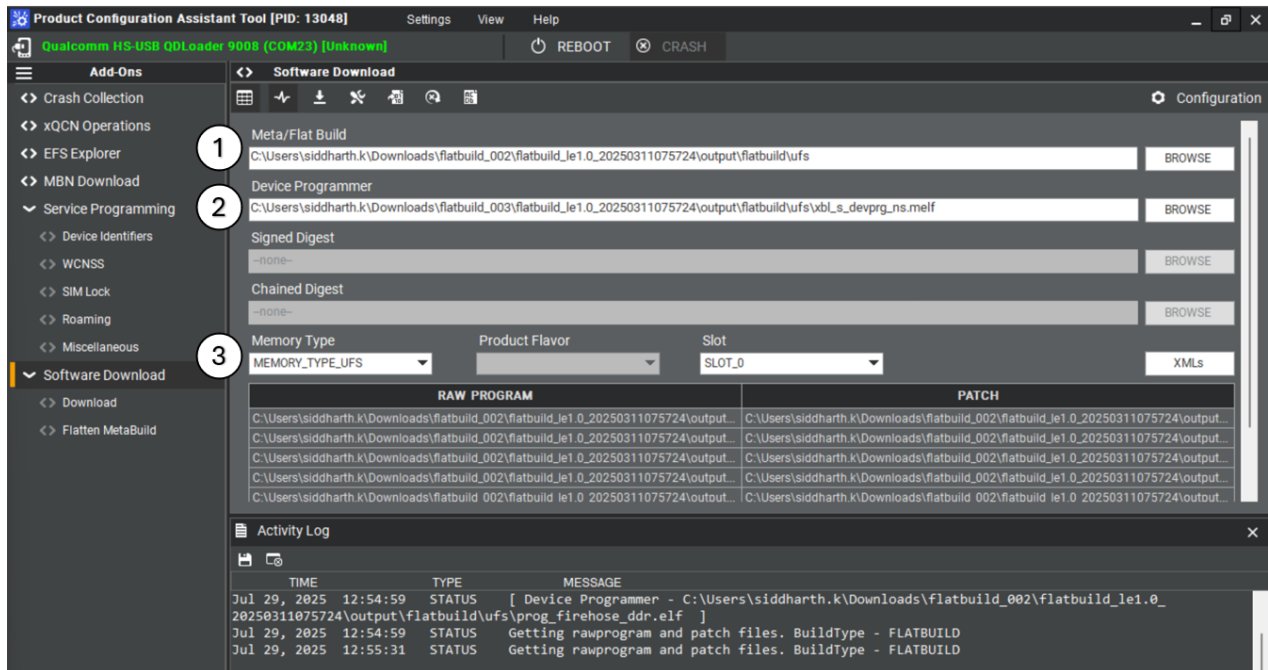


Figure 15: Flat build selections

6. Scroll down and click on **DOWNLOAD**

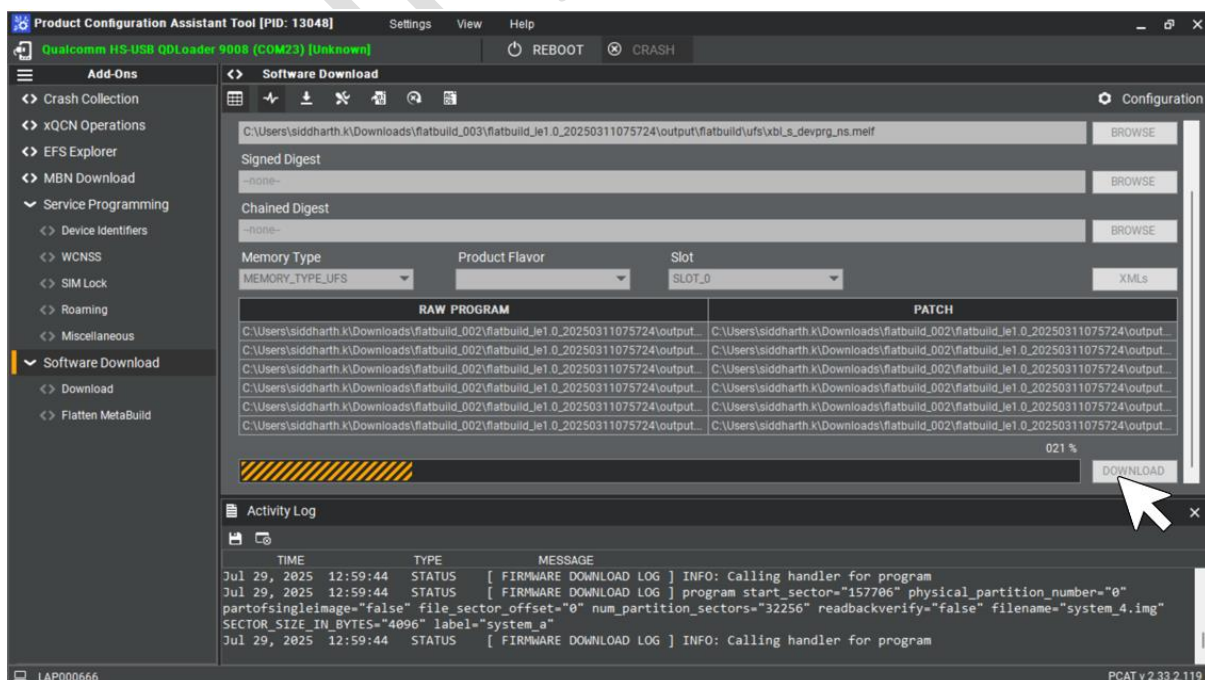


Figure 16: Download flat build to target

7. Once Programming is completed **Build loaded successfully on the Device**

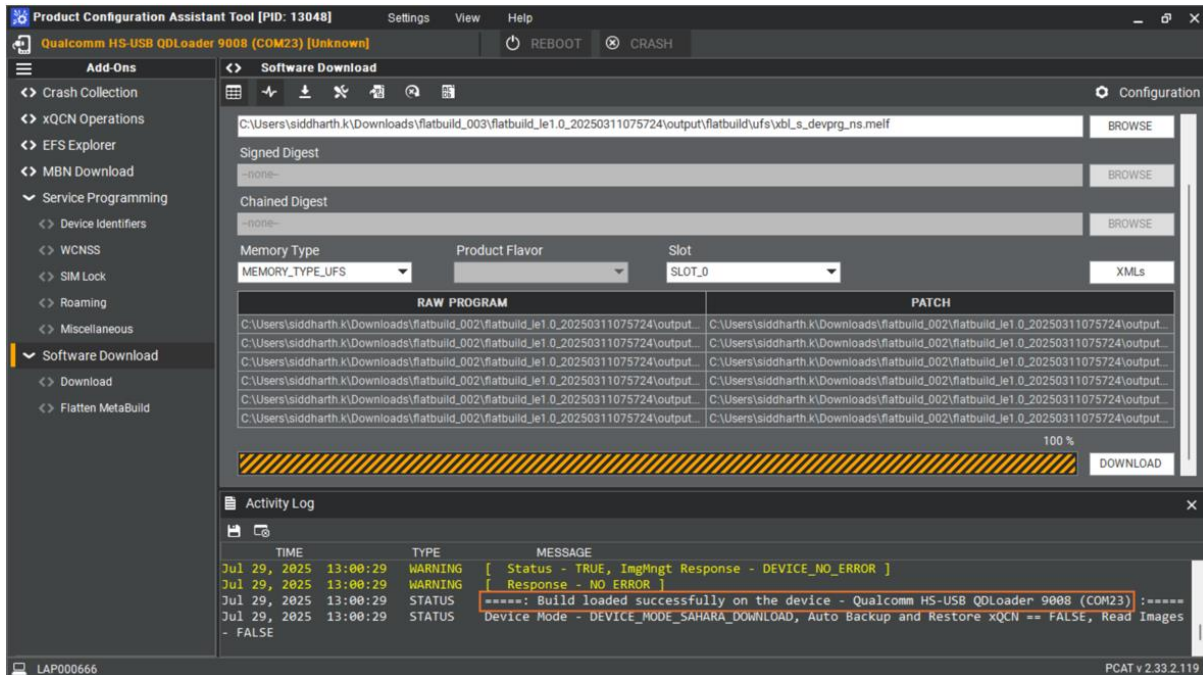


Figure 17: Downloading successful

7. Fastboot Programming

1. Host PC setup

a. Windows Host PC adb and fastboot installation

Download platform tools for Windows from the link provided below.

<https://developer.android.com/tools/releases/platform-tools>

b. Ubuntu Host PC adb and fastboot-t installation

Use the commands below to install adb and fastboot.

```
$ sudo apt-get update
```

```
$ sudo apt-get install android-tools-adb android-tools-fastboot
```

2. Merlin Kit fastboot mode set

a. Fastboot mode set using adb commands

- Connect the device over adb, verify the device presence in adb
`mode$ adb devices`
- Enter as a root user
`$ adb root`
- Enter into fastboot mode
`$ adb reboot bootloader`
- After few seconds, check the device presence in fastboot mode
`$ fastboot devices`

b. Fastboot mode set using VOL- key

- Disconnect the Type-C and Power cable
- Press Vol- Key/SW3 switch
- Reconnect the Type-C and Power Cable while holding the SW3

Once the device is present in fastboot mode, run the following command for fastboot programming/flashing.

```
$ fastboot flash <partition_name> <file_name>
```

Example: Boot image flash

```
$ fastboot flash cdt falcon-kit_cdt.bin  
$ fastboot flash dtbo_a dtbo.img  
$ fastboot flash boot_a boot.img
```

Once flash is completed, reboot the device to boot the flashed images

```
$ fastboot reboot
```

8. Verification of Programming with Boot Logs

1. **Power on the Merlin Kit** by supplying power through the standard power input.
2. **Monitor the boot process** via the serial debug console using the Micro-B USB connection.
 - Open a serial console (e.g., Minicom) with the correct device node and baud rate (115200).
3. Observe the boot logs. A successful boot will be indicated by system messages followed by the appearance of a login prompt, typically shown as **"kalama-login: "**

After successfully flashing the image, follow the steps below to verify that the Merlin Kit boots correctly and reaches the login prompt.

```

Welcome to minicom 2.8

OPTIONS: I18n
Port /dev/ttyUSB0, 10:55:28

Press CTRL-A Z for help on special keys

Welcome to minicom 2.8

OPTIONS: I18n
Port /dev/ttyUSB0, 10:55:28

Press CTRL-A Z for help on special keys

Format: Log Type - Time(microsec) - Message - Optional Info
Log Type: B - Since Boot(Power On Reset), D - Delta, S - Statistic
S - QC_IMAGE_VERSION_STRING=BOOT.MXF.2.1.1.c1-00019-KAILUA-1
S - IMAGE_VARIANT_STRING=SocKailuaLAA
S - OEM_IMAGE_VERSION_STRING=ip-10-195-202-164
S - Boot Interface: UFS
S - Secure Boot: Off
S - Boot Config @ 0x221c8600 = 0x00000001
S - JTAG ID @ 0x221c8744 = 0x202520e1
S - OEM ID @ 0x221c8700 = 0x00000000
S - Serial Number @ 0x221c8610 = 0x000004377e00c5e7
S - OEM Config Row 0 @ 0x221c2110 = 0x0000000000000000
S - OEM Config Row 1 @ 0x221c2118 = 0x0000000000000000
S - Feature Config Row 0 @ 0x221c2138 = 0x003fffffffffbf00
S - Feature Config Row 1 @ 0x221c2140 = 0x0000000000000000
S - OEM LCS:PROD
S - Core 0 Frequency, 1363 MHz
S - PBL Patch Ver: 3
S - PBL freq: 600 MHZ
S - -----
PBL Timestamps (in usecs)
-----
APBL start: 345
APBL Boot Media Detect Start: 9653
APBL Boot Media Detect End: 53006
APBL SHELF Load+Auth Start: 53008
APBL ELF MD Load Start: 56800
  
```

Figure 18: Merlin Kit Initial Boot Logs

```
sensor-service.service: Main process exited, code=killed, status=6/ABRT
sensor-service.service: Failed with result 'signal'.
sensor-service.service: Scheduled restart job, restart counter is at 8.
[ 40.652768] tftp_server[515]: ERR:pid=515 tid=2153 tftp-server : ERR :[tftp_os_la.c, 70] open failed: [2] [No such file or dire
[ 40.653457] tftp_server[515]: ERR:pid=515 tid=2153 tftp-server : ERR :[tftp_server.c, 1751] open failed : [-2] [Unknown error
[ 40.654057] tftp_server[515]: ERR:pid=515 tid=2153 tftp-server : ERR :[tftp_protocol.c, 1230] sending error-pkt. Code = 1, Msg
[ 40.679177] tftp_server[515]: ERR:pid=515 tid=2158 tftp-server : ERR :[tftp_os_la.c, 70] open failed: [2] [No such file or dire
[ 40.679408] tftp_server[515]: ERR:pid=515 tid=2158 tftp-server : ERR :[tftp_server.c, 1751] open failed : [-2] [Unknown error
[ 40.679605] tftp_server[515]: ERR:pid=515 tid=2158 tftp-server : ERR :[tftp_protocol.c, 1230] sending error-pkt. Code = 1, Msg
[ 40.681331] tftp_server[515]: ERR:pid=515 tid=2159 tftp-server : ERR :[tftp_os_la.c, 70] open failed: [2] [No such file or dire
[ 40.681594] tftp_server[515]: ERR:pid=515 tid=2159 tftp-server : ERR :[tftp_server.c, 1751] open failed : [-2] [Unknown error
[ 40.681836] tftp_server[515]: ERR:pid=515 tid=2159 tftp-server : ERR :[tftp_protocol.c, 1230] sending error-pkt. Code = 1, Msg

kalama login: sensor-service.service: Main process exited, code=killed, status=6/ABRT
sensor-service.service: Failed with result 'signal'.
sensor-service.service: Scheduled restart job, restart counter is at 9.
sensor-service.service: Main process exited, code=killed, status=6/ABRT
sensor-service.service: Failed with result 'signal'.
sensor-service.service: Scheduled restart job, restart counter is at 10.
sensor-service.service: Start request repeated too quickly.
sensor-service.service: Failed with result 'signal'.

kalama login: root
Password:
~ #
```

Figure 19: Merlin Kit Complete Boot Up and Login Prompt

9. Additional Assistance

Please contact our support team for further assistance:

Phone India: +91-80-4562 1100

Email: info@mistralsolutions.com

Web: <https://mistralsolutions.com/MRD8550-Merlin-Drone-Controller>

Note: Information contained in this document is subject to change

CONFIDENTIAL