SX-SDMAH EVK Users Guide

silex technology

Table of Contents

Introduction

SX-SDMAH is a HAT module for Raspberry Pi single board computer with a Morse Micro MM6108 IEEE802.11ah Wi-Fi HaLow wireless module. The Evaluation Kit Image is provided as 8GByte SD card image with Kernel version 5.15.84. The EVK image contains prebuilt driver, configuration utility, driver load script and sample configuration files for Station mode (wpa_supplicant_s1g) and AP mode (hostapd_s1g).

In order to run SX-SDMAH EVK image, following components are required.

- Micro SD card media, capacity 8GByte or more.
- SX-SDMAH EVK board
- Raspberry Pi4
- USB Type-C Power supply
- 100BASE-T Ethernet cable and client PC (Windows or Linux)
  or
- micro HDMI connector and monitor
- USB Keyboard and USB Mouse

Software preparation

The EVK image is provided as a ZIP compressed binary image. When extracted, you will get SX-SDMAH-EVK_vX.X.X.img where X.X.X will show the driver version. This image has to be written to a micro SD media.

Image setup on Linux

Extract ZIP file.

```
# unzip SX-SDMAH-EVK_v1.8.0.zip
Archive:  SX-SDMAH-EVK_v1.8.0.zip
  inflating: SX-SDMAH-EVK_v1.8.0.img
```

Insert the micro SD media to the flash card writer. Use "dmesg | tail -10" command to verify the device name of the micro SD media.

```
[ 6386.205039] mmc0: new high speed SDHC card at address b368
[ 6386.511350] mmcblk0: mmc0:b368 LX32G 29.5 GiB
[ 6386.515154]  mmcblk0: p1 p2
```

Depending on the Linux distribution / configuration, auto-mount may be executed. It is safer to unmount them before the image writing.

```
# mount | grep mmcblk0
/dev/mmcblk0p2 on /media/user/rootfs type ext4 (rw,…)
/dev/mmcblk0p1 on /media/user/boot type vfat (rw,…)

# umount /media/user/rootfs
# umount /media/user/boot
```

Once the device name is determined, use dd command to write EVK image file to the micro SD media.

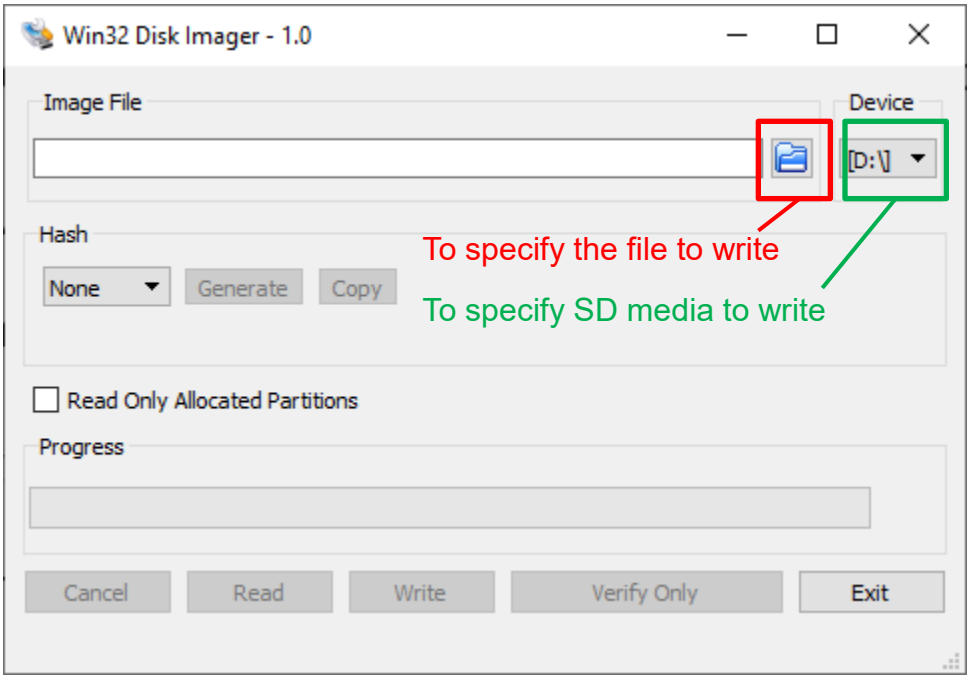
```
# dd if=SX-SDMAH-EVK_v1.8.0.img of=/dev/mmcblk0 bs=8M
```

When dd command is finished, remove the media from the slot.

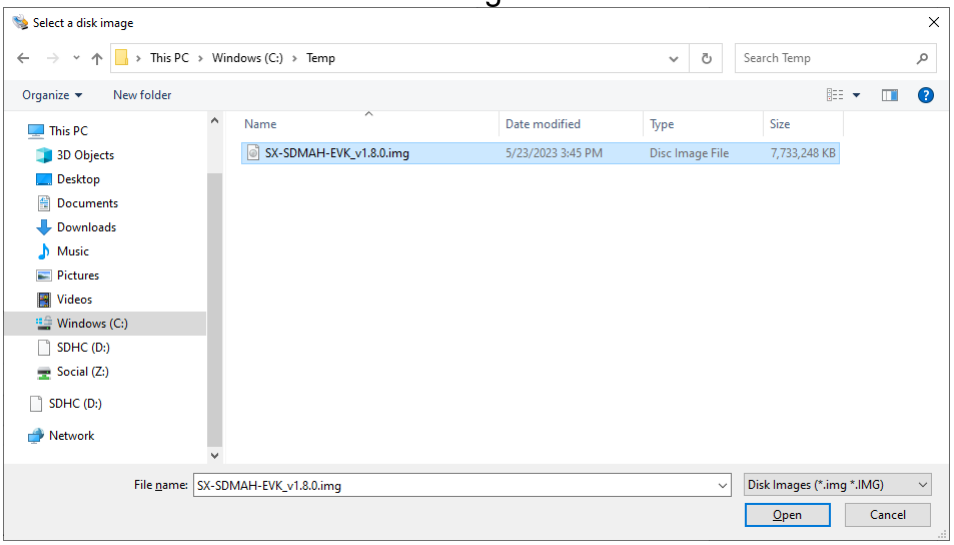
Image setup on Windows

Install win32diskimager on your Windows PC, which can be download from:
https://sourceforge.net/projects/win32diskimager/

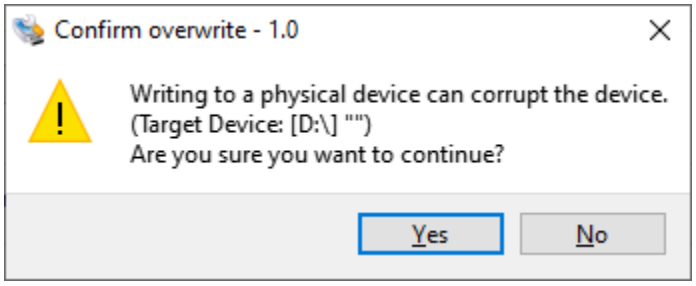
Win32diskimage will show screen like below. The file button (red square) to select the file to write, the Device drop-down (green square) to select the drive which SD media is inserted.



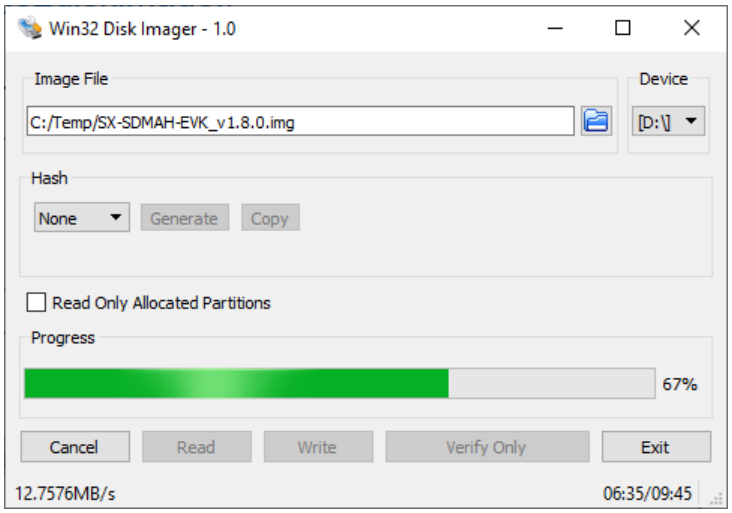
First, click the file button and select EVK image file.



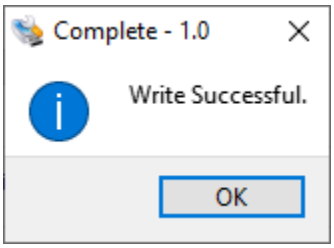
Next, select the drop-down for the SD card driver then click “Write” button. Warning will be shown. Verify the destination media drive (in this case D:) is right then click “Yes” to continue.



It will take a few minutes to complete image write.



When finish message is shown, remove the SD media from the slot.



Hardware Setup

SX-SDMAH Jumper pin configuration

Figure 1 shows SX-SDMAH Jumper pin configuration.

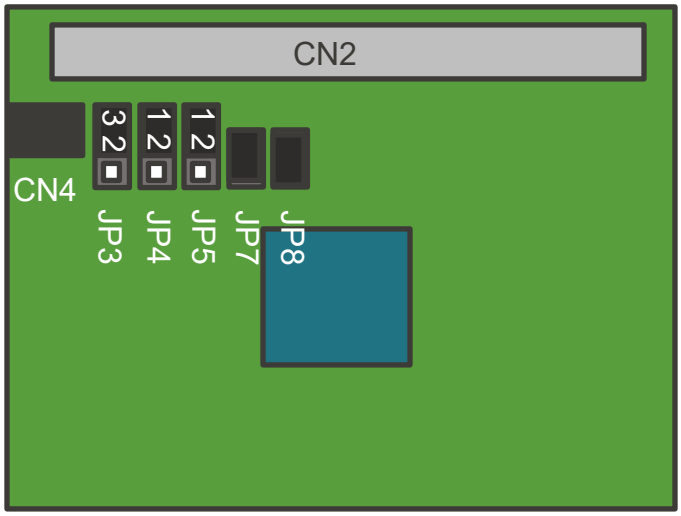


Figure 1: SX-SDMAH jumper pin configuration

SX-SDMAH installation

Figure 2 shows SX-SDMAH is installed on a Raspberry Pi 4.

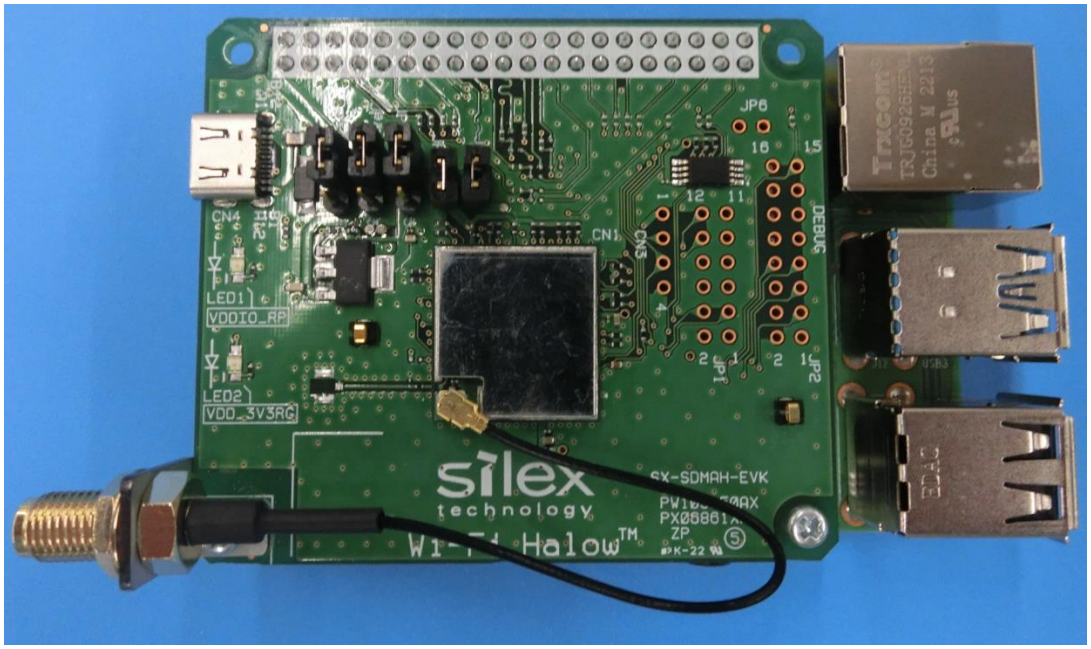


Figure 2: SX-SDMAH mounted on a Raspberry Pi 4

Step-by-step setup guide

(1) Mount SX-SDMAH EVK on the Raspberry Pi as shown on Figure 2.
(2) Insert EVK image microSD card to Raspberry Pi slot.
(3) Connect Ethernet cable, optionally HDMI and USB (keyboard/mouse) cables.
(4) Connect Power Supply to the Raspberry Pi

Driver load and wireless setup

On the EVK image, the Raspberry Pi Ethernet port eth0 is pre-configured with default IP address **192.168.0.10/24**. You can login with ssh using username="pi", password="raspberry".

After login to the Raspberry Pi, run following command:

```
# ls /sys/bus/sdio/devices/
```

If the SX-SDMAH is detected by the Kernel, "**mmc1:0001:1 mmc1:0001:2**" will be shown. If nothing is shown, something is wrong. Shutdown the power, wait for 5 seconds, remove and re-insert the SX-SDMAH EVK and try again. If you still experience the issue, please contact our customer support.

Following command will load the SX-SDMAH driver:

```
# cd ~/sx-sdmah && sudo ./load_driver.sh
```

After that, run "ifconfig -a" and verify "wlan0" is shown. If wlan0 is not shown, "dmesg" may show some hint (error message). When contact to our customer support, please attach the content of dmesg.

SX-SDMAH uses specially modified supplicants. Those are stored under /usr/local/sbin. Sample supplicant configuration files are stored under /home/pi/sx-sdmah/conf/US. There are config files for AP and STA, Open / WPA3-SAE / WPA3-OWE for each.

Access Point mode setup

Following command launches Access Point mode with open security:

```
# sudo hostapd_s1g ~/sx-sdmah/conf/US/ap_halow_open.conf -B
```

If you want to change the channel, edit ap_halow_*.conf and modify **op_class=X** and **channel=Y**. See Table 1 - Table 4 for list of available op_class and channel for US region.

You can manually assign IP address with following command:

```
# sudo ip addr flush dev wlan0 && sudo ip addr add 192.168.200.1/24 brd
192.168.200.255 dev wlan0 && sudo ip addr
```

Station mode setup

Following command launches Station mode with open security:

```
# sudo wpa_supplicant_s1g -i wlan0 -c ~/sx-sdmah/conf/US/sta_halow_open.conf
-B
```

You can manually assign IP address with:

```
# sudo ip addr flush dev wlan0 && sudo ip addr add 192.168.200.2/24 brd
192.168.200.255 dev wlan0 && sudo ip addr
```

Wireless Security settings

There are two initial key negotiation modes with WPA3-SAE. One is legacy "Hunting-and-Pecking" method, another is newer "Hash-to-Element (H2E)" mode. In ap_halow_sae.conf, sae_pwe=X specifies which key negotiation mode is accepted.

0: Hunting-and-Pecking only
1: H2E only
2: Hunting-and-Pecking and H2E

Default setting is 2.
In sta_halow_sae.conf, sae_pwe=X specifies which key negotiation mode is used.

0: Hunting-and-Pecking only
1: H2E only
2: Hunting-and-Pecking and H2E

Default setting is 2. If both AP and STA are sae_pwe=2, H2E is selected.

Utilities

morsectrl is used to configure various chip-specific options. Note that root privilege is required to run morsectrl.
Commands other than those listed in the functional specification for SX-SDMAH are not supported.

For example

```
# sudo morsectrl version
```

Will show target firmware and morsectrl versions.

Appendix

Table 1: 1MHz bandwidth channels, op_class=68

Channel	Frequency	Channel	Frequency	Channel	Frequency
3	903.5MHz	19	911.5MHz	35	919.5MHz
5	904.5MHz	21	912.5MHz	37	920.5MHz
7	905.5MHz	23	913.5MHz	39	921.5MHz
9	906.5MHz	25	914.5MHz	41	922.5MHz
11	907.5MHz	27	915.5MHz	43	923.5MHz
13	908.5MHz	29	916.5MHz	45	924.5MHz
15	909.5MHz	31	917.5MHz	47	925.5MHz
17	910.5MHz	33	918.5MHz	49	926.5MHz

Table 2: 2MHz bandwidth channels, op_class=69

Channel	Frequency	Channel	Frequency	Channel	Frequency
6	905MHz	22	913MHz	38	921MHz
10	907MHz	26	915MHz	42	923MHz
14	909MHz	30	917MHz	46	925MHz
18	911MHz	34	919MHz		

Table 3: 4MHz bandwidth channels, op_class=70

Channel	Frequency	Channel	Frequency
16	910MHz	32	918MHz
24	914MHz	40	922MHz

Table 4: 8MHz bandwidth channels, op_class=71

Channel	Frequency
12	908MHz
28	916MHz

About Silex Technology America, Inc.

Silex Technology builds on more than 40 years of hardware and software connectivity know-how and IP, custom design development experience, and in-house manufacturing capabilities, bringing value to customers with a foundation of technical expertise. With relentless attention to quality, exclusive access to Qualcomm Atheros expertise, and strategic partnerships with leading semiconductor providers, Silex Technology is the global leader in reliable Wi-Fi connectivity for products ranging from a medical device to a document imaging product to a video or digital display. With Silex Technology, customers get a single vendor that provides hardware and software support from design through manufacturing for successful product after successful product. For more information, please visit www.silexamerica.com.

Silex Technology America has made reasonable efforts to ensure the accuracy of the information contained herein as of the date of this publication but does not warrant that the information is accurate or complete. Silex Technology America undertakes no obligation to update the information in this publication. Silex Technology America specifically disclaims any and all liability for loss or damages of any kind resulting from decisions made or actions taken by any party based on this information.

Revision History

Revision	Date	Notes
1.0	12/15/2023	Initial Revision
1.1	12/27/2023	908MHz added to the 8MHz bandwidth available frequencies

silex technology