Sierra Wireless HL78 Series

# HL78xx Firmware Update Methods

SIERRA WIRELESS®

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Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

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# Document History

| Version | Date | Updates |
|---|---|---|
| 1.0 | April 2020 | Creation |
| 2.0 | October 2022 | Updated for H781x and HL7845 modules |
| 2.1 | February 2023 | • Correct [CommPort] as [Download] in INI.<br>• Remove USB mentioned in SFT steps. |
| 2.2 | June 2023 | • Update Download Full Firmware Package for HL781X/45 to include Customized Firmware Download.<br>• Refine the details in Configure Download Options<br>• Removed Patents section |

# Contents

# 1. Introduction

This document describes the methods for downloading firmware to HL78xx module devices.

## 1.1. Download Location of Firmware Packages

Firmware packages can be downloaded from The Source.

## 1.2. Supported Modules

This document is applicable to the following HL78 series modules:

- HL780x Series: HL7800, HL7800-M, HL7802
- HL781x/45 Series: HL7810, HL7812, HL7845

*Note: This document does not describe FOTA (Firmware Over The Air) upgrades, which are performed through AirVantage.*

## 1.3. Firmware Package Types

The following types of firmware packages are available:

### 1.3.1. Full Firmware Package (applicable to HL780X)

The package is a self-extractable file that can be executed in shell or double clicking in Windows environment to start the firmware download. It is bundled with a download program SFT (Standalone firmware download tool) and firmware images files. By default, this package runs interactively prompting for user inputs like UART/USB port.

### 1.3.2. SFT Standalone Package (applicable to HL780X)

The package is the same as Full Firmware Package except that it has a .7z extension rather than .exe and stores both Linux and Windows versions of SFT inside. It can be extracted in Linux or Windows environment and the entry script is used to start the firmware download.

### 1.3.3. Full Firmware Package (applicable to HL781X/45)

The package is a self-extractable file that can be executed in shell or double clicking in Windows/Linux environment to start the firmware download. It is bundled with a download program IBT (Image Burn Tool) and firmware images files. This package runs silently without prompting user, except that when INI option file is absent (the first time), it prompts and guides user to create an INI file.

Two packages are provided for Windows and Linux each.

### 1.3.4. Local Delta Firmware Upgrade Package (applicable to all modules)

The package is a firmware binary file with delta compression. It is downloaded over AT command port using X-modem 1K protocol.

X-modem 1K is system-independent protocol that is supported by many tools on Windows (like Tera Term) and Linux (like sx package).

## 1.4. Host System Requirements

1. SFT / Full Firmware Package (applicable to HL780X)
   - Windows 10 OS - x86 32bit or 64bit architecture, or
   - Linux x86_64 architecture (Debian/Ubuntu/Redhat Linux recommended)
2. IBT / Full Firmware Package (applicable to HL781X/45)
   - Windows 10 OS - x86 32bit or 64bit architecture, or
   - Linux x86_64 architecture (Debian/Ubuntu/Redhat Linux recommended) with the following tools installed
     - bash
     - mono-runtime, mono-runtime-x86_64-installer is provided on The Source
3. Local Delta Firmware Upgrade Package
   - A Host software supporting 1K X-Modem, regardless of system architecture

# 2. Installing Host Drivers

The HL78 firmware can be downloaded via USB port or by a physical UART port. The download speed over USB port is higher and the port is automatically recognized by the Firmware Download Tool.

## 2.1. Installing the Host Driver for USB Serial Port

The USB serial port driver is pre-installed in Windows 10 and Ubuntu 16.04, or later versions, so no driver installation is required.

The VID/PID of u-boot USB download port is: `216f:0051`.

*Note: Firmware Download over USB is supported by IBT but not SFT.*

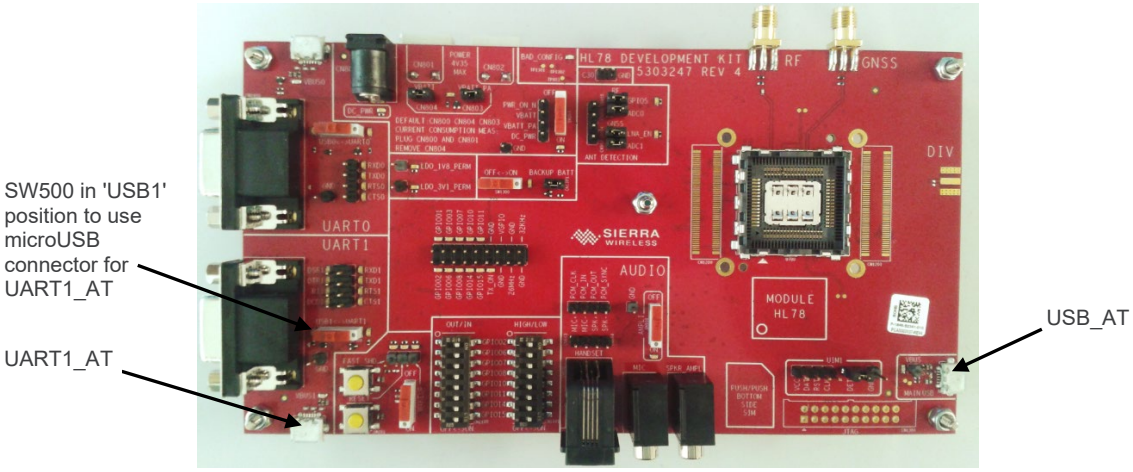
## 2.2. Installing the Host Driver for Physical UART

The HL78 development kit uses the USB to Serial chip from FTDI and its driver is pre-installed in Windows 10 and Ubuntu 16.04, or later versions, so no driver installation is required.

If necessary, install the USB to Serial driver using the installer provided by the chip vendor.

The VID/PID of FTDI USB2Serial port may appear as `0403:6014` or `0403:6015` depending on the FTDI chipset being used.

# 3. Connecting the Host to the Development Kit



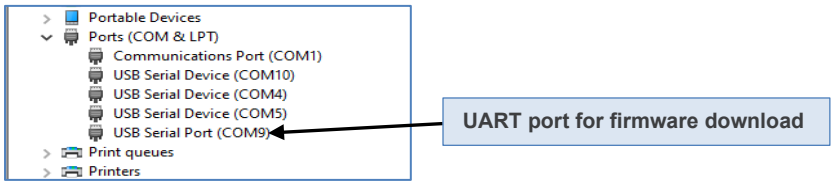

*Note: The following steps are applicable with HL78xx modules installed on the HL78 Development Kit board. Other configurations may use similar steps.*

The module's USB/UART port can be connected using the following steps:

1. On Linux, grant read-write access for the Linux user to access the USB/UART port. On Ubuntu, the following can be done:

```
sudo tee /etc/udev/rules.d/70-persistent-usb.rules <<EOM
# USB : 216f:0051 , FTDI USB2Serial : 0403:6014 0403:6015
SUBSYSTEMS=="usb", ATTRS{idVendor}=="216f", ATTRS{idProduct}=="0051", MODE="0666"
SUBSYSTEMS=="usb", ATTRS{idVendor}=="0403", ATTRS{idProduct}=="6014", MODE="0666"
SUBSYSTEMS=="usb", ATTRS{idVendor}=="0403", ATTRS{idProduct}=="6015", MODE="0666"
EOM
sudo udevadm control --reload-rules ; sudo udevadm trigger
```

2. To download over USB:
   a. Connect via a micro-USB cable USB_AT ("MAIN USB" CN401) port to PC.
   b. The USB download port has VID=216F PID=0051 and it only appears momentarily during module boot.
3. To download over UART:
   a. Connect via a micro-USB cable UART1_AT ("UART1" section – CN400) port to PC.
   b. On Windows, open Device Manager to identify the USB Serial Port which corresponds to the UART port. Do not use any USB Serial Device which corresponds to a USB ACM port.



c. On Linux, open a terminal and identify the the /dev/ttyUSB* port that corresponds to the UART port. Do not use any /dev/ttyACM* port which corresponds to a USB ACM port.
e.g. `dmesg | grep -i ttyusb | tail`

```
$ dmesg|grep -i ttyusb | tail
[  296.126786] usb 3-2: FTDI USB Serial Device converter now attached to ttyUSB0
```

# 4. HL780X Full Firmware Package

## 4.1. Downloading the Full Firmware Package on Windows

1. Connect the module USB/UART port to the PC (refer to Connecting the Host to the Development Kit).
2. Start the firmware download to module by double clicking the firmware file.
3. For the Installation COM Port Type, enter: 1 for UART installation
4. For the COM Port ID, enter the AT port (i.e. COM4 for USB, COM3 for UART).

```
Available ports:

COM1     (Communications Port (COM1))
COM3     (USB Serial Port (COM3))
COM9     (USB Serial Port (COM9))
Enter COM Port ID:COM3
```

5. For the COM speed, press Enter to use the default (921600) then firmware download will start.

```
File to download: AppFW_flash.bin
File to download: ue_lte.fw
File to download: ue_lte.fw2
File to download: sysHeader_modem.bin.alt1250

Using port COM3 at 921600 bps
Synchronizing with module...
AT port detected. Trying to synchronize with bootloader...
```

6. Wait for the firmware download to complete and the module to reboot.

```
Download session complete.

Rebooting module... done.
Hit ENTER to continue...
```

## 4.2. Downloading the SFT Standalone Package

1. Unzip the installation file to a target folder, which contains:
   - <fw_install>.bat / .sh – entry script to start firmware download on Windows / Linux
   - sft.exe / sft – SFT on Windows / Linux
   - tool configuration files
   - firmware images
2. Connect the module UART port to the PC – refer to Connecting the Host to the Development Kit
3. Update <fwinstall>.bat / .sh with the appropriate UART port – Replace the -p value with AT port.

```
15  sft.exe -p COM3 -b 921600 -s AppFW_flash.bin sysHeader_backup.bin.alt1250 sysHeader.bin.alt1250
    sysHeader_modem.bin.alt1250 u-boot.bin ue_lte.fw partmap.bin ue_lte.fw2
16  @set /p DUMMY=Hit ENTER to continue...
```

Windows <fwinstall>.bat

```
15  sft.exe -p /dev/ttyACM1 -g /dev/ttyACM0 -b 921600 -s AppFW_flash.bin sysHeader_backup.bin.alt1250
    sysHeader.bin.alt1250 sysHeader_modem.bin.alt1250 u-boot.bin ue_lte.fw partmap.bin ue_lte.fw2
16  @set /p DUMMY=Hit ENTER to continue...
```

Linux <fwinstall>.sh

4. Run the <fwinstall>.bat / .sh to start the firmware download.
5. Wait for the firmware download to complete and the module to reboot.

# 5. HL781X/45 Full Firmware Package

## 5.1. Downloading the Full Firmware Package

### 5.1.1. One-Click Firmware Download

1. For Linux, after downloading the firmware package:
   a. Download and install the mono runtime if not yet installed to ~/mono-runtime.

```
chmod a+x mono-runtime-x86_64-installer
./mono-runtime-x86_64-installer
```

   b. Ensure the execution bit of the firmware file is set.

```
chmod a+x HL7810.5.4.6.0
```

2. Connect the module USB/UART port to the PC – refer to Connecting the Host to the Development Kit.
3. Start the firmware download to module by double-clicking the firmware file.
   - To download over USB, reboot the module or re-power it ON.

*Note: To download over USB, Bootloader delay must be configured with AT+KBOOTCFG=0,<delay> for <delay> larger than or equal to 1 (second).*

   - To download over UART, the module will reboot automatically if AT port is working. If AT port is not working (e.g. due to boot failure), the module must be reboot or re-powered ON to initiate the download.

The IBT (Image Burn tool) then starts downloading the firmware image to the module once attached to u-boot:

```
ImageBurnTool.exe -f %TEMP%\test_HL78XX.
1 -s 1 /1 /2 /4 /7 /13 /3

Image Burn Tool for SWI HL78xx
(c) Sierra Wireless, Inc. All rights res

Pre burning preparations ...
Download over USB

Please reset your device ...

Looking for: VID_216f&PID_0051
Found port number: 5

Entered u-boot
Burning first phase ...

Log file's location:
'C:\Users\pca\AppData\Local\Temp\test_HL

Starting burning phase ...
```

```
ImageBurnTool.exe -f %TEMP%\test_HL78XX.
1 -s 1 /1 /2 /4 /7 /13 /3 -uartparams 0

Image Burn Tool for SWI HL78xx
(c) Sierra Wireless, Inc. All rights res

Pre burning preparations ...
Download over UART
Opened COM51 at Baud 115200
Entered u-boot
Burning first phase ...
Setting baudrate to 3000000
Setting flow control off


Log file's location:
'C:\Users\pca\AppData\Local\Temp\test_HL

Starting burning phase ...
```

*Note: Download may fail after the system installs the USB driver for the first time. Retry the download.*

4. If the download is completed successfully without any errors, the window will close automatically. Otherwise, errors are displayed.

```
SUCCESS:
The burning process completed successfully
```

5. Open an AT port then verify the firmware version using the AT command `ATI3`.

### 5.1.2. Customized Firmware Download

Customers may use the following steps to customize the console log file path and INI file path, as well as integrate the Firmware Download process with external applications.

1. Install 7-zip software from https://www.7-zip.org/ if not yet installed.
2. Extract the One-Click firmware package by 7-zip software into an output directory:
   a. On Windows, right-click on the package. An extraction option is available.
   b. On Linux, execute ‘7z x -oOutput path/to/package’ in a shell.
3. Customize the file launch_args.bat|.sh per need.
   a. Modify LOG_FILE to point to a desired path for console log.
   b. Create a customized INI file (Refer to Download Options from the INI file).
   c. Modify INI_FILE to point to the INI file.

   For example, write logs and read INI from the extracted directory (.\) on Windows:

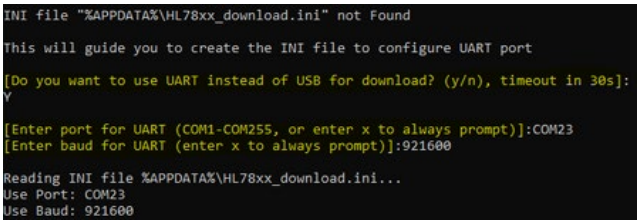
```
set LOG_FILE=.\%LOG_PFX%.log
set INI_FILE=.\HL78xx_download.ini
```

4. Execute launch.bat|.sh to start the FW download process
   a. On Windows,
      i. double-click the file, or
      ii. execute 'cmd.exe /c launch.bat' from an external process
   b. On Linux, execute ‘./launch.sh’ in a shell
5. The extracted directory containing a customized INI file above can be copied and reused in another machine

## 5.2. Configure Download Options

By default, the USB port is used for firmware downloads. Download options like UART port number and UART baud rate can be specified through an INI file or the OS environment. Refer to Supported UART Baud Rates for the list of supported baud rates.

When INI option file is absent (the first time, or removed by user), the package prompts and guides the user to create an INI file with a timeout of 30 seconds.




*Note:*
*- Adjust the parameters based on the serial port in your system.*
*- The default port is USB1. And The default UART Baud is 460800. Some Usb2Serial cables fail at Baud >=921600.*
*- The option values in INI file takes precedence over the corresponding values in the OS environment.*

### 5.2.1. Download Options from the INI file

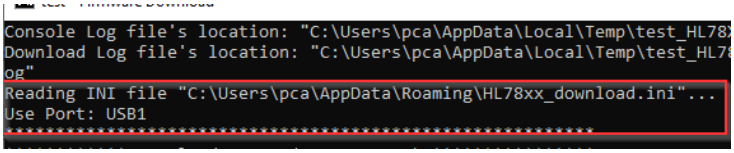
1. Create or Open the INI file named HL78xx_download.ini

| Path on Windows | Path on Linux |
|---|---|
| %APPDATA%\HL78xx_download.ini (%APPDATA% can be entered in Explorer or Run) | ~/HL78xx_download.ini |

2. Open the file using text editor like notepad / gedit, and save the following options into it.

| INI content: | On Windows | On Linux |
|---|---|---|
| To download over UART | [Download]<br>Port=COM7<br>ComBaud=3000000 | [Download]<br>Port=ttyUSB0<br>ComBaud=3000000 |
| To download over USB | [Download]<br>;Port=COM7<br>Port=USB1 | [Download]<br>;Port=COM7<br>Port=USB1 |

The file HL78xx_download.ini will be loaded when the package is executed:



### 5.2.2. Download Options from the Environment

Open a terminal and execute the package. For example, when downloading firmware over UART:

| On Windows | On Linux |
|---|---|
| `set DL_PORT=COM7`<br>`set DL_BAUD=3000000`<br>`HL7810.5.4.6.0.exe` | `SFXTERM=0 DL_PORT=ttyUSB0`<br>`DL_BAUD=3000000 ./HL7810.5.4.6.0` |

*Note: On Linux, SFXTERM=0 reuses the current Terminal window without opening an additional one.*

# 6. Local Delta Firmware Download

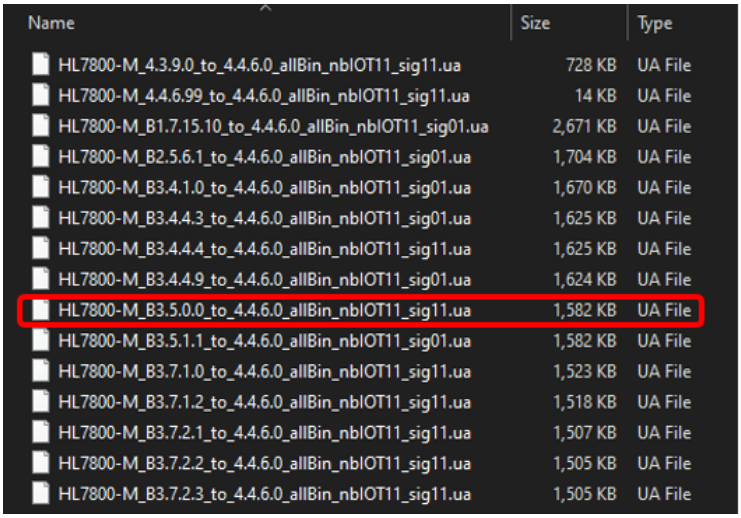
1. Prepare the X-Modem client software on the PC host.
2. For Xmodem .zip file like XMODEM_HL7800-M.4.4.6.0.7z. It contains multiple 'delta' firmware upgrade files but only one of them is applicable for the download. For instance, a file

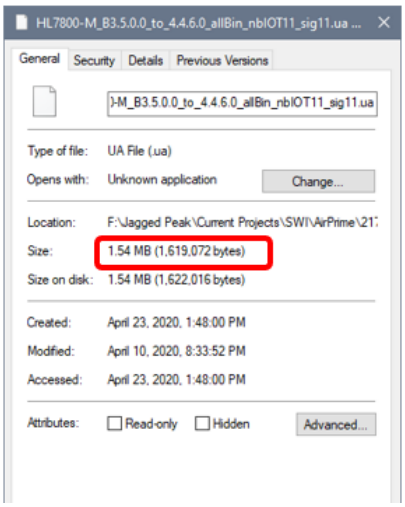
   *HL7800-M_**B3.5.0.0**_to_**4.4.6.0**_allBin_nbIOT11_sig11.ua*

   can **only** be downloaded to modules of source firmware **B3.5.0.0** to target firmware **4.4.6.0**.

***Important:*** *Ensure that the source firmware version is the same as the one in your module or else module will reject the upgrade without modifying its firmware and show the +WDSI: 15 upgrade failure notification.*

*Note: Upgrade files of HL7800/HL7802 older than 3.5.0.0 release uses the extension ".foto" rather than ".ua".*




3. Activate all indications `with AT+WDSI=4470.`

```
AT+WDSI=4470
OK
```

4. Initiate local download mode by `AT+WDSD=<file_size>` then send the firmware upgrade file using the 1K-Xmodem protocol via the client software on PC host.

```
AT+WDSD=1619072
                // <-- Send firmware using 1K-Xmodem
OK              // 1K-Xmodem download has completed sucessfully
+WDSI :3        //indication received - the device has downloaded the
package
```

5. Initiate installation by `AT+WDSR=4` and wait for the notification result `+WDSI: 15` (failed) or `+WDSI: 16` (succeeded).

```
AT+WDSR=4       // Start (accept) the installation
OK
+WDSI :14       // Indicates update will be launched
                // <-- Device automatically reboot here
…               // Installation starts
+WDSI :16       // Upgrade completed successfully
```

6. Verify the firmware version using `ATI3.`

# 7. Appendix

## 7.1. Download Time of Full Firmware Package

1. Full Firmware Package (applicable to HL780X)
   - Downloading firmware over UART with 921600 Baud takes approximately 360 seconds.
2. One-Click Full Firmware Package (applicable to HL781X/45)
   - Downloading firmware over USB 1.1 takes approximately 100 seconds.
   - Downloading firmware over UART with 3000000 Baud takes approximately 80 seconds.

## 7.2. Aborting Download

If a firmware download is aborted, the module may be recovered by re-running the same download steps since only a validated firmware image will be launched during module boot.

However, it is not recommended to abort firmware download as this may risk damaging the hardware and corrupting modem configuration data.

## 7.3. Supported UART Baud Rates

The following baud rates are supported by SFT (HL780X):

- 115200
- 460800
- 921600

The following baud rates are supported by IBT (HL781X/45):

- 115200
- 230400
- 460800
- 921600
- 3000000

Actual available baud rates depend on the USB to Serial Driver installed on Windows or Linux.