Linux Firmware Update Procedure for NL-SW-LTE-S7x Skywire Family

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Updated: April 2019

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1. Introduction

1.1. Overview

This guide documents performing firmware updates for the NL-SW-LTE-S7x family of Skywire modems using a Linux host operating system.

1.2. Orderable Parts

Orderable Device	Firmware Revision	Description	Manufacturer	Carrier
NL-SW-LTE-S7618RD	V1.10	4G LTE CAT1 Verizon	NimbeLink	Verizon
NL-SW-LTE-S7648	A12	4G LTE CAT1 AT&T/T-Mobile	NimbeLink	AT&T/T-Mobile
NL-SW-LTE-S7588-V	V.3.6	4G LTE CAT4 Verizon	NimbeLink	Verizon
NL-SW-LTE-S7588-V-B	V.3.15	4G LTE CAT4 Verizon	NimbeLink	Verizon
NL-SW-UAV-S7588	V.3.14	4G LTE CAT4 Verizon	NimbeLink	Verizon
NL-SW-LTE-S7588-T	A.2.10	4G LTE CAT4 AT&T/T-Mobile	NimbeLink	AT&T/T-Mobile
NL-SW-LTE-S7588-T-C	A.2.13	4G LTE CAT4 AT&T/T-Mobile	NimbeLink	AT&T/T-Mobile

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2. Firmware Update

2.1. Introduction

The S7x Skywire family uses the XMODEM-1K protocol to perform any firmware update over UART or USB. The files can be downloaded from Sierra Wireless - Source, which is a web platform containing technical information for Sierra Wireless products.

Sierra Wireless Modem with Link to Source	Associated Nimbelink Part(s)
AirPrime HL7618RD	NL-SW-LTE-S7618RD
AirPrime HL7648	NL-SW-LTE-S7648
AirPrime HL7588	NL-SW-LTE-S7588-V NL-SW-LTE-S7588-V NL-SW-LTE-S7588-V-B NL-SW-UAV-S7588 NL-SW-LTE-S7588-T NL-SW-LTE-S7588-T-C

This document uses the NL-SW-LTE-S7648 modem with a NL-SWDK (Skywire Development Kit) for demonstration.

2.2. Switching Carrier Firmware (S7588-x Only)

Since the NL-SW-LTE-S7588-V and NL-SW-LTE-S7588-T Skywires share the same hardware, it is possible to load the S7588-T's firmware on a S7588-V, and vice versa.

Please note that this can only be done reliably once. Loading a different firmware on the part more than once may corrupt the flash memory and permanently damage the Skywire, voiding the warranty.

2.3. Prerequisites

In order to complete the firmware update, you'll need a tool that can transfer data using the XMODEM protocol. XMODEM is a simple file transfer protocol which allows data to be transmitted over a serial connection. This example uses `sx` to facilitate the XMODEM transfer using the terminal program `picocom` on Ubuntu 18.04.

To install `sx`, run the following command:

```
$ sudo apt install lrzsz
```

To install `picocom`, run the following command:

```
$ sudo apt install picocom
```

2.4. Downloading the XMODEM File

Navigate to the desired modem on the Source website. Links for each modem type are provided in the table above. Select "Firmware" and download the XMODEM file (not the .exe), and save it to your system in a known location. For this demonstration the file was saved in "Download". The firmware file for the demonstration modem, the NL-SW-LTE-S7648, can be found here.

2.5. Using UART for Firmware Update

2.5.1. Connecting to the Modem

Before connecting to `picocom` from the terminal, confirm that `picocom` is being run from the same relative path as the location in which the XMODEM file was just saved.

NOTE: You may need to uninstall or disable the `modem manager`, which is typically included in the Ubuntu operating system installation.

Connect to the modem via picocom using:

```
$ sudo picocom -f h -b 115200 -s "sx -k" /dev/ttyUSBx
```

where `x` is your modem. `-f h` turns on hardware flow control, `-b` sets the baud rate, and the `-s "sx -k"` tells `picocom` to use the program `sx` to send the file. `-k` means use the 1K size (in bytes) for sending.

2.5.2. Setting Up the Skywire

Issue command:

```
AT+KSLEEP=2
```

```
AT&K3
```

This turns off the UART sleep functionality, as well as enables hardware flow control.

Issue command:

```
AT+WDSI=4095
```

to enable URCs for firmware update process.

A higher baud rate is recommended to transfer the file faster. Issue command:

```
AT+IPR=3000000
```

to up the baud rate to three megabit per second. `picocom` will need to be changed to this higher baudrate. To do this, type:

```
CTRL-A, CTRL-U
```

until you are at the 3000000 baud rate. Verify communications by typing:

```
AT
```

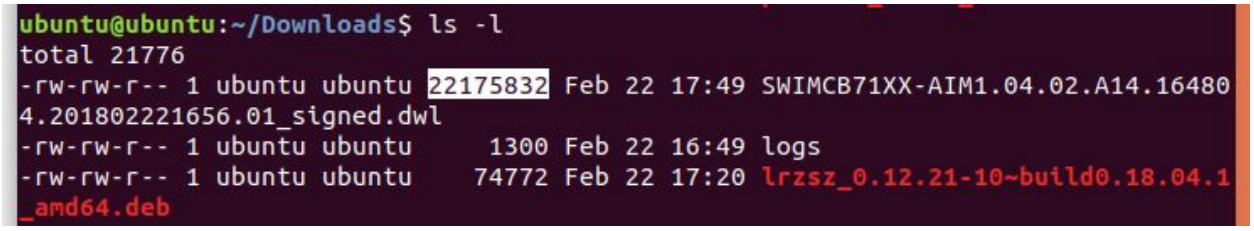
and making sure you receive

```
OK
```

Open up another command terminal window and issue command:

```
$ ls -l
```

Locate the firmware update file and copy its size. The file size is highlighted in the image below.

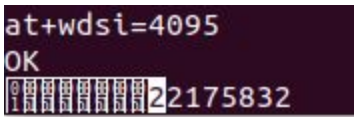


Copy the file size (`CTRL+SHIFT+C`).

In your `picocom` window, issue command and paste the file size (`CTRL+SHIFT+V`):

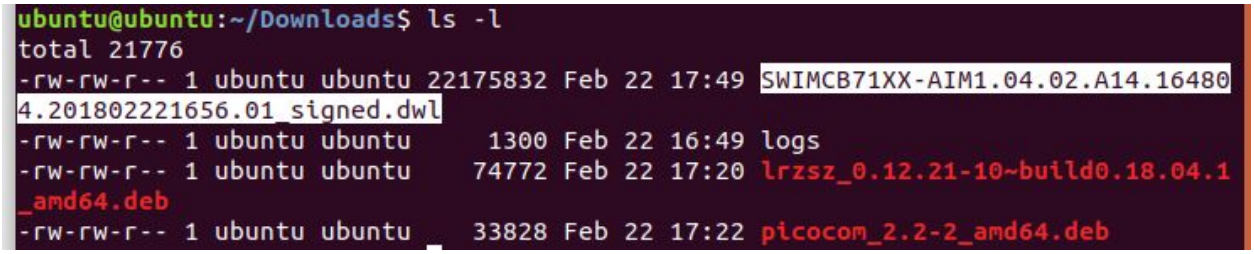
```
AT+WDSD=[file size] → Example: AT+WDSD=22175832
```

There will not be a response, but the modem is now in XMODEM transfer mode. The terminal may look something like the image below.



Type `CTRL-A CTRL-S` which will initiate a prompt requesting the file.

Go back to the other command terminal that was previously opened. Copy the name of the firmware update file as shown in the image below.



Paste the filename into `picocom` as shown in the image below.

Press `enter`. The XMODEM process will initiate the update.

2.5.3. Accepting the Install

You'll receive the following message when complete:

```
Transfer complete
*** exit status: 0 ***
OK
```

and the following URC:

```
+WDSI: 3
```

This means the transfer completed, and you need to accept it to proceed.

Issue command:

```
AT+IPR=115200
```

to put the baud rate back to the default.

Again,we need to change `picocom` to the new baudrate. Type:

```
CTRL-A CTRL-D
```

until you are back down to the 115200 baud in `picocom`.

Issue:

```
AT+WDSR=4
```

to accept and start the upgrade. This will take a few seconds for the file verification.

2.5.4. Waiting for the Install

After a little bit of time, you will receive the following URCs:

```
+WDSI: 12
+WDSI: 14
```

The first says that the verification was successful and the second starts the update. Once complete, the modem will reboot. You may lose your connection. If you do, reconnect using `picocom`.

2.5.5. Verifying the Update

Once the modem reboots issue the command:

```
ATI3
```

to verify the firmware update is complete. You should see a response showing the new version of firmware such as the one shown below.

```
SWIMCB71XX-AIM1.04.02.A14.164804.201802221656.01
```

2.6. Using USB for Firmware Update

2.6.1. Connecting to the Modem

Before connecting to `picocom` from the terminal, confirm that `picocom` is being run from the same relative path as the location in which the XMODEM file was just saved.

NOTE: You may need to uninstall or disable the `modem manager`, which is typically included in the Ubuntu operating system installation.

Connect using:

```
$ sudo picocom -s "sx -k" /dev/ttyACMx
```

Where `x` is your modem. Setting the baud on USB is not necessary. The `-s "sx -k"` tells `picocom` to use the program `sx` to send the file. `-k` means use the 1K size (in bytes) for sending.

2.6.2. Setting Up the Skywire

Issue command:

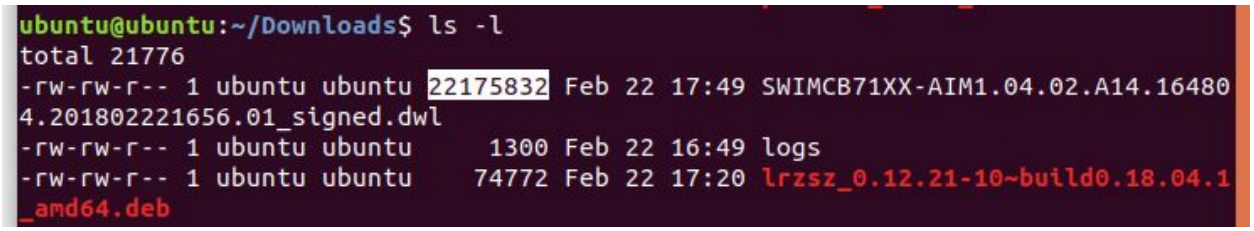
```
AT+WDSI=4095
```

to enable URCs for firmware update process.

Open up another command terminal window and issue command:

```
$ ls -l
```

Locate the firmware update file and copy the size. The file size is highlighted in the image below.

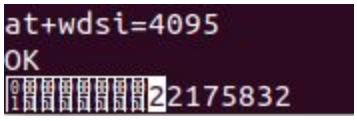


Copy the file size (`CTRL+SHIFT+C`).

Issue command and paste the file size (`CTRL+SHIFT+V`):

```
AT+WDSD=[file size] → Example: AT+WDSD=22175832
```

There will not be a response, but the modem is now in XMODEM transfer mode. The terminal may look something like the image below.



Type `CTRL-A CTRL-S` which will initiate a prompt requesting the file.

Go back to the other command terminal that was previously opened. Copy the name of the firmware update file as shown in the image below.

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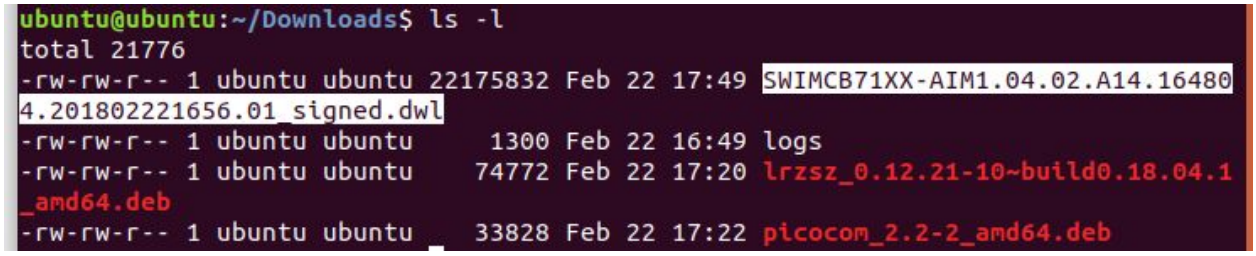

Paste the filename into `picocom` as shown in the image below.

Press enter. The XMODEM process will initiate the update.

2.6.3. Accepting the Install

You'll receive the following message when the transfer is complete:

```
Transfer complete
*** exit status: 0 ***
OK
```

and the following URC:

```
+WDSI: 3
```

This means the transfer completed, and you need to accept it to proceed.

Issue the command:

```
AT+WDSR=4
```

to accept and start the upgrade. This will take a few seconds for file verification.

2.6.4. Waiting for the Install

You will receive the following URCs:

```
+WDSI: 12
+WDSI: 14
```

as the install proceeds. The first indicates that the file verification was successful and the second starts the update. Once the update is finished, the modem will automatically reboot. You will lose your `picocom` connection and need to wait for USB to re-enumerate. Once it does, reconnect the modem.

You will receive the following URCs:

```
+SIM: 0
+KSUP: 2
```

```
+WDSI: 16
```

The last of which says that the installation was successful.

2.6.5. Verifying the Update

Once the modem reboots, and you've reconnected it, issue command:

```
ATI3
```

to verify the firmware update is complete. You will receive the following response:

```
SWIMCB71XX-AIM1.04.02.A14.164804.201802221656.01
```

indicating the modem now has the new version of firmware.

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