LI170 on Linux Host Application Note

Version: 0.5

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History

Version	Date	Description	Author
0.1	2013/01/24	First draft	Pierce Chen
0.2	2013/10/14	Add update image section	Pierce Chen
0.3	2013/10/16	Merge Android section	Pierce Chen
0.4	2014/01/10	Update chapter 2 and 4	Pierce Chen
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Contents

1 Instruction

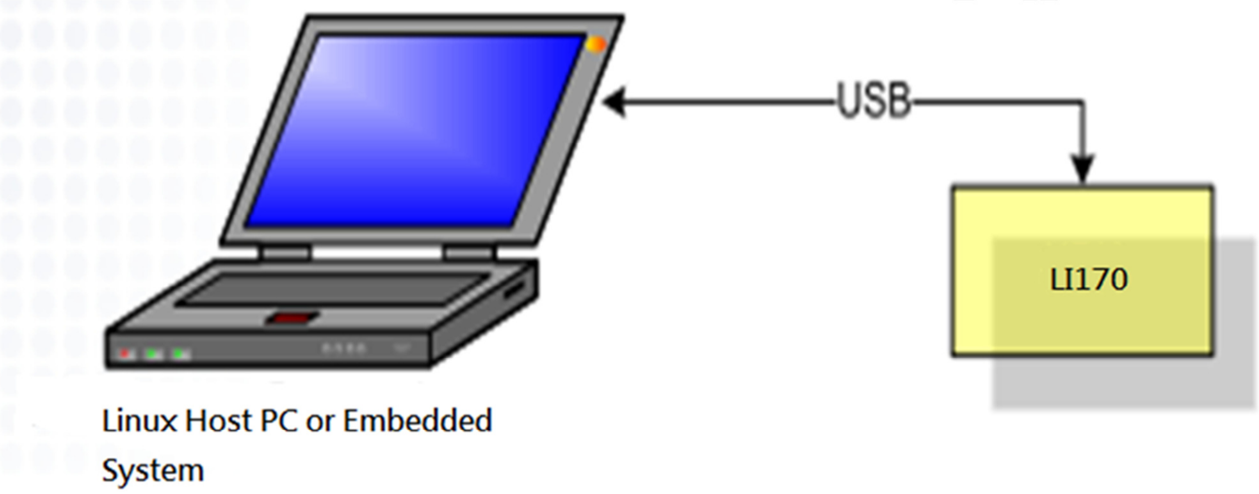
1.1 Purpose

This document lists the requirements for LI170 on Linux Host. After that you will be able to send AT commands through Putty or Minicom tool.

2 Linux Host requirement

When LI170 is connecting to Linux host, there are some host kernel requirements for LI170. Below is the requirement:

- Kernel version is better up to 2.6.21.
- When you build the kernel, please make sure that **Ethernet Gadget (CDC Ethernet)** and **Serial Gadget (CDC ACM)** modules are included in USB Gadget driver.

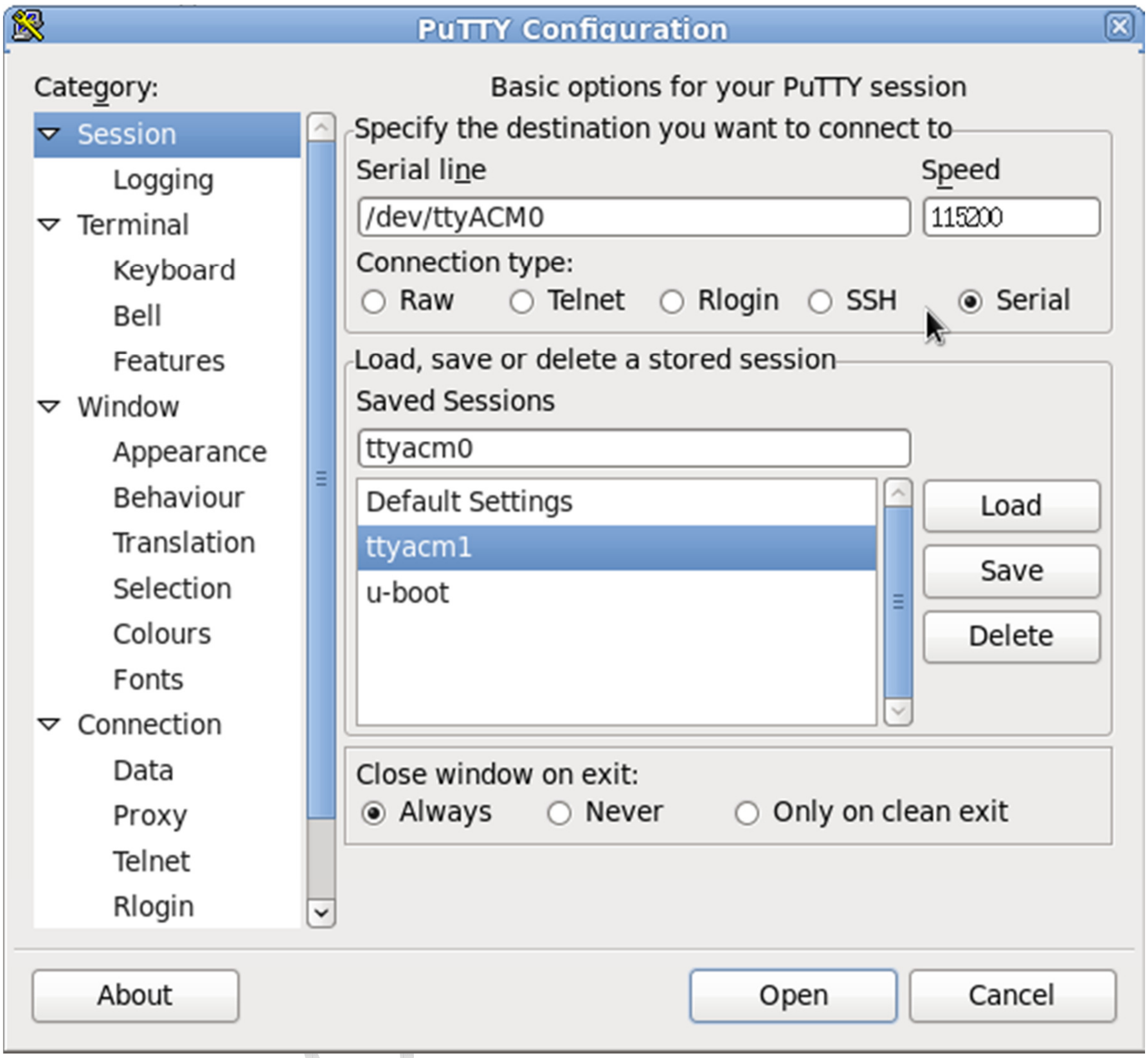


3 Test LI170 on Linux Host

When LI170 connect to Linux host, after about 30 seconds, you can find eth1 or eth0 interface by ifconfig command. Below is the example.

```
[root@pierce-fedora build]# ifconfig

eth1        Link encap:Ethernet   HWaddr 00:11:22:33:44:56

            inet addr:10.0.0.10   Bcast:10.0.0.255   Mask:255.255.255.0

            inet6 addr: fe80::211:22ff:fe33:4456/64 Scope:Link

            UP BROADCAST RUNNING MULTICAST   MTU:1500   Metric:1

            RX packets:101 errors:0 dropped:0 overruns:0 frame:0

            TX packets:106 errors:0 dropped:0 overruns:0 carrier:0

            collisions:0 txqueuelen:1000

            RX bytes:27496 (26.8 KiB)   TX bytes:23127 (22.5 KiB)
```

When LI170 connect to Linux host, after about 30 seconds, you can also find ttyACM0 or ttyACM1 on dev path. Then you can use putty or minicom to open ttyACM0, like the below. Please check that you have **root** priority to open /dev/ttyACM0 when you open fail.



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Serial line: /dev/ttyACM0

Speed: 115200

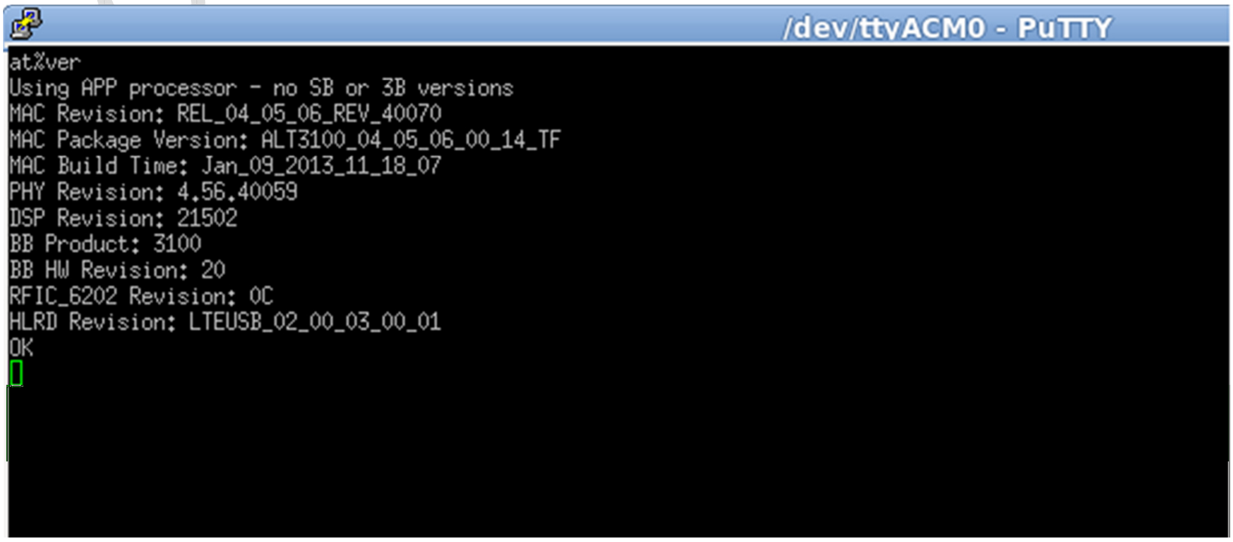
Connection type: ○ Raw ○ Telnet ○ Rlogin ○ SSH ● Serial

Load, save or delete a stored session

Saved Sessions: ttyacm0

Close window on exit: ● Always ○ Never ○ Only on clean exit

After that you can type AT commands by putty. But when you want to launch AT command, you can’t press enter button. Use Ctrl+j to replace enter button. Below is AT command example.



/dev/ttyACM0 - PuTTY

```
at%ver
Using APP processor - no SB or 3B versions
MAC Revision: REL_04_05_06_REV_40070
MAC Package Version: ALT3100_04_05_06_00_14_TF
MAC Build Time: Jan_09_2013_11_18_07
PHY Revision: 4.56.40059
DSP Revision: 21502
BB Product: 3100
BB HW Revision: 20
RFIC_6202 Revision: 0C
HLRD Revision: LTEUSB_02_00_03_00_01
OK
```

4 How to attach LTE with LI170

User can use AT%CMATT=1/0 command to connect/disconnect LTE. When LTE connected, user use AT%DPDNACT=1 to make internet PDN.

- “Connect”/”Disconnect” commands
  - ***AT%CMATT=1***
  - ***AT%CMATT=0***

- Open/Close INTERNET/Data PDN:
  - ***AT%DPDNACT=1***
  - ***AT%DPDNACT=0***

After internet PDN connected, user can type below example Linux command to update network interface IP Address.

```
>dhclient eth1
```

Or

```
>udhcpc -i eth1
```

Type ifconfig command to check that eth1 IP address is changed. Below is example. IP address is change to 192.168.10.108 from network server.

```
eth1      Link encap:Ethernet    HWaddr 00:11:22:33:44:56
          inet addr:192.168.10.108    Bcast:192.168.10.255    Mask:255.255.255.0
          inet6 addr: fc01:abab:cdcd:efe0:211:22ff:fe33:4456/64 Scope:Global
          inet6 addr: fe80::211:22ff:fe33:4456/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST    MTU:1500    Metric:1
          RX packets:1782 errors:0 dropped:0 overruns:0 frame:0
          TX packets:444 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1982787 (1.8 MiB)    TX bytes:203646 (198.8 KiB)
```

5 How to Update LI170 Images

LI170 use Kermit tool to update images. User must install Kermit in Linux Host PC before update LI170 images. Below command is example for Fedora host PC to install Kermit tool.

```
>sudo yum install *kermit*
```

If you use embedded Linux host, you may need to download the Kermit source code. And build for your Linux kernel version.

Copy all image and script files to Linux host PC. My example all images put in “images” folder and all scripts put in “scripts” folder. Remember to change all script files for executing mode.

The binary images are found in the “/images” folder.

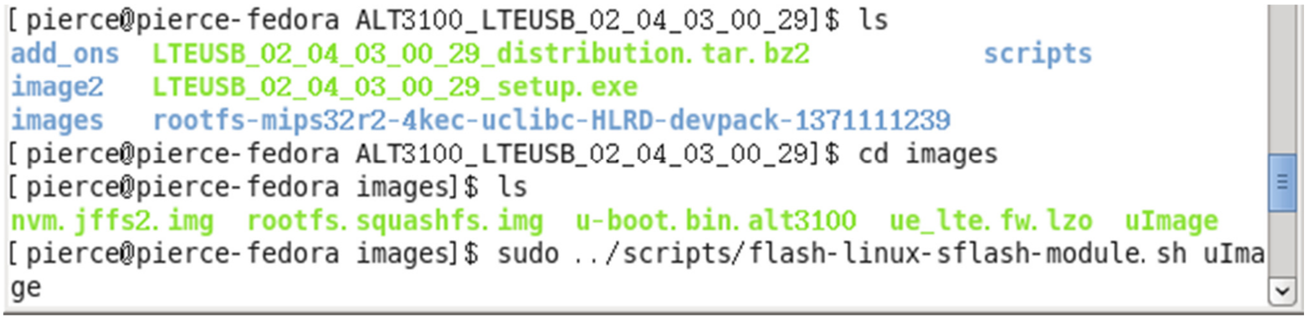
- **uImage** - the Linux kernel.
- **rootfs.jffs2.img** - the root file-system (in jffs2 format).
- **Ue_lte.fw.lzo** - the modem LTE firmware.
- **nvm.jffs2.img** - the configuration and BSP files (in jffs2 format).
- **u-boot.bin.alt3100** - U-Boot image.

The scripts are found in the “/scripts” folder.

- **Connect.sh** - basic script for all images update.
- **flash-linux-sflash-module.sh** - the script to update Linux kernel.
- **flash-rootfs-modemfw-sflash-module.sh** - the script to update file system and LTE firmware.
- **flash-u-boot-sflash-module.sh** - the script to update U-boot.

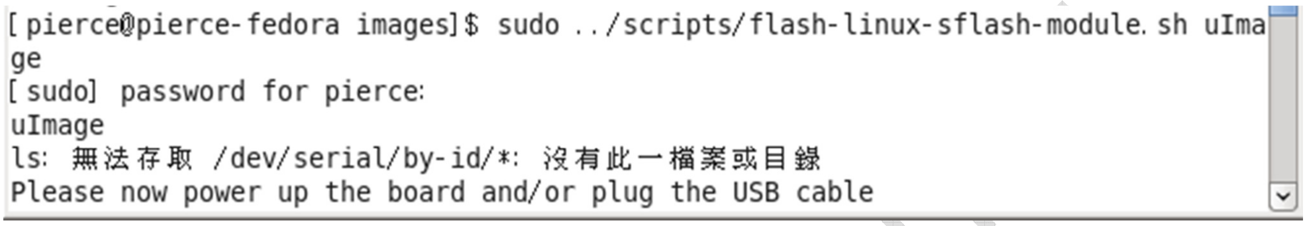
5.1 Update Linux Kernel

Use flash-linux-sflash-module.sh script to update uImage. Below is example.



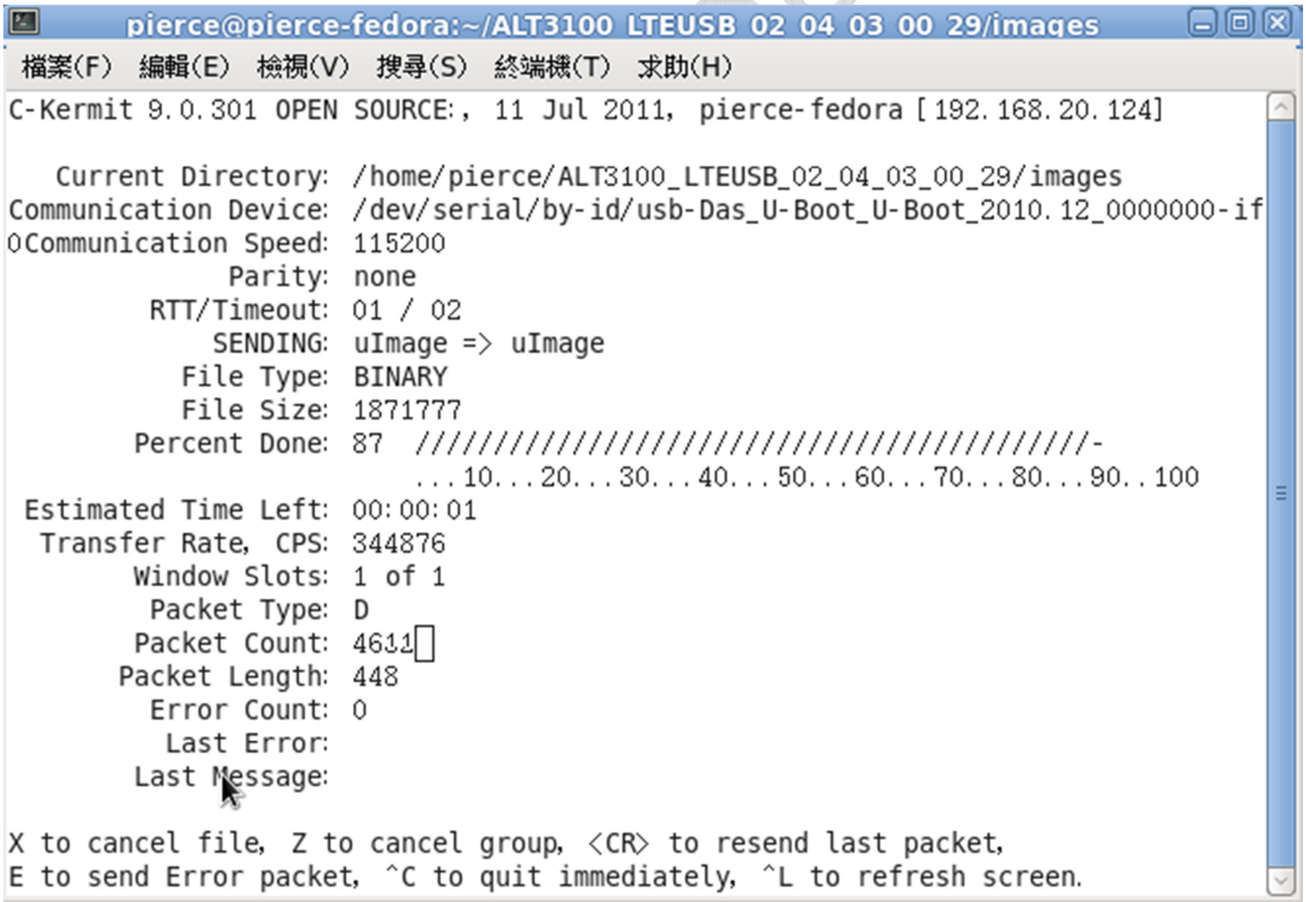
```
[pierce@pierce-fedora ALT3100_LTEUSB_02_04_03_00_29]$ ls
add_ons   LTEUSB_02_04_03_00_29_distribution.tar.bz2          scripts
image2    LTEUSB_02_04_03_00_29_setup.exe
images    rootfs-mips32r2-4kec-uclibc-HLRD-devpack-1371111239
[pierce@pierce-fedora ALT3100_LTEUSB_02_04_03_00_29]$ cd images
[pierce@pierce-fedora images]$ ls
nvm.jffs2.img  rootfs.squashfs.img  u-boot.bin.alt3100  ue_lte.fw.lzo  uImage
[pierce@pierce-fedora images]$ sudo ../scripts/flash-linux-sflash-module.sh uIma
ge
```

It will show up “Please now power up the board and/or plug the USB cable”.



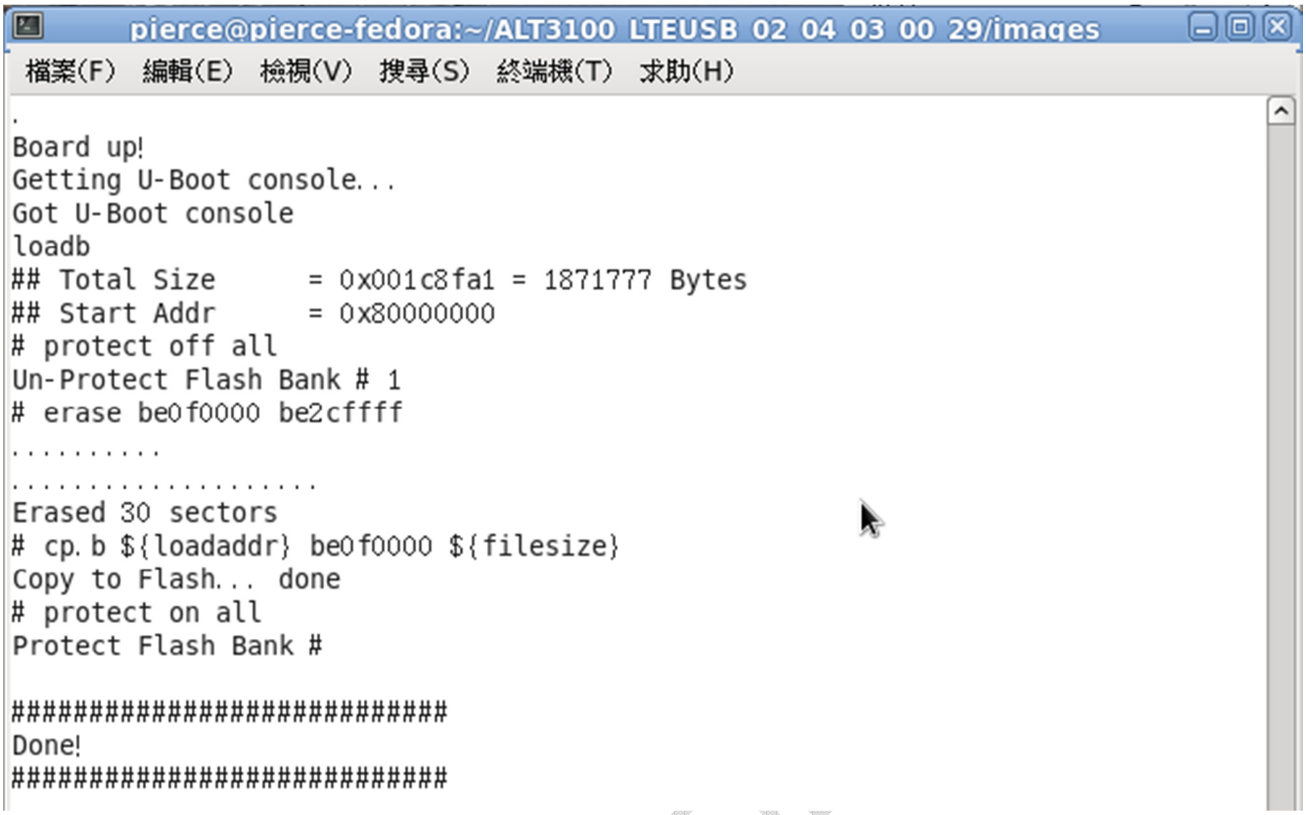
```
[pierce@pierce-fedora images]$ sudo ../scripts/flash-linux-sflash-module.sh uIma
ge
[sudo] password for pierce:
uImage
ls: 無法存取 /dev/serial/by-id/*: 沒有此一檔案或目錄
Please now power up the board and/or plug the USB cable
```

And now power on or plug in the LI170 module. Then it will start to download and update image to flash.


pierce@pierce-fedora:~/ALT3100_LTEUSB_02_04_03_00_29/images
檔案(F) 編輯(E) 檢視(V) 搜尋(S) 終端機(T) 求助(H)

```
C-Kermit 9.0.301 OPEN SOURCE:, 11 Jul 2011, pierce-fedora [192.168.20.124]

   Current Directory: /home/pierce/ALT3100_LTEUSB_02_04_03_00_29/images
Communication Device: /dev/serial/by-id/usb-Das_U-Boot_U-Boot_2010.12_0000000-if
0Communication Speed: 115200
              Parity: none
         RTT/Timeout: 01 / 02
             SENDING: uImage => uImage
           File Type: BINARY
           File Size: 1871777
        Percent Done: 87  ////////////////////////////////////////////-
                          ...10...20...30...40...50...60...70...80...90..100

 Estimated Time Left: 00:00:01
  Transfer Rate, CPS: 344876
        Window Slots: 1 of 1
         Packet Type: D
        Packet Count: 4611
       Packet Length: 448
         Error Count: 0
          Last Error:
        Last Message:

X to cancel file, Z to cancel group, <CR> to resend last packet,
E to send Error packet, ^C to quit immediately, ^L to refresh screen.
```

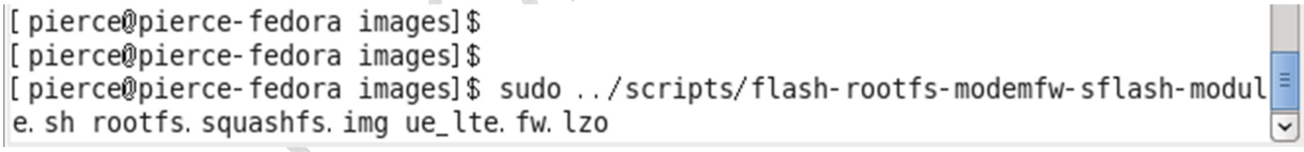
After finish, it will show “Done” as below.


pierce@pierce-fedora:~/ALT3100_LTEUSB_02_04_03_00_29/images
檔案(F) 編輯(E) 檢視(V) 搜尋(S) 終端機(T) 求助(H)

```
.
Board up!
Getting U-Boot console...
Got U-Boot console
loadb
## Total Size      = 0x001c8fa1 = 1871777 Bytes
## Start Addr      = 0x80000000
# protect off all
Un-Protect Flash Bank # 1
# erase be0f0000 be2cffff
..........
....................
Erased 30 sectors
# cp.b ${loadaddr} be0f0000 ${filesize}
Copy to Flash... done
# protect on all
Protect Flash Bank #

############################
Done!
############################
```

5.2 Update file system and LTE firmware.

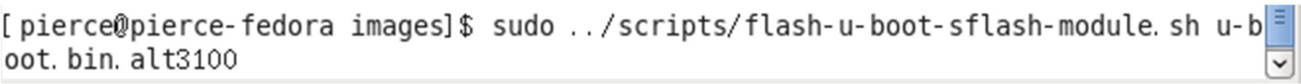
Use flash-rootfs-modemfw-sflash-module.sh script to update file system and LTE firmware. Below is example. Then follow the same process of section 5.1.



```
[pierce@pierce-fedora images]$
[pierce@pierce-fedora images]$
[pierce@pierce-fedora images]$ sudo ../scripts/flash-rootfs-modemfw-sflash-modul
e.sh rootfs.squashfs.img ue_lte.fw.lzo
```

5.3 Update U-boot

Use flash-u-boot-sflash-module.sh script to update U-boot. Below is example. Then follow the same process of section 5.1.



```
[pierce@pierce-fedora images]$ sudo ../scripts/flash-u-boot-sflash-module.sh u-b
oot.bin.alt3100
```

Usually user **doesn't** need to update U-boot. Only when the release U-boot is changed, U-boot should be updated. If your U-boot image is LTEUSB_02_00_***, you need to update U-boot first. And be careful that if U-boot fail to boot up, you could not to update any images by U-boot any more.

After update U-boot, the U-boot parameter will reset to default. The boot delay will reset to 10 seconds. Use below AT commands to set boot delay to 2 seconds.

AT%SRVCHANGE=debug,616967229

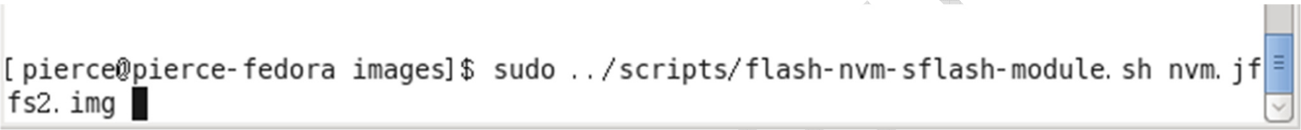
AT%exe=boot-delay-control.sh,2

AT%SRVCHANGE=comm,616967229

The password “**616967229**” is only for LTEUSB_02_04_03_00_30. If you use other LTEUSB software version, please contact Quanta to get the password.

5.4 Update NVM

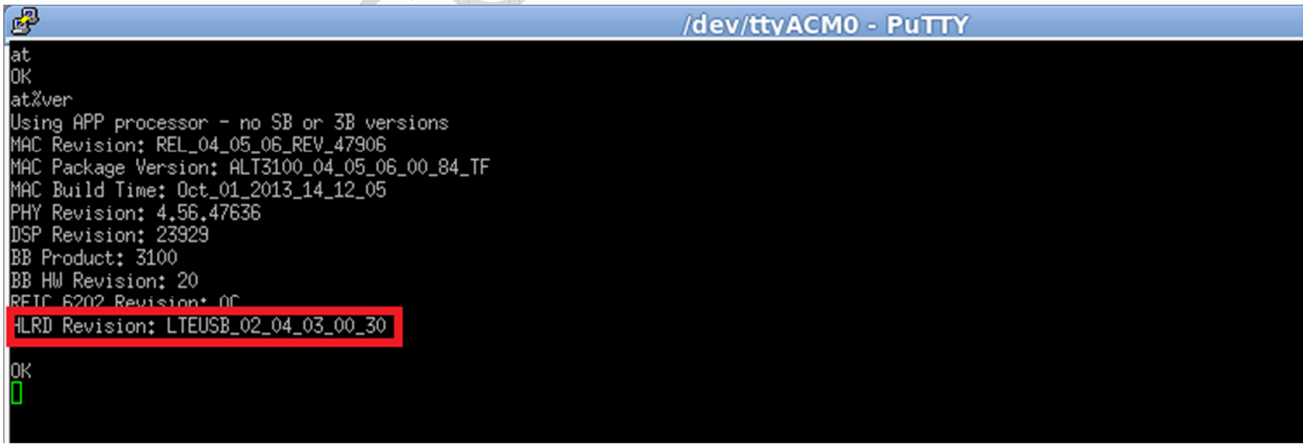
Use flash-nvm-sflash-module.sh script to update NVM. Below is example. Then follow the same process of section 5.1.



```
[pierce@pierce-fedora images]$ sudo ../scripts/flash-nvm-sflash-module.sh nvm.jf
fs2.img
```

Usually user **doesn’t** need to update UVM. There are calibration BSP files save in NVM. If you update the NVM, you also need to update the BSP files. Quanta doesn’t release flash-nvm-sflash-module.sh script file. If you need to update NVM, please contact Quanta.

If you successfully update all the images, you can use **at%ver** AT command to check the LTEUSB version. Below is example. I use LTEUSB_02_04_03_00_30 to update LI170.



```
at
OK
at%ver
Using APP processor - no SB or 3B versions
MAC Revision: REL_04_05_06_REV_47906
MAC Package Version: ALT3100_04_05_06_00_84_TF
MAC Build Time: Oct_01_2013_14_12_05
PHY Revision: 4.56.47636
DSP Revision: 23929
BB Product: 3100
BB HW Revision: 20
RFIC 6202 Revision: 0C
HLRD Revision: LTEUSB_02_04_03_00_30

OK
```

6 Porting Instruction for Android

6.1 RIL library source

Extract the released source AltAndroid_01_01_00_00_xx.tar.bz2 and copy hardware/ril/altair-ril/ folder to hardware/ril/ under your target source tree. Enter into the altair-ril folder and execute scripts/mklinks.sh.

Steps:

```
1. tar jxf AltAndroid_01_01_00_00_xx.tar.bz2
2. cp –rdpf hardware/ril/altiar-ril/ src_tree/hardware/ril/
3. cd src_tree/hardware/ril/altair-ril/
4. ./scripts/mklinks.sh
```

After creating the links these files should be available in your altair-ril directory:

```
altair_at_socket.c
altair_at_socket.h
altair-ril.c
altAtSocket
Android.mk
atchannel.c -> ../reference-ril/atchannel.c
atchannel.h -> ../reference-ril/atchannel.h
at_tok.c -> ../reference-ril/at_tok.c
at_tok.h -> ../reference-ril/at_tok.h
misc.c -> ../reference-ril/misc.c
misc.h -> ../reference-ril/misc.h
push.sh -> scripts/push.sh
ril.h -> ../reference-ril/ril.h
scripts
SMS3GPP2.c
SMS3GPP2.h
```

6.2 Android Patch

6.2.1 PRODUCT_PACKAGES variable setting.

First thing is to tell the Android build system to build the altair vendor ril library and rild packages. So make sure your PRODUCT_PATCKAGES variable of your target product contains rild and libaltair-ril. If these two packages built successfully, they will be in out/target/product/yourProductName/system/bin/rild and out/target/product/yourProductName/system/lib/libaltair-ril.so

6.2.2 system.prop settings

To allow altair vendor RIL activation, two parameters should be added to the android properties. These properties are read by the rild to decide which dynamic library to execute as vendor RIL and what parameter to provide as AT channel.

Modify the system.prop file as follows:

- rild.libpath=/system/lib/libaltair-ril.so

- rild.libargs=-d /dev/ttyACM0

The following parameter should also be added to system.prop file to define this UE as a LTE only

```
ro.telephony.default_network=11
```

6.2.3 config.xml modification

Check the networkAttributes setting in framework/base/core/res/res/values/config.xml or your config.xml overlay is as following:

```
<string-array translatable="false" name="networkAttributes">
    <item>"wifi,1,1,1,-1,true"</item>
    <item>"mobile,0,0,0,-1,true"</item>
    <item>"mobile_mms,2,0,2,60000,true"</item>
    <item>"mobile_supl,3,0,2,60000,true"</item>
    <item>"mobile_hipri,5,0,3,60000,true"</item>
    <item>"mobile_fota,10,0,2,60000,true"</item>
    <item>"mobile_ims,11,0,2,60000,true"</item>
    <item>"mobile_cbs,12,0,2,60000,true"</item>
    <item>"wifi_p2p,13,1,0,-1,true"</item>
    <item>"mobile_ia,14,0,2,-1,true"</item>
```

```
        </string-array
```

Make sure the ril-daemon service is defined in init.rc.

```
service ril-daemon /system/bin/rild

class main

socket rild stream 660 root radio

socket rild-debug stream 660 radio system socket altair_at_socket stream 660 radio system

user root

group radio cache inet misc audio sdcard_rw log
```

Check the interface name of the mobile connection on your platform. Usually will be eth0. You should change the following line in config.xml to make your mobile interface name to start with eth1 to match the ETH_IF_NAME definition in hardware/ril/altair-ril.c. Another option is to change the definition of ETH_IF_NAME to match your environment.

```
translatable="false" name="config_ethernet_iface_regex">eth(^0)\\d</string>
```

6.2.3 APN Definition

The last step is to add APN definition in an xml file, for example apns-conf_verizon.xml in your device folder as following

```
<apn carrier="LTE - Verizon Internet"

            mcc="311"

            mnc="480"

            apn="VZWINTERNET"

            type="default,dun"

            protocol="IPV4V6"

            roaming_protocol="IPV4V6"

            bearer="14"

      />

      <apn carrier="LTE - Verizon CBS"

            mcc="311"

            mnc="480"
```

```
        apn="VZWAPP"

        type="cbs"

        protocol="IPV4V6"

        roaming_protocol="IPV4V6"

        bearer="14"

    />

    <apn carrier="LTE - Verizon IMS"

        mcc="311"

        mnc="480"

        apn="VZWIMS"

        type="ims"

        protocol="IPV4V6"

        roaming_protocol="IPV4V6"

        bearer="14"

    />
```

Tell the Android build system to copy apn definition file to /system/etc/ on the target by adding the following two lines in your device.mk

```
PRODUCT_COPY_FILES += \

$(LOCAL_PATH)/apns-conf_verizon.xml:system/etc/apns-conf.xml
```

6.3 Linux Kernel Patch

Check the kernel configurations about USB Network Adapters support for USB driver.

```
CONFIG_USB_USBNET=y
CONFIG_USB_NET_CDCETHER=y

CONFIG_USB_NET_CDC_SUBSET=y

CONFIG_USB_ACM=y
```