

# **UC20 Linux USB Driver User Guide**

**UMTS/HSPA Module Series**

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## About the document

### History

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# 1 Introduction

This document introduces how to generate the USB driver for UC20 module in Linux OS, and how to use the module after the USB driver is loaded successfully.

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## 2 Product Overview

Quectel UC20 is a wireless WCDMA module. With it, you can implement some functions such as VOICE CALL and browsing internet and so on.

In general, UC20 module will create five interfaces when you connect it with embedded equipments. These five interfaces have different functionalities. The details are shown as below:

**Table 1: Interface Description**

|                        |                                     |
|------------------------|-------------------------------------|
| <b>DM interface</b>    | Diagnose port                       |
| <b>NMEA interface</b>  | For GPS NMEA sentence output        |
| <b>AT interface</b>    | For AT commands                     |
| <b>Modem interface</b> | For PPP connections and AT commands |
| <b>NDIS interface</b>  | Network driver interface            |



# 3 System Setup

Linux OS includes a generic USB to serial driver for communication module. You can use the module in the Linux OS only by adding the module's information (VID/PID) in the Linux kernel.

The first part of this chapter is to describe the structure of Linux USB Driver and the rest is to explain how to build the USB driver for UC20 module.

## 3.1. Linux USB Drivers Structure

USB is a kind of hierarchical bus structure. The data transmission between USB devices and Host is achieved by USB Controller. The following picture illustrates the architecture of USB Driver. Linux USB Host driver includes three parts: USB Host Controller driver, USB core, USB device drivers.

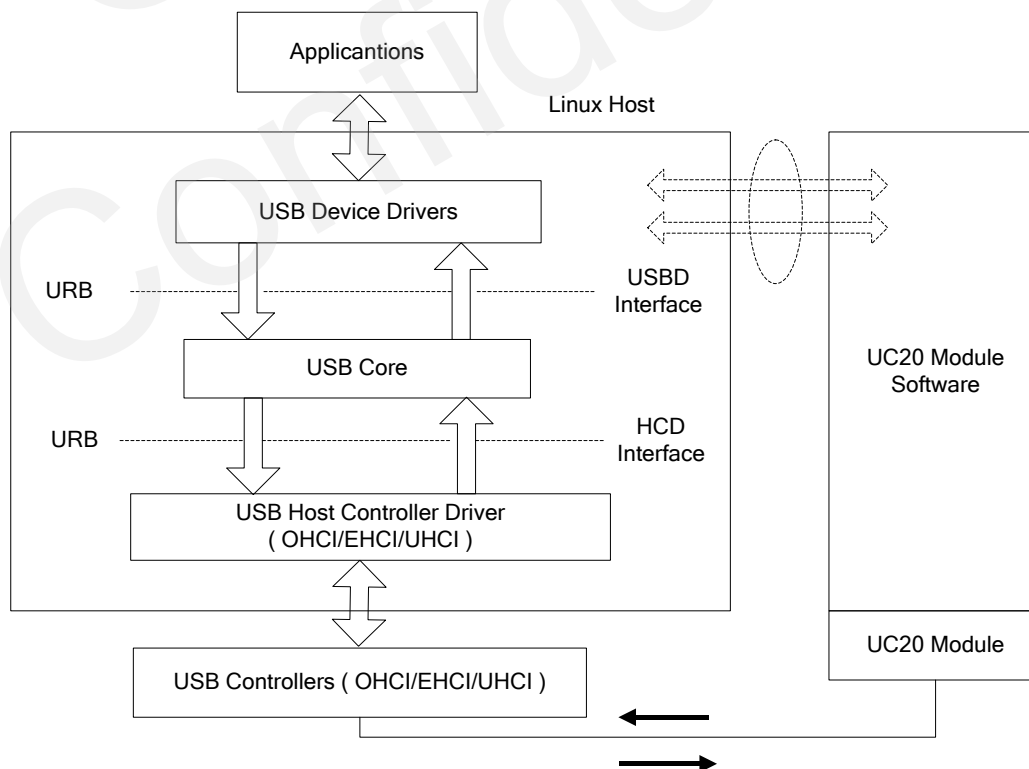


Figure 1: USB Driver structure

The USB Host Controller driver, the bottom of the hierarchical structure, is a software module which interacts directly with hardware.

USB core, the core of the whole USB host driver, is responsible for the management of USB bus, USB bus devices, and USB bus bandwidth, providing the interfaces for USB device driver, through which the applications can access the USB system files.

USB device drivers interact with the applications, and mainly provide the interfaces for accessing the specific USB devices.

## 3.2. Building the Driver

The USB driver is a part of Linux kernel. You can load the USB to Serial Driver in two ways:

1. Compile the driver into kernel.
2. Load the driver module dynamically.

The second way is to load the driver module with the command "insmod" after compiling the corresponding source code files, but the premise is that you have had the Linux kernel source code files and you have already compiled the whole kernel.

Here we only introduce the first method. Before replacing the Linux kernel, you need to modify the kernel configuration and the source code files responding to USB to serial driver by adding the VID and PID of UC20 in the file. The detailed steps are shown as below. (Take Fedora 14 as an example)

### 3.2.1. Download and Modify Source Code of Linux Kernel

Download the Linux kernel file and decompress the file into the directory "/usr/src/kernels". You can decompress the file by executing the following commands.

```
#cd /usr/src/kernels  
#tar -jxf linux-2.6.34.14.tar.bz2 -c /usr/src/kernels/
```

Then you should modify the driver source code file so that the UC20 module can be recognized by Linux OS. The file path is "/usr/src/kernels/driver/usb/serial/option.c". Open it and insert the VID and PID of UC20 module into the file, then save it and get ready to compile the kernel.

The UC20's VID and PID are listed as follows:

1. VID – 0x05c6
2. PID – 0x9003

```

option.c (/opt/FriendlyARM/tiny210/android/linux-2.6.35.7/drivers/usb/serial) - gedit
File Edit View Search Tools Documents Help
option.c x
    .ifaceinfo = alcatel_x200_no_sendsetup,
    .reason = OPTION_BLACKLIST_SENDESETUP
};

static const u8 zte_k3765_z_no_sendsetup[] = { 0, 1, 2 };
static const struct option_blacklist_info zte_k3765_z_blacklist = {
    .info = ARRAY_SIZE(zte_k3765_z_no_sendsetup),
    .ifaceinfo = zte_k3765_z_no_sendsetup,
    .reason = OPTION_BLACKLIST_SENDESETUP
};

static const struct usb_device_id option_ids[] = {
    { USB_DEVICE(0x85c6, 0x9903) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_COLT) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA_LIGHT) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA_QUAD) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA_QUAD_LIGHT) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA_NDIS) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA_NDIS_LIGHT) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA_NDIS_QUAD) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_RICOLA_NDIS_QUAD_LIGHT) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_COBRA) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_COBRA_BUS) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_VIPER) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_VIPER_BUS) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_GT_MAX_READY) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_FUJI_MODEM_LIGHT) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_FUJI_MODEM_GT) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_FUJI_MODEM_EX) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_KOI_MODEM) },
    { USB_DEVICE(OPTION_VENDOR_ID, OPTION_PRODUCT_SCORPION_MODEM) },
};

```

Figure 2: Add UC20 support

### 3.2.2. Clear Old Compiled File and Other Configuration File

Execute the following command in Terminal

```

#cd linux-2.6.34.14
#make mrproper

```

### 3.2.3. Modify Kernel Configuration

There are several mandatory selected items in kernel configuration:

USB Support

- USB Support →
  - USB Serial Converter Support→
    - USB Generic Serial Driver
    - USB driver for GSM and CDMA modems

PPP Support

For PPP dialing function you must select the below items:

PPP (point-to-point protocol) support

And you'd better select the following items to support the modules' dynamic loading.

- Enable loadable module support→
  - Forced module loading
  - Module unloading
  - Source checksum for all modules

Modify kernel configuration by executing the following command:

```
#make menuconfig
```

You must modify the kernel configuration manually, as shown in the following figures below:

Device Drivers → USB Support

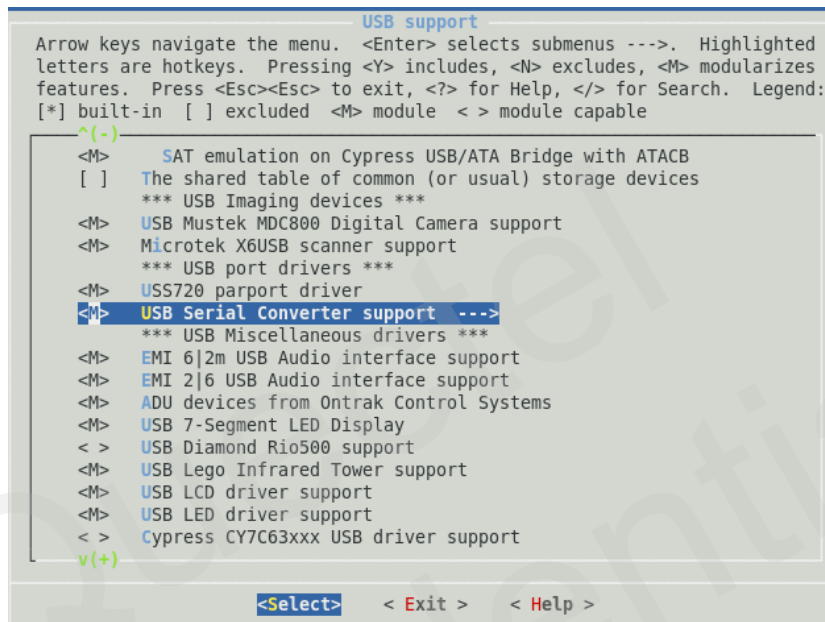


Figure 3: Select USB Serial Converter Support

Device Drivers → USB support → USB Serial Converter Support.

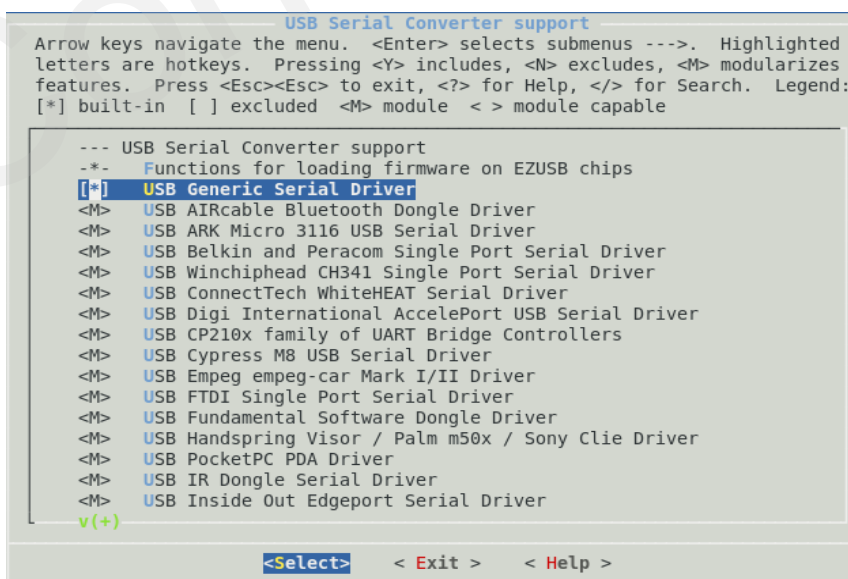


Figure 4: Select USB Generic Serial Driver

Device Drivers → USB support → USB Serial Converter Support.

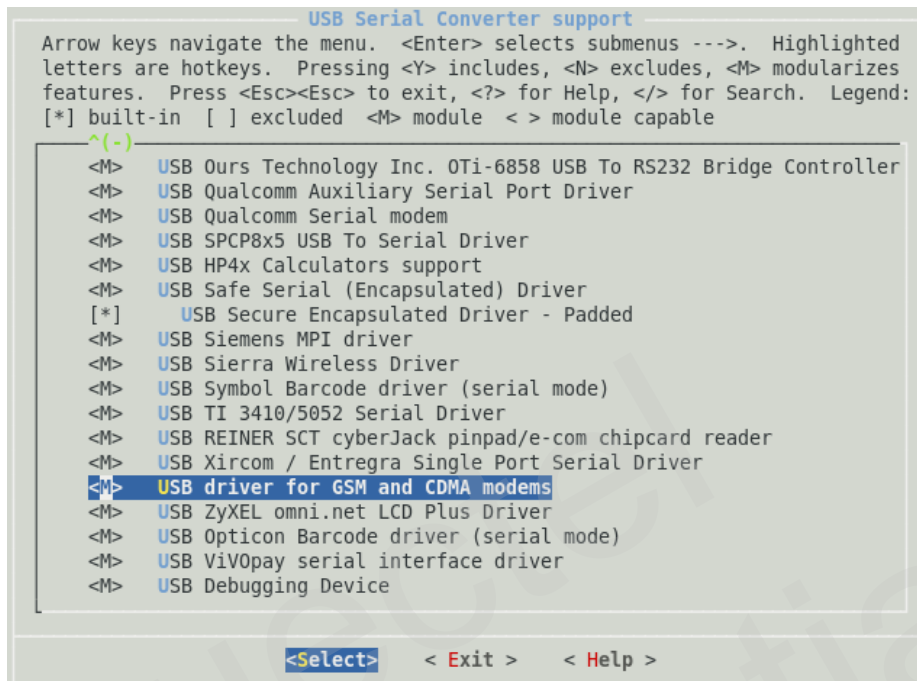


Figure 5: Select USB Driver for GSM and CDMA Modems

Enable Loadable Module Support

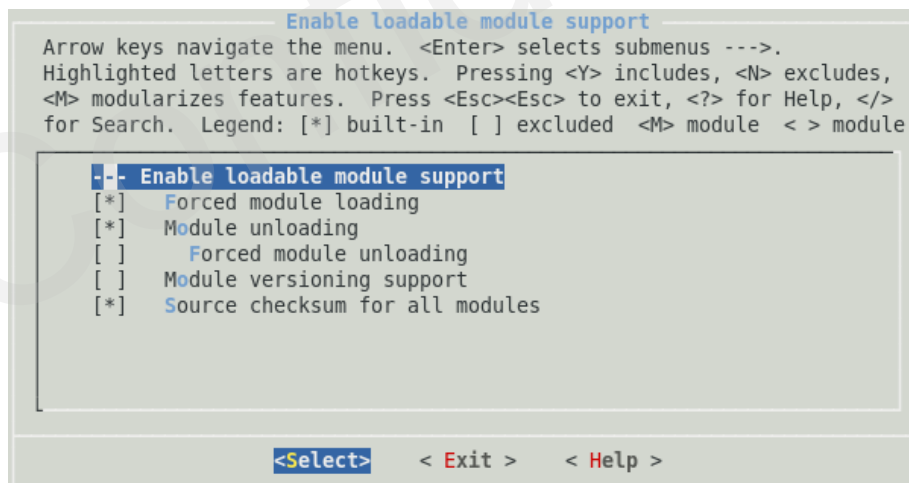


Figure 6: Select Enable Loadable Module Support

Device Drivers → Network Device Support

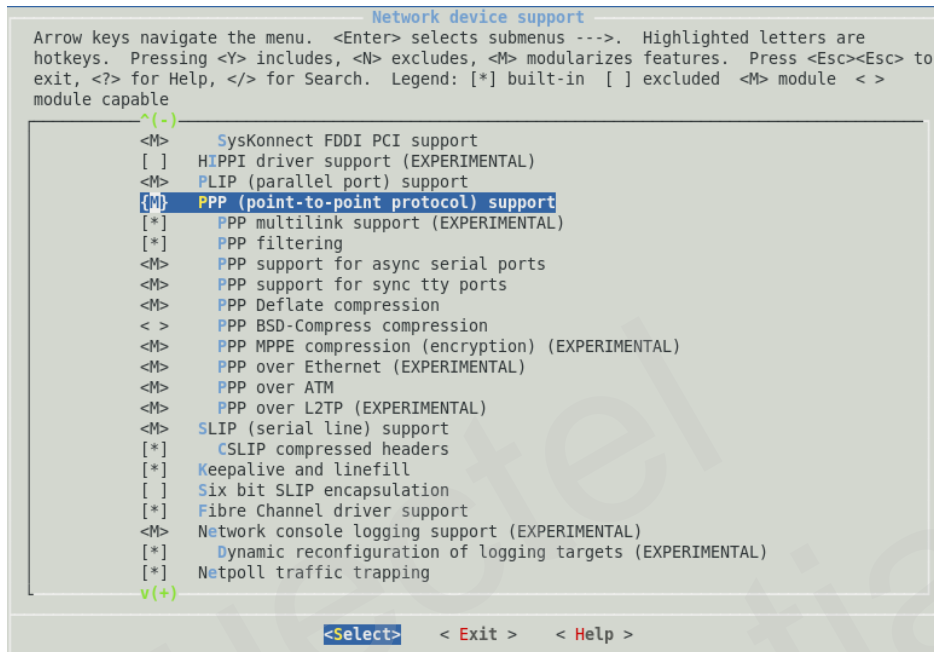


Figure 7: Select PPP (point-to-point protocol) Support

### 3.2.4. Compile and Install Linux Kernel

After finishing the above steps, you can compile and install the Linux kernel step by step as follows:

1. Before compiling, you should clean the configuration and executable file.

```
#make clean
```

2. Generate core file

```
#make bzImage
```

3. Make modules

```
#make modules
```

4. Install modules

```
#make modules_install
```

After installing successfully, all modules will be installed into the path "/lib/modules/\$(uname -r) ".

## 5. Install kernel

There are two ways to install kernel: automatic way and manual way.


**Automatic way:** Just execute the following command in Terminal

```
#make install
```

**Manual way:** Available for the version earlier than 2.6.

```
#cp /usr/src/kernels/linux-2.6.34.14/arch/i386/boot/bzImage \  
>/boot/vmlinuz-2.6.34.14-2  
  
#cp /usr/src/kernels/linux-2.6.34.14/system.map \  
>/boot/system.map-2.6.34.14-2  
  
#mkinitrd -v /boot/initrd-2.6.33.img 2.6.33.2 //create "initrd"
```

Edit the grub configuration file: " /boot/grub/menu.lst ". The content is shown as below:



```
mymenu.lst x
# grub.conf generated by anaconda
#
# Note that you do not have to rerun grub after making changes to this file
# NOTICE: You have a /boot partition. This means that
#           all kernel and initrd paths are relative to /boot/, eg.
#           root (hd0,0)
#           kernel /vmlinuz-version ro root=/dev/mapper/vg_clare-lv_root
#           initrd /initrd-[generic]-version.img
#boot=/dev/sda
default=0
timeout=0
splashimage=(hd0,0)/grub/splash.xpm.gz
hiddenmenu
title Fedora (2.6.35.14-106.fc14.i686)
  root (hd0,0)
  kernel /vmlinuz-2.6.34.14 ro root=/dev/mapper/vg_clare-lv_root rd_LVM_LV=vg_clare/lv_root rd_LVM_LV=vg_clare/lv_swap
  rd_NO_LUKS rd_NO_MD rd_NO_DM LANG=en_US.UTF-8 SYSFONT=latarcyrheb-sun16 KEYTABLE=us rhgb quiet
  initrd /initramfs-2.6.35.14-106.fc14.i686.img
title Fedora (2.6.34.14)
  root (hd0,0)
  kernel /vmlinuz-2.6.34.14 ro root=/dev/mapper/vg_clare-lv_root rd_LVM_LV=vg_clare/lv_root rd_LVM_LV=vg_clare/lv_swap
  rd_NO_LUKS rd_NO_MD rd_NO_DM LANG=en_US.UTF-8 SYSFONT=latarcyrheb-sun16 KEYTABLE=us rhgb quiet
  initrd /initramfs-2.6.35.6-45.fc14.i686.img
```

**Figure 8: Content of the Grub Configuration "menu.lst"**

## 6. Restart the Linux OS.

After operating system is restarted, it will list all kernel versions. You only need to select the new kernel to enter the system.

### 3.3. Loading the Driver

When UC20 module was connected to host computer via USB, meanwhile, the USB driver is loaded successfully, the following five devices will be created.

- /dev/ttyUSB0
- /dev/ttyUSB1
- /dev/ttyUSB2
- /dev/ttyUSB3
- /dev/ttyUSB4

You can check the result as below:

```
[root@clare /]# cd dev
[root@clare dev]# ls ttyUSB*
ttyUSB0  ttyUSB1  ttyUSB2  ttyUSB3  ttyUSB4
```

If the five device node files are shown as above, it is certain that the UC20 module has been recognized by Linux OS, and the corresponding relations between interfaces and devices are shown as below:

**Table 2: Relationship between Interfaces and Devices**

| INDEX | Interface Name  | Device Name  |
|-------|-----------------|--------------|
| 0     | DM interface    | /dev/ttyUSB0 |
| 1     | NMEA interface  | /dev/ttyUSB1 |
| 2     | AT interface    | /dev/ttyUSB2 |
| 3     | Modem interface | /dev/ttyUSB3 |
| 4     | NDIS interface  | /dev/ttyUSB4 |



## 4 System Setup

After the USB driver of UC20 module is loaded successfully, you can use the functions of the UC20 module.

It is suggested that you dispose the Voice Call and SMS service on AT interface and dispose the Data service on Modem interface.

### 4.1. Modifying the Rights of the Devices' Port

Before using the UC20 module, you should make sure the two ports possess readable, writable and executable.

For example: type the following commands in the terminal.

```
Chomd 777 /dev/ttyUSB2  
Chomd 777 /dev/ttyUSB3
```

### 4.2. Testing AT commands on the Devices' Port

In Linux OS, module's AT interface and Modem interface are serial ports. You can use the tool "minicom" to test the communication via the two ports. The method of using "minicom" is shown as below:

First, set the serial port configuration:

In the terminal type

```
# minicom -s
```

Then select "Serial port setup" in the configuration window, shown as below:

```
+-----[configuration]-----+
| Filenames and paths          |
| File transfer protocols      |
| Serial port setup          |
| Modem and dialing           |
| Screen and keyboard         |
| Save setup as dfl           |
| Save setup as..             |
| Exit                         |
| Exit from Minicom           |
+-----+
```

**Figure 9: Serial Port Setup in minicom**

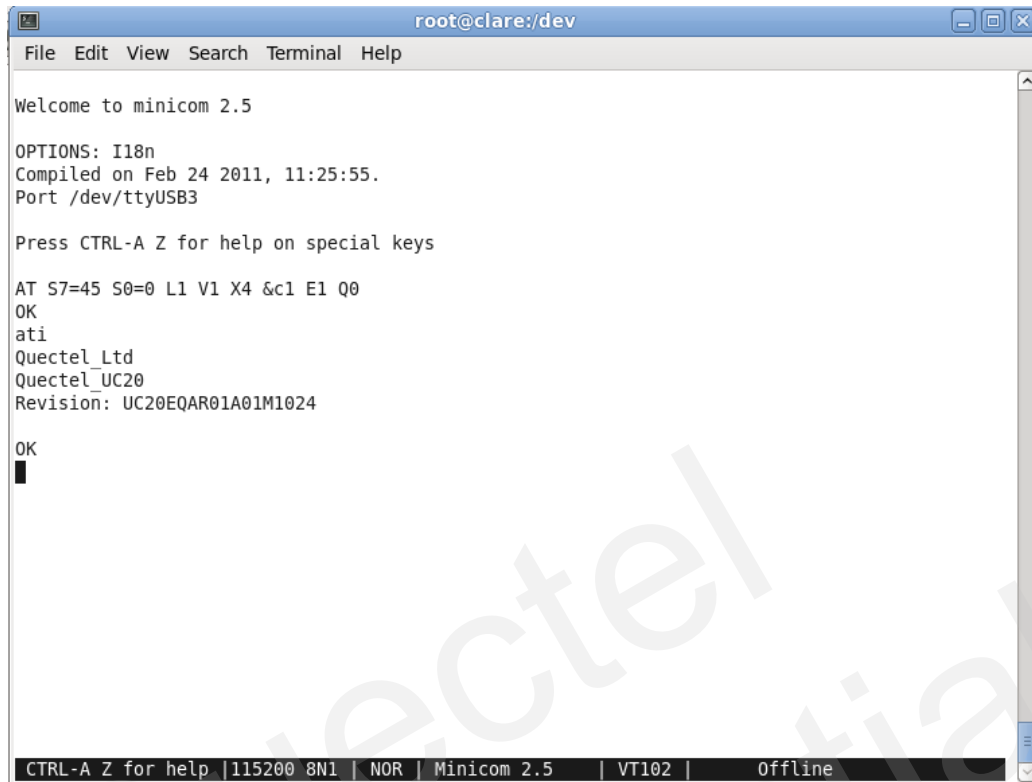
Enter and set the "Serial Device" to be `"/dev/ttyUSB2"` or `"/dev/ttyUSB3"` in the following window.

```
+-----+
| A - Serial Device      : /dev/ttyUSB3 |
| B - Lockfile Location  : /var/lock    |
| C - Callin Program     :              |
| D - Callout Program    :              |
| E - Bps/Par/Bits       : 115200 8N1  |
| F - Hardware Flow Control : No        |
| G - Software Flow Control : No        |
|                          |
| Change which setting? |
+-----+
| Screen and keyboard   |
| Save setup as dfl     |
| Save setup as..       |
| Exit                  |
| Exit from Minicom     |
+-----+
```

**Figure 10: Serial Port Configuration in minicom**

After setting the tool's communicative parameters, you can use it to send AT commands.

In the Terminal type "minicom", press enter, and then you can input AT commands to send it in the following place.



```
root@clare:/dev
Welcome to minicom 2.5
OPTIONS: I18n
Compiled on Feb 24 2011, 11:25:55.
Port /dev/ttyUSB3
Press CTRL-A Z for help on special keys
AT S7=45 S0=0 L1 V1 X4 &c1 E1 Q0
OK
ati
Quectel_Ltd
Quectel_UC20
Revision: UC20EQAR01A01M1024
OK
█
CTRL-A Z for help | 115200 8N1 | NOR | Minicom 2.5 | VT102 | Offline
```

Figure 11: Send AT Command in minicom

To close the minicom, press " CTRL+A" and press " Q" a few seconds later, and select "Yes" to exit it.

### 4.3. Create a PPP Connection

In general, you should create a PPP connection before you apply data service into UC20 module. The command of creating a PPP connection is shown as below:

```
# pppd call wcdma
```

The parameter "wcdma" is a script file of PPP dial. In general, the PPP dial script file includes three files, which are "wcdma", "wcdma-chat-connect", and "wcdma-chat-disconnect".

The content of the file "wcdma" is shown as below:

```
#!/etc/ppp/peers/wcdma
# Usage:root>pppd call wcdma
# Hide password in debug messages
hide-password
# The phone is not required to authenticate
noauth
```

```
# The chat script (be sure to edit that file,too!)  
connect '/usr/sbin/chat -s -v -f /etc/ppp/peers/wcdma-chat-connect'  
# The close script(be sure to edit that file,too!)  
disconnect '/usr/sbin/chat -s -v -f /etc/ppp/peers/wcdma-chat-disconnect'  
# Debug info from pppd  
debug  
# Serial Device to which the HSPDA phone is connected  
/dev/ttyUSB3  
# Serial port line speed  
115200  
# If you want to use the HSDPA link as your gateway  
defaultroute  
# pppd must not propose any IP address to the peer  
noipdefault  
# No ppp compression  
novj  
novjccomp  
noccp  
ipcp-accept-local  
ipcp-accept-remote  
local  
# For sanity, keep a lock on the serial line  
lock  
dump  
# Keep pppd attached to the terminal  
# Comment this to get daemon mode pppd  
nodetach  
user <insert here the correct username for authentication>  
password <insert here the correct password for authentication>  
# Hardware flow control
```

```
crtscts  
remotename 3gppp  
ipparam 3gppp  
# Ask the peer for up to 2 DNS server addresses  
usepeerdns
```

The content of the file "wcdma-chat-connect" is shown as below:

```
ABORT "BUSY"  
ABORT "NO CARRIER"  
ABORT "NO DIALTONE"  
ABORT "ERROR"  
ABORT "NO ANSWER"  
TIMEOUT 120  
"" AT  
OK \rATZ  
# Connection to the network  
OK \rAT+CGDCONT=1,"IP","<insert here the correct APN provided by your network operator>",,0,0  
# Dial the number  
OK-AT-OK ATDT*99#  
CONNECT \d\c
```

The content of the file "wcdma-chat-disconnect" is shown as below:

```
ABORT "ERROR"  
ABORT "NO DIALTONE"  
SAY "\nSending break to the modem\n"  
""\k  
""+++ATH  
SAY "\nGood bay\n"
```

After creating the three files under the path "/etc/ppp/peers", you can do the PPP dialing:

Execute the following command in Terminal:

```
#pppd call wcdma
```

The process of dialing is shown as below:

```
[root@clare linux-2.6.34.14]# pppd call wcdma
pppd options in effect:
debug          # (from /etc/ppp/peers/wcdma)
nodetach       # (from /etc/ppp/peers/wcdma)
dump          # (from /etc/ppp/peers/wcdma)
noauth        # (from /etc/ppp/peers/wcdma)
user          # (from /etc/ppp/peers/wcdma)
password ?????? # (from /etc/ppp/peers/wcdma)
remotename 3gppp # (from /etc/ppp/peers/wcdma)
/dev/ttyUSB3 # (from /etc/ppp/peers/wcdma)
115200      # (from /etc/ppp/peers/wcdma)
lock        # (from /etc/ppp/peers/wcdma)
connect /usr/sbin/chat -s -v -f /etc/ppp/peers/wcdma-chat-connect # (fr
om /etc/ppp/peers/wcdma)
disconnect /usr/sbin/chat -s -v -f /etc/ppp/peers/wcdma-chat-disconnect # (fr
om /etc/ppp/peers/wcdma)
crtscts      # (from /etc/ppp/peers/wcdma)
local        # (from /etc/ppp/peers/wcdma)
hide-password # (from /etc/ppp/peers/wcdma)
novj         # (from /etc/ppp/peers/wcdma)
novjccomp    # (from /etc/ppp/peers/wcdma)
ipcp-accept-local # (from /etc/ppp/peers/wcdma)
ipcp-accept-remote # (from /etc/ppp/peers/wcdma)
ipparam 3gppp # (from /etc/ppp/peers/wcdma)
noipdefault  # (from /etc/ppp/peers/wcdma)
defaultroute # (from /etc/ppp/peers/wcdma)
usepeerdns   # (from /etc/ppp/peers/wcdma)
noccp        # (from /etc/ppp/peers/wcdma)
abort on (BUSY)
abort on (NO CARRIER)
abort on (NO DIALTONE)
abort on (ERROR)
abort on (NO ANSWER)
timeout set to 120 seconds
send (AT^M)
expect (OK)
```

Figure 12: PPP Dial-1

```

^M
OK
-- got it

send (^MATZ^M)
expect (OK)
^M
^M
OK
-- got it

send (^MAT+CGDCONT=1,"IP","uninet",,0,0^M)
expect (OK)
^M
AT+CGDCONT=1,"IP","uninet",,0,0^M^M
OK
-- got it

send (ATDT*99#^M)
expect (CONNECT)
^M
ATDT*99#^M^M
CONNECT
-- got it

send (\d)
Script /usr/sbin/chat -s -v -f /etc/ppp/peers/wcdma-chat-connect finished (pid 7284),
status = 0x0
Serial connection established.
using channel 18
Using interface ppp0
Connect: ppp0 <-> /dev/ttyUSB3
sent [LCP ConfReq id=0x1 <asyncmap 0x0> <magic 0xb3f8c3d4> <pcomp> <accomp>]
rcvd [LCP ConfReq id=0x0 <asyncmap 0x0> <auth chap MD5> <magic 0x1f768a5> <pcomp> <ac
comp>]

```

Figure 13: PPP Dial-2

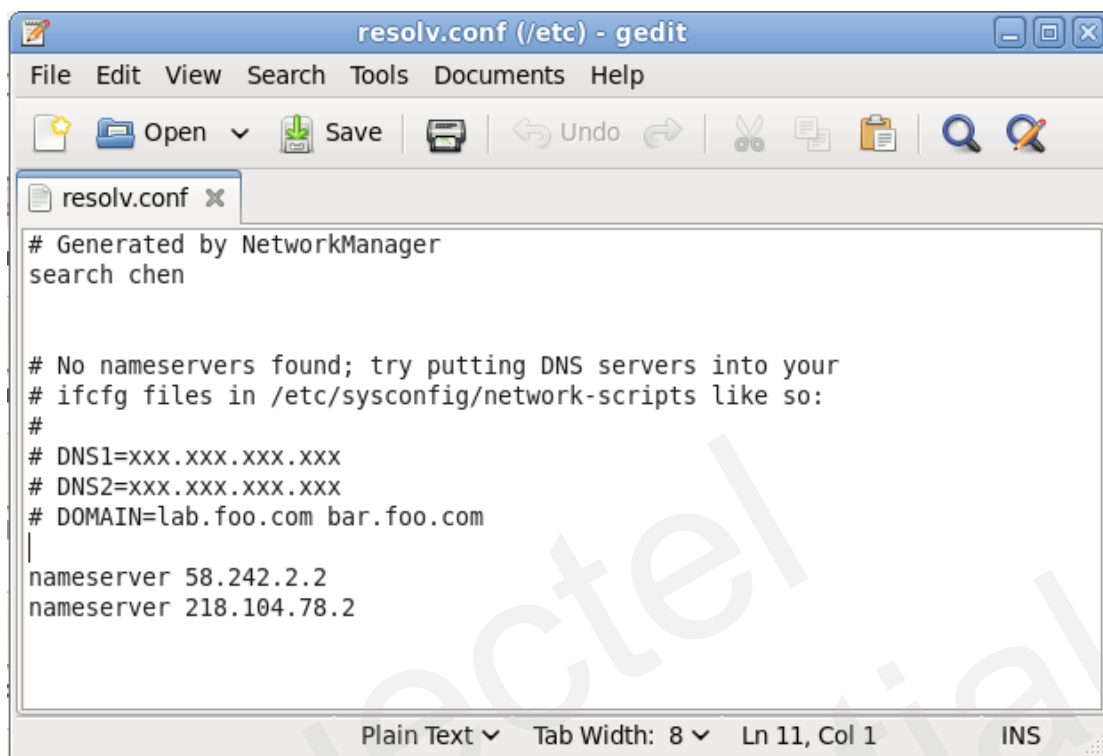
```

sent [LCP ConfRej id=0x0 <auth chap MD5>]
rcvd [LCP ConfAck id=0x1 <asyncmap 0x0> <magic 0xb3f8c3d4> <pcomp> <accomp>]
rcvd [LCP ConfReq id=0x1 <asyncmap 0x0> <magic 0x1f768a5> <pcomp> <accomp>]
sent [LCP ConfAck id=0x1 <asyncmap 0x0> <magic 0x1f768a5> <pcomp> <accomp>]
sent [IPCP ConfReq id=0x1 <addr 0.0.0.0> <ms-dns1 0.0.0.0> <ms-dns2 0.0.0.0>]
rcvd [LCP DiscReq id=0x2 magic=0x1f768a5]
rcvd [IPCP ConfReq id=0x0]
sent [IPCP ConfNak id=0x0 <addr 0.0.0.0>]
rcvd [IPCP ConfNak id=0x1 <addr 172.28.240.236> <ms-dns1 58.242.2.2> <ms-dns2 218.104
.78.2>]
sent [IPCP ConfReq id=0x2 <addr 172.28.240.236> <ms-dns1 58.242.2.2> <ms-dns2 218.104
.78.2>]
rcvd [IPCP ConfReq id=0x1]
sent [IPCP ConfAck id=0x1]
rcvd [IPCP ConfAck id=0x2 <addr 172.28.240.236> <ms-dns1 58.242.2.2> <ms-dns2 218.104
.78.2>]
Could not determine remote IP address: defaulting to 10.64.64.64
local IP address 172.28.240.236
remote IP address 10.64.64.64
primary DNS address 58.242.2.2
secondary DNS address 218.104.78.2
Script /etc/ppp/ip-up started (pid 7293)
Script /etc/ppp/ip-up finished (pid 7293), status = 0x0

```

Figure 14: PPP Dial-3

After PPP connection is created successfully, you must add the DNS information in the file "etc/resolv.conf". The content to be inserted is shown as below:



**Figure 15: Content of the DNS Configuration File**

Then you must set the default route as ppp0 before browsing internet. The commands are shown as below:

```
[root@clare ~]# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
10.64.64.64 * 255.255.255.255 UH 0 0 0 ppp0
default * 0.0.0.0 U 0 0 0 eth0
[root@clare ~]#
```

```
[root@clare ~]# route del default
[root@clare ~]# route add default dev ppp0
[root@clare ~]# route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
10.64.64.64 * 255.255.255.255 UH 0 0 0 ppp0
default * 0.0.0.0 U 0 0 0 ppp0
```

**Figure 16: route setting**

Then you can browse internet:



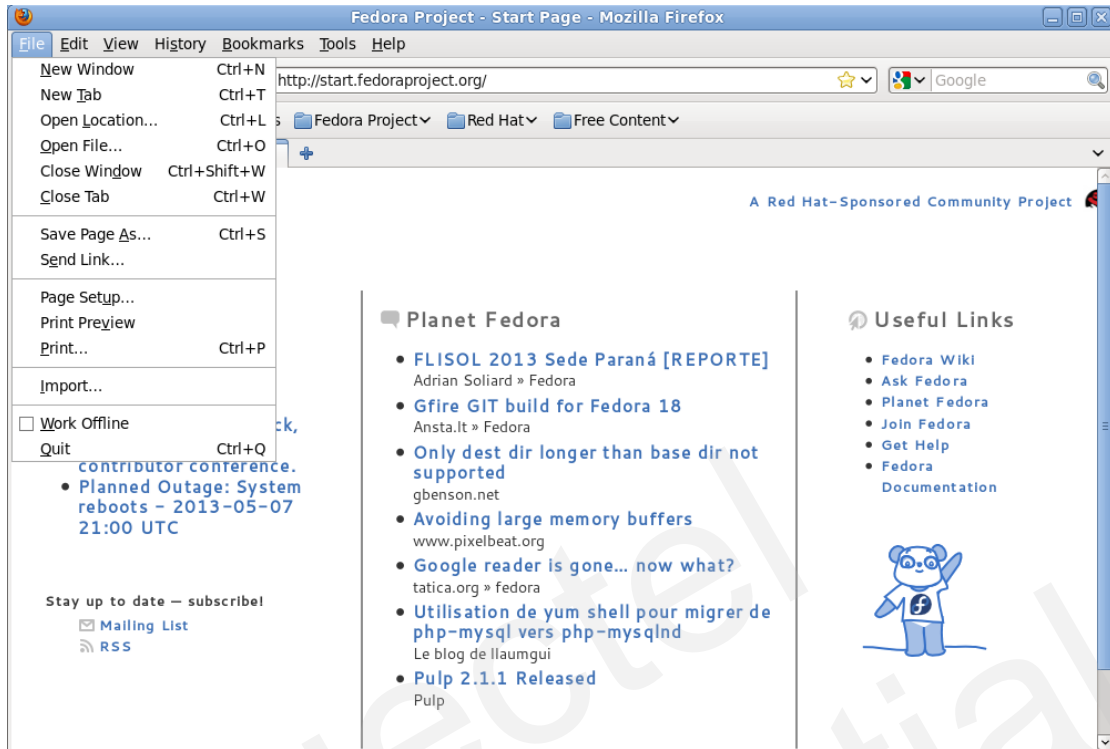


Figure 17: Browsing Internet in Linux OS

# 5 Appendix A Reference

Table 3: Terms and Abbreviations

| Abbreviation | Description      |
|--------------|------------------|
| OS           | Operating System |
| PID          | Product ID       |
| VID          | Vendor ID        |

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