A76XX Series_Linux _USB_Application Note

LTE Module

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About Document

Version History

Version	Date	Owner	What is new
V1.00	2019-06-06	Yulong.Zheng	First Release
	2019-08-07	Yulong.Zheng	Add +DIALMODE and $MYCONFIG description. Replace /DEV/ttyUSB3 with /DEV/ttyUSB2.
	2020-11-27	Yulong.Zheng	Add +USBNETIP
	2021-08-10	Yulong.Zheng	Add NMEA port
	2021-09-03	Zhen.Chen	Modify +USBNETIP

Contents

1 Introduction

1.1 Purpose of the document

This user guide serves the following purpose:

- Short introductions how to customize the USB driver for Simcom A7600 module in Linux OS
- Describes how software developers can use Linux devices for typical use cases.

2 Device Driver Installation

In order to recognize the modem, you must add VID and PID in Linux driver option, after the operating system recognizes the modem, devices named /dev/ttyUSBx are created, for example:

- /dev/ttyUSB0 diag port for output developing messages
- /dev/ttyUSB1 AT port for AT commands
- /dev/ttyUSB2 Modem port for ppp-dial
- /dev/ttyUSB3 NMEA port for GNSS(GNSS must be supported)

2.1 Add VID and PID

Edit option.c source file

a. gedit linux-x.x.x/drivers/usb/serial/option.c

b. Check if the following #define statement exists,If the #define does not exist ,add:

```
#define SIMCOM_VENDOR_ID                    0x1e0e
#define SIMCOM_PRODUCT_PID_X9011            0x9011
```

c. Check the following struct statement exists,If the struct does not exist ,add the following struct

```
static const struct option_blacklist_info simcom_pid9011_blacklist = {
    .reserved = BIT(0) | BIT(1),
}
```

d. Add the following line to usb_device_id option_ids[] structure, if not exists

```
    { USB_DEVICE(SIMCOM_VENDOR_ID, SIMCOM_PRODUCT_PID_X9011),
      .driver_info = (kernel_ulong_t)&simcom_pid9011_blacklist }
```

If your kernel code is different from the above, please be careful to modify it as appropriate.

2.2 Building a Linux Driver Module

How to compile and install a kernel module in Linux , follow the steps below will guide you along in compiling and install your option driver On Ubuntu operating system.

Step 1: Enter to kernel directory.

```
cd <your kernel directory>
```

Step 2: Build the driver.

```
sudo make -C /lib/modules/`uname -r`/build M=`pwd`/drivers/usb/serial obj-m=option.o modules
```

Step 3: Load the driver and reboot.

```
sudo cp drivers/usb/serial/option.ko /lib/modules/`uname -r`/kernel/drivers/usb/serial
sudo depmod
sudo reboot
```

2.3 Kernel Compilation Configuration

2.3.1 Compilation Configuration for USB Serial Driver

Configuration	Configuration(Y/N)
CONFIG_USB_SERIAL	Y
CONFIG_USB_SERIAL_OPTION	Y

2.3.2 Compilation Configuration for RNDIS Driver

Configuration	Configuration(Y/N)
CONFIG_USB_SERIAL	Y
CONFIG_USB_SERIAL_OPTION	Y
CONFIG_USB_USBNET	Y
CONFIG_USB_NET_CDCETHER	Y

2.3.3 Compilation Configuration for PPP Driver

Configuration	Configuration(Y/N)
CONFIG_USB_SERIAL	Y
CONFIG_USB_SERIAL_OPTION	Y
CONFIG_PPP	Y

CONFIG_PPP_FILTER	Y
CONFIG_PPP_MULTILINK	Y
CONFIG_PPP_BSDCOMP	Y
CONFIG_PPP_ASYNC	Y
CONFIG_PPP_SYNC_TTY	Y
CONFIG_PPP_DEFLATE	Y

3 Modem Usage

This chapter mainly introduces several commonly used dialing methods and their general processes.

USB devices must be recognized before use modem.

3.1 Description of AT Command

3.1.1 AT+DAILMODE Enable/Disable Auto-Dial

AT+DAILMODE Enable/Disable Auto-Dial	
Test Command **AT+DIALMODE =?**	Response **+DIALMODE: (0-1)** **OK**
Read Command **AT+ DIALMODE?**	Response **+ DIALMODE: 0** **+ DIALMODE: 1** **OK**
Write Command **AT+ DIALMODE =<0/1>**	Response a)If successfully: **OK** b)If failed: **ERROR**

Defined Values

<0/1>	The Auto Dial status Enable/Disable, the default value is 1. 0 –Enable Auto Dail 1 –Disable Auto Dail The function will take effect immediately.

3.1.2 AT$MYCONFIG Set RNDIS/ECM Mode

AT$MYCONFIG Set RNDIS/ECM Mode	
Write Command **AT$MYCONFIG="USBNETMODE",<0/1>**	Response a)If successfully: **OK** b)If failed: **ERROR**

Defined Values

<0/1>	The RNDIS/ECM mode, the default value is 0. 0 –RNDIS 1 –ECM The function will reset modem then take effect.

NOTE

this command will auto reboot(take effect after reboot).

3.1.3 AT+USBNETIP Change RNDIS/ECM Private IP to Public IP

AT+USBNETIP Change RNDIS/ECM Private IP to Public IP	
Test Command **AT+USBNETIP=?**	Response **+USBNETIP: (0-1)[,(0-255)[,(0-255)[,(1-254)]]]** **OK**
Write Command **AT+USBNETIP=mode[,tpos[,dhcps[,thcpe]]]**	Response a)If successfully: **OK** b)If failed: **+CME ERROR: unknown error**
Read Command **AT+USBNETIP?**	Response a)If successfully: **+USBNETIP: mode** **OK** b)If failed: **+CME ERROR: unknown error**
Parameter Saving Mode	AUTO_SAVE

Defined Values

<mode>	0 –Public Ip 1 –Private Ip
<tpos>	The third position of Gateway Addr
<dhcps>	Dhcp start value
<dhcpe>	Dhcp end value

Examples:

Open a CMD window and input ipconfig

```
以太网适配器 以太网 7:

   连接特定的 DNS 后缀 . . . . . . . :
   IPv6 地址 . . . . . . . . . . . . : 2409:8960:1e58:324c:2934:bda5:f9e8:88d7
   临时 IPv6 地址. . . . . . . . . . : 2409:8960:1e58:324c:65cd:269c:30d1:17f0
   本地链接 IPv6 地址. . . . . . . . : fe80::2934:bda5:f9e8:88d7%18
   IPv4 地址 . . . . . . . . . . . . : 192.168.0.100
   子网掩码 . . . . . . . . . . . . : 255.255.255.0
   默认网关. . . . . . . . . . . . . : fe80::1234%18
                                       192.168.0.1
```

Input AT+USBNETIP=0,10,117 over the serial port and input ipconfig again

```
以太网适配器 以太网 7:

   连接特定的 DNS 后缀 . . . . . . . :
   IPv6 地址 . . . . . . . . . . . . : 2409:8960:1e58:324c:2934:bda5:f9e8:88d7
   临时 IPv6 地址. . . . . . . . . . : 2409:8960:1e58:324c:65cd:269c:30d1:17f0
   本地链接 IPv6 地址. . . . . . . . : fe80::2934:bda5:f9e8:88d7%18
   IPv4 地址 . . . . . . . . . . . . : 192.168.10.117
   子网掩码 . . . . . . . . . . . . : 255.255.255.0
   默认网关. . . . . . . . . . . . . : fe80::1234%18
                                       192.168.10.1
```

Input AT+USBNETIP=0,12,198 over the serial port and input ipconfig again

```
以太网适配器 以太网 7:

   连接特定的 DNS 后缀 . . . . . . . :
   IPv6 地址 . . . . . . . . . . . . : 2409:8960:1e58:324c:2934:bda5:f9e8:88d7
   临时 IPv6 地址. . . . . . . . . . : 2409:8960:1e58:324c:65cd:269c:30d1:17f0
   本地链接 IPv6 地址. . . . . . . . : fe80::2934:bda5:f9e8:88d7%18
   IPv4 地址 . . . . . . . . . . . . : 192.168.12.98
   子网掩码 . . . . . . . . . . . . : 255.255.255.0
   默认网关. . . . . . . . . . . . . : fe80::1234%18
                                       192.168.12.1
```

3.2 Test AT Commands

```
#cat /dev/ttyUSB2 &
#echo -e "at\r\n">/dev/ttyUSB2
#
OK
```

3.3 Use PPP Data connection

How Does a PPP Dial-Up Connection Work?
You will need the right software and a couple of pieces of information before you start.First, check the pppd. If the programs do not exist, you can download the source code from https://ppp.samba.org/download.html and port them to your embedded development environment.
Next you must write configuration file for pppd.

3.3.1 Chat Scription

```
#named simcom-connect-chat and place in /etc/ppp/peers
ABORT "BUSY"
ABORT "NO CARRIER"
ABORT "NO DIALTONE"
ABORT "ERROR"
ABORT "NO ANSWER"
TIMEOUT 30
"" AT
OK ATE0
OK ATI;+CSUB;+CSQ;+CPIN?;+COPS?;+CGREG?;&D2
# Insert the APN provided by your network operator, default apn is 3gnet
OK AT+CGDCONT=1,"IP","3gnet",,0,0
OK ATD*99#
CONNECT
```

```
#named simcom-disconnect-chat and place in /etc/ppp/peers
ABORT "ERROR"
ABORT "NO DIALTONE"
SAY "\nSending break to the modem\n"
""   +++
""   +++
""   +++
```

```
SAY "\nGoodbay\n"
```

3.3.2 Configure dialing and AT port

```
# named simcom-pppd and place in /etc/ppp/peers
/dev/ttyUSB2 115200
#Insert the username and password for authentication, default user and password are test
user "test" password "test"
# The chat script, customize your APN in this file
connect 'chat -s -v -f /etc/ppp/peers/simcom-connect-chat'
# The close script
disconnect 'chat -s -v -f /etc/ppp/peers/simcom-disconnect-chat'
# Hide password in debug messages
hide-password
# The phone is not required to authenticate
noauth
# Debug info from pppd
debug
# 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
modem
dump
nodetach
```

```
# Hardware flow control
nocrtscts
remotename 3gppp
ipparam 3gppp
ipcp-max-failure 30
# Ask the peer for up to 2 DNS server addresses
usepeerdns
```

3.3.3 Dial-Up Connection

```
# pppd call simcom-pppd &
```

When you see the output below,it shows that dial-up succeeded.

```
Connect: ppp0 <--> /dev/ttyUSB2
sent [LCP ConfReq id=0x1 <asyncmap 0x0> <magic 0x5107d141> <pcomp> <accomp>]
rcvd [LCP ConfReq id=0x0 <asyncmap 0x0> <auth chap MD5> <magic 0x9a5c1936> <pcomp>
<accomp>]
sent [LCP ConfAck id=0x0 <asyncmap 0x0> <auth chap MD5> <magic 0x9a5c1936> <pcomp>
<accomp>]
rcvd [LCP ConfAck id=0x1 <asyncmap 0x0> <magic 0x5107d141> <pcomp> <accomp>]
sent [LCP EchoReq id=0x0 magic=0x5107d141]
rcvd [LCP DiscReq id=0x1 magic=0x9a5c1936]
rcvd [CHAP Challenge id=0x1 <dd93b9f04d75e2bbba3786f6d24df3d7>, name =
"UMTS_CHAP_SRVR"]
sent [CHAP Response id=0x1 <498d4d7cf3b59dacfc07a45ce6eb7e26>, name = "test"]
rcvd [LCP EchoRep id=0x0 magic=0x9a5c1936 51 07 d1 41]
rcvd [CHAP Success id=0x1 ""]
CHAP authentication succeeded
CHAP authentication succeeded
sent [IPCP ConfReq id=0x1 <addr 0.0.0.0> <ms-dns1 0.0.0.0> <ms-dns2 0.0.0.0>]
rcvd [IPCP ConfReq id=0x0]
sent [IPCP ConfNak id=0x0 <addr 0.0.0.0>]
rcvd [IPCP ConfNak id=0x1 <addr 10.51.68.23> <ms-dns1 222.66.251.8> <ms-dns2 116.236.159.8>]
sent [IPCP ConfReq id=0x2 <addr 10.51.68.23> <ms-dns1 222.66.251.8> <ms-dns2 116.236.159.8>]
rcvd [IPCP ConfReq id=0x1]
```

```
sent [IPCP ConfAck id=0x1]
rcvd [IPCP ConfAck id=0x2 <addr 10.51.68.23> <ms-dns1 222.66.251.8> <ms-dns2 116.236.159.8>]
Could not determine remote IP address: defaulting to 10.64.64.64
local  IP address 10.51.68.23
remote IP address 10.64.64.64
primary     DNS address 222.66.251.8
secondary DNS address 116.236.159.8
Script /etc/ppp/ip-up started (pid 6616)
Script /etc/ppp/ip-up finished (pid 6616), status = 0x0
```

Now PPP call is set up successfully. Please use following commands to check IP/DNS/Route.

```
# ifconfig ppp0
ppp0          Link encap:Point-to-Point Protocol
              inet addr:10.216.159.39  P-t-P:10.64.64.64  Mask:255.255.255.255
              UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1
              RX packets:9 errors:0 dropped:0 overruns:0 frame:0
              TX packets:9 errors:0 dropped:0 overruns:0 carrier:0
              collisions:0 txqueuelen:3
              RX bytes:362 (362.0 B)  TX bytes:316 (316.0 B)

# cat /etc/resolv.conf
nameserver 221.180.132.108

# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         0.0.0.0         0.0.0.0         U     0      0        0 ppp0
10.64.64.64     0.0.0.0         255.255.255.255 UH    0      0        0 ppp0

# ping baidu.com
PING baidu.com (220.181.57.216) 56(84) bytes of data.
64 bytes from 220.181.57.216: icmp_seq=1 ttl=50 time=84.0 ms
64 bytes from 220.181.57.216: icmp_seq=2 ttl=50 time=34.2 ms
```

Following commands can be used to terminate PPPD process to disconnect a PPP call:

```
# killall pppd
```

3.4 Use ECM Data connection

Enable ECM

```
# cat /dev/ttyUSB2 &
# echo -e "AT+DIALMODE=0\r\n">/dev/ttyUSB2
#
# OK
# echo -e "AT\$MYCONFIG=\"usbnetmode\",1 ">/dev/ttyUSB2
#
# OK
```

Please use following commands to check IP/DNS/Route.

```
# ifconfig usb0
usb0      Link encap:Ethernet  HWaddr ae:68:46:d6:b2:80
          inet addr:192.168.0.100  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::ac68:46ff:fed6:b280/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:45 errors:0 dropped:0 overruns:0 frame:0
          TX packets:104 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4237 (4.2 KB)  TX bytes:13148 (13.1 KB)

# ping baidu.com
PING baidu.com (123.125.114.144) 56(84) bytes of data.
64 bytes from 123.125.114.144: icmp_seq=1 ttl=56 time=114 ms
64 bytes from 123.125.114.144: icmp_seq=2 ttl=56 time=58.6 ms
64 bytes from 123.125.114.144: icmp_seq=3 ttl=56 time=45.1 ms
```

3.5 Use RNDIS Data connection

```
# cat /dev/ttyUSB2 &
# echo -e "AT+DIALMODE=0\r\n">/dev/ttyUSB2
#
# OK
# echo -e "AT\$MYCONFIG=\"usbnetmode\",0\r\n">/dev/ttyUSB2
#
# OK
```

Please use following commands to check IP/DNS/Route.

```
# ifconfig usb0
usb0      Link encap:Ethernet  HWaddr ae:68:46:d6:b2:80
          inet addr:192.168.0.100  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::ac68:46ff:fed6:b280/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:45 errors:0 dropped:0 overruns:0 frame:0
          TX packets:104 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4237 (4.2 KB)  TX bytes:13148 (13.1 KB)

# ping baidu.com
PING baidu.com (220.181.38.148) 56(84) bytes of data.
64 bytes from 220.181.38.148: icmp_seq=1 ttl=50 time=94.8 ms
64 bytes from 220.181.38.148: icmp_seq=2 ttl=50 time=135 ms
64 bytes from 220.181.38.148: icmp_seq=3 ttl=50 time=61.9 ms
```

4 Troubleshooting

If Linux does not create devices, check for the kernel module:

 # lsmod | grep option

If entries aren't found, load the kernel module with root privileges:

 # modprobe option

Check dmesg output to see that the radio was detected:

 # dmesg | grep option

Check dmesg output to see that the radio was detected:

 # dmesg | grep option

[16.672003] usbcore: registered new interface driver option

[16.672105] option 2-1.2:1.0: GSM modem (1-port) converter detected

[16.672216] option 2-1.2:1.1: GSM modem (1-port) converter detected

[16.672292] option 2-1.2:1.2: GSM modem (1-port) converter detected

[16.672365] option 2-1.2:1.3: GSM modem (1-port) converter detected

[16.672438] option 2-1.2:1.4: GSM modem (1-port) converter detected

If this returns an error response, the kernel module is not on your system. You will need to build the driver

5 Appendix A Abbreviations

Table 1: Terms and Abbreviations

Abbreviation	Description
USB	Universal Serial Bus
PPP	Point-to-Point Protocol. The Point-to-Point Protocol is designed for simple links which transport packets between two ports. These links provide full-duplex simultaneous bi-directional operation, and are assumed to deliver packets in order. It is intended that PPP provides a common solution for easy connection of a wide variety of hosts, bridges and routers.
IPCP	IP Control Protocol
IP	Internet Protocol
DNS	Domain Name Server