# Guide to Kernel Driver Integration in Linux for Huawei Modules

Issue 2.0

Date 2014-12-12

## Notice

Some features of the product and its accessories described herein rely on the software installed, capacities and settings of local network, and therefore may not be activated or may be limited by local network operators or network service providers.
Thus, the descriptions herein may not exactly match the product or its accessories which you purchase.
Huawei reserves the right to change or modify any information or specifications contained in this manual without prior notice and without any liability.

## DISCLAIMER

ALL CONTENTS OF THIS MANUAL ARE PROVIDED “AS IS”. EXCEPT AS REQUIRED BY APPLICABLE LAWS, NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE MADE IN RELATION TO THE ACCURACY, RELIABILITY OR CONTENTS OF THIS MANUAL.
TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL HUAWEI BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, OR LOSS OF PROFITS, BUSINESS, REVENUE, DATA, GOODWILL SAVINGS OR ANTICIPATED SAVINGS REGARDLESS OF WHETHER SUCH LOSSES ARE FORSEEABLE OR NOT.
THE MAXIMUM LIABILITY (THIS LIMITATION SHALL NOT APPLY TO LIABILITY FOR PERSONAL INJURY TO THE EXTENT APPLICABLE LAW PROHIBITS SUCH A LIMITATION) OF HUAWEI ARISING FROM THE USE OF THE PRODUCT DESCRIBED IN THIS MANUAL SHALL BE LIMITED TO THE AMOUNT PAID BY CUSTOMERS FOR THE PURCHASE OF THIS PRODUCT.

## Import and Export Regulations

Customers shall comply with all applicable export or import laws and regulations and be responsible to obtain all necessary governmental permits and licenses in order to export, re-export or import the product mentioned in this manual including the software and technical data therein.

## Privacy Policy

To better understand how we protect your personal information, please see the privacy policy at http://consumer.huawei.com/privacy-policy.

# About This Document

## Revision History

| Document Version | Date | Chapter | Change Description |
|---|---|---|---|
| V1.0 | 2010-11-29 | | Completed the draft |
| V1.0.1 | 2011-05-03 | | Add the method of modifying the kernel files to support new PIDs and to enable the autosuspend feature |
| V1.2.1 | 2011-08-25 | | Add the method to solve upgrade problem in android system used by MC509 |
| V1.2.3 | 2011-11-10 | | Enable zero Packet feature. |
| V1.2.4 | 2013-01-31 | | Update the comment scope |
| V1.2.6 | 2013-09-06 | 2 | Updated Table 2-1 Linux kernel driver architecture supporting Huawei modules in Android |
| | | All | Added the description related to the CDC ECM Driver |
| | | All | Added the product scope of LTE |
| | | 5 | Added chapter Appendix |
| V1.2.7 | 2013-11-13 | All | Updated the document title |
| V1.2.8 | 2013-11-30 | 4.1.1 | Updated supporting declarations for Huawei modules |
| V1.2.9 | 2013-12-30 | 4.3 | Added 4.3 Delay Time for Selective Suspend Mode |
| V2.0 | 2014-12-12 | All | Added the supported kernel system and kernel version |
| | | All | Updated description of USB and CDC ECM driver integration |
| | | All | Added description of CDC MBIM and power management driver integration |
| | | 8 | Added make menuconfig Configuration |

| Document Version | Date | Chapter | Change Description |
|---|---|---|---|
| | | 9 | Added FAQ |
| | | 10 | Added Abbreviations |

# Contents

# 1 Purpose

This guide instructs the kernel driver integration development for Huawei modules based on Linux operating system (OS), such as Android, Ubuntu and Chrome OS. It is intended for the driver developers of the products based on Linux kernel OS.

# 2 Scope

| Item | Description | |
|---|---|---|
| Applicable operating systems (OSs) | Linux, Android, and Chrome | |
| Applicable network standards | WCDMA, CDMA, and LTE | |
| Inapplicable kernel version | Versions earlier than 2.6.12 | Not applicable |
| Applicable kernel versions | 2.6.12–2.6.21 | Supports USB serial port driver integration (see chapter 4 "USB Serial Port Driver Integration") |
| | 2.6.22–2.6.31 | • Supports USB serial port driver integration (see chapter 4 "USB Serial Port Driver Integration")<br>• Supports CDC ECM driver integration (see chapter 5 "CDC ECM Driver Integration") |
| | 2.6.32–3.8 | • Supports USB serial port driver integration (see chapter 4 "USB Serial Port Driver Integration")<br>• Supports CDC ECM driver integration (see chapter 5 "CDC ECM Driver Integration")<br>• Supports power management integration (see chapter 7 "Power Management Integration") |

| Item | Description | |
|---|---|---|
| | 3.9 or later | • Supports USB serial port driver integration (see chapter 4 "USB Serial Port Driver Integration")<br>• Supports CDC ECM driver integration (see chapter 5 "CDC ECM Driver Integration")<br>• Supports CDC MBIM driver integration (see chapter 6 "CDC MBIM Driver Integration")<br>• Supports power management integration (see chapter 7 "Power Management Integration") |

# 3 Overview

This document describes how to modify the Linux kernel codes so customer systems (such as the Android system) can properly load Huawei modules.

Two types of drivers may be required for Huawei modules in Linux.

- Huawei-developed port: If this type of port is used, the general drivers must have adaptation data integrated before being used for Huawei modules. The adapted drivers are named **option**.
- General port: If this type of port (such as the ECM and MBIM ports) is used, the general drivers can be directly used for Huawei modules.

Set the kernel compilation configuration items for all drivers to make sure the drivers can be compiled in kernels.

# 4 USB Serial Port Driver Integration

After the USB serial port driver is integrated in Linux, Huawei modules can provide the most basic functions.

## 4.1 Context

The USB serial port driver involves Huawei-developed ports, including the Modem, PCUI, Diag, GPS, and GPS Control ports.

- Modem port: used for interaction between Linux and a Huawei module for PPP-Modem dial-up connections and data services.
- PCUI port: used for interaction between Linux and a Huawei module for AT command execution.
- Diag port: used to capture logs on a Huawei module.
- GPS and GPS Control ports: used to send GPS commands and obtain GPS NMEA information.

USB serial port driver integration requires modification of the following Linux kernel source code files:

`linux_src/drivers/usb/serial/option.c`

`linux_src/drivers/usb/serial/usb_wwan.c`

`linux_src/include/linux/usb.h`

## 4.2 Source Code File Modification

### 4.2.1 Adding Macro Definitions

Step 1 (Optional) If the following macro definitions are not contained in the **usb.h** file under **linux_src/include/linux**, add them, as shown in Figure 4-1 :

```
#define USB_VENDOR_AND_INTERFACE_INFO(vend, cl, sc, pr) \
    .match_flags = USB_DEVICE_ID_MATCH_INT_INFO \
        | USB_DEVICE_ID_MATCH_VENDOR, \
```

```
.idVendor = (vend), \
.bInterfaceClass = (cl), \
.bInterfaceSubClass = (sc), \
.bInterfaceProtocol = (pr)
```

**Figure 4-1** Adding macros to the usb.h file

```
#define USB_DEVICE_AND_INTERFACE_INFO(vend, prod, cl, sc, pr) \
        .match_flags = USB_DEVICE_ID_MATCH_INT_INFO \
        | USB_DEVICE_ID_MATCH_DEVICE, \
        .idVendor = (vend), \
        .idProduct = (prod), \
        .bInterfaceClass = (cl), \
        .bInterfaceSubClass = (sc), \
        .bInterfaceProtocol = (pr)

#define USB_VENDOR_AND_INTERFACE_INFO(vend, cl, sc, pr) \
        .match_flags = USB_DEVICE_ID_MATCH_INT_INFO \
        | USB_DEVICE_ID_MATCH_VENDOR, \
        .idVendor = (vend), \
        .bInterfaceClass = (cl), \
        .bInterfaceSubClass = (sc), \
        .bInterfaceProtocol = (pr)
```

Step 2 Add the following statements to the ID list of **static const struct usb_device_id option_ids[]** in the **option.c** file under **linux_src/drivers/usb/serial** to match device data:

**NOTE**

- Make sure the following statements are added in the **option.c** file. Otherwise, USB port mappings of the module may be abnormal.
- The items in the brackets correspond to the VID, InterfaceClass, InterfaceSubClass, and InterfaceProtocol, respectively.

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0xff,
0xff) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x01) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x02) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x03) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x04) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x05) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x06) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x31) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x32) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x33) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x34) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x35) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x36) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x61) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x62) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x63) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x64) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x65) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x66) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x0A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x0B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x0D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x0E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x0F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x3A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x3B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x3D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x3E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x3F) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x6A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x6B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x6D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x6E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x6F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x10) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x12) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x13) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x14) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x15) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x17) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x18) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x19) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x1A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x1B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x1C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x1D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x48) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x49) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x4A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x4B) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x4C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x4D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x72) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x73) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x74) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x75) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x78) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x79) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x7A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x7B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x7C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x01,
0x7D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x01) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x02) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x03) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x04) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x05) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x06) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x31) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x32) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x33) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x34) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x35) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x36) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x61) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x62) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x63) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x64) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x65) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x66) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x0A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x0B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x0D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x0E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x0F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x3A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x3B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x3D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x3E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x3F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x6A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x6B) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x6D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x6E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x6F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x10) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x12) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x13) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x14) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x15) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x17) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x18) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x19) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x1A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x1B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x1C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x1D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x48) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x49) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x4A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x4B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x4C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x4D) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x72) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x73) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x74) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x75) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x78) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x79) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x7A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x7B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x7C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x02,
0x7D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x01) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x02) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x03) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x04) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x05) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x06) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x31) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x32) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x33) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x34) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x35) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x36) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x61) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x62) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x63) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x64) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x65) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x66) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x0A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x0B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x0D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x0E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x0F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x3A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x3B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x3D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x3E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x3F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x6A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x6B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x6D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x6E) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x6F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x10) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x12) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x13) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x14) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x15) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x17) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x18) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x19) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x1A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x1B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x1C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x1D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x48) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x49) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x4A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x4B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x4C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x4D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x72) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x73) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x74) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x75) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x78) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x79) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x7A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x7B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x7C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x03,
0x7D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x01) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x02) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x03) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x04) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x05) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x06) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x31) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x32) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x33) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x34) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x35) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x36) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x61) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x62) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x63) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x64) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x65) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x66) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x0A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x0B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x0D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x0E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x0F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x3A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x3B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x3D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x3E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x3F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x6A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x6B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x6D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x6E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x6F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x10) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x12) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x13) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x14) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x15) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x17) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x18) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x19) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x1A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x1B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x1C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x1D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x48) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x49) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x4A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x4B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x4C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x4D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x72) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x73) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x74) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x75) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x78) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x79) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x7A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x7B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x7C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x04,
0x7D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x01) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x02) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x03) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x04) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x05) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x06) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x31) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x32) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x33) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x34) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x35) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x36) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x61) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x62) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x63) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x64) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x65) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x66) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x0A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x0B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x0D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x0E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x0F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x3A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x3B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x3D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x3E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x3F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x6A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x6B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x6D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x6E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x6F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x10) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x12) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x13) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x14) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x15) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x17) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x18) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x19) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x1A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x1B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x1C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x1D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x48) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x49) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x4A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x4B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x4C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x4D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x72) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x73) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x74) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x75) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x78) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x79) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x7A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x7B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x7C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x05,
0x7D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x01) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x02) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x03) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x04) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x05) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x06) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x31) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x32) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x33) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x34) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x35) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x36) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x61) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x62) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x63) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x64) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x65) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x66) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x0A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x0B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x0D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x0E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x0F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x3A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x3B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x3D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x3E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x3F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x6A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x6B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x6D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x6E) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x6F) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x10) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x12) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x13) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x14) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x15) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x17) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x18) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x19) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x1A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x1B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x1C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x1D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x48) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x49) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x4A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x4B) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x4C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x4D) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x72) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x73) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x74) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x75) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x78) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x79) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x7A) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x7B) },
```

```
{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x7C) },

{ USB_VENDOR_AND_INTERFACE_INFO(HUAWEI_VENDOR_ID, 0xff, 0x06,
0x7D) },
```

## 4.2.2 Adding the Zero Packet Mechanism

As required by the USB protocol, add the mechanism for processing zero packets during transmission to the **usb_wwan.c** file under **linux_src/drivers/usb/serial**:

Step 1 Define the values of **bcdUSB** and **vid**, as shown in Figure 4-2 .

Add **#define HW_bcdUSB 0x0110** to define the value of **bcdUSB**.

Add **#define HUAWEI_VENDOR_ID 0x12d1** to define the value of **vid**.

**Figure 4-2** Defining the values of bcdUSB and vid

```
#define N_IN_URB 4
#define N_OUT_URB 4
#define IN_BUFLEN 4096
#define OUT_BUFLEN 4096
#define HW_bcdUSB 0x0110
#define HUAWEI_VENDOR_ID 0x12d1
```

The details are as follows:

```
#define HW_bcdUSB 0x0110

#define HUAWEI_VENDOR_ID 0x12d1
```

Step 2 Add **struct usb_host_endpoint *ep=NULL;** to the **usb_wwan_write** function, as shown in Figure 4-3 .

**Figure 4-3** Adding struct usb_host_endpoint *ep=NULL;

```
int usb_wwan_write(struct tty_struct *tty, struct usb_serial_port *port,
                   const unsigned char *buf, int count)
{
    struct usb_wwan_port_private *portdata;
    struct usb_wwan_intf_private *intfdata;
    int i;
    int left, todo;
    struct urb *this_urb = NULL; /* spurious */
    struct usb_host_endpoint *ep=NULL;
```

The details are as follows:

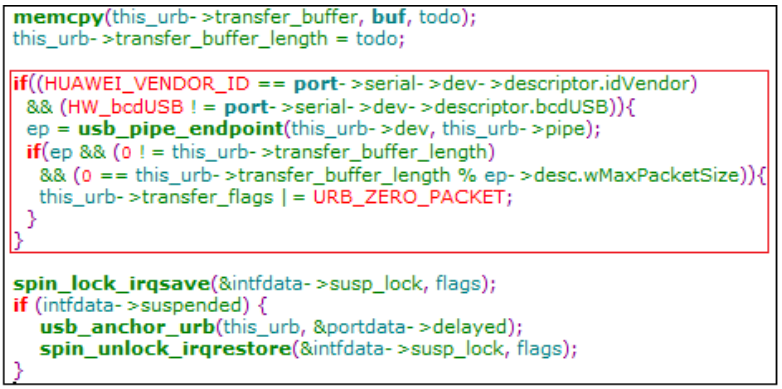
```
struct usb_host_endpoint *ep=NULL;
```

Step 3 Add the following statements to the **sb_wwan_write** function, as shown in Figure 4-4 :

```
if((HUAWEI_VENDOR_ID == port->serial->dev->descriptor.idVendor)
    && (HW_bcdUSB != port->serial->dev->descriptor.bcdUSB)){
    ep = usb_pipe_endpoint(this_urb->dev, this_urb->pipe);
```

```
    if(ep && (0 != this_urb->transfer_buffer_length)
        && (0 == this_urb->transfer_buffer_length %
ep->desc.wMaxPacketSize)){
        this_urb->transfer_flags |= URB_ZERO_PACKET;
    }
}
```

**Figure 4-4** Adding statements to the sb_wwan_write function




# 4.3 Compilation Configuration

In the .**config** file under **linux_src**, modify the configuration options related to the USB serial port driver and PPP dial-up connections as follows:

- Configuration options related to the USB serial port driver:

  ```
  CONFIG_USB_SERIAL=y
  CONFIG_USB_SERIAL_OPTION=y
  CONFIG_USB_SERIAL_WWAN=y
  ```

  **NOTE**

  For details about how to modify the configuration options related to the USB serial port driver from the make menuconfig user interface, see section 8.1 "Compilation Configuration Options for USB Serial Port Driver".

- Configuration options related to PPP dial-up connections:

  ```
  CONFIG_PPP=y
  CONFIG_PPP_MULTILINK=y
  CONFIG_PPP_FILTER=y
  CONFIG_PPP_ASYNC=y
  CONFIG_PPP_SYNC_TTY=y
  CONFIG_PPP_DEFLATE=y
  CONFIG_PPP_BSDCOMP=y
  ```

**NOTE**

For details about how to modify the configuration options related to the PPP dial-up connections from the make menuconfig user interface, see section 8.2 "Configuration Options Related to PPP Dial-up".

# 5 CDC ECM Driver Integration

## 5.1 Context

The CDC ECM driver is a general ECM driver for Huawei modules without the need for code modifications. Only compilation configuration is required. CDC ECM driver integration is applicable to kernel version 2.6.22 or later. After the CDC ECM driver is integrated in Linux, Huawei modules can provide data services.

For kernel versions earlier than 2.6.22, to use data services using PPP-Modem dial-up connections, set the configuration options related to the PPP dial-up connections in Linux (for details, see section 4.3 "Compilation Configuration"). This method also applies to kernel version 2.6.22 or later.

## 5.2 Compilation Configuration

In the **.config** file under **linux_src**, modify the configuration options related to the CDC ECM driver as follows:

```
CONFIG_USB_USBNET=y

CONFIG_NETDEVICES=y

CONFIG_USB_NET_CDCETHER=y
```

**NOTE**

For details about how to modify the configuration options related to the CDC ECM driver from the make menuconfig user interface, see section 8.3 "Compilation Configuration Options for CDC ECM Driver".

# 6 CDC MBIM Driver Integration

## 6.1 Context

The CDC MBIM driver is a general driver for Huawei modules without the need for code modifications. Only compilation configuration is required. CDC MBIM driver integration is applicable to kernel version 3.9 or later.

## 6.2 Compilation Configuration

In the **.config** file under **linux_src**, modify the configuration options related to the CDC MBIM driver as follows:

```
CONFIG_USB_USBNET=y

CONFIG_NETDEVICES=y

CONFIG_USB_NET_CDC_MBIM=y
```

**NOTE**

For details about how to modify the configuration options related to the CDC MBIM driver from the make menuconfig user interface, see section 8.4 "Compilation Configuration Options for CDC MBIM Driver".

# 7 Power Management Integration

Power management integration is applicable to kernel version 2.6.32 or later.

## 7.1 Power Management Integration for the USB Serial Port Driver

Linux kernels in version 2.6.32 or later versions have the selective suspend feature for USB serial port drivers. Therefore, to enable this feature and the USB serial port drivers will support the selective suspend feature for power management.

### 7.1.1 Source Code File Modification

Step 1 In the **option.c** file under **linux_src/drivers/usb/serial**, find the functions to which the structure **attach** (under **option_1port_device**) direct.

In different versions, the functions directed are different. In version 2.6.35, the function to which **attach** direct is **usb_wwan_startup()**, as shown in Figure 7-1 .

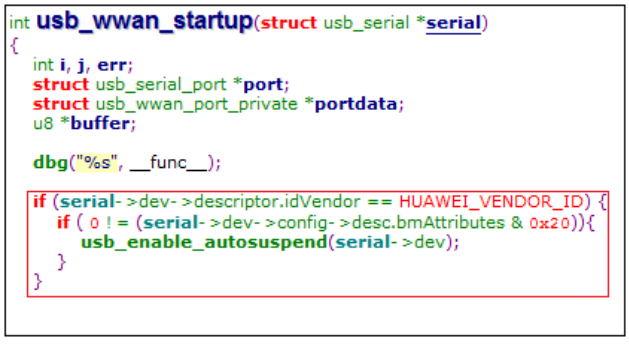
**Figure 7-1** Finding the functions directed

```
static struct usb_serial_driver option_1port_device = {
    .driver = {
    .owner =    THIS_MODULE,
    .name =     "option1",
    },
    .description       = "GSM modem (1-port)",
    .usb_driver        = &option_driver,
    .id_table          = option_ids,
    .num_ports         = 1,
    .probe             = option_probe,
    .open              = usb_wwan_open,
    .close             = usb_wwan_close,
    .dtr_rts    = usb_wwan_dtr_rts,
    .write             = usb_wwan_write,
    .write_room        = usb_wwan_write_room,
    .chars_in_buffer   = usb_wwan_chars_in_buffer,
    .set_termios       = usb_wwan_set_termios,
    .tiocmget          = usb_wwan_tiocmget,
    .tiocmset          = usb_wwan_tiocmset,
    .attach            = usb_wwan_startup,
    .disconnect        = usb_wwan_disconnect,
    .release           = usb_wwan_release,
    .read_int_callback = option_instat_callback,
#ifdef CONFIG_PM
    .suspend           = usb_wwan_suspend,
    .resume            = usb_wwan_resume,
#endif
};
```

Step 2 In the **usb_wwan.c** file under **linux_src/drivers/usb/serial**, define **usb_wwan_startup()**. Then, add the following statements, as shown in Figure 7-2 , to enable the **selective suspend** feature: (Before adding **usb_wwan_startup()**, add **#define HUAWEI_VENDOR_ID 0x12d1**.)

```
if (serial->dev->descriptor.idVendor == HUAWEI_VENDOR_ID) {
if ( 0 != (serial->dev->config->desc.bmAttributes & 0x20)){
usb_enable_autosuspend(serial->dev);
}
}
```

**Figure 7-2** Adding statements to enable the selective suspend feature



```
int usb_wwan_startup(struct usb_serial *serial)
{
    int i, j, err;
    struct usb_serial_port *port;
    struct usb_wwan_port_private *portdata;
    u8 *buffer;

    dbg("%s", __func__);

    if (serial->dev->descriptor.idVendor == HUAWEI_VENDOR_ID) {
        if ( 0 != (serial->dev->config->desc.bmAttributes & 0x20)){
            usb_enable_autosuspend(serial->dev);
        }
    }
```

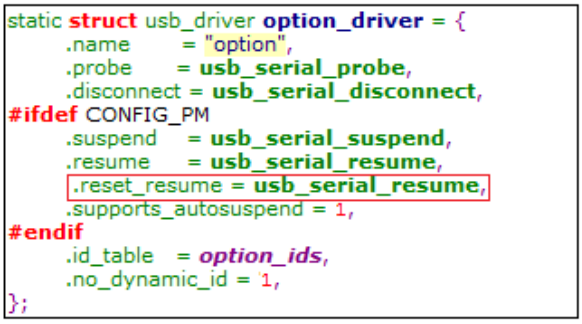
**NOTE**

The **reset_resume** function is used to reset a suspended USB device. If this function is removed, skip step 3.

Step 3 In the **option.c** file under **linux_src/drivers/usb/serial**, add the following statement to the **option_driver** structure to invoke the **reset_resume** function, as shown in Figure 7-3 :

```
.reset_resume = usb_serial_resume,
```

**Figure 7-3** Adding the statement to invoke the reset_resume function



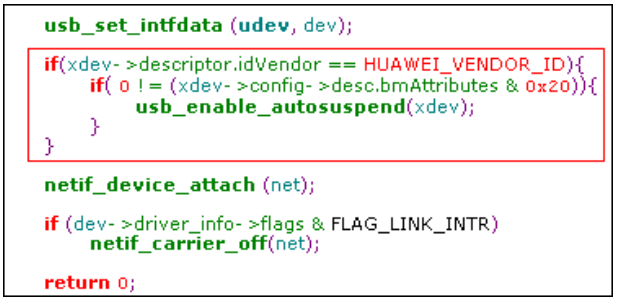

## 7.1.2 Compilation Configuration

In the **.config** file under **linux_src**, modify the configuration options of the Linux kernel as follows:

```
CONFIG_USB_SUPPORT=y

CONFIG_USB =y

CONFIG_PM_RUNTIME=y

CONFIG_USB_SUSPEND=y
```

# 7.2 Power Management Integration for the CDC ECM Serial Port Driver

To enable selective suspend feature, add the contents enclosed in the red rectangle in the following figure into the **usbnet_probe()** function in the **linux_src/drivers/net/usb/usbnet.c**. As shown in the following figure, first add the macro of **#define HUAWEI_VENDOR_ID 0x12d1**.

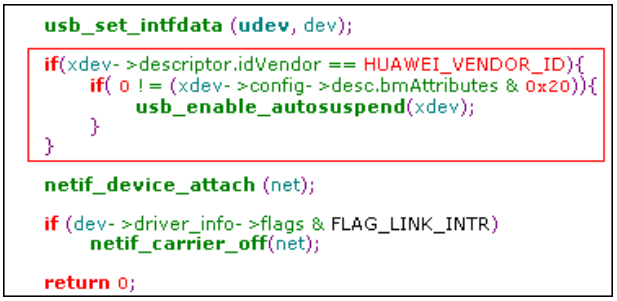



The details are as follows:

```
if(xdev->descriptor.idVendor == HUAWEI_VENDOR_ID){
        if( 0 != (xdev->config->desc.bmAttributes & 0x20)){
            usb_enable_autosuspend(xdev);
        }
    }
```

# 7.3 Power Management Integration for the CDC MBIM Serial Port Driver

To enable selective suspend feature, add the contents enclosed in the red rectangle in the following figure into the **usbnet_probe(……)** function in the **linux_src/drivers/net/usb/usbnet.c**. As shown in the following figure, first add the macro of **#define HUAWEI_VENDOR_ID 0x12d1**.




The details are as follows:

```
if(xdev->descriptor.idVendor == HUAWEI_VENDOR_ID){
        if( 0 != (xdev->config->desc.bmAttributes & 0x20)){
            usb_enable_autosuspend(xdev);
        }
```

# 7.4 Delay Time for Selective Suspend Mode

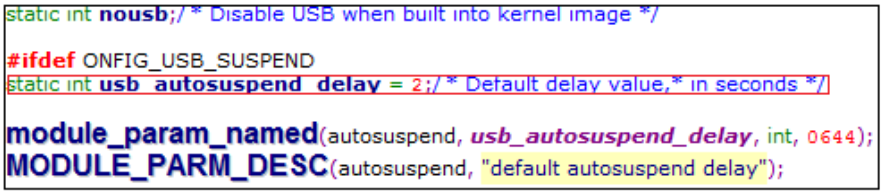
When the power management is enabled, the delay time for selective suspend is 2s by default. That is to say, if the USB communication between the terminal equipment and module is idle for more than 2s, the USB HOST will make USB module go into suspend automatically. The customer can change the delay time based on actual needs and information in Table 7-1 .

**Table 7-1** Minimum delay time for selective suspend mode

| Module Name | Minimum Delay Time for Selective Suspend Mode | Reason |
|---|---|---|
| MU736 | 5s | The GPS data submission cycle will be relatively long for the first time. Setting the minimum delay time as 5s guarantees sufficient time for data submission. |

Modifications need be made in the information in the red rectangle shown in Figure 7-4 .

**Figure 7-4** Modifying area




The details are as follows:

```
static int usb_autosuspend_delay = 2;/* Default delay value,* in
seconds */
```

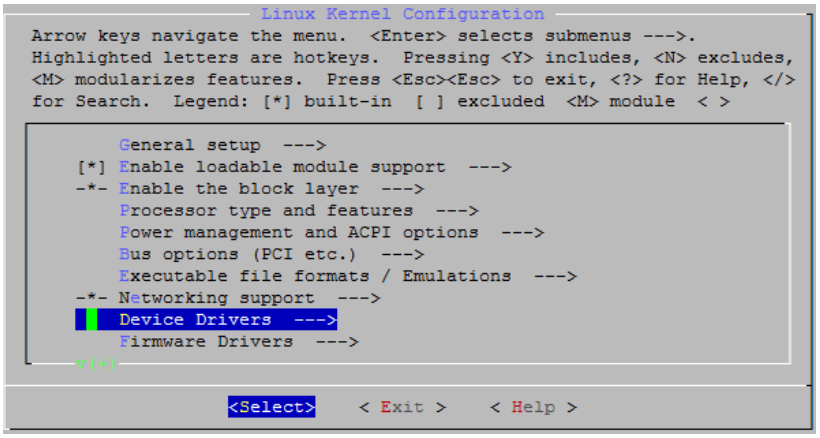
Change the value of **usb_autosuspend_delay** to a desired delay time.

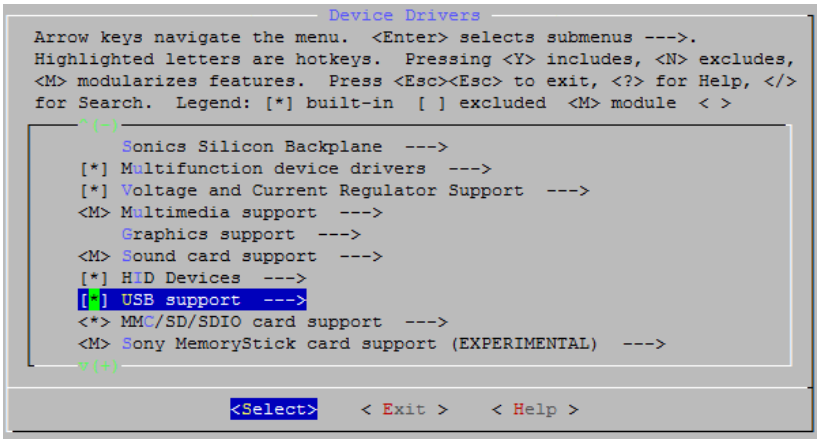
**NOTE**

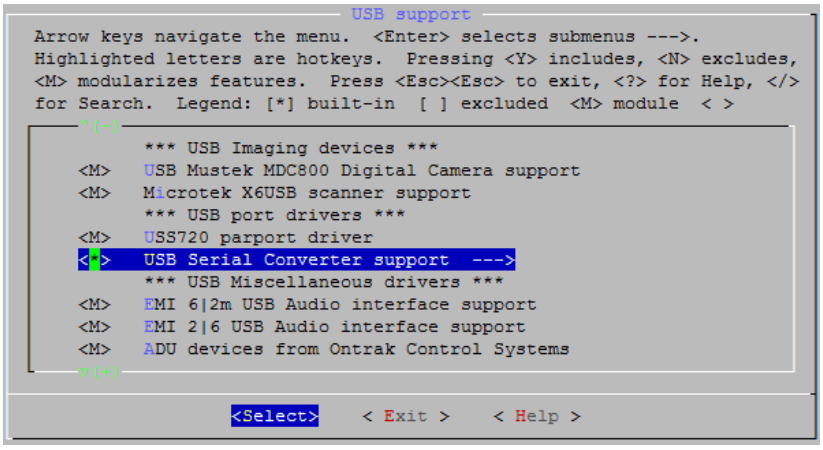
- Make sure the delay time is longer than the GPS data submission cycle; otherwise the product may enter suspend mode before a GPS data submission cycle ends.
- See AT^WPDFR in module's AT Command Interface Specification for the time settings of the GPS data submission cycle. By default, the GPS data submission cycle is 1s, and the minimum delay time for the selective suspend mode is 2s.

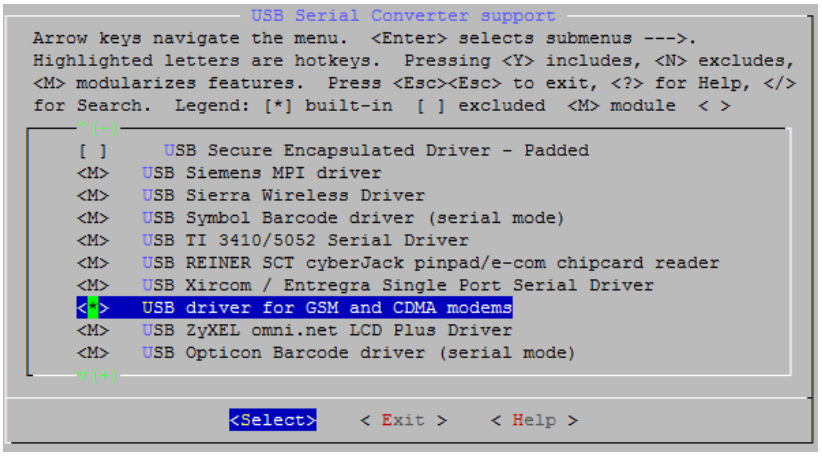
# 8 make menuconfig Configuration

## 8.1 Compilation Configuration Options for USB Serial Port Driver

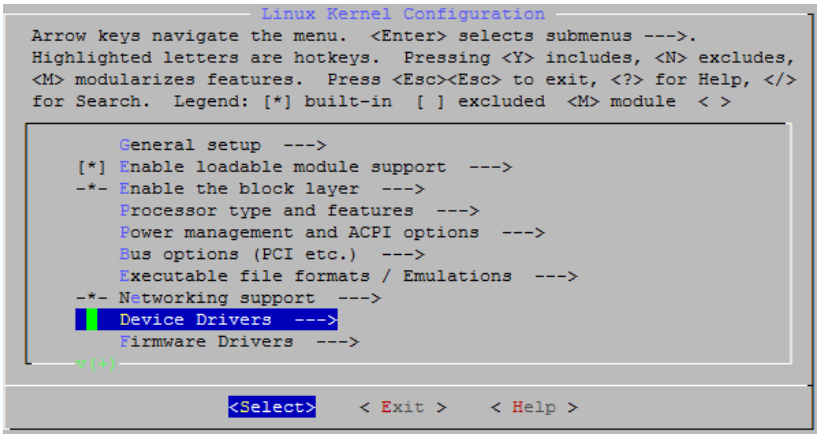


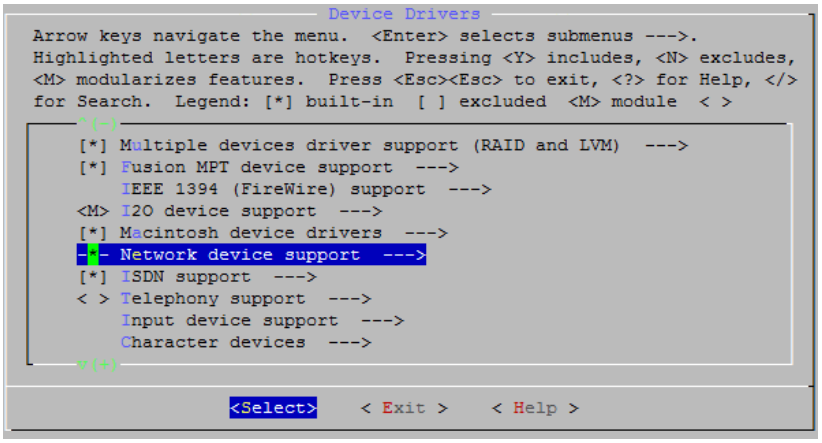



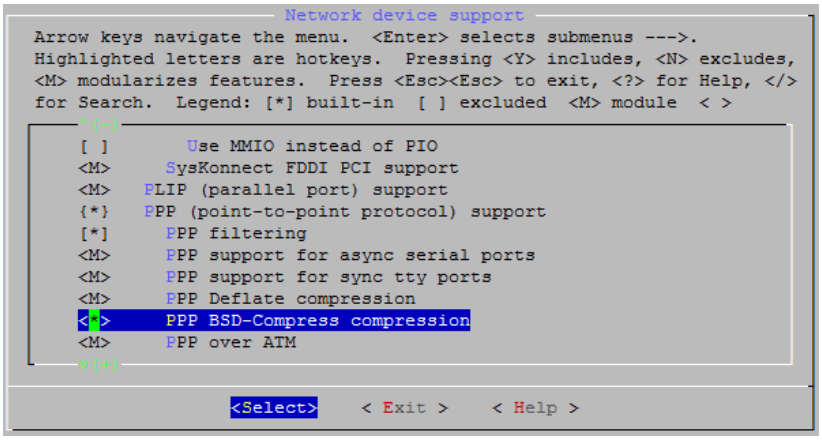


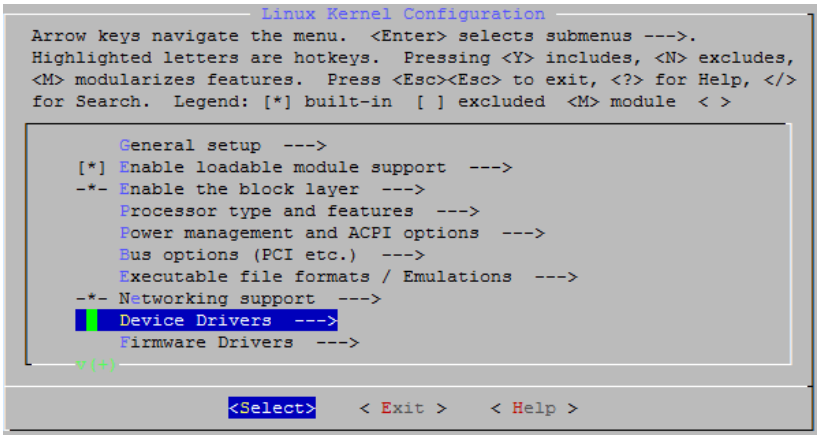

# 8.2 Configuration Options Related to PPP Dial-up

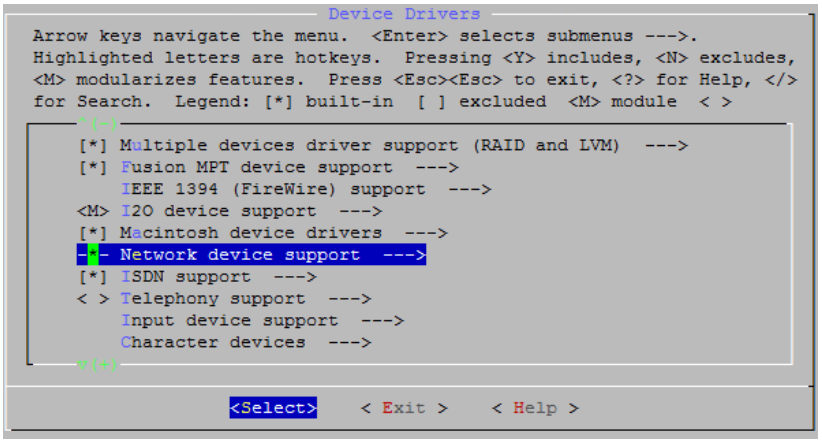


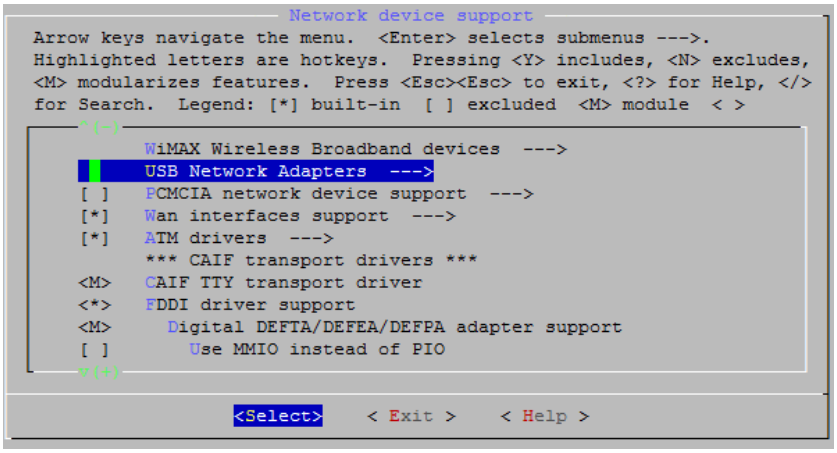


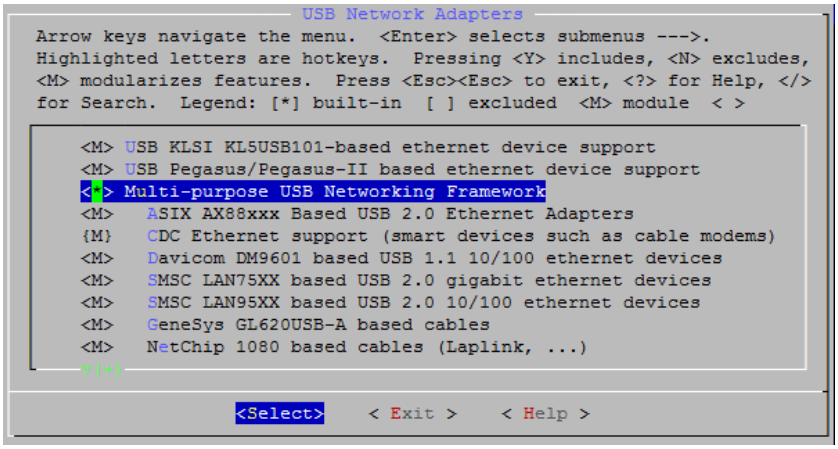



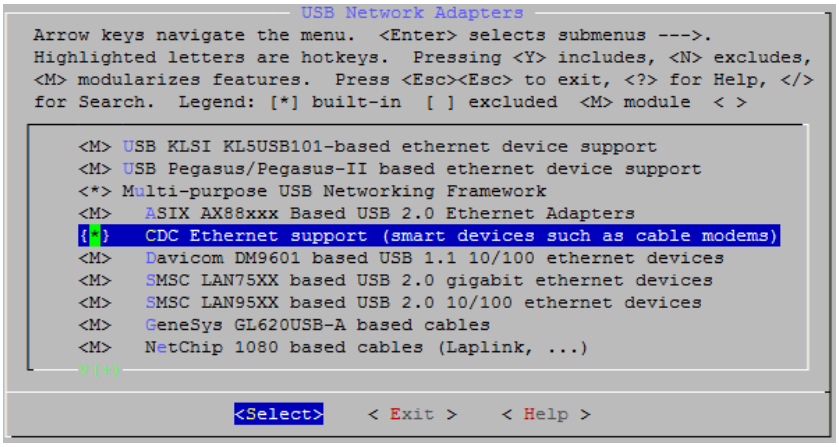

# 8.3 Compilation Configuration Options for CDC ECM Driver



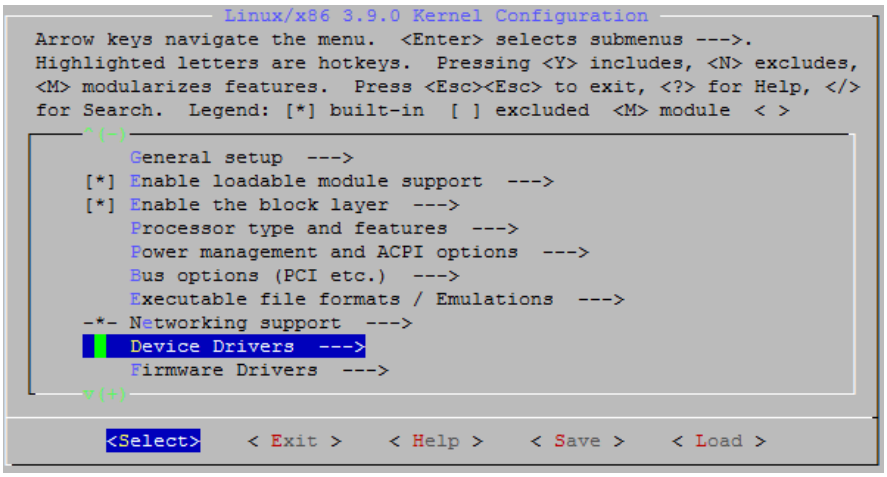


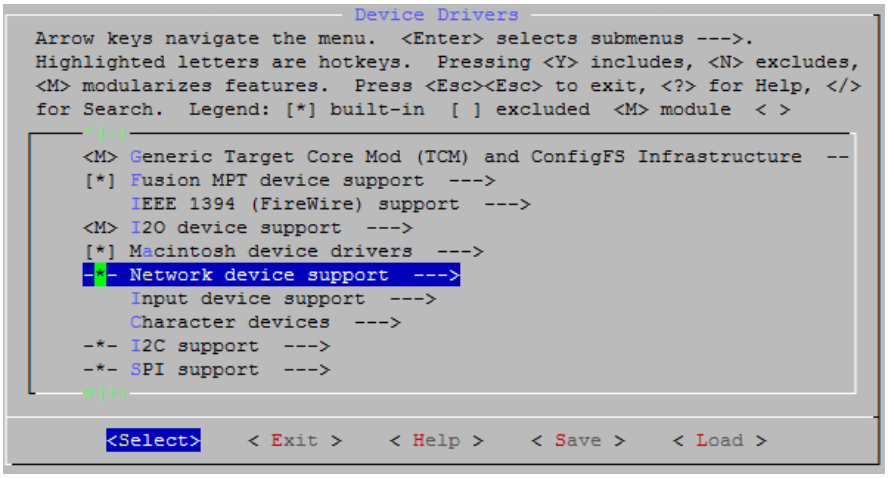



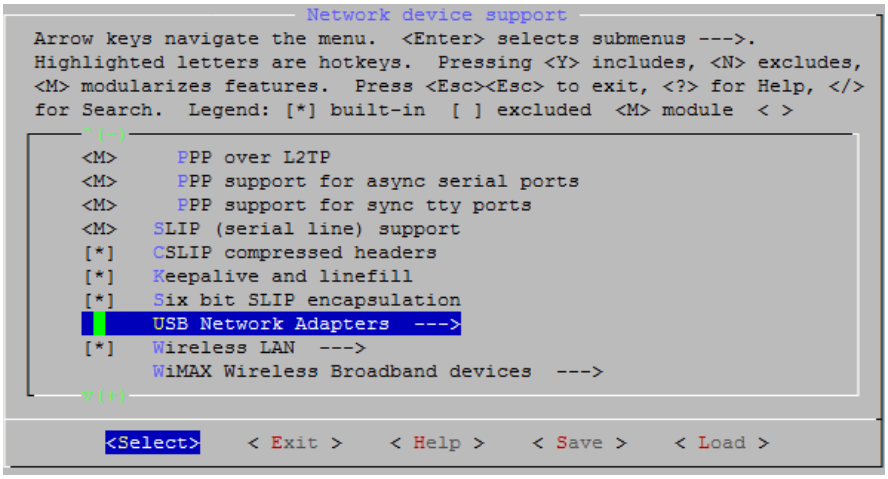



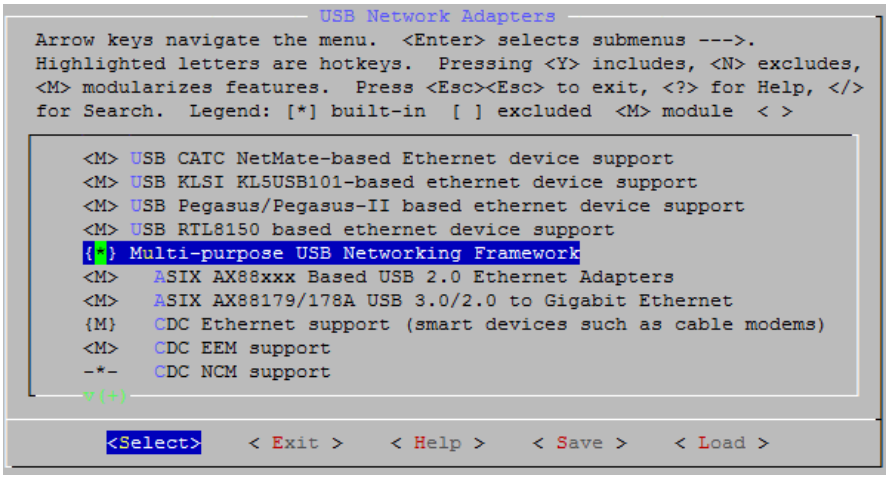


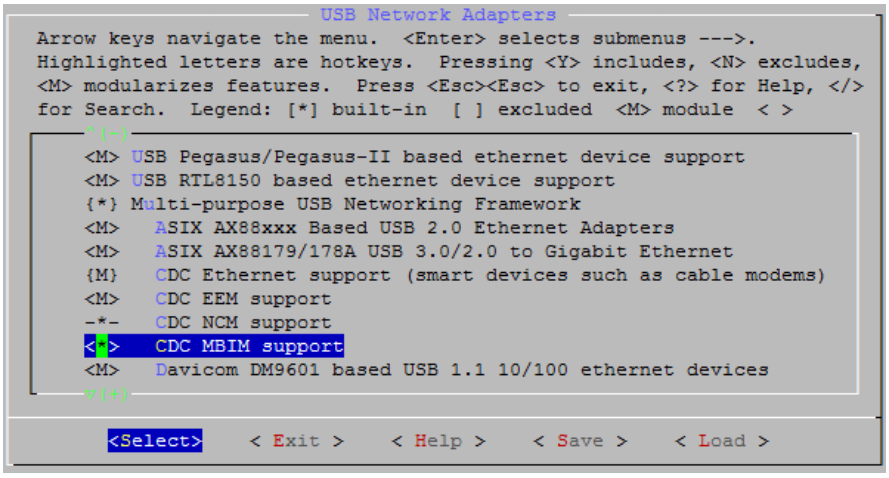

# 8.4 Compilation Configuration Options for CDC MBIM Driver



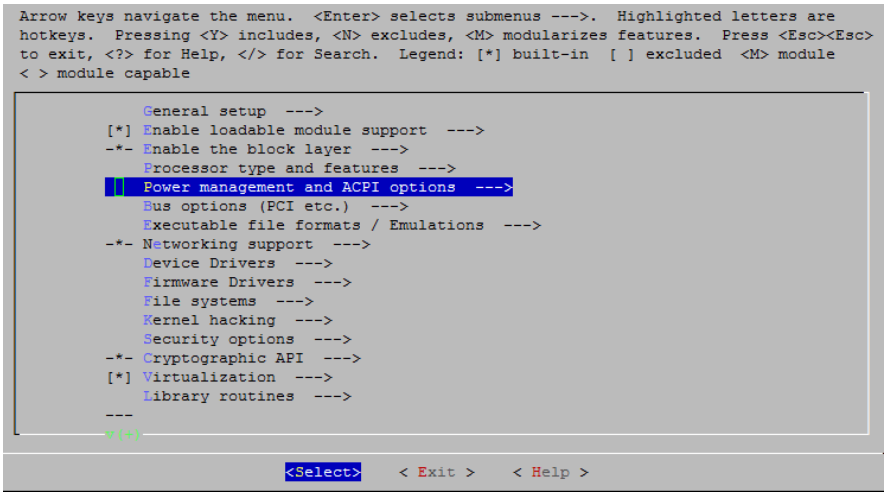



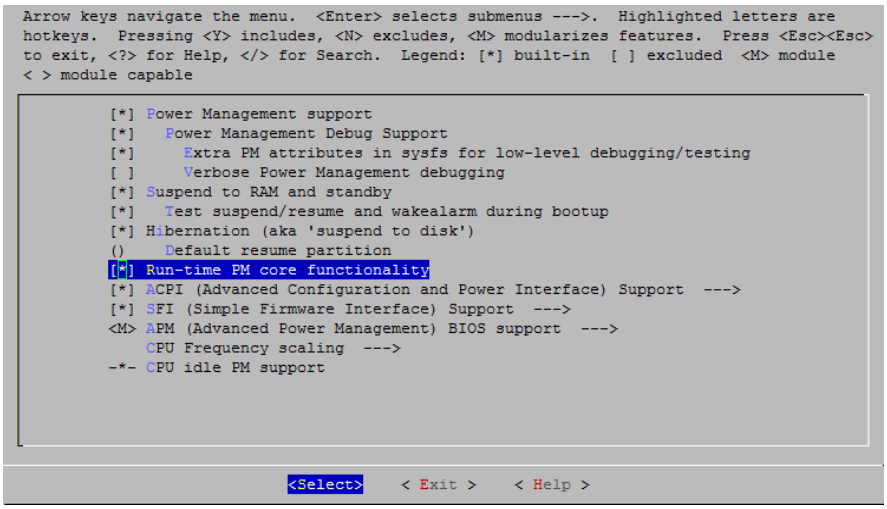


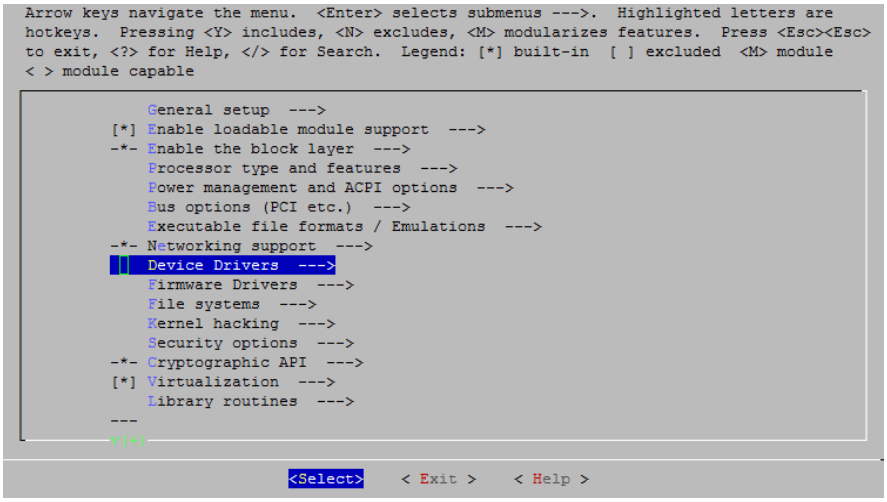



# 8.5 Configuration Options for Power Management



```
Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
hotkeys.  Pressing <Y> includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc>
to exit, <?> for Help, </> for Search.  Legend: [*] built-in  [ ] excluded  <M> module
< > module capable
        [*] SPI support  --->
            PPS support  --->
        -*- GPIO Support  --->
        {M} Dallas's 1-wire support  --->
        -*- Power supply class support  --->
        {*} Hardware Monitoring support  --->
        -*- Generic Thermal sysfs driver  --->
        [*] Watchdog Timer Support  --->
            Sonics Silicon Backplane  --->
        [*] Multifunction device drivers  --->
        [*] Voltage and Current Regulator Support  --->
        <M> Multimedia support  --->
            Graphics support  --->
        <M> Sound card support  --->
        [*] HID Devices  --->
        [*] USB support  --->
        <*> MMC/SD/SDIO card support  --->
                <Select>    < Exit >    < Help >
```

```
Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
hotkeys.  Pressing <Y> includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc>
to exit, <?> for Help, </> for Search.  Legend: [*] built-in  [ ] excluded  <M> module
< > module capable
        --- USB support
        (*)   Support for Host-side USB
        [ ]     USB verbose debug messages
        [*]     USB announce new devices
                *** Miscellaneous USB options ***
        [ ]     USB device filesystem (DEPRECATED)
        [*]     USB device class-devices (DEPRECATED)
        [*]     Dynamic USB minor allocation
        [*]     USB runtime power management (suspend/resume and wakeup)
        <*>     USB Monitor
        <M>     Support WUSB Cable Based Association (CBA)
        [ ]       Enable CBA debug messages
                *** USB Host Controller Drivers ***
        <M>     Cypress C67x00 HCD support
        <*>     EHCI HCD (USB 2.0) support
        [*]       Root Hub Transaction Translators
        <M>     OXU210HP HCD support
                <Select>    < Exit >    < Help >
```

# 9 FAQ

## 9.1 How to check whether the correct USB serial port driver exists in the kernel?

Open **Terminal** and run the command **dmesg** to check the kernel log information. If the following information (or similar information) exists in the kernel log, the correct USB serial port driver has been integrated into the kernel.

```
[1558586.308060] usb 1-1.2: new high-speed USB device number 7 using ehci-pci
[1558586.402563] usb 1-1.2: New USB device found, idVendor=12d1, idProduct=1404
[1558586.402568] usb 1-1.2: New USB device strings: Mfr=3, Product=2, SerialNumber=0
[1558586.402571] usb 1-1.2: Product: HUAWEI MOBILE WCDMA EM770W
[1558586.402574] usb 1-1.2: Manufacturer: HUAWEI Technology
[1558586.404738] option 1-1.2:1.0: GSM modem (1-port) converter detected
[1558586.404916] usb 1-1.2: GSM modem (1-port) converter now attached to ttyUSB0
[1558586.405016] option 1-1.2:1.1: GSM modem (1-port) converter detected
[1558586.405168] usb 1-1.2: GSM modem (1-port) converter now attached to ttyUSB1
[1558586.405260] option 1-1.2:1.2: GSM modem (1-port) converter detected
[1558586.405389] usb 1-1.2: GSM modem (1-port) converter now attached to ttyUSB2
[1558586.405459] option 1-1.2:1.3: GSM modem (1-port) converter detected
```

## 9.2 How to check whether the correct CDC ECM serial port driver exists in the kernel?

Open **Terminal** and run the command **dmesg** to check the kernel log information. If the information in the red rectangle in the following figure exists in the kernel log, the correct CDC ECM serial port driver has been integrated into the kernel.

```
[  226.168555] usb 2-1.2: USB disconnect, device number 3
[  226.170773] cdc_ether 2-1.2:2.0 eth0: unregister 'cdc_ether' usb-0000:00:1d.0
-1.2, CDC Ethernet Device
[  226.177183] option1 ttyUSB0: GSM modem (1-port) converter now disconnected fr
om ttyUSB0
[  226.177198] option 2-1.2:2.2: device disconnected
[  257.419920] usb 2-1.2: new high-speed USB device number 4 using ehci-pci
[  257.536485] usb 2-1.2: New USB device found, idVendor=12d1, idProduct=1573
[  257.536489] usb 2-1.2: New USB device strings: Mfr=2, Product=3, SerialNumber
=4
[  257.536493] usb 2-1.2: Product: HUAWEI Mobile
[  257.536496] usb 2-1.2: Manufacturer: HUAWEI Technology
[  257.536498] usb 2-1.2: SerialNumber: 0123456712ABCA17
[  257.595410] cdc_ether 2-1.2:2.0 eth0: register 'cdc_ether' at usb-0000:00:1d.
0-1.2, CDC Ethernet Device, 00:1e:10:1f:00:00
[  257.608340] option 2-1.2:2.2: GSM modem (1-port) converter detected
[  257.608735] usb 2-1.2: GSM modem (1-port) converter now attached to ttyUSB0
```

# 9.3 How to obtain the port mapping information of the board?

Step 1 Run the command **dmesg** to check whether the driver for Huawei modules has been loaded successfully. If the information in the red rectangle in the following figure exists in the kernel log, the correct driver has been loaded successfully. (The value of **idProduct** varies with the actual product.)

```
[  226.168555] usb 2-1.2: USB disconnect, device number 3
[  226.170773] cdc_ether 2-1.2:2.0 eth0: unregister 'cdc_ether' usb-0000:00:1d.0
-1.2, CDC Ethernet Device
[  226.177183] option1 ttyUSB0: GSM modem (1-port) converter now disconnected fr
om ttyUSB0
[  226.177198] option 2-1.2:2.2: device disconnected
[  257.419920] usb 2-1.2: new high-speed USB device number 4 using ehci-pci
[  257.536485] usb 2-1.2: New USB device found, idVendor=12d1, idProduct=1573
[  257.536489] usb 2-1.2: New USB device strings: Mfr=2, Product=3, SerialNumber
=4
[  257.536493] usb 2-1.2: Product: HUAWEI Mobile
[  257.536496] usb 2-1.2: Manufacturer: HUAWEI Technology
[  257.536498] usb 2-1.2: SerialNumber: 0123456712ABCA17
[  257.595410] cdc_ether 2-1.2:2.0 eth0: register 'cdc_ether' at usb-0000:00:1d.
0-1.2, CDC Ethernet Device, 00:1e:10:1f:00:00
[  257.608340] option 2-1.2:2.2: GSM modem (1-port) converter detected
[  257.608735] usb 2-1.2: GSM modem (1-port) converter now attached to ttyUSB0
```

Step 2 Run the command **ls /dev/ttyUSB*** to query the device file names of Huawei modules' ports (such as the Modem and PCUI ports)

```
root@localhost:~/linux-3.9# ls /dev/ttyUSB*
/dev/ttyUSB0  /dev/ttyUSB1  /dev/ttyUSB2  /dev/ttyUSB3  /dev/ttyUSB4  /dev/ttyUSB5
```

For most of Huawei modules, the device file name of the Modem port is **/dev/ttyUSB0**, the device file name of the Diag port is **/dev/ttyUSB1** and the device file name of the PCUI port is **/dev/ttyUSB2**.

# 9.4 What can I do if the port number does not start from ttyUSB0?

Check the ttyUSB port usage. Check whether the ttyUSB port is released when the module is disconnected.

# 9.5 How do I manually load the USB serial port driver?

Confirm that the compilation configuration described in chapter 4 "USB Serial Port Driver Integration" is complete.

Step 1 Query the module VID and PID.

In Linux, run the **lsusb** command to obtain the VID and PID. If this command is not supported, query the VID and PID in Windows or follow the instructions in the module documentation.

If the VID is **12D1** and PID **1573**, the module is identified correctly.

Step 2 Open **Terminal** and run **echo "12d1 1573" >/sys/bus/usb-serial/drivers/option1/new_id**.

Step 3 Run **dmesg** or **ls /dev/ttyUSB***.

***** specifies the port number.

# 9.6 How do I provide required logs if port mapping fails or the corresponding ports are not found?

Step 1 Open **Terminal**, run the command **dmesg**, and save the output to the **dmesg.txt** file.

Step 2 Run the command **ls –l /sys/bus/usb/drivers/** and save the output to the **logcat.txt** file. Make sure the **option** folder is available under **/sys/bus/usb/drivers/** where the **logcat.txt** file is placed.

Step 3 Run the command **ls –l /sys/bus/usb/drivers/option/***/** and save the output to the **logcat.txt** file.

Step 4 Run the command **cat /sys/bus/usb/drivers/option/***/bInterface*** and save the output to the **logcat.txt** file.

Step 5 Run command the **cat /proc/bus/usb/devices** and save the output to the **logcat.txt** file. If the command cannot be executed, skip this step.

# 10 Abbreviations

| Abbreviations | Full Spelling |
|---|---|
| CDC | Communications Device Class |
| CDMA | Code Division Multiple Access |
| ECM | Ethernet Networking Control Model |
| GPS | Global Positioning System |
| LTE | Long Term Evolution |
| MBIM | Mobile Broadband Interface Model |
| OS | Operating system |
| PPP | Point-to-Point Protocol |
| USB | Universal Serial Bus |
| WCDMA | Wideband Code Division Multiple Access |