

LTE Standard UAC

Application Note

LTE Standard Module Series

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About the Document

History

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1 Introduction

This document mainly introduces the general operation procedures of UAC (USB Audio Class) function of LTE Standard modules, and the modules are listed below.

Table 1: Applicable Modules

LTE Standard Module Series	EC2x: EC25, EC21, EC20 R2.0, EC20 R2.1
	EG2x-G: EG25-G, EG21-G
	EG9x: EG91, EG95

2 Overview

The voice path of the UAC function is shown in the following Figure.

UAC (USB Audio Class) is an audio protocol class in the USB specification. In UAC mode, the module is recognized as a USB sound card in the host device, and an "AC Interface" device appears in the host device manager. Standard third-party audio library such as *alsa-lib* can be used to run the audio application on Linux device (host device), and some third-party tools can also be used to play/record the application on Windows devices.

In voice call status, the module obtains voice data through the air interface. The DSP decodes the data into voice PCM stream and the stream will be transferred to the device by the USB bus. Therefore, the audio application in the host device can obtain PCM data through the USB sound card, and transfer the voice data to the speaker. Similarly, after recording voice through a microphone on the device, the data will be transferred in the opposite direction. Please note that the UAC function of LTE Standard modules only support mono, and the PCM data must be to 8KHz sample rate and 16-bit linear format.

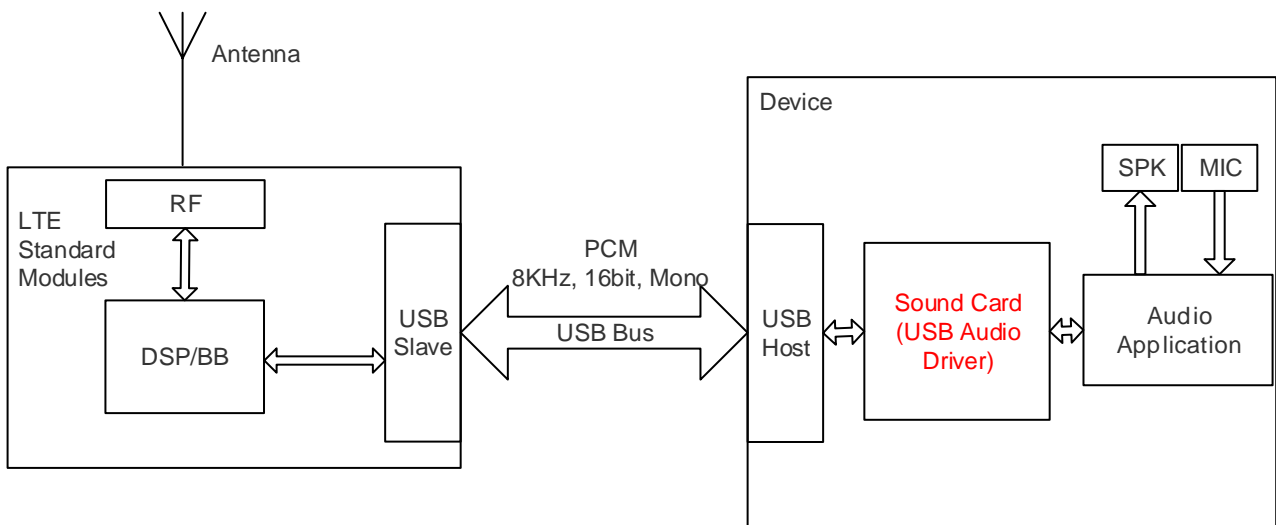


Figure 1: Voice Path of UAC Function

3 Description of AT Command

LTE Standard modules support **AT+QPCMV** command to enable/disable the UAC function. After the function is enabled, when a call is made, the voice data from the opposite side will be decoded into PCM data by the module, and then be outputted to the device through the configured USB port. In the meantime, the device writes the PCM data to the port and the data will be transferred to the other end of the calling device over the network. When the call ends, no data is to be outputted and the inputted data is invalid. The outputted and inputted PCM data must be set to 8KHz sample rate and 16-bit linear format.

AT+QPCMV Enable/Disable UAC Function	
Test Command AT+QPCMV=?	Response +QPCMV: (0,1),(0-2) OK
Read Command AT+QPCMV?	Response +QPCMV: <enable>[,<option>] OK
Write Command AT+QPCMV=<enable>[,<option>]	Response OK or ERROR
URC	+QPCMV: 0 or +QPCMV: 1

Parameter

<enable>	Enable/disable UAC function <ul style="list-style-type: none"> <u>1</u> Enable 0 Disable
<option>	Configure the port or sound card for PCM data transmission <ul style="list-style-type: none"> 0 USB NMEA mode, which is not supported by LTE Standard modules. 1 Debug UART mode with baud rate 230400bps, which is not supported by LTE Standard modules. 2 UAC mode. LTE Standard modules serve as a USB sound card in the mode.

NOTES

1. The settings take effect immediately. The parameters are not saved and will restore to default values after the module is restarted.
2. If the modem outputs URC **+QPCMV: 0**, it means the modem is busy, unable to receive more PCM data, and stop sending PCM data. If the modem outputs URC **+QPCMV: 1**, it means the modem is ready to receive more PCM data.
3. If UAC mode is used, USB audio device must be enabled via **AT+QCFG="USBCFG",0x2C7C,0x0125,x,x,x,x,x,1** and **AT+QPCMV=1,2**. For more details about the two commands, please contact Quectel Technical Support Team.

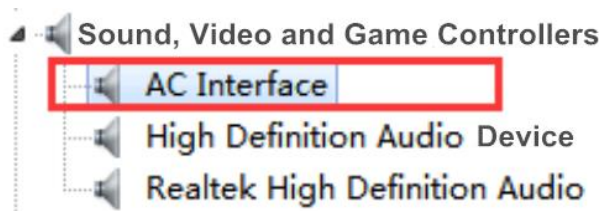
4 Operation Procedures

This chapter describes the detailed operation procedures of the UAC function of LTE Standard modules.

4.1. Operation Procedures of UAC

Step 1: Power on the module, and it will connect to the network automatically.

Step 2: Execute **AT+QCFG="USBCFG",0x2C7C,0x0125,x,x,x,x,x,1** on the USB AT port to enable the UAC device of the module ("x" in the commands means variable value, which can only be 0 or 1). Setting the seventh function parameter in the command to 1 enables the UAC device, and keep other parameters unchanged as the corresponding values of the returned URC for other USB configuration. For example, check USB function setting firstly by executing **AT+QCFG="USBCFG"**, and URC **+QCFG: "USBCFG",0x2C7C,0x0125,1,1,1,1,1,0** will be returned. Then **AT+QCFG="USBCFG",0x2C7C,0x0125,1,1,1,1,1,1** should be executed to enable the UAC device on the module. (This step only needs to be performed once if customers do not upgrade the firmware.)



NOTE

If **AT+QCFG="USBCFG"** has only 6 function parameters, the current firmware does not support AT command to enable the UAC sound card device.

Step 3: Execute **AT+QPCMV=1,2** on the USB AT port to enable UAC function.

Step 4: Execute **ATD** to make a call or **ATA** to answer the call on the USB AT port.

Step 5: Audio driver on the device receives 640 bytes of PCM data through the USB sound card every 40ms and immediately send the data to the host through USB.

Step 6: Audio driver on the device obtains voice data through DSP. It is required that the PCM application should send 1600 bytes of voice data to the USB sound card at an interval of 100ms.

Step 7: Execute **ATH** to end the call.

Step 8: Execute **AT+QPCMV=0** on the USB AT port to disable UAC function.

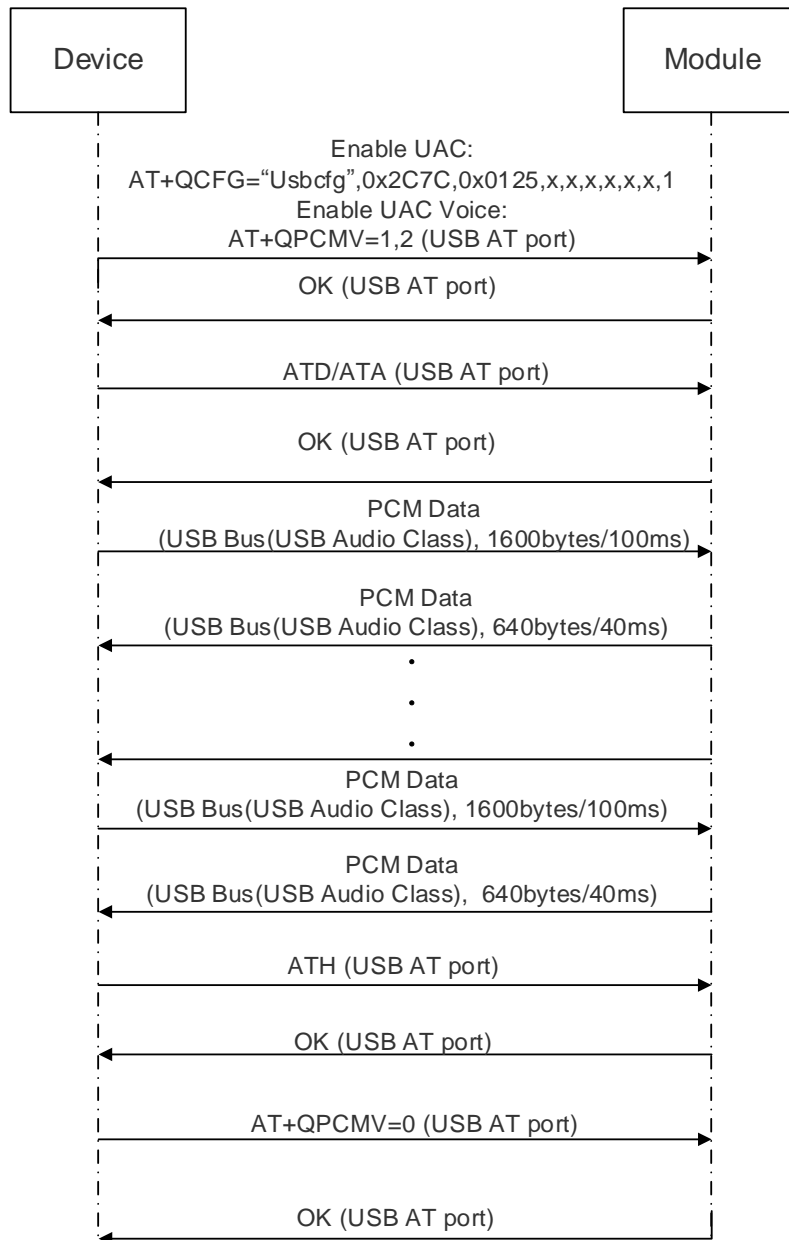


Figure 2: Operation Procedures of UAC Function

4.2. UAC Use in Host PC for Windows

4.2.1. UAC Use in Windows Devices

USB sound card driver (UAC device driver) is included in Windows system. Therefore, when the USB sound card device is enabled and module USB interface is connected to Windows device, a USB sound card device "AC Interface" will be found in the device manager. If there is no USB sound card device in the device manager but an unrecognized device with a yellow exclamation point, the USB sound card driver needs to be upgraded by using the Windows built-in or a third-party driver tool. Then the USB sound card can be used to play or record the voice data of the call as a normal sound card.

4.2.2. UAC Use in Linux Devices

Step 1: Add VID and PID.

In order to recognize the module, the following module VID and PID information should be added to the file `[KERNEL]/drivers/usb/serial/option.c`.

```
static const struct usb_device_id option_ids[] = {
#if 1 //Added by Quectel
    { USB_DEVICE(0x2C7C, 0x0121) }, /* Quectel EC21 */
    { USB_DEVICE(0x2C7C, 0x0125) }, /* Quectel EC25/EC20 R2.0/EC20 R2.1 */EG25G/EG21G
    { USB_DEVICE(0x2C7C, 0x0191) }, /* Quectel EG91 */
    { USB_DEVICE(0x2C7C, 0x0195) }, /* Quectel EG95 */
#endif
```

Also, the following information should be added for different Linux kernel versions.

For Linux kernel version later than 2.6.30, the following information should be added to the file `[KERNEL]/drivers/usb/serial/option.c`.

```
static int option_probe(struct usb_serial *serial, const struct usb_device_id *id) {
    struct usb_wwan_intf_private *data;
    .....
#if 1 //Added by Quectel
//Quectel EC25&EC21&EC20 R2.0&EC20 R2.1&EG91&EG95&EG25G&EG21G's interface 4 can be
used as USB sound card device
    if (serial->dev->descriptor.idVendor == cpu_to_le16(0x2C7C)
        && serial->interface->cur_altsetting->desc.bInterfaceNumber >= 4)
        return -ENODEV;
#endif
    /* Store device id so we can use it during attach. */
    usb_set_serial_data(serial, (void *)id);
    return 0;
}
```

```
}
```

For Linux kernel version older than 2.6.31, the following information should be added to the file `[KERNEL]/drivers/usb/serial/option.c`.

```
static int option_startup(struct usb_serial *serial)
{
.....
dbg("%s", __func__);
#if 1 //Added by Quectel
//Quectel EC25&EC21&EC20 R2.0&EC20 R2.1&EG91&EG95&EG25G&EG21G's interface 4 can be
used as USB sound card device
    if (serial->dev->descriptor.idVendor == cpu_to_le16(0x2C7C)
        && serial->interface->cur_altsetting->desc.bInterfaceNumber >= 4)
        return -ENODEV;
#endif
.....
}
```

For more details, please refer to **document [1]**.

Step 2: Enable USB sound function, and rebuild the Linux kernel.

Run `make menuconfig` command, then enable USB sound function in Linux kernel menuconfig interface by choosing the following options in turn.

- [*] Device Drivers →
- [*] Sound card support →
- [*] Advanced Linux Sound Architecture →
- [*] USB sound devices →

```
.config - Linux/arm 4.14.52 Kernel Configuration
Device Drivers  Sound card support  Advanced Linux Sound Architecture
Advanced Linux Sound Architecture
Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty 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

(-)
[*]  Verbose procfs contents
[ ]  Verbose printk
[ ]  Debug
<*> Sequencer support
< >  Sequencer dummy client
<*>  OSS Sequencer API
[*]  Use HR-timer as default sequencer timer
[*]  Generic sound devices --->
    HD-Audio ----
(64) Pre-allocated buffer size for HD-audio driver
[*]  ARM sound devices ----
[ ]  SPI sound devices ----
[*]  USB sound devices --->
<*>  ALSA for SoC audio support --->

<Select>  < Exit >  < Help >  < Save >  < Load >
```

Then rebuild the Linux kernel and reboot the device.

Step 3: Use and verify the UAC function.

Restart customers' Linux device and connect the module through the USB port. Then a new sound card device will be found in the path `/dev/snd`, and customers can use it as a normal sound card device through a third-party audio tool or a third-party audio library. But the PCM data format is fixed at 8KHz sampling rate and 16bit linear.

The source code for tinyalsa tool can be acquired from <https://github.com/tinyalsa/tinyalsa>.

Run the following two commands with tinyalsa tool to play and record the voice respectively. The "x" in the commands is the sound card number of customers' device.

Voice play:

```
tinypplay music.wav -D x -d 0 -c 1 -r 8000
```

Voice recording:

```
tinycap rec.wav -D x -d 0 -c 1 -r 8000
```

5 Appendix A References

Table 2: Related Documents

SN	Document Name	Remark
[1]	Quectel_LTE&5G_Linux_USB_Driver_User_Guide	Linux USB driver user guide for LTE and 5G modules

Table 3: Terms and Abbreviations

Abbreviation	Description
DSP	Digital Signal Processing
NMEA	National Marine Electronics Association
PCM	Pulse Code Modulation
UAC	USB Audio Class
USB	Universal Serial Bus