EC2x&AG35-QuecOpen Linux 侧低功耗问题调试

LTE Standard/Automotive Module Series

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前言

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文档历史

修订记录

版本	日期	作者	变更表述
1.0	2018-09-29	高飞虎	初始版本
1.1	2018-10-15	高飞虎	添加 QMI 信息类型

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1 引言

本文研究对象 Linux 侧低功耗问题的调试，主要问题类别有 3 类；

1. 使能自动休眠但 Linux 未进入休眠流程
2. 进入休眠流程但中途被打断
3. 休眠成功后 Linux 被唤醒

本文档主要适用于 Global 市场，目前适用该文档的 LTE Standard/Automotive 模块包括：

- EC2x: EC20 R2.1/EC25/EC21
- AG35

2 使能 Autosleep 但系统未进入休眠流程

使用下面指令查看当前系统内持有的唤醒锁；

awk '$6 != 0 {print $1"   "$6}' /sys/kernel/debug/wakeup_sources

1. 类似下面，如果出现**"msm_otg"**则说明 USB_vbus 处于高电平状态，目前设计需要将 vbus 断开才能休眠；

```
~ # awk '$6 != 0 {print $1"   "$6}' /sys/kernel/debug/wakeup_sources
name    active_since
msm_otg   77464
~ #
```

2. 如果出现**"DATA1"**,则说明 SMD7 通道在进行数据交互，需要停掉才能休眠；

```
~ # awk '$6 != 0 {print $1"   "$6}' /sys/kernel/debug/wakeup_sources
name    active_since
DATA1   448
msm_otg   1105442
~ #
```

3. **"DATA2"**表示 SMD9 通道在进行数据交互，需要停掉才能休眠；

```
name    active_since
DATA2   16810
7c40000.qcom,emac    480654
msm_otg   878109
```

4. **"DATA4"**表示 SMD8 通道在进行数据交互，需要停掉才能休眠；

```
name    active_since
DATA4   8465
msm_otg   132022
root@mdm9607-perf:~# ati
```

5. 如果出现**"bam_dmux_wakelock"**，则说明在 rmnet_data 网口上有数据交互，需要停止数据的交互；

```
~ # awk '$6 != 0 {print $1"   "$6}' /sys/kernel/debug/wakeup_sources
name    active since
bam_dmux_wakelock   1714
msm_otg   226735
~ #
```

6. 如果出现**"qcom.emac"**，目前的做法是在进休眠前调用 *ql_sgmii_disable()*接口关闭以太网;


```
root@mdm9607-perf:~# awk '$6 != 0 {print $1" "$6}' /sys/kernel/debug/wakeup_sou
rces
name    active_since
7c40000.qcom,emac  19544
msm_otg  416999
root@mdm9607-perf:~#
root@mdm9607-perf:~#
root@mdm9607-perf:~# []
```

3 开始休眠流程但中途被打断

另一种情况，作为第 1 类的衍生，当 SMD 数据或者 UART 数据交互的频率不是连续的，是以大约 500ms 为周期进行交互，那么刚好 Autosleep 机制进入休眠流程，但是没有完全进入休眠，就会被突然过来的数据中断休眠，如下：

执行命令，前台输出内核日志：

~ # echo 1 > /sys/module/printk/parameters/perf_mode_console

1. 休眠中途被串口数据打断了，所以再要进休眠，上位机不要继续给模块发数据；

```
[  284.050525] PM: suspend entry 2018-08-03 08:55:59.211297805 UTC
[  284.056103] PM: Syncing filesystems ... done.
[  284.077351] Freezing user space processes ...
[  284.083198] Error: returning -512 value
[  284.089076] mbim_read: Waiting failed
[  284.094159] PM: Wakeup pending, aborting suspend
[  284.097869] last active wakeup source: 78b1000.uart
[  284.102857]
[  284.104099] Freezing of tasks aborted after 0.021 seconds
[  284.109478] Restarting tasks ... done.
[  284.130672] cpufreq: Frequency violation fixed for CPU0
[  284.135449] Abort: Last active Wakeup Source: 78b1000.uart
[  284.141079] PM: suspend exit 2018-08-03 08:55:59.301853846 UTC
[  284.162038] msm_otg 78d9000.usb: phy_reset: success
[  284.280462] msm_otg 78d9000.usb: msm_otg_reset motg->inputs=1, motg->id_state=1
[  284.304682] msm_otg 78d9000.usb: USB exited from low power mode
```

2. SMD8 数据打断了休眠流程；SMD7, SMD9, rmnet_data 网口数据也类似；

```
[ 1598.106891] mbim_read: Waiting failed
[ 1598.109794] PM: Wakeup pending, aborting suspend
[ 1598.114556] active wakeup source: DATA4
[ 1598.118114]
[ 1598.119464] Freezing of tasks aborted after 0.022 seconds
[ 1598.125163] Restarting tasks ... done.
[ 1598.138415] PM: suspend exit 1980-01-06 00:48:42.302488036 UTC
[ 1598.155532] msm_otg 78d9000.usb: phy_reset: success
[ 1598.260784] msm_otg 78d9000.usb: msm_otg_reset motg->inputs=1, motg->id_state=1
[ 1598.267393] msm_otg 78d9000.usb: USB exited from low power mode
```

3. 当在模块上有网络设备(物理的以及虚拟的)加入或者离开时，如 rmnet， USB 网络，以太网，或者 WiFi，高通 QTI 服务会进行管理，管理的过程中会持有 QTI 的 Wakelock，也会打断休眠流程；

```
[  258.487912] Error: returning -512 value
[  258.492237] mbim_read: Waiting failed
[  258.497742] PM: Wakeup pending, aborting suspend
[  258.501950] last active wakeup source: ipc0000001b_qti
[  258.506539]
[  258.507953] Freezing of tasks aborted after 0.024 seconds
[  258.513412] Restarting tasks ... done.
[  258.531176] cpufreq: Frequency violation fixed for CPU0
[  258.536329] Abort: Last active Wakeup Source: ipc0000001b_qti
[  258.542184] PM: suspend exit 2018-08-03 08:53:04.053850164 UTC
```

4 休眠成功后被唤醒

系统一旦休眠下去，不是所有事件都可以唤醒 Linux 的，默认支持 USB vbus 中断唤醒，QMI 消息（nas,wds,sms,voice 等），IP 数据报文（bam_dmux 通道），RTC 定时唤醒；以及客户增加的外部中断引脚；

执行以下命令打开详细日志

```
~ # echo 1 > /sys/module/printk/parameters/perf_mode_console
~ # echo 1 > /sys/module/msm_show_resume_irq/parameters/debug_mask
```

1. USB vbus 高电平唤醒;

```
[ 1682.5xxxxx] PM: suspend of devices complete after 15.xxx msecs
[ 1682.571021] PM: late suspend of devices complete after 2.048 msecs
[ 1682.573478] PM: noirq suspend of devices complete after 2.405 msecs
[ 1682.573513] CPU0:msm_cpu_pm_enter_sleep mode:3 during suspend
[ 1682.573513] __qpnpint_handle_irq: 294 triggered [0x0, 0xa1,0x0] vbus_det_irq
[ 1682.573513] gic_show_resume_irq: 200 triggered qcom,smd-rpm
[ 1682.573513] gic_show_resume_irq: 203 triggered 601d0.qcom,mpm
[ 1682.573513] gic_show_resume_irq: 222 triggered 200f000.qcom,spmi
[ 1682.575096] PM: noirq resume of devices complete after 1.110 msecs
[ 1682.579404] PM: early resume of devices complete after 2.404 msecs
```

2. IP 数据报文唤醒,走的是 smsm 通道与 QMI(SMD)是不同的, 中断号为 58；类似如下：

```
[  353.084021] PM: noirq suspend of devices complete after 2.057 msecs
[  353.084051] CPU0:msm_cpu_pm_enter_sleep mode:3 during suspend
[  353.084051] gic_show_resume_irq: 58 triggered qcom,smsm-modem
[  353.084051] gic_show_resume_irq: 200 triggered qcom,smd-rpm
[  353.086726] PM: noirq resume of devices complete after 0.773 msecs
[  353.089624] PM: early resume of devices complete after 2.156 msecs
```

3. QMI 唤醒通道为 SMD，唤醒事件包含 nas,wds,短信,电话等；中断号为 57;

```
[  495.106564] PM: noirq suspend of devices complete after 2.617 msecs
[  495.106601] CPU0:msm_cpu_pm_enter_sleep mode:3 during suspend
[  495.106601] gic_show_resume_irq: 57 triggered qcom,smd-modem
[  495.106601] gic_show_resume_irq: 200 triggered qcom,smd-rpm
```

4. RTC 定时唤醒
   9x07 平台上：

```
[  529.080910] PM: noirq suspend of devices complete after 2.411 msecs
[  529.080946] CPU0:msm_cpu_pm_enter_sleep mode:3 during suspend
[  529.080946] gic_show_resume_irq: 200 triggered qcom,smd-rpm
[  529.080946] gic_show_resume_irq: 203 triggered 601d0.qcom,mpm
[  529.082955] PM: noirq resume of devices complete after 1.117 msecs
[  529.084541] PM: early resume of devices complete after 1.016 msecs
```

9x28 平台上：

5 QMI 唤醒

5.1. QMI 唤醒分析

如果确认是 57 号中断唤醒了 Linux，那么我们可以执行以下命令进一步打开 IPCRTR 日志：

```
~ # echo 1 > /sys/module/printk/parameters/perf_mode_console
~ # echo 1 > /sys/module/msm_show_resume_irq/parameters/debug_mask
~ # echo 0x2 > /sys/module/ipc_router_core/parameters/debug_mask
```

QMI 唤醒事件到来时，会看到以下日志：

```
gic_show_resume_irq: 57 triggered qcom,smd-modem
[IPCRTR]   CLI RX Len:0xd T:0x1 CF:0x0 SVC:<0x3:0x1> SRC:<0x3:0x11> DST:<0x1:0x43> DATA:
51000b04 13000600
```

分析：

gic_show_resume_irq	irq 57 表示：Modem 通过 SMD 通道向 AP 侧发送 QMI 消息
CLI RX	QMI Client 收到消息，可能是 Response,也可能是 Indication,需要通过 DATA 字段区分
SVC:<0x3,0x1>	这里 0x3 代表 QMI msg id: NAS
DATA: 51000b04 13000600	这个字段逆序看 13000600 51000b04： 0x04 表示 Indication, 0x0051 根据下表表示 QMI_NAS_SIG_INFO_IND，即因为信号强度的改变而上报状态变化的 QMI msg.

表 1：常见 NAS 唤醒消息 Indication 参考

命令	ID	描述
QMI_NAS_ERR_RATE_IND	0x0053	Provides RAT-specific error rate information
QMI_NAS_SIG_INFO_IND	0x0051	Provides any change in signal strength status
QMI_NAS_RF_BAND_INFO_IND	0x0066	Reports current RF band information

QMI_NAS_SYS_INFO_IND	0x004E	Indicates a change in the system information
QMI_NAS_SERVING_SYSTEM_ IND	0x0024 indication	Indicates a change in the current serving system registration state and/or radio technology. (Deprecated)

5.2. QMI 服务类型值

以下为 QMI 服务类型值，具体看高通 QMI 文档

QMI service	QMI service type value
QMI_CTL (Control Service)	0x00
QMI_WDS (Wireless Data Service)	0x01
QMI_DMS (Device Management Service)	0x02
QMI_NAS (Network Access Service)	0x03
QMI_QOS (QoS Service)	0x04
QMI_WMS (Wireless Messaging Service)	0x05
QMI_PDS (Position Determination Service)	0x06
QMI_AUTH (Authentication Service)	0x07
QMI_AT (ATCoP) (Access Terminal Command Processor)	0x08
QMI_VOICE (Voice Service)	0x09
QMI_CAT (Card Application Toolkit)	0x0A
QMI_UIM (User Identity Module)	0x0B
QMI_PBM (Phone Book Manager)	0x0C
QMI_QCHAT (QChat™ Service)	0x0D
QMI_RMTFS (Remote File System)	0x0E
QMI_TEST (Test Service)	0x0F
QMI_LOC (Location Service)	0x10
QMI_SAR (Specific Absorption Rate)	0x11
QMI_IMS (IP Multimedia Subsystem)	0x12
QMI_ADC (Analog to Digital Converter)	0x13
QMI_CSD (Core Sound Driver)	0x14
QMI_MFS (Modem File System)	0x15
QMI_TIME (Time Service)	0x16
QMI_TS (Thermal Sensors)	0x17
QMI_TMD (Thermal Mitigation Device)	0x18
QMI_SAP (Service Access Proxy)	0x19
QMI_WDA (Wireless Data Administrative Service)	0x1A
QMI_TSYNC (TSync Control Interface)	0x1B
QMI_RFSA (Remote Filesystem Access)	0x1C

QMI service	QMI service type value
QMI_CSVT (Circuit-Switched Videotelephony)	0x1D
QMI_QCMAP (Qualcomm Mobile Access Point)	0x1E
QMI_IMSP (IP Multimedia Subsystem Presence)	0x1F
QMI_IMSVT (IP Multimedia Subsystem Videotelephony)	0x20
QMI_IMSA (IP Multimedia Subsystem Application)	0x21
QMI_COEX (Coexistence Service)	0x22
Reserved	0x23
QMI_PDC (Persistent Device Configuration)	0x24
Reserved	0x25
QMI_STX (Simultaneous Transmit Service)	0x26
QMI_BIT (Bearer Independent Transport)	0x27
QMI_IMSRTP (IP Multimedia Subsystem RTP)	0x28
QMI_RFRPE (Radio Frequency Radiated Performance Enhancement)	0x29
QMI_DSD (Data System Determination)	0x2A
QMI_SSCTL (Subsystem Control)	0x2B
QMI_MFSE (Modem File System External)	0x2C
QMI_FDS (Flash Driver Service)	0x2F
QMI_ATP (Application Traffic Pairing)	0x2E
QMI_DPM (Data Port Mapper)	0x2F
QMI_DFS (Data Filter Service)	0x30
QMI_IPA (Internet Protocol Accelerator Service)	0x31
QMI_UIMRMT (UIM Remote Service)	0x32
QMI_QDSSC (Qualcomm Debug Subsystem Control Service)	0x33
QMI_DHMS (Dynamic Heap Memory Sharing)	0x34
QMI_SSREQ (Subsystem Request)	0x35
QMI_CFCM (Common Flow Control Manager)	0x36
QMI_SLIM (Sensor Location Interface Manager)	0x37
QMI_LOWI (Location WiFi Interface)	0x38
QMI_WLPS (Wireless LAN Proxy Service)	0x39
QMI_WLS (WLAN Location Service)	0x3A
QMI_AOSTLM (Advanced Optional Software Technology Licensing Manager)	0x3B
QMI_HMON (Health Monitor)	0x3C
QMI_SFS (Secure File System)	0x3D
Reserved	0x3E–0xDF
QMI_CAT2 (Card Application Toolkit 2)	0xE0
QMI_RMS (Remote Management Service)	0xE1
QMI_OMA (Open Mobile Alliance – Device Management)	0xE2
Vendor-specific	0xE3–0xFF
Sensors services	0x0100–0x0132
Sensors reserved	0x0133–0x01FF
Femto reserved	0x0200–0x02FF

QMI service	QMI service type value
Obsolete	0x0300
QMI_SLIMBUS (SLIMbus®)	0x0301
QMI_IMSDCM (IP Multimedia Subsystem Data Connection Management)	0x0302
QMI_QUPM (Qualcomm Universal Peripheral Manager)	0x0303
General - Reserved Range	0x0304–0x03FF
QMI_QCMAP_MSGR (Qualcomm Mobile Access Point Messenger)	0x0400

5.3. QMI NAS Messages

Table 3-1 QMI_NAS messages

Command	ID	Description
QMI_NAS_RESET	0x0000	Resets the NAS service state variables of the requesting control point.
QMI_NAS_ABORT	0x0001	Aborts a previously issued QMI_NAS command.
QMI_NAS_SET_EVENT_REPORT	0x0002	Sets the NAS state reporting conditions for the requesting control point. (Deprecated)
QMI_NAS_EVENT_REPORT_IND	0x0002 indication	Indicates the NAS state change. (Deprecated)
QMI_NAS_INDICATION_REGISTER	0x0003	Sets the registration state for different QMI_NAS indications for the requesting control point.
QMI_NAS_GET_SUPPORTED_MSGS	0x001E	Queries the set of messages implemented by the currently running software.
QMI_NAS_GET_SUPPORTED_FIELDS	0x001F	Queries the fields supported for a single command as implemented by the currently running software.
QMI_NAS_GET_SIGNAL_STRENGTH	0x0020	Queries the current signal strength as measured by the device. (Deprecated)
QMI_NAS_PERFORM_NETWORK_SCAN	0x0021	Performs a scan for visible networks.
QMI_NAS_INITIATE_NETWORK_REGISTER	0x0022	Initiates a network registration. (Deprecated)
QMI_NAS_INITIATE_ATTACH	0x0023	Initiates a domain attach or detach action. (Deprecated)
QMI_NAS_GET_SERVING_SYSTEM	0x0024	Queries information regarding the system that currently provides service. (Deprecated)
QMI_NAS_SERVING_SYSTEM_IND	0x0024 indication	Indicates a change in the current serving system registration state and/or radio technology. (Deprecated)
QMI_NAS_GET_HOME_NETWORK	0x0025	Retrieves information about the home network of the device.
QMI_NAS_GET_PREFERRED_NETWORKS	0x0026	Queries the list of preferred networks from the device.
QMI_NAS_SET_PREFERRED_NETWORKS	0x0027	Writes the specified list of preferred networks to the device.

Command	ID	Description
QMI_NAS_GET_FORBIDDEN_NETWORKS	0x0028	Queries the list of forbidden networks from the device.
QMI_NAS_SET_FORBIDDEN_NETWORKS	0x0029	Writes the specified list of forbidden networks to the device.
QMI_NAS_SET_TECHNOLOGY_ PREFERENCE	0x002A	Sets the technology preference. (Deprecated)
QMI_NAS_GET_TECHNOLOGY_ PREFERENCE	0x002B	Retrieves the technology preference. (Deprecated)
QMI_NAS_GET_ACCOLC	0x002C	Queries the Access Overload Class (ACCOLC) of the device.
QMI_NAS_SET_ACCOLC	0x002D	Sets the ACCOLC of the device.
QMI_NAS_GET_NETWORK_SYSTEM_ PREFERENCE	0x002E	Retrieves the network system preference.
QMI_NAS_GET_DEVICE_CONFIG	0x002F	Queries the network-related configuration setting of the device.
QMI_NAS_SET_DEVICE_CONFIG	0x0030	Sets network-related configuration settings of the device.
QMI_NAS_GET_RF_BAND_INFO	0x0031	Queries radio band/channel information regarding the system currently providing service.
QMI_NAS_GET_AN_AAA_STATUS	0x0032	Queries the status of the last AN-AAA authentication request for the current 1xEV-DO session.
QMI_NAS_SET_SYSTEM_SELECTION_ PREFERENCE	0x0033	Sets the different system selection preferences of the device.
QMI_NAS_GET_SYSTEM_SELECTION_ PREFERENCE	0x0034	Queries the different system selection preferences of the device.
QMI_NAS_SET_DDTM_PREFERENCE	0x0037	Sets the Data Dedicated Transmission Mode (DDTM) preference for the device.
QMI_NAS_DDTM	0x0038	Provides the DDTM status of the device.
QMI_NAS_GET_OPERATOR_NAME_DATA	0x0039	Retrieves operator name data from multiple sources. (Deprecated)
QMI_NAS_OPERATOR_NAME_DATA_IND	0x003A	Indicates a change in operator name data, which is obtained from multiple sources. (Deprecated)
QMI_NAS_GET_CSP_PLMN_MODE_BIT	0x003B	Retrieves the PLMN MODE bit data from the Customer Service Profile (CSP).
QMI_NAS_CSP_PLMN_MODE_BIT_IND	0x003C	Provides any change in the PLMN MODE bit in the CSP.
QMI_NAS_UPDATE_AKEY	0x003D	Updates the A-KEY. (Discontinued)

Command	ID	Description
QMI_NAS_GET_3GPP2_SUBSCRIPTION_INFO	0x003E	Retrieves 3GPP2 subscription-related information.
QMI_NAS_SET_3GPP2_SUBSCRIPTION_INFO	0x003F	Writes 3GPP2 subscription-related information.
QMI_NAS_GET_MOB_CAI_REV	0x0040	Retrieves Mobile CAI revision information.
QMI_NAS_GET_RTRE_CONFIG	0x0041	Retrieves current RTRE configuration information.
QMI_NAS_SET_RTRE_CONFIG	0x0042	Sets RTRE configuration preference.
QMI_NAS_GET_CELL_LOCATION_INFO	0x0043	Retrieves cell location-related information.
QMI_NAS_GET_PLMN_NAME	0x0044	Queries the operator name for a specified network.
QMI_NAS_BIND_SUBSCRIPTION	0x0045	Binds the current control point to a specific subscription.
QMI_NAS_MANAGED_ROAMING	0x0046	Indicates whether managed roaming is enabled.
QMI_NAS_DUAL_STANDBY_PREF_IND	0x0047	Informs the control point of any changes in dual standby subscription.
QMI_NAS_SUBSCRIPTION_INFO_IND	0x0048	Indicates any change in the subscription information.
QMI_NAS_GET_MODE_PREF	0x0049	Retrieves the mode preference.
QMI_NAS_SET_DUAL_STANDBY_PREF	0x004B	Configures dual standby preference.
QMI_NAS_NETWORK_TIME_IND	0x004C	Indicates a time change reported by the network.
QMI_NAS_GET_SYS_INFO	0x004D	Provides the system information.
QMI_NAS_SYS_INFO_IND	0x004E	Indicates a change in the system information.
QMI_NAS_GET_SIG_INFO	0x004F	Queries information regarding the signal strength.
QMI_NAS_CONFIG_SIG_INFO	0x0050	Sets the signal strength reporting thresholds. (Deprecated)
QMI_NAS_SIG_INFO_IND	0x0051	Provides any change in signal strength status.
QMI_NAS_GET_ERR_RATE	0x0052	Queries the current error rate information.
QMI_NAS_ERR_RATE_IND	0x0053	Provides RAT-specific error rate information.
QMI_NAS_HDR_SESSION_CLOSE_IND	0x0054	Indicates when an HDR session has closed and returns a close reason.

Command	ID	Description
QMI_NAS_HDR_UATI_UPDATE_IND	0x0055	Indicates when an HDR unique access terminal identifier has been updated and returns its new value.
QMI_NAS_GET_HDR_SUBTYPE	0x0056	Retrieves the current HDR protocol subtype.
QMI_NAS_GET_HDR_COLOR_CODE	0x0057	Retrieves the HDR color code value.
QMI_NAS_GET_CURRENT_ACQ_SYS_MODE	0x0058	Retrieves the current acquisition system mode. (Deprecated)
QMI_NAS_SET_RX_DIVERSITY	0x0059	Sets the Rx diversity.
QMI_NAS_GET_TX_RX_INFO	0x005A	Retrieves the detailed Tx/Rx information.
QMI_NAS_UPDATE_AKEY_EXT	0x005B	Updates the A-KEY (extended).
QMI_NAS_GET_DUAL_STANDBY_PREF	0x005C	Retrieves dual standby preference.
QMI_NAS_DETACH_LTE	0x005D	Detaches the current LTE system.
QMI_NAS_BLOCK_LTE_PLMN	0x005E	Blocks the LTE PLMN.
QMI_NAS_UNBLOCK_LTE_PLMN	0x005F	Unblocks the LTE PLMN.
QMI_NAS_RESET_LTE_PLMN_BLOCKING	0x0060	Resets all previous LTE PLMN blocking operations.
QMI_NAS_CURRENT_PLMN_NAME_IND	0x0061	Indicates the current SPN and PLMN name information.
QMI_NAS_CONFIG_EMBMS	0x0062	Requests the UE to enable/disable eMBMS.
QMI_NAS_GET_EMBMS_STATUS	0x0063	Queries the eMBMS status.
QMI_NAS_EMBMS_STATUS_IND	0x0064	Reports the UE's current eMBMS status change.
QMI_NAS_GET_CDMA_POSITION_INFO	0x0065	Queries the current CDMA base station position information for active and neighbor's position information.
QMI_NAS_RF_BAND_INFO_IND	0x0066	Reports current RF band information.
QMI_NAS_FORCE_NETWORK_SEARCH	0x0067	Forces a network search procedure.
QMI_NAS_NETWORK_REJECT_IND	0x0068	Reports network reject information.
QMI_NAS_GET_MANAGED_ROAMING_CONFIG	0x0069	Queries the current managed roaming configuration information.
QMI_NAS_RTRE_CONFIG_IND	0x006A	Reports a change in the RTRE configuration status.

Command	ID	Description
QMI_NAS_GET_CENTRALIZED_EONS_SUPPORT_STATUS	0x006B	Queries the modem support status for centralized EONS.
QMI_NAS_CONFIG_SIG_INFO2	0x006C	Sets the signal strength reporting thresholds.
QMI_NAS_GET_TDS_CELL_AND_POSITION_INFO	0x006D	Retrieves the cell information and neighbor cell information for TD-SCDMA.
QMI_NAS_SET_HPLMN_IRAT_SEARCH_TIMER	0x006E	Sets the periodic search timer configuration for a home operator-specific BPLMN search to LTE.
QMI_NAS_GET_EMBMS_SIG	0x006F	Retrieves the current signal quality at L1 for each MBSFN area.
QMI_NAS_LIMIT_SYS_INFO_IND_REPORTING	0x0070	Limits the reporting of QMI_NAS_SYS_INFO_IND to only when certain fields have changed.
QMI_NAS_GET_SYS_INFO_IND_REPORTING_LIMIT	0x0071	Retrieves the limitations set on the reporting of QMI_NAS_SYS_INFO_IND.
QMI_NAS_UPDATE_IMS_STATUS	0x0072	Updates the IMS registration status.
QMI_NAS_GET_IMS_PREF_STATUS	0x0073	Retrieves the IMS preference status.
QMI_NAS_IMS_PREF_STATUS_IND	0x0074	Reports a change in the IMS preference.
QMI_NAS_CONFIG_PLMN_NAME_IND_REPORTING	0x0075	Configures whether QMI_NAS_CURRENT_PLMN_NAME_IND returns the modem-determined name or all available information.
QMI_NAS_CDMA_AVOID_SYSTEM	0x0076	Facilitates avoiding a CDMA system and clearing the avoided systems list.
QMI_NAS_GET_CDMA_AVOID_SYSTEM_LIST	0x0077	Retrieves the list of previously avoided CDMA systems.
QMI_NAS_SET_HPLMN_SEARCH_TIMER	0x0078	Sets the HPLMN search timer in the modem.
QMI_NAS_GET_HPLMN_SEARCH_TIMER	0x0079	Retrieves the HPLMN search timer.
QMI_NAS_GET_SUBSCRIPTION_INFO	0x007C	Queries the current subscription information.
QMI_NAS_GET_NETWORK_TIME	0x007D	Retrieves the latest time change reported by the network.
QMI_NAS_GET_LTE_SIB16_NETWORK_TIME	0x007E	Retrieves the LTE network time from the UE.
QMI_NAS_LTE_SIB16_NETWORK_TIME_IND	0x007F	Indicates an LTE time change reported by the network.

Command	ID	Description
QMI_NAS_SET_LTE_BAND_PRIORITY	0x0080	Sets the priority for LTE bands.
QMI_NAS_GET_EMBMS_SIG_EXT	0x0081	Retrieves the current signal quality at L1 for each MBSFN area.
QMI_NAS_LTE_CPHY_CA_IND	0x0082	Indicates a carrier aggregation event has occurred.
QMI_NAS_GET_LTE_BAND_PRIORITY_LIST	0x0083	Gets the list of priority LTE bands.
QMI_NAS_SET_BUILTIN_PLMN_LIST	0x0084	Sets the built-in PLMN list.
QMI_NAS_PERFORM_INCREMENTAL_ NETWORK_SCAN	0x0085	Performs the network scan and gives results incrementally.
QMI_NAS_SET_DRX	0x0088	Sets the DRX for the device.
QMI_NAS_GET_DRX	0x0089	Retrieves the DRX for the device.
QMI_NAS_CSG_SEARCH_SELECTION_ CONFIG	0x008A	Configures the CSG search and selection parameters, and triggers an immediate periodic search and selection based on the configured parameters.
QMI_NAS_CSG_IMMEDIATE_SEARCH_ SELECTION	0x008B	Triggers an immediate CSG search and selection based on already configured parameters.
QMI_NAS_GET_CSG_SEARCH_ SELECTION_CONFIGURATION	0x008C	Retrieves configured CSG search and selection parameters.
QMI_NAS_SSAC_INFO_IND	0x008D	Indicates service-specific access class barring information for MMTEL voice/video originating calls.

6 附录

表 2：术语缩写

术语	描述
USB	Universal Serial Bus
SMD	Surface Mounted Devices
UART	Universal Asynchronous Receiver/Transmitter
QTI	Qualcomm Technologies, Inc.
QMI	Qualcomm Message Interface
IP	Internet Protocol
RTC	Real-Time Clock
NAS	Network Attached Storage
AP	Application Processor
RAT	Radio Access Technologies
RF	Radio Frequency
ACCOLC	Access Overload Class
DDTM	Data Dedicated Transmission Mode
PLMN	Public Land Mobile Network
CSP	Customer Service Profile
3GPP2	3rd Generation Partnership Project 2
CAI	Cairo
HDR	High-Dynamic Range
LTE	Long Term Evolution
SPN	Slicing Packet Network
eMBMS	Evolved Multimedia Broadcast/ Multicast Services

CDMA	Code Division Multiple Access
TD-SCDMA	Time Division - Synchronous Code Division Multiple Access
UE	User Equipment
IMS	IP Multimedia Subsystem
HPLMN	Home Public Land Mobile Network
MBSFN	Multicast Broadcast Single Frequency Network
DRX	Discontinuous Reception
CSG	Closed Subscriber Group
MMTEL	MultiMedia Telephony