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APN Content Level		BASIC	✓	INTERMEDIATE		ADVANCED		Confidentiality		Public	✓	Private	
Software Compatibility*	FW:	R1A	Open AT® SW Suite:	N/A	Plug-Ins:	TCP/IP	N/A	C-GPS	N/A	Compiler Used:	ADS GCC	Reference Hardware	No
			M2mpower	N/A		Internet	N/A	Bluetooth	N/A		Reference Software		Yes
				MQTT	N/A	M2MC	N/A	RTE :	N/A				
<i>* refer to software compatibility matrix section for more detail</i>													
Wireless CPU Compatibility	Plug & Play:			Integra M2106B		Fastrack Supreme		Fastrack Xtend		Fastrack GO			
	Quik (CDMA):			Q2438F		Q2438R		Q26 Elite	✓				
	Quik (GSM):			Q2400A		Q2406A		Q2406B		Q2426B		Q52 Omni	
				GR64		GS64		Q2686H		Q2687H		Q26 Extreme	
				Q24 Classic		Q24 Plus		Q24 Extended		Q24 Auto		Q64	
	Wireless Microprocessor® :			WMP50		WMP100		WMP120		WMP150			
WISMO Family :			WISMO218		WISMO228								



1 Introduction

This application note describes the acceptable methods for starting and stopping the operation of the Q26 Elite. Shutdown is typically done to reduce the Q26 Elite power consumption to zero in anticipation of a partial or full system shutdown.

The Q26 Elite may be shut down normally or abnormally. Normal shutdown is intentional and controlled. An abnormal shutdown is uncontrolled. This note describes some of the considerations involved in a shutdown and why a shutdown should be done in a controlled manner. Abnormal shutdowns should be prevented whenever possible.

2 Recommended startup sequencing

Sierra Wireless recommends the following sequence for proper startup of the Q26 Elite:

1. De-assert any signal to ON/OFF.
2. Apply power to V_BAT.
3. Connect V_BAT to ON/OFF for a period of at least 2 seconds.
4. Wait for a "WIND: 4" unsolicited report that indicates the Q26 Elite is ready for AT command processing.
5. De-assert any signal to ON/OFF.

3 Recommended shutdown sequencing

A normal Q26 Elite shutdown can be initiated as follows:

1. Issue the AT+CFUN=0 command or connect V_BAT to ON/OFF for at least 4 seconds.
2. Wait for the "WIND: 10" unsolicited report.
3. Remove power from V_BAT.

If the Q26 Elite does not power down and produce the unsolicited message after the de-registration time limit plus 5 seconds it can be assumed the Q26 Elite will not power down correctly and there is no other option than to remove V_BAT.

4 Why is it important to perform a controlled shutdown?

The most important reason to use a controlled shutdown is to prevent data corruption that could lead to unpredictable behaviour.

Sierra Wireless has engineered the Q26 Elite to be both reliable and robust. Nevertheless an abnormal shutdown can cause data to be corrupted resulting in subsequent unpredictable behavior. You can minimize the risk of data corruption by terminating Q26 Elite operations normally.

An abnormal shutdown can cause data corruption

Non-volatile memory, or NVM, is used to retain data when the Q26 Elite is not powered.

Data can only be written to NVM one item at a time. Each write request takes many milliseconds to complete due to the physical properties of the NVM storage media. So that the processor can continue to handle other tasks, the process of writing data to the NVM is an asynchronous operation. That means write requests to NVM can be queued in memory, awaiting the completion of previous write request operations. Shutting down correctly will enable these queued write requests to be completed before the Q26 Elite actually powers down.

If an abnormal shutdown occurs, queued write requests will be lost. As a result, at the next power-on the Q26 Elite may find a different configuration than what was intended when the write requests were made. This can cause unpredictable behavior.

Controlled shutdowns can improve startup times

Operational data is maintained in RAM for performance reasons. Whenever a normal power down occurs, some operational data is saved to NVM to be used on the subsequent startup. While this data is not required on startup, if present it shortens the startup time and thus reduces operational latency and power consumption. Here are two examples.

The Most Recently Used (MRU) list is used by the wireless device to decrease the time-to-fix. The MRU list improves the time to scan and lock onto a network. The wireless device will retain a list of networks the wireless device has camped on in the past. When a scan is performed, these networks are scanned first. The assumption is the wireless device probably hasn't left the network it was last camped on, so look there first. If it has left, look at the other recently camped networks; service is likely to be found without having to perform an exhaustive scan.

Time-to-fix during a power up sequence is important to many of our customers. Failure to save the MRU list could result in longer time-to-fix during a power up, and longer time to scan when the current system is lost (leaving one coverage area and entering a new coverage area).

The wireless device itself has the ability to modify a limited number of calibration fields over time. This learning process was put into place to decrease time-to-fix in extreme operating conditions. The wireless device will retain information regarding how the physical hardware needs to be adjusted for the fastest means to acquire the channel signal.

The learning table data is kept in RAM throughout the execution of the wireless device. Only when the wireless device is instructed to power down is this data written out to NVM. Therefore a power cycle will retain the last used values; thus providing more up-to-date and accurate information for acquiring signals.

Network considerations

An important step during the power down phase is to inform the providing network that the mobile station is powering down. This information or notification to the network signals that the device is unavailable. The removal from the network saves on resources; most notably the device is removed from a table that lists all devices currently communicating with the network. In addition the network knows not to attempt to locate the device using over-the-air page requests. Instead the network routes the incoming voice call directly to voicemail or retains an Short Message Service (SMS) message in the network for delivery at a later time.

Informing the network when powering down is part of the CDMA standards and required by many network carriers for certification. They expect that designs will comply with the requirements. Clearly the carriers' networks can tolerate abnormal device shutdowns but this should be the exception rather than the rule.

5 Why does it take so long to complete a controlled shutdown?

Powering down correctly has been met with some concerns from customers. The biggest concern is the length of time the customer application must wait for the shutdown indication from the wireless device to the customer application. This time could theoretically exceed seven minutes. In properly structured networks the theoretical time limit is never reached. However a rogue network could lead to power down cycles that are not typical.

The reason for the lengthy delay in powering down is a requirement to perform a de-registration sequence with the network. The remaining process of powering down is very short. In a proper network the de-registration time is limited by the network itself. For example, Verizon Wireless' retry strategy is approximately 10 seconds in most market areas.

It is very rare that a mobile station would not complete the de-registration sequence within a few seconds; in the event de-registration sequence is delayed for technical reasons the Q26 Elite will abort the de-registration sequence with the network to insure a reasonable time to power down.

The de-registration sequence time limit is set during factory provisioning and is not alterable in the field. The default value is 30 seconds. The timer will be used only for the de-registration step of the power down sequence, as a result the maximum shutdown time will be slightly greater than 30 seconds. Under normal conditions, the network de-registration time will determine the power down registration completion.

A customer can request a different maximum de-registration time limit for the customer's devices. In that case, it will be the customer's responsibility to report the change to their service provider (carrier). The customer must also perform whatever testing that the carrier deems necessary to verify that the changed limit is acceptable within the carrier's network. Along with the customer PRI modification, the customer must provide to Sierra Wireless a letter from the carrier stating the modification to the de-registration time limit is acceptable.

6 Prevent abnormal shutdowns

An abnormal shutdown is unexpected and uncontrolled. An abnormal termination, for example, is caused by removing the V_BAT power source without using AT+CFUN=0 or ON/OFF. An abnormal shutdown must be prevented whenever possible.

The JTAG_RESOUT_N signal is capable of causing a device reset. JTAG_RESOUT_N is provided at the connector for Sierra Wireless testing only. JTAG_RESOUT_N should NEVER be used to reset the Q26 Elite in a customer application.

7 Software compaibility matrix

Core	Open AT®	IP	Compatibility
R1A	N/A	N/A	YES

8 Support

For direct clients: contact your Sierra Wireless FAE

For distributor clients: contact your distributor FAE

For distributors: contact your Sierra Wireless FAE

9 Document history

Level	Date	History
001	September 5, 2009	Creation

10 Legal notice

Important Notice

Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

Safety and Hazards

Do not operate the Sierra Wireless modem in areas where blasting is in progress, where explosive atmospheres may be present, near medical equipment, near life support equipment, or any equipment which may be susceptible to any form of radio interference. In such areas, the Sierra Wireless modem MUST BE POWERED OFF. The Sierra Wireless modem can transmit signals that could interfere with this equipment. Do not operate the Sierra Wireless modem in any aircraft, whether the aircraft is on the ground or in flight. In aircraft, the Sierra Wireless modem MUST BE POWERED OFF. When operating, the Sierra Wireless modem can transmit signals that could interfere with various onboard systems.

Note Some airlines may permit the use of cellular phones while the aircraft is on the ground and the door is open. Sierra Wireless modems may be used at this time.

The driver or operator of any vehicle should not operate the Sierra Wireless modem while in control of a vehicle. Doing so will detract from the driver or operator's control and operation of that vehicle. In some states and provinces, operating such communications devices while in control of a vehicle is an offence.

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