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APN Content Level	BASIC	INTERMEDIATE	✓	ADVANCED	Confidentiality	Public	✓	Private	
Hardware Compatibility	Product Line	AirPrime	Series	EM9190					
				EM9191					
				EM7690					
Software Compatibility	ALL			Document Type	Application Note	✓	Technical Note		

## 1 Introduction

This document is provided to Sierra Wireless distributors and clients. To request a new application/technical note, contact your regional Sierra Wireless Product Marketing Manager.

## 2 Glossary

Term/Initials	Definition
EHPLMN	Equivalent Home PLMN
GNSS	Global Navigation Satellite System
HPLMN	Home PLMN
MHI	Modem Host Interface
PCIe	Peripheral Component Interconnect Express
PLMN	Public Land Mobile Network
PRI	Product Requirement Information
RAT	Radio Access Technology
RPLMN	Registered PLMN
SMS	Short Message Service
TBD	To be done
USB	Universal Serial Bus
VPLMN	Visited PLMN

## 3 Scope

EM919x/EM7690 series includes variants of EM9190, EM9191 and EM7690. This document is applicable for all variants.

There are 5 power states (Normal, Lower Power, Sleep, Off, and Disconnected) of the module, refer to section "Module Power States" of the document [AirPrime EM919X-EM7690 Product Technical Specification](#) for details. This document only focuses on sleep state which is also known as **sleep mode** or **deep sleep mode**.

## 4 Power Consumption for Sleep

Refer to section "Power Consumption" of the document [AirPrime EM919X-EM7690 Product Technical Specification](#) for power consumption for details when the module is in sleep mode.

## 5 Precondition for Sleep

This section summarizes all necessary preconditions with which module can enter sleep mode.

## 5.1 PCIe Suspension

The PCIe on the module works on device mode. The module cannot enter sleep mode if the PCIe is not suspended. There are two ways to suspend PCIe on the module:

- 1) Suspending the host can trigger suspension of the module's PCIe. The example below illustrates how to suspend the host.
  - With below command if it is Linux host.  
`echo mem > /sys/power/state`
  - Click "Power" -> "Suspend" if it is Linux host or click "Power" -> "Sleep" if it is Windows host.
- 2) Automatic PCIe suspension (TBD).

## 5.2 USB Suspension

The module cannot enter sleep mode if the USB is not suspended. There are two ways to suspend the module's USB:

- 1) Suspending host can trigger suspension of the module's USB. The example below illustrates how to suspend the host.
  - With below command if it is Linux host.  
`echo mem > /sys/power/state`
  - Click "Power" -> "Suspend" if it is Linux host or click "Power" -> "Sleep" if it is Windows host.
- 2) Automatic USB suspension (TBD).

## 5.3 No Network Search

The module cannot enter sleep mode if there is ongoing network search.

Network search may happen in many cases as follows:

- RPLMN/HPLMN searching after module boots up.
- Background PLMN searching when the modem is in roaming status.
- The module is searching for preferred or higher-priority RAT.
- The module loses the serving cell.
- The module gets redirect indication from network.
- The module is trying to reselect the neighbor cell.

## 5.4 No Network Data Transfer

The module cannot enter sleep mode if there is data transfer (SMS, data call, etc.) over network.

## 5.5 No Active GNSS Engine

The module cannot enter sleep mode if its GNSS engine is working.

The `AT!GPSSTATUS` can query GNSS state, and `AT!GPSEND` can stop GNSS engine if it's active.

## 5.6 No Working Diagnosis Service

The module cannot enter sleep mode if there is working diagnose service.

The diagnosis service will keep working when the diagnosis application (Qualcomm QXDM tool, Sierra SwiLogPlus tool, etc.) is connected to the module.

## 6 Wakeup Source

This section summarizes the sources which can wake up module.

## 6.1 PCIe

The module will be woken up when PCIe resumes from suspension if the module is in sleep mode.

## 6.2 USB

The module will be woken up when USB resumes from suspension if the module is in sleep mode.

## 6.3 Periodic Network Search

The module will perform periodic network search if the module loses the serving cell or wants to search for HPLMN/EHPLMN or a higher-priority PLMN network. The periodic network search will periodically wake up the module if the module is in sleep mode.

## 6.4 Data Transfer Originated from Network

The module will be woken up when it receives data originated from network. For example, receiving SMS or data packages routed to the module.

## 6.5 Periodic Network Monitoring

The module will periodically monitor the paging channel and signal of the serving network. The periodic network monitoring will periodically wake up the module if it is in sleep mode.

The figure below is an illustration of power consumption during periodic network monitoring.

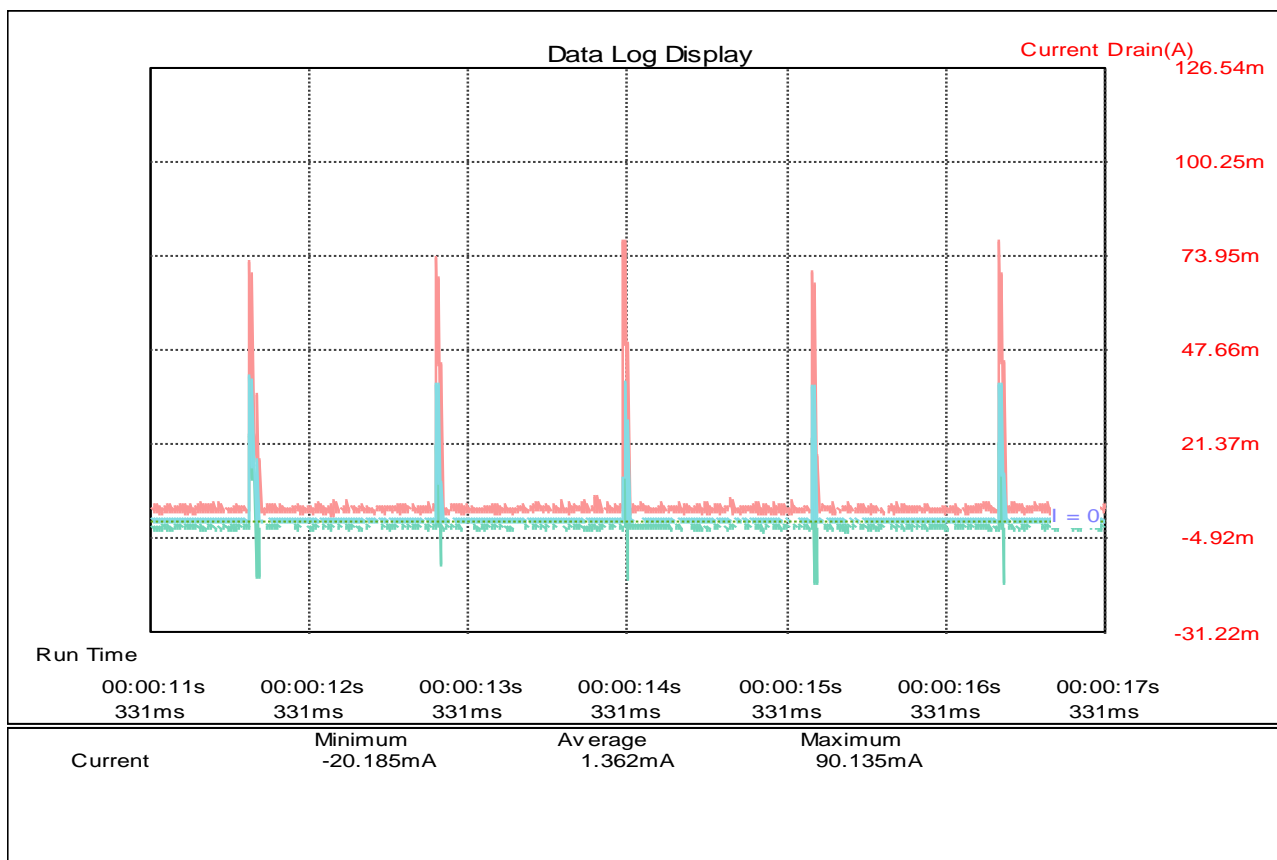


Figure 1. Power Consumption during Periodic Network Monitoring

## 6.6 Periodic Switch of WWAN\_LED Pin's State

The LED connected with WWAN\_LED pin (refer to the document [AirPrime EM919X-EM7690 Product Technical Specification](#) for details) will blink periodically to indicate different network states (no service, roaming, data active, airplane mode, etc.). The periodic switch of WWAN\_LED pin's state (from off to on or vice versa) will periodically wake up the module (similar to periodic network monitoring) if the module is in sleep mode.

The LED blinking feature is enabled by default and can be disabled with the setting in Sierra Wireless PRI.

## 7 References

No.	Reference	Document
[1]	41113174	AirPrime EM919X-EM7690 Product Technical Specification
[2]	41113480	AirPrime EM919x AT Command Reference

## 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

Version	Date	History
1.0	June 2020	Creation
1.1	September 2020	Added EM7690 variant and removed PCIE_PEWAKE_N related information

## 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 cellular modems are not advised without proper device certifications. These areas include environments where cellular radio can interfere such as explosive atmospheres, medical equipment, or any other equipment which may be susceptible to any form of radio interference. 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.

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*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.*

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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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