AirPrime Intelligent Embedded Modules

Hardware Integration Guide

2130114
Rev 2.02

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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Consult our website for up-to-date product descriptions, documentation, application notes, firmware upgrades, troubleshooting tips, and press releases:

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Revision History

Revision number	Release date	Changes
2.02	September 2010	• Created document

Contents

1: Introduction

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Sierra Wireless' AirPrime Intelligent Embedded Modules form the radio component for the products in which they are embedded.

Table 1-1 identifies embedded modules that are available for use on CDMA and GSM networks.

Table 1-1: CDMA and UMTS AirPrime Intelligent Embedded Modules

Device	Networks	Network standards	GPS features					
			Stand-alone	gpsOne	gpsOne XTRA	A-GPS	Nav2.0	NMEA sentences
MC5727 MC5727V MC5728V	CDMA	CDMA IS-95 1X 1xEV-DO (IS-856)	✔	✔		✔	✔	✔
MC8201	GSM	GSM, GPRS, EDGE, UMTS, HSDPA						
MC8355	CDMA	CDMA 1xRTT, EV-DO Rev.A						
	GSM	GSM, GPRS, EDGE, UMTS, HSDPA, HSUPA, HSPA+	✔		✔	✔		
MC8700	GSM	GSM, GPRS, EDGE, UMTS, HSDPA, HSUPA, HSPA+						
MC8704 MC8705 MC8801	GSM	GSM, GPRS, EDGE, UMTS, HSDPA, HSUPA, HSPA+	✔		✔	✔	✔	✔ (5)
MC8775 MC8775V	GSM	GSM, GPRS, EDGE, UMTS, HSDPA	✔					
MC8780 MC8781 MC8790 MC8790V MC8791V MC8792V MC8795V	GSM	GSM, GPRS, EDGE, UMTS, HSDPA, HSUPA	✔		✔	✔	✔	✔ (5)

Note: An understanding of network technology, and experience in integrating hardware components into electronic equipment is assumed.

Purpose of this guide

This guide addresses issues that affect the integration of AirPrime embedded modules into host products, and includes design recommendations for the host products.

The Universal Development Kit

Sierra Wireless manufactures a Universal Development Kit (UDK) that facilitates all phases of the integration process.

This kit is a hardware development platform that is designed to support the AirPrime embedded modules listed in Table 1-1 on page 7. It contains the hardware components that are typically necessary for evaluating and developing with the module, including:

- Development board
- Cables
- Antennas
- Other accessories

For instructions on setting up the UDK, see *PCI Express Mini Card Dev Kit Quick Start Guide (Document 2130705)*.

Required connectors

Note: Contact vendors before choosing your connectors—the numbers included here are for reference only. Choose connectors that are appropriate to your design.

When integrating AirPrime embedded modules into your host device, you need the following connector types:

- RF cables that mate with Hirose U.FL connectors (model U.FL #CL331-0471-0-10). Modules include one to three connector jacks depending on individual module support for diversity or GPS functionality.
- Industry-standard mating connector for 52-pin EDGE—some manufacturers include Tyco, Foxconn, and Molex. For example, the connector used on the Mini Card Dev Kit board is a Molex 67910-0001.
- Industry-standard USIM connector (MC8xxx only)—the actual connector you use depends on how your device exposes the USIM socket. For example, the USIM connector used on the Mini Card Dev Kit board is an ITT CCM03-3518.

Guide organization

This guide includes the following sections:

1. **Introduction** (this section)
2. Power Interface on page 13
   Describes power control signals used by the module and discusses design issues related to power supply integration.
3. RF Integration on page 17
   Describes antenna connection methods and grounding issues, RF interference and desense issues.

4. Host/Module Interfaces on page 21
   Describes the USB interface for host/module communication, and the USIM interface for host/module integration.
5. Regulatory Information on page 21
   Describes regulatory approvals and regulatory information requirements.
6. Acronyms and Definitions on page 25
   Lists acronyms and definitions used throughout this guide.
7. Index on page 27

Note: The term "host" always refers to the host device.

Related documents

This guide deals specifically with hardware integration issues that are unique to AirPrime embedded modules.

Table 1-2 lists other documents referenced in this guide.

Table 1-2: Related documentation

Document title	Description
AT Command Set for User Equipment (UE) (Release 6) (3GPP TS 27.007)	Standard AT commands for GSM/UMTS devices.
CDMA 1X Standard (CDMA 200 Series Release A (2000) - Document #TIA/EIA/IS-2000 Series, Release A)	Technical requirements for CDMA systems, including details on sleep cycle index (SCI) values.
CDMA CnS Reference (Document 2130754)	CnS (Control and Status) messages supported by AirPrime CDMA embedded modules.
CDMA AT Command Reference (Document 2130620)	Proprietary, basic AT commands for AirPrime CDMA embedded modules. For UMTS-specific commands, see *AirCard/AirPrime UMTS devices Supported AT Command Reference (Document 2130617).*
CDMA Extended AT Command Reference (Document 2130621)	Proprietary AT commands for AirPrime CDMA embedded modules. For UMTS-specific commands, see *AirPrime MC8xxx Embedded Modules Extended AT Command Reference (Document 2130616).*
FCC Regulations - Part 15 - Radio Frequency Devices	This section of the FCC Code of Federal Regulations, Title 47 deals with radio frequency devices, including shielding requirements for embedded modules.
IEC-61000-4-2 level 3	Techniques for testing and measuring electrostatic discharge (ESD) immunity.
MC5727 Mini Card Product Specification (Document 2130958)	Features, mechanical and electrical specifications, and standards compliance of the MC5727.
MC5727V Mini Card Product Specification (Document 2131023)	Features, mechanical and electrical specifications, and standards compliance of the MC5727V.

Table 1-2: Related documentation (Continued)

Document title	Description
MC5728V Mini Card Product Specification (Document 2111350)	Features, mechanical and electrical specifications, and standards compliance of the MC5728V.
MC8201 PCI Express Mini Card Product Specification (Document 2131362)	Features, mechanical and electrical specifications, and standards compliance of the MC8201.
MC8700 PCI Express Mini Card Product Specification (Document 2131202)	Features, mechanical and electrical specifications, and standards compliance of the MC8700.
AirPrime MC8704 with Audio PCI Express Mini Card Product Specification (Document 2400059)	Features, mechanical and electrical specifications, and standards compliance of the MC8704.
AirPrime MC8705 PCI Express Mini Card Product Specification (Document 2400057)	Features, mechanical and electrical specifications, and standards compliance of the MC8705.
MC8775 PCI Express Mini Card Product Specification (Document 2130697)	Features, mechanical and electrical specifications, and standards compliance of the MC8775.
MC8775V with Audio PCI Express Mini Card Product Specification (Document 2130700)	Features, mechanical and electrical specifications, and standards compliance of the MC8775V.
MC8780 / MC8781 PCI Express Mini Card Product Specification (Document 2130782)	Features, mechanical and electrical specifications, and standards compliance of the MC8780/MC8781.
MC8790 PCI Express Mini Card Product Specification (Document 2111279)	Features, mechanical and electrical specifications, and standards compliance of the MC8790.
MC8790V PCI Express Mini Card Product Specification (Document 2111280)	Features, mechanical and electrical specifications, and standards compliance of the MC8790V.
MC8791V PCI Express Mini Card Product Specification (Document 2131032)	Features, mechanical and electrical specifications, and standards compliance of the MC8791V.
MC8792V PCI Express Mini Card Product Specification (Document 2131033)	Features, mechanical and electrical specifications, and standards compliance of the MC8792V.
MC8795V PCI Express Mini Card Product Specification (Document 2131276)	Features, mechanical and electrical specifications, and standards compliance of the MC8795V.
MC87XX Modem CnS Reference (Document 2130602)	CnS (Control and Status) messages supported by AirPrime UMTS embedded modules.
MC87xx Modem CnS Reference (Voice) (Document 2130817)	Voice-related CnS (Control and Status) messages supported by voice-enabled AirPrime UMTS embedded modules (MC8704, MC8775V, MC8790V, MC8791V, MC8792V, and MC8795V).
AirPrime MC8801 PCI Express Mini Card Product Specification (Document 2400068)	Features, mechanical and electrical specifications, and standards compliance of the MC8801.
AirCard/AirPrime UMTS devices Supported AT Command Reference (Document 2130617)	Proprietary, basic AT commands for UMTS AirCard and AirPrime devices. For CDMA-specific commands, see the *CDMA AT Command Reference (Document 2130620).*
AirPrime MC8xxx Embedded Modules Extended AT Command Reference (Document 2130616)	Proprietary AT commands for UMTS AirPrime embedded modules. For CDMA-specific commands, see the *CDMA Extended AT Command Reference (Document 2130621).*

Table 1-2: Related documentation (Continued)

Document title	Description
Mobile Station (MS) Conformance Specification; Part 4: Subscriber Interface Module (3GPP TS 11.10-4)	SIM testing methods.
PCI Express Mini Card Dev Kit Quick Start Guide (Document 2130705)	Setup and configuration of modules.
PCI Express Mini Card Electromechanical Specification Revision 1.1	
Universal Serial Bus Specification, Rev 2.0	

2: Power Interface

2

Overview of operation

Note: This chapter contains information for both CDMA (MC57xx) and GSM (MC8xxx) AirPrime embedded modules.
*Information that is **unique** to specific module types is clearly identified.*

AirPrime embedded modules are designed to use a 3.3V (nominal) power supply (3.8V for the MC8201) provided by the host. It is the host's responsibility to provide safe and continuous power to the module at all times; the module does NOT have an independent power supply, or protection circuits to guard against electrical issues.

The module's power state is controlled by the host's assertion/de-assertion of the `W_Disable#` signal. The module also monitors its supply voltage and requests shutdown if the supply is insufficient.

Power signals

The module must be connected to a 3.3V power supply (3.8V for the MC8201), as described in *PCI Express Mini Card Electromechanical Specification Revision 1.1*.

The MC8xxx has more power pins than the MC57xx due to higher peak current requirements for GSM devices.

For detailed pinout and voltage/current requirements of these modules, see the Product Specification Document for your AirPrime embedded module (see Table 1-2 on page 9).

Electrostatic discharge (ESD)

You are responsible for ensuring that the host has adequate ESD protection on digital circuits and antenna ports as described by the following specifications:

- (Operational) RF port (antenna launch and RF connector): *IEC-61000-4-2—Level (Electrostatic Discharge Immunity Test)*
- (Non-operational) Host connector interface: *JESD22-A114-B +/- 1kV Human Body Model* and *JESD22-C101 +/- 125 V Charged Device Model*
- MC5728V only: (Non-operational) Host connector interface: *JESD22-A114-B +/- 125V Human Body Model and JESD22-C101 +/- 100 V Charged Device Model*
  MC5728V has placeholders for additional ESD devices, for cases where the device must, per customer requirements, meet the higher Human Body Model (+/-1kV) ESD rating.

This guide provides specific recommendations where needed, however, the level of protection required depends on your application.

Note: ESD protection is highly recommended for the USIM connector at the point where the contacts are exposed, and for any other signals from the host interface that would be subjected to ESD by the user of the product.

Module power states

Note: The module unit defaults to the Normal state when VCC is first applied in the absence of W_Disable# control.

The module has four power states:

- Disconnected
  No power to the module.
- Off
  Power to the module, but the module is powered off.
- Normal
  The module is active. Several modes are possible (Receive, Transmit, Sleep, Shutdown).
- Low power (“airplane mode”)
  The module is active, but RF is disabled.

State machines are implemented in the module to monitor the power supply and operating temperature.

Disconnected state

Note: The difference between the Disconnected and Off states is that, in the Off state, the module is still connected to the power source and draws minimal current.

This state occurs when there is no power to the module—the host power source is disconnected from the module and all voltages associated with the module are at 0 V.

Whether the host device is also powered off depends on the power rail design:

- If the connection between the power rail and the module is controlled by the host, the host can stay powered on and cut the power to put the module into the disconnected state.
- If the power rail is shared between the host device and the module, the host is powered off when the module is powered off.

Off state

In this state, the host is powered up and the module is powered down (but still connected to the power source).

The host keeps the module powered off by driving the `W_Disable#` signal low. In this state, the module draws minimal current.

Note: This is the default state when VCC is first applied in the absence of W_Disable# control.

Normal state

This is the active state of the module. In this state:

- The module is fully powered.
- The module is capable of placing/receiving calls or establishing data connections on the wireless network.
- The USB interface is fully active.

Low power state

In this state (also called “airplane mode”), RF (both Rx and Tx) is disabled in the module, but the USB interface is still active.

Usage models

Usage models can be used to calculate expected current consumption. A sample usage model is provided in Table 2-1,

Table 2-1: Power consumption of sample application

	Used by a field worker (data only)	Used for remote data logging
Upload (module Tx)	1000 kB/day	40 kB/h
Download (module Rx)	500 kB/day	100 kB/day
Coverage/data rate	1X/80 kbps	IS-95/14.4 kbps
Hours of operation	8 hrs/day (off 16 hrs/day)	24/day
Total power consumed over 24 hours	60 mAh	200 mAh

This example model applies to a battery-operated device. In practice, because the module is isolated from the battery (the host device manages the power source), the mAh ratings depend on the module’s supply efficiency.

The module automatically enters slotted sleep mode when there is no transmission or reception occurring (SCI = 2).

Transmit power is assumed to be +3 dBm.

3: RF Integration

AirPrime embedded modules operate on the following frequencies:.

Table 3-1: RF Parameters (AirPrime UMTS embedded modules)

Frequencies (MHz)	AirPrime UMTS embedded module (MC8xxx)															
	8201	8355	8700	8704	8705	8775	8775V	8777V	8780	8781	8790	9890V	8791V	8792V	8795V	8801
GSM 850[a] Tx: 824–849 Rx: 869–894	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
EGSM_900[a] Tx: 880–915 Rx: 925–960	✘	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
DCS 1800[a] Tx: 1710–1785 Rx: 1805–1880	✘	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
PCS 1900[a] Tx: 1850–1910 Rx: 1930–1990	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Band I[b] (UMTS 2100) Tx: 1920–1980 Rx: 2110–2170	✘	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Band II[b] (UMTS 1900) Tx: 1850–1910 Rx: 1930–1990	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✘	✔	✔	✔
Band V[b,c] (UMTS 850) Tx: 824–849 Rx: 869–894	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✘	✘	✔	✔
Band VIII[b] (UMTS 900) Tx: 880–915 Rx: 925–960	✘	✔		✔	✔	✘	✘	✘	✘	✘	✘	✘	✘	✔	✔	✔
CDMA2000 BC0 Tx: 824–849 Rx: 869–894		✔														
CDMA2000 BC1 Tx: 1850–1910 Rx: 1930–1990		✔														
CDMA2000 BC6 Tx: 1920–1980 Rx: 2110–2170		✔														
GPS 1575.42	✘		✔	✔	✔	✘	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

a. (2%) CS
b. (0.1%) 12.2 kbps
c. Band VI is included as a subset of Band V.

RF connection

When attaching an antenna to the module:

- Use a Hirose U.FL connector (model U.FL #CL331-0471-0-10) to attach an antenna to a connection point on the module.
- Match coaxial connections between the module and the antenna to 50 Ω.
- Minimize RF cable losses to the antenna; the recommended maximum cable loss for antenna cabling is 0.5 dB.

*Note: To **disconnect** the antenna, make sure you use the Hirose U.FL connector removal tool (P/N UFL-LP-N-2(01)) to prevent damage to the module or coaxial cable assembly.*

Ground connection

When connecting the module to system ground:

- Prevent noise leakage by establishing a very good ground connection to the module through the host connector.
- Connect to system ground using the two mounting holes at the top of the module.
- Minimize ground noise leakage into the RF.
  Depending on the host board design, noise could *potentially* be coupled to the module from the host board. This is mainly an issue for host designs that have signals traveling along the length of the module, or circuitry operating at both ends of the module interconnects.

Shielding

The module is fully shielded to protect against EMI and to ensure compliance with FCC Part 15 - “Radio Frequency Devices” (or equivalent regulations in other jurisdictions).

Note: The module shields must NOT be removed.

Antenna and cabling

When selecting the antenna and cable, it is critical to RF performance to match antenna gain and cable loss.

Note: Values in this guide are taken from the appropriate product specification documents (PSDs) (listed in Related documents on page 9)—in the case of a discrepancy between this document and the relevant PSD, use the value listed in the PSD.

Choosing the correct antenna and cabling

Consider the following points for proper matching of antennas and cabling:

- The antenna (and associated circuitry) should have a nominal impedance of 50 Ω with a return loss of better than 10 dB across each frequency band of operation.
- The system gain value affects both radiated power *and* regulatory (FCC, IC, CE, etc.) test results.

Developing custom antennas

Consider the following points when developing custom-designed antennas:

- A skilled RF engineer should do the development to ensure that the RF performance is maintained.
- Identify the bands that need to be supported.

Determining the antenna's location

Consider the following points when deciding where to put the antenna:

- Antenna location may affect RF performance. Although the module is shielded to prevent interference in most applications, the placement of the antenna is still very important—if the host device is insufficiently shielded, high levels of broadband or spurious noise can degrade the module's performance.
- Connecting cables between the module and the antenna must have 50 Ω impedance. If the impedance of the module is mismatched, RF performance is reduced significantly.
- Antenna cables should be routed, if possible, away from noise sources (switching power supplies, LCD assemblies, etc.). If the cables are near the noise sources, the noise may be coupled into the RF cable and into the antenna.

Interference and sensitivity

Note: These modules are based on ZIF (Zero Intermediate Frequency) technologies. When performing EMC (Electromagnetic Compatibility) tests, there are no IF (Intermediate Frequency) components from the module to consider.

Several sources of interference can affect the RF performance of the module (RF desense). Common sources include power supply noise and device-generated RF.

RF desense can be addressed through a combination of mitigation techniques and radiated sensitivity measurement.

Power supply noise

Noise in the power supply can lead to noise in the RF signal.

Note: Values in this guide are taken from the appropriate product specification documents (PSDs) (listed in Related documents on page 9)—in the case of a discrepancy between this document and the relevant PSD, use the value listed in the PSD.

The power supply ripple limit for the module is no more than 200 mVp-p 1 Hz to 100 kHz. This limit includes voltage ripple due to transmitter burst activity.

Interference from other wireless devices

Wireless devices operating inside the host device can cause interference that affects the module.

To determine the most suitable locations for antennas on your host device, evaluate each wireless device's radio system, considering the following:

- Any harmonics, sub-harmonics, or cross-products of signals generated by wireless devices that fall in the module's Rx range may cause spurious response, resulting in decreased Rx performance.

- The Tx power and corresponding broadband noise of other wireless devices may overload or increase the noise floor of the module's receiver, resulting in Rx desense.

The severity of this interference depends on the closeness of the other antennas to the module's antenna. To determine suitable locations for each wireless device's antenna, thoroughly evaluate your host device's design.

Device-generated RF

Note: The module can cause interference with other devices such as hearing aids and on-board speakers.

Wireless devices such as AirPrime embedded modules transmit in bursts (pulse transients) for set durations (RF burst frequencies). Hearing aids and speakers convert these burst frequencies into audible frequencies, resulting in audible noise.

All electronic computing devices generate RF interference that can negatively affect the receive sensitivity of the module.

The proximity of host electronics to the antenna in wireless devices can contribute to decreased Rx performance. Components that are most likely to cause this include:

- Microprocessor and memory
- Display panel and display drivers
- Switching-mode power supplies

These and other high-speed devices (in particular, the processor) can decrease Rx performance because they run at frequencies of tens of MHz. The rapid rise and fall of these clock signals generates higher-order harmonics that often fall within the operating frequency band of the module, affecting the module's receive sensitivity.

Example

On a sub-system running at 40 MHz, the 22nd harmonic falls at 880 MHz, which is within the cellular receive frequency band.

Note: In practice, there are usually numerous interfering frequencies and harmonics. The net effect can be a series of desensitized receive channels.

A: Regulatory Information

A

Important notice

Because of 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 and its affiliates accept 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 your MC57xx/MC8xxx modem:

- In areas where blasting is in progress
- Where explosive atmospheres may be present including refuelling points, fuel depots, and chemical plants
- Near medical equipment, life support equipment, or any equipment which may be susceptible to any form of radio interference. In such areas, the MC57xx/MC8xxx modem **MUST BE POWERED OFF**. Otherwise, the MC57xx/MC8xxx modem can transmit signals that could interfere with this equipment.

In an aircraft, the MC57xx/MC8xxx modem **MUST BE POWERED OFF**. Otherwise, the MC57xx/MC8xxx modem can transmit signals that could interfere with various onboard systems and may be dangerous to the operation of the aircraft or disrupt the cellular network. Use of a cellular phone in an aircraft is illegal in some jurisdictions. Failure to observe this instruction may lead to suspension or denial of cellular telephone services to the offender, or legal action or both.

Some airlines may permit the use of cellular phones while the aircraft is on the ground and the door is open. The MC57xx/MC8xxx modem may be used normally at this time.

Important compliance information for North American users

The MC57xx/MC8xxx modem has been granted modular approval for mobile applications. Integrators may use the MC57xx/MC8xxx modem in their final products without additional FCC/IC (Industry Canada) certification if they meet the following conditions. Otherwise, additional FCC/IC approvals must be obtained.

1. At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.
2. To comply with FCC / IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 5 dBi in the cellular band (4.5dBi for MC8801) and 4 dBi in the PCS band (3.4dBi for MC8801).
3. The MC57xx/MC8xxx modem and its antenna must not be co-located or operating in conjunction with any other transmitter or antenna within a host device.
4. A label must be affixed to the outside of the end product into which the MC57xx/MC8xxx modem is incorporated, with a statement similar to the following:
   - For MC5727/MC5727V:
     This device contains FCC ID: N7N-MC5727
     This equipment contains equipment certified under IC: 2417C-MC5727
   - For MC5728V:
     This device contains FCC ID: N7N-MC5728
     This equipment contains equipment certified under IC: 2417C-MC5728
   - For MC8201:
     This device contains FCC ID: N7NMC8201
     This equipment contains equipment certified under IC: 2417C-MC8201
   - For MC8355:
     This device contains FCC ID: N7NMC8355
     This equipment contains equipment certified under IC: 2417C-MC8355
   - For MC8700:
     This device contains FCC ID: N7NMC8700
     This equipment contains equipment certified under IC: 2417C-MC8700
   - For MC8704:
     This device contains FCC ID: N7NMC8704
     This equipment contains equipment certified under IC: 2417C-MC8704
   - For MC8705:
     This device contains FCC ID: N7NMC8705
     This equipment contains equipment certified under IC: 2417C-MC8705
   - For MC8775/MC8775V:
     This device contains FCC ID: N7NMC8775
     This equipment contains equipment certified under IC: 2417C-MC8775
   - For MC8780:
     This device contains FCC ID: N7NMC8780

- For MC8781:
  This device contains FCC ID: N7NMC8781
  This equipment contains equipment certified under IC: 2417C-MC8781
- For MC8790/MC8790V:
  This device contains FCC ID: N7NMC8790
  This equipment contains equipment certified under IC: 2417C-MC8790
- For MC8792V:
  This device contains FCC ID: N7NMC8792
  This equipment contains equipment certified under IC: 2417C-MC8792
- For MC8795V:
  This device contains FCC ID: N7NMC8795
  This equipment contains equipment certified under IC: 2417C-MC8795
- For MC8801:
  This device contains FCC ID: N7NMC8801
  This equipment contains equipment certified under IC: 2417C-MC8801

5. A user manual with the end product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC / IC RF exposure guidelines.

The end product with an embedded MC57xx/MC8xxx modem may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

Note: If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093 and IC RSS-102.

EU regulatory conformity

Sierra Wireless hereby declares that the MC8700, MC8704, MC8705, MC8775, MC8775V, MC8780, MC8790, MC8790V, MC8791V, MC8792V, MC8795V, and MC8801 modems conform with all essential requirements of Directive 1999/5/EC.

MC8355: TBD

MC8775, MC8775V, MC8780, MC8790, MC8790V, MC8791V, MC8792V:

CE 0682

MC8795V:

CE 0168

MC8700, MC8704, MC8705, MC8801:

CE 0678

The Declaration of Conformity made under Directive 1999/5/EC is available for viewing at the following location in the EU community:

Sierra Wireless (UK), Limited
Lakeside House
1 Furzeground Way, Stockley Park East

Uxbridge, Middlesex
UB11 1BD
England

Brazil ANATEL homologation

(MC8790 somente) Este produto está homologado pela ANATEL, de acordo com os procedimentos regulamentados pela Resolução 242/2000, e atende aos requisitos técnicos aplicados.

Para maiores informações, consulte o site da ANATEL www.anatel.gov.br.

B: Acronyms and Definitions

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Table B-1: Acronyms and definitions

Acronym or term	Definition
AGC	Automatic Gain Control
BER	Bit Error Rate - a measure of receive sensitivity
BLER	Block Error Rate
Call Box	Base Station Simulator - Agilent E8285A or 8960, Rohde & Schwarz CMU200
CDMA	Code Division Multiple Access
dB	Decibel = 10 x $\log_{10}$ (P1/P2) *P1 is calculated power; P2 is reference power* Decibel = 20 x $\log_{10}$ (V1/V2) *V1 is calculated voltage, V2 is reference voltage*
dBm	Decibels, relative to 1 mW - Decibel(mW) = 10 x $\log_{10}$ (Pwr (mW)/1mW)
DUT	Device Under Test
EDGE	Enhanced Data rates for GSM Evolution
EM	Embedded Module
ESD	ElectroStatic Discharge
FER	Frame Error Rate - a measure of receive sensitivity
GPRS	General Packet Radio Services
GPS	Global Positioning System
GSM	Global System for Mobile communications
Hz	Hertz = 1 cycle/second
inrush current	Peak current drawn when a device is connected or powered on
IS-2000	3G radio standards for voice and data (CDMA only)
IS-95	2G radio standards targeted for voice (cdmaONE)
LDO	Low Drop Out - refers to linear regulator
MC5727/MC5727V/ MC5728V	Sierra Wireless AirPrime embedded modules used on CDMA networks
MC57xx	Any of the following CDMA AirPrime embedded modules: MC5727/ MC5727V/MC5728V

Table B-1: Acronyms and definitions

Acronym or term	Definition
MC8201/MC8700/ MC8704/MC8705/ MC8775/MC8775V / MC8780/MC8781/ MC8790/MC8790V/ MC8791V/MC8792V/ MC8795V/MC8801	Sierra Wireless AirPrime embedded modules used on GSM/UMTS networks
MC8xxx	Any of the following GSM/UMTS AirPrime embedded modules: MC8201/ MC8700/MC8704/MC8705/MC8775/MC8775V/MC8780/MC8781/ MC8790/MC8790V/MC8791V/MC8792V/MC8795V/MC8801
MHz	MegaHertz = 10E6 Hertz (Hertz = 1 cycle/second)
MIO	Module Input/Output
MPE	Maximum Permissible Exposure—the level of radiation to which a person may be exposed without hazardous effect or adverse biological changes
OTA	Over-The-Air or Radiated through the antenna
PCS	Personal Communication System - PCS spans the 1.9 GHz radio spectrum
RF	Radio Frequency
RMS	Root Mean Square
SA	Selective Availability
Sensitivity (Audio)	Measure of lowest power signal that the receiver can measure
Sensitivity (RF)	Measure of lowest power signal at the receiver input that can provide a prescribed BER/BLER/SNR value at the receiver output.
SIM	Subscriber Identity Module
SNR	Signal to Noise Ratio
SOF	Start of Frame - a USB function
UART	Universal Asynchronous Receiver Transmitter
UDK	Universal Development Kit (PCI Express Mini Card Dev Kit)
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
USIM	Universal Subscriber Identity Module
VCC	Supply voltage (3.8 V for MC8201, 3.3 V for all others)
WCDMA	Wideband Code Division Multiple Access—In this document, the term “UMTS” is used instead of “WCDMA”.
XIM	In this document, XIM is used as part of the contact identifiers for the USIM interface (XIM_VCC, XIM_CLK, etc.).

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