



Hardware Integration Guide

AirPrime SL3010T



SIERRA
WIRELESS

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1. Introduction

The AirPrime SL3010T embedded module is a 74-pin soldered-down module based on the Intel pin-out specification proposal for the standard JEDEC LGA packaging form factor. Its wireless modem provides CDMA wireless data connectivity for eBooks, portable navigation devices, mobile Internet devices, point-of-sale devices, industrial handhelds and other machine-to-machine and vertical applications. The SL3010T is part of a family of embedded wireless engines spanning a number of air interface technologies and wide area networking protocols. It has a dual-band diversity radio supporting the 800 MHz cellular and 1900 MHz PCS bands as well as GPS frequency band. For more information on the bands supported by the SL3010T embedded module, refer to Table 1 Band and Power Class Features.

The SL3010T is based on QUALCOMM's QSC6085 integrated processor.

The purpose of this document is to describe the features and specifications of the module and to provide our OEM partners/customers with the information required to integrate the SL3010T into their products. Application and hardware interface requirements are described at a high level only; for more details, visit www.sierrawireless.com.

1.1. Physical Features

- Small form factor – Based on the 74-pin LGA Intel Moorestown form factor specification (25mm x 30mm x 2.47mm (nominal))
- Complete body shielding
- RF connection pads – RF primary, diversity and GPS interfaces
- Baseband signals connection

1.2. Electrical Features

- One supply voltage, VCC, with a minimum voltage of 3.3 V, and a maximum of 4.3 V.
- Self-shielded; no additional shielding is required.

1.3. Environmental Features

Temperature operating range:

- Normal use (3GPP compliant): -30°C to +70°C
- Industry extended temperature range (non-3GPP compliant): -40°C to +85°C

1.4. RF Features

- Dual-band support for both the 800 MHz cellular and 1.9 GHz PCS bands
- Receive diversity support for the 800 MHz cellular and 1.9 GHz PCS bands
- Adheres to CDMA authentication as specified in CDMA 1X
- Support for IS-95A/B and CDMA 1X Release 0/A
- Support for gpsOne™ and stand-alone GPS

1.5. Application Interface Features

- USB supporting multiple logical channels over the USB MUX protocol
- USB selective suspend supported for maximum power savings
- Wakeup Enable – the module can be set to wake the host device upon ring, restoration of radio coverage, and/or receipt of SMS
- One UART port and one USB port
- AT command interface
- Limited RUIIM support (does not support STK)

1.5.1. Voice Features

- PCM interface
- Echo cancellation

TheSL3010T has internal IS-127 and IS-733 vocoders and supports:

- Call origination
- Silent retry call origination protocol
- Echo cancellation
- E911
- Incoming call notification

1.6. Packet Mode Features

IS-2000 data rates up to 153 kbps, simultaneous forward and reverse channel. (Note that data rate supported depends on network implementation.)

1.7. IS-95 Circuit-Switched Features

- V.34 data rates to 14.4 kbps
- G3 facsimile receive and transmit
- Quick Net Connect (QNC) support

1.8. Short Message Service (SMS) Features

- Send and receive
- Notification of new messages

1.9. Hardware Development Components

Sierra Wireless manufactures two hardware development components to facilitate the hardware integration process:

- AirPrime SL Socket Board — Adapter board on which an SL module is embedded. This board may be used as a stand-alone platform for basic hardware development.
- AirPrime SL Development Kit — Hardware development board on which an SL socket board is plugged. The development kit provides access to all of the interfaces supported by the SL module.

For instructions on using the SL Development Kit, see document [2] AirPrime SL Series Universal Development Kit User Guide and [3] AirPrime SL Series Mechanical Socket Development Kit Quick Start Guide.



2. Standards Compliance

This section describes the SL3010T standards compliance. Many of these features require the support of the host device for full compliance. These cases are noted.

2.1. General Compliance

2.1.1. Mobile Station Class

The output power and band class features of the SL3010T are summarized in the following table.

Table 1. Band and Power Class Features

Band Class	Mobile Station Class
Band Class 0 (North American Cellular) ¹	Class III
Band Class 1 (North American PCS) ²	Class II
Receive diversity Band Class 0	
Receive diversity Band Class 1	
Voice capability (PCM digital audio)	
GPS (1575.42)	

1 Band Class 0 also supports cellular bands in other regions including Asia Pacific, Latin America and the Middle East.

2 Band Class 1 also supports PCS bands in other regions including Asia Pacific and Latin America.

2.1.2. Protocol Revision Support

The SL3010T supports all protocol revisions through P_REV 6. Detailed protocol revision feature compliance is described in the next two sections.

2.2. TIA/EIA-95B

The SL3010T is compliant with TIA/EIA-95-B, including all protocol revisions through P_REV 4. Feature support for P_REV 5 is defined in the following table.

Table 2. Support for P_REV 5 Features

Feature	Supported?
Access Entry Handoff	Yes
Access Probe Handoff	Yes
Channel Assignment into Soft Handoff	Yes
Mobile Assisted Hard Handoff	Yes
Network Directed System Selection	Yes
Calling Name Presentation (CNAP)	Yes ¹
Priority Access and Channel Assignment (PACA)	No

Feature	Supported?
Power-Up Function (PUF)	No
AMPS Improvements (IS-553-A)	N/A
Supplemental Code Channels (MDR)	Yes ²
Hopping Pilot Beacon	No
IS-95B Wireless Local Loop (WLL) Features	No

1 Host support is required for this feature

2 Only F-SCCH is supported. Up to seven F-SCCH supported.

2.3. TIA/EIA/IS-2000

The SL3010T support for TIA/EIA/IS-2000 features is defined by the capabilities of the QUALCOMM MDM6085/QSC6085 hardware and AMSS6085 software.

2.3.1. Radio Configurations

The SL3010T supports all mandatory radio configurations. Detailed channel and radio configuration support is shown in the following table.

The following table also outlines the data rates supported by each radio configuration. The maximum data rate supported by 1X is 153 kbps simultaneously on the forward and reverse link.

Table 3. Channel and Radio Configuration Support¹

Feature	Supported	Simultaneous Data Rate (kbps)	
		Forward Link	Reverse Link
Quick Paging Channel (F-QPCH)	Yes		
Fundamental Channel (FCH)			
Rate Set 1 RCs (fwd: 1,3,4; rev: 1,3)	Yes	9.6	9.6
Rate Set 2 RCs (fwd: 2,5; rev: 2,4)	Yes	14.4	14.4
Supplemental Channel (SCH)			
Rate Set 1 RCs (fwd: 3,4; rev: 3)	Yes	9.6/19.2/38.4/76.8/153.6/ 307.2	9.6/19.2/38.4/76.8/153.6 /307.2
Rate Set 2 RCs (fwd: 5; rev: 4)	Yes	14.4/28.8/57.6/115.2/230.4	14.4/28.8/57.6/115.2/230.4
Dedicated Control Channel (DCCH)²			
Rate Set 1 RCs (fwd: 3,4; rev: 3)	Yes	9.6	9.6
Rate Set 2 RCs (fwd: 5; rev: 4)	Yes	14.4	14.4
Reverse Pilot Channel (R-PICH)	Yes		

1 Support of maximum data rates is dependent on MSM supplier software, memory speed grade availability and network implementation.

2 20 ms frames only

2.3.2. Release A Feature Support

The SL3010T supports all mandatory P_REV 6 features. Additional support for P_REV 6 features is described in the following table. Note that not all Release A features may be supported by carriers or network equipment.

Table 4. Support for P_REV 6 Feature

Optional P_REV 6 Feature	Supported?
Simultaneous Maximum Data rates on Forward and Reverse Channels	Yes
Quasi Orthogonal Functions (QOF)	Yes
Turbo encoding/decoding	Yes
Quick Paging Channel	Yes
Slotted Mode Timer	Yes
Orthogonal Transmit Diversity (OTD)	Yes
Reverse Pilot Gating	Yes
1/8 Rate Traffic Channel Gating	Yes
Mobile Assisted Burst Operation (MABO)	No
Traffic Channel Control Hold	Yes
Short Data Bursts	Yes
5 ms, 10 ms Frame sizes	No

2.4. CDMA Data Services

The SL3010T supports the data features of IS-707-A as shown in the following table. Actual data speeds supported by the SL3010T are shown in Table 3. The following table outlines support for additional data features that are not part of IS-707-A.

Table 5. IS-707-A Data Features

CDMA Data Service	IS-707-A Section	Supported?
RLP	IS-707.2	Yes*
AT Command Set	IS-707.3	Yes
Asynchronous Data and Fax at 9.6 kbps and 14.4 kbps	IS-707.4	No
Packet Data Service	IS-707.5	Yes
STU-III	IS-707.6	No
Analog Fax	IS-707.7	No
Radio Link Protocol Type 2 (RLP2)	IS-707.8	Yes
High Speed Packet Data (MDR - Medium Data Rate)	IS-707.9	No
Radio Link Protocol Type 3 (RLP3)	IS-707.10	Yes
CDMA High Speed Packet Data	IS-707.12	No

* Encrypted mode and non-transparent modes are NOT supported.

Table 6. Data Features Supported

Features	Supported?
Quick Net Connect	No
Pre-arrangement for incoming Async data or fax	No
In-Band DCE Control (TIA/EIA-617)	Yes
Facsimile Digital Interfaces (TIA/EIA/IS-134)	Yes
Asynchronous facsimile DCE Control Standard (TIA/EIA-592)	Yes
Simple IP	Yes
Mobile IP (TIA/EIA/IS-835-A)	Yes

2.5. CDMA Voice Services

The SL3010T supports EVRC and 13QCELP vocoders and complies with the following Voice Service Option standards:

- TIA/EIA/IS-733-1: 13QCELP Vocoder Specification
- TIA/EIA/IS-736: 13QCELP Minimum Performance Requirements
- TIA/EIA/IS-127-2: EVRC Vocoder Specification
- TIA/EIA/IS-718: EVRC Minimum Performance Requirements
- TTY/TDD compatibility (no interface for Open AT Application Framework)

2.6. CDMA Short Message Service (SMS)

The following table summarizes the SL3010T compliance with SMS features per TIA/EIA/637-B. Note that not all of these features are available on all carrier networks, and host device support is required for compliance with these features. The SL3010T also complies with specific carrier requirements for SMS as defined by each CDMA carrier.

Table 7. SMS Features

Feature	Supported?
Mobile Terminated SMS	Yes
Mobile Originated SMS	Yes
Point-to-Point Messaging	Yes
Broadcast Messaging	No
Acknowledge Messaging	Yes
Analog Mode SMS	No
Wireless Paging Teleservice	Yes
Wireless Messaging Teleservice	Yes
Voice Mail Notification	Yes
Wireless Application Teleservice	Yes
Service Category Programming Teleservice	Yes

2.7. Over-The-Air Service Provisioning (OTASP)

2.7.1. IS-683 Features

The SL3010T supports TIA/EIA/IS-683-A for Over-the-Air Service-Provisioning (OTASP) and Parameter Administration (OTAPA) as summarized in the following table. The SL3010T also complies with carrier specific OTASP and OTAPA requirements.

Table 8. OTASP/OTAPA Features

Feature	Supported?
OTASP (user initiated)	Yes*
OTAPA (network initiated)	Yes
NAM Parameter Download	Yes
Preferred Roaming List (PRL) Download	Yes
A-Key Exchange	Yes
OTAPA NAM Lock	Yes
Re-Authenticate Messaging	Yes
Protocol Capability Messaging	Yes

* Host support is required for this feature.

2.7.2. Internet Over The Air (IOTA) Features

The SL3010T firmware includes an embedded IOTA client that includes the following support:

- Automatically initiates and attempts to complete an IOTA session in the SL3010T when the network initiates an IOTA session.
- Provides an interface to the host to request the SL3010T to initiate and attempt a client initiated IOTA session.
- Provides notifications to the host of status and results of the current IOTA session in the SL3010T.
- Provides an interface to the host to cancel, at any time, an active IOTA session running in the SL3010T.

IOTA feature support is defined in the following table.

Table 9. IOTA Features

Feature	Supported?
Bootstrap Provisioning	Yes*
Network Initiated Provisioning using WAP Push	Yes
Reassembly of Multiple IOTA Trigger Messages	Yes
HTTP and SSL Support (Download Agent)	Yes
MMC XML and MIME Parser / Assembler	Yes
IS-683-A/B Tunneling	Yes
WBXML Parser / Assembler	Yes

Feature	Supported?
Bearer Selection Table Provisioning	Yes
User NAI Profiles and CDMA Objects	Yes

* Host support is required for this feature.

2.8. Position Location

The SL3010T supports position location features as specified in the following table.

Table 10. Position Location Features

Feature	Supported?
TIA/EIA/IS-801.1 Compliant	Yes
FCC E911 Phase II Position Determination Compliance	Yes
TIA/EIA/IS-J-STD-036 Enhanced Wireless 9-1-1 Phase II	Yes
TIA/EIA/IS-801.1 Compliant Data Burst Messaging Transport	Yes
TIA/EIA/IS-801.1 Messaging Compliant TCP/IP Transport	Yes
Mobile initiated, PDE calculated position	Yes
PDE initiated, PDE calculated position (Mobile terminated request)	Yes
Mobile calculated position	Yes
Advanced Forward Link Trilateration (AFLT)	Yes
Compliant with Snap Track Sensor Interface Application and Position Determination Entity (SIA/PDE)	Yes

2.9. Additional Standards

The following additional standards, required for CDMA operation, are also supported:

- **TIA/EIA-126-D, Mobile Station Loop back Service Options Standard** – Specifies loop back service options used during testing and certification.
- **TIA/EIA TSB 50, User Interface for Authentication Key Entry** – Specifies the method for A-Key Entry from the device user interface.
- **TIA/EIA TSB 58-C, Parameter Value Assignments for TIA/EIA Wideband Spread Spectrum Standards** – Assigns values to reserved parameters and specifies which are standard and which may be used for proprietary (manufacturer specific) values.
- **CDG 36, Markov Service Options for Wideband Spread Spectrum Systems Communications Systems** – Specifies the function of specific service options used for one-way, over-the-air testing of mobiles.
- **TIA/EIA/IS-870, Test Data Service Option (TDSO) for CDMA2000® Spread Spectrum Systems** – Defines a test data service option for testing of CDMA2000® mobile units.

2.10. CDMA Certification Requirements

The SL3010T is designed to be fully compliant with the requirements below. However, final product certification requires a fully integrated host device (that incorporates the SL3010T).

Tests that require features not supported by the SL3010T (as defined in this document) are not supported.

2.10.1. CDMA Parametric Performance

The SL3010T meets or exceeds TIA/EIA/IS-98D/E specifications for performance for CDMA2000®.

2.10.2. Interoperability

The SL3010T complies with the following interoperability standards:

- CDG 22 – Stage 2 Interoperability Tests (TIA/EIA/IS-95A)
- CDG 53 – Stage 2 Interoperability Tests (TIA/EIA-95-B)
- C.S0031-0 – Signaling Conformance Tests for CDMA2000® Spread Spectrum Systems (Stage 2 for TIA/EIA/IS-2000)
- CDG 64 – Stage 3 Testing for CDMA2000®
- C.S0032 – Recommended Minimum Performance Standards for CDMA2000® High Rate Packet Data Access Terminal (TIA/EIA/IS-866)

2.10.3. FCC Type Acceptance

The SL3010T complies with the agency certifications specified in the following table.

Table 11. US Compliance Requirements

Compliance Area	US Regulation
Licensed transmission	FCC Part 22, 24

Final product certification depends on the OEM host device and particularly the OEM antenna implementation. Regulatory agency compliance testing is required for final product certification.



3. Electrical Specifications

3.1. Host Interface

The SL3010T host I/O connector provides pins for power, serial communications and control. The details of these interfaces are described in the sections that follow.

3.1.1. Pin Assignments

The SL3010T's host connector provides the power, LED and USB communications through a single connector. Detailed pin assignments are shown in the table below.

Table 12. Connector Pin Assignments

Pin #	Signal Name	Description	Direction to Module	Active State	Voltage Levels (V)*		
					Min	Typ	Max
1	GPIO_3	General purpose I/O or External interruption	Input High	High/Low	1.69	-	2.9
			Input Low		-0.3		0.91
			Output High		2.15		2.6
			Output Low		0		0.45
2	GPIO_2	General purpose I/O or External interruption	Input High	High/Low	1.69	-	2.9
			Input Low		-0.3		0.91
			Output High		2.15		2.6
			Output Low		0		0.45
3	GPIO_1	General purpose I/O or External interruption	Input High	High/Low	1.69	-	2.9
			Input Low		-0.3		0.91
			Output High		2.15		2.6
			Output Low		0		0.45
4	GPIO_4	General purpose I/O or External interruption	Input High	High/Low	1.69	-	2.9
			Input Low		-0.3		0.91
			Output High		2.15		2.6
			Output Low		0		0.45
5	GPIO_5	General purpose I/O or External interruption	Input High	High/Low	1.69	-	2.9
			Input Low		-0.3		0.91
			Output High		2.15		2.6
			Output Low		0		0.45
6	EXT_VREG_USIM	USIM VCC supply	Output (1.8 V)	Power	1.65	1.80	1.95
			Output (3.0V)		2.70	3.00	3.30

Pin #	Signal Name	Description	Direction to Module	Active State	Voltage Levels (V)*		
					Min	Typ	Max
7	EXT_USIM_RESET	USIM reset	Output High (1.8V)		1.44	1.80	2.10
			Output Low (1.8V)		0		0.36
			Output High (3.0V)		2.70	3.00	3.30
			Output Low (3.0V)		0		0.60
8	EXT_USIM_DATA	USIM I/O pin	Input High (1.8 V)		1.26		2.10
			Input Low (1.8 V)		-0.30		0.40
			Output High (1.8 V)		1.26	1.80	2.10
			Output Low (1.8 V)		0		0.30
			Input High (3.0 V)		2.10		3.30
			Input Low (3.0 V)		-0.30		0.60
			Output High (3.0 V)		2.10	3.00	3.30
			Output Low (3.0 V)		0.00		0.60
9	EXT_USIM_CLK	USIM clock	Output High (1.8V)		1.26	1.80	2.10
			Output Low (1.8V)		0.00		0.36
			Output High (3.0V)		2.10	3.00	3.30
			Output Low (3.0V)		0.00		0.60
10	VREG_MSMP_2V6	2.6 V LDO	Output	High (when module is on)	2.52	2.6	2.68
11	NC	Not connected					
12	NC	Not connected					
13	NC	Not connected					
14	NC	Not connected					
15	NC	Not connected					
16	I2C_SDA/GPIO_6	I ² C bus data, General purpose I/O or External interruption	I/O				
17	I2C_SCL/GPIO_7	I ² C bus clock, General purpose I/O or External interruption	I/O		0	-	2.5
18	ADC_2**	Analog/Digital conversion Input	Input		0	-	2.5
19	GND	Ground	GND	GND	-	-	-
20	GND	Ground	GND	GND	-	-	-
21	GND	Ground	GND	GND	-	-	-

Pin #	Signal Name	Description	Direction to Module	Active State	Voltage Levels (V)*		
					Min	Typ	Max
22	ANT_DIV	Diversity antenna			tbd	tbd	Tbd
23	GND	Ground	GND	GND	-	-	-
24	NC	Not connected					
25	NC	Not connected					
26	NC	Not connected					
27	NC	Not connected					
28	GND	Ground	GND	GND	-	-	-
29	ANT_PRM	Main (primary) antenna			tbd	tbd	Tbd
30	GND	Ground	GND	GND	-	-	-
31	NC	Not connected					
32	NC	Not connected					
33	NC	Not connected					
34	NC	Not connected					
35	GND	Ground	GND	GND	-	-	-
36	ANT_GPS	GPS antenna			tbd	tbd	Tbd
37	GND	Ground	GND	GND	-	-	-
38	GND	Ground	GND	GND	-	-	-
39	GND	Ground	GND	GND	-	-	-
40	NC	Not connected					
41	NC	Not connected					
42	VCC_3V6	3.6 V supply	Input	Power	3.3	3.6	4.3
43	POWER_ON_N	Power on	Input		0		2.6
44	VCC_3V6	3.6 V supply	Input	Power	3.3	3.6	4.3
45	UART1_TXD	UART Transmit Data	Input High		1.69	-	2.9
			Input Low		-0.3		0.91
46	UART1_RXD	UART Receive Data	Output High		2.15		2.6
			Output Low		0		0.45
47	UART1_CTS_N	UART Clear To Send	Output High		2.15		2.6
			Output Low		0		0.45
48	UART1_RTS_N	UART Request To Send	Input High		1.69	-	2.9
			Input Low		-0.3		0.91
49	NC	Not connected					
50	USB_D+	USB data positive (Low/Full speed)	Input High		2.00	3.30	3.60
			Input Low		0.00		0.80
			Output High		2.80	3.30	3.60
			Output Low				0.30
51	USB_D-	USB data negative (Low/Full speed)	Input High		2.00	3.30	3.60
			Input Low		0.00		0.80
			Output High		2.80	3.30	3.60
			Output Low				0.30
52	GND	Ground	GND	GND	-	-	-

Pin #	Signal Name	Description	Direction to Module	Active State	Voltage Levels (V)*		
					Min	Typ	Max
53	NC	Not connected					
54	NC	Not connected					
55	NC	Reserved					
56	NC	Not connected					
57	NC	Not connected					
58	NC	Not connected					
59	NC	Not connected					
60	LED_FLASH**	LED driver	Output High	High	2.15		2.6
			Output Low		0		0.45
61	WAKE_N	Wake Host Interface	Output High	Low	2.15		2.6
			Output Low		0		0.45
62	W_DISABLE_N	Wireless disable	Input High		1.69	-	2.9
			Input Low		-0.3		0.91
63	SYSTEM_RESET_N	Reset	Input High		1.17	-	2.9
			Input Low		-0.3		0.63
64	PCM_SYNC	PCM Synch Output	Output High		2.15		2.6
			Output Low		0		0.45
65	PCM_DOUT	PCM Data Output	Output High		2.15		2.6
			Output Low		0		0.45
66	PCM_DIN	PCM Data Input	Input High		1.69	-	2.9
			Input Low		-0.3		0.91
67	PCM_CLK	PCM Clock	Output High		2.15		2.6
			Output Low		0		0.45
68	BUZZER_EN**	General purpose I/O	Output High		2.15		2.6
			Output Low		0		0.45
69	TDI	Test Data Input	Input High		1.69	-	2.9
			Input Low		-0.3		0.91
70	TMS	Test Mode Select	Input High		1.69	-	2.9
			Input Low		-0.3		0.91
71	TCK	Test Clock	Input High		1.69	-	2.9
			Input Low		-0.3		0.91
72	TRST_N	Test Reset	Input High		1.69	-	2.9
			Input Low		-0.3		0.91
73	TDO	Test Data Output	Output High		2.15	-	2.6
			Output Low		0		0.45
74	RTCK	Return TCK	Output High		2.15	-	2.6
			Output Low		0		0.45

* All values are preliminary.

** This feature is available in the SL3010T hardware, but currently not supported in the firmware.

3.1.2. Host Interface Descriptions

This section and the sections that follow provide additional detail on each portion of the host connector interface.

Each pin has a type code as part of its description. The type code is one of the following:

- **A** – Analog Pin
- **I** – Input
- **NP** – No pull
- **O** – Output
- **PU** – Digital Pin, Internal Pull Up
- **PD** – Digital Pin, Internal Pull Down
- **V** – Power or Ground Pin

3.1.3. Power Supply

Power is provided to the SL3010T through multiple power and ground pins as described in the following table.

Table 13. Power and Ground Specifications

Signal Name	Pin #	Type	Specification	Parameter	Min	Typ	Max	Unit
VCC_3V6	42, 44	V	Voltage Range	VCC	3.3	3.6	4.3	V
			Ripple Voltage		-	-	100	mVpp
VREG_MSMP_2V6	10	V	Maximum supply current = 10 mA		2.52	2.6	2.68	V
GND	19, 20, 21, 23, 28, 30, 35, 37, 38, 39, 52	V			-	0	-	V

3.2. RF Specifications

The SL3010T supports cell, PCS and GPS.

Table 14. Main Antenna Specifications ^{1,2}

Parameter	Min*	Typ*	Max*	Unit	Notes
Cable loss	-	-	0.5	dB	Maximum loss to antenna
Impedance	-	50	-	Ω	Antenna load impedance
VSWR	-	-	2.5:1		Maximum allowed VSWR of antenna

1 Sierra Wireless provides detailed antenna requirements in device integration guides. Contact Sierra Wireless for further information.

2 Main antenna connects to pin 29

* Preliminary values

Table 15. RF Performance

Parameter	Min	Typ	Max	Unit	Notes
Maximum output power	+23.0	+24.0	+25.0	dBm	+25.0 dBm is the maximum output power for IS-95, IS-2000
RX sensitivity (US Cell)	-	-107	-	dBm	IS-2000 SO2
RX sensitivity (US PCS)	-	-107	-	dBm	IS-2000 SO2

Table 16. Diversity Antenna Specifications

Parameter	Min	Typ	Max	Unit	Notes
Cable loss	-	-	0.5	dB	Maximum loss to antenna
Impedance	-	50	-	Ω	Antenna load impedance
VSWR	-	-	2.5:1		Maximum allowed VSWR of antenna
Isolation between main and diversity antenna	10	-	-	dB	Minimum isolation

If the antenna connection is shorted or open, the radio module will not sustain permanent damage.

Table 17. GPS Sensitivity

Parameter	Typical	Unit	Notes
Single-satellite sensitivity w/SA	-155	dBm	Sensitivity is where 50% of the visible satellites can be acquired

Table 18. GPS Specifications

Parameter/Feature	Description
Satellite channels	12 channel, continuous tracking
Protocols	NMEA 0183 V3.0
Acquisition time	Re-acquisition: 2 sec. Hot start: 9 sec. Warm start: 35 sec. Cold start: 39 sec.
Accuracy	Horizontal: < 3 m (50%); < 8 m (90%) Altitude: < 10 m (50%); < 16 m (90%) Velocity: 0.06 m/sec.
Sensitivity	Acquisition: -158 dBm Tracking: -160 dBm Cold-start: -145 dBm
Operational limits	Altitude < 18,000 m or velocity: 515 m/sec (either limit may be exceeded, but not both)

Table 19. Recommended GPS Antenna Specifications

Parameter/Feature	Description
Gain	Maximum gain and uniform coverage in high-angle elevation and zenith. Gain in the azimuth plane is not desired.
Average 3D gain	> -5 dBi
VSWR	Typical value < 2:1
Isolation (GPS ↔ Main)	> 10 dB in all related bands
Polarization	Any, other than LHCP (left-hand circular polarized)



4. RF Circuit Routing Constraints

To route the RF antenna signals, the following recommendations must be observed for PCB layout:

The RF signals must be routed using traces with a 50Ω characteristic impedance.

Basically, the characteristic impedance depends on the dielectric constant (ϵ_r) of the material used, trace width (W), trace thickness (T), and height (H) between the trace and the reference ground plane.

In order to respect this constraint, Sierra Wireless recommends that a MicroStrip structure be used and trace width be computed with a simulation tool (such as AppCAD, shown in the figure below and available free of charge at <http://www.avagotech.com>).

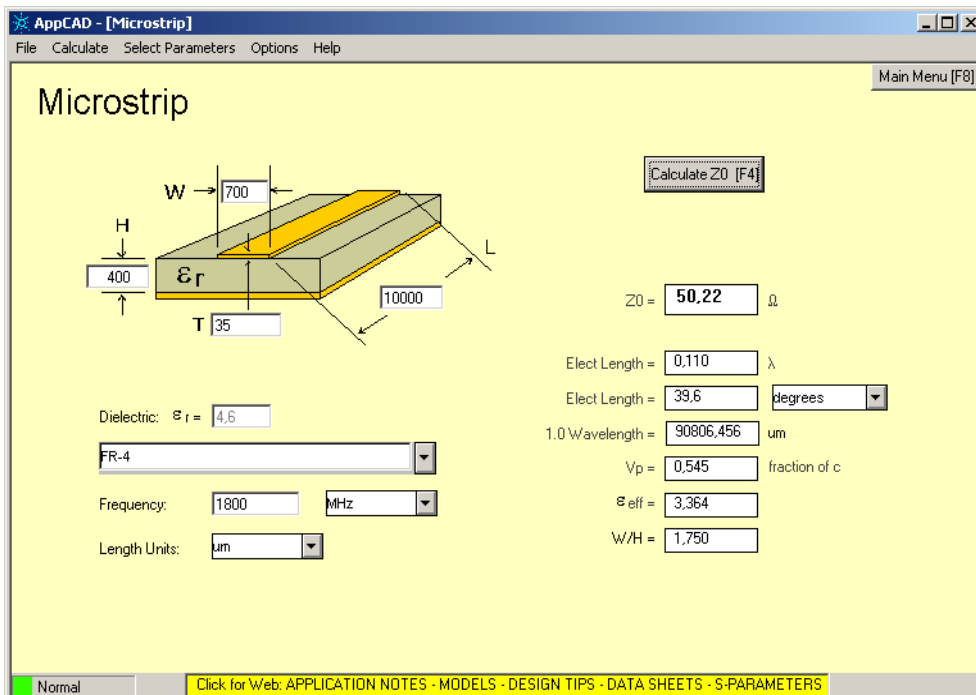


Figure 1. AppCAD Screenshot for MicroStrip Design Power Mode Diagram

The trace width should be wide enough to maintain reasonable insertion loss and manufacturing reliability. Cutting out inner layers of ground under the trace will increase the effective substrate height; therefore, increasing the width of the RF trace.

Caution: *It is critical that no other signals (digital, analog, or supply) cross under the RF path. The figures below show generic examples of good routing techniques.*

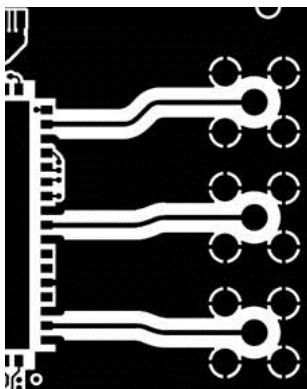


Figure 2. RF Routing Example with Lead Type RF Connectors

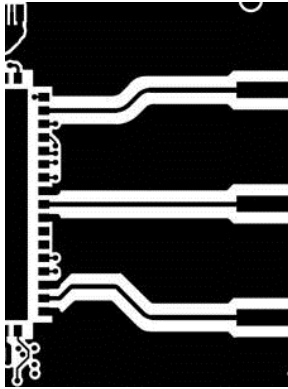


Figure 3. RF Routing Example with SMT Type RF Connectors

- Fill the area around the RF traces with ground and ground vias to connect inner ground layers for isolation.
- Cut out ground fill under RF signal pads to reduce stray capacitance losses.
- Avoid routing RF traces with sharp corners. A smooth radius is recommended.
- The ground reference plane should be a solid continuous plane under the trace.
- The coplanar clearance (G, below) from the trace to the ground should be at least the trace width (W) and at least twice the height (H). This reduces the parasitic capacitance, which potentially alters the trace impedance and increases the losses. Note the figure below shows several internal ground layers cutout, which may not be necessary for every application.

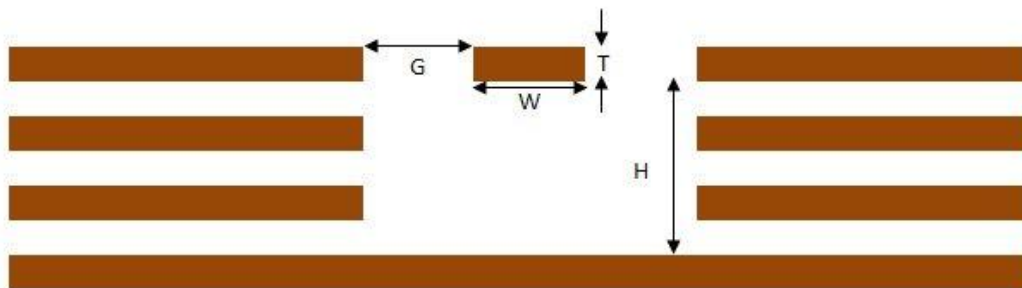


Figure 4. Coplanar Clearance Example

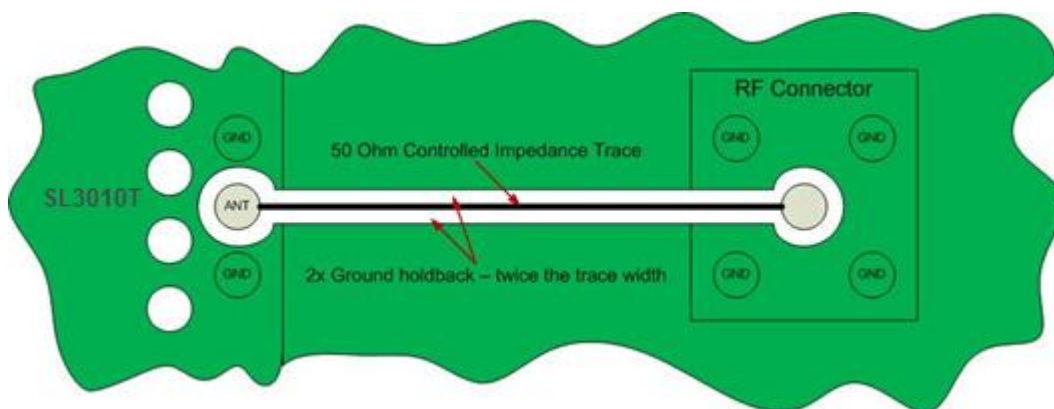


Figure 5. Antenna Microstrip Routing Example



5. Mechanical and Environmental Specifications

Note: After performing the non-operational tests (for example, vibration, shock, and drop), the SL3010T meets all operating parameters.

The SL3010T complies with the mechanical and environmental specifications in this section. Final product conformance to these specifications depends on the OEM device implementation.

Table 20. Mechanical and Environmental Specifications

Parameter	Mode	Details
Temperature	Operational	-30°C to +70°C – Full RF compliance -40°C to +85°C – Function work +70°C to +85°C – Reduced RF performance
	Non-operational	-40°C to +85°C, 96 hours (from MIL-STD 202 Method 108)
Relative Humidity	Non-operational	Temperature: 65°C Relative humidity (non-condensing): 95% Test duration: 10 days Recover time: 1 hour Ref Std IEC 60068-2-3 DUT op state toggled every 15 minutes (on/off)
Vibration	Non-operational	Random vibration, 10 to 1000 Hz, nominal 6 G rms in each of three mutually perpendicular axes. Test duration of 60 minutes for each axis, for a total test time of three hours.
Shock	Non-operational	Half sine shock, 2 ms, 180 in/sec (375 g). Tested in each of three mutually perpendicular axes, positive and negative (5 x 6, 30 bumps total).
Drop	Non-operational	1 m on concrete on each of 6 faces, 2 times (module only).
Electrostatic discharge	Operational	The RF port (antenna launch and RF connector) complies with the IEC 61000-4-2 standard: Electrostatic Discharge Immunity: Test: Level3 Contact Discharge: ±6 kV Air Discharge: ±8 kV
	Non-operational	The host connector Interface complies with the following standards only (unless otherwise specified for individual interfaces): <ul style="list-style-type: none"> ±2 kV Human Body Model (JESD22-A114-B) ±300 V Charged Device Model (JESD22-C101)
Form factor		The SL3010T is a 74-pin LGA soldered-down module with a two-piece shielded case. The device is based on the LGA Intel Moorestown specification.
Dimensions		Length: 30 mm
		Width: 25 mm
		Thickness: 2.47 mm (2.37mm module thickness + 0.1mm label thickness)
		Weight: Approximately 3.5g

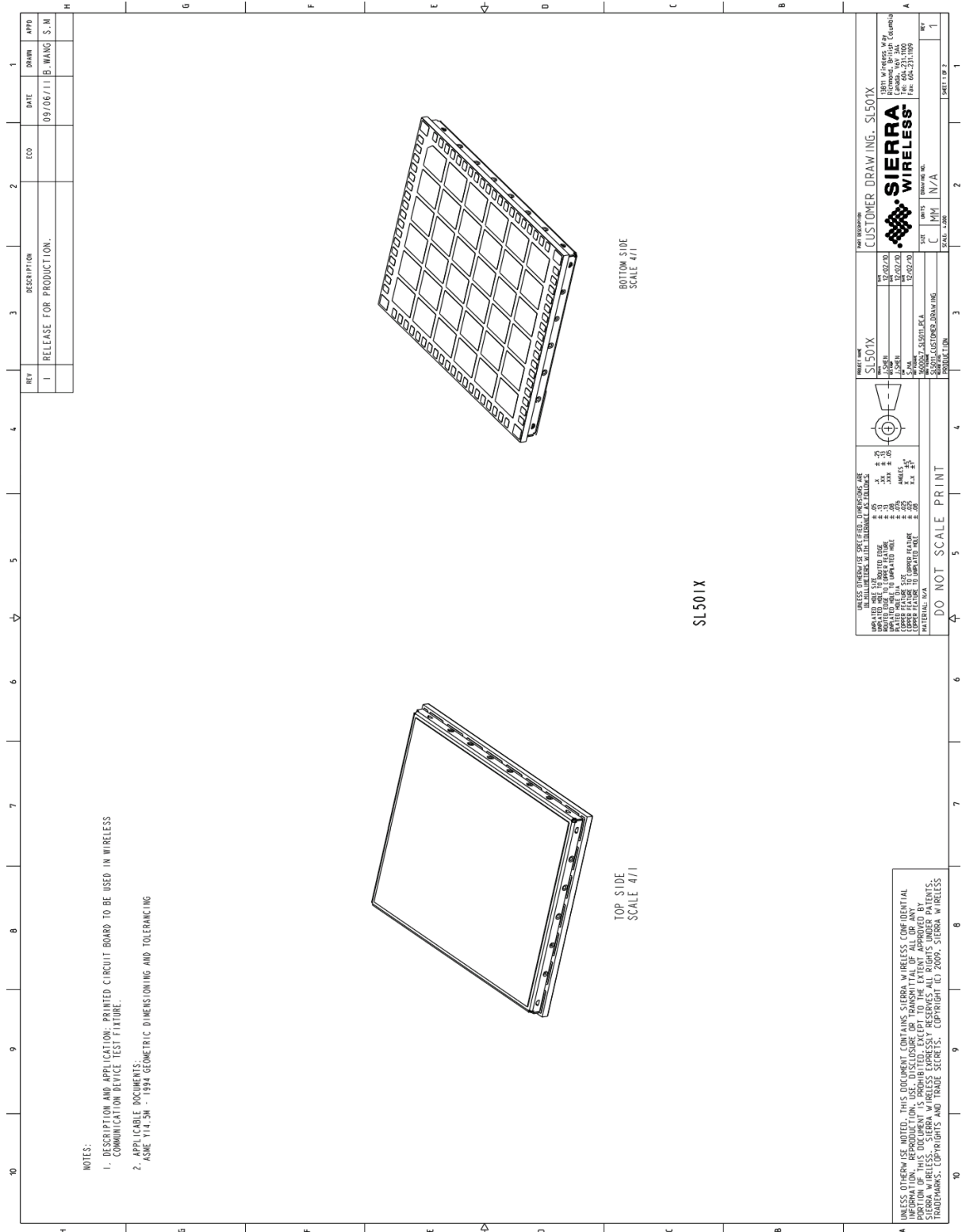
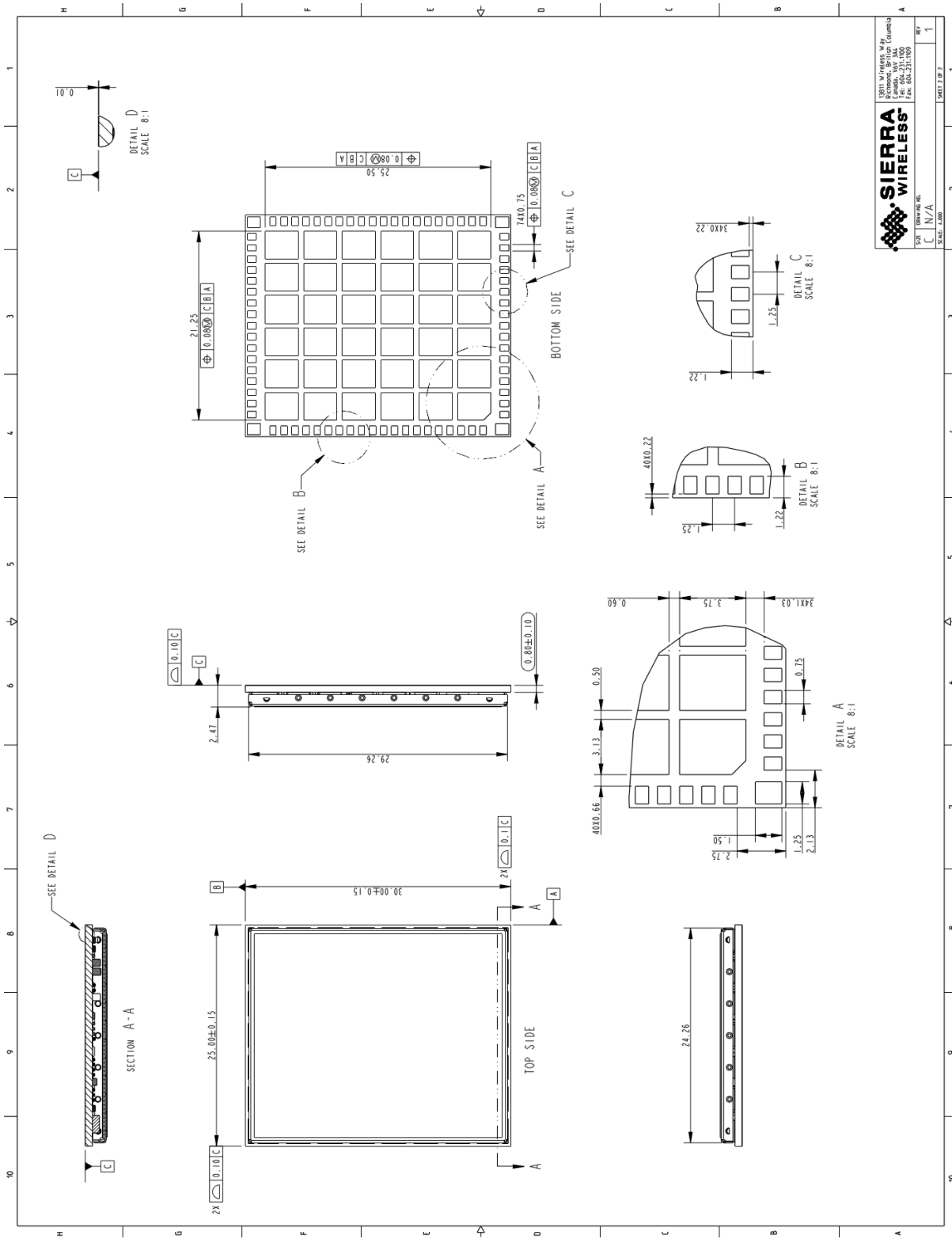


Figure 6. Top and Bottom View



SIERRA WIRELESS
 19715 W. Highway 97
 Richmond, British Columbia
 V4V 1V7
 Tel: 604-271-1000
 Fax: 604-271-1005

SCALE: 1:1

REV: 1

C: N/A

SCALE: 1:1

SHEET 2 OF 2

5.1. Labeling

<TBD>

Figure 8. SL3010T Unit Label

The SL3010T label is 28 mm x 23 mm. It is non-removable and contains:

- Sierra Wireless AirPrime logo
- Product name SL3010T
- Carrier name
- CPN: Optional Customer Number*
- Serial number and barcode
- FCC certification
- ESN number and barcode

Note: * The SL3010T supports OEM partner specific label requirements.



6. Regulatory Approval

6.1. 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 Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

6.1.1. Safety and Hazards

Do not operate you SL3010T modem:

- In areas where blasting is in progress
- Where explosive atmospheres may be present including refueling 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 SL3010T modem **MUST BE POWERED OFF**. Otherwise, the SL3010T modem can transmit signals that could interfere with this equipment

In an aircraft, the SL3010T modem **MUST BE POWERED OFF**. Otherwise, the SL3010T 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 cellular phone in 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 SL3010T modem may be used normally at this time.

6.1.2. Important Compliance Information for USA OEM Integrators

The SL3010T modem is granted with a modular approval for mobile applications. Integrators may use the SL3010T 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 20cm 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 5dBi for Cellular band and 4dBi for CDMA PCS band.
3. The SL3010T modem and the 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 SL3010T modem is incorporated, with a statement similar to the following:
This device contains FCC ID: **N7NSL5011**
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 SL3010T modem may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized.

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.

6.2. Integration Requirements

When integrating the SL3010T, the following items need to be addressed:

- Mounting, and its effect on temperature, shock, and vibration performance
- Power supply, and the impact on battery drain and possible RF interference
- Antenna location and type, and their impact on RF performance
- Regulatory approvals, as described in this section
- Service provisioning, manufacturing process
- Software, as described in document [1] AirPrime SL3010T Product Technical Specification and Customer Design Guidelines
- Host interface, compliance with interface voltage levels

Note: Sierra Wireless provides guidelines for successful integration of the SL3010T in the document suite; and also offers integration support services as necessary.

>> 7. References

7.1. Sierra Wireless Documentation

- [1] AirPrime SL3010T Product Technical Specification and Customer Design Guidelines
Reference: 4112902
- [2] AirPrime SL Series Universal Development Kit User Guide
Reference number: WA_DEV_LG_UGD_003
- [3] AirPrime SL Series Mechanical Socket Development Kit Quick Start Guide
Reference number: 4112314
- [4] AT Command Reference Guide
Reference: 2130620
- [5] EMConnect Guide
Reference: 2131177
- [6] CnS Reference
Reference: 2130754

7.2. Acronyms and Definitions

Table 21. Acronyms and Definitions

Acronym or Term	Definition
1xEV-DO	Single Carrier (1X) EVolution – Data Only. A high-speed standard for cellular packet data communications Supports Internet connections with data rates up to 3.1 Mbps (downlink from the network) and 1.8 Mbps (uplink to the network). Average data rates are roughly: for Rev. A: 600-1300 kbps (downlink from the network) and 300-400 kbps (uplink to the network); for Rev. 0: 400-700 kbps (downlink from the network) and 40-80 kbps (uplink to the network). Actual speed depends on the network conditions. Compare to 1X.
1X	Single Carrier (1X) Radio Transmission Technology. A high-speed standard for cellular packet data communications Supports Internet connections with data rates up to 153 kbps (simultaneously in each direction—downlink and uplink). Actual speed depends on the network conditions. Compare to 1xEV-DO.
API	Application Programming Interface
AT	A set of modem commands, preceded by “AT,” originally developed by Hayes, Inc. for their modems. The structure (but not the specific commands, which vary greatly from manufacturer to manufacturer) is a de facto modem industry standard.
CDG	CDMA Development Group
CDMA	Code Division Multiple Access A wideband spread spectrum technique used in digital cellular, personal communications services, and other wireless networks. Wide channels (1.25 MHz) are obtained through spread spectrum transmissions, thus allowing many active users to share the same channel. Each user is assigned a unique digital code, which differentiates the individual conversations on the same channel.
CDMAOne	The IS-95 CDMA standard developed by QUALCOMM Inc.

Acronym or Term	Definition
CnS	Sierra Wireless proprietary Control and Status language interface
DCE	Data Communications Equipment
EIA	Electronics Industry Association
ERP	Effective Radiated Power
ESN	Electronic Serial Number—The unique first-generation serial number assigned to the SL3010T for use on the wireless network. Compare to MEID.
FCC	Federal Communications Commission The U.S. federal agency that is responsible for interstate and foreign communications. The FCC regulates commercial and private radio spectrum management, sets rates for communications services, determines standards for equipment, and controls broadcast licensing. Consult www.fcc.gov .
firmware	Software stored in ROM or EEPROM; essential programs that remain even when the system is turned off. Firmware is easier to change than hardware but more permanent than software stored on disk.
FSN	Factory Serial Number—A unique serial number assigned to the SL3010T during manufacturing.
GPS	Global Positioning System A system that uses a series of 24 geosynchronous satellites to provide navigational data.
IOTA	Internet Over The Air—an automated feature, supported by some service providers, to perform account setup for you by making a connection to the CDMA network and using a secure Internet connection to download account parameters to your device.
IS	Interim Standard After receiving industry consensus, the TIA forwards the standard to ANSI for approval.
kbps	kilobits per second – Actually 1000, not 1024, as used in computer memory size measurements of kilobytes.
LED	Light Emitting Diode A semiconductor diode that emits visible or infrared light.
Mbps	Millions of bits per second, or Megabits per second.
MEID	Mobile Equipment Identifier—The unique second-generation serial number assigned to the SL3010T for use on the wireless network. Compare to ESN.
NAM	Number Assignment Module Semi-permanent information stored in the modem's non-volatile memory, including the modem's Mobile Identification Number, the station class mark, carrier code, and other cellular identifiers. Essentially the phone number, it should be treated as confidential information and should not be disclosed to anyone other than the cellular service provider.
NV	Non-Volatile (memory)
OEM	Original Equipment Manufacturer A company that manufactures a product and sells it to a reseller.
OTAPA	Over the Air Parameter Administration
OTASP	Over the Air Service Provisioning
PCS	Personal Communications Services A cellular communication infrastructure that uses a different frequency range than AMPS.
PPP	Point to Point Protocol An alternative communications protocol used between computers, or between computers and routers on the Internet. PPP is an enhanced SLIP.
PRI	Product Release Instructions—a file that contains the settings used to configure modems for a particular service provider, customer, or purpose.

Acronym or Term	Definition
QAM	Quadrature Amplitude Modulation This form of modulation uses amplitude, frequency, and phase to transfer data on the carrier wave.
RF	Radio Frequency
RLP	Radio Link Protocol This protocol improves the error characteristics of the wireless link, thereby reducing the need for transport layer retransmission due to lost data.
Rx	Receive
SAR	Specific Absorption Rate
SKU	Stock Keeping Unit—identifies an inventory item: a unique code, consisting of numbers or letters and numbers, assigned to a product by a retailer for purposes of identification and inventory control.
SMS	Short Message Service A feature that allows users of a wireless device on a wireless network to receive or transmit short electronic alphanumeric messages (up to 160 characters, depending on the service provider).
TIA/EIA	Telecommunications Industry Association / Electronics Industry Association Telecommunications Industry Association – A standards setting trade organization, whose members provide communications and information technology products, systems, distribution services and professional services in the United States and around the world. Consult www.tiaonline.org .
Tx	Transmit
USB	Universal Serial Bus



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