EM3420 Embedded Modem

Product Specification

SIERRA WIRELESS
HEART OF THE WIRELESS MACHINE®
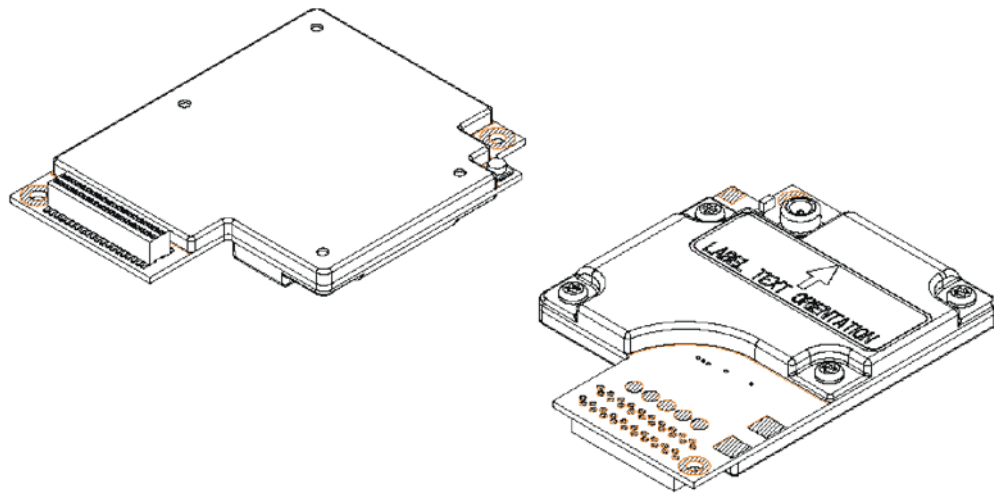
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Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices 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.

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5,845,216	5,847,553	5,878,234	5,890,057	5,929,815
6,169,884	6,191,741	6,199,168	6,327,154	6,339,405
D367,062	D372,248	D372,701	D416,857	D442,170
D452,495	D452,496	and other patents pending.		

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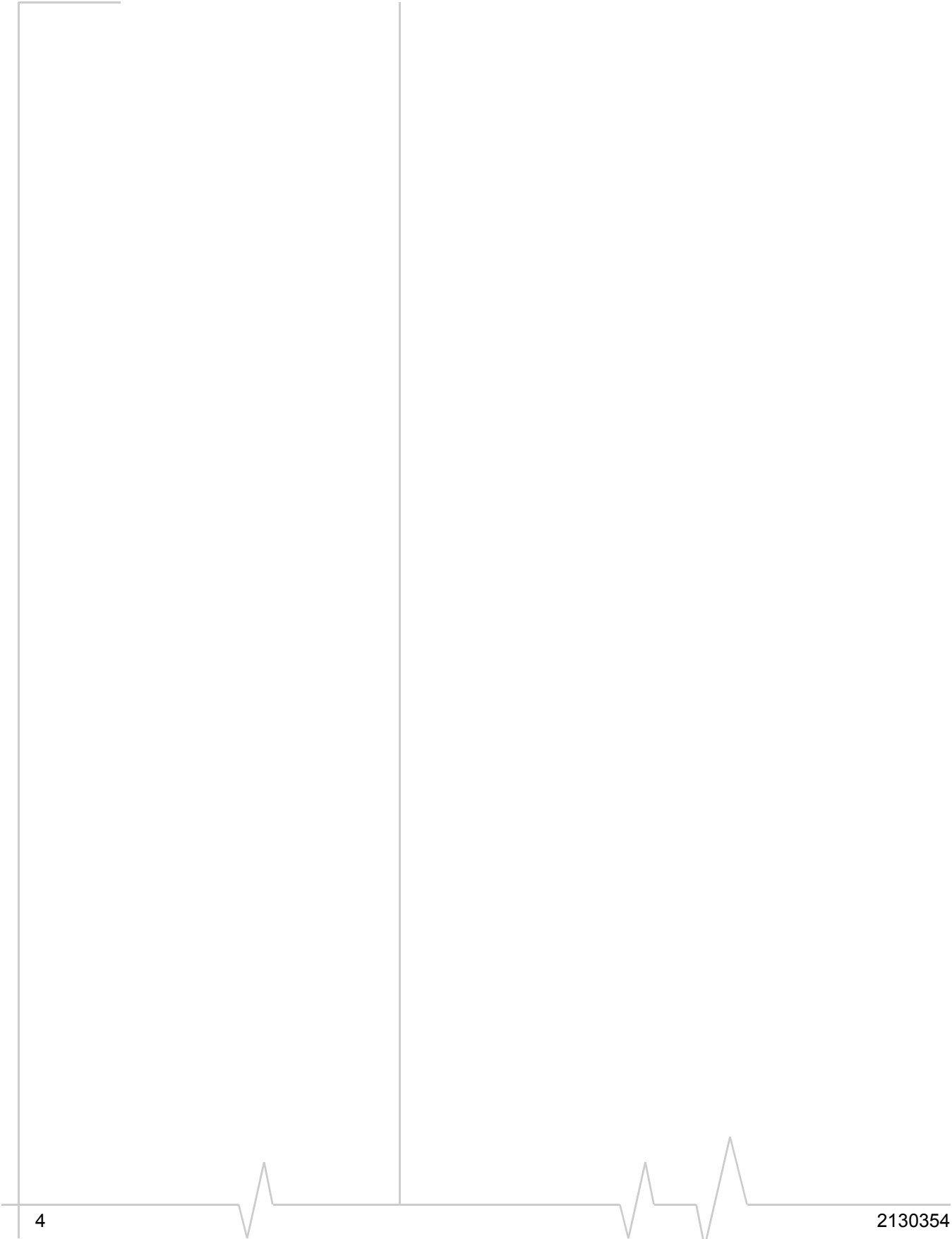Other trademarks are the property of the respective owners.

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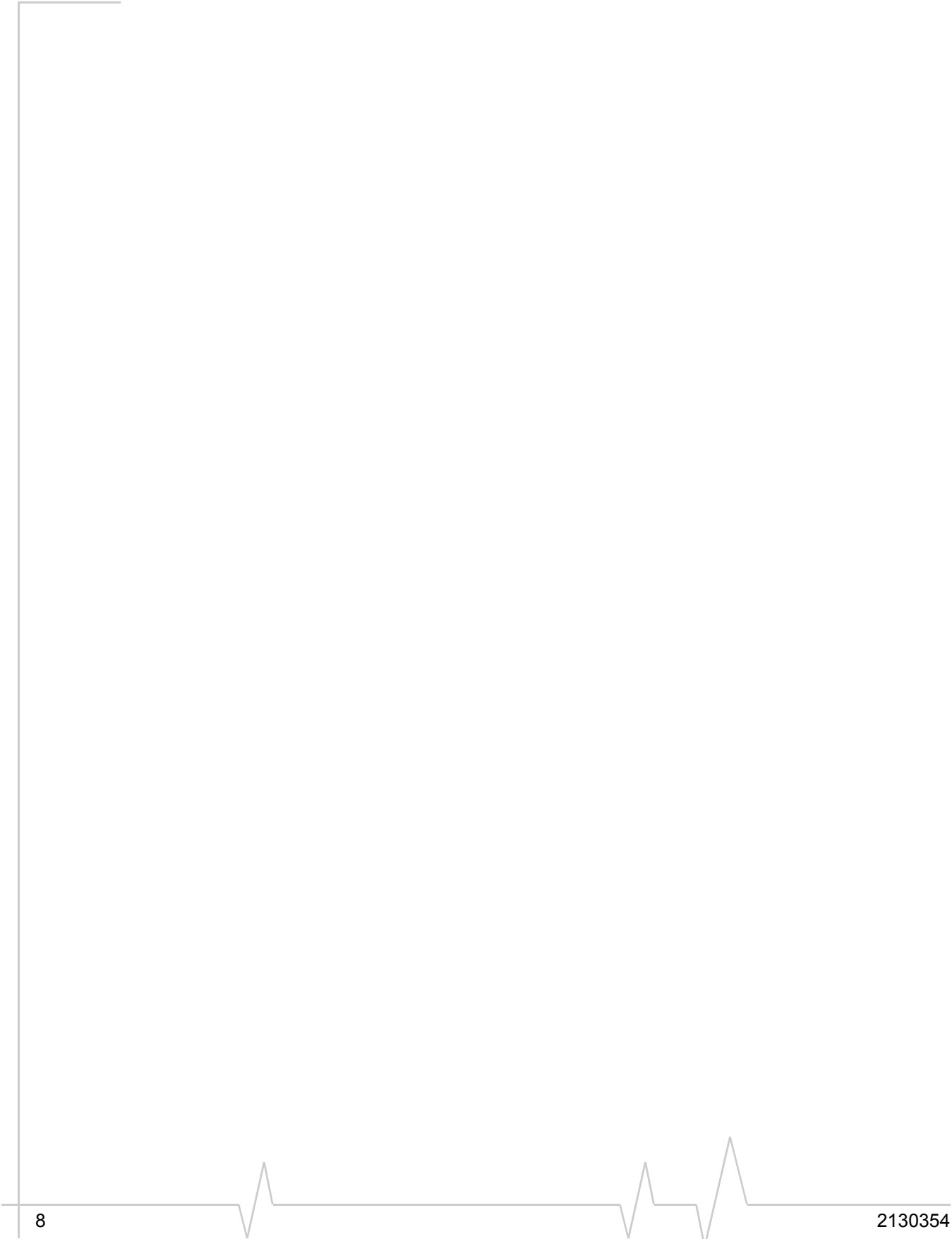
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Table of Contents

1: Introduction

The Sierra Wireless EM3420 embedded modem is a compact, light-weight, wireless modem that provides CDMA2000 1X connectivity for portable and handheld computers, point-of-sale devices, and telemetry applications. It has a dual-band radio supporting both the 800 MHz cellular and 1900 MHz PCS bands.

The purpose of this document is to describe the features and specifications of the modem, and to provide interested OEMs with the information required to integrate the EM3420 into their products. Application and hardware interface requirements are discussed at a high level only; for more detail refer to the Sierra Wireless technical references available in the EM3420 Reference Guide and the Universal Development Kit.

Specifications at a glance

This section outlines the critical high-level features of the Sierra Wireless EM3420 embedded modem. More detailed specifications are provided in following chapters.

Physical features

- Small form factor
- RF connector jack and launch pad
- Single host connector
- Two mounting holes

Short Message Service (SMS) features

- Send and receive
- Notification of new messages

Electrical features

The EM3420 has two supply voltage options:

- VCC_BB—Min 3.15 V, Max 4.15 V
- VBATT—Min 3.4 V, Max 4.15 V

Typical DC power consumption is:

- Talk current: 181 mA—340 mA
- Stand-by current: 1.75 mA—3.5 mA

The EM3420 is self-shielded; no additional shielding is required.

Packet mode features

- Data rates up to 153.6 kbps, simulataneous forward and reverse channel.

Voice mode features

The EM3420 has internal IS-127 and IS733 vocoders and supports:

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

Application interface features

- Dual serial ports: one for data and one for device control
- AT command interface
- Sierra Wireless proprietary Control and Status (CnS) language interface
- Available Software Development Kit (SDK) including an Application Program Interface (API) for Windows OS-based applications

IS-95 circuit-switched features

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

RF features

- Dual-band support for both the 800 MHz cellular and 1.9 GHz PCS bands
- Adheres to CDMA authentication as specified in CDMA2000 1X
- Support for IS-95A/B and CDMA2000 1X Release A
- Support for gpsOne

Support features

The EM3420 is a self-contained CDMA module, based on the Qualcomm MSM6050 chip set, that is capable of both voice and data connectivity. The EM3420 offers:

- Standard 1-year warranty
- Extended warranties of 1 or 2 additional years available
- Enabling software for Windows operating systems: 98, Me, 2000, XP
- Host-assisted, over-the-air firmware upgrades
- Over-The-Air-Service Provisioning (OTASP)
- Support for gpsOne for Position Location services
- Interfaces to support line level audio input and outputs
- Flexible I/O that allows for control of ringer, vibrator, and LED functions
- Support for R-UIM

Environmental features

Operating ranges:

- Temperature: -30 to +60 degrees C
- Humidity: 85 degrees C, 85% Relative Humidity
- Vibration: 10 to 1000 Hz, 6G RMS in each axes
- Shock: Half sine shock, 2 ms, 180 in/sec (375 g)

Supporting documents

- Project Planning Guide
- Design Guide
- Hardware Integration Guide
- Software Integration Guide
- AT Command Reference
- API Reference
- CnS Reference
- Enabling Software Guide
- Verification and Configuration Guide

Accessories available

The EM3420 Development Kit includes:
- Embedded Modem Interface Kit
- Documentation Suite
- Initial allotment of support hours
- Two serial cords

Sierra Wireless also offers antennas.

Ordering information

All orders can be made by contacting the Sierra Wireless Sales Desk at +1 (604) 232-1488 between 8 AM and 5 PM Pacific Time

2: CDMA2000 1X Primer

The market has been demanding faster wireless data services and the industry has been working at developing third generation wireless systems. 3G systems are intended to provide users with high-speed Internet services for improved performance of new multimedia content delivery, and to improve network capacity to support more subscribers. The International Telecommunications Union (ITU) initiated the IMT-2000 program to develop standards for 3G systems, and completed them in late 1999. The IMT-2000 program defined several standards; CDMA2000 1X is one of them. For additional information on the IMT-2000 program visit the ITU web site at www.itu.int/imt/. For additional information on CDMA in general, consult the CDMA Development Group web site at www.cdg.org.

CDMA2000 3G services are intended to appeal to a wide range of carriers. There have been commercial deployments beginning in October 2000. Lucent, Nortel Networks, Hitachi, CommWorks, Ericsson, Motorola, and Samsung all have infrastructure products in use or development.

Fundamental and supplemental channels

CDMA2000 1X achieves higher speeds for packet services by making use of supplemental channels to provide additional bandwidth.

The modem first connects in a circuit-switched fashion, using a fundamental channel. When there is a requirement for a burst of packet data at high speed, the modem can request a supplemental channel to carry the traffic. When the burst is finished, the supplemental channel is released for other network users.

Allocation of supplemental channels is managed by the network. In particularly busy networks, this means that throughput could be reduced when many users request the supplemental channel resource. If a supplemental channel is unavailable, the modem continues to move traffic over the fundamental channel.

1xRTT and IS-95A

The type of data connection made at any given time depends on the services available from the carrier in the given coverage area. If 1xRTT packet services are not available, the modem can connect using circuit-switched data over the IS-95A technology. The modem can automatically select the fastest connection mode available when a data call is connecting.

When roaming, the modem *does not* automatically change connection modes. If the modem connects using 1xRTT and then roams outside of the packet service area, the connection is dropped. A new connection using IS-95A has to be created to resume data communication. Similarly, an IS-95A call established in one area does not automatically speed up to 1xRTT when the unit enters the 3G coverage area.

3: Standards Compliance

This section describes the compliance of the EM3420 to the standards outlined in Appendix B. Note that many of these features require the support of the host device for full compliance. These cases are noted.

Appendix A summarizes the service options supported by the EM3420.

General compliance

Mobile station class

The output power and band class features of the EM3420 are summarized in Table 3-1.

Table 3-1: Band and Power Class Features

Band Class	Mobile Station Class	Supported?
0 (North American Cellular)[a]	Class III	Yes
1 (North American PCS)	Class II	Yes
2 (TACS)	N/A	No
3 (JTACS)	N/A	No
4 (Korean PCS)	N/A	No
5 (NMT 450)	N/A	No
6 (IMT-2000)	N/A	No

a. Band Class 0 also supports the Korean and South American cellular bands.

Protocol revision support

The EM3420 supports all protocol revisions through P_REV 7. Detailed protocol revision feature compliance is described in the next two sections.

TIA/EIA-95B

The EM3420 is compliant with TIA/EIA-95B including all protocol revisions through P_REV 4. P_REV 5 feature support is defined in Table 3-2.

Table 3-2: EM3420 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[a]
Priority Access and Channel Assignment (PACA)	No
Power-Up Function (PUF)	No
AMPS Improvements (IS-553-A)	N/A
Supplemental Code Channels (MDR)	Yes[b]
Hopping Pilot Beacon	No
IS-95B Wireless Local Loop (WLL) Features	No

a. Host support is required for this feature
b. Ony F-SCCH is supported. Up to seven F-SCCH supported.

TIA/EIA/IS-2000

EM3420 support for TIA/EIA/IS-2000 features is defined by the capabilities of the Qualcomm MSM6050 hardware and DMSS6050 software.

Radio configurations

The EM3420 supports all mandatory radio configurations. Detailed channel and radio configuration support is shown in Table 3-3.

Table 3-3 also outlines the data rates supported by each radio configuration. The maximum data rate supported by IS-2000 Release 0 is 153.6 kbps. The EM3420 is capable of supporting the 153.6 kbps data rate simultaneously on the forward and reverse link.

Table 3-3:   EM3420 channel and radio configuration support[a]

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	9.6/19.2/38.4/76.8/153.6
Rate Set 2 RCs (fwd: 5; rev: 4)	Yes	14.4/28.8/57.6/115.2	14.4/28.8/57.6/115.2
Dedicated Control Channel (DCCH)[b]			
Rate Set 1 RCs (fwd: 3,4; rev: 3)	Yes		9.6
Rate Set 2 RCs (fwd: 5; rev: 4)	No		14.4
Reverse Pilot Channel (R-PICH)	Yes		

a. Support of maximum data rates is dependant on MSM supplier software and memory speed grade availability.
b. **20 ms frames only**

Release 0 feature support

The EM3420 supports all mandatory P_REV 6 features. Additional support for P_REV 6 features is outlined in Table 3-4.

Table 3-4: EM3420 Support for P_REV 6 Features

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)	No
Reverse Pilot Gating	Yes
1/8 Rate Traffic Channel Gating	Yes
Mobile Assisted Pilot Burst (MAPB)	No
Traffic Channel Control Hold	Yes
Short Data Bursts	No
5ms, 10ms Frame sizes	No

Release A feature support

The EM3420 provides support for P_REV 7 Release A features as supported by Qualcomm MSM6050 software. Specific features are to be determined. Note that not all Release A features may be supported by carriers or network equipment.

CDMA data services

The EM3420 supports the data features of IS-707-A as outlined in Table 3-5. Actual data speeds supported by the EM3420 are outlined under "Radio configurations" on page 14. Table 3-6 outlines support for additional data features that are not part of IS-707-A.

Table 3-5: IS-707-A data features

CDMA Data Service	IS-707-A Section	Supported?
RLP	IS-707.2	Yes[a]
AT Command Set	IS-707.3	Yes

Table 3-5: IS-707-A data features

CDMA Data Service	IS-707-A Section	Supported?
Asynchronous Data and Fax at 9.6kbps and 14.4 kbps	IS-707.4	Yes
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[a]
High Speed Packet Data (MDR - Medium Data Rate)	IS-707.9	Yes
Radio Link Protocol Type 3 (RLP3)	IS-707.10	Yes[a]
CDMA2000 High Speed Packet Data	IS-707.12	Yes

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

Table 3-6: EM3420 data features

Feature	Supported?
Quick Net Connect	Yes
Pre-arrangement for incoming Async data or fax	Yes
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

CDMA voice services

The EM3420 supports both EVRC and 13QCELP vocoders and complies with the following Voice Service Option standards:

• TIA/EIA/IS-733-1: 13QCELP Vocoder Specification
• TIA/EIA-736: 13QCELP Minimum Performance Requirements
• TIA/EIA/IS-127-2: EVRC Vocoder Specification
• TIA/EIA/IS-718: EVRC Minimum Performance Requirements

The EM3420 supports TTY/TDD compatibility through the microphone/speaker connections.

CDMA Short Message Service (SMS)

Table 3-7 summarizes the EM3420 compliance with the SMS features per TIA/EIA-637-A. 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 EM3420 also complies with specific carrier requirements for SMS as defined by each CDMA carrier.

Table 3-7: EM3420 SMS features

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

Over-The-Air Service Provisioning (OTASP)

IS-683 features

The EM3420 supports TIA/EIA/IS-683-A for Over-the-Air Service-Provisioning (OTASP) and Parameter Administration (OTAPA) as summarized in Table 3-8. The EM3420 also complies with carrier specific OTASP and OTAPA requirements.

Table 3-8: EM3420 OTASP/OTAPA features

Feature	Supported?
OTASP (user initiated)	Yes[a]
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

a. Host support is required for this feature.

Internet Over The Air (IOTA) features

The EM3420 supports an interface that allows an IOTA thin client running on the host to send and receive tunneled Openwave compliant IOTA messages. (See reference 42 in Appendix B.) The host device must have an IOTA client that conforms to the IOTA requirements of the carrier network. IOTA feature support as defined in Table 3-9.

Table 3-9: EM3420 IOTA features

Feature	Supported?
Bootstrap Provisioning	Yes[a]
Network Initiated Provisioning using WAP Push	Yes[a]
Reassembly of Multiple IOTA Trigger Messages	Yes[a]
HTTP and SSL Support (Download Agent)	Yes[a]
MMC XML and MIME Parser / Assembler	Yes[a]
IS-683-A/B Tunneling	Yes
WBXML Parser / Assembler	Yes[a]
Bearer Selection Table Provisioning	Yes[a]
User NAI Profiles and CDMA Objects	Yes

a. Host support is required for this feature.

Position location

The EM3420 supports position location features as specified in Table 3-10.

Table 3-10: EM3420 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	No
Advanced Forward Link Trilateration (AFLT)	Yes
Compliant with Snap Track Sensor Interface Application and Position Determination Entity (SIA/PDE)	Yes

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. Note: Requires host support for compliance.

- **TIA/EIA TSB-58C,** *Parameter Value Assignments*—Assigns values to reserved parameters and specifies which are standard and which may be used for proprietary (manufacturer specific) values.

- **CDG 36,** *Markov Service Option*—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.

CDMA certification requirements

The EM3420 is designed to be fully compliant with the following requirements. However, final product certification requires a fully integrated host device (which incorporates the EM3420).

Tests that require features not supported by the EM3420 (as defined by this document) are not supported.

CDMA parametric performance

The EM3420 meets or exceeds TIA/EIA IS-98-D specifications for performance.

Interoperability

The EM3420 complies with the following interoperability standards:

- **CDG 22**—Stage 2 Interoperability Tests (TIA/EIA/IS-95-A)
- **CDG 53**—Stage 2 Interoperability Tests (TIA/EIA-95-B)
- **C.S0031**—0 - Signaling Conformance Tests for CDMA 2000 Spread Spectrum Systems (Stage 2 for TIA/EIA/IS-2000)
- **CDG 64**—Stage 3 Interoperability Tests (TIA/EIA/IS-2000)

FCC and Industry Canada type acceptance

The EM3420 complies with the agency certifications specified in Table 3-11.

Table 3-11: US and Industry Canada compliance requirements

Compliance Area	US regulation	Industry Canada regulation
Emissions	FCC Part 15	ICES-003
Licensed transmission	FCC Part 22, 24	RSS-133, RSS-129

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.
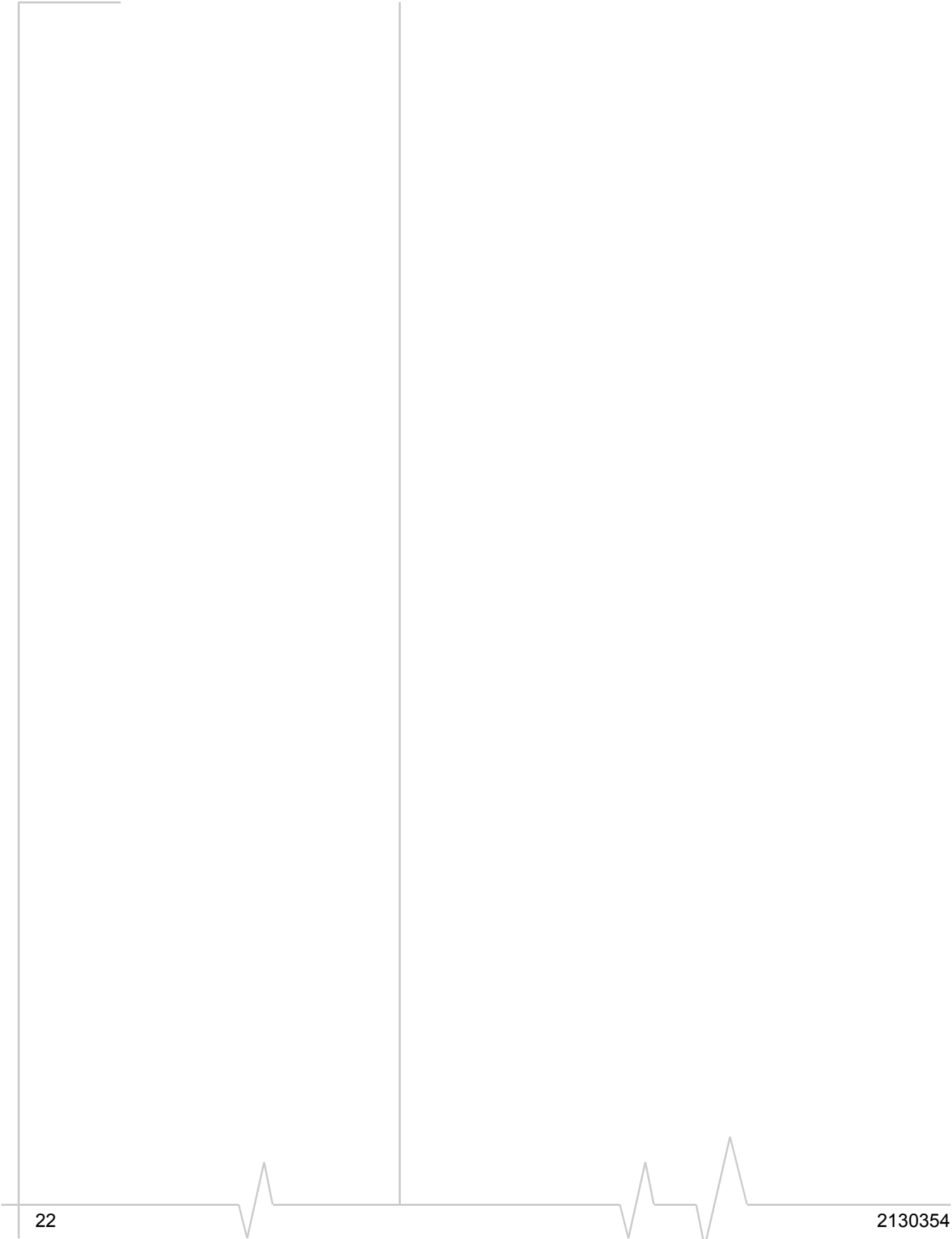
4: Electrical Specifications

Figure 4-1 shows how an EM3420 is integrated into a larger system. The EM3420 has these interfaces to the host:

- **Power**—The EM3420 relies on the host as its sole power source.

- **Handshaking signals**—The optional handshaking signals may be used to power up/down the EM3420 and control the sleep state of the module or host.

- **Serial port interface**—Serial communications is supported via dual UART ports.

- **Audio**—Line level inputs/outputs are supported to enable connection to an external audio interface (such as an AC97 codec).

- **Module IO**—Multiple general purpose IOs are supported for external switches, LEDs, vibrator enable, etc.

- **Antenna**—The EM3420 has an RF test connector and an antenna launch area.

Figure 4-1: EM3420 system block diagram

Host interface

The EM3420 has two main interface points, the host connector and the RF port. The details of these interfaces are described in the sections that follow.

Pin assignments

The EM3420 host connector provides the power, serial communications, control and audio interfaces through a single 40-pin connector.

Detailed pin assignments are shown below:

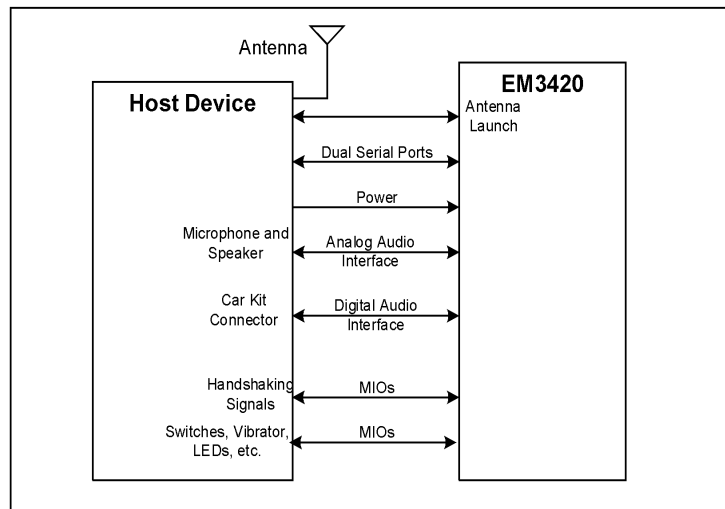**Table 4-1: EM3420 connector pin assignments**

Pin	Signal Name	Description	Direction to module	Active state
1	SPEAKER_P/MIO	Speakerphone Pass through Signal	Input	Programmable
2	SPEAKER_N/ ~RUIM-DETECT	Speakerphone Pass through Signal	Input	Low
3	SPK_P	Line Level Audio Output	Output	Differential
4	MIC_P	Line Level Audio Input	Input	Differential
5	SPK_N	Line Level Audio Output	Output	Differential
6	MIC_N	Line Level Audio Input	Input	Differential
7	GND	Ground	Input	Power
8	GND	Ground	Input	Power
9	PCM_DIN/R-UIM_CLK	External Codec Interface Data In	Input	High / High
10	PCM_DOUT/R-UIM_EN	External Codec Interface Data Out	Output	High / High
11	PCM_FRAME/R-UIM_DATA	External Codec Interface Frame	Output	High / High
12	PCM_CLK/~R-UIM_RESET	External Codec Interface Clock Out	Output	High / Low
13	RI1	UART1 Ring Indicate	Output	Low
14	CD1	UART1 Carrier Detect	Output	Low
15	CTS1	UART1 Clear to Send	Output	Low
16	RTS1	UART1 Ready to Send	Input	Low
17	DTR1	UART1 Data Terminal Ready	Input	Low
18	DSR1	UART1 Data Set Ready	Output	Low
19	TXD1	UART1 Transmit Data	Input	High
20	RXD1	UART1 Receive Data	Output	High
21	TXD2	UART2 Transmit Data	Input	High
22	RXD2	UART2 Receive Data	Output	Low
23	CTS2	UART2 Clear to Send	Output	Low

Table 4-1: EM3420 connector pin assignments

Pin	Signal Name	Description	Direction to module	Active state
24	~RTS2	UART2 Ready to Send	Input	Low
25	~RESET	Module Reset Input (open Collector)	Input	Low
26	~RESET_OUT	Modem Reset Status	Output	Low
27	ON/~OFF	Modem Power On (high=on)	Input	Low
28	~HOST_STATUS	Host Awake Status	Input	Low
29	HOST_WAKE	Modem Signal to wake up Host	Output	High
30	MODULE_WAKE	Signal from Host to Wake up Modem	Input	High
31	VCC_BB	Baseband Power Input	Input	Power
32	VCC_RADIO	Baseband Power Reference Output	Output	Power
33	VBATT	Battery Power Supply	Input	Power
34	GND	Ground	Input	Power
35	VBATT	Battery Power Supply	Input	Power
36	GND	Ground	Input	Power
37	VBATT	Battery Power Supply	Input	Power
38	GND	Ground	Input	Power
39	VBATT	Battery Power Supply	Input	Power
40	GND	Ground	Input	Power

Host interface descriptions

This section and the sections that follow provide additional detail on each portion of the host connector interface. Many pins have multiple functional assignments, and may have different properties based on function. Pins with multiple functional assignments are described in multiple sections.

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

- V—Power or Ground Pin
- A—Analog Pin
- O—Digital Pin, Output
- PU—Digital Pin Input, Interal Pull Up
- PD—Digital Pin Input, Internal Pull Down

Digital pins with output capability have maximum drive strength numbers (1,2,3,5 +/- mA) as part of the type code. In addition, all digital signals conform to the specifications in Table 4-2.

Table 4-2: Digital Signal DC Characteristics

Specification	Parameter	Conditions	Minimum	Typ.	Max	Units
Supply Voltage	VCC_RADIO	10 mA max	2.71	2.85	2.99	V
High Level Input Voltage	VIH		VCC_RADIO *0.65	2.85	VCC_RADIO +0.3	V
Low Level Input Voltage	VIL		-0.3	0	VCC_RADIO *0.35	V
High Level Output Voltage	VOH	Load < 3 mA	VCC_RADIO -0.45	2.85	VCC_RADIO	V
Low Level Output Voltage	VOL	Load < 3 mA	0.00	0	0.45	V

Power supply

Power is provided to the EM3420 through multiple power and ground pins as outlined in Table 4-3.

Table 4-3: Power and ground specifications

Name	Pins	Type	Specification	Parameter	Min	Typ.	Max	Units
VBATT	33,35,37,39	V	Voltage Range	Vin	3.4	-	4.5	V
			Ripple Voltage		-	-	200	mVpp
VCC_BB	31	V	Voltage Range	Vin	3.15	-	4.5	V
			Ripple Range		-	-	200	mVpp
GND	7,8,34,36,38,40	V			-	0	-	V

The VBATT pins may be connected directly to the main battery provided the voltage remains in the acceptable voltage range even during charging. There is no current limiting circuitry on the EM3420. The host device must perform current limiting of the module. If using the VBATT input range for your power supply, VBATT can be tied to VCC_BB.

The VCC_RADIO signal provides a reference output voltage for driving level shifters. This signal can also be used to monitor the modem CPU power rail. VCC_RADIO parameters are further described in Table 4-2.

UART interface

The EM3420 provides two serial port interfaces. Serial Port 1 provides the full set of handshaking signals, while Serial Port 2 provides only minimal handshaking capability. Serial Port 1 supports data receipt and transmission and the AT Command set. Serial Port 2 supports a proprietary protocol used to convey control and status information.

Table 4-4: Serial Port 1 Interface (Supports baud rate up to 230 kbps)

Name	Pin	Description	Type	Notes
TXD1	19	Transmit Data	PD	UART1 Serial data transmit line (modem input)
RXD1	20	Receive Data	O	UART1 Serial data receive line (modem output)
~CTS1	15	Clear to Send	O	
~RTS1	16	Request to Send	PD	
~DSR1	18	Data Set Ready	O	
~DTR1	17	Data Terminal Ready	PU	
~RI1	13	Ring Indicator	O	
~CD1	14	Carrier Detect	O	

Table 4-5: Serial Port 2 Interface (Supports baud rate up to 115 kbps)

Name	Pin	Description	Type	Notes
TXD2	21	Transmit Data	PD	UART2 Serial data transmit line (modem input)
RXD2	22	Receive Data	O	UART2 Serial data receive line (modem output)
~CTS2	23	Clear to Send	O	
~RTS2	24	Request to Send	PU	

The EM3420 can support a third serial interface connection. Definition and implementation of this interface is to be determined.

Audio interface

The audio interface is summarized in Table 4-6. Detailed performance specifications are in Table 4-7 and Table 4-8.

The AUX_PCM interface supports interfacing to an external audio codec. This feature is currently not supported.

Table 4-6: Audio interface connections

Name	Pin	Description	Type	Notes
MIC_P	4	Line Audio Input	A	Differential audio input, line level
MIC_N	6	Line Audio Input	A	Differential audio input, line level
SPK_P	3	Main speaker	A	Differential audio output, line level
SPK_N	5	Main speaker	A	Differential audio output, line level
PCM_DIN	9	Audio data in	PD	Digital audio data line in
PCM_DOUT	10	Audio data output	O	Digital audio data line out
PCM_FRAME	11	Data Frame signal	O	Digital audio frame sync (input or output)
PCM_CLK	12	Data clock signal	O	Digital audio clock (input or output)

The following tables provide detailed specifications for the audio paths.

Table 4-7: Audio transmit path performance characteristics for MIC_P/MIC_N

Parameter	Test Conditions	Min	Typ.	Max	Units
Transmit Path reference-signal level (0dBm0)	Differential analog input	-	455	-	mVRMS
Overload-signal level (+3dBm0)	Differential analog input	-	1820	-	mVPP
Absolute gain error	0dBm0 analog input level, 1.02KHz sine-wave	-1	-	+1	dB
Gain error relative to gain at -10dBm0	Analog Input level from +3dBm0 to -30dBm0	-0.5	-	0.5	dB
	Analog Input level from -31dBm0 to -45dBm0	-1	-	1	dB
	Analog Input level from -46dBm0 to -55dBm0	-1.5	-	1.5	dB

Table 4-7: Audio transmit path performance characteristics for MIC_P/MIC_N

Parameter	Test Conditions	Min	Typ.	Max	Units
Microphone Mute attenuation	+3dBm0 analog input level, 1.02KHz	80	-	-	dB
Input Impedance	Fully differential	62	72	82	kΩ
Transmit noise, C-message weighted		-	-	10	μVRMS
Signal-to-THD+N ratio with 1002Hz sine-wave	Input level +3dBm0	35	-	-	dB
	Input level 0dBm0	50	-	-	dB
	Input level -5dBm0	50	-	-	dB
	Input level -10dBm0	46	-	-	dB
	Input level -20dBm0	45	-	-	dB
	Input level -30dBm0	40	-	-	dB
	Input level -40dBm0	30	-	-	dB
	Input level +3dBm0 to -45dBm0	25	-	-	dB

Note: the total transmit channel gain in this configuration is +6 dB.

Table 4-8: Audio receive path performance characteristics for SPK_P/SPK_N

Parameter	Test Conditions	Min	Typ	Max	Units
Receive Path reference-signal level (0dBm0) Typical load: 32 Ω	Digital Input = 0dBm0, 1.02KHz sine-wave	-	750	-	mVRMS
Overload-signal level (+3dB)	Digital Input = +3dBm0, 1.02KHz sine-wave	-	3000	-	mVPP
Absolute gain error	Digital input = 0dBm0, 1.02KHz sine-wave	-1	-	+1	dB
Gain error relative to gain at -10dBm0	Digital input = +3dBm0 to -40dBm0, 1.02KHz sine-wave	-0.5	-	0.5	dB
	Digital input = -41dBm0 to -50dBm0, 1.02KHz sine-wave	-1	-	1	dB
	Digital input = -51dBm0 to -55dBm0, 1.02KHz sine-wave	-1.2	-	1.2	dB
Receive Noise (A-weighted)	Digital Input = "0000000000000000	"-	-	200	μVRMS
Differential output impedance	At 1.02KHz	-	-	5	Ω

Table 4-8: Audio receive path performance characteristics for SPK_P/SPK_N

Parameter	Test Conditions	Min	Typ	Max	Units
Output common mode voltage	Measured at each output pin with respect to GND	1.12	1.2	1.27	V
Gain flatness	300Hz - 3KHz, 0dBm0 sine-wave	-1	-	+1	dB
Signal-to-THD+N ratio with 1002Hz sine-wave	Digital Input = +3dBm0	29	-	-	dB
	Digital Input = 0dBm0	50	-	-	dB
	Digital Input = -5dBm0	47	-	-	dB
	Digital Input = -10dBm0	46	-	-	dB
	Digital Input = -20dBm0	42	-	-	dB
	Digital Input = -30dBm0	40	-	-	dB
	Digital Input = -40dBm0	30	-	-	dB
	Digital Input = -45dBm0	25	-	-	dB
Total Harmonic Distortion	Differential, 32O load, 3dBm0, 1.02kHz sine wave	-	-	5	%

Control signals

The EM3420 provides several signals for control and handshaking of the module from the host. These signals are summarized in Table 4-9 and paragraphs below. For more detailed information concerning usage and timing of the control signals see Reference 3 in Appendix B.

Table 4-9: EM3420 Control Signals

Name	Pin	Description	Type
ON/~OFF	27	Module power control	PD
HOST_WAKE	29	Wakeup request to host	O
~HOST_STATUS	28	Host wake status	PU
~RESET_OUT	26	Modem reset status	O
MODULE_WAKE	30	Wakeup request to modem	PD

ON/OFF is used by the host device to control the on/off state of the module. Asserting this signal (high) powers up the module, provided VBATT is supplied.

The module asserts the HOST_WAKE signal. It performs an interrupt and wake-up of the host device if it is asleep.

HOST_STATUS is an output from the host device to indicate when it is awake (low) or asleep (high). It is critical that the host device assert this signal when it is asleep, as the module uses this signal to determine if non-critical periodic messages should be sent to the host.

RESET_OUT is an output from the EM3420 to indicate the reset status of the module. If this signal is low then the module is either powered down or has not completed the start-up handshaking sequence. RESET_OUT will go high once the start-up handshaking sequence is complete.

R-UIM interface

Table 4-10: R-UIM interface

Name	Pin	Description	Type
R-UIM_CLK	9	R-UIM Clock signal	O
R-UIM_DATA	11	R-UIM Data signal	O,PU
R-UIM_RESET*	12	R-UIM Reset output, Active Low	O
R_UIM_PWR_EN*	10	R-UIM external LDO Enable, Active Low	O

There is an optional R-UIM interface available on Pins 9 through 12. If the R-UIM interface is required, the AUX_PCM interface is not available. This option is configurable through NV.

See Reference 4 in Appendix B for details on developing an interface to a R-UIM card.

RF specifications

The EM3420 does not have an integrated antenna. RF connections are supported through the antenna launch area or one of two RF connectors. There are two version of the module available: one with an antenna launch area, and one that has a Hirose UFL connector rather than a launch clip. Both versions include the main car kit ready RF connector. (IMS is the manufacturer.)

The optional antenna launch is a 3 mm x 3 mm area that supports a contact connection to the antenna. Further details are given in Table 4-11. There is a matching network available when using this RF path.

The optional Hirose UFL connector (Hirose # CL331-0471-0-10) is a 3 mm x 3 mm low profile connector that supports a coaxial cable connection to the module. There is no matching option available using this RF path. The path is assumed to be 50 ohms. For additional information, please refer to the EM3420 Reference Guide.

Table 4-11: Antenna Launch Specifications

Parameter	Min	Typ	Max	Units	Notes
Cable Loss	-	-	0.5	dB	Maximum loss to antenna
Impedance	-	50	-	Ω	Antenna load impedance
VSWR	-	-	2.5:1[a]		Maximum allowed VSWR of antenna
Maximum Output Power	+22.0	+23.0	+24.0	dBm	IS-95 Only 1 across entire band

a. IS-2000 allows a 2.5 dB output power reduction during transmission of R-DCCH to reduce ACPR.

In the event that the antenna connection is shorted or open, the radio module shall not sustain permanent damage.

The RF connector has been designed to support an external RF connection for testing.

Power consumption

Table 4-12 summarizes the DC power consumption of the module in various modes.

Table 4-12: DC Power Consumption

Signal	Description	Band	Min	Typ	Max	Units	Notes
VCC_RF/ VCC_BB	IS-95 Talk current	PCS	-	181	-	mA	+10dBm at RF connector, SO9, 65% 1/8th rate, 35% full rate
		Cellular	-	189	-	mA	
	IS-95 Standby current	PCS or Cellular	-	3.5	-	mA	SCI=2, PCH = full rate, Registration rate = 30 min, Sector power -70 dBm. Neighbor list on.

Table 4-12: DC Power Consumption

Signal	Description	Band	Min	Typ	Max	Units	Notes
VCC_RF/ VCC_BB	IS-2000 Talk current, Reverse Pilot Channel Gating Disabled	PCS	-	261	-	mA	SO9, RC5 (Fwd) / RC4 (Rvs), CDG Urban Profile
			-	284	-	mA	SO9, RC5 (Fwd) / RC4 (Rvs), CDG Suburban Profile
		Cellular	-	275	-	mA	SO9, RC5 (Fwd) / RC4 (Rvs), CDG Urban Profile
			-	300	-	mA	SO9, RC5 (Fwd) / RC4 (Rvs), CDG Suburban Profile
	IS-2000 Talk current, Reverse Pilot Channel Gating enabled[a]	PCS	-	220	-	mA	SO9, RC5 (Fwd) / RC4 (Rvs), CDG Urban Profile
			-	240	-	mA	SO9, RC5 (Fwd) / RC4 (Rvs), CDG Suburban Profile
		Cellular	-	232	-	mA	SO9, RC5 (Fwd) / RC4 (Rvs), CDG Urban Profile
			-	250	-	mA	SO9, RC5 (Fwd) / RC4 (Rvs), CDG Suburban Profile
	IS-2000 Data current	PCS	-	290	-	mA	SO32, RC3 (Fwd) / RC3 (Rvs), 153.6kbps (Fwd) / 76.8kbps (Rvs), CDG Urban Profile
			-	320	-	mA	SO32, RC3 (Fwd) / RC3 (Rvs), 153.6kbps (Fwd) / 76.8kbps (Rvs), CDG Suburban Profile
		Cellular	-	305	-	mA	SO32, RC3 (Fwd) / RC3 (Rvs), 153.6kbps (Fwd) / 76.8kpbs (Rvs), CDG Urban Profile
			-	340	-	mA	SO32, RC3 (Fwd) / RC3 (Rvs), 153.6kbps (Fwd) / 76.8kbps (Rvs), CDG Suburban Profile
	IS-2000 Standby current	PCS or Cellular	-	1.75	-	mA	SCI=2, PCH = full rate, Registration rate = 30 min, Sector power -70 dBm. Neighbor list on. QPCH on.
VCC_RF/ VCC_BB	Maximum Talk current	PCS or Cellular	-	-	1.2	A	Max RF output power, full rate, full operating temperature range

Table 4-12: DC Power Consumption

Signal	Description	Band	Min	Typ	Max	Units	Notes
	Module OFF leakage current		-	60	-	µA	Full operating temperature range.
VCC_RADIO	Maximum supply current from module		-	-	10	mA	Full operating temperature range.

a. Theoretical calculation: live network or test equipment not available to directly benchmark this feature.

All specifications in the previous table are preliminary.

The EM3420 does not have its own power source and depends on the host device for power. Typical values are measured at room temperature. Minimum and maximum values are measured over the entire operating temperature range. Input voltage requirements are described under "Power supply" on page 26.

5: Software Interface

Physical interface options

The EM3420 module supports communication with the host via two serial ports. Each serial port supports a specific channel function:

- **Data channel**—Supports AT command and PPP packet exchange during data calls
- **Control channel**—Supports modem control, call processing, and diagnostic interface

Host modem handshaking

Hardware signals are used to control messaging via the UART interfaces. The handshaking protocol between the host and modem is described in Reference 3 in Appendix B. It includes the handshaking protocols for:

- Wakeup of the host or modem to initiate messaging
- Resetting the messaging link
- Message transfer on the serial ports

Data channel interface

The data channel supports the AT command set defined by TIA/EIA/IS-707.3.

AT command set support is outlined in Reference 2 in Appendix B.

Control channel interface

The control channel is used to communicate to the modem via host interface messaging.

The general categories of host interface messages are described below. Detailed message formats and descriptions are found in Reference 1 in Appendix B.

Table 5-1: Host interface messages

Host interface message	Description
Call manager messages	Supports host initiation and termination of voice calls; call progress monitoring; and modem connectivity/operating mode monitoring.
SMS messages	Supports sending and receiving SMS messages via the modem.
Hardware control messages	Allows miscellaneous control of modem peripherals such as vibrator, battery monitoring ADC, LEDs, and generic MIOs.
Sound manager messages	Supports modem sound generation and audio control. This includes ringer, speaker and microphone audio control, as well as headset and speaker/microphone mode control.
Position determination messages	Supports position requests and communication of position determination information to the host device. Position may be determined through AFLT or gpsOne.
1X messages	Provides an interface to the 1X Packet Data Profiles (PDP) stored in the EM3420.
IOTA messages	Allows an IOTA client on the host device to tunnel IOTA messages to the modem.
Miscellaneous messages	Supports a variety of module functions such as: RSSI, host reset, module wakeup, and system time.

Support tools

The EM3420 control channel interface is compatible with the following third-party support tools:

- CDMA Air Interface Tool (CAIT) from Qualcomm
- QXDM from Qualcomm
- Universal Diagnostic Monitor (UDM) from Spirent Communications
- Universal Product Support Tool (UPST) from Spirent Communications

Other features

Manufacturing test support

The EM3420 supports the following features for manufacturing tests:

- Compatibility with the current manufacturing test software (C-wrapper, loader for flashing) and serial pass-through mode
- Retry mechanisms for software download packets
- A test mode designed to minimize the startup sequence time for the module
- Audio loop back on all audio ports and tone generation
- PRI table read/write as a single object
- Ability to read/write all NV and PRI values individually.

Memory requirements

NV memory on the module is available for storage of ring tones, audio files, etc. The amount of this memory available for storage is to be determined (but will not exceed 500 kB).
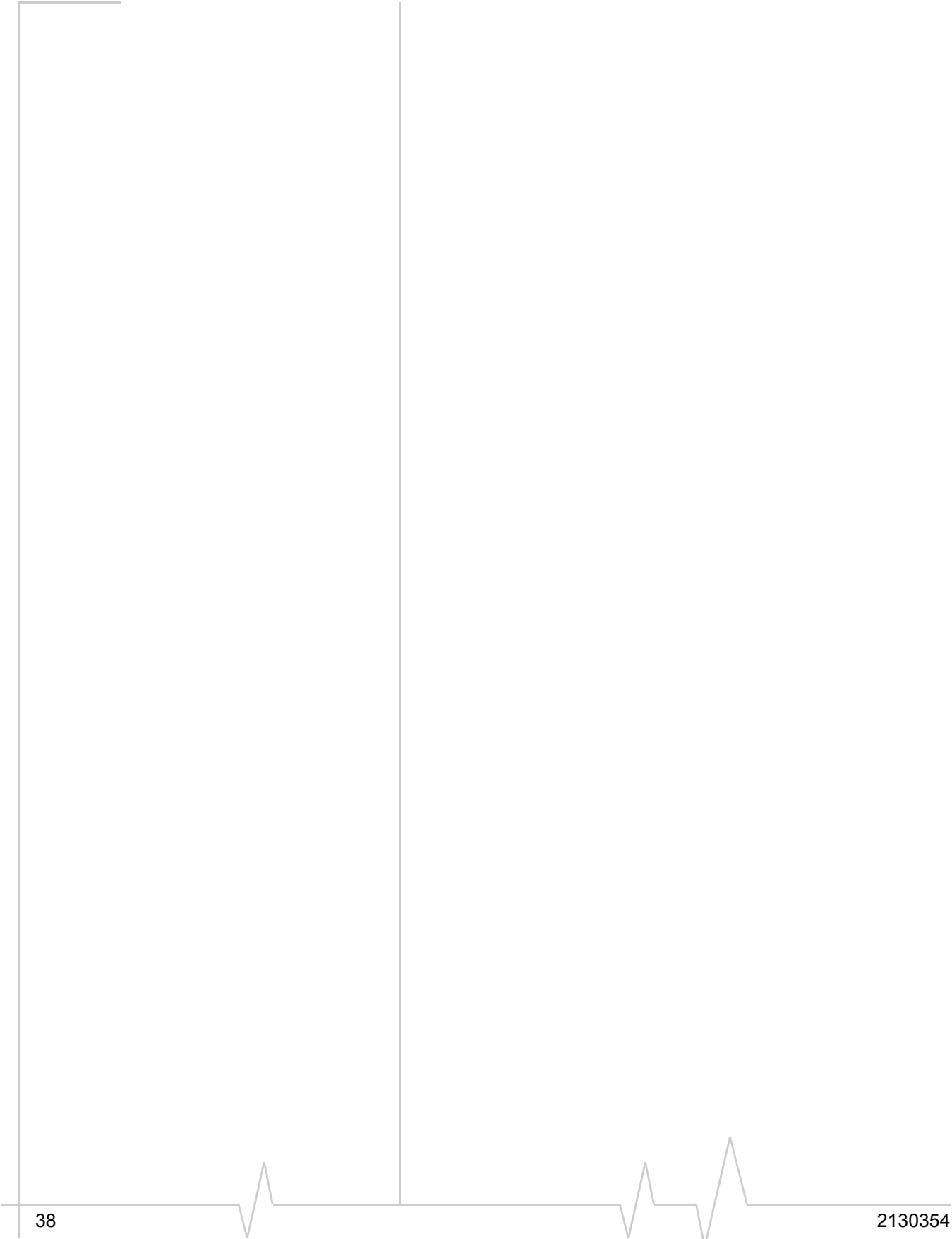
6: Mechanical Specification

The EM3420 module complies with the mechanical and environmental specifications in this section. Final product conformance to these specifications depends on the OEM device implementation.

Table 6-1: Mechanical and environmental specifications

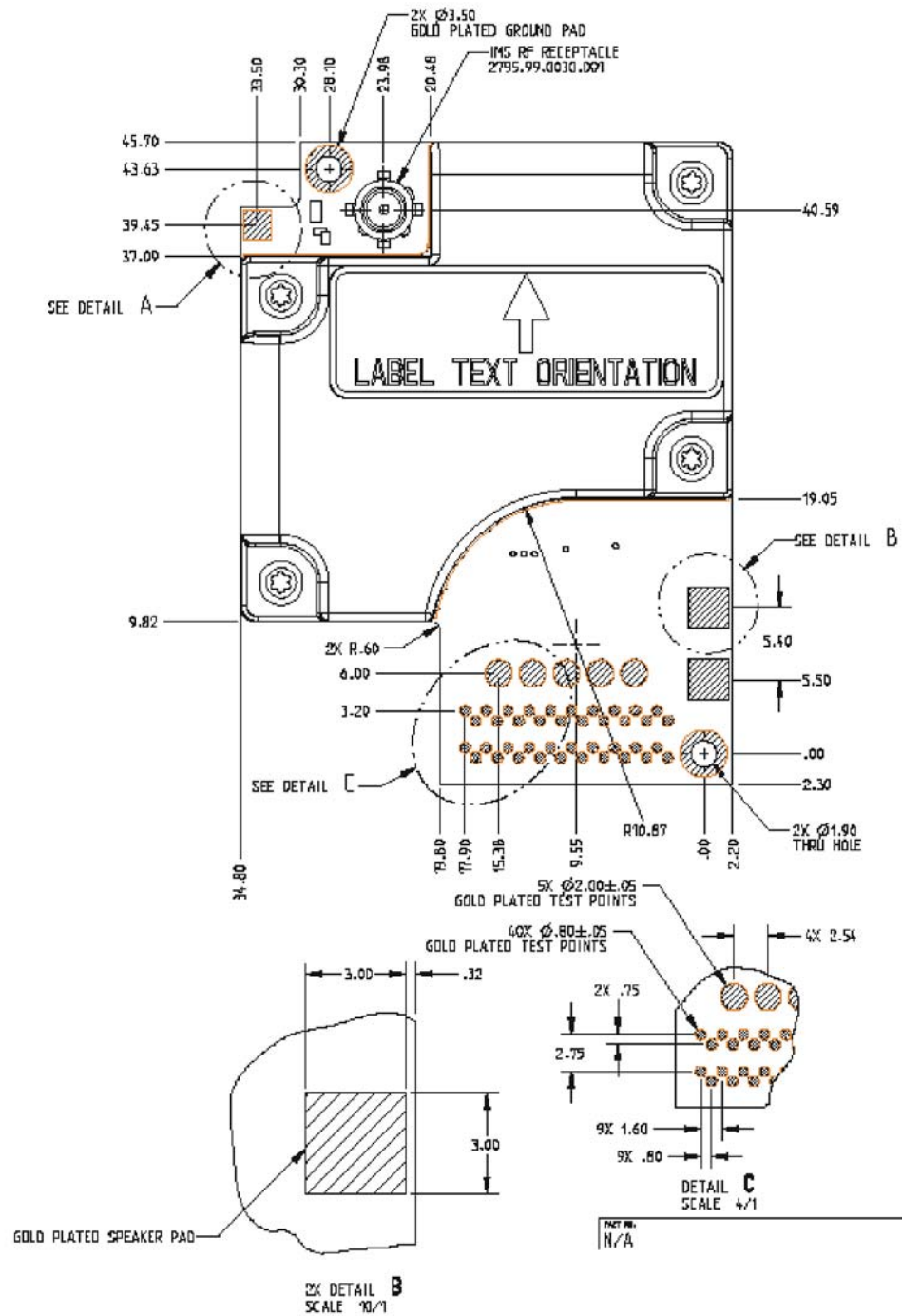|		
Temperature	*Operational*: *Non-operational:*	-30°C to +60°C (from TIA/EIA/IS-98-D) -40°C to +85°C
Relative Humidity	*Non-operational:*	85° C, 85% Relative humidity for 48 hours (non condensing)
Vibration	*Non-operational:*	Random vibration, 10 to 1000 Hz, nominal 6 G RMS in each of 3 mutually perpendicular axes. The test duration for each axis shall be for 60 minutes for a total test time of 3 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:* *Contact Discharge:* *Air Discharge:* *Non-operational:*	The RF port (antenna launch and RF connector complies with the following standard: IEC 61000-4-2 *Electrostatic Discharge Immunity Test*, Level 3 ±6 kV ±8 kV The host connector Interface complies with the following standards only: +/- 1 kV Human Body Model (JESD22-A114-B) +/- 125 V Charged Device Model (JESD22-C101)
Thermal Considerations	Please refer to the *EM3420 Reference Guide*.	
Form Factor	The EM3420 is an embedded module in a metal-shielded case. The 2 mm x 2 mm antenna launch pad and RF test connector are accessible from the cutout in the corner of the top shield. The U.FL RF connector is accessible from the cutout in the corner of the bottom shield. The I/O connector is on the bottom side of the module.	
Dimensions	The dimensions are as defined by drawings shown in Figure 6-3 and Figure 6-1. Length: 48 mm Width: 37 mm Thickness: 5.3 mm Weight: approximately 19 g	

Figure 6-1: Dimensions of EM3420 from the top

5.30 MAX

1.06±.10

.80±.08

R2.

25.60

30.55

32.70

2X Ø4.00
GOLD PLATED GROUND PAD

40.35
38.95
37.09

HIROSE RF RECEPTACLE
P/N: U.FL-R-SNT(01)

PIN 1

4.10

.00

PIN 2

.00

SAMTEC SOCKET
CLE-120-01-G-DV-PTR
(40 PINS)
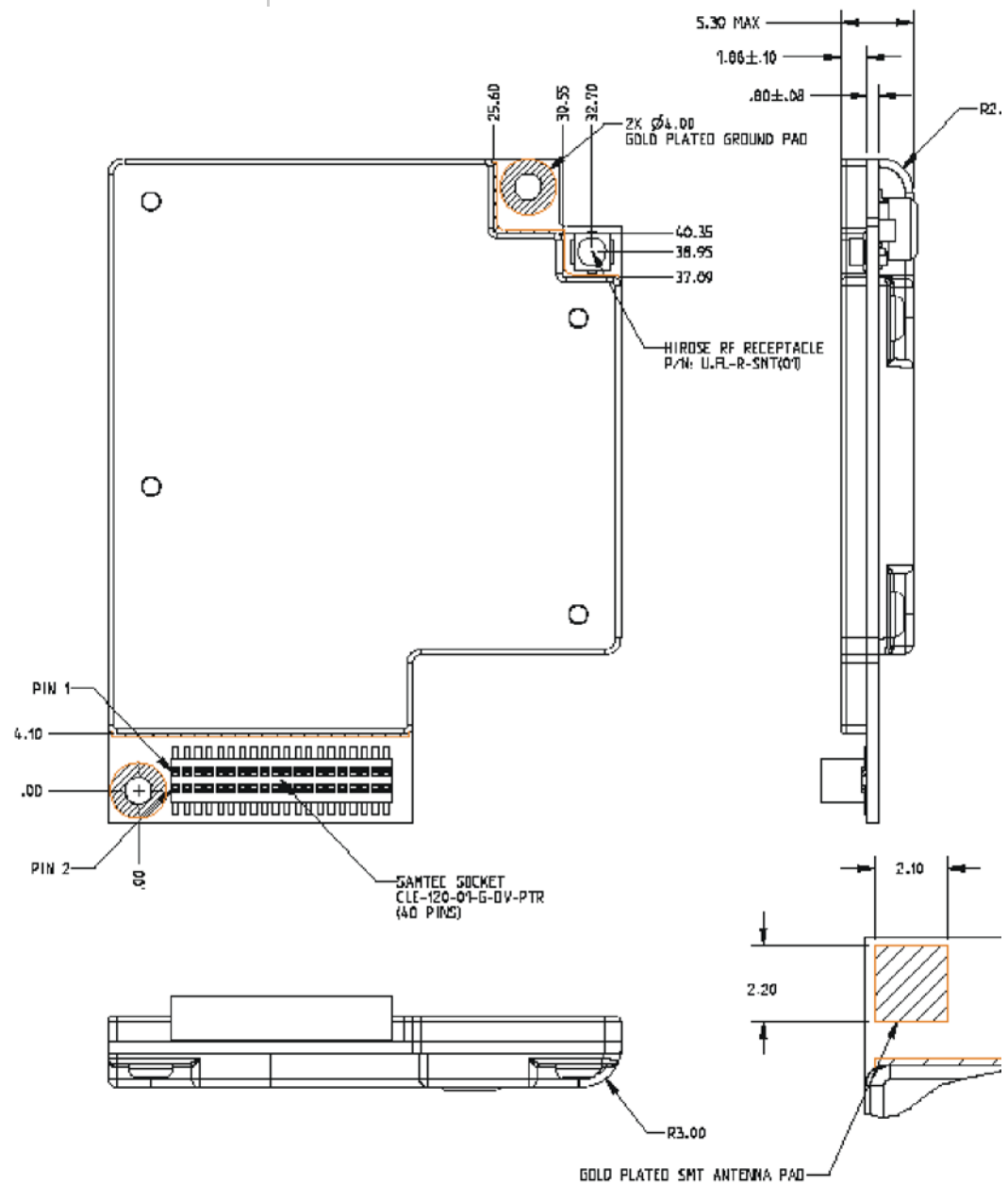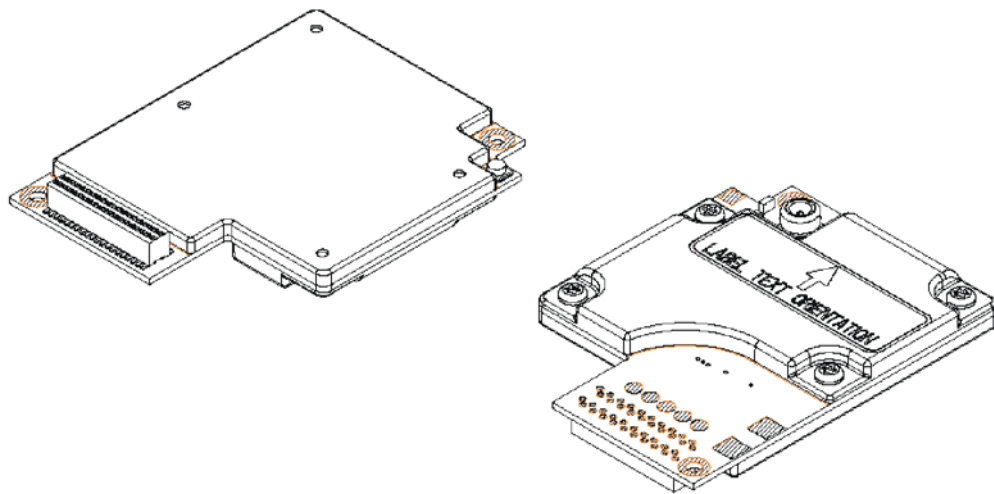
2.10

2.20

R3.00

GOLD PLATED SMT ANTENNA PAD

Figure 6-2: Dimensions of EM3420 from the bottom

Labeling

Figure 6-4: EM3420 unit label

The EM3420 label is non-removable and contains this content:
- Sierra Wireless logo
- Electronic Serial Number (ESN) in code 39 bar code format
- ESN in hexadecimal format
- Sierra Wireless part number in code hexadecimal format
- Manufacturing date code

Note: The EM3420 supports OEM partner specific label requirements.

7: Additional Requirements

Regulatory approvals

The EM3420 modem meets appropriate regulatory requirements, including FCC Parts 2, 15, 22, and 24. Formal testing and approval will still be needed based on your particular integration. You are also responsible for obtaining any other required regulatory approvals in your target markets for your finished product.

FCC

For North American operation, your integration is required to meet appropriate regulatory approvals for stand-alone operation, including FCC parts 2, 15, 22, and 24 approvals.

The EM3420 embedded modem has an FCC ID for mobile applications. The modem has been tested and approved by a test laboratory for conductive tests for FCC parts 22 and 24.

Radiated tests (SAR, ERP, spurious harmonics) are dependent on the antenna configuration and cannot be done by Sierra Wireless. These tests can only be performed using your own antenna design.

FCC Part 15 tests must be performed on the "whole device" and are therefore your responsibility.

Assistance provided by Sierra Wireless

Extended AT commands have been implemented to assist with performing the FCC tests.

A list of test houses familiar with Sierra Wireless products is included in the SB555 Verification and Configuration Guide (document number 2130078).

Sierra Wireless offers additional assistance to integrators with the FCC approvals process, if required.

CDG

CDG-1　The EM3420 modem has been proven against CDG 1 at Qualcomm and Sierra Wireless labs.

CDG-2　The EM3420 modem has been tested on Nortel, Lucent, and Motorola carrier infrastructure. Future testing for Ericcson and Samsung is planned. Sierra Wireless will provide to integrators the CDG 2 modem test reports for you to provide to

Appendix A: Service Option Support

Table 8-1: Service Option Support

Service Option (SO)	Description	Supported?
1	Basic Variable Rate Voice Service	No
2	Mobile Station Loop back (RS1)	Yes
3	Enhanced Variable Rate Voice Service (8 kbps)	Yes
4, 4100	Asynchronous Data Service (RS1)	Yes
5, 4101	Group 3 Facsimile (RS1)	Yes
6	Short Message Services	Yes
7, 4103	Packet Data Service (IP Stack Only)	Yes
9	Mobile Station Loop back (RS2)	Yes
12	Asynchronous Data Service (RS2)	Yes
13	Group 3 Facsimile (RS2)	Yes
14	Short Message Services	Yes
15	Packet Data Service (IP Stack Only)	Yes
17, 32768	High Rate Voice Service (13 k)	Yes
18-19	Over-the-Air Service Administration	Yes
20-21	Group 3 Analog Facsimile	No
22	High Speed Packet Data Services	Yes
23	High Speed Packet Data Services	No
24	High Speed Packet Data Services	No
25	High Speed Packet Data Services	Yes
30-31	Supplemental Code Channel Loop back	No
32	Test Data Service Option (TDSO)	Yes
33	1X High Speed Packet Data Services	Yes
35-36	Location Services	Yes

Table 8-1: Service Option Support

Service Option (SO)	Description	Supported?
54	Markov Service Option (MSO)	No
55	Loop back Service Option (LSO)	No
32798	Markov Calls (RS1)	Yes
32799	Markov Calls (RS2)	Yes

Appendix B: References

<div style="text-align: right">B</div>

Sierra Wireless documents

These documents are (or will be) available on the Sierra Wireless web site, www.sierrawireless.com.

1. *Host Modem Interface Control Port ICD*.

2. *AT Command Specification*.

3. *Embedded Module Hardware Integration Guide*.

4. *EM3420 Reference Guide*.

TIA/EIA standards

TIA standards are available on the web site, www.tiaonline.org.

5. TIA/EIA/IS-2000.1 through .6. *cdma2000 Standards for Spread Spectrum Systems*. Release 0. April 2000.

6. TIA/EIA/IS-2000.1-1 through .6-1. *cdma2000 Addendum* 1. April 2000.

7. TIA/EIA/IS-2000.1-2 through .6-2. *cdma2000 Addendum 2*. June 2001.

8. TIA/EIA/95-B. *Mobile Station-Base Station Compatibility Standard for Dual-Mode Spread Spectrum Systems*. December 4, 1998.

9. TIA/EIA/IS-707-A. *Data Service Options for Wideband Spread Spectrum Systems*. March 2000.

10. TIA/EIA/IS-134. *Facsimile Digital Interfaces - Amendments to TIA/EIA-592 to Support ITU-T T.30-1993*. October 1994.

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12. TIA/EIA-617. *Data Transmission Systems and Equipment for In-Band DCE Control*. January 1996.

13. TIA/EIA/IS-733-1. *High Rate Speech Service Option 17 for Wideband Spread Spectrum Communication Systems*. September 1999.

14. TIA/EIA-736. *Recommended Minimum Performance Standard for the High Rate Speech Service Option 17 for Spread Spectrum Communication Systems*. August 2000.

15. TIA/EIA/IS-127-2. *Enhanced Variable Rate Codec, Speech Service Option 3 for Wideband Spread Spectrum Digital Systems - Addendum* 2. September 1999.

16. TIA/EIA/IS-718. *Minimum Performance Specification for the Enhanced Variable Rate Codec, Speech Service Option 3 for Spread Spectrum Digital Systems*. July 1998.

17. TIA/EIA-637-A. *Short Message Service for Spread Spectrum Systems*. September 1999.

18. TIA/EIA/IS-683-A. *Over-the-Air Service Provisioning of Mobile Stations in Spread Spectrum Systems*. June 1998.

19. TIA/EIA/IS-835-A. *Wireless IP Network Standard*. May 2001.

20. TIA/EIA/IS-870. *Test Data Service Option (TDSO) for cdma2000 Spread Spectrum Systems*. 2001.

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22. TIA/EIA-126-D. *Mobile Station Loop back Service Options Standard*. 2001.

23. TIA/EIA TSB 58C. *Administration of Parameter Value Assignments*. May 2000.

24. TIA/EIA TSB 50. *User Interface for Authentication Key Entry* .March 1993.

25. TIA/EIA/IS-801.1. *Location Service Standard for Dual-Mode Spread Spectrum Systems*. March 2001.

26. C.S0031-0. *Signaling Conformance Tests for CDMA 2000 Spread Spectrum Systems, Ballot Resolution*. Version 3GPP2 TSG-C v2.0

27. TIA/EIA/IS-J-STD-036. *Enhanced Wireless 9-1-1 Phase II*. January 2001.

CDG standards

28. CDG 22. *Stage 2 Interoperability Tests (TIA/EIA/IS-95-A)*. Ver. 8.0. September 2000.

29. CDG 53. *Stage 2 Interoperability Tests (TIA/EIA-95-B)*. Ver. 2.0. June 2000.

30. CDG 57. *Stage 2 Interoperability Tests (TIA/EIA/IS-2000)*. Ver. 0.7. February 2001.

31. CDG 36. *Markov Service Options for Wideband Spread Spectrum Systems*.

32. CDG 64. *CDG Stage 3 Testing for CDMA2000*. Ver. 1.0. August 2002.

Agency standards

33. FCC 47 CFR - Part 15. *Radio Frequency Devices*. January 2001.

34. FCC 47 CFR - Part 22. *Cellular Radiotelephone Services*. October 1998.

35. FCC 47CFR - Part 24. *Personal Communications Services*. October 1998.

36. Industry Canada ICES-003. *Interference-Causing Equipment Standard - Digital Apparatus*. November 22, 1997.

37. Industry Canada RSS-129. *800MHz Dual-Mode CDMA Cellular Telephones*. Issue 2. September 2, 1999.

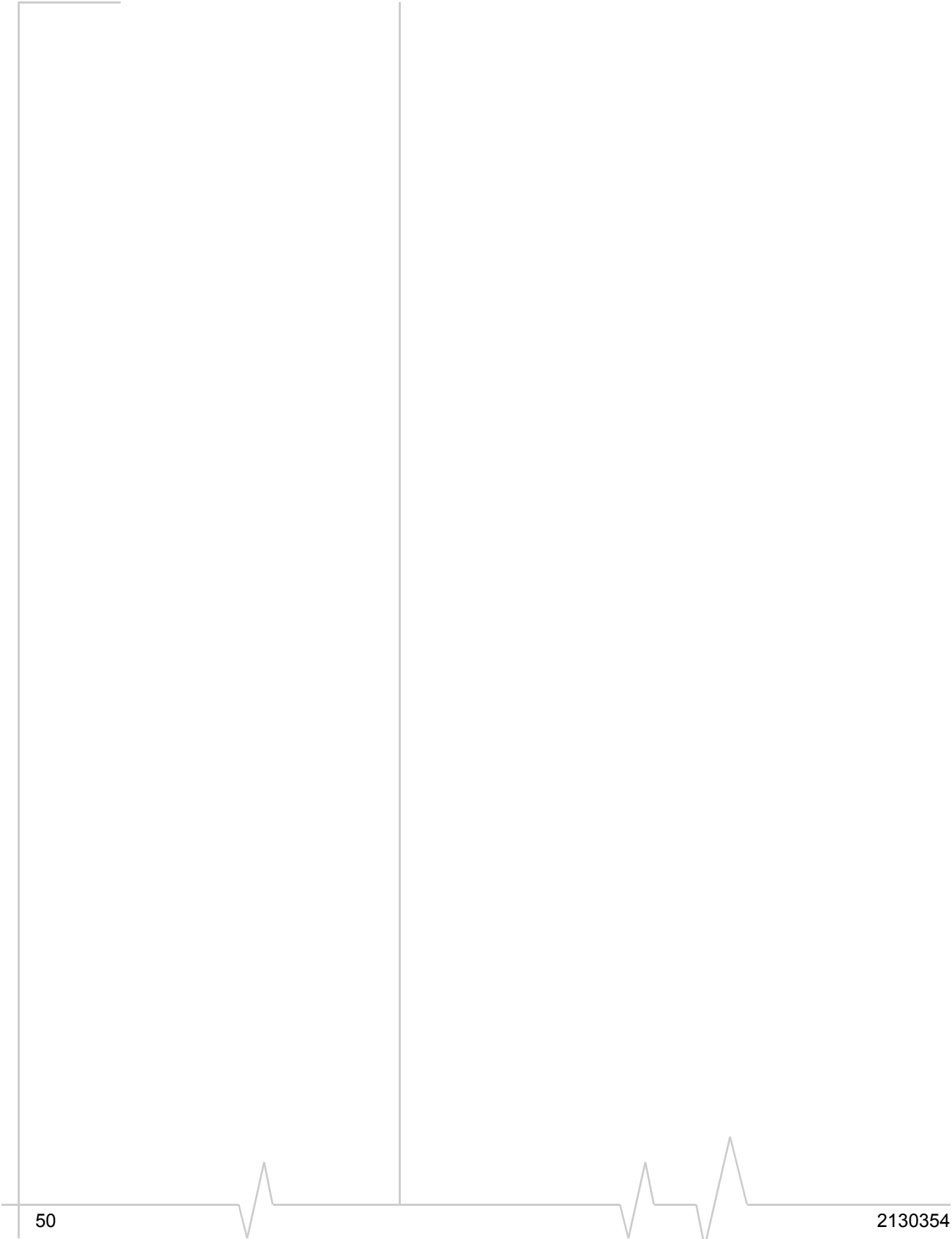38. Industry Canada RSS-133. *2 GHz Personal Communications Services*. September 25, 1999.

39. IEC 61000-4-2. *Electrostatic Discharge Immunity Test*.

40. JESD22-A114-B. *+/- 1 kV Human Body Model.*

41. JESD22-C101. *+/- 125 V Charged Device Mode*l.

Other standards

42. *Openwave_IOTA_Protocol_v2.0_Specifications_doc_v2.04*. February 2002.

Appendix C: Acronyms

Table 10-1: Acronyms

1xRTT	**Single Carrier (1x) Radio Transmission Technology**
AFLT	Advanced Forward Link Trilateration
API	Application Programming Interface
CDG	CDMA Development Group
CDMA	Code Division Multiple Access
CNAP	Calling Name Presentation
CTIA	Cellular Telecommunication & Internet Association
DCE	Data Communications Equipment
DM	Diagnostic Monitor
DMSS	Dual-Mode Subscriber Software
EIRP	Effective Isotropic Radiated Power
ERP	Effective Radiated Power
ESD	Electro-Static Discharge
EVRC	Enhanced Variable Rate Codec
FCC	Federal Communications Commission
GPS	Global Positioning System
IS	Interim Standard
KBC/R	Keyboard Column/Row
LED	Light Emitting Diode
MIO	Module Input/Output
MSM	Mobile Station Modem
NAM	Number Assignment Module
NVM	Non-Volatile Memory
OEM	Original Equipment Manufacturer
OTAPA	Over the Air Parameter Administration

Table 10-1: Acronyms

OTASP	Over the Air Service Provisioning
PACA	Priority Access and Channel Assignment
PC	Personal Computer
PCS	Personal Communications Services
PDA	Personal Digital Assistant
PDP	Packet Data Profile
PPP	Point to Point Protocol
P-REV	Protocol Revision
PRL	Preferred Roaming List
PSD	Product Specification Document
PST	Product Support Tools
PWM	Pulse Width Modulation
QCELP	Qualcomm Codebook Excited Linear Prediction
QNC	Quick Net Connect
RC	Radio Configuration
RLP	Radio Link Protocol
RTC	Real Time Clock
R_UIM	Removable User Identity Module
SAR	Specific Absorption Rate
SMS	Short Message Service
TIA/EIA	Telecommunications Industry Association / Electronics Industry Association
UART	Universal Asynchronous Receiver Transmitter
UI	User Interface
USB	Universal Serial Bus