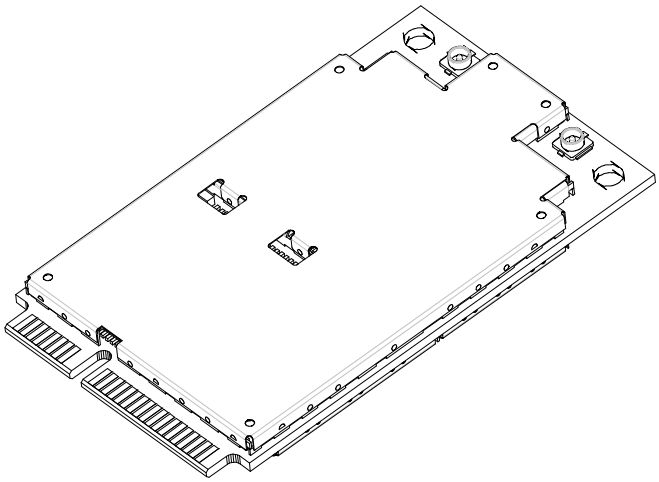
AirPrime MC8790V with Audio PCI Express Mini Card

Product Specification



SIERRA WIRELESS™

2111280
Rev 3

Important Notice

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

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Contact Information

Sales Desk:	Phone:	1-604-232-1488
	Hours:	8:00 AM to 5:00 PM Pacific Time
	E-mail:	sales@sierrawireless.com
Post:	Sierra Wireless 13811 Wireless Way Richmond, BC Canada V6V 3A4	
Fax:	1-604-231-1109	
Web:	www.sierrawireless.com	

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

www.sierrawireless.com

Revision History

Revision number	Release date	Changes
1.0	Mar 2008	Created document
1.1	May 2008	Added up-to-date measurements to tables 6-1, 6-2, and 6-3
1.2	June 2008	General release version
1.3	May 2009	Added PDP type PPP support; removed ‘preliminary values’ footnotes Added extended UART details
2	October 2010	New document branding Changed Low Power mode note in Table 6-1
3	November 2011	Corrected model # on cover; updated trademarks

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1: Introduction

The Sierra Wireless AirPrime MC8790V PCI Express Mini Card is a compact, lightweight, wireless UMTS-based modem. It provides GPS, EDGE, GPRS, GSM, WCDMA, HSDPA and HSUPA connectivity for portable and handheld computers, point-of-sale devices, telemetry products and other machine-to-machine and vertical applications over several radio frequency bands:

- **GSM, GPRS, EDGE**
  850 MHz, 900 MHz, 1800 MHz, 1900 MHz
- **UMTS WCDMA / HSDPA / HSUPA**
  800 MHz, 850 MHz, 1900 MHz, 2100 MHz
- Receive diversity:
  Optimized for diversity on 800, 850, 1900 and 2100 MHz
- **GPS**
  1575.42 MHz

The modem, based on Qualcomm's MSM6290 baseband processor, supports data and voice operation on HSDPA, HSUPA, WCDMA, EDGE, and GPRS networks.

Specifications at a glance

This document describes high-level application and hardware interface requirements for integrating the MC8790V into a host product.

For more detailed information, see Supporting documents on page 14.

Table 1-1: MC8790V Modem features

Physical features
• Small form factor—conforms to **PCI Express Mini Card Electro-mechanical Specification Revision 1.2** [R-18] • Two U.FL RF connector jacks
Electrical features
• Single supply voltage (VCC)—3.0V–3.6V • Self-shielded—no additional shielding required

Table 1-1: MC8790V Modem features (Continued)

Short Message Service (SMS) features

• Send and receive (mobile originate and mobile terminate)
  ◦ Mobile-originated / terminated over CS and PS channels
  ◦ Mobile-originated SMS over PS falls back to CS if PS service is not available, or there is a PS network failure.
• New message notification
• Message sorting
• Multiple recipients
• Return voice call
• Save contact details
• Mobile-originated SMS e-mail
• Mobile-originated / terminated SMS concatenation
• Mobile-originated SMS e-mail concatenation
• Receipt notification

Application interface features
• NDIS NIC interface support (Windows XP, Windows Vista™) • Multiple logical channel USB support using 27.010 multiplexing protocol • Multiple non-multiplexed USB channel support • Dial-up networking • USB selective suspend to maximize power savings • AT command interface (27.007 standard, plus proprietary extended AT commands) • CnS—Sierra Wireless' proprietary Control and Status host interface protocol • Software Development Kit (SDK) including a Windows API (Application Program Interface)
Phone book
Supports Release 99 phone book features

Table 1-1: MC8790V Modem features (Continued)

Packet mode features

• Quad-mode UMTS (WCDMA) / HSDPA / EDGE / GPRS operation
• GPRS / EDGE class B, multislot class 12 operation—supports all coding schemes (CS1–CS4, MCS1–MCS9)
• UMTS R99 (WCDMA) data rates—384 kbps downlink, 384 kbps uplink
• HSDPA category 6 / 8 / 12 data rates—3.6 / 7.2 / 1.8 Mbps downlink respectively
• HSUPA data rates
  ◦ Category 3 / 5—1.45 / 2.0 Mbps uplink respectively
  ◦ Category 6—2.0 Mbps (at product launch) / 4.5 Mbps (future firmware upgrade)
• Circuit-switched data bearers—64 kbps (maximum) uplink and downlink

Voice mode features
Supports: • All GSM vocoders, Enhanced Full Rate (EFR), Full Rate (FR), Half Rate (HR), and WCDMA Adaptive Multirate (AMR) encoders • MO and MT calling • Echo cancellation • Emergency calls (112, 110, 911, etc.) • Incoming call notification • TTY/TDD compatibility through microphone/speaker connections using the audio interface
GPS features
Provides: • Standalone GPS functionality • gpsOneXTRA™ • A-GPS features • Enhanced Navigation 2.0 feature • NMEA support *Note: GPS specifications are preliminary targets which are subject to change without notice. Actual GPS functionality is dependent on the firmware version, and on module configuration.*

Table 1-1: MC8790V Modem features (Continued)

Connectivity / GSM features

• Multiple (up to 16) cellular packet data profiles
• Traditional modem COM port support for DUN, CSD, and AT commands (concurrent with NDIS)
• Suspend / Resume
• Sleep mode for minimum idle power draw
• SIM application tool kit with proactive SIM commands
• Enhanced Operator Name String (EONS)
• Profile list. Typical carrier profiles are available in a drop-down list in Watcher; the user can select a profile rather than enter all the parameters.
• Automatic GPRS attach at power-up
• GPRS detach
• GPRS detach only
• Combined GPRS / IMSI detach; MS-initiated and network-initiated detach
• Mobile-originated PDP context activation / deactivation
• Support QoS profile
  ◦ Release 99 QoS negotiation—Background, Interactive, and Streaming
  ◦ Release 97—Precedence Class, Reliability Class, Delay Class, Peak Throughput, Mean Throughput
• Static and Dynamic IP address. The network may assign a fixed IP address or dynamically assign one using DHCP (Dynamic Host Configuration Protocol).
• PAP and CHAP support
• PDP context type (IPv4). IP Packet Data Protocol context
• RFC1144 TCP/IP header compression
• Interaction with existing GSM services (MO / MT SMS and voice calls) while:
  ◦ GPRS is attached, or
  ◦ In a GPRS data session (class B GPRS suspend / resume procedures)
• Support for EAP-SIM authentication and PC / SC. EAP-SIM is available through:
  ◦ The API
  ◦ AT commands
  ◦ The PC / SC interface

Table 1-1: MC8790V Modem features (Continued)

Network selection
• Network selection procedures described in 3G 22.011, R5 (June 2005) • Network selection procedures described in 3G 23.122, R5 (June 2005) • RRC connection reject message to redirect from a 3G system to a 2G system, according to 25.331, R5 (June 2004) • Network selection procedures described in 3G 43.022, R4 • A CPHS Customer Service Profile-like feature [PLMN Mode bit] on a USIM / SIM that hides network selection related menus • Initial HPLMN scan at two minutes after power on • An HPLMN rescan irrespective of the serving MCC • Disabling of non-North American 2G and 3G frequency bands when served by a North American 2G / 3G system • Equivalent PLMN • Network selection generally within 30 seconds of power up • Enhanced network selection (ENS)
RF features
• Quad-band GSM / GPRS (850 MHz, 900 MHz, 1800 MHz, 1900 MHz) • Quad-band UMTS WCDMA FDD (800 MHz, 850 MHz, 1900 MHz, 2100 MHz) • GPS (1575.42)
Environmental features
Operating temperature ranges • Regular use: -25 °C to +60 °C • Reduced RF performance: +60 °C to +75 °C

Support features

The MC8790V offers the following support features:

- Standard 1-year warranty
- Extended warranties available (additional one or two years)
- Enabling software (drivers, SDK, etc.): Windows XP, Windows Vista
- Host-assisted, over-the-air firmware upgrades
- USIM support

Supporting documents

Note: For a detailed list of related Sierra Wireless documents and related industry standards, see References on page 79.

The following documents describe various aspects of the Mini Card, including design, usage, and integration issues.

- CDMA / GSM Mini Card Hardware Integration Guide
- UMTS Modems Supported AT Command Reference
- MC87xx Modem Extended AT Command Reference
- GSM Software Development Kit API Manual
- MC87xx modem CnS Reference
- Embedded Module / Mini Card / AirCard USB Driver Developer's Guide
- Enabling Software Users Guide (Watcher Modem Management)

Accessories

The MC8790V Development Kit includes:

- Embedded Modem Interface Kit
- Documentation suite
- Initial allotment of support hours
- USB cable

Sierra Wireless also offers antennas.

Ordering information

To order, contact the Sierra Wireless Sales Desk at +1 (604) 232-1488 between 8 AM and 5 PM Pacific Time.

2: UMTS / GPRS / EDGE Overview

UMTS

The Universal Mobile Telecommunications System (UMTS) specification is the third generation (3G) mobile systems standard developed by the 3rd Generation Partnership Project (3GPP), based on an evolution of GSM core network components. High-speed 3G systems implementing the UMTS standard enable improved performance for wireless data applications, delivery of enhanced multimedia content, and improved network capacity to support additional subscribers.

The MC8790V supports the **3GPP Release 5 UMTS Specification for Mobile Terminated Equipment** [R-9]. For additional information on this specification, visit the 3GPP web site at www.3gpp.org.

3GPP UMTS Release 5 adds the WCDMA air interface, support for new UMTS services, and an IP-based infrastructure migration path, to the core GSM functionality, infrastructure and air interface.

At the radio access layer, the UMTS WCDMA air interface is the Direct Sequence WCDMA Frequency Division Duplex spread spectrum CDMA variant; the interface provides a three-layer radio channel organization supporting physical, transport and logical channel types. This allows abstraction of UMTS and GSM Radio Access Network base station control elements from MSC / VLR and SGSN Core Network elements and end-to-end services, enabling seamless network support for UMTS UE and GSM MS mobile devices.

UMTS supports Quality of Service (QoS) classes that describe differing use requirements. From most to least delay-sensitive, the QoS classes are:

- **Conversational**—Preserves the time relation between information entities of the data stream (conversational pattern - stringent and low-delay).
  Example: wireless telephone conversation
- **Streaming**—Preserves the time relation between information entities of the data stream.
  Example: streaming multimedia
- **Interactive**—Preserves the data integrity of information entities (request / response pattern).
  Examples: web browsing, network games
- **Background**—Preserves the data integrity of information entities. The destination is not expecting the data within a certain time.
  Example: downloading email

These classes support everything from time-insensitive background data transfer to more time-critical applications.

GPRS / EDGE

GPRS / EDGE is a 2.5G wireless technology providing end-to-end packet data services through reuse of existing GSM infrastructure.

GPRS / EDGE packet data rates are determined by the number of timeslots available for downlink (Rx) and uplink (Tx), and the coding scheme used for any given transmission. The MC8790V supports multislot class 12 (four Rx slots (maximum), four Tx slots (maximum), five active slots total), and standardized coding schemes (CS 1 to CS 4, MCS1 to MCS9).

Note: The network controls slot assignments based on current network loads and the bandwidth required by the mobile device - users cannot change slot assignments.

Data rates for the MC8790V vary depending on timeslot / packet service availability. Table 2-1 summarizes typical and theoretical data rates (see Data Rates on page 75 for details):

Table 2-1: MC8790V data rates[a]

Packet data service		Theoretical max physical layer throughput	Typical user data throughput[b],[c]
EDGE	Upload	236 kbps	100–130 kbps
	Download	236 kbps	100–130 kbps (with bursts over 200 kbps)
UMTS	Upload	384 kbps	over 300 kbps
	Download	384 kbps	over 300 kbps
HSUPA	Upload	2.0 Mbps (at product launch) 5.76 Mbps (future firmware upgrade)	1.34 Mbps (Category 3)[2] 1.8 Mbps (Category 5)[2] (Category 6)[2] 2.0 Mbps (at product launch) 4.5 Mbps (future upgrade)
HSDPA	Download	7.2 Mbps	1.6 Mbps (Category 12)[2] 3.36 Mbps (Category 6)[2] 6.6 Mbps (Category 8)[2]

a. Rates are for conducted throughput only. Radiated data would depend on host device diversity antenna implementation.
b. HSUPA and HSDPA rates represent the peak possible user data rates.
c. Throughput rates depend on network configuration, network loading, and connection (signal) conditions.

3: Standards Compliance

The MC8790V complies with the **3GPP Release 5 UMTS Specification for Mobile Terminated Equipment** [R-9] and several other 3GPP / ETSI standards ([R-10]–[R-17]).

Note: Specifications requiring host device support for full compliance with standards are identified accordingly.

This section describes compliance details relating to:

- UMTS WCDMA FDD specifications
- GSM / GPRS / EDGE specifications
- Common UMTS WCDMA / GSM specifications
- UMTS supported
- Short Message Service
- UMTS compliance acceptance and certification

UMTS WCDMA FDD specifications

The MC8790V supports the WCDMA FDD specifications listed in Table 3-1.

Table 3-1: Supported WCDMA FDD specifications

Item
Physical layer specifications
DL Channels: BCH, PCH, FACH, DCH, AICH, CPICH
UL Channels: RACH, DCH
Measurement for PCCPCH RSCP RSCP/SIR
BTFD
CCTrCH As defined by examples in 25.944
Multifinger support
Cell reselection
Soft handover
Power control
PICH / DRX
Measurement for SFN / CFN timing, SFN / SFN timing
Cell selection

Table 3-1: Supported WCDMA FDD specifications (Continued)

Item
RLC specifications
TM / UM / AM
Max AM entities (4) • 3 for signalling • 1 for user data
Only timer based polling for AM
No timer based SDU discard for TM / UM / AM
Poll PU polling for AM
Poll prohibit
Polling options: Last ReTX PU Poll, Poll Window, Poll SDU
Status report transfer: Timer Status, Status Prohibit, Missing PU indicator
Reset procedure: Indication to RRC
Suspend / Resume
Timer based SDU discard (UM / AM / TM)
Status report transfer: Piggybacked Status PDUs, EPC based transfer
SUFIs: Sending BITMAP and RLIST
Start / stop for all three modes
RRC Specifications
Cell selection
RRC connection establishment
RRC connection release
System information processing
Idle mode paging
Dedicated mode paging
Initial direct transfer
Uplink direct transfer
Downlink direct transfer
Signalling connection release
Signalling connection release request
Radio bearer establishment
Radio bearer release

Table 3-1: Supported WCDMA FDD specifications (Continued)

Item
Cell update
UE capability enquiry
Transmission of UE capability
Cell reselection
Measurement control
Measurement reporting
Soft HO/Active Set update
DRX mode
NV support for RRC channel scan
Radio bearer reconfiguration
Transport channel reconfiguration
Physical channel reconfiguration
UTRAN mobility information
Integrity protection
Security mode control
Encryption: UEA1
Integrity algorithm: U1A1

GSM / GPRS / EDGE specifications

The MC8790V supports the GSM / GPRS / EDGE specifications listed in Table 3-2, as well as Enhanced Network Selection (ENS), and Enhanced Operator Name String (EONS).

EONS allows the operator to define the operator name displayed for any registered network based on the MCC / MNC / LAI on which the MS is currently registered. Strings that can be displayed when a MS is registered on a network are:

- Enhanced Operator Name String (EONS) from SIM
- Operator Name String (ONS) from SIM
- Service Provider Name (SPN) from SIM
- Network Identity and Time Zone (NITZ) as broadcast by network
- String from internal lookup table in UE

Table 3-2: Supported GSM / GPRS specifications

Item	Comments
8PSK modulation	Octagonal Phase Shift Keying Coding schemes MCS1-4 are GMSK and MCS5-9 are 8PSK.
GPRS header compression	Data packet header compression supported
3GPP compliance	Protocol stack supports the requirements of: • GPRS/EDGE: 3GPP Release 99 and GERAN Feature Package #1 • WCDMA: Release 5 plus HSUPA (Release 6)
GPRS operation mode class B	Class B terminals support either circuit-switched or packet-switched traffic (with simultaneous network attachment) but do not support both kinds of traffic simultaneously.
Link Adaptation (LA)	Together with IR (next table entry), LA adapts the EGPRS transmission to meet changing radio link conditions.
EGPRS Incremental Redundancy (IR)	IR adjusts the physical layer code rate to actual channel conditions by incrementally transmitting redundant information until decoding is successful. Automatic Repeat Request (ARQ) protocol takes care of requesting and retransmitting incorrectly received blocks. ARQ enables both dynamic RLC window management (to avoid window stalling) and dynamic RLC polling frequency (to minimize retransmission delay and save radio bandwidth).
GPRS multislot class 12	Multi-slot class 12 with extended dynamic allocation of time slots Class 12 allows up to four time slots in Rx and four for Tx with a maximum of five time slots active simultaneously. See Table A-1 on page 75.
EGPRS multislot class 12	
NC0	NC0 is the normal mode of control for a GPRS mobile in which the MS (Mobile Station) performs autonomous cell reselection.
DPC	Downlink Power Control Allows the network to adjust the downlink power of any dedicated channels on the BTS based on measurement reports sent by the mobile. This allows the network to reduce interference between multiple mobiles while still maintaining adequate signal quality for the individual mobiles.
One-phase packet access for GPRS	In establishing a TBF (Temporary Block Flow) connection, the MS (Mobile Station) requests either one-phase or two-phase packet access. In one-phase access, the network responds to a packet channel request by sending a packet uplink assignment message and reserving resources for uplink transfer of a number of radio blocks. In two-phase access, a packet resource request is sent on receipt of the packet uplink assignment.
One-phase packet access for EGPRS	
Two-phase packet access for GPRS	
Two-phase packet access for EGPRS	

Table 3-2: Supported GSM / GPRS specifications (Continued)

Item	Comments
RLC-acknowledged operation mode	The RLC-acknowledged and LLC-acknowledged modes are used to ensure the integrity of received data where QoS requires it. RLC (Radio Link Control) acknowledgment is typically the default (depending on the network and user profile). LLC-acknowledgment is optional and ensures that all LLC (Logical Link Control) frames are received without error. Since LLC-acknowledged mode requires acknowledgement of all LLC frames, the mode has an impact on throughput.
RLC-unacknowledged operation mode	
LLC-acknowledged transmission mode	
LLC-unacknowledged transmission mode	
GSM network operation mode I and II	The Network Operating Mode specifies the coordination of paging for circuit-switched and packet-switched services. Mode I - The mobile can receive circuit-switched pages while in a packet-switched call. Mode II - The mobile cannot receive a circuit-switched page while in a packet-switched call, as it would force the mobile to constantly monitor its CCCH channel.
PBCCH / PCCCHI	Packet Broadcast Control Channel PBCCH is a packet data signaling channel that can supplement the BCCH GSM control channel, allowing decoupling of voice and packet control channels to set up data calls. PBCCH broadcasts GPRS / EGPRS specific cell re-selection parameters for serving and neighbor cells used in cell selection / re-selection for packet services.
GPRS test modes (ETSI test mode A and B)	The European Telecommunications Standards Institute (ETSI) defines standards and requirements for testing of GSM mobile equipment. In test mode A, the mobile requests an uplink TBF and transmits random data on a designated number of timeslots. This causes a device to transmit data without using upper layer protocols. Once the transmission has started, the downlink TBF halts. The device remains in this mode until the testing equipment terminates it. In test mode B, the mobile is prompted to receive data on a number of specified downlink timeslots and re-transmit the same data back on the corresponding uplink timeslots. Test mode B allows tests to be performed on both the transmitter and receiver within a single session.
NACC (R4 GERAN Feature Set 1)	Network Assisted Cell Change Enables the network to provide additional information about neighbor cells to the mobile while in a packet data session, which decreases the experienced service delays caused by cell re-selection.
MAIO	Mobile Allocation Index Offset MAIO and Hopping Sequence Number (HSN) are used in conjunction with Frequency Hopping to determine the hopping sequence used in each frame. The MAIO supports as many values as there are frequencies in the hopping list, and these are used to indicate the offset within the hopping list that identifies the frequency used.

Table 3-2: Supported GSM / GPRS specifications (Continued)

Item	Comments
Packet enhanced measurement report (PEMR)	Packet Enhanced Measurement Report (PEMR) is one of the RLC / MAC (Radio Link Control and Medium Access Control) control messages that include a carrier identifier. This message is a requirement of supporting multicarrier TBF.
Delayed TBF Release	Delayed Temporary Block Flow Release (also called Extended Uplink TBF) Delayed TBF Release reduces latency between uplink data transfers and reduced signaling on the network by maintaining a connection for brief periods when the network is temporarily inactive and the mobile station has no radio link control information to send. For this feature to work properly, the mobile station must support delayed TBF release.
Extended Dynamic Allocation	Radio blocks can be transmitted on up to four different PDCHs. Permits full class 12 operation.
Single Antenna Interference Cancellation (SAIC)	SAIC mitigates code-channel interference from neighboring cells resulting in fewer dropped calls, and faster download rates for e-mail and websites.
Circuit-switched data bearers	These circuit-switched data bearers are supported on 2G networks: • Asynchronous 9,600 bps • Asynchronous 14,400 bps
Security	
Encryption support	GPRS / EGPRS support GEA1 and GEA2 data ciphering. GSM CSD and SMS use A5/1 and A5/3 encryption.
PAP for RADIUS authentication - GPRS / EGPRS	PAP (Password Authentication Protocol) is a method of authenticating usernames and passwords against a database on a RADIUS (Remote Authentication Dial-In User Service) server. In a standard login, the service provider prompts for a username and password. In PAP authentication, the username and password are entered in the client's dialing software and sent as one data package, rather than the server sending a login prompt and waiting for a response.
CHAP for RADIUS authentication - GPRS / EGPRS	CHAP (Challenge Handshake Authentication Protocol) is a more secure method for connecting to a system than PAP. After a link is established, the server sends a challenge message to the client. The client responds with a value calculated using a one-way hash function. The server compares its own calculation of the expected hash value to the client's response. If the values match, the authentication is acknowledged; otherwise the connection is terminated.
Support for encryption algorithm UEA1 (Kasumi)	UEA1 (UMTS Encryption Algorithm) generates the keystream as a function of a cipher key that is re-synchronized to every MAC / RLC frame. UEA is based on the Kasumi algorithm.
Support for integrity algorithm UIA1 (Kasumi)	UIA1 (UMTS Integrity Algorithm) is the algorithm used to compute the IK (Integrity Key) used in message authentication. UIA is based on the Kasumi algorithm.

Table 3-2: Supported GSM / GPRS specifications (Continued)

Item	Comments
UMTS	
WCDMA-to-GPRS reselection in CELL_FACH	CELL_FACH is an RRC (Radio Resource Control) service state in which cell reselection is performed. This feature prevents dropping of RRC connections.
Inter-frequency reselection in Cell_FACH	
Radio link failure	Radio link failure is a procedure that indicates an 'out-of-synch' state on one or more radio links. Node B of the RNC (Radio Network Controller) reports this event before attempting resynchronization. The radio link restoration procedure indicates restoration of the 'synchronized' state.
SIB scheduling	SIB (System Information Block) scheduling controls the broadcasting of information to user equipment in a cell. The user equipment retrieves the schedule, and is then able to change to sleep mode, receiving only those blocks that it needs.
SIB modification	
Re-establishment procedure	Following a radio link failure, the RNC maintains the RRC connection, waiting for re-establishment.
VT + PS call (subject to network availability)	Simultaneous VT (Video Terminal) and PS (Packet Switched) calls are supported.
Packet Cell Change Order from GSM→UTRAN	Call transfer between GSM-based and UTRAN-based cells is supported.
Background PLMN search	Improved algorithm for Higher Priority PLMN (HPPLMN) search while camped on a 3G cell.
Configurable Release 5 or Release 99 support	
Circuit-switched data bearers	
Data bearers	These circuit-switched data bearers are supported on 3G networks: • Synchronous transparent mode = 64000 bps • Synchronous transparent mode = 56000 bps • Asynchronous V110 UDI = 14400 bps • Asynchronous V110 UDI = 28800 bps • Asynchronous V110 UDI = 38400 bps • Asynchronous V120 = 14400 bps • Asynchronous V120 = 28800 bps • Asynchronous V120 = 56000 bps
HSDPA	
Data rates	The following data rates are supported: • Category 12 (1.8 Mbps) • Category 6 (3.6 Mbps) • Category 8 (7.2 Mbps)

Table 3-2: Supported GSM / GPRS specifications (Continued)

Item	Comments
HSDPA logical channels	These HSDPA logical channels are supported: • HS-SCCH • HS-DPCCH • HS-PDSCH—Up to five HS-PDSCH channels are supported.
HSDPA transport channels	HS-DSCH is supported at these rates: • 120 kbps • 240 kbps • 360 kbps
Incremental redundancy	IR adjusts the physical layer code rate to actual channel conditions by incrementally transmitting redundant information until decoding is successful. Automatic Repeat Request (ARQ) protocol takes care of requesting and retransmitting incorrectly received blocks. ARQ enables both dynamic RLC window management (to avoid window stalling) and dynamic RLC polling frequency (to minimize retransmission delay and save radio bandwidth).
Chase combining retransmission scheme	The Chase combining retransmission scheme is the simplest HARQ (Hybrid Automatic Request) link adaptation technique. HARQ techniques are used to enhance system performance.
HSDPA Compressed Mode	Allows the user equipment to interrupt transmission and reception during a call for brief periods in order to measure the signal strength of neighboring cells that use different frequencies.
Concurrent voice and HSDPA data	
HSDPA Indicator	Allows user interface to display an indicator when HSDPA data transfer is in progress.
Simultaneous receive diversity support	Receive diversity bands: • Band I, UMTS 2100 • Band II, UMTS 1900 • Band V, UMTS 850 • Band VI, UMTS 800
Receiver equalizer support	
HSUPA	
Support for: Category 3 / 5 / 6	
HSUPA indicator	Allows user interface to display an indicator when HSUPA data transfer is in progress.
Miscellaneous	
Fast link adaptation	The data rate is adapted to radio conditions.

Table 3-2: Supported GSM / GPRS specifications (Continued)

Item	Comments
Vary the effective code rate	The effective code rate is varied based on code space resources.
HARQ, MAC-HS disassembly	MAC-HS (High Speed MAC) is the base station MAC (Medium Access Control) protocol. MAC-HS enables fast radio resource allocation.
MAC-HS reordering queue distribution and processing support	
Cell change	These cell change methods are supported: • Synchronous and non-synchronous • Intra-Node B (softer repointing) • Inter-Node B (soft repointing)
Up-switching and down-switching of PS RAB between HS-PDSCH and DPCH	RAB (Radio Access Bearer) and channel mappings between the HS-PDSCH (High Speed Physical Downlink Shared Channel) and DPCH (Dedicated Physical Channel) are reallocated according to volume thresholds and inactivity timers.
Ciphering on the HS channel	Ciphering on high-speed channels protects radio-transmitted data against unauthorized third parties.
Support to not resume the HS channel if inter-RAT handover fails, but save the RB mapping information	RB (Radio Bearer) mapping information is preserved if a high-speed channel is dropped due to the failure of an inter-RAT (Radio Access Technology) transfer.
Support to not resume the HS channel if a radio link failure occurs, but save the RB mapping information	RB (Radio Bearer) mapping information is preserved if a high-speed channel is dropped due to a radio link failure.
WINS address support primary and secondary	Primary and secondary IP addresses can be assigned for WINS (Windows Internet Name Service) name servers.
Voice support	
Unstructured supplementary services data (USSD)	USSD provides support for transmitting information over the GSM network signalling channels. It provides fast session-based communication between the user and an application, enabling applications such as text messaging, prepaid roaming, and chat.
Supplementary services	Support for supplementary voice services such as Call Hold, Call Forward, Call Waiting, Multi-party Calls, Caller ID, Fixed Number Dialing, Service Dialing Numbers, etc.
Security - IMEI Security	
SIM lock	The device can be ‘MEP locked’ to a particular PLMN.
SIM security	Both CHV1 and CHV2 are supported (unlock and unblock).

Supported voice features

The MC8790V supports the voice-related features listed in Table 3-3.

Table 3-3: Supported voice features

Item	Comments
USSD (Unstructured Supplementary Services Data)	This is a GSM-specific capability that supports transmitting information over GSM network signalling channels.
Voice encryption	Both A5/1 and A5/2 voice encryption are supported.
SIM Application Tool Kit with proactive SIM commands (compliant to R96)	3GPP TS 11.14 SIM Application Toolkit commands are stored on the SIM. These commands enable the SIM card to proactively drive the GSM host device and support interactions between the network and the end user.
User-configurable audio prompts	Several audio features, such as ‘Incoming Call’ and ‘New SMS message’, can be configured in Watcher.
Multi-party calling	Up to 5 remote parties are supported on a single call, plus an additional party on hold (on a separate call).

Table 3-4: Supported supplementary services

Service	Supported by		
	Watcher / CnS	GSM service code	AT command
Calling Line Identification Presentation (Caller ID)	Yes	Yes	Yes
Calling LIne Identification Restriction (hides your ID on outgoing calls)	Yes	Yes	Yes
Call Waiting	Yes	Yes	Yes
Call Hold	Yes	N/A	Yes
Multi-party service	Yes	N/A	Yes
Call Forwarding			
Unconditional	Yes	Yes	Yes
on Mobile Subscriber Busy	Yes	Yes	Yes
on No Reply	Yes	Yes	Yes
on Mobile Subscriber Not Reachable	Yes	Yes	Yes
Call Barring			
All outgoing calls	Yes	Yes	Yes
Outgoing international calls	Yes	Yes	Yes
Outgoing international calls (except those directed to the home PLMN country)	Yes	Yes	Yes

Table 3-4: Supported supplementary services (Continued)

Service	Supported by		
	Watcher / CnS	GSM service code	AT command
All incoming calls	Yes	Yes	Yes
Incoming calls when roaming outside the home PLMN country	Yes	Yes	Yes

Common UMTS WCDMA / GSM specifications

The MC8790V supports the common UMTS WCDMA / GSM specifications listed in Table 3-5.

Table 3-5: UMTS WCDMA / GSM specifications

Item	GSM	UMTS
Mobility management		
Automatic PLMN selection / reselection	Supported	Supported
Location updating procedure	Supported	Supported
IMSI attach procedure	Supported	Supported
IMSI detach procedure	Supported	Supported
Periodic location update	Supported	Supported
Authentication procedure	Supported	Supported
CM connection establishment from MS or network	Supported	Supported
CM connection release	Supported	Supported
Encryption key management	Supported	Supported
TMSI reallocation	Supported	Supported
Paging response	Supported	Supported
Abort procedure	Supported	Supported
Identification	Supported	Supported
CN system information	Supported	Supported
Call re-establishment	Supported	Supported
MM connection establishment emergency calls	Supported	Supported
Inter-RAT change procedure	Supported	Supported

Table 3-5: UMTS WCDMA / GSM specifications (Continued)

Item	GSM	UMTS
CS follow-on procedure	Supported	Supported
Access class barring	Supported	Supported
Resumption procedure for Class B operation in GPRS	Supported	Supported
Handling of domain change CS to CS/PS and other combinations	Supported	Supported
MM information	Supported	Supported
Network mode of operation I, II	Supported	Supported
GPRS mobility management		
GPRS attach	Supported	Supported
GPRS detach	Supported	Supported
Routing area update	Supported	Supported
GPRS authentication	Supported	Supported
GPRS identification	Supported	Supported
GMM status	Supported	Supported
Periodic routing area update	Supported	Supported
Ciphering	Supported	Supported
Access class barring	Supported	Supported
GMM status	Supported	Supported
Combined GPRS attach	Supported	Supported
Combined GPRS detach	Supported	Supported
Combined routing location / area update	Supported	Supported
PS SMS	Supported	Supported
Network initiated combined GPRS detach	Supported	Supported
Network mode of operation change	Supported	Supported
RAB management		
QoS-based activation, network offers lower / higher QoS	Supported	Supported
Primary PDP context activation	Supported	Supported
PDP context deactivation	Supported	Supported
Data services		
AT commands	Supported	Supported

Table 3-5: UMTS WCDMA / GSM specifications (Continued)

Item	GSM	UMTS
MS PS data calls	Supported	Supported
Single PDP context	Supported	Supported
PDP type PPP	Supported	Supported
PDP type IP	Supported	Supported
9.6 / 14.4 CS transparent data	Supported	N/A
9.6 / 14.4 CS nontransparent data	Supported	N/A
Fax	Not Supported	Not Supported
MT Sync CS data calls	Supported	Supported
MO Sync CS data calls	Supported	Supported
V.80	N/A	Supported
V.42bis	Not Supported	N/A
Multiple PDP context profiles (up to 16)	Supported	Supported
SMS specifications		
CS domain MT SMS point-to-point	Supported	Supported
CS domain MO SMS point-to-point	Supported	Supported
SMMA	Supported	Supported
Dedicated mode	Supported	Supported
Message classes 0, 1, 2, 3, none	Supported	Supported
SMS / SMSP / SMSS access from SIM / USIM	Supported	Supported
Reply path	Supported	Supported
Validity period	Supported	Supported
PS domain MT SMS point-to-point	Supported	Supported
PS domain MO SMS point-to-point	Supported	Supported
SMS status reports	Supported	Supported
SMS commands	Supported	Supported

UMTS RABs supported

Table 3-6 lists radio access bearers supported by the MC8790V as defined in **3GPP TS 34.108 (2001-01), sections 6.10.2.1 and 6.10.2.2** [R-11]:

Table 3-6: Radio access bearers

Feature
Combinations on Dedicated Physical Channel (DPCH)
• Stand-alone UL:3.4 DL:3.4 kbps SRBs for DCCH
• Stand-alone UL:13.6 DL:13.6 kbps SRBs for DCCH
• Streaming / unknown / UL:0 DL:64 kbps / CS or PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Streaming / unknown / UL:64 DL:0 kbps / CS or PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Streaming / unknown / UL:0 DL:128 kbps / CS or PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Streaming / unknown / UL:128 DL:0 kbps / CS or PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Streaming / unknown / UL:0 DL:384 kbps / CS or PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or background / UL:32 DL:8 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or background / UL:64 DL:8 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or background / UL:32 DL:64 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or background / UL:64 DL: 64 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or background / UL:64 DL:128 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or background / UL:128 DL:128 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or background / UL:64 DL:144 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or background / UL:144 DL:144 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or background / UL:64 DL:256 kbps / PS RAB + UL:3.4 DL: 3.4 kbps SRBs for DCCH
• Interactive or background / UL:64 DL:384 kbps / PS RAB + UL:3.4 DL: 3.4 kbps SRBs for DCCH

Table 3-6: Radio access bearers (Continued)

Feature
• Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + Interactive or background / UL:32 DL:8 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + Interactive or background / UL:32 DL:64 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + Interactive or background / UL:64 DL:64 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + Interactive or background / UL:64 DL:128 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + Interactive or background / UL:64 DL:256 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + Streaming / unknown / UL:0 DL:64 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + Streaming / unknown / UL:0 DL:128 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / unknown / UL:64 DL:64 kbps / CS RAB + Interactive or background / UL:64 DL:64 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / unknown / UL:64 DL:64 kbps / CS RAB + Interactive or background / UL:64 DL:128 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / unknown / UL:64 DL:64 kbps / CS RAB + Interactive or background / UL:128 DL:128 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or /background / UL:64 DL:128 kbps / PS RAB + Streaming / unknown / UL:0 DL:64 kbps / CS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Interactive or /background / UL:64 DL:128 kbps / PS RAB + Streaming / unknown / UL:0 DL:128 kbps / CS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
Combinations on DSCH and DPCH
• Interactive or background / UL:64 DL:256 kbps / PS RAB + UL:3.4 DL: 3.4 kbps SRBs for DCCH

Table 3-6: Radio access bearers (Continued)

Feature
• Interactive or background / UL:64 DL:384 kbps / PS RAB + UL:3.4 DL: 3.4 kbps SRBs for DCCH
• Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + Interactive or background / UL:64 DL:256 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
• Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + Interactive or background / UL:64 DL:384 kbps / PS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH
Combinations on SCCPCH
• Stand-alone 32 kbps SRB for PCCH
• Interactive or background / DL:32 kbps / PS RAB + SRB for CCCH + SRBs for DCCH + SRB for BCCH
• Interactive or background / DL:32 kbps / PS RAB + SRB for PCCH + SRB for CCCH + SRBs for DCCH + SRB for BCCH
Combinations on PRACH
• Interactive or background / UL:32 kbps / PS RAB + SRB for CCCH + SRBs for DCCH

Short Message Service (SMS)

Table 3-7 summarizes the MC8790V Mini Card's compliance with specific SMS features:

Table 3-7: SMS features

Feature	Supported
Mobile-terminated SMS	Yes
Mobile-originated SMS	Yes
Point-to-Point messaging	Yes
Cell Broadcast messaging	No

UMTS compliance acceptance and certification

The MC8790V is designed to be compliant with the **3GPP Release 5 UMTS Specification for Mobile Terminated Equipment** [R-9]. Final regulatory and operator certification requires regulatory agency testing and approval with the fully integrated UMTS UE host device incorporating the MC8790V modem.

The OEM host device and, in particular, the OEM antenna design and implementation will affect the final product functionality, RF performance, and certification test results.

Note: Tests that require features not supported by the MC8790V (as defined by this document) are not supported.

For additional information on UMTS certification requirements, see Approvals on page 71.

EU certification requirements

Integrated mobile product European UMTS Certification requirements typically include:

- Full Type Approval (FTA) GCF regulatory certification for EU UMTS markets
- CE Mark regulatory certification of compliance for EU UMTS markets
- Interoperability Testing (IOT) for EU UMTS Operators
- Operator acceptance testing and approvals as required based on UMTS operator business relationships

FCC and Industry Canada certifications

The MC8790V complies with the agency certifications specified in Table 3-8.

Table 3-8: US and Industry Canada compliance requirements

Compliance Area	Regulations	
	US	Canada
Radio Spectrum	FCC Part 22, 24	IC RSS-132, RSS-133

4: Electrical Specifications

The system block diagram in Figure 4-1 represents the MC8790V module integrated into a host system. The module includes the following interfaces to the host:

- **Power**—Supplied to the module by the host.
- **Wireless Disable**—As described in the PCI-Express Mini Card specification
- **LED output**—As described in the PCI-Express Mini Card specification. If desired, LED behavior can be configured by adjusting software settings.
- **Antenna**—Two U.FL RF connectors for the Rx / Tx path and for GPS. For more details, see RF Specifications on page 55.
- **USIM**—Supported through the interface connector. The USIM cavity / connector needs to be placed on the host device for this feature.
- **USB**—Interface to the host for data, control, and status information.
- **UART**—Available for Control / stats and low data throughput applications
- **PCM audio**—Provides configurable A-Law / μ-Law / Linear PCM audio to external codec for wider application

The MC8790V has two main interface areas, the host I/O connector and the RF ports. The details of these interfaces are described in the sections that follow.

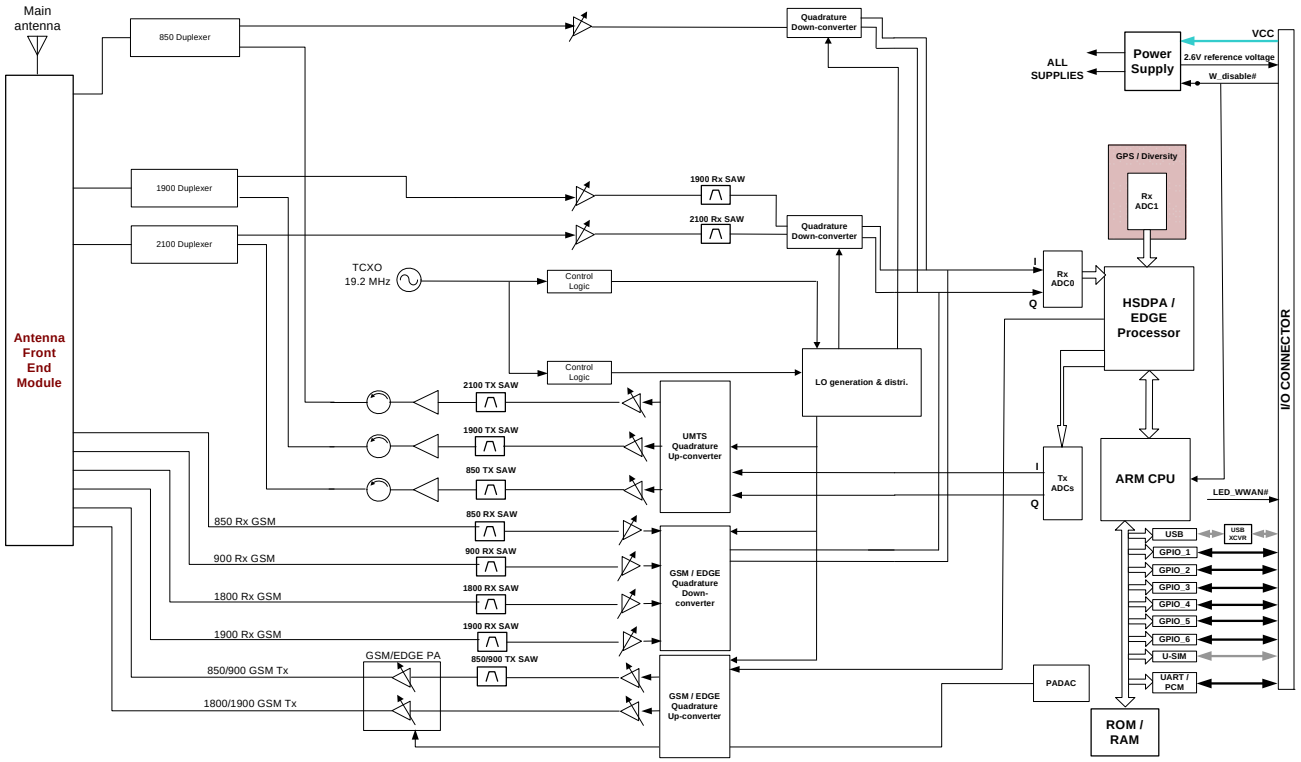

Figure 4-1: System block—Main antenna

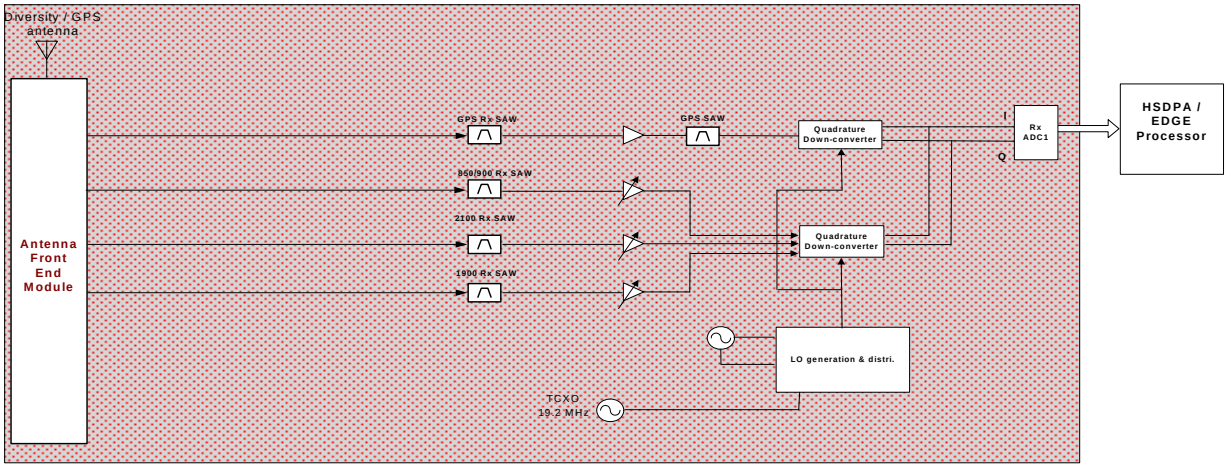

Figure 4-2: System block - GPS / Diversity antenna

Host interface pin assignments

The MC8790V host I/O connector provides pins for power, serial communications, audio, and control. Pin assignments are listed in Table 4-1. See the following tables for pin details based on interface types:

- Table 4-2, Power and ground specifications, on page 41

- Table 4-3, USB interface, on page 42
- Table 4-4, Serial port extended UART interface, on page 42
- Table 4-5, USIM interface signal, on page 43
- Table 4-6, Module control signal, on page 43

*Note: The following table describes the **internal** structure of the module.*

Table 4-1: MC8790V connector pin assignments

Pin	Signal name	Description	Input / Output (Direction to module)	Active state	Voltage levels (V)		
					Min	Typ	Max
1	MIC_P	Microphone positive (Differential input across MIC_P / MIC_N)	Input			200 (mV_{pp})	2.6 (V_{pp})
2	VCC	3.3 V supply	Input	Power	3.00	3.30	3.60
3	MIC_N	Microphone negative (Differential input across MIC_P / MIC_N)	Input			200 (mV_{pp})	2.6 (V_{pp})
4	GND	Ground	GND	GND	-	-	-
5	SPK_P	Speaker positive (Differential output across SPK_P / SPK_N)	Output			80 (mV_{pp})	4.24 (V_{pp})
6	GPIO_1	General purpose I/O [a]	Input High		1.69	2.60	2.90
			Input Low		0.00		0.91
			Output High		2.20	2.60	2.70
			Output Low		0.00		0.45
7	SPK_N	Speaker negative (Differential output across SPK_P / SPK_N)	Output			80 (mV_{pp})	4.24 (V_{pp})
8	USIM_PWR	USIM VCC supply	Output (1.8 V)	Power	1.60	1.80	1.90
			Output (3.0 V)		2.70	3.00	3.30
9	GND	Ground	GND	GND	-	-	-

Table 4-1: MC8790V connector pin assignments (Continued)

Pin	Signal name	Description	Input / Output (Direction to module)	Active state	Voltage levels (V)		
					Min	Typ	Max
10	USIM_DATA	USIM I/O pin	Input High (1.8 V)	Low	1.20		2.10
			Input Low (1.8 V)		0.00		0.63
			Output High (1.8 V)		1.30	1.80	2.10
			Output Low (1.8 V)		0.00		0.30
			Input High (3.0 V)		1.95		3.30
			Input Low (3.0 V)		0.00		1.05
			Output High (3.0 V)		2.10	3.00	3.30
			Output Low (3.0 V)		0.00		0.40
11	VCC_MSM26_DIG	2.6 V voltage reference	Output	High (when module is on)	2.5	2.60	2.7
12	USIM_CLK	USIM clock	Output High (1.8 V)	High	1.30	1.80	2.10
			Output Low (1.8 V)		0.00		0.47
			Output High (3.0 V)		1.90	3.00	3.30
			Output Low (3.0 V)		0.00		0.60
13	NC	No connect					
14	USIM_RESET	USIM reset	Output High (1.8 V)	Low	1.30	1.80	2.10
			Output Low (1.8 V)		0.00		0.47
			Output High (3.0 V)		2.20	3.00	3.30
			Output Low (3.0 V)		0.00		0.70
15	GND	Ground	GND	GND	-	-	-
16	GPIO_2	General purpose I/O[1]	Input High		1.69	2.60	2.90
			Input Low		0.00		0.91
			Output High		2.20	2.60	2.70
			Output Low		0.00		0.45
17	NC	No connect (UIM Pin 8)					
18	GND	Ground	GND	GND	-	-	-
19	NC	No connect (UIM Pin 4)					
20	W_DISABLE#	Wireless disable	Input High	Low	2.30	3.30	3.60
			Input Low				0.90
21	GND	Ground	GND	GND	-	-	-

Table 4-1: MC8790V connector pin assignments (Continued)

Pin	Signal name	Description	Input / Output (Direction to module)	Active state	Voltage levels (V)		
					Min	Typ	Max
22	AUXV1	Auxiliary Voltage 1	Input (Analog)	N/A	0.00		2.60
23	NC	No connect					
24	VCC	3.3 V supply	Input	Power	3.00	3.30	3.60
25	NC	No connect					
26	GND	Ground	GND	GND	-	-	-
27	GND	Ground	GND	GND	-	-	-
28	GPIO_3	General purpose I/O[1]	Input High		1.69	2.60	2.90
			Input Low		0.00		0.91
			Output High		2.20	2.60	2.70
			Output Low		0.00		0.45
29	GND	Ground	GND	GND	-	-	-
30	Reserved for future use	Do not use this pin for any purpose.					
31	NC	No connect					
32	UART RI	Ring Indicator	Output High		2.20	2.60	2.70
			Output Low		0.00		0.45
33	MDL_RESET_N	Reset	Input	Low			
34	GND	Ground	GND	GND	-	-	-
35	GND	Ground	GND	GND	-	-	-
36	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
		USB data negative (High speed)	Input High		0.30		0.44
			Input Low		0.00		0.01
			Output High		0.36	0.38	0.44
			Output Low		0.00		0.01
37	GND	Ground	GND	GND	-	-	-

Table 4-1: MC8790V connector pin assignments (Continued)

Pin	Signal name	Description	Input / Output (Direction to module)	Active state	Voltage levels (V)		
					Min	Typ	Max
38	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
		USB data positive (High speed)	Input High		0.30		0.44
			Input Low		0.00		0.01
			Output High		0.36	0.38	0.44
			Output Low		0.00		0.01
39	VCC	3.3 V supply	Input	Power	3.00	3.30	3.60
40	GND	Ground	GND	GND	-	-	-
41	VCC	3.3 V supply	Input	Power	3.00	3.30	3.60
42	LED_WWAN#	LED driver	Tri-state				
			Output Low		0.00		0.45
43	GND	Ground	GND	GND	-	-	-
44	DCD / GPIO_4[b]	UART Data Carrier Detect *or* General purpose I/O[1]	Input High		1.69	2.60	2.90
			Input Low		0.00		0.91
			Output High		2.20	2.60	2.70
			Output Low		0.00		0.45
45	CTS / PCM_CLK[c]	UART Clear To Send *or* PCM Clock	Output High	High/Low	2.20	2.60	2.70
			Output Low		0.00		0.45
46	DSR / GPIO_5[2]	UART Data Set Ready *or* General purpose I/O[1]	Input High		1.69	2.60	2.90
			Input Low		0.00		0.91
			Output High		2.20	2.60	2.70
			Output Low		0.00		0.45
47	RTS / PCM_DIN[3]	UART Ready To Send *or* PCM Data in	Input High	High/Low	1.70	2.60	2.90
			Input Low		0.00		0.91
48	DTR / GPIO_6[2]	UART Data Terminal Ready *or* General purpose I/O[1]	Input High		1.69	2.60	2.90
			Input Low		0.00		0.91
			Output High		2.20	2.60	2.70
			Output Low		0.00		0.45

Table 4-1: MC8790V connector pin assignments (Continued)

Pin	Signal name	Description	Input / Output (Direction to module)	Active state	Voltage levels (V)		
					Min	Typ	Max
49	RD / PCM_DOUT[3]	UART Receive Data *or* PCM Data out	Output High	High/Low	2.20	2.60	2.70
			Output Low		0.00		0.45
50	GND	Ground	GND	GND	-	-	-
51	TD / PCM_SYNC[3]	UART Transmit Data	Input High	High/Low	1.70	2.60	2.90
			Input Low		0.00		0.91
		PCM Sync out	Output High	High/Low	2.20	2.60	2.70
			Output Low		0.00		0.45
52	VCC	3.3 V supply	Input	Power	3.00	3.30	3.60

a. No defined function - Reserved for future use
b. Default functionality is GPIO.
GPIO/UART functionality is switched via AT command or configuration during fulfillment.
The maximum series impedance on GPIO lines is 1 kΩ, and on UART lines is 1.5 kΩ.
c. Default functionality is PCM.
PCM/UART functionality is switched via AT command or configuration during fulfillment.
The maximum series impedance on PCM lines is 1 kΩ, and on UART lines is 1.5 kΩ.

Host interface descriptions

This section and the sections that follow provide additional detail on each portion of the host I/O connector: power interface, USB interface, UART interface, and USIM interface. Tables in these sections describe these portions of the interface and the pins used. Each pin includes a type code as part of its description:

- **A**-Analog pin
- **O**-Digital pin, Output
- **PU**-Digital pin input, internal Pull Up
- **PD**-Digital pin input, internal Pull Down
- **V**-Power or Ground pin

Power supply

Power is provided to the MC8790V through multiple power and ground pins as summarized in Table 4-2.

Table 4-2: Power and ground specifications

Name	Pins	Type	Specification	Parameter	Min	Typ	Max	Units
VCC	2, 24, 39, 41, 52	V	Voltage range	VCC	3.0	3.3	3.6	Va
			Ripple voltage		-	-	100	mV_{pp}

Table 4-2: Power and ground specifications (Continued)

Name	Pins	Type	Specification	Parameter	Min	Typ	Max	Units
VCC_MSM26_DIG	11	V	Maximum supply current = 10 mA		2.52	-	2.8	V
GND	4, 9, 15, 18, 21, 26, 27, 29, 34, 35, 37, 40, 43, 50	V			-	0	-	V

USB interface

The USB interface requires 3.3 V regulated voltage from the host device to provide power to the USB transceiver on the MC8790V. The USB interface is compliant with Version 2.0 of the USB standard for high speed operation.

Table 4-3: USB interface

Name	Pin	Description	Type
USB_D-	36	USB data	A
USB_D+	38	USB data	A

The USB interface is powered directly from the VCC supply.

UART interface

The MC8790V provides an extended (eight-line, not including ground) serial interface based on the TIA-232 standard interface (also known as RS-232). Since the speed of the serial port is limited to 230.4 kbps, it should only be used for AT commands and control of the modem. The USB interface should be used for all high speed data transfers.

If a simple four-line serial interface is needed, leave the RI, DSR, and DCD signals floating. For a detailed description of the extended UART interface, see the *EMConnect Guide (Document 2131177)*.

Table 4-4: Serial port extended UART interface

Name	Pin	Description	Direction wrt host	Notes
RI	32	Ring Indicator	Input	
DCD	44	Data carrier detect	Input	
CTS	45	Clear to send	Input	
DSR	46	Data set ready	Input	
RTS	47	Ready to send	Output	
DTR	48	Data terminal ready	Output	

Table 4-4: Serial port extended UART interface (Continued)

Name	Pin	Description	Direction wrt host	Notes
RD	49	Receive data	Input	UART serial data receive line (modem output)
GND	50	Ground	n/a	
TD	51	Transmit data	Output	UART serial data transmit line (modem input)

USIM interface

The USIM pins provide the connections necessary to interface to a USIM socket located on the host device. Voltage levels over this interface comply with 3GPP standards.

Table 4-5: USIM interface signal

Name	Pin	Description	Notes
USIM_PWR	8	USIM voltage	Power supply for USIM
USIM_DATA	10	Data I/O	
USIM_CLK	12	Serial clock	
USIM_RESET	14	Reset	
USIM_GND		Ground	Ground reference USIM_GND is common to module ground

The MC8790V provides signals for control and handshaking of the module from the host. These signals are summarized in Table 4-6.

Table 4-6: Module control signal

Name	Pin	Description	Type
W_DISABLE#	20	Wireless disable	PU
MDL_RESET_N	33	Reset modem	PU
LED_WWAN#	42	LED driver	O

W_DISABLE# is used to ask the module to shut down. Letting this signal float high allows the module to operate normally. This switch follows the behavior as described in the PCI-Express Mini Card specification. There is a 20 k pull-up resistor to VCC on this pin.

LED_WWAN# is driven, by default, by the module as described in Table 3-5 in **PCI Express Mini Card Electromechanical Specification Revision 1.2** [R-18]. If desired, LED behavior can be configured by adjusting software settings.

MDL_RESET_N is used by the host device to reset the module. Pulsing this signal (low) resets the modem. This signal must be an open drain / collector output on the host board.

Audio interface

The analog audio interface is summarized in Table 4-7, with detailed performance specifications in Table 4-8 and Table 4-9.

The MC8790V supports both a differential analog interface and PCM digital audio, and allows dynamic run-time selection of the appropriate interface.

TTY/TDD compatibility is supported through the microphone/speaker connections using the audio interface. (TTY/TDD is not supported by the PCM interface.)

Table 4-7: Analog audio interface connections

Name	Pin	Description	Type	Notes
MIC_P	1	Line Audio input	A	Differential audio input, line level
MIC_N	3	Line Audio input	A	Differential audio input, line level
SPK_P	5	Main speaker	A	Differential audio output, line level
SPK_N	7	Main speaker	A	Differential audio output, line level

Table 4-8: Microphone interface parameters

Parameter / Description		Test	Min	Typ	Max	Units
	Input DC common mode voltage		1.13	1.25	1.38	V
Z_{In1}	Input impedance between MIC_P and MIC_N	Fully differential, A/D path	16	20	24	kΩ
THD_V	Total harmonic distortion +Noise (voice)	All inputs: • AV_{DD} = 2.5 V • 13-bit mode • analog input at 229 mV_{pp} • 498 Hz sine wave			3.5	%

Table 4-9: Speaker interface parameters

Parameter / Description		Test	Min	Typ	Max	Units
P_{O1}	SPK_AMP output power (rms)	• Differential • 32Ω load • PCMI = +3 dBm0 • 1.02 kHz sine wave		70		mW
	Output DC offset voltage between MIC_P and MIC_N, SPK_P and SPK_N	Fully differential	-20		20	mV
	Output common mode voltage, SPK_P and SPK_N	Measured at each output pin with respect to AVSS: V_{DD} = 2.5 V to 2.7 V	1.13	1.25	1.38	V
Z_{OUT1}	Differential output impedance	At 1.02 kHz, for outputs SPK_P and SPK_N			1	Ω

PCM interface

The MC8790V module's PCM audio interface features the following characteristics:

- runs in master mode
- supports Linear (16-bit), A-Law (8-bit), and μ-Law(8-bit) companding algorithms
- supports 2.048 MHz short frame sync (PCM) and 128 kHz long frame sync (AUX_PCM) operation

Note: The PCM interface is not AC97-compliant.

Note: The selected interface persists until it is explicitly changed using AT commands.

The PCM audio interface, described in the figures and tables below, is selected at run-time using AT commands—both the PCM audio and UART interfaces share the same physical pins. Once selected, the chosen interface becomes effective after the module resets.

Table 4-10: PCM digital audio interface connections

Name	Pin	Description	Type	Notes
PCM_CLK	45	PCM clock	O	
PCM_DIN	47	PCM data in	PD	
PCM_DOUT	49	PCM data out	O	
PCM_SYNC	51	PCM sync out	O	

PCM interface - short frame sync (2.048 MHz)

Figures 4-3, 4-4, 4-5, and Table 4-11 describe the short frame sync (2.048 MHz) PCM interface.

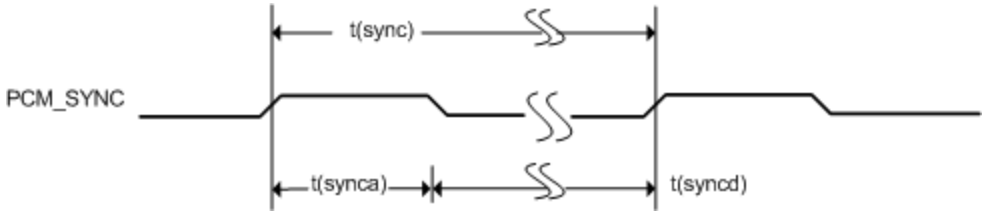

Figure 4-3: Timing diagram: short frame sync (PCM_SYNC)

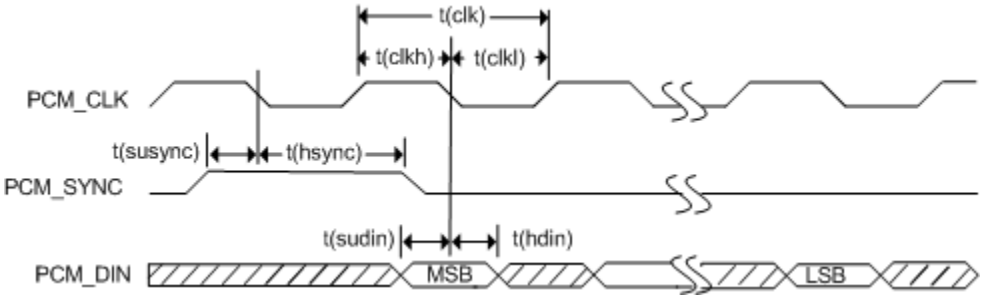

Figure 4-4: Timing diagram: PCM_CODEC to MC8790V

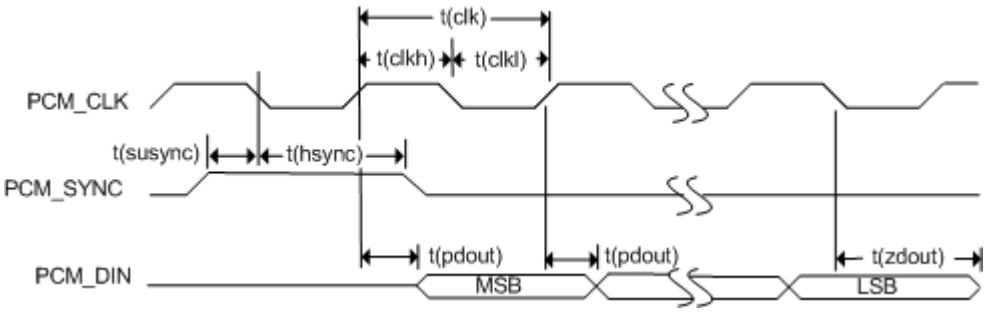

Figure 4-5: MC8790V to external PCM_CODEC

Table 4-11: PCM_CODEC short frame sync (2.048 MHz) timing parameters

Parameter	Description	Min	Typ	Max	Units	Notes
t(sync)	PCM_SYNC cycle time (PCM_SYNC_DIR=1)		125		µs	A
	PCM_SYNC cycle time (PCM_SYNC_DIR=0)		125		µs	

Table 4-11: PCM_CODEC short frame sync (2.048 MHz) timing parameters

Parameter	Description	Min	Typ	Max	Units	Notes
t(synca)	PCM_SYNC asserted time (PCM_SYNC_DIR=1)	400	488		ns	A
	PCM_SYNC asserted time (PCM_SYNC_DIR=0)				ns	
t(syncd)	PCM_SYNC de-asserted time (PCM_SYNC_DIR=1)		124.5		µs	A
	PCM_SYNC de-asserted time (PCM_SYNC_DIR=0)				µs	
t(clk)	PCM_CLK cycle time (PCM_CLK_DIR=1)	400	488		ns	A
	PCM_CLK cycle time (PCM_CLK_DIR=0)				ns	
t(clkh)	PCM_CLK high time (PCM_CLK_DIR=1)	200	244		ns	A, B
	PCM_CLK high time (PCM_CLK_DIR=0)				ns	
t(clkl)	PCM_CLK low time (PCM_CLK_DIR=1)	200	244		ns	A, B
	PCM_CLK low time (PCM_CLK_DIR=0)				ns	
t(susync)	PCM_SYNC setup time to PCM_CLK falling		150		ns	
	(PCM_SYNC_DIR = 1, PCM_CLK_DIR = 1)					
	PCM_SYNC setup time to PCM_CLK falling				ns	
	(PCM_SYNC_DIR = 0, PCM_CLK_DIR = 0)					
t(hsync)	PCM_SYNC hold time after PCM_CLK falling		300		ns	
	(PCM_SYNC_DIR = 1, PCM_CLK_DIR = 1)					
	PCM_SYNC hold time after PCM_CLK falling				ns	
	(PCM_SYNC_DIR = 0, PCM_CLK_DIR = 0)					
t(sudin)	PCM_DIN setup time to PCM_CLK falling	60			ns	
t(hdin)	PCM_DIN hold time after PCM_CLK falling	60			ns	
t(pdout)	Delay from PCM_CLK rising to PCM_DOUT valid			60	ns	
t(zdout)	Delay from PCM_CLK falling to PCM_DOUT HIGH-Z	5		60	ns	

Notes:

A. This value assumes that CODEC_CTL is not being used to override the CDMA CODEC clock and sync operation.

B. t(clkh) and t(clkl) are independent of PCM_CLK_SENSE.

Auxiliary PCM (long frame sync, 128 kHz)

Figures 4-6, 4-7, 4-8, and Table 4-12 describe the long frame sync (128 kHz) PCM interface

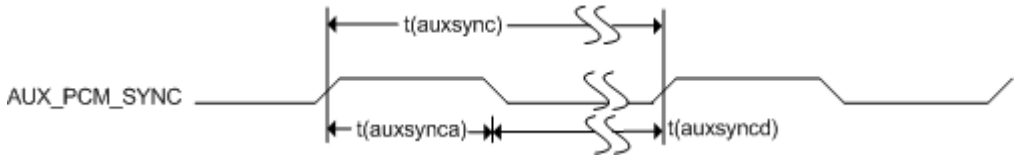

Figure 4-6: Timing diagram: long frame sync (AUX_PCM_SYNC)

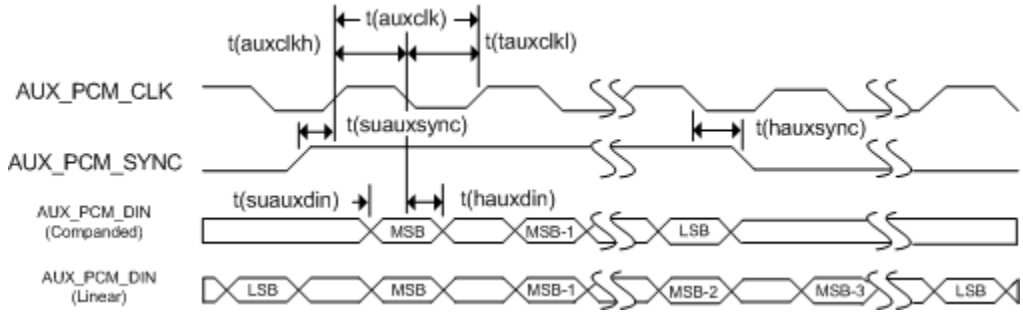

Figure 4-7: Timing diagram: AUX_PCM_CODEC to MC8790V

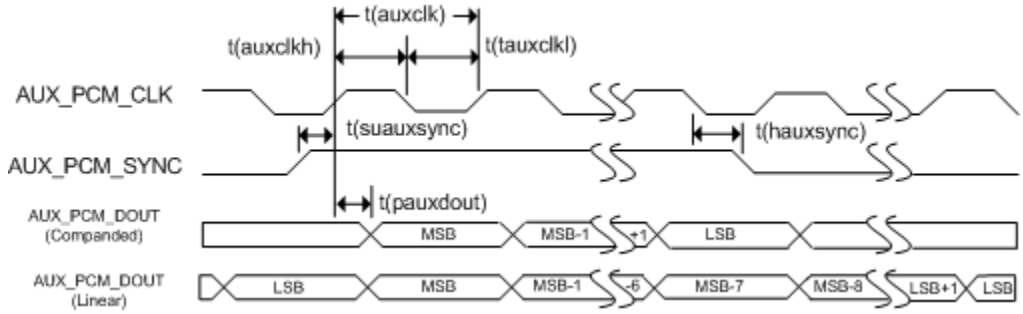

Figure 4-8: Timing diagram: MC8790V to AUX_PCM_CODEC

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Table 4-12: AUX_PCM_CODEC timing parameters

Parameter	Description	Min	Typ	Max	Units	Notes
t(auxsync)	AUX_PCM_SYNC cycle time		125		µs	A
t(auxsynca)	AUX_PCM_SYNC asserted time		62.5		µs	A
t(auxsyncd)	AUX_PCM_SYNC de-asserted time		62.5		µs	A
t(auxclk)	AUX_PCM_CLK cycle time		7.8		µs	A
t(auxclkh)	AUX_PCM_CLK high time		3.9		µs	A

Table 4-12: AUX_PCM_CODEC timing parameters (Continued)

Parameter	Description	Min	Typ	Max	Units	Notes
t(auxclkl)	AUX_PCM_CLK low time		3.9		µs	A
t(suauxsync)	AUX_PCM_SYNC setup time to AUX_PCM_CLK rising	1.95			µs	
t(hauxsync)	AUX_PCM_SYNC hold time after AUX_PCM_CLK rising	1.95			µs	
t(suauxdin)	AUX_PCM_DIN setup time to AUX_PCM_CLK falling	60			ns	
t(hauxdin)	AUX_PCM_DIN hold time after AUX_PCM_CLK falling	60			ns	
t(pauxdin)	Propagation delay from AUX_PCM_CLK AUX_PCM_DOUT valid			60	ns	

Notes:

A. This value assumes that CODEC_CTL is not being used to override the CDMA CODEC clock and sync operation.

VOICE path specifications

The following tables describe additional codec specifications for Transmit and Receive Voice path parameters (Table 4-13 to Table 4-20).

Table 4-13: Transmit VOICE path level translation and linearity, differential input[a]

Parameter	Test	Min	Typ	Max	Units
Level: Transmit reference signal (0 dBm0)	Differential analog input		57.3		mV_{rms}
Level: Overload signal (+3 dBm0)	Differential analog input		229		mV_{pp}
Absolute gain error	• -10 dBm0 analog input level • 1.02 kHz sine wave	-1		1	dB
Gain error relative to gain at -10 dBm0	Analog input level: +3 dBm0 to -30 dBm0	-0.5		0.5	dB
	Analog input level: -31 dBm0 to -45 dBm0	-1		1	dB
	Analog input level: -46 dBm0 to -55 dBm0	-1.2		1.2	dB

a. Total transmit channel gain = +24 dB in default configuration (MIC_GAIN = +24 dB);
Sampling rate = 8 kHz;
Applies to all microphone amplifier gain settings

Table 4-14: Transmit Voice path frequency response and image rejection, digital transmit slope filter disabled (8K)[a]

Parameter	Test frequency (Hz)	Min	Typ	Max	Units
Gain relative to input signal gain at 1.02 kHz, digital Tx high pass filter disabled	< 100	-0.5		0.5	dB
	200	-0.5		0.5	dB
	300–3000	-0.5		0.5	dB
	3400	-1.5		0	dB
	3980			-14	dB
	4600			-35	dB
	7980			-47	dB
Gain relative to input signal gain at 1.02 kHz, digital Tx high pass filter enabled	< 100			-15	dB
	200			-5	dB

a. Tx input path level = -10 dBm0;
To determine image rejection performance, use the 4600_Hz and 7980 Hz frequencies;
Sampling rate = 8 kHz

Table 4-15: Transmit Voice path anti-aliasing image rejection, differential input (8K)[a]

Parameter	Test	Min	Typ	Max	Units
Transmit image rejection at 2.048 MHz	• MIC_GAIN gain = +24 dB • Analog input level = 229 mV_{pp} at 2.047 MHz	30	60		dB

a. Specifications must be met for left and right channels;
Select MIC1 differential input;
13-bit mode;
Sampling rate = 8 kHz

Table 4-16: Transmit Voice path frequency response and image rejection, digital transmit slope filter enabled[a]

Parameter	Test frequency (Hz)	Min	Typ	Max	Units
Gain relative to input signal gain at 1.02 kHz, with slope filter selected, and digital Tx high pass filter enabled	100			-27	dB
	200			-8	dB
	250			-4	dB
	300		-1.80		dB
	400		-1.50		dB
	500		-1.30		dB
	600		-1.1		dB
	700		-0.8		dB
	800		-0.57		dB
	900		-0.25		dB
	1020		0		dB
	1500		1.8		dB
	1980		4.0		dB
	2500		6.5		dB
	3000		7.6		dB
	3100		7.7		dB
	3300		8.0		dB
	3500		6.48		dB
	3980			-13	dB
	4500			-35	dB
	5000			-45	dB
	7980			-50	dB

a. Passband tolerance (300 Hz–3500 Hz) = ±0.25 dB; Tx input path level = -10 dBm0; Sampling rate = 8 kHz
To determine image rejection performance, use the 4500 Hz, 5000 Hz, and 7980 Hz frequencies;

Table 4-17: Transmit Voice path idle channel noise and distortion (8K)[a]

Parameter	Test	Min	Typ	Max	Units
Transmit noise (input refer noise)	• TXPGA gain = 0 dB • MIC_GAIN = +24 dB		10	15	μV_{rms}
Transmit signal-to-THD+N ratio with 1020 Hz sine wave input across MIC_P and MIC_N	Analog input level at +3 dBm0	35			dB
	Analog input level at 0 dBm0	50			dB
	Analog input level at -5 dBm0	50			dB
	Analog input level at -10 dBm0	46			dB
	Analog input level at -20 dBm0	45			dB
	Analog input level at -30 dBm0	40			dB
	Analog input level at -40 dBm0	30			dB
	Analog input level at -45 dBm0	25			dB

a. Specifications must be met with and without Tx slope filter enabled; C-message weighted for 8k sampling rate; Measurement bandwidth = 100 kHz to 20 kHz; Sampling rate = 8 kHz

Table 4-18: Receive Voice path level translation and linearity, SPK_AMP selected[a]

Parameter	Test	Min	Typ	Max	Units
Level: Receive reference signal (0 dBm0)	• PCMI = 0 dBm0 • 1.02 kHz sine wave		1.06		V_{rms}
Level: Overload signal (+3 dBm0)	• PCMI = +3 dBm0 • 1.02 kHz sine wave		4.24		V_{pp}
Absolute gain error	• CPMI = 0 dBm0 • 1.02 kHz sine wave	-1		+1	dB
Gain error relative to gain at -10 dBm0	PCMI = +3 dBm0 to -40 dBm0	-0.5		+0.5	dB
	PCMI = -41 dBm0 to -50 dBm0	-1		+1	dB
	PCMI = -51 dBm0 to -55 dBm0	-1.2		+1.2	dB

a. RXPGA = 0 dB
Output measured differentially between SPK_N and SPK_P;
+3 dBm0 level corresponds to 0 dB full-scale sine wave;
Loaded condition (32 Ω);
13-bit mode;
Sampling rate = 8 kHz

Table 4-19: Receive Voice path frequency response and image rejection (8K) [a]

Parameter	Test frequency (Hz)	Min	Typ	Max	Units
Gain relative to input signal gain at 1.02 kHz, digital Rx high pass filter disabled	< 100	-0.5		0.5	dB
	200	-0.5		0.5	dB
	300–3000	-0.5		0.5	dB
	3400	-1.5		0	dB
	3980			-14	dB
	4600			-40	dB
	7980			-50	dB
Gain relative to input signal gain at 1.02 kHz, digital Rx high pass filter enabled	< 100			-15	dB
	200			-5	dB

a. RXPGA = 0 dB;
Rx input path level = -10 dBm0;
Specification applies to SPK_AMP;
Loaded condition (32 Ω);
Determine image rejection performance using the 3980 Hz, 4600 Hz, 7980 Hz frequencies;
13-bit mode;
Sampling rate = 8 kHz

Table 4-20: Receive Voice path idle channel noise and distortion, SPK_AMP [a]

Parameter	Test	Min	Typ	Max	Units
Receive noise	PCMIN = “0000000000000”		124	150	μV_{rms}
Receive signal-to-THD+N ratio with 1.02 kHz sine wave input	PCMI = +3 dBm0	29			dB
	PCMI = 0 dBm0	50			dB
	PCMI = -5 dBm0	47			dB
	PCMI = -10 dBm0	46			dB
	PCMI = -20 dBm0	42			dB
	PCMI = -30 dBm0	40			dB
	PCMI = -40 dBm0	30			dB
	PCMI = -45 dBm0	25			dB
Intermodulation distortion (2-tone method)	PCMI = 498 Hz and 2.02 kHz equal amplitude tones, composite peak level equivalent to 0 dBm0 sine wave	50			dB

a. RXPGA = 0 dB;
Output measured differentially between SPK_N and SPK_P;
+3 dBm0 level corresponds to 0 dB full-scale sine wave;
Loaded condition (32 Ω);
13-bit mode;
A-weighted;
Sampling rate = 8 kHz
Measurement bandwidth = 100 Hz to 20 kHz

5: RF Specifications

The MC8790V includes two RF connectors for use with host-supplied antennas. (It does not have integrated antennas.) One connector is used for the main Rx/Tx path and the second connector is used for diversity and stand-alone GPS.

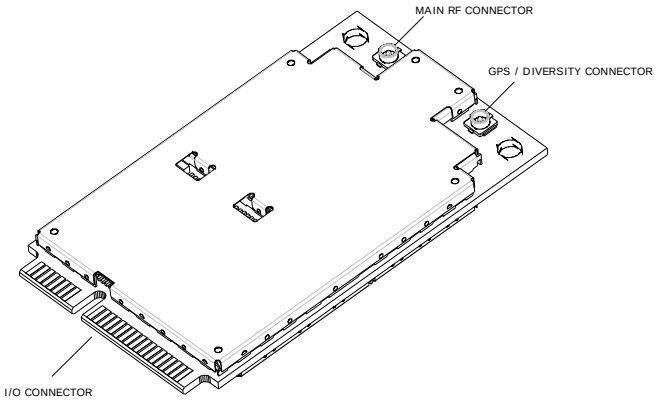

Figure 5-1: Module connectors

The RF Connectors (Hirose part number U.FL # CL331-0471-0-10 or equivalent) are 3 mm x 3 mm low profile connectors that support coaxial cable connections to the module. The path is assumed to be 50 Ω. These connectors are installed on the top side of the module (see Figure 5-1).

Note: If the antenna connection is shorted or open, the modem will not sustain permanent damage.

The MC8790V supports quad-band 850 / 900 / 1800 / 1900 MHz GSM / GPRS / EGPRS, quad-band 800 / 850 / 1900 / 2100 MHz WCDMA / HSDPA / HSUPA frequency bands with quad-band WCDMA receive diversity, and GPS. The module's radio transceiver meets the requirements of 3GPP Release 5 and 6.

Table 5-1: WCDMA frequency band support[a]

Band	Frequencies
Band I WCDMA 2100	Tx: 1920 – 1980 MHz Rx: 2110 – 2170 MHz
Band II WCDMA 1900	Tx: 1850 – 1910 MHz Rx: 1930 – 1990 MHz

Table 5-1: WCDMA frequency band support[a]

Band	Frequencies
Band V WCDMA 850	Tx: 824 – 849 MHz Rx: 869 – 894 MHz
Band VI WCDMA 800	Tx: 830 – 840 MHz Rx: 875 – 885 MHz

a. WCDMA channel spacing is 5 MHz, but this can be adjusted to optimize performance in a particular deployment scenario.

Table 5-2: GSM frequency band support

Band	Frequencies
GSM 850	Tx: 824 – 849 MHz Rx: 869 – 894 MHz
EGSM 900	Tx: 880 – 915 MHz Rx: 925 – 960 MHz
GSM 1800	Tx: 1710 – 1785 MHz Rx: 1805 – 1880 MHz
GSM 1900	Tx: 1850 – 1910 MHz Rx: 1930 – 1990 MHz

Table 5-3: MC8790V GPS frequency band support

Band	Frequencies
GPS	1575.42 MHz

The MC8790V supports High Speed Download Packet Access (HSDPA) category 5 and High Speed Upload Packet Access (HSUPA) category 4.

Table 5-4: MC8790V Conducted Rx (Receive) Sensitivity

Band	Typical Conducted Rx Sensitivity (dBm)	Maximum Conducted Rx Sensitivity (dBm)
GSM 850 (2%[a]) CS[b]	-107.5	-106
EGSM 900 (2%[1]) CS[2]	-107.5	-106
DCS 1800 (2%[1]) CS[2]	-106.5	-105
PCS 1900 (2%[1]) CS[2]	-106.5	-105
Band I UMTS 2100 (0.1%[1]) 12.2 kbps	-110.5	-109
Band II UMTS 1900 (0.1%[1]) 12.2 kbps	-110.5	-109

Table 5-4: MC8790V Conducted Rx (Receive) Sensitivity (Continued)

Band	Typical Conducted Rx Sensitivity (dBm)	Maximum Conducted Rx Sensitivity (dBm)
Band V UMTS 850 (0.1%[2]) 12.2 kbps	-111.5	-110
Band VI UMTS 800 (0.1%[2]) 12.2 kbps	-111.5	-110

a. % = Bit Error Rate
b. CS = Circuit switched

Table 5-5: MC8790V — Conducted Tx (Transmit) Power Tolerances

Parameter	Conducted Transmit Power (dBm)	Notes
GSM / EDGE		
GSM850 & GSM900 bands CS	+32 ± 1	GMSK mode, connectorized (Class 4)
	+27 ± 1	8PSK mode, connectorized (Class E2)
DCS1800 & PCS1900 bands CS	+29 ± 1	GMSK mode, connectorized (Class 1)
	+26 ± 1	8PSK mode, connectorized (Class E2)
UMTS		
Band II, V, & VI (1900, 850, and 800 MHz) 12.2 kbps	+23 ± 1	Connectorized (Class 3)
Band I (IMT 2100 MHz band) 12.2 kbps	+23 ± 1	Connectorized (Class 3)

Table 5-6: Main antenna specifications[a]

Parameter	Min	Typ	Max	Units	Notes
Cable loss	-	-	0.5	dB	Maximum loss to antenna
Impedance	-	50	-	Ω	Antenna load impedance
VSWR	-	-	3:1		Maximum allowed VSWR of antenna

a. Sierra Wireless provides detailed antenna requirements in the *CDMA / GSM Mini Card Hardware Integration Guide (Document #2130114).*

Table 5-7: GPS antenna specifications[a]

Parameter	
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

Table 5-7: GPS antenna specifications[a] (Continued)

Parameter	
Isolation (GPS ↔ Main)	> 10 dB in all related bands
Polarization	Any, other than LHCP (left-hand circular polarized)

a. Sierra Wireless provides detailed antenna requirements in the *CDMA / GSM Mini Card Hardware Integration Guide (Document #2130114).*

Table 5-8: InterRAT and InterFrequency hopping

GSM 850 ↔ WCDMA 1900 handover - blind mode	GSM 1900 ↔ WCDMA 1900 handover - blind mode
GSM 850 ↔ WCDMA 850 handover - blind mode	GSM 1900 ↔ WCDMA 850 handover - blind mode
EGSM 900 ↔ WCDMA 2100 handover - blind mode	GSM 850 ↔ WCDMA 850 handover - idle frame measurements
GSM 1800 ↔ WCDMA 2100 handover - blind mode	GSM 850 ↔ WCDMA 1900 handover - idle frame measurements
EGSM 900 ↔ WCDMA 2100 handover - idle frame measurements	GSM 1900 → WCDMA 1900 handover - idle frame measurements
GSM 1800 ↔ WCDMA 2100 handover - idle frame measurements	GSM 1900 → WCDMA 850 handover - idle frame measurements
EGSM 900 ↔ WCDMA 2100 cell reselection	GSM 850 ↔ WCDMA 850 cell reselection
GSM 1800 ↔ WCDMA 2100 cell reselection	GSM 850 ↔ WCDMA 1900 cell reselection
EGSM 900 ↔ WCDMA 2100 CCO	GSM 1900 ↔ WCDMA 1900 cell reselection
GSM 1800 ↔ WCDMA 2100 CCO	GSM 1900 ↔ WCDMA 850 cell reselection
EGSM 900 (w/BCCH/PBCCH) → WCDMA 2100 reselection in packet transfer	GSM 850 ↔ WCDMA 850 CCO
GSM 1800 (w/BCCH/PBCCH) → WCDMA 2100 reselection in packet transfer	GSM 850 ↔ WCDMA 1900 CCO
PS data continuity during OOS and RAT change	GSM 1900 ↔ WCDMA 1900 CCO
PS data continuity with MPDP (primary and secondary contexts) and RAT change	GSM 1900 ↔ WCDMA 850 CCO
EDGE ↔ WCDMA cell reselection in packet transfer	GSM 850 (w/BCCH/PBCCH) → WCDMA 850 reselection in packet transfer
Inter-RAT NACC 2G ↔ 3G	GSM 850 (w/BCCH/PBCCH) → WCDMA 1900 reselection in packet transfer
3G background PLMN search while in 2G	GSM 1900 (w/BCCH/PBCCH) → WCDMA1900 reselection in packet transfer
3G background PLMN search while in 3G	GSM 1900 (w/BCCH/PBCCH) → WCDMA 850 reselection in packet transfer

6: Power Consumption

Note: All specifications in these tables are preliminary, based on chipset published expectations.

The power consumption numbers listed in this section are for the MC8790V Mini Card module connected to the host PC via USB. The module does not have its own power source and depends on the host device for power. Typical values are measured at room temperature, and minimum and maximum values are measured over the entire operating temperature range. For a description of input voltage requirements, see Power supply on page 41.

Table 6-1: Averaged standby DC power consumption

Signal	Description	Bands	Typ	Max	Units	Notes / Configuration
VCC	**Standby current consumption with Sleep mode activated** (assumes USB bus is fully suspended during measurements)					
	HSDPA / WCDMA	UMTS bands	4	5	mA	DRX cycle = 8 (2.56 s)
	GSM / GPRS / EDGE	GSM bands	4	5	mA	MFRM = 5 (1.175 s)
	Standby current consumption with Sleep mode deactivated (assumes USB bus is fully suspended during measurements)					
	HSDPA / WCDMA	UMTS bands	40	50	mA	DRX cycle = 8 (2.56 s)
	GSM / GPRS / EDGE	GSM bands	40	50	mA	MFRM = 5 (1.175 s)
	Low Power Mode (LPM) / Offline Mode					
	RF disabled, but module is operational		4	5	mA	This state is entered when Watcher shuts down / turns off the radio and the USB bus is suspended.

Table 6-2: Averaged Call Mode WCDMA / HSDPA data DC power consumption

Signal	Description	Band	Average current	Units	Notes / Configuration
VCC	**WCDMA data current consumption** (includes USB bus current)				
	WCDMA	UMTS bands	700	mA	384 kbps at 20 dBm Tx power[a]
			300	mA	0 dBm Tx power
	HSUPA	UMTS bands	800	mA	2 Mbps at 20 dBm Tx power
			350	mA	0 dBm Tx power
	HSDPA (1.8 Mbps / 3.6 Mbps / 7.2 Mbps)	UMTS bands	800	mA	All speeds at 20 dBm Tx power[b]
			370	mA	0 dBm Tx power
	Peak current (averaged over 100 µs)	UMTS bands	720	mA	

a. Highest current is on Band II (PCS1900)
b. Approximate current difference between speeds = 30 mA

Table 6-3: Averaged Call Mode GSM / EDGE data DC power consumption (with 4 time slots)

Signal	Description	Band	Average current	Units	Notes / Configuration
VCC	**GSM / EDGE data current consumption** (assumes USB bus current)				
	GSM / GPRS	GSM bands	650	mA	Max PCL for each band[a]
			300	mA	10 dBm Tx
	EDGE	GSM bands	620	mA	Class 12[1]
	Peak current (averaged over 100 µs)	GSM bands	2.6	A	Worst case on 850/ 900 band

a. Highest current is on 850 / 900 band Class 10 (Class 12 implements power backoff). Current on 1800 / 900 bands is typically 100–200 mA less.

Table 6-4: Miscellaneous DC power consumption

Signal	Description	Band	Typ	Max	Units	Notes/Configuration
VCC	Module OFF leakage current	All bands	400	600	µA	Full operating temperature range
	USB transmit current	All bands	10	10	mA	Full speed USB connection, C_L = 50 pF on D+ and D- signals

Table 6-5: Supported GPRS / EDGE power classes

Feature	Notes
EGSM 900 / GSM 850 Power Class 4	2 W 33 dBm
GSM 1800 / 1900 Power Class 1	1 W 30 dBm
EDGE Power Class for 850 / 900MHz	Class E2[a] 27 dBm, 0.5 W
EDGE Power Class for 1800 / 1900MHz	Class E2[1] 26 dBm, 0.4 W

a. E2 power class applies to 8PSK modulation.

7: GPS

Note: The specifications in this section are preliminary targets which are subject to change without notice. Actual GPS functionality is dependent on the firmware version, and on module configuration.

The MC8790V Mini Card module includes a built-in GPS module that provides the following features:

Standalone GPS

- Leading standalone / autonomous GPS performance
- -145 dBm cold start sensitivity
- -155 dBm hot start sensitivity
- -158 dBm tracking sensitivity
- < 1 minute average cold start TTFF (Time To First Fix) in open sky
- < 3 second average super hot TTFF in open sky
- < 10 m accuracy in open sky

Note: For optimum performance, the modem should be registered on the GSM / UMTS network, but does not need to be on an active data or voice call.

gpsOneXTRA™

- Enables enhanced standalone GPS operation by downloading < 40 kB file from a server on the Internet
- Performance closer to UE-based operation than traditional stand-alone GPS operation
- Best if downloaded once every 1–2 days, but valid for up to 7 days with some accuracy degradation

A-GPS features

- Leading A-GPS performance
  - Exceeds 3GPP RAN 4 AGPS performance specification
- -155 dBm cold start sensitivity
- -158 dBm tracking sensitivity
- < 5 second average cold start TTFF in open sky (UE-based)
- < 3 second average super hot TTFF in open sky
- < 10 m accuracy in open sky
- UMTS Control Plane (CP)—UE-assisted and UE-based
- GSM Control Plane (CP)—UE-assisted and UE-based

- OMA SUPL 1.0 User Plane (UP)—UE-assisted and UE-based

Enhanced Navigation 2.0 feature

- Provides leading performance in car and walking navigation modes as well as accuracy while stationary
- Airline / Game / Offline mode
- GPS capability is available while phone is offline

Application types

- Supports NMEA (supported sentences: GGA, GSA, GSV, RMC, and VTG)

8: Software Interface

Physical interface options

The MC8790V module communicates with the host via the USB (Universal Serial Bus) or UART physical interface.

Two different USB architectures are supported: non-MUX (non-composite USB) and MUX (27.010 multiplexing).

- The MUX architecture is supported through available drivers (Win32 and Win64) and the SDK.
- The non-MUX architecture supports multiple pairs of endpoints, each with a unique supported service (Control, AT/PPP, HIP). Documentation outlining the design requirements for non_MUX is available—see the **Embedded Module / Mini Card / AirCard USB Driver Developer's Guide** [R-8] for details.

Support tools

The MC8790V is compatible with the following support tools from Sierra Wireless and authorized third parties:

- Sierra Wireless Watcher
- CDMA Air Interface Tool (CAIT) from Qualcomm
- QXDM from Qualcomm

Other features

Customization

Subject to commercial terms, Sierra Wireless can supply custom-configured modems to facilitate a carrier's network and performance requirements. Sierra Wireless also offers a standard configuration for each country.

Custom configurations are entered into a selector spreadsheet that Sierra supplies. A unique part number is assigned to each custom configuration to facilitate customer ordering.

Table 8-1: Customizable features

Name	Description	Default
Voice functionality	When enabled, supports voice calls and displays the Watcher ‘voice’ tab.	Enabled

Table 8-1: Customizable features (Continued)

Name	Description	Default
MEP network locked	Mobile Equipment Personalization network locked to only allow use with specific preconfigured PLMNs (SIMs). MMI supports the entry of an unlock code subject to permanent locking feature below.	Off
MEP service provider locked		
Permanent MEP locked	Can block deactivation of MEP locked feature	Off
Roaming indicator disable[a]	Watcher never shows the onscreen roaming indicator.	Indicator enabled
Service indicator disable[1]	Watcher never shows the onscreen “HSDPA”, “GPRS”, “EDGE”, or “3G” indicator.	Indicator enabled
Data counter disable[1]	Watcher never shows Rx and Tx data counters.	Rx and Tx data counters enabled
Disable advanced profile menu (QoS)[1]	If disabled Watcher never shows advanced profile's QoS menus and user cannot change the minimum and requested QoS parameters.	Advance profile menu disabled
SIM PUK prompt enable	If enabled, Watcher shows the message "SIM blocked please enter PIN code".	Disabled, Watcher displays "Contact Service Provider" when SIM PIN is blocked
GPRS attach on start-up[1]	If disabled, modem attaches when GPRS connection is required.	The modem GPRS attaches at start-up.
Disable Auto Connect	If disabled, the Auto Connect feature is blocked and cannot be enabled by the user. If blocked, the "Auto Connect" button on the profile edit menu is greyed out and cannot be selected.	The auto-connect feature menu item is enabled with the default state set to manual (not auto-connect).
Scan for profile	The modem scans through all its programmed profiles to find successful GPRS connection.	Not scanning. Only the selected profile is used for connection.

a. Features only available if supported in the user interface

9: Mechanical and Environmental Specifications

9

The MC8790V module complies with the mechanical and environmental specifications in this section. Final product conformance to these specifications depends on the OEM device implementation.

Table 9-1: Mechanical and environmental specifications

	Mode	Details
Temperature (Temperature of immediate environment—for example, the interior of a laptop)	Operational	-25ºC to +60ºC - Full RF performance +60ºC to +75ºC - Reduced RF performance
	Non-operational	-40ºC to +85ºC, 96 hours (from MIL-STD 202 Method 108)
Relative humidity	Non-operational	85ºC, 85% relative humidity for 48 hours (non-condensing)
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 six faces, two times (module only).
Electrostatic discharge	Operational	The RF port (antenna launch and RF connector) complies with the following standard: • IEC 61000-4-2 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: • +/- 1 kV Human Body Model (JESD22-A114-B) • +/- 125 V Charged Device Model (JESD22-C101)
Thermal considerations		See the **CDMA / GSM Mini Card Hardware Integration Guide** [R-2].

Table 9-1: Mechanical and environmental specifications (Continued)

	Mode	Details
Form factor		The MC8790V is a PCI-Express Mini Card in a metal-shielded case.
Dimensions		Length: 51 mm Width: 30 mm* Thickness: 4.5 mm Weight: approximately 10 g * The actual width may exceed the 30 mm specification because the sides of the module are depaneled using a V-score process that can cause a rough surface.

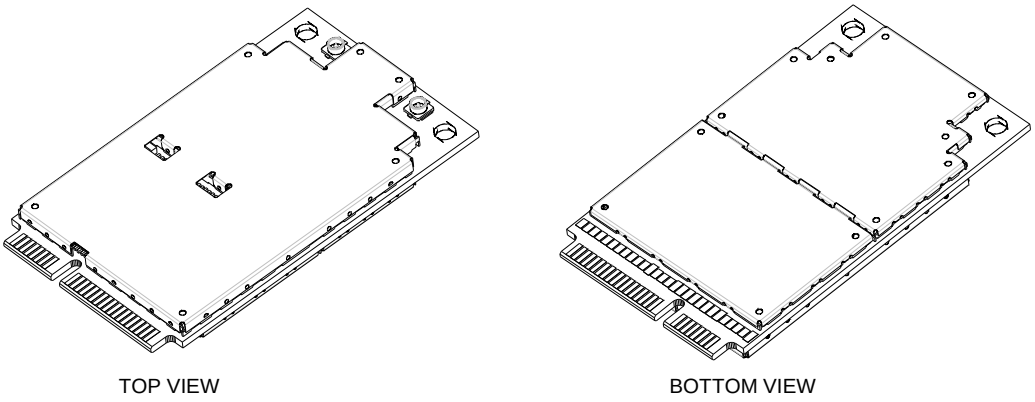

Figure 9-1: Top and bottom views (MC8790V)

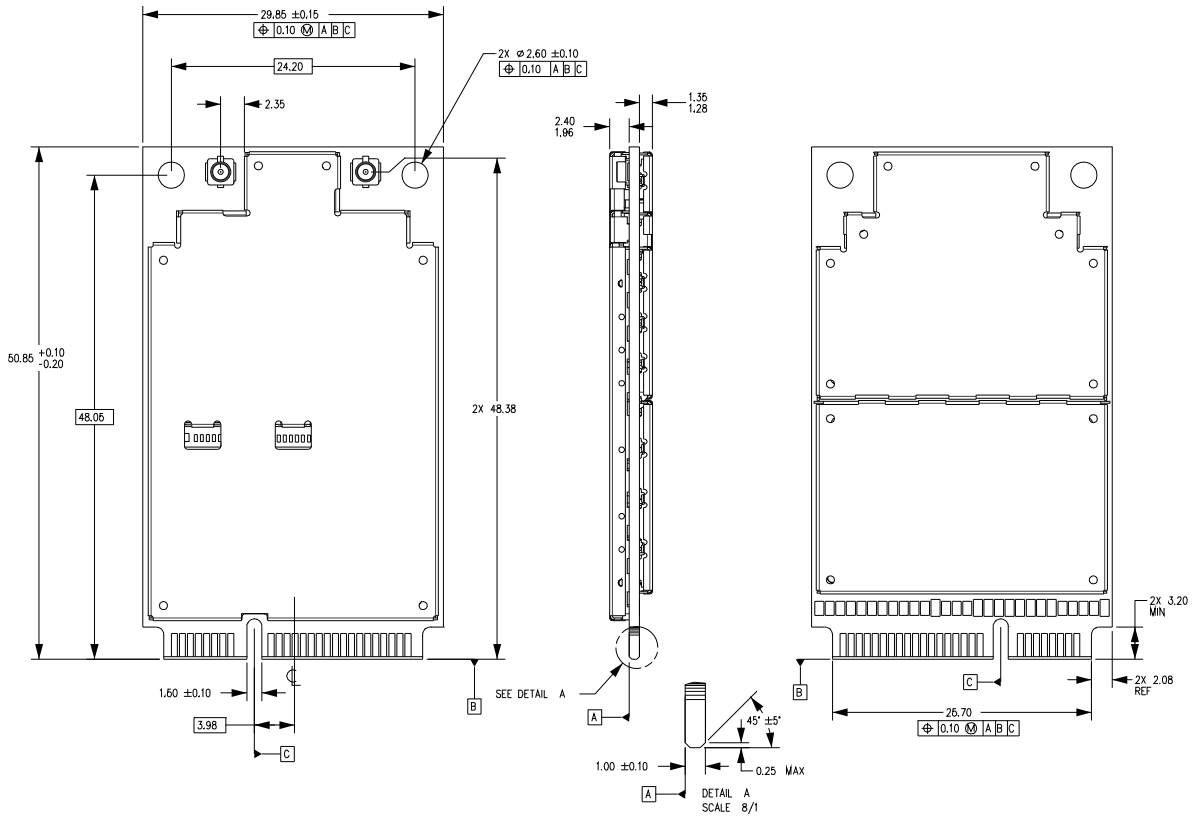

Figure 9-2: Dimensioned view (MC8790V)

Labeling

Figure 9-3: Unit label

The MC8790V label is non-removable and contains:

- Sierra Wireless logo and product name
- IMEI number in Code-128 barcode format
- SKU number (when required)
- Factory Serial Number (FSN) in alphanumeric format
- Batch revision number in hexadecimal format

- Manufacturing date code (incorporated into FSN)
- Licensed vendor logo

Note: The MC8790V supports OEM partner specific label requirements.

10: Approvals

Regulatory approvals

North America (USA / Canada)

The Sierra Wireless MC8790V modem has been granted modular approval for mobile applications. Integrators may use the MC8790V modem in their final products without additional FCC / IC (Industry Canada) certification if they meet the following conditions. Otherwise, additional FCC / IC approvals must be obtained.

1. At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.
2. To comply with FCC / IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 5 dBi in the cellular band and 4 dBi in the PCS band.
3. The MC8790V modem and its antenna must not be co-located or operating in conjunction with any other transmitter or antenna within a host device.
4. A label must be affixed to the outside of the end product into which the MC8790V modem is incorporated, with a statement similar to the following:
   - **This device contains FCC ID: N7NMC8790**
     This equipment contains equipment certified under IC: 2417C-MC8790.
5. A user manual with the end product must clearly indicate operating requirements and conditions to ensure compliance with current FCC / IC RF exposure guidelines.

The end product with an embedded MC8790V modem may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

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

The European Union

Sierra Wireless hereby declares that the MC8790V modem conforms with all essential requirements of Directive 1999/5/EC.The Declaration of Conformity made under Directive 1999/5/EC is available for viewing at the following location in the EU community:

Sierra Wireless (UK), Limited
Lakeside House
1 Furzeground Way, Stockley Park East
Uxbridge, Middlesex
UB11 1BD
England

The end product with an embedded MC8790V modem is subject to the R&TTE Directive, and the CE mark is required before the product can be placed on the EU market. Compliance testing needs to be performed on the end product, and is the responsibility of the OEM. Sierra Wireless offers professional services-based assistance to OEMs with the R&TTE testing and CE certification process, if required.

Industry approvals

GCF full type approval testing per 3GPP TS 34.121 [R-12] and 3GPP TS 34.123 [R-13][R-14][R-15] will be required for European type approval certification of the finished UMTS UE mobile product to be deployed in EU/UK markets. For NA markets, PTCRB type approval testing according to NAPRD requirements will be mandatory. Some of these tests (e.g. MMI) are dependent on the finished integrated system and are the responsibility of the OEM. Sierra Wireless offers professional services-based assistance to OEMs with FTA testing and certification process, if required.

11: Additional Requirements

Testing assistance provided by Sierra Wireless

Extended AT commands have been implemented to assist with performing FTA GCF tests and portions of CE Mark tests requiring radio module access. These are documented in the **UMTS Modems Supported AT Command Reference** [R-4] and **MC87xx Modem Extended AT Command Reference** [R-5].

The **CDMA / GSM Mini Card Hardware Integration Guide** [R-2] includes a list of test houses familiar with Sierra Wireless products.

Sierra Wireless offers optional professional services based assistance to OEMs with regulatory approvals.

Integration requirements

When integrating the MC8790V PCI-Express Mini Card, the following items need to be addressed:

- **Mounting**—Effect on temperature, shock, and vibration performance
- **Power supply**—Impact on battery drain and possible RF interference
- **Antenna location and type**—Impact on RF performance
- **Regulatory approvals**—As discussed in Approvals on page 71.
- **Service provisioning**—Manufacturing process
- **Software**—As discussed in Software Interface on page 65.

Sierra Wireless provides guidelines for successful MC8790V PCI-Express Mini Card integration with the document suite and offers integration support services as necessary.

IOT/Operator

Interoperability and Operator/Carrier testing of the finished system is the responsibility of the OEM. The test process will be determined with the chosen network operator(s) and will be dependent upon your business relationship with them, as well as the product's application and sales channel strategy.

Sierra Wireless offers assistance to OEMs with the testing process, if required.

A: Data Rates

A

Multi-slot class definitions

Table A-1: Multislot class definitions

Class	Rx slots	Tx slots	Max Sum
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5
11	4	3	5
12	4	4	5

GPRS data throughput

Table A-2: GPRS data throughput

GPRS Coding Scheme Data Throughput	Max throughput for 4 timeslots	Modulation
CS 1 = 8.0 kbps / timeslot	32 kbps	GMSK
CS 2 = 12.0 kbps / timeslot	48 kbps	GMSK
CS 3 = 14.4 kbps / timeslot	57.6 kbps	GMSK
CS 4 = 20.0 kbps / timeslot	80 kbps	GMSK

EDGE data throughput

Table A-3: EDGE data throughput

EDGE coding scheme data throughput	Max throughput for 4 timeslots	Modulation
MCS 1 = 8.8 kbps / timeslot	35.2 kbps	GMSK
MCS 2 = 11.2 kbps / timeslot	44.8 kbps	GMSK
MCS 3 = 14.8 kbps / timeslot	59.2 kbps	GMSK
MCS 4 = 17.6 kbps / timeslot	70.4 kbps	GMSK
MCS 5 = 22.4 kbps / timeslot	89.6 kbps	8PSK
MCS 6 = 29.6 kbps / timeslot	118.4 kbps	8PSK
MCS 7 = 44.8 kbps / timeslot	179.2 kbps	8PSK
MCS 8 = 54.4 kbps / timeslot	217.6 kbps	8PSK
MCS 9 = 59.2 kbps / timeslot	236.8 kbps	8PSK

UMTS throughput

The MC8790V supports 64 kbps, 128 kbps, and 384 kbps for the uplink and downlink on UMTS networks.

HSDPA throughput

Table A-4: HSDPA-capable terminals

Category	Maximum number of supported HS-DSCH codes	Minimum inter-TTI interval	Number of soft values in terminal's hybrid ARQ buffer	Theoretical download maximum (L1peak rate [Mbps])	Modulation
Category 1	5	3	19,200	1.2	16QAM, QPSK
Category 2	5	3	28,800	1.2	16QAM, QPSK
Category 3	5	2	28,800	1.8	16QAM, QPSK
Category 4	5	2	38,400	1.8	16QAM, QPSK
Category 5	5	1	57,600	3.6	16QAM, QPSK
Category 6[a]	5	1	67,200	3.6	16QAM, QPSK
Category 7	10	1	115,200	7.2	16QAM, QPSK
Category 8[a]	10	1	134,400	7.2	16QAM, QPSK
Category 9	15	1	172,800	10.0	16QAM, QPSK
Category 10	15	1	172,800	14.0	16QAM, QPSK
Category 11	5	2	14,400	0.9	QPSK
Category 12[a]	5	1	28,800	1.8	QPSK

a. Supported on MC8790V

HSUPA throughput

Table A-5: HSUPA-capable terminals

E-DCH Category	Maximum number of E-DCH codes transmitted	Minimum spreading factor	Support for 10 ms; 2 ms TTI E-DCH	Maximum data rate with 10 ms TTI	Maximum data rate with 2 ms TTI
Category 1	1	SF4	10 ms only	0.72 Mbps	N/A
Category 2	2	SF4	10 ms and 2 ms	1.45 Mbps	1.45 Mbps
Category 3[a]	2	SF4	10 ms only	1.45 Mbps	N/A
Category 4	2	SF2	10 ms and 2 ms	2.0 Mbps	2.91 Mbps
Category 5[a]	2	SF2	10 ms only	2.0 Mbps	N/A
Category 6[a]	4	SF2	10 ms and 2 ms	2.0 Mbps	5.76 Mbps

a. Supported on MC8790V

B: References

B

Sierra Wireless documents

These documents are (or will be) available in the Embedded Module Universal Development Kit:

Table B-1: Supporting documents

Reference	Doc Number	Title
[R-1]	2130391	Universal Development Kit User's Guide
[R-2]	2130114	CDMA / GSM Mini Card Hardware Integration Guide
[R-4]	2130617	UMTS Modems Supported AT Command Reference
[R-5]	2130616	MC87xx Modem Extended AT Command Reference
[R-6]	2130143	GSM Software Development Kit API Manual
[R-7]	2130602	MC87xx modem CnS Reference
[R-8]	2130634	Embedded Module / Mini Card / AirCard USB Driver Developer's Guide

3GPP / ETSI standards

Table B-2: 3GPP / ETSI standards

Reference	Doc Number	Title
[R-9]	3GPP Release 5	3GPP Release 5 UMTS Specification for Mobile Terminated Equipment
[R-10]	ETSI TS 100 916 V7.5.0 (1999-12)	AT Command Set for GSM Mobile Equipment
[R-11]	3GPP TS 34.108 (2001-01), sections 6.10.2.1 and 6.10.2.2	Common Test Environment User Equipment (UE) Conformance Testing
[R-12]	3GPP TS 34.121 v5.6.0 (2003-09)	Technical Specification Group Terminals; Terminal conformance specification; Radio transmission and reception (FDD) (Release 5)
[R-13]	3GPP TS 34.123-1 v3.5.0 (2001-09)	Technical Specification Group Terminals; User Equipment (UE) conformance specification; Part 1: Protocol conformance specification (Release 1999)
[R-14]	3GPP TS 34.123-2 v3.5.0 (2001-09)	Technical Specification Group Terminal; User Equipment (UE) conformance specification; Part 2: Implementation Conformance Statement (ICS) proforma specification (Release 1999)
[R-15]	3GPP TS 34.123-3 v3.6.1 (2004-07)	Technical Specification Group Terminals; User Equipment (UE) conformance specification; Part 3: Abstract Test Suite (ATS) (Release 1999)
[R-16]	3GPP TS 27.010 v3.4.0 (2002-03)	Technical Specification Group Terminals; Terminal Equipment to User Equipment (TE-UE) multiplexer protocol (Release 1999)
[R-17]	3GPP TS 51.010 v5.10.0 (2004-09)	Technical Specification Group GSM/EDGE Radio Access Network Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification (Release 5)

Other documents

Table B-3: Other documents

Reference	Doc Number	Title
[R-18]		PCI Express Mini Card Electromechanical Specification Revision 1.2

Agency standards

1. FCC 47 CFR - Part 15. Radio Frequency Devices. January 2001.
2. FCC 47 CFR - Part 22. Cellular Radiotelephone Services. October 1998.
3. FCC 47 CFR - Part 24. Personal Communications Services. October 1998.
4. Industry Canada ICES-003. Interference-Causing Equipment Standard - Digital Apparatus. November 22, 1997.
5. Industry Canada RSS-132. Cellular Telephones Employing New Technologies Operating in the Bands 824–849 MHz and 869–894 MHz. Issue 2. September 2005.
6. Industry Canada RSS-133. 2 GHz Personal Communications Services. September 25, 1999.
7. IEC 61000-4-2. Electrostatic Discharge Immunity Test.
8. JESD22-A114-B. +/- 1 kV Human Body Model.
9. JESD22-C101. +/- 125 V Charged Device Model.

C: WWAN Frequency Bands

C

The MC8790V supports bands that appear in bold.

Table C-1: Worldwide Wide Area Network (WWAN) frequency bands

Network			Frequency bands (MHz)	FRX–FTX (MHz)
GSM	**GSM 850**	**Tx**	**824–849**	**45**
		Rx	**869 – 894**	
	GSM 900	**Tx**	**890 – 915**	**45**
		Rx	**935–960**	
	EGSM 900	**Tx**	**880–915**	**45**
		Rx	**925–960**	
	R-GSM	Tx	876–915	
		Rx	921–960	
	GSM 1800	**Tx**	**1710–1785**	**95**
		Rx	**1805–1880**	
	GSM 1800 Korea	Tx	1750–1780	
		Rx	1840–1870	
	GSM 1900	**Tx**	**1850–1910**	**80**
		Rx	**1930–1990**	
PDC (Japan)		Tx	810–826	
		Rx	940–956	
		Tx	1429–1453	
		Rx	1477–1501	
IS-54 and IS-136 (D-AMPS and TDMA)	IS-54 and IS-136	Tx	824–849	
		Rx	869–894	
	IS-36	Tx	1850–1910	
		Rx	1930–1990	
CdmaOne		Tx	824–849	
		Rx	869–894	
		Tx	1850–1910	
		Rx	1930–1990	

Table C-1: Worldwide Wide Area Network (WWAN) frequency bands (Continued)

Network			Frequency bands (MHz)	FRX–FTX (MHz)
CDMA2000 1x RTT	BC0: US Cellular	Tx	824–849	
		Rx	869–894	
	BC1: North American PCS	Tx	1850–1910	
		Rx	1930–1990	
	BC2: TACS Band	Tx	872–915	
		Rx	917–960	
	BC3: JTACS Band	Tx	887–925	
		Rx	832–870	
	BC4: Korean PCS	Tx	1750–1780	
		Rx	1840–1870	
	BC5: NMT 450	Tx	411–483	
		Rx	421–493	
	BC6: IMT 2000	Tx	1920–1980	
		Rx	2110–2170	
	BC7: North American 700 MHz Cellular	Tx	776–794	
		Rx	746–764	
	BC8: 1800 MHz Band	Tx	1710–1785	
		Rx	1805–1880	
	BC9: 900 MHz Band	Tx	880–914	
		Rx	925–959	
	BC10: Secondary 800 MHz Band	Tx	806–901	
		Rx	851–940	
	BC11: 400 MHz European PAMR Band	Tx	410–458	
		Rx	420–468	
	BC12: 800 MHz PAMR Band	Tx	870–876	
		Rx	915–921	

Table C-1: Worldwide Wide Area Network (WWAN) frequency bands (Continued)

Network			Frequency bands (MHz)	FRX–FTX (MHz)
WCDMA 3GPP/FDD	**I**	**Tx**	**1920–1980**	**190**
		Rx	**2110–2170**	
	II	**Tx**	**1850–1910**	**80**
		Rx	**1930–1990**	
	III	Tx	1710–1785	
		Rx	1805–1880	
	IV	Tx	1710–1755	
		Rx	2155–2210	
	V	**Tx**	**824–849**	**45**
		Rx	**869–894**	
	VI	**Tx**	**830–840**	**45**
		Rx	**875–885**	
	VII	Tx	2500–2570	
		Rx	2620–2690	
	VIII	Tx	880–915	
		Rx	925–960	
	IX	Tx	1749.9–1784.9	
		Rx	1844.9–1879.9	
	WCDMA900	Tx	880–915	
		Rx	925–960	
	WCDMA2600	Tx	2500–2570	
		Rx	2620–2690	
WCDMA 3GPP/TDD (UTRA TDD HCR)			1900–1920	
			2010–2025	
			1850–1910	
			1930–1990	
			1910–1930	
TD-SCMA (UTRA TDD LCR)			1900–1920	
			2010–2025	
			1850–1910	
			1930–1990	
			1910–1930	

D: Acronyms

Table D-1: Acronyms and definitions

Acronym or term	Definition
3GPP	3rd Generation Partnership Project
8PSK	Octagonal Phase Shift Keying
A-GPS	Assisted GPS
AM	(RLC) Acknowledged Mode
AMR	Adaptive Multi-Rate Vocoder
AC97	Audio Code ‘97
API	Application Programming Interface
ARQ	Automatic Repeat Request
BER	Bit Error Rate
BTFD	Blind Transport Format Detection
CAIT	CDMA Air Interface Tool
CCTRCH	Coded Composite Transport Channel
CFN	Connection Frame Number
CHAP	Challenge Handshake Authentication Protocol
CNS	Control and Status (Sierra Wireless’ propriety host interface protocol)
CP	Control Plane
CPHS	Common PCN Handset Specification
CS	Circuit-switched
CSD	Circuit-switched Data
DHCP	Dynamic Host Configuration Protocol
DL	Downlink (network to mobile)
DPCH	Dedicated Physical Channel
DSCH	Downlink Shared Channel
DUN	Dial-Up Networking
EAP-SIM	Extensible Authentication Protocol Method for GSM Subscriber Identity

Table D-1: Acronyms and definitions (Continued)

Acronym or term	Definition
EDGE	Enhanced Data rates for GSM Evolution
ENS	Enhanced Network Selection
EONS	Enhanced Operator Name String
EPC	Enhanced Power Control
ERP	Effective Radiated Power
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
FSN	Factory Serial Number
GMSK	Gaussian Minimum Shift Keying modulation
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HARQ	Hybrid Automatic Request
HPLMN	Home PLMN
HPPLMN	Higher Priority PLMN
HSDPA	High Speed Downlink Packet Access
HS-DPCCH	High Speed Dedicated Physical Control Channel
HS-PDSCH	High Speed Physical Downlink Shared Channel
HS-SCCH	High Speed Shared Control Channel
HSUPA	High Speed Uplink Packet Access
IK	Integrity Key
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
inter-RAT	Radio Access Technology
IOT	Interoperability Testing
LED	Light Emitting Diode
LLC	Logical Link Control
LPM	Low Power Mode

Table D-1: Acronyms and definitions (Continued)

Acronym or term	Definition
MAC	Medium Access Control
MAC-HS	High Speed Medium Access Control
MAIO	Mobile Allocation Index Offset
MEP	Mobile Equipment Personalization
MSC	Mobile Switching Center
MSM	Mobile Station Modem
MUX	Multiplexing
NACC	Network Assisted Cell Change
NDIS	Network Driver Interface Specification
NIC	Network Interface Card
NITZ	Network Identity and Time Zone
OEM	Original Equipment Manufacturer
ONS	Operator Name String
PAP	Password Authentication Protocol
PC/SC	PC / Smart Card
PCCPCH	Primary Common Control Physical Channel
PCS	Personal Communication System
PDP	Packet Data Protocol
PICH/DRX	Paging Indicator Channel / Discontinuous Reception
PLMN	Public Land Mobile Network
PPP	Point to Point Protocol
PS	Packet-switched
PST	Product Support Tools
PU	Payload Unit
PUK	Personal Unblocking Key
QOS	Quality of Service
RAB	Radio Access Bearer
RADIUS	Remote Authentication Dial-In User Service

Table D-1: Acronyms and definitions (Continued)

Acronym or term	Definition
RATSCCH	Robust AMR Traffic Synchronized Control Channel
RLC	Radio Link Control
RNC	Radio Network Controller
RRC	Radio Resource Control
RSCP	Received Signal Code Power
SAIC	Single Antenna Interference Cancellation
SAR	Specific Absorption Rate
SCCPCH	Secondary Common Control Physical Channel
SDK	Software Development Kit
SDU	Service Data Unit
SFN	Systm Frame Number
SGSN	Serving GPRS Support Node
SIB	System Information Block
SIM	Subscriber Identity Module
SIR	Signal-to-Interference Ratio
SKU	Stock Keeping Unit
SMS	Short Message Service
SPN	Service Provider Name
TBF	Temporary Block Flow
TM	Transparent Mode (RLC)
TMSI	Temporary Mobile Subscriber Identity
TTFF	Time To First Fix
UE	User Equipment
UEA	UMTS Encryption Algorithm
UIA	UMTS Integrity Algorithm
UL	Uplink (mobile to network)
UM	Unacknowledged Mode (RLC)
UMTS	Universal Mobile Telecommunications System

Table D-1: Acronyms and definitions (Continued)

Acronym or term	Definition
USB	Universal Serial Bus
USIM	Universal Subscriber Identity Module (UMTS)
USSD	Unstructured Supplementary Services Data
UTRAN	UMTS Terrestrial Radio Access Network
VLR	Visitor Location Register
VSWR	Voltage Standing Wave Ratio
VT	Video Terminal
WCDMA	Wideband Code Division Multiple Access
WINS	Windows Internet Name Service


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