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Dec 3<sup>rd</sup> 2008

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## Reference Documents

### PCI Express Mini Card References

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PCI Express Mini Card Electromechanical Specification Revision 1.0 June 2, 2003

PCI Express Card Electromechanical Specification revision 1.1 March 28<sup>th</sup> 2005

SMBus Specification, Revision 2.0

The I2C-BUS SPECIFICATION Version 2.1 January 2000

### 3GPP References

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The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

For a specific reference, subsequent revisions do not apply.

For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] Void.
- [2] 3GPP TS 23.038: "Alphabets and language-specific information".
- [3] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".
- [4] 3GPP TS 23.041: "Technical realization of the Cell Broadcast Service (CBS)".
- [5] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".
- [6] 3GPP TS 24.011: "Short Message Service (SMS) support on mobile radio interface".
- [7] 3GPP TS 24.012: "Cell Broadcast Service (CBS) support on the mobile radio interface".
- [8] 3GPP TS 27.001: "General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".
- [9] 3GPP TS 27.007: "AT command set for User Equipment (UE)".
- [10] 3GPP TS 51.011: "Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".
- [11] ITU-T Recommendation V.25ter: "Serial asynchronous automatic dialing and control".
- [12] ITU-T Recommendation V.24: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".
- [13] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

- 
- [14] ITU-T Recommendation E.163: "Numbering plan for the international telephone service".
  - [15] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
  - [16] 3GPP TS 31.102: "Characteristics of the USIM application."

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## Notices

### Safety Warning

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The EU850D, EU860D, EU870D AND E760, E760 products may not be used in an environment where radio frequency equipment is prohibited or restricted in its use. This includes aircraft/airports, hospitals, and other sensitive electronic areas.

**Do not operate RF devices in an environment that may be susceptible to radio interference resulting in danger, specifically:**

- **Areas where prohibited by the law**  
Follow any special rules and regulations and obey all signs and notices. Always turn off the host device when instructed to do so, or when you suspect that it may cause interference or danger.
- **Where explosive atmospheres may be present**  
Do not operate your modem in any area where a potentially explosive atmosphere may exist. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death. Be aware and comply with all signs and instructions.
- **Users are advised not to operate the modem while at a refueling point or service station.**  
Users are reminded to observe restrictions on the use of radio equipment in fuel depots (fuel storage and distribution areas), chemical plants or where blasting operations are in progress.
- **Areas with a potentially explosive atmosphere are often but not always clearly marked.**  
Potential locations can include gas stations, below deck on boats, chemical transfer or storage facilities, vehicles using liquefied petroleum gas (such as propane or butane), areas where the air contains chemicals or particles, such as grain, dust or metal powders, and any other area where you would normally be advised to turn off your vehicle engine.
- **Near Medical and life support equipment**  
Do not operate your modem in any area where medical equipment, or life support equipment may be located, or near any equipment that may be susceptible to any form of radio interference. In such areas, the host communications device must be turned off. The modem may transmit signals that could interfere with this equipment.
- **On an aircraft, either on the ground or airborne**  
In addition to FAA requirements, many airline regulations state that you must suspend wireless operations before boarding an airplane. Please ensure that the host device is turned off and your modem is removed from the card slot prior to boarding aircraft in order to comply with these regulations. The modem can transmit signals that could interfere with various onboard systems and controls.
- **While operating a vehicle**  
The driver or operator of any vehicle should not operate a wireless data device. Doing so will detract from the driver or operator's control and operation of that

vehicle. In some countries, operating such communication devices while in control of a vehicle is an offence.

Under extended operation the EU850D, EU860D, EU870D and E760 modem will generate a noticeable amount of heat. Like all PC Cards, the modem generates heat during normal operation and will be heated by the host computer. For this reason it is recommended that after extended periods of operation, prior to removal and handling, you allow the modem to cool down.

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## **Federal Communications Commission Notice (FCC—United States)**

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This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Contact your service provider for help.

Warning: Changes or modifications made to this equipment not expressly approved by Novatel Wireless may void the FCC authorization to operate this equipment.

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada.

Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

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## **Radio Frequency Exposure Requirements**

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In general, for the United States market, the embedded modules are treated as “mobile devices” as per FCC CFR47 paragraph 2.1091. A mobile device is defined as “a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 cm is normally maintained between the transmitter’s radiating structure(s) and the body of the user or nearby persons.”

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## **CE (Conformité Européenne or European Conformity)**

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This module will be tested to and conforms to the regulatory requirements of the European Union and has attained CE Marking. The CE Mark is a conformity marking consisting of the letters "CE".



The CE Mark applies to products regulated by certain European health, safety and environmental protection legislation. The CE Mark is obligatory for products it applies to: the manufacturer affixes the marking in order to be allowed to sell his product in the European market.

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## **Compliance & Certification Requirements**

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### **PCS Type Certification Review Board (PTCRB)**

PTCRB Certification is mandated and the product is technically evaluated to meet the minimum requirements for registration on the PTCRB Operators' networks. The purpose of the PTCRB is to provide the framework within which GSM Mobile Equipment (ME) Type Certification can take place for members of the PTCRB. The PTCRB process is recommended for all Manufacturers who wish to have their products operating within the areas served by the PTCRB Operators. This includes but is not limited to determination of the test specifications and methods to implement the Type Certification process for GSM Mobile Equipment.

PTCRB type certification will be based on GSM and OMA (Open Mobile Alliance) Specifications with modifications per North American Standards and additional requirements from FCC rules, and any other government agency that may have jurisdiction and or competence in the matter. Additions to the PTCRB Specifications will be developed by the GSM operators. The additions will be limited to MS-related features. The PTCRB document NAPRD 03 (Permanent Reference Document) will be modified to include references to the above specifications once they are written and accepted by majority of the review board.

To learn more about device certifications, please visit the [PTCRB Website](#). You must sign up as a member to gain access.

### **Global Certification Forum (GCF),**

The Global Certification Forum (GCF) is an independent organization with a wide-ranging membership of operators, equipment manufacturers and other interested parties. The actions of the Forum are actively supported by key staff from the Association Technical Projects operation and by the Association Executive Management Committee.

GCF is recommended but not mandatory for attachment to the European network. It is a partnership between network operators and terminal manufacturers and allows independent interoperability validation of the 2G and 3G mobile wireless terminal. GCF is typically required for formal carrier technical acceptance of the mobile wireless terminal.

Membership of GCF is entirely voluntary. Full GCF membership is open to mobile terminal manufacturers and network operators. Other interested members of the mobile wireless community, including test laboratories and test equipment manufacturers, may participate in GCF as observers.

The current membership includes almost 150 network operators worldwide, more than 35 leading terminal manufacturers and over 50 test equipment manufactures. Members decide the organization and administration of the forum at regular Steering Group meetings. Technical issues associated with testing new terminals and features are reviewed at regular Agreement Group meetings by manufacturers, test laboratories and other observers.

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To learn more about device certifications, please visit the [GCF Website](#). The website identifies manufacture, terminal names and the date which the terminal was certified. You must sign up as a member to gain full access.

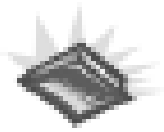
## Windows Platforms

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The Phoenix API will interface with your top level applications and provide the abstraction of the module specifics to the upper applications. Please contact Novatel Wireless for more details.

## Technical Support Contacts

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**WWW:** <http://www.nvtl.com/support/index.html>

Email: [support@novatelwireless.com](mailto:support@novatelwireless.com)

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## Getting Started

### General

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The purpose of this document is to provide basic design and integration information to assist in the integration of Novatel Wireless PCI Express Mini-cards. This document is intended to outline key components of the integration tools available for the Novatel Wireless line of PCI Express Mini-cards.

The EU850D, EU860D, EU870D and E760 are Novatel Wireless' versatile modules that add WWAN capability to other devices. They were developed to be integrated into other devices based on the PCI Express Mini-card specification 1.0.

The EU850D, EU860D, EU870D and E760 will work with all Windows driven laptops given the drivers are properly installed. When MobiLink™ is installed on a Windows OS system it will automatically include the drivers necessary to communicate with the PCI Express Mini-card. MobiLink™ is Novatel's Windows application manager for the PCI Express Mini Card. MobiLink provides an easy interface to make a data connection, change operating parameters, and view alerts such as SMS or signal strength indicator. However, anyone can still install the drivers manually. In addition, once the drivers are installed, following the Phoenix Client API functions, anyone could develop their Client side software manager to interact with the PCI Express Mini-card.

When using any of these devices, EU850D, EU860D, EU870D or the E760, activation is required for the device to be allowed on the operator's network. For example, Sprint requires the customer to run IOTA (Internet Over-The-Air) provisioning to prepare the device to work on the wireless network. Please refer to the Customer Configuration section on provisioning with IOTA for assistance.

The EU850D, EU860D, and EU870D require a valid SIM card before it can be used on the operator's wireless network. Please refer to the Customer Configuration section on PRI for further information.

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## Product Overview

The purpose of this section is to provide a high level overview of the EU850D, EU860D, EU870D AND E760 HSDPA modules.



EU850D shown above

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### HSDPA Module Overview

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The EU860D is primarily targeted for the North American market while the EU850D and EU870D are primarily targeted for the European market. They are both wireless modem modules designed to be embedded into laptop computers and other host devices.

The EU850D and **EU870D** will operate in the **850/900/1800/1900 GPRS/EDGE** bands and in the **850/1900/2100D UMTS/HSDPA** band. The 2100 band supports receive diversity as indicated by the "D" appended to the bands frequency. The EU870D is built on the MSM6280/RF Platform D chipset from Qualcomm™ with Equalizer and receive Diversity supported. This product will be commercially launched operating up to 3.6 Mbps and will be capable of future upgrade to 7.2Mbps.

The **EU860D** will operate in the **850/900/1800/1900 GPRS/EDGE** bands, and **850D/1900D/2100 UMTS/HSDPA** band. The 850D/1900D bands supports receive diversity as indicated by the "D" appended to the bands frequency. The EU860D is built on the MSM6280/RF Platform D chipset from Qualcomm™ with Equalizer and receive Diversity supported. This product will be commercially launched operating up to **3.6 Mbps** and will be capable of future upgrade to **7.2Mbps**.

The modules will be compatible with Windows™ compliant applications including VPN, e-mail, and web browsing.

The core protocol stack will be supplied by Qualcomm™ and contains UMTS, HSDPA, GPRS and EDGE technologies. Around this core, Novatel Wireless has created the firmware drivers that provide access to the hardware on the embedded modem. The feature set is comprised of the data device features supported in the Qualcomm™ protocol stack.

The hardware consists of a PCI Express Mini Card compliant interface (except as detailed herein), a baseband chipset from Qualcomm™, an RF radio chipset from Qualcomm™, and the various other components used to support these major components.

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## **CDMA Module Overview**

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The E760 will operate in the 800/1900 CDMA bands. The E760 Modem is primarily targeted for the North American market.

The core protocol stack will be supplied by Qualcomm™ and will contain CDMA, CDMA 1XRTT, and CDMA 1XEV-DO Rev 0, and 1XEV-DO Rev A technologies.

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## Device Specifications

### PCI Express Mini Card

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Novatel Wireless has designed a line of embedded broadband access modules around the PCI Express Mini Card Specification 1.1<sup>1</sup>. This product line provides platform developers and system integrators with the ability to enable global 3G broadband access. The governing body for PCI Express standardization is PCI SIG (Peripheral Component Interconnect Special Interest Group.) The website for PCI SIG can be found at the following URL:

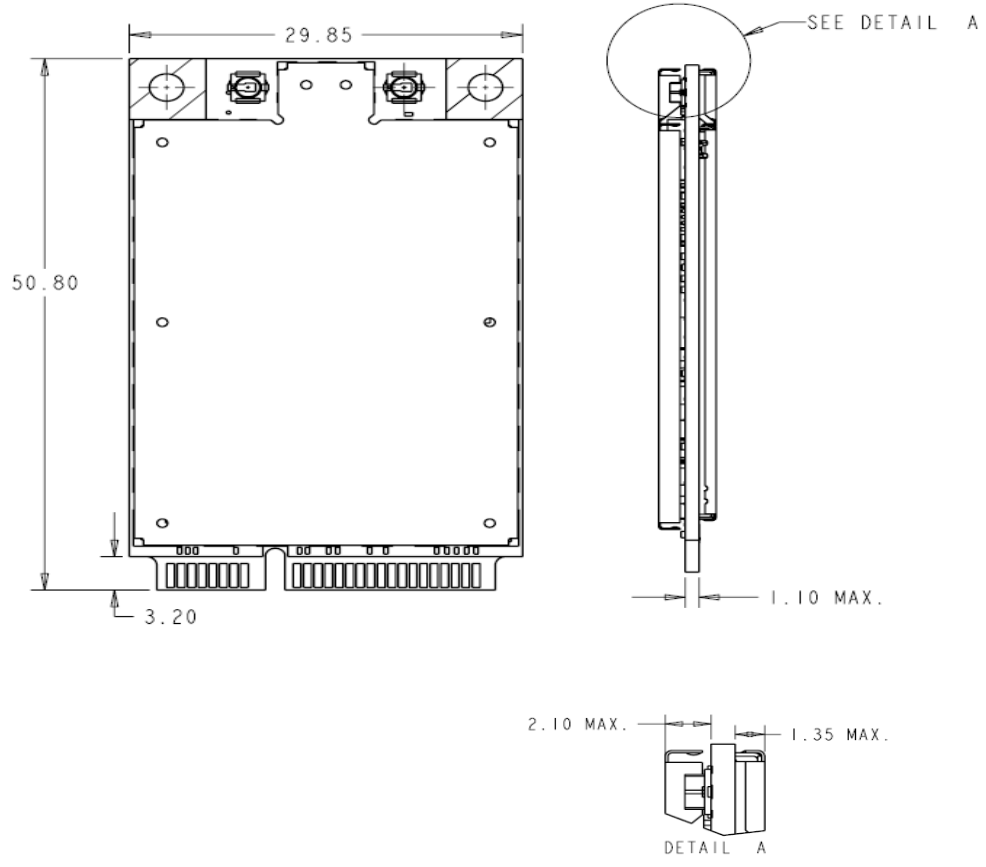
[www.pcisig.com/home](http://www.pcisig.com/home)

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<sup>1</sup> Customizations that deviate from the *PCI Express Card Electromechanical Specification revision 1.1* are noted in this document

# Mechanical Dimensions

Figure 1: EU860D/EU870D Module



**Figure 2: EU860D/EU870D Module**

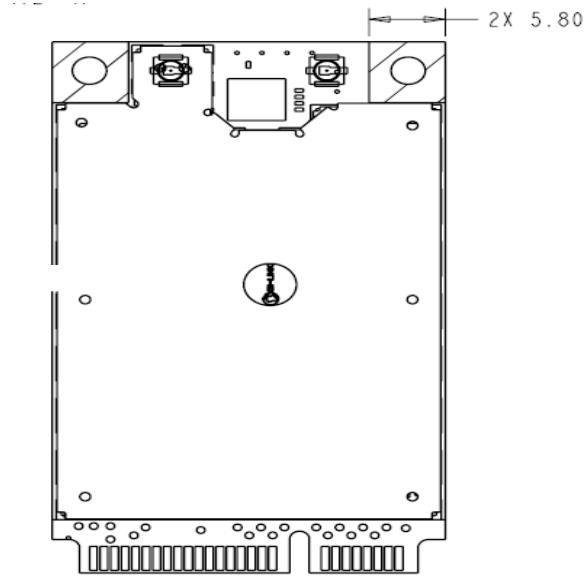
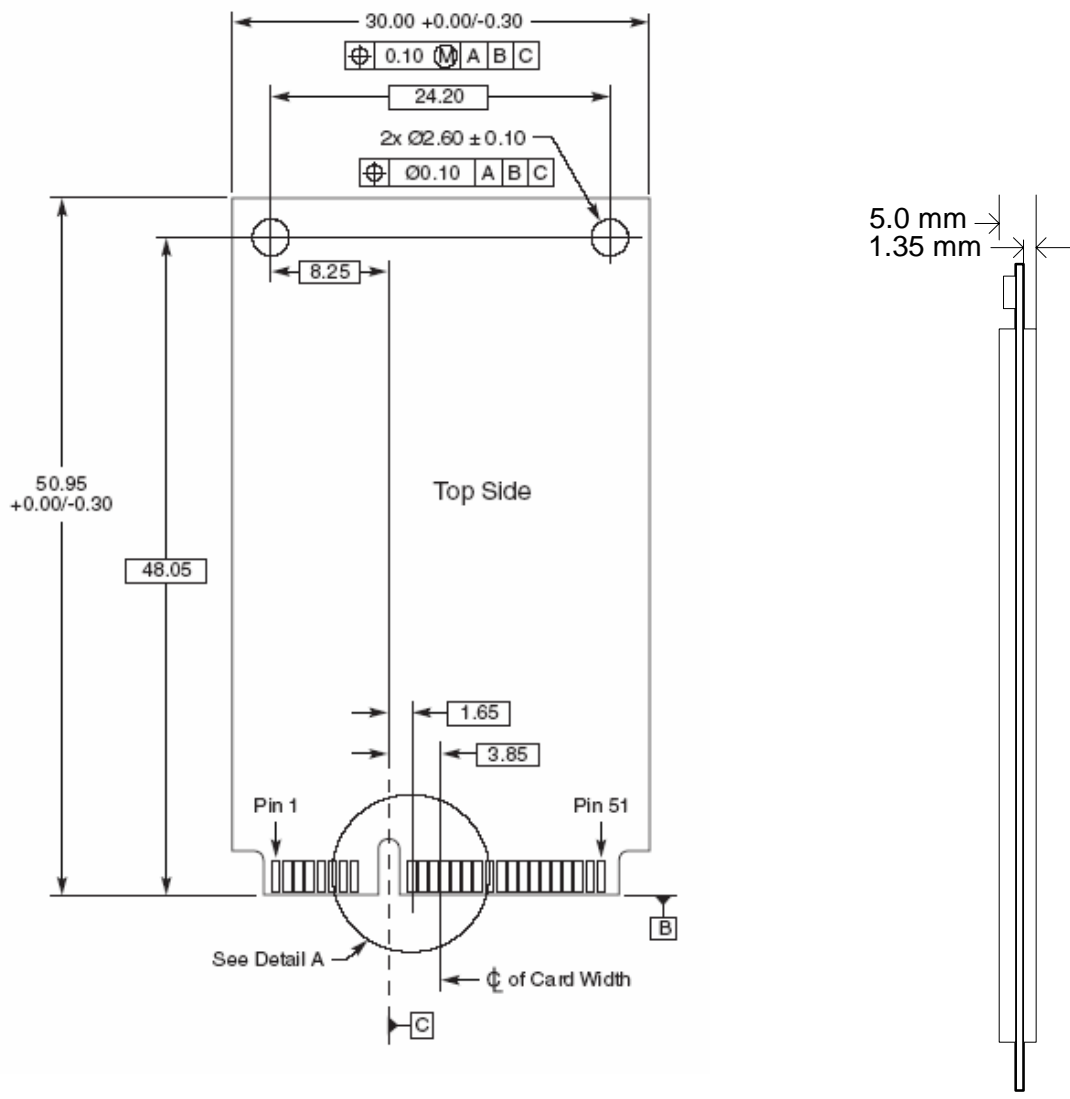
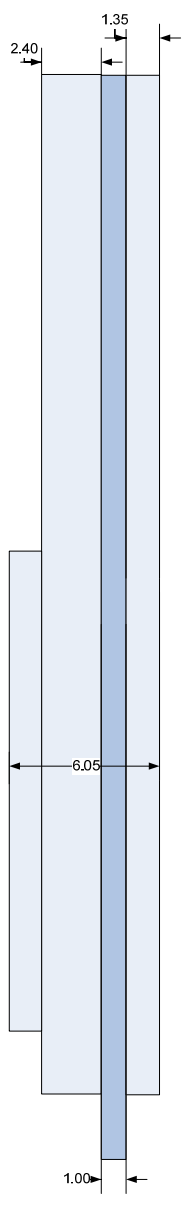




Figure 3: PCIe Minicard Module Envelope



**Figure 4: EU850D Envelope**



The EU850D has a built in SIM card socket and which increases the overall thickness as shown above.

## Interface Specification

### Host Interface

The EU850D, EU860D, EU870D and E760 are designed to meet the PCI Express Mini-Card specification. The table below gives a description of the pin-out and usage. The USB option of the specification is supported. Deviations from the Mini PCI Express card specification 1.1 are noted.

**Table 1: Host Interface specification**

Pin	PCIe Spec	EVDO	HSDPA	Pin	PCIe Spec	EVDO	HSDPA
1	WAKE#	NC	NC	2	3.3V	3.3V	3.3V
3	Reserved	NC	NC	4	GND	GND	GND
5	Reserved	NC	NC	6	1.5V	NC	NC
7	CLKREQ#	NC	NC	8	UIM_PWR	UIM_PWR	UIM_PWR
9	GND	GND	GND	10	UIM_DATA	UIM_DATA	UIM_DATA
11	REFCLK-	NC	NC	12	UIM_CLK	UIM_CLK	UIM_CLK
13	REFCLK+	NC	NC	14	UIM_RESET	UIM_RESET	UIM_RESET
15	GND	GND	GND	16	UIM_VPP	NC	NC
<b>Mechanical Key</b>							
17	Reserved	NC	NC	18	GND	GND	GND
19	Reserved	NC	NC	20	W_DISABLE#	W_DISABLE#	W_DISABLE#
21	GND	GND	GND	22	PERST#	PERST#	PERST#
23	PERn0	NC	NC	24	+3.3Vaux	NC	NC
25	PERp0	NC	NC	26	GND	GND	GND
27	GND	GND	GND	28	+1.5V	NC	NC
29	GND	GND	GND	30	SMB_CLK	SMB_CLK	SMB_CLK
31	PETn0	NC	NC	32	SMB_DATA	SMB_DATA	SMB_DATA
33	PETp0	NC	NC	34	GND	GND	GND
35	GND	GND	GND	36	USB_D-	USB_D-	USB_D-
37	Reserved	GND	NC/GND	38	USB_D+	USB_D+	USB_D+
39	Reserved	3.3V	3.3V	40	GND	GND	GND
41	Reserved	3.3V	3.3V	42	LED_WWAN#	LED_WWAN#	LED_WWAN#
43	Reserved	GND	GND	44	LED_WLAN#	NC	NC
45	Reserved	NC	NC/PCM_CLK	46	LED_WPAN#	NC	NC
47	Reserved	NC	NC/PCM_SYNC	48	+1.5V	NC	NC
49	Reserved	NC	NC/PCM_DOUT	50	GND	GND	GND
51	Reserved	NC	NC/PCM_IN	52	3.3V	3.3V	3.3V

Notes:

NC	No Connect
W_DISABLE	Radio Transmit Disable
NC/XXXX	Standard product will have No Connect, Population option,
PCM_XXXX	PCM Voice interface (Data in, Data out, Sync & clock)

## USB Interface

The Mini card acts as a peripheral device and supports the USB 2.0 standard at low speed (1.5 Mbps) and full speed (12 Mbps). It does not support the high speed (480 Mbps) mode of operation.

## Subscriber Identification Module (SIM) Interface

A 4 line SIM interface is provided on the mini-card edge connector for the EU860D. The EU850D has an onboard SIM connector. The signal levels comply with the ETSI standard Specification of the 3 Volt Subscriber Identity Module - Mobile Equipment (SIM-ME) interface (GSM 11.12 version 4.3.1). Note that no ESD protection will be provided on the mini-card. The host device is expected to provide the ESD protection at the SIM connector for the EU850D, EU860D, EU870D and E760.

The OEM Module supports a 3.0V SIM as described in ETSI 11.12. The relevant signals are brought out on the 70 pin connector.

- The SIM interface shall support 1.8 V USIMs
- The SIM interface shall support 3.0V USIMs
- The SIM interface shall support 3.0V SIMs

The USIM will be provided by the host. A SIM connector is not included on the mini-card. The interface to the USIM is provided on the host interface connector. A recommended interface card design criteria is available from Novatel. Please refer to the ***Integrator Design Elements: Antenna, Power & SIM*** section for further details.

Parameter	Min	Typ	Max	Units
High-level Input voltage	1.69		2.8	V
Low-level Input voltage	-3V		0.91	V
Schmitt hysteresis voltage	150			mV
Input high leakage current	-		1	uA
Input low leakage current with pull-up	-60		-10	uA
Input capacitance	-		7	pF

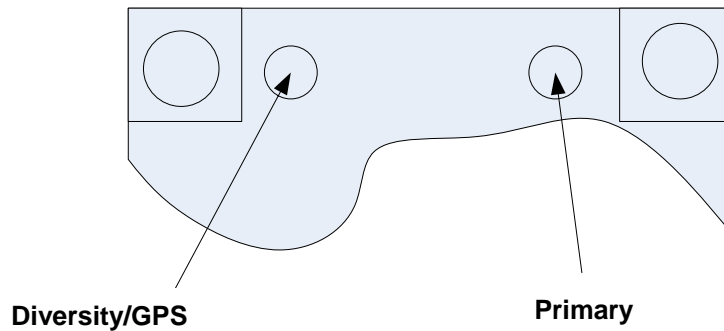
## Power Supply

The card shall operate within specification for the voltage range of 3.00 to 3.56 V with the nominal voltage being 3.3 V.

## RF Antenna Connections

There are two RF connectors which are Hirose U.FL-R-SMT or equivalent. These connectors are designed for a limited number of insertions. For an embedded application this is expected to be acceptable.

The connector location shall be as shown below:



The EU850D, EU860D, EU870D and E760 are designed to be connected to an external antenna integrated into the host system. The antenna port presents a nominal 50 $\Omega$  impedance.

### Diversity Receiver connection

The EU860D shall support receiver diversity on the UMTS/HSDPA 850 and 1900 bands. Roaming onto the 2100 band is supported.

The EU850D and EU870D shall support receiver diversity on the UMTS/HSDPA 2100 bands. Roaming onto the 850 and 1900 bands is supported.

The EU850D, EU870D and EU860D shall operate in the 850/900/1800/1900 GPRS/EDGE bands. Receiver Diversity is not supported in the GPRS/EDGE bands.

The E760 shall support receiver diversity on the CDMA 850 and 1900 bands.

### GPS Receiver connection

The GPS receiver capabilities can be activated optionally. Please contact Novatel Wireless for more details.

The GPS receiver antenna shares the Diversity receive connector.

## Environmental

The E760, EU850D, EU860D, EU870D and E760 will be compliant with the Mini PCI Express Electromechanical specification as detailed in the table below.

It should be noted that Novatel Wireless cannot guarantee that the host device (laptop; PDA; notebook etc.) will be able to endure these same environmental conditions. Users are advised to consult the host device documentation for specifications and observe any restrictions of use.

**Table 2: E760, EU850D/860D/870D Environmental Specification**

Parameter	E760	EU850D/860D/870D
Low Temperature Storage	-30 °C	-30 °C
High Temperature Storage	85 °C	85 °C
Low Temperature Operating	-20 °C	0 °C <sup>Note 1</sup>
High Temperature Operating	65 °C <sup>2</sup>	65 °C
Relative Humidity	95% maximum (non condensing)	95% maximum (non condensing)
ESD EVDO Rev A	8kV Air / 4kV Contact	
ESD HSDPA USB & SIM Pins only		8kV Air / 4kV Contact Performance Criterion 3
Vibration and High Frequency	147m/s <sup>2</sup> (15G) peak; 10 to 2000 Hz	147m/s <sup>2</sup> (15G) peak; 10 to 2000 Hz
Drop	75 cm	75 cm

Note 1: Low Temp Operation limit under review pending component review. Design target -20 °C

Note 2: Limit under review, design target for USB & SIM pins IEC 61000-4-2; Level 4 (ESD) 15kV air, 8kV contact.

The E760 product operates in a reliable fashion consistent with CDMA (IS-98C) and PCMCIA V2.1 standards. It will withstand three-foot drop and still remain functional.

### Electrostatic Discharge and Electro-Magnetic Interference

The modem does not protect itself from ESD. It is the responsibility of the host to ensure that there will not be any harmful discharges to the modem.

With regard to EMI, the modem will meet FCC part 15 for North American markets, and ETSI EN 301 489-1 for European markets. This device when incorporated in any other product may require FCC and/or other approvals. It is the user's responsibility to do this.

<sup>2</sup> It is required that the shield temperature not exceed 80°C at anytime. It may be necessary for the system integrator to provide some method to insure this surface temperature is not exceeded.

## Integrator Design Elements: Antennas

### Antenna

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#### HSDPA and EVDO Rev A Antenna Requirements

##### Total Radiated Power (TRP)

TRP measures the effective level of radiated power that is emitted while in transmit mode. To quantify the performance of the transmitter, the output power is measured on a spherical surface surrounding the laptop/handheld. The result of the measurement is a spherical radiation pattern of the radiated power or EIRP (Effective Isotropic Radiated Power). To obtain a single figure of merit the EIRP pattern is integrated over the spherical surface to obtain the TRP (Total Radiated Power). Carriers provide antenna performance specifications which identify the necessary TRP performance in order to be compliant with the carrier limits and attain Technical Acceptance.

##### Total Radiated Power Estimator

TRP can be estimated by summing the transmitted power of the Novatel Mini PCI Express cards with the expected losses and antenna efficiency. A basic spreadsheet estimator<sup>3</sup> is available from Novatel Wireless and a sample is shown below. The EU850D, EU860D, EU870D and E760 set points are typical of factory production. The Cable & Connector Loss and the Antenna efficiency are estimated by the host integrator to be representative of the laptop or handheld under consideration. The results are typically compared against carrier requirements to estimate compliance margin.

##### Total Isotropic Sensitivity (TIS)

TIS measures the effective sensitivity for a designated error rate. To quantify the performance of the receiver, the receiver sensitivity is measured on a spherical surface surrounding the Laptop/Handset. The sensitivity is defined as the minimum power level at which the digital error rate of the receiver is better than a specific limit. Depending on the system this limit is a Bit Error Rate (BER) limit, Block Error Rate (BLER) limit or a Frame Erasure Rate (FER) limit. Sensitivity is measured by lowering the transmit power level of the base station simulator until the specified digital error limit is reached. The power that was required to obtain the error limit is the sensitivity value.

##### TIS (Total Isotropic Sensitivity) Estimator

TIS can be estimated by reducing the Conducted Sensitivity of the module by losses and desense noise. The Conducted Sensitivity is reduced by Cable loss, Cable loss, Antenna

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<sup>3</sup> **Disclaimer:** This spread sheet is provided with no warranties whatsoever. Novatel Wireless disclaims all liability relating to the use of information in this specification. Note that this table is provided for rough estimation purposes only and is intended to provide a first pass guideline for antenna loss planning. It is not to be a substitute for detailed design activity. Additional losses, efficiency considerations and other system affects will modify the actual resulting TRP and as such results will deviate from the TRP calculator shown above. Updates to TRP limits are not controlled in this document.

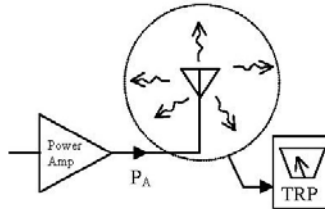
Efficiency and reduced by an estimation of the Laptop/Handheld noise. A basic spreadsheet estimator<sup>4</sup> is available from Novatel wireless and a sample is shown below.

The EU850D, EU860D, EU870D and E760 conducted Sensitivity typical of factory production units will be made available from Novatel Wireless. Although the data cards operate in Packet switched mode the values used for estimation are from Circuit Switched mode of operation as this is the mode the TIS is measured. The results are typically compared against carrier requirements to estimate compliance margin.

### TRP (Total Radiated Power) Requirements

Good radiated performance is critical to the effective operation of a mobile in networks. A comprehensive characterizing of radiated performance enables carriers to know how well mobiles work within the specific network design constraints.

**Figure 5: Total Radiated Power**



Tests shall be carried out for three different frequency pairs across the bands supported by the device, as defined for CDMA TIA/EIA-98-D and for GSM 1900 3GPP TS 51.010 in the tables below.

**Table 3: GSM-1900 Test Frequencies**

Band	Channel Pair	Designation	Frequency (MHz)
PCS A	512	CH <sub>1</sub> -TX	1850.20
PCS A	512	CH <sub>1</sub> -RX	1930.20
PCS B	661	CH <sub>2</sub> -TX	1880.00
PCS B	661	CH <sub>2</sub> -RX	1960.00
PCS C	810	CH <sub>3</sub> -TX	1909.80
PCS C	810	CH <sub>3</sub> -RX	1989.80

Radiated power measurements will be recorded in the “free-space” configuration on all applicable frequencies. For portable units, TPR measurements are repeated on all applicable frequencies. TPR will be reported using the Figure of Merit for industry analysis. Device power shall comply with the power levels specified in the relevant industry standards

<sup>4</sup> **Disclaimer:** This spread sheet is provided with no warranties whatsoever. Novatel disclaims all liability relating to the use of information in this specification. Note that this table is provided for rough estimation purposes only and is intended to provide a first pass guideline for antenna loss planning. It is not to be a substitute for detailed design activity. Additional losses, efficiency considerations and other system affects will modify the actual resulting TIS and as such results will deviate from the TIS calculator shown above. Updates to TIS limits are not controlled in this document.



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## Appendix A - Regulatory Approval and Compliance

As the EU850D, EU860D, and EU870D support four bands of GPRS operation, including North American and European bands, all products are covered by regulatory requirements of North America and Europe. All products will have FCC, PTCRB, CE and GCF certification.

The E760 as a CDMA product in North America requires FCC certification.

### **FCC (Federal Communication Commission)**

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The E760, EU850D, EU860D, EU870D and E760 products conform to the requirements of applicable American laws with respect to safety; health, environment and consumer protection.

This E760, EU850D, EU860D, EU870D and E760 will comply, per applicable band, with the following parts of the Federal Communication Commission's (FCC) Code of Federal Regulations (CFR):

- FCC CFR47 Part 2 (General Rules and Regulations, RF Exposure Evaluation)

- FCC CFR47 Part 15 (All Radio Frequency Devices)

- FCC CFR47 Part 24 (Narrow and wideband PCS modules)

- FCC CFR47 Part 22 (Cellular Service)

A FCC grant shall be obtained in order to demonstrate compliance.

## CE (Conformance European)

The EU850D, EU860D, and EU870D products comply with the essential requirements of the applicable European laws and directives with respect to safety; health, environment and consumer protection. The products conform to the essential requirements of the R&TTE (Radio and Telecommunications Terminal Equipment) Directive, 1999/5/EC, and have the CE mark affixed. The applicable sections of the following standards have been used to demonstrate compliance to this requirement. The EU850D, EU860D, EU870D and E760 products will comply with the 3GPP standards TS 51.010 for GSM and TS 34.121 for WCDMA.

**Table 4: R&TTE**

R&TTE Requirement	Discipline	Definition	Applied Standard
Article 3.1(a)	Health	Safety Testing (flammability, etc...)	ICNIRP 1998 <sup>5</sup> European Council Rec.1999/519 EC
Article 3.1(a)	Safety		IEC 60950-1 <sup>6</sup>
Article 3.1(b)	EMC	EMC testing (unintentional radiators, etc....)	EN 301 489-01 <sup>7</sup>
			EN 301 489-07 <sup>8</sup>
			EN 301 489-24 <sup>9</sup>
Article 3.2	Spectrum	Network Testing (power, frequency stability, etc...)	EN 301 511 <sup>10</sup>
			EN 301 908-1 <sup>11</sup>
			EN 301 908-2 <sup>12</sup>

<sup>5</sup> International Commission on Non-Ionizing Radiation Protection

<sup>6</sup> Safety of Information Technology Equipment

<sup>7</sup> Electromagnetic compatibility and Radio Spectrum Matters (ERM) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services  
Part 1: Common Technical requirements

<sup>8</sup> Electromagnetic compatibility and Radio Spectrum Matters (ERM) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services  
Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)

<sup>9</sup> Electromagnetic compatibility and Radio Spectrum Matters (ERM) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services  
Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (URTA) for Mobile and portable radio and ancillary equipment.

<sup>10</sup> Global System for Mobile communications (GSM):  
Harmonized EN for mobile stations in the GSM 900 and GSM1800 bands covering essential requirements under article 3.2 of the R&TTE directive

<sup>11</sup> Electromagnetic compatibility and Radio Spectrum Matters (ERM) Base Stations (BS) and User Equipment (UE) for IMT-2000 Third-Generation cellular networks.

<sup>12</sup> Electromagnetic compatibility and Radio Spectrum Matters (ERM) Base Stations (BS) and User Equipment (UE) for IMT-2000 Third-Generation cellular networks.

Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive

The EU850D, EU860D, and EU870D products will comply with the applicable GSM/GPRS European Regional Regulatory Requirements as per the following table.

**Table 5: GSM/GPRS European Regulations**

<b>GSM 11.10 / TS 51.010 Requirement</b>	<b>Description</b>	<b>EU / R&amp;TTE Directive</b>
12.1.1	Conducted spurious emissions - MS allocated a channel	Yes
12.1.2	Conducted spurious emissions - MS in idle mode	Yes
12.2.1	Radiated spurious emissions - MS allocated a channel	Yes
12.2.2	Radiated spurious emissions - MS in idle mode	Yes
13.1	Transmitter – Frequency error and phase error	Yes
13.2	Transmitter – Frequency error under multipath and interference conditions	Yes
13.3-1	Transmitter output power and burst timing - MS with permanent antenna connector	Yes
13.4	Transmitter - Output RF spectrum	Yes
13.6	Transmitter – Frequency error and phase error in HSCSD multislot configuration	Yes
13.7	Transmitter output power and burst timing in HSCSD configurations	Yes
13.8	Transmitter, Output RF spectrum in HSCSD multislot configuration	Yes
13.16.1	Frequency error and phase error in GPRS multislot configuration	Yes
13.16.2	Transmitter output power in GPRS multislot configuration	Yes
13.16.3	Output RF spectrum in GPRS multislot configuration	Yes
13.17.1	Frequency error and Modulation accuracy in EGPRS Configuration	Yes
13.17.2	Frequency error under multipath and interference conditions in EGPRS Configuration	Yes
13.17.3-1	EGPRS Transmitter output power- MS with permanent antenna connector	Yes
13.17.4	Output RF spectrum in EGPRS Configuration	Yes
14.7.1	Blocking and spurious response - speech channels	Yes
14.18.5	Blocking and spurious response in EGPRS Configuration	Yes



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\* Information for OEM integrator

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user manual of the end product.

The user manual which is provided by OEM integrators for end users must include the following information in a prominent location.

“To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.”

Label for end product must include “Contains FCC ID: PKRNVWE760 or “ A RF transmitter inside,  
FCC ID: PKRNVWE760”.