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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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Neither the E725 nor EU860D / EU870D products may 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 EU870D and EU860D 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.

### **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.

### **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.”

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

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.

### **Radiocommunications and Telecommunications Terminal Equipment Industries (R&TTE)**

This is mandatory for European operation and the directive applies to products using the radio frequency spectrum and all equipment attached to public telecommunications networks.

This product conforms to the essential requirements of the Radiocommunications and Telecommunications Terminal Equipment Directive (R&TTE) 1999/5/EC with respect to the following articles:

- 3.1a Safety
- 3.1b EMC
- 3.2 Spectrum

A notified body will determine that this device has properly demonstrated that the requirements of the directive have been met and has issued a favorable certificate of expert opinion. As such the device will bear the notified body number (TBD) after the CE Mark.

## **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

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### 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.

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.

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### Windows Platforms

The Phoenix API will interface with your top level applications and provide the abstraction of the module specifics to the upper applications. Please refer to the Phoenix API Interface Appendix for details.

Please refer to the MobiLink Phoenix SDK chapter for details on developing applications and communicating with the modem on Windows platforms.

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### Technical Support Contacts



**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 advance design and integration information to assist in the integration planning and evaluation of Novatel Wireless PCI Express Mini-cards. This document is intended to specify key components of the integration tools available for the Novatel Wireless line of PCI Express Mini-cards.

The E725, EU860D & EU870D 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 E725, EU860D and EU870D 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, EU860D, EU870D or the E725, 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 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.

### Setting Up

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The purpose of this section is to assist in the initial connection and provide the reader with instructions for how to setup and establish communication with the Novatel Wireless line of PCI Express Mini-card. The following setup guide refers to an HSDPA Mini-card for convenience of the set up discussion. The same setup is valid for both the HSDPA and EVDO Mini-cards.

Setting up and establishing communication with the Novatel Wireless PCI Express Mini-card involves:

- Connecting the PCI Express Mini-card to the computer and the Development Board.
- Establishing communication with the PCI Express Mini-card and determining the computer COM Port being used.
- Setting up and using the HyperTerminal program to communicate with the Mini-card

#### **CONNECTING THE PCI EXPRESS MINI-CARD TO THE COMPUTER AND THE DEVELOPMENT BOARD**

Insert the PCI Express Mini-card into the Development Board (Novatel Wireless Part # 01017568) by sliding the connector end of the Mini-card into the Molex connector. Push down on the opposite end of the Mini-card until the 2 black locking tabs snap into place.

Connect an A to B USB cable from the Development Board to the computer USB port. When ready to power up the modem, plug the AC wall adaptor that came with the Development board into the wall.

If desired, the Development Board can be powered by a bench top power supply. See the Hardware Development Kit section for more details.

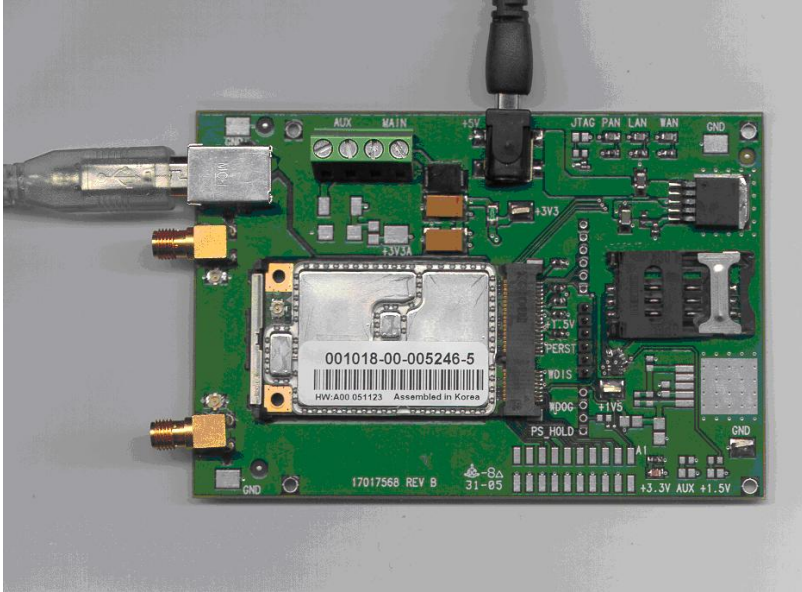


Figure 1 – Modem Interface Board and Cables

#### ESTABLISHING COMMUNICATION WITH THE PCI EXPRESS MINI-CARD AND DETERMINING THE COMPUTER COM PORT BEING USED

Once the modem is powered up and connected, you should hear a sound indicating the computer has recognized the modem.

#### Determining the Computer's Active Primary COM Port

To verify the computer's recognition of the modem and to verify which Primary COM Port it is connected to, navigate to Start\Control Panel\Phone and Modem Options and then click on the Modems tab within the Phone and Modem Options window. Refer to Figure 2 below.

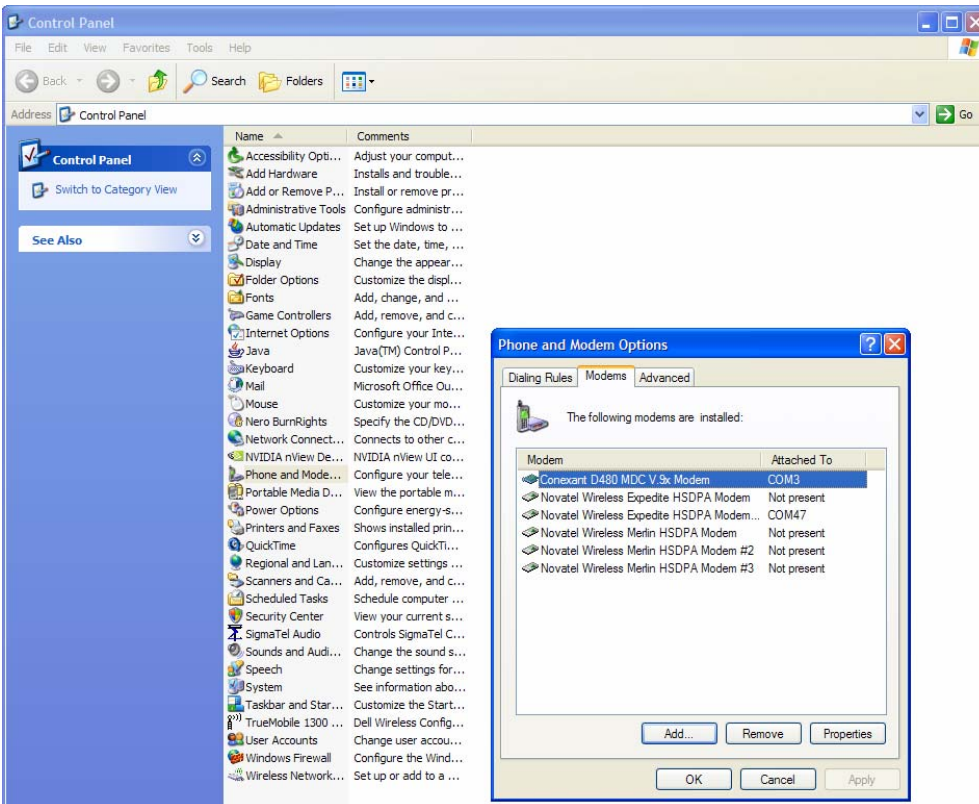


Figure 2 – Phone and Modems Options Window

Look for the Novatel Wireless Merlin HSDPA Modem item on the list. To the right of this item in the 'Attached To' column, you will see a COM port number - make a note of this Primary COM Port Number. If you do not see any COM No. for this item and you only see "Not Present", then this indicates that the modem is not being recognized and is not attached to a COM Port on the computer. In this case, make sure the USB and power cable are properly connected at both ends. If the modem has properly booted up, with no SIM in the SIM holder, the WAN LED on the Development Board should be blinking at a steady rate. If there is a SIM in the SIM Holder, the LED will be solid green.

#### Determining the Computer's Active Secondary or Status COM Port

To verify which Secondary, or Status COM Port the modem is connected to, navigate to Start\Control Panel\System. After you have double-clicked on the System Icon, click on the Hardware Tab within the System Properties window. Now click on the Device Manager tab. In the Device Manager window, click on the "+" beside Modems to expand this item. You should now see the Novatel Wireless Expedite HSDPA Modem, or something similar listed here. Refer to Figure 3 below. Now click on the "+" beside Ports (COM & LPT) to expand this item. You should now see the Novatel Wireless Expedite HSDPA Status Port (COM XX) listed here. This is the Secondary or Status COM port Number. Again, refer to Figure 3 below. Make a note of this Port Number.

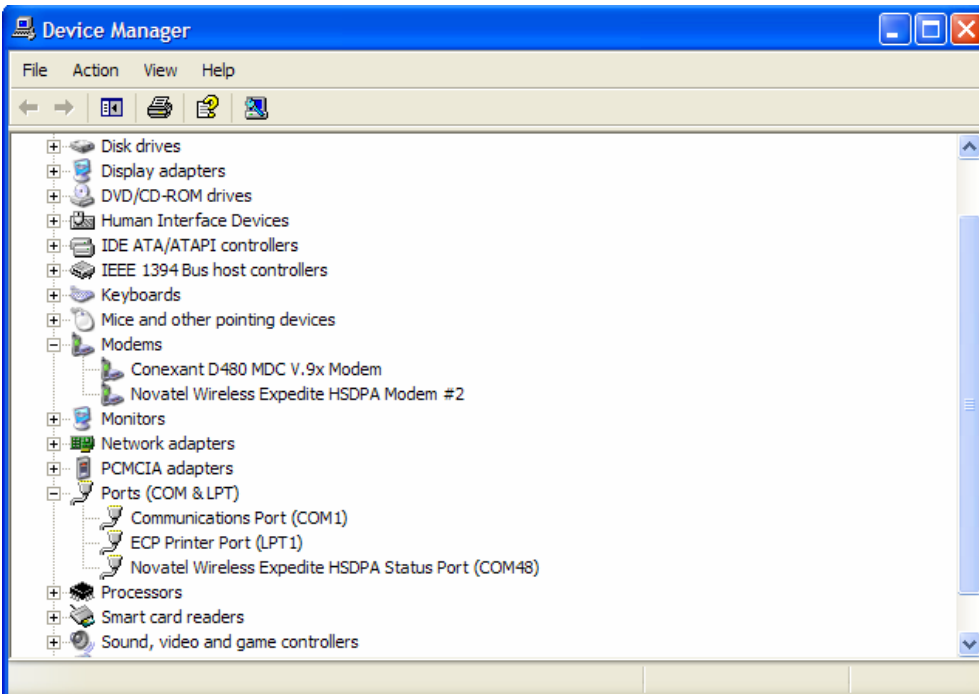


Figure 3 – Device Manager Window Showing the Computer's Active Status COM Port

#### SETTING UP HYPERTERMINAL TO COMMUNICATE WITH THE MODEM

Ensure that the Mini-card is still powered on with a USB connection to the computer, and that it is recognized by the computer as per the previous step.

Open up a HyperTerminal session by navigating to Start\All Programs\Accessories\Communications\HyperTerminal.



Type in a Connection Description title, such as the Active Primary COM Port number that was identified earlier - click 'OK'. See Figure 4 below as an example:

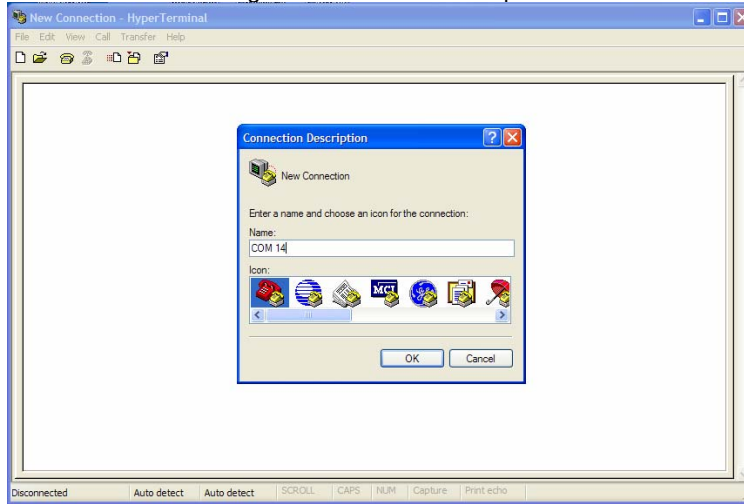


Figure 4 – HyperTerminal Connection Description Window

In the “Connect Using” pull down menu, select the proper COM port (Primary COM port number), that the computer is using to communicate with the modem, then click 'OK'. See the example in Figure 5 below:

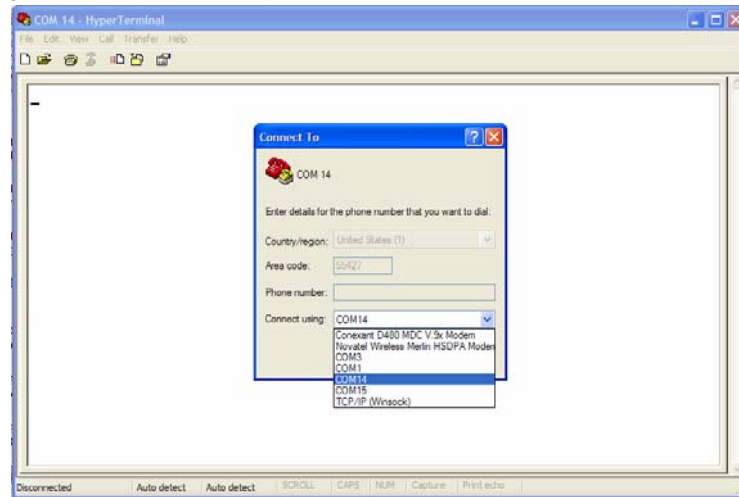


Figure 5 – HyperTerminal COM Port Selection Window

When the 'COM XX Properties' window comes up, just click on OK as there is no need to select or modify any of these settings. Refer to Figure 6 below:

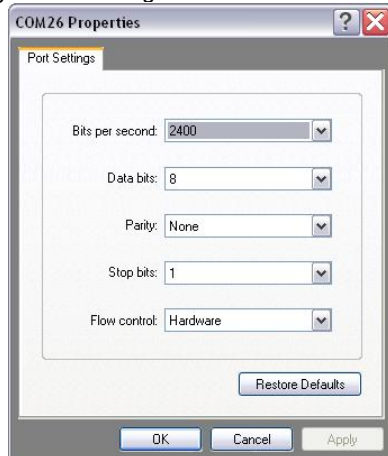


Figure 6 – HyperTerminal Properties Window

Now the modem should be automatically connected, as will be indicated in the bottom left corner of the HyperTerminal window. To further ensure there is communication to the modem, type "ATI" and press ENTER. The modem manufacturer, model number, FW revision and IMEI information will then be returned as is shown in Figure 7 below.

If no information is returned in the HyperTerminal window after typing ATI, then click on the Disconnect tab at the top of the HyperTerminal window (or click on Call\Disconnect). Reconnect by clicking on the Connect tab at the top of the HyperTerminal window (or click on Call\Connect). Now type ATE which will enable the "echo" function of the modem and therefore will allow the characters typed in the HyperTerminal window to be displayed. Once this has been done, retype the ATI command and all the modem information should now be displayed in the HyperTerminal window.

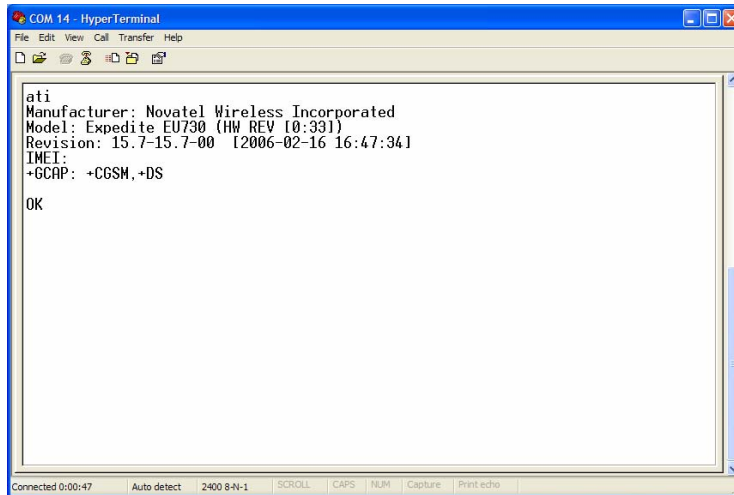


Figure 7 – HyperTerminal Communication Window



## Product Overview

The purpose of this section is to provide a high level overview of the EU860D & EU870D HSDPA and E725 EVDO module.



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### HSDPA Module Overview

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

The **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/21200 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.

---

## HSDPA Module Key Feature List

- Release 5 HSDPA Category 6
  - Triband- UMTS/HSDPA 850/1900/2100
  - Up to 3.6 Mbps DL
  - Up to 384Kbps UL
- EDGE/GPRS class 12
- Quadband- GPRS/EDGE 850/900/1800/1900
- GPS
- SIM/USIM
- MobiLink and SDK available for third party dashboards
- Advanced HSDPA equalizer support
- HSDPA Category 8 (7.2 Mbps DL) Upgrade based on Qualcomm (Rel. 4.x Dec. 2006)

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## **Network Overview**

**HSDPA** (High Speed Downlink Packet Access)

HSDPA is based on WCDMA and is standardized as part of 3GPP Release 5 WCDMA specifications. The new modulation method improves system capacity and increases user data rates in the downlink direction. Key performance improvements are:

- Adaptive modulation and coding
- Fast packet scheduling function as controlled by the Node B (base station or BTS), rather than by the radio network controller (RNC).
- Fast retransmissions (HARQ-Hybrid Automatic Repeat Request) with incremental redundancy

The WCDMA system normally carries user data over dedicated transport channels, or DCHs. HSDPA introduces a new transport channel type, High Speed Downlink Shared Channel (HS-DSCH) that makes efficient use of radio frequency resources and accounts for bursty packet data. The High Speed Downlink Shared Channel (HS-DSCH) shares multiple access codes, transmission power and also shares infrastructure hardware between several users. The radio network resources can efficiently serve a large number of users who are accessing bursty data.

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## **Application Software Overview**

### MobiLink™ connection manager

Novatel Wireless provides Mobilink™ application software. The software is defined in later Chapters.

MobiLink™ connection manager software to install and configure modem (for all supported platforms)

### Key Features

- AT Command Set Support per IS-707

- 
- Fully compatible and interoperable with current Microsoft™ OS platforms: PPC 2000/2002/HPC, Windows 98, Windows 2000, Windows ME, & Windows XP
  - Integrated drivers for Windows OS, configurable as either a modem or network card
  - PCI Express Mini-card
  - Compatibility with all major brands of PC's and PPC computing platforms
  - Sleep Mode capabilities
  - Uses common base technology shared with OEM Module
  - IS-683A compliant - Over-The-Air activation and parameter update capabilities.
  - On-line help, getting started guide, documentation
  - All software applications necessary to communicate with the PCI Express Mini Card will operate with the following platforms: PPC 200/2002/HPC, Windows 98, Windows 2000, Windows ME, & Windows XP
  - All software shall support 640x480, 640x240, and 800x600 color and monochrome displays
  - MobiLink allows the user to configure the modem easily
  - MobiLink provides diagnostic capability
  - MobiLink provides a Help menu that is Context Sensitive

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## Device Specifications

### PCI Express Mini Card

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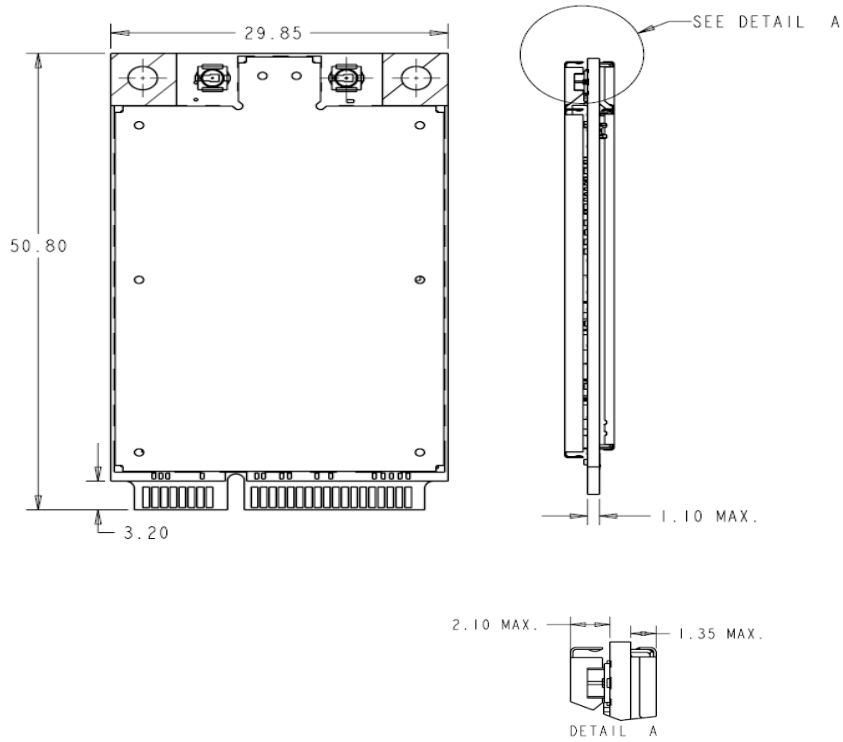
Novatel Wireless has designed a line of embedded broadband access modules around the PCI Express Mini Card Specification 1.1<sup>1</sup>. This product line provides platform developers and system integrators with the ability to enable global 3G broadband access. The governing body for PCI Express standardization 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

**Figure 2: EU860D/EU870D Module**





**Figure 3: EU860D/EU870D Module**

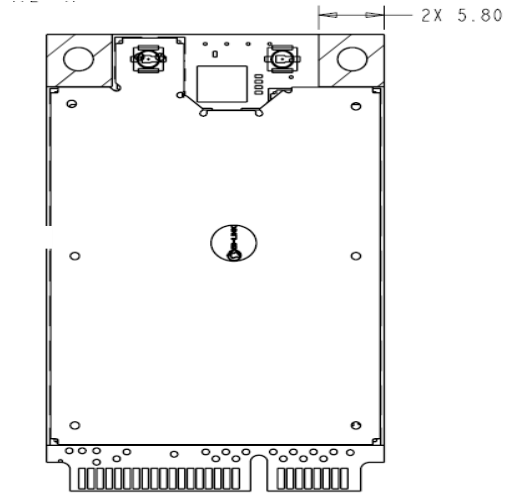
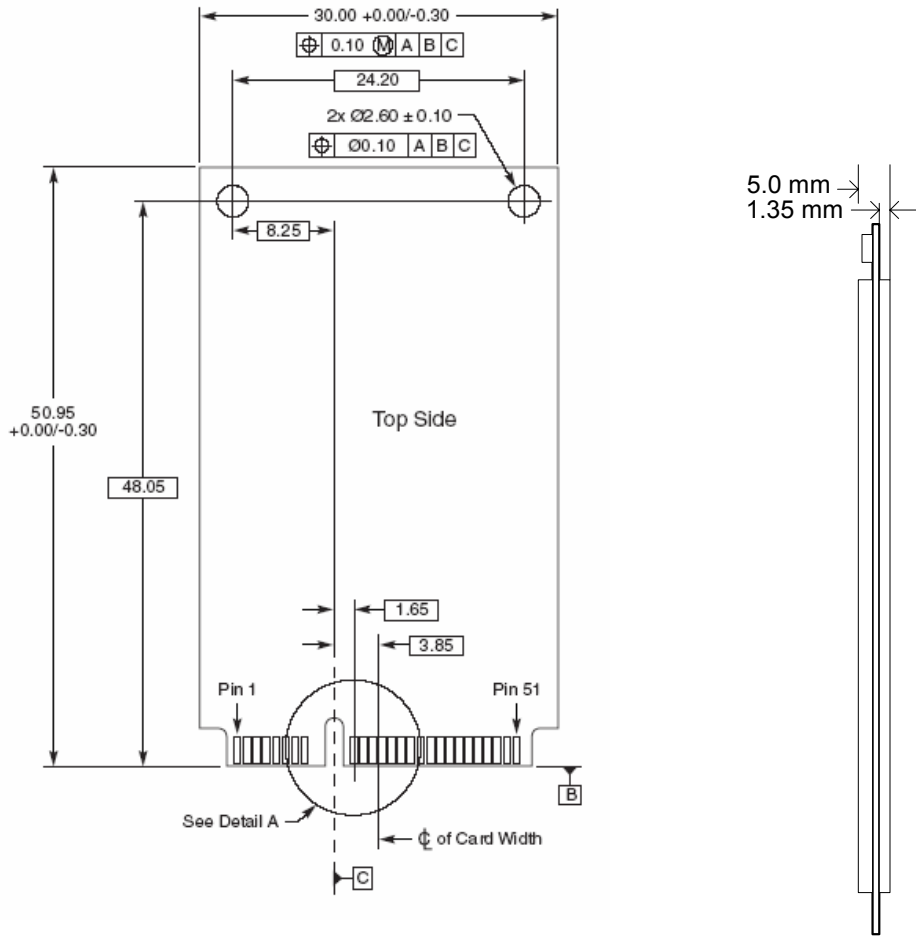


Figure 4: PCIe Minicard Module Envelope



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## Interface Specification

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### Host Interface

The E725 and EU860D/870D 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.

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 (*EU860D/EU870D only*)

A 4 line SIM interface is provided on the mini-card edge connector for the EU860D/860. 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.

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.

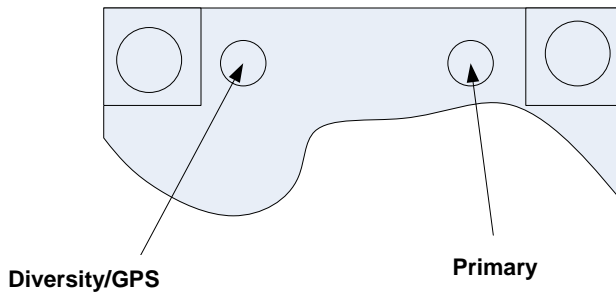
Parameter	Min	Typ	Max	Units
High-level Input voltage	1.69		2.8	V
Low-level Input voltage	-.3V		0.91	V
Schmitt hysteresis voltage	150			mV
Input high leakage current	-		1	uA
Input low leakage current with pull-up	-60		-10	uA
Input capacitance	-		7	pF

## 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.

The RF connectors shall be Hirose U.FL-R-SMT or equivalent. This connector is 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 E725 and EU860/870 are designed to be connected to an external antenna integrated into the host system. The antenna port presents a nominal 50Ω impedance.

## Diversity

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

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

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

The E725 supports receive diversity in the 800/1900 bands.

## GPS

<b>E725</b>	<b>EU860D/EU870D</b>
GPS is supported.	GPS is supported.

The EVDO Rev. A and HSDPA module receives GPS signals on the diversity antenna.

The EVDO Rev A and HSDPA module will support the following GPS features to the extent the associated application and network also supports the operation of the features identified below. Thus some of the features will not be operational until the application and/or network support is available.

### **GPS Features**

- **GPS Standalone** runs well without network
- **GPS MS-Based** gives fast fix and better sensitivity - requires periodic PDE support
- **GPS MS-Assisted** best coverage and best accuracy - requires constant PDE support
- **GPS Control Plane** network service completion
- **GPS SMS** Remote initiation with service payload for GPS tracking (planned)

### **GPS Application Services**

- Simultaneous GPS fix and data session
- Autonomous GPS with caching of ephemeris and last fix
- Interfaces
  - Serial NMEA interface pass-through
    - MobiLink API for location request, tracking
  - SMS Activated Location Responder
  - GPS Timer and Fencepost trigger
- Application
  - Common GPS client on host device
  - Popular Adapters to Browser, Map, Traffic & POI client apps
  - Vertical Market Subsystem enabler – client tracking & fixing
  - Possible Location Server / Dispatch Assist

## Environmental

The EU860D/870D and E725 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.

### EU860D/870D & E725 Environmental Specification

Parameter	E725	EU860D/860
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 E725 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.

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## Integrator Design Elements: Antenna, SIM & SMBus

### 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 EU860D/870D and E725 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.



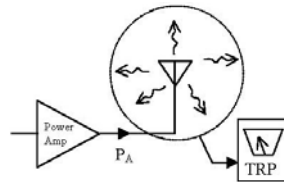
Efficiency and reduced by an estimation of the Laptop/Handheld noise. A basic spreadsheet estimator<sup>4</sup> is available from Novatel wireless and a sample is shown below.

The EU860D/870D and E725 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.

#### **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.

<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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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

## SIM Design Guidelines

### Description

The SIM contains subscriber identification, specification and authentication information; and is required to obtain service. 3.0V and 1.8V SIMs are supported. The physical size and contact location for the "Plug-in SIM" format is defined in reference [2]. Contact identification is defined in reference [7]. Electrical characteristics for a 3V SIM are defined in reference [3], and for a 1.8V SIM in reference [4]. Power sequencing and general protocol operation is defined in reference [8]. The figure below shows a "Plug-in SIM".

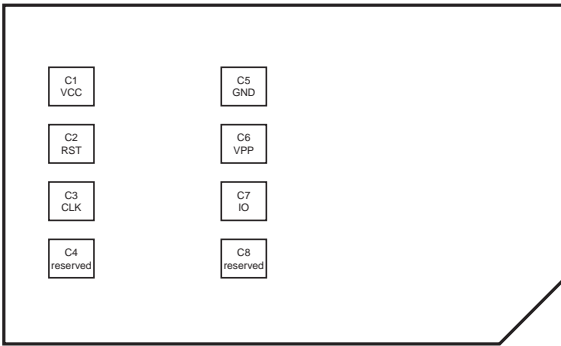


Figure 6: Plug-in SIM (shown from contact side)

### References

1. 3GPP TS 01.04: "Abbreviations and acronyms"
2. 3GPP TS 11.11: "Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface"
3. 3GPP TS 11.12: "Specification of the 3 Volt Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".
4. 3GPP TS 11.18: "Specification of the 1.8 Volt Subscriber Identity Module - Mobile Equipment (SIM - ME) interface"
5. 3GPP TS 51.010-1 "Mobile Station (MS) conformance specification; Part 1: Conformance specification"
6. ISO/IEC 7816-1: "Identification cards – Integrated circuit cards with contacts – Part 1: Physical characteristics"
7. ISO/IEC 7816-2: "Identification cards – Integrated circuit cards with contacts – Part 2: Dimensions and locations of the contacts"
8. ISO/IEC 7816-3 "Identification cards – Integrated circuit cards with contacts – Part 3: Electronic signals and transmission protocols"

### Operation of SIM interface

For the purposes of this document, the SIM interface is the interface between the SIM and the laptop at the SIM connector. The ME includes the HSDPA module and laptop SIM circuit. The SIM interface provides power, clock, reset and data to the SIM. The data is half-duplex (bi-directional but only able to transfer data in one direction at any time) circuit implemented as an open-collector signal. When data is transmitted, the ME or the SIM will pull the line to a low voltage, otherwise the line is pulled up through a resistor. The SIM operates in a command/response mode where it will only transmit data in response to a received command. One exception to this is the Answer-To-Reset (ATR) when the SIM transmits data in response to a reset.

The SIM is interrogated during the boot sequence. First the SIM interface is power sequenced for 1.8 volt operation. If 1.8 volt operation is unsuccessful then the SIM interface is power sequenced for 3.0 volt operation. Initially a large amount of data is transferred. After this the SIM is periodically polled to insure it has not been removed.

The following is a high level summary of SIM operation:

1. power cycle at 1.8 volts
2. power cycle at 3.0 volts (if required)
3. SIM transmits ATR
4. ME and SIM exchange data continuously over several seconds
5. ME polls SIM every 25 to 30 seconds

### Description of signals

The SIM interface consists of the signals listed in Table 1.

**Table 1: SIM interface signals**

Name	MiniCard pin	SIM pin
VCC	8	C1
RST	14	C2
CLK	12	C3
Reserved	not connected	C4
GND	4, 9, 15, 18, 21, 26, 27, 29, 34, 35, 40, 50	C5
VPP	16	C6
IO	10	C7
Reserved	not connected	C8

### GND

The GND signal is the ground for the ME. All voltages are referenced to this.

### VCC

VCC is supplied from the ME by a dedicated regulator. Operation is at 3V and 1.8V. See Table 2 for a summary of the 3GPP electrical requirements.

**Table 2: VCC electrical requirements**

Symbol	Conditions	Minimum	Maximum	Unit
V <sub>cc</sub>	3V operation	2.7	3.3	V
V <sub>cc</sub>	1.8V operation	1.62	1.98	V

### RST

RST is driven by the ME. A low signal indicates a reset condition. See Table 3 for a summary of the 3GPP electrical requirements.

**Table 3: RST electrical requirements**

Symbol	Conditions	Minimum	Maximum	Unit
V <sub>OH</sub>	I <sub>OHmax</sub> = + 200 $\mu$ A	0.8 x V <sub>cc</sub>	V <sub>cc</sub>	V
V <sub>OL</sub>	I <sub>OLmax</sub> = 200 $\mu$ A	0	0.2 x V <sub>cc</sub>	V
t <sub>R</sub> t <sub>F</sub>			400	$\mu$ s

## CLK

CLK is driven by the ME. It is the system clock for the SIM. It may be used by the SIM as a processor clock. The frequency of this signal is from 1 to 4 MHz. The clock is not continuously running and is stopped in between data transfers.

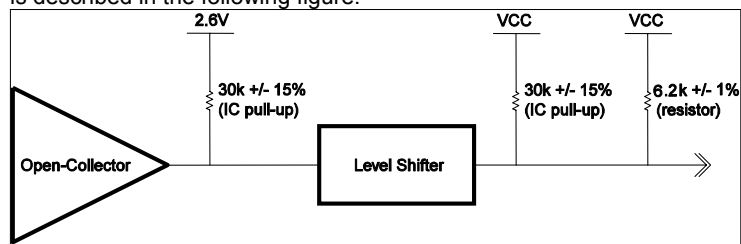
See Table 4 for a summary of the 3GPP electrical requirements.

**Table 4: CLK electrical requirements**

Symbol	Conditions	Minimum	Maximum	Unit
$V_{OH}$	$I_{OHmax} = + 20 \mu A$	$0.7 \times V_{CC}$	$V_{CC}$	V
$V_{OL}$	$I_{OLmax} = - 20 \mu A$	0	$0.2 \times V_{CC}$	V
$t_R$ $t_F$			50	ns

## IO

IO is the bi-directional data signal. The ME may drive this signal low, or may pull it up to VCC. The SIM may drive this signal low, or it may pull it up to VCC. The pull-up on the HSDPA module is described in the following figure.



**Figure 7: IO driver and pull-ups**

The IO signal is much slower than the CLK signal. The default bit time is 372 clock periods. Each data word is 10 bit times; a start bit, eight (8) data bits, and a parity bit. The data signal may be direct convention (high voltage is a binary 1, LSB sent first) or inverse convention (low voltage is a binary 1, MSB sent first) depending on the ATR. See Table 5 for a summary of the 3GPP electrical requirements.

**Table 5: IO electrical requirements**

Symbol	Conditions	Minimum	Maximum	Unit
$V_{IH}$	$I_{IHmax} = \pm 20 \mu A$	$0.7 \times V_{CC}$	$V_{CC} + 0.3$	V
$V_{IL}$	$I_{ILmax} = + 1 mA$	- 0.3	$0.2 \times V_{CC}$	V
$V_{OH}$	$I_{OHmax} = + 20 \mu A$	$0.7 \times V_{CC}$	$V_{CC}$	V
$V_{OL}$	$V_{CC} = 3V, I_{OLmax} = - 1mA$	0	0.4	V
$V_{OL}$	$V_{CC} = 1.8V, I_{OLmax} = - 1mA$	0	0.3	V
$t_R$ $t_F$			1	$\mu s$

## VPP

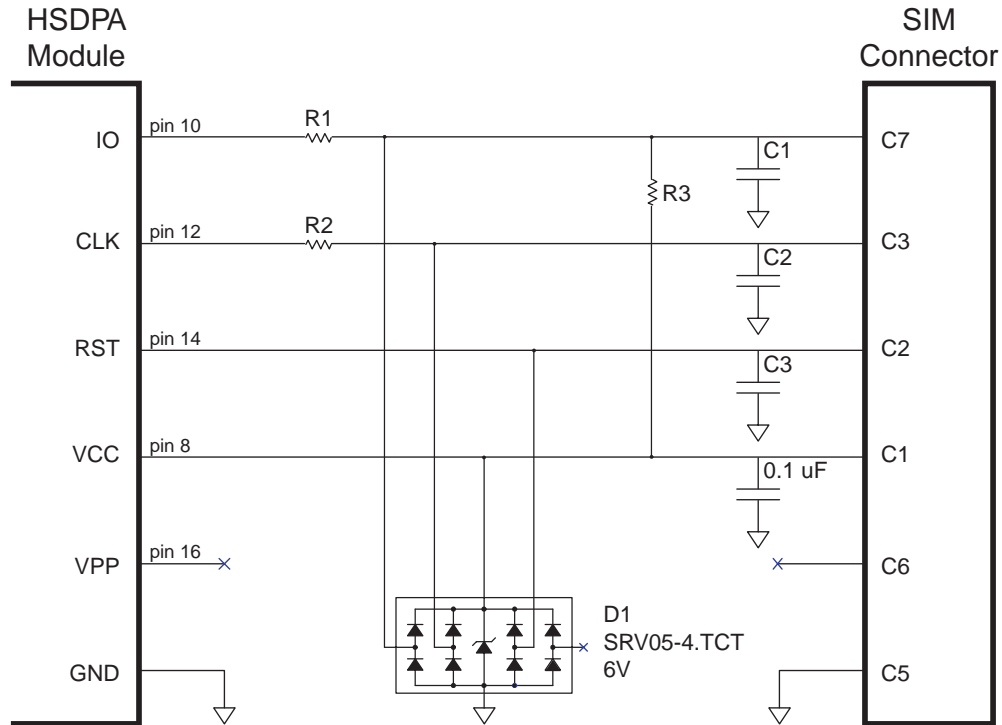
VPP is the programming voltage. It is not used and the SIM connector pin should not be connected. The module pin is not connected.

## Reserved

The reserved pins should not be connected on the SIM connector. The SIM connector need not have contacts at these locations.

## Implementation

Refer to the figure below for the recommended circuit.



**Figure 8: Reference circuit**

### C1, C2, C3

C1, C2 and C3 are not to be populated. They exist if additional filtering is required. These components should be placed close to the SIM connector.

### R1

R1 should be zero ohms. It exists if additional filtering is required.

### R2

R2 should be zero ohms. It exists if additional filtering is required.

### R3

R3 should not be populated. It exists if pull-up adjustments are required.

## D1

D1 should be a low capacitance ESD diode array (5 pF or less). It is important to minimize the capacitance on the IO line. D1 should be placed close to the SIM connector. There is no ESD protection on the HSDPA module. It is recommended that the ESD protection meet IEC61000-4-2, level 4 ( $\pm 15$ kV air,  $\pm 8$ kV contact).

## Signal routing

The CLK line is a high speed digital signal and care must be taken to insure it is isolated from the other signals. A guard trace between it and the other signals should be used if they are to be adjacent for any length. A multi-layer PCB with a ground plane should be used. Traces should be as short as possible. All the SIM interface signals should be routed carefully to avoid being corrupted by each other or external signals.

## IO signal capacitance

The rise time of the IO signal is determined by the total capacitance on the line and the pull-up resistance. The module has a maximum capacitance of 50 pF and the SIM is considered to have a maximum capacitance of 30 pF. The laptop capacitance on the IO signal (including connectors) should be as targeted to be lower than 30 pF. Additional capacitance may be required to reduce noise, however the IO circuit rise time limit of 1  $\mu$ s must be considered.

## **IO signal resistance**

The SIM may also have a pull-up on the IO signal, which would have the effect of injecting up to 1 mA into the ME when the ME is transmitting a low level. Series resistance of the IO signal must be kept very low as the voltage drop across it due to the injected current may cause the output voltage to rise above the voltage output low specification.

## **Certification**

As the SIM interface is unique to each laptop, each laptop must pass several test cases to obtain certification. The SIM electrical test cases are specified in section 27.17.2 in reference [5]. The following is a summary of these tests:

- **27.17.2.1.1 Electrical tests on contact C1 (VCC) – Test 1**

- e.1) The voltage on contact C1 of the SIM/ME interface shall be  $3V \pm 10\%$  for Icc up to 6 mA when the interface is in 3V operation mode.
- e.2) The voltage on contact C1 of the SIM/ME interface shall be  $1.8V \pm 10\%$  for Icc up to 4 mA when the interface is in 1.8V operation mode.

- **27.17.2.1.2 Electrical tests on contact C1 (VCC) – Test 2**

- e.1) The voltage on contact C1 of the SIM/ME interface shall be  $3V \pm 10\%$  for spikes in the current consumption with a maximum charge of 12 nAs with no more than 400 ns duration and an amplitude of at most 60 mA when the interface is in 3V operation mode.
- e.2) The voltage on contact C1 of the SIM/ME interface shall be  $1.8V \pm 10\%$  for spikes in the current consumption with a maximum charge of 12 nAs with no more than 400 ns duration and an amplitude of at most 60 mA when the interface is in 1.8V operation mode.

The following current spikes are applied (The specified spike durations are measured at 50 % of the spike amplitude):

- 1) continuous spikes:  
current amplitude 12 mA  
current offset 0 mA  
Duration 100 ns  
Pause 100 ns
  - 2) continuous spikes:  
current 12 mA  
current offset 0 mA  
Duration 400 ns  
Pause 400 ns
  - 3) continuous spikes:  
current amplitude 9 mA  
current offset 3 mA  
(i.e. maximum amplitude = 3 mA + 9 mA = 12 mA)  
Duration 150 ns  
Pause 300 ns
  - 4) random spikes:  
current amplitude 60 mA  
current offset 0 mA  
Duration 200 ns  
Pause between 0.1 ms and 500 ms, randomly varied
  - 5) random spikes:  
current amplitude 30 mA  
current offset 0 mA  
Duration 400 ns  
Pause between 0.1 ms and 500 ms, randomly varied
  - 6) random spikes  
current amplitude 57 mA  
current offset 3 mA  
(i.e. maximum amplitude = 3 mA + 57 mA = 60 mA)  
Duration 200 ns  
Pause between 0.1 ms and 500 ms, randomly varied
- **27.17.2.2 Electrical tests on contact C2 (RST)**
    - e.1)The voltage on contact C2 (RST) of the SIM/ME interface shall be between 0.3V and +0.7V for a current of 200  $\mu$ A in low state and between 2.15 V and  $V_{cc} + 0.3V$  for a current of +200  $\mu$ A in high state when the interface is in 3V operation mode.
    - e.2)The voltage on contact C2 (RST) of the SIM/ME interface shall be between 0.3V and +0.47V for a current of 200  $\mu$ A in low state and between 1.3 V and  $V_{cc} + 0.3V$  for a current of +200  $\mu$ A in high state when the interface is in 1.8V operation mode.
  - **27.17.2.3 Electrical tests on contact C3 (CLK)**



- e.1) The voltage on contact C3 (CLK) of the SIM/ME interface shall be between 0.3V and +0.47V for a current of 20  $\mu$ A in low state and between 1.21V and  $V_{cc} + 0.3V$  for a current of +20  $\mu$ A in high state when the interface is in 1.8V operation mode.
  - e.2) The rise and the fall time of the clock signal shall not exceed 50 ns when the interface is in 1.8V operation mode.
  - e.3) The cycle ratio of the clock signal shall be between 40 % and 60 % of the period, in steady state when the interface is in 1.8V operation mode.
  - e.4) The frequency of the clock signal shall be between 1 MHz and 4 MHz when the interface is in 1.8V operation mode.
  - e.5) The voltage on contact C3 (CLK) of the SIM/ME interface shall be between 0.3V and +0.6V for a current of 20  $\mu$ A in low state and between 1.9V and  $V_{cc} + 0.3V$  for a current of +20  $\mu$ A in high state when the interface is in 3V operation mode.
  - e.6) The rise and the fall time of the clock signal shall not exceed 50 ns when the interface is in 3V operation mode.
  - e.7) The cycle ratio of the clock signal shall be between 40 % and 60 % of the period, in steady state when the interface is in 3V operation mode.
  - e.8) The frequency of the clock signal shall be between 1 MHz and 4 MHz when the interface is in 3V operation mode.
- **27.17.2.5 Electrical tests on contact C7 (IO)**
    - e.1) ME receiving state A (low state):  
With an imposed voltage of 0V the current flowing out of the ME shall not exceed 1 mA when the ME is in 3V operation mode.
    - e.2) ME transmitting state A (low state):  
The voltage shall be between 0.3V and 0.4V when a current of 1 mA flowing into the ME is applied when the ME is in 3V operation mode.
    - e.3) ME transmitting or receiving state Z (high state):  
The voltage shall be between  $0.7 \cdot V_{cc}$  and  $V_{cc} + 0.3V$  when a current of 20  $\mu$ A flowing out of the ME is applied when the ME is in 3V operation mode.
    - e.4) The rise time and the fall time of the I/O signal shall not exceed 1  $\mu$ s when the ME is in 3V operation mode.
    - e.5) ME receiving state A (low state):  
With an imposed voltage of 0V the current flowing out of the ME shall not exceed 1 mA when the ME is in 1.8V operation mode.
    - e.6) ME transmitting state A (low state):  
The voltage shall be between 0.3V and 0.3V when a current of 1 mA flowing into the ME is applied when the ME is in 1.8V operation mode.
    - e.7) ME transmitting or receiving state Z (high state):  
The voltage shall be between  $0.7 \cdot V_{cc}$  and  $V_{cc} + 0.3V$  when a current of 20  $\mu$ A flowing out of the ME is applied when the ME is in 1.8V operation mode.
    - e.8) The rise time and the fall time of the I/O signal shall not exceed 1  $\mu$ s when the ME is in 1.8V operation mode.

---

## SM Bus Design Guidelines

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### Introduction

This section will describe the SMBus interface parameters ensuring interoperability with Novatel's PCI Express Mini Cards the SM Bus interface.

The SMBus is a two-wire interface through which various system components can communicate with each other and the rest of the system. It is based on the principles of operation of I<sup>2</sup>C. See the PCI Express Card Electromechanical Specification for more details on the functional requirements for the SMBus.

The SMB\_CLK signal and the SMB\_DAT signal are available on pins 30 and 32 of the PCI Express Mini connector.

This interface will support a subset of the specification as detailed in this section.

SMBus is an i2c based protocol that will drive a slave device and report various data regarding mobile status or real-time e-mail to it, in accordance to the SMBus protocol specification. It is important to note that the **EU860D/EU870D & E725 PCI Express Mini-card acts as a bus master and not as a slave.**

### I2C Controller

The controller is an I2C-compliant, master-only device. The controller can access all available I2C slaves on the bus, but cannot be accessed by any other masters on the bus.

Both SDA and SCL are bi-directional lines, connected to a positive supply voltage via a current-source or pull-up resistor. When the bus is free, both lines are HIGH. The output stages of devices connected to the bus must have an open-drain or open-collector to perform the wired-AND function.

A simplified version of the I2C bus operation is as follows:

- The master generates a START condition, signaling all ICs on the bus to listen for data.
- The master writes a 7-bit address, followed by a read/write bit to select the device as a transmitter or receiver.
- The receiver sends an acknowledge bit over the bus. The transmitter must read this bit to determine whether or not the addressed device is on the bus.
- Depending on the value of the read/write bit, any number of 8-bit messages can be transmitted or received by the master. These messages are specific to the I2C device used. After 8 message bits are written to the bus, the transmitter will receive an acknowledge bit. This message and acknowledge transfer continues until the entire message is transmitted.
- The message is terminated by the master with a STOP condition. This frees the bus for the next master to begin communications.
- Data on the I2C-bus can be transferred at rates of up to 100 kbps in the Standard-mode,
- The number of interfaces connected to the bus is solely dependent on the bus capacitance limit of 400 pF.

## HW Parameters

The System Management Bus (SMBus) is a two-wire interface through which various system component chips can communicate with each other and with the rest of the system. It is based on the principles of operation of I<sup>2</sup>C.

The reader is referred to SMBus reference as described in the *System Management Bus (SMBus) Specification, Version 2.0* for further details on its operation.

The peripheral board communicating to the SMBus must provide pull-ups to 2.6V. It is recommended that a 2.7 K ohm pull connected to 2.6 Volt rail.

### DC parameters

Symbol	Parameter	Limits			Units
		Min	Max		
VIL	Data, Clock Input Low Voltage		- 0.3	0.86	V
VIH	Data, Clock Input High Voltage		1.78	2.77	V
VOL	Data, Clock Output Low Voltage		0	0.45	V
I <sub>LEAK</sub>	Input Leakage	--	±5		µA
VDD	Nominal bus voltage	2.47	2.73		V

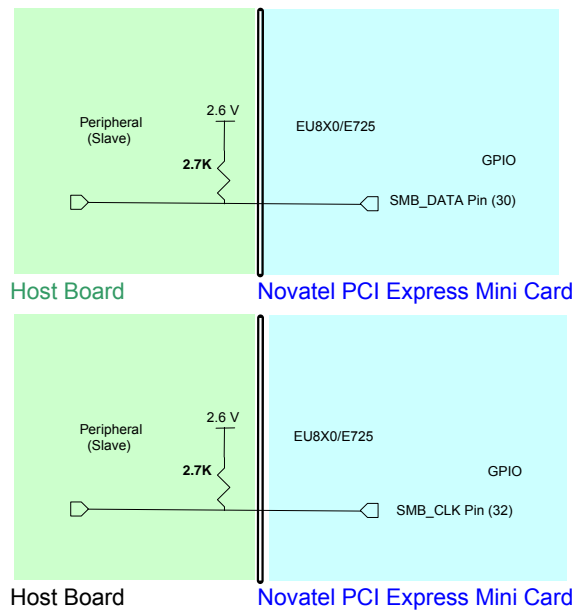
**Table 2: SMBus DC specification**

### SM Bus interface Board

Pull up resistors on both lines (SMB\_CLK and SMB\_DATA) and solid ground connections are necessary. Without proper pull up values and good ground and instability in communication will be experienced.

As illustrated below it is recommended that a 2.7 K ohm pull connected to 2.6 Volt rail.

**Figure 9: SM Pull-up Configuration**



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## MobiLink Connection Manager

### Overview

The Novatel Wireless MobiLink™ Communications Software Suite is a family of wireless connectivity applications that connect mobile devices using wireless wide area networks (WWAN) as well as WiFi and Ethernet in a single application to allow quick and easy access to email, the Internet and corporate networks anytime, anywhere. With MobiLink and a wide area wireless device, mobile users can stay productive and connected to customers and colleagues while out of the office. MobiLink is optimally engineered to work with all of Novatel Wireless' Wireless Modems for best in class 3G wireless broadband access solutions.

The MobiLink Communications Software Suite of applications contains a messaging Client that manages 2 way SMS operations, an address book Client that manages contacts and phone number, connection manager that manages the connectivity, and a customization utility to manage and generate install customization settings. The following section will detail the features of each application.

### Purpose

This section provides high level user interface information regarding the appearance and operation of the **MobiLink™** Connection Manager application developed for Windows 2000, XP Pro, and XP Home.

### Applicable Documents

All software names and version numbers displayed should meet the requirements outlined in the **Consistency & Naming Conventions Requirements Document**. This document also covers the requirements for the desktop, including the necessary icons and the use of the Start menu.

For more details on meeting the requirements for Microsoft™ Windows certification, refer to the document entitled, **Application Specification for Microsoft™ Windows 2000 and Windows XP for Desktop Applications**, which can be found on Microsoft™'s web site.

## **GENERAL FEATURES**

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### User Interface Functionality

The first design principle for MobiLink applications is that the basic information and controls needed for day-to-day operations are quickly and easily accessible while less frequently used functions are located deeper in the menu system. The user interface is designed to be intuitive to use and will not require a large learning curve for the average user. The second design principle for MobiLink is to be easily customizable in order to be able to meet the various requirements of a global market.

### Layout

The general layout of the main windows is designed to display important information for connectivity while making it easy to navigate to other functions. The main function such as mobile status and signal strength display is shown in the main window. The connection button is prominently displayed and easily accessible. The main MobiLink display is shown below.

**Figure 10: Main MobiLink Display**

The menu button is located on the left upper corner and contains additional functionality such as settings and configurations. The menu system is designed as a button that when clicked, shows a drop down list of other options. Because it's a drop down list, it allows for expansion of functions as well as reduces the clutter on the main display.

The Device Links area is an active navigation bar that shows status for all the three types of connections as well as a clickable area to shift the main display information to the specific type of connection

The Dashboard Area in the layout is designed as a launching area for other applications. The default applications in the current design are internet browser, SMS Client, Addressbook, and Help file. Other applications can be launched.

The Active Profile Selection is a list that allows for easy access to choose the active profile to use for connection. For 3G, this list is a list of connection profiles while for WiFi, this is a list of access points found. For WiFi, this list also shows the signal quality and whether the access point is encrypted.

Lastly, there are the standard minimize and close buttons that are the main stay of any application. The minimize button hides the application as a tray icon and the close button gracefully closes the application.

### Mouse Over

Mouse over is a feature of the application that displays helpful hint about the function of the application as the mouse is moved over an active area of the application such as the menu button.

### Snap to Edge

Snap to edge is a feature that makes the MobiLink application window snap to the sides of the Windows desktop as the user drags the application close to the edge.

## Hot Swapping

The design of MobiLink allows for hot swapping of the 3G device. Users can plug and unplug a 3G wireless device and MobiLink will automatically recognize the technology and dynamically change the display to show the relevant information.

## Skinning Customization

Due to the software design and the underlying graphics engine used, the main “skin” of MobiLink is completely customizable. The skin is contained in separate resource files that can be easily changed for branding or function. One design is shown below and more can be developed.

**Figure 11: Skin Design**



## Localization

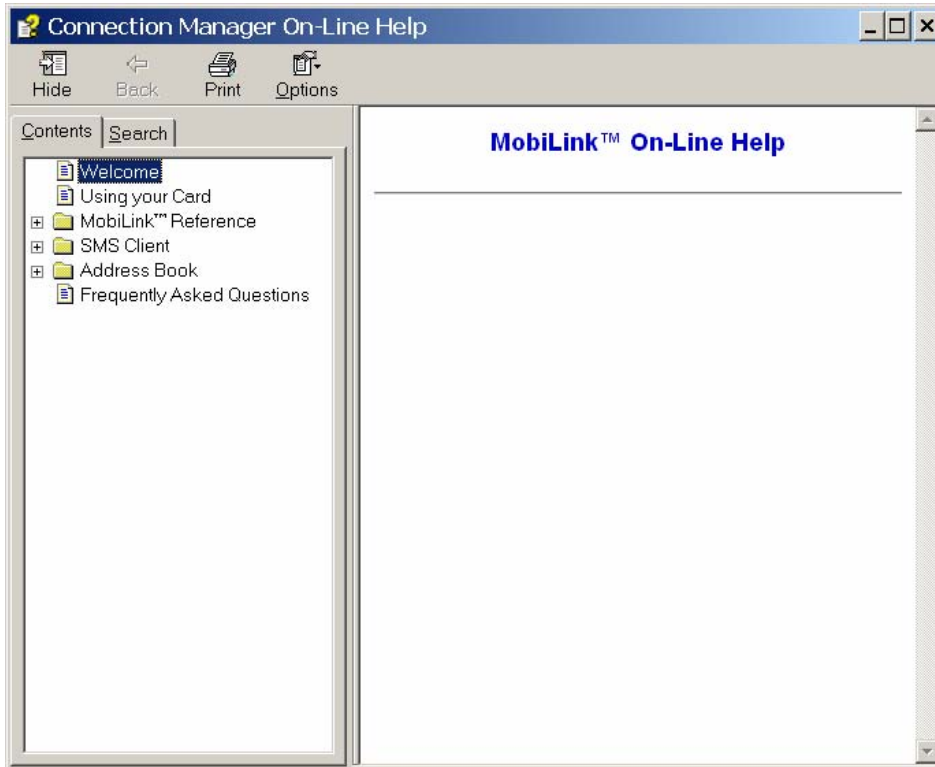
It is the intent of the MobiLink™ connection manager design to be able to support localization. Double byte Unicode is used and all the text used by MobiLink is kept in resource files that can easily be translated and added. Currently MobiLink supports the following languages:

- Chinese Simplified
- Chinese Traditional
- Danish
- English
- French
- German
- Italian
- Spanish
- Swedish
- Polish

## File

The MobiLink™ connection manager shall contain a help file that can be accessed through a help button or via F1 key. The help file is also localizable and is in HTML format as shown below:

**Figure 12: On-Line Help**



## MOBILINK™ FEATURES

The following sections describe the various features of MobiLink.

### Main Display Window

The main display area of MobiLink is used for status indication of the different types of connections. The following information is displayed.

**Figure 13: Status Indication**



**Status Indication**

Number Reference	Status Information	Description
1	Signal Strength Bar	This is the quality of the signal for the selected
2	Connection Status	This is a text indicating the connection status
3	Connect Duration	This indicates the number of hours, minutes, and seconds the current connection has been up
4	Bytes Out/Packets Out	This indicates the number of bytes sent for the current connection
Number Reference	Status Information	Description



5	Bytes In/Packet In	This indicates the number of bytes received for the current connection
6	Network Name	For UMTS/HSDPA, this would show the network name received from the AT+COPS command
7	Profile List	This is the list of supported profiles that contains the connection settings such as username and password and QoS for 3G. This is a list of the 3G profiles for the 3G networks and a list of WiFi profiles for the WiFi network. The displayed profile is the active profile.
8	Indicators	The indicators are icons that show additional status of the 3G wireless. Each indicator will be described below.
9	Connection Type Selection Bar	This is a navigation bar that selects which connection information is displayed in the main window. As the connection is selected, the main window will slide to show the right information. Each of the connection icons for this navigation bar also shows the signal strength of the respective connection.

The connection navigation bar was added to support the universal connection management functionality. By having a navigation bar, the user is presented with just the information that is required for the connection of interest. The pictures below show the three views for each connection type.

**Figure 14: 3G Wireless View**



With the 3G Wireless view, connection button can be used to connect to the chosen profile displayed. The status icons for 3G will be displayed on the top right corner and when connected, byte count and time displayed will be shown. The vertical bar next to the navigation bar indicates which view is currently active. When the user clicks on the WiFi navigation button, the WiFi view will be shown.

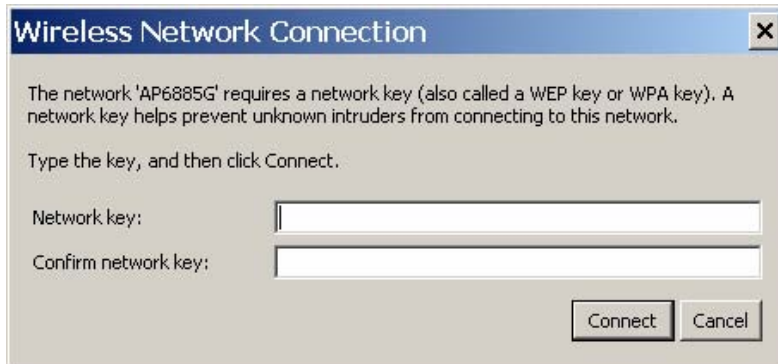
**Figure 15: WiFi View**



The WiFi view does not have a connection button since WiFi is a connectionless adaptor. The view does show signal strength, packet count, and connection time as well as connection status. Since MobiLink's WiFi is developed using Windows zero configuration, MobiLink WiFi control can coexist with Windows wireless network connection. The default hotspot is shown in the selection list in the same place as the 3G profile list. The list of hotspots is dynamically generated based on a WiFi network scan of the area. Users can chose to make another hotspot active by clicking on the selection list shown below.

**Figure 16: HotSpot Activation**

The connection list displays all the available hotspots seen by the WiFi adaptor. The list is arranged in alphabetical order and the signal level for each is shown on the side. Also, if the hotspot is WEP protected, a lock icon will be shown. To change hotspot, users can select one from the list. If the hotspot is WEP protected the following dialog will be displayed to query for the network key.

**Figure 17: Network Connection**

Lastly, the user can view the Ethernet connection by clicking on the Ethernet navigation bar icon.

Figure 18: Ethernet View







The Ethernet view shows the connection status, the packet count, and the connection duration.

### Indicators

3G indicators are shown on the right upper corner of the main status display. The design of these indicators is based on standard 3G indicators used on mobile devices. The following table describes all the indicators.

#### 3G Indicators

Indicator	Status/Description
	3G radio is roaming
	3G in dormant mode (May not be applicable for all MAs)
	New SMS is available
	3G device is locked
WWAN Network	<p>This is the type of WWAN protocol that is acquired. The types are:</p> <ul style="list-style-type: none"> <li>• HSDPA</li> <li>• GPRS</li> <li>• IS95a</li> <li>• UMTS</li> <li>• GSM</li> <li>• 1XRTT</li> <li>• EVDO</li> </ul>

## Connect/Disconnect Button

Since the main purpose of MobiLink's connection manager is for connecting the user to the internet, the connection button is prominently placed. The Connection button is used to initiate a 3G data connection. The connection button is not used for WiFi or Ethernet since the network adaptors are connectionless and will automatically connect as long as there is a valid connection.

**Figure 19: Connection Button**



## Menu

When the Menu button is clicked, the following menu subjects are displayed:

### **Menu Subjects**

Menu Item	Description
Profile Manager	This menu item opens up the dialog for creating, editing, and deleting profiles
Configuration	This menu item opens up a dialog for changing MobiLink settings
Properties	This menu item opens up a dialog that displays the properties of the 3G modem
Report	This menu item opens up a dialog that displays the connections statistics and connection history
Transparency	This menu item is to set the application display transparency. This feature allows the desktop items below the application to be shown

	through the transparency
About	This menu item brings up information about the MobiLink application
Exit	This menu item will quit the MobiLink application

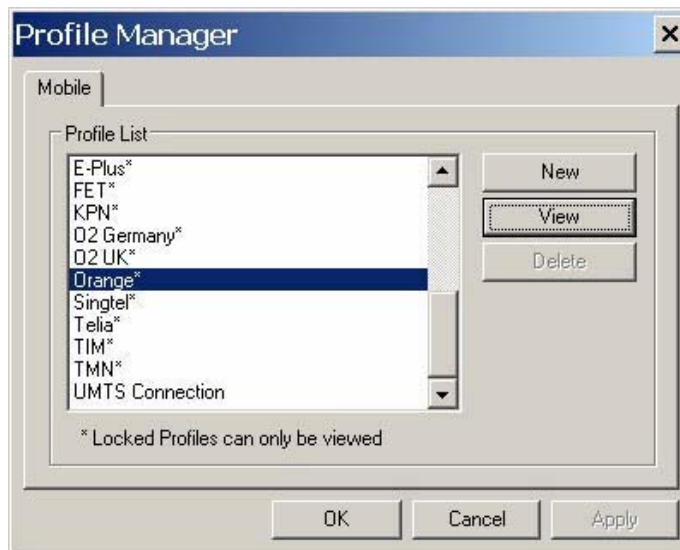
### **Profile Manager**

The profile manager allows the user to manage the connection profiles for both the 3G connection and WiFi connection. The user can create a profile using the New, edit or view the profile, and delete a profile.

#### **3G Wireless Profiles**

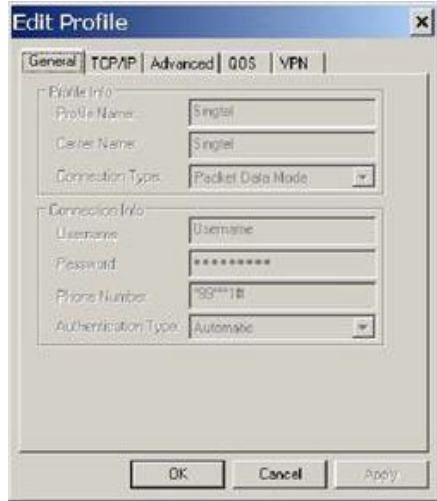
The first tab shows the 3G wireless profiles as shown below.

**Figure 20: 3G Profiles**



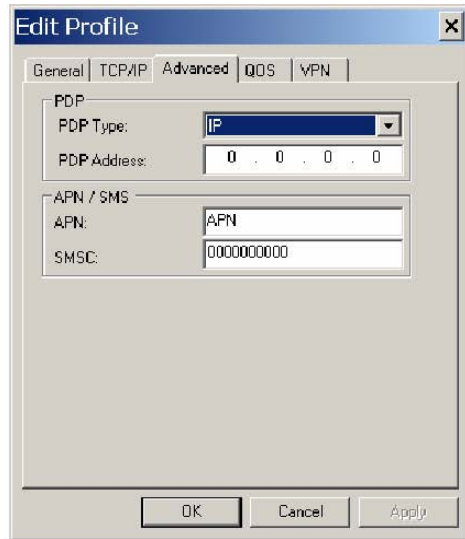
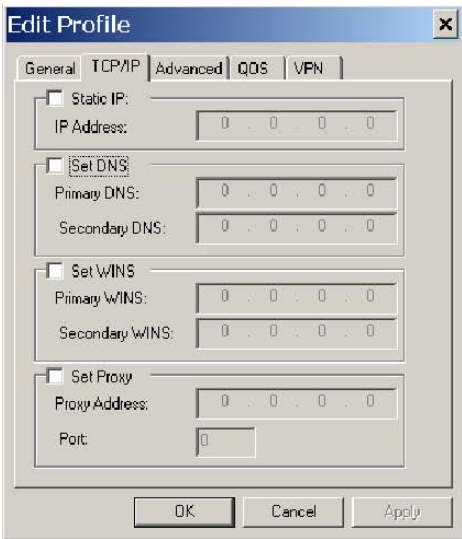
The wireless profiles can be selected for viewing in the case of a locked profile and for editing in the case of an unlocked profile. Locked profiles are preset and can not be deleted or altered. This is to reduce the incidence of connection problems related to incorrect settings due to user error. The dialog below shows the actual profile settings. For locked profiles, the settings are grayed out and cannot be modified.

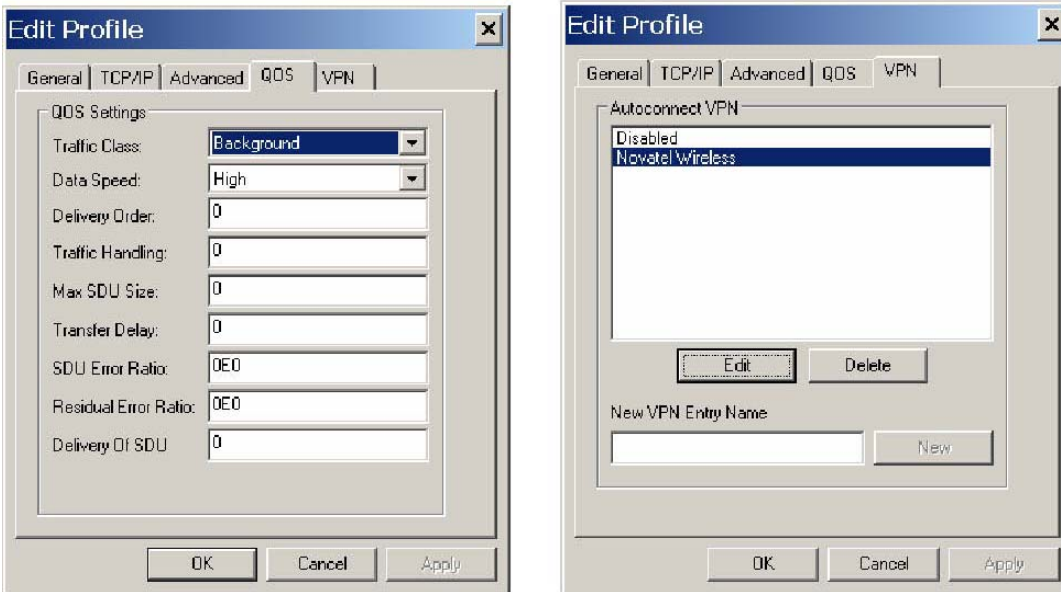
Figure 21: Profile Settings



The profile settings are categorized under different tabs and can be different for UMTS and CDMA. In the case of CDMA, the QoS tab does not apply. The following screens show the various settings under each tab.

Figure 22: Different Tab Settings





When changes are made to any of the tabs, the user must click the Apply button to effect the changes. Cancel can be clicked to cancel the settings. The exception is the on the last VPN tab. When creating a new VPN, the VPN entry is created when the user clicks the New button with an entry name. The apply button is used to change the associated VPN for the profile. VPN association is used to automatically establish a VPN session after a successful 3G connection.

When creating a profile by clicking on the New button, the profile wizard is used to guide the user through some simple steps for creating a new profile. The advanced settings are preset based on a template profile for the carrier network and hidden from the user. In the rare case where advanced parameters need to be changed, the user can then select the newly created profile and click on Edit to edit the parameters.

**Figure 23: Profile Wizard Step 1**





**Figure 24: Profile Wizard Step #2**

Profile Wizard Step 2 of 3

Phone Number:

Please enter the following information that will be needed to log on to the network.

< Back   Next >   Cancel

**Figure 25: Profile Wizard Step #3**

Profile Wizard Step 3 of 3

Username:

Password:

Confirm Password:

< Back   Finish   Cancel

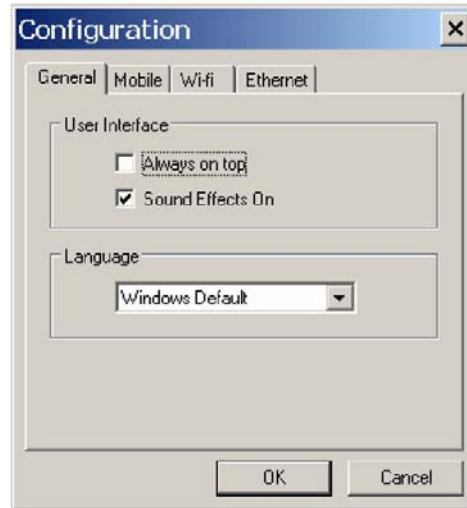
**WiFi Profiles**

TBD

**Configuration**

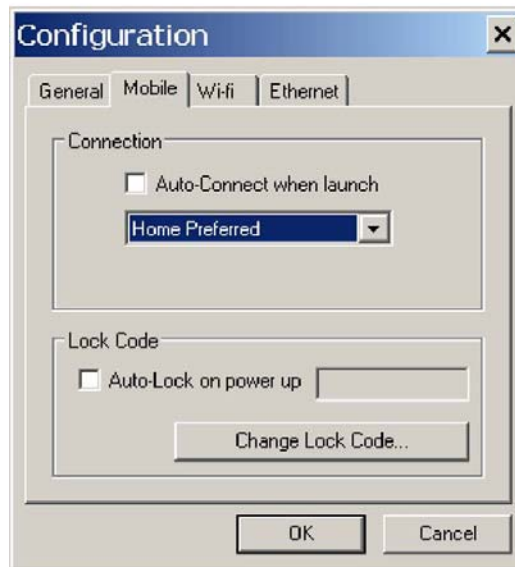
The configuration menu has all the available settings for MobiLink. The configuration window is broken down in to four functional tabs. The General tab is for the user interface settings and language selection. The Mobile tab is used to set parameters for the 3G device. The WiFi tab has settings for WiFi adaptor, and the Ethernet tab is used to set the Ethernet adaptor. Each of the tabs is shown below.

Figure 26: General Tab

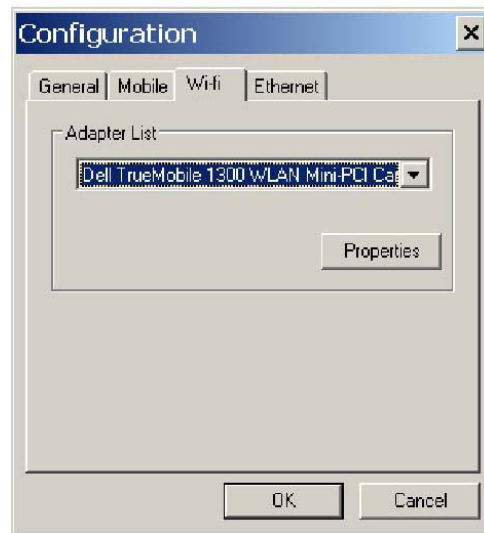


#### General Tab Features

General Tab Feature	Description
Always on top	When checked, the application is always the top most application on the desktop
Sound Effects On	When checked, sounds will be played on user actions
Language	This is a selection list for choosing the language to be used for MobiLink. Windows Default will base the language on what Windows uses as the native language

**Figure 27: Mobile Tab****Mobile Tab Features**

Feature	Description
Auto-Connect when launch	This feature is for MobiLink to automatically connect to the network when launched
Network Selection	This selection is used to select the network preference. For CDMA, this is to select the operating network and for UMTS/HSDPA, it's for selecting the radio access technology
Auto-Lock on power up	Check to lock the SIM upon power up. A 4 to 8 digits code must be supplied to turn on and off the auto lock feature.
Change Lock Code	Click this button to change the lock code. This button is only active if the auto-lock SIM feature is turned on.

**Figure 28: WiFi Tab**

The WiFi tab allows user to choose the WiFi adaptor from a list of detected adaptors. Also, the adaptor properties can be modified by clicking on the properties button. The wireless adaptor properties window is shown below.

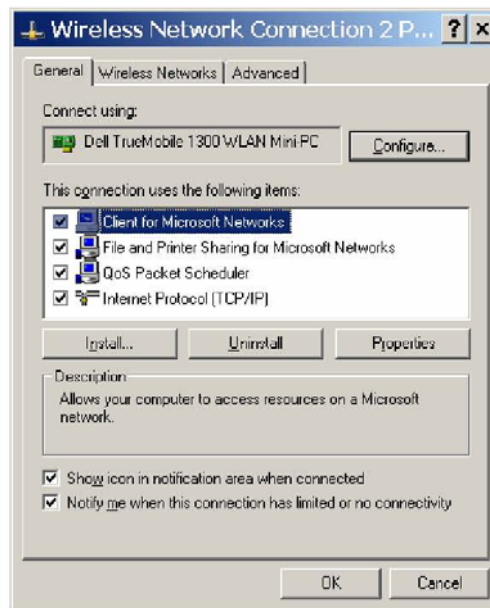
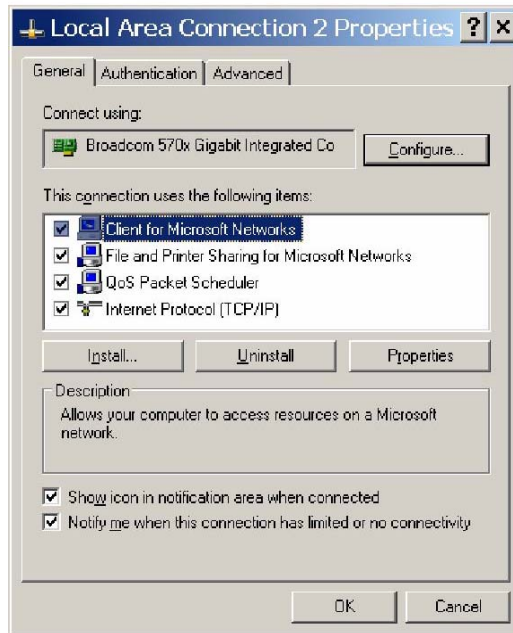
**Figure 29: WAP Window**

Figure 30: Ethernet Tab



The Ethernet tab allows user to choose the Ethernet adaptor from a list of detected adaptors. Also, the adaptor properties can be modified by clicking on the properties button. The adaptor properties window is shown below.

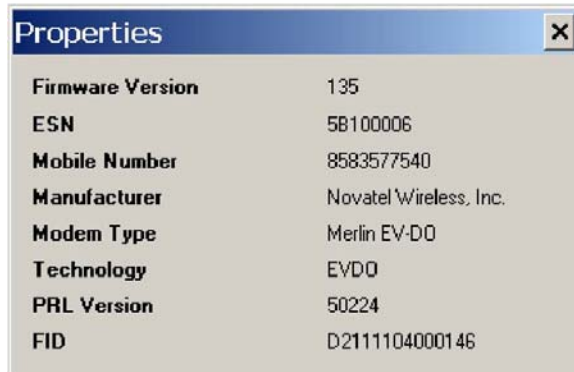
Figure 31: AP Window



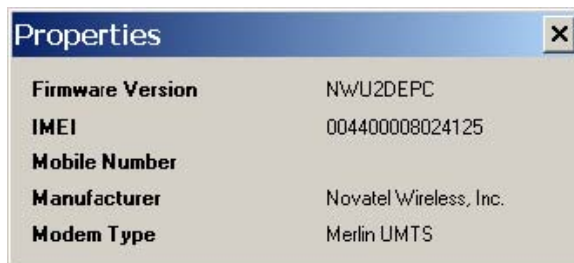
## Properties Menu

The properties menu displays some of the key properties of the UMTS and EVDO devices.

**Figure 32: CDMA**



**Figure 33: UMTS/HSDPA**



### Identity Properties

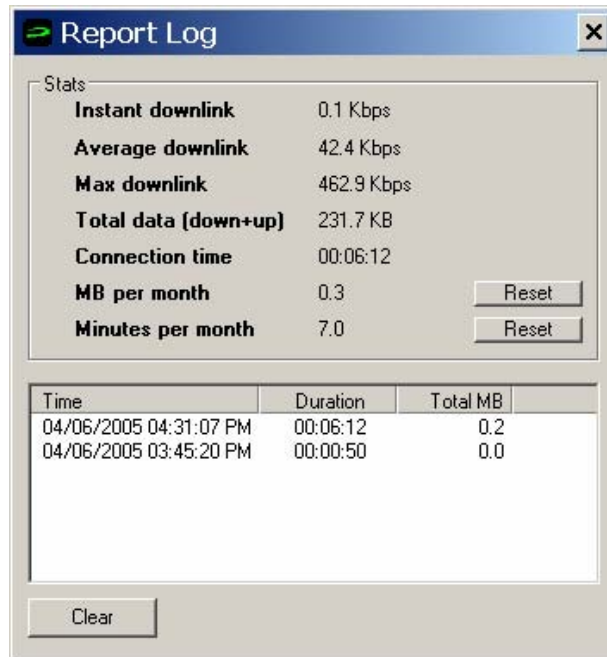
Property	Description
Firmware Version	Firmware version of the 3G device
IMEI/ESN	International Mobile Equipment Identity (UMTS)/ Electronic Serial Number (CDMA)
Mobil Number	Number for the mobile
Manufacturer	Who produced the modem
Modem Type	Modem technology
Technology	3G technology

PRL version	Preferred Roaming List version number(CDMA)
FID	Factory ID. This is a unique tracking number for factory builds

### Report Log

The report log has statistic information about the current connection as well as a history list of past connections.

Figure 34: Report Log



### Report Values

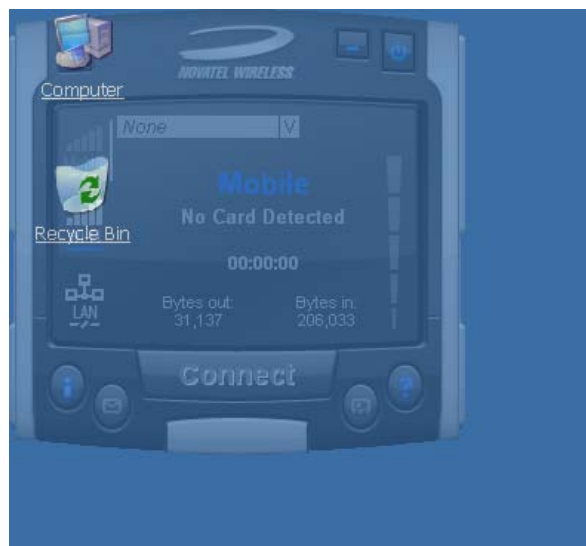
Value	Description
Instant downlink	This is most recent measured downlink throughput
Average downlink	This is the average of all the measured downlink throughput
Max downlink	This is the maximum achieved downlink throughput
Total data	This is the total data that has been ever sent since MobiLink has been installed on the machine

Connection time	The is the amount of time the connection has lasted
MB per month	This is a resettable counter of how many bytes since the last reset
Minutes per month	This is a resettable counter of how many minutes since the last reset

### **Transparency**

This menu feature allows the user to select the percent transparency for MobiLink. The choices range from 0% to 90% with 0% being solid and 90% being very transparent. Transparency allows desktop items below MobiLink to be displayed for better multitasking. Below is an example of MobiLink transparency on a desktop.

**Figure 35: Desktop Transparency**



### **About**

The About dialog displays MobiLink information such as version number, release date, and copyright.



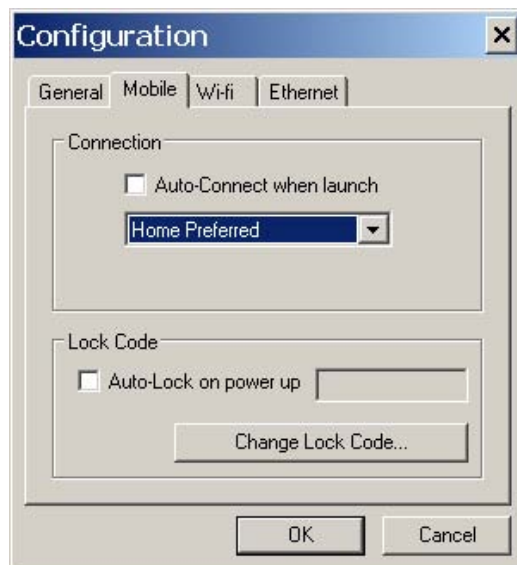
**Figure 36: About Dialogue**

### SIM/Lock Management

Upon MobiLink startup, if the device is locked on power up, a small dialog will be displayed such as below to ask the user to enter the unlock code prior to continuing with MobiLink.

**Figure 37: Enter PUK**

The lock setting and code can be managed in the Mobile tab of the configuration menu shown below.

**Figure 38: Configuration Menu**

## Quick Access Buttons

The quick access buttons are designed to provide a launch pad for other applications. Four buttons are provided and can be remapped to other applications. The picture below shows the default functions assigned to the quick access buttons.

**Figure 39: Quick Access Button Default Functions**



## Software Web Upgrade

TBD

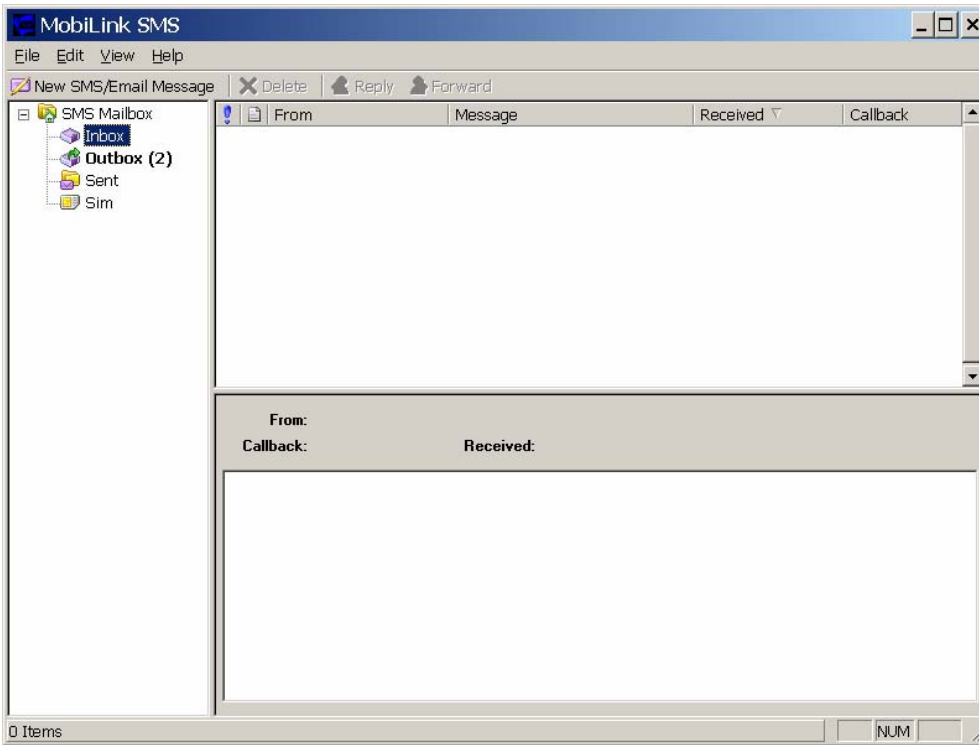
## SMS Client

The MobiLink SMS Client is used to manage reading and sending SMS messages. The SMS Client is an application that is part of the MobiLink application suite. The design of this application is to emulate an email Client to reduce the amount of new learning that is required to start using this application. This application is launched from the main connection manager Quick Access button. The following features are supported.

- Send new messages
- Reply to message
- Forward message
- Email interworking
- Concatenated SMS
- Set priority of message
- Rich text editing functions
- Printing
- Support for embedded hyper links and email links in message
- Auto language selection

- Send to multiple recipients
- Status receipt of sent messages
- Status bar to indicate number of messages, character count, etc...

Figure 40: MobiLink SMS Client



### SMS Mailboxes

Very much like an email Client, the SMS Client has multiple mail boxes to store different types of messages.

#### Mailbox List

Mailbox	Description
Inbox	All incoming SMS is delivered to this mail box and will be highlighted if unread.
Outbox	All outgoing SMS will be put into this mailbox. If the SMS has not been sent to the card, it will be held here until it can be sent.
Sent	All sent SMS messages are placed here.

Formatted: Centered

Formatted: Centered

Formatted: Centered

SIM	All SMS messages that are still stored on the SIM.
-----	--

The message panel contains the key information for a list of messages. The messages can be reorded in the message panel by clicking on the fields located on the top strip. The fields are the following:

#### Fields List

Field	Description
!	Importance
From	Where the message is from. Only shown when Inbox is selected.
To	Where the message is sent. Only shown when Outbox or Sent box is selected.
Message	Displays the first few characters of the message
Received	Time when the message is received
Sent	Time when the message is sent
Callback	Callback number

#### Menu Bar

The menu bar contains the following items:

Menu	Item	Description
• File	o Exit	Exits the application
• Edit	o Undo	Undo last text editing
	o Cut	Cut the selected text
	o Copy	Copy the selected text
	o Paste	Paste text on clipboard
	o Select All	Select all text in message content panel
• View	o Toolbar	Display tool bar
	o Statusbar	Display Status bar
• Help	o About SMSClient	Display About dialog

## Toolbar

The tool bar is accessible across the top and gives user quick access to common tasks. The tool bar contains the following buttons:

**Tool Bar Button**

Button	Description
New SMS Message	Opens up dialog to create a new SMS message
Delete	Deletes the highlighted message or group of messages.
Reply	Reply to the highlighted message.
Forward	Forward the contents of the highlighted message.

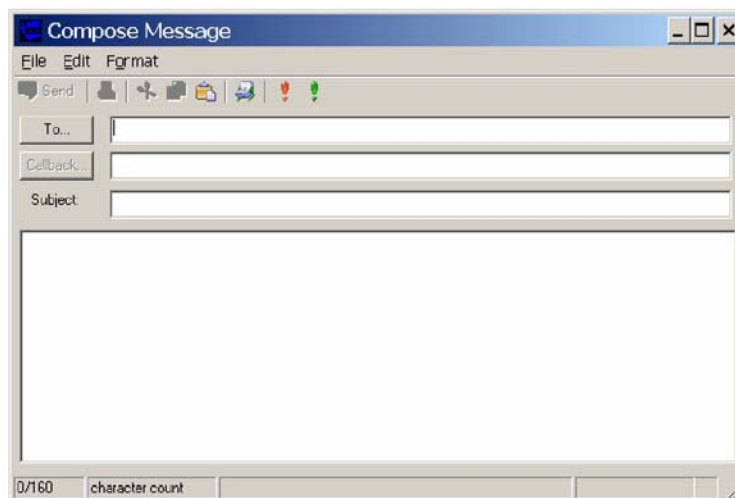
## Status Bar

The status bar displays information about each of the mailboxes selected. It will give the number of messages and the number of unread messages. The status bar is located on the bottom strip.

## Compose Message Window

Clicking on the New SMS Message button will bring up the following dialog: This window allows the user to enter the destination address, SMS message, a callback number for CDMA, and a subject text. Standard text editing such as cutting, copying, pasting is supported in the message box. In addition, the user can use the tool bar or the menu to set the priority and encoding of the message. Both Unicode and ASCII are supported. Unicode is used to send characters not in the standard ASCII character set.





**Figure 41: Compose Message**



For the destination address, users can chose to select from the address book by clicking on the To button. Also, multiple destinations can be entered separated by a comma or semicolon.

The toolbar supports the following functions: Clicking on the "To" button or the Addressbook button will bring up the following dialog to select the contact to insert into the destination field. Multiple destination addresses can be selected.

#### Destination Addresses

Button	Description
Send	Send the SMS message
	Print the SMS message
	Editing functions. Cut, copy, and paste text
	Open the addressbook to select from
!	Emergency priority
!	Urgent priority
	Set Unicode encoding for message

#### **Email Interworking**

A new feature added to this version of MobiLink is the ability for email interworking. What this feature does is to allow an email message to be sent over an SMS message. If the user types in an email address in the To field, the application will automatically format the SMS message so that the SMSC on the network side will forward it as an email.

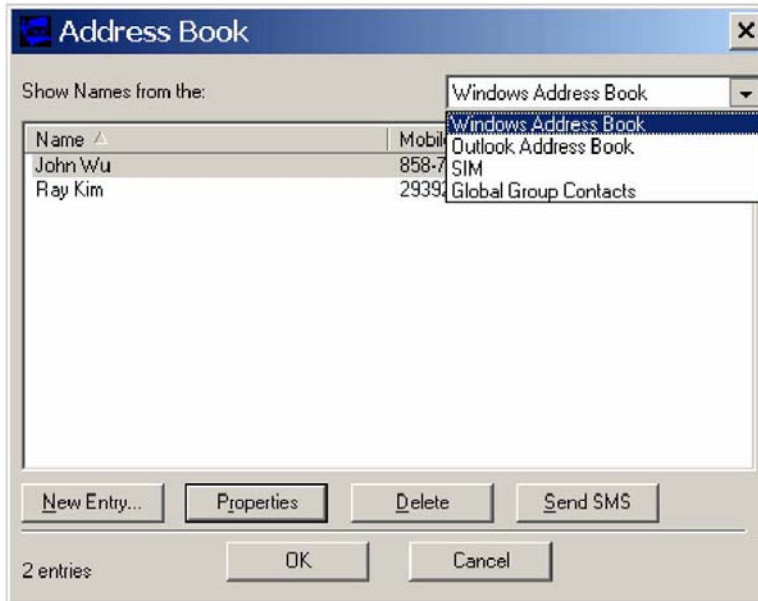
The recipient of this email can simply reply to the message and the message will be forwarded back to the wireless device.

#### **Concatenated SMS**

With the addition of email interworking, the ability to send an SMS that is longer than the limited 160 characters is very important. To address that issue, the SMS Client will allow the user to enter a long message and automatically segment the message and send it as separate SMS with a special tag to indicate the messages are segments of a long message.

#### **Addressbook Features**

The MobiLink address book allows the management of phone numbers on the SIM, Windows Address Book and Outlook. The following screen shows the address book Client.

**Figure 42: Address Book**

The address book Client has a selection box that allows the user to chose which address book to view. The following addresses can be selected:

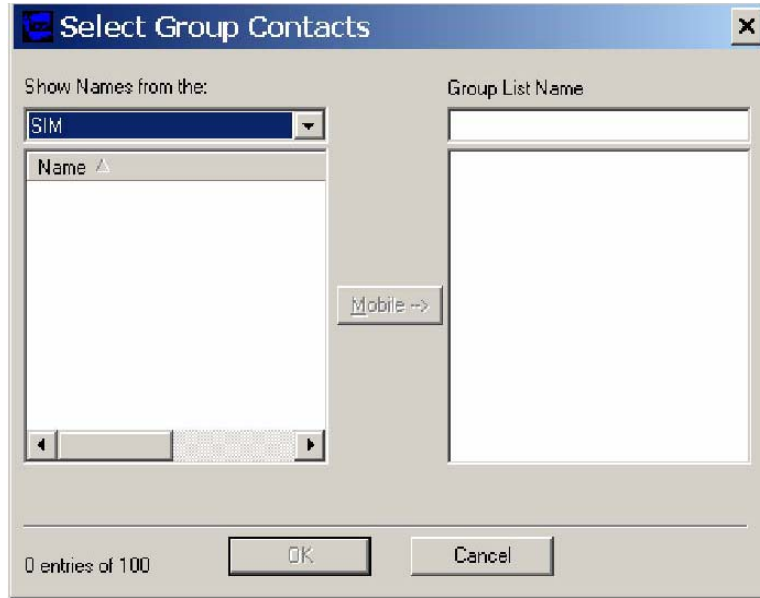
#### Address Books

Address book	Description
Windows Address Book	This is the native Windows Addressbook that is part of Windows Accessories folder
Outlook Address Book	This is the local Outlook Addressbook. This is only accessible if Outlook is installed on the computer
SIM	This is the address book located on the 3G device or the SIM of the device
Global Group Contact	This is the group contacts that contain distribution lists created by the user. This list can contain contacts from any of the above address books

User can create, delete, and view contact properties as well as send an SMS message using the selected contact by clicking on one of the buttons on the bottom of the Address Book Client.

#### ***Global Group Contact***

Global Group Contact feature allows users to create distribution lists for sending SMS.

**Figure 43: Select Group Contacts**

When the user chooses to create a Global Group Contact, a new dialog will be opened up to allow the user to select from the different address books and move them to create a new distribution list. The total number in a distribution list is up to 100. The list can contain a mixture from different address books and can contain both mobile numbers as well as email addresses.



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## Appendix C - Regulatory Approval and Compliance

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

The E725, as a CDMA product in North America requires FCC certification.

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

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The E725, EU870D and EU860D products conform to the requirements of applicable American laws with respect to safety; health, environment and consumer protection.

This E725, EU870D and EU860D 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 EU870D and EU860D 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 EU860D and EU870D products will comply with the 3GPP standards TS 51.010 for GSM and TS 34.121 for WCDMA.

### 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,

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

### 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 multislots configuration	Yes
13.7	Transmitter output power and burst timing in HSCSD configurations	Yes
13.8	Transmitter, Output RF spectrum in HSCSD multislots configuration	Yes
13.16.1	Frequency error and phase error in GPRS multislots configuration	Yes
13.16.2	Transmitter output power in GPRS multislots configuration	Yes
13.16.3	Output RF spectrum in GPRS multislots 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

CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive

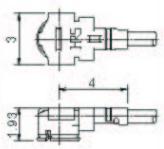
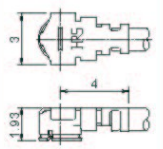
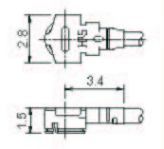
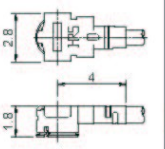
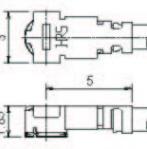
## Appendix D - Reference Parts Specifications

### RF Connector

Hirose U.FL series, with U.FL-R-SMT receptacle mating to the following connectors illustrated. Note that . This connector is designed for a limited number of insertions. For an embedded application this is expected to be acceptable.

Figure 44: RF Connector

#### ■ Cable Assembly (Plug)

Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 0.81mm Coaxial cable	Dia. 1mm Coaxial cable	Dia. 1.37mm Coaxial cable
Weight (mg)	53.7	59.1	34.8	45.5	71.7

#### ● Cable Guide

Description	Cable Type	Cable Specification					Nominal attenuation	
		Inner Conductor*	Dielectric Diameter	Outer Conductor*	Jacket Diameter	Nominal Impedance	At 1.3GHz	At 6GHz
Dia. 0.81mm Coaxial Cable	04	7/0.05 SA (AWG36)	Dia. 0.40 PFA	Single Shield SA	Dia. 0.81 PFA	50 ohms	6.45dB/m	9.42dB/m
Dia. 1.13mm Coaxial Cable	068	7/0.08 SA (AWG32)	Dia. 0.68 FEP	Single Shield SA(TA)	Dia. 1.13 FEP	50 ohms	3.43dB/m [3.73dB/m]	5.13dB/m [5.44dB/m]
Dia. 1.32mm Coaxial Cable	066	7/0.08 SA (AWG32)	Dia. 0.66 FEP	Double Shield TA	Dia. 1.32 FEP	50 ohms	3.8dB/m	5.6dB/m
Dia. 1mm Coaxial Cable	062	7/0.071 SA (AWG33)	Dia. 0.62 FEP	Tape, single Shield TAT	Dia. 1 FEP	50 ohms	3.1dB/m	4.4dB/m
Dia. 1.37mm Coaxial Cable	088	7/0.102 SA (AWG30)	Dia. 0.88 FEP	Single Shield TA	Dia. 1.37 FEP	50 ohms	2.8dB/m	4.3dB/m

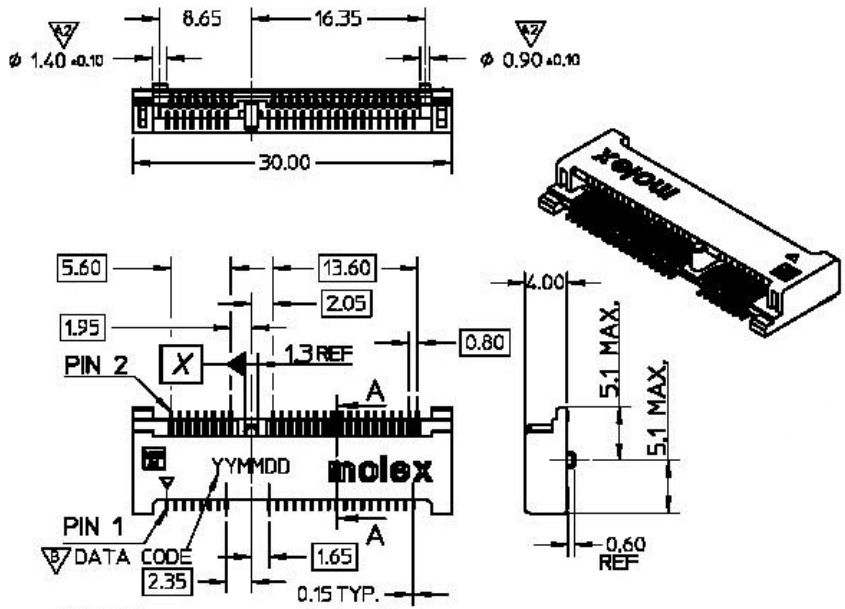
(data as provided by cable suppliers, for reference only)

\* SA : Silver plated annealed copper wire, TA : Tin plated annealed copper wire, TAT : Tin plated copper wire alloyed with tin

### Mini Card Connector

Molex 67910 series, mates with the mini PCI Express Card. Use with Latch 48099-0003.

Figure 45: Mini PCI Express Connector







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## Appendix I - Glossary

Abbreviations given in 3GPP TR 21.905 [15] and the following] apply.

**Access Point Name (APN)**

The IP domain name (i.e. Novatel Wireless.com) of the network device that acts as a gateway by connecting a CDMA wireless radio network to a wired local or wide area network.

**Active Network Session**

An active network session allows you to send and receive data across the Internet using point-to-point protocol through your network connection.

**Anonymous Access (AA)**

Network does not know the real identity of the mobile. Opposite to non-anonymous.

**AP Access Point**

An entry point to an external network.

**AT Commands**

AT commands are a language type that enables PC communications software to give the modem directions. The term **AT** comes from the command terminology which always begins with **attention**, or AT.

**Authentication Authorization Accounting (AAA)**

Used as shared secret passwords during a Mobile IP registration.

**Baud Rate**

The actual bit rate, excluding compression and other TX enhancements, on a communication line.

**Border Gateway (BG)**

Logical box that connects two (or more) operators together via an Inter-PLMN backbone. BG protects operator's intra-PLMN network against intruders.

**Carrier**

See Service Provider

**Circuit Switched Data**

A wireless network connection established, using a single circuit that extends from you, directly through the network to your call's destination. Opposite to packet switched.

**CLI**

Command Line Interface.

**CLIR**

Call Line Identification Restriction.

**Code Division Multiple Access (CDMA)**

Code Division Multiple Access is a spread spectrum wireless access technology that allows multiple users to share the same physical RF channel (1.25MHz for single carrier direct spread 1X) by use of orthogonal code spreading.

**Connection Oriented Network Service (CONS)**

Same as X.25 protocol for packet network transmission and switching.



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## Connection Profile

See **Network Connection Profiles**

## CSD

See **Circuit Switched Data**

## dBm

dBm stands for decibels below 1 milliwatt. It is essentially a device's signal output power compared against a standard input signal strength of 1 (one) milliwatt. This number represents a ratio and is expressed as a negative number (i.e. -60dBm)

## Default Network Connection Profile

The default network connection profile is the connection profile, chosen by you that the Modem Manager will use to connect to the network. The default network connection profile can be thought of as the **active** network connection profile.

## Direct Memory Access (DMA)

A fast method of moving data from a storage device or LAN device interface card directly to RAM which speeds up processing. DMA bypasses the CPU.

## Domain Name

The name assigned to a computer or group of computers that constitute an IP network domain. In general, a domain name is comprised of its local host name and its top-level domain. The top-level domain can be made up of several names, each separated by a period (.). An example of a domain name is **novatellwireless.com**.

## Domain Name System (DNS)

This is a network server used on IP networks, such as the Internet, for translating network host names and Universal Resource Locators (URL's) into IP addresses.

## Domain Name System (DNS) Address

The IP (internet protocol) address of the Domain Name System (DNS).

## Edge Technologies

Edge (Enhanced Data for Global Evolution) is an enhanced version of GPRS providing three to four times more capacity and data throughput. Average speeds range from 100 to 130 kbps with theoretical peak data rates of 473 kbps. Average rates are fast enough to support a wide range of advanced data services such as streaming audio and video, fast Internet access and large file downloads, EDGE can also support a greater range of enterprise applications, and more multimedia applications including push-to-talk services.

## EVDF

Enhanced Validity Period Format

## Firmware

Firmware is a program or set of programs that have been set permanently into a computer chip. The programs themselves usually are low-level programs that directly manipulate or interact with the hardware. An example of firmware is your desktop computer's BIOS.

## General Packet Radio Service (GPRS)

GPRS is a packet-based, always-on data connection standard.

## High Speed Downlink Packet Access (HSDPA)

HSDPA is a packet-based data service that improves upon UMTS by increasing speeds to 500-800 kbps with peak data rates of up to 10 Mbps (five times faster than UMTS and other 3G technologies) in a 5 Mhz channel. In addition, HSDPA significantly improves packet data throughput capacity, thereby increasing the number of users that can be supported at higher data rates on a single radio carrier.

**Home Agent (HA)**

A router in the home subnet of the mobile node. Used in part with Mobile IP.

**Home Public Land Mobile Network (HPLMN)**

The home network.

**IMEI**

IMEI stands for International Mobile Station Equipment Identity.

**Internet Protocol (IP)**

Internet Protocol works in conjunction with Transmission Control Protocol (TCP). TCP/IP are part of a group of protocols that provide communication across interconnected networks. TCP/IP is the protocol used on the Internet. The TCP protocol first establishes a connection between the two systems in order to send and receive data, and then breaks and sequentially marks the message into small packets. The IP protocol routes and sends the packets based on the IP address.

**Internet Control Message Protocol (ICMP)**

IP network control protocol.

**Internet Over-The-Air (IOTA)**

Network operators can remotely provision a device on their network by using an Internet Over-The-Air implementation. Usually, a newly purchased device needs to initiate an IOTA session to perform provisioning before it is allowed to be on the operator's wireless network.

**IP Addresses**

As with personal computers that access the Internet, modems using CDMA technology also have a dedicated Internet Protocol (IP) address, which is used to identify the node or access point for the modem on the Internet. The service provider assigns this IP address.

The 32-bit host address is usually represented in dotted decimal notation, e.g. 128.121.4.5. The address can be split into a network number (or network address) and a host number unique to each host on the network and sometimes also a subnet address.

**IP Network**

A network of computer networks that employ Internet Protocol allowing a user to access the Internet, provided that the user has a modem; telephone line, cable line, or wireless data network (e.g. CDPD); and a service provider.

**Local Area Network (LAN)**

A computer network that spans a relatively small area (typically up to a 1 km radius), although most LANS are confined to a single building or group of buildings. This type of networking allows for easy interconnection of terminals, printers, and computers within a building or buildings.

**Logical Link Control (LLC)**

Protocol layer between MS and SGSN.

**Medium Access Control (MAC)**

Protocol in the radio level that is used to allocate the radio channel.

**Megahertz (MHz)**

One million hertz. Hertz is another word for cycles in a radio frequency.

**Mobile Directory Number (MDN)****Mobile Identification Number (MIN)****Mobile IP (MIP)**

Mobile IP provides a method to allow IP traffic to find nodes whose point of attachment to the Internet changes.

**Mobile Node (MN)**

This is either an application running on a handset, or a data device connected to a handset with IP connectivity.

**Mobile Station (MS)**

The device being used to receive/transmit data and/or voice.

**Mobile-Terminal (MT)****Network Access Identifier (NAI)**

Used as an Identifier/login for Mobile IP.

**Network Connection Profiles**

A network connection profile is a group of connection settings that define a specific network connection to the Modem Manager. This includes such settings as network ID, network password, APN, DNS addresses and so on.

**Novatel Wireless Inc. (NWI) (NVTL)****Original Equipment Manufacturer (OEM)**

The original manufacturer of a pieces of equipment, typically complete boards, duplexers or enclosures etc.

**Over-The-Air (OTA)****Packet**

A short block of data transmitted across a network.

**Packet Data Network (PDN)**

Network that carries user data in packets. ex. Internet and X.25

**Packet Size**

The size of a packet expressed in bytes.

**PC Card**

A PC Card, similar in size to a credit card, is used for adding devices on to portable computing devices such as laptop, handheld, and palmtop computers. Some examples of these devices are modems, network cards, disk drive adapters, and extra memory. PC cards are often called PCMCIA cards.

**Peripheral Component Interconnect Special Interest Group (PCI SIG)****PCMCIA Card Slots**

The PCMCIA card slots are the sockets in the computing device, in which the PCMCIA card is inserted. It is the hardware interface between the computing device and the PCMCIA card.

**Point to Multipoint (PTM)**

Widely used IP protocol used to connect, i.e. PC and ISP via modems.

**Point to Point (PTP)**

One sender on receiver.

**Point-to-Point Protocol (PPP)**

PPP is an interconnection protocol which allows a device, such as a wireless IP modem, to connect to a network or the Internet.

**Primary Domain Name System**

In order to get the translated IP addresses, the modem will try to connect to the server with the primary DNS address. If the modem cannot connect to this address, it will try to connect using the secondary DNS address.

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**Primary Roaming List (PRL)****Protocol Data Unit (PDU)**

One data packet.

**Quality of Service (QoS)**

Definition of the service class of the connection between MS and the network.

**Radio Link Protocol (RLP)****Registration**

In order to send and receive data across a given network, a CDMA modem must first register to a CDMA network. This involves the selection of an available channel and interaction with various systems on the CDMA network to set up a communication path.

**Remote Access Service (RAS)**

Software that enables distant PCs and workstations to get into a Remote Access Server to retrieve software and/or data on a corporate LAN. This service is provided through modems, analog telephone lines or digital ISDN lines.

**Routing Area (RA)**

A set of cells that belongs to one group. RA is always a subset of an LA (Location Area).

**Secondary Domain Name System**

If the modem cannot connect to the DNS using the primary address, it will try to connect using the secondary DNS address.

**Security Parameter Index (SPI)**

Used in part with Mobile IP.

**Segment**

Each IP network address consists of four numeric segments, which are divided by a period ("."). For example, 204.119.63.40.

**Service Provider**

A company that provides network connections to the Internet.

**Short Message Service (SMS)**

Short messages either in binary (160 characters) or text messages (140 bytes) format.

**Terminal Equipment (TE)****Transmission Control Protocol (TCP)**

Protocol layer on top of conventional IP protocol.

**Type II PCMCIA Card**

A Type II PCMCIA card is identical to the Type I PCMCIA card in all ways except that it is thicker than the Type I card. The Type II PCMCIA card is in general use now.

**U<sub>m</sub>**

Mobile-to-Base Station air interface link.

**Universal Product Support Tool (UPST)**

The Universal Product Support Tool (UPST) consists of the UPST Framework and UPST device DLLs. The UPST Framework is a Windows 32 application (UPST.exe) that uses UPST device Dynamic Link Libraries (DLLs) to provide basic device provisioning functions such as Refurbish, Software upgrades, Preferred Roaming List (PRL) upgrades, and Phone Settings programming.

**User Datagram Protocol (UDP)**

Another protocol on top of IP.

**Wireless IP Network**

A wireless network (e.g. CDMA) that uses Internet Protocol (IP)