



HTM1000 PCIe Half Mini Card User Guide

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1. Introduction

1.1 Revision History

Revision	Date	Author	Description
1.0	July 2009	Customer Operations	Initial Draft

1.2 Purpose

This document describes the product design and specification for HTM1000 half mini PCIe card. HTM1000 supports multi-mode (2G/3G) with HSDPA/HSUPA capabilities.

1.3 Scope

This document describes: the platform architecture, the hardware / software interactions, Technical/Electrical Specifications.

1.4 Target Audience

This document is intended to provide a design specification for the teams involved in and an introduction to the platform for product integration teams.

1.5 Abbreviations

AES	Advanced Encryption Standard
AGPS	Assisted Global Positioning System
AMR-NB	Adaptive Multi-Rate Narrow Band
AMR-WB	Adaptive Multi-Rate Wide Band
AP	Applications Processor
BP	Baseband Processor
DES	Data Encryption Standard
DDR	Double Data Rate
DTM	Dual Transfer Mode
DUN	Dial Up Networking
EDGE	Enhanced Data rate for GSM Evolution
EFR	Enhanced Full Rate
FM	Frequency Modulation
FPS	Frames-Per-Second
FR	Full Rate
GEA	GSM Encryption Algorithm
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
HR	Half Rate
HS	High Speed
HSDPA	High-Speed Downlink Packet Access
HSUPA	High-Speed Uplink Packet Access
IMEI	International Mobile Equipment Identity
IMS	IP Multimedia Subsystems
IPC	Inter Processor Communications
NAND	Not AND (electronic logic gate)
OHA	Open Handset Alliance
OMA	Open Mobile Alliance
OTG	On-The-Go
PCI	Peripheral Component Interconnect
PMIC	Power Management IC
RF	Radio Frequency
SAM	Stand Alone Modem
SDRAM	Synchronous Dynamic Random Access Memory
SIM	Subscriber Identity Module
UEA	UMTS Encryption Algorithm
UICC	Universal Integrated Circuit Card
USB	Universal Serial Bus
USIM	Universal SIM
W3G	Wrigley3G (Motorola 3G baseband processor)
WCDMA	Wideband Code Division Multiple Access
WLAN	Wireless Local Area Network
WWAN	Wireless Wide Area Network

2. Product Overview

HTM1000 is a half mini data card supporting tri-band HSPA and quad-band EDGE/GPRS, with data rates of up to 10.1Mbps downlink and 5.76Mbps uplink. It complies with PCIe Mini CEM spec, version 1.2.

HTM1000 is based on a custom 3G baseband processor that was developed by Motorola. Other main hardware components on this platform are the RF transceiver from Infineon, the Power Management IC, the RF analog front end and Power amplifiers. HTM1000 has external DDR SDRAM and NAND flash memories, packaged on top of the baseband processor (POP).

HTM1000 uses USB signals on PCIe interface to connect with a PC, netbook or MID. HTM1000 uses 3.3V power supply on PCIe interface for power up.

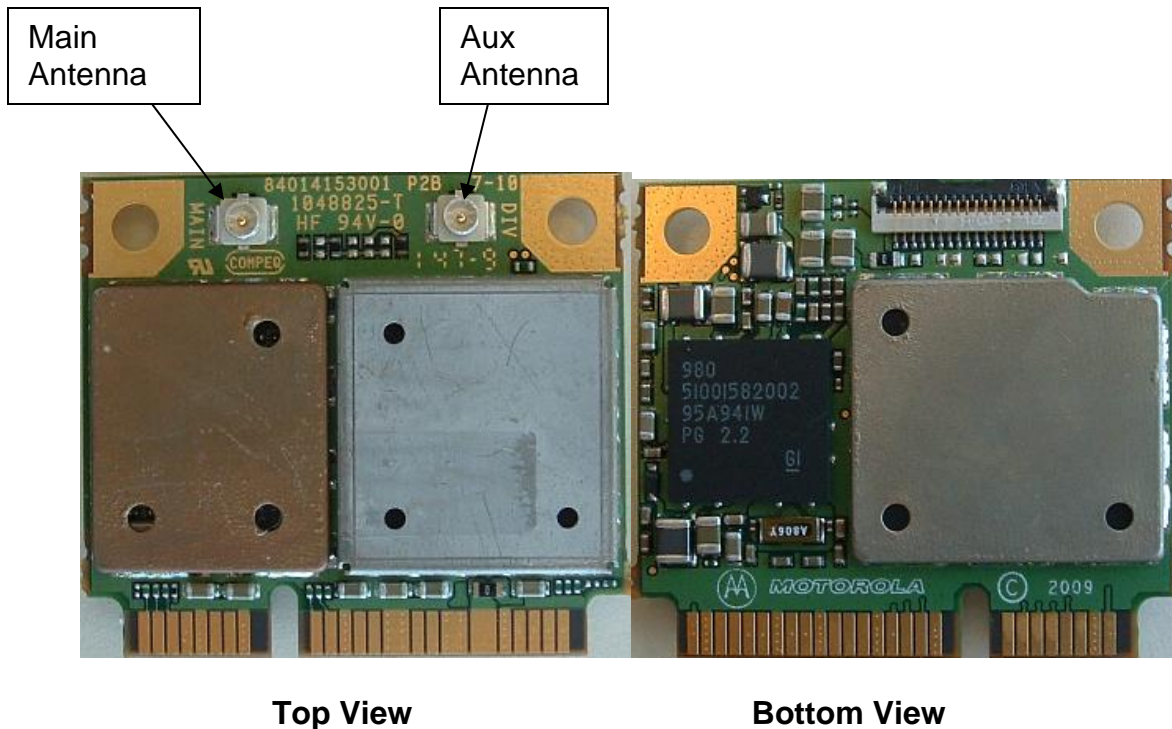


Figure 1 -HTM 1000 Half Mini PCIe card (Top and Bottom views)

3. Hardware Architecture

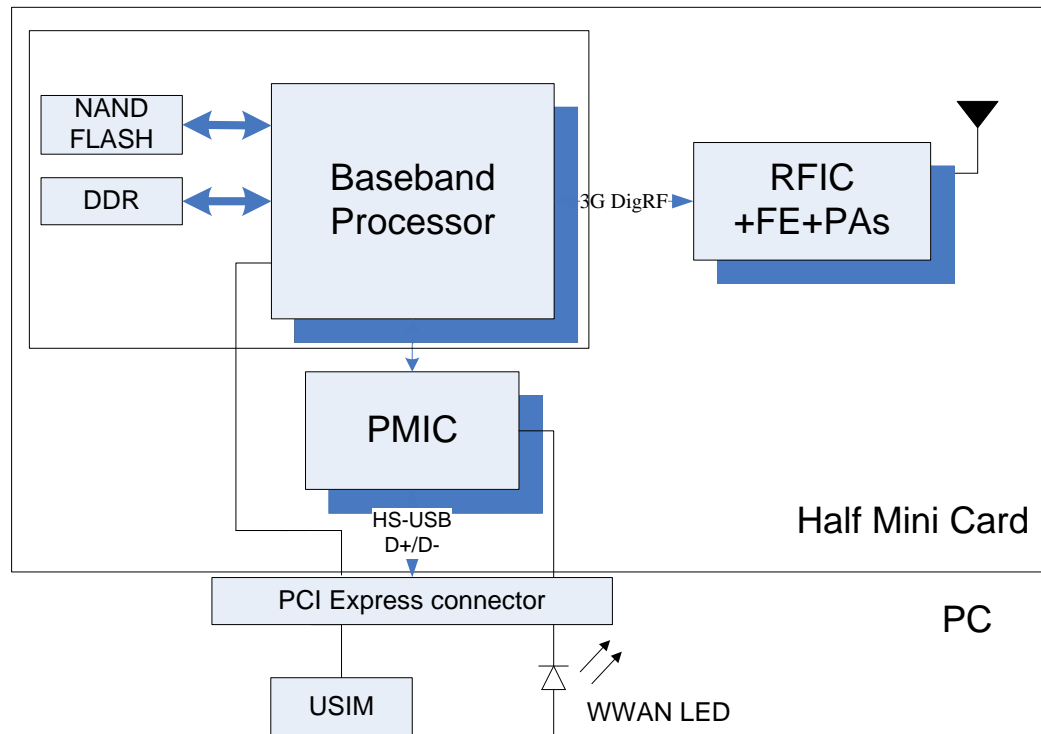


Figure 2 – HTM1000 high level block diagram

4. HTM1000 Data Card Feature Summary

Key capabilities for the data card and associated features of the platform are listed below. The following summary describes some of the platform capabilities.

4.1 Hardware Revision: P2B

4.2 2G

- Release 6 compliant
- Quad-band GSM 850/900/1800/1900 MHz

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- GPRS Class 12
- EDGE Class 12
- DTM Class 11 (unused because no voice)
- A5/1-3 (unused because no voice) and GEA/1-3 Encryption
- DARF

4.3 3G

- Release 6 compliant
- Frequency Bands
 - 850/1900/2100 MHz (Supported)
 - 900/1900/2100 MHz (Available upon request)
 - 1700/1900 MHz (Available upon request)
- WCDMA 384kbps uplink (UL) – 384kbps downlink (DL)
- HSDPA 7.2 / 10.1 Mbps
- HSUPA 1.46 / 2 / 5.76 Mbps
- UEA01, UEA02, UIA1, UIA2 Encryption
- 3G Rx Diversity in all bands

4.4 Advanced Services

- GPS is not supported in this revision of the data card.

4.5 Audio

- Audio is not supported in this revision of the data card.
- Audio is supported in hardware via PCM signals in data card revisions of P2B and higher. External audio codecs are required to process PCM data from baseband.

4.6 External Memory

- 64MB64MByte NAND Flash Memory
- 32MB32MByte DDR-333 166 MHz clock SDRAM

4.7 System Requirements

- Linux Android Kernel in the ARM9 of the W3G
- VTRXmc in the C55x+ of the W3G

4.8 Security

- High Assurance Boot with Multiple Super Root Key Support
- MD5, SHA-1, SHA-256, 3DES, AES 128, RC4, RSA
- Subsidy Lock
- IMEI Protection

4.9 Connectivity

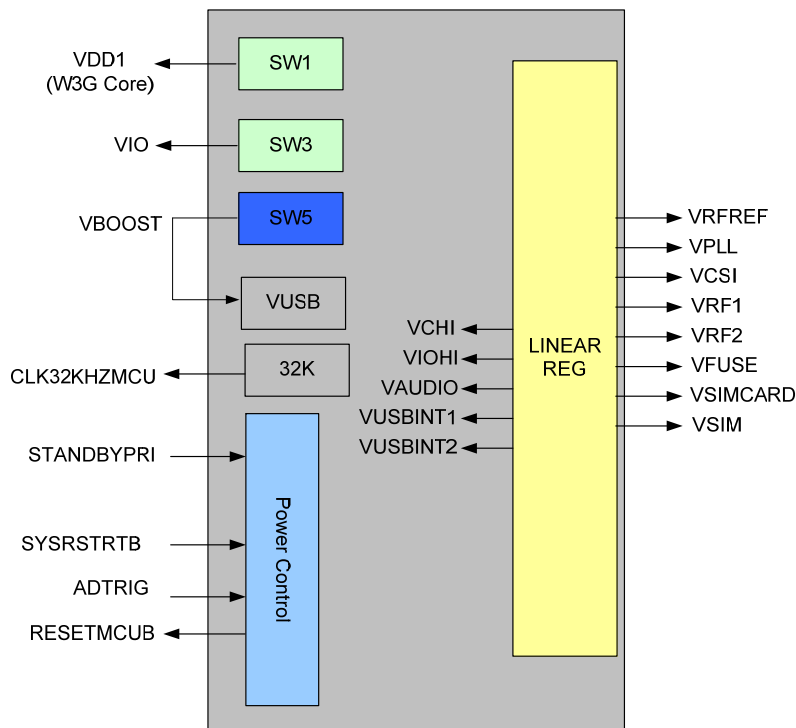
- SIM or UICC (SIM and USIM)

- USB client 2.0 HS Support (PC connectivity)
- EMU local Bus Support
- 3GDigRF RF interface version 3.07

4.10 Power Up Sequence

The main power management function is performed by Power management IC (CPCAP), which receives its voltage input from the PCIe interface. 3.3V on PCIe interface supplies power to PMIC.

CPCAP manages all data card power; it includes 2 bucks, 1 boost and 8 linear regulators.



4.11 Power Consumption

Following table shows data card power consumption.

Typical Power	
Supply	3.3V DC
HSDPA 7.2Mbps download @ 0dBm	< 1.5W
EDGE 4RX 200kbps	< 0.5W
Idle Mode	< 20mW
Sleep Mode (radio disabled)	< 10mW

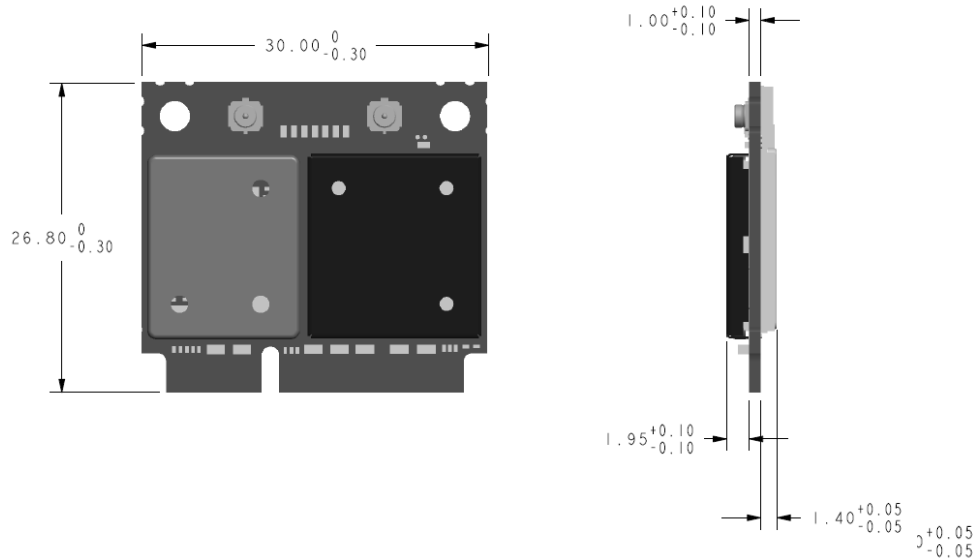
5. Mechanical Specifications

5.1.1 Electrical Specification

HTM1000 powers up using 3.3V supply on PCIe interface. The supply voltage should be within $\pm 9\%$ of 3.3v.

5.1.2 Mechanical Specification

Physical dimensions of the card are: 30mm x 26.8mm x 4.35mm (Double sided)
Weight: 5g



5.1.3 Thermal Specification

Operating temperature range for HTM1000 is -10°C to $+65^{\circ}\text{C}$.

6. Data Card Interfaces

6.1.1 PCIe Interface

HTM1000 connects with netbook, notebook or MID using PCIe interface. HTM1000 uses USB interface on PCIe interface. Electrically the PCI Express card will be seen as a USB device since it uses standard USB2.0 connection. Power is supplied by motherboard. A SIM card must be provided by PC manufacturer for user authentication.

A Radio disable ($W_Disable$) signal is connected from PC to the card; this allows the user to be able to enable/disable RF activity (Airplane mode) on demand.

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The card controls one of the PC's LED to indicate RF activity has been disabled or enabled.

To summarize main characteristics of PCIe are as follows:

- Standard USB interface
- 3.3V power supply from motherboard is used. Voltage should be within $\pm 9\%$ of 3.3V.
- Max current is 1.1A averaged over 1sec, 2.75A averaged over 100 μ s.
- W_DISABLE is used to enable/disable RF activity: 30s to disable, 1s to enable.
- PC WWAN LED is controlled by HTM1000.

The following table shows signals on PCIe interface.

PIN Number	PCIe Spec	HTM1000 data card	Pin Number	PCIe spec	HTM1000 data card
51	Reserved		52	+3.3Vaux	+3.3Vaux
49	Reserved		50	GND	GND
47	Reserved		48	+1.5V	
45	Reserved		46	LED_WPA N#	
43	GND	GND	44	LED_WLAN #	
41	+3.3Vaux	+3.3Vaux	42	LED_WWA N#	LED_WWAN #
39	+3.3Vaux	+3.3Vaux	40	GND	GND
37	GND	GND	38	USB_D+	USB_D+
35	GND	GND	36	USB_D-	USB_D-
33	PETp0		34	GND	GND
31	PETn0		32	SMB_DATA	
29	GND	GND	30	SMB_CLK	
27	GND	GND	28	+1.5V	
25	PERp0		26	GND	GND
23	PERn0		24	+3.3Vaux	+3.3Vaux
21	GND	GND	22	PERST#	
19	Reserved		20	W_DISABLE#	W_DISABLE #
17	Reserved		18	GND	GND
15	GND	GND	16	UIM_VPP	
13	REFCLK+		14	UIM_RESET	SIM_RESET
11	REFCLK-		12	UIM_CLK	SIM_CLK
9	GND	GND	10	UIM_DATA	SIM_DATA

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7	CLKREQ #		8	UIM_PWR	SIM_PWR
5	COEX2	COEX2	6	1.5V	
3	COEX1	COEX1	4	GND	GND
1	WAKE#		2	3.3Vaux	+3.3Vaux

Table 1 – HTM1000 52-pin PCI Express connector pinout

6.1.2 SIM Interface

A standard ISO7816 SIM interface has been used on the card. SIM card is connected to the SIM controller on ARM9.

SIM card slot must be provided by PC manufacturer. SIM signals are routed through PCIe interface. SIM signals are shown in the previous section.

6.1.3 Audio Interface

Audio is not supported in P2A hardware revision. Audio support will be available starting in P2B hardware revision.

Following table shows routing of PCM signals to PCIe connector:

Pin Number	PCIe Specification	HTM1000 Data card
51	Reserved	PCM_SYNC
49	Reserved	PCM_IN (WAN_HOST_WAKE)
47	Reserved	PCM_OUT
45	Reserved	PCM_CLK

7. AT commands

Data Card supports AT commands interface using TTY/ACM. There will be two TTY ports supported for AT commands, and both allow all the AT commands, and PC Connection Manager client shall be using only one instance for PPP at any time. Since the PC Connection Manager Client cannot execute AT commands when data is active using PPP, a second TTY Port instance of AT parser was added to execute non-data commands like SMS or SIM.

PC Connection Manager client shall use all the relevant dependent AT commands on one instance of AT parser only. E.g. For CGACT to work CGDCONT and any other dependent commands need to be issued on the same TTY port.

Data Card supports only one PDP context/PPP and the Context ID 1 shall be used. AT parser shall allow only one PDP activation using AT+CGACT or

ATD*99#, so any time one PDP is active AT Parser shall return an ERROR for the next PDP activation request.

Data Card shall support only USIM based Phonebook and SMS.

Data Card shall support 27.007 Rel5 Spec defined options and parameters and there are some deviations from the specifications. Please refer to Data Card AT commands ICD document for more details.

Data Card AT parser shall check the existence and validity of mandatory fields. If any mandatory field is absent or validity check fails then Data Card AT parser shall return ERROR.

Data card shall not support CS Calling, and incoming calls shall be rejected with appropriate status code. Any AT command functionality related to CS and supplementary services shall not be supported.

Data Card AT parser shall support extended error reporting.

The PC Connection manager client shall use ATD*99# to trigger the PPP and Data call activation.

The values stored using any of the AT commands like CGDCONT are not persistent across power cycle.

7.1.1 Network Connection Management

- Data Card Allows AT commands for Network Connection Management like APN management: Set, Read, and Reset.
- Activate and Deactivate network connection.
- GPRS Attach and Detach to the network.
- QOS Profile Management: Set QOS, Modify QOS, Minimum QOS.
- Get the PDP Context IP address.

7.1.2 Registration or Mobility Management

- Network Registration Event Notifications.
- PLMN selection: Manual, Automatic. Preferred PLMN list: Adding, deleting, updating. Also for reading used entries from the USIM list of preferred PLMNs.
- Preferred PLMN list type: Selecting, Reading.
- Reading all the operator names.
- Reading the current activity status.
- Airplane mode and turning ON and OFF the RF.

- Enabling and Disabling the signal strength change event notification and also to get current signal quality.
- Indications like Signal Strength, Service availability, Roam and SMS full status.
- GPRS mobile class: Setting, Reading
- GPRS registration change notification: Enabling, Disabling.
- Selection of network connection types, for example: GSM only Automatic, WCDMA only Automatic, GSM and WCDMA Automatic.
- Service Supported in Current Cell and Packet Data activity indications.

7.1.3 SMS

- Supports SMS using PDU mode only. Messages are stored in the SIM/USIM.
- Writing, Sending and Receiving SMS messages.
- New SMS message indications.
- List SMS messages.
- Send SMS messages from Storage.
- Delete SMS message.
- Write message to memory.

7.1.4 USIM and Phonebook

- Query IMEI, IMSI, MSISDN's of Data card.
- Query FLEX version, CARRIER name and Country code of the Data Card subscriber unit.
- Read a specific record from the phonebook entries (of USIM) or records of specified range.
- Write the phonebook record into the storage entry specified i.e. only USIM is supported. Capacity: It depends on the SIM/USIM card capacity.
- PIN management: activate/deactivate PIN, PIN lock, changing PIN, unblocking by using the PUK.
- Subsidy Lock support.
- SIM file access: read, write facility.

8. NVM/FLASH

The data card uses Single Level Cell (SLC) Large Page (LP) NAND flash to store all data. Flash block sizes is 128K, divided each in 64 pages of 2K each.. Default flash size is fixed to 64 Mbytes.

NAND flash is shared for AP and BP needs, but can only be physically accessed by the AP side.

9. RF Calibration/Phasing

All boards are calibrated and tested in order to meet 3GPP specifications with margins.

In 2G, output powers are calibrated for each PCL and with compensation over frequency. 2G Calibration points are then validated by testing output power levels in GMSK and 8PSK. Critical parameters such as modulation and switching spectrum are also tested.

RSSI levels are also calibrated across the range with frequency compensation. BLER and BER level are measured to validate sensitivity meets expectations.

In 3G, output power is calibrated through the whole range (from below -55dBm up to the maximum output power level for each band). The receive chain is calibrated for input power levels. There are some compensation over frequency both in uplink and downlink.

3G calibration points are also validated by checking output power together with ACLR and EVM. BLER is measured is WCDMA for different transfer rates in order to validate the downlink path.

10. Hardware Installation

10.1 HTM1000 Data Card Installation

This chapter describes physical installation of data card and configuration of HTM1000 3G data card.

An extender board is used to convert half mini 3G data card to a full mini card. The extender board is attached to 3G data card as shown in the picture below.

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Top View

Bottom View

Locate an available Mini PCIe V2 card slot in computer.



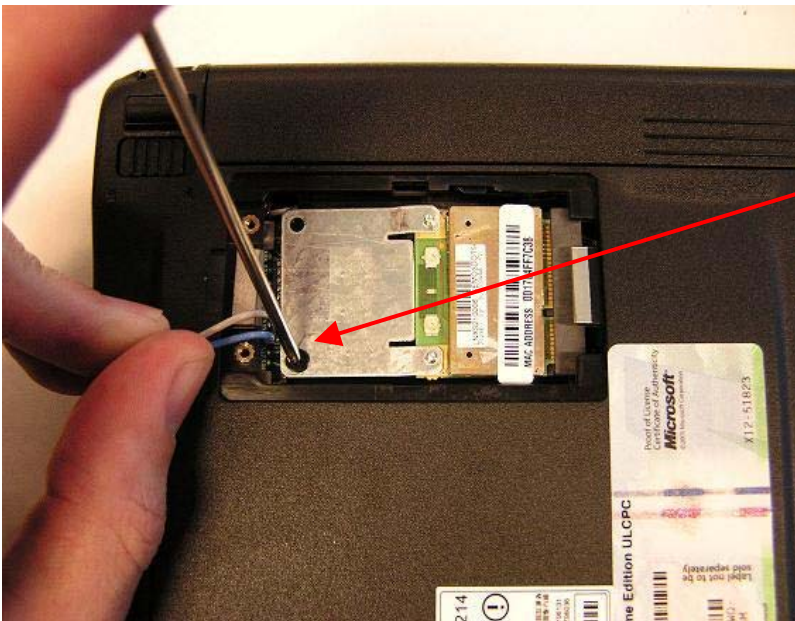
Mini-PCIe Card Slot

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To ensure proper installation, insert the card into the slot at a 45° angle as shown in the picture below.



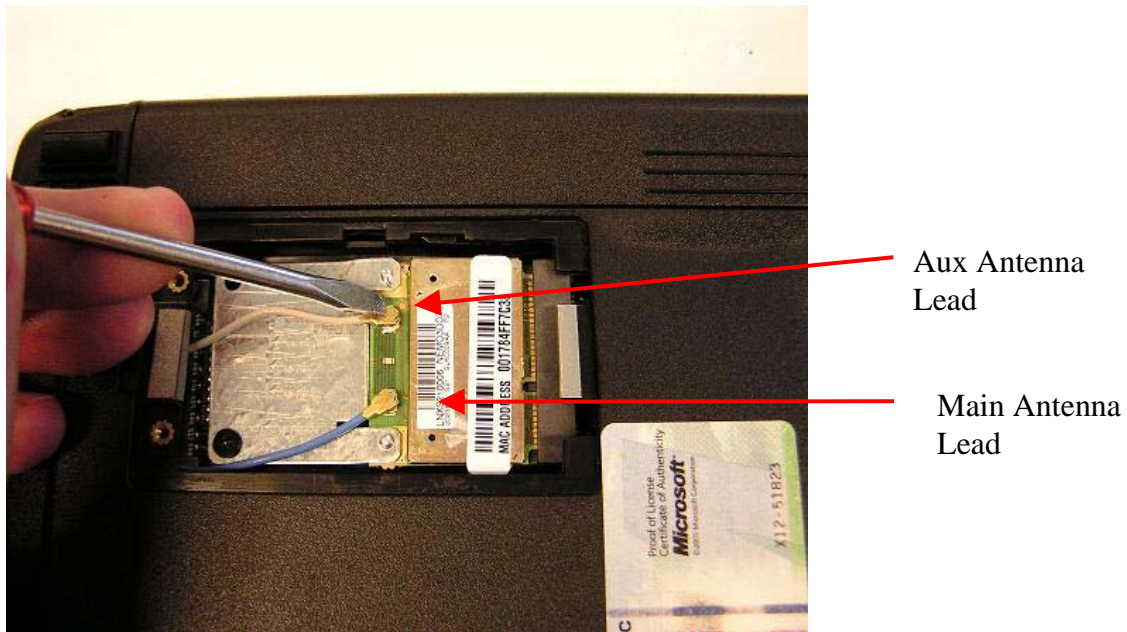
The HTM1000 must be pushed down and securely fastened in the MINI-PCIe V2 slot by the means provided by the laptop vendor (screw or clip)



Vendor Screw
Fastener for Full
Mini-PCIe slot.

Connect the provided laptop antennas to the UFL connectors on the HTM1000 card. The UFL connectors will snap down when properly connected to the HTM1000. If the Main and Aux antennas are specified by the computer manufacturer then the antennas must be connected accordingly.

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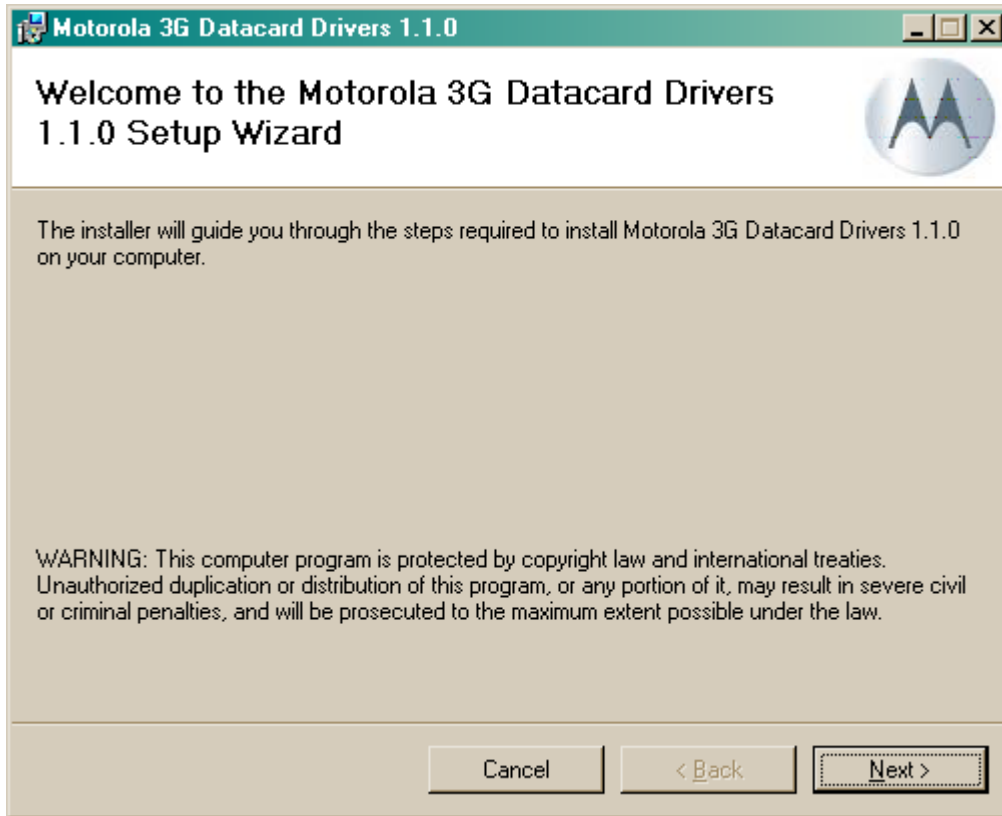


11. Motorola Data Card Driver Installation

Motorola driver package for data card is included in deliverables. The driver package is available for Windows XP and Windows 7 operating systems. The driver package is an msi (Microsoft Installer) package.

Double click on Motorola “3G Data card drivers.msi” to start installation. Installation window opens, and click ‘Next’ on the window.

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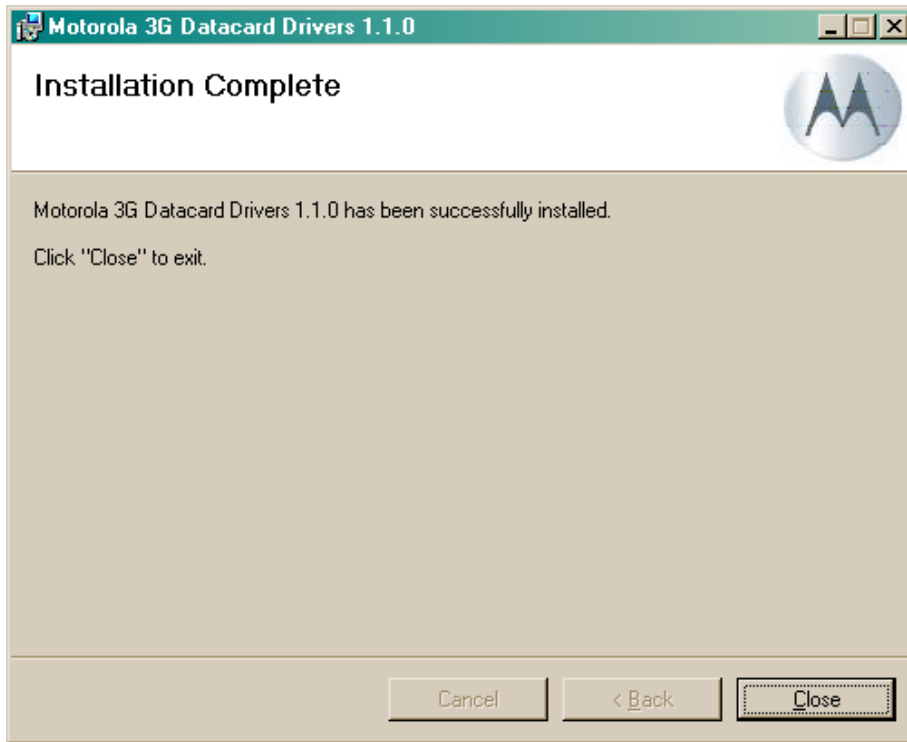


Agree to license terms, click on 'Next'.

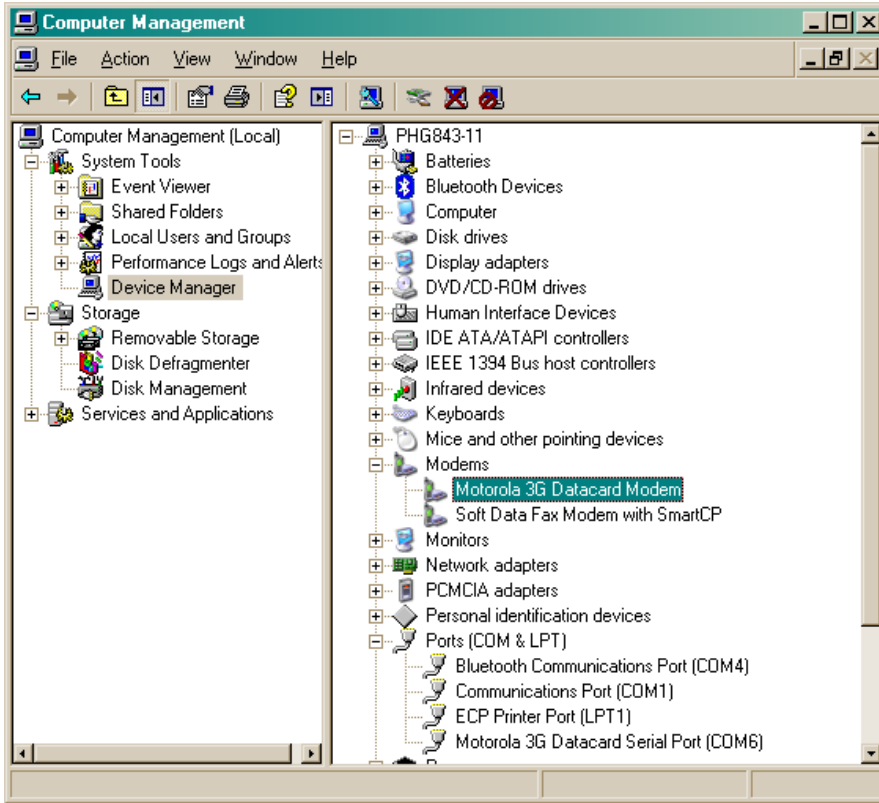


Installation complete message comes up.

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After successful installation of 3G data card drivers, the data card appears in device manager as shown in the picture below.



12. Live Network Connection

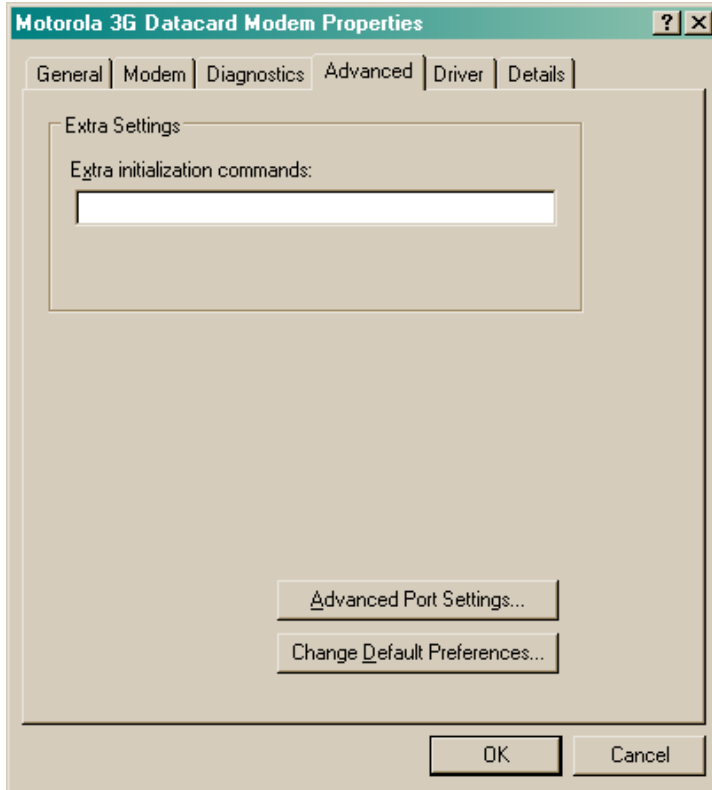
12.1 Setting up Dial Up Networking (DUN) Connection using Data Card as a Modem

This section describes how one can setup dial up networking connection using data card as a modem.

Open device manager, right click on Motorola 3G Data card Modem under modems and choose properties. Click on 'Advanced' tab and enter the initialization command:

AT+CGDCONT = 1,"IP","APN". Where APN is the access point name. APN information must be obtained from the carrier that is supplying SIM card. Then click on 'OK' on the window to save settings.

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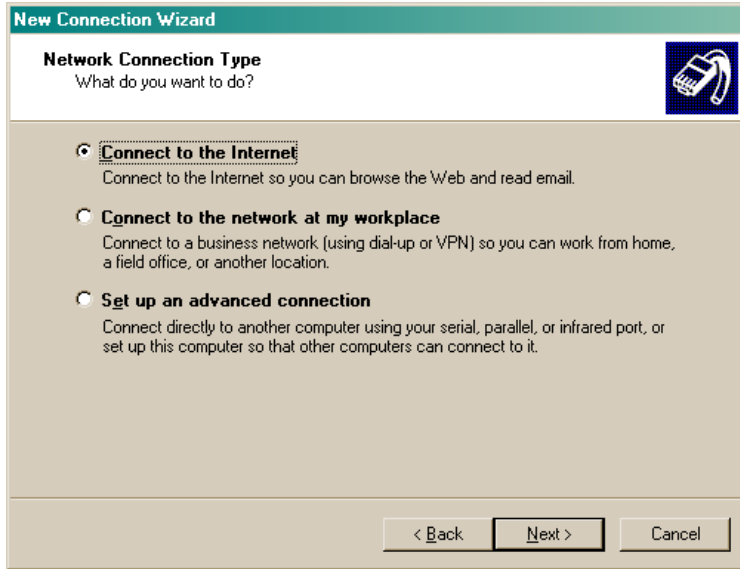


From Start→Settings→network Connections open New Network Connection wizard and setup a new dial up network connection.

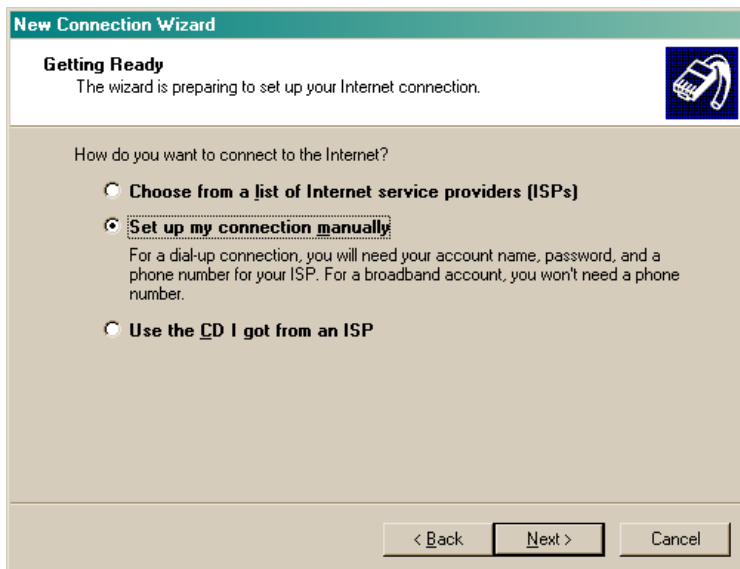


To continue click 'Next'

Choose “connect to the Internet” and click on ‘Next’

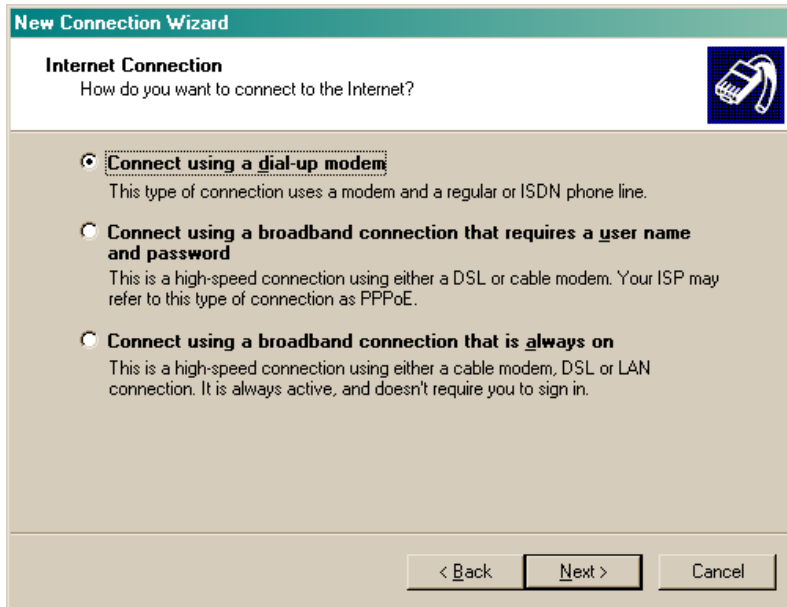


Choose to ‘Set up the connection manually’ and click on ‘Next’

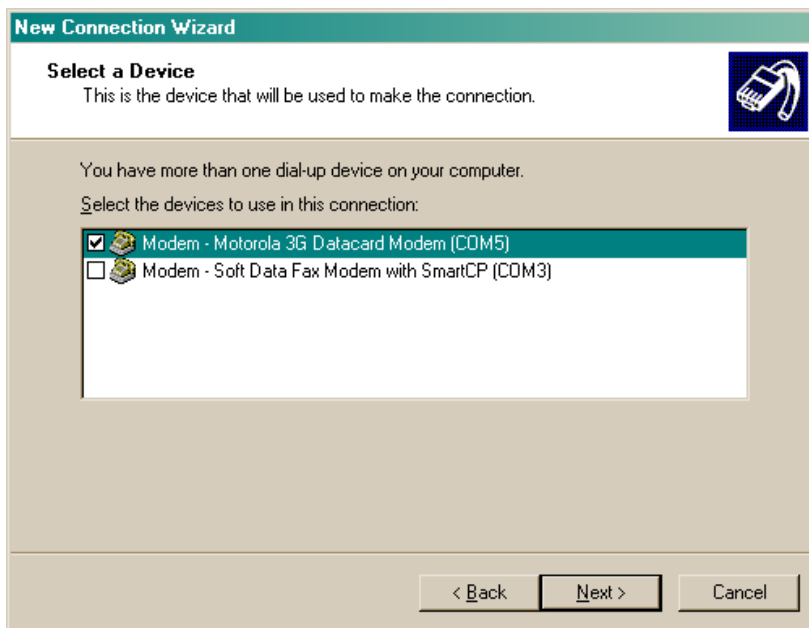


Choose ‘Connect using a dial-up modem’ and click on ‘Next’

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Choose Motorola 3G Data card Modem and click 'Next'




Enter a name for ISP and click 'Next'

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New Connection Wizard

Connection Name
What is the name of the service that provides your Internet connection?



Type the name of your ISP in the following box.

ISP Name


The name you type here will be the name of the connection you are creating.

< Back Next > Cancel

Enter phone number, for data connection dial in number is *99#. Click on 'Next'

New Connection Wizard

Phone Number to Dial
What is your ISP's phone number?



Type the phone number below.


Phone number:

You might need to include a "1" or the area code, or both. If you are not sure you need the extra numbers, dial the phone number on your telephone. If you hear a modem sound, the number dialed is correct.

< Back Next > Cancel

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New Connection Wizard

Connection Availability 

You can make the new connection available to any user or only to yourself.

A connection that is created for your use only is saved in your user account and is not available unless you are logged on.


Create this connection for:

An on e's use

My use only

< Back Next > Cancel

New Connection Wizard

Internet Account Information 

You will need an account name and password to sign in to your Internet account.

Type an ISP account name and password, then write down this information and store it in a safe place. (If you have forgotten an existing account name or password, contact your ISP.)

User name:

Password:

Confirm password:

Use this account name and password when anyone connects to the Internet from this computer

Make this the default Internet connection

< Back Next > Cancel



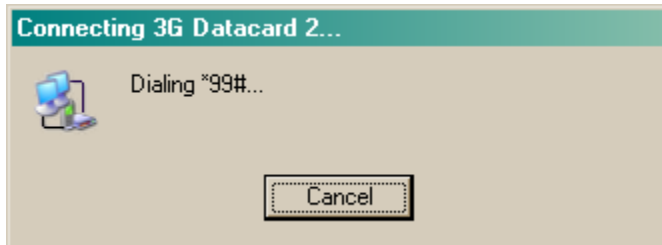
Now you are ready to connect to live network. Double click on 3G Data Card icon on the desktop. 3G Data Card appears in a window as shown below.



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Click on properties and ensure that 3G data card modem is chosen for connection. Click on 'OK' on Properties window and then Click on 'Dial' on 3G Data card window.

The following window appears which shows dial up connection.



12.2 Trouble Shooting Live Network Connection

13. Known Issues

13.1 P2B HW revision

- None

Antenna Installation • The "main" antenna installation must provide a minimum separation distance of 20 cm from users and nearby persons and must not be co-located or operating in conjunction with any other antenna or transmitter. • The combined cable loss and antenna gain must not exceed +4.2 dBi (800 band). The combined cable loss and antenna gain must not exceed +2.85 dBi and total system output must not exceed 2.0W EIRP in the PCS (1900) band in order to comply with the EIRP limit of 24.232 (b). OEM installers must be provided with antenna installation instruction and transmitter operating conditions for satisfying RF exposure compliance. • For system integrations requiring higher antenna gain, or a "main" antenna position closer than 20cm from the body, SAR compliance testing of the completed product will be required. It is strongly recommended that the system integrator seeks the advice of a suitably accredited test laboratory to develop a test plan and carry out necessary testing.

Safety & General Information

This section contains important information on the safe and efficient operation of your mobile device. Read this information before using your mobile device.

Exposure to Radio Frequency (RF) Energy

Your mobile device contains a transmitter and receiver. When it is ON, it receives and transmits RF energy through the external antenna. When you communicate with your mobile device, the system handling your call controls the power level at which your mobile device transmits.

Your Motorola mobile device is designed to comply with local regulatory requirements in your country concerning exposure of human beings to RF energy.

Operational Precautions

For optimal mobile device performance and to be sure that human exposure to RF energy does not exceed the guidelines set forth in the relevant standards, always follow these instructions and precautions.

External Antenna Care

If your mobile device has an external antenna, use only a Motorola-supplied or approved replacement antenna. Use of unauthorized antennas, modifications, or attachments could damage the mobile device and/or may result in your device not complying with local regulatory requirements in your country.

DO NOT hold the external antenna when the mobile device is IN USE. Holding the external antenna affects call quality and may cause the mobile device to operate at a higher power level than needed. Do not operate your mobile telephone when a person is within a minimum of 20 cm (8 inch) of the vehicle antenna. A person or object within 20 cm (8 inch) of the antenna could impair call quality and may cause the phone to operate at a higher power level than necessary and expose that person to RF energy in excess of that established by the FCC RF Exposure Guidelines.

RF Energy Interference/Compatibility

Nearly every electronic device is subject to RF energy interference from external sources if inadequately shielded, designed, or otherwise configured for RF energy compatibility. In some circumstances your mobile device may cause interference with other devices. Using accessories not supplied or approved by Motorola may cause your mobile device to exceed RF energy exposure guidelines. For a list of Motorola-supplied or approved accessories, visit our web site at <http://www.motorola.com>.