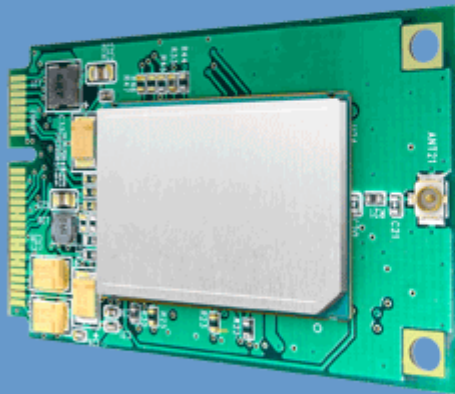




CINTERION
a Gemalto company

EHS5 miniPCle

Version: 01.000
DocId: EHS5_miniPCle_v01.000



Hardware Interface Description

Document Name:	EHS5 miniPCle Hardware Interface Description
Version:	01.000
Date:	2012-11-16
DocId:	EHS5_miniPCle_v01.000
Status	Confidential / Preliminary

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0 Document History

New document: "EHS5 miniPCle Hardware Interface Description" Version 01.000

Chapter	What is new
--	Initial document setup.

1 Introduction

This document¹ describes the hardware of the Cinterion EHS5 miniPCle product that connects to the mobile computing platform and the air interface. It helps you quickly retrieve interface specifications, electrical and mechanical details and information on the requirements to be considered for integrating further components.

Note:

EHS5 and *EHS5 miniPCle* in this document refers to both the EHS5-E miniPCle product variant with mounted EHS5-E module and support for UMTS 900/1800MHz bands as well as the EHS5-US miniPCle product variant with mounted EHS5-US module and UMTS 850/1900MHz bands. Where necessary a note is made to differentiate between these product variants.

1.1 Ordering Information

Table 1: EHS5 miniPCle

Product	Supplier	Ordering information
EHS5-E miniPCle	Cinterion	Order number: L30960-N3210-A100
EHS5-E miniPCle (3FF)	Cinterion	Order number: L30960-N3211-A100
EHS5-US miniPCle	Cinterion	Order number: L30960-N3220-A100
EHS5-US miniPCle (3FF)	Cinterion	Order number: L30960-N3221-A100

1.2 Related Documents

- [1] EHS5 AT Command Set
- [2] EHS5 miniPCle Release Note
- [3] PCI Express[®] Mini Card Electromechanical Specification, Revision 2.0, April 21, 2012

1.3 Terms and Abbreviations

Abbreviation	Description
3FF	Third Form Factor
3GPP	3rd Generation Partnership Project
CE	Conformité Européene (European Conformity)
CSD	Circuit Switched Data

1. The document is effective only if listed in the appropriate Release Notes as part of the technical documentation delivered with your Cinterion product.

Abbreviation	Description
CTM	Cellular Text Telephone Modem
ETS	European Telecommunication Standard
FCC	Federal Communications Commission (U.S.)
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HSPA	High Speed Packet Access
HSDPA	High Speed Download Packet Access
I/O	Input/Output
IC	Integrated Circuit
IEC	International Electrotechnical Commission
ISO	International Standards Organization
ITU	International Telecommunications Union
LED	Light Emitting Diode
Mbps	Mbits per second
MFF2	M2M UICC Form Factor 2
MIM	Machine Identification Module
MMI	Man Machine Interface
MNO	Mobile Network Operator
MO	Mobile Originated
MT	Mobile Terminated
PBCCH	Packet Switched Broadcast Control Channel
PCI	Peripheral Component Interconnect (personal computer bus)
PDU	Protocol Data Unit
PIN	Personal Identification Number
PPP	Point-to-point protocol
R&TTE	Radio and Telecommunication Terminal Equipment
RF	Radio Frequency
RLP	Radio Link Protocol
RoHS	Restriction of the use of certain hazardous substances in electrical and electronic equipment.
SAR	Specific Absorption Rate
SIM	Subscriber Identification Module
SMS	Short Message Service
TTY	Text Telephone
UICC	Universal Integrated Circuit Card
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
USSD	Unstructured Supplementary Service Data

2 Product Concept

Figure 1 and Figure 2 show the top and bottom view of EHS5 miniPCle.

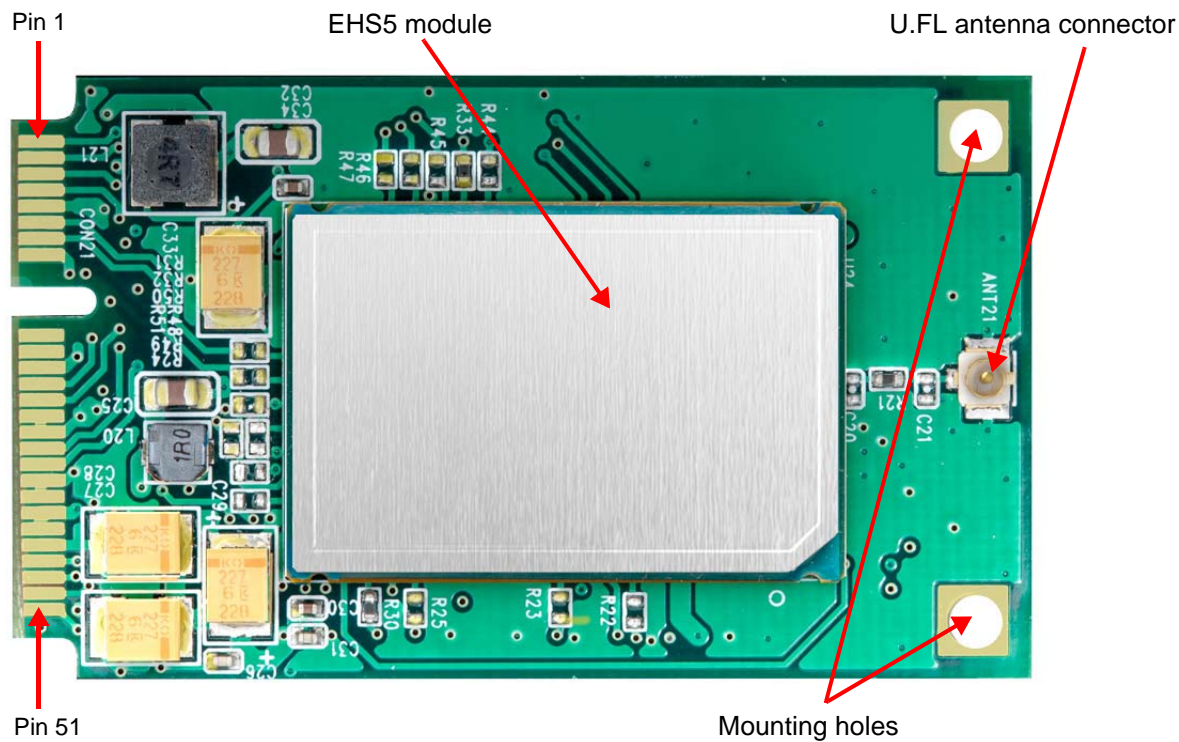


Figure 1: EHS5 miniPCle top view

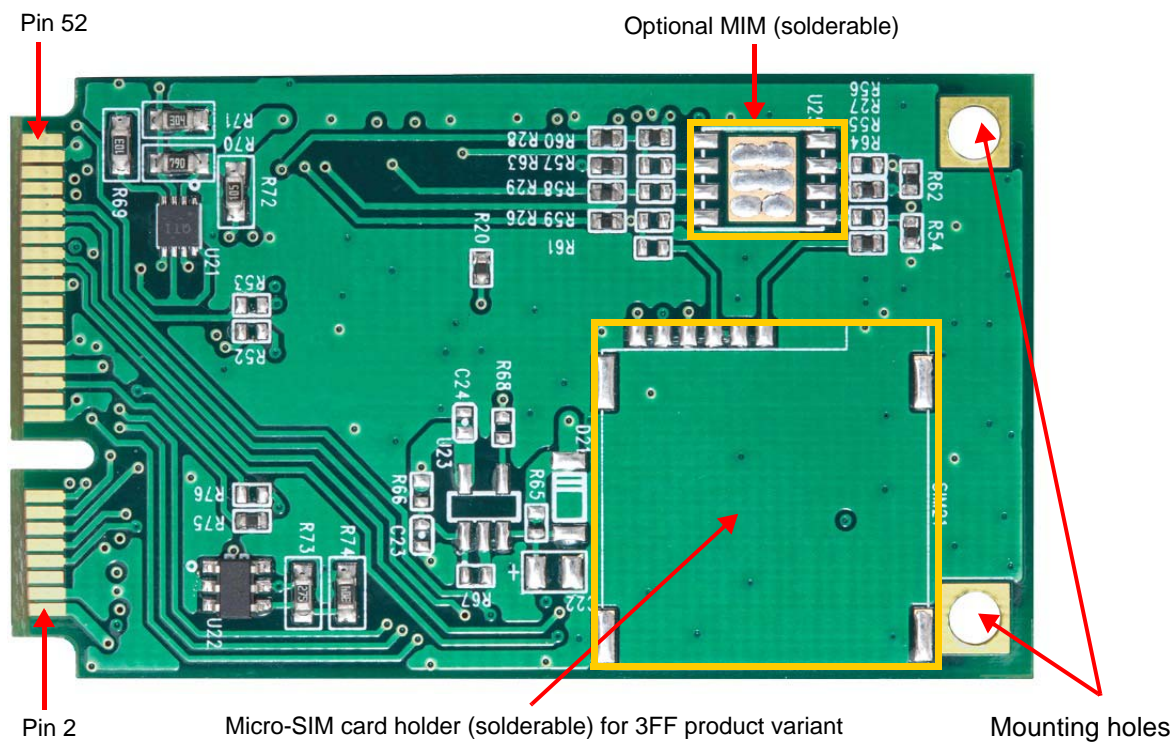


Figure 2: EHS5 miniPCle bottom view

2.1 Key Features at a Glance

Feature	Implementation
<i>General</i>	
Incorporates EHS5 module	The EHS5 module handles all signal and data processing within the EHS5 miniPCle. Internal software runs the complete GSM/GPRS protocol stack.
Frequency bands	<p>EHS5-E: GSM/GPRS/EDGE: Dual band GSM 900/1800MHz UMTS/HSPA+: Dual band UMTS 900/2100MHz</p> <p>EHS5-US: GSM/GPRS/EDGE: Dual band GSM 850/1900MHz UMTS/HSPA+: Dual band UMTS 850/1900MHz</p>
GSM class	Small MS
Output power (according to Release 99, V5)	<p>EHS5-E: Class 4 (+33dBm \pm2dB) for EGSM900 Class 1 (+30dBm \pm2dB) for GSM1800 Class E2 (+27dBm \pm 3dB) for GSM 900 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1800 8-PSK Class 3 (+24dBm +1/-3dB) for UMTS 2100, WCDMA FDD BdI Class 3 (+24dBm +1/-3dB) for UMTS 900, WCDMA FDD BdVIII</p> <p>EHS5-US: Class 4 (+33dBm \pm2dB) for EGSM850 Class 1 (+30dBm \pm2dB) for GSM1900 Class E2 (+27dBm \pm 3dB) for GSM 850 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1900 8-PSK Class 3 (+24dBm +1/-3dB) for UMTS 1900, WCDMA FDD BdII Class 3 (+24dBm +1/-3dB) for UMTS 850, WCDMA FDD BdV</p>
Power supply	3.0V to 3.6V (typical +3.3V)
Operating temperature	-40°C to +85°C
Physical	Dimensions: 51mm x 30mm x 4.7mm Weight: approx. 7.5g
RoHS	All hardware components fully compliant with EU RoHS Directive
<i>HSPA features</i>	
3GPP Release 6, 7	DL 7.2Mbps, UL 5.7Mbps HSDPA Cat.8 / HSUPA Cat.6 data rates Compressed mode (CM) supported according to 3GPP TS25.212
<i>UMTS features</i>	
3GPP Release 4	PS data rate – 384 kbps DL / 384 kbps UL CS data rate – 64 kbps DL / 64 kbps UL

Feature	Implementation
<i>GSM/GPRS features</i>	
Data transfer	GPRS: <ul style="list-style-type: none"> • Multislot Class 12 • Full PBCCH support • Mobile Station Class B • Coding Scheme 1 – 4 EGPRS: <ul style="list-style-type: none"> • Multislot Class 12 • EDGE E2 power class for 8 PSK • Downlink coding schemes – CS 1-4, MCS 1-9 • Uplink coding schemes – CS 1-4, MCS 1-9 • SRB loopback and test mode B • 8-bit, 11-bit RACH • PBCCH support • 1 phase/2 phase access procedures • Link adaptation and IR • NACC, extended UL TBF • Mobile Station Class B CSD: <ul style="list-style-type: none"> • V.110, RLP, non-transparent • 14.4kbps • USSD
SMS	Point-to-point MT and MO Cell broadcast; Text and PDU mode Storage: SIM card plus SMS locations in mobile equipment
<i>Software</i>	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Cinterion
SIM Application Toolkit	SAT Release 99
TCP/IP stack	Access by AT commands
<i>Interfaces</i>	
Application connector	PCI Express® Mini Card system connector (52 pin)
UICC interface	Supported SIM/USIM cards: 3V, 1.8V External SIM card reader has to be connected via application connector. Micro-SIM card reader is provided with the EHS5 miniPCle (3FF) product variant only. Solderable MIM is an option on customer request.
USB interface	USB 2.0 High Speed (480Mbit/s) device interface, Full Speed (12Mbit/s) compliant
Status LED interface	LED signalling configurable by AT command
Antenna interface	U.FL-R-SMT connector 50Ω
<i>Power on/off, Reset</i>	
Power on/off	Switch-off by AT command (AT^SMSO) Automatic switch-off in case of critical temperature and voltage conditions
Reset	Orderly shutdown and reset by AT command
<i>Special features</i>	
Phonebook	SIM and phone
TTY/CTM support	Integrated CTM modem

2.2 System Overview

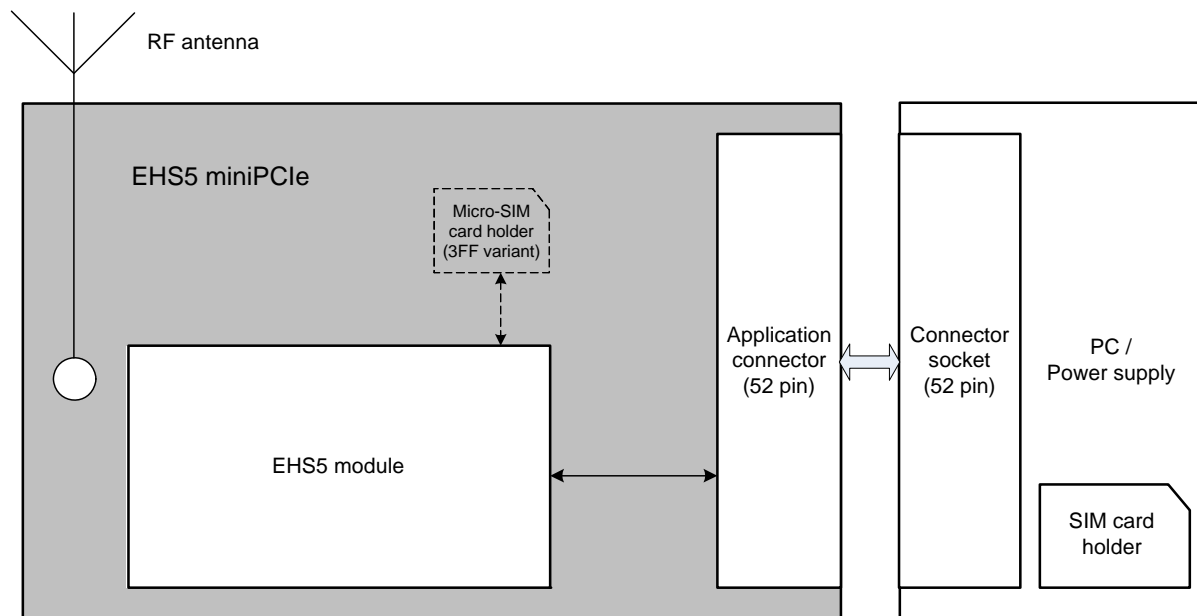


Figure 3: EHS5 miniPCle system overview

2.3 Mechanical Dimensions

The mechanical dimensions for PCI Express Mini Cards with a Full-Mini Card form factor are specified in [3] and shown in Figure 6.

EHS5 miniPCle fully complies with these values and does not extend the hatched areas shown in Figure 4 that represents the available potential component volume for the card's circuitry.

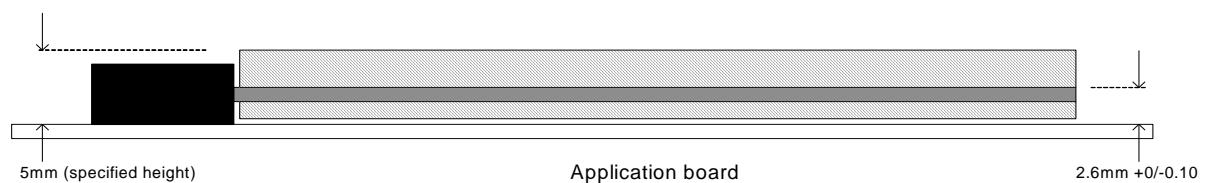


Figure 4: EHS5 miniPCle mechanical dimensions (height)

3 Application Connector Interface

3.1 Pin Assignments and Electrical Description

Table 2 matches the EHS5 miniPCle pin assignments at the 52-pin application connector to the pin assignments specified in [3]. Table 3 lists electrical characteristics of the assigned and available pins at the application connector interface.

Table 2: Pin assignments

Pin No.	EHS5 miniPCle pin name	Comments	PCI Express Mini-Card EM Spec. Rev 2.0 (April 21, 2012)
1	nc ¹	Not connected	WAKE#
2	BATT+	Supply voltage range: 3.0V to 3.6V	3,3Vaux
3	nc	Not connected	COEX1
4	GND	Ground	GND
5	nc	Not connected	COEX2
6	nc	Not connected	1,5V
7	nc	Not connected	CLKREQ#
8	CCVCC	SIM/UICC supply voltage (UICC contact C1)	UIM_PWR
9	GND	Ground	GND
10	CCIO	SIM/UICC input and output (UICC contact C7)	UIM_DATA
11	nc	Not connected	REFCLK-
12	CCCLK	SIM/UICC clock (UICC contact C3)	UIM_CLK
13	nc	Not connected	REFCLK+
14	CCRST	SIM/UICC reset (UICC contact C2)	UIM_RESET
15	GND	Ground	GND
16	nc	Not connected	UIM_SPU
17	nc	Not connected	UIM_IC_DM
18	GND	Ground	GND
19	nc	Not connected	UIM_IC_DP
20	nc	Not connected	W_DISABLE1#
21	GND	Ground	GND
22	EMERG_RST	Emergency reset	PERST#
23	nc	Not connected	PERn0
24	BATT+	Supply voltage range: 3.0V to 3.6V	+3,3Vaux
25	nc	Not connected	PERp0
26	GND	Ground	GND
27	GND	Ground	GND
28	nc	Not connected	+1,5V

Table 2: Pin assignments

Pin No.	EHS5 miniPCle pin name	Comments	PCI Express Mini-Card EM Spec. Rev 2.0 (April 21, 2012)
29	GND	Ground	GND
30	nc	Not connected	SMB_CLK
31	nc	Not connected	PETn0
32	nc	Not connected	SMB_DATA
33	nc	Not connected	PETp0
34	GND	Ground	GND
35	GND	Ground	GND
36	USB_DN	USB Data Negative	USB_D-
37	GND	Ground	GND
38	USB_DP	USB Data Positive	USB_D+
39	BATT+	Supply voltage range: 3.0V to 3.6V	+3.3Vaux
40	GND	Ground	GND
41	BATT+	Supply voltage range: 3.0V to 3.6V	+3.3Vaux
42	Status LED	Default: high impedance; LED setting via AT command (see [1])	LED_WWAN#
43	GND	Ground	GND
44	nc	Not connected	LED_WLAN#
45	nc	Not connected	Reserved
46	nc	Not connected	LED_WPAN#
47	nc	Not connected	Reserved
48	nc	Not connected	+1,5V
49	nc	Not connected	Reserved
50	GND	Ground	GND
51	nc	Not connected	W_DISABLE#2
52	BATT+	Supply voltage range: 3.0V to 3.6V	+3,3Vaux

1. Not connected

Table 3: Electrical description of connector interface pins

Function	Pin name	IO	Signal form and level	Comment
Power supply	BATT+	I	$V_{I\max} = 3.6V$ $V_{I\text{norm}} = 3.3V$ $V_{I\min} = 3.0V$ during Tx burst on board	Lines of BATT+ and GND must be connected in parallel for supply purposes because higher peak currents may occur.
	GND		Ground	Application Ground
Emergency restart	EMERG_RST	I	$R_I \approx 1k\Omega$, $C_I \approx 1nF$ $V_{IH\max} = 1.9V$ $V_{IH\min} = 1.35V$ $V_{IL\max} = 0.3V$ $\sim\sim ___ \sim\sim$ low impulse width > 10ms	This line must be driven low by an open drain or open collector driver connected to GND. If unused keep line open.
3V SIM Card Interface	CCRST	O	$V_{OL\max} = 0.20V$ at $I = 2mA$ $V_{OH\min} = 2.40V$ at $I = -2mA$ $V_{OH\max} = 2.90V$	Maximum cable length or copper track from soldered pad to SIM card holder should not exceed 100mm.
	CCIO	I/O	$V_{IL\max} = 0.60V$ $V_{IH\min} = 1.95V$ $V_{IH\max} = 2.90V$ $V_{OL\max} = 0.20V$ at $I = 2mA$ $V_{OH\min} = 2.40V$ at $I = -2mA$ $V_{OH\max} = 2.90V$	
	CCCLK	O	$V_{OL\max} = 0.20V$ at $I = 2mA$ $V_{OH\min} = 2.40V$ at $I = -2mA$ $V_{OH\max} = 2.90V$	
	CCVCC	O	$V_{O\min} = 2.80V$ $V_{O\text{typ}} = 2.85V$ $V_{O\max} = 2.90V$ $I_{O\max} = -30mA$	
1.8V SIM Card Interface	CCRST	O	$V_{OL\max} = 0.20V$ at $I = 2mA$ $V_{OH\min} = 1.50V$ at $I = -2mA$ $V_{OH\max} = 1.90V$	Maximum cable length or copper track from soldered pad to SIM card holder should not exceed 100mm.
	CCIO	I/O	$V_{IL\max} = 0.37V$ $V_{IH\min} = 1.22V$ $V_{IH\max} = 1.90V$ $V_{OL\max} = 0.20V$ at $I = 2mA$ $V_{OH\min} = 1.50V$ at $I = -2mA$ $V_{OH\max} = 1.90V$	
	CCCLK	O	$V_{OL\max} = 0.20V$ at $I = 2mA$ $V_{OH\min} = 1.50V$ at $I = -2mA$ $V_{OH\max} = 1.90V$	
	CCVCC	O	$V_{O\min} = 1.75V$ $V_{O\text{typ}} = 1.80V$ $V_{O\max} = 1.85V$ $I_{O\max} = -30mA$	
USB	USB_DN	I/O	Signal characteristics according USB 2.0 Specification.	If unused keep line open.
	USB_DP			
Status LED interface	Status LED	O	$V_{OL\max} = 0.20V$ at $I = 2mA$ $V_{OH\min} = 1.50V$ at $I = -2mA$ $V_{OH\max} = 1.90V$	If unused keep line open.

3.2 Characteristics

3.2.1 Power Supply and Ground

The EHS5 miniPCle uses the five BATT+ (+3.3Vaux) pins and 14 GND pins listed in [Section 3.1](#) and specified in [\[3\]](#) as power supply sources and ground.

3.2.2 USB Interface

The EHS5 miniPCle's USB interface (USB_DP, USB_DN) as part of the 52-pin application connector supports a USB 2.0 High Speed (480Mbit/s) device interface that is Full Speed (12Mbit/s) compliant. Because there is no separate voltage detection line available on the application connector, the EHS5 miniPCle reports as a self-powered device compliant with the "Universal Serial Bus Specification Revision 2.0"¹.

Via the USB interface it is possible to implement a Cinterion Wireless Module USB modem as well as six further Cinterion Wireless Module ports that provide an AT interface to the module. The appropriate modem and port configuration files (INF) can be downloaded from the Cinterion Extranet.

3.2.3 SIM/UICC Interface

The EHS5 miniPCle provides a SIM/UICC interface at the 52-pin application connector compliant to the ISO/IEC 7816-3 specification. The SIM interface is intended for 1.8V and 3V SIM cards in accordance with GSM 11.12 Phase 2.

The following table lists the pins available for the SIM/UICC interface.

Table 4: Signals of the SIM interface

Signal	Description
CCCLK	Chipcard clock
CCVCC	SIM supply voltage.
CCIO	Serial data line, input and output.
CCRST	Chipcard reset

Note: No guarantee can be given, nor any liability accepted, if loss of data is encountered after removing the SIM card during operation. Also, no guarantee can be given for properly initializing any SIM card that the user inserts after having removed the SIM card during operation. In this case, the EHS5 miniPCle must be restarted.

The total cable length between the EHS5 module pads soldered onto the EHS5 miniPCle and the pads of an external SIM card holder must not exceed 100mm in order to meet the specifications of 3GPP TS 51.010-1 and to satisfy the requirements of EMC compliance.

To avoid possible cross-talk from the CCCLK signal to the CCIO signal be careful that both lines are not placed closely next to each other. A useful approach is using a GND line to shield the CCIO line from the CCCLK line.

1. The specification is ready for download on <http://www.usb.org/developers/docs/>

Besides the above mentioned product variant employing an external SIM card holder there exists a variant with a micro-SIM (3FF) card holder soldered directly onto the miniPCle board. With this variant - EHS5 miniPCle (3FF) - it is possible to insert a micro-SIM card (3FF) into the holder on the EHS5 miniPCle. There is no need for a card holder in an external application. Simultaneous operation of an external and the onboard SIM/UICC is not possible. Only one SIM/UICC card must be connected to the EHS5 module.

As an option it is also possible to use a MFF2 UICC by soldering the MIM chip directly onto the EHS5 miniPCle board during production. However, no other SIM/UICC card must be connected to the EHS5 miniPCle in case a MFF2 UICC is used.

3.2.4 Status LED

The EHS5 miniPCle provides a status indication line over the 52-pin application connector specified in [3] - the LED line.

The line can be configured to drive a status LED which indicates different operating modes of the module. To take advantage of this function an LED may be connected to the status line as shown in Figure 5.

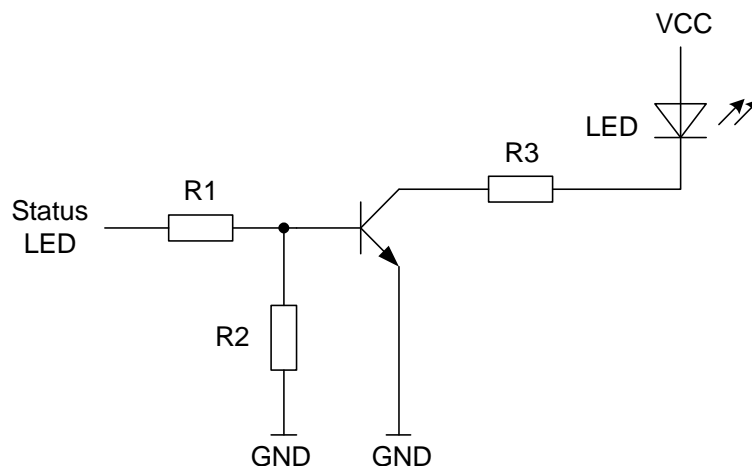


Figure 5: Status signalling with LED driver

3.2.5 Restart Signal

The EMERG_RST signal is internally connected to the central GSM processor of the EHS5 miniPCle. A low level for more than 10ms sets the processor and with it all the other signal pads to their respective reset states usually reached right after EHS5 miniPCle startup. After releasing the EMERG_RST line, i.e., with a change of the signal level from low to high, the module restarts.

It is recommended to control this EMERG_RST line with an open collector transistor or an open drain field-effect transistor.

Caution: Use the EMERG_RST signal only when, due to serious problems, the software is not responding for more than 5 seconds. Pulling the EMERG_RST line causes the loss of all information stored in the volatile memory. Therefore, this procedure is intended only for use in case of emergency, e.g. if EHS5 miniPCle does not respond, if reset or shutdown via AT command fails.

4 Antenna Interface

The EHS5 miniPCle has an U.FL-R-SMT antenna connector as RF interface (see [Figure 1](#)). The RF interface has an impedance of 50Ω . EHS5 miniPCle is capable of sustaining a total mismatch at the antenna lines without any damage, even when transmitting at maximum RF power.

The external antenna must be matched properly to achieve best performance regarding radiated power, modulation accuracy and harmonic suppression. Antenna matching networks are not included on the EHS5 miniPCle module and should be placed in the host application if the antenna does not have an impedance of 50Ω .

Regarding the return loss EHS5 miniPCle provides the following values in the active band:

Table 5: Return loss in the active band

State of module	Return loss of module	Recommended return loss of application
Receive	$\geq 8\text{dB}$	$\geq 12\text{dB}$
Transmit	not applicable	$\geq 12\text{dB}$

5 Operation

5.1 Supported Operating Systems

The EHS5 miniPCle supports the following operating systems:

- Microsoft® Windows® operating systems
 - Microsoft Windows 8
 - Microsoft Windows 7
 - Microsoft Windows Vista
 - Microsoft Windows XP

To operate the EHS5 miniPCle with applications using Microsoft Windows operating systems USB modem and port configuration files (INF) provided by Cinterion are required and will have to be installed as described in [Section 5.2](#). The INF files can be downloaded from the Cinterion Extranet.

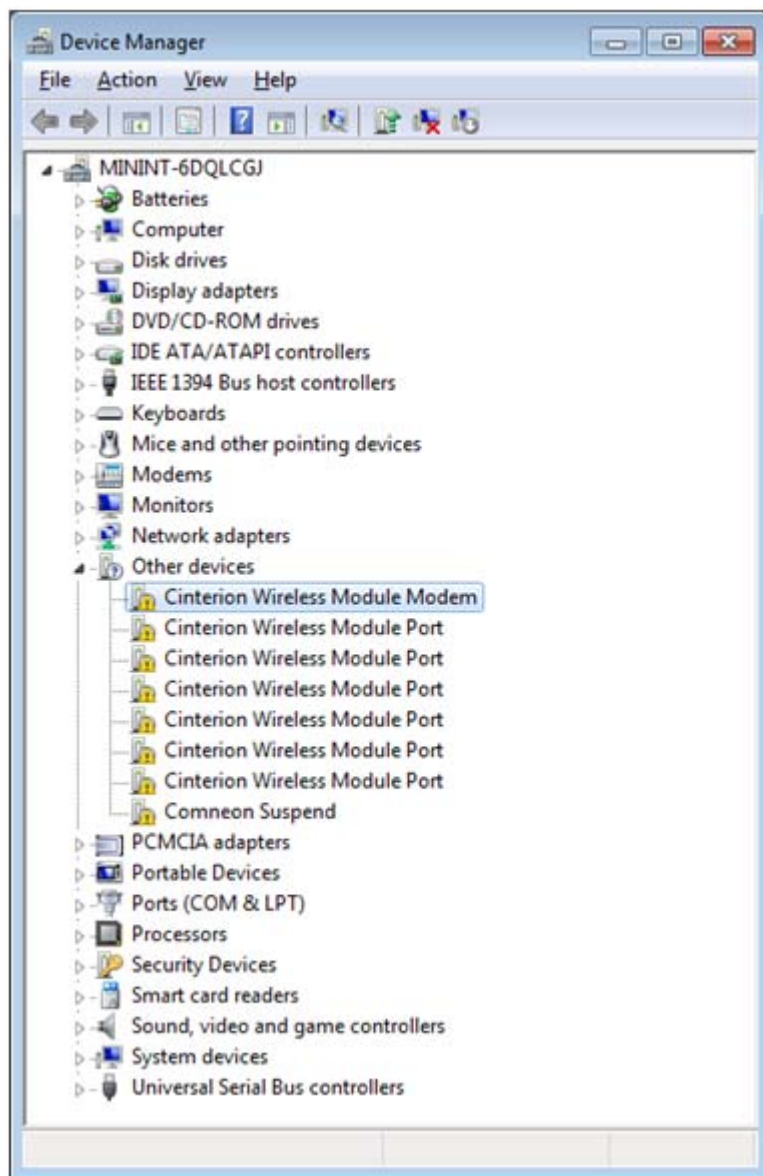
- Linux operating systems
 - Linux Kernel 2.4.31 (and above)

With the above mentioned Linux versions the provided standard USB drivers may be used.

5.2 Step-by-Step Startup

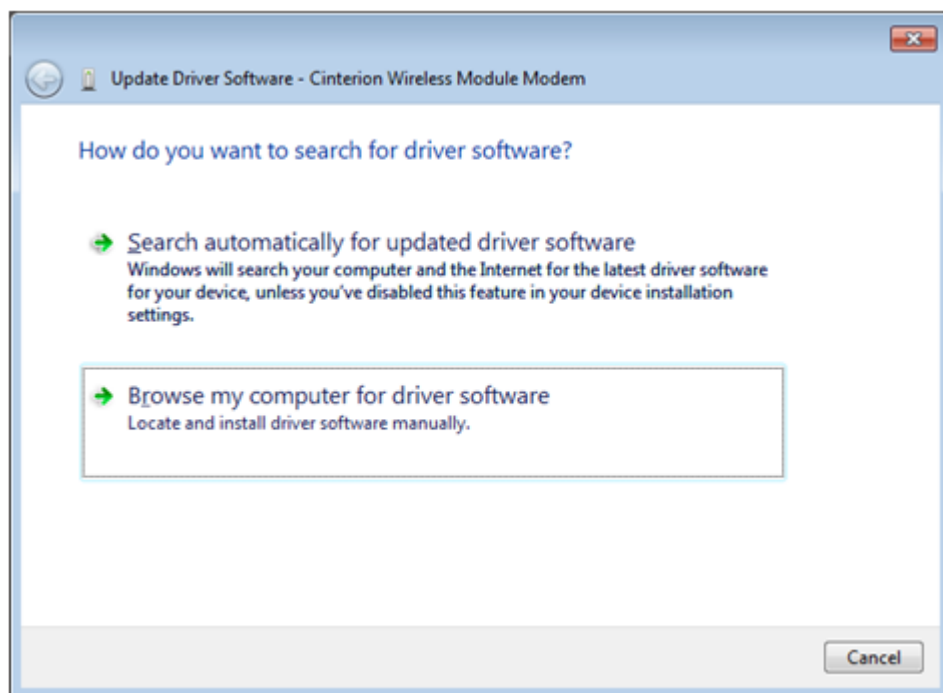
To set up the EHS5 miniPCle under Windows 7 (and other Windows operating systems) please follow the below step-by-step instructions.

- Plug the EHS5 miniPCle into the PCI Express Mini Card socket (full size mini card) and fix the card for example by means of screws.
- Connect the RF antenna cable using the U.FL-R-SMT connector of the EHS5 miniPCle.
- Insert the SIM card into the externally connected SIM card holder.
- Power up the system/application containing the EHS5 miniPCle. The following instructions that are based on an application with Windows 7 as operating system.
- Open the Device Manager, right click on Cinterion Wireless Modules Modem under Other devices and select Update Driver Software.

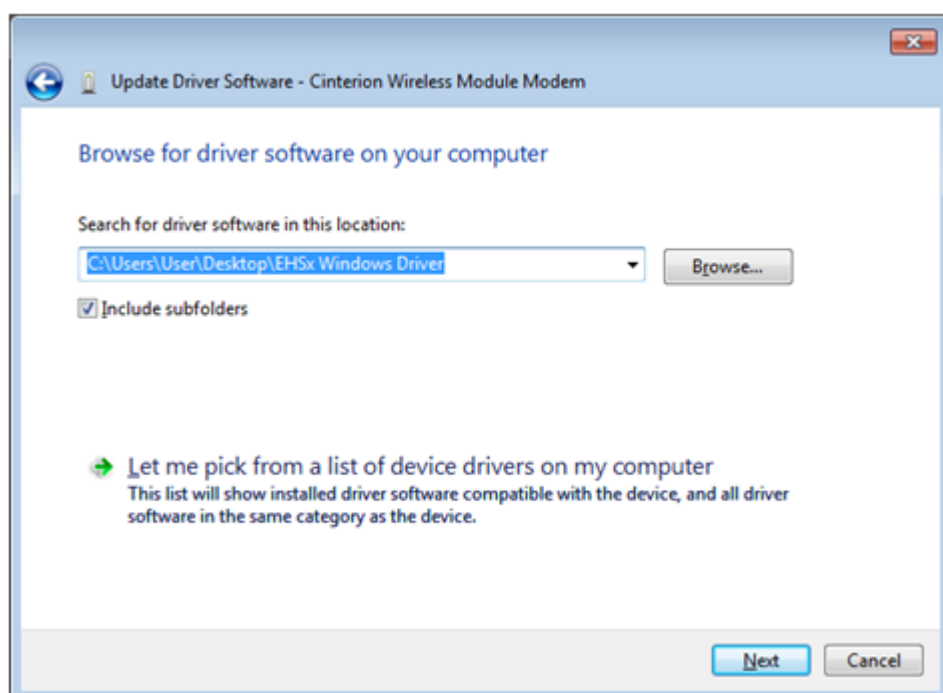


Please note that besides the Cinterion Wireless Module Modem there are six further Cinterion Wireless Module ports located under „Other devices“ that may in parts be used to access the module. The INF file to configure these ports can also be downloaded from the Cinterion Extranet and will have to be installed in the same way as the USB modem file. The module ports numbered 3, 4 and 5 provide an AT command interface to the module via USB. The other ports are reserved for future use.

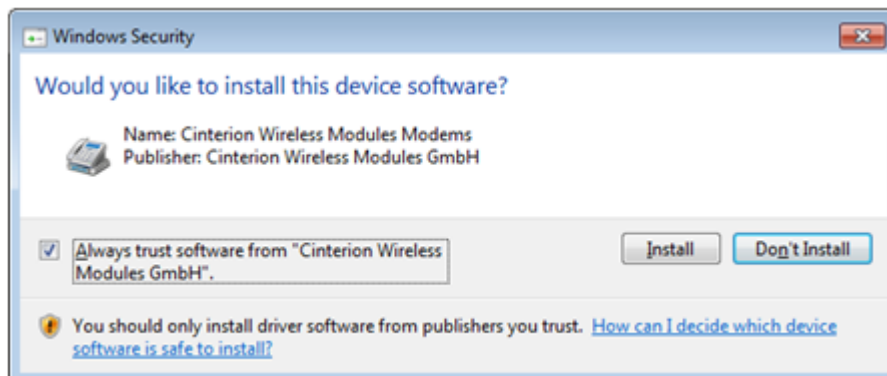
- Select Browse my computer for driver software



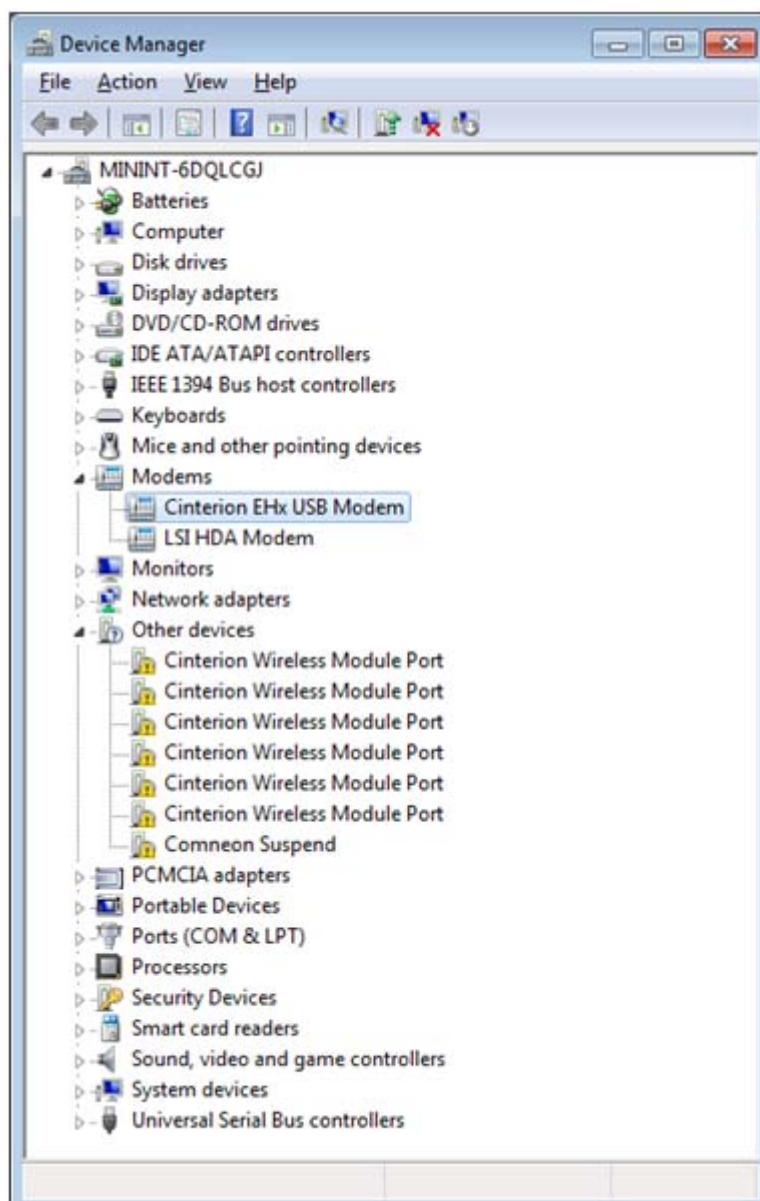
- Browse to the folder with the provided Cinterion USB modem INF file and click Next



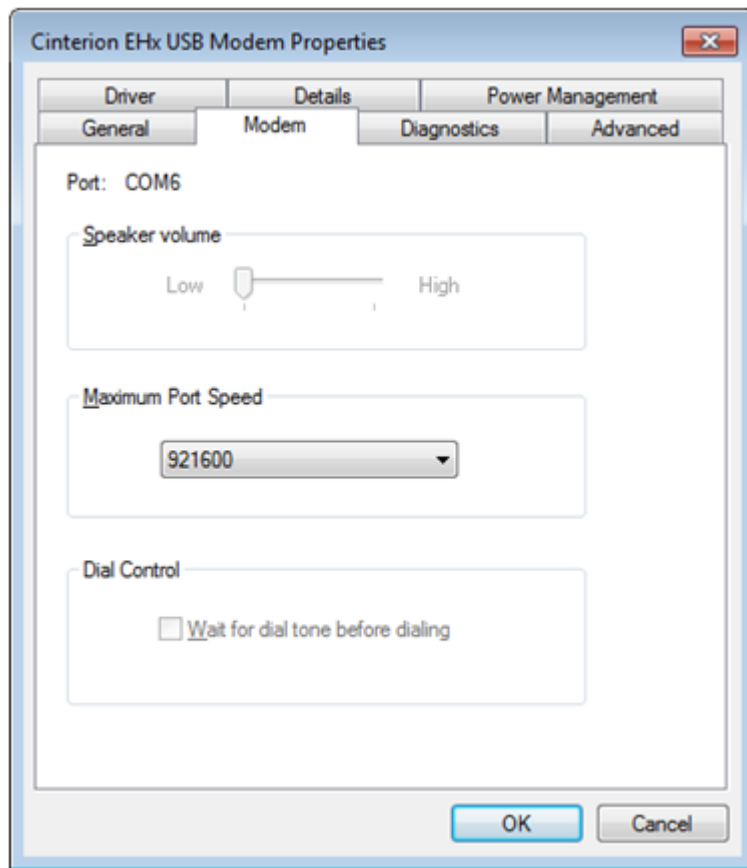
- Install the Cinterion Wireless Modules Modem and close the window if the driver software update has been completed.



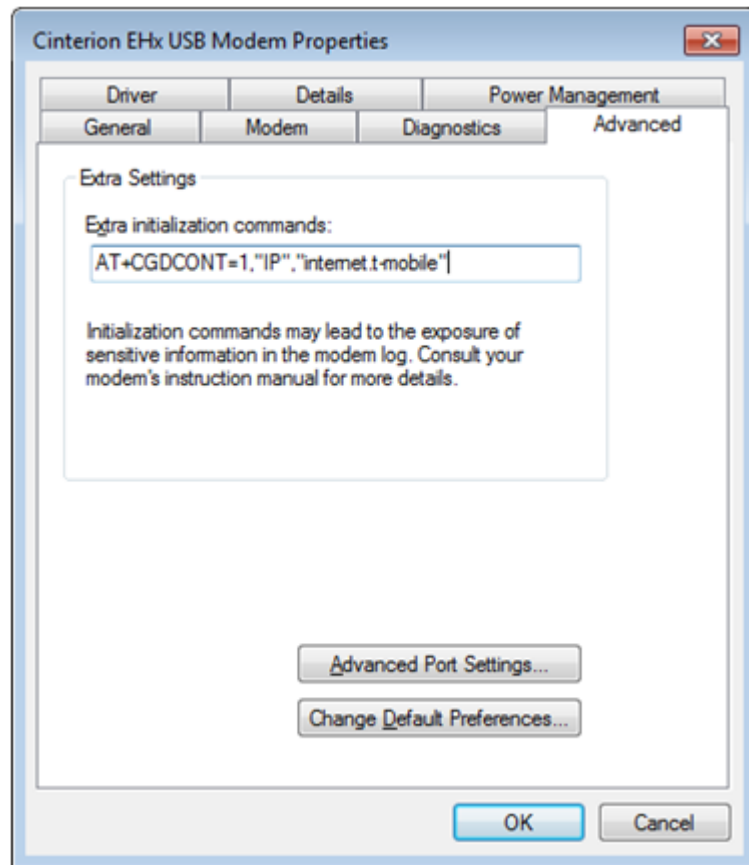
- After installation the Cinterion EHx USB Modem is available in the Device Manager under Modems.



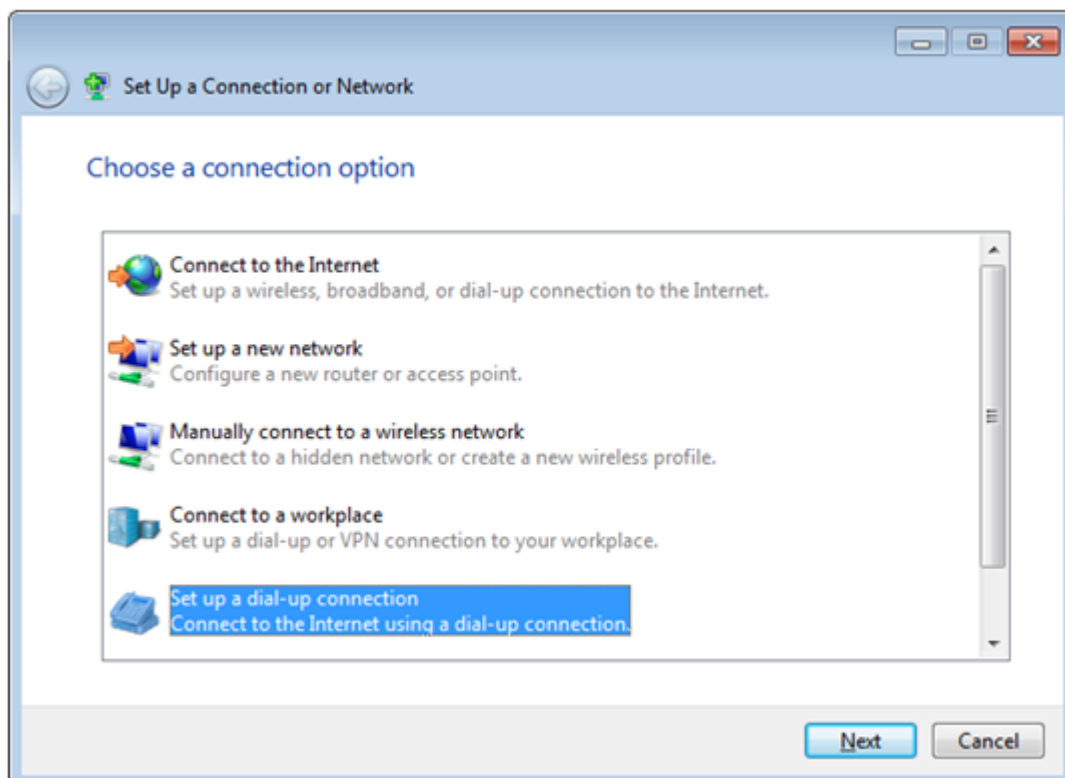
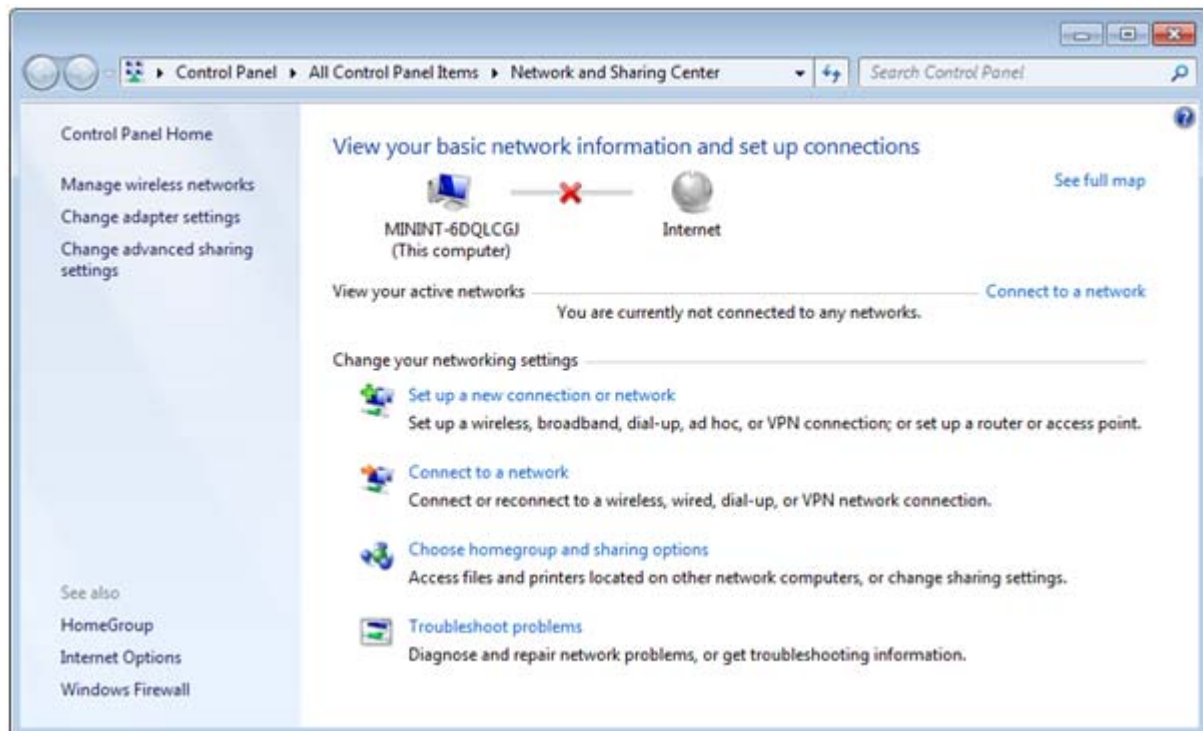
- Right click on Cinterion EHx USB Modem, select Properties and open the the Modem tab to display the selected COM port (e.g. COM6) as well as the maximum port speed



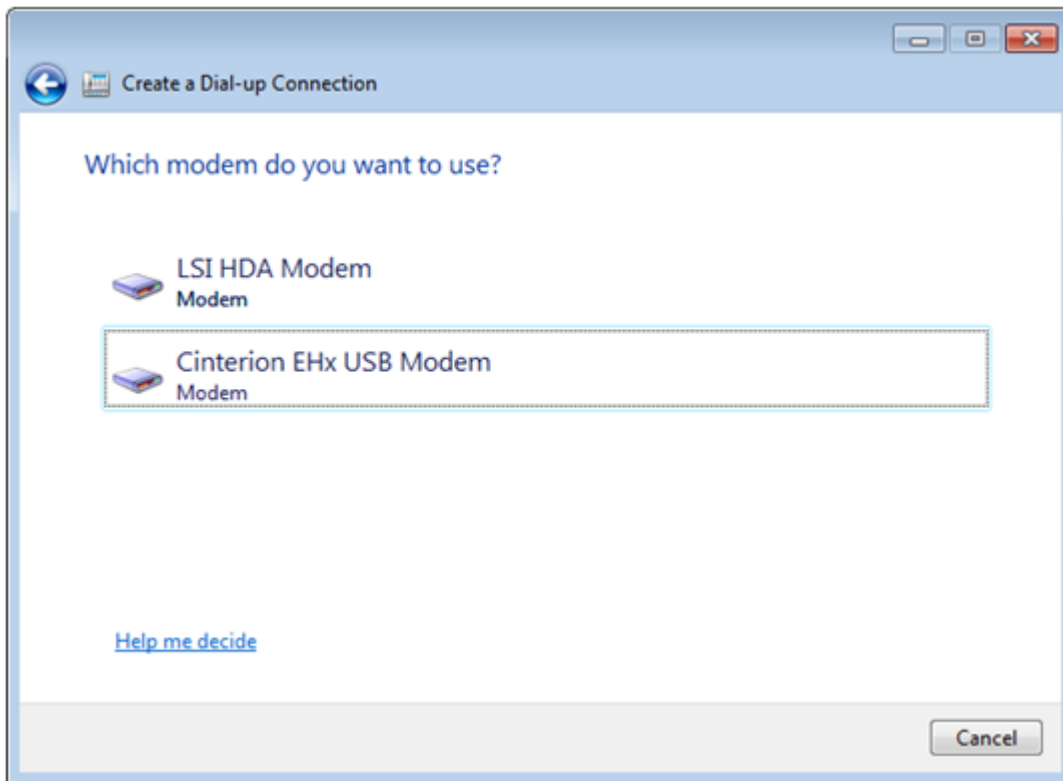
- Open the Advanced tab to specify the Extra Initialization Commands in the Advanced tab:
AT+CGDCONT=1,"IP","[APN]"
[APN] stands for the APN information provided by the MNO of the used SIM card. Ensure that the SIM card does not require a PIN.



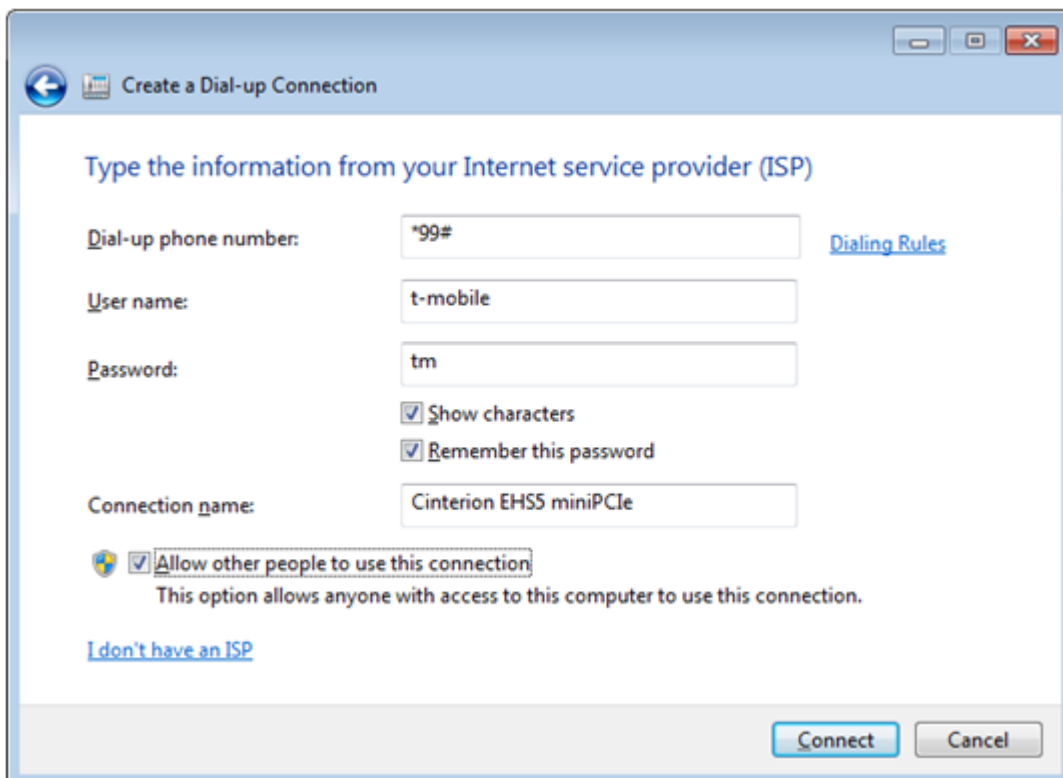
- Set up a new connection or network using the Control Panel to (Control Panel --> Network and Sharing Center).

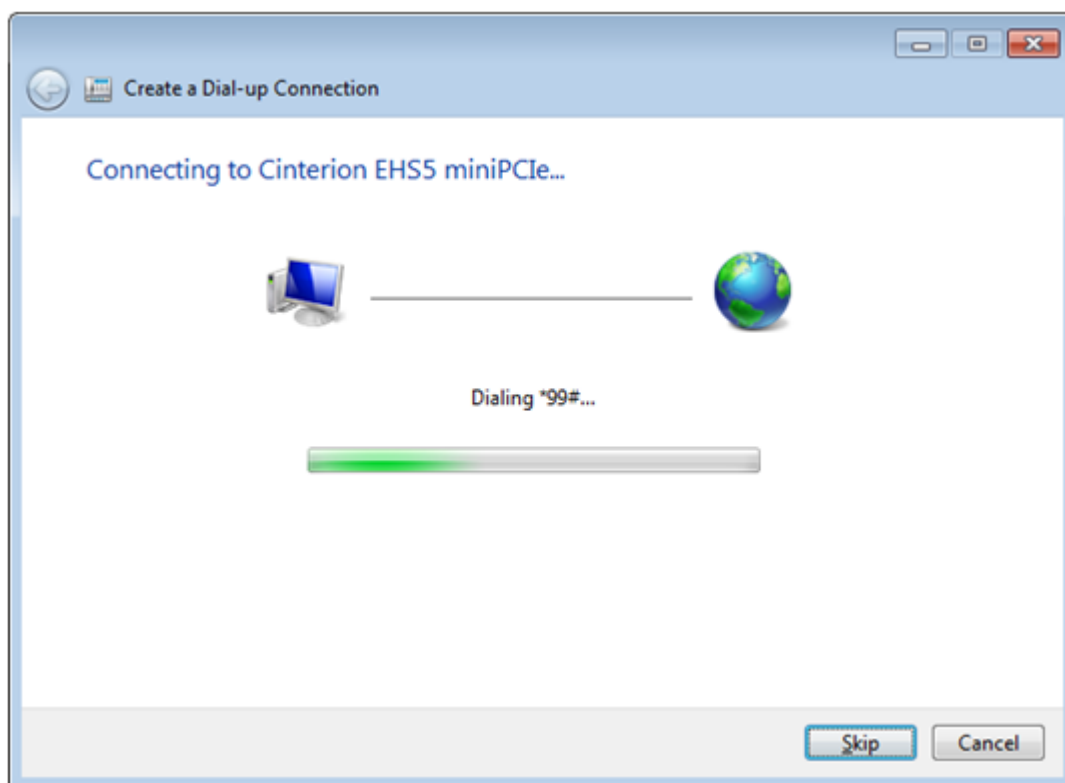


- Select the 'Cinterion EHx USB Module' if required.

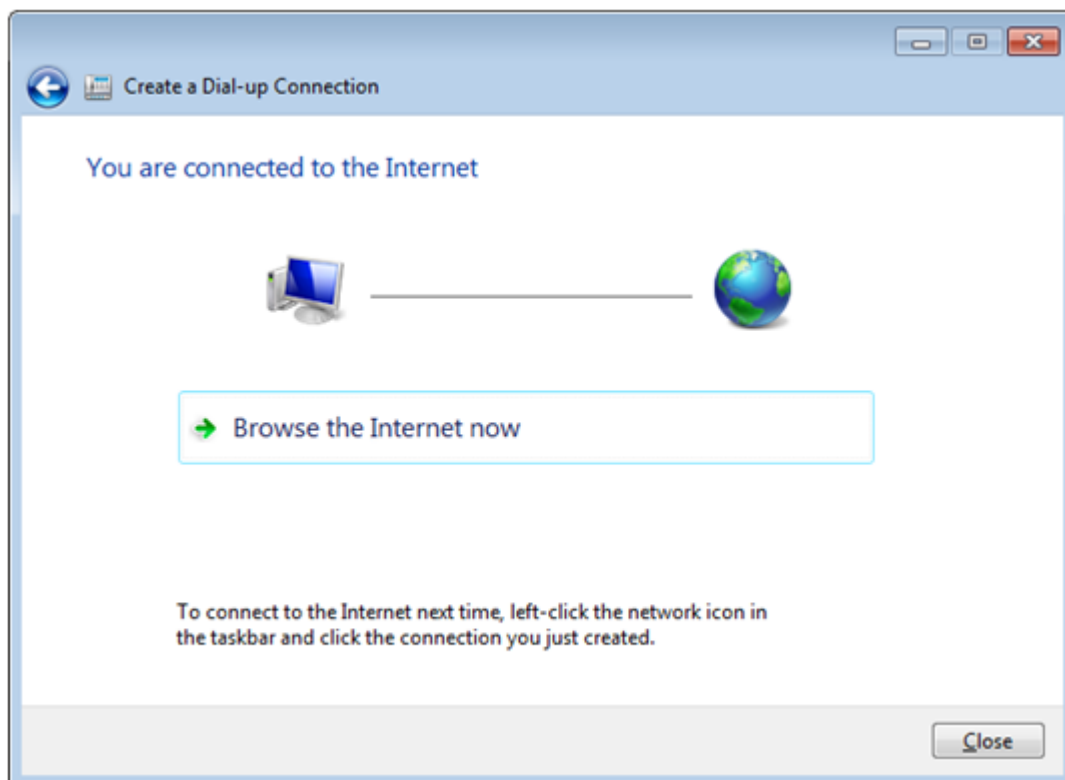


- Enter the Internet Service Provider settings according to the information provided by the MNO of the SIM card you are using and click Connect to startup the Internet connection

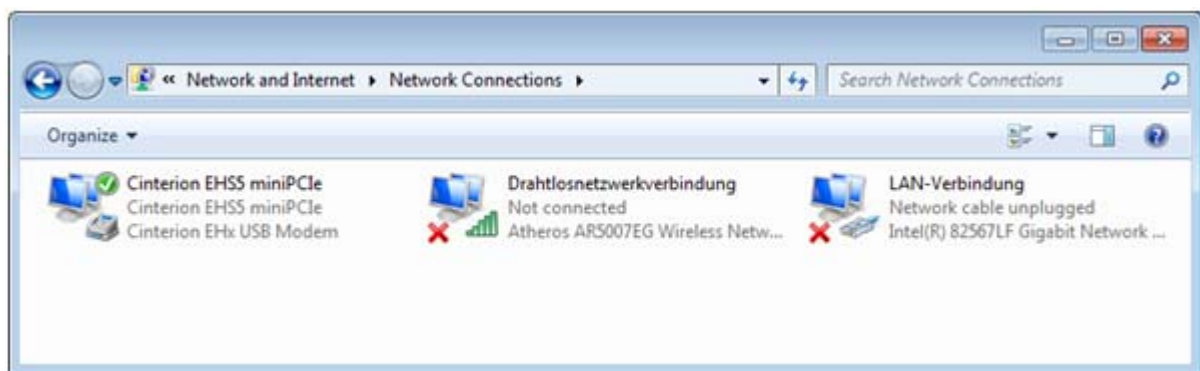
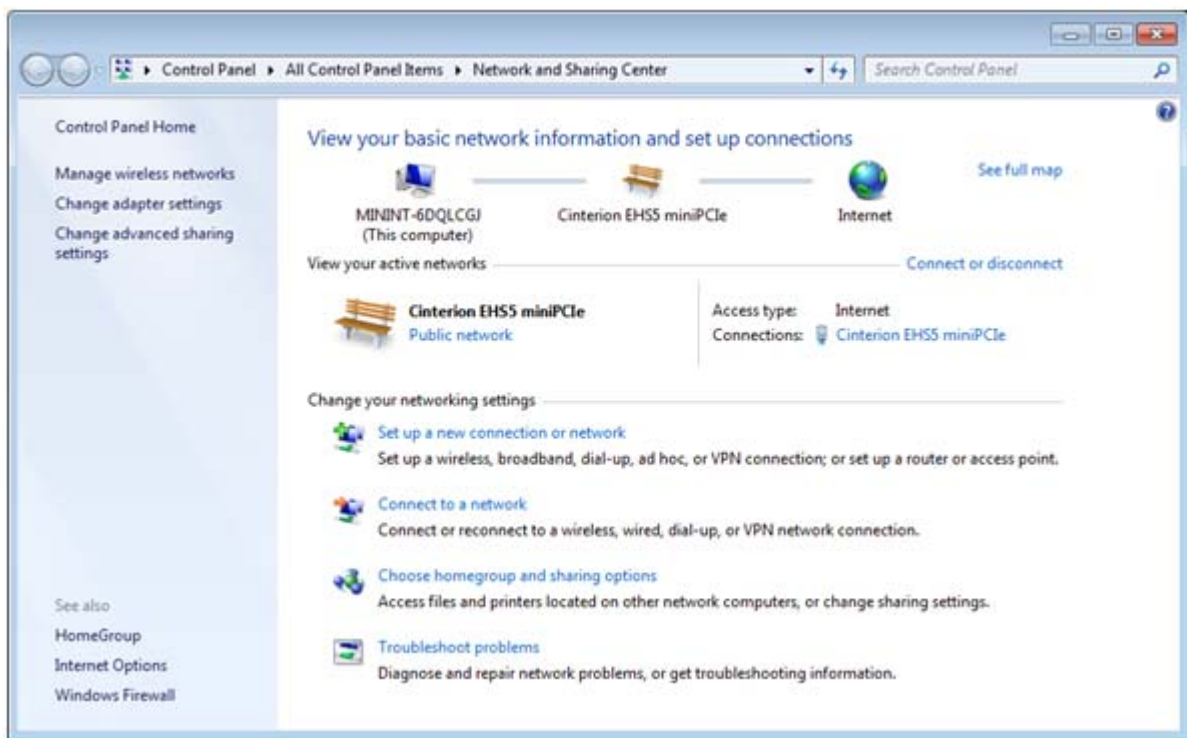


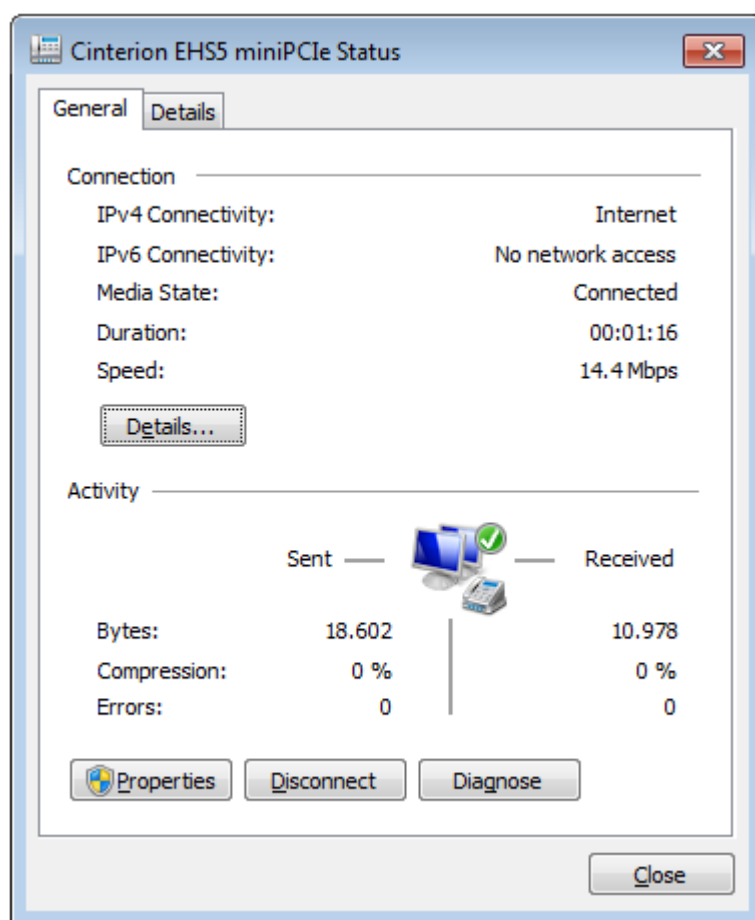


- After the dial-up connection has been created the system is connected to the Internet



- To get further information select Change Adapter Settings and double click on Cinterion EHS5 miniPCle'





5.3 Power Supply Ratings

Table 6: Power supply ratings¹

	Description	Conditions	Min	Typ	Max	Unit
BATT+	Supply voltage	Voltage must stay within the min/max values, including voltage drop, ripple, spikes	3.0	3.3	3.6	V
	Maximum allowed voltage drop during transmit burst	Normal condition, power control level for Pout max			400	mV
	Voltage ripple	Normal condition, power control level for Pout max @ f ≤ 250 kHz @ f > 250 kHz				mV _{pp} mV _{pp}
I _{BATT+} ²	Average GSM / GPRS supply current	SLEEP ³ @ DRX=9	USB suspended		1.2	mA
		SLEEP ³ @ DRX=5	USB suspended		1.5	mA
		SLEEP ³ @ DRX=2	USB suspended		1.9	mA
		GPRS Data transfer GSM850/900; PCL=5; 1Tx/4Rx	ROPR=4 (max. reduction)		240	mA
			ROPR=0 (no reduction)			
		GPRS Data transfer GSM850/900; PCL=5; 2Tx/3Rx	ROPR=4 (max. reduction)		320	mA
			ROPR=0 (no reduction)		440	mA
		GPRS Data transfer GSM850/900; PCL=5; 4Tx/1Rx	ROPR=4 (max. reduction)		400	mA
			ROPR=0 (no reduction)		800	mA
		EDGE Data transfer GSM850/900; PCL=5; 1Tx/4Rx	ROPR=4 (max. reduction)		170	mA
			ROPR=0 (no reduction)			
		EDGE Data transfer GSM850/900; PCL=5; 2Tx/3Rx	ROPR=4 (max. reduction)		240	mA
			ROPR=0 (no reduction)		290	mA
		EDGE Data transfer GSM850/900; PCL=5; 4Tx/1Rx	ROPR=4 (max. reduction)		360	mA
			ROPR=0 (no reduction)		500	mA

Table 6: Power supply ratings¹

	Description	Conditions		Min	Typ	Max	Unit
I _{BATT+} ²	Average GSM / GPRS supply current	GPRS Data transfer GSM1800/1900; PCL=0; 1Tx/4Rx	ROPR=4 (max. reduction)		185		mA
			ROPR=0 (no reduction)				
		GPRS Data transfer GSM1800/1900; PCL=0; 2Tx/3Rx	ROPR=4 (max. reduction)		230		mA
			ROPR=0 (no reduction)		320		mA
		GPRS Data transfer GSM1800/1900; PCL=0; 4Tx/1Rx	ROPR=4 (max. reduction)		280		mA
			ROPR=0 (no reduction)		570		mA
		EDGE Data transfer GSM1800/1900; PCL=0; 1Tx/4Rx	ROPR=4 (max. reduction)		150		mA
			ROPR=0 (no reduction)				
		EDGE Data transfer GSM1800/1900; PCL=0; 2Tx/3Rx	ROPR=4 (max. reduction)		230		mA
			ROPR=0 (no reduction)		250		mA
		EDGE Data transfer GSM1800/1900; PCL=0; 4Tx/1Rx	ROPR=4 (max. reduction)		350		mA
			ROPR=0 (no reduction)		420		mA
I _{BATT+} ² I _{BATT+} ²	Average WCDMA supply current Average WCDMA supply current	SLEEP ³ @ DRX=9	USB suspended		1.6		mA
		SLEEP ³ @ DRX=8	USB suspended		1.6		mA
		SLEEP ³ @ DRX=6	USB suspended		2.3		mA
		UMTS Data transfer Band I @+24dBm			550		mA
		UMTS Data transfer Band II @+24dBm			590		mA
		UMTS Data transfer Band V @+24dBm			500		mA
		UMTS Data transfer Band VIII @+24dBm			580		mA
		HSPA Data transfer Band I @+24dBm			550		mA
		HSPA Data transfer Band II @+24dBm			590		mA
		HSPA Data transfer Band V @+24dBm			500		mA
		HSPA Data transfer Band VIII @+24dBm			580		mA

1. Please note that the listed frequency bands apply as follows:

- EHS5-E miniPCle: GSM/GPRS 900/1800MHz; UMTS/HSPA+: 900/2100MHz (Band I / VIII)
- EHS5-US miniPCle: GSM/GPRS: 850/1900MHz; UMTS/HSPA+: 850/1900MHz (Band II / V)

2. With an impedance of Z_{LOAD}=50Ohm at the antenna connector.

All measurements have been done with BATT+ = 3.4V.

3. Measurements start 6 minutes after switching ON the module,

Averaging times: SLEEP mode - 3 minutes, transfer modes - 1.5 minutes

Communication tester settings: no neighbour cells, no cell reselection etc., RMC (reference measurement channel)

SLEEP mode (power saving) is enabled via AT command AT^SPOW=2,1000,3

5.4 Approval Information

The EHS5 module as part of the EHS5 miniPCle has been type approved. The Cinterion reference setup submitted to type approve the module consisted of the following components: EHS5, PC as MMI, Power Supply.

Approval of mobile computing platforms containing EHS5 miniPCle can therefore be based on the existing module approval together with this document as appropriate technical documentation. No further approval may be required if the conditions mentioned in [Section 5.4.3](#) are met.

5.4.1 CE Conformity

The EHS5 miniPCle meets the requirements of the EU directives listed below:

- R&TTE Directive 1999/5/EC

5.4.2 EMC

The EHS5 miniPCle complies with the equipment requirements specified in EN 301489-1, EN 301489-7 and is covered by the R&TTE Directive.

5.4.3 Compliance with FCC Rules and Regulations

As an integrated product, the EHS5-US miniPCle is fully compliant with the grant of the FCC Equipment Authorization issued for a possible built-in EHS5-US module.

The Equipment Authorization Certification for the EHS5-US module is listed under the following identifiers:

FCC Identifier: QIPEHS5-US

Industry Canada Certification Number: 7830A-EHS5US

Granted to Cinterion Wireless Modules GmbH

Radiofrequency radiation exposure Information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Note: This terminal 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.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications made to this equipment not expressly approved by Cinterion may void the FCC authorization to operate this equipment.

Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

6 Appendix

6.1 Mechanical Drawings

Figure 6 shows detailed mechanical dimensions of the EHS5 miniPCle.

TBD.

Figure 6: Detailed mechanical drawings