Cellular M2M Communication
Cinterion simply and securely connects Intelligent Systems anywhere

Holger Lenz / Director Business Development

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Cinterion – the leading M2M module supplier

Cinterion – who we are

- Worldwide leading supplier of industrial cellular machine-to-machine (M2M) communication modules - GSM, GPRS, EDGE, UMTS, HSPA+
- Founded as a business unit of Siemens Communication in 1995 and spun off in 2008
- A Gemalto company since 2010
- Intel® Intelligent System Alliance Associate (2012)

M2M Module Market Shares 2011

- CINTERION 27%
- Sierra Wireless
- Novatel
- SIMcom
- Sagem
- Other

1997
1st automotive grade module

2000
1st Compact GSM module

2002
1st GPRS module on the market

2003
1st Java module

2004
1st GSM/GPS module on the market

2005
1st EDGE module on the market

2006
1st HSDPA module on the market

2007
HSDPA with worldwide roaming

2008
Scalability GPRS + EDGE platform

2009
Evolution Products LGA surface mounting

2010
Scalable UMTS & HSPA+ module

2011
Automotive HSPA+ module
Cinterion – global reach and local support

**Americas**
- USA
- Canada
- Brazil

**Europe**
- Present in 11 countries

**Asia**
- China
- Taiwan
- Japan
- Korea
- India
- Singapore
- Australia

**MEA**
- South Africa
- Israel

**Technology Center**
- Berlin (GER)

**Headquarters**
- Munich (GER)

**Manufacturing**
- Leipzig (GER)
- Curitiba (BRA)
- Shanghai (CHN)

**Sales Office**
- Leipzig (GER)
- Curitiba (BRA)
- Shanghai (CHN)

**Factory**
- Further local Gemalto offices

**Distributors all over the world**
Cinterion – a Gemalto company

<table>
<thead>
<tr>
<th>Gemalto</th>
<th>Gemalto Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gemalto, the leader in digital security</strong>&lt;br&gt;Developing software applications as well as designing and producing secure personal devices such as smart cards, e-passports and secure tokens.</td>
<td>Gemalto’s secure personal devices are in the hands of billions of individuals enabling users to:</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Key figures</th>
<th>Communicate</th>
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<td>2011 Revenue €2 billion</td>
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<td>10,000 employees</td>
<td>Travel</td>
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<td>100 nationalities</td>
<td>Work</td>
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<td>43 countries</td>
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<td>14 R&amp;D sites</td>
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<tr>
<td>1300 patent families</td>
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www.gemalto.com
<table>
<thead>
<tr>
<th></th>
<th>U-MIM Quad</th>
<th>M2M\textsuperscript{Plug} 85</th>
<th>M2M\textsuperscript{Plug} 105</th>
<th>Full M2M Quad</th>
<th>Full Auto Quad</th>
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<td><strong>Drivers</strong></td>
<td>Miniaturization M2M consumer electronics</td>
<td>Fit any equipment M2M industrial</td>
<td>Fit any equipment Extended endurance M2M industrial</td>
<td>Industrial grade Extended endurance M2M industrial</td>
<td>Auto grade Extended endurance Automotive std</td>
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<tr>
<td><strong>Temperature resistance range</strong></td>
<td>GSM standard</td>
<td>-35° / +85°</td>
<td>-40° / +105°</td>
<td>-40° / +105°</td>
<td>-40° / +105°</td>
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<td><strong>M2M qualification (JEDEC)</strong></td>
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<tr>
<td><strong>eXtended Life mechanism</strong></td>
<td>As an option</td>
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<td><strong>Enhanced silicon</strong></td>
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<td><strong>Burn-in</strong></td>
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</tr>
<tr>
<td><strong>Data retention</strong></td>
<td>10y / 25°C</td>
<td>10y / 85°C</td>
<td>10y / 85°C</td>
<td>10y / 85°C</td>
<td>17y / 80°C</td>
</tr>
<tr>
<td><strong>Automotive req compliancy</strong></td>
<td></td>
<td></td>
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<td></td>
<td>AEC Q100 (TS 16 949)</td>
</tr>
</tbody>
</table>
M2M is used in a wide range of industrial verticals to enable businesses

M2M communication is a cross-segment technology to embed cellular connectivity for:

- Connecting assets into business process
- Optimizing processes and driving efficiency
- Creating new value-added services
Where is the need for cellular in an Embedded Intel® Architecture (EIA)

Cellular Communication

- M2M Module
- M2M PCIe Mini Card (latest technology)
- M2M Module or Chipset
- PCIe Mini Card (mature technology)
- Chipset

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Cinterion offers a broad portfolio of Intel®-based M2M products

- **EHS5 - 3G M2M Modules**
  - HSPA / HSPA+
  - Compact size, same form-factor and pad layout as 2G Module

- **BGS2 - 2G LGA Surface Mount Module**
  - Size and cost optimized
  - LGA surface mounting
  - Broad M2M feature set

- **MC55i / BG2 - 2G Connector Module**
  - Flexible mounting via connector
  - Broad M2M feature set

- **AGS2 - Automotive Modules**
  - Certified automotive grade quality
  - Automotive specific feature set
  - eCall compliant

- **EHS5 & BGS2 miniPCIe – M2M PCIe Mini Card**
  - 3G and 2G data modem functionality
  - Dedicated to M2M systems based on EIA (x86) architecture (Window, Linux)

- **BGS2 Terminals**
  - Plug and Play M2M solution
  - Fully type approved terminal
Industrial M2M relies on long term relationships with the customer

**How cellular comes in the device**

- Cinterion delivers the module, an unfinished good, to System Integrators or OEMs
- The SI or OEM integrates the modules into devices to create solutions for end users

**Typical timelines for customers**

**Typical durations / cycles in M2M:**

- Design-in phase: 6 months or more (less knowledge and resources required and faster than chipset integration)
- Certification and approvals: approx. 2 months (much faster and cheaper than chipset integration)
- Cycle till next design phase: up to 3 years
- Required module availability: up to 7 years
Reduced design-in phase and other benefits by Cinterion M2M miniPCIe

- Simple electro-mechanical system integration by standardized PCIe system connector → only 26 out of 52 pins needed: USB (2), SIM (4), Power (5), Ground (14), Reset (1)
- Simple software integration by standard Windows or Linux modem drivers of OS
- Easy migration between cellular technologies and vendors by drop-in product replacement → 2G/GPRS to 3G/HSPA and visa versa

**Cinterion M2M miniPCIe: M2M industry grade vs. consumer electronic grade**
→ meeting customer requirements of extended temperature range (-40°C to +85°C), 24x7 operation, extended product lifetime, long time product availability

**Cinterion M2M miniPCIe: Mature technology vs. latest technology**
→ hitting sweet spot of cost efficient design and adequate uplink/downlink performance

- Fast certification and approvals by use of full-type approved (FTA) Cinterion module for a data only applications

**Cinterion M2M miniPCIe: the preferred cellular solution for x86-based M2M applications**
Cellular PCIe® Mini Card can be integrated with embedded x86-based applications in various ways.

- Box-PC
- Industrial PC (IPC)
- PCI-104 System
- Kiosk Systems
- Vending Machines
- Digital Signage
- DS Media Player
- Wireless M2M Gateway
- Embedded M2M Applications (Intel® x86-based Architectures)
- Intel® M2M Reference Design
Targeted Intel® x86-based system architecture for Cinterion M2M miniPCIe

**Cinterion M2M miniPCIe**

- Cellular WWAN data modem in PCI Express® Mini Card form factor
- Standardized plug-in integration via electromechanical PCIe connector
- Data exchange with Intel® Platform Controller Hub via USB 2.0 interface
- MNO SIM card connected via PCIe connector and UICC interface
- GSM antenna attached via U.FL antenna connector on miniPCIe card

UICC (Universal Integrated Circuit Card) = SIM

Intel® M2M Reference Design (Fish River Island II)
Cinterion M2M miniPCIe Pin Assignment: USB + SIM + Power/Ground + RST

<table>
<thead>
<tr>
<th>Pin#</th>
<th>Signal</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>2</td>
<td>VCC</td>
<td>Supply voltage range: 3.0V to 3.6V</td>
</tr>
<tr>
<td>3</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>8</td>
<td>CCVCC</td>
<td>SIM/UICC supply voltage (UICC contact C1)</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>10</td>
<td>CCIO</td>
<td>SIM/UICC I/O (UICC contact C7)</td>
</tr>
<tr>
<td>11</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>12</td>
<td>CCCLK</td>
<td>SIM/UICC clock (UICC contact C3)</td>
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<tr>
<td>13</td>
<td>NC</td>
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</tr>
<tr>
<td>14</td>
<td>CCRST</td>
<td>SIM/UICC reset (UICC contact C2)</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>16</td>
<td>NC</td>
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<tr>
<td>17</td>
<td>NC</td>
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<tr>
<td>18</td>
<td>GND</td>
<td>Ground</td>
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<tr>
<td>19</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>20</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>21</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>22</td>
<td>RESET</td>
<td>EMERG_RST</td>
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<tr>
<td>23</td>
<td>NC</td>
<td>Not connected</td>
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<tr>
<td>24</td>
<td>VCC</td>
<td>Supply voltage range: 3.0V to 3.6V</td>
</tr>
<tr>
<td>25</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>26</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>27</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>28</td>
<td>NC</td>
<td>Not connected</td>
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<tr>
<td>29</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>30</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>31</td>
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<td>32</td>
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<td>Ground</td>
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<tr>
<td>35</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>36</td>
<td>USB_DN</td>
<td>USB Data Negative</td>
</tr>
<tr>
<td>37</td>
<td>GND</td>
<td>Ground</td>
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<tr>
<td>38</td>
<td>USB_DP</td>
<td>USB Data Positive</td>
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<td>39</td>
<td>VCC</td>
<td>Supply voltage range: 3.0V to 3.6V</td>
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<tr>
<td>40</td>
<td>GND</td>
<td>Ground</td>
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<tr>
<td>41</td>
<td>VCC</td>
<td>Supply voltage range: 3.0V to 3.6V</td>
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<tr>
<td>42</td>
<td>LED</td>
<td>Default: high impedance; LED setting via AT command</td>
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<tr>
<td>43</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>44</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>45</td>
<td>NC</td>
<td>Not connected</td>
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<tr>
<td>46</td>
<td>NC</td>
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<td>47</td>
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<td>48</td>
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</tr>
<tr>
<td>49</td>
<td>NC</td>
<td>Not connected</td>
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<tr>
<td>50</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>51</td>
<td>NC</td>
<td>Not connected</td>
</tr>
<tr>
<td>52</td>
<td>VCC</td>
<td>Supply voltage range: 3.0V to 3.6V</td>
</tr>
</tbody>
</table>

Flexible U-FL antenna connector on miniPCIe: offers a variety of antenna solutions for different needs.
PCle® Mini Cards are limited to dedicated features to act as a cellular modem

In the cases the features of a PCle® Mini Card don’t fulfill customer requirements select one of Cinterion’s M2M module
How to select the suitable M2M miniPCIE for your M2M application

- How much maximum speed does the M2M application really need? 
  < 7.2 < 14.4 < 21 < LTE

- Will the majority of the M2M applications be able to get the speed form the network?

- Will you use specific M2M data tariffs with a cap of the maximum speed; e.g. 7.2 Mbps?

- Do you want to download OS updates over the air?

- Is there a demand for real-time video streaming?

- In which regions or countries do you want to deploy our M2M application?

- Is it a mobile M2M application moving in different geographical regions?

→ In most cases machines to not care about speed – speed is an user topic

→ In most cases intelligent systems do not travel – global roaming is an user topic
GSMA frequencies globally:
Latest technologies, more varieties, more combinations

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Band</th>
<th>1 Europe / RSA</th>
<th>2 US 3GPP</th>
<th>3 China / India</th>
<th>4 Japan / Korea</th>
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<tbody>
<tr>
<td>LTE700 Security</td>
<td>Band 12</td>
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<td>LTE700</td>
<td>Band 13, 17</td>
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<td>AT&amp;T (17)</td>
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<tr>
<td>LTE800</td>
<td>Band 18,19</td>
<td></td>
<td></td>
<td></td>
<td>KDDI / SKT</td>
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<tr>
<td>LTE800 (DD)</td>
<td>Band 20</td>
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<td></td>
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<tr>
<td>LTE850</td>
<td>Band 5</td>
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<td>LTE1500</td>
<td>Band 11, 21</td>
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<td>Band 3</td>
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<tr>
<td>LTE2600</td>
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<td>CMCC? / India</td>
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<td>UMTS800</td>
<td>Band 6, 19</td>
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<td>DoCoMo /SBM</td>
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<tr>
<td>GSM 850, 900, 1800, 1900</td>
<td>4</td>
<td>DB</td>
<td>DB</td>
<td>DB</td>
<td>DB</td>
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</tbody>
</table>
Cinterion M2M miniPCle variants to cover the regions in cost efficient way

**BGS2-W miniPCle**
for low bandwidth M2M applications: e.g. remote monitoring
- 2G/GPRS: DL 85.6 kbps / UL 42.8 kbps
- GSM quad-band: 850 / 900 / 1800 / 1900 MHz

**EHS5-E miniPCle**
for M2M applications demanding mid-range bandwidth
- 3G/HSPA: DL 7.2 Mbps / UL 5.76 Mbps
- UMTS dual-band: 900 / 2100 MHz
- GSM dual-band: 900 / 1800 MHz

**EHS5-US miniPCle**
for M2M applications demanding mid-range speed or 3G service
- 3G/HSPA: DL 7.2 Mbps / UL 5.76 Mbps
- UMTS dual-band: 850 / 1900 MHz
- GSM dual-band: 850 / 1900 MHz
BGS2 miniPCIe

**GENERAL FEATURES**
- GSM Quad-Band: 850/900/1800/1900 MHz
- GPRS multi-slot class 10
- Compliant to GSM phase 2/2+
  3GPP Release 99
- SIM Application Toolkit Rel.99
- Control via AT commands
  (Hayes, 3GPP TS 27.007 and 27.005)
- Supply voltage range 3.0...3.6 V
- Dimension: 51 x 30 x 4.8 mm (full mini card size)
- Operating temperature: -40°C to +85°C
- Weight 7.6g
- RoHS and EuP compliant

**SPECIFICATIONS**
- GPRS class 10 data rates
  DL: max. 85.6 kbps, UL: max. 42.8 kbps
- Mobile Station class B
- SMS text and PDU mode, cell broadcast
- Fax Group 3, class 1

**INTERFACES**
- PCI Express® Mini Card system connector (52 pin)
  - Supply voltage: 3.3 V
  - USB 2.0 full speed
  - UICC/SIM card interface 1.8 V / 3.0 V
  - Reset
  - Status LED (configurable GPIO)
- Antenna connector: U.FL 50 Ω

**SPECIAL FEATURES**
- Advanced Temperature Management
- USB driver for Microsoft® Windows® 8, Windows® 7,
  Windows Vista®, Windows XP™
- Compatible with modem driver of Microsoft® Windows®
  8, Windows® 7, Windows Vista®, Windows XP™
- Compatible with USB and modem driver of Linux kernel,
  e.g. Wind River Linux

**APPROVALS**
- R&TTE, GCF, FCC, PTCRB, IC
  (BGS2-W module full type approved)
- CE, UL
EHS5-E miniPCIe

GENERAL FEATURES
- Dual-Band UMTS (WCDMA/FDD) : 900/2100 MHz
- Dual-Band GSM: 900/1800 MHz
- 3GPP Release 7 Compliant Protocol Stack
- SIM Application Toolkit, letter class “c”
- Control via AT commands (Hayes, 3GPP TS 27.007 and 27.005)
- Supply voltage range 3.0…3.6 V
- Dimension: 51 x 30 x 4.4 mm (full mini card size)
- Operating temperature: -40°C to +85°C
- Weight 7.5g
- RoHS and EuP compliant

SPECIFICATIONS
- HSPDA Cat.8 / HSUPA Cat.6 data rates
  DL: max. 7.2 Mbps, UL: max. 5.76 Mbps
- EDGE Class 12 data rates
  DL: max. 237 kbps, UL: max. 237 kbps
- GPRS Class 12 data rates
  DL: max. 85.6 kbps, UL: max. 85.6 kbps
- SMS text and PDU mode, cell broadcast

INTERFACES
- PCI Express® Mini Card system connector (52 pin)
  - Supply voltage: 3.3 V
  - USB 2.0 HS interface up to 480 Mbps
  - UICC/SIM card interface 1.8 V / 3.0 V
  - Reset
  - Status LED (configurable GPIO)
- Antenna connector: U.FL 50 Ω
- Optional: Micro-SIM holder on backside

SPECIAL FEATURES
- Advanced Temperature Management
- Compatible with USB and modem driver of Microsoft® Windows 8®, Windows 7®, Windows Vista®, Windows XP™
- Compatible with USB and modem driver of Linux kernel, e.g. Wind River Linux
- Parallel COM ports (6) under Microsoft® Windows® 8, Windows® 7, Windows Vista®, Windows XP™ and Linux

APPROVALS
- R&TTE, GCF (EHS5-E module full type approved)
- CE
EHS5-US miniPCIe

GENERAL FEATURES
- Dual-Band UMTS (WCDMA/FDD) : 850/1900 MHz
- Dual-Band GSM: 850/1900 MHz
- 3GPP Release 7 Compliant Protocol Stack
- SIM Application Toolkit, letter class “c”
- Control via AT commands (Hayes, 3GPP TS 27.007 and 27.005)
- Supply voltage range 3.0…3.6 V
- Dimension: 51 x 30 x 4.4 mm (full mini card size)
- Operating temperature: -40°C to +85°C
- Weight 7.5g
- RoHS compliant

SPECIFICATIONS
- HSPDA Cat.8 / HSUPA Cat.6 data rates
  DL: max. 7.2 Mbps, UL: max. 5.76 Mbps
- EDGE Class 12 data rates
  DL: max. 237 kbps, UL: max. 237 kbps
- GPRS Class 12 data rates
  DL: max. 85.6 kbps, UL: max. 85.6 kbps
- SMS text and PDU mode, cell broadcast

INTERFACES
- PCI Express® Mini Card system connector (52 pin)
  - Supply voltage: 3.3 V
  - USB 2.0 HS interface up to 480 Mbps
  - UICC/SIM card interface 1.8 V / 3.0 V
  - Reset
  - Status LED (configurable GPIO)
  - Antenna connector: U.FL 50 Ω
  - Optional: Micro-SIM holder on backside

SPECIAL FEATURES
- Advanced Temperature Management
- Compatible with USB and modem driver of Microsoft® Windows 8®, Windows 7®, Windows Vista®, Windows XP™
- Compatible with USB and modem driver of Linux kernel, e.g. Wind River Linux
- Parallel COM ports (6) under Microsoft® Windows® 8, Windows® 7, Windows Vista®, Windows XP™ and Linux

APPROVALS
- FCC, PTCRB, IC (EHS5-US module full type approved)
- UL

Preliminary and subject to change
Customers of Cinterion M2M miniPCIe are providing Intelligent Systems based on Intel® x86 architecture

Intelligent Systems developers and manufactures

- use Intel® processors and an Intel® system architecture (x86-based designs)
- prefer PCI Express Mini Card plug-in extensions for their system design
- provide devices with operating systems and integrated IP stack: e.g. Wind River Linux, Microsoft® Window® 8, Window® 7, Windows Vista®, Windows XP™
- demand long product and technology availability (beyond consumer electronic lifecycles)
- require industrial product quality and reliability not given with consumer electronic cards
- benefit from extended temperature ranges and advanced temperature management
- require just wireless data connectivity with low or mid-range bandwidth
- don’t want to pay higher prices for latest wireless technology and highest bandwidth

But, if you need more than Cinterion M2M miniPCIe can provide just select one out of our Cinterion M2M module portfolio
Cinterion – a Gemalto company

Any further questions !?