BAP M852

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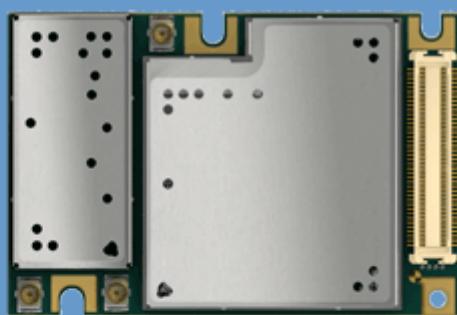
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Contents

Tables

Figures

1 Introduction

The document[1] describes the hardware of the M852 module, designed to connect to a cellular device application 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.

1.1 Related Documents

[1]   M852 AT Command Set
[2]   M852 Release Notes
[3]   DSB75 Support Box - Evaluation Kit for Cinterion Wireless Modules

1.2 Terms and Abbreviations

Abbreviation	Description
AGPS	Assisted GPS
ANSI	American National Standards Institute
AMR	Adaptive Multirate
ARP	Antenna Reference Point
B2B	Board-to-board connector
BB	Baseband
BEP	Bit Error Probability
BTS	Base Transceiver Station
CB or CBM	Cell Broadcast Message
CE	Conformit? Europ業ne (European Conformity)
CS	Coding Scheme
CS	Circuit Switched
CSD	Circuit Switched Data
CTM	Cellular Text Modem
DAC	Digital-to-Analog Converter
DCS	Digital Cellular System
DL	Download
DRX	Discontinuous Reception
DSB	Development Support Board

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

Abbreviation	Description
DSP	Digital Signal Processor
DTMF	Dual Tone Multi Frequency
DTX	Discontinuous Transmission
EDGE	Enhanced Data rates for GSM Evolution
EFR	Enhanced Full Rate
EGSM	Extended GSM
EMC	Electromagnetic Compatibility
ERP	Effective Radiated Power
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission (U.S.)
FDD	Frequency Division Duplex
FDMA	Frequency Division Multiple Access
FR	Full Rate
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global Standard for Mobile Communications
HiZ	High Impedance
HSDPA	High Speed Downlink Packet Access
HR	Half Rate
I/O	Input/Output
IF	Intermediate Frequency
IMEI	International Mobile Equipment Identity
ISO	International Standards Organization
ITU	International Telecommunications Union
kbps	kbits per second
LED	Light Emitting Diode
Mbps	Mbits per second
MCS	Modulation and Coding Scheme
MO	Mobile Originated
MS	Mobile Station, also referred to as TE
MT	Mobile Terminated
NMEA	National Marine Electronics Association
NTC	Negative Temperature Coefficient
PBCCH	Packet Switched Broadcast Control Channel

Abbreviation	Description
PCB	Printed Circuit Board
PCL	Power Control Level
PCM	Pulse Code Modulation
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PS	Packet Switched
PSK	Phase Shift Keying
QAM	Quadrature Amplitude Modulation
R&TTE	Radio and Telecommunication Terminal Equipment
RF	Radio Frequency
ROPR	Radio Output Power Reduction
RTC	Real Time Clock
Rx	Receive Direction
SAR	Specific Absorption Rate
SELV	Safety Extra Low Voltage
SIM	Subscriber Identification Module
SLIC	Subscriber Line Interface Circuit
SMPL	Sudden Momentary Power Loss
SMS	Short Message Service
SNR	Signal-to-Noise Ratio
SRAM	Static Random Access Memory
SRB	Signalling Radio Bearer
SUPL	Secure User Plane Location
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TPC	Transmit Power Control
TS	Technical Specification
TTFF	Time To First Fix
Tx	Transmit Direction
UL	Upload
UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
USB	Universal Serial Bus
UICC	USIM Integrated Circuit Card
USIM	UMTS Subscriber Identification Module
WCDMA	Wideband Code Division Multiple Access

1.3 Regulatory and Type Approval Information

1.3.1 Directives and Standards

M852 has been designed to comply with the directives and standards listed below.

It is the responsibility of the application manufacturer to ensure compliance of the final product with all provisions of the applicable directives and standards as well as with the technical specifications provided in the "M852 Hardware Interface Description". [1]

Table 1: Directives

99/05/EC	Directive of the European Parliament and of the council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (in short referred to as R&TTE Directive 1999/5/EC). The product is labeled with the CE conformity mark **C€ 0682**
2002/95/EC	Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

Table 2: Standards of North American type approval

CFR Title 47	Code of Federal Regulations, Part 22, Part 24 ; US Equipment Authorization FCC
OET Bulletin 65 (Edition 97-01)	Evaluating Compliance with FCC Guidelines for Human Exposure to Radio-frequency Electromagnetic Fields
UL 60 950-1	Product Safety Certification (Safety requirements)
NAPRD.03 V5.8	Overview of PCS Type certification review board Mobile Equipment Type Certification and IMEI control PCS Type Certification Review board (PTCRB)
RSS132, RSS133, RSS13	Canadian Standard

Table 3: Standards of European type approval

3GPP TS 51.010-1	Digital cellular telecommunications system (Release 7); Mobile Station (MS) conformance specification;
ETSI EN 301 511 V9.0.2	Global System for Mobile communications (GSM); Harmonized standard for mobile stations in the GSM 900 and DCS 1800 bands covering essential requirements under article 3.2 of the R&TTE directive (1999/5/EC)
GCF-CC V3.43.1	Global Certification Forum - Certification Criteria
ETSI EN 301 489-01 V1.8.1	Electromagnetic Compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common Technical Requirements

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[1.] Manufacturers of applications which can be used in t he US shall ensure that their applications have a PTCRB approval. For this purpose they can refer to the PTCRB approval of the respective module.

Table 3: Standards of European type approval

ETSI EN 301 489-03 V1.4.1	Electromagnetic Compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz
ETSI EN 301 489-07 V1.3.1	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)
ETSI EN 301 489-24 V1.4.1	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 (UTRA) for Mobile and portable (UE) radio and ancillary equipment
EN 301 908-01 V3.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third Generation cellular networks; Part 1: Harmonized EN for IMT-2000, introduction and common requirements of article 3.2 of the R&TTE Directive
EN 301 908-02 V3.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive
EN 300 440-02 V1.3.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive
EN 62311:2008	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)
IEC/EN 60950-1:2006	Safety of information technology equipment

Table 4: Requirements of quality

IEC 60068	Environmental testing
DIN EN 60529	IP codes

Table 5: Standards of the Ministry of Information Industry of the People?s Republic of China

SJ/T 11363-2006	equirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products? (2006-06).
SJ/T 11364-2006	?Marking for Control of Pollution Caused by Electronic Information Products?(2006-06). According to the ?Chinese Administration on the Control of Pollution caused by Electronic Information Products? (ACPEIP) the EPUP, i.e., Environmental Protection Use Period, of this product is 20 years as per the symbol shown here, unless otherwise marked. The EPUP is valid only as long as the product is operated within the operating limits described in the Cinterion Hardware Interface Description. Please see Table 6 for an overview of toxic or hazardous substances or elements that might be contained in product parts in concentrations above the limits defined by SJ/T 11363-2006.

Table 6: Toxic or hazardous substances or elements with defined concentration limits

部件名称 Name of the part	有毒有害物质或元素 Hazardous substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件 (Metal Parts)	O	O	O	O	O	O
电路模块 (Circuit Modules)	X	O	O	O	O	O
电缆及电缆组件 (Cables and Cable Assemblies)	O	O	O	O	O	O
塑料和聚合物部件 (Plastic and Polymeric parts)	O	O	O	O	O	O

O:

表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。

Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X:

表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。

Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part *might exceed* the limit requirement in SJ/T11363-2006.

1.3.2 SAR requirements specific to portable mobiles

Mobile phones, PDAs or other portable transmitters and receivers incorporating a GSM module must be in accordance with the guidelines for human exposure to radio frequency energy. This requires the Specific Absorption Rate (SAR) of portable M852 based applications to be evaluated and approved for compliance with national and/or international regulations.

Since the SAR value varies significantly with the individual product design manufacturers are advised to submit their product for approval if designed for portable use. For European and US-markets the relevant directives are mentioned below. It is the responsibility of the manufacturer of the final product to verify whether or not further standards, recommendations or directives are in force outside these areas.

Products intended for sale on US markets
ES 59005/ANSI C95.1 Considerations for evaluat ion of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz

Products intended for sale on European markets
EN 50360 Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300MHz - 3GHz)

IMPORTANT:
Manufacturers of portable applications based on M852 modules are required to have their final product certified and apply for their own FCC Grant and Industry Canada Certificate related to the specific portable mobile.

1.3.3 SELV Requirements

The power supply connected to the M852 module shall be in compliance with the SELV requirements defined in EN 60950-1.

1.3.4 Safety Precautions

The following safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal or mobile incorporating M852. Manufacturers of the cellular terminal are advised to convey the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. Cinterion Wireless Modules assumes no liability for customer failure to comply with these precautions.

	When in a hospital or other health care facility, observe the restrictions on the use of mobiles. Switch the cellular terminal or mobile off, if instructed to do so by the guidelines posted in sensitive areas. Medical equipment may be sensitive to RF energy.
	The operation of cardiac pacemakers, other implanted medical equipment and hearing aids can be affected by interference from cellular terminals or mobiles placed close to the device. If in doubt about potential danger, contact the physician or the manufacturer of the device to verify that the equipment is properly shielded. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while it is on.
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it cannot be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communications systems. Failure to observe these instructions may lead to the suspension or denial of cellular services to the offender, legal action, or both.
	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. Remember that interference can occur if it is used close to TV sets, radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the cellular terminal or mobile wherever forbidden, or when you suspect that it may cause interference or danger.
	Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for speakerphone operation. Before making a call with a hand-held terminal or mobile, park the vehicle.
	Speakerphones must be installed by qualified personnel. Faulty installation or operation can constitute a safety hazard.

SOS	IMPORTANT! Cellular terminals or mobiles operate using radio signals and cellular networks. Because of this, connection cannot be guaranteed at all times under all conditions. Therefore, you should never rely solely upon any wireless device for essential communications, for example emergency calls. Remember, in order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency calls if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may need to deactivate those features before you can make an emergency call. Some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.
	Bear in mind that exposure to excessive levels of noise can cause physical damage to users! With regard to acoustic shock, the cellular application must be designed to avoid unintentional increase of amplification, e.g. for a highly sensitive earpiece. A protection circuit should be implemented in the cellular application.
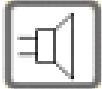
2 Product Concept

2.1 Key Features at a Glance

Feature	Implementation
General	
Frequency bands	GSM/GPRS/EDGE: Quad band, 850/900/1800/1900MHz UMTS/HSPA+: M852: Five band, 800/850/900 [2]/1900/2100MHz
GSM class	Small MS
Output power (according to Release 99)	Class 4 (+33dBm ?dB) for EGSM850 Class 4 (+33dBm ?dB) for EGSM900 Class 1 (+30dBm ?dB) for GSM1800 Class 1 (+30dBm ?dB) for GSM1900 Class E2 (+27dBm ?3dB) for GSM 850 8-PSK Class E2 (+27dBm ?3dB) for GSM 900 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1800 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1900 8-PSK Class 3 (+24dBm +1/-3dB) for UMTS 2100, WCDMA FDD BdI Class 3 (+24dBm +1/-3dB) for UMTS 1900,WCDMA FDD BdII Class 3 (+24dBm +1/-3dB) for UMTS AWS, WCDMA FDD BdIV[1] Class 3 (+24dBm +1/-3dB) for UMTS 900, WCDMA FDD BdVIII[2] Class 3 (+24dBm +1/-3dB) for UMTS 850, WCDMA FDD BdV Class 3 (+24dBm +1/-3dB) for UMTS 800, WCDMA FDD BdVI
Power supply	$3.3V \le V_{BATT+} \le 4.2V$
Operating temperature (board temperature)	Normal operation: -30蚓 to +85蚓 Restricted operation: -40?C to +95?C
Physical	Dimensions: 33.9mm x 50mm x 3.1mm Weight: approx. 9.5g
RoHS	All hardware components fully compliant with EU RoHS Directive
HSPA features	
3GPP Release 6, 7	DL 14.4Mbps, UL 5.7Mbps UE CAT. 1-12 supported Compressed mode (CM) supported according to 3GPP TS25.212
UMTS features	
3GPP Release 4	PS data rate ?384 kbps DL / 384 kbps UL CS data rate ?64 kbps DL / 64 kbps UL

Feature	Implementation
GSM / GPRS / EGPRS features	
Data transfer	GPRS: ? Multislot Class 12 ? Full PBCCH support ? Mobile Station Class B ? Coding Scheme 1 ?4 EGPRS: ? 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: ? V.110, RLP, non-transparent ? 14.4kbps ? USSD
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode
GPS Features	
Protocol	NMEA

Modes	Standalone GPS
	Assisted GPS
	    - Control plane - E911
	    - User plane - gpsOneXTRA?

General	Power saving modes Power supply for active GPS antenna supported
Software	
AT commands	Hayes, 3GPP TS 27.007 and 27.005, and proprietary Cinterion Wireless Modules commands
SIM Application Toolkit	SAT Release 99
Audio	Audio speech codecs GSM: AMR, EFR, FR, HR 3GPP: AMR Speakerphone operation, echo cancellation, noise suppression, 9 ringing tones, TTY support
Firmware update	Generic update from host application over ASC0 or USB
Interfaces	
Module interface	80-pin board-to-board connector
Antenna	50Ohms. Main GSM/UMTS antenna, UMTS diversity antenna, GPS antenna (active/passive)

Feature	Implementation
USB	USB 2.0 High Speed (480Mbit/s) and full speed (12Mbit/s) compliant
Serial interface	ASC0: ? 8-wire modem interface with status and control lines, unbalanced, asynchronous ? Adjustable baud rates from 9,600bps up to 921,600bps ? Supports RTS0/CTS0 hardware flow control ? Multiplex ability according to GSM 07.10 Multiplexer Protocol
UICC interface	Supported chip cards: UICC/SIM/USIM 3V, 1.8V
Status	Signal line to indicate network connectivity state
Audio	1 analog interface with microphone feeding 1 digital interface: PCM or I^{2}S
Power on/off, Reset	
Power on/off	Switch-on by hardware signal IGT Switch-off by AT command (AT^SMSO) Automatic switch-off in case of critical temperature or voltage conditions
Reset	Orderly shutdown and reset by AT command
Emergency-off	Emergency-off by hardware signal EMERG_OFF if IGT is not active
Special Features	
Phonebook	SIM and phone
TTY/CTM support	Integrated CTM modem
Antenna	SAIC (Single Antenna Interference Cancellation) / DARP (Downlink Advanced Receiver Performance) Rx diversity (receiver type 3i - 16-QAM)[3]
Evaluation kit	
DSB75	DSB75 Evaluation Board designed to test and type approve Cinterion Wireless Modules and provide a sample configuration for application engineering. A special adapter is required to connect the module to the DSB75.

[1.] AWS UMTS/HSPA+ band IV supported by PH8 only.

[2.] 900MHz UMTS/HSPA+ band VIII supported by M852 only. Band VIII however, is not supported by the UMTS Rx diversity antenna.

[3.] UMTS Rx diversity antenna does not support UMTS/HSPA+ band VIII.

2.2 M852 **System Overview**
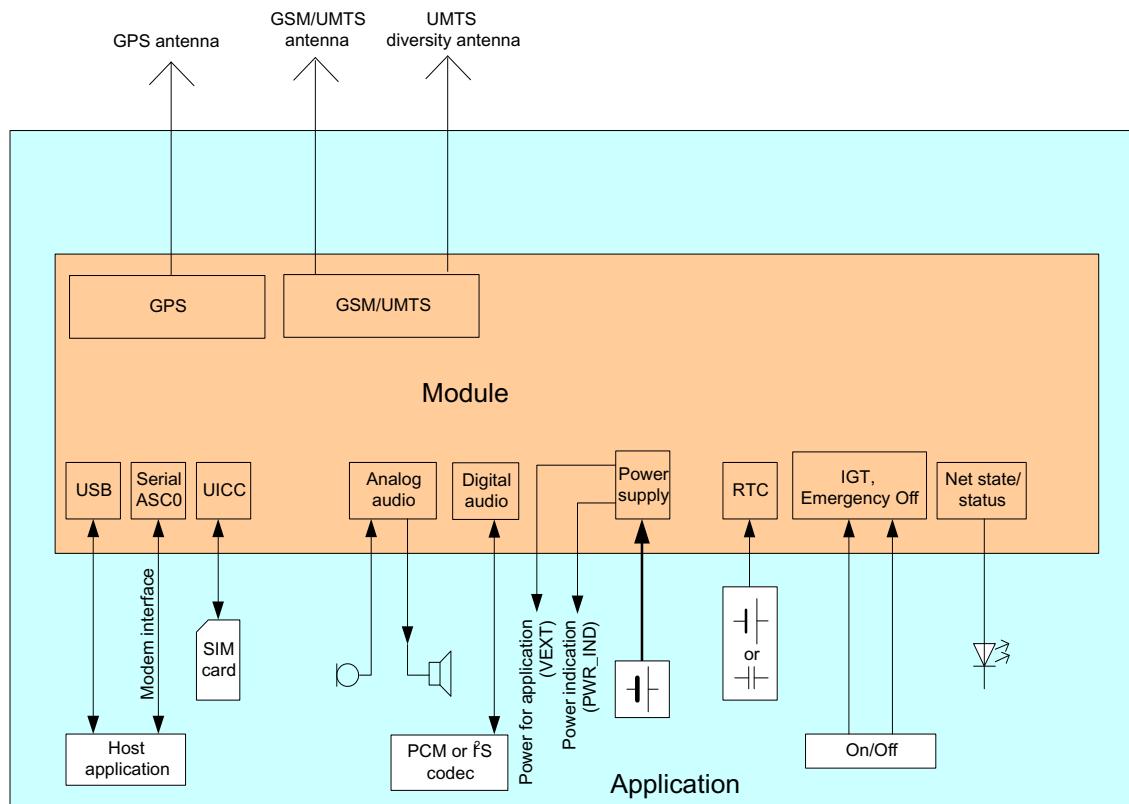
Figure 1: M852 system overview

3 Application Interface

M852 is equipped with an 80-pin board-to-board connector that connects to the external application. The host interface incorporates several sub-interfaces described in the following sections:

? Operating modes - see Section 3.1
? Power supply - see Section 3.2
? Serial interface USB - see Section 3.3
? Serial interface ASC0 - Section 3.4
? UICC/SIM/USIM interface - see Section 3.5
? Analog audio interface - see Section 3.6
? Digital audio interface (PCM or ΓS) - see Section 3.7

3.1 Operating Modes

The table below briefly summarizes the various operating modes referred to in the following chapters.

Table 7: Overview of operating modes

Mode	Function	
Normal operation	GSM / GPRS / UMTS / HSPA SLEEP	Power saving set automatically whenno call is in progress and the USB connection is suspended by host or not present and no active communication via ASC0.
	GSM / GPRS / UMTS / HSPA IDLE	Power saving disabled (see [1]: AT^SCFG "MEopMode/ PwrSave",<PwrSaveMode>) or an USB connection not suspended, but no call in progress.
	GSM TALK/ GSM DATA	Connection between two subscribers is in progress. Power consumption depends on the GSM network coverage and several connection settings (e.g. DTX off/on, FR/EFR/HR, hopping sequences and antenna connection). The following applies when power is to be measured in TALK_GSM mode: DTX off, FR and no frequency hopping.
	GPRS DATA	GPRS data transfer in progress. Power consumption depends on network settings (e.g. powercontrol level), uplink / downlink data rates and GPRS configuration (e.g. used multislot settings).
	EGPRS DATA	EGPRS data transfer in progress. Power consumption depends on network settings (e.g. powercontrol level), uplink / downlink data rates and EGPRS configuration (e.g. used multislot settings).
	UMTS TALK/ UMTS DATA	UMTS data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
	HSPA DATA	HSPA data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
Power Down	Normal shutdown after sending the AT^SMSO command. Only a voltage regulator is active for powering the RTC. Software is not active. Interfaces are not accessible. Operating voltage (connected to BATT+) remains applied.	
Airplane mode	Airplane mode shuts down the radio part of the module, causes the module to log o fffrom the GSM/GPRS network and disables all AT commands whose execution requires a radio connection. Airplane mode can be controlled by AT command (see[1]).	

3.2   Power Supply

M852 needs to be connected to a power supply at the board-to-board connector - 5 lines each BATT+ and GND.

The power supply of PH8/PH8-P has to be a single voltage source at BATT+. It must be able to provide the peak current during the uplink transmission.

All key functions for supplying power to the device are handled by the power management IC. It provides the following features:

? Stabilizesthe supply voltages for the baseband using switching regulators and low drop linear voltage regulators.
? Switches the module's power voltages for the power-up and -down procedures.
? Delivers, across the VEXT line, a regulated voltage for an external application. This voltage is not available in Power-down mode and can be reduced via AT command to save power.
? SIM switch to provide SIM power supply.

3.3   USB Interface

M852 supports a USB 2.0 High Speed (480Mbit/s) device interface that is Full Speed (12Mbit/s) compliant. The USB interface is primarily intended for use as command and data interface and for downloading firmware.

The USB host is responsible for supplying the VUSB_IN line. This line is for voltage detection only. The USB part (driver and transceiver) is supplied by means of BATT+. This is because M852 is designed as a self-powered device compliant with the   niversal Serial Bus Specification Revision 2.0?[1].
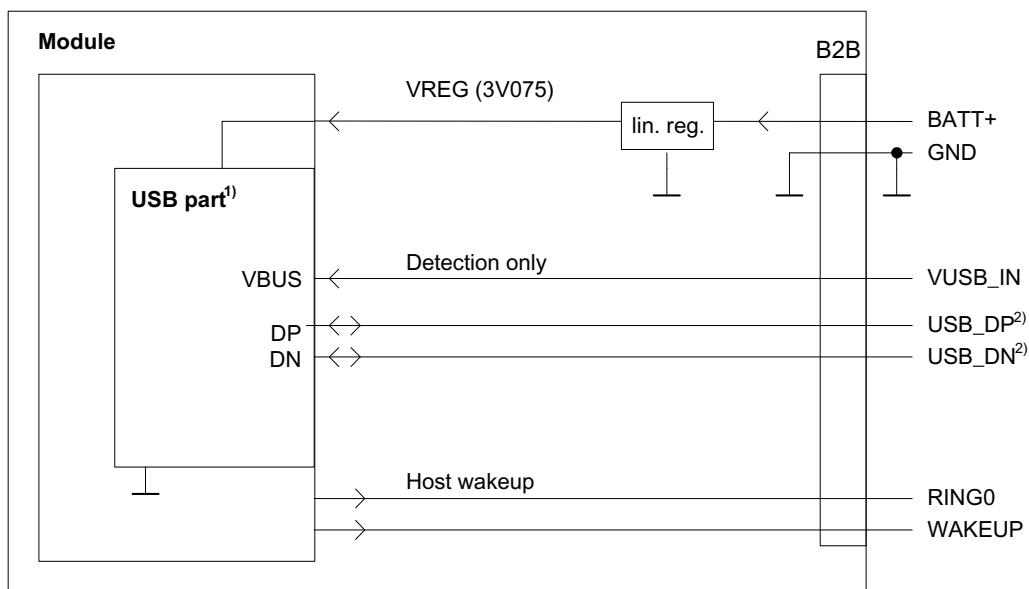
[1] All serial and pull-up resistors for data lines are implemented.
[2] If the USB interface is operated in High Speed mode (480MHz), it is recommended to take special care routing the data lines USB_DP and USB_DN. Application layout should in this case implement a differential impedance of 90Ohm for proper signal integrity.

Figure 2: USB circuit

To properly connect the module's USB interface to the host a USB 2.0 compatible connector is required. Furthermore, the USB modem driver distributed with M852 needs to be installed.

While the USB connection is active, the module will not change into SLEEP Mode. To enable switching into SLEEP mode the USB host must bring its USB interface into Suspend state (see   niversal Serial Bus Specification Revisi n 2.0?[1] for a description of the Suspend state). On incoming calls PH8/PH8-P will then generate a remote wake up request to resume the USB connection (active low). If configured for SDPORT=6, i.e., if using a CDC ACM compatible USB driver on the host system, a selective suspend on the USB host may not be supported and the module may therefore not be able to change into SLEEP mode.

As an alternative to the regular USB remote wakeup mechanism it is possible to employ the RING0 or WAKEUP line to wake up the host application. The benefit is that the RING0 or WAKEUP lines can wake up the host application in case of incoming calls or other events signalized by URCs while the USB interface is suspended or shut down.

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

3.4 Serial Interface ASC0

M852 offers an 8-wire unbalanced, asynchronous modem interface ASC0 conforming to ITU-T V.24 protocol DCE signalling. The electrical characteristics do not comply with ITU-T V.28. The significant levels are 0V (for low data bit or active state) and 1.8V (for high data bit or inactive state).

M852 is designed for use as a DCE. Based on the conventions for DCE-DTE connections it communicates with the customer application (DTE) using the following signals:
? Port TXD @ application sends data to the module?s TXD0 signal line
? Port RXD @ application receives data from the module?s RXD0 signal line
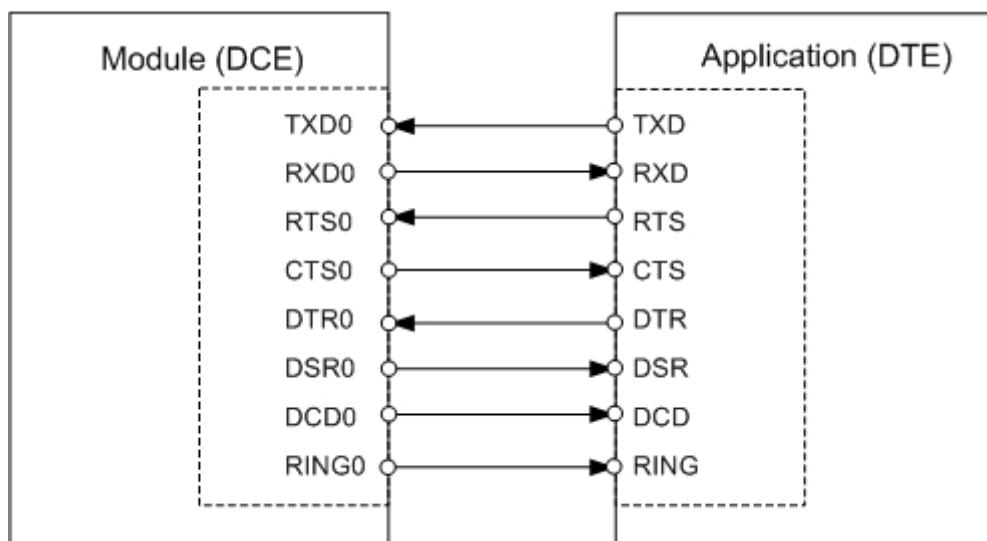
Figure 3: Serial interface ASC0

Features:
? Includes the data lines TXD0 and RXD0, the status lines RTS0 and CTS0 and, in addition, the modem control lines DTR0, DSR0, DCD0 and RING0.
? ASC0 is designed for controlling GSM/UMTS voice calls, transferring data and for controlling the module with AT commands.
? Full multiplexing capability allows the interface to be partitioned into virtual channels.
? The RING0 signal serves to indicate incoming calls and other types of URCs (Unsolicited Result Code). It can also be used to send pulses to the host application, for example to wake up the application from power saving state. See[1] for details on how to configure the RING0 line by AT^SCFG.
? Configured for 8 data bits, no parity and 1 stop bit.
? ASC0 can be operated at fixed bit rates from 9600bps up to 921600bps.
? Supports RTS0/CTS0 hardware flow control.
? Wake up from SLEEP mode by RTS0 activation (high to low transition).

Note. If the ASC0 serial interface is the application only interface, it is suggested to connect test points on the USB signal lines as a potential tracing possibility.

Table 8: DCE-DTE wiring of ASC0

V.24 circuit	DCE		DTE	
	Line function	**Signal direction**	**Line function**	**Signal direction**
103	TXD0	Input	TXD	Output
104	RXD0	Output	RXD	Input
105	RTS0	Input	RTS	Output
106	CTS0	Output	CTS	Input
108/2	DTR0	Input	DTR	Output
107	DSR0	Output	DSR	Input
109	DCD0	Output	DCD	Input
125	RING0	Output	RING	Input

3.5 UICC/SIM/USIM Interface

M852 has an integrated UICC/SIM/USIM interface compatible with the 3GPP 31.102 and
ETSI 102 221. This is wired to the host interface in order to be connected to an external SIM
card holder. Six pins on the board-to-board connector are reserved for the SIM interface.

The UICC/SIM/USIM interface supports 3V and 1.8V SIM cards.

The CCIN signal serves to detect whether a tray (with SIM card) is present in the card holder.
Using the CCIN signal is mandatory for compliance with the GSM 11.11 recommendation if the
mechanical design of the host application allows the user to remove the SIM card during oper-
ation. To take advantage of this feature, an appropriate SIM card detect switch is required on
the card holder. For example, this is true for the model supplied by Molex, which has been test-
ed to operate with M852 and is part of the Cinterion reference equipment submitted for
type approval. See Chapter 9 for Molex ordering numbers.

Table 9: Signals of the SIM interface (board-to-board connector)

Signal	Description
CCGND	Separate ground connection for SIM card to improve EMC. Be sure to use this ground line for the SIM interface rather than any other ground line or plane on the module.
CCCLK	Chipcard clock
CCVCC	SIM supply voltage.
CCIO	Serial data line, input and output.
CCRST	Chipcard reset
CCIN	Input on the baseband processor for detecting a SIM card tray in the holder. If the SIM is removed during operation the SIM interface is shut down immediately to prevent destruc-tion of the SIM. The CCIN signal is active low. The CCIN signal is mandatory for applications that allow the user to remove the SIM card during operation. The CCIN signal is solely intended for use with a SIM card. It must not be used for any other purposes. Failure to comply with this requirement may invalidate the type approval of PH8/ PH8-P.

*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 initializ-
ing any SIM card that the user inserts after having removed the SIM card during operation. In
this case, the application must restart M852.*
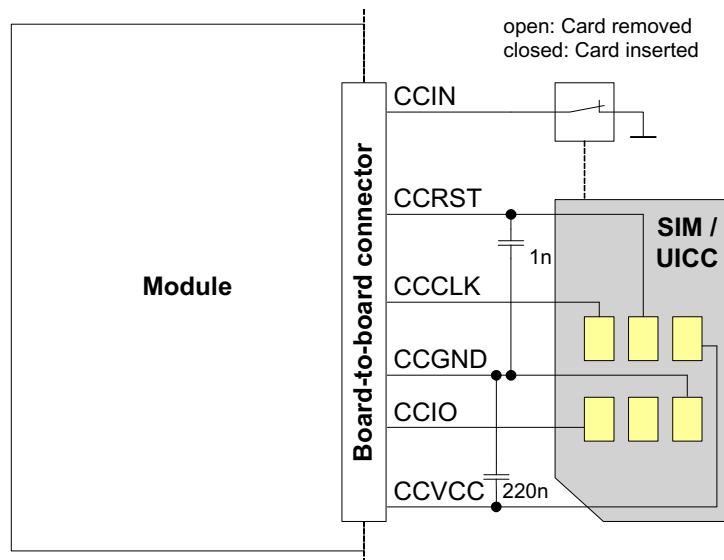
Figure 4: UICC/SIM/USIM interface

The total cable length between the board-to-board connector pins on M852 and the pads of the 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 the CCGND line to shield the CCIO line from the CCCLK line.

3.6 Analog Audio Interface

M852 has an analog audio interface with a balanced analog microphone input and a balanced analog earpiece output. A supply voltage and an analog ground connection are provided at dedicated lines.

M852 offers eight audio modes which can be selected with the AT^SNFS command. The electrical characteristics of the voiceband part vary with the audio mode. For example, sending and receiving amplification, sidetone paths, noise suppression etc. depend on the selected mode and can in parts be altered with AT commands (except for mode 1).

When shipped from factory, all audio parameters of M852 are set to audio mode 1. This is the default configuration optimised for the Votronic HH-SI-30.3/V1.1/0 handset. Audio mode 1 has fix parameters which cannot be modified. To adjust the settings of the Votronic handset simply change to another audio mode.

3.7 Digital Audio Interface

M852 supports a digital audio interface that can be employed either as pulse code modulation or as inter IC sound interface. Operation of these interface variants is mutually exclusive.

4　　GPS Receiver

M852 integrates a GPS receiver that offers the full performance of GPS technology. The GPS receiver is able to continuously track all satellites in view, thus providing accurate satellite position data.

The integrated GPS receiver supports the NMEA protocol via USB or ASC0 interface. NMEA is a combined electrical and data specification for communication between various (marine) electronic devices including GPS receivers. It has been defined and controlled by the US-based National Marine Electronics Association. For more information on the NMEA Standard please refer to http://www.nmea.org.

Depending on the receiver knowledge of last position, current time and ephemeris data, the receiver startup time (i.e., TTFF = Time-To-First-Fix) may vary: If the receiver has no knowledge of its last position or time, a startup takes considerably longer than if the receiver has still knowledge of its last position, time and almanacor has still access to valid ephimeris data and the precise time.

By default, the GPS receiver is switched off. It has to be switched on and configured using AT commands. For more information on how to control the GPS interface via the AT command AT^SGPSC see [1].

5 Antenna Interfaces

5.1 GSM/UMTS Antenna Interface

The M852 GSM/UMTS antenna interface comprises a main GSM/UMTS antenna as well as an optional UMTS Rx diversity antenna to improve signal reliability and quality[1]. The interface has an impedance of 50Ω. M852 is capable of sustaining a total mismatch at the antenna interface without any damage, even when transmitting at maximum RF power.

The external antenna must be matched properly to achieve best performance regarding radiated power, DC-power consumption, modulation accuracy and harmonic suppression. Matching networks are not included on the M852 PCB and should be placed in the host application, if the antenna does not have an impendance of 50Ω.

Regarding the return loss M852 provides the following values in the active band:

Table 10: Return loss in the active band

State of module	Return loss of module	Recommended return loss of application
Receive	$\geq$ 8dB	$\geq$ 12dB
Transmit	not applicable	$\geq$ 12dB
Idle	$\leq$ 5dB	not applicable

The connection of the antenna or other equipment must be decoupled from DC voltage. This is necessary because the antenna connector is DC coupled to ground via an inductor for ESD protection.

5.1.1 Antenna Installation

The U.FL antenna connector from Hirose/Molex of the main GSM/UMTS antenna has been chosen as antenna reference point (ARP) for the Cinterion Wireless Modules reference equipment submitted to type approve PH8/PH8-P. See Section 5.1.2 for details. All RF data specified throughout this manual is related to the ARP. The positions of the module?s antenna connectors can be seen in Figure 9.

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[1] By delivery default the optional UMTS Rx diversity antenna is configured as available for the module. To avoid negative side effects and performance degradation it is recommended to disable the diversity antenna path if
- the host application does not support a diversity antenna
- the host application includes a diversity antenna - but a 3G network simulator is used for development and performance tests.
Please refer to [1] for details on how to configure antenna settings.

5.1.2 Antenna Connector

M852 uses either an ultra-miniature SMT antenna connector from Hirose Ltd: U.FL-R-SMT, or the Molex 07341201 U.FL antenna connector. Both connectors have identical mechanical dimensions (see Figure 5). Minor differences in product specifications are mentioned in Table 11. The position of the antenna connectors on the PH8/PH8-P board can be seen in Figure 9.
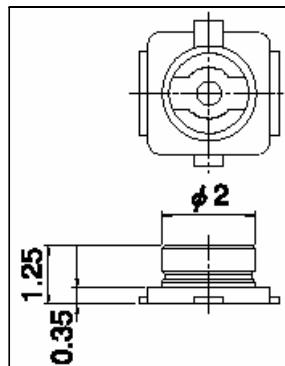

Figure 5: Mechanical dimensions of PH8/PH8-P antenna connectors

Table 11: Product specifications of PH8/PH8-P antenna connectors

Item	Specification	Conditions
Ratings		
Nominal impedance	50	Operating temp:-40蚓 to + 90?C
Rated frequency	DC to 3GHz	Operating humidity: max. 90%
Mechanical characteristics		
Repetitive operation	Contact resistance: Center 25m Outside 15m	30 cycles of insertion and disengagement
Vibration	No momentary disconnections of 1盗. No damage, cracks and looseness of parts.	Frequency of 10 to 100Hz, single amplitude of 1.5mm, acceleration of 59m/s^2, for 5 cycles in the direction of each of the 3 axes
Shock	No momentary disconnections of 1盗. No damage, cracks and looseness of parts.	Acceleration of 735m/s^2, 11ms duration for 6 cycles in the direction of each of the 3 axes
Environmental characteristics		
Humidity resistance	No damage, cracks and looseness of parts. Insulation resistance: 100M min. at high humidity 500M min. when dry	Exposure to 40?C, humidity of 95% for a total of 96 hours
Temperature cycle	No damage, cracks and looseness of parts. Contact resistance: Center 25m Outside 15m	Temperature: +40?C 5 to 35蚓 +90?C 5 to 35?C Time: 30min within 5min 30min within 5min
Salt spray test	No excessive corrosion	48 hours continuous exposure to 5% salt water

Table 12: Material and finish of PH8/PH8-P antenna connectors and recommended plugs

Part	Material	Finish
Shell	Phosphor bronze	Hirose: Silver plating Molex: Gold plating
Male center contact	Brass	Gold plating
Female center contact	Phosphor bronze	Gold plating
Insulator	Receptacle: LCP	Hirose: Beige, Molex: Ivory

Mating plugs and cables can be chosen from the Hirose U.FL Series or from other antenna equipment manufacturers like Molex or IMS. Examples from the Hirose U.FL Series are shown below and listed in Table 13. For latest product information please contact your respective antenna equipment manufacturer.
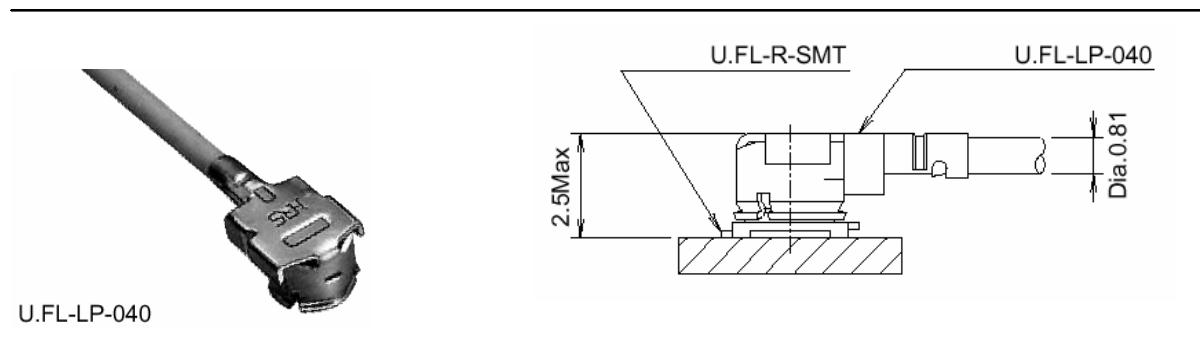
Figure 6: U.FL-R-SMT connector with U.FL-LP-040 plug
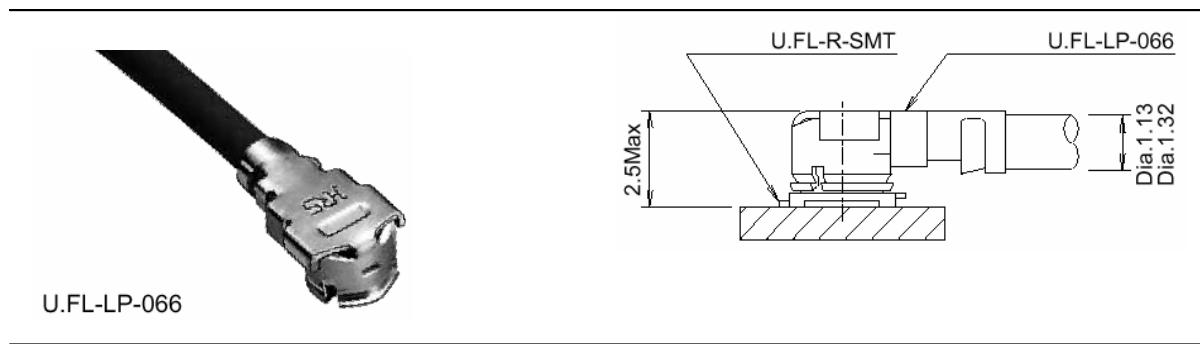
Figure 7: U.FL-R-SMT connector with U.FL-LP-066 plug

In addition to the connectors illustrated above, the U.FL-LP-(V)-040(01) version is offered as an extremely space saving solution. This plug is intended for use with extra fine cable (up to ? 0.81mm) and minimizes the mating height to 2mm. See Figure 8 which shows the Hirose data sheet.

Figure 8: Specifications of U.FL-LP-(V)-040(01) plug

Table 13: Ordering information for Hirose U.FL Series

Item	Part number	HRS number
Connector on PH8/PH8-P	U.FL-R-SMT	CL331-0471-0-10
Right-angle plug shell for ?0.81mm cable	U.FL-LP-040	CL331-0451-2
Right-angle plug for ?0.81mm cable	U.FL-LP(V)-040 (01)	CL331-053-8-01
Right-angle plug for ? 1.13mm cable	U.FL-LP-068	CL331-0452-5
Right-angle plug for ? 1.32mm cable	U.FL-LP-066	CL331-0452-5
Extraction jig	E.FL-LP-N	CL331-04441-9

5.2   GPS Antenna Interface

In addition to the RF antenna interface M852 also has a GPS antenna interface. See Section 6.1 to find out where the GPS antenna connector is located. The GPS antenna installation and connector are the same as for the RF antenna interface (see Section 5.1.1 and Section 5.1.2).

It is possible to connect active or passive GPS antennas. In either case they must have 50 Ohm impedance. The simultaneous operation of GSM and GPS has been implemented.

Active 3V GPS antennas can be supplied via the GPS antenna interface, if the supply voltage is switched on. This is done by AT command: AT^SGPSC="Power/Antenna" to configure the use of an active GPS antenna and AT^SGPSC="Engine" to start the GPS receiver (for command details see [1]). The available current is limited to prevent short circuits.

6 Mechanics

6.1 Mechanical Dimensions of M852

Figure 9 shows the top view of M852 and provides an overview of the board's mechanical dimensions. For further details see Figure 10.

Length: 50.00mm
Width: 33.90mm
Height: 3.10mm
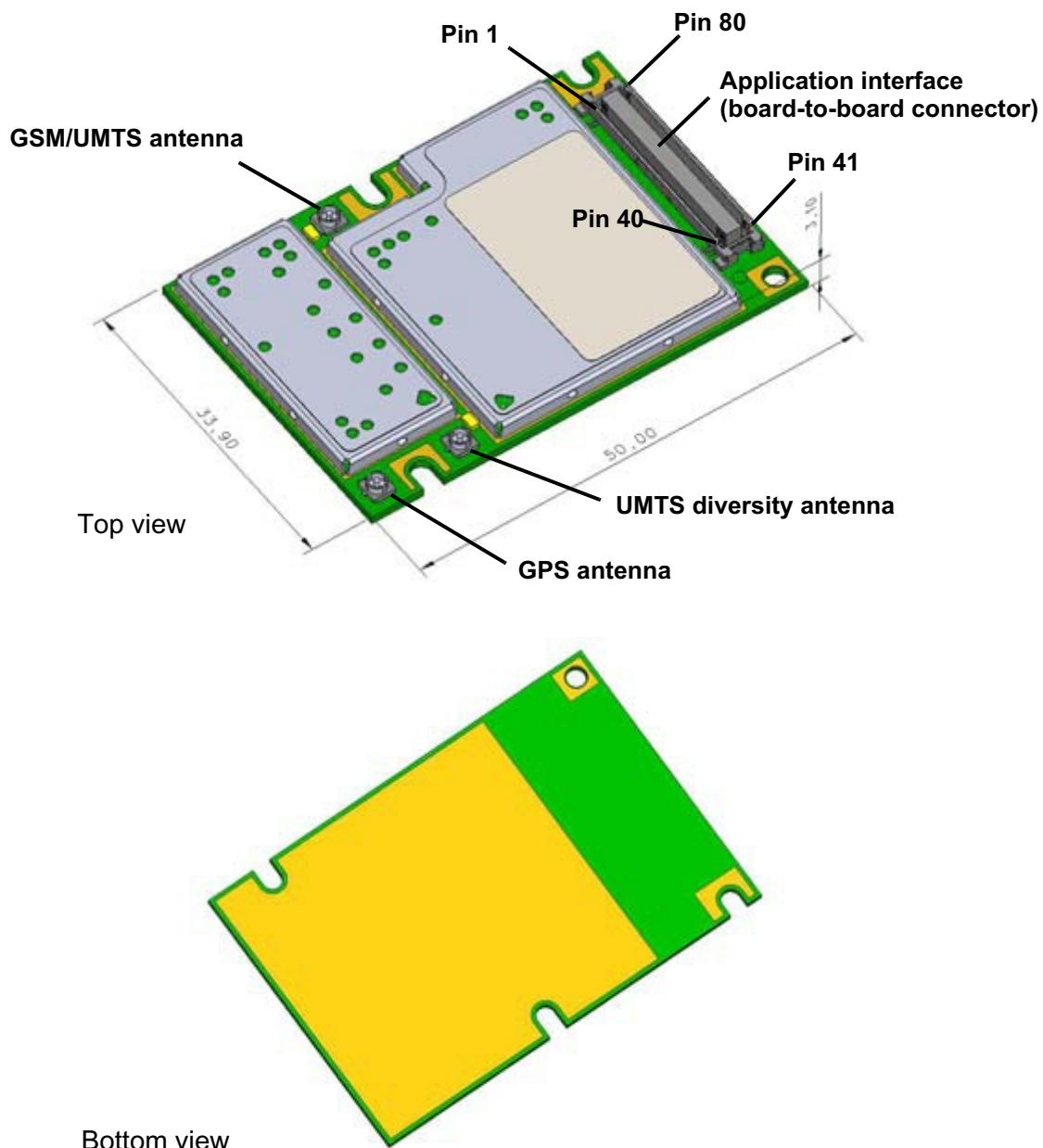
Figure 9: M852 top and bottom view
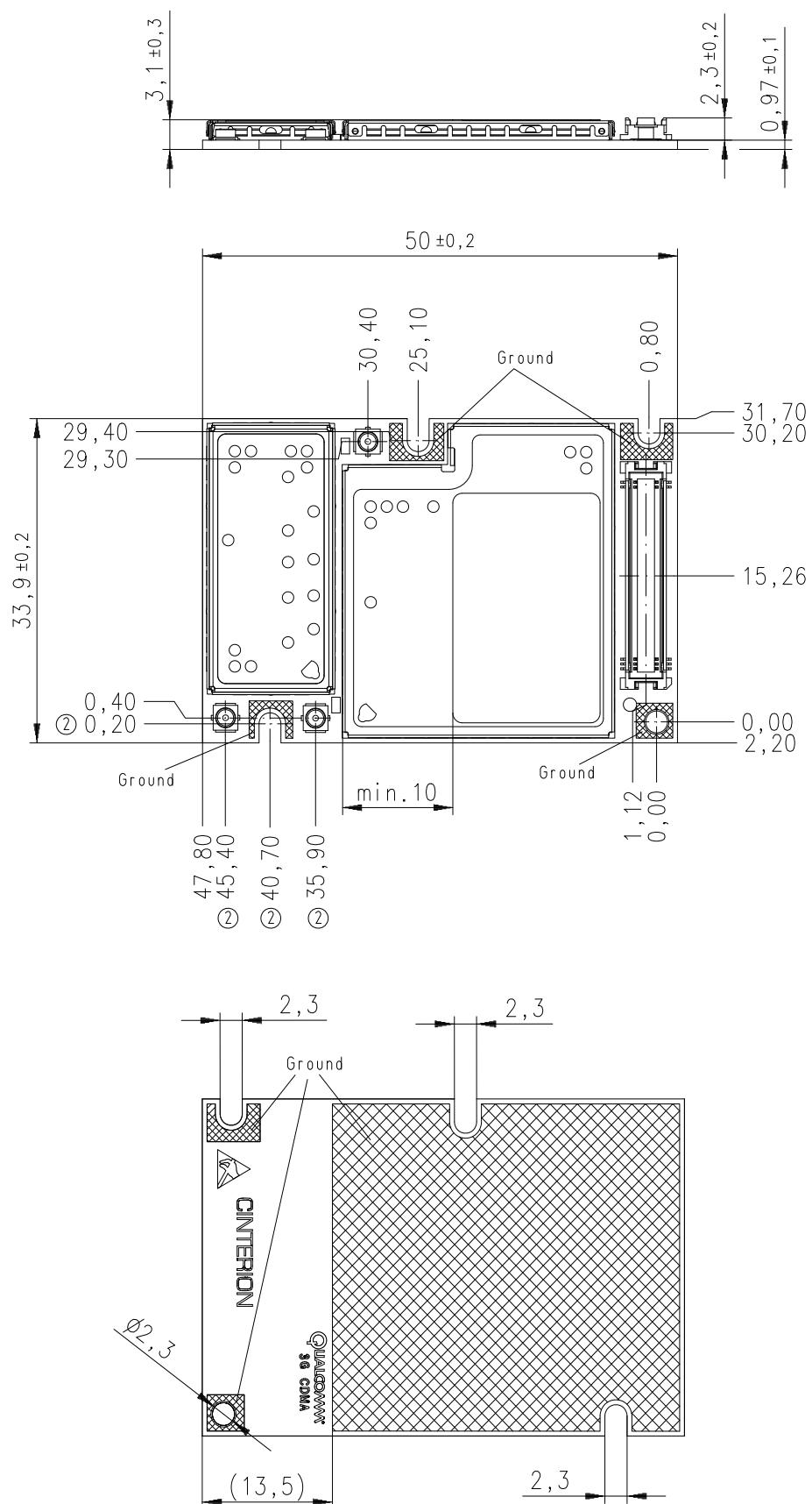
Figure 10: Dimensions of M852 (all dimensions in mm)

6.2   Mounting M852 to the Application Platform

There are many ways to properly install M852 in the host device. An efficient approach
is to mount the M852 PCB to a frame, plate, rack or chassis.

Fasteners can be M2 screws plus suitable washers, circuit board spacers, or customized
screws, clamps, or brackets. In addition, the board-to-board connection can also be utilized to
achieve better support.

For proper grounding it is strongly recommended to use large ground plane on the bottom of
board in addition to the five GND pins of the board-to-board connector. The ground plane may
also be used to attach cooling elements, e.g. a heat sink or thermally conductive tape.

To prevent mechanical damage, be careful not to force, bend or twist the module. Be sure it is
positioned flat against the host device.

6.3   Board-to-Board Application Connector

This section provides the specifications of the 80-pin board-to-board connector used to connect
M852 to the external application.

Connector mounted on the M852 module:
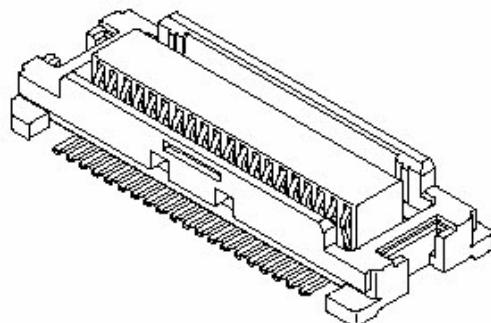
Type: 52991-0808 SlimStack Receptacle 80 pins, 0.50mm pitch, for stacking heights of
             3.0 or 4.0mm, see Figure 12 for details.
Supplier: Molex, http//www.molex.com

Table 14: Technical specifications of Molex board-to-board connector

| Parameter	Specification (80-pin B2B connector)
Electrical	
Number of Contacts	80
Contact spacing	0.5mm (.020")
Voltage	50V
Rated current	0.5A max per contact
Contact resistance	50m max per contact
Insulation resistance	> 100M
Dielectric Withstanding Voltage	500V AC (for 1 minute)
Physical	
Insulator material (housing)	White glass-filled LCP plastic, flammability UL 94V 0
Contact material	Plating: Gold over nickel
Insertion force 1st	< 74.4N
Insertion force 30th	< 65.6N
Withdrawal force 1st	> 10.8N
Maximum connection cycles	30 (@ 70m max per contact)

Mating connector types for the customer's application offered by Molex:
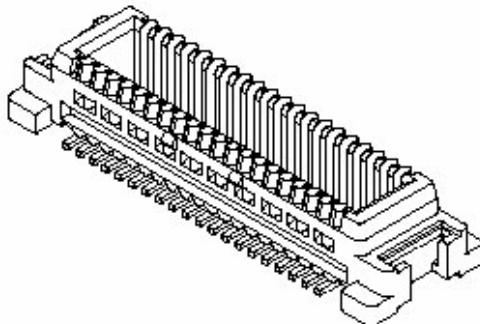
Figure 11: Mating board-to-board connector 53748-0808 on application

? 53748-0808 SlimStack Plug, 3mm stacking height,
    see Figure 13 for details.
? 53916-0808 SlimStack Plug, 4mm stacking height

Note: There is no inverse polarity protection for the board-to-board connector. It is therefore very important that the board-to-board connector is connected correctly to the host application, i.e., pin1 must be connected to pin1, pin2 to pin 2, etc. Pin locations are shown in Figure 9.

Figure 12: Molex board-to-board connector 52991-0808 on M852

Figure 13: Mating board-to-board connector 53748-0808 on application

7 Sample Application

Figure 14 shows a typical example of how to integrate an M852 module with an application.

The audio interface demonstrates the balanced connection of microphone and earpiece. This solution is particularly well suited for internal transducers.

The PWR_IND line is an open collector that needs an external pull-up resistor which connects to the voltage supply VCC 潏 of the microcontroller. Low state of the open collector pulls the PWR_IND signal low and indicates that the PH8/PH8-P module is active, high level notifies the Power-down mode.

If the module is in Power-down mode avoid current flowing from any other source into the module circuit, for example reverse current from high state external control lines. Therefore, the controlling application must be designed to prevent reverse flow. If an external level controller is required, this can be done by using for example a 5V I/O tolerant buffer/driver like a "74AVC4T245" with $\overline{\text{OE}}$ (Output Enable) controlled by PWR_IND.

The EMC measures are best practice recommendations. In fact, an adequate EMC strategy for an individual application is very much determined by the overall layout and, especially, the position of components.

Disclaimer:
No warranty, either stated or implied, is provided on the sample schematic diagram shown in Figure 14 and the information detailed in this section. As functionality and compliance with national regulations depend to a great amount on the used electronic components and the individual application layout manufacturers are required to ensure adequate design and operating safeguards for their products using M852 modules.
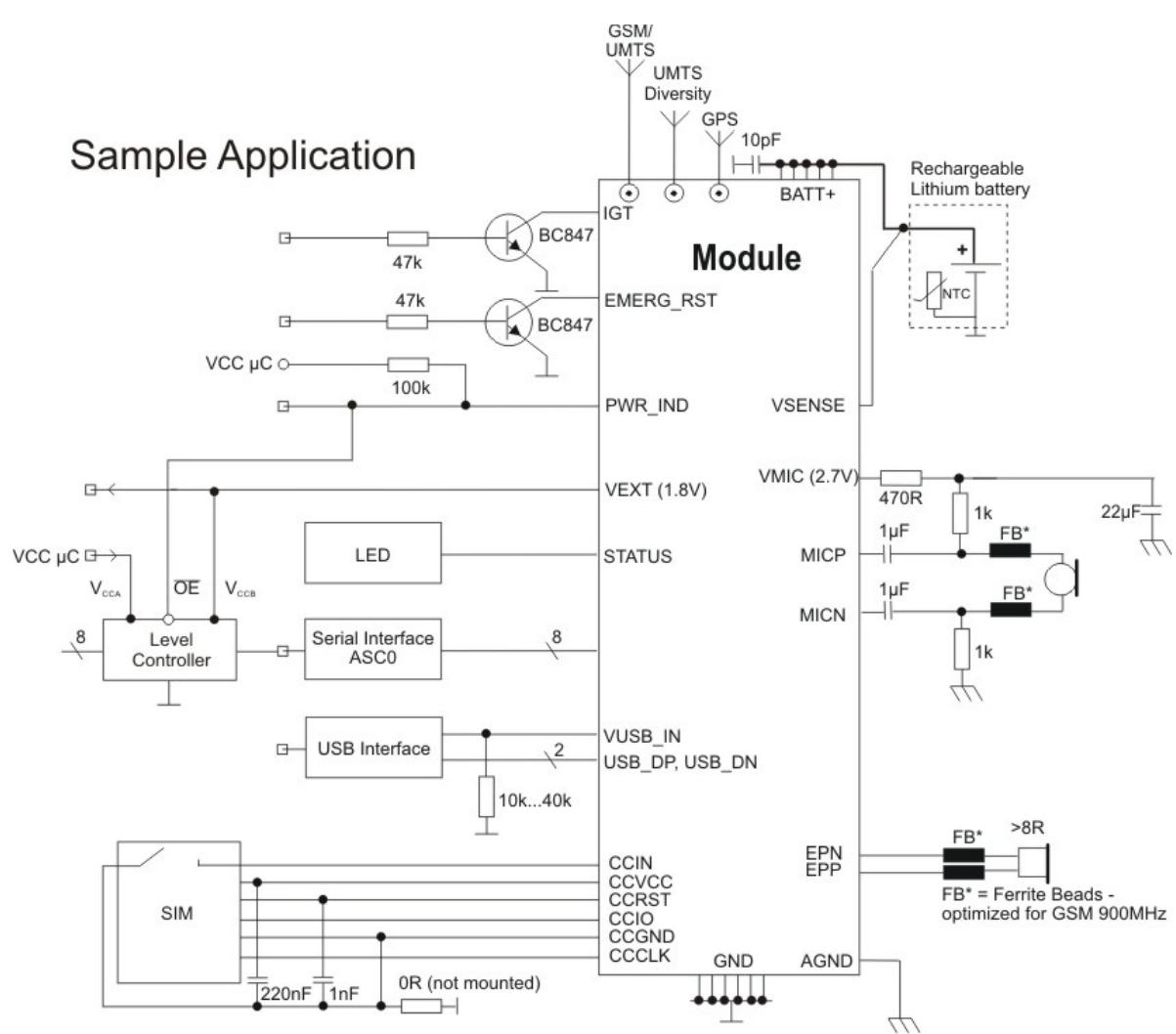
Figure 14: M852 sample application

8 Reference Approval

8.1 Reference Equipment for Type Approval

The Cinterion Wireless Modules reference setup submitted to type approve M852 is shown in the following figure[1]. The module is connected to the DSB75 via a special adapter and either mounted directly onto the adapter or connected using a flex cable:
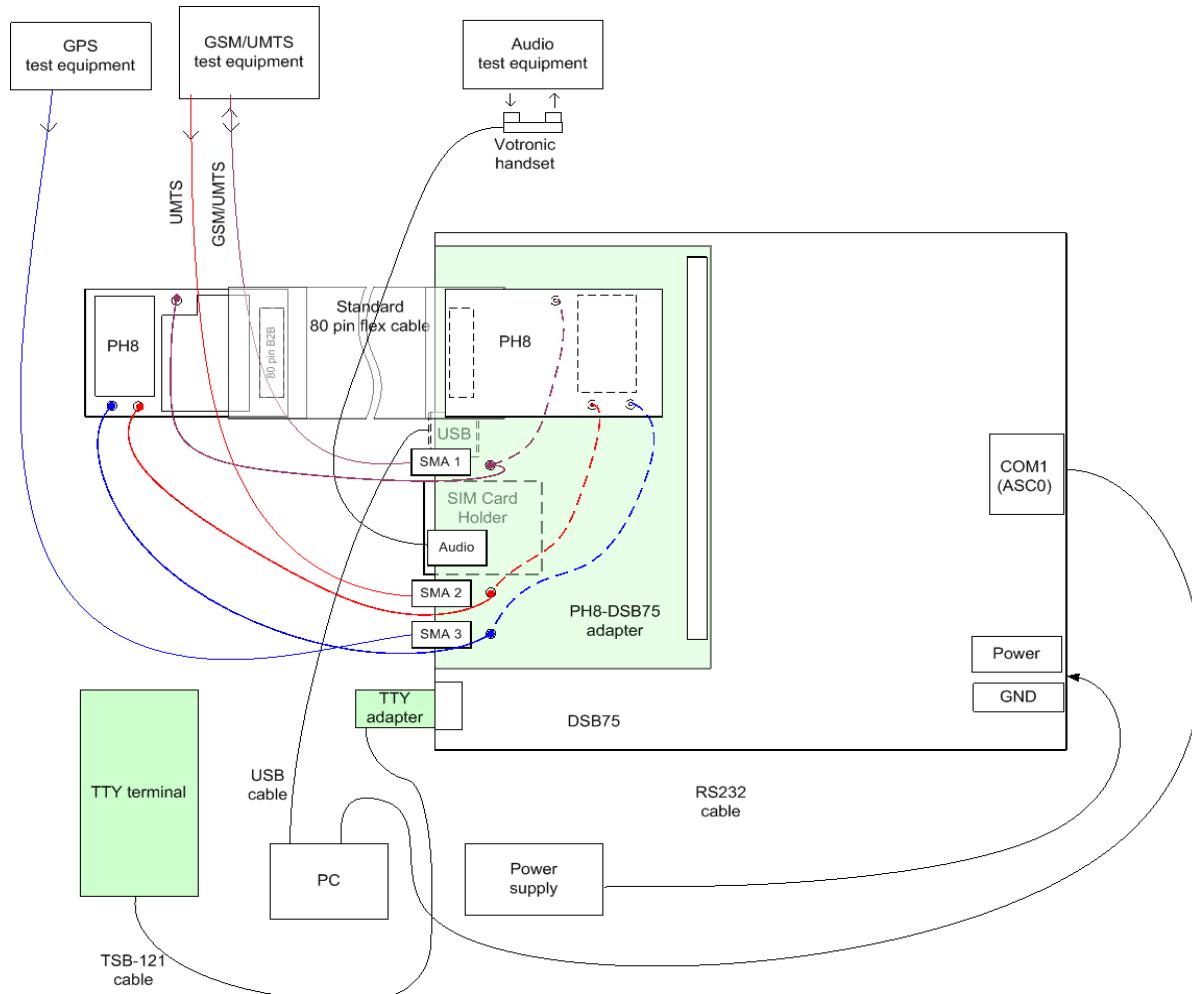
Figure 15: Reference equipment for type approval

[1]. For RF performance tests a mini-SMT/U.FL to SMA adapter with attached 6dB coaxial attenuator is chosen to connect the module directly to the GSM/UMTS/GPS test equipment instead of employing the SMA antenna connectors on the M852-DSB75 adapter as shown in Figure 15. The following products are recommended:
Hirose SMA-Jack/U.FL-Plug conversion adapter HRMJ-U.FLP(40)
(for details see see http://www.hirose-connectors.com/ or http://www.farnell.com/
Aeroflex Weinschel Fixed Coaxial Attenuator Model 3T/4T
(for details see http://www.aeroflex.com/ams/weinschel/pdfiles/wmod3&4T.pdf)

8.2 Compliance with FCC and IC Rules and Regulations

The Equipment Authorization Certification for the Cinterion Wireless Modules reference application described in Section 8.1 will be registered under the following identifiers:

M852:
FCC Identifier ZK7MSERIES

Granted to BAP

Manufacturers of mobile or fixed devices incorporating M852 modules are authorized to use the FCC Grants and Industry Canada Certificates of the M852 modules for their own final products according to the conditions referenced in these documents. In this case, the FCC label of the module shall be visible from the outside, or the host device shall bear a second label stating resp. "Contains FCC ID ZK7MSERIES", and accordingly resp.
The integration is limited to fixed or mobile categorised host devices, where a separation distance between the antenna and any person of min. 20cm can be assured during normal operating conditions. For mobile and fixed operation configurations the antenna gain, including cable loss, must not exceed the limits that are stated on the FCC Grant.

IMPORTANT:
Manufacturers of portable applications incorporating M852 modules are required to have their final product certified and apply for their own FCC Grant and Industry Canada Certificate related to the specific portable mobile. This is mandatory to meet the SAR requirements for portable mobiles.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: 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.
— Consult the dealer or an experienced radio/TV technician for help.

CAUTION:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. 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.

This device complies with Part 15 of the FCC Rules. 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.

RF exposure warning

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provide with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

9 Appendix

9.1 List of Parts and Accessories

Table 15: List of parts and accessories

Description	Supplier	Ordering information
PH8	Cinterion	Standard module Cinterion Wireless Modules IMEI: Ordering number: L30960-N1900-A200 Customer IMEI: Ordering number: L30960-N1905-A200
M852	BAP	Standard module Cinterion Wireless Modules IMEI: Ordering number: L30960-N1910-A200 Customer IMEI: Ordering number: L30960-N1915-A200
DSB75 Support Box	Cinterion	Ordering number: L36880-N8811-A100
DSB75 adapter for mounting the M852 evaluation module	BAP	Ordering number: L30960-N1802-A100
Votronic Handset	VOTRONIC	Votronic HH-SI-30.3/V1.1/0 VOTRONIC Entwicklungs- und Produktionsgesellschaft f?r elektronische Ger�halhe mbH Saarbr ker Str. 8 66386 St. Ingbert Germany Phone: +49-(0)6 89 4 / 92 55-0 Fax: +49-(0)6 89 4 / 92 55-88 Email: contact@votronic.com
SIM card holder incl. push button ejector and slide-in tray	Molex	Ordering numbers: 91228 91236 Sales contacts are listed in Table 16.
Board-to-board connector	Molex	Sales contacts are listed in Table 16.
U.FL antenna connector	Hirose or Molex	Sales contacts are listed in Table 16 and Table 17.

M852 Hardware Interface Overview

9.1 List of Parts and Accessories

Table 16: Molex sales contacts (subject to change)

Molex For further information please click: http://www.molex.com	Molex Deutschland GmbH Felix-Wankel-Str. 11 4078 Heilbronn-Biberach Germany Phone: +49-7066-9555 0 Fax: +49-7066-9555 29 Email: mxgermany@molex.com	American Headquarters Lisle, Illinois 60532 U.S.A. Phone: +1-800-78MOLEX Fax: +1-630-969-1352
Molex China Distributors Beijing, Room 1319, Tower B, COFCO Plaza No. 8, Jian Guo Men Nei Street, 100005 Beijing P.R. China Phone: +86-10-6526-9628 Phone: +86-10-6526-9728 Phone: +86-10-6526-9731 Fax: +86-10-6526-9730	Molex Singapore Pte. Ltd. Jurong, Singapore Phone: +65-268-6868 Fax: +65-265-6044	Molex Japan Co. Ltd. Yamato, Kanagawa, Japan Phone: +81-462-65-2324 Fax: +81-462-65-2366

Table 17: Hirose sales contacts (subject to change)

Hirose Ltd. For further information please click: http://www.hirose.com	Hirose Electric (U.S.A.) Inc 2688 Westhills Court Simi Valley, CA 93065 U.S.A. Phone: +1-805-522-7958 Fax: +1-805-522-3217	Hirose Electric GmbH Herzog-Carl-Strasse 4 73760 Ostfildern Germany Phone: +49-711-456002-1 Fax: +49-711-456002-299 Email: info@hirose.de
Hirose Electric UK, Ltd Crownhill Business Centre 22 Vincent Avenue, Crownhill Milton Keynes, MK8 OAB Great Britain Phone: +44-1908-305400 Fax: +44-1908-305401	Hirose Electric Co., Ltd. 5-23, Osaki 5 Chome, Shinagawa-Ku Tokyo 141 Japan Phone: +81-03-3491-9741 Fax: +81-03-3493-2933	Hirose Electric Co., Ltd. European Branche First class Building 4F Beechavenue 46 1119PV Schiphol-Rijk Netherlands Phone: +31-20-6557-460 Fax: +31-20-6557-469