

## **WISMO Quik Q2686**

# **Product Technical Specification**

Reference: **WM\_PRJ\_Q2686\_PTS\_001**

Revision: **004**

Date: **22<sup>nd</sup> November 2005**



Powered by the Wavecom Operating System and Open AT<sup>®</sup>

## Document Information

Level	Date	History of the evolution	
001	01/17/2005	Creation (Preliminary version)	
002	06/01/2005	Pin-out modification (see chapter 3.1)	
003	15/09/2005	Update Functional architecture Pin-out modification (see chapter 4.1) Add RESET state of all IO of all interface Update power supply range (see chapter 3.2) Update electrical information for digital IO (see chapter 3.2) Update SPI bus configuration (see chapter 3.4) Remove 3 GPIO (see chapter 3.9) Change MIC1 biasing voltage configuration (see chapter 3.11) Change SPK1 definition to only single ended (see chapter 3.11) Update ON/OFF operating sequence (see chapter 3.14) Update BOOT definition (see chapter 3.15) Update ~RESET operating sequence and electrical characteristics(see chapter 3.14) Update Interrupts activation (see chapter 3.17) Update RTC electrical characteristics (see chapter 3.19) Update PCM description and add waveform (see chapter 3.21)	
004	November 22, 2005	Update Q2686 version "Overview" section Update "Cautions", "Trademarks" and "Copyright" Update "Electrical information for digital I/O" (see chapter 3.3) Update SPI max frequency (see chapter 3.4) Update available GPIO (see chapter 3.9) Add "OFF state" voltage caution (see chapter 3.2) Update "Battery charging interface" (see chapter 3.13) Update "Analogue audio interface" (see chapter 3.11) Update "Environmental Specifications" (see chapter 4.2) Update "General Purpose Connector pin out description" (see chapter 4.1)	

## Overview

This document defines and specifies the WISMO QUIK Q2686, available under two GSM/GPRS Class 10 quad-band versions:

- **Q2686H**: EGSM/GPRS **900/1800/850/1900** MHz version with **32** Mb of Bursted Flash memory and **8** Mb of SRAM (**32/8**)

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## Cautions

This platform contains a modular transmitter. This device is used for wireless applications. Note that all electronics parts and elements are ESD sensitive.

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## 1 References

### 1.1 References documents

For more details, several references documents can be consulted. The WAVECOM reference documents are provided in the WAVECOM documents package contrary at the general reference documents which are not WAVECOM owner.

#### 1.1.1 WAVECOM reference document

- [1] Automotive Environmental Control Plan for WISMO Quik Q2686  
WM\_PRJ\_Q2686\_DCP\_001
- [2] WISMO Quik Q2686 Customer Design Guidelines  
WM\_PRJ\_Q2686\_PTS\_003
- [3] WISMO Quik Q2686 Process Customer Guidelines  
WM\_PRJ\_Q2686\_PTS\_004

#### 1.1.2 General reference document

- [4] "I<sup>2</sup>C Bus Specification", Version 2.0, Philips Semiconductor 1998
- [5] ISO 7816-3 Standard



## 1.2 List of abbreviations

<b>Abbreviation</b>	<b>Definition</b>
AC	Alternative Current
ADC	Analog to Digital Converter
A/D	Analog to Digital conversion
AF	Audio-Frequency
AT	ATtention (prefix for modem commands)
AUX	AUXiliary
CAN	Controller Area Network
CB	Cell Broadcast
CEP	Circular Error Probable
CLK	CLock
CMOS	Complementary Metal Oxide Semiconductor
CS	Coding Scheme
CTS	Clear To Send
DAC	Digital to Analogue Converter
dB	Decibel
DC	Direct Current
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Digital Cellular System
DR	Dynamic Range
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
E-GSM	Extended GSM
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EMS	Enhanced Message Service
EN	ENable
ESD	ElectroStatic Discharges
FIFO	First In First Out
FR	Full Rate

**Abbreviation Definition**

FTA	Full Type Approval
GND	GrouND
GPI	General Purpose Input
GPC	General Purpose Connector
GPIO	General Purpose Input Output
GPO	General Purpose Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
HR	Half Rate
I/O	Input / Output
LED	Light Emitting Diode
LNA	Low Noise Amplifier
MAX	MAXimum
MIC	MICrophone
MIN	MINimum
MMS	Multimedia Message Service
MO	Mobile Originated
MT	Mobile Terminated
na	Not Applicable
NF	Noise Factor
NMEA	National Marine Electronics Association
NOM	NOMinal
PA	Power Amplifier
Pa	Pascal (for speaker sound pressure measurements)
PBCCH	Packet Broadcast Control CHannel
PC	Personal Computer
PCB	Printed Circuit Board
PDA	Personal Digital Assistant
PFM	Power Frequency Modulation
PSM	Phase Shift Modulation
PWM	Pulse Width Modulation
RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference

**Abbreviation Definition**

RHCP	Right Hand Circular Polarization
RI	Ring Indicator
RST	ReSeT
RTC	Real Time Clock
RTCM	Radio Technical Commission for Maritime services
RTS	Request To Send
RX	Receive
SCL	Serial CLock
SDA	Serial DAta
SIM	Subscriber Identification Module
SMS	Short Message Service
SPI	Serial Peripheral Interface
SPL	Sound Pressure Level
SPK	SPeaKer
SRAM	Static RAM
TBC	To Be Confirmed
TDMA	Time Division Multiple Access
TP	Test Point
TVS	Transient Voltage Suppressor
TX	Transmit
TYP	TYPical
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus
USSD	Unstructured Supplementary Services Data
VSWR	Voltage Standing Wave Ratio

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## 2 General description

### 2.1 General information

WISMO Quik Q2686 is a self-contained E-GSM/GPRS 900/1800 and 850/1900 quad-band module including the following characteristics :

#### 2.1.1 Overall dimensions

- Length: 40 mm
- Width: 32.2 mm
- Thickness: 4 mm

#### 2.1.2 Environment and mechanics

- Green policy: RoHS compliant
- Complete shielding

The Q2686 module is compliant with RoHS (Restriction of Hazardous Substances in Electrical and Electronic Equipment) Directive 2002/95/EC which sets limits for the use of certain restricted hazardous substances. This directive states that "from 1st July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)".

Modules which are compliant with this directive are identified by the RoHS logo on their label.



#### 2.1.3 GSM/GPRS Features

- 2 Watts EGSM 900/GSM 850 radio section running under 3.6 Volts
- 1 Watt GSM1800/1900 radio section running under 3.6 Volts
- Hardware GPRS class 10 capable

#### 2.1.4 Interfaces

- Digital section running under 2.8 Volts and 1.8V.
- 3V/1V8 SIM interface
- Complete interfacing :
  - Power supply
  - Serial link
  - Analogue audio
  - PCM digital audio
  - SIM card
  - Keyboard
  - USB 1.1 slave
  - Serial LCD (not available with AT commands)

**2.1.5 Operating system**

- Real Time Clock with calendar
- Battery charger
- Echo Cancellation + noise reduction (quadri codec)
- Full GSM or GSM/GPRS Operating System stack

**2.1.6 Connection interfaces**

WISMO Quik Q2686 has four external connections :

- Three for RF circuit:
  - UFL connector
  - Soldered connection
  - Third connection **TBD**
- One for base band signals:
  - 100 pin I/O connector.

## 2.2 Functional description

The global architecture of WISMO Quik Q2686 is described below :

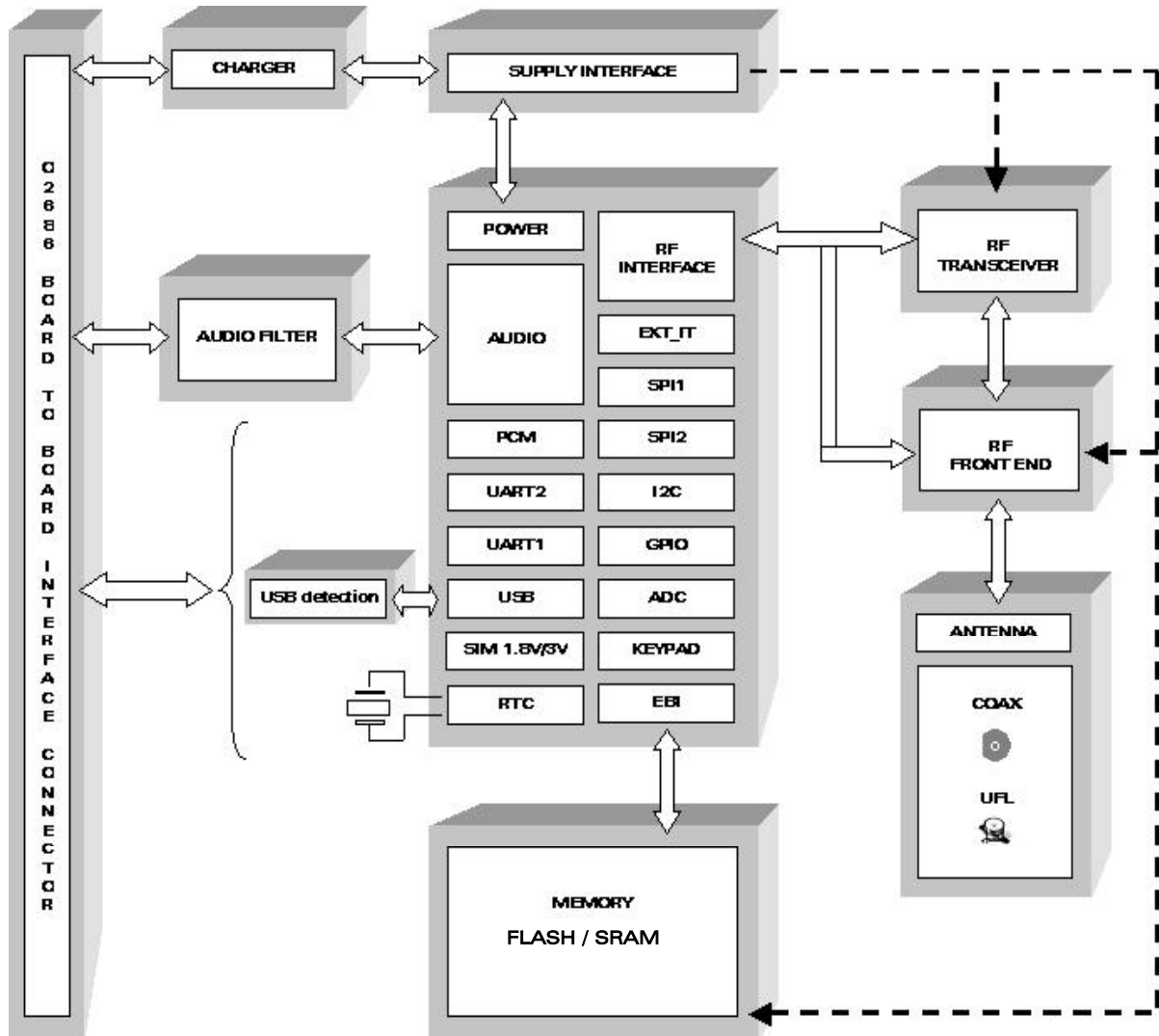


Figure 1 : Functional architecture

### 2.2.1 RF functionalities

The Radio Frequency (RF) range comply with the Phase II EGSM 900/DCS 1800 and GSM 850/PCS 1900 recommendation. The frequencies are :

	Transmit band (Tx)	Receive band (Rx)
<b>GSM 850</b>	824 to 849 MHz	869 to 894 MHz
<b>E-GSM 900</b>	880 to 915 MHz	925 to 960 MHz
<b>DCS 1800</b>	1710 to 1785 MHz	1805 to 1880 MHz
<b>PCS 1900</b>	1850 to 1910 MHz	1930 to 1990 MHz

The Radio Frequency (RF) part is based on a specific quad band chip including:

- a Digital low-IF receiver
- a Quad-band LNAs (Low Noise Amplifier)
- an Offset PLL (Phase Locked Loop) transmitter
- a Frequency synthesizer
- a Digitally controlled crystal oscillator (DCXO)
- a Tx/Rx FEM ( Front-End Module) for quad-band GSM/GPRS

### 2.2.2 Baseband functionalities

The digital part of the WISMO Quik Q2686 is composed of a PCF5212 PHILIPS chip. This chipset is using a 0,18  $\mu\text{m}$  CMOS mixed technology, which allows massive integration as well as low current consumption.

## 2.3 Operating System

WISMO Quik Q2686 is designed to integrate various types of specific process applications such as vertical applications (telemetry, multimedia, automotive...).

The Operating System offers a set of AT commands to control the module. With this standard Operating System, some interfaces of the module are not available since they are dependent on the peripheral devices connected to the module.

The Operating System is Open AT<sup>®</sup> compliant.



## 3 Interfaces

### 3.1 General Purpose Connector (GPC)

A 100-pin connector is provided to interface the WISMO Quik Q2686 with a board containing either a serial LCD module, a keyboard, a SIM connector, or a battery connection.

The available interfaces on the GPC are described below.

**⚠ Please be aware that some of these interfaces can not be handled when using the WISMO Quik Q2686 driven by AT commands**



**This symbol is used to indicate the unavailable interfaces with AT commands.**

**These functions have then to be managed externally i.e. using the main processor of the application.**

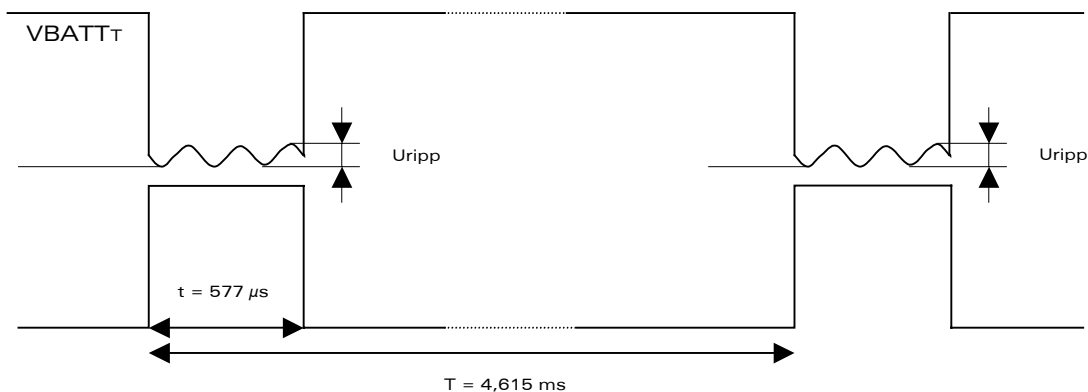
### 3.2 Power supply

#### 3.2.1 Power supply description

The power supply is one of the key issue in the design of a GSM terminal.

Due to the bursted emission in GSM / GPRS, the power supply must be able to deliver high current peaks in a short time. During the peaks the ripple ( $U_{ripp}$ ) on the supply voltage must not exceed a certain limit (see Table 1 Power supply voltage“ Power Supply Voltage”).

- In communication mode, a GSM/GPRS class 2 terminal emits 577 $\mu$ s radio bursts every 4.615ms. (See Figure 2)



**Figure 2 : Power supply during burst emission**

- In communication mode, a GPRS class 10 terminal emits 1154 $\mu$ s radio bursts every 4.615ms.

Only the VBATT power supply input is necessary to provide the Q2686 module.

VBATT:

- supplies directly the RF components with 3.6 V. It is essential to keep a minimum voltage ripple at this connection in order to avoid any phase error.

The RF Power Amplifier current (2.0 A peak in GSM /GPRS mode) flows with a ratio of:

- 1/8 of the time (around 577 $\mu$ s every 4.615ms for GSM /GPRS cl. 2) and
- 2/8 of the time (around 1154 $\mu$ s every 4.615ms for GSM /GPRS cl. 10).

The rising time is around 10 $\mu$ s.

- is internally used to provide through several regulators, the power supply VCC\_2V8 and VCC\_1V8 needed for the base band signals.

The WISMO QUIK Q2686 shielding case is the grounding. The ground has to be connected on the mother board through a complete layer on the PCB.

**Input power Supply Voltage**

	V <sub>MIN</sub>	V <sub>NOM</sub>	V <sub>MAX</sub>	Ripple max (U <sub>ripp</sub> )
VBATT <sup>1,2</sup>	3.2	3.6	4.8	10mV(TBC)

**Table 1** Power supply voltage

(1): This value has to be guaranteed during the burst (with 2.0A Peak in GSM or GPRS mode)

(2): max operating Voltage Stationary Wave Ratio (VSWR) 2:1

When supplying the module with a battery, the total impedance (battery+protections+PCB) should be <150 mOhms.

**3.2.2 Power consumption**

Following information are given assuming a 50 Ω RF output.

**Power consumption in OFF mode**

(module supplied, OFF state, no Operating System running)

	Conditions	I <sub>NOM</sub>	I <sub>MAX</sub>
Overall consumption	Off	25 μA	TBD

**When the module is in OFF state, no voltage must be applied on any pin of the 100-pin connector excepted on the BAT-RTC (pin 7 ) for RTC operation, or ON~OFF (pin 19) to power the module.**

**Power consumption**  
 in EGSM/GPRS 900 MHz and GSM/GPRS 850 MHz mode classe 10

	Conditions	I <sub>NOM</sub>	I <sub>MAX</sub>
VBATT	During TX bursts @Pcl5	1.7 A peak [TBC]	TBD
VBATT	During RX bursts	75 mA peak [TBC]	TBD
VBATT	Average 1Rx/1Tx @Pcl5	270 mA [TBC]	TBD
VBATT	Average 1Rx/1Tx @Pcl8	180 mA [TBC]	TBD
VBATT	Average Idle mode	2.3mA [TBC]	TBD
VBATT	Average GPRS Cl 10 (3Rx/2Tx) @Pcl5	540 mA [TBC]	TBD
VBATT	Average GPRS Cl 10 (3Rx/2Tx) @Pcl8	360 mA [TBC]	TBD

Power Control Level : Pcl5=2W typ. ; Pcl8=0,5W typ.

**Power consumption**  
 in GSM/GPRS 1800 MHz and GSM/GPRS 1900 MHz mode classe 10

	Conditions	I <sub>NOM</sub>	I <sub>MAX</sub>
VBATT	During TX bursts @Pcl0	1.3 A peak [TBC]	TBD
VBATT	During RX bursts	75 mA peak [TBC]	TBD
VBATT	Average 1Rx/1Tx @Pcl0	240 mA [TBC]	TBD
VBATT	Average 1Rx/1Tx @Pcl3	150 mA [TBC]	TBD
VBATT	Average Idle mode	2.3mA [TBC]	TBD
VBATT	Average GPRS Cl 10 (3Rx/2Tx) @Pcl0	480 mA [TBC]	TBD
VBATT	Average GPRS Cl 10 (3Rx/2Tx) @Pcl3	300 mA [TBC]	TBD

Power Control Level : Pcl0=1W typ. ; Pcl3=0,25W typ.

**Power Supply Pinout**

Signal	Pin number
VBATT	1,2,3,4
GND	Shielding

**The grounding connection is done through the shielding** ⇒ the four legs have to be soldered to the ground plane.

### 3.3 Electrical information for digital I/O

There is three types of digital I/O on the WISMO Quik Q2686 : 2.8Volt CMOS , 1.8Volt CMOS and Open drain.

The three types are described below.

#### Electrical characteristics of digital I/O

2.8 Volts type (2V8 )						
Parameter	I/O type	Minim.	Typ	Maxim.	Condition	
Internal 2.8V power supply	VCC_2V8	2.74V	2.8V	2.86V		
Input / Output pin	V <sub>IL</sub>	CMOS	-0.5V*		0.84V	
	V <sub>IH</sub>	CMOS	1.96V		TBD*	
	V <sub>OL</sub>	CMOS			0.4V	I <sub>OL</sub> = - 4 mA
	V <sub>OH</sub>	CMOS	2.4V			I <sub>OH</sub> = 4 mA
	I <sub>OH</sub>				4mA	
	I <sub>OL</sub>				- 4mA	

\*Absolute maximum ratings

1.8 Volts type (1V8)						
Parameter	I/O type	Minim.	Typ	Maxim.	Condition	
Internal 1V8 power supply	VCC_1V8	1.76V	1.8V	1.94V		
Input / Output pin	V <sub>IL</sub>	CMOS	-0.5V*		0.54V	
	V <sub>IH</sub>	CMOS	1.33V		TBD*	
	V <sub>OL</sub>	CMOS			0.4V	I <sub>OL</sub> = - 4 mA
	V <sub>OH</sub>	CMOS	1.4V			I <sub>OH</sub> = 4 mA
	I <sub>OH</sub>				4mA	
	I <sub>OL</sub>				- 4mA	

\*Absolute maximum ratings

Open drain outputs type						
Signal name	Parameter	I/O type	Minimum	Typ	Maximum	Condition
FLASH-LED	V <sub>OL</sub>	Open Drain			0.4V	
	I <sub>OL</sub>	Open Drain			8mA	
BUZZ-OUT	V <sub>OL</sub>	Open Drain			0.4V	
	I <sub>OL</sub>	Open Drain			100mA	
SDA / GPIO27 and SCL / GPIO26	V <sub>TOL</sub>	Open Drain			3.3V	Tolerated voltage
	V <sub>IH</sub>	Open Drain	2V			
	V <sub>IL</sub>	Open Drain			0.8V	
	V <sub>OL</sub>	Open Drain			0.4V	
	I <sub>OL</sub>	Open Drain			3mA	

The reset state of the I/O are given in each interfaces descriptions chapter. The definition of those states are described below:

Reset state definition	
Parameter	Définition
<b>0</b>	Set to GND
<b>1</b>	Set to supply 1V8 or 2V8 depending of I/O type
<b>Pull down</b>	Internal pull down with ~60K resistor.
<b>Pull up</b>	Internal pull up with ~60K resistor to supply 1V8 or 2V8 depending of I/O type.
<b>Z</b>	High impedance
<b>Undefined</b>	Be careful, undefined mustn't be used in your application if a special state at reset is needed. Those pins can be a toggling signal during reset.

### 3.4 Serial interface

The WISMO Quik Q2686 can be connected to a LCD module driver through either two SPI bus or an I<sup>2</sup>C 2-wire interfaces.

#### 3.4.1 SPI bus

The both SPI bus interfaces include-:

- a CLK signal,
- an I/O signal,
- an I signal
- an CS signal complying with standard SPI bus.

SPI bus characteristics:

- Master mode operation
- The maximum speed transfer is 13 Mb/s in master mode operation
- 
- 3 or 4-wire interface
- SPI-mode configuration: 0 to 3

##### 3.4.1.1 SPI configuration

Operation	Maximum Speed	SPI-Mode	Duplex	3-wire type	4-wire type
Master	13 Mb/s	0,1,2,3	Half	SPIx-CLK; SPIx-IO; ~SPIx-CS	SPIx-CLK; SPIx-IO; SPIx-I; ~SPIx-CS

For the 4-wire configuration, the SPIx-I/O is used as output only.

##### 3.4.1.2 SPI1 bus

###### Pin description

Signal	Pin number	I/O	I/O type	Reset state	Description	Multiplexed with
SPI1-CLK	23	O	2V8	Z	SPI Serial Clock	GPIO28
SPI1-IO	25	I/O	2V8	Z	SPI Serial input/output	GPIO29
SPI1-I	24	I	2V8	Z	SPI Serial input	GPIO30
~SPI1-CS	22	O	2V8	Z	SPI Enable	GPIO31

For Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition refer to chapter 3.3 Electrical information for digital I/O.

### 3.4.1.3 SPI2 bus

#### Pin description

Signal	Pin number	I/O	I/O type	Reset state	Description	Multiplexed with
SPI2-CLK	26	O	2V8	Z	SPI Serial Clock	GPIO32
SPI2-IO	27	I/O	2V8	Z	SPI Serial input/output	GPIO33
SP2-I	29	I	2V8	Z	SPI Serial input	GPIO34
~SPI2-CS	28	O	2V8	Z	SPI Enable	GPIO35

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.

### 3.4.2 I2C bus

The I2C interface includes a clock signal (SCL) and a data signal (SDA) complying with a 100KHz-standard interface ( Standard mode : s-mode ).

The maximum speed transfer range is 400Kb/s ( Fast mode : f-mode ).

For more information on the bus, see the "I<sup>2</sup>C Bus Specification Version 2.0" from PHILIPS.

#### Pin description

Signal	Pin number	I/O	I/O type	Reset state	Description	Multiplexed with
SCL	44	I/O	Open drain	Z	Serial Clock	GPIO26
SDA	46	I/O	Open drain	Z	Serial Data	GPIO27

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.



### 3.5 Keyboard interface

This interface provides 10 connections :

- 5 rows (ROW0 to ROW4) and
- 5 columns (COL0 to COL4).

The scanning is a digital one and the debouncing is done in the WISMO Quik Q2686.

No discrete components like R,C (Resistor, Capacitor) are needed.

Pin description of the Keyboard interface

Signal	Pin number	I/O	I/O type	Reset state	Description	Multiplexed with
ROW0	68	I/O	1V8	0	Row scan	GPIO9
ROW1	67	I/O	1V8	0	Row scan	GPIO10
ROW2	66	I/O	1V8	0	Row scan	GPIO11
ROW3	65	I/O	1V8	0	Row scan	GPIO12
ROW4	64	I/O	1V8	0	Row scan	GPIO13
COL0	59	I/O	1V8	Pull up	Column scan	GPIO4
COL1	60	I/O	1V8	Pull up	Column scan	GPIO5
COL2	61	I/O	1V8	Pull up	Column scan	GPIO6
COL3	62	I/O	1V8	Pull up	Column scan	GPIO7
COL4	63	I/O	1V8	Pull up	Column scan	GPIO8

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.

### 3.6 Main serial link (UART1)

A flexible 6-wire serial interface is available complying with V24 protocol signaling but not with V28 (electrical interface) due to a 2.8 Volts interface.

The signals are the follows:

- TX data (CT103/TX)
- RX data (CT104/RX)
- Request To Send (~CT105/RTS)
- Clear To Send (~CT106/CTS)
- Data Terminal Ready (~CT108-2/DTR) and
- Data Set Ready (~CT107/DSR).

The set of RS-232 signals can be required for GSM DATA services application and is generated by the general purpose I/O provided by the Q2686. The two additional signals are:

- Data Carrier Detect (~CT109/DCD) and
- Ring Indicator (CT125/RI).

Pin description of UART1 interface

Signal	Pin number	I/O	I/O type	Reset state	Description	Multiplexed with
CT103/TXD1*	71	I	2V8	Z	Transmit serial data	GPIO36
CT104/RXD1*	73	O	2V8	1	Receive serial data	GPIO37
~CT105/RTS1*	72	I	2V8	Z	Request To Send	GPIO38
~CT106/CTS1*	75	O	2V8	Z	Clear To Send	GPIO39
~CT107/DSR1*	74	O	2V8	Z	Data Set Ready	GPIO40
~CT108-2/DTR1*	76	I	2V8	Z	Data Terminal Ready	GPIO41
~CT109/DCD1 *	70	O	2V8	Undefined	Data Carrier Detect	GPIO43
~CT125/RI1 *	69	O	2V8	Undefined	Ring Indicator	GPIO42
CT102/GND*	Shielding legs		GND		Ground	

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.

\*According to PC view

The **rising time** and **falling time** of the reception signals (mainly CT103) have to be less than **(TBD) ns**.

The Q2686 is designed to operate using all the serial interface signals. In particular, it is necessary to use RTS and CTS for hardware flow control in order to avoid data corruption during transmission.

Maximum baud rate of the UART1 is **921** Kbit/s.

### 3.7 Auxiliary serial link (UART2)

For future applications (e.g. Bluetooth connectivity) an auxiliary serial interface (UART2) will be available on Q2686 product.

#### Pin description of UART2 interface

Signal	Pin number	I/O	I/O type	Reset state	Description	Multiplexed with
CT103 / TXD2*	31	I	1V8	Z	Transmit serial data	GPIO14
CT104 / RXD2*	30	O	1V8	Z	Receive serial data	GPIO15
~CT106 / CTS2*	32	O	1V8	Z	Clear To Send	GPIO16
~CT105 / RTS2*	33	I	1V8	Z	Request To Send	GPIO17

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.

\* According to PC view

Maximum baud rate of the UART2 is **921** Kbit/s.

### 3.8 SIM interface

The Subscriber Identification Module can be directly connected to the WISMO Quik Q2686 module through this dedicated interface.

#### 3.8.1 General Description

5 signals exist :

- SIM-VCC : SIM power supply.
- ~SIM-RST : reset.
- SIM-CLK : clock.
- SIM-IO : I/O port.
- SIMPRES : SIM card detect.

The SIM interface controls a 3V / 1V8 SIM. This interface is fully compliant with GSM 11.11 recommendations concerning SIM functions.

NOTE:

The SIM interface can control a 5V SIM through an external SIM driver.

#### Pin description of SIM interface

Signal	Pin number	I/O	I/O type	Reset state	Description	Multiplexed with
SIM-CLK	14	O	2V9 / 1V8	0	SIM Clock	Not mux
~SIM-RST	13	O	2V9 / 1V8	0	SIM Reset	Not mux
SIM-IO	11	I/O	2V9 / 1V8	*Pull up	SIM Data	Not mux
SIM-VCC	9	O	2V9 / 1V8		SIM Power Supply	Not mux
SIMPRES	12	I	1V8	Z	SIM Card Detect	GPIO18

\*SIM-IO pull up is about 10K ohm

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.

## Electrical Characteristics of SIM interface

Parameter	Conditions	Minim.	Typ	Maxim.	Unit
SIM-IO $V_{IH}$	$I_{IH} = \pm 20\mu A$	$0.7 \times SIMVCC$			V
SIM-IO $V_{IL}$	$I_{IL} = 1mA$			0.4	V
$\sim$ SIM-RST, SIM-CLK $V_{OH}$	Source current = $20\mu A$	$0.9 \times SIMVCC$			V
SIM-IO $V_{OH}$	Source current = $20\mu A$	$0.8 \times SIMVCC$			
$\sim$ SIM-RST, SIM-IO, SIM-CLK $V_{OL}$	Sink current = $-200\mu A$			0.4	V
SIM-VCC Output Voltage	SIMVCC = 2.9V $I_{VCC} = 1mA$	2.84	2.9	2.96	V
	SIMVCC = 1.8V $I_{VCC} = 1mA$	1.74	1.8	1.86	V
SIM-VCC current	VBATT = 3.6V			10	mA
SIM-CLK Rise/Fall Time	Loaded with 30pF		20		ns
$\sim$ SIM-RST, Rise/Fall Time	Loaded with 30pF		20		ns
SIM-IO Rise/Fall Time	Loaded with 30pF		0.7	1	$\mu s$
SIM-CLK Frequency	Loaded with 30pF			3.25	MHz

Note :

When **SIMPRES** is used, a **low to high** transition means that the SIM card is inserted and a **high to low** transition means that the SIM card is removed.

### 3.9 General Purpose Input/Output

The WISMO Quik Q2686 provides up to 42 General Purpose I/O. They are used to control any external device such as a LCD or a Keyboard backlight.

All grey highlight I/O are 1V8 whereas the others are 2V8.

Pin description of GPIO

Signal	Pin number	I/O	I/O type*	Reset state	Multiplexed with
Reserved	42		Do not used		
GPIO1	51	I/O	1V8	0	Not mux
GPIO2	53	I/O	1V8	0	Not mux
GPIO3	50	I/O	1V8	Z	INT0
GPIO4	59	I/O	1V8	Pull up	COL0
GPIO5	60	I/O	1V8	Pull up	COL1
GPIO6	61	I/O	1V8	Pull up	COL2
GPIO7	62	I/O	1V8	Pull up	COL3
GPIO8	63	I/O	1V8	Pull up	COL4
GPIO9	68	I/O	1V8	0	ROW0
GPIO10	67	I/O	1V8	0	ROW1
GPIO11	66	I/O	1V8	0	ROW2
GPIO12	65	I/O	1V8	0	ROW3
GPIO13	64	I/O	1V8	0	ROW4
GPIO14	31	I/O	1V8	Z	CT103 / TXD2
GPIO15	30	I/O	1V8	Z	CT104 / RXD2
GPIO16	32	I/O	1V8	Z	~CT106 / CTS2
GPIO17	33	I/O	1V8	Z	~CT105 / RTS2
GPIO18	43	I/O	1V8	Z	SIMPRES
GPIO19	45	I/O	2V8	Z	Not mux
GPIO20	48	I/O	2V8	Undefined	Not mux
GPIO21	47	I/O	2V8	Undefined	Not mux
GPIO22	57	I/O	2V8	Z	Not mux
GPIO23	55	I/O	2V8	Z	Not mux
GPIO24	58	I/O	2V8	Z	Not mux

GPIO25	49	I/O	2V8	Z	INT1
GPIO26	44	I/O	Open drain	Z	SCL
GPIO27	46	I/O	Open drain	Z	SDA
GPIO28	23	I/O	2V8	Z	SPI1-CLK
GPIO29	25	I/O	2V8	Z	SPI1-IO
GPIO30	24	I/O	2V8	Z	SP1-I
GPIO31	22	I/O	2V8	Z	~SPI1-CS
GPIO32	26	I/O	2V8	Z	SPI2-CLK
GPIO33	27	I/O	2V8	Z	SPI2-IO
GPIO34	29	I/O	2V8	Z	SP2-I
GPIO35	28	I/O	2V8	Z	~SPI2-CS
GPIO36	71	I/O	2V8	Z	CT103 / TXD1
GPIO37	73	I/O	2V8	1	CT104 / RXD1
GPIO38	72	I/O	2V8	Z	~CT105 / RTS1
GPIO39	75	I/O	2V8	Z	~CT106 / CTS1
GPIO40	74	I/O	2V8	Z	~CT107 / DSR1
GPIO41	76	I/O	2V8	Z	~CT108-2 / DTR1
GPIO42	69	I/O	2V8	Undefined	~CT125 / RI1
GPIO43	70	I/O	2V8	Undefined	~CT109 / DCD1
GPIO44	43	I/O	2V8	Undefined	Not mux

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.



### 3.10 Analog to Digital Converter

Two Analog to Digital Converters inputs are provided by the WISMO Quik Q2686. Those converters are 10 bits resolution, ranging from 0 to 2V.

Pin description of ADC

Signal	Pin number	I/O	I/O type	Description
BAT-TEMP*	20	I	Analog	A/D converter
AUX-ADC	21	I	Analog	A/D converter

This input is reserved for battery charging temperature sensor, see chapter "2.12 Battery Charging interface".

Electrical Characteristics of ADC

Parameter		Min	Typ	Max	Unit
Resolution			10		bits
Sampling rate			216		sps
Input signal range		0		2	V
ADC Reference Accuracy					%
Integral Accuracy					LSB
Differential Accuracy					LSB
Input impedance	BAT-TEMP		100K*		$\Omega$
	AUX-ADC		1M		$\Omega$

\* internally pull up to 2.8V

### 3.11 Analogue audio interface

Two different microphone inputs and two different speakers outputs are supported.

The WISMO Quik Q2686 also includes an echo cancellation feature which allows handsfree function.

#### 3.11.1 Microphone inputs

The MIC2 inputs already include the biasing for an electret microphone allowing an easy connection.

The MIC1 input needs to have an external biasing if an electret micro is used.

##### 3.11.1.1 Common microphone inputs characteristics

The connection can be either differential or single-ended but using a differential connection in order to reject common mode noise and TDMA noise is strongly recommended. When using a single-ended connection, be sure to have a very good ground plane, a very good filtering as well as shielding in order to avoid any disturbance on the audio path.

The gain of MIC inputs is internally adjusted and can be tuned using an AT command.

Both can be configured in differential or single ended.

##### 3.11.1.2 Main Microphone Inputs (MIC2)

By default, the MIC2 inputs are differential ones, but it can be configured in single ended. They already include the convenient biasing for an electret microphone. The electret microphone can be directly connected on those inputs.

AC coupling is already embedded in the module.

Pin description of MIC2

Signal	Pin number	I/O	I/O type	Description
MIC2P	36	I	Analog	Microphone 2 positive input
MIC2N	34	I	Analog	Microphone 2 negative input

### 3.11.1.3 Auxiliary Microphone Inputs (MIC1)

By default, the MIC1 inputs are single-ended but it can be configured in differential. An external biasing is needed if an electret micro is used.

AC coupling is already embedded in the module.

Pin description of MIC1

Signal	Pin number	I/O	I/O type	Description
MIC1P	40	I	Analog	Microphone 1 positive input
MIC1N	38	I	Analog	Microphone 1 negative input

### 3.11.1.4 Micro Electrical characteristics

The characteristics of the both micro inputs of the WISMO Quik Q2686 are defined in the following arrays.

MIC2 Characteristics					
Parameter		Min.	Typ	Max.	Unit
Internal Biasing	Voltage	2	2.1	2.2	V
	Output Current			1.5	mA
Impedance	Internal AC coupling		100		nF
	Input impedance to gnd for MIC2P and MIC2N		1.9		kΩ
Voltage input	Differential Input Voltage *			346	mV <sub>RMS</sub>
	Absolute maximum ratings	0		TBD	V

MIC1 Characteristics					
Parameter		Minim.	Typ	Maxim.	Unit
Internal Biasing	Voltage		N/A		V
	Output Current		N/A		A
Impedance	Internal AC coupling		100		nF
	Single Input impedance	140	200	320	kΩ
	Differential input impedance	70	100	160	kΩ
Voltage input	Differential Input Voltage *			346	mV <sub>RMS</sub>
	Absolute maximum ratings	0		TBD	V

The input voltage depends of the input micro gain set by AT command.  
 Those values are given for differential design.

### 3.11.2 Common speaker outputs characteristics

The connection is single-ended on SPK1 and is differential or single-ended on SPK2. Using a differential connection to reject common mode noise and TDMA noise is strongly recommended. Moreover in single-ended mode, 1/2 of the power is lost. When using a single-ended connection, be sure to have a very good ground plane, a very good filtering as well as shielding in order to avoid any disturbance on the audio path.

#### 3.11.2.1 Differential Connection

Impedance of the speaker amplifier output in differential mode is shown below:

Parameter	Typ	Unit
Z (SPK2P, SPK2N)	8	Ω

#### 3.11.2.2 Single-ended Connection

Impedance of the speaker amplifier output in single-ended mode is shown below:

#### Electrical Characteristics

Parameter	Typ	Unit
Z (SPK1P, SPK1N)	16 or 32	Ω
Z (SPK2P, SPK2N)	4	Ω

### 3.11.3 Speaker outputs

#### 3.11.3.1 Speaker 2 Outputs

##### Pin description of Speaker 2 outputs

Signal	Pin number	I/O	I/O type	Description
SPK2P	39	O	Analog	Speaker 2 positive output
SPK2N	41	O	Analog	Speaker 2 negative output

### 3.11.3.2 Speaker 1 Outputs

Pin description of Speaker 1 outputs

Signal	Pin number	I/O	I/O type	Description
SPK1P	35	O	Analog	Speaker 1 positive output
SPK1N	37	O	Analog	Speaker 1 negative output

### 3.12 PWM / Buzzer Output

This output is controlled by a PWM controller and can be used as buzzer or as PWM.

The BUZZ-OUT is an open drain one. A buzzer can be directly connected between this output and VBATT. The maximum current is 100 mA (PEAK).

Pin description of PWM/Buzzer output

Signal	Pin number	I/O	I/O type	Reset state	Description
BUZZ-OUT	15	O	Open drain	Z	PWM / Buzzer output

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.

Electrical Characteristics

Parameter	Condition	Minimum	Maximum	Unit
$V_{OL}$	$I_{ol} = 100mA$		0.4	v
$I_{PEAK}$	$VBATT = VBATTmax$		100	mA
Frequency		TBD	TBD	Hz
Duty cycle		TBD	TBD	%

### 3.13 Battery charging interface

The WISMO Quik Q2686 module supports one battery charging circuit for Li-Ion batteries. This circuit uses an interface which consists of a current source inputs (CHG-IN) where the constant current has to flow in order to charge the battery.

This current value depends on the battery capacity. It is recommended to provide a current equal to the value of the capacity plus 50mA. For a 550mA battery the current will be 600mA. The maximum current is 800mA.

A specific AT command allows to manage the charge battery (start and stop the charge, enable or disable unsolicited Battery Charge Indications and set the battery charge parameters).

The WISMO Quik Q2686 module monitors the battery voltage to detect the end of the charge. WISMO Quik Q2686 also monitors the temperature of the battery through the BAT-TEMP pin which has to be connected to a temperature sensor inside the battery (a NTC resistor for instance).

Pin description of battery charging interface

Signal	Pin number	I/O	I/O type	Description
CHG-IN	6,8	I	Analog	Current source input
BAT-TEMP	20	I	Analog	A/D converter

Electrical Characteristics of battery charging interface

Parameter		Minimum	Typ	Maximum	Unit
Charging Operating temperature		0		50	°C
BAT-TEMP (pin 20 )	resolution		10		bits
	sampling rate		216		sps/s
	Input Impedance ( R )				Ω
	Input Impedance ( C )				nF
	Input signal range	0		2	V
CHG-IN (pin 6, 8 )	Voltage (for I=Imax)	4.6*		6	V
	Current			800	mA

\* To be parameterized as per battery manufacturer

### 3.13.1 Li-ion charging procedure

A constant current source has to be provided through **CHG-IN** input in order to charge the Li-ion battery, and **BAT-TEMP** input has to be connected to a battery temperature sensor. During this procedure the voltage of the battery is accurately monitored.

The Li-ion charging involves two phases.

- During the first phase, the battery is charged with a constant current until its voltage reaches 4.1V.
- During the second phase the constant current is pulsed by the module. The width and the frequency of the pulse change during this phase in order to ensure a safety charge. The battery is considered as fully charged when, after a pulse, the voltage remains at a 4.1V during more than 10s.

The Li-ion battery must have an included safety circuit to avoid any discharge or overcharge. This circuit is delivered by the manufacturer inside the battery pack. The impedance of this safety circuit has to be the lowest possible in order to reduce the drop-out of the voltage. This drop-out is due to the RF Power Amplifier current (up to 2.0A). A maximum of 150mΩ is required.

### 3.14 ON / ~OFF signal

This input is used to switch ON or OFF the WISMO Quik Q2686 module.

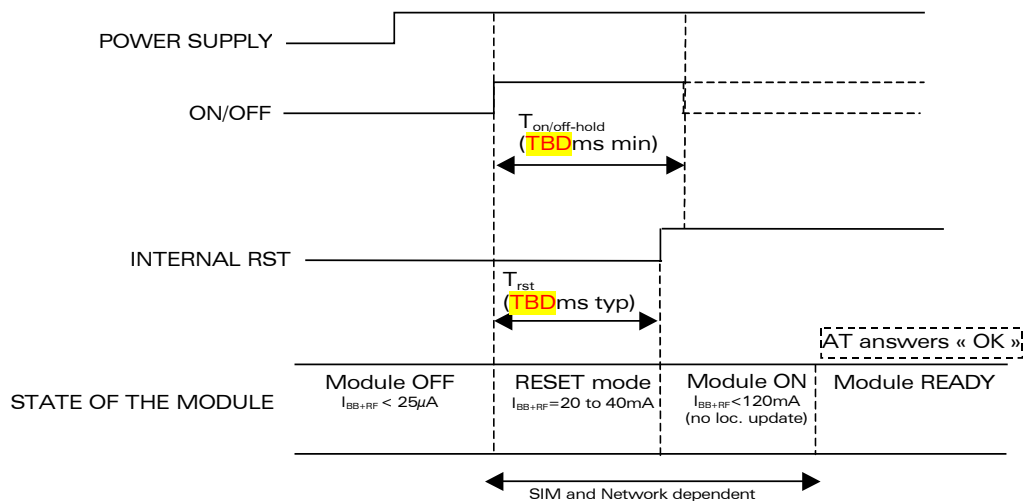
A high level signal has to be provided on the pin ON/~OFF to switch ON the module. The voltage of this signal has to be maintained during a minimum of 1000ms. This signal can be left at high level until switch off.

To switch OFF the module, the pin ON/OFF has to be released. The module can be switched off through the Operating System.

#### 3.14.1 Operating sequences

##### 3.14.1.1 Power ON

Once the module supplied, the application must set the ON/OFF signal to high to start the module power ON sequence. The ON/OFF signal must be hold for 1000ms minimum. After this time, an internal mechanism keeps it on hold. During the power ON sequence, an internal reset is automatically performed by the module for 40ms (typical). During this phase, any external reset should be avoided. Once the initialization is complete (timing is SIM and network dependent) the AT interface answers « OK » to the application. For further details, please check the AT commands Interface Guide.



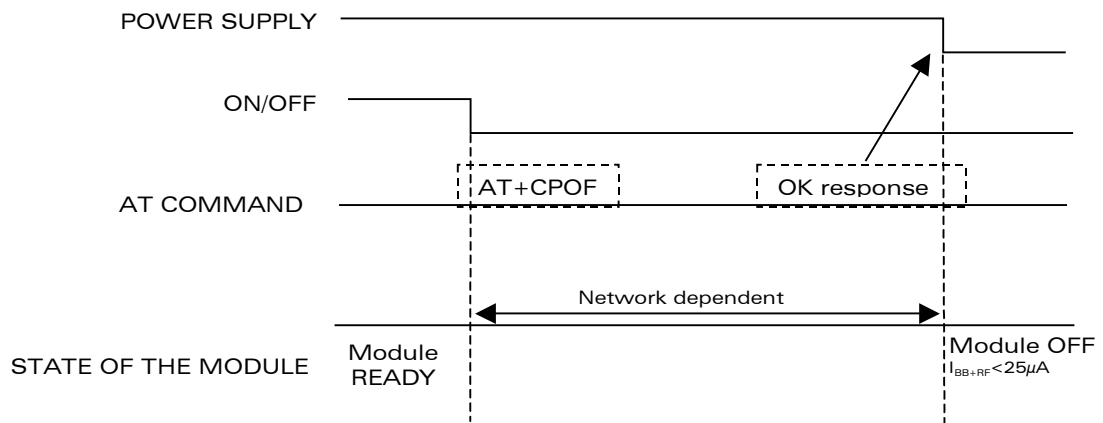
$I_{BB+RF}$  = overall current consumption (Base Band + RF part)

**Figure 3 : Power-ON sequence (no PIN code activated)**



**3.14.1.2 Power OFF**

To properly power OFF the module, the application must set the ON/OFF signal to low and then send the AT+CPOF command to deregister from the network and switch off the module. Once the « OK » response is issued by the module, the power supply can be switched off.



$I_{BB+RF}$  = overall current consumption (Base Band + RF part)

**Figure 4 : Power-OFF sequence**

**Pin description**

Signal	Pin number	I/O	I/O type	Description
ON/~OFF	19	I	CMOS	Module Power ON

**Electrical Characteristics of the signal**

Parameter	I/O type	Minimum	Maximum	Unit
$V_{IL}$	CMOS		$VBATT \times 0.2$	V
$V_{IH}$	CMOS	$VBATT \times 0.8$	$VBATT$	V

### 3.15 BOOT signal

A specific control pin BOOT is available to download the WISMO Quik Q2686 module only if the standard XMODEM download, controlled with AT command, is not possible.

A specific PC software, provided by WAVECOM, is needed to performed this specific download.

The BOOT pin must be connected to the VCC\_1V8 for this specific download.

#### Operating mode description

BOOT	Operating mode	Comment
Leave open	Normal use	No download
Leave open	Download XMODEM	AT command for Download AT+WDWL
1	Download specific	Need WAVECOM PC software

For more information, see Q2686 / X60 AT Command Interface Guide.

This BOOT pin can be leave open for normal use or XMODEM download, but it is recommended to set a test point , a jumper or a switch to VCC\_1V8 (pin 5) power supply.

#### Pin description

Signal	Pin number	I/O	I/O type	Description
BOOT	16	I	1V8	Download mode selection

### 3.16 Reset signal (~RESET)

This signal is used to force a reset procedure by providing low level during at least 200µs. This signal has to be considered as an emergency reset only. A reset procedure is already driven by an internal hardware during the power-up sequence.

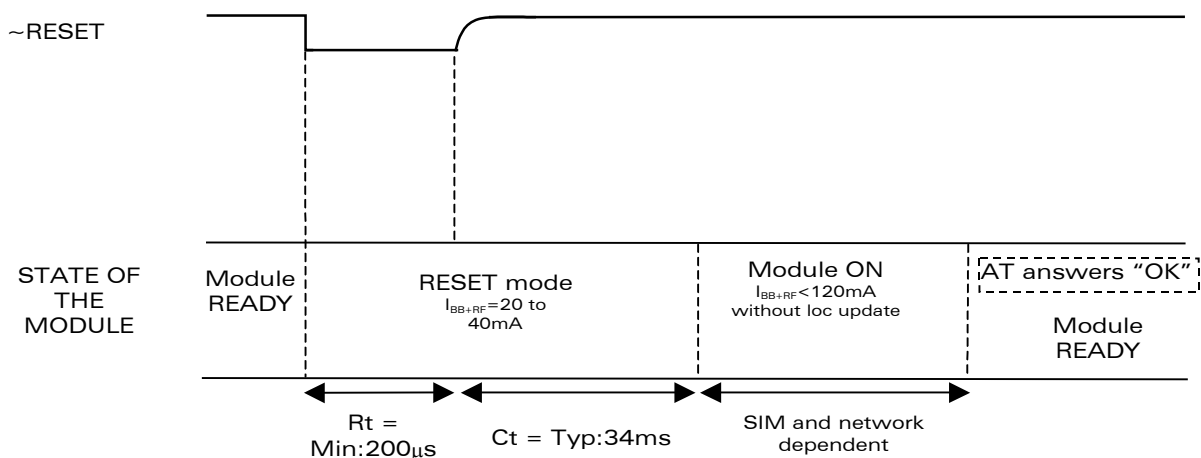
This signal can also be used to provide a reset to an external device (at power up only ). If no external reset is necessary this input can be left open. If used (emergency reset), it has to be driven by an open collector or an open drain.

The module remains in reset mode as long as the ~RESET signal is held low. CAUTION: This signal should be used only for "emergency" resets.

A Operating System reset will be preferred to an hardware reset.

#### Reset sequence :

To activate the « emergency » reset sequence, the ~RESET signal has to be set to low for 200µs minimum. As soon as the reset is complete, the AT interface answers « OK » to the application.



**Figure 5 : Reset sequence waveform**

At power up, the ~RESET time (Rt), is performed after switching ON the module. It is generated by internal WISMO Quik Q2686 voltage supervisor.

The ~RESET time is provided by the internal RC component. To keep the same time, it's not recommended to plug an other R or C component on the ~RESET signal. Only a switch or an open drain gate is recommended.

The Ct time is the cancellation time needed for the module Q2686 initialization. Ct time is automatically done by the Q2686 module after a hardware reset.

#### Electrical Characteristics of the signal

Parameter	Minimum	Typ	Maxomum	Unit
Input Impedance ( R )*		330K		$\Omega$
Input Impedance ( C )		10n		F
~RESET time (Rt)	200			$\mu$ s
~RESET time (Rt) at power up only	20	40	100	ms
Cancellation time (Ct)		34		ms
V <sub>H</sub>	0.57			V
V <sub>IL</sub>	0		0.57	V
V <sub>IH</sub>	1.33			V

\* internal pull up

\* V<sub>H</sub>: Hysterisis Voltage

#### Pin description

Signal	Pin number	I/O	I/O type	Description
~RESET	18	I/O Open Drain	1V8	Module Reset

### 3.17 External Interrupt

The WISMO Quik Q2686 provides two external interrupts inputs. Those interrupt input can be activated on :

- high to low edge
- low to high edge
- low to high and high to low edge
- low level
- high level

When used, interruptions input must not be left opened.

If not used, they have to be configured as GPIO.

#### Pin description

Signal	Pin number	I/O	I/O type	Reset state	Description	Multiplexed with
INT1	49	I	2V8	Z	External Interrupt	GPIO25
INT0	50	I	1V8	Z	External Interrupt	GPIO3

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.

#### Electrical characteristics of the signals

Parameter		Minimum	Maximum	Unit
INT1	$V_{IL}$		0.84	V
	$V_{IH}$	1.96		V
INT0	$V_{IL}$		0.54	V
	$V_{IH}$	1.33		V

### 3.18 VCC\_2V8 and VCC\_1V8 output

Those outputs can be used only for pull-up resistor. VCC\_2V8 and VCC\_1V8 have to be used as a reference supply. Those voltages supplies are available when the module is on.

Pin description

Signal	Pin number	I/O	I/O type	Description
VCC_2V8	10	O	Supply	Digital supply
VCC_1V8	5	O	Supply	Digital supply

Electrical characteristics of the signals

Parameter		Minimum	Typ	Maximum	Unit
VCC_2V8	Output voltage	2.74	2.8	2.86	V
	Output Current			15	mA
VCC_1V8	Output voltage	1.76	1.8	1.94	V
	Output Current			15	mA

### 3.19 BAT-RTC (Backup Battery)

The WISMO Quik Q2686 provides an input / output to connect a Real Time Clock power supply.

#### 3.19.1 Interface description

This pin is used as a back-up power supply for the internal Real Time Clock. The RTC is supported by the module when VBATT is available but a back-up power supply is needed to save date and hour when the VBATT is switched off.

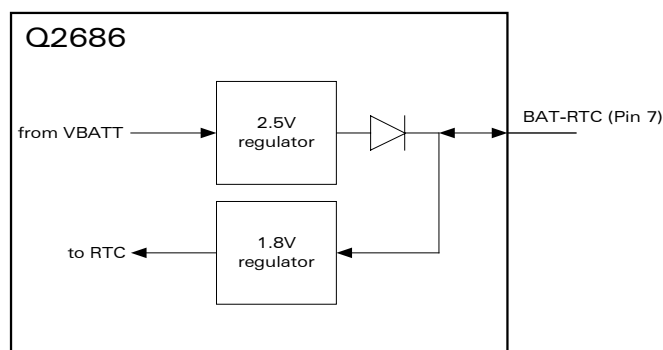


Figure 6 : Real Time Clock power supply

If the RTC is not used this pin can be left open.

If the VBATT is available, the back-up battery can be charged by the internal 2.5V power supply regulator.

#### Pin description

Signal	Pin number	I/O	I/O type	Description
BAT-RTC	7	I/O	Supply	RTC Back-up supply

#### Electrical characteristics of the signal

Parameter	Minimum	Typ	Maximum	Unit
Input voltage	1.85		2.5	V
Input current consumption*		TBD		µA
Output voltage		2.45		V
Output current			2	mA

\*Provided by a RTC back-up battery when module is off and VBATT = 0V.



**3.20 FLASH-LED signal**

FLASH LED is an open drain output. A LED and a resistor can be directly connected between this output and VBATT.

When  $2.8V < VBATT < 3.2V$  and a charger is connected, this output indicates, by flashing ( 100 ms ON, 900 ms OFF ) , the pre-charging phase of the battery and a current generator is connected on CHG-IN inputs.

When  $VBATT > 3.2V$ , this output can be used as a LED driver.

**Pin description**

Signal	Pin number	I/O	I/O type	Reset state	Description
FLASH-LED	17	O	Open Drain Output	Z	LED driving

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.

**Electrical characteristics of the signal**

Parameter	Condition	Minimum	Typ	Maximum	Unit
$V_{OL}$				0.4	V
$I_{OUT}$				8	mA



### 3.21 Digital audio interface (PCM)

The Digital audio interface (PCM) interface mode allows the connectivity with audio standard peripherals. It can be used, for example, for connecting an external audio codec or a BLUETOOTH chipset.

The programmability of this mode allows address a large range of audio peripherals.

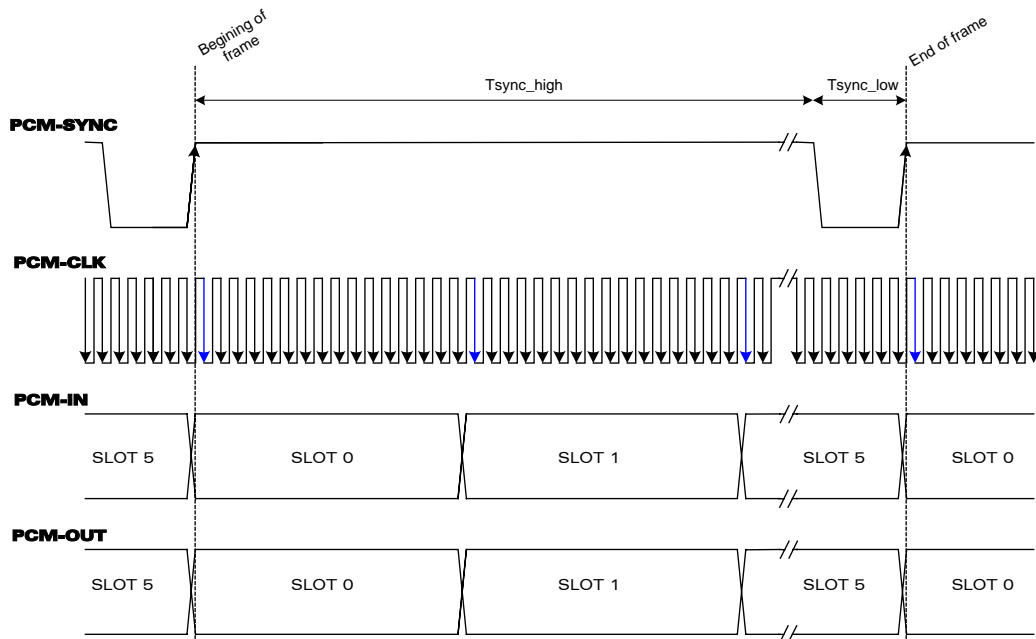
PCM features :

- IOM-2 compatible device on physical level
- Master mode with 6 slots by frame, user on slot 0
- Bit rate single clock mode at 768KHz
- 16 bits data word MSB first
- Long Frame Synchronization
- Push pull configuration on PCM-OUT and PCM-IN

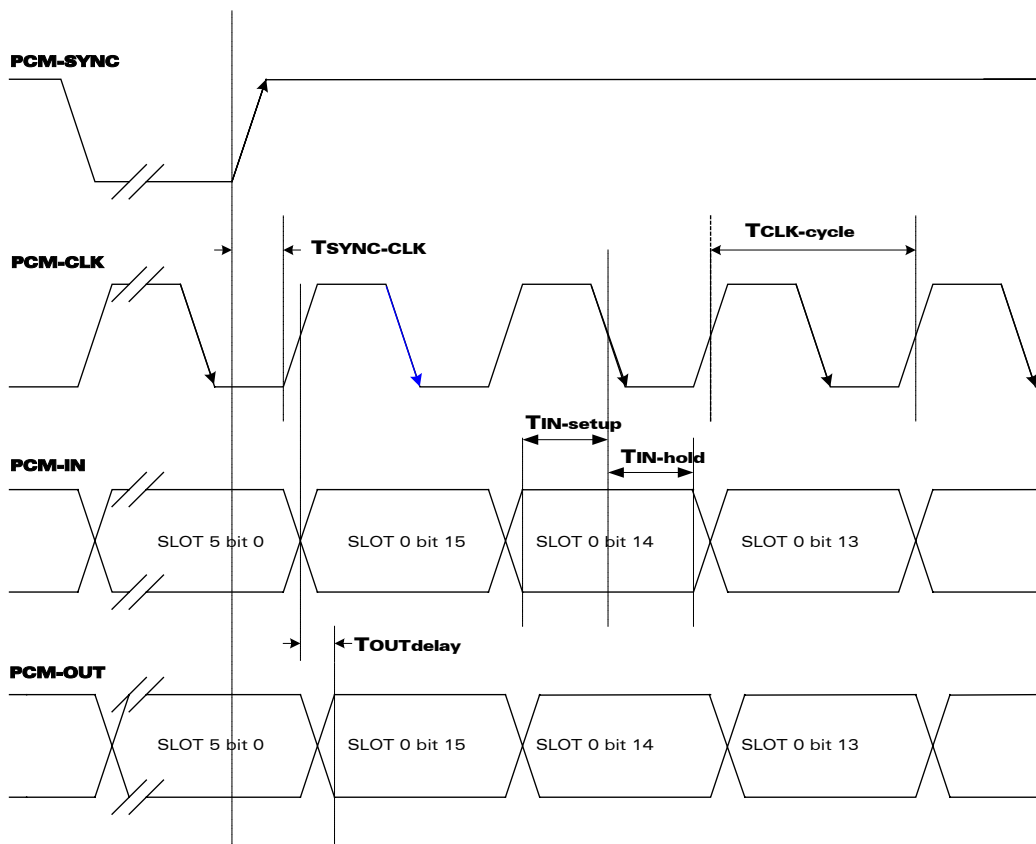
#### 3.21.1 Description

PCM interface consists of 4 wires :

- **PCM-SYNC** ( output ) : The frame synchronization signal delivers an 8KHz frequency pulse that synchronizes the frame data in and the frame data out.
- **PCM-CLK** ( output ) : The frame bit clock signal controls the data transfer with the audio peripheral.
- **PCM-OUT** ( output ) : The frame "data out" depending on the selected configuration mode.
- **PCM-IN** ( input ) : The frame "data in" is depending on the selected configuration mode.



**Figure 7 : PCM Frame waveform**



**Figure 8 : PCM Sampling waveform**

**AC characteristics**

Signal	Description	Minimum	Typ	Maximum	Unit
Tsync_low + Tsync_high	PCM-SYNC period		125		$\mu$ s
Tsync_low	PCM-SYNC low time		93		$\mu$ s
Tsync_high	PCM-SYNC high time		32		$\mu$ s
TSYNC-CLK	PCM-SYNC to PCM-CLK time		-154		ns
TCLK-cycle	PCM-CLK period		1302		ns
TIN-setup	PCM-IN setup time	50			ns
TIN-hold	PCM-IN hold time	50			ns
TOUT-delay	PCM-OUT delay time			20	ns

**Pin description of PCM interface**

Signal	Pin number	I/O	I/O type	Reset state	Description
PCM-SYNC	77	O	1V8	Pull down	Frame synchronization 8Khz
PCM-CLK	79	O	1V8	Pull down	Data clock
PCM-OUT	80	O	1V8	Pull up	Data output
PCM-IN	78	I	1V8	Pull up	Data input

See chapter "3.3 Electrical information for digital I/O" for Open drain, 2V8 and 1V8 voltage characteristics and for Reset state definition.

### 3.22 USB interface

A 4-wire USB slave interface is available, compiling with USB 1.1 protocol signaling, but not with electrical interface, due to the not complying 5V of VPAD-USB.

The USB interface signals are VPAD-USB, USB-DP, USB-DM and GND.

USB interface features :

- 12Mbit/s data transfer in CDC mode
- 3.3V typ compatible
- Soft connect USB high speed detection embedded

NOTE:

A 5V to 3.3V typ voltage regulator is needed between the external interface power in line ( +5V ) and the module line ( VPAD-USB ).

#### Pin description of USB interface

Signal	Pin number	I/O	I/O type	Description
VPAD-USB	52	I	VPAD_USB	USB Power Supply
USB-DP	54	I/O	VPAD_USB	Differential data interface positive
USB-DM	56	I/O	VPAD_USB	Differential data interface negative

#### Electrical characteristics of the signals

Parameter	Min	Typ	Max	Unit
VPAD-USB, USB-DP, USB-DM	3	3.3	3.6	V

### 3.23 RF interface

The impedance is 50 Ohms nominal and the DC impedance is 0 Ohm.

#### 3.23.1 RF connections

##### U.FL Connector

A wide variety of cables fitted with U.FL connectors is proposed by different supplier.

##### Soldered solution

The soldered solution will preferably be based on a RG178 coaxial cable.

##### Third connection

**TBD.**

##### Notes :

- The WISMO Quik Q2686 does not support an antenna switch for a car kit but this function can be implemented externally and it can be driven using a GPIO.
- The antenna cable and connector should be chosen in order to minimize losses in the frequency bands used for GSM 850/900MHz and 1800/1900MHz.
- 0.5dB can be considered as a maximum value for loss between the module and an external connector.

#### 3.23.2 RF performances

RF performances are compliant with the ETSI recommendation GSM 05.05.

The main parameters for Receiver are :

- GSM850 Reference Sensitivity = -104 dBm Static & TUHigh
- E-GSM900 Reference Sensitivity = -104 dBm Static & TUHigh
- DCS1800 Reference Sensitivity = -102 dBm Static & TUHigh
- PCS1900 Reference Sensitivity = -102 dBm Static & TUHigh
- Selectivity @ 200 kHz : > +9 dBc
- Selectivity @ 400 kHz : > +41 dBc
- Linear dynamic range : 63 dB
- Co-channel rejection : >= 9 dBc

And for Transmitter :

- Maximum output power (EGSM & GSM850): 33 dBm +/- 2 dB at ambient temperature
- Maximum output power (GSM1800 & PCS1900) : 30 dBm +/- 2 dB at ambient temperature
- Minimum output power (EGSM & GSM850) : 5 dBm +/- 5 dB at ambient temperature
- Minimum output power (GSM1800 & PCS1900) : 0 dBm +/- 5 dB at ambient temperature

**3.23.3 Antenna specifications**

The antenna must fulfill the following requirements :

- The optimum operating frequency depends on application. A dual Band or a quad band antenna shall work in these frequency bands and have the following characteristics :

Characteristic	Q2686			
	E-GSM 900	DCS 1800	GSM 850	PCS 1900
TX Frequency	880 to 915 MHz	1710 to 1785 MHz	824 to 849 MHz	1850 to 1910 MHz
RX Frequency	925 to 960 MHz	1805 to 1880 MHz	869 to 894 MHz	1930 to 1990 MHz
Impedance	50 Ohms			
VSWR	Rx max	1.5 :1		
	Tx max	1.5 :1		
Typical radiated gain	0dBi in one direction at least			

## 4 Technical specifications

### 4.1 General Purpose Connector pin out description

Description	I/O*	Voltage	Signal Name		Pin Number		Signal Name		Voltage	I/O*	Description
			Mux	Nominal			Nominal	Mux			
Power Supply	I	VBATT		VBATT	1	2	VBATT		VBATT	I	Power Supply
Power Supply	I	VBATT		VBATT	3	4	VBATT		VBATT	I	Power Supply
1.8V Supply Output	O	VCC_1V8		VCC_1V8	5	6	CHG-IN		CHG-IN	I	Charger input
RTC Battery connection	I/O	BAT-RTC		BAT-RTC	7	8	CHG-IN		CHG-IN	I	Charger input
SIM Power Supply	O	1V8 or 3V		SIM-VCC	9	10	VCC_2V8		VCC_2V8	O	2.8V Supply Output
SIM Data	I/O	1V8 or 3V		SIM-IO	11	12	SIMPRES	GPIO18	VCC_1V8	I	SIM Detection
SIM reset Output	O	1V8 or 3V		~SIM-RST	13	14	SIM-CLK		1V8 or 3V	O	SIM Clock
Buzzer Output	O	Open Drain		BUZZ-OUT	15	16	BOOT		VCC_1V8	I	Not Used
Flash Led Output	O	Open Drain		FLASH-LED	17	18	~RESET		VCC_1V8	I	RESET Input
ON / ~OFF Control	I	VBATT		ON/~OFF	19	20	BAT-TEMP		Analog	I	Analogue temperature
Analogue to Digital Input	I	Analog		AUX-ADC	21	22	~SPI1-CS	GPIO31	VCC_2V8	O	SPI1 Chip Select
SPI1 Clock	O	VCC_2V8	GPIO32	SPI1-CLK	23	24	SPI1-I	GPIO30	VCC_2V8	I	SPI1 Data Input
SPI1 Data Input / Output	I/O	VCC_2V8	GPIO29	SPI1-IO	25	26	SPI2-CLK	GPIO32	VCC_2V8	O	SPI2 Clock
SPI2 Data Input / Output	I/O	VCC_2V8	GPIO33	SPI2-IO	27	28	~SPI2-CS	GPIO35	VCC_2V8	O	SPI2 Chip Select
SPI2 Data Input	I	VCC_2V8	GPIO34	SPI2-I	29	30	CT104-RXD2	GPIO15	VCC_1V8	O	Auxiliary RS232 Receive
Auxiliary RS232 Transmit	I	VCC_1V8	GPIO14	CT103-TXD2	31	32	~CT106-CTS2	GPIO16	VCC_1V8	O	Auxiliary RS232 Clear To Send
Auxiliary RS232 Request To Send	I	VCC_1V8	GPIO17	~CT105-RTS2	33	34	MIC2N		Analog	I	Micro 2 Input Negative
Speaker 1 Output Positive	O	Analog		SPK1P	35	36	MIC2P		Analog	I	Micro 2 Input Positive
Speaker 1 Output Negative	O	Analog		SPK1N	37	38	MIC1N		Analog	I	Micro 1 Input Negative

Speaker 2 Output Positive	O	Analog		SPK2P	<b>39</b>	<b>40</b>	MIC1P		Analog	I	Micro 1 Input Positive
Speaker 2 Output Negative	O	Analog		SPK2N	<b>41</b>	<b>42</b>	Reserved				
	I/O	VCC_2V8		GPIO44	<b>43</b>	<b>44</b>	SCL	GPIO26	Open Drain	I/O	I <sup>2</sup> C Clock
	I/O	VCC_2V8		GPIO19	<b>45</b>	<b>46</b>	SDA	GPIO27	Open Drain	I/O	I <sup>2</sup> C Data
	I/O	VCC_2V8		GPIO21	<b>47</b>	<b>48</b>	GPIO20		VCC_2V8	I/O	
Interruption 1 Input	I	VCC_2V8	GPIO25	INT1	<b>49</b>	<b>50</b>	INT0	GPIO3	VCC_1V8	I	Interruption 0 Input
	I/O	VCC_1V8		GPIO1	<b>51</b>	<b>52</b>	VPAD-USB		VPAD-USB	O	USB Power supply input
	I/O	VCC_1V8		GPIO2	<b>53</b>	<b>54</b>	USB-DP		VPAD-USB	I/O	USB Data
	I/O	VCC_2V8		GPIO23	<b>55</b>	<b>56</b>	USB-DM		VPAD-USB	I/O	USB Data
	I/O	VCC_2V8		GPIO22	<b>57</b>	<b>58</b>	GPIO24		VCC_2V8	I/O	
Keypad column 0	I/O	VCC_1V8	GPIO4	COL0	<b>59</b>	<b>60</b>	COL1	GPIO5	VCC_1V8	I/O	Keypad column 1
Keypad column 2	I/O	VCC_1V8	GPIO6	COL2	<b>61</b>	<b>62</b>	COL3	GPIO7	VCC_1V8	I/O	Keypad column 3
Keypad column 4	I/O	VCC_1V8	GPIO8	COL4	<b>63</b>	<b>64</b>	ROW4	GPIO13	VCC_1V8	I/O	Keypad Row 4
Keypad Row 3	I/O	VCC_1V8	GPIO12	ROW3	<b>65</b>	<b>66</b>	ROW2	GPIO11	VCC_1V8	I/O	Keypad Row 2
Keypad Row 1	I/O	VCC_1V8	GPIO10	ROW1	<b>67</b>	<b>68</b>	ROW0	GPIO9	VCC_1V8	I/O	Keypad Row 0
Main RS232 Ring Indicator	O	VCC_2V8	GPIO42	~CT125-RI	<b>69</b>	<b>70</b>	~CT109-DCD1	GPIO43	VCC_2V8	O	Main RS232 Data Carrier Detect
Main RS232 Transmit	I	VCC_2V8	GPIO36	CT103-TXD1	<b>71</b>	<b>72</b>	~CT105-RTS1	GPIO38	VCC_2V8	I	Main RS232 Request To Send
Main RS232 Receive	O	VCC_2V8	GPIO37	CT104-RXD1	<b>73</b>	<b>74</b>	~CT107-DSR1	GPIO40	VCC_2V8	O	Main RS232 Data Set Ready
Main RS232 Clear To Send	O	VCC_2V8	GPIO39	~CT106-CTS1	<b>75</b>	<b>76</b>	~CT108-2-DTR1	GPIO41	VCC_2V8	I	Main RS232 Data Terminal Ready
PCM Frame Synchro	O	VCC_1V8		PCM-SYNC	<b>77</b>	<b>78</b>	PCM-IN		VCC_1V8	I	PCM Data Input
PCM Clock	O	VCC_1V8		PCM-CLK	<b>79</b>	<b>80</b>	PCM-OUT		VCC_1V8	O	PCM Data Output
				NC-1	<b>81</b>	<b>82</b>	Reserved				
				NC-3	<b>83</b>	<b>84</b>	NC-2				
				NC-5	<b>85</b>	<b>86</b>	NC-4				
				NC-7	<b>87</b>	<b>88</b>	NC-6				
				NC-9	<b>89</b>	<b>90</b>	NC-8				



				NC-11	<b>91</b>	<b>92</b>	NC-10				
				NC-13	<b>93</b>	<b>94</b>	NC-12				
				NC-15	<b>95</b>	<b>96</b>	NC-14				
				NC-17	<b>97</b>	<b>98</b>	NC-16				
				NC-19	<b>99</b>	<b>100</b>	NC-18				

\* The I/O direction information is concerning only the nominal signal. When the signal is configured in GPIO, it can always be an Input or an Output.

## 4.2 Environmental Specifications

Wavecom specify following temperature range Q2686 product

The Wismo Quik Q2686 is compliant with following operating class

Conditions	Temperature range
Operating / Class A	-20 °C to +55°C
Operating / Storage / Class B	-40 °C to +85°C

### Function Status Classification:

#### **Class A:**

The module shall have full function during and after an external influence. The GSM performance shall meet the minimum ETSI requirements.

#### **Class B:**

Any functions can be out of specified tolerances. All the functions will be going back to normal tolerances automatically after that the external influence has been removed. Performance is allowed to go outside of the minimum ETSI requirements, but it must be possible to connect a call and send an SMS.

Q2686		ENVIRONNEMENTAL CLASSES		
TYPE OF TEST	STANDARDS	STORAGE Class 1.2	TRANSPORTATION Class 2.3	OPERATING (PORT USE) Class 7.3
Cold	IEC 68-2.1 Ab test	-25° C                      72 h	-40° C                      72 h	-20° C (GSM900)            16 h -10° C (GSM1800/1900) 16h
Dry heat	IEC 68-2.2 Bb test	+70° C                      72 h	+70° C                      72 h	+55° C                      16 h
Change of temperature	IEC 68-2.14 Na/Nb test		-40° / +30° C            5 cycles t1 = 3 h	-20° / +30° C (GSM900) 3 cycles -10° / +30° C (GSM1800/1900): 3 cycles                      t1 = 3 h
Damp heat cyclic	IEC 68-2.30 Db test	+30° C                      2 cycles 90% - 100% RH variant 1	+40° C                      2 cycles 90% - 100% RH variant 1	+40° C                      2 cycles 90% - 100% RH variant 1
Damp heat	IEC 68-2.56 Cb test	+30° C                      4 days	+40° C                      4 days	+40° C                      4 days
Sinusoidal vibration	IEC 68-2.6 Fc test	5 - 62 Hz :                5 mm / s 62 - 200Hz :              2 m / s2 3 x 5 sweep cycles		
Random vibration wide band	IEC 68-3.36 Fdb test		5 - 20 Hz :                0.96 m2 / s3 20 - 500Hz :              - 3 dB / oct 3 x 10 min	10 - 12 Hz :                0.96 m2 / s3 12 - 150Hz :              - 3 dB / oct 3 x 30 min

Figure 9 : Environmental classes

## **4.3 Mechanical specifications**

### **4.3.1 Physical characteristics**

The WISMO Quik Q2686 module has a complete self-contained shield.

- Overall dimensions : 32.2x40x4 mm (except shielding pins)
- Weight : <10 g

### **4.3.2 Mechanical drawings**

The next page gives the mechanical specifications of WISMO Quik Q2686.

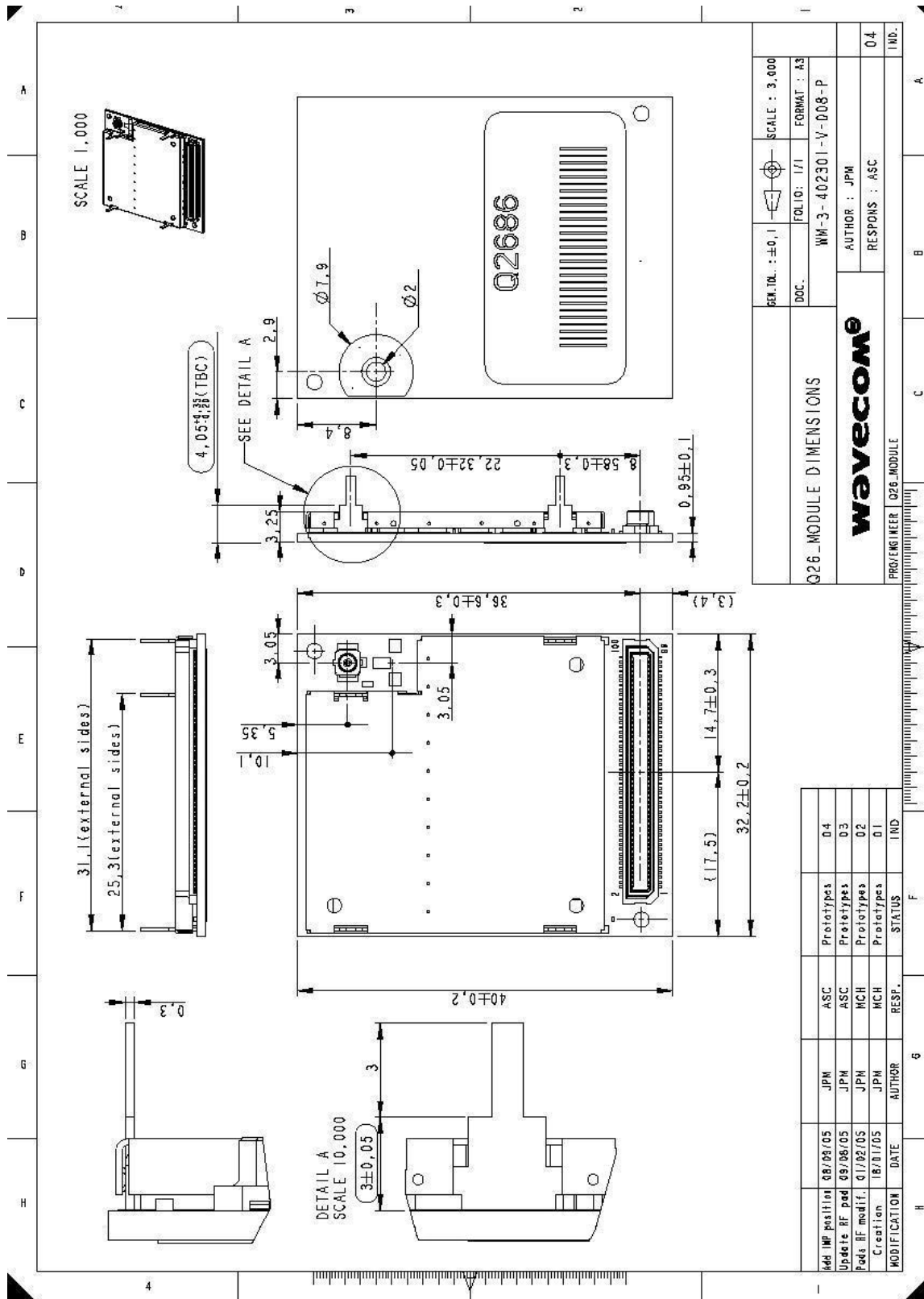


Figure 10 : Mechanical drawing

## **5 Connectors and peripheral devices references**

### **5.1 General Purpose Connector**

The GPC is a 100-pin connector with 0.5mm pitch of P5K series from NAIS group with the following reference :

**AXK600345J**

The matting connector has the following reference :

**AXK500145J**

The stacking height is 3.0 mm.

For further details see GPC data sheets in appendix. More information is also available from [http://www.naisweb.com/e/connecte/con\\_eng/](http://www.naisweb.com/e/connecte/con_eng/)

### **5.2 SIM Card Reader**

- ITT CANNON CCM03 series (see <http://www.ittcannon.com> )
- AMPHENOL C707 series (see <http://www.amphenol.com> )
- JAE (see <http://www.jae.com> )

Drawer type :

- MOLEX 99228-0002 (connector) / MOLEX 91236-0002 (holder) (see <http://www.molex.com> )

### **5.3 Microphone**

Possible suppliers :

- HOSIDEN
- PANASONIC
- PEIKER

## 5.4 Speaker

Possible suppliers :

- SANYO
- HOSIDEN
- PRIMO
- PHILIPS

## 5.5 Antenna Cable

The following cable reference has been qualified for being mounted on WISMO Quik Q2686:

- RG178
- **TBD**

## 5.6 GSM antenna

GSM antennas and support for antenna adaptation can be obtained from manufacturers such as:

- ALLGON (<http://www.allgon.com> )
- IRSCHMANN (<http://www.hirschmann.com/> )

## 6 Design Guidelines

The purpose of the following paragraphs is to give design guidelines.

### 6.1 HARDWARE and RF

#### 6.1.1 EMC recommendations

The EMC tests have to be performed as soon as possible on the application to detect any possible problem.

When designing, special attention should be paid to:

- Possible spurious emission radiated by the application to the RF receiver in the receiver band
- ESD protection: SIM (if accessible from outside), serial link,...
- EMC protection on audio input/output (filters against 900MHz emissions)
- Biasing of the microphone inputs
- Length of the SIM interface lines (preferably <10cm)
- Ground plane : WAVECOM recommends to have a common ground plane for analog / digital / RF grounds.
- Metallic case or plastic casing with conductive paint are recommended

Note :

The module does not include any protection against overvoltage.

#### 6.1.2 Power Supply

The power supply is one of the key issues in the design of a GSM terminal.

A weak power supply design could affect in particular :

- EMC performances
- the emissions spectrum
- the phase error and frequency error

**WARNING:**

**Careful attention should be paid to :**

- **Quality of the power supply : low ripple, PFM or PSM systems should be avoided (PWM converter preferred).**
- **Capacity to deliver high current peaks in a short time (pulsed radio emission).**

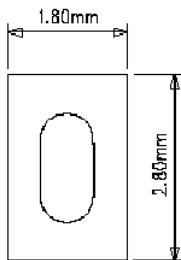


**6.1.3 Layout requirement**

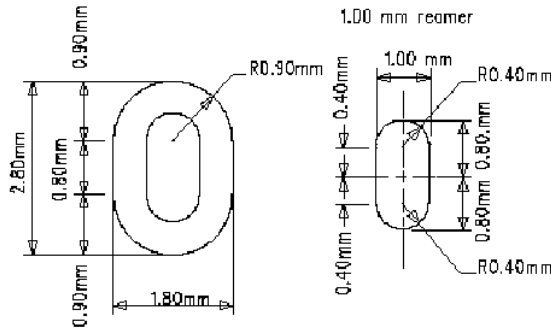
**CHIPS & BORING DIAMETER**

of the WISMO QUIK mechanical insertion pins

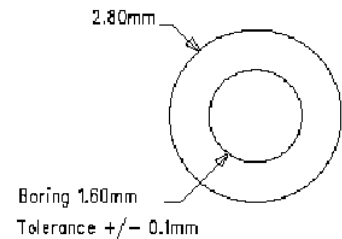
**CASE N 1**  
To be used in priority



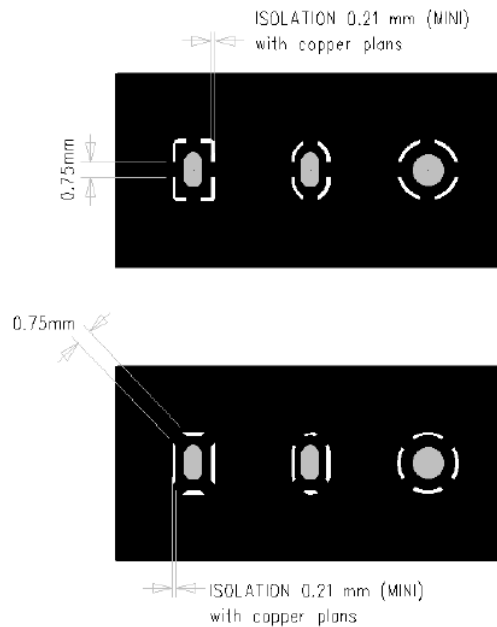
**CASE N 2**  
on specific request



**CASE N 3**  
Other



**THERMAL BRAKES DEFINITION**



**Figure 11 : Layout requirement**

### 6.1.4 Antenna

**WARNING:**

Wavecom strongly recommends to work with an antenna manufacturer either to develop an antenna adapted to the application or to adapt an existing solution to the application.

Both the mechanical and electrical antenna adaptation is one of the key issues in the design of the GSM terminal.

## 6.2 Mechanical integration

Attention should be paid to :

- Antenna cable integration (bending, length, position, etc)
- Legs of the module to be soldered on the Ground plane

## 6.3 Operating System upgrade

The WISMO Quik Q2686 Operating System is stored in flash memory and it can easily be upgraded.

**IMPORTANT:**

In order to follow the regular evolutions of the GPRS standard and to offer state of the art Operating System, Wavecom recommends that the application designed around a WISMO (or WISMO based product) allows easy Operating System upgrades on the module via the standard Xmodem protocol. Therefore, the application shall either allow a direct access to the WISMO serial link through an external connector or implement any mechanism allowing the WISMO Operating System to be downloaded via Xmodem.

The Operating System file can be downloaded into the modem using the Xmodem protocol. AT+WDWL command allows to launch the download process (see description in the AT command User Guide.

The necessary serial signals to proceed with the Xmodem downloading are:

Rx, Tx, RTS, CTS and GND.

## 7 Appendix

### 7.1 Standards and Recommendations

GSM ETSI, 3GPP, GCF and NAPRD03 recommendations for Phase II.

Specification Reference	Title
3GPP TS 45.005 v5.5.0 (2002-08) Release 5	Technical Specification Group GSM/EDGE. Radio Access Network; Radio transmission and reception
GSM 02.07 V8.0.0 (1999-07)	Digital cellular telecommunications system (Phase 2+); Mobile Stations (MS) features (GSM 02.07 version 8.0.0 Release 1999)
GSM 02.60 V8.1.0 (1999-07)	Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description, Stage 1 (GSM 02.60 version 8.1.0 Release 1999)
GSM 03.60 V7.9.0 (2002-09)	Technical Specification Group Services and System Aspects; Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 2 (Release 1998)
3GPP TS 43.064 V5.0.0 (2002-04)	Technical Specification Group GERAN; Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2 (Release 5)
3GPP TS 03.22 V8.7.0 (2002-08)	Technical Specification Group GSM/EDGE. Radio Access Network; Functions related to Mobile Station (MS) in idle mode and group receive mode; (Release 1999)
3GPP TS 03.40 V7.5.0 (2001-12)	Technical Specification Group Terminals; Technical realization of the Short Message Service (SMS) (Release 1998)
3GPP TS 03.41 V7.4.0 (2000-09)	Technical Specification Group Terminals; Technical realization of Cell Broadcast Service (CBS) (Release 1998)
ETSI EN 300 903 V8.1.1 (2000-11)	Digital cellular telecommunications system (Phase 2+); Transmission planning aspects of the speech service in the GSM  Public Land Mobile Network (PLMN) system (GSM 03.50 version 8.1.1 Release 1999)

Specification Reference	Title
3GPP TS 04.06 V8.2.1 (2002-05)	Technical Specification Group GSM/EDGE Radio Access Network; Mobile Station - Base Station System (MS - BSS) interface; Data Link (DL) layer specification (Release 1999)
3GPP TS 04.08 V7.18.0 (2002-09)	Technical Specification Group Core Network; Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification (Release 1998)
3GPP TS 04.10 V7.1.0 (2001-12)	Technical Specification Group Core Networks; Mobile radio interface layer 3 Supplementary services specification; General aspects (Release 1998)
3GPP TS 04.11 V7.1.0 (2000-09)	Technical Specification Group Core Network; Digital cellular telecommunications system (Phase 2+); Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface (Release 1998)
3GPP TS 45.005 v5.5.0 (2002-08)	Technical Specification Group GSM/EDGE. Radio Access Network; Radio transmission and reception (Release 5)
3GPP TS 45.008 V5.8.0 (2002-08)	Technical Specification Group GSM/EDGE Radio Access Network; Radio subsystem link control (Release 5)
3GPP TS 45.010 V5.1.0 (2002-08)	Technical Specification Group GSM/EDGE Radio Access Network; Radio subsystem synchronization (Release 5)
3GPP TS 46.010 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Transcoding (Release 5)
3GPP TS 46.011 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Substitution and muting of lost frames for full rate speech channels (Release 5)
3GPP TS 46.012 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Comfort noise aspect for full rate speech traffic channels (Release 5)

Specification Reference	Title
3GPP TS 46.031 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Discontinuous Transmission (DTX) for full rate speech traffic channels (Release 5)
3GPP TS 46.032 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Voice Activity Detector (VAD) for full rate speech traffic channels (Release 5)
TS 100 913V8.0.0 (1999-08)	Digital cellular telecommunications system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (GSM 07.01 version 8.0.0 Release 1999)
GSM 09.07 V8.0.0 (1999-08)	Digital cellular telecommunications system (Phase 2+); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) (GSM 09.07 version 8.0.0 Release 1999)
3GPP TS 51.010-1 v5.0.0 (2002-09)	Technical Specification Group GSM/EDGE ; Radio Access Network ;Digital cellular telecommunications system (Phase 2+);Mobile Station (MS) conformance specification; Part 1: Conformance specification (Release 5)
3GPP TS 51.011 V5.0.0 (2001-12)	Technical Specification Group Terminals; Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface (Release 5)
ETS 300 641 (1998-03)	Digital cellular telecommunications system (Phase 2); Specification of the 3 Volt Subscriber Identity Module - Mobile Equipment (SIM-ME) interface (GSM 11.12 version 4.3.1)
GCF-CC V3.7.1 (2002-08)	Global Certification Forum – Certification criteria
NAPRD03 V2.6.0 (2002-06)	North America Permanent Reference Document for PTCRB tests

## 7.2 Safety recommendations (for information only)

**IMPORTANT**  
**FOR THE EFFICIENT AND SAFE OPERATION OF YOUR GSM APPLICATION**  
**BASED ON WISMO Quik Q2686**  
**PLEASE READ THIS INFORMATION CAREFULLY**

### 7.2.1 RF safety

#### 7.2.1.1 General

Your GSM terminal<sup>1</sup> is based on the GSM standard for cellular technology. The GSM standard is spread all over the world. It covers Europe, Asia and some parts of America and Africa. This is the most used telecommunication standard.

Your GSM terminal is actually a low power radio transmitter and receiver. It sends out and receives radio frequency energy. When you use your GSM application, the cellular system which handles your calls controls both the radio frequency and the power level of your cellular modem.

#### 7.2.1.2 Exposure to RF energy

There has been some public concern about possible health effects of using GSM terminals. Although research on health effects from RF energy has focused on the current RF technology for many years, scientists have begun research regarding newer radio technologies, such as GSM. After existing research had been reviewed, and after compliance to all applicable safety standards had been tested, it has been concluded that the product was fitted for use.

If you are concerned about exposure to RF energy there are things you can do to minimize exposure. Obviously, limiting the duration of your calls will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your cellular terminal efficiently by following the below guidelines.

#### 7.2.1.3 Efficient terminal operation

For your GSM terminal to operate at the lowest power level, consistent with satisfactory call quality :

If your terminal has an extendible antenna, extend it fully. Some models allow you to place a call with the antenna retracted. However your GSM terminal operates more efficiently with the antenna fully extended.

Do not hold the antenna when the terminal is « IN USE ». Holding the antenna affects call quality and may cause the modem to operate at a higher power level than needed.

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<sup>1</sup> based on WISMO2D

#### **7.2.1.4 Antenna care and replacement**

Do not use the GSM terminal with a damaged antenna. If a damaged antenna comes into contact with the skin, a minor burn may result. Replace a damaged antenna immediately. Consult your manual to see if you may change the antenna yourself. If so, use only a manufacturer-approved antenna. Otherwise, have your antenna repaired by a qualified technician.

Use only the supplied or approved antenna. Unauthorized antennas, modifications or attachments could damage the terminal and may contravene local RF emission regulations or invalidate type approval.

### **7.2.2 General safety**

#### **7.2.2.1 Driving**

Check the laws and the regulations regarding the use of cellular devices in the area where you have to drive as you always have to comply with them. When using your GSM terminal while driving, please :

- give full attention to driving,
- pull off the road and park before making or answering a call if driving conditions so require.

#### **7.2.2.2 Electronic devices**

Most electronic equipment, for example in hospitals and motor vehicles is shielded from RF energy. However RF energy may affect some improperly shielded electronic equipment.

#### **7.2.2.3 Vehicle electronic equipment**

Check your vehicle manufacturer representative to determine if any on-board electronic equipment is adequately shielded from RF energy.

#### **7.2.2.4 Medical electronic equipment**

Consult the manufacturer of any personal medical devices (such as pacemakers, hearing aids, etc...) to determine if they are adequately shielded from external RF energy.

Turn your terminal **OFF** in health care facilities when any regulations posted in the area instruct you to do so. Hospitals or health care facilities may be using RF monitoring equipment.

### 7.2.2.5 Aircraft

Turn your terminal OFF before boarding any aircraft.

- Use it on the ground only with crew permission.
- Do not use it in the air.

To prevent possible interference with aircraft systems, Federal Aviation Administration (FAA) regulations require you to have permission from a crew member to use your terminal while the aircraft is on the ground. To prevent interference with cellular systems, local RF regulations prohibit using your modem while airborne.

### 7.2.2.6 Children

Do not allow children to play with your GSM terminal. It is not a toy. Children could hurt themselves or others (by poking themselves or others in the eye with the antenna, for example). Children could damage the modem, or make calls that increase your modem bills.

### 7.2.2.7 Blasting areas

To avoid interfering with blasting operations, turn your unit OFF when in a « blasting area » or in areas posted : « turn off two-way radio ». Construction crew often use remote control RF devices to set off explosives.

### 7.2.2.8 Potentially explosive atmospheres

Turn your terminal **OFF** when in any area with a potentially explosive atmosphere. It is rare, but your modem or its accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injuries or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas such as petrol stations ; below decks on boats ; fuel or chemical transfer or storage facilities ; and areas where the air contains chemicals or particles, such as grain, dust, or metal powders.

Do not transport or store flammable gas, liquid, or explosives, in the compartment of your vehicle which contains your terminal or accessories.

Before using your terminal in a vehicle powered by liquefied petroleum gas (such as propane or butane) ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is to be used.