User Manual

SM3000 SmartPoint OEM module

Ambient Systems B.V.

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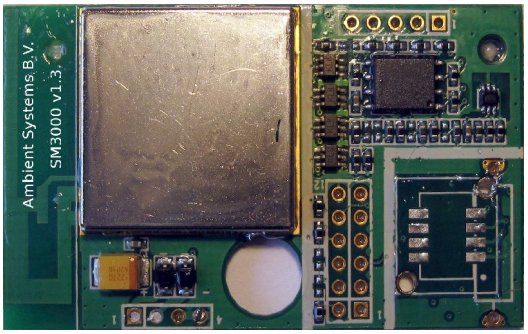


SM3000 SmartPoint OEM module

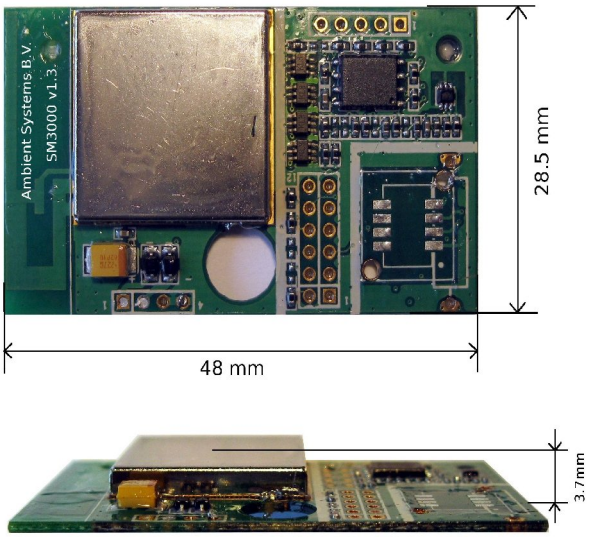
SmartPoints are part of Ambient's Series 3000, which comprises a set of easy to install and use, highly scalable Third Generation Active RFID network products. Such networks consists of three types of devices, namely GateWays, MicroRouters and SmartPoints. Each network contains at least one GateWay and – depending on the type of GateWay – can comprise up to 127 MicroRouters. SmartPoints then use this backbone infrastructure to transmit their data and alerts.
The SM3000 is the OEM module version of the SP3000 SmartPoint. The SP3000 SmartPoint is a small, battery operated wireless device that is uniquely characterized by its intelligence. Using its on-board transceiver it can transmit as well as receive messages. The SP3000 and SM3000 OEM module have a highly accurate on-board temperature sensor and are able to provide periodic measurements as well as alert situations when temperature thresholds are breached. They also contain a built-in 3D Real-Time Location System (RTLS) localization engine, enabling the SmartPoint to calculate its own position relieving the necessity of expensive back office localization software. The SM3000 OEM module contains as well a LED for visual feed-back, 1 MB of memory, for storing product information (e.g. EPC, shipping bill, product description) and historical sensor and location data.
3000 Series Networks can grow up to thousands of SmartPoints allowing for very large and versatile applications. Their transceiver enables on-demand behaviour but also allows you to configure the SmartPoint remotely. So if your application requirements change, the behaviour of the SmartPoint can change with it. The SP3000 and SM3000 SmartPoints are ideally suited for management by exception as you can configure your SmartPoint to only sent alerts when a certain situation arises; this is what we refer to as Dynamic Event Reporting.
Every SmartPoint is accessible using Ambient's Device Driver Interface (DDI). DDI provides a uniform means to address all devices in your network – GateWays, MicroRouters and SmartPoints – and their resources, which are made available by drivers.

Applications

Traditional Active RFID
Wireless Temperature Monitoring
Wireless Temperature Logger
Real-time Location System (RTLS)
Paperless Data Carrier
Intelligent transceiver for sensors and actuators
Machine-to-Machine (M2M)

SM3000 SmartPoint OEM module Functions and Features

Built-In Temperature Sensor, EN12830 (1,D,transportation) compatible
Built-In RTLS 3D Location Engine
Built-in 1MB File System
Low power consumption:
TX Peak Current: 26.9mA
RX Peak Current: 26.7mA
Sleep current: <4µA
User-configurable temperature & location intervals
User-configurable security features
User-configurable sleep modes
User-configurable alerts
Dynamic Event Reporting™
Temperature Alerts
Visual feed-back via built-in LED



	Technical Specifications[1]
Frequency Range	2.405 to 2.475 GHz, IEEE 802.15.4 PHY compliant
Antenna	Integrated on PCB, Omni-directional
TX (Maximum radiated power(EIRP))	+4.6dBm (including PCB antenna gain)
RX	-85.0 dBm @ 1%PER
Typical Range indoor	25 m
Typical Range outdoor	50 m
	Power requirements
Supply voltage	3.3 – 3.8V
Transmit current(typical)	26.9mA
Receive Current(typical)	26.7mA
Sleep Current (maximum)	4µA
	Physical Specifications
Dimensions (H x W x D)	48 x 28.5 x 3.7 mm
Weight	10 gr
	General
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
	Temperature
Typical accuracy[2]	±0.5°C from -25°C to +85°C ±1.0°C from -40°C to +85°C
Resolution	0.0625°C
	Compliances
FCC	FCC part 15.247 and part 15B, IC RSS-210 and RSS GEN, safety certification according to CB and $_{c}CSA_{us}$
CE	ETS EN 300 328, ETS EN 301 389-1, ETS EN 389-17, EN 61000-6-1, EN 61000-6-3, EN 61000-3-2, EN 61010-1:04, EN12830, EN60068-27
RoHS	yes

Warranty & Recycling

One year warranty applies to all SmartPoint products. At the end of life SmartPoint products are considered WEEE and need to be treated accordingly. We recycle obsolete products or products that have drained their batteries. Contact us for more details.

About Ambient Systems

Ambient Systems helps customers in distribution, transport and industry to improve the quality and efficiency of their processes with third generation Active RFID solutions. Unlike traditional Active RFID solutions, Ambient utilizes the power of intelligent tags (SmartPoints) to monitor, locate, and protect physical assets and people. Together with Ambient's robust and secure all-wireless network, this enables management by exception at a total cost of ownership (TCO) which is at least three times lower.

For more information, please visit www.ambient-systems.net.

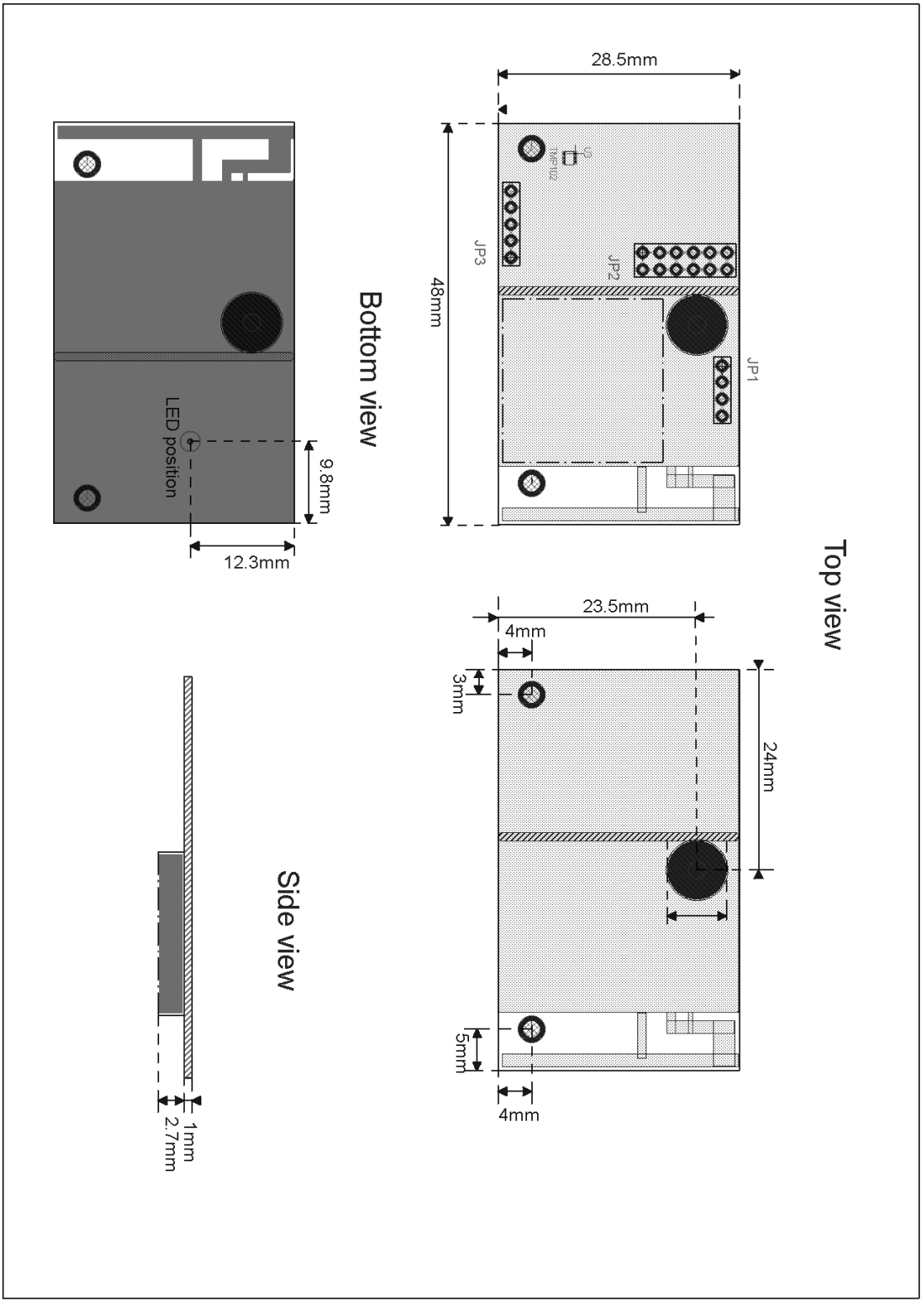
Ordering Information

You can place your order via sales@ambient-systems.net providing any of the product codes below.

1 Specifications are subject to change without notice

2 Applies to the TMP102 temperature sensor.

1 Mechanical drawings



2 Pin layout

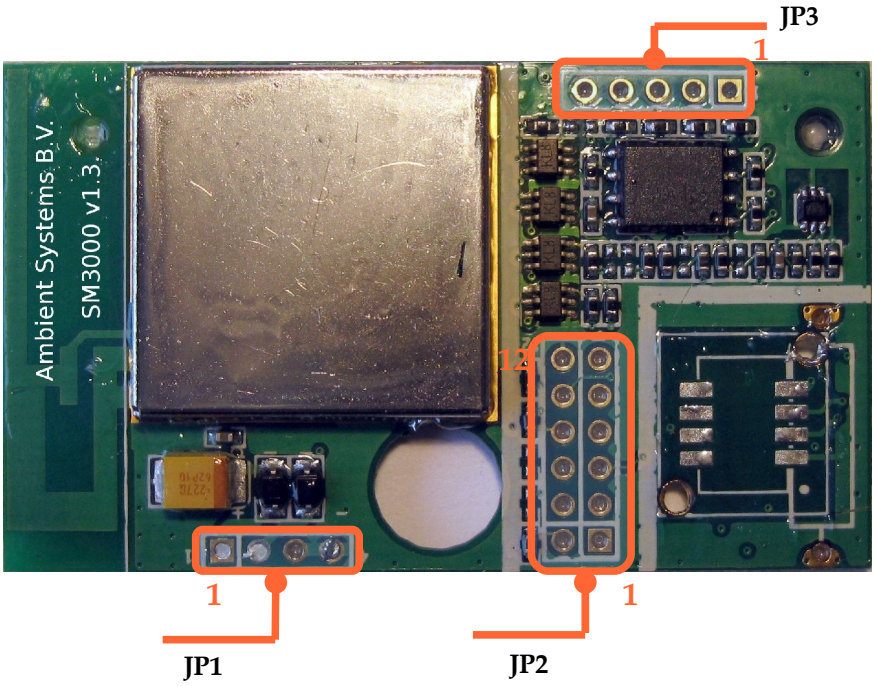


Table 1: Pins configuration

Connector	Pin #	Pin Name	Description
JP1	1	VBAT 1	Power supply 1
	2	VBAT 2	Power supply 2
	3	GND	Ground
	4	GND	Ground
JP2	1	VDD	Power supply 3
	2	N/A	-
	3	N/A	-
	4	N/A	-
	5	N/A	-
	6	CS/DSR	SPI slave chip select/Data set ready
	7	SCLK/DTR	SPI Clock/Data terminal ready
	8	MISO/RX	SPI master in slave out/RX data
	9	MOSI/TX	SPI master out slave in/TX data
	10	DR/CTS	Data ready/Clear to send
	11	RTS	Request to send
	12	GND	Ground
JP3	1	N/A	-
	2	N/A	-
	3	N/A	-
	4	RESET	SM3000 reset line.
	5	N/A	-

3 Operating conditions

Table 2: Operating Conditions

Parameter	Min	Typical	Max	Units	Condition
Operating temperature	-40	-	85	°C	

4 Electrical Specifications

Table 3: Electrical Specifications

Parameter	Min	Typical	Max	Units	Condition
Supply voltage	3.3	3.6	3.8	V	Applied via VBAT 1 or VBAT 2*
	3.0	3.3	3.6	V	Applied via VDD**
Current consumption RX	-	26.9	-	mA	Excluding peripherals consumption.***
Current consumption TX	-	26.7	-	mA	Excluding peripherals consumption.***
Current consumption, overall	-	-	50	mA	Worst case scenario, radio in RX mode and all peripherals working.
Sleep current.	-	2	4	µA	

* The supply voltage can be applied to either VBAT 1 and VBAT 2 or both. Protected for reverse polarity.
** Unprotected for reverse polarity.
*** On board serial flash memory, temperature sensor, LED

5 Radio Section

Table 4: Radio section

Parameter	Min	Typical	Max	Units	Condition
Frequency Range	2405	-	2475	MHz	15 channels with 5MHz spacing.
Receiver sensitivity		-85		dBm	PER=1%
Output Power	-	1.9	4.6	dBm	EIRP, PCB integrated antenna

6 Connectivity

6.1 Power

Power can be applied to the SM3000 OEM module via JP1 or JP2 (see Table 1). Connections must use 2mm pitch pin headers or wires. The maximum allowed wire length is 10cm.

Applying power via JP1:

- supply voltage can be applied to either VBAT 1 or VBAT 2 (one connection is enough)
- reverse polarity protection is included via two Shotkey diodes
- please refer to Table 3 for voltage supply range

Applying power via JP2:

- if power is applied via JP1, leave VDD unconnected
- reverse polarity protection is not provided in this case
- please refer to Table 3 for voltage supply range

6.2 Data

The SM3000 OEM module supports the following serial interfaces:

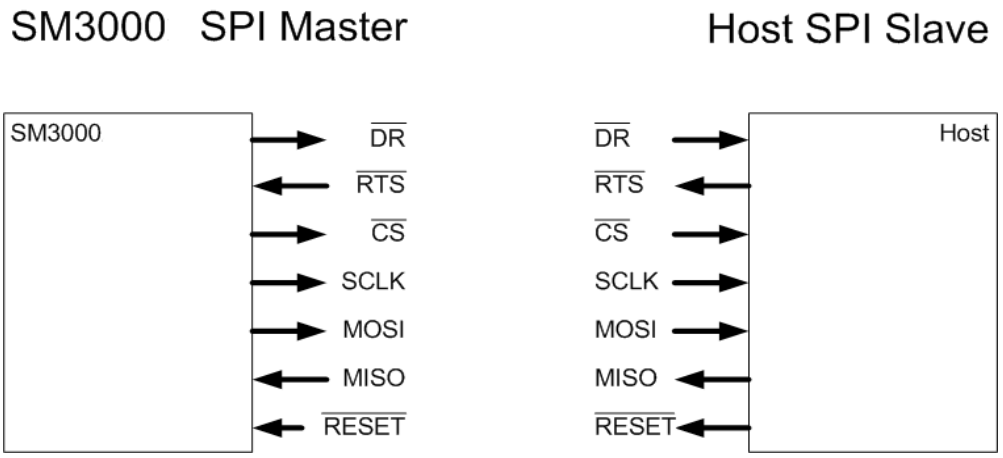
- SPI
- UART
- I2C

Physical connection must be made via JP2 (see Table 1). Use 2mm pitch pin headers or wires of maximum 10cm length.

6.2.3 SPI interface

Physical connections

The following pictures show the physical connections needed to enable SM3000 SPI communication. The arrow indicates the direction of information flow. For example the DR pin is an output of the module and an input for the Host. The CS can be used by the Host to enable its SPI hardware module. CS is active lo. Assumed is that module and Host are powered by the same power supply using the same voltage to drive the pins.



Pin mapping for SM3000

Pin	Description	Voltage levels
VDD	SM3000 supply voltage	VDD
GND	Supply ground	GND
CS	Slave chip select	VDD
DR	Data communication start signal line (Data ready)	VDD
RTS	Host Request To Send signal line	VDD
SCLK	SPI clock	VDD
MOSI	SPI master out slave in	VDD
MISO	SPI master in slave out	VDD
RESET	SM3000 device reset line	-

Functional description

The module uses SPI for its interface. The module is configured as SPI master, the host as SPI slave. The clock speed is 1MHz More on timing later.

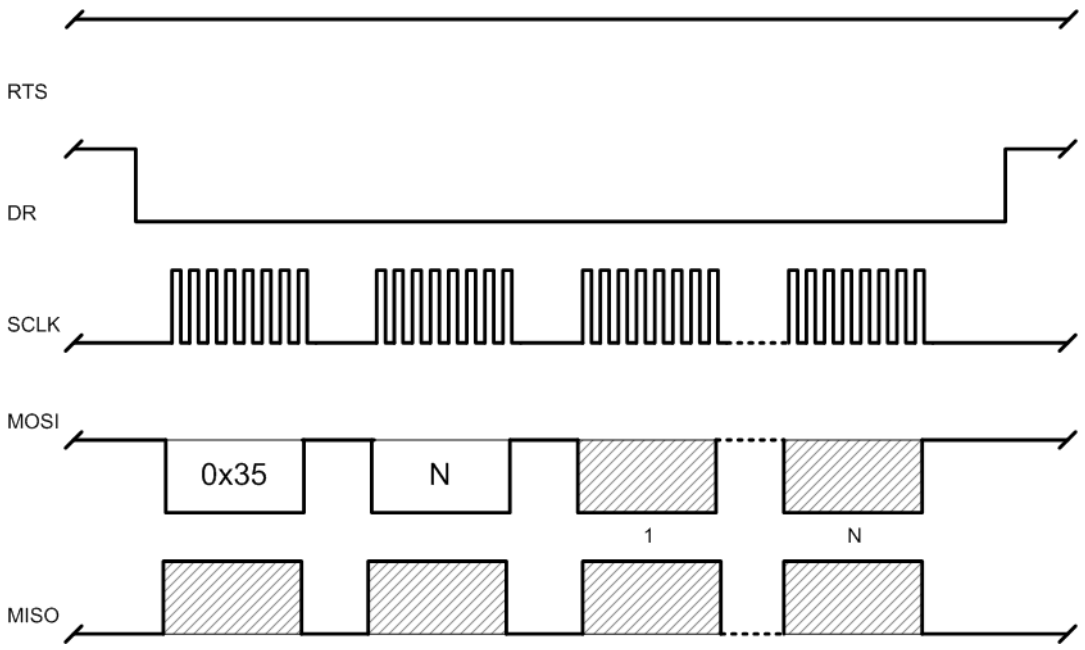
The module always starts SPI communication by signalling the DR (Data Ready) line. When data is available for the host the module will transmit the data upon reception to the host using a "write" command. When the host needs to send data to the module it must signal the RTS (Request To Send) line. The module will then in due time send a "read" command to receive the data from the host. If both module and host have data to send the module will issue a "read/write" command for full duplex communication. The drawings in the following sections omit the CS line. The CS line will be pulled low to mark the start of a byte or a group of bytes and is intended to function as a SPI hardware enable line for the Host.

Write command

If the module has data to send and the host does not, it will send a write command. The RTS line is kept high by the host indicating that it has no data to send[1]. The module will lower the DR line to indicate the start of communication.

The module will generate a clock signal on the SCLK line. The clock signal consists of groups of 8 pulses. Each group represents one byte transmitted and received.

The first byte that is outputted on the MOSI line by the module is the write command: 0x35. The second byte is N: the number of bytes the module will send afterwards. The host may put any data on the MISO line. These values are ignored by the module. When all bytes are sent the module raises the DR line again to mark end of communication.



1 The SM3000 features a 10K pull-up resistor on the RTS- and DR line

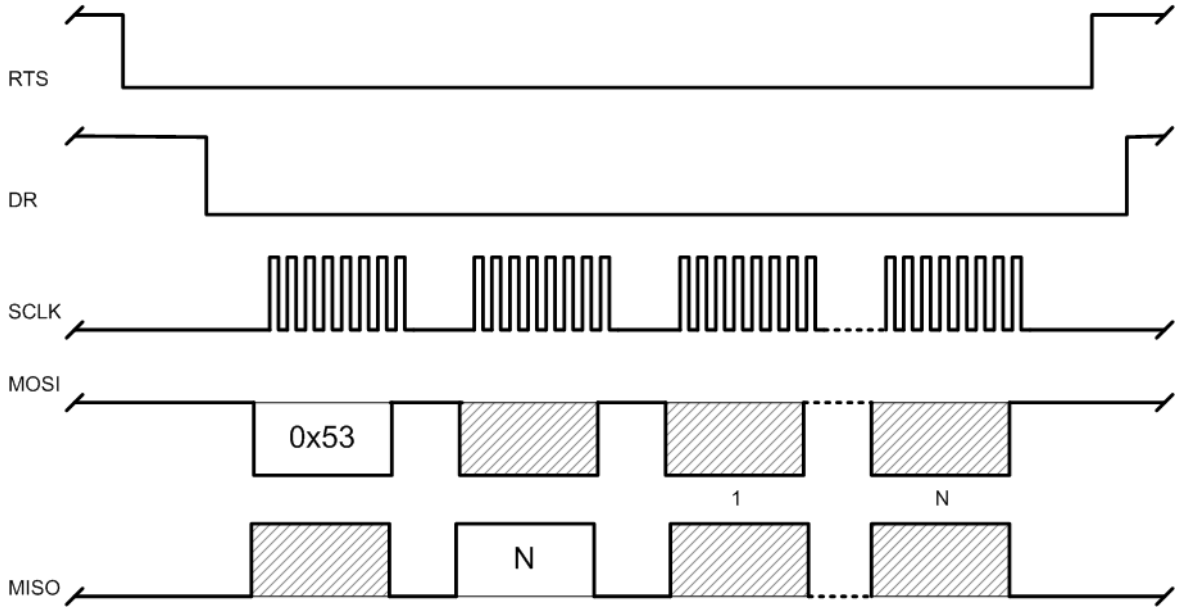
Read command

The module will periodically check if the host has any data to send and start communication if so[1].

The host signals the module it has data to send by pulling the RTS line low. In due time the module lowers the DR line to mark start of communication.

The module will generate a clock signal on the SCLK line. The clock signal consists of groups of 8 pulses. Each group represents one byte transmitted and received.

The first byte that is outputted on the MOSI line by the module is the read command: 0x53. For the second byte the host must then output N: the number of bytes it will send. The module will then generate a clock signal for N bytes. The host must put its data on the MISO line. The module may put any data on the MOSI line. These values can be ignored by the host. When all bytes are sent the module raises the DR line again to mark end of communication.



1 The SM3000 features a wake-up on RTS mechanism. If the SM3000 is in energy saving sleep mode, a downward flank on the RTS line will wake it up and the module will respond typically within a couple of milliseconds

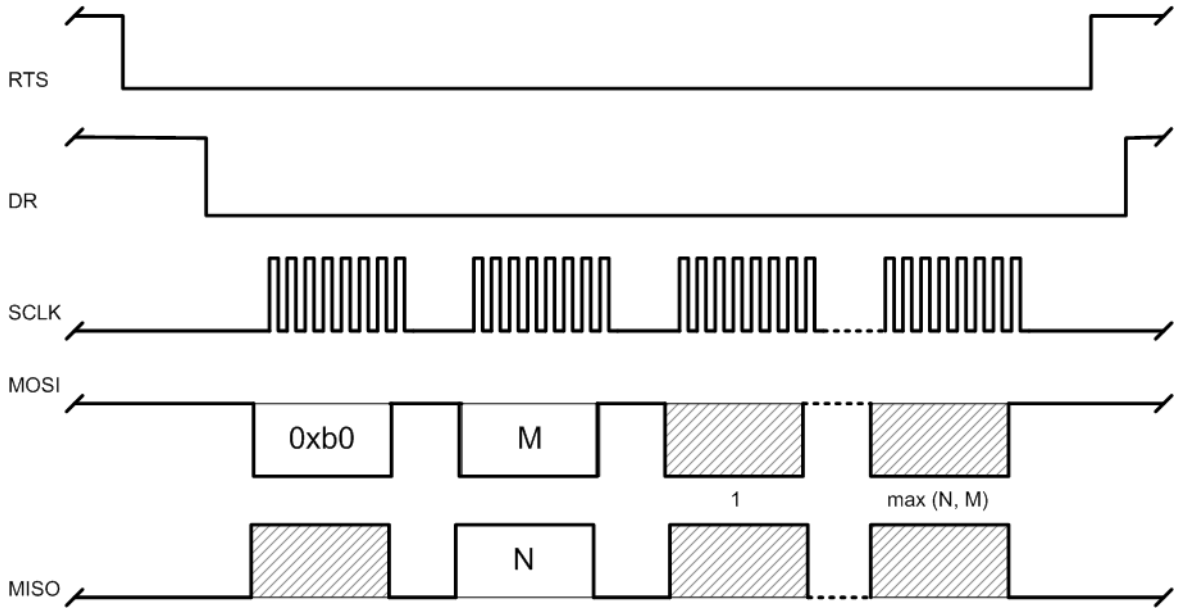
Read/Write command

If the module has data to send and it detects that also the host has data to send it will start a read/write communication sequence.

The host signals the module it has data to send by pulling the RTS line low. In due time the module lowers the DR line to mark start of communication.

The module will generate a clock signal on the SCLK line. The clock signal consists of groups of 8 pulses. Each group represents one byte transmitted and received.

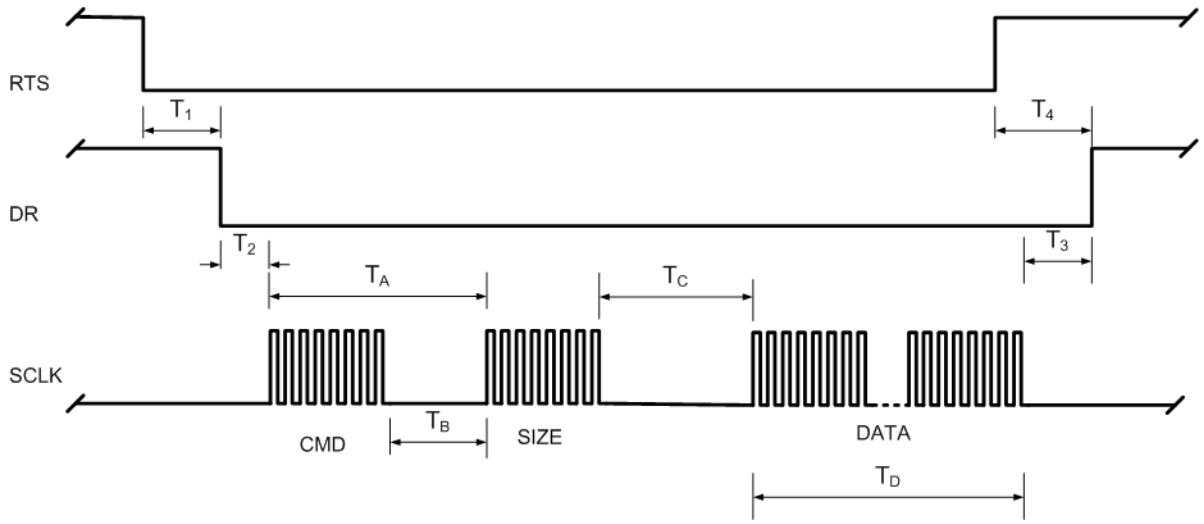
The first byte that is outputted on the MOSI line by the module is the read/write command: 0xb0. For the second byte the host must then output N: the number of bytes it will send and the module will output M: the number of bytes it will send. The module will then generate a clock signal for max(M,N) bytes. The host must put its data on the MISO line. The module must put its data on the MOSI line. After sending M bytes the module will continue sending (max(M,N) – M) bytes which can be ignored by the host. After sending N bytes the host will continue sending (max(M,N) – N) bytes which can be ignored by the module. When all bytes are sent the module raises the DR line again to mark end of communication.



Timing

The module operates using SPI mode 0. Which means the Clock Phase is 0 and the Clock polarity is 0. The data is output on the rising edge of SCLK. The data is read on the falling edge of SCLK.

The following timing characteristics apply to the module module:



Value	Description	Min.	Typical.	Max.	Unit
T_1	RTS response time		< 10	>2000[1]	ms
T_2	Communication set-up time	30		60	µs
T_3	Communication clean-up time		100		ns
T_4	RTS reset time	0			s
T_A	CMD to SIZE time	8	10		µs
T_B	SIZE set-up time	0.5	2		µs
T_C	SIZE to DATA time	80		120	µs
T_D	DATA time		SIZE*8		µs

1 If the module is communicating with the network or running the location engine the response time depends on the delay induced by these operations. For the location engine the delay is a direct result of its configuration

Start-up procedure

It is strongly advised that the host resets the SM3000 upon start-up just before initializing its own SPI interface. Pulling the RESET line low for about one millisecond will suffice. The RESET line must be kept high by the host during normal operation for the SM3000 to function.

After initialization the host can detect the presence of the SM3000 by sending a DDI request to the localhost address (00:00:00:00:00:00) and waiting for a reply. The "echo" function in the DDI echo driver (0:1:1) is very suitable for this purpose. After a reset the SM3000 is typically responsive within 5 seconds[1]. If the reply does not come the host can opt for retrying or resetting a couple of times before the SM3000 is considered not present.

The source address of the reply is equal to the serial Id of the connected module. The host must use this address as its own source address if it sends DDI messages over the network. The host must use level 2 for its source level.

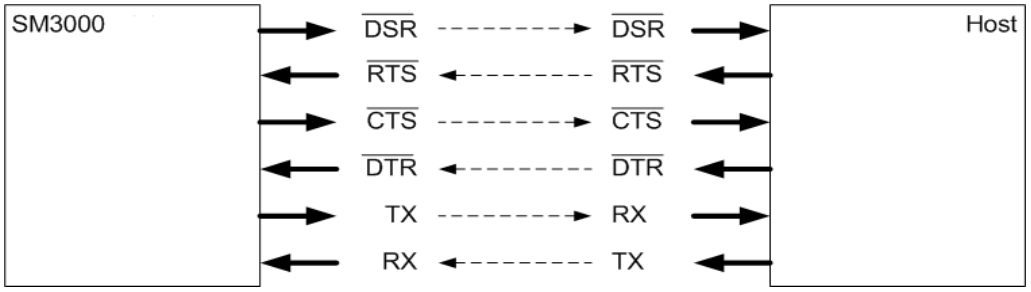
1 In case a new firmware file is present in the file system the start-up time of the SM3000 is extended with roughly 2 seconds

6.2.4 UART interface

Physical connections

The following pictures shows the physical connections needed to enable serial communication. The arrow indicates the direction of information flow.

Assumed is that SM3000 and host are either powered by the same power supply and use the same voltage to drive the pins or are separated through an RS232 level converter. The (signal) ground line should be shared.



Pin mapping for SM3000

Pin	Description	Voltage levels
DSR	Data Set Ready	VDD
RTS	Request to Sent	VDD
CTS	Clear to Sent	VDD
DTR	Data Terminal Ready	VDD
TX	Transmit	VDD
RX	Receive	VDD
VCC	Supply voltage	VDD
GND	Signal ground	–

Functional description

The interface on the module enables a full-duplex message oriented communication protocol. It uses 6 (six) IO lines, 2 data – and 4 control lines. The control lines are used to provide a hardware flow control mechanism for the communication of a single message. A message is formatted according the SPP protocol which is described in a separate document [1]. Having an SPP formatted message enables error checking and message synchronization.

The module is a battery operated device which preserves energy by entering an low power mode of operation whenever it has no action to perform. In LPM the serial receiver is disabled and if the connected host wants to communicate it needs to wake up the module. The module will respond if it is ready to receive a message. To facilitate this the interface uses the RTS and CTS control lines. The host signals the module it has data to send by pulling the RTS line low. If this is detected by the module it will pull the CTS line low indicating it is ready to receive.

The same mechanism is provided for communication from module to host. This enables the possibility for also the host device to enter a energy efficient sleep mode. The DTR and DSR control lines are used in this case. If the module has data to send to the host it will pull the DSR line low to wakeup and signal the host. The host must pull the DTR line low when it is ready to receive a message from the module. If the module detects a low DTR line it will start transmitting a single message.

These mechanisms are specified in detail in the following sections.

Serial port(UART) settings

The following serial communication settings are used

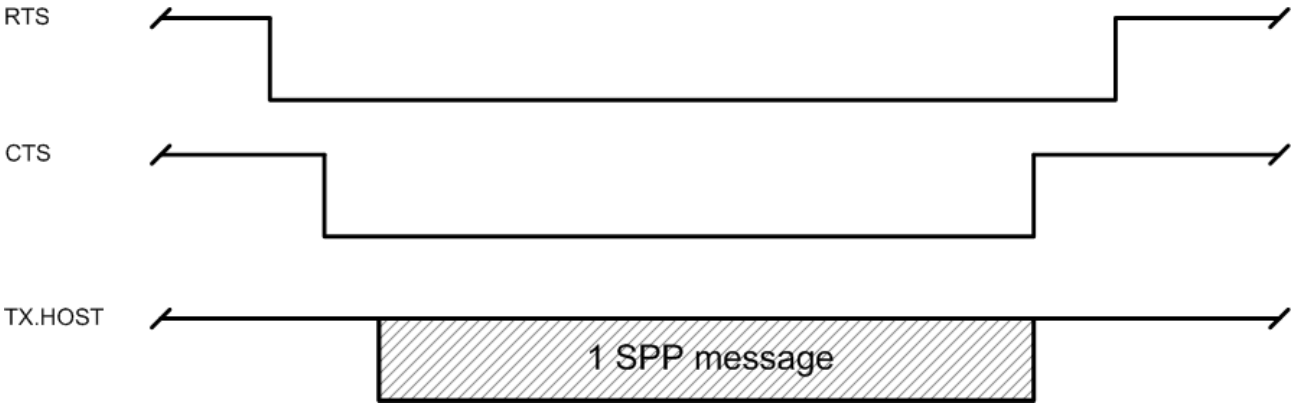
Speed	115200 baud
Data bits	8
Parity	None
Stop bits	1

Host to SM3000 transmission

If the host has data to send it will pull down its RTS line. If detected the module will pull its CTS line low allowing the host to send its message. As soon as the message is transmitted the host will pull it RTS line high again. The module will pull its line high if it received a complete message.

1 Kernel_Serialport protocol_1.0.x.pdf

This is illustrated in the following diagram:



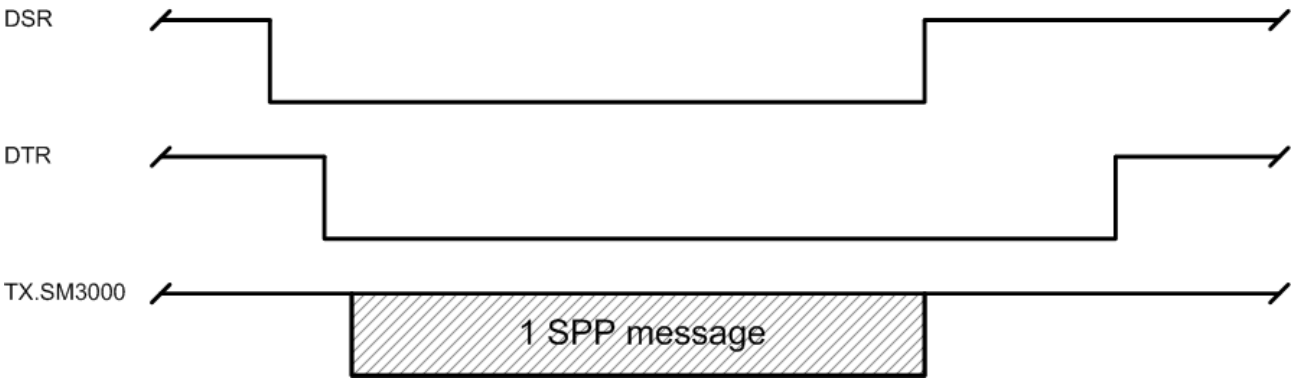
At the moment the RTS is pulled low the module is either sleeping or active. When active the module is most probably busy with wireless communication during which it will not respond to the RTS event. Only after finishing wireless communication will it acknowledge any pending communication requests. By this the module's response time can be quite significant. Refer to Section ***Timing*** for T_A (module response time) . If the module does not respond within the given time the host should retry communication by generating a new downward flank on the RTS line.

After the module lowered its CTS line it starts timing the reception of a full message. The host has T_B (module receive time) to complete sending the message after the CTS was lowered. Failure to do so will make the module raise its CTS line before the end of the message and the host should retry communication by generating a new downward flank on the RTS line

SM3000 to Host transmission

If the module has data to send it will pull down its DSR line. It then waits for the host to lower its DTR line. When a low DTR is detected the module starts transmitting the message. As soon as the message is completed the DSR line is raised. The host can raise the DTR as soon as it received the complete message or detected the DSR being pulled high.

This is illustrated in the following diagram:



If the DTR is pulled high before the end of the message the module will stop transmission and considers the message lost (message is thrown away).

Please refer to Section ***Timing*** for timing values. After lowering the DSR the module will wait for maximum T_1 (host response time) for the host to lower its DTR line. If this time is exceeded the module will raise its DSR line and consider the message lost (message is thrown away)

After lowering the DTR line the host should receive a complete message within T_2. If this is not the case the host can raise its DTR line and disable its receiver until the module generates a new negative edge on the DSR line.

In case the host is always on (e.g. a PC) and needs no wake-up mechanism, implementation of the interface can be simplified by pulling the DTR line low continuously and ignore the DSR line (see also: **Remarks – Host implementationWin32**)

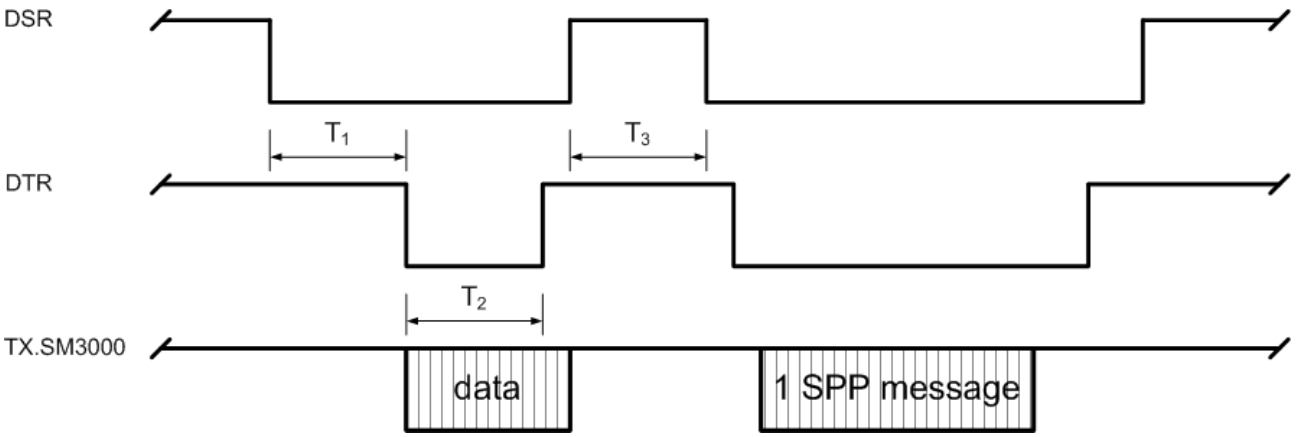
Parallel execution

Please note that both module and host should support parallel execution of sending and receiving. It is for example possible that the module after lowering its CTS starts a transmission by pulling its DSR line low. The host should be able to accept this request and start receiving data in parallel to its active transmission.

Timing

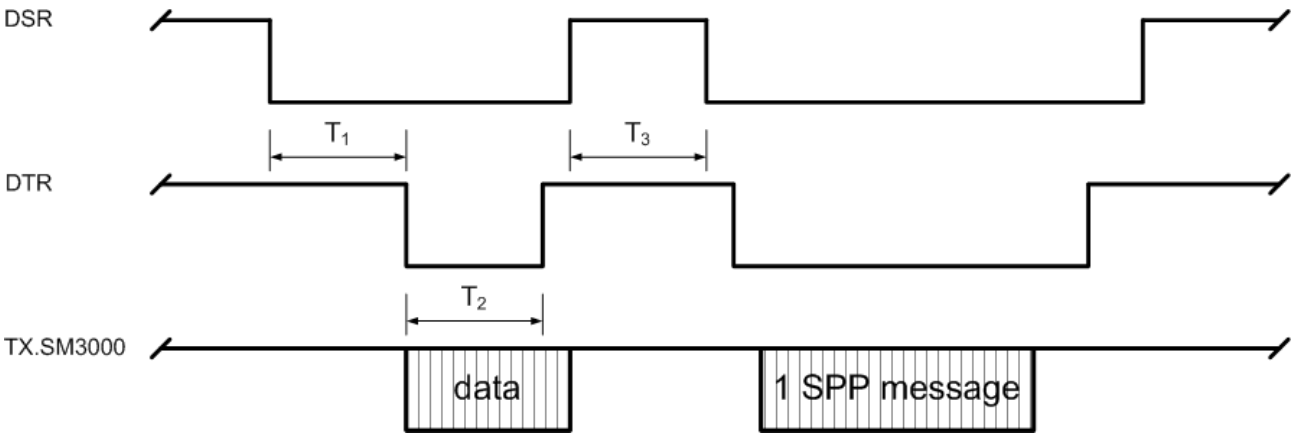
The following section specify the timing characteristics of the interface

Host to SM3000



Value	Description	Min.	Typical.	Max.	Unit
T_A	Module response time			1500	ms
T_B	Module receive time			31.25	ms
T_C	Message Inter arrival time	10			ms

SM3000 to Host



Value	Description	Min.	Typical.	Max.	Unit
T_1	Host response time			31.25	ms
T_2	Host receive time			31.25	ms
T_3	Message Inter arrival time	10			ms

Remarks – Host implementationWin32

In case a PC host implementation uses the C++ Win32 API to open a COM port it can use the flow control provided by it (WindowsXP and up):

In the DCB of the SetCommState function use the following values:

// The windows driver will only transmit if the CTS line is low
fOutxCtsFlow = TRUE

// Make sure the DTR line is always low
fDtrControl = DTR_CONTROL_ENABLE

//RTS is low when there is data in the output buffer and high if not
fRtsControl = RTS_CONTROL_TOGGLE

Be sure to write exactly one SPP message to the COM port and wait for it to complete before sending another.

Wait at least T_C between messages.

6.2.3 I2C interface

The SM3000 OEM module supports up to two software emulated I2C bus. One of the bus is used by the current on-board temperature sensor while the other bus is available on pins 11 and 12 of JP2.

7 Compliance(s)

7.1 United States and Canada (FCC and IC)

The SM3000 SmartPoint OEM module 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 is described in Part 15.19 (a)(3) and (5).

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numerique del la classe B est conforme al norme NMB-003 du Canada.

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 wit 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 and correct the interference by one or more of the following measures:

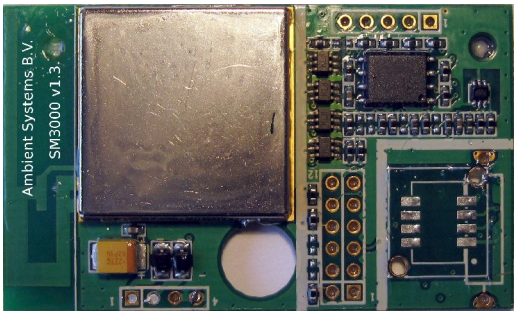
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

WARNING: Any modifications to the units, unless expressly approved by the party responsible for compliance, could void the user's authority to operate the equipment.

A copy of all FCC and Industry Canada certificates can be obtained by contacting the support department: support@ambient-systems.net.

Modular requirements overview

Own RF shielding
The module has an 18 x 18 x 4mm tin-plated brass shield that covers the essential radio components. It is located near the middle of the PC-board as shown in the following photo.



Buffered modulation and data input(s)
In an organized, periodic manner, the SM3000 processor, a sub-section of the radio chip (U1 – CC2430, samples digital data inputs introduced to the Module. Data buffering and formatting takes place within the SM3000 processor, so the actual input data amplitude or rate does not directly modulate the RF carrier and therefore cannot change the actual RF output level or emission spectrum.

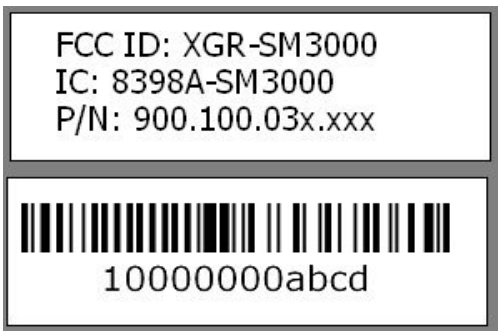
Power supply regulation and local reference oscillator
The radio chip (U1) contains internal voltage regulation to ensure RF output power and modulation remains consistent. The reference oscillator is crystal-based (X51).

Antenna requirements
The module has an integral antenna (pc-board trace) that cannot be modified or connected to. There is no mechanism provided for connecting an external antenna.

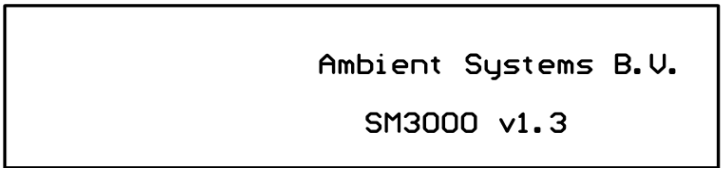
RF exposure requirements
The module meets the requirements for a portable device that may be used at separation distances of less than 2.5cm from the human body because its output power is below the threshold of 25mW for a 2.4GHz device. The Module's output power is approximately 10mW EIRP.

Testing in stand-alone configuration
The SM3000 Module was tested as a 'stand-alone' device for radiated spurious emissions and found to comply. Since the device is only battery powered, AC-conducted emissions tests were not applicable.

Label requirements
The label on the module follows the FCC and Industry Canada requirements. The module has two labels as shown below:



Additionally, the manufacturer's name is silkscreened on the PC-board:



- If the SM3000 OEM module is to be used inside another device than the final product label must contain the following statements:
  - "Contains FCC ID: XGR-SM3000"
  - "Contains Model SM3000, IC: 9398A-SM3000"
  - "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 Class B digital apparatus complies with Canadian ICES-003. Cet appareil numerique del la classe B est conforme al norme NMB-003 du Canada."

- The SM3000 packaging label contains the following text.:
  - "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 is described in Part 15.19 (a)(3) and (5)."
  - "This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numerique del la classe B est conforme al norme NMB-003 du Canada."

7.2 Europe

The SM3000 OEM module has a CE certification. Ambient Systems B.V. has issued a Declaration of Conformity which can be obtained by contacting the support department: support@ambient-systems.net.

7.3 EN12830

The SM3000's temperature sensor is compliant with EN12830, Class 1 accuracy, class D climatic environment, suitable for transportation.

7.4 RoHS

All materials used to produce the SM3000 OEM module are RoHS certified.

8 Appendices

8.1 Additional label informations

In addition to label specified at **8.1.3** the Module will contain the following markings:

8.2 Appendix D: Technical Support

All customers can contact Ambient Systems technical support through our web site or by email. Before you contact technical support, please have the following ready:

- Model number of the product (e.g. MR3000, SP3000, etc.)
- Hardware Revision (located on the label of the device)
- Current firmware version (can be obtained using Ambient Studio)
- Serial ID (located on the label of the device)

Also, if you have encountered any problems visit the support section of our website where you can find software updates and user documentation as well as Frequently Asked Questions (FAQ) and answers to technical issues.

Website	www.ambient-systems.net Then browse to the support section
E-mail	support@ambient-systems.net

8.3 Appendix E: Warranty & Disclaimer

To all products and related documentation Ambient Systems B.V. Terms & Conditions (T&C) apply. The T&C can be found and downloaded from our website.

8.3.3 Trademarks

Ambient is a registered trademark of Ambient Systems B.V. Other trademarks or registered trademarks are the property of their respective owners.

8.3.4 Copyright Statement

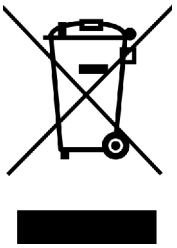
8.3.5 CE Mark Warning

In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

8.3.6 Manufacturer Declaration of Conformity

Hereby, Ambient Systems BV declares that the 3000 Series products are in compliance with the essential requirements and other relevant provisions of Directive 1999/5/ EC. A copy of the Declaration of Conformity can be obtained by sending a mail to support@ambient-systems.net

8.4 Appendix F: Recycling



a) General Information
Electric and electronic devices must not be disposed of in the domestic waste. Please dispose of the inoperative product in accordance with the current legal

regulations.

b) Batteries and Rechargeable Batteries
You, as the end user, are required by law (Battery Ordinance) to return all used batteries/rechargeable batteries. Disposal of them in the household waste is prohibited! Contaminated batteries/rechargeable batteries are labelled with these symbols to indicate that disposal in domestic waste is forbidden. The description of dangerous heavy metal constituents are: Cd=cadmium, Hg=mercury, Pb=lead (name on battery/rechargeable battery, e.g. under the trash icons on the left). You can return your exhausted batteries/rechargeable batteries free of charge to any authorized disposal station in your local authority, to our stores or to any other store where batteries/rechargeable batteries are sold. You thus fulfil your statutory obligations and contribute to the protection of the environment.

For more information contact support@ambient-systems.net

8.5 Appendix G: Registration

Please sent an email to support@ambient-systems.net to register the Ambient 3000 Series products.

8.6 Appendix H: Manual Revisions

Ambient Systems B.V. reserves the right to revise this publication and to make changes in the content hereof without obligation to notify any person or organization of such revisions or changes.

Revision	Date	Description
1.0	**23/10/09**	Release 1.0 documentation.