



Smart SAM2S User Guide



Revision History

Version	Modified By	Date	Description
1.0		18/04/2012	Initial version
1.1		19/06/2013	Update
1.2		09/10/2013	New Packaging Information
1.3		25/11/2014	Software Update
1.4		27/01/2015	Added AT\$LGSMS

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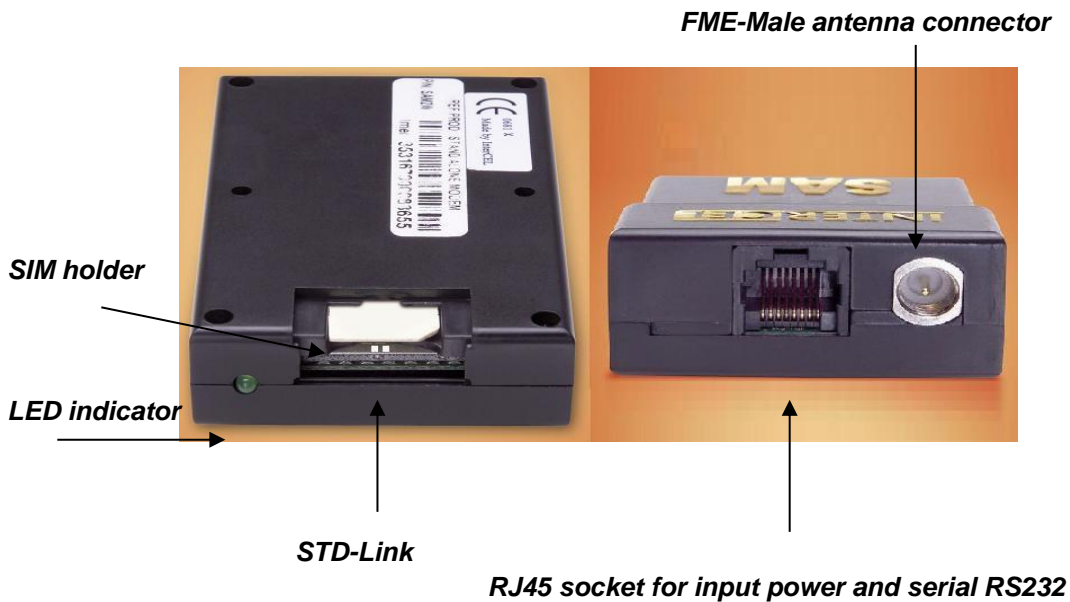
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1 Introduction

The Smart SAM2S is a compact, light-weight, GSM/GPRS based modem. It provides GSM and GPRS connectivity. The Smart SAM2S comes in 2 selectable options:

The Smart SAM2S is designed for both mobile and fixed M2M applications. It has an RJ45 socket for input voltage and the serial RS232 signals, an FME-male for antenna connection, a SIM holder and an LED indicator.

The Smart SAM2S is capable of sending/receiving SMS; Circuit switched data and Packet-switched data.



Mobile station engine
EU approval
GCF-CC
A-tick

MC52i
CE-0682
Version 3.27.1

2 Safety Precautions

The following safety precautions must be observed whenever the Smart SAM2S modem is in operation or in service. Failure to comply with these precautions violates the safety standards of the design, manufacture and intended use of the product

- Switch off the Smart SAM2S modem :
 - In hospitals or places where medical equipment may be in use.
 - In an aircraft
 - Refueling points
 - Explosive areas

- Restricted use of the Smart SAM2S modem
 - Near any chemical plant
 - Near any fuel depot
 - Areas with mobile phone warning signs

Respect national regulations on the use of cellular devices.

The Smart SAM2S modem receives and transmits radio frequency energy while switched on, therefore interference can occur if the Smart SAM2S is near TVs, radios, PCs or any inadequately shielded equipment.

3 Radio Frequency Exposure - SAR

The Smart SAM2S modem is a low-power transceiver, similar to a typical handheld GSM/GPRS mobile phone. When it is turned on, it will emit low-level radio frequency energy.

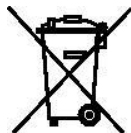
There are different guidelines and standards around the world that govern the permitted levels of radio frequency exposure for general population. The levels include a safety margin to a human body.

The Specific Absorption Rate (SAR) is a measure of the rate at which radio frequency energy is absorbed by the body when exposed to radio frequency electromagnetic field. The SAR value is determined at the highest certified power level in the laboratory conditions, but the actual SAR level of the transceiver while operating can be well below this value. This is because the transceiver is designed to use minimum power to connect to the network.

The Smart SAM2S modem is approved to use in applications where the ***antenna is placed more than 21cm from the body.***

For other applications, the integrator is responsible for the local SAR requirements.

4 WEEE Directive 2002/96/EC, Disposal Of Old Electronic Equipment



This symbol on the product indicates that this product shall not be treated as household waste. It must be placed at an appropriate collection point for the recycling of electrical and electronic equipments.

By ensuring the correct disposal of this equipment, it will help the environment and human's health. Recycling will help to conserve natural resources.

The Smart SAM2S product is RoHS compliant



5 Packaging

5.1 Contents

The Smart SAM2S package consists of:

- A Smart SAM2S Modem
- A Data Cable
- A Smart SAM2S User Guide



5.2 The Packaging Box

The carton box dimensions are 230mm x 155mm x 70mm

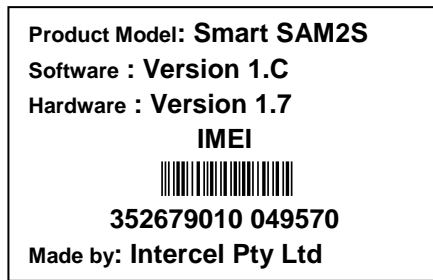
The data cable is 2m long

The label size is 50mm x 33mm

A power supply is available on request. It is recommended that the Smart SAM2S is powered using a 12Vdc/1A power supply.

Various antenna options are also available on request. Please make sure the correct antenna is used to get optimised performance from the Smart SAM2S.

5.3 The Production Label



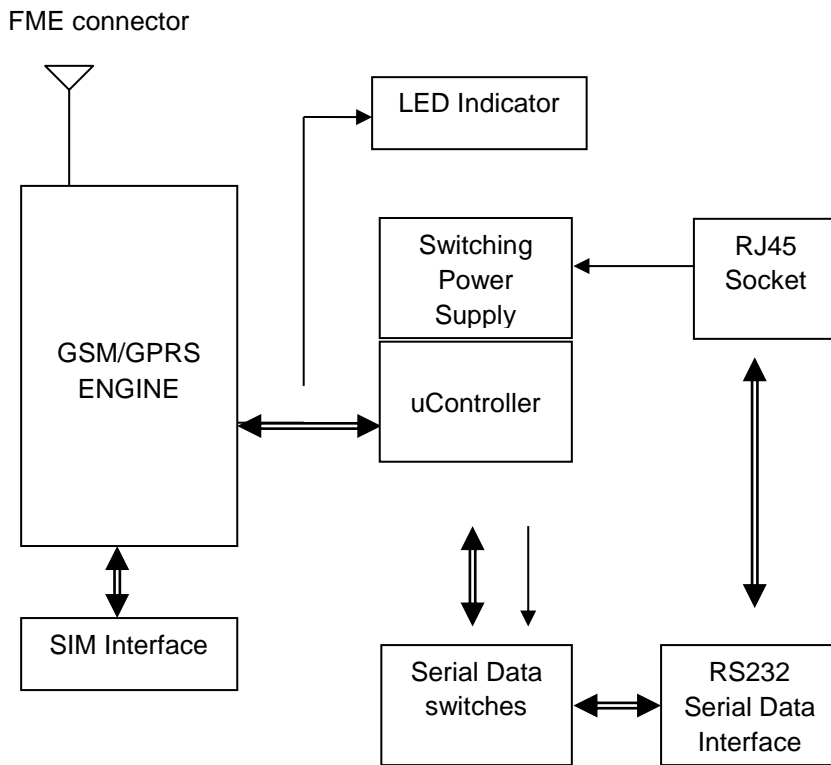
The production part number is located at the back of the Smart SAM2S, which includes:

- The product model
- The software version
- The hardware version
- The IMEI number
- The manufacturer
- The part number

6 Functionality

6.1 General

The Smart SAM2S modem consists of an RJ45 socket for serial port and input power, an FME male antenna connector and a SIM holder. The LED indicator, located next to the SIM holder, indicates the Smart SAM2S operating status.



The Smart SAM2S Functional Block Diagram

6.2 RJ45 Socket

Pin	Signals	Description
1	VIN	Input Voltage 5Vdc - 32Vdc
2	DCD	Data Carrier Detect
3	DTR	Data Terminal Ready
4	GND	Common Ground
5	RXD	Serial Data out of the SAM
6	TXD	Serial Data into the SAM
6	CTS	Clear to Send
8	RTS	Ready to Send

6.3 FME-Male 50Ω Antenna Connector

The FME male antenna connector is a 50Ω impedance antenna connector. The antenna used for the Smart SAM2S must have 50Ω impedance.

6.4 SIM Holder

The SIM holder is designed to accommodate a mini-SIM card. The SIM card can either be 3V or 1V8 SIM. To insert the SIM card, remove the door by sliding it back toward the end. Make sure the SIM card faces the right way as indicated on the box. Voltage levels over this SIM interface complies with 3GPP standards

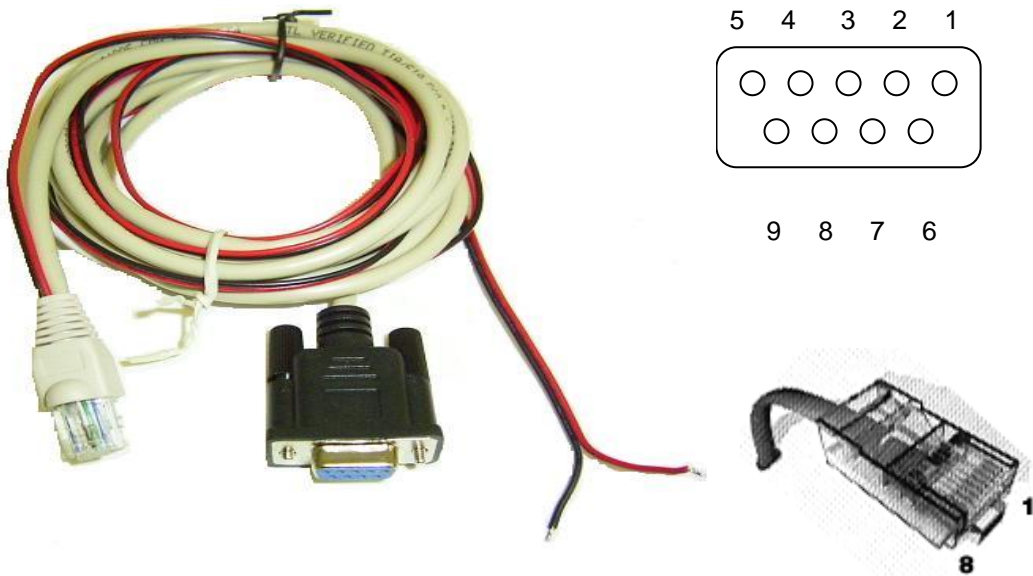
6.5 LED Status

The LED indication has the following status:

- 600ms on/ 600ms off: No SIM card or no SIM PIN or Network search in progress or Network login in progress.
- 75ms on/ 3sec off: Idle mode, registered to the GSM network.
- 75ms on/75ms off/75ms on/3sec off: at least 1 GPRS PDP context activated.
- 500ms on/25ms off: Packet-switched data transfer in progress.
- LED is on steady: CSD call is connected
- LED is off permanently : No power

6.6 Data Cable

The data cable is 2m long. It consists of an RJ45 plug, a DB9-female connector and a 2-wire input power.



DB9	Signals		RJ45	Description
1	DCD	↔	2	Data Carrier Detect
2	RXD	↔	5	Serial Data out of the Smart SAM2S
3	TXD	↔	6	Serial Data into the Smart SAM2S
4	DTR		3	Not Used
5	GND	↔	4	Common Ground
6	DSR			
7	CTS	↔	8	Clear to Send
8	RTS	↔	7	Request to Send
9	RI	Not used		
			1	RED wire: Input voltage from 5Vdc to 32Vdc
			4	BLACK wire: Power Ground

7 Electrical Characteristics

7.1 Power Consumption

Network search	70mA @ 12V
Idle mode	45mA @ 12Vdc
Connected mode	95mA @ 12Vdc
GPRS PSD transfer	250mA @ 12Vdc
Peak current during the 577µs transmission pulse	1.2A @ 12V

7.2 RF Bands

EGSM900 :	Tx = 880MHz - 915MHz,	Rx = 925MHz - 960MHz
DCS1800 :	Tx = 1710MHz - 1785MHz,	Rx = 1805MHz - 1880MHz

7.3 Receive Sensitivity

Band	Typical Rx Sensitivity (dBm)	Maximum Rx Sensitivity (dBm)
EGSM900 (2% ber) CS	-102	-107
DCS1800 (2% ber) CS	-102	-107

Note:

- Bit error rate < 2.4%

7.4 Conducted Transmit Power

Parameter	Min	Typical	Max
GSM900	+31dBm	+33dBm	+35dBm
DCS1800	+28dBm	+30dBm	+32dBm

7.5 Main Antenna Specifications

Max cable loss	0.5dBm
Impedance	50Ω
Max allowed VSWR	3:1

The maximum antenna gain recommended for consideration against RF exposure and ERP/EIRP limits, is:

- In Cellular band : 5dBi
- In PCS band : 4dBi

7.6 Environmental Characteristics

Operating temperature	-40°C to +75°C
Storage temperature	-40°C to +90°C
Humidity	90% relative humidity (non-condensing)

8 The Smart SAM2S TCP/IP Operation

The Smart SAM2S has a MCU (Microcontroller) to control the 2G module PHS8-P, the Smart SAM2S can be operating in there different modes, defined by parameter SAMMODE:

-SAMMODE=0, modem is in dumb mode, when power on the MCU turn on the 2G module, check its baud rate, turn on LED and release control of the 2G module to the connecting device, AT commands can be send from serial port here after, the MCU keep monitor the 2G module Rx pin for AT\$ commands and check time in the POLLPERIOD parameter (to reset itself and the 2G module).

-SAMMODE=1, modem is in GPRS or PSD (Packet Switch Data) smart mode, the MCU is in total control of the 2G module, on power up the software reads all parameters from flash and activates a GPSR connection, it then creates an UDP and a TCP socket to listen for data transfer connection, opens an UDP and a TCP socket to listen for remote AT commands connection, if programmed as TCP client it will tries to connect to a remote TCP server, the modem then stays in GPRS online idle state waiting for CSD call, SMS, UDP data or TCP connection, the software maintains GPRS connectivity by the mean of IP TRACE using POLLPERIOD parameter stored in flash.

-SAMMODE=2, modem is in CSD (Circuit Switch Data) smart mode, this mode is used if SIM card is not setup for GPRS, MCU is in total control of the 2G module, modem is always in waiting for CSD call or SMS.

The modem supports DDNS, for SIM card that has dynamic public IP address the software can performs **dynamic DNS updating** to a DNS server (supporting **dyndns.com** and **noip.com**).

The modem provides security for remote management by keeping a list of SMS sending mobile numbers, a list of CSD calling numbers, a list of PSD sending IP addresses and username and password login, password data is encrypted for remote transaction.

8.1 Communication Sockets

TCP Data: Socket connection allows transparent data to pass through from host computer to the modem serial port and vice versa, this operation is similar to the CSD data communication, in TCP server mode the socket will be disconnected after 5 minutes of no data transfer.

UDP Data: Socket connection allows transparent data to pass through from host computer to the modem serial port and vice versa, this operation is similar to the CSD data communication, a block of data received from a remote UDP server will open a 2 minutes window for data to be transfer from the serial port.

TCP AT Command: Socket connection allows a user from the host computer to send AT commands to the modem and receive its responses, socket will be disconnected after 5 minutes of no activity, and socket also can be used for remote firmware update.

UDP AT Command: Socket connection allows a user from the host computer to send AT commands to the modem and receive its responses, and socket also can be used for remote firmware update.

8.2 TCP/IP AT\$ Commands

Communications parameters are stored in Flash using AT\$PARAMETERS.

Parameters are defined as:

APN=Access Point Name

USERNAME=Username that may required with GPRS login

PASSWORD=Password that may required with GPRS login

LTCPPORT=Local TCP listening port

RTCPIP=Remote TCP server IP

RTCPPORT= Remote TCP server port

TCPMODE=0 or 1 (0 disable modem TCP client, 1 enable modem TCP client)

LUDPPORT=Local binding UDP port (modem listen for UDP data on this port)

RUDPIP=Remote binding UDP IP (modem only accept data from this IP)

RUDPPORT=Remote binding UDP port (modem send UDP data to this port)

POLLPERIOD=Modem use this time to send TRACE packet to check for GPRS connectivity.

SBREAKTIME=Serial port break time, modem will wait for this break in serial port transmission before packetize the data and send.

MBREAKTIME=Modem or GSM module serial break time, use to adjust the way the modem rebuild long IP packet from fragments of CMUX frames.

BAUDRATE=Serial port baud rate.

DATALEN=Serial port data bits 7 or 8

PARITY= NONE or ODD or EVEN

SAMMODE=0 for standard modem, 1 for PSD mode, 2 for CSD mode.

All parameters can be programmed all at once.


```
AT$PARAMETERS=APN=telstra.extranet,USERNAME=intercel,PASSWORD=mach,LTCPPORT=10000,RT  
CPIP=203.45.1.236,RTCPPORT=10000,TCPMODE=,LUDPPORT=20000,RUDPIP=203.45.1.236,RUDPPO  
RT=20000,POLLPERIOD=60,SBREAKTIME=100,MBREAKTIME=5,BAUDRATE=115200,DATALEN=8,PAR  
ITY=NONE,SAMMODE=0
```

Saved parameters to flash...

OK

Or a few parameters or one at a time.

```
AT$PARAMETERS=APN=telstra.extranet,USERNAME=intercel,PASSWORD=mach
```

Saved parameters to flash...

OK

```
AT$PARAMETERS=LTCPPORT=10000,RTCPPIP=203.45.1.236,RTCPPORT=10000,TCPMODE=,LUDPPO  
RT=20000,RUDPIP=203.45.1.236,RUDPPORT=20000
```

Saved parameters to flash...

OK

```
AT$PARAMETERS=POLLPERIOD=60,SBREAKTIME=100,MBREAKTIME=5,BAUDRATE=115200,DATALE  
N=8,PARITY=NONE
```

Saved parameters to flash...

OK

```
AT$PARAMETERS=SAMMODE=0
```

Saved parameters to flash...

OK

```
AT$PARAMETERS?  
$PARAMETERS:  
APN: telstra.extranet  
USERNAME: intercel  
PASSWORD: mach  
LTCPPORT: 10000  
RTCPPIP: 203.45.1.236  
RTCPPORT: 10000  
TCPMODE: 0  
LUDPPORT: 20000  
RUDPIP: 203.45.1.236  
RUDPPORT: 20000
```

BAUDRATE: 115200
DATALEN: 8
PARITY: NONE
POLLPERIOD: 60
SBREAKTIME: 100
MBREAKTIME: 5
SAMMODE: 0
OK

AT\$UDPCONNECT

If modem is already allocated an IP address, this command will put the modem in UDP data mode, modem DCD pin go high, data from serial will be packetized into UDP packet and send to remote UDP server (UDP settings must be set prior), modem will return to AT Command mode if it receiving no UDP data in 30 seconds.

If modem has no IP address (CSD mode or SAMMODE=2), the modem will connect to PSD and go into UDP data mode, modem DCD pin go high, data from serial will be packetized into UDP packet and send to remote UDP server (UDP settings must be set prior), modem will reset and return to CSD mode if it receiving no UDP data in 30 seconds.

AT\$TCPCONNECT

If modem is already allocated an IP address, this command will make a TCP client connection to the remote TCP server, modem will return to AT Command mode if it receives no TCP ACK in 30 seconds.

If modem has no IP address (CSD mode or SAMMODE=2), the modem will connect to PSD and make a TCP client connection to the remote TCP server, modem will reset and return to CSD mode if it receives no TCP ACK in 30 seconds.

AT\$DDNS

Use to setup parameters required for Dynamic DNS updating.

Parameters are defined as:

DDNSENABLE= 0 or 1 (0 disable, 1 enable)

DDNSHOST=Host name

DDNSUSERNAME=DNNS account name

DDNSPASSWORD=DDNS account password

DDNSSERVER=DDNS server

DDNSSTRING: Only need to change from default in some circumstances with Intercel support

DDNSAUTH: Only need to change from default in some circumstances with Intercel support

DDNSAGENT: Only need to change from default in some circumstances with Intercel support

PDNSIP=Primary DNS, leave blank if not using your own DNS server, not a requirement for DDNS.

SDNSIP=Secondary DNS, leave blank if not using your own DNS server, not a requirement for DDNS

DNSTTL= DNS Time To Live in minutes before updating of DNS entries, not a requirement for DDNS.

AT\$DDNS=PDNSIP=8.8.8.8,SDNSIP=8.8.4.4,DNSTTL=240,DDNSEnable=0,DDNSHOST=intercelau.ddns.net,DDNSUSERNAME=intercelau,DDNSPASSWORD=123456789,DDNSSERVER=dynupdate.noip.com,DDNSSTRING=GET/nic/update?hostname=%s&myip=%sHTTP/1.0,DDNSAUTH=Authorization: Basic%s,DDNSAGENT=User-Agent:SAM2S/1.0 intercel@intercel.com.au

Saved parameters to flash...

OK

AT\$DDNS?

\$DDNS:

DDNSEnable: 0

DDNSHOST: intercelau.ddns.net

DDNSUSERNAME: van.phamus@yahoo.com

DDNSPASSWORD: 123456789

DDNSSERVER: dynupdate.no-ip.com

DDNSSTRING: GET /nic/update?hostname=%s&myip=%s HTTP/1.0

DDNSAUTH: Authorization: Basic %s

DDNSAGENT: User-Agent: SAM2S/1.0 intercel@intercel.com.au

PDNSIP: 8.8.8.8

SDNSIP: 8.8.4.4

DNSTTL: 240

OK

AT\$DDNSTEST

Use to force a manual updating of IP to the DDNS server, all required parameters must be set beforehand.

AT\$DDNSTEST

\$DDNSTEST: Starting....

\$DDNSTEST: Resolving dynupdate.no-ip.com....

Connecting to DDNS dynupdate.no-ip.com

Connected to DDNS dynupdate.no-ip.com
HTTP/1.1 200 OK
Date: Tue, 02 Sep 2014 00:33:32 GMT
Server: Apache/2
Content-Location: update.php
Vary: negotiate
TCN: choice
Content-Length: 19
Connection: close
Content-Type: text/plain; charset=UTF-8

good 123.209.169.62
DDNS host intercelau.ddns.net updated with 123.209.169.62

OK

AT\$ACCESS

Use to setup parameters required for remote access.

Parameters are defined as:

IPBLOCK=0 or 1 (0 disable, 1 enable remote IP access from REMOTEIP1-REMOTEIP4)

REMOTEIP1= nnn.nnn.nnn.nnn

REMOTEIP2= nnn.nnn.nnn.nnn

REMOTEIP3= nnn.nnn.nnn.nnn

REMOTEIP4= nnn.nnn.nnn.nnn

SMSBLOCK=0 or 1 (0 disable, 1 enable remote SMS access from REMOTESMS1-REMOTESMS4)

REMOTESMS1= ccnnnnnnnnn cc for country code

REMOTESMS2= ccnnnnnnnnn

REMOTESMS3= ccnnnnnnnnn

REMOTESMS4= ccnnnnnnnnn

DIALBLOCK= 0 or 1 (0 disable, 1 enable remote dialling access from REMOTEDIAL1-REMOTEDIAL4)

REMOTEDIAL1= acnnnnnnnnn ac for area code

REMOTEDIAL2= acnnnnnnnnn

REMOTEDIAL3= acnnnnnnnnn

REMOTEDIAL4= acnnnnnnnnn

```
AT$ACCESS=IPBLOCK=1,REMOTEIP1=10.64.24.2,REMOTEIP2=,REMOTEIP3=,REMOTEIP4=,SMSBLO  
CK=1,REMOTESMS1=0413586218,REMOTESMS2=,REMOTESMS3=,REMOTESMS4=,DIALBLOCK=1,R  
EMOTEDIAL1=0395612959,REMOTEDIAL2=,REMOTEDIAL3=,REMOTEDIAL4=
```

Saved parameters to flash...

OK

AT\$ACCESS?

```
$ACCESS:  
IPBLOCK: 1  
REMOTEIP1: 10.64.24.2  
REMOTEIP2:  
REMOTEIP3:  
REMOTEIP4:  
SMSBLOCK: 1  
REMOTESMS1: 0413586218  
REMOTESMS2:  
REMOTESMS3:  
REMOTESMS4:  
DIALBLOCK: 1  
REMOTEDIAL1: 0395612959  
REMOTEDIAL2:  
REMOTEDIAL3:  
REMOTEDIAL4:
```

OK

AT\$LGSMS

Use to program parameters for last gasp SMS.

Parameters are defined as:

LGSMSMSG=SMS message text, default is "SAM2S low power detected..."

LGSMSNO=SMS phone number

AT\$LGSMS= LGSMSMSG= SAM2S power supply is low...., LGSMSNO=+61418505361

Saved parameters to flash...

OK

AT\$LGSMS?

```
$LGSMS:  
LGSMSMSG: SAM2S power supply is low....
```

LGSMSNO: +61418505361

OK

AT\$LOGIN

Use to setup login details for remote sending of AT commands, parameters and software updating; password is encrypted so remote login required PC software SAM2S Terminal.

AT\$LOGOFF

Use to log off remote access instantly; modem will lock out remote access that has been idled for 120 seconds.

AT\$IP

Use to return the allocated IP address of the current GPRS connection

AT\$IP

\$IP: 123.209.157.9

OK

AT\$VERSION

This command returns the TCP/IP software version.

AT\$VERSION

SAM2S V2.1 22/12/14 13:54

OK

AT\$RESET

Use to remotely reset the modem, normally after sending of new parameters

AT\$RESET

SAM Reset...

OK

AT\$SMSTOSERIALON

This command allows the connecting device to receive SMS notification for 300s: e.g. "+CMTI: "SM",1", the connecting device must send AT+CMGR to read SMS and AT+CMGD to delete it, during this 300s period, modem will not be able to decode AT\$ commands sending to it over SMS.

8.3 CSD Call Escape Sequence

During CSD call to the Smart SAM2S modem, send three consecutive EscEscEsc or hex number sequence 0x1B 0x1B 0x1B to switch the modem between data mode and remote AT commands mode.

Notices

-In SAMMODE=0, after power on the MCU turns on the 2G module, checks its baud rate, turns on LED before releases control of the 2G module to the connecting device, all this take between 5 to 10 seconds, so the modem is only ready for AT commands here after.

-In SAMMODE=1, the modem take 30 to 60 seconds to connect to GPRS, modem only response to AT commands from serial port once it is connected to GPRS or after it has failed, if it failed to connect it will reset after 120 seconds.

-In SAMMODE=2, the MCU take about 20 seconds to set up the 2G module, the modem only response to AT commands from serial port after setting up is finished.

-In SAMMODE 1 and 2 if the Smart SAM2S modem is powered up without a SIM card it will go into AT command mode after 20 seconds.

The parameter POLLPERIOD which keep the time in minute which when expired will reset the modem if SAMMODE=0 or SAMMODE=2, if SAMMODE=1 for PSD mode the modem will use this time to send TRACE IP packet to check for network connectivity.

-In SAMMODE=1 and 2 the modem can be reset remotely by calling the voice number.

9 Firmware Upgrade

9.1 Firmware Upgrade for the 2G Module

The module's firmware can be upgraded over the serial or USB port using the dedicated Upgrade Program running on PC, if using USB ,the 2G module's driver must be installed on the PC beforehand.

9.2 Firmware Upgrade for the Cortex M3 ARM Processor

The processor's firmware can be upgraded over the serial port or JTAG port using the LM Flash Programmer running on PC.

Firmware and parameters can be upgraded over the serial port, GPRS, CSD or SMS (parameters only) using SAM3X Terminal program running on PC.

Notes

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