RB800
User Manual

GSM/UMTS

english version

TELEORIGIN
www.teleorigin.com

Elproma Elektronika Sp. z.o.o
Ul. Szymanowskiego 13;
05-092 Łomianki k/Warszawy

e-mail: info@teleorigin.com
Tel. +48 (022) 751 76 80
Fax. +48 (022) 751 76 81

Contents

1. Overview

The RB800 Terminal is the complete modem solution for wireless m2m applications. Based on the Telit GL865 or UL865 module, it is available as quad or dual-band version and offers high level GSM/GPRS/UMTS features in compact aluminium housing with all the standardized interfaces. Together with its small size and wide supply voltage range, makes it easy to integrate into all kinds of machines.

The RB800 terminal enabling voice, high speed data transmission, SMS and fax communication is a universal solution for all low-volume M2M and mobile data applications including metering, traffic systems, transportation and logistics, security, vending machines, and facility management.

Device can be controlled by standard AT commands or by customer's application inside (embedded Python Script Interpreter), thus making it the smallest, complete SMT platform for m2m solutions.

This document contains full RB800 modem description and gives information about installation and using it.

2. References

[1] Telit_AT_Commands_Reference_Guide.pdf

[2] Telit_HE910_UE910_UL865_AT_Commands_Reference_Guide.pdf

[3] Telit_GL865-DUAL_QUAD_Product_Description.pdf

[4] Telit_UL865_Product_Description.pdf

[5] Telit_Easy_Script_Python_1.5.2.pdf

[6] Telit_Easy_Script_Python_2.7.pdf

[7] http://www.telit.com/en/products/umts.php?p_id=14&p_ac=show&p=145

[8] http://www.python.org/

3. Product variants

Product variants, codes and description are listed below.

RB800 □.□.□.□.□.□

X	- GL865 Quad (standard)
D	- GL865 Dual
U	- UL865 EUD
Ur	- UL865 EUR
XM	- GL865 Quad+MicroSD
DM	- GL865 Dual+MicroSD
UM	- UL865+MicroSD

X	- standard
IO	- option GPIO

X	- 1SIM
2	- 2SIM

X	- RS232
2	- RS232+RS485

Special Software

X	- standard

Special Option

X	- standard: - power supply - antenna - wall mount kit
3	- Standard + DIN rail mounting kit

Example:
RB800U.X.2.X.X.3 – UMTS modem with RS232 interface, 2 x SIM holder, with DIN rail mounting kit

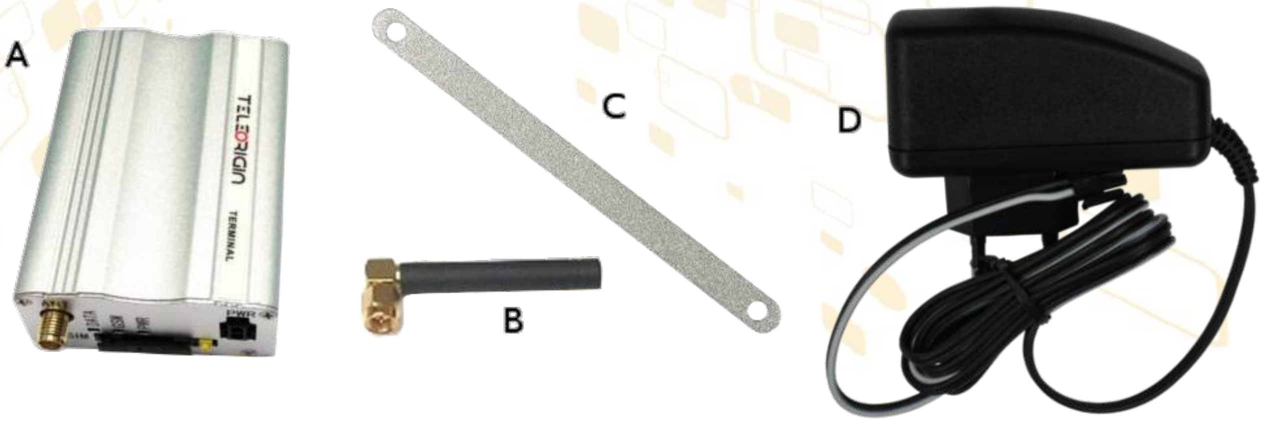
4. Package

4.1 Box

Original box of the product is shown in the picture below.

You can find product sticker on the box. It matches modems sticker that is placed on the device. This proves that your modem is original product. More information about stickers in **Product sticker**.

5. Complete package contents

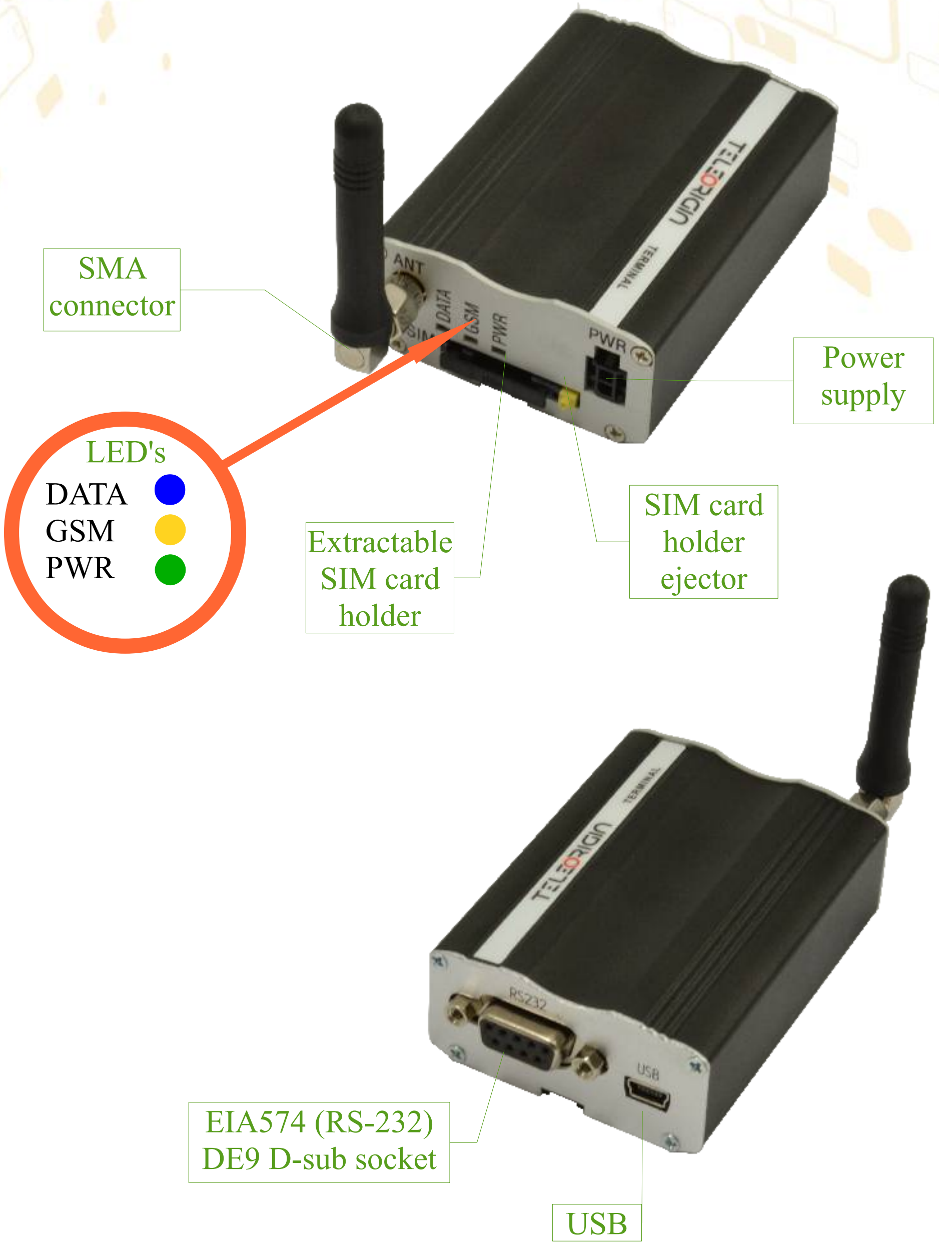


Complete package contains:

RB800 terminal	(item A)
GSM antenna (via SMA)	(item B)
wall handle	(item C)
power adaptor	(item D)

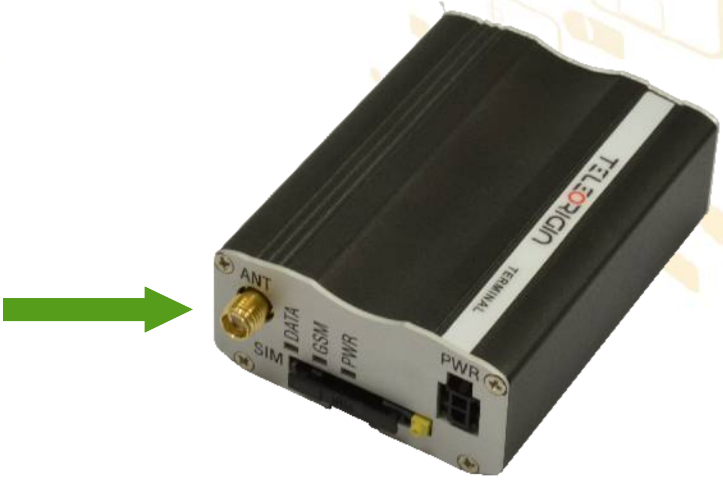
6. General presentation

6.1 Product pictures



6.2 External connections

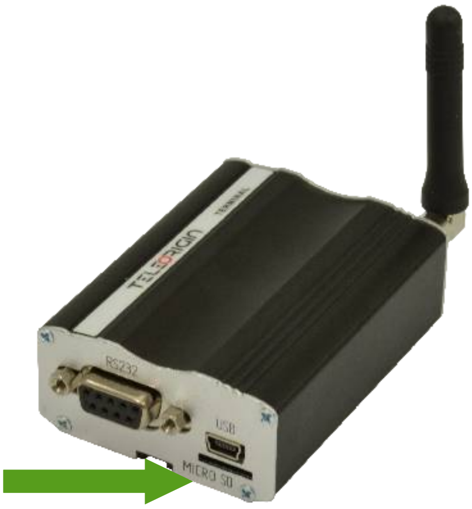
6.2.1 Antenna connector



SMA antenna input is used to connect external GSM antenna. To establish connection with GSM network an external antenna must be used. Type of antenna depends on GSM coverage. In good circumstances (level of received signal is high) use antenna which is attached in the package. If range of GSM is low or none, an outdoor or indoor (for instance in place where GSM range is sufficient) antenna should be used.

Note: *If there is no antenna connected to SMA connector, the connection with GSM network is impossible.*

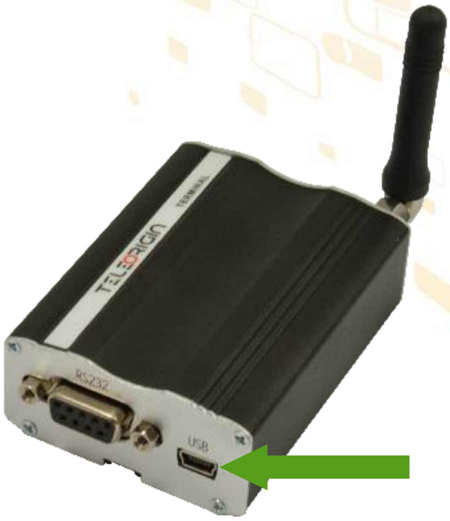
6.2.2 Memory slot



RB800 can be optionally equipped with memory card slot to store all the measured data. The slot type is microSD. Memory card can be controlled only by Python script using special AT commands which is sends through SER2 interface, see chapter **Python Script Interpreter** and **AT Reference manual**.

6.2.3 USB Interface

RB800 terminal (only UMTS variant) is equipped with USB interface (as shown below) – miniUSB connector type.



6.2.4 RS-232 Interface (EIA574)

RB800 terminal is equipped with RS-232 interface (as shown below). DE9 DSUB socket is connected via voltage level translator circuit to the GSM module.

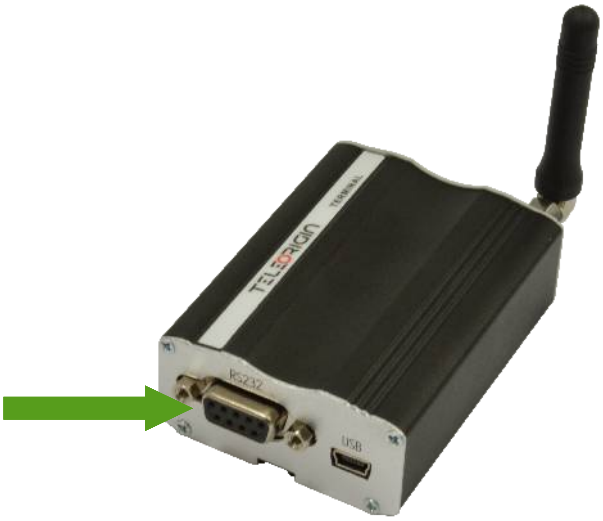
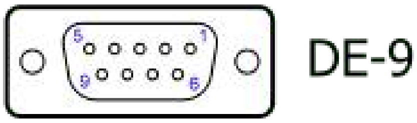


Table of RS-232 DB9 pins:

Pin No.	Name	Dir	Description
1	DCD	IN	Data Carrier Detect. Raised by DCE when modem synchronized.
2	RD	IN	Receive Data (a.k.a RxD, Rx). Arriving data from DCE.
3	TD	OUT	Transmit Data (a.k.a TxD, Tx). Sending data from DTE.
4	DTR	OUT	Data Terminal Ready. Raised by DTE when powered on. In auto-answer mode raised only when RI arrives from DCE.
5	SGND	-	Ground
6	DSR	IN	Data Set Ready. Raised by DCE to indicate ready.
7	RTS	OUT	Request To Send. Raised by DTE when it wishes to send. Expects CTS from DCE.
8	CTS	IN	Clear To Send. Raised by DCE in response to RTS from DTE.
9	RI	IN	Ring Indicator. Set when incoming ring detected - used for auto-answer application. DTE raised DTR to answer.

DE-9 (EIA/TIA 574)
looking into female connector



6.2.5 D-Sub HD 15-pin connector

RB800 can be equipped with DE9 15-pin connector to control RS232 interface and GPIO lines. GPIO lines can be controlled by internal Python application, see **Python Script Interpreter** and **AT Reference manual** for details. Below you can find pins description of this variant of modem.

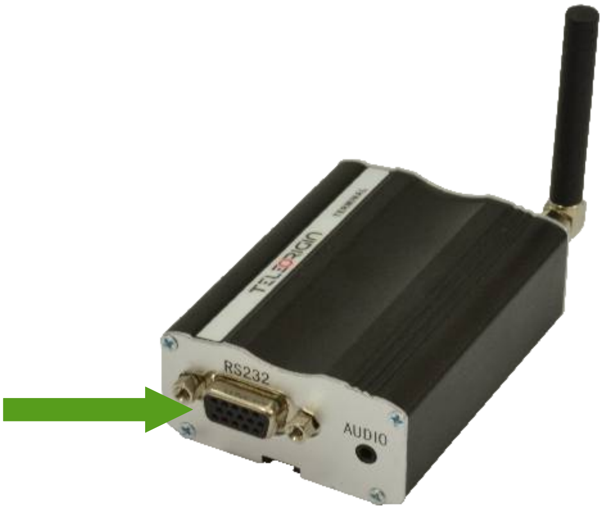
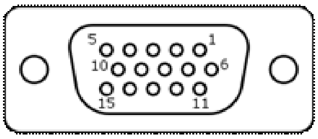


Table of RS-232 DB9 pins:

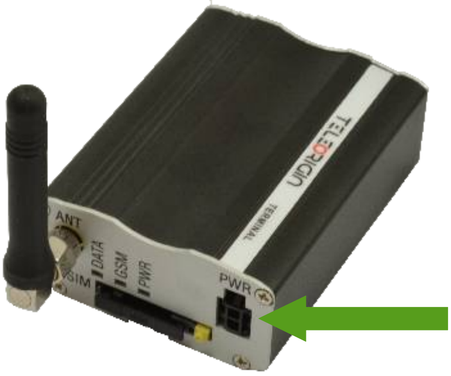
Pin No.	Name	Dir	Description
1	GND	-	Ground
2	GPIO1 (ADC)	IN/OUT	General purpose input/output. ADC range 0..3V, 10 bit resolution.
3	GPIO2 (ADC)	IN/OUT	General purpose input/output (high-drive 30mA). ADC range 0..3V, 10 bit resolution.
4	RTS	IN	Request To Send. Raised by DTE when it wishes to send. Expects CTS from DCE.
5	TX	OUT	Request To Send. Raised by DTE when it wishes to send. Expects CTS from DCE.
6	GPIO3 (ADC)	IN/OUT	General purpose input/output. ADC range 0..3V, 10 bit resolution.
7	GPIO6 (I2C_SDA)	IN/OUT	General purpose input/output. Open-drain, pull-up 2k / I^{2}C data – SDA.
8	GPIO4 (ADC)	IN/OUT	General purpose input / output. ADC range 0..3V, 10 bit resolution.
9	DTR	IN	Data Terminal Ready. Raised by DTE when powered on. In auto-answer mode raised only when RI arrives from DCE.
10	GND	-	Ground
11	GPIO5 (ADC)	IN/OUT	General purpose input/output. ADC range 0..3V, 10 bit resolution.
12	GPIO7 (I2C_SCL)	IN/OUT	General purpose input/output. Open-drain, pull-up 2k / I^{2}C clock – SCL
13	GND	-	Ground
14	RX	IN	Receive Data (a.k.a RxD, Rx). Arriving data from DCE.
15	CTS	OUT	Clear To Send. Raised by DCE in response to RTS from DTE.

DE-15 looking into female connector:



6.2.6 Power supply connector

The power supply connector is a 2-pin connector for external DC power supply connection, which can handle voltage from range 5..30 V DC, 2.5 W max. continuous power.

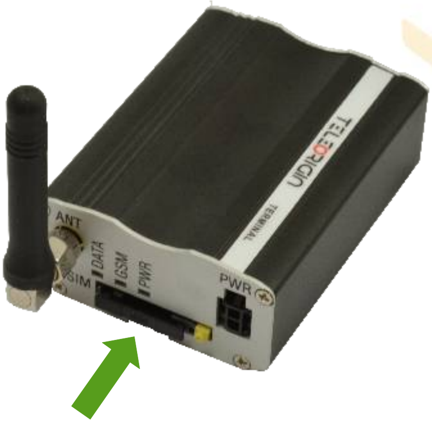


No.	Singal	I/O	Description
+	V+BATTERY	I	5 V – 30 V DC
-	GND	-	Ground

Attention!
An attempt to power terminal from DC source outside of 5..30 V range may result in physical destruction of the device.

6.2.7 SIM card holder

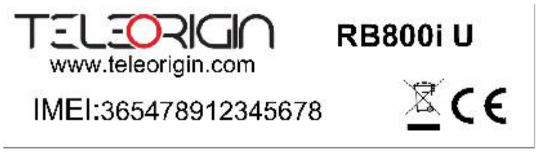
SIM card holder is placed in front of RB800 terminal (as shown below) and is accessible externally. To insert SIM card into the holder press the **yellow button**, eject the little drawer, place there Your SIM card and insert drawer into the modem (You will hear click). To operate the module in a GSM network, it is necessary to insert a SIM card obtained from the network operator.



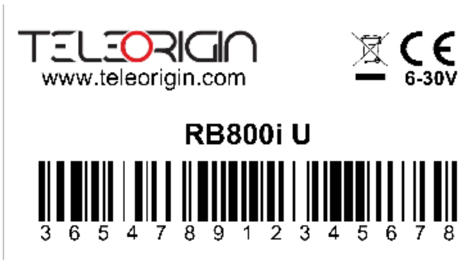
6.3 Product sticker

Product stickers are on the modem and on the box of the product.
A production sticker includes the following information:

- Product serial number (IMEI)
- the CE marking
- the 15-digit bar code
- the model signature



Device sticker



Box sticker

7. Basic features and services

Basic features and available services for RB800 are contained in table below.

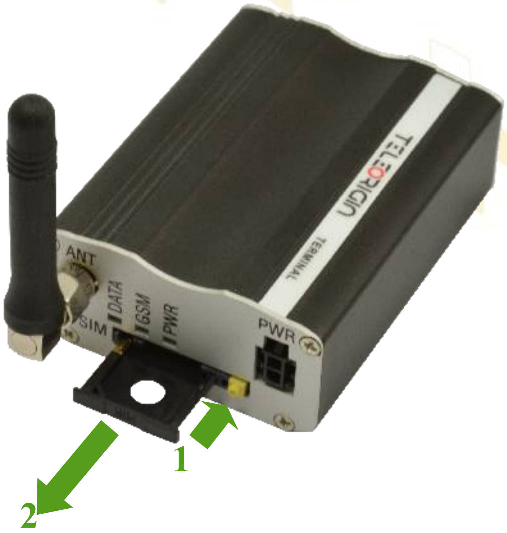
Feature/service	Description
Standard	Supported Bands: UMTS variant: - UMTS/HSPA 900/2100 Mhz (EUR/EUD version) - UMTS/HSPA 850/1900 Mhz (NAR/NAD version) - GSM/GPRS/EDGE 900/1800 MHz (EUR/EUD version) - GSM/GPRS/EDGE 850/1900 MHz (NAR/NAD version) GPRS variant: - GSM/GPRS 850/900/1800/1900 Mhz Physical: - 83 x 53,5 x 25 mm - Weight 151 g
Speed	UMTS variant: - HSDPA class 8 up to 7.2 Mbps - HSUPA class 6 up to 5.76 Mbps - WCDMA up to 384kbps downlink/uplink - EDGE class 33 for EUx variants and class 10 for NAx variants - GPRS class 33 for EUx variants and class 10 for NAx variants - CSD up to 9.6 kbps - DTM (Dual Transfer Mode)
Interfaces	Connectors - SMA antenna SIM Card - 3.0V / 1.8V - STK 3.1 Connectivity - USB 2.0 HS (UMTS variant) - UART: BR from 300 bps to 115.2 Kbps - Auto BR - SPI
SMS	- MO / MT Text and PDU mode - Cell broadcast - SMS over GPRS
Audio	- DVI (UMTS variant) or standard (GPRS variant) - eCall - DTMF
GSM supplementary services	- USSD phase II - Call forwarding - Call barring - Call hold & call waiting - CLIP - CLIR - Advice of charge
Power supply	5V – 30V DC

8. Using the modem

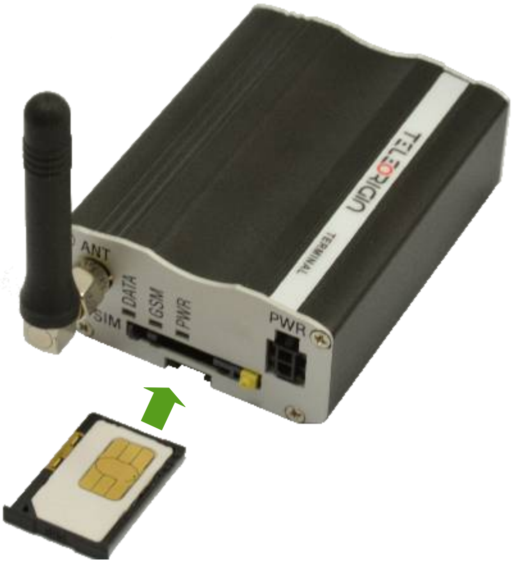
8.1 Setting up the modem

To set up the modem, do the following steps:

- Eject SIM card holder using yellow button and pull out the drawer.

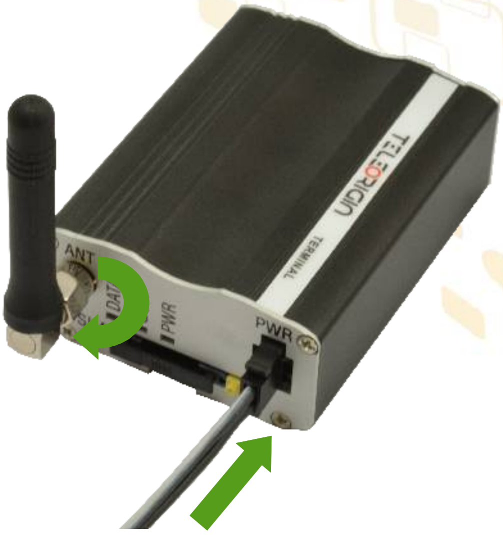


- Insert Your SIM card into drawer.



- Verify if SIM card fits in the drawer properly (as shown).
- Insert the drawer into the modem.

- Connect the antenna to the SMA connector
- Optionally it can be connected using RS-232 and miniUSB cables
- Plug the power supply cable to the power supply input

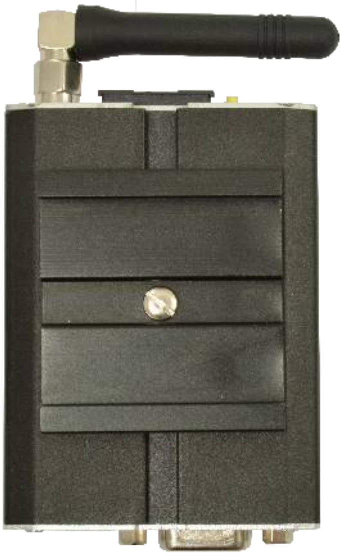


- Now the modem is ready to work.

8.2 Mounting the modem

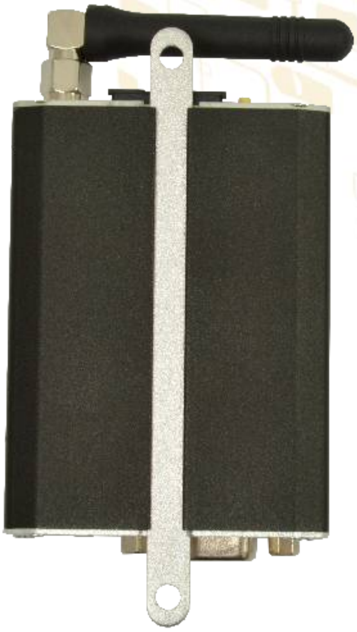
8.2.1 On DIN bus

To mount modem on DIN bus install DIN handle as shown below



8.2.2 On the wall

To mount modem on the wall install wall handles as shown below.



8.3 Checking the communication with the modem

Once the modem is connected you can check communication between RB800 terminal and the PC using Telit AT Controller available here:
http://teleorigin.com/file_upl/pliki/1/Telit_AT_Controller.zip
You can use any Terminal program also. Configuration of the DTE (port COM) should be as follows:

- Bits per second: **115200 bps**,
- Data bits: **8**,
- Parity: **None**,
- Stop bits: **1**,
- Flow control: **hardware**.

To communicate with modem use software such as Hyperterminal (AT commands) or use attached Telit AT Controller.

Using a communication software such as Hyperterminal, enter the ***AT*** and **push 'enter'** button. The response of the terminal should be '***OK'*** displayed in the Hyperterminal window.

If the connection with the modem cannot be established do the following:

- Check if modem is connected with PC via RS-232 or USB.
- Check the configuration of the COM port.

Examples of AT commands:

- ***ATE1*** enables modem echo function,
- **AT+CGMI** modem answers “Motorola” when connection is OK.
- **AT+CPIN?** shows current status of SIM card
- **AT+CPIN=xxxx** to enter PIN, where 'xxxx' are digitals

- **AT+CSQ** to verify received signal strength
- **ATD<phone_number>;** to initiate a voice call
- **ATH** to hang up a voice call

For further information about AT commands and their usage, refer to [1].

8.4 Status of the modem (LEDs)

The operational status of the RB800 Terminal is signalized by external LEDs placed on the front panel of the modem.

The table below shows what is the meaning of LEDs.

LED name	LED colour	Description
DATA	blue	Software controlled: In **GPRS** modem variant: AT#GPIO=5,1,1 – diode ON, AT#GPIO=5,0,1 – diode OFF In **UMTS** modem variant: AT#GPIO=5,0,1 – diode ON, AT#GPIO=5,1,1 – diode OFF
GSM	orange	Software controlled using AT#SLED (**GPRS** modem variant) or AT#GPIO=8 and AT#SLED (**UMTS** modem variant): Blinking every second – modem is not logged on to GSM network Blinking every 3 seconds – modem is logged on to GSM network.
PWR	green	Lights when modem is power on

8.5 Disabling and enabling echo function

If echo is not displayed when entering AT command, that means:

- The local echo function in software (such as Hyperterminal) is disabled
- The echo function of the modem is disabled

To enable echo function of the modem enter ***ATE1*** command.

In Machine to Machine communication it is recommended to disable echo function (type ***ATE0***) in order to avoid useless CPU processing.

For further information about ***AT*** commands and their usage, refer to [1].

8.6 Verifying the strength of received signal

RB800 terminal can establish connection with network if the received signal strength is sufficiently strong.

To verify the signal strength and bit error rate, do the following:

Using software such as Hyperterminal enter ***AT+CSQ***. This command displays the received signal strength indication <rssi> and channel bit error rate <ber>. The modem answers as follows:

```
+CSQ: <rssi>,<ber>
OK
```

<parameter>	Description
<rssi>	0 through 31 - covers the range of -113 dbm (or less) to -51dbm (or greater)
<ber>	Channel bit error rate (in percent) 0–7 RXQUAL values in the GSM 05.08 table 99 Unknown or not detectable

For further information about ***AT*** commands and their usage, refer to [1].

8.7 PIN code status

To check PIN code status enter ***AT+CPIN?*** Command.

The table below shows the most interesting responses of the modem:

Answer	Description
+CPIN: SIM PIN	PIN code has not been entered
+CPIN: READY	PIN code has been entered correctly

For further information about ***AT*** commands and their usage, refer to [1].

8.8 Network registration

8.8.1 GSM network registration

To check *GSM* network registration status enter ***AT+CREG?*** into software (for instance Hyperterminal) Modem will answer in following format:

+CREG: <n>,<stat>[,<lac>,<ci>]
OK

The following table shows the *+CREG* parameters:

<parameter>	Description
<n>	**0** Disables the network registration unsolicited result code. **1** Enables the network registration unsolicited result code +CREG: <stat>. **2** Enables the network registration and location information in unsolicited reports and Read command +CREG:<stat>[,<lac>,<ci>]. The default is **0**.
<stat>	**0** Not registered, and the ME is not currently searching for a new operator to which to register. **1** Registered, home network. **2** Not registered, but the ME is currently searching for a new operator to which to register. **3** Registration denied.* **4** Unknown. **5** Registered, roaming.
<lac>	Two-byte location area code in hexadecimal format
<ci>	Two-byte cell ID in hexadecimal format.

*To manage connecting to network SIM card inserted into the modem must be valid.
For further information about ***AT*** commands and their usage, refer to [1].

8.9 GPRS network registration

To check *GPRS* network registration status enter ***AT+CGREG?*** into software (for instance Hyperterminal) Modem will answer in following format:

+CGREG: <n>,<stat>[,<lac>,<ci>]
OK

The following table shows the *+CGREG* parameters:

<parameter>	Description
<n>	**0** Disables the network registration unsolicited result code. **1** Enables the network registration unsolicited result code +CGREG: <stat>. **2** Enables the network registration and location information in unsolicited reports and Read command +CGREG:<stat>[,<lac>,<ci>]. The default is **0**.
<stat>	**0** Not registered, and the ME is not currently searching for a new operator to which to register. **1** Registered, home network. **2** Not registered, but the ME is currently searching for a new operator to which to register. **3** Registration denied.* **4** Unknown. **5** Registered, roaming.
<lac>	Two-byte location area code in hexadecimal format
<ci>	Two-byte cell ID in hexadecimal format.

*To manage connecting to network SIM card inserted into the modem must be valid.

For further information about ***AT*** commands and their usage, refer to [1].

8.10 AT commands summary

As a conclusion table below shows most common and useful AT commands.
For more AT commands refer to [1].

Action	Syntax	Response	Comments
Echo enable	**ATE1**	OK	Typed text is seen.
Echo disable	**ATE0**	OK	Typed text is not seen.
Voice call	**ATD<phoneNo>;** Remember of ';'	OK	Call initiated.
		NO CARRIER/BUSY/NO ANSWER	Connection failure.
		+CME ERROR: <err>	General error*
		OPERATION NOT ALLOWED	Security reason (such as SIM card not inserted)
		UNKNOWN CALLING ERROR	Unknown reason
Hung up call	**ATH**	NO CARRIER	Connection is hanged up.
Receiving call	**ATA**	OK	Call is answered.
Communication loss		NO CARRIER	
Enter PIN code	**AT+CPIN=[<puk> or <pin>], [<newpin>]**	OK	Set PIN or PUK or new PIN code.*
		+CME ERROR: <err>	General error*
Check PIN code status	**AT+CPIN?**	+CPIN: <code> OK	Returns status of PIN. e.g. READY or SIM PIN
		+CME ERROR: <err>	General error*

*Refer to [1].

9. Troubleshooting

9.1 No connection/communication with the modem

If there is no communication with the modem do the following steps:

- Check all external connections of the modem (RS-232 or USB, Power supply)
- Verify if power supply is correct (see **Power supply**)
- Check if COM port is correctly parametrized
- Check if program used for communication works properly and if there is none other program interfering. If yes close the interfering program.

9.2 Receiving ERROR message

Modem answers ***ERROR*** on AT command in following cases:

- Syntax of typed AT command is incorrect – check the command syntax in [1]
- Parameters of typed AT command are incorrect – type ***AT+CMEE=1*** for enabling wide description of error which occurred. The response now will be in format:

  ERROR
  +CME ERROR: <err>
  where <err> is a description of error which has occurred
- Refer to [1] for further details about occurred error

9.3 Receiving NO CARRIER message

There are some common cases when modem answers ***NO CARRIER:***

- If data/voice/fax connection cannot be established
- Right after hanging up the data/voice/fax connection
- If there is no connection with network – check antenna and registration status (see **Network registration**)
- If there is no power supply (see **Power supply)**

If modem answers ***NO CARRIER*** in some cases, you can have extended error code using ***AT+CEER.*** The table below shows some of codes which can appear.

Error code	Description
1	Unassigned or unallocated number
3	No route to destination
6	Channel unacceptable
8	Operator determined barring
16	Normal call clearing
17	User busy
18	No user responding
19	User alerting, no answer
21	Call rejected
22	Number changed
27	Destination out of order
28	Invalid number format (incomplete number)
34	No circuit/channel available
38	Network out of order
41	Temporary failure

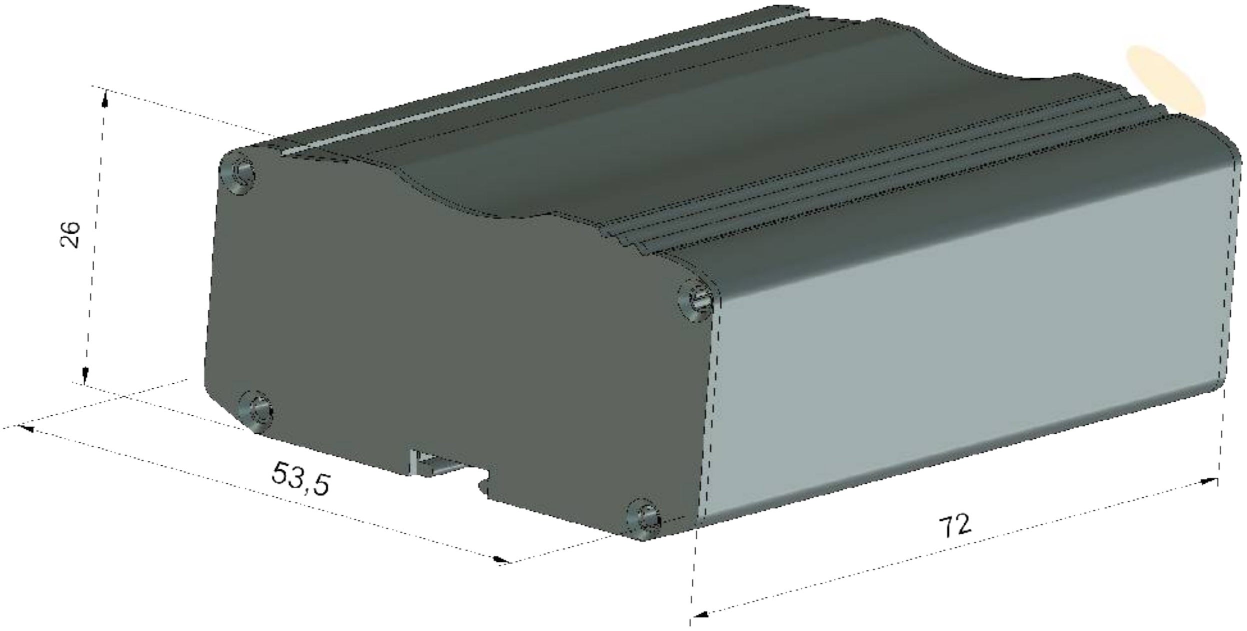
For further information about ***AT*** commands and their usage, refer to [1].

10. Technical characteristics

10.1 Mechanical characteristic

Max. dimensions	72 x 53.5 x 26 mm (w/o connectors) 83 x 53.5 x 26 mm (w/ connectors)
Weight	≈ 89 g
Volume	100 cm^3 (w/o connectors)

10.2 Housing description (dimensioning diagram)



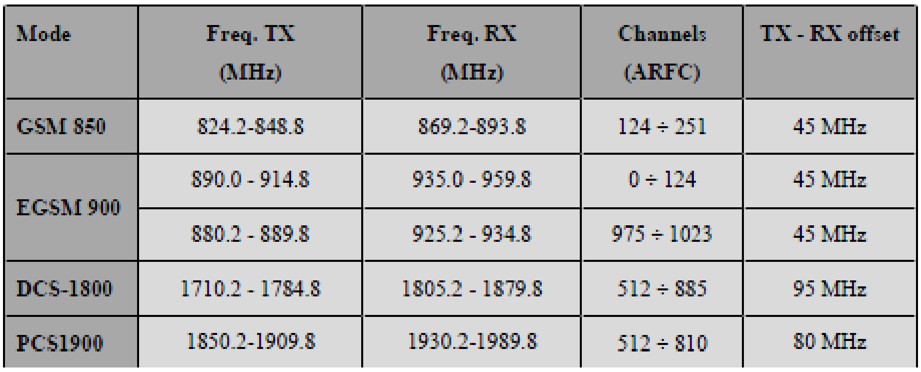
11. Electrical characteristic

11.1 Power supply

- Nominal voltage range: 5..30 V, 10%
- Maximum continuous (average) supply power: 2.5 W
- Maximum continuous (average) supply current: 200 mA at 12V, 100 mA at 24V

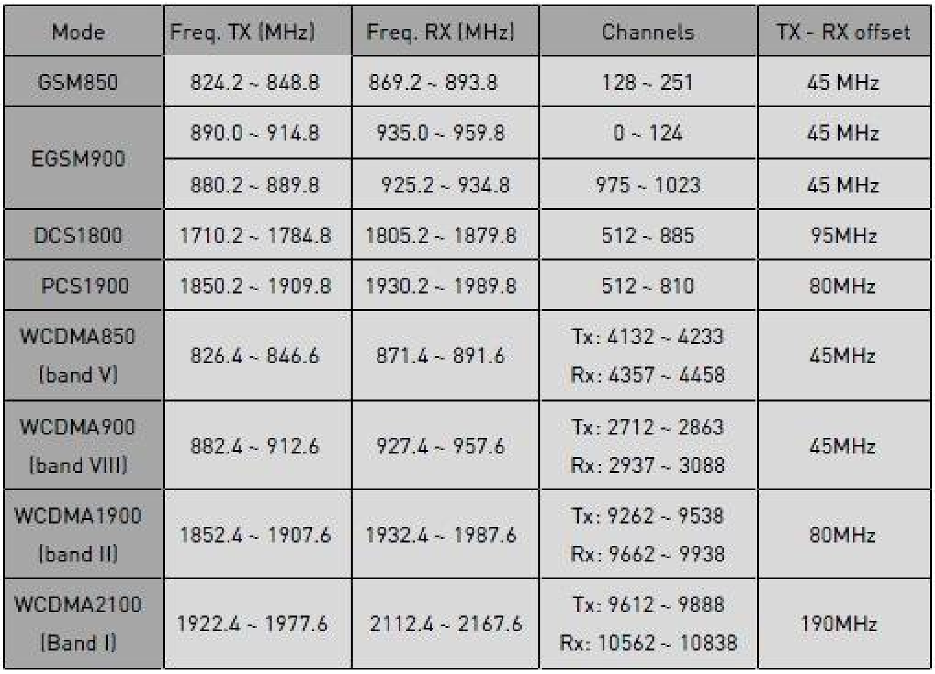
11.2 RF characteristics

GPRS variant:



Mode	Freq. TX (MHz)	Freq. RX (MHz)	Channels (ARFC)	TX - RX offset
GSM 850	824.2-848.8	869.2-893.8	124 ÷ 251	45 MHz
EGSM 900	890.0 - 914.8	935.0 - 959.8	0 ÷ 124	45 MHz
	880.2 - 889.8	925.2 - 934.8	975 ÷ 1023	45 MHz
DCS-1800	1710.2 - 1784.8	1805.2 - 1879.8	512 ÷ 885	95 MHz
PCS1900	1850.2-1909.8	1930.2-1989.8	512 ÷ 810	80 MHz

UMTS variant:



Mode	Freq. TX (MHz)	Freq. RX (MHz)	Channels	TX - RX offset
GSM850	824.2 ~ 848.8	869.2 ~ 893.8	128 ~ 251	45 MHz
EGSM900	890.0 ~ 914.8	935.0 ~ 959.8	0 ~ 124	45 MHz
	880.2 ~ 889.8	925.2 ~ 934.8	975 ~ 1023	45 MHz
DCS1800	1710.2 ~ 1784.8	1805.2 ~ 1879.8	512 ~ 885	95MHz
PCS1900	1850.2 ~ 1909.8	1930.2 ~ 1989.8	512 ~ 810	80MHz
WCDMA850 (band V)	826.4 ~ 846.6	871.4 ~ 891.6	Tx: 4132 ~ 4233 Rx: 4357 ~ 4458	45MHz
WCDMA900 (band VIII)	882.4 ~ 912.6	927.4 ~ 957.6	Tx: 2712 ~ 2863 Rx: 2937 ~ 3088	45MHz
WCDMA1900 (band II)	1852.4 ~ 1907.6	1932.4 ~ 1987.6	Tx: 9262 ~ 9538 Rx: 9662 ~ 9938	80MHz
WCDMA2100 (Band I)	1922.4 ~ 1977.6	2112.4 ~ 2167.6	Tx: 9612 ~ 9888 Rx: 10562 ~ 10838	190MHz

11.3 External antenna

The external antenna is connected to the modem via SMA connector.
Antenna must have parameters as shown below in table.

Antenna frequency range	Quad-band GSM 850/900/1800/1900 MHz or UMTS 900/2100 Mhz
Impedance	50 Ω
DC impedance	0 Ω
Gain	0 dBi w/o cable; 2dBi w/ cable
VSWR (with cable)	-10 dB

The antenna chosen for working with modem should best fit to circumstances of environment it is used in. When the modem is placed in a room or somewhere where the range of networks signal is too low, the outdoor or specific indoor antenna should be used to increase it.

11.4 Environmental characteristic

Table below gives the environmental operating conditions of RB800 terminal.

Attention!
Exceeding the values may result in permanent damage to the module.

Parameter	Conditions	Min	Max	Unit
Ambient Operating Temperature		-20	60	°C
Storage Temperature		-40	85	°C
ESD	At antenna connector Contact Air At interface connector		± 6 ± 15 ± 1	KV
Humidity		5	85	%

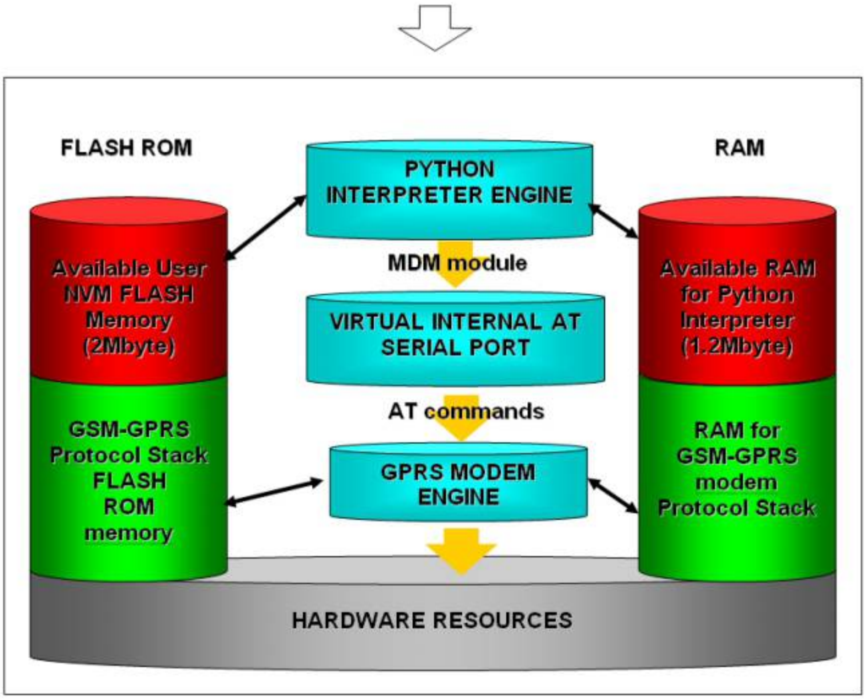
12. Python Script Interpreter

The Easy Script Extension is a feature that allows driving the modem internally, writing the controlling application directly in the Python high level language. A typical application usually consists of a microcontroller managing several I/O pins on the module through the AT command interface.

The Easy Script Extension functionality lets the developer to get rid of the external controller and further simplify the programmed sequence of operations. The equipped Python version features the following:

- Python script interpreter engine v.2.7 for UMTS variant and v1.5.4 for GPRS variant
- 1 MB of Non Volatile Memory space for user scripts and data
- 1.2 MB RAM reserved for the Python engine

The following depicts a schematic of this approach:


FLASH ROM
PYTHON INTERPRETER ENGINE
RAM
Available User NVM FLASH Memory (2Mbyte)
MDM module
Available RAM for Python Interpreter (1.2Mbyte)
VIRTUAL INTERNAL AT SERIAL PORT
AT commands
GSM-GPRS Protocol Stack FLASH ROM memory
GPRS MODEM ENGINE
RAM for GSM-GPRS modem Protocol Stack
HARDWARE RESOURCES

To use Python language features on Telit module use PythonWin. It is an Python editor for Windows. In order for the software to function correctly, it is required the use of either Windows 2000, XP, Vista or 7 as operating systems.

PythonWin can be found here http://www.python.org/download/windows/

Python scripts are text files stored in Telit module NVM (Non Volatile Memory). There is a file system inside the module that allows to write and read files with different names on one single level (no subdirectories are supported)

The Python script is executed in a task with the lowest priority on the Telit module, so it's execution won't interfere with GSM/GPRS normal operations. Furthermore, this allows serial ports, protocol stack etc. to run independently from the Python script. The Python script interacts with the Telit module functionalities through several built-in interfaces, as depicted below:

- **The MDM interface** is the most important one. It allows the Python script to send AT commands, receive responses and unsolicited indications, send data to the network and receive data from network during connections. It is quite similar to the regular serial port interface on the Telit module. The only difference being that this interface is an internal software bridge between Python and module internal AT command handling engine, and not a physical serial port. All AT commands working on the Telit module are working with this software interface as well.
- **The MDM2 interface** is the second interface between Python and the module internal AT command handling. It's purpose is to send AT commands from the Python script to the module and receive AT responses from the module to the Python script when the regular MDM built-in module is already in use.
- **The SER interface** lets the Python script to read from and write to the physical serial port ASC0, usually the default port to send AT commands to the module (e.g. to read information from an external device). When Python is running, this serial port is free to be use by the Python script since it is not used as the AT command interface; the AT parser, in fact, is mapped into the internal virtual serial port. No flow control is available from Python on this port.
- **The SER2 interface** lets Python script to read from and write to the physical serial port ASC1, usually the default port for tracing and debugging.
- **The GPIO interface** lets the Python script to handle general purpose input output faster than through AT commands, skipping the command parser and controlling directly the pins.
- **The MOD interface** is a collection of useful functions like timeouts, watchdogs etc.
- **The II2 interface** is an implementation on the Python core of the IIC bus Master. It allows Python to create one or more IIC bus on the available GPIO pins.
- **The SPI interface** is an implementation on the Python core of the SPI bus Master. It allows Python to create one or more SPI bus on the available GPIO pins.
- **The GPS interface** is the interface between Python and the module's internal GPS controller. Its purpose is to handle the GPS controller without the use of dedicated AT commands through the MDM built-in module.

Visit Python official web site for more information http://www.python.org/. More information can be found also in [5] and [6]

13. AT Reference manual

Important: the following table list of AT commands i**s available only for Python scripts to communicate with microcontroller through SER2 interface**.

COMMAND	Function
AT	Starting a Command Line
E	Command Echo
#VER	Device Version
#GPIO	General Purpose Input/Output Pin Control
#ADC	Analog/Digital Converter Input
#I2C	I2C Bus Control
#SLEEP	Switch device into power-down mode
#SD	SD card status
#SDRBLOCK	Read data block from SD card
#SDWBLOCK	Write data block to SD card
#FMKDIR	Create a directory
#FCREATE	Create a file
#FREMOVE	Removing a file or directory
#FREMOVEALL	Remove all directories and files
#FCD	Change current location
#FDIR	List of all files and directories
#FINIT	Initialize FAT32 and set time and date
#FWRITE	Write a file
#FREAD	Read a file

12.1. Command Echo - E

E - Command Echo	
ATE<n>	Set command enables/disables the command echo. Parameter: **<n>** 0 - disables command echo 1 - enables command echo (default) , hence command sent to the device are echoed back to the DTE before the response is given.
ATE?	Read command current state in format: **<n>** where **<n>** - as seen before

12.2. Device Version - #VER

#VER – Device Version	
AT#VER	Read software and hardware version in format: **AT#VER=<swver><hwver>** where **<swver>** - version of microcontroler software **<hwver>** - version of hardware

12.3. General Purpose Input/Output Pin Control - #GPIO

#GPIO - General Purpose Input/Output Pin Control	
AT#GPIO=[<pin>,<mode>[,<dir>[,<pull>]]] 0 - no	Execution command sets the value of the general purpose output pin **GPIO<pin>** according to **<dir>**, **<mode>** and **<pull>** parameter. Parameters: **<pin>** - GPIO pin number; supported range is from 1 to a 7. **<mode>** - its meaning depends on **<dir>** setting: meaning if **<dir>=0** - INPUT

#GPIO - General Purpose Input/Output Pin Control	
	- output pin cleared to 0 (Low) if **<dir>=1** - OUTPUT - no meaning if **<dir>=2** - ALTERNATE FUNCTION 1 - no meaning if **<dir>=0** - INPUT - output pin set to 1 (High) if **<dir>=1** - OUTPUT - no meaning if **<dir>=2** - ALTERNATE FUNCTION 2 - Reports the read value from the input pin (see Note). **<dir>** - GPIO pin direction 0 - pin direction is INPUT 1 - pin direction is OUTPUT 2 - pin direction is ALTERNATE FUNCTION (see Note). **<pull>** - GPIO pull resistor (see Note). 0 - no pull resistor 1 - pull-down resistor 2 - pull-up resistor Note: when **<mode>=2** the command reports the direction, value of pin **GPIO<pin>** and pull resistor setting in the format: **#GPIO: <dir>,<stat>,<pull>** where: **<dir>** - current direction setting for the **GPIO<pin>** **<stat>** • logic value read from pin **GPIO<pin>** in the case the pin **<dir>** is set to input; • logic value present in output of the pin **GPIO<pin>** in the case the pin **<dir>** is currently set to output; • no meaning value for the pin **GPIO<pin>** in the case the pin **<dir>** is set to alternate function Note: "ALTERNATE FUNCTION" value has following meaning: • GPIO1-GPIO5 - alternate function is “ADC” • GPIO6 - alternate function is “I2C SDA” • GPIO7 - alternate function is “I2C SCL” Note: **<pull>** parameter has no meaning when **<pin>=6** or **7**. GPIO6 and GPIO7 has always 2k pull-up resistors.
AT#GPIO?	Read command reports the read direction and value of all GPIO pins, in the format: **#GPIO: <dir>,<stat>,<pull>**

#GPIO - General Purpose Input/Output Pin Control	
	... **#GPIO: <dir>,<stat>,<pull>** where **<dir>** - as seen before **<stat>** - as seen before **<pull>** - as seen before
Example	*Read all inputs state:* AT#GPIO? #GPIO: 0,1,1 #GPIO: 0,1,1 #GPIO: 0,1,1 #GPIO: 0,1,1 #GPIO: 0,1,1 #GPIO: 0,1,1 #GPIO: 0,1,1 OK *Set GPIO1 as input with pull-up resistor* AT#GPIO=1,0,0,2 OK *Read GPIO input state* AT#GPIO=1,2 #GPIO: 0,1,2 OK Set GPIO1 as output with high state and no pull resistor AT#GPIO=1,1,1,0 OK

12.4. Analog/Digital Converter Input - #ADC

#ADC - Analog/Digital Converter Input	
AT#ADC=<adc>	Execution command reads pin<adc> voltage, converted by ADC, and outputs it in the format: **#ADC: <value>** where: **<value>** - pin**<adc>** voltage, expressed in mV Parameters: **<adc>** - index of pin from 1 to 5
Example	*Set GPIO3 as ADC input with pull-up resistor* AT#GPIO=3,0,2,1 OK *Read ADC3 input value* AT#ADC=3 #ADC: 2991 OK

12.5. I2C Bus Control - #I2C

#I2C - I2C Bus Control	
AT#I2C=<speed>, <cmd>	This command is used to execute read and write operations on I2C bus as a master divice. **<speed>** - I2C bus clock frequency 0 - 100 kHz 1 - 200 kHz 2 - 300 kHz 3 - 400 kHz **<cmd>** - commands bytes stream in hexadecimal format (e.g. “A601EF”) First byte of **<cmd>** is slave device address (7 MSB) with write/read bit (1 LSB). LSB bit of first byte equal 0 mean write operation, equal 1 mean read

#I2C - I2C Bus Control

operation.

Any command is preceded by start condition and followed by stop condition.

Write N bytes to slave device:

SLAVE ADDR + W	N (number of bytes to write)	DATA 1	...	DATA N

Response for write operation is only “OK” if succeed.

Read N bytes from slave device:

SLAVE ADDR + R	N (number of bytes to read)

If succeed, response to read operation is read the data stream in hexadecimal format.

Write N bytes to slave device and read M bytes from slave device:

SLAVE ADDR + W	N (number of bytes to write)	DATA 1	...	DATA N	SLAVE ADDR + R	M (number of bytes to read)

Between write and read command will be perform repeated start condition. If succeed, response for read operation is read data stream in hexadecimal format.

If any operation fails, response will be follow:

ERROR <err>

where
<err>
1 – NACK on address byte
2 – NACK on data byte
3 – arbitration lost
4 – timeout
5 – I2C bus busy
6 – **<cmd>** parse error

NOTE: At the end of the execution GPIO will be restored to the original setting (check AT#GPIO Command)

#I2C - I2C Bus Control	
Example	*Write 6 bytes to slave device with address 0x53, with 100kHz clock* AT#I2C=0,"a60601aabbccddee" OK *Read 5 bytes from slave device with address 0x53, with 400kHz clock* AT#I2C=3,"a705" 0000000001 OK *Read data is 0x00, 0x00, 0x00, 0x00, 0x01* *Write 1 bytes and read 5 bytes from slave device with address 0x53, with repeated start condition.* AT#I2C=0,"A60101A705" AABBCCDDEE OK *Read data is 0xAA, 0xBB, 0xCC, 0xDD, 0xEE*

12.6. Power-down mode - #SLEEP

#SLEEP – Power-down mode	
AT#SLEEP=<n>	Set power-down mode. Parameter: **<n>** 0 - active mode 1 - deep power-down mode, GL865 is turn off. Automatically switch into active mode when external power connected. 2 - deep power-down mode after 30 seconds, GL865 is turn off. Automatically switch into active mode when external power connected. NOTE: from version 2014061301

#SLEEP – Power-down mode	
AT#SLEEP?	Read current power mode state in format: **#SLEEP: <n>** where: **<n>** - as seen before

12.7. SD card status - #SD

#SD – SD card status	
AT#SD=<n>	Reset and initialize sd card. Parameter: **<n>** 1 - reset and initialize sd card.
AT#SD?	Read current sd card state in format: **#SD: <n>,<size>** where: **<n>** 0 - sd card not detected 1 - sd card initialized 2 - sd card initialization failed **<size>** - number of sectors in user area, hexadecimal format.
Example	AT#SD? AT#SD: 1,001E4600 OK

12.8. SDRBLOCK read data block from memory card - #SDRBLOCK

#SDRBLOCK – Read data block from memory card	
AT#SDRBLOCK= <sector>	Read one sector (512 bytes) from memory card Parameter: **<sector> -** sector address to read, ascii hexadecimal format (max 8 characters) The microcontroler shall prompt a five character sequence: <<< <CR><LF><less_than><less_than><less_than> followed by the sector content in binary format.
Example	*Read 6836th sector from memory card:* AT#SDRBLOCK=1AB3 <<<0123456789abcdef0123456789abcdef0123456789abcdef012345678 9abcdef0123456789abcdef0123456789abcdef0123456789abcdef012345 6789abcdef0123456789abcdef0123456789abcdef0123456789abcdef012 3456789abcdef0123456789abcdef0123456789abcdef0123456789abcdef 0123456789abcd_f0123456789abcdef0123456789abcdef0123456789abc def0123456789abcdef0123456789abcdef0123456789abcdef0123456789 abcdef0123456789abcdef0123456789abcdef0123456789abcdef0123456 789abcdef0123456789abcdef0123456789abcdef0123456789abcdef0123 456789abcdef0123456789abcdez OK

12.9. SDWBLOCK write data block to memory card - #SDWBLOCK

#SDWBLOCK – Write data block to memory card	
AT#SDWBLOCK= <sector>	Write one sector (512 bytes) to memory card Parameter: **<sector> -** sector address to write, ascii hexadecimal format (max 8 characters) The microcontroler shall prompt a five character sequence: >>>

#SDWBLOCK – Write data block to memory card	
	<CR><LF><greater_than><greater_than><greater_than> after that 512 bytes can be send to microcontroler, in binary format. The operations completes when all the bytes are received. If writing ends successfully, the response is OK; otherwise an error is reported.
Example	*Write to 6836th sector of memory card:* AT#SDWBLOCK=1AB3 >>> *here receive the prompt; then send 512 bytes* OK

FAT32 commands

12.10 FMKDIR – create a directory - #FMKDIR

#FMKDIR – create a directory	
AT#FMKDIR=<name>	Create a directory in a current location Where: <name> - string, max 11 characters
Example	Creating *“newdir”* directory: *AT#FMKDIR=”newdir”* *OK*

12.11 FCREATE – create a file - #FCREATE

#FCREATE – create a file	
AT#FCREATE=<name.ext>	Create a file in a current location
Example	*Creating “info.txt” file:* *AT#FCREATE=”info.txt”* OK

12.12 FREMOVE – removing a file or directory - #FREMOVE

#FREMOVE – removing a file or directory	
AT#FREMOVE= <name.ext>	Remove a directory or a file from a current location Where: - If it is a file: <name.ext> - string, name - max 8 characters, ext – max 3 characters - if it is a file: <name.ext> - file name without .ext (e.g. “newdir”)
Example	*Removing a file:* *AT#FREMOVE=”info.txt”* *OK* *Removing a directory:* *AT#FREMOVE=”newdir”* *OK*

12.13 FREMOVEALL – remove all directories and files - #FREMOVEALL

#FREMOVEALL – remove all directories and files	
AT#FREMOVEALL	Remove all directories and files from a current location NOTE: Removed directories can't contain any files or other directories
Example	*Removing all directories and files from a current location* AT#FREMOVEALL OK

12.14 FCD – change current location - #FCD

#FCD – change current location	
AT#FCD=<name>	Change current location Where: <name> - string, name of directory with”\” before, to move in directory or with “\..” to move out from current directory
Example	*Moving in directory “newdir”* AT#FCD=”\newdir” OK *Moving out from current directory* AT#FCD=”\..” OK

12.15 FDIR - list of all files and directories - #FDIR

#FDIR – list of all files and directories	
AT#FDIR	List of all files and directories in current location
Example	AT#FDIR newdir info.txt OK

12.16 FINIT – initialize FAT32 and set time and date - #FINIT

#FINIT – initialize FAT32 and set time and date	
AT#FINIT=<year>, <month>,<day>, <hour>,<minute>, <sec>	Initialize FAT32 file system and set actual time and date Where: <year> - current year in binary format <month> - current month in binary format <day> - current day in binary format <hour> - current hour in binary format <minute> - current minute in binary format <sec> - current second in binary format
Example	*Initializing FAT32 file system and set a time and date to “2014:11:19 10:17:00”*

#FINIT – initialize FAT32 and set time and date	
	AT#FINIT=2014,11,19,10,17,00 OK

12.17 FWRITE – write a file - #FWRITE

#FWRITE – write a file	
AT#FWRITE=<name.ext>,<offset>,<mode>,<byte_num>,<data>	Write to file Where: <name.ext> - as seen before <offset> - shift indicator in bytes <mode> - the way of shifting 0 – beginning of the file 1 – current index 2 – end of file <byte_num> - byte number to writing in hexadecimal format <data> - data for writing to file
Example	*Writing "info.txt" file with "123456789012345678901234567890" data* AT#FWRITE="info.txt",00,2,1F,"123456789012345678901234567890 " OK

12.18 FREAD – read a file - #FREAD

#FREAD – read a file	
AT#FREAD=<name.ext>,<offset>,<mode>,<byte_num>	Read from file Where: <name.ext> - as seen before <offset> - shift indicator in bytes <mode> - the way of shifting 0 – beginning of the file 1 – current index 2 – end of file <byte_num> - byte number to writing in hexadecimal format, if higher than file size will return whole file
Example	*Reading "info.txt" file* AT#FREAD="info.txt",00,0,FFFFFF 123456789012345678901234567890 OK

14. Safety recommendations

14.1 General Safety

Please follow safety regulations regarding the use of radio equipment due to the possibility of radio frequency interference. Read given advices carefully.

Switch ***off*** GSM terminal when:

- in an aircraft – using cellular telephones in aircraft may endanger the operation of the aircraft; it is illegal
- at a refuelling point
- in any area with potentially explosive atmosphere which could cause an explosion or fire
- in hospitals and any other places where medical equipment is in use

Respect restrictions on the use of radio equipment in any area or place where it is signalized that using cellular telephony is forbidden or dangerous.

Using GSM modem close to other electronic equipment may also cause interference if the equipment is inadequately protected. It may lead to damage or failure of GSM modem or the other equipment.

14.2 Care and Maintenance

The RB800 terminal is an electronic product that should be treated with care. Please follow suggestions shown below due to using modem for many years.

- Do not expose RB800 to any extreme circumstances like high temperature or high humidity
- Do not keep modem in dirty and dust places
- Do not disassemble the RB800 modem
- Do not expose the modem to any water, rain or steam
- Do not drop, shake or knocking your modem
- Do not place your modem close to magnetic devices – credit cards, etc
- Use of third party equipment or accessories, not made or authorized by Elproma Electronics may invalid the warranty of modem and/or cause failure or permanent damage of modem
- Do not expose the modem to children under 3 years

14.3 Responsibility

The modem is under your responsibility. Please treat it with care, and respect local regulations. This is not a toy – keep it out of the reach of children.

Try to use security features (PIN etc.) to block unauthorized use or theft.

15. Accessories

The tables below shows recommended accessories for RB800 terminal.

15.1 Accessories critical for using modem

Table below shows accessories critical for using modem. Without them usage of modem is impossible.

Accessory	Description	Part no.
Power adaptor	6 V	

Example of power adaptor is shown in the picture below

Power adaptor 6V

15.2 Additional accessories

Table below shows available accessories for RB800 modem series.

Part No.	Name	Description
RB-PS12VP2L15	12V power adaptor	<1,5m> 2 PIN
RB-PSCP2L15	Supply cable	2PIN <1,5m> open end
RB-903G	3G angle antenna	2J010
RB-89MSH	SIM drawer	MOLEX 0912360001
RB-89DH	DIN Holder	
RB-89WMK	Wall mount kit	
RB-89R2L18	RS232 cable	DB9 male <1,8m> DB9 female
RB-902G	2G angle antenna	
RB-89R2L10IOL3	RS232+GPIO cable	rs232=1m DB9F, IO=0,3m open end
RB-8ACU	Battery	3 pin connector

16. Conformity Assessment Issues

The RB800 has been assessed in order to satisfy the essential requirements of the R&TTE Directive 1999/05/EC (Radio Equipment & Telecommunications Terminal Equipments) to demonstrate the conformity against the harmonised standards with the final involvement of a Notified Body.

CE

17. Safety Recommendations

READ CAREFULLY

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc
- Where there is risk of explosion such as gasoline stations, oil refineries, etc

It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity.

We recommend following the instructions of the hardware user guides for a correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conforming to the security and fire prevention regulations.

The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. The same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible of the functioning of the final product; therefore, care has to be taken to the external components of the module, as well as of any project or installation issue, because the risk of disturbing the GSM network or external devices or having impact on the security. Should there be any doubt, please refer to the technical documentation and the regulations in force.

Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the people (20 cm). In case of this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

18. List of Acronyms

ACM	Accumulated Call Meter
ASCII	American Standard Code for Information Interchange
AT	Attention commands
CB	Cell Broadcast
CBS	Cell Broadcasting Service
CCM	Call Control Meter
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
CMOS	Complementary Metal-Oxide Semiconductor
CR	Carriage Return
CSD	Circuit Switched Data
CTS	Clear To Send
DAI	Digital Audio Interface
DCD	Data Carrier Detected
DCE	Data Communications Equipment
DRX	Data Receive
DSR	Data Set Ready
DTA	Data Terminal Adaptor
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
DTR	Data Terminal Ready
EMC	Electromagnetic Compatibility
ETSI	European Telecommunications Equipment Institute
FTA	Full Type Approval (ETSI)
GPRS	General Radio Packet Service
GSM	Global System for Mobile communication
HF	Hands Free
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IRA	Internationale Reference Alphabet
ITU	International Telecommunications Union
IWF	Inter-Working Function
LCD	Liquid Crystal Display

LED	Light Emitting Diode
LF	Linefeed
ME	Mobile Equipment
MMI	Man Machine Interface
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
OEM	Other Equipment Manufacturer
PB	Phone Book
PDU	Protocol Data Unit
PH	Packet Handler
PIN	Personal Identity Number
PLMN	Public Land Mobile Network
PUCT	Price per Unit Currency Table
PUK	PIN Unblocking Code
RACH	Random Access Channel
RLP	Radio Link Protocol
RMS	Root Mean Square
RTS	Ready To Send
RI	Ring Indicator
SAR	Specific Absorption Rate (e.g. of the body of a person in an electromagnetic field)
SCA	Service Center Address
SIM	Subscriber Identity Module
SMD	Surface Mounted Device
SMS	Short Message Service
SMSC	Short Message Service Center
SPI	Serial Protocol Interface
SS	Supplementary Service
TIA	Telecommunications Industry Association
UDUB	User Determined User Busy
USSD	Unstructured Supplementary Service Data

19. On-line support

Elproma provides a range on on-line support which includes:

- the latest version of this document
- the latest drivers for RB800
- technical support

This information can be found on our web sites at **www.teleorigin.com**

For further information You can contact us at:
email: **info@elproma.com.pl**
tel.: **+48 (22) 751 76 80**
fax.: +48 (22) 751 76 81