RB865i Terminal
User Manual

Date: 27 Aug 2013

Powered by

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

E-mail: office@elproma.com.pl
Tel. +48 (22) 751 76 80
www.teleorigin.com

Contents

1. Overview

The RB865i Terminal is the complete modem solution for wireless m2m applications. Based on the Telit GL865 module, it is available as DUAL or QUAD band version and offers high level GSM/GPRS 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 RB865i Terminal enabling voice, data, 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 RB865i modem description and gives information about installation and using it.

2. References

[1] Telit_AT_Commands_Reference_Guide.pdf

[2] Telit_GL865-DUAL/QUAD_Hardware_User_Guide.pdf

[3] Telit_Modules_Software_User_Guide.pdf

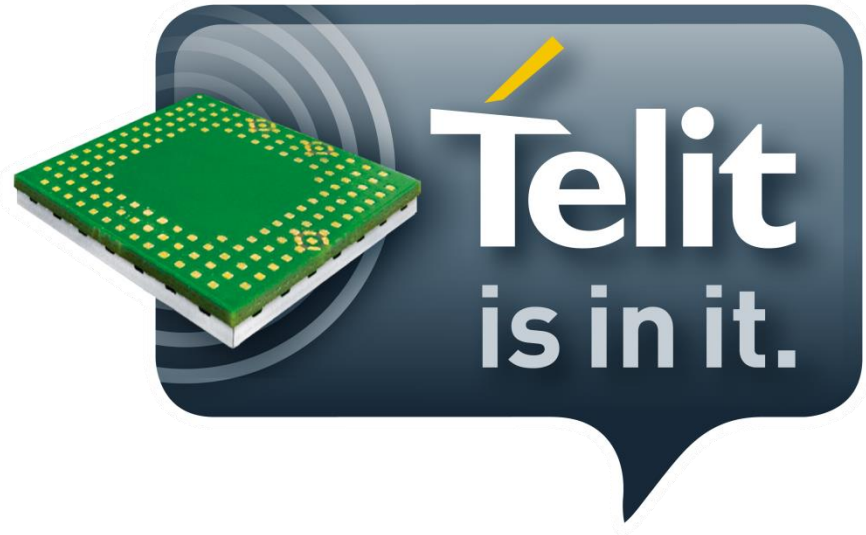
[4] Telit_GL865-DUAL/QUAD_Product_Description.pdf

[5] Telit_Easy_Script_Python.pdf

[6] http://www.telit.com/en/products/gsm-gprs.php?p_id=12&p_ac=show&p=93

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

3. Trademarks



TELIT and the Stylized T Logo are registered in Trademark Office. All other product or service names are the property of their respective owners.

4. Package

4.1. Box

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

We 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 chapter 6.3Product sticker.

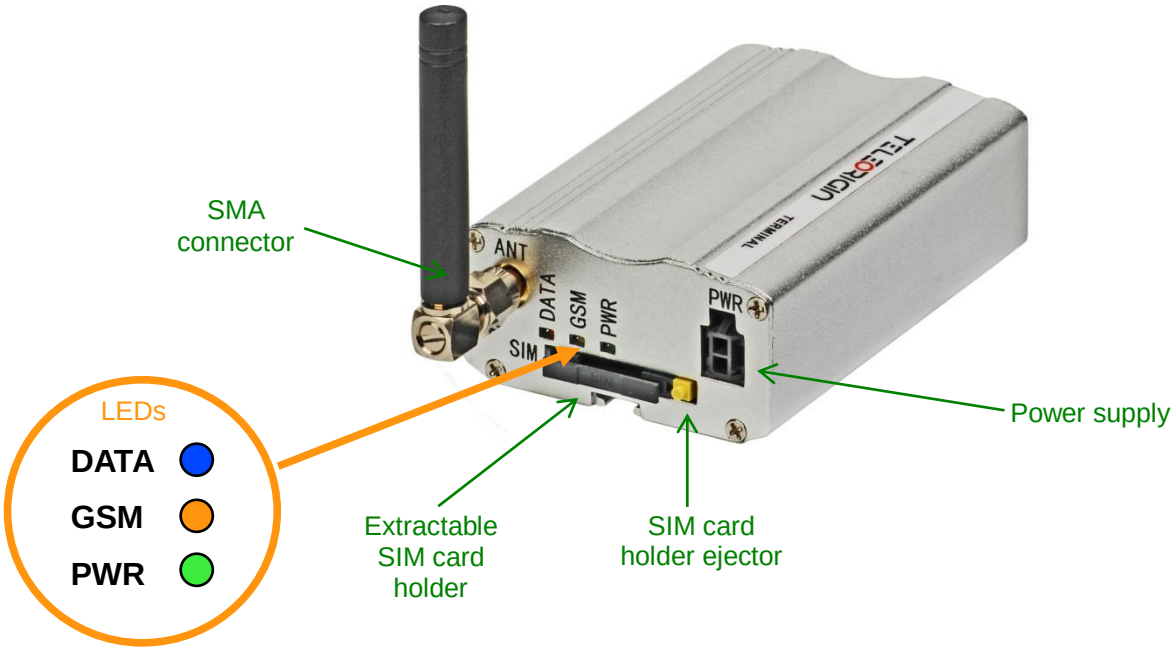
5. Complete package contents

Complete package contains:

- RB865i terminal (item A)
- Power adaptor (item B)

6. General presentation

6.1. Description



6.2. External connections

6.2.1. Antenna connector

SMA connector
for antenna

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.*

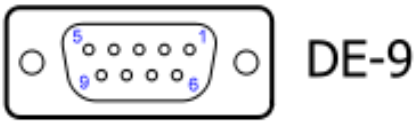
6.2.2. RS-232 Interface (EIA574)

RB865i terminal is equipped with RS-232 interface (as shown below). DE9 DSUB socket is connected via voltage level translator circuit to GL865.

Table of RS-232 DB9 pins:

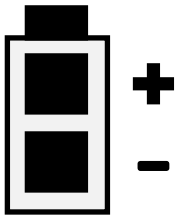
Pin No.	Name	Dir	Description
1	DCD	IN	Data Carrier Detect. Raised by DCE when modem synchronized.
2	RD	IN	Receive Data (a.k.a RxD, Rx). Arriving data from DCE.
3	TD	OUT	Transmit Data (a.k.a TxD, Tx). Sending data from DTE.
4	DTR	OUT	Data Terminal Ready. Raised by DTE when powered on. In auto-answer mode 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



6.2.3. 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!

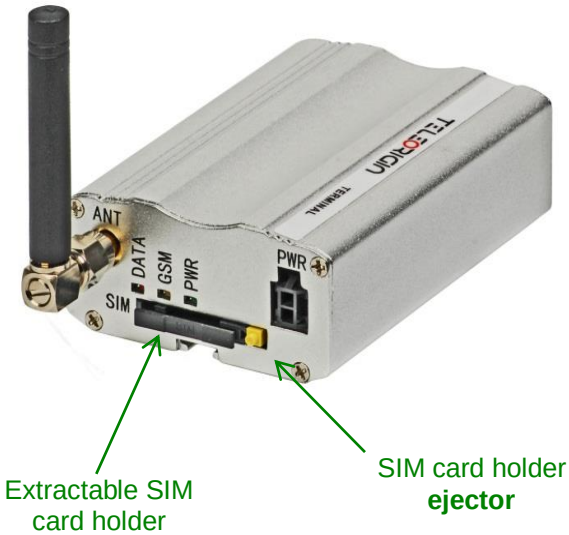
An attempt to power terminal from DC source outside of 5..30 V range may result in physical destruction of the device.

6.2.4. Audio Input/Output

The RB865i modem is equipped with audio interface, which can be used for transmitting voice communication while calling. To use this interface plug the HandsFree headphones into it. The Audio I/O is shown in the picture below.

6.2.5. SIM card holder

SIM card holder is placed in front of RB865i 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 (RB865i)

7. Basic features and services

Basic features and available services for RB865i are contained in table below.

Feature/service	Description
Standard	Supported Bands: • GSM Quad-band • 850/900/1800/1900MHz Physical: • 83 x 72 x 25 mm • Weight 151g
GPRS	• Multi-slot class 10 (4 Down; 2 Up; 5 Total) • Max BR Downlink 85.6 Kbps • Coding Scheme CS1-CS4
Interfaces	Connectors • Single 70 pin board to board • RF MMCX SIM Card • 3.0V / 1.8V • STK 3.1 Connectivity • USB 1.1 full speed • UART: BR from 300 bps to 115.2 Kbps • Auto BR
SMS	• MO / MT Text and PDU mode • Cell broadcast
Audio	• Telephony • Digital audio • Differential analog audio lines • Vocoders HR/FR/EFR/AMR • DTMF support • Audio control: echo suppression; noise suppression; side tone; gain control
GSM supplementary services	• USSD phase II • Call forwarding • Call hold; waiting; multiparty • Call diverting • Missed call indicator • AOC • Call barring CSD • Max BR 14.4 Kbps
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 cable
- Plug the power supply cable to the power supply input

- Plug the hands-free headphones into Audio I/O
- 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 RB865i terminal and the PC using Telit AT Controller available here:

http://teleorigin.com/download/Tools/Common/Telit_AT_Controller_r2_2_1.zip

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 GPRS Control v.2.1.0.0 software. For further information about GPRS Control, refer to '**GPRS Control 3.1.0.0 User's Manual**' [3], and to install refer to **'GPRS Control Installation Guide'** [4].

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 RB865i 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 status	LED name	LED colour	Status description
on	GPRS	blue	Lights when GPRS connection is established
	GSM	orange	Shows the RF activity of GSM module
	PWR	green	Modem is on
off	GPRS	none	No GPRS connection is established
	GSM	none	Terminal has no connection with GSM network
	PWR	none	Modem is off

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

RB865i 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].

8.8.2. 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].

8.8.3. 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>;**	OK	Call initiated.
	Remember of ';'	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 *11.1 Power supply*)
- Check if COM port is correctly parametrized (see *8.3 Checking the communication with the modem*)
- 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 *8.8 Network registration*)
- If there is no power supply (see *11.1 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

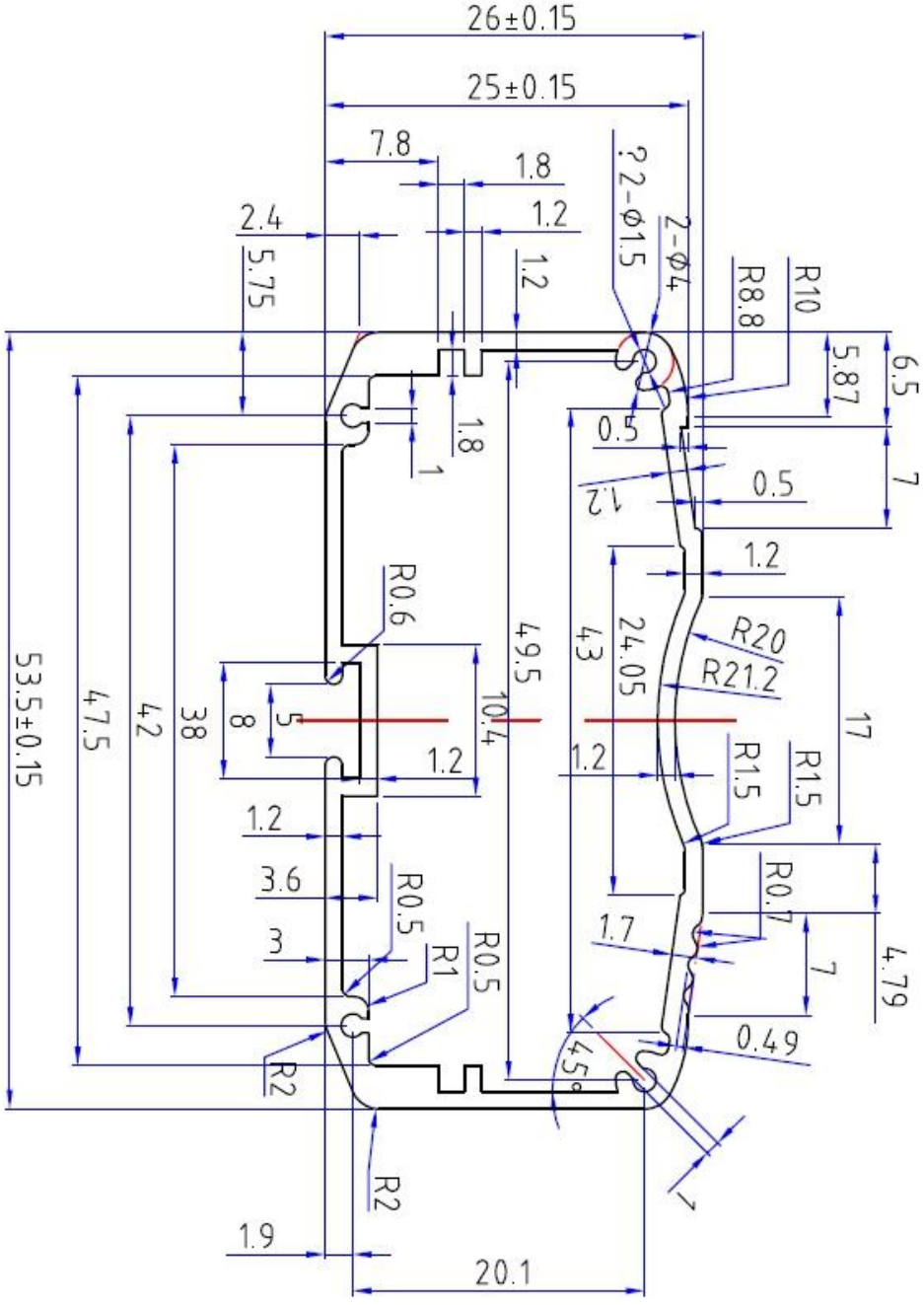
For further information about ***AT*** commands and their usage, refer to [1].

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

11.2.1. Frequency ranges

Parameter	Conditions	Specifications
GSM 850	TX	824 – 849 MHz
	RX	869 – 894 MHz
GSM 900	TX	880 – 915 MHz
	RX	925 – 960 MHz
DCS 1800	TX	1710 – 1785 MHz
	RX	1805 – 1880 MHz
PCS 1900	TX	1850 – 1910 MHz
	RX	1930 – 1990 MHz

11.2.2. RF performance

Minimum radiated RF performance is shown in the table below:

Band		850/900	1800/1900
GSM/GPRS	TRP [dBm]	22	24,5
	TIS [dBm]	-99	-101,5
EGPRS	TRP [dBm]	20,5	19,5
	TIS [dBm]	-92,5	-93,5

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	Dual-band GSM 900/DCS 1800 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 RB865i 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

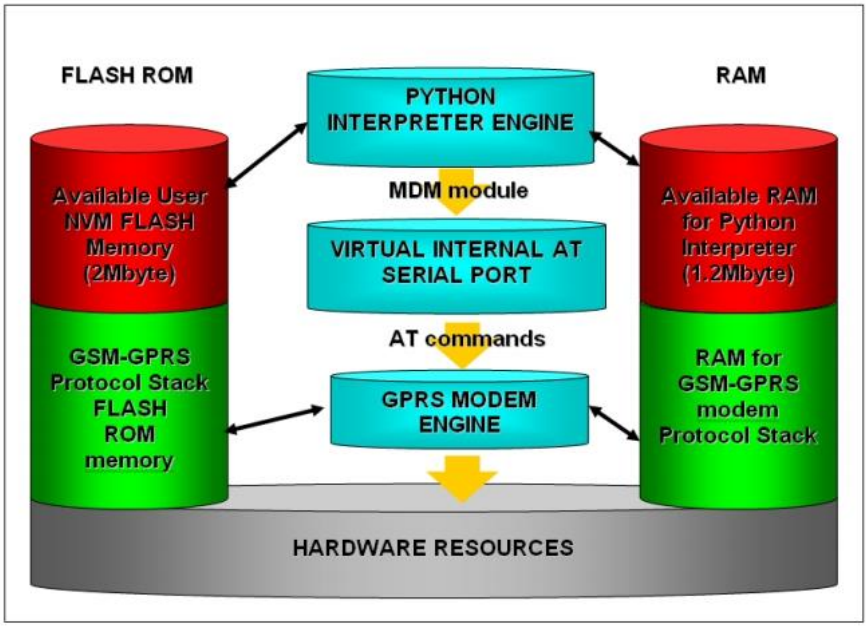
12. Python Script Interpreter

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.1.5.2+
- 1 MB (2 MB in versions up to 10.0x.xx5) 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:



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 or XP 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
- **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 *Telit_Easy_Script_Python.pdf* [5]

13. Safety recommendations

13.1. 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.

13.2. Care and Maintenance

The RB865i terminal is a electronic product that should be treated with care. Please follow suggestions shown below due to using modem for many years.

- Do not expose RB865i to any extreme circumstances like high temperature or high humidity
- Do not keep modem in dirty and dust places
- Do not disassemble the RB865i 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

13.3. 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.

14. Accessories

The tables below shows recommended accessories for RB865i terminal.

14.1. 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	5 V	

Example of power adaptor is shown in the picture below

Power adaptor 5 V

14.2. Additional accessories

Table below shows additional accessories that are not essential for modem usage.

Accessory	Description	Part no.
Magnetic antenna 2dBi	Antenna with extra gain	ANT-DBMAG
HandsFree headphones	Headphones and microphone	HF24

Magnetic antenna 2dBi ANT-DBMAG

HandFree headphones HF24

15. On-line support

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

- the latest version of this document
- the latest drivers for RB865i
- 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**
forum: www.elproma.fora.pl
tel.: **+48 (22) 751 76 80**
fax.: +48 (22) 751 76 81
skype: elproma.elektronika