

LE51868 S SW User Guide

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APPLICABILITY TABLE

PRODUCT
LE51-868 S

SW Version
GP.S03.00.01



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1. Introduction

1.1. Scope

Scope of this document is to present the features and the application of the SIGFOX® embedded firmware, available on the LE51.

1.2. Audience

This document is intended for developers who are using the LE51 modules and SIGFOX® embedded firmware.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

<http://www.telit.com/en/products/technical-support-center/contact.php>

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

<http://www.telit.com>

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.



1.4. Document Organization

This document contains the following chapters (sample):

["Chapter 1: "Introduction"](#) provides a scope for this document, target audience, contact and support information, and text conventions.

["Chapter 2: "LE51-SIGFOX architecture"](#) gives an overview of the features of the product.

["Chapter 3: "Configuring LE51-SIGFOX module"](#) describes in details how to configure the product.

["Chapter 4: "Serial Protocol Interface"](#) provides some fundamental hints about the serial protocol interface used in DATA mode.

1.5. Text Conventions



Danger - This information MUST be followed or catastrophic equipment failure or bodily injury may occur.



Caution or Warning - Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.



Tip or Information - Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.6. Related Documents



2. LE51-SIGFOX architecture

One of the keys to SIGFOX's incredibly competitive low throughput Machine-to-Machine and Internet of Things communication technology ultimately lies in its radio technology. This UNB, that stands for Ultra Narrow Band, technology uses free frequency radio bands (no license needed) to transmit data over a very narrow spectrum to and from connected objects.

Designed for low throughput transmission (10b/s and 1kb/s typical range), the UNB Wireless technology benefits from a high level of sensitivity. Data transportation becomes very long range (distances up to 40km in open field) and communication with buried, underground equipment becomes possible, all this being achieved with high reliability and minimal power consumption. Furthermore, the narrow throughput transmission combined with sophisticated signal processing provides effective protection against interference. This also ensures that the integrity of the data transmitted is respected.

2.1. SIGFOX network

SIGFOX provides an end-to-end solution for your transmission chain, from your equipment through to your information system. With a clear Internet focus and a specifically designed and tailored cloud service, SIGFOX's network uses web communication protocols that make it easy to integrate your applications.

SIGFOX's network is designed around a hierarchical structure:

- UNB modems communicate with base stations, or cells, covering large areas of several hundred square kilometers,
- Base stations route messages to servers,
- Servers check data integrity and route the messages to your information system.

2.2. LE51

LE51 is the UNB modem used to communicate in the SIGFOX® network. It allows user sending a great amount of data on the



serial port, up to 255 bytes per time, just using a simple serial protocol interface.

When the module receives a complete packet, the firmware will split the buffer in 'n' smaller buffers and send them on the air using the SIGFOX® protocol.

During sending period, the user can not send data across the serial port. It is mandatory using the hardware flow control, in this way the host connected to the module will be able to know if the module is able to receive data on the serial port.

It is possible to configure two parameters of serial port:

- Serial port baudrate
- Serial port timeout

The module has two different working modes:

- DATA mode
- COMMAND mode

When the module starts it is in DATA mode. While in Data mode the module is able to receive data from serial port and forward them on the air using SIGFOX® protocol.

If the user send on the serial port the sequence '+++' without any other bytes, he puts the module in COMMAND mode. In this state, the module is able to receive configuration commands. In the following all the available commands will be described.



3. Configuring LE51-SIGFOX module

In order to exit from data mode and be able to configure the module, the user shall send the command '+++>' and wait the answer **OK<cr>**.

It will be possible either to get or to set a register value-

In order to get a register value, the user shall send:

- **ATSxxx?< cr>**, where 'xxx' is the register address.
- The answer will be: **Sxxx=yy<cr>**, where 'xxx' is the register address and 'yy' the register value (up to 255, it depends to the available values).

In order to set a new register value, the user shall send:

- **ATSxxx=yy<cr>**, where 'xxx' is the register address and 'yy' the register value (up to 255, it depends to the available values).
- The answer will be **OK<cr>** or **ERROR<cr>**, it depends to the register value or register address or command syntax

3.1. Available registers

Register	Access	Register Name	Possible Values	Description
192	R	Serial Number		Serial Number of the radio module. The answer is only composed by the 11 characters of serial number followed by <CR> Ex: GPAJ4400018<CR>
210	R/W	Serial Time Baudrate	1: 1200 2: 2400 3: 4800 4: 9600 5: 19200 6: 38400 7: 57600 8:115200	



214	R/W	Serial Time Out	2 – 255 (ms)	Default value is 5 ms, but the software can change it automatically depending on the 210 register value
-----	-----	-----------------	--------------	---

After sending `ATS210=xxx` command, the serial speed is immediately changed, then the user shall change the serial speed also in the host controller.

3.2. Available commands

Every command listed below, must be followed by the `<cr>`.

- **ATR:** resets register default values
- **AT/V:** displays the modem's firmware version number as follows: `GP.S03.xx.yy-Bzzz<cr>GP.B00.mm.nn<cr>`, where the first part is the firmware version and the second part is the bootloader version.
- **ATBL:** escapes from the main program and run the bootloader
- **ATX:** put the module in DATA mode
- **AT/L:** displays the library version number as follows: `TLT.zz.yy-Txk.j.l<cr>`, where the first part is the Telit library version and the second part is the SigFox library version. (zz, yy, k, j and l are numbers)



4. Serial Protocol Interface

In order to avoid data loss or data error, we provide a serial protocol interface. The Serial protocol described in this chapter shall be used only when the module is in DATA mode.

Please note that this protocol must be used in conjunction with hardware flow control.

Frame format:

FIELD	LENGTH (bytes)	Possible values	Comments
Header	1	0xA5	
Length	1	0x00 – 0xFF	It's the payload length
Type	1	DATA - 0x01 KEEP - 0x02 BIT - 0x03 CONFIRM - 0x10	DATA: simple data KEEP: used to send a keep alive message as described in the SIGFOX standard; it's in charge to the user to send the keep alive message every 24 hours BIT: send a status bit following the SIGFOX protocol
Sequence Number	1	0x01 – 0xFF	It's in charge to user to put a valid value to recognize the association packet send – confirm received
Payload	0x00 – 0xFF	Up to customer	DATA: up to 255 bytes KEEP: must be omitted BIT: one byte with value 0 or 1
CRC	2	Up to customer	It's the sum of all bytes except header and tailer (lsb first)
Tailer	1	0x5A	



After receiving a packet on the serial, the firmware sends a confirm packet on the serial port to inform the user about success or packet error.

The confirm format is the same shown above, and the fields will be filled as follow:

Length: it's the payload length, usually 1

Type: it is the same type sent by the host ORed with CONFIRM value.

Sequence number: it's the same sent by the host

Payload: is the error code returned by the firmware

```
enum Ack
{
    NO_ERROR = 0,
    SERIAL_LENGTH_ERROR,
    SERIAL_CRC_ERROR,
    SERIAL_TAILER_MISS_ERROR,
    SERIAL_TIMEOUT_ERROR,
    SERIAL_GENERIC_ERROR,
    SFX_INIT_ERROR,
    SFX_SEND_ERROR,
    SFX_CLOSE_ERROR
}
```



In order to fulfill the ETSI 70-03 specification requirement regarding duty cycle on ISM band and to be aligned with Sigfox network management, each hour the application can send up to 72 Bytes (e.g., 6 messages of 12 bytes each).



5. ACRONYMS AND ABBREVIATIONS



6. Document History

Revision	Date	Changes
Rev0	2013-12-20	First issue

