STMICROELECTRONICS STM32L0 Ultra Low Power MCUs User Manual

Contents

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Product Information

The RYLR993 module is a LoRa SOC core-based device that uses the AT command set developed by REYAX for controlling the module. The module supports LoRaWAN communication and provides features such as activation by personalization, over-the-air activation, and long-range radio technology. The module also supports the use of keys, IDs, and EUIs for management purposes. Additionally, the module can be used to join and send data on the LoRa network and perform radio tests.

Product Usage Instructions

To use the RYLR993 module, the user must send AT commands to the module using a serial interface. The AT command set provided by REYAX consists of a series of short text strings that can be used to perform various operations such as joining the LoRa network, sending data to the network, and setting parameters. The user can also manage keys, IDs, and EUIs using the module.
For example, to join the LoRa network, the user can send the following command:

- AT+JOIN
  - To check the link status, the user can send:
- AT+LINKC
  - To send data to the LoRa network, the user can use the following command:
- AT+SEND
  - The RYLR993 module also supports radio test commands. To perform a radio test, the user can use the following command:
- AT+RADIO=1
  - For more detailed information on using the RYLR993 module, please refer to the product user manual.

General information

The document applies to the REYAX RYLR993 module that are LoRa SOC core-based devices.

Overview

The following sections contain the interface description, the AT commands definition, and the description of some use cases and of the embedded software.

AT commands

The AT command set is a standard developed by REYAX to control module. The command set consists of a series of short text strings for performing operations such as joining, data exchange and parameters setting. The AT commands are used to drive the LoRa module and to send data. The AT commands are sent through the UART.

- Baud rate: 9600
- Data: 8 bits
- Parity: none
- Stop: 1 bit
- Flow control: none

All commands are of the form AT+XXX, with XXX denoting the command. The following command behaviors are available:

- AT+XXX? provides a short help of the given command (such as AT+DEUI?).
- AT+XXX is used to run a command (such as AT+JOIN).
- AT+XXX=? is used to get the value of a given command (such as AT+CFS=?).
- AT+XXX=<value> is used to provide a value to a command (such as AT+SEND=2:Hello).

Output of the commands is provided on the UART. The output format is typically:

Considering:

- <value><CR><LF> is returned when help AT+XXX? and get AT+XXX=? commands are run.
- <CR> and <LF> stands for the carriage return and line feed.
- When no value is returned, then <value><CR><LF> is not returned at all.
- Every command, except ATZ (MCU reset), returns a status string, that is preceded and followed by <CR><LF>.
  Possible status are:
  - OK: command run correctly without error.
  - AT_ERROR: generic error
  - AT_PARAM_ERROR: parameter of the command is wrong.
  - AT_BUSY_ERROR: LoRa network is busy, so the command could not complete.
  - AT_TEST_PARAM_OVERFLOW: parameter is too long.
  - AT_NO_NETWORK_JOINED: LoRa network is not joined.

- AT_RX_ERROR: error detection during the reception of the command

More details on each command description and examples are given in the next sections. Each command preceded by # is provided by the host to the module, then the return of the module is printed.

AT_RX_ERROR

In case of AT_RX_ERROR, the command is corrupted when received in AT_Slave. Hence the command is not run.
However, in case of long commands, some spurious characters can still be in the queue, ready to be processed as a command. So, in case the user receives an AT_RX_ERROR, the user must first send <CR><LF> to purge the queue, and then send back the same command so that it is processed.

Example

AT command overview

Event table
The table below details the events that the AT_Slave application sends as a notification to the host module.

General commands

AT

Example:

AT?

Example:

ATZ – MCU reset

Example:

The displayed keys by command above after ###### (DevEUI, AppEui, and DevAddr) are just informative and not a command response.

AT+VL – Verbose level

Examples:

AT+LTIME – Local time in UTC format

Example:

AT+OPMODE – Set operating mode

Example:

Keys, IDs and EUIs management

AT+APPEUI – Application identifier

Examples:

AT+NWKKEY – Network root key

Examples:

AT+APPKEY – Application root key

Examples:

AT+APPSKEY – Application session key

Example:

AT+NWKSKEY – Network session key

Example:

AT+DADDR – Device address

Examples:

AT+DEUI – Device EUI

Examples:

AT+NWKID – Network ID

Examples:

Join and send data on LoRa network

AT+JOIN – Join LoRa network

Examples:

AT+LINKC – Link check request

Examples:

AT+SEND – Send data to LoRa network

Examples:

LoRa network management

AT+VER – Firmware version

Example:

AT+ADR – Adaptive data rate functionality

Examples:

AT+DR – Data rate

Note: To be able to set data rate, the ADR must be disabled.

Examples:

AT+BAND – Active region

Examples:

AT+CLASS – LoRa class

Examples:

AT+DCS – Duty cycle settings

AT+JN1DL – Join delay on Rx window 1

Examples:

AT+JN2DL – Join delay on Rx window 2

Examples:

AT+RX1DL – Delay of the Rx window 1

Examples:

AT+RX2DL – Delay of the Rx window 2

Examples:

AT+RX2DR – Data rate of the Rx window 2

Examples:

AT+RX2FQ – Frequency of the Rx window 2

Examples:

AT+TXP – Transmit power

Examples:

AT+PGSLOT – Ping slot

Example

Radio test commands

AT+TTONE – RF tone test

Example:

AT+TRSSI – RF RSSI tone test

Example

AT+TCONF – LoRa RF test configuration

Note: <pa>, <freqdev>, <lowdropt> and <BT> arguments are required by the command syntax but are not used on the B-L072Z-LRWAN1 platform.

Examples:

AT+TTX – Packets to be sent for PER RF TX test

Example:

AT+TRX – Packets to be received for PER RF RX test

Example:

AT+TTH – RF Tx hopping test

Example:

AT+CERTIF – Module in LoRaWAN certification with join mode

Examples:

AT+TOFF – RF test

Example:

Information

AT+BAT – Battery level

Example:

AT+TEMP – Temperature

Example:

Examples

Here are some basic examples that describe how to use the AT commands. In the following sections, commands provided by the host are preceded by #, and comments are embraced with /* */.

Join and send in unconfirmed mode

Join and send in confirmed mode

Rx received data
It is possible to retrieve data sent from a specified port, when +EVT:RX is received.

Class B enable request
The example below shows how to do a Class B request through an AT command sequence.

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Documents / Resources

	STMICROELECTRONICS STM32L0 Ultra Low Power MCUs [pdf] User Manual STM32L0 Ultra Low Power MCUs, STM32L0, Ultra Low Power MCUs, Low Power MCUs, Power MCUs

References

- REYAX: IoT Solution Provider Modules, Wireless Solution IoT Connectivity
- REYAX: IoT Solution Provider Modules, Wireless Solution IoT Connectivity