Low Power Modes

RM126x Series Modules

Application Note *v2.0*

Introduction

The RM126x series modules have two power modes (in AT firmware):

- **Run mode** – Factory default mode for the RM126x series where the low power UART is disabled which allows AT commands to be sent over UART. At power up, the AT firmware maintains the UART in an on state waiting to receive AT commands.
- **Sleep mode (Low Power UART Mode) –** The module is placed in Sleep mode (also called Low power UART mode in AT firmware user guide document). The module wakes up from sleep if any LoRa event occurs or UART activity is required.

This guide demonstrates the current consumption of sleep mode using the AT firmware by putting the module into constant sleep (no LoRa activity and low power UART enabled, etc.).

Requirements

- Current measuring digital multimeter (DMM) that can measure down to 0.4uA. For this document, the Fluke 289 is used. The Fluke85 is also suitable.
- Use the appropriate RM126x series development board and AT firmware specific for the particular RM126x series module.

Table 1: Development Board, AT Firmware and Bootloader part numbers

Development Kit Part Number and Description	AT Firmware Part Number and Description	Bootloader
453-00140-K1 Development Kit, RM1261, SX1261, MHF4	480-00214-R127.4.1.461	480-00323-R1.0.24
453-00139-K1 Development Kit, RM1262, SX1262, MHF4	480-00215-R128.4.1.461	480-00324-R1.0.24

- RM126x series AT firmware for the particular module variant can be found at: https://github.com/LairdCP/RM126x_Firmware
- Windows PC and Micro USB to USB (Type-A) Cable – provided with development kit.
- UwTerminalX by Ezurio available at https://github.com/LairdCP/UwTerminalX/release
- For programming instructions, see User Guide – Firmware Options and Upgrading – RM126x Series

Development Kit Setup

To set up the RM126x series development board, complete the following steps:

1. Modification 1: Cut solder bridge SB3 (on bottom side of board) and solder 2-pin header into J5, as shown in Figure 1.
2. To measure the module's current consumption, connect the current measuring DMM to J5 on the board (Figure 1).

   Note: After the test is complete, remember to replace the jumper on J5.

3. Connect the RM126x series development board to PC via USB cable.
4. For more information on the RM126x series development kit, see the RM126x series DVK User Guide at: https://www.ezurio.com/rm126x-series

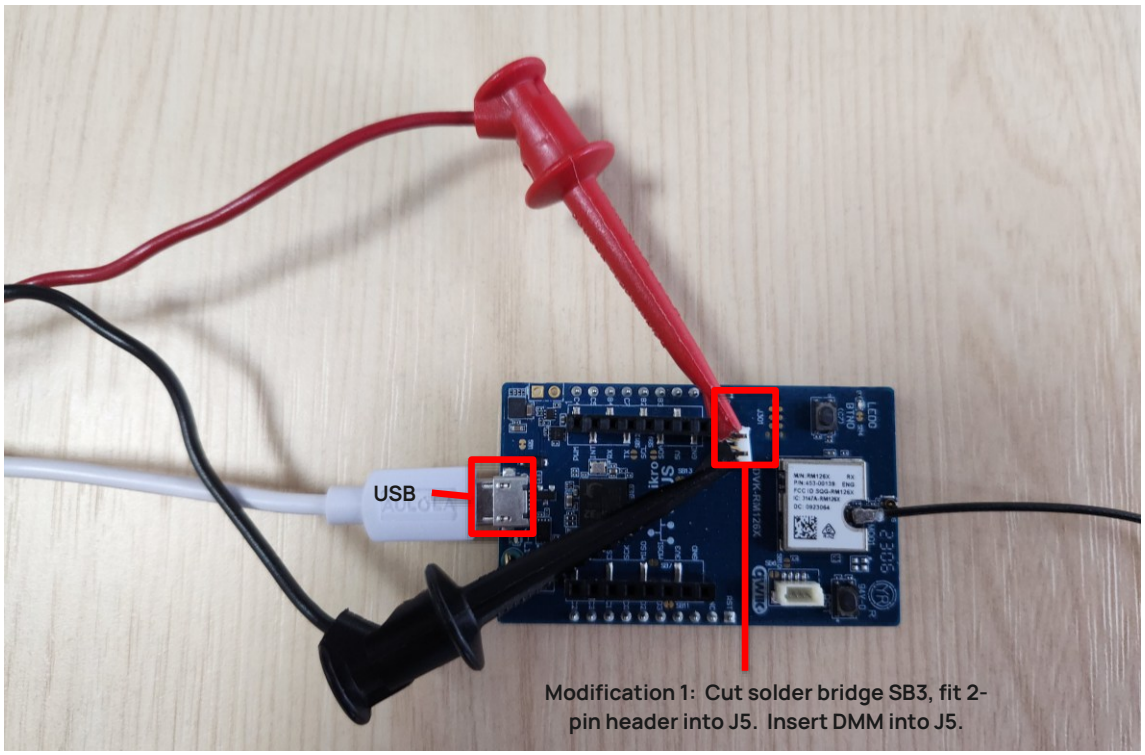

Figure 1: RM126x series development board modifications for adding J5 pin header (cut SB3)

Entering AT Firmware Low Power Sleep Mode over the UART

1. Connect the RM126x series development board USB connector to your PC via the included USB-A to USB micro cable.
2. Ensure that the current measuring DMM is connected to J5 before the development kit is powered up (or else the board will not be powered).
3. Ensure that the Windows Device Manager displays a new virtual COM port for the USB to Serial adapter.
4. Open UwTerminal with the settings shown in Figure 2.

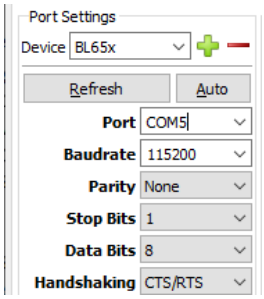

Figure 2: COM port settings

5. Press **Return**. For modules where low power UART operation is disabled, a response of *OK* will be displayed as shown in Figure 3.

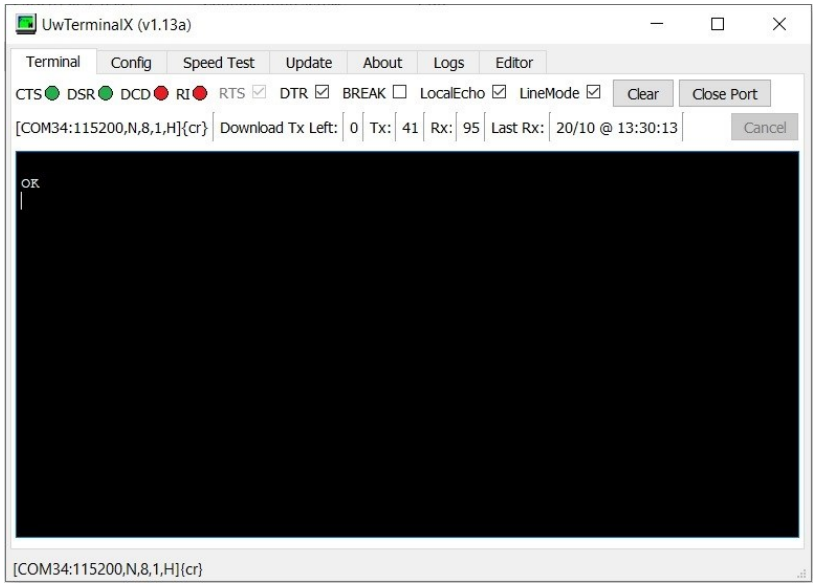

Figure 3: Press return key, response ok

If low power UART operation is enabled, the expected response is shown in Figure 4.

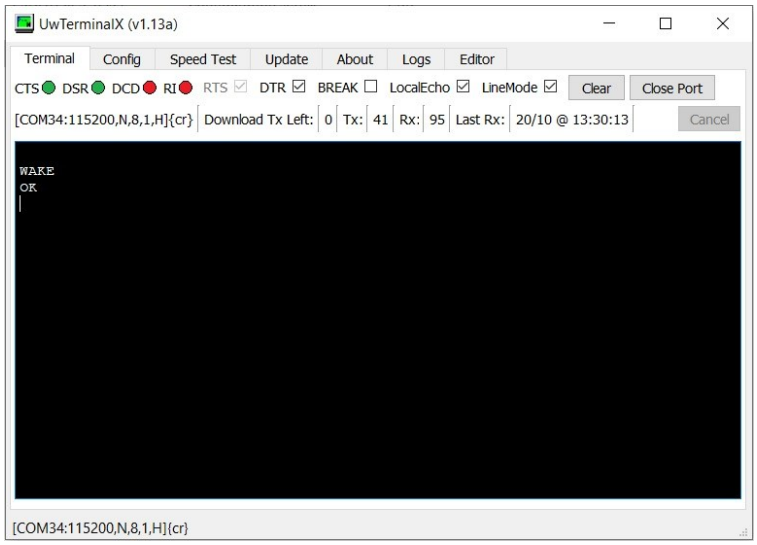

Figure 4: Response for initial message with low power UART enabled

6. Set the UART Idle Time delay in milliseconds to be used before entering low power mode. In this example we use 1000ms (1s). Any value between 500 and 30000 can be used.

Note: Setting a value less than 500 disables the low power UART operation.

Note: The first command received when waking up from low power UART mode is discarded, with wake up being indicated by the WAKE asynchronous response.

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7. Change the UART Idle Time by sending the command **ATS213=1000** and press **Return**. Response is *OK*. See Figure 5.

Note: The following assumes low power UART operation is disabled.

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8. Save this to the non-volatile memory by sending the command **AT&W** and then press return key. Response is *OK*.
9. Reset the device by sending the command **ATZ** and pressing **Return**. Response is *OK*. Refer to Figure 5.

```
ats213=1000

OK
at&w

OK
atz

OK
```

Figure 5: AT commands sent and responses

10. Sleep (Low power mode in AT firmware) is now active. To exit Sleep mode, a command must be sent to wake the UART up. A carriage return character is sufficient to achieve this. Wake up of the UART is indicated by the module outputting the WAKE asynchronous response. Upon receipt of the WAKE response, AT commands can be sent as usual. The UART will re-enter low power mode upon no activity of the UART for the time configured via the UART Idle Time non-volatile parameter.

Measured Sleep Mode Current Consumption - 453-00140-K1 – Development Kit, RM126x – RM1261 Module

1. The measured sleep current is 1.96uA in Figure 6. The sleep current target is about 2.1uA, which is typical at 25°C temperature.

Figure 6: RM1261 LoRa PCB Module Sleep current at 25°C temperature with AT firmware

Note: Once you're done with the current measurement, place the jumper back on J5. Otherwise, the RM126x series module is not powered through the USB port; it is powered parasitically instead.

Note: In low power sleep mode the module's SoC is in EM2 mode, 32kB RAM with full RAM retention with RTC running from LFXO (1.4uA), SoC Radio RAM retention is disabled (-0.25uA) and the BURTC is running in EM2 (0.37uA). The Semtech SX1261 radio is in Sleep mode with Warm Start (0.6uA). The typical current consumption expected is therefore 2.1uA.

Measured Sleep Mode Current Consumption - 453-00139-K1 – Development Kit, RM126x – RM1262 Module

1. The measured sleep current is 1.9uA in Figure 7. The sleep current target is about 2.1uA, which is typical at 25°C temperature.

Figure 7: RM1262 PCB Module Sleep current at 25°C temperature with AT firmware

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Note: Once you're done with the current measurement, place the jumper back on J5. Otherwise, the RM126x series module is not powered through the USB port; it is powered parasitically instead.

Note: In low power sleep mode the module's SoC is in EM2 mode, 32kB RAM with full RAM retention with RTC running from LFXO (1.4uA), SoC Radio RAM retention is disabled (-0.25uA) and the BURTC is running in EM2 (0.37uA). The Semtech SX1261 radio is in Sleep mode with Warm Start (0.6uA). The typical current consumption expected is therefore 2.1uA.

Further Information

Additional documents are also accessible from the Documentation tab in the RM126x Series Product Page.

Revision History

Version	Date	Notes	Contributor(s)	Approver
1.0	20 October 2023	Initial Release	Raj Khatri Greg Leach	Senthooran Ragavan
1.1	4 December 2023	Updated UART Idle Time with lower limit enforced from firmware release 1.3.	Greg Leach	Senthooran Ragavan
2.0	22 Apr 2025	Ezurio rebranding	Sue White	Dave Drogowski

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