

EMB-LR-Picocell

User Manual



Rev 1.4

Embit S.r.l.

Document information

Versions & Revisions

Revision	Date	Author	Comments
1.0	2021-02-09	Embit	Initial release
1.1	2021-06-17	Embit	Added installation guide
1.2	2022-11-21	Embit	Aligned to the new Hardware release
1.3	2023-03-7	Embit	Aligned to new web interface
1.4	2025-11-06	Embit	New Operating System Version

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1 Introduction

The EMB-LR-Picocell gateway is a multi-service platform designed to meet the requirements of IoT (Internet of Things) and M2M (Machine-to-Machine) scenarios. It integrates the EMB-LR1302-mPCIe card and the Semtech Packet Forwarder to provide LoRaWAN® 868 MHz connectivity, acting as a fully compliant LoRaWAN® Gateway.

Key Features:

- **LoRaWAN® Connectivity:** Based on the EMBIT Mini PCI-express board, EMB-LR1302-mPCIe, it offers LoRaWAN® packet forwarder functionality.
- **Network Connectivity:** Provides TCP/IP connection via Ethernet.
- **Radio Performance:** Thanks to the Semtech® SX1302 performance and efficient EMBIT RF design, it achieves radio ranges of up to 15 km in rural areas and up to 3 km in urban environments.
- **Operating System:** Linux-based, offering an integrated web interface for managing and configuring network protocols.
- **Power Supply:** The device is powered via 5 VDC Power Supplier

This guide explains how to start using the EMB-LR-Picocell and will describe its functionalities in detail in the following paragraphs.

2 Hardware Specification

- Processor: CPU ARM Cortex-A72 quad-core a 64 bit da 1,5 GHz
- RAM Memory: 2 GB, LPDDR4 DRAM
- Flash Memory: 8/16/32 GB, eMMC Flash Memory
- LAN Connection: Ethernet RJ45 10/100/1000 Base-T
- LoRa® Connectivity: EMB-LR1302-mPCIe
- Receiver Sensitivity: down to -141 dBm @ SF12 BW 125kHz
- Power Source: 5 VDC
- Ports: Ethernet 10/100/1000 RJ 45 / 1 SMA Antenna Connector / Power Supply Connector
- Operating System: Debian 13 "Trixie" based Operating System
- Average Power consumptions: 9 watts

3 LoRaWAN® Features Overview

In this network Architecture, three main roles are defined:

- **End-Device:** endpoints with sensors embedded;
- **Gateways:** they provide LoRaWAN® wireless connectivity to the devices. They are the connection between the devices and the IP backhaul network to the Network Server;
- **Network Server:** the intelligence of the network. It is centralized radio controller, which performs radio management, the provisioning and authentication of devices, and the delivery of the data to one or multiple application servers through a set of Application Programming Interfaces (APIs).

Another role is the **Application Server**. It is managed by the final customer and it is put on top of the Network Server *. Full Network Image follows.

NOTE: nowadays the most common Network Server, such as The Things Network, Chirpstack, and more, also integrates the Application Server functionalities and configurations in their web interface.

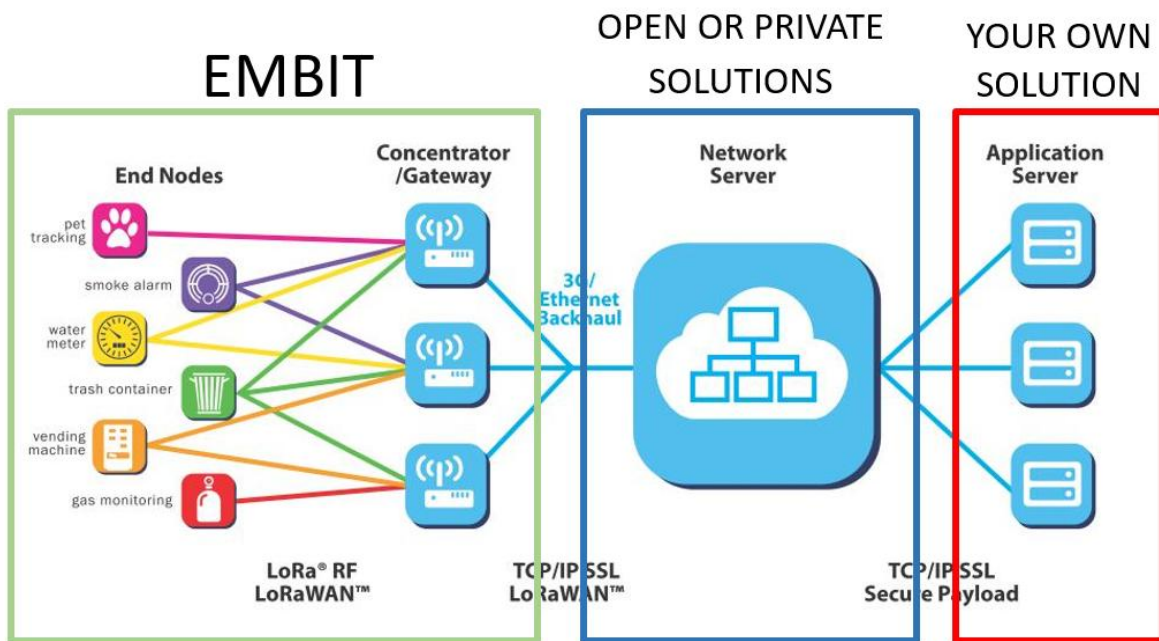


Figure 5 - LoRaWAN® Network Architecture

Each communication is fully encrypted with three keys, each one with a length of 128 bits. The algorithm used for it is AES-128. These algorithms have been analyzed by the cryptographic community for many years, are NIST approved and widely adopted as a best security practice for constrained nodes and networks.

EMB-LR-Picocell provides LoRaWAN® 868 connectivity up to 3 km in urban area and up to 15 km in rural environment.

The RF path is fully compliant to Semtech® specifications and it is able to achieve a Receiver Sensitivity up to -141 dBm.

4 Gateway Features & Web User Interface

The **EMB-LR-Picocell** runs a Debian Linux-based operating system, customized by Embit to optimize both peripheral management and device power consumption.

The system provides a Web User Interface (Web UI) that allows monitoring, management, and configuration of all aspects related to radio communication protocols. In addition, the Web UI enables the user to perform basic system administration tasks.

The interface can be accessed from any web browser at the following address:

[https://\[gateway_IP_address\]:10000](https://[gateway_IP_address]:10000)

4.1 Network Connections

The **EMB-LR-Picocell** supports a backhaul IP connection through the Ethernet RJ45 port. The IP Address is assigned through DHCP.

The **EMB-LR-Picocell** is accessible by default through:

- HTTPS connection at port 10000 – Cockpit Interface.
- SSH connection at standard port 22, with username and password.

The device has LLNMR enabled (it exposes port 5355) to allow name resolution in local networks without a DNS server.

4.2 Users & Password Management

4.2.1 Standard User: user

The default customer account is **user**, which is created with the password **embit**.

On the first login, the user will be required to change this password to one that complies with the system's minimum-security requirements:

- Minimum length: 8 characters
- At least 1 uppercase letter
- At least 1 lowercase letter
- At least 1 number
- At least 1 special character

The user account is intended for customer operation through the Cockpit web interface. From the CLI, the account has only the permissions granted to non-privileged Linux users and cannot perform administrative tasks.

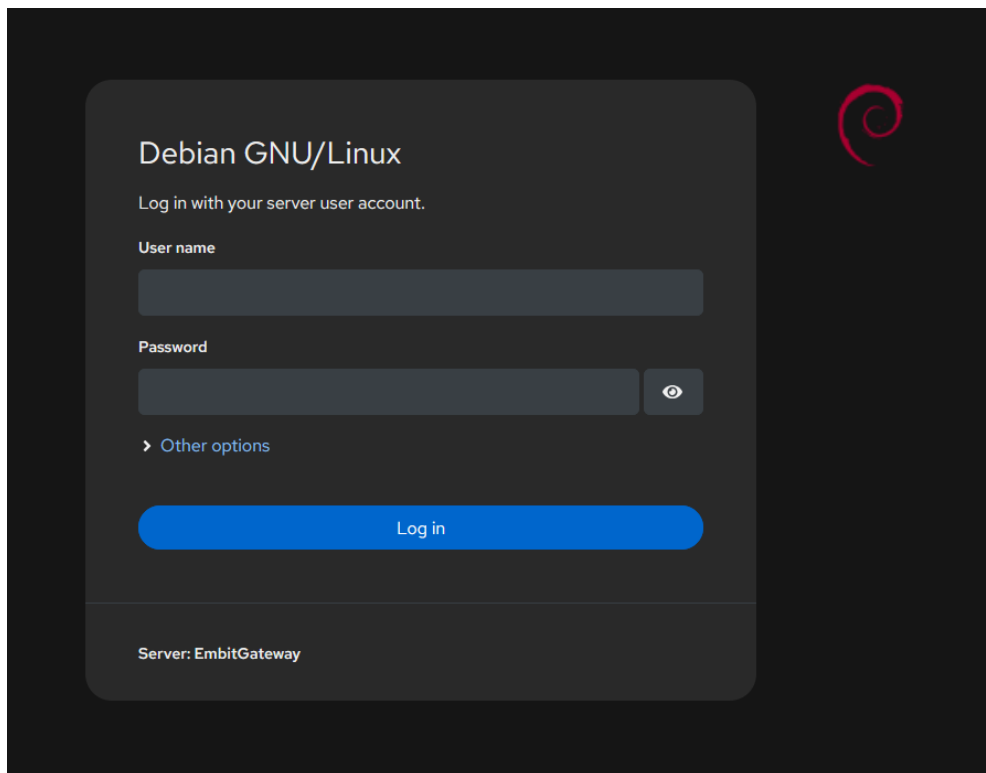


Figure 6 - Login Page

4.2.2 Full Root Access

If advanced access is required (e.g., for development purposes), an **administrator** user with full root capabilities can be provided, upon explicit agreement with *Embit S.r.l.*

- The admin account is created by Embit during factory testing with username and password provided by the end customer, that must comply with the same minimum-security requirements listed above for the “Standard User”.
- The administrator user can escalate privileges and become root, granting full control over the system through *sudo* command.

4.2.3 Password Change in Cockpit Web UI

You can change your password as a Standard User from the “Accounts” Tab.

(If you have the *administrator* account, you can manage also other users’ passwords).

When changing a password through the Cockpit web interface, the system enforces predefined security requirements.

- If the entered password does not meet these requirements, Cockpit will display a warning and ask whether the user wants to “*force the use of an insecure password.*”

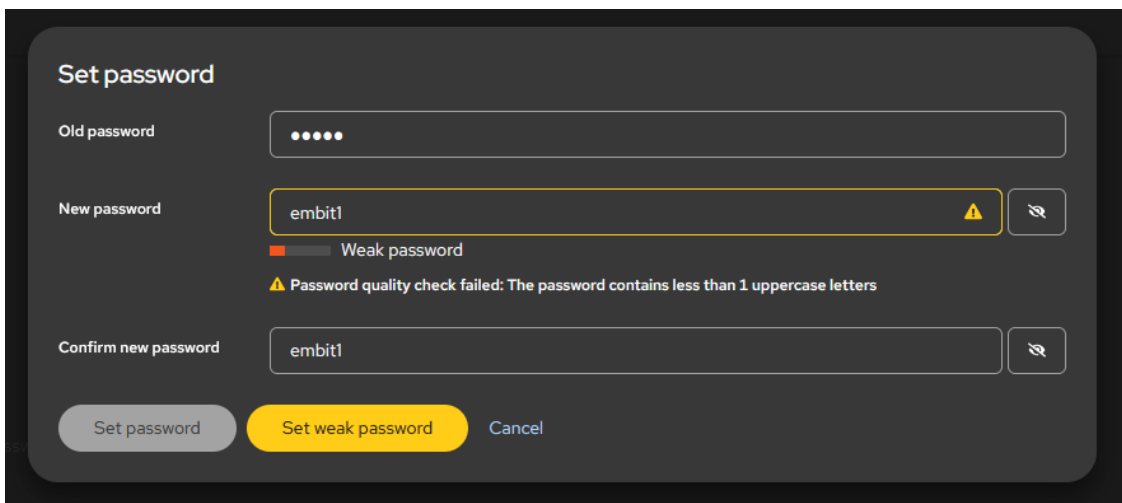


Figure 7 - “Set weak password” warning

- Cockpit also provides a password strength indicator. Please note that this indicator is independent from the system’s actual requirements. For example, a password such as *Test123!* fully meets the minimum requirements and will be accepted, even though the indicator may classify it as “weak”; this indicator shows the actual strength of the password.

Administrator behavior: The *administrator* user can override Cockpit’s warnings and set any password, even if it does not comply with the system requirements.

User behavior: The *user* account cannot force the setting of a weak or non-compliant password. Even if Cockpit displays the option, the system will reject such passwords.

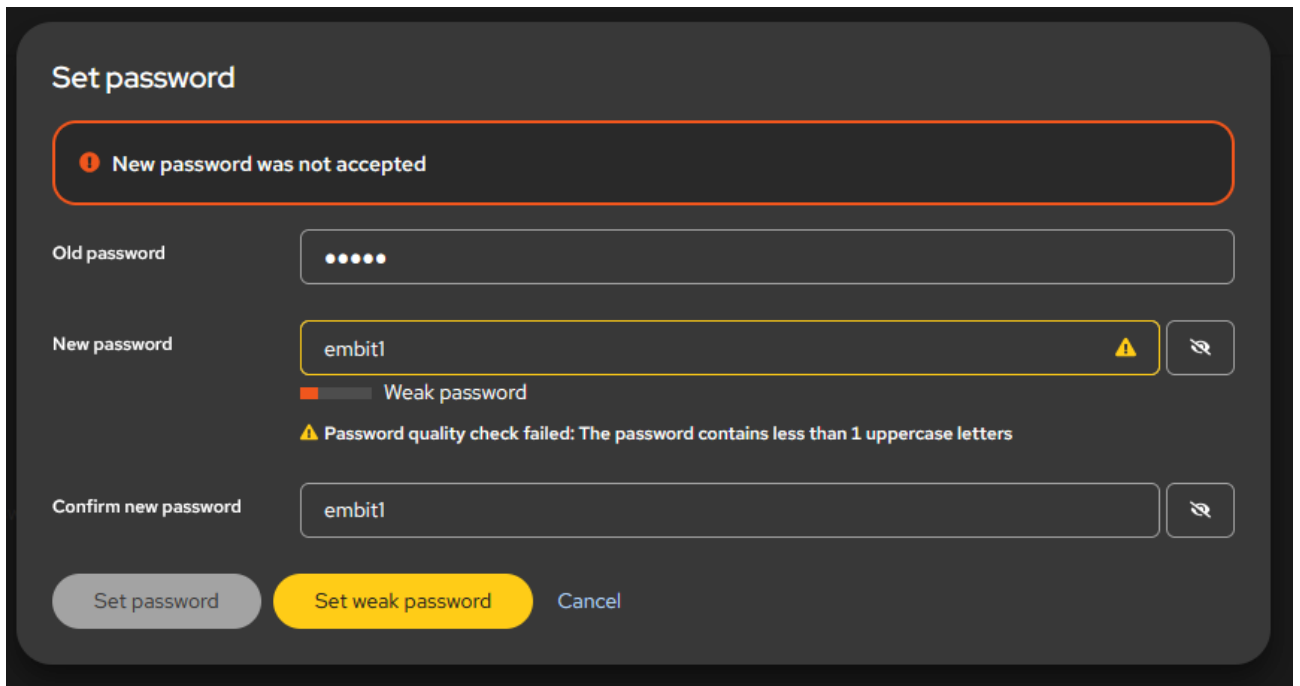


Figure 8 - Weak password enforcement error

4.3 **Embit Page – Gateway Configuration**

All configurations related to the Gateway's functionalities are available to the user in the "Embit" tab, located on the left side of the Cockpit interface.

4.3.1 **LoRaWAN**



Figure 9 - LoRaWAN Configuration

This section serves as your central control panel for configuring and managing the LoRaWAN connectivity of your gateway. At the top-right, you'll find a toggle switch that allows you to easily enable or disable the entire LoRaWAN functionality of the device, giving you immediate control over its operation. You'll also see essential identifiers displayed, such as the **Gateway EUI**, which is your device's unique 64-bit identifier necessary for registration with any LoRaWAN Network Server, and the **LoRaWAN Region**, indicating the specific frequency plan (e.g., EU868) your gateway is configured to operate within. The **LoRaWAN Card** field provides information about the installed LoRaWAN module.

Below these identifiers, you can define your connection to a LoRaWAN Network Server.

- **Network Server** field: hostname or IP address of the LoRaWAN Network Server your gateway will communicate with. By default this field is set to *eu1.cloud.thethings.network*.
- **Network Server Port** specifies the UDP port number used for this communication, commonly set to 1700.

NOTE: It is recommended to turn off the packet forwarder before configuring new parameters, and turn it back on afterwards.

4.3.2 Support VPN

The device includes a "Support VPN" feature, which provides a secure VPN interface to Embit's private VPN support server. This functionality is disabled by default. It can be explicitly enabled by the customer upon request to facilitate remote assistance and troubleshooting by Embit R&D Team, ensuring secure access to the device for diagnostic and support purposes.

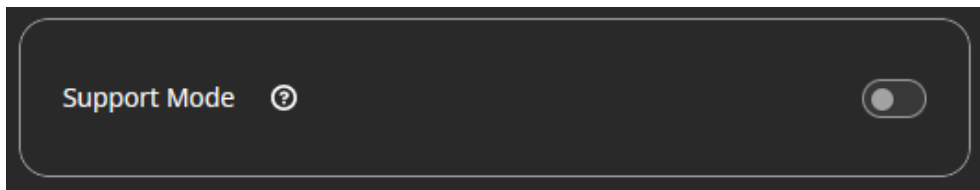


Figure 10 - Support VPN Connection Toggle

4.3.3 System Updates

Standard *user* is able to update system packages to keep the system up to date and protected from security bug in system packages.

The "Software updates" tab, provides a clear overview of available updates, categorized into "security" and general updates. While this interface displays the updates, users without root privileges are prevented from directly utilizing the update buttons for security reasons.

Instead, to ensure a controlled and secure update process, such users must execute the appropriate update commands via the terminal:

- **sudo apt update:** Refreshes the list of available software packages from repositories, showing what *can* be installed or upgraded.
- **sudo apt upgrade:** Installs newer versions of *already installed* packages without removing or installing new ones.
- **udo apt dist-upgrade:** Performs a full system upgrade, intelligently handling dependency changes by installing new packages or removing old ones as needed.

This approach enhances system integrity by requiring explicit command-line execution for all system modifications.

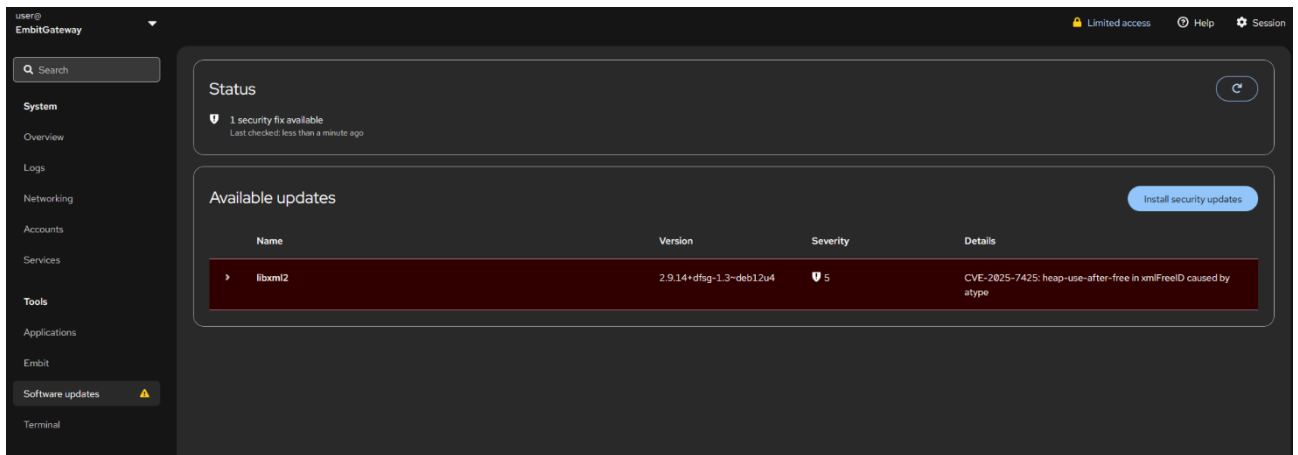


Figure 12 - Software Updates Tab

4.3.4 Gateway Registration on LoRaWAN Network Server

You can find every information about "Gateway Registration" on The Things Industries Network Server following the video-guide at: [The Things Industries](#)

5 Disclaimer of Liability

The user must read carefully all the documentation available before using the product. In particular, care must be taken in order to comply with the regulations (e.g., power limits, duty cycle limits, etc.).

The information provided in this and other documents associated to the product might contain technical inaccuracies as well as typing errors. Regulations might also vary in time. Updates to these documents are performed periodically and the information provided in these manuals might change without notice. The user is required to ensure that the documentation is updated and the information contained is valid. Embit reserves the right to change any of the technical/functional specifications as well as to discontinue manufacture or support of any of its products without any written announcement.

5.1 Handling Precautions

This product is an ESD sensitive device. Handling precautions should be carefully observed.

5.2 Warranty

Any operation involving a modification to the device's internal components will void the warranty.

Furthermore, in the event of unlocked root access, Embit S.r.l. will not be held responsible for any operating system malfunction caused by customer modifications, whether reversible through remote intervention or irreversible without on-site maintenance by Embit S.r.l.

5.3 Trademarks

Embit is a registered trademark owned by Embit s.r.l.

All other trademarks, registered trademarks and product names are the sole proprietary of their respective owners.