RAK831 Pilot Gateway
Product Specification V1.0

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1. Overview

RAK831 Pilot Gateway is targeted for a huge variety of applications like Smart Metering, IoT and M2M applications. It is a multi-channel high performance Transmitter/receiver module designed to receive several LoRa packets simultaneously using different spreading factors on multiple channels. RAK831 Pilot provides the possibility to enable robust communication between a LoRa gateway and a huge amount of LoRa end-nodes spread over a wide range of distance.

This is a ideal Pilot to help you realize the whole Lora system development, you can quickly to make the software development,This is very economic way to address for a huge variety of applications like Smart Grid, Intelligent Farm,intelligent Farm and Other IoT applications.

RAK831 Pilot is able to receive up to 8 LoRa packets simultaneously sent with different spreading factors on different channels. This unique capability allows to implement innovative network architectures advantageous over other short range systems.

End-point nodes (e.g. sensor nodes) can change frequency with each transmission in a random pattern. This provides vast improvement of the system robustness in terms of interferer immunity and radio channel diversity.

RAK provide the enclosed product(s) under the following conditions: This evaluation board/kit is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by RAK to be finished end-product fit for general consumer use. Persons handling the product must have electronics training and observe good engineering practice standards. As such the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing related protective considerations, including product safety and environmental measures typically found in the products that incorporate such semiconductor components or circuit boards.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further the user indemnifies RAK from all claims arising from the handling or use of the goods. Due to the open construction of the product, it’s the user responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

NOTE: EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT SPECIAL INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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2. Introduction

The RAK831 Pilot Gateway is a device that consists of a Raspberry-Pi 3, an RAK831 LoRa Concentrator and a converter board with GPS module, Adding a heat sink on top of RAK831 module. Built with an aluminum housing.

RAK831 uses the SX1301 chip from Semtech, the SX1301 chip built-in LoRa concentrator IP core, is a massive digital signal processing engine. RAK831 is able to receive up to 8 LoRa packets simultaneously sent with different spreading factors on different channels. This unique capability allows to implement innovative network architectures advantageous over other short range systems.

The RAK831 Pilot Gateway can used as a ready to use LoRaWAN Gateway that can be connected to a LoRaWAN server. It is meant to be used as demonstration system for the LoRaWAN network system. It is not designed to be a full featured outdoor gateway.

Please operate the Pilot Gateway only indoor and in combination with the delivered power supply and antenna. The RAK831 Pilot Gateway is shown as below.



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3. System Structure

Following figure shows the basic system concept for the LoRaWAN system. The RAK831 Pilot Gateway is the central hardware solution for all LoRa based radio communication. It receives and transmits radio messages. Processing of the radio messages as well as the protocol related tasks is done by the embedded host system (Raspberry Pi). Received and processed radio messages are being sent to a LoRaWAN server. The concrete segmentation of the protocol related tasks is outside the scope of this document.

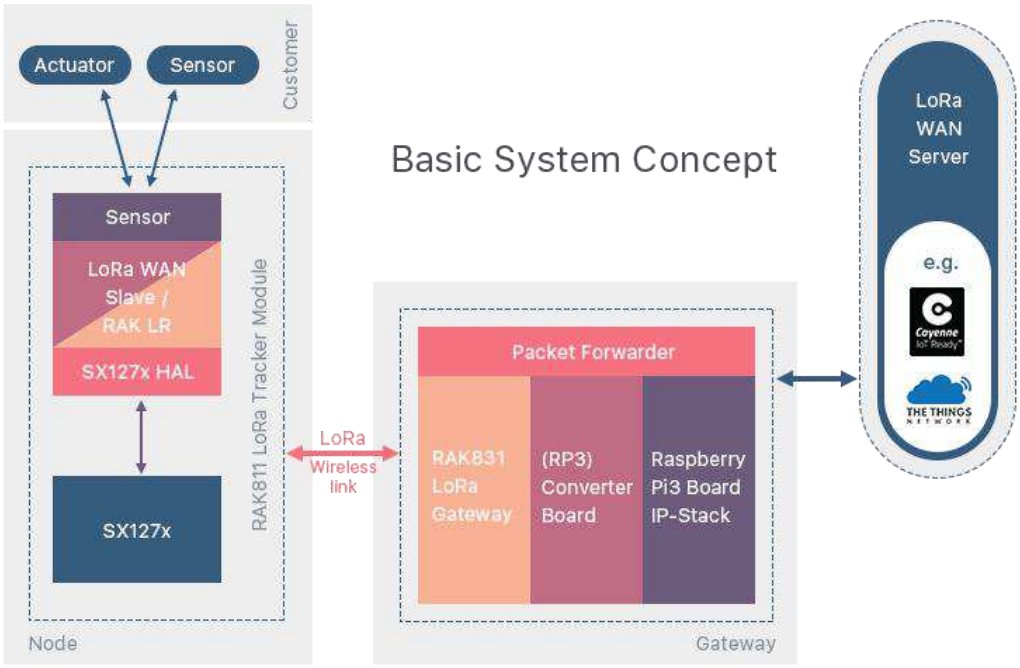


Figure 3.1: System Structure

The pre-installed github repositories are:

“lora_gateway” (V5.0.1) https://github.com/Lora-net/lora_gateway

“packet_forwarder” (V4.0.1) https://github.com/Lora-net/packet_forwarder

Note:Both repositories have been installed on the folder /home/pi/github.

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4. Technical Features

Parameter	Description
Computing	Resaberry pi 3(Liunx)
Protocol	LoRaWAN 1.0.2
Lora Chipset	SX1301 base band processor, 70 dB CW interference suppression when 1 MHz offset; Able to work with negative SNR and CCR up to 9dB; Emulation 49x LoRa demodulator and 1x (G) FSK demodulator; Dual digital TX&RX radio front-end interface; 10 programmable parallel demodulation paths; Dynamic data rate (DDR) adaptation; True antenna diversity or simultaneous dual band operation.
Frequency Range	470MHz, 868MHz, 915MHz
Supply Voltage	VDD: 5V-2.5A
Interfaces	Front: USB power, HDMI, Audio Left: GPS Antenna, LoRa Antenna,1xTF Card, 2xLED(indication the status of TX or RX) Right: LAN, 2xDual USB Port
Antenna	SMA(female) for GPS Antenna, SMA(male) for LoRa Antenna
Range	Urban2~4km/Subur5~10km/Open Area>15km
Current Consumption	Depending on the operating mode up to 2300mA
RX Sensitivity	Down to -142.5 dBm
TX Power	Up to 25.5dBm at setting 27 dBm
Max RF Output	Up to +25 dBm
Mean RF Output	Up to +23 dBm
Modulation	LoRa™/FSK
Operation Temperature	0℃ ~ 70℃
Relative Humidity	20%~75% non condensing
Housing	Top cover, body, bottom cover with riveted motherboard standoff
Application Environment	Indoor
Size	92mm x 68.3mm x 53.5mm

Table 4.1: Technical Features

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5. Hardware

The RAK831 Pilot Gateway consists of a Raspberry-Pi 3, an RAK831 LoRa Concentrator and a converter board with GPS for routing the signals between the Raspberry and the RAK831. For detailed information on RAK831, please refer to the datasheet as:

http://docs.rakwireless.com/en/RAK831%20LoRa%20Gateway/Hardware%20Design/RAK831%20Datasheet%20V1.3.pdf

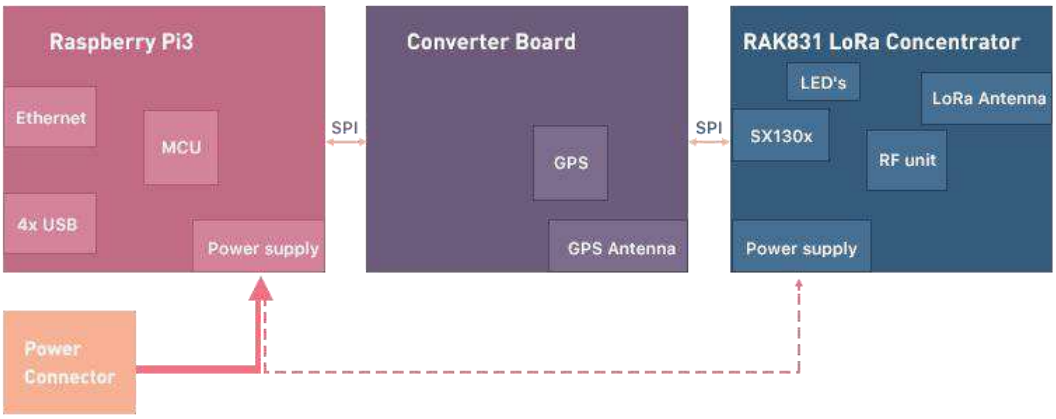


Figure 5.1: Hardware structure

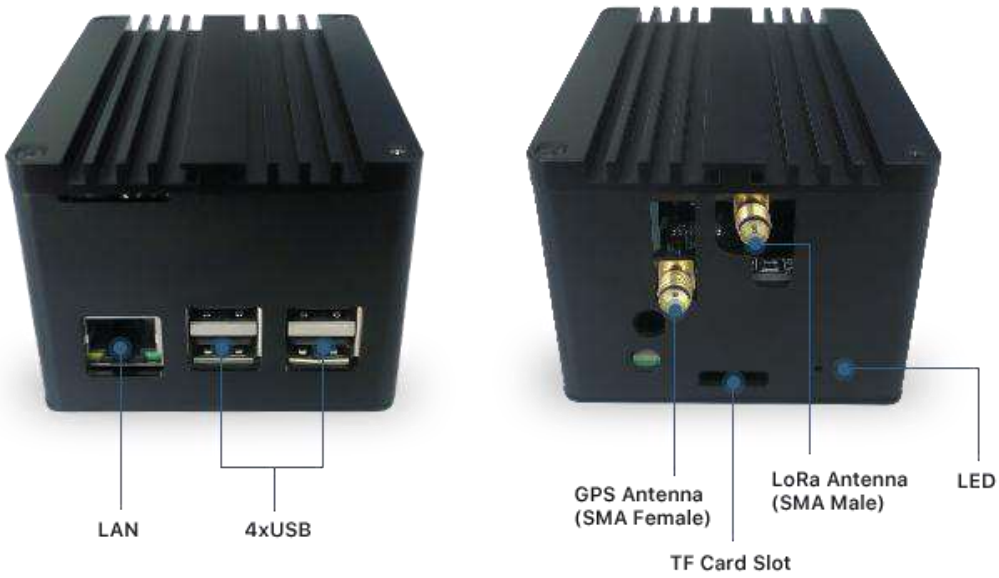


Figure 5.2: Hardware Interface-1

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Figure 5.3: Hardware Interface-2



Figure 5.4: 5V-2.5A power supply

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6. RF Characteristics

6.1. Transmitter RF Characteristics

The RAK831 Pilot Gateway has an excellent transmitter performance. It is highly recommended, to use an optimized configuration for the power level configuration, which is part of the HAL. This results in a mean RF output power level and current consumption.

PA Control	DAC Control	MIX Control	DIG Gain	Nominal RF Power Level [dBm]
0	3	8	0	-5
0	3	9	0	-3
0	3	11	0	0
0	3	15	0	3
1	3	9	0	6
1	3	11	0	10
1	3	12	0	11
2	3	8	0	12
2	3	9	0	13
1	3	15	0	14
2	3	10	0	15
2	3	11	0	16
2	3	11	0	17
2	3	12	0	18
2	3	13	0	19
2	3	14	0	20

Table 6.1: RF outout power level

T=25℃,VDD=5V(Typ.) if nothing else stated.

Parameter	Condition	Min	Typ.	Max	Unit
Frequency Range		863		870	MHz
Modulation Techniques	FSK/LoRa™				
TX Frequency Variation vs. Temperature	Power Level Setting:20	-3		+3	KHz
TX Power Variation vs. Temperature		-5		+5	dB
TX Power Variation		-1.5		+1.5	dB

Table 6.2: TX Power Variation

Note：Also support 470/868/915 Frequency Range.

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6.2. Receiver RF Characteristics

It is highly recommended, to use optimized RSSI calibration values, which is part of the HAL v3.1. For both, Radio 1 and 2, the RSSI-Offset should be set -169.0.

The following table gives typically sensitivity level of the RAK831 Pilot Gateway:

Signal Bandwidth/[KHz]	Spreading Fachor	Sensitivity/[dBm]
125	12	-137
125	7	-126
250	12	-136
250	7	-123
500	12	-134
500	7	-120

Table 6.3: sensitivity level

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7. Ordering Information

P/N	Band Frequency
RAK831 Pilot Gateway_470	465~475MHz
RAK831 Pilot Gateway_868	865~872MHz
RAK831 Pilot Gateway_915	902~928MHz

Table 7.1: ordering information

We also can help customer to build customize version, please contact with your sales window to get the detail information.

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8. Contact information

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9. Change Note

Version	Date	Modify content	Arthur
V1.0	2018-06-21	Create the document	Farce
V1.0	2018-07-02	Add technical feature , modify the format	Penn

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