RAK Hotspot Miner

longfi™

Helium LongFi Compatible

Overview

Hotspot Details

- Efficient miner for a new cryptocurrency, Helium (HNT)
- Complete set-up in minutes using a smartphone
- LongFi technology maximizes range and battery life without Wi-Fi, cellular or Bluetooth
- Low Power – only uses about the same amount as an LED light bulb (5W)
- Easily manage Hotspots and tokens from the mobile app
- LongFi™ Technology

Helium LongFi is a technology architecture that combines a leading wireless technology, LoRaWAN, and the Helium Blockchain. LongFi is optimized for miles of range, and long battery life for IoT devices.

Proof-of-Coverage

RAK Hotspot Miners earn Helium when devices connect, and for validating wireless coverage delivered by peers. Using a system called Proof-of-Coverage, RAK Hotspot Miners earn more Helium when they're in range of other RAK Hotspot Miners, but need to be at least 300 meters apart.

Range depends on the environment, for rural areas up to 10 miles or more, but for more dense areas up to a mile. Single RAK Hotspot Miners earn less as they can only issue Challenges over the internet, and can't participate in Proof-of-Coverage.

Cover Your City in Miles of Wireless Coverage

- Deliver may square miles of coverage from a single RAK Hotspot Miner
- Based on initial testing, only about 50 to 100 RAK Hotspot Miners are needed to provide complete coverage for an entire city

Connect Anything

- Create a new global network for billions of devices
- Any IoT device can become Helium-enabled using readily available off-the-shelf hardware components, software, and a reference design that is open source for anyone to improve upon

Features

- Computing with Raspberry Pi4 (Linux)
- 2GB on-board RAM
- 32GB SD card
- Based on the LoRa Concentrator Engine: Semtech® SX1302
- Built-in Ublox ZOE-M8Q GPS Module
- Built-in Heat Sink for thermal heat dissipation management
- Supports 5V/ 3A power supply
- IP30 housing
- TX power up to 27dBm, RX sensitivity down to -139 dBm @SF12, BW 125 KHz
- LoRa® Frequency band support: RU864, IN865, EU868, US915, AU915, KR920, AS923.
- Includes Pi ready 'ID EE PROM', GPIO setup, and device tree can be automatically configured from vendor information
- Supports a fully open source LoRaWAN server

Package Contents

*(1) RAK Hotspot Miner*   *(1) LoRa® Antenna*   *(1) USB C Power Adapter*   *(1) 32GB SD Card*


Hotspot Details

The figure below summarizes the basic building blocks of the RAK Hotspot Miner. The RAK2287 is an essential part of it as it provides all LoRaWAN connectivity. It receives and transmits LoRa Frames and takes care of modulating/demodulating the signals among others. The processing of the LoRa Frames as well as higher-level protocol related tasks are done by the embedded host system (Raspberry Pi). Received and processed LoRa Frames are being sent to a LoRaWAN Server. The segmentation of protocol related tasks is outside the scope of this document.
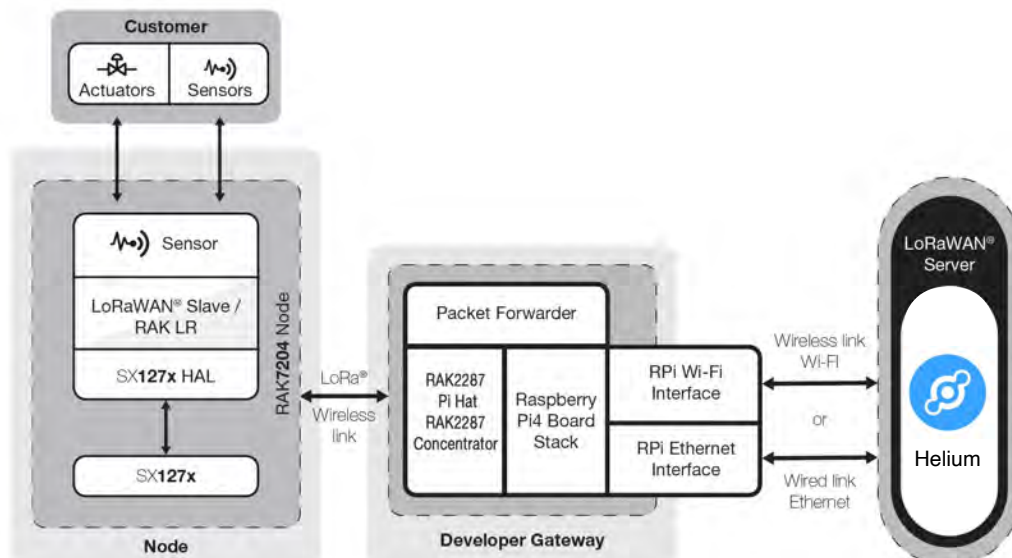
Block Diagram

The RAK Hotspot Miner is the central hardware solution for all LoRa based radio communication. It receives and transmits radio messages. The processing of radio messages as well as the protocol related tasks is done by the embedded host system (Raspberry Pi4). Received and processed radio messages are being sent to a LoRaWAN server. The following figure shows the block diagram of the RAK Hotspot Miner.

Note: The concrete segmentation of the protocol related tasks is outside the scope of this document.
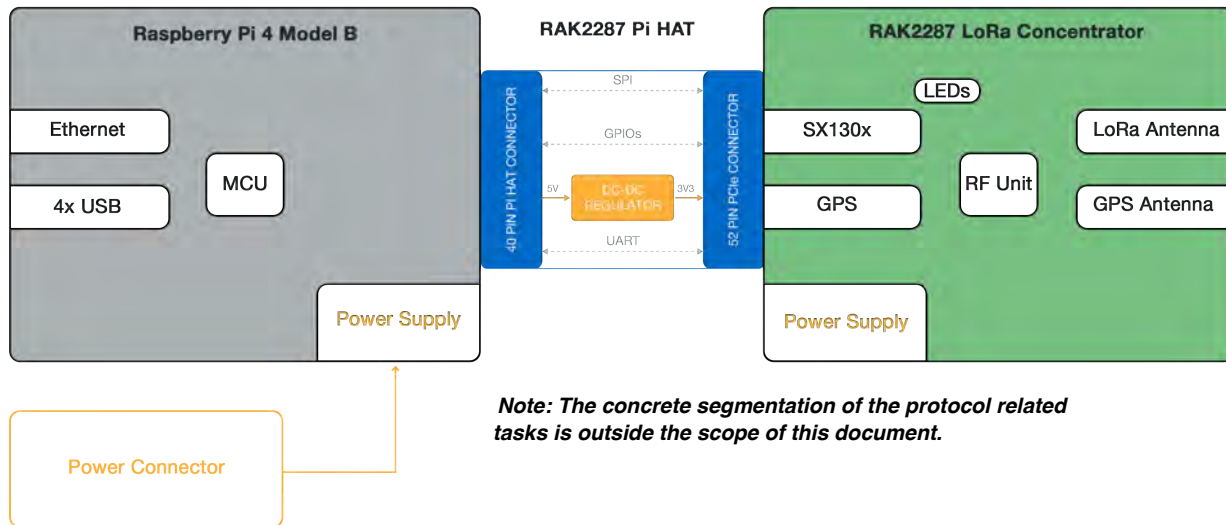
Hardware – RF Characteristics – Frequencies

The RAK Hotspot Miner supports all LoRaWAN frequency channels as below. It is easy to configure while building the firmware from the source code.

REGION	FREQUENCY (MHZ)
Europe	EU868
North America	US915
Asia	AS923
Australia	AU915
Korea	KR920
India	IN865
Russia	RU864

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LoRa® Transmitter RF Characteristics

The RAK Hotspot Miner 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	PWID CONTROL	POWER
0	10	-6dBm
0	13	-3dBm
0	17	0dBm
0	20	4dBm
1	0	8dBm
1	2	IOdBm
1	4	12 dBm
1	7	14dBm
1	9	16dBm
1	10	17 dBm
1	12	19dBm
1	13	20dBm
1	16	23dBm
1	18	25 dBm
1	20	26dBm
1	22	27dBm

Note:
• Normally, there is a ±J.SdB difference between the actual test value and the table data.
• T=25°C, VDD=SV (Typ.) if nothing else is stated.

LoRa® RF Transmitter Characteristics *Continued*

PARAMETER	CONDITION	MIN	TYP.	MAX
Frequency Range		863 MHz		870 MHz
Modulation Techniques	FSK/LoRa			
TX Frequency Variation vs. Temperature	Power Level Setting : 20	-3 KHz		+3KHz
TX Power Variation vs. Temperature	Power Level Setting: 20	-5 dBm		+5 dBm
TX Power Variation		-1.5 dBm		1.5 dBm
PARAMETER	CONDITION	MIN	TYP.	MAX
Frequency Range		902 MHz		928 MHz
Modulation Techniques	FSK/LoRa			

LoRa® RF Receiver Characteristics

It is highly recommended, to use optimized RSSI calibration values, which is part of the HAL v3.l. For both, Radio 1 and 2, the RSSI-Offset should be set -169.0. The following table gives the typical sensitivity level of the RAK Hotspot Miner.

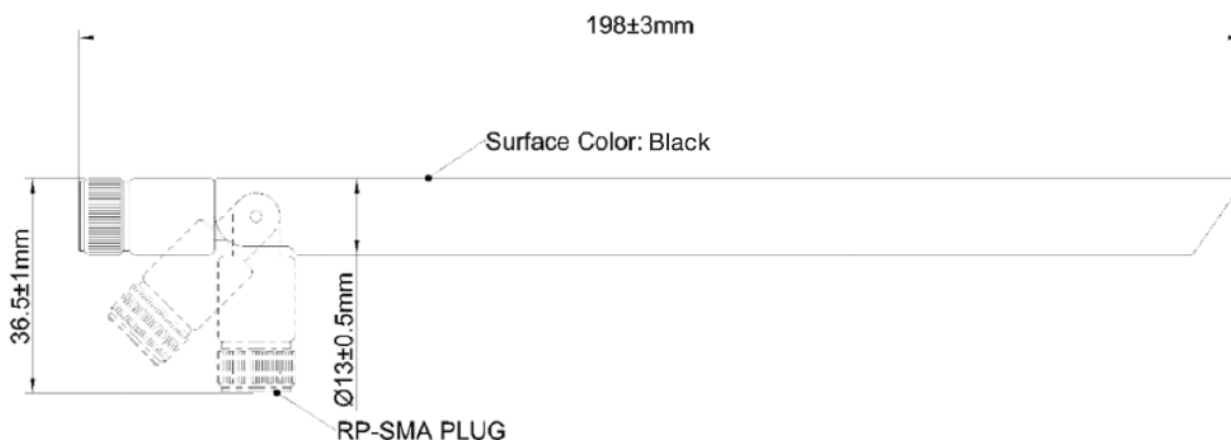| SIGNAL BANDWIDTTH (KHZ)	SPREADING FACTOR	SENSITIVITY (DBM)
125	12	-139
125	7	-125
250	12	-136
250	7	-123
500	12	-134
500	7	-120

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LoRa® Antenna

The LoRa Antenna with RP-SMA female connector shown in the figure below:

Antenna Dimensions
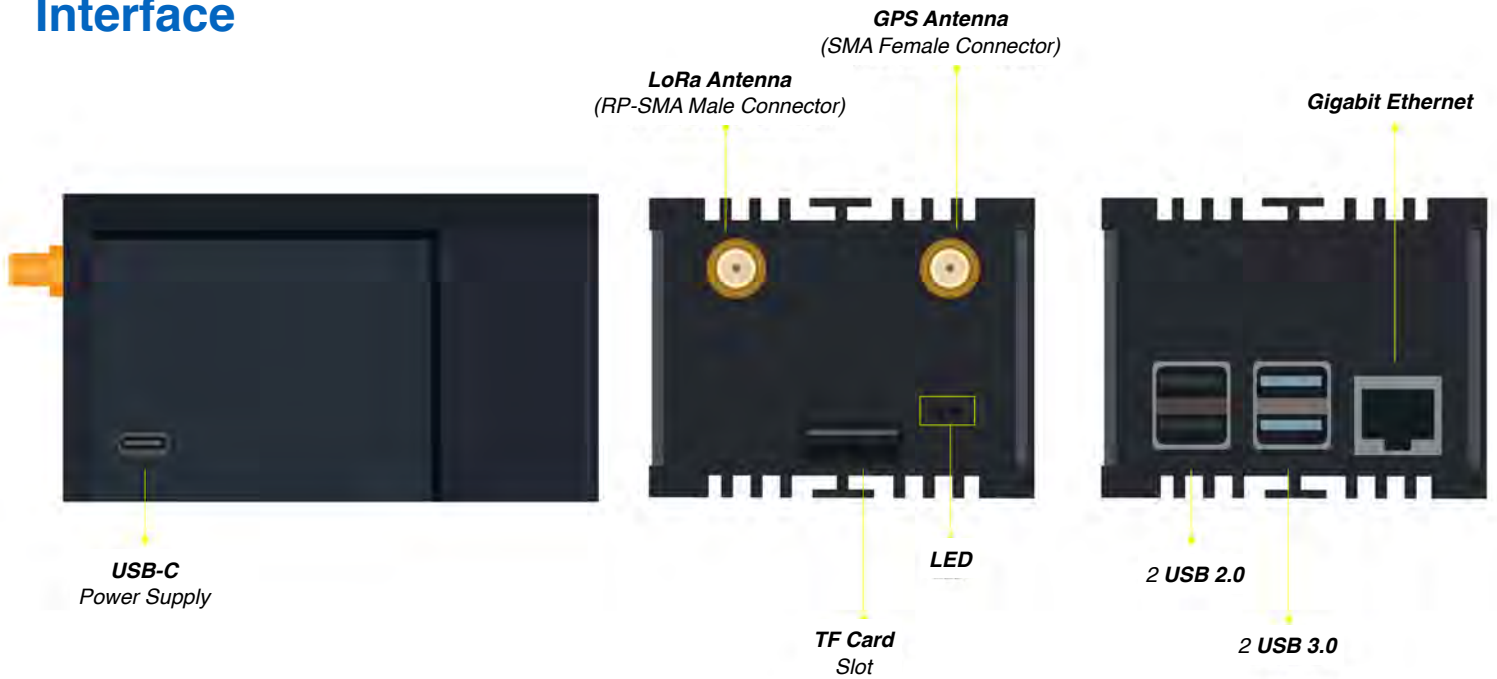
The antenna's mechanical dimensions are shown below:

Antenna Parameters

ITEMS	SPECIFICATIONS	SPECIFICATIONS
Frequency Range	863-870 MHz	902-928 MHz
Peak Gain	2.8 dBi	2.3 dBi
Voltage Standard Wave Ratio (VSWR)	::::;1.5	::sl.5
Efficiency	>80%	>80%
Feed Impedance	50 Ohms	50 Ohms
Working Temperature & Humidity	T: -35-+75 °C H: 5-95%	T: -35-+75 °C H: 5-95%

Dimensions

57,2 mm

68,3 mm

92 mm

Interface

GPS Antenna
(SMA Female Connector)

LoRa Antenna
(RP-SMA Male Connector)

Gigabit Ethernet

USB-C
Power Supply

LED

TF Card
Slot

2 USB 2.0

2 USB 3.0

The RAK Hotspot Miner operates at 5V/ 3A

PARAMETER	MIN.	TYPICAL	MAX
LoRa Txmode			950mA
Standby power		550mA	
Bum test mode			940mA

*Note: LoRa Tx mode: The LoRa module works at the maximum transmit power
state. Burn test mode: Raspberry Pi CPU and memory are running at full capacity.*

Environmental Requirements

The table below lists the operation and storage temperature requirements:

PARAMETER	MIN.	TYPICAL	MAX
Operation Temperature Range	-10 °C	+25 °C	+55 °C
Storage Temperature Range	-40 °C		+85 °C

Firmware

MODEL	RASPBERRY PI BOARD	FIRMWARE VERSION	SOURCE
RAK Hotspot Miner	Raspberry Pi 4		

LoRaWAN

- Supports class A, C
- Supports connect to TTN server Supports LoRa package forward
- Supports build-in ChirpStack® LoRaWAN Server

Network Protocol Stack

- Supports 802.1lac
- Supports Wi-Fi AP mode and Client mode Supports DHCP

Certificate Information

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation .

IMPORTANT NOTE:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, according to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used following the inst ructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/I'V technician for help.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator& your body.

ISEDC Warning:

This device complies with Innovation, Science, and Economic Development Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) this device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

The device complies with RF exposure guidelines, users can obtain Canadian information on RF exposure and compliance. The minimum distance from the body to use the device is 20 cm.