

RAK7244 WisGate Developer D4 Gateway Datasheet

Overview

Description

The RAK7244 WisGate Developer D4 Gateway is a device that consists of a Raspberry Pi 4, a RAK2245 Pi HAT, which includes a GPS module and a Heat Sink for better performance and thermal heat dissipation management.

There is a total of 3 configuration options:

1. **RAK7244** - this is the base model with the Raspberry Pi 4 and RAK2245.
2. **RAK7244C** - this is the Cellular Version that includes the Raspberry Pi 4, RAK2245, and the RAK2013 Cellular Pi Hat
3. **RAK7244P** - this version allows for powering the gateway via PoE by adding the RAK9003 Pi HAT to the base configuration (RPI 4 + RAK2245 + RAK9003)

The built-in RAK2245 Pi HAT uses the SX1301 RF front-end chip from Semtech®, which is a powerful LoRa digital processing engine. It is able to receive up to 8 LoRa packets simultaneously sent with different spreading factors on different channels and available in multiple variants so it can be used for all LoRa Alliance® frequency bands. This unique capability allows for innovative network architectures to be implemented, that are advantageous over other short-range systems. The built-in RAK2013 Cellular Pi HAT in the RAK7244C, is based on the EG95 from Quectel, which is an LTE CAT4 module optimized specifically for M2M and IoT Applications. The RAK7244P is particularly suitable for deployment in cases where there is existing networking infrastructure and PoE is provisioned.

The RAK7244 WisGate Developer D4 Gateway is ideal for prototyping, proof-of-concept demonstrations or for the evaluation on future deployment scenarios. It includes a ready to use Firmware based on Raspbian OS, that makes it possible to connect the Gateway to any standard LoRaWAN Server. It is developer friendly as the large Raspbian OS community is a well-established one. It is especially suited to addressing a variety of applications like Smart Grids, Intelligent Farms and other IoT Enterprise applications.

Features

- Refreshed Case design with a new MCU (**Raspberry Pi4**)
- Preassembled, fully functioning **LoRaWAN Gateway**
- Full LoRaWAN Stack support (**version 1.0.2**)
- Supports for **8 channels** and spreading factors (SF7-SF12)
- Frequency band support: EU433, CN470, RU864, IN865, EU868, US915, AU915, KR920, AS923
- Tx Power: **27 dBm Max**
- RX Sensitivity: **-139dBm**
- Integrates **Ublox MAX-7Q GPS** module
- **Quectel EG95** LTE module (Optional with the RAK7244C model)
- **PoE 802.3 af** support (Optional with the RAK7244P model)

Package Contents



Figure 1: RAK7244/RAK7244P Package Contents



Figure 2: RAK7244C Package Contents

Specifications

Overview

The overview covers the RAK7244 board overview and block diagram of the three configuration options: RAK7244, RAK7244C and RAK7244P.

Board Overview

The outer dimensions of Casing are 92 x 68.3 x 57.2mm (LxWxH) as shown below. They are the same for all 3 models: RAK7244/7244C/7244P. The example in Figure 3 is RAK7244C



Figure 3: RAK7244C Casing Outer Dimensions

Block Diagram

RAK7244

The figure below summarizes the basic building blocks of RAK7244. The RAK2245 is an essential part of any of the RAK7244 models 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 is 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.

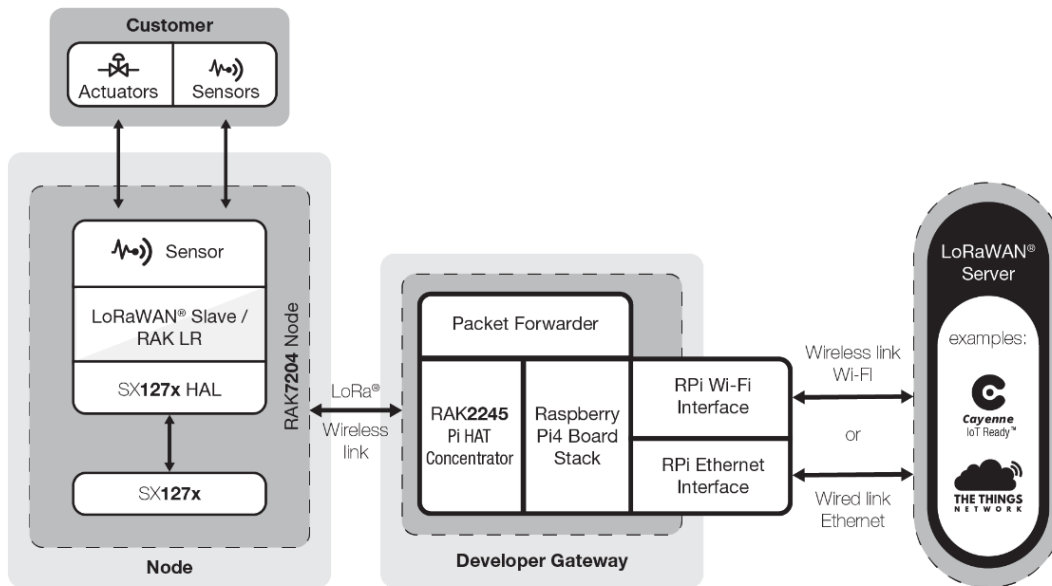


Figure 4: RAK7244 System Structure

RAK7244P

The figure below summarizes the basic building blocks of RAK7244P. It has the same functionality as far as LoRaWAN goes as RAK7244. In addition, there is the possibility to power the Gateway using a PoE 802.3 af compatible source (42-57VDC). This is made possible by the RAK9003 PoE HAT.

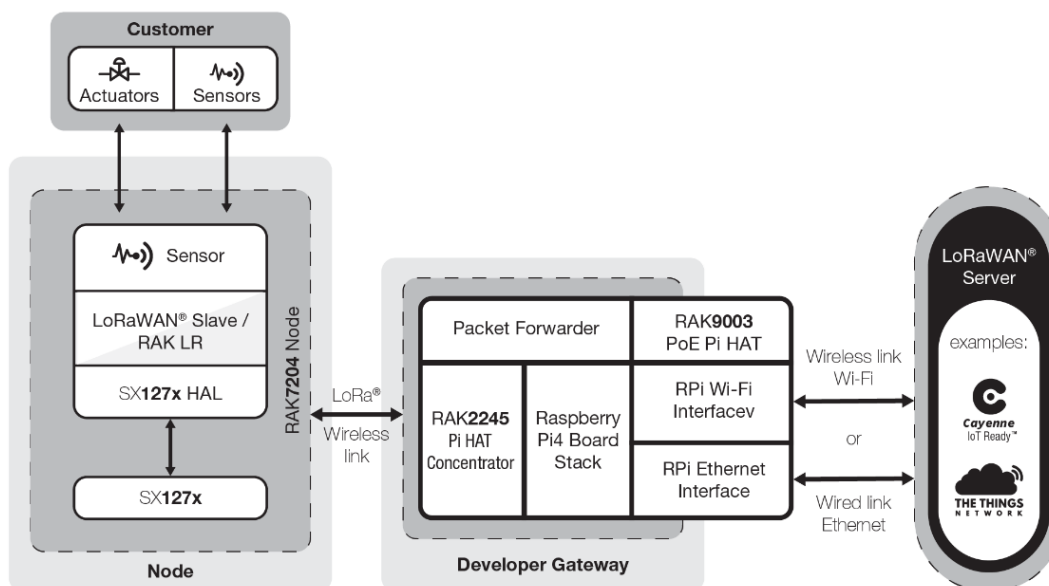


Figure 5: RAK7244P System Structure

RAK7244C

The figure below summarizes the basic building blocks of RAK7244C. It has the same functionality as far as LoRaWAN goes as RAK7244. Its backhaul capabilities, however are enhanced, with the additional of the RAK2013 Cellular HAT. This allows the Gateway to use its LTE modem to forward data to the Cloud.

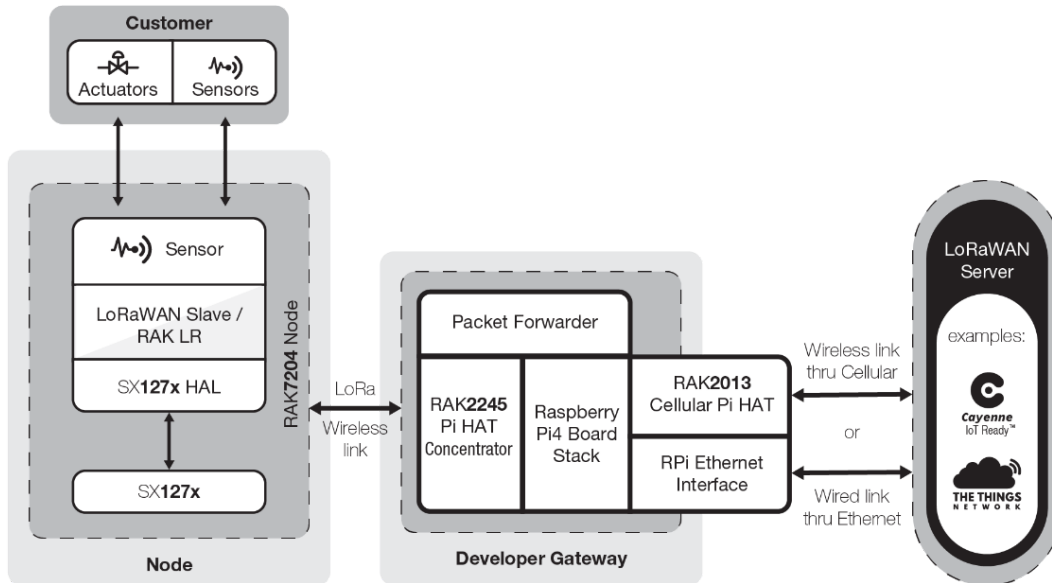


Figure 6: RAK7244C Gateway System Structure

Hardware

The hardware specification is categorized into six parts. It discusses the interfacing, pinouts, and its corresponding functions and diagrams. It also covers the parameters of operating frequencies, antenna, electrical, and environmental.

Interfaces

RAK7244 / RAK7244P

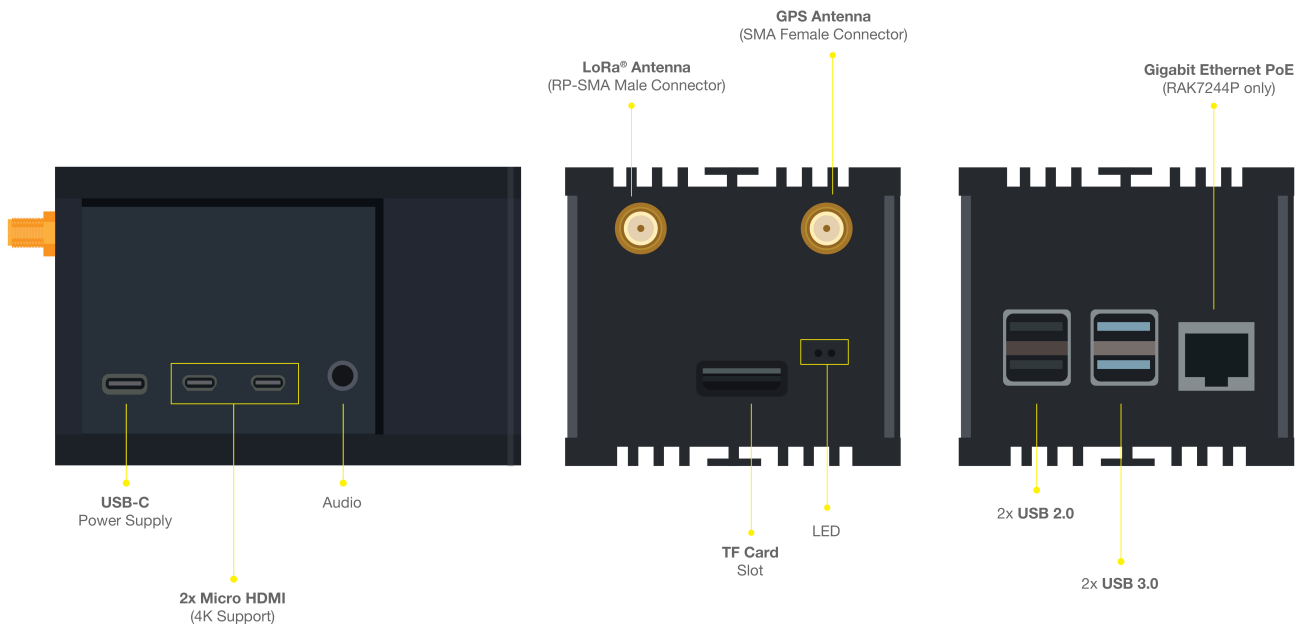


Figure 7: RAK7244/RAK7244P Interfaces

RAK7244C

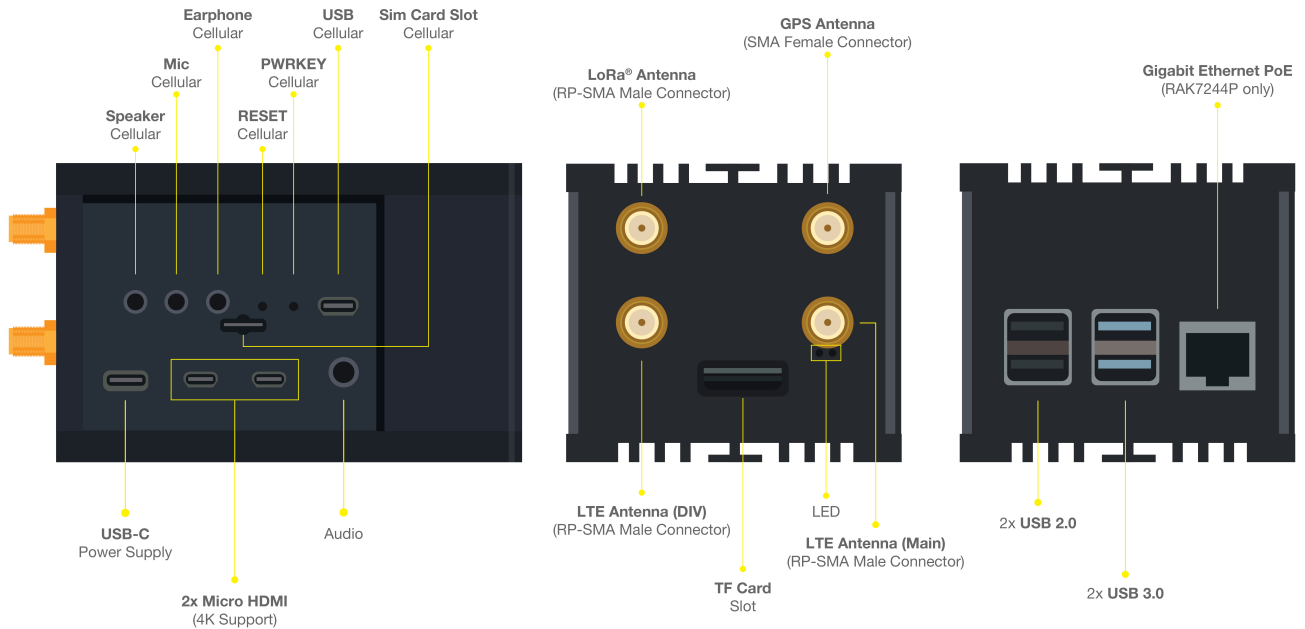


Figure 8: RAK7244C Interfaces

Pin Definition

There are 3 available configuration options for the RAK7244x:

1. RAK7244 - Raspberry Pi 4 + RAK2245 Pi hat
2. RAK7244C - Raspberry Pi 4 + RAK2245 Pi Hat + RAK2013 Cellular Pi Hat
3. RAK7244P - Raspberry Pi 4 + RAK2245 Pi Hat + RAK9003 PoE Hat.

RAK9003 Pi Hat

The RAK9003 Pi HAT is a PoE (802.3 af) board, that is designed to be mounted on top of the 40-pin connector on a Raspberry Pi 3/4.

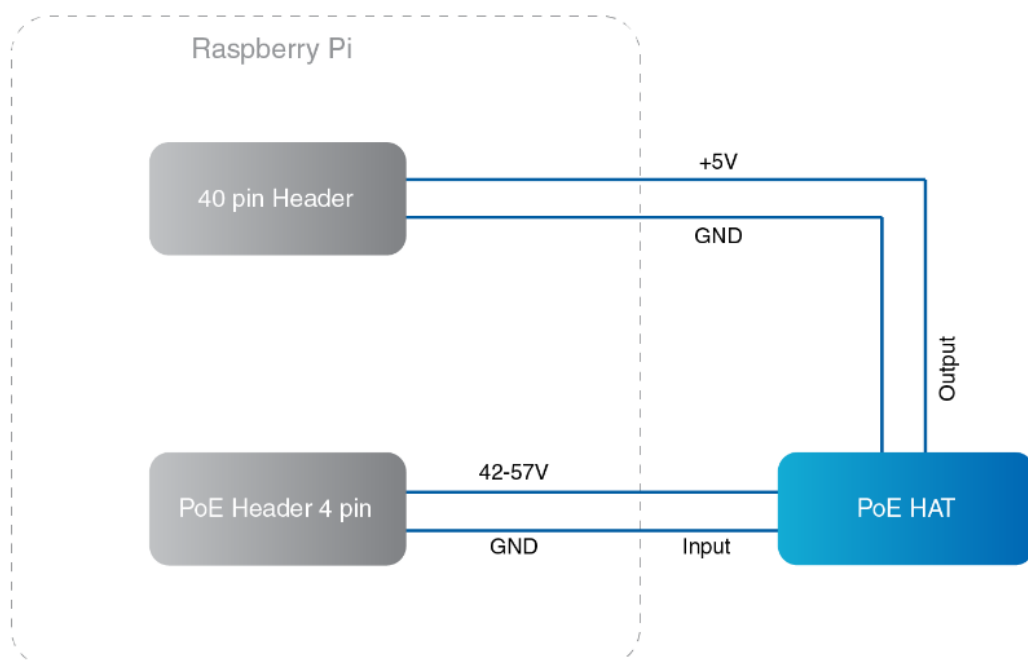


Figure 9: RAK7244P Hardware Structure

For detailed information about the RAK9003 Pi Hat, go to the [RAK9003 PoE Hat Datasheet](#).

RAK2245 Pi Hat

The **RAK2245 Pi HAT** is an LPWAN Gateway Concentrator Module based on the Pi HAT standard, and can be mounted to Pi board with 40-pin connector. The image below shows the hardware structure of the LoRa portion which describes the integration between RAK2245 and Raspberry Pi 4.

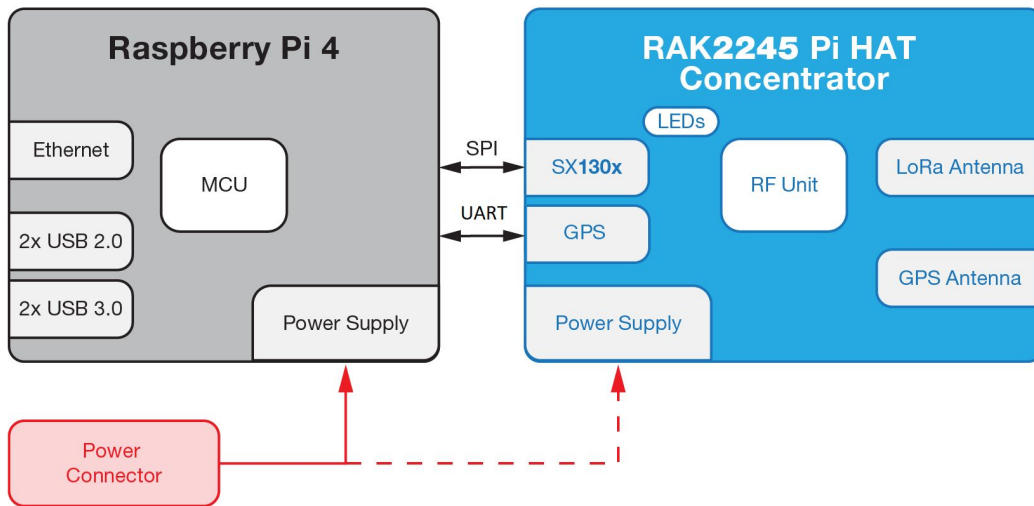


Figure 10: RAK7244C LPWAN Developer Gateway Hardware Structure

For detailed information about the RAK2245 Pi Hat, Go to the [RAK2245 Pi Hat Datasheet](#).

RAK2013 Pi HAT

The RAK2013 is an add-on board based on the Raspberry Pi HAT standard that can transmit UART data from Raspberry Pi to the Cellular network. It supports several cellular protocol, such as NB-IOT, CAT-M, CAT1 or CAT 4, by choosing different modular on the board. The device is capable of integrating audio codec and audio amplifier along with the carrier operator's network, plus it supports Voice Over LTE (VoLTE) function. It is easy to use with the earphone connector, MIC connector and speaker connector having audio amplifier.

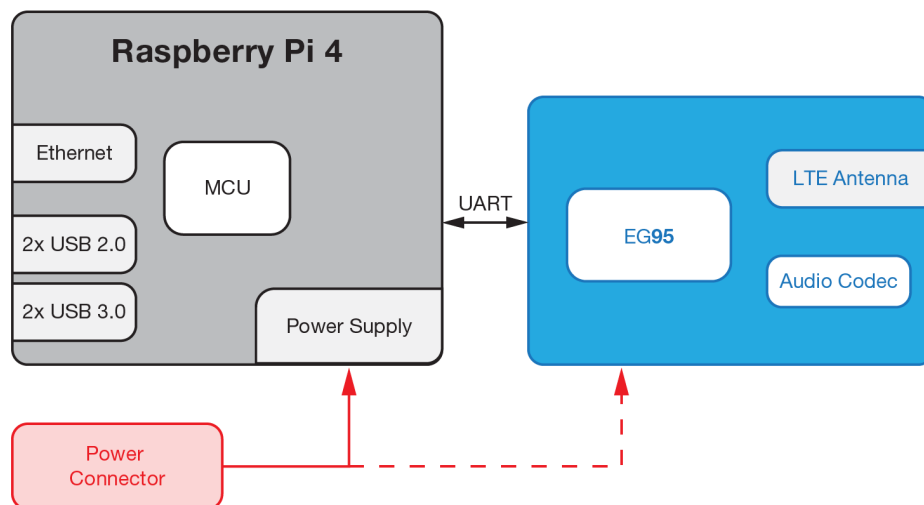


Figure 11: Cellular Hardware Structure

For detailed information about the RAK2013 Pi HAT, Go to the [RAK2013 Pi HAT Datasheet](#).

RF Characteristics

Operating Frequencies

All models of the Developer Gateway support all LoRaWAN bands.

Region	Frequency (Mhz)
Europe	EU433, EU868
China	CN470
Russia	RU864
India	IN865
North America	US915
Australia	AU915
Korea	KR920
Asia	AS923

LoRa

Transmitter RF

The RAK2245 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 are 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	-6
0	3	10	0	-3
0	3	14	0	0
1	3	9	3	4
1	3	8	0	8
1	3	9	0	10
1	3	11	0	12
1	3	12	0	14
1	3	13	0	16
2	3	12	0	17
2	3	13	0	19
2	3	14	0	20
3	3	10	0	0
3	3	11	0	0
3	3	12	0	25
3	3	13	0	26
3	3	14	0	27

T = 25°C at VDD = 5V (Typ.) as default if nothing else stated.

Parameter	Condition	Min	Typ.	Max
Frequency Range		863 Mhz		870 Mhz
Modulation Techniques	FSK/LoRaTM			
TX Frequency Variation vs. Temperature	Power Level Setting : 20	-3 KHz		+3 KHz
TX Power Variation vs. Temperature	Power Level Setting : 20	-5 dBm		+5 dBm
TX Power Variation		-1.5 dBm		+1.5 dBm

Receiver RF

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 to -169.0. The following table gives typically sensitivity level of the RAK2245.

Signal Bandwidthth (Khz)	Spreading Factor	Sensitivity (dBm)
125	12	-139
125	7	-126
250	12	-136
250	7	-123
500	12	-134
500	7	-120

Cellular

The Quectel EG95 is part of the LTE CAT4 module series that are specially optimized for Machine to Machine (M2M) and Internet of Things (IoT) applications. Adopted from 3GPP Rel. 11 LTE technology, which delivers a data rates of 150Mbps downlink and 50Mbps uplink.

Frequency	EG95-E	EG95-NA
LTE FDD	B1 / B3 / B7 / B8 / B20 / B28A	B2 / B4 / B5 / B12 / B13
WCDMA	B1 / B8	B2 / B4 / B5
GSM / EDGE	900 / 1800 MHz	
Region	Europe	North America

Antenna Specifications

LoRa

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



Figure 12: LoRa Antenna Overview

Antenna Dimension

The figure below shows the antenna's mechanical dimension.

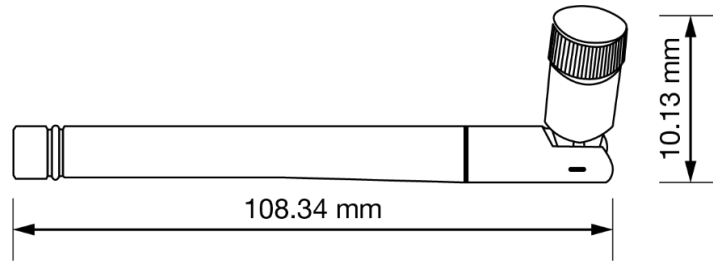


Figure 13: LoRa Antenna Dimension

Antenna Parameters

Items	Specifications
Voltage Standard Wave Ratio (VSWR)	1:1.5
Gain	-2.0 dBi
Working Temperature & Humidity	T:-35 °C ~ +80 °C, H: 0% ~ 95%
Storage Temperature & Humidity	T:-40 °C ~ +85 °C, H: 0% ~ 95%

LTE

The LTE antenna for the Developer Gateway covers working frequency band from 824MHz to 2690MHz. The antenna is shown in Figure 14.



Figure 14: LTE Antenna

Antenna Dimension

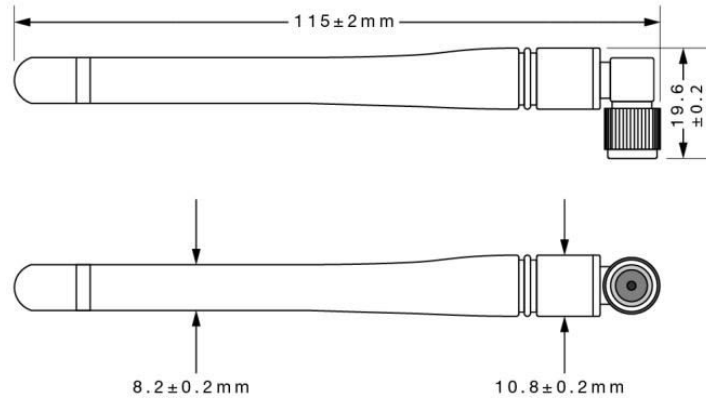


Figure 15: LTE Antenna Dimension

Antenna Parameters

Items	Specifications
Frequency (MHz)	700 / 800 / 880 / 960 / 1710 / 1880 / 2170
Voltage Standard Wave Radio (VSWR)	9.3 / 4.6 / 3.6 / 4.9 / 9.3 / 4.4 / 15
Gain (dBi)	1.63 / 1.84 / 1.96 / 2.23 / 0.03 / 0.01 / 1.97
Working Temperature & Humidity	T: -35 °C ~ +80 °C, H: 0% ~ 95%
Storage Temperature & Humidity	T: -40 °C ~ +85 °C, H: 0% ~ 95%

GPS

The GPS antenna for Pilot Gateway is shown below



Figure 16: GPS Antenna

GPS Antenna Dimension

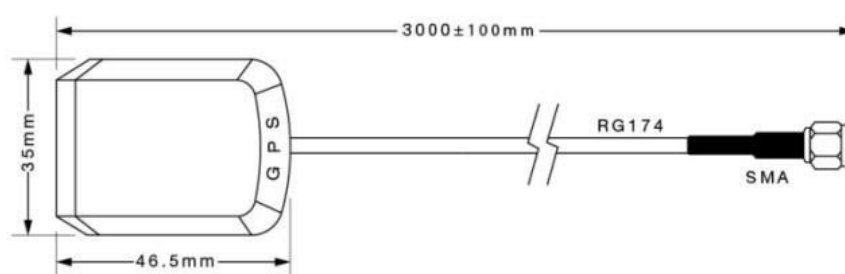


Figure 17: GPS Antenna Dimensions

GPS Environmental Requirements

The antenna environmental requirements are listed in the table below:

Conditions	Temperature	Humidity
Working	-35 °C ~ +80 °C	0% ~ 95%
Storage	-40 °C ~ +85 °C	0% ~ 95%

GPS Antenna Parameters

The GPS Antenna specifications are listed in the table below:

Item	Specifications	PET
Range of Receiving Frequency	1575.42±1.1	±2.5
Center Frequency (MHz) w/ 30mm2 GND plane	1575.42	±3.0
Bandwidth (MHz) (Return Loss ≤ -10dB)	≥10	±0.5
VSWR (in Center Frequency)	≤2.0	±0.5
Gain (Zenith) (dBi Typ.) w/ 70mm2 GND Plane	4.5	±0.5
Axial Ratio (dB) w/ 70mm2 GND Plane	3.0	±0.2
Polarization	Right-Handed Circular	
Impedance (Ω)	50	
Frequency Temperature Coefficient (ppm/°C)	0±10	

Amplifier Specifications are listed below:

Item	Specifications
Frequency Range	1575.42 MHz
Gain	27 dB
VSWR	≤ 2.0 V
Noise Coefficient	≤ 2.0 dBm
DC Voltage	3 ~ 5 V
DC Current	5 ± 2 mA

Environmental test performance specifications are listed below:

Item	Normal Temp.	High Temp [1]	Low Temp [2]
Amplifier Gain	27dB ± 2.0	27dB ± 2.0	27dB ± 2.0
VSWR	≤ 2.0	≤ 2.0	≤ 2.0
Noise Coefficient	≤ 2.0	≤ 2.0	≤ 2.0

 **NOTE**

- 1 - High temperature test: soap in temperature (85° C) and humidity (95%) chamber for 24- hour and return to normal temperature (at least for 1-hour) without visual shape change.
- 2 - Low temperature test: soap in temperature (-40° C) chamber for 24-hour and return to normal temperature (at least for 1-hour) without visual shape change

Electrical Characteristics

The Pilot Gateway Pro operates at 5V/2.5A, that are provisioned through an USB Type C port.

Parameter	Min.	Typical	Max
Current in CAT M mode		300mA	
Current in GSM mode (peak)			3500mA
Cellular power off mode		10mA	

Environmental Requirements



The table below lists the operation and storage temperature requirements for RAK7244C:

Parameter	Min.	Typical	Max
Operation Temperature Range	-35 °C	+25 °C	+70 °C
Extended Temperature Range	-40 °C		+75 °C
Storage Temperature Range	-40 °C		+80 °C

Software

Download the latest firmware of RAK7244X series in the table provided below.

Firmware

Model	Raspberry Pi Board	Firmware Version	Source
RAK7244 and RAK7244P	Raspberry Pi 4	4.2.0R	Download 
RAK7244C	Raspberry Pi 4	4.2.0R	Download 

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