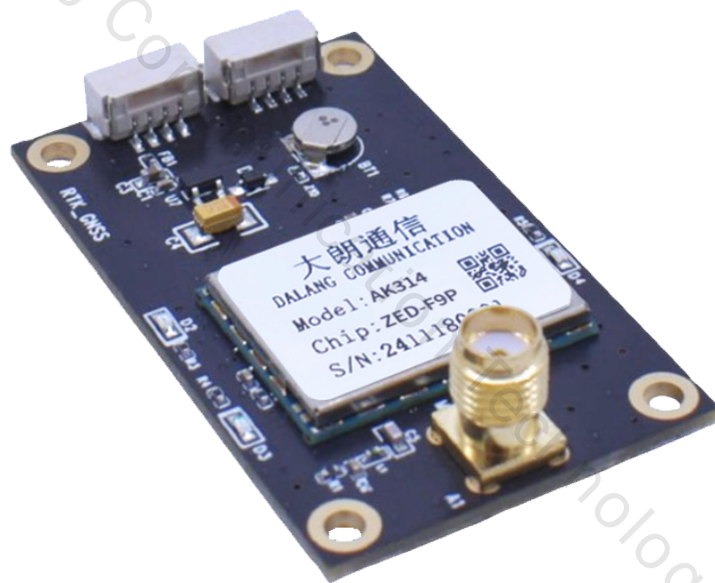




AK314





**Dalang Communication
Technology Co., Ltd
Product Specification**

Product Name:	Circuit Board
Product Model:	AK314
Version Number:	V 1.0
Revision Date:	2024.06.27

Confidentiality Statement

This document and the information contained within are the property of **"Dalang Communication Technology Co., Ltd"**, and are for use only by authorized individuals for specific purposes. This document contains confidential information. Without explicit written permission from **"Dalang Communication Technology Co., Ltd"**, no person or group may copy, distribute, disseminate, display, or disclose this document or any part of it to a third party in any form. Recipients must strictly adhere to confidentiality obligations, protect the information in the document from being disclosed or misused, and ensure that all relevant personnel follow the same confidentiality rules. Individuals or organizations violating this statement will face legal prosecution and/or contractual penalties.

Thank you for your support and cooperation in protecting the confidential information of **"Dalang Communication Technology Co., Ltd"**.

Contents

1 Product Application Scenarios	1
Figure 1 Product Application Scenarios	1
2 Features	2
3 Structural Characteristic	3
Figure 2 Dimensional Drawing (in millimeters)	3
Table 1 PIN Functionality	3
Table 2 Interface Characteristics	4
4 Specifications	5
Table 3 Product Specifications	5
5 Product Photos	7
Figure 4 Product Images	7
6 Typical Applications	8
6.1 Application of high-precision positioning for medium and short distances	8
6.2 Application of Medium to Long Range High Precision Positioning	9
6.3 High precision positioning application without reference station	10

1 Product Application Scenarios

The AK314 Beidou/GPS/Galileo/Glonass/QZSS RTK board is a low-cost, low-power, high-performance module offering centimeter-level accuracy. It can function as a "rover" or "base station" using carrier phase differential technology to eliminate various errors for high-precision positioning. As a base station, it outputs RTCM2.x/3.x data streams compatible with most commercial rovers and supports network RTK. As a rover, it supports RTCM2.x/3.x formats and can connect to other base stations or the national Beidou system. The board provides <math><1\text{cm}</math> static and <math><5\text{cm}</math> dynamic accuracy with an output rate of 1-10Hz, making it highly cost-effective for various applications. See Figure 1 for details.



Figure 1 Product Application Scenarios

2 Features

In this chapter, we will delve into and comprehensively elaborate on the functionalities and operating principles of the AK314, detailing how it plays a pivotal role in various applications as follows:

1. **Advanced Technology:** Based on UBLOX-F9P, the module provides stable, high-precision positioning even in harsh environments.
2. **Multi-System Frequency Support:** Highly compatible and flexible, it can receive and process signals from multiple satellite navigation systems, supporting Beidou/GPS/GALILEO/GLONASS quad-mode RTK.
3. **10Hz Data Output Rate:** Demonstrates high-performance processing, ideal for applications like UAVs that require rapid position updates.
4. **High Precision:** Supports differential positioning and vector attitude measurement, providing high-precision positioning and orientation.
5. **Compatibility:** Fully compatible with PIXHAWK and APM flight control systems.
6. **Secondary Development:** Compact, low power supports secondary development with reference designs for various applications.
7. **Flexibility:** Configurable as either a base station or a rover.

3 Structural Characteristic

In this section, we will thoroughly present and analyze the design details of the product, depicting its exterior features through comprehensive imagery. This view offers a holistic perspective, facilitating an understanding of the product's architecture. Refer to Figure 2, Table 1, and Table 2 for details.

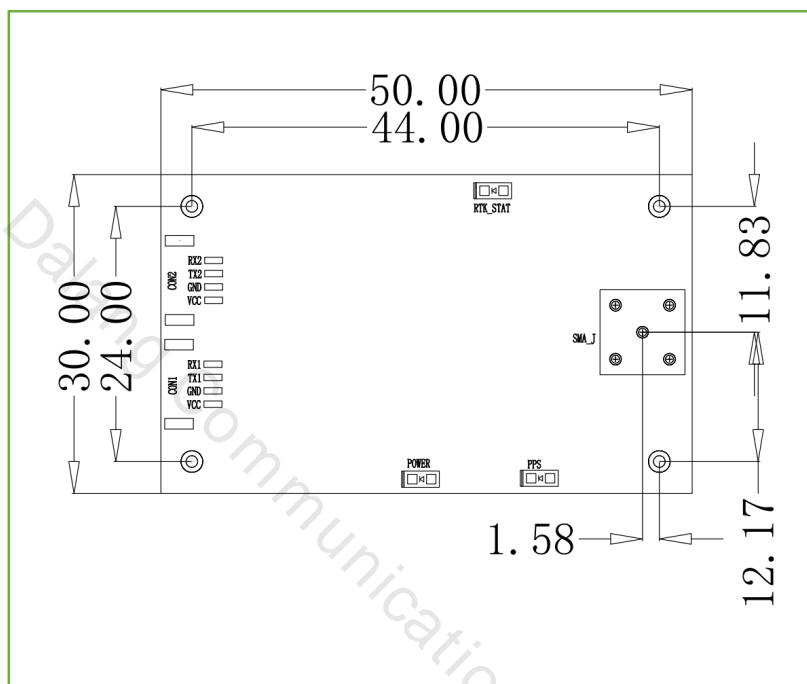


Figure 2 Dimensional Drawing (in millimeters)

Table 1 PIN Functionality

Pin Number	Signal Name	Signal Description
CON1	VCC	Com1 Main Power Input
	GND	Com1 Module Ground
	TXD 1	Main serial port (com1): outputs NMEA0183 when "rover," RTCM2.x/3.x when "base station."
	RXD 1	Main serial port (com1) data reception for command input.
CON2	VCC	Com2 Main Power Input
	GND	Com2 Module Ground
	TXD 2	Com2 Output Interface
	RXD 2	Differential serial port (com2) input: valid for "rover" mode, accepts RTCM2.x/3.x data.

Table 2 Interface Characteristics

Name	Symbol	Minimum Value	Typical Value	Maximum Value	Unit
Main Power	VCC	2.7	3.3	5.0	V
Backup Power	VBAT	1.4	3.3	3.6	V
RF Port Feed	VRF	3.0	3.1	3.3	V
High-Level Input	VIH	2.0			V
Low-Level Input	VIL			0.7	V
High-Level Output	VOH	3.2			V
Low-Level Output	VOL			0.1	V
Main Serial Port Baud Rate	Baud		38400		bps
Differential Baud Rate	Baud		38400		bps

4 Specifications

In this section, we will provide a detailed list and explanation of the product's chip features, sensitivity, accuracy, operating principles, and other technical details, as detailed in Table 3.

Table 3 Product Specifications

	chip	UBLOX-F9P
Chip characteristics	working frequency	BDS: B1 B2 GPS: L1 L2 GLONASS: G1 G2 GALILEO: E1 E5b QZSS: L1 L2
	Receiving channel	184 search channel
Sensitivity	track	-167 dBm
	Re capture	-160 dBm
	cold boot	-148 dBm
	Hot start	-157 dBm
First positioning time TTFF	cold boot	26s
	Hot start	2s
	Re capture	2s
Accuracy	RTK horizontal accuracy	0.01 m + 1 ppm CEP
	RTK vertical accuracy	0.01 m + 1 ppm CEP
	Single point horizontal accuracy	1.5m CEP
	Single point vertical accuracy	1.5m CEP
	Speed accuracy	0.05m/s
	1PPS time accuracy	RMS 30ns 99% 60ns
Convergence time	Convergence time	≤10s
Output data	Baud rate	38400bps (default) [Optional: 4800-921600]
	Output interface	TTL
	Output Protocol	NMEA0183, RTCM 3.3, UBX
	update frequency	Default 1Hz (0.25Hz-10Hz)
	Carrier phase output	Support, output RAWX statement

	FLASH	built-in
Working conditions	height	<50,000m
	speed	500m/s
	Gravitational acceleration	≤4g
Environment	working temperature	-35°C+80°C
	Storage temperature	-40°C+85°C
Electrical specifications	working voltage	3.3V-5V DC
	power waste	<150mW @3.3V
Physical parameters	size	PCB length: 50 * 30 * 3.5mm
	weight	9g
	Connector	GH1.25mm 4pin*2
	Antenna connector	SMA-J straight head (customizable)

5 Product Photos

In this chapter, we will showcase real-life images of the product, as shown in Figure 4. These images provide a detailed view of our product from various angles and perspectives. We believe that through authentic representation, we can better convey the value and concept of the product, thereby enhancing your trust and satisfaction.

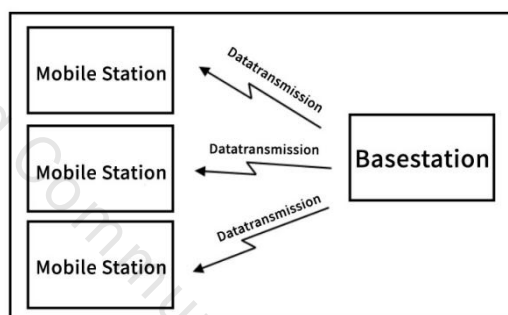


Figure 4 Product Images

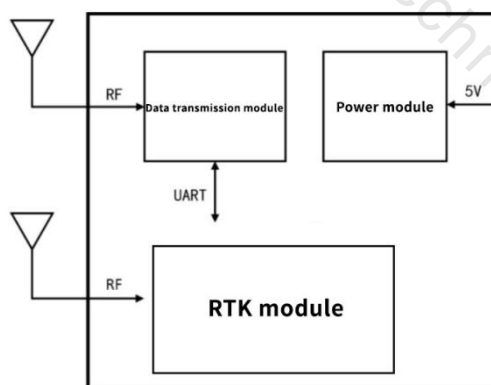
6 Typical Applications

6.1 Application of high-precision positioning for medium and short distances

In high-precision positioning applications for medium to short distances (<3km), the module can be combined with a data transmission module to form a complete high-precision positioning system with only a small amount of external circuits. It is suitable for applications with a large number of mobile stations in a small range, and the module is fully compatible with other automatic flight control systems such as Pixhawk and APM. The schematic diagram is as follows:



The reference station is stationary and fixed, and differential data is broadcasted to all mobile stations through a data transmission module. The circuit diagrams of the mobile station and the reference station are as follows:



3) If the antenna coordinates have been accurately determined through other surveying methods, please use the # set position command to input the antenna coordinates into the reference station module in latitude, longitude, and altitude format;

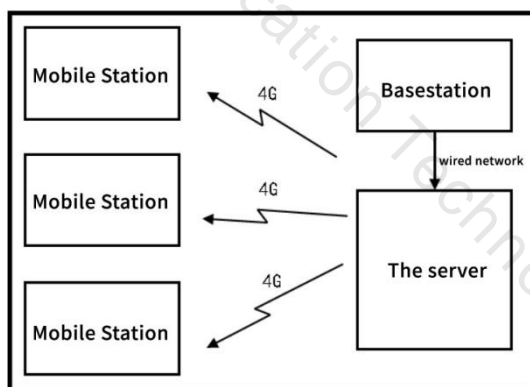
4) If the antenna coordinates are unknown, please wait patiently for about 5 minutes. The module will calculate the antenna position as accurately as possible. After the calculation is c

ompleted, the differential data port will begin to output data. At this point, the base station has already recorded the coordinates and broadcasted them wirelessly to ensure that the base station does not lose power, as the coordinates will be recalculated after a power outage and the repeatability of the mobile station measurement points cannot be guaranteed;

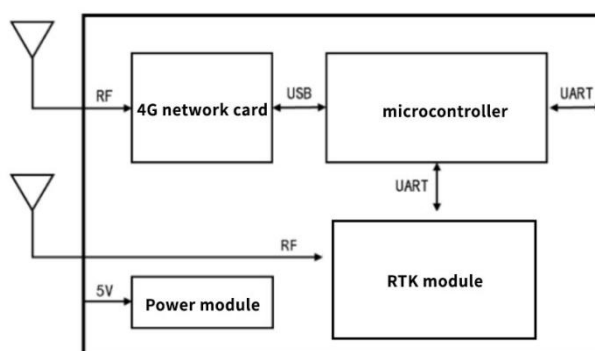
5) Install the mobile station antenna on the mobile carrier, confirm receipt of differential data, and wait for about 120 seconds to obtain high-precision positioning results.

6.2 Application of Medium to Long Range High Precision Positioning

In the application of high-precision positioning over medium to long distances (<10km), common data transmission modules are difficult to provide reliable differential data connections and suffer from serious packet loss problems. For this purpose, the company provides a solution based on 4G network (as shown in the figure below). The benchmark station sends differential data to the server through a wired network and is cached by the server. Mobile stations access servers through 4G networks to obtain differential data. This solution can greatly expand the coverage area of base stations, and mobile stations equipped with 4G network cards can simultaneously transmit positioning results back to designated servers.



The circuit diagram of the mobile station is as follows:



In practical applications, the number of mobile stations that a server can access simultaneously is limited only by server performance and is more suitable for a large number of users. Requirements between the server and the base station: the server can be directly accessed from the public network (with a public IP address), and a network connection can be established between the base station and the server (either through the public network or local area network).

6.3 High precision positioning application without reference station

In high-precision positioning applications without reference stations, the module needs to cooperate with the 4G communication module to obtain differential data. We provide Qianxun with differential data sources nationwide, and users can obtain high-precision positioning results without deploying base stations. The circuit diagram is as follows:

