



SPK-GR-009, Centimeter-level

L1/L2 Multi-band GNSS

Smart Antenna

Overview

SPK-GR-009 is equipped with high-sensitivity, high precision engine of **u-blox ZED-F9P**, GNSS multi-band antenna, backup battery in a compact IP67 housing.

Mounted with wide-band antenna, this module supports dual band L1/L2 GPS/GLONASS/BEIDOU/Galileo/QZSS satellite systems simultaneously in one design.

This module exhibits fast RTK fix, reliable performance, high update rate for highly dynamic applications and centimeter accuracy in a small and energy-efficient way. It could be served as either an RTK rover or a base.

This all-in-one smart antenna allows just plug and play, fast time to market with outstanding performance.

Applications

- UAV
- Automatic farming
- Machine control
- Robotic guidance

Features

- *Based on ZED-F9P high precision module.*
- **Plug and play cm-level smart antenna**
- *USB/RS232/UART TTL options*
- Built-in L1/L2 band antenna and circuits supporting multiple constellations simultaneously
 - GPS+Galileo+GLONASS+BeiDou
 - SBAS, QZSS
- DGNS RTCM 10403.3 version 3 messages

RoHS
Compliant



support for RTK fix.

- High sensitivity*:-167dBm tracking/-148dBm acquisition
- Up to 8Hz update rate for quad-GNSS constellation or 15Hz for dual-GNSS constellations.
- Magnet option available
 - Plain disk without magnet inside
 - Disk and pedestal with embedded magnet
- Pole support for acting as an RTK base
 - Quad-M3x8 screw holes for pole fixing
- Windows location sensor support
- OMA SUPL compliant A-GPS support
- SBAS (WAAS, EGNOS, MSAS, GAGAN) support
- Excellent EMI protection

Technical Specifications

Receiver Performance Data*

	u-blox ZED-F9P
Supported	GPS/SBAS/QZSS: (MHz)
GNSS	L1 C/A (1575.42),
Constellations	L2C (1227.60)
	GLONASS: (MHz)
	L1OF (1602+k*0.5625, k= -7,...,5,6),
	L2OF (1246+k*0.4375, k= -7,...,5,6),
	Galileo: (MHz)
	E1-B/C (1575.42),
	E5b (1207.140)
	BeiDou: (MHz)
	B1I (1561.098)
	B2I (1207.140)

Add : 10F,NO.510,SEC.5,CHUNG HSIAO E. RD, TAIPEI, TAIWAN

Tel : 02-2346-2323

Fax : 02-2346-3939

E-mail : spk@spkecl.com WEB:<http://www.spkecl.com>



SPK ELECTRONICS CO., LTD.

Cm-level GNSS Smart Antenna / SPK-GR-009

Position Accuracy (RTK baseline up to 20km; 24 hours static)	Horizontal: RTK: 1 cm+1ppm CEP SBAS: 1 m CEP PVT: 1.5 m CEP Vertical: (result with 1km baseline) RTK: 1 cm+1ppm R50	Max. Altitude	50,000 m
		Max. Velocity	500 m/s
Velocity Accuracy	<0.05 m/s (speed) <0.3° (heading) (50% @ 30 m/s for dynamic operation)	Protocol Support	NMEA 0183 up to v 4.11, ASCII GGA, GLL, GSA, GSV, RMC, VTG, TXT UBX: u-blox proprietary, binary RTCM 3.3: binary
Time Pulse Signal	0.25Hz...10MHz RMS: 30ns, 99%: 60ns	Default Settings	UART1 & 2: 38400bps, N-8-1 UART1: NMEA, UBX, RTCM 3.3 enabled Only NMEA output UART2: RTCM 3.3 enabled, No output, NMEA disabled, UBX not supported
Time To First Fix (TTFF) Hot start Aided start Cold start	Autonomous (All at -130dBm) 2sec (GPS+Glonass+Galileo+BeiDou) 2sec (GPS+Glonass+Galileo+BeiDou) 25sec (GPS+Glonass+Galileo+BeiDou)	Augmentation System Support	QZSS: Support L1S SLAS Correction data broadcasted on L1 SBAS: WAAS, EGNOS, MSAS, GAGAN DGNSS: RTCM 10403.3 ● Rover mode messages: (RTCM) 1001~1012, 1033, 1074, 1075, 1077, 1084, 1085, 1087, 1094, 1095, 1097, 1124, 1125, 1127 ● Base mode messages: (RTCM) 1005, 1074, 1077, 1084, 1087, 1094, 1097, 1124, 1127, 1230, 4072.0, 4072.1
Sensitivity	GPS+Glonass+Galileo+BeiDou Acquisition: -148 dBm Reacquisition: -160 dBm Tracking & navigation: -167 dBm	Dynamics	< 4g
Max. Update Rate	a. GPS+Glonass+Galileo+BeiDou b. GPS+BeiDou c. GPS RTK: 8Hz@a, 15Hz@b, 20Hz@c PVT: 10Hz@a, 25Hz@b, 25Hz@c RAW: 20Hz@a, 25Hz@b, 25Hz@c	* Note. According to IC Spec	
RTK Convergence Time	<10s@a&b, <30s@c Depends on atmospheric conditions, baseline length, multipath conditions, satellite visibility and geometry	Electrical Data	
Moving Base RTK Performance	a. GPS+Glonass+Galileo+BeiDou b. GPS+BeiDou c. GPS Max. update rate: 8Hz@a, 10Hz@b, 10Hz@c Heading accuracy: 0.4°@a,b,c	Power Supply	3.3 ~ 5.5 VDC
		Power Consumption (10Hz update rate)	118mA/average tracking (USB) # of SVs tracked: L1: 37, L2: 27
		Environmental Data	
		Operating temperature	-40 ~ 85°C except battery: -20~60°C
		Storage temperature	-40 ~ 85°C except battery: -20~60°C

Add : 10F,NO.510,SEC.5,CHUNG HSIAO E. RD, TAIPEI, TAIWAN

Tel : 02-2346-2323

Fax : 02-2346-3939

E-mail : spk@spkecl.com WEB:<http://www.spkecl.com>



SPK ELECTRONICS CO., LTD.

Cm-level GNSS Smart Antenna / SPK-GR-009

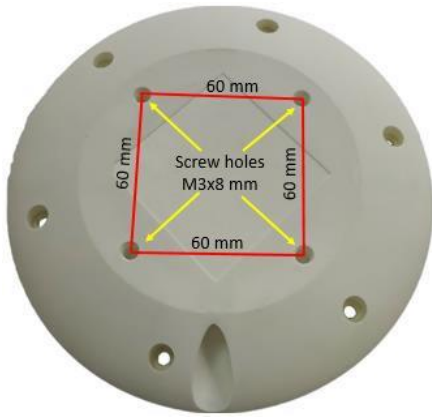
Operating humidity	5% ~ 95% non-condensing
--------------------	-------------------------

Mechanical Data:

- $\Phi 116 \times 24.6$ (mm) for disk without pedestal



- $\Phi 116 \times 56.8$ (mm) for disk with pedestal
- Fixing screw holes, bottom of disk:



Other Data

Cable Length (default, customizable)	1.5 m for GR-901U 3 m for GR-901R 1 m for GR-901T
--------------------------------------	---

Interfaces

	GR-009T_S	GR-009R_Q	GR-009U_V
Pin	Mini-Din 6-pin PS/2 Male Plug	Mini-Din 6-pin PS/2 Male Plug	USB A type Male Plug
1	GND	GND	VDD 5V
2	VCC	VCC	D-
3	TXD-TTL	TX-RS232	D+
4	RXD-TTL	RX-RS232	GND
5	^S PPS	^S PPS	
6	[#] TP2	[#] TP2	

^S: TTL signal level.

[#]TP2 is by default disabled.

LED Indication

Green LED for GNSS fix	ON , position not fixed, Blinking , position fixed, OFF , power is OFF
Orange LED for RTK fix	ON , RTK fixed Blinking , RTK under fixing OFF , not in RTK mode, i.e. RTCM correction data is not available.

Road Test (For Indicative Reference Only)

- Fix two GR-901Vs 84-cm apart on car roof.
- Drive a round-trip along a city road.



- Around 24.7817339,121.0416466
- Calculate the distance for all (4324) position pairs and analyze its variations.
- Result
 - Average: 83.5-cm, 1-sigma = 0.926cm
 - 1-sigma: 68.8%, 2-sigma: 93.27%, 3-sigma: 99.72%,

Ordering Information

GR-009X:

\ X \	RS-232	TTL	USB
Disk Only (w/o magnet)	R	-	-
	-	T	-
	-	-	U
Disk + Pedestal (w/ magnet)	Q	-	-
	-	S	-
	-	-	V

*This document is subject to change without notice.