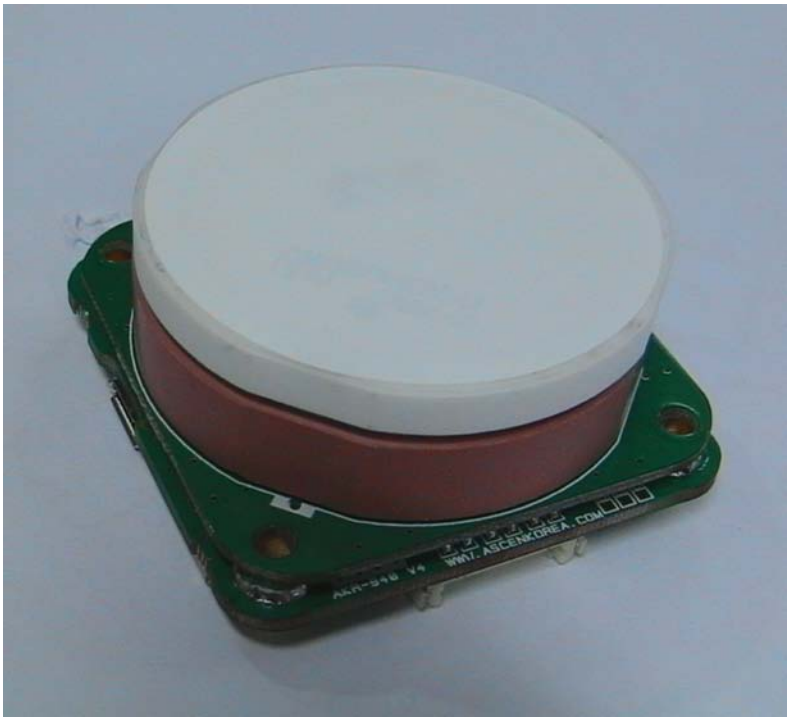
AKR-940



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1. Functional Description

- 184-channel u-blox F9 engine
  GPS : L1C/A L2C
  Glonass: L1OF L2OF
  Galileo : E1B/C E5b
  Beidou : B1L B2L
  QZSS : L1C/A L2C
- Concurrent reception of GPS,GLONASS,Galileo and Beidou
- Multi-band RTK with fast convergence times and reliable performance
- High update rate for highly dynamic applications
- Centimeter accuracy in a small and energy-efficient receiver

- Built in L1/L2 active antenna
- Power input 5.0V
- Internal fit backup battery for Cold/Warm/Hot start
- Fit micro USB 2.0 connector
- 1.25mm pitch 8pin wire connector
- Communication port UART1 and UART2
- Changeable CMOS or RS-232 level by resistor fit
- Size : 44 x 44 x 22mm
- Weight : 85 grams

2. Performance

PARAMETER		SPECIFICATION	UNIT
Accuracy of time pulse signal	RMS	33	nS
	99%	60	nS
Frequency of time pulse signal	configurable	0.25Hz ~10MHz	
Operational limits [1]	Dynamics	<=4	g
	Altitude g	50,000	m
	Velocity	500	m/S
Velocity accuracy		0.05	m/S [2]
Dynamic heading accuracy		0.3	Deg [2]

GNSS		GPS +GLO +GAL +BDS	GPS +GLO +GAL	GPS +GAL	GPS +GLO	GPS +DBS	GPS	UNIT
Acquisition [3]	Cold start	24	25	29	26	28	29	Sec
	Hot start	2	2	2	2	2	2	
	Aided start [4]	2	2	2	2	2	2	
Nav. Update rate	RTK	8	10	12	12	12	20	Hz
	PVT	10	12	16	25	25	25	
	RAW	20	20	25	25	25	25	
Convergence time [5]	RTK	<10	<10	<10	<10	<10	<30	Sec
Horizontal pos. accuracy	RTK [5,6]	0.01m+1ppm CEP						meter
Sensitivity [5]	Tracking & Nav	-167						dBm
	Reacquisition	-160						
	Cold Start	-148						
	Hot Stard	-157						

1 Assuming Airborne 4g platform

2 50%@30m/s for dynamic operation

3 All satellites at -130 dBm, except Galileo at -127 dBm

4 Dependent on the speed and latency of the aiding data connection, command starts.

5 Depends on atmospheric conditions, baseline length, GNSS antenna, multipath conditions, satellite visibility and geometry, Demonstrated with a good external LNA

6 Measured using 1Km baseline and patch antennas with good ground planes.
Does not account for possible antenna phase cent offset errors.
ppm limited baselines up to 20Km.

3. Input Protocols : Differential GNSS (DGNSS)

When operating in RTK mode, RTCM version 3 messages are required and the module supports DGNSS according to RTCM 10403.3.

Operating in ROVER mode can decode the following RTCM 3.3 input messages:

RTCM 1001	L1-only GPS RTK observables
RTCM 1002	Extended L1-only GPS RTK observables
RTCM 1003	L1/L2 GPS RTK observables
RTCM 1004	Extended L1/L2 GPS RTK observables
RTCM 1005	Stationary RTK reference station ARP
RTCM 1006	Stationary RTK reference station ARP with antenna height
RTCM 1007	Antenna descriptor
RTCM 1009	L1-only GLONASS RTK observables
RTCM 1010	Extended L1-only GLONASS RTK observables
RTCM 1011	L1/L2 GLONASS RTK observables
RTCM 1012	Extended L1/L2 GLONASS RTK observables
RTCM 1074	GPS MSM4
RTCM 1075	GPS MSM5
RTCM 1077	GPS MSM7
RTCM 1084	GLONASS MSM4
RTCM 1084	GLONASS MSM5
RTCM 1084	GLONASS MSM7
RTCM 1094	Galileo MSM4
RTCM 1094	Galileo MSM5
RTCM 1094	Galileo MSM7
RTCM 1124	BeiDou MSM4
RTCM 1124	BeiDou MSM5
RTCM 1124	BeiDou MSM7
RTCM 1230	GLONASS code-phase biases

4. Output Protocols

- Data format

  WGS-84 NMEA 0183 Ver.4.1

- NMEA message

  GGA, GLL, GSA, GSV, RMC, VTG, GRS, GST, ZDA, GBS, DTM, GNS, VLW

- UART signal format

  Buad rate : 4800 ~ 921600 bps

  Byte : 8bit

  Stop bit : 1

  Parity : none

- Up-date rate

  1~10 Hz

- Operating as a BASE station can generate the following RTCM 3.3 output messages:

RTCM 1005	Stationary RTK reference station ARP
RTCM 1077	GPS MSM7
RTCM 1087	GLONASS MSM7
RTCM 1097	Galileo MSM7
RTCM 1127	BeiDou MSM7
RTCM 1230	GLONASS code-phase biases

5. Pin Description (Connector : Yeonho 12505WR-08P, 1.25mm Pitch)

Pin No.	Name	Pin Description	I/O	Comment
1	1PPS	Time pulse	O	100mS Pulse out
2	LED_RTK	RTK status Indicator	O	Fixed=1, Receiving data = blinking
3	VCC	System Power 5.0V input		3.6~5.0V
4	TX1	Data output	O	Changeable CMOS or RS-232 level by resistor(100Ω) position
5	RX1	Data input	I	
6	GND			
7	TX2	Data output	O	
8	RX2	Data input	I	

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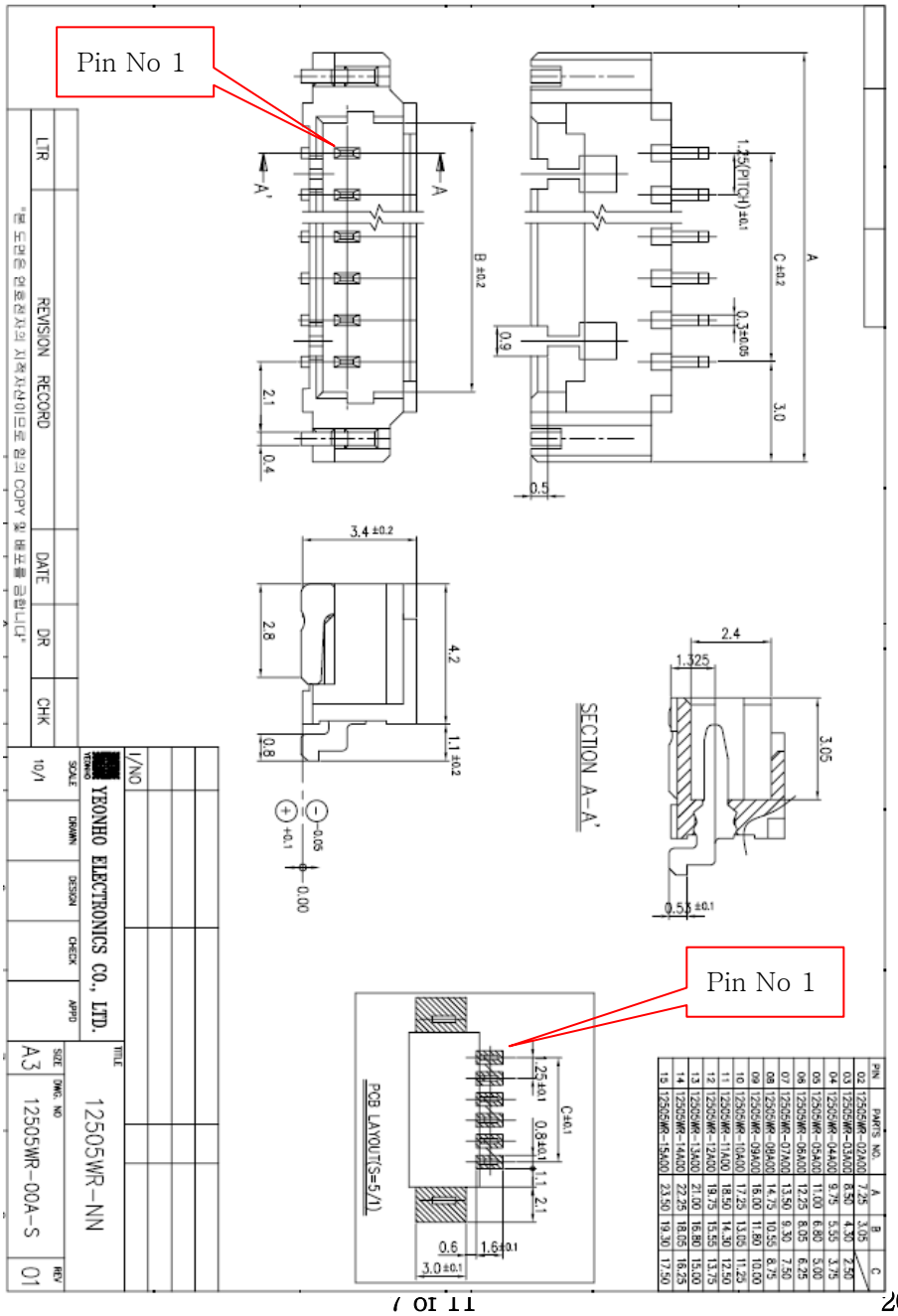


6. Absolute Maximum Ratings

Parameter	Min	Max	Unit
Power supply voltage (VCC_5V0)		5.5	V
I/O port voltage	-0.3	3.6	V
I/O port current		±10	mA
Storage temperature	-40	85	℃

7. Electrical Characteristics

Parameter		Condition	Min.	TYP	Max.	Unit
Operating supply voltage			3.6	5.0	5.5	V
Operating supply ripple voltage					50	mV
Sustained supply current (ex. : at 3D Fixed)				110	120	mA
Peak current					130	mA
I/O INPUT CMOS level	High		1.96		3.3	V
	Low		-0.2		0.84	V
I/O OUTPUT CMOS level	High	Ioh=2mA	2.4		3.3	V
	Low	Iol=2mA	0.1		0.4	V
Back-up Current consumtion				80		uA
Back-up full charge time (Battery capacity: 4mAh)				4		hours
Operating temperature			-40	25	+80	℃

8. Active Antenna Performance

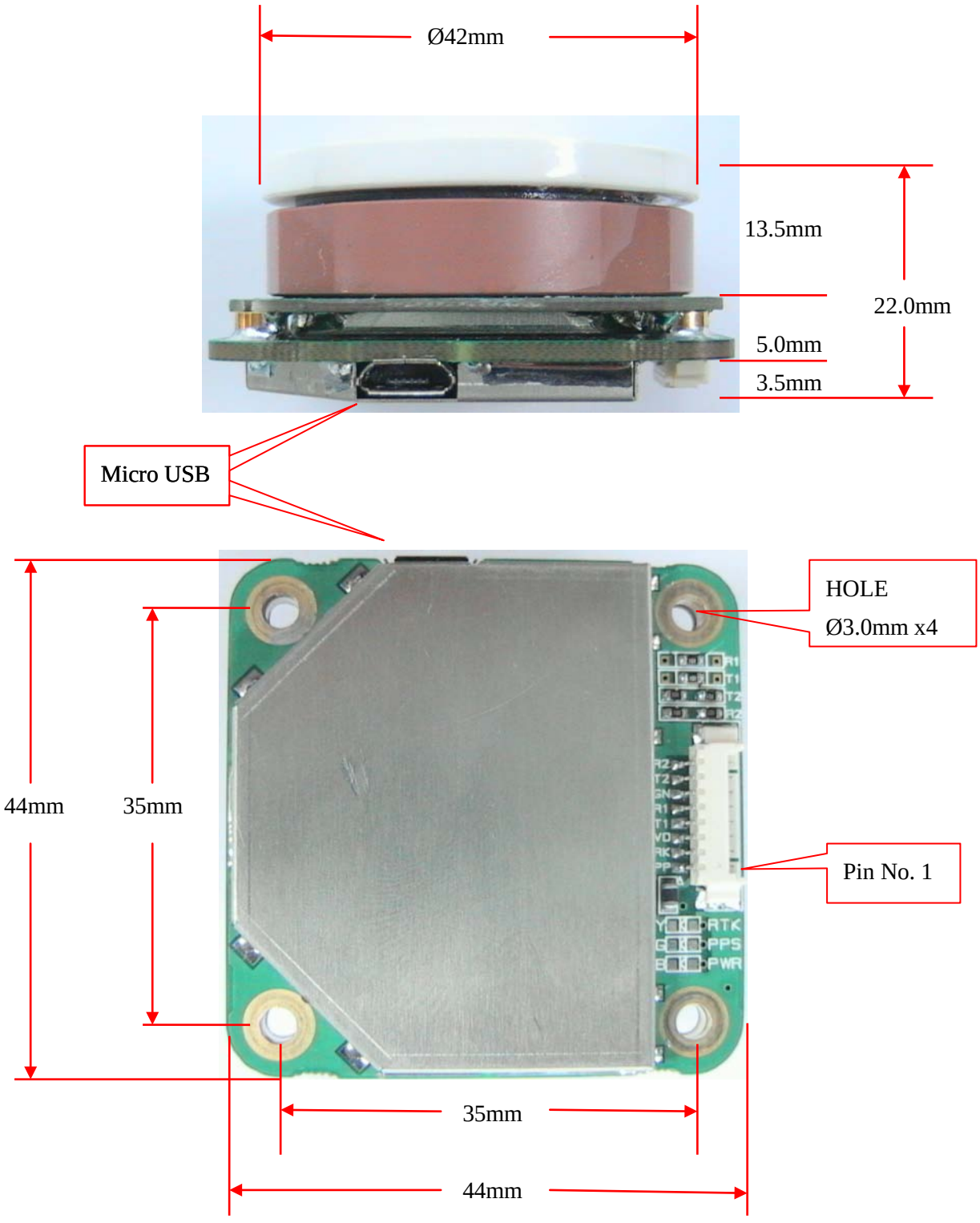
Patch Antenna Element Electrical Specifications (Measured on the 150Ømm ground plane)

No	Item	Specification		Unit
		L1 Band	L2 Band	
1	Frequency	1559.0~1606.0	1197.0~1249.0	MHz
2	Polarization	RHCP	RHCP	
3	Gain @ Zenith	Typ. 3.5	Typ. 0~2.0	dBic
4	Axial Tatio	Typ. 2.0 @ Zenith	Typ. 2.0 @ Zenith	dB
5	Bandwidth @ -10dB	Min 200	Min 200	MHz
6	Impedance	50		Ω

LNA Electrical Specifications

No	Item	Specification		Unit
		L1 Band	L2 Band	
1	Frequency	1559.0~1606.0	1197.0~1249.0	MHz
2	Gain	28.0 ± 3.0 @5V	28.0 ± 3.0 @5V	dB
3	Noise Figure	Typ. 2.8 @5V	Typ. 3.2 @5V	dB
4	Output VSWR	Typ. 2.0:1	Typ. 2.0:1	
5	Voltage Range	DC 3.0~5.0		V
6	Current	Typ. 15.0 @5V		mA
7	Impedance	50		Ω

9. Mechanical Specification

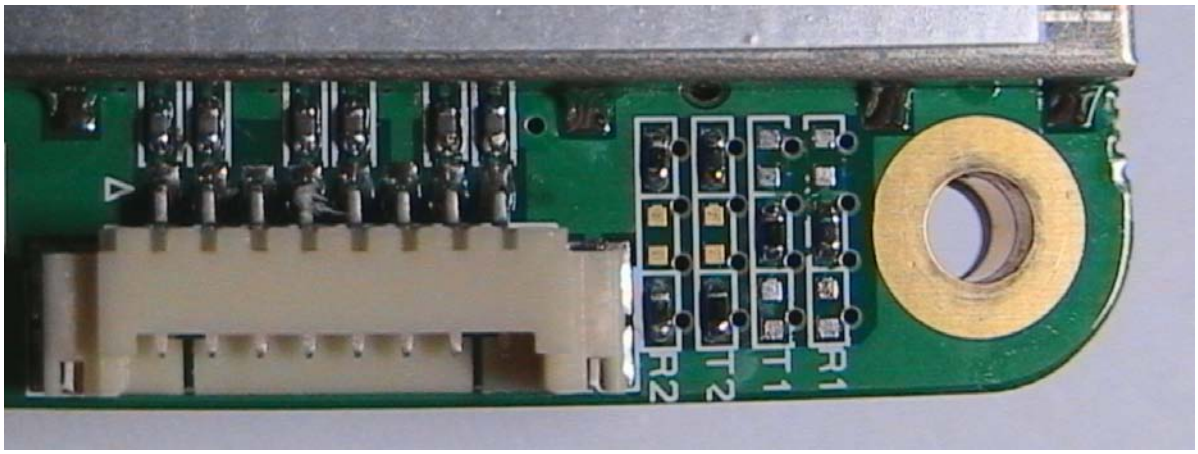


10. Factory Default setting

Interface	Settings	
TX1	115200 bps RS-232 level	UBX + NMEA + RTCM3 Configured to transmit NMEA protocols. 1Hz out GGA,GLL,GSA,GSV,RMC,VTG
RX1		UBX + NMEA + RTCM3
TX2	115200 bps RS-232 level	NMEA Configured to transmit NMEA protocols. 1Hz out GGA,GLL,GSA,GSV,RMC,VTG
RX2		RTCM3
USB		UBX + NMEA + RTCM3 Configured to transmit NMEA protocols. 1Hz out GGA,GLL,GSA,GSV,RMC,VTG
1PPS		1 pulse per second, synchronize at rising edge, pulse length 100mS

Example view) UART Hardware Setting

Changeable to CMOS or RS-232 by resistor(100Ω) position

RX1, TX1 : CMOS Level

RX2, TX2 : RS-232 Level