SPECIFICATION
OF
GPS UNIT

MODEL : TE2041(D8100-2041)

Revision:1.00
DEC.8.1997

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AISIN SEIKI CO.,LTD.

2-1, ASAHI-MACHI, KARIYA,
AICHI, 448 JAPAN

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1.Application Area

This specification is applied to GPS Unit MODEL : TE2041(D8100-2041) which is manufactured by AISIN SEIKI CO.,LTD..

2.General Specifications of GPS Unit

	Item		Specification
1	Dimension		154(W)×115(D) mm
2	Weight		T.B.D.
3	GPS receiver	Frequency	1575.42MHz±1MHz(L1,C/A)
		Channel	8-channel
		Max..no. satellites tracked	8
		Tracking	Parallel (all in view)
		Dynamics	Velocity 300km/h Acceleration 5m/s^2
		Sensitivity	Less than –132dBm (at antenna input)
		Position accuracy*1	Less than 100m, 2DRMS(HDOP<3, SA ON)
		Speed accuracy*1	Less than 0.9m/s(SA OFF)
		Bearing accuracy*1	Less than 3.5degree(60km/h, SA OFF)
		Time To First Fix (TTFF.)	25seconds(Typ.) *2 Min.30seconds Max.960seconds (Cold start)*3
		Reacquisition	Less than 10seconds(after 10seconds interrupt) Less than 12seconds(after 2minutes interrupt) Less than 42seconds(after 6minutes interrupt)
		Adapted antenna	D1200-2041(AISIN SEIKI CO.,LTD.) only
4	Adapted display		D1500-2041(AISIN SEIKI CO.,LTD.) only
5	Display connection method		8p mini DIN connector
6	IVS navigator connection method		8p connector data format : Draft Communication Specification for Final System Aisin Seiki Display and GPS Receiver & IVS Navigator(97/10/23)
7	Rated voltage		13.8VDC
8	Operating voltage		10.5~16.0VDC
9	Power consumption	Operating	850mA(include GPS antenna and display) at 25°C,12VDC
		Stand by	T.B.D.
10	Temperature range	Operating	-20°C to +70°C
		Storage	-40°C to +80°C
11	Humidity Range	Storage	30%~90%RH
		Operating	30%~90%RH(No dewfall)

*1:It can receive continuously more than 4 satellites signal without the effect of the obstacle.

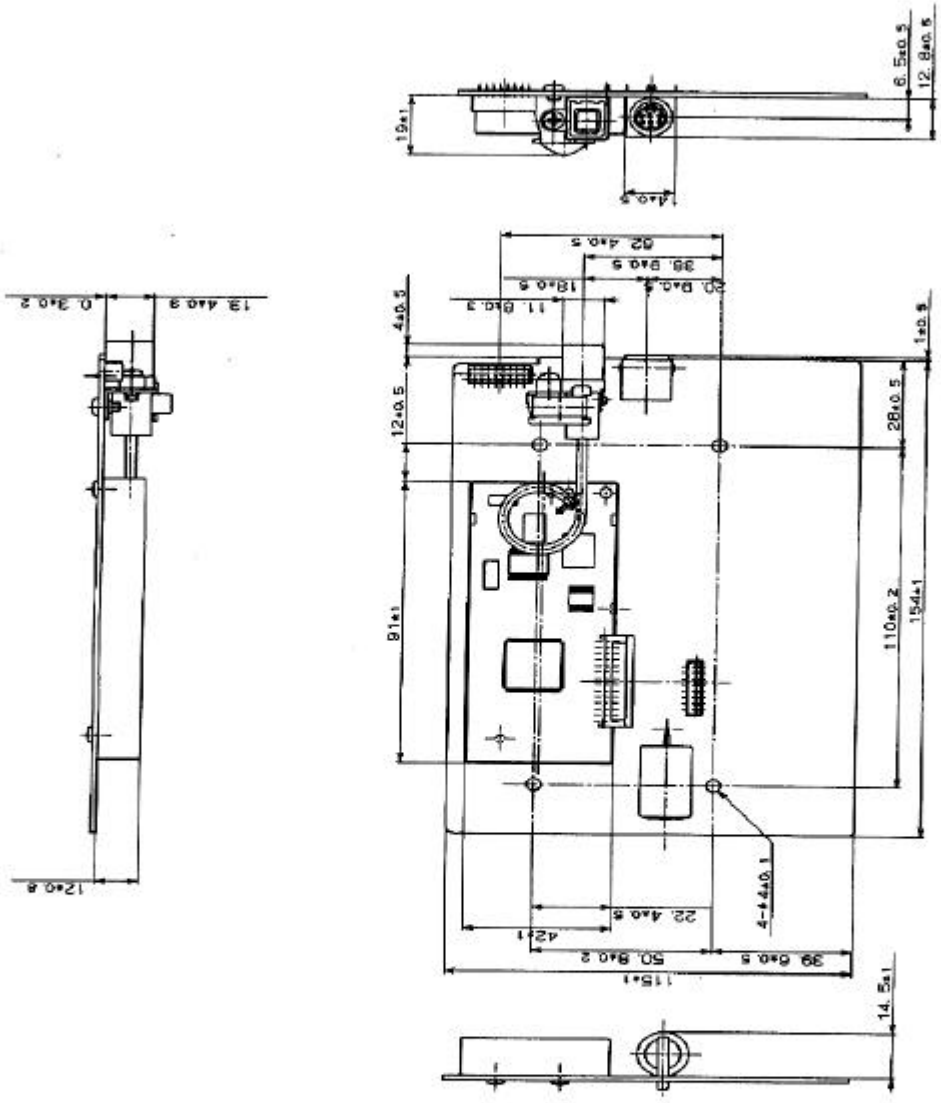
*2:with current almanac, ephemeris, 8visible satellites, HDOP less than 3, current position within ±10seconds, current time within ±22seconds and velocity less than 150km/h

*3:with HDOP less than 5 and it can receive continuously more than 5 satellites signal without the effect of the obstacle

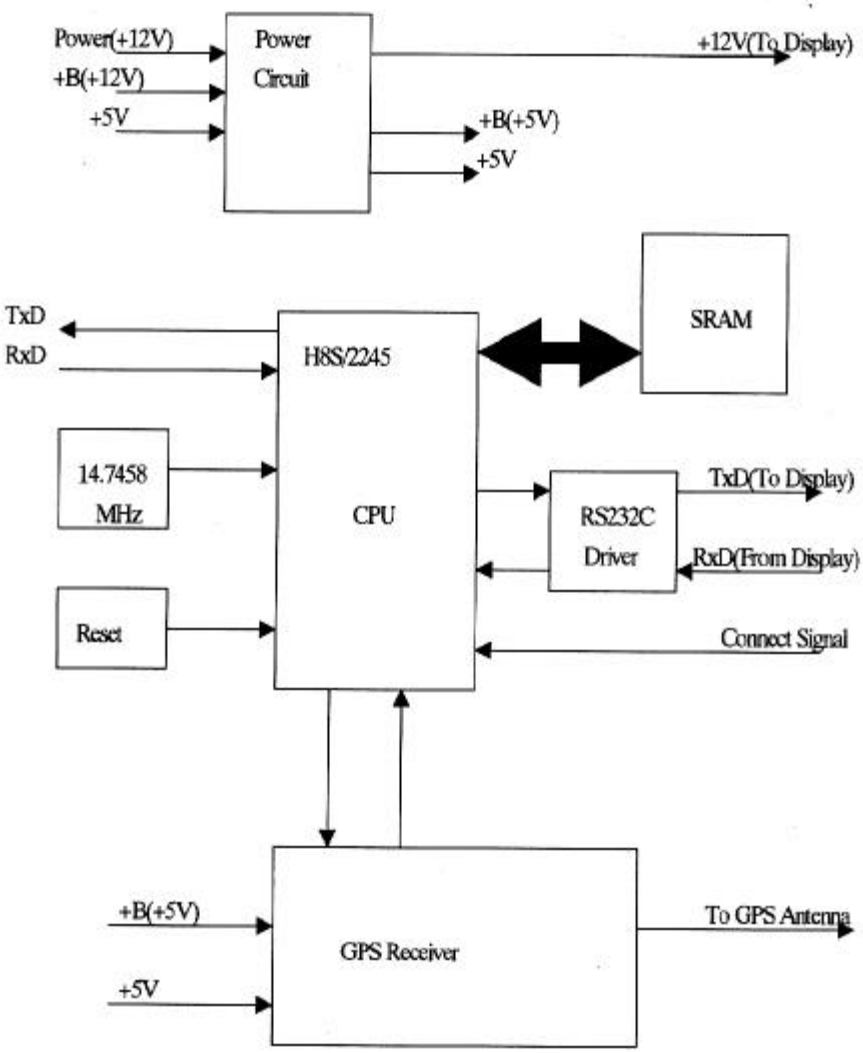
Note : Under the condition that there are some electrical noises have the spectrum of near 1575.42MHz around the GPS Unit or GPS Antenna, these specifications may not be accomplished.

Note : As GPS is developed by the U.S. Department of Defense, the GPS signal is occasionally intentionally changed. In that case these specifications may not be accomplished.

3.Outside View



4.Block Diagram



5.Functions

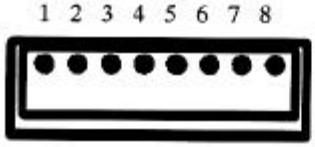
GPS Unit includes high performance GPS receiver also calculates distance by GPS data and approaching turn command sends to IVS navigator. GPS Unit receives the commands from IVS navigator, converts them to the format for the display units and send the display units the commands. The detail is prescribed by the function specification of GPS Unit and Display Unit.

6.Electric Specification

6-1.Connector of GPS unit

6-1-1.Interface Connector

Pin No.	Contents		To be connected to
1	Power.(+12VDC)	In	IVS Navigator
2	GND	GND	
3	Power(+5VDC)	In	
4	GND	GND	
5	Transmit Signal(Tx)	Out	
6	Received Signal(Rx)	In	
7	Signal GND	GND	
8	Back up(+12VDC)	In	

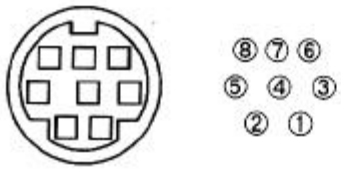


HIROSE DF3A-8P-2DSA

Fig.6-1 Pin No.

6-1-2.Display Connector

Pin No.	Contents		To be connected to
1	Power(+12VDC)	Out	Display
2	Power(+12VDC)	Out	
3	Transmit Signal(Tx)	Out	
4	Signal GND	GND	
5	Receive Signal(Rx)	In	
6	GND	GND	
7	GND	GND	
8	Connect Signal	In	

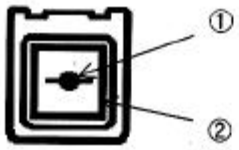


HOSHIDEN TCS7927-58-401

Fig.6-2 Pin No.

6-1-3.GPS Antenna connector

Pin No.	Contents		To be connected to
1	GPS Signal / power(+5VDC)	In/out	GPS Antenna
2	GND	GND	



HIROSE GT5-1PP-HU

Fig.6-3 Pin No.

6-2.Electronic Specifications

6-2-1.Interface Line

Pin No.	Contents	Electric Condition	Electric Character	Absolute maximum rating	Input/Output Circuit
1	Power(+12VDC)	13.8V(Typ.)	10.5~16.0V	18V	Fig.6-4
2	GND	-	-	-	-
3	Power(+5VDC)	-	5±0.25V	-0.3~7.0V	-
4	GND	-	-	-	-
5	Transmit Signal(Tx)	0~5V	L level : 0~0.4V H level : 3.5~ Vcc	-0.3~ Vcc+0.3V	Fig.6-5
6	Receive Signal(Rx)	0~5V	L level : -0.3~0.8V H level : 2.0~ Vcc+0.3V	-0.3~ Vcc+0.3V	Fig.6-6
7	Signal GND	-	-	-	Fig.6-5
8	Back up(+12VDC)	13.8V(Typ.)	10.5~16.0V	18V	-

Note : Vcc=5±0.25 V

6-2-2.Display Line

Pin No.	Contents	Electric Condition	Electric Character	Absolute maximum rating	Input/Output Circuit
1	Power(+12VDC)	13.8V(Typ.)	10.5~16.0V	18V	-
2	Power(+12VDC)	13.8V(Typ.)	10.5~16.0V	18V	-
3	Transmit Signal(Tx)	-	-	-	Fig.6-7
4	Signal GND	-	-	-	Fig.6-7
5	Receive Signal(Rx)	-	-	±30V	Fig.6-8
6	GND	-	-	-	-
7	GND	-	-	-	-
8	Connect Signal	0~5V	L level : 0~0.8V H level : 3.70~5.05 V	Vcc+0.3V	Fig.6-9

Note : Vcc=5±0.25 V

6-2-3. GPS Antenna Line

Pin No.	Contents	Electric Condition	Electric Character	Absolute maximum rating	Input/Output Circuit
1	GPS Signal / Power(+5VDC)	-	-	-	-
2	GND	-	-	-	-

6-3.Input/Output Circuit Diagram

6-3-1.Interface Line

Power(+12V) and GND

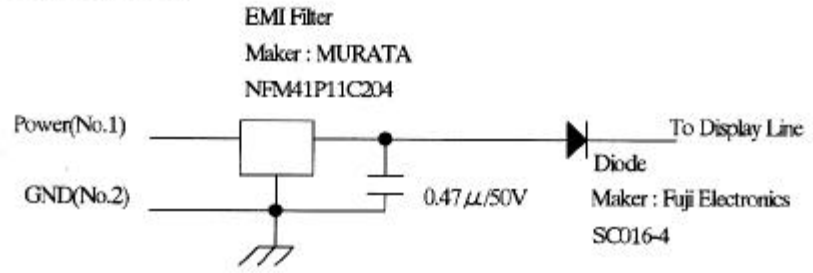


Fig.6-4 Power Line

Tx and Signal GND

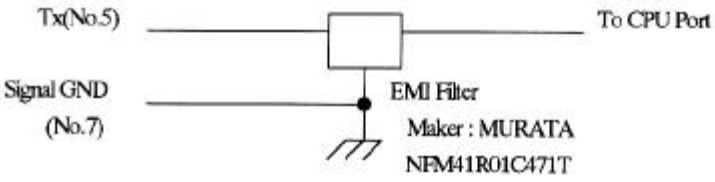


Fig.6-5 Tx Line

Rx and Signal GND

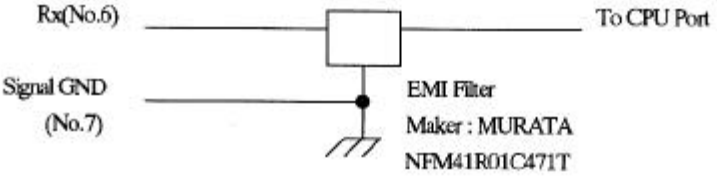


Fig.6-6 Rx Line

6-3-2. Display Line

Tx and Signal GND

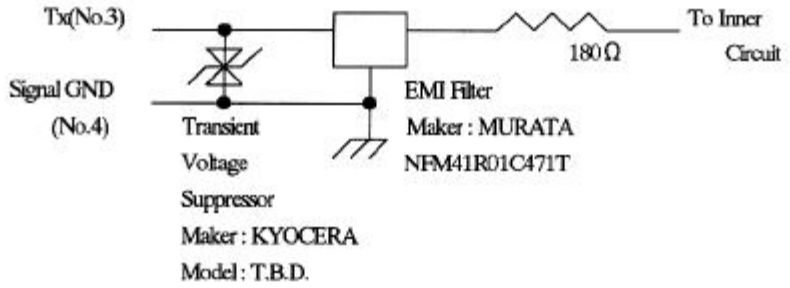


Fig.6-7 Tx Line

Rx and Signal GND

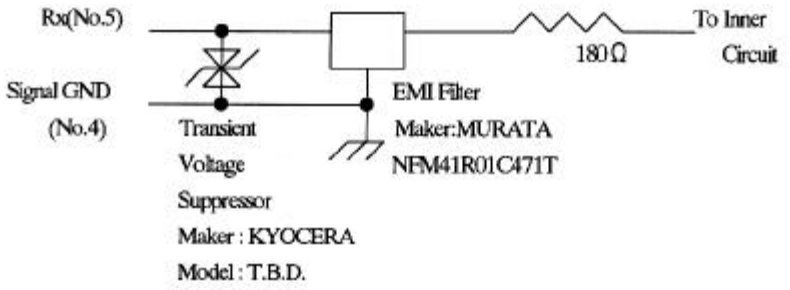


Fig.6-8 Rx Line

Connect Signal

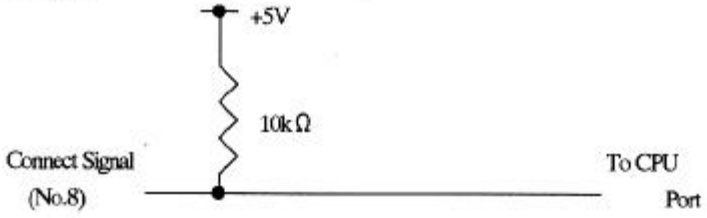


Fig.6-9

7. Reliability Specification

7-1. Standard Test Conditions

Unless otherwise specified, the following test conditions will apply.

Temperature	25±5°C
Humidity	Uncontrolled
Supply Voltage	13.8±0.2VDC
Hook Up	Display is not connected.

7-2. General Tests

7-2-1. Functional Test and Inspection

Unless otherwise specified, functional testing of the GPS Unit shall be done before and after each environmental test to determine if it is functioning correctly. A minimum of 1 hour soak time at ambient temperature should elapse before functional testing.

Unless otherwise specified, the GPS Unit shall be visually inspected externally before and after each environmental test for damage, changes or other anomalous conditions induced by testing.

7-2-2. Operating Voltage Range Test

Nominal Voltage	Minimun Voltage	Maximum Voltage
13.8V	10.5V	16.0V

The GPS Unit shall be functionally tested at each of the above voltages.

7-2-3. Operating Temperature Range Test

Min. Temperature	Max. Temperature	Requirements
-20°C	+70°C	Must Function
-30°C	+80°C	Malfunction OK if Recoverable

The GPS Unit shall be powered off during all temperature transition and for one hour of each temperature soak time. After the hour of temperature soaking, the GPS Unit shall be powered on with 13.8V and functionally tested.

7-3. Temperature and Humidity Test

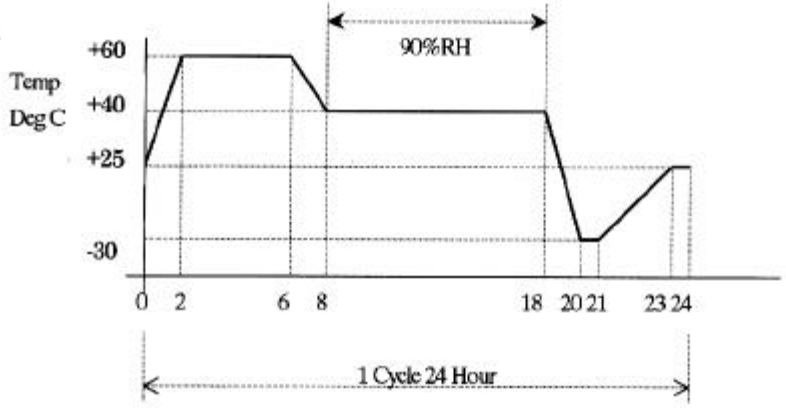
7-3-1. Low Humidity/Temperature Storage Test

Temperature	Humidity	Power	Duration
+40°C	30%RH	Off	96 Hours

After the low humidity/temperature test is complete, the GPS Unit will stay at ambient temperature for a minimum of 2 hours. After 2 hours, the GPS

Unit shall be functionally tested.

7-3-2. Temperature/Humidity Cycling Test



The GPS Unit shall be unpowered through the test. After 5 temperature and humidity cycles, the GPS Unit shall remain at ambient temperature and humidity for a minimum of two hours and then be functionally tested.

7-3-3. Low Temperature Storage Test

Temperature	Power	Duration
-40°C	Off	96 Hours

After the low temperature test is complete, the GPS Unit will stay at ambient temperature for a minimum of 2 hours. After 2 hours, the GPS Unit shall be functionally tested and inspected.

7-3-4. High Temperature Storage Test

Temperature	Power	Duration
+80°C	Off	96 Hours

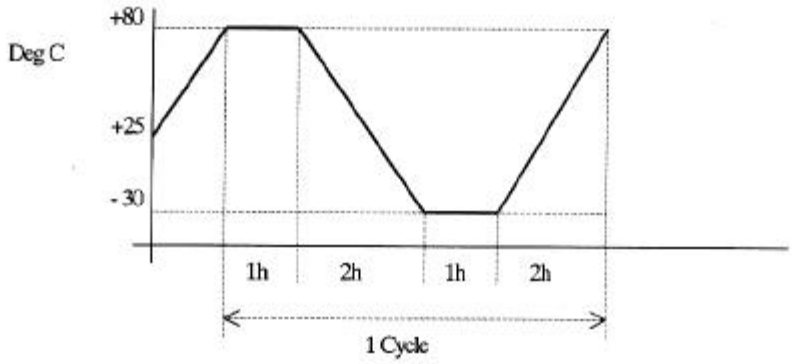
After the high temperature test is complete, the GPS Unit will stay at ambient temperature for a minimum of 2 hours. After 2 hours, the GPS Unit shall be functionally tested and inspected.

7-3-5. High Temperature/Humidity Storage Test

Temperature	Humidity	Power	Duration
+60°C	90%RH	Off	96 Hours

After the high temperature/humidity test is complete, the GPS Unit will stay at ambient temperature for a minimum of 2 hours. After 2 hours, the GPS Unit shall be functionally tested.

7-3-6. Temperature Cycling Test



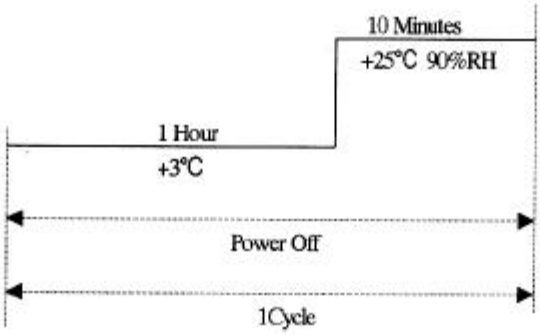
After 50 temperature cycles, the GPS Unit shall stabilize at ambient temperature for a minimum of two hours and then be functionally tested.

7-3-7. Thermal Shock Test

Low Temperature	High Temperature	Temperature Soak Time	Transfer Time	Cycles	Supply Voltage
-30°C	+80°C	1h	<5min	100	Off

After 50 cycles, the GPS Unit shall be allowed to soak at ambient temperature for a minimum of 2 hours. The GPS Unit will then be functionally tested and inspected externally.

7-3-8. Dew Test



Multiple test chambers can be used for this test. The transfer time from the +3°C test chamber to the +25°C, 90%RH, test chamber shall take no longer

than 2 minutes. Recovery of the second chamber for temperature or humidity control within the 10 minute dwell period due to the transfer is not necessary.

After completion of the dew test cycle, the GPS Unit will be dried out at +55°C, 20%RH for 6 hours with the power off. After the dry out period, the GPS Unit will be allowed to remain at ambient temperature and humidity for a minimum period of 8 hours. The GPS Unit will then be functionally tested and visually examined externally for anomalous conditions induced by the test.

7-4. Mechanical Test

7-4-1. Sinusoidal Vibration Test, Power Off

Frequency Range	Acceleration	Sweep Cycle	Duration Each Axis	Power
15-150Hz	3.0G	20 Minutes	X 2Hours Y 2Hours Z 2Hours	Off

The GPS Unit shall be tested in mounted only 4standoffs. After the vibration test is complete, the GPS Unit will be functionally tested and visually inspected.

7-4-2. Sinusoidal Vibration Test, Power On

Frequency Range	Acceleration	Sweep Cycle	Duration Each Axis	Power
15-75Hz	3.0G	20 Minutes	X 2Hours Y 2Hours Z 2Hours	On

The GPS Unit shall be tested in mounted only 4standoffs. After the vibration test is complete, the GPS Unit will be functionally tested and visually inspected.

7-5. Electrical Test

7-5-1. Reversed Polarity Test

Voltage	Duration
Interface connector No.1,8 : GND	1 minute
Interface connector No.2,4,7 : -13.8V	

After subjecting the GPS Unit to the reversed polarity condition, the GPS Unit shall be functionally tested.

7-5-2. Overvoltage Test

Voltage	Duration
+18.0V	1 hour
+24.0V	1 minute

After subjecting the GPS Unit to each overvoltage condition, the GPS Unit shall be functionally tested.

7-6 Transportation Tests

7-6-1. Packaging Drop Test

Drop Height	Drop Orientation	Drop Repetitions	Drop Surface
90 cm	1 Corner 3 edges 6 surfaces	1 Times Per Orientation 10 Times Total	Smooth Concrete

After the drop test, the GPS Unit shall be functionally tested and inspected for damage.

8.GPS character

8-1.GPS Accuracy

GPS is a space-based satellite radio navigation system developed by the U.S. Department of Defense. GPS has essentially very high accuracy. But the GPS signal is intentionally degraded to a certain extent by Selective Availability(SA). SA is used to limit access to the full accuracy of GPS in the interest of U.S. national security. Normally they have about 20m~200m error. But under some condition (ex. multi-path of the building), there is possibility that the error increase.

8-2.GPS Satellites Signal Character and Receive Condition

If there are some obstacle between GPS antenna and GPS satellites, GPS receiver can not receive GPS signal. To determine the position GPS receiver requires to receive more than 3 satellites signals at the same time. So GPS receiver may not determine the position at the particular place described below.

- in a tunnel , underground , indoor parking lot.
- at the place surrounded by tall building or obstacle.
- at the place surrounded by tall tree.
- under the elevated road.

And GPS receiver occasionally may not be able to determine the position when there are some obstacle on or around the GPS antenna.

As the GPS satellite moves around the earth, at the same place the condition of the received GPS signal is changed by the position of the GPS satellites. And the signal of low elevation GPS satellites is easily influenced by some obstacle.

8-3. Time To First Fix

At the first power on after shipping or without use for long time it takes 5 to 16 minutes to fix the position. At the usually use it takes 2 to 5 minutes to fix the position after power on.