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General specification for in-vehicle satellite navigation equipment

车载卫星导航设备通用规范

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General specification for in-vehicle satellite navigation equipment

1 Scope

This Standard specifies the requirements, test methods, inspection rules, marking, packaging, transport, and storage of in-vehicle satellite navigation equipment (hereafter referred to as equipment).

This Standard applies to the development and production of in-vehicle satellite navigation equipment. Other in-vehicle electronic products which combine wireless communication and satellite navigation and have route navigation function can refer for use.

2 Normative references

The following documents are indispensable for the application of this document. For the dated references, only the editions with the dates indicated are applicable to this document. For the undated references, the latest edition (including all the amendments) are applicable to this document.

GB/T 191 Packaging - Pictorial Marking for Handling of Goods

GB/T 2423.1 Environmental testing - Part 2: Test methods - Tests A: Cold

GB/T 2423.2 Environmental testing - Part 2: Test methods - Tests B: Dry heat

GB/T 2423.3 Environmental testing - Part 2: Testing method - Test Cab: Damp heat, steady state

GB/T 2423.5 Environmental testing for electric and electronic products - Part 2: Test methods - Test Ea and guidance: Shock

GB/T 2423.10 Environmental testing for electric and electronic products - Part 2: Tests methods - Test Fc: Vibration (sinusoidal)

GB/T 2828.1-2012 Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

GB/T 2829-2002 Sampling procedures and tables for periodic inspection by attributes (Apply to inspection of process stability)

GB/T 4857.5 Packaging - Transport packages - Vertical impact test method by dropping

GB/T 5080.1-2012 Reliability testing - Part 1: Test conditions and statistical test principles

GB/T 5080.7-1986 Equipment reliability testing - Compliance test plans for failure rate and mean time between failures assuming constant failure rate

GB 5296.1 Instructions for use of products of consumer interest - Part 1: General principles

GB/T 6388 Transport package shipping mark

GB/T 8566 Information technology - Software life cycle processes

GB/T 8567 Specification for computer software documentation

GB/T 12504 Specification for computer software quality assurance plan

GB/T 13384-2008 General specifications for packing of mechanical and electrical product

GB 15842-1995 Mobile radio equipment - Safety requirements and testing methods

GB/T 17619-1998 Limits and methods of testing for immunity of electrical/electronic sub-assemblies in vehicles to electromagnetic radiation

GB/T 18655-2010 Vehicles boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of on-board receivers

GB/T 19951-2005 Road vehicles - Test methods for electrical disturbances from electrostatic discharge

GB 20263-2006 Navigable electronic map - Basic requirements of security processing technology

GB/T 20267-2006 Criterion of digital map production for automotive navigation system

GB/T 21437.2-2008 Road vehicles - Electrical disturbances from conduction and coupling - Part 2: Electrical transient conduction along supply lines only

The process of using information such as the road network provided by the map database for navigation to help the driver plan the route.

3.6 Route guidance

The process of guiding the driver to drive along a planned route.

3.7 Positioning accuracy

The deviation of the vehicle position determined by the equipment via map matching from the actual position (2DRMS measure).

3.8 Start-up time

The time from the start of power-up of the equipment to the output of the first position data which meets the positioning accuracy requirements.

3.9 Node

The intersection of roads, or the points which distinguish parts of different attributes in a road.

3.10 Segment

The road between two nodes.

3.11 Road network

A road network consisting of nodes and segments.

3.12 Cartographic background

Buildings, railways, water systems, green spaces, boundary lines, etc. in the map which reflect positional relationships.

3.13 Cartographic text

The text of types such as administrative division, road name, street name, national and provincial road markings displayed as map elements, and names of famous places or features.

3.14 North up

The general map display mode, that is, a map is displayed in the manner of north up, south down, west left, and east right.

3.15 Head up

4.1.1 Equipment composition

4.1.1.1 The equipment composition shall include at least the following devices or equipment units:

a) Computing control unit;

b) Navigation positioning devices, including satellite positioning receiver, inertial navigation device;

c) Data storage media, including storage medium of map database for navigation and storage medium of user data;

d) Man-machine interface devices, including display device, voice output device, and device for information input and operation control;

e) External interfaces, including data communication interface or automotive signal interface, such as: speed pulse signal, hand brake signal, vehicle light signal, and reversing signal, etc.

Note: The data communication interface can be built-in.

4.1.1.2 The in-vehicle satellite dynamic navigation equipment shall at least include a receiving device for real-time traffic information.

4.1.2 Basic functions

4.1.2.1 It shall have at least the following basic functions:

a) The function of determining the current position of vehicle in real time during the travel time and performing map matching;

b) The equipment which provides a map display function has a function of displaying the current position and driving direction of vehicle on a map;

c) Target search function;

d) Route planning function;

e) The function of real-time route guidance for the driver.

4.1.2.2 The in-vehicle satellite dynamic navigation equipment shall also have the function of receiving, analyzing, and processing real-time traffic information.

4.1.3 Software design

The following requirements shall be met:

e) The security processing shall comply with the provisions of GB 20263-2006.

4.1.7 Operation and control

The following requirements shall be met:

a) The operation shall be simple and sensitive, in line with normal usage habits;

b) Mis-operation shall not cause malfunction of the equipment and equipment damage;

c) Control shall be sensitive and convenient for normal regulation;

d) Commonly-used operations shall be easy to complete.

4.1.8 Appearance quality

The surface shall be free of defects such as dents, scratches, cracks, deformation, rust, mildew stain, and overflow of the infusion. The coating (plating) layer shall not be foamed, cracked, or peeled off. The text symbols and markings shall be clear and beautiful.

4.1.9 Boundary dimensions, mass, and installation

Boundary dimensions, mass, and installation methods are specified by product standards, but the installation of the equipment shall not affect the driver's safe driving.

4.2 Performance and function requirements

4.2.1 Performance

4.2.1.1 Positioning accuracy

The positioning accuracy of the satellite positioning equipment shall be less than 15 m (2DRMS measure). The position of the vehicle displayed on the map or the position of voice prompt shall be consistent with the actual position of vehicle. The error probability shall be less than 5%.

4.2.1.2 Position update rate

At least every 1 s, a new vehicle position shall be generated, displayed, and output.

4.2.1.3 Start-up time

Two map display modes of north up and head up shall be provided. When using the head-up display mode, the function of rotating the map anywhere in the map area shall be provided. The angular difference between the map rotation and the head direction shall be within the range of ±6°.

d) Map roaming

Two types of map roaming functions, position scrolling and smooth scrolling, shall be provided.

e) Cartographic text display

- Overlapping display of cartographic text shall be avoided;

- When the map is rotated, the rotation angle of cartographic text, based on the horizontal display, shall be within the range of ±90°.

f) Display of icons for points of interest

- Overlapping display of icons for points of interest shall be avoided;

- The size of icons for points of interest shall not be scaled with the zoom of map. The direction of icons for points of interest shall not rotate with the rotation of map.

g) Route display

When the map is displayed during the route guidance process, the route shall be highlighted, to make it easy for the driver to distinguish the direction of the route.

4.2.2.3 Target search functions

The following target search functions shall be provided:

a) Address search function;

b) Name search function for point of interest;

c) Classification search function for point of interest;

d) Peripheral search function.

4.2.2.4 Route planning functions

It shall have the following route planning functions:

the current road grade, information such as the turning direction (left turn, right turn, turn around), turn angle, or ease or emergency at the intersection shall be provided;

- When encountering a roundabout in the route, information on the intersection for leaving the roundabout shall be provided.

c) Prompt information

In the following situations, prompt information shall be provided:

- DRIVE into or out of the highway;

- Close to the destination.

d) Timing to provide maneuver guidance information and prompt information

Prior to the maneuver and prompt position, the appropriate information shall be provided. On ordinary roads or streets, at least 300 m shall be advanced. On highways, at least 1000 m shall be advanced. If the distance between two consecutive maneuver or prompt positions is less than 100 m on an ordinary road, or less than 300 m on a highway, while providing guidance information for the previous maneuver or prompt position, it shall be stated that the next maneuver or prompt is very close.

e) Modes of route guidance

It shall have the following route guidance modes:

- Voice guidance: Provide maneuver guidance information and prompt information. When the situation described in 4.2.2.5d) occurs, by playing accurate and concise voice multiple times, the guidance information shall be provided;

- Maneuver guidance screen: DISPLAY a schematic diagram of the maneuver intersection, to provide maneuver guidance information and general guidance information. When the situation described in 4.2.2.5d) occurs, it shall be displayed;

- Map guidance screen: An equipment which provides map display functions shall be able to, through this screen, display a map and provide maneuver guidance information and general guidance information. This screen shall be able to switch with the maneuver guidance screen each other.

4.2.3 Power supply and power consumption

a standard test signal source, the resulting signal shall have the same characteristics as the satellite signal.

5.1.5 All test equipment shall have sufficient resolution, accuracy, and stability. The performance shall meet the requirements of the technical performance index under test. Unless otherwise specified, the accuracy shall be one order of magnitude or one third higher than the accuracy of the index under test.

5.1.6 All test equipment shall pass the metrological verification and be valid.

5.2 General requirements

5.2.1 Overview

For the requirements in Clause 4, if the specific test methods are not specified in this clause, it can be done by visual inspection, drawing, text, object check, operation demonstration, or according to the method specified in the product standard.

5.2.2 Appearance quality

USE visual inspection and hand-feeling to check; or USE a magnifying glass with a magnification of not more than 10.

5.2.3 Boundary dimensions, mass, and installation

USE measuring tool and weighing apparatus to check the dimensions and mass. USE review method to inspect the installation requirements.

5.3 Performance and functions

5.3.1 Positioning accuracy

The positioning accuracy of the satellite positioning device selected by the equipment is tested according to the method specified in the product standard. The positioning accuracy of the equipment is tested as follows:

Install the equipment on the vehicle; and LET it work properly. SELECT roads including typical road conditions such as viaducts, tunnels, parallel roads, T-shaped roads, roundabouts, highway entry-exit, and highway ramps as test roads. Each of the typical road conditions is not less than 5; and the total number is not less than 100. The total test road mileage is not less than 200 km. LET the vehicle, at a speed of not less than 20 km/h, drive on the test road. RECORD the road matching result of the vehicle in the typical road condition maneuver point. COUNT the error probability. When a matching error occurs, an error with an error correction time of less than 10 s is not counted as an error.

recovery time is 2 h. The test time is 16 h. The initial testing and final testing items are carried out according to the items in Table 7.

5.4.3 Cold work

The test method of cold work is carried out in accordance with the provisions of GB/T 2423.1. The temperature stabilization time is 2 h. The recovery time is 2 h. The intermediate testing items are carried out according to the No. 1, 2, and 3 in Table 7. After 2 h of recovery, the initial testing and the final testing items are carried out according to the items in Table 3.

5.4.4 Cold storage

The test method of cold storage is carried out in accordance with the provisions of GB/T 2423.1. The temperature stabilization time is 2 h. The recovery time is 2 h. The test time is 16 h. The initial testing and final testing items are carried out according to the items in Table 7.

5.4.5 Damp heat

The damp heat test method is carried out in accordance with the provisions of GB/T 2423.3.

After the completion of the test for 48 h, the initial testing and the final testing items of the sample under test are carried out according to the items in Table 7.

5.4.6 Vibration

The vibration test method is carried out in accordance with the provisions of GB/T 2423.10.

The intermediate testing items of the sample under test are carried out according to the No. 1, 2, and 3 in Table 3. The initial testing and the final testing items are carried out according to the items in Table 7.

5.4.7 Shock

The shock test method is carried out in accordance with the provisions of GB/T 2423.5.

The sample under test, during the test, shall be in working condition. The initial and final testing items of the sample under test are carried out according to the items in Table 7.

5.5 Safety

5.5.1 Equipment safety

It shall be carried out according to the method specified in Clause 4 of GB/T 21437.2-2008. It is recommended that the performance criterion uses the functional status Class C in Appendix A; that is, the equipment or system, during the application of the disturbance, does not perform one or more of its pre-designed functions; but after the application of the disturbance is stopped, can automatically return to normal operation state.

5.7.6 Electrical transient conduction along single lines

It shall be carried out according to the method specified in Clause 3 of GB/T 21437.3-2012. It is recommended that the performance criterion uses the following functional status: The equipment or system, during the application of the disturbance, does not perform one or more of its pre-designed functions; but after the application of the disturbance is stopped, can automatically return to normal operation state.

5.8 Packaging inspection

The packaging inspection is as follows:

a) Visually inspect and check the contents and packaging marks in the packaging box;

b) According to the provisions of GB/T 4857.5, the vertical impact dropping test is carried out.

6 Quality assessment procedures

6.1 Inspection classification

The inspection includes identification inspection and quality conformity inspection.

6.2 Identification inspection

The purpose of identification inspection is to verify whether the equipment meets its specifications. In one of the following cases, an identification inspection shall be carried out:

a) Design and production finalization;

b) When there are major improvements in design, significant changes in important raw materials, components, and processes so that the former identification conclusions are no longer valid;

c) When production resumes after a long-term shutdown;

6.3.5.1.1 Sampling scheme

The product of lots submitted by the producer for inspection is 100% inspected.

6.3.5.1.2 Criteria

According to the inspection results, the one-hundred percent inspection is judged as follows:

a) When a Class A unqualified item is found, the lot of products shall be judged to be unqualified;

b) When it is found that the Class B and Class C unqualified items are less than or equal to the specified value, the lot of products is judged to be qualified, otherwise it is unqualified. The specific values are specified by the product standard.

6.3.5.1.3 Sample processing

In the lot which has passed the one-hundred percent inspection, for an unqualified product found, the producer shall be responsible for repairing; and after meeting the requirements, may deliver it as a qualified product.

6.3.5.2 Sampling inspection

6.3.5.2.1 Sampling scheme

From the qualified lots submitted for inspection, samples are randomly selected. Unless otherwise specified, the sampling scheme is based on the single normal inspection sampling scheme of general inspection level II specified in GB/T 2828.1-2012. Its acceptance quality limit (AQL) is specified as:

Class A unqualified product: AQL is 0.65;

Class B unqualified product: AQL is 6.5;

Class C unqualified product: AQL is 15.

6.3.5.2.2 Criteria

According to the inspection results, if the number of the three types of unqualified products found is not greater than the specified acceptance number, it is judged that the inspection is passed, otherwise it is unqualified.

6.3.5.3 Re-inspection

If the sampling inspection is unqualified, the producer shall analyze the lot of products; find out the reasons for the non-conformity; take corrective measures;

Based on the number of unqualified products inspected, according to the judgment array requirements in the sampling scheme, it is judged qualified or unqualified. If there is one unqualified group, the delivery shall be suspended; the cause shall be analyzed; and improvement measures shall be taken, to re-perform the periodic inspection. Only after passing the inspection, can the product be delivered.

When the periodic inspection is unqualified, for the products which have been produced and the products which have been delivered, corrective measures are taken by the producer.

6.3.6.3 Sample processing

Samples which are subjected to periodic inspection cannot leave the factory as quality products.

7 Marking, packaging, transport, and storage

7.1 Marking

Product marking shall comply with the provisions of GB/T 191 and GB/T 6388.

On the product, there shall be the following marks: trademark, enterprise name and address, product model, date of manufacture.

Unless otherwise specified by the user, on the packaging box, there shall be the following marks: shipping mark, pictorial marking for packaging and handling, size and mass of packages, etc.

7.2 Packaging

a) Product packaging shall meet the requirements of GB/T 13384-2008;

b) The packing level is carried out according to the level B requirements of SJ/Z 3216-1989;

c) The packages shall be able to withstand the dropping test of GB/T 4857.5. After the test, there shall be no mechanical damage or unqualified electrical property indexes;

d) Unless otherwise specified by the user, the packaging box shall be provided with packing list, certificate of conformity, instructions for use (book), etc.

7.3 Transport

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