

ICS 43.150

CCS Y

团 体 标 准

T/CHINABICYCLE X—202X

智能码表

Smart Bicycle Computer

(征求意见稿)

202X-XX-XX 发布

202X-XX-XX 实施

中国自行车协会 发布

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前 言

本文件按照GB/T 1.1-2020《标准化工作导则 第1部分：标准化文件的结构和起草规则》的规定起草。

请注意本文件的某些内容可能涉及专利。本文件的发布机构不承担识别专利的责任。

本文件由中国自行车协会提出并归口。

本文件起草单位：。

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智能码表

1 范围

本文件界定了具有卫星导航定位功能的智能码表（以下简称码表）的术语和定义，规定了智能码表的通则、要求、检验规则、标志、包装运输和贮存，描述了相应的试验方法。

本文件适用于应用卫星导航定位功能的自行车码表的产品定型和生产检验。也适用于具有卫星导航定位功能的电助力自行车车仪表产品。

2 规范性引用文件

下列文件中的内容通过文中的规范性引用而构成本文件必不可少的条款。其中，注日期的引用文件，仅该日期对应的版本适用于本文件；不注日期的引用文件，其最新版本（包括所有的修改单）适用于本文件。

GB/T 191 包装储运图示标志

GB/T 2423.17 环境试验 第2部分：试验方法 试验Ka：盐雾

GB/T 2829 周期检验计数抽样程序及表（适用于对过程稳定性的检验）

GB/T 4208 外壳防护等级（IP代码）

GB/T 6113.201 无线电骚扰和抗扰度测量设备和测量方法规范 第2-1部分：无线电骚扰和抗扰度测量方法 传导骚扰测量

GB/T 6113.203 无线电骚扰和抗扰度测量设备和测量方法规范 第2-1部分：无线电骚扰和抗扰度测量方法 传导骚扰测量

GB/T 16422.2-2022 塑料 实验室光源暴露试验方法 第2部分：氙弧灯

GB 20263 导航电子地图安全处理技术要求

GB/T 26572 电子电气产品中有害物质的限量要求

GB/T 35774 运输包装件性能测试规范

GB/T 39267 北斗卫星导航术语

3 术语和定义

GB/T 39267及下列术语和定义适用于本文件。

3.1

智能码表

内置智能化系统，具有卫星导航定位功能，能够测量、分析、记录、显示、存储骑行过程中数据信息，且能够应用通信协议控制外部设备，实现人机智能交互的电子设备。

注：数据类型可包括速度、里程、时间、温度、爬升等。

3.2

冷启动

设备在星历、历书、概略时间和概略位置未知的状态下启动。

3.3

热启动

设备在星历、历书、概略时间和概率位置已知的状态下启动。

3.4 缩略语

RTK: 实时动态载波相位差分技术

4 通则

4.1 系统配置

产品系统配置应符合以下要求:

- a) 处理器级别: 32位及以上处理器, 64MHz及以上运行频率;
- b) 存储器: 程序存储器 (Flash) 容量 512kB 及以上, 数据存储器 (RAM) 容量 64kB 及以上;
- c) 协议: 应支持蓝牙 4.2 及以上, 可支持 ANT+、Wi-Fi、USB 等协议;
- d) 支持卫星导航定位系统定位, 至少支持北斗导航定位系统。
- e) 内置导航地图应符合GB 20263标准要求。

4.2 功能

产品应具有以下功能:

- a) 码表可实时显示并记录骑行过程中的骑行速度、里程、时间、温度、爬升等数据;
- b) 码表能够通过无线协议连接外部设备, 能实时采集外部设备的信息, 并可显示外部设备的数据, 如踏频、心率、功率等, 也可通过无线协议控制外部设备;
- c) 码表可通过内置存储器, 存储骑行过程中的各项数据;
- d) 码表可将数据上传至服务器。

5 要求

5.1 外观及结构要求

码表表面不应有碰伤、划痕、变形、污渍。表面涂镀层应均匀, 不应有气泡、龟裂、脱落、磨损。金属部件不应有锈蚀及其他机械损伤。

按键操作灵活可靠, 零部件紧固无松动, 显示屏显示完整、清晰, 亮度色彩均匀。

5.2 性能要求

5.2.1 搜星定位时间

- a) 搜星定位冷启动时间不应大于 50s; 参与定位卫星个数不少于 4 颗;
- b) 搜星定位热启动定位时间不应大于 10s, 参与定位卫星个数不少于 4 颗。

5.2.2 定位精度

- a) 水平精度 $\leq 10\text{m}$;
- b) 垂直精度 $\leq 80\text{m}$ 。

5.2.3 里程精度

码表所测骑行里程与实际里程差值百分比应不大于5%。

5.2.4 平均速度精度

码表所测骑行平均速度与实际速度差值百分比应不大于5%。

5.2.5 爬升精度

码表所测爬升高度与实际爬升高度差值百分比应不大于15%。

5.2.6 温度精度

码表所测温度与实际的环境温度差值绝对数值应不大于3K。

5.3 环境适应性

5.3.1 低温工作

码表经低温试验后，结构和功能应正常，外观良好，防水性能无劣化。

5.3.2 高温工作

码表经高温试验后，结构和功能应正常，外观良好，防水性能无劣化。

5.3.3 温度冲击

码表温度冲击试验后，结构和功能应正常，外观良好，防水性能无劣化。

5.3.4 恒定湿热

码表经恒定湿热试验后，结构和功能应正常，外观良好，显示屏内部不应起雾。

5.3.5 耐候老化

码表经耐候老化试验后，结构和功能应正常，外观良好，无明显变色，显示屏内部不应起雾。

5.3.6 盐雾

码表经盐雾试验后，结构和功能应正常，内部器件不应有腐蚀或损坏。

5.3.7 振动

码表经振动试验后，结构和功能应正常，无零部件松动、脱落、损伤、无间隙增大、变形、外观良好，防水性能无劣化。

5.3.8 跌落

码表经跌落试验后，结构和功能正常，无零部件松动、脱落、损伤、无间隙增大、变形、外观良好，防水性能无劣化。

5.3.9 外壳防护等级

码表外壳防护等级应在IPX6及以上。

5.4 信息安全

5.4.1 升级

码表应具有系统更新升级功能，且至少采用一种安全机制，保证在升级中断等异常情况下码表可恢复，升级过程中的安全性。

5.4.2 数据传输安全

采用蓝牙接口连接设备时，设备之间的通信链路应启用加密方式。

5.5 电气安全

码表电气安全应符合GB 4943.1的相关规定，如有内置锂离子电池组，其安全应符合GB 31241的规定。

5.6 电磁兼容

码表电磁兼容符合GB/T 9254.1《信息技术设备、多媒体设备和接收机 电磁兼容 第1部分：发射要求》中B级设备要求。

5.7 限用物质限量要求

码表限用物质限量要求符合GB/T 26572《电子电气产品有害物质限量要求》。

6 试验方法

6.1 一般试验环境条件

除特殊规定外，所有测试均应在下列环境条件下进行：

- a) 环境温度：15℃-35℃；
- b) 相对湿度：25%RH-75%RH；
- c) 大气压力：86kPa-106kPa。

6.2 外观检查

采用目视和手触方式检查产品。

6.3 性能测试

6.3.1 搜星定位时间

按以下环境条件测试码表搜星定位时间，并记录时间，查看搜星卫星数量。

- 1) 室外空旷环境，天气晴朗、少云，周围150m内无明显遮挡，（一般1.5m以上视为明显遮挡），周边无变电站、通信基站、高铁轨道电磁信号干扰源；
- 2) 使码表的屏幕朝上，将码表置于与实际使用场景基本一致的高度90cm；
- 3) 开启码表，定位成功后读取时间和卫星数量数值。

6.3.2 定位精度

测试位置应选择室外空旷环境，天气晴朗、少云，周围150m内无明显遮挡，（一般1.5m以上视为明显遮挡）在周边无显著电磁信号干扰。

码表测试前通过辅助工具对码表搜星定位时间数值进行读取，应满足5.2.1条搜星定位时间要求。再将码表安装在码表支架上，码表屏幕面朝上进行测试，随机选择3处测试点，每两点之间直线距离至少大于100m，测试3点码表输出的经纬度和海拔数值与RTK设备测试数据进行差值计算。每个测试点重复测试10次，90%以上数据符合要求。

6.3.3 里程精度

a) 测试前路程校准:

--在路面用通用测量工具量出距离 L, L 至少 400m;

--骑着装有琼斯计数器的自行车骑行 4 次分别记作 D1、D2、D3、D4;

--根据计数器显示的数据取平均值, 得出一个换算系数 K, K 按公式 (1) 计算得出;

--用系数 K 计算整个骑行路程。

$$K = \frac{4L}{D1+D2+D3+D4} \dots\dots\dots (1)$$

b) 将琼斯计数器安装于前轮, 开始骑行计数 DN, 骑行不少于 10km。对比码表里程于琼斯计数器计量换算校准的里程 S, 按公式 (2) 计算得出, 计算差值百分比。

$$S = 4L \times DN \times K \dots\dots\dots (2)$$

6.3.4 平均速度精度

在 6.2.4 测试方法下测得的里程和时间, 计算出码表平均速度与码表实际平均速度差值百分比。

6.3.5 爬升精度

码表按正常使用场景安装, 开始骑行后, 骑行路程中累积爬升高度不小于 300m, 对比 RTK 设备测量的爬升数据和码表爬升数据, 计算差值百分比。

6.3.6 温度精度

测试温度设定值: 0℃、25℃、40℃;

按测试温度设定值, 分别设置环境试验箱温度, 试验箱达到设定温度后, 将码表开启和温度计放置环境试验箱中稳定温度 30min 后, 读取码表温度数据输出数值, 与温度计进行对比, 计算差值。

6.4 环境适应性

6.4.1 低温工作

将试验样品放入低温试验箱中, 启动试验箱, 以平均值不大于 5K/min 的变化速率使箱内温度逐渐降低到 -10℃, 温度稳定后开机, 使样品处于工作状态, 检查样品的低温启动性能, 确认启动正常后, 在工作状态下持续测试 2h。

试验结束后马上取出样品检查外观、结构和功能。

6.4.2 高温工作

将试验样品放入高温试验箱中, 样品处于工作状态, 启动试验箱, 以平均值不大于 5K/min 的变化速率使箱内温度逐渐升高到 50℃, 在箱内温度稳定后持续测试 2h。试验结束后马上取出样品检查外观、结构和功能。

6.4.3 温度冲击

a) 两箱法

分别将低温试验箱和高温试验箱设置为-10℃和50℃并达到温度稳定，试验样品处于开机工作状态，先将样品放入高温试验箱中，温度稳定后保持30min，然后取出样品，在3min时间内转移至低温试验箱中，温度稳定后保持30min，然后再取出样品，在3min时间内转移至高温试验箱中进行下一循环，测试10个循环。

试验结束后马上取出样品检查外观、结构和功能。

b) 温度冲击试验箱法

温度冲击试验箱的温度变化速率不应低于25K/min。

将试验样品放于温度冲击试验箱中，样品处于开机工作状态，低温设定-10℃，高温设定50℃，转换时间设定30min，启动试验箱开始试验，持续测试10个循环。

试验结束后马上取出样品检查外观、结构和功能。

6.4.4 恒定湿热

将试验样品放入温度40℃、相对湿度93%的湿热试验箱中，样品处于关机状态，在温湿度稳定后，测试96h。

试验结束后取出样品在常温下静置1h后，检查外观、结构和功能。

6.4.5 耐候老化

按GB/T 16422.2-2022表3方法A循环序号1或表4方法A循环序号4规定的试验方法进行试验，试验时间120h。

6.4.6 盐雾

按GB/T 2423.17规定的试验方法进行试验，试验时间48h。

6.4.7 振动

将试验样品安装在测试工装上，工装固定在振动试验机的台面上，样品的安装应符合码表实际使用状态。样品处于开机工作状态，所受振动为正弦波形，频率循环范围10-150Hz，交越点60.1Hz以下设定恒定位移峰值0.35mm，60.1Hz以上设定恒定加速度5g，在垂直方向（Z向）上持续扫频，扫频速率1 oct/min，每个扫频周期包括10Hz-150Hz-10Hz的完整循环，持续测试100个循环。

6.4.8 跌落

试验样品处于开机工作状态，使用跌落试验机从1m的高度分别对样品的上、下、左、右、前、后6个面自由跌落，每面跌落1次，跌落后检查外观、结构和功能。

6.4.9 外壳防护等级

外壳防护等级按GB/T 4208中对应等级规定的方法进行检测。

6.5 信息安全

6.5.1 升级测试

对设备进行固件升级测试，升级过程中中断数据通信，使得本次升级失败。重启设备后设备应能正常启动或通过再次升级恢复到正常状态。

6.5.2 数据传输安全

对于蓝牙连接设备，采用蓝牙抓包器进行抓包，数据传输应为加密模式。

6.6 电气安全

码表电气安全按GB 4943.1的描述的方法进行试验。

如有内置锂离子电池组，安全应按GB 31241的规定试验方法。

6.7 电磁兼容

码表辐射发射按GB/T 6113.203描述的测试方法进行试验，传导发射按GB/T 6113.201描述的方法进行试验。

6.8 限用物质限量要求

码表的限用物质限量按GB/T 26572 《电子电气产品有害物质限量要求》检测。

7 检验规则

7.1 通则

产品应经生产企业质量检验部门检验合格，并附有合格证方能出厂。

产品检验分出厂检验、周期检验和型式检验。

7.2 型式检验

7.2.1 检验时机

型式检验可在下列情况进行：

- 1) 在产品的设计定型和生产定型时；
- 2) 产品的主要设计、工艺、材料有重大改变时；
- 3) 合同环境下用户或第三方监督部门提出要求时。

7.2.2 型式检验方法

型式试验是使用与正常生产相同的材料、工艺和设备生产并随机抽取的产品，型式检验项目、要求、方法见表2。

表2

序号	项目检验	要求章节号	试验方法章条号
1	外观及结构要求	5.1	6.2
2	搜星定位时间	5.2.1	6.3.1
3	定位精度	5.2.2	6.3.2
4	里程精度	5.2.3	6.3.3
5	平均速度精度	5.2.4	6.3.4
6	爬升精度	5.2.5	6.3.5
7	温度精度	5.2.6	6.3.6
8	低温工作	5.3.1	6.4.1
9	高温工作	5.3.2	6.4.2
10	温度冲击	5.3.3	6.4.3
11	恒定湿热	5.3.4	6.4.4

12	耐候老化	5.3.5	6.4.5
13	盐雾	5.3.6	6.4.6
14	振动	5.3.7	6.4.7
15	跌落	5.3.8	6.4.8
16	外壳防护等级	5.3.9	6.4.9
17	信息安全	5.4	6.5
18	电气安全	5.5	6.6
19	电磁兼容	5.6	6.7
20	限用物质限量要求	5.7	6.8

7.2.3 判定规则

产品型式检验项目全部合格。

7.3 出厂检验

按照本文件规范性条款要求，由企业技术文件规定的出厂检验项目，对出厂产品逐一进行检验，应全部合格。

出厂检验用于供需双方交货验收时，可以在合同中另作约定。

7.4 周期检验

按照 GB/T 2829 的规定，采用一次抽样方案。本文件所有检验项目从出厂检验合格品中抽取样本进行检验。检验项目、判别水平（DL）、不合格分类、不合格质量水平（RQL）、样本量（ n ）、判定数组等内容见表 3。

表3

序号	项目检验	标准要求章节号	试验方法章条号	DL	不合格分类	RQL	n	判定数组
1	外观及结构要求	5.1	6.2	II	B	120	n=3	Ae=1;Re=2
2	搜星定位时间	5.2.1	6.3.1	II	B	65	n=3	Ae=1;Re=2
3	定位精度	5.2.2	6.3.2	II	B	65	n=3	Ae=1;Re=2
4	里程精度	5.2.3	6.3.3	II	B	65	n=3	Ae=1;Re=2
5	平均速度精度	5.2.4	6.3.4	II	B	65	n=3	Ae=1;Re=2
6	爬升精度	5.2.5	6.3.5	II	B	65	n=3	Ae=1;Re=2
7	温度精度	5.2.6	6.3.6	II	B	65	n=3	Ae=1;Re=2
8	低温工作	5.3.1	6.4.1	II	B	65	n=3	Ae=1;Re=2

								=2
9	高温工作	5.3.2	6.4.2	II	B	65	n=3	Ae=1;Re =2
10	温度冲击	5.3.3	6.4.3	II	B	65	n=3	Ae=1;Re =2
11	恒定湿热	5.3.4	6.4.4	II	B	65	n=3	Ae=1;Re =2
12	耐候老化	5.3.5	6.4.5	II	B	65	n=3	Ae=1;Re =2
13	盐雾	5.3.6	6.4.6	II	B	65	n=3	Ae=1;Re =2
14	振动	5.3.7	6.4.7	II	B	65	n=3	Ae=1;Re =2
15	外壳防护等级	5.3.9	6.4.9	II	B	65	n=3	Ae=1;Re =2

8 标签和随行文件

8.1 标签

产品应在外包装或标签、说明书上应标示以下信息：

- a) 产品名称，型号，品牌；
- b) 主要技术参数（至少包括协议、防水等级、屏幕尺寸、电池容量）；
- c) 执行标准；
- d) 制造商名称，生产地址，生产编号。

8.2 随行文件

产品出厂应包含以下随行文件：

- a) 合格证；
- b) 保修卡；
- c) 装箱单（包含配件、附件明细清单）；
- d) 说明书。

9 包装、运输和贮存

9.1 包装

产品应符合GB/T 35774标准要求，转运外部包装箱运输标识应符合GB/T 191标准要求。

9.2 运输

运输过程中应捆扎牢固，不能重压、抛掷、雨淋、暴晒。不得与有腐蚀性物质混装。

9.3 贮存

产品应放在清洁、通风、阴凉、干燥的库房内贮存，避免阳光暴晒、雨淋、潮湿。并不得与有腐蚀性物质共同存放。

ICS 43.150

CCS Y

Group Standard

T/CHINABICYCLE XX—202X

Smart Bicycle Computer

智能码表

(Draft)

Issued on XX-XX-202X Implemented on XX-XX-202X

Issued by China Bicycle Association

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Preface

This document is drafted in accordance with the provisions of GB/T 1.1-2020 Directives for Standardization - Part 1: Rules for the Structure and Drafting of Standardizing Documents.

Please note that some of the contents of this document may be patent-related. The issuing organization of this document does not assume responsibility for identifying patents.

This document is proposed by and under the jurisdiction of China Bicycle Association.

Drafting organizations of this document:

Main drafters:

Bicycle Computer

1 Scope

This document defines the terms and definitions of smart bicycle computers (hereinafter referred to as bicycle computer) with satellite navigation and positioning functions, stipulates the general rules, requirements, inspection rules, marking, packaging, transportation, and storage of bicycle computers, and describes the corresponding test methods.

This document applies to the product finalization and production inspection of bicycle computers with satellite navigation and positioning functions. It is also suitable for power-assisted bicycle instrument products with satellite navigation and positioning functions.

2 Normative References

The contents in the following documents constitute essential clauses of this document through normative references. Among them, for dated references, only the version corresponding to the date applies; for undated references, the latest version (including all amendments) applies.

GB/T 191 Packaging - Pictorial marking for handling of goods

GB/T 2423.17 Environmental testing - Part 2: Test method - Test Ka: Salt mist

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

GB/T 4208 Degrees of protection provided by enclosure (IP code)

GB/T 6113.201 Specification for radio disturbance and immunity measuring apparatus and methods—Part 2-1:Methods of measurement of disturbances and immunity—Conducted disturbance measurements

GB/T 6113.203 Specification for radio disturbance and immunity measuring apparatus and methods—Part 2-3:Methods of measurement of disturbances and immunity—Radiated disturbance measurements

GB/T 16422.2-2022 Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps

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

GB/T 26572 Requirements of concentration limits for certain restricted substances in electrical and electronic products

GB/T 35774 Standard practice for performance testing of shipping containers

GB/T 39267 Terminology for BeiDou navigation satellite system (BDS)

3 Terms and Definitions

GB/T 39267 and the following terminologies and definitions are applicable to this document.

3.1

Bicycle Computer

An electronic device with a built-in intelligent system and satellite navigation and positioning functions that can measure, analyze, record, display, and store data information during the cycling process. Moreover, it can use communication protocols to control external devices and realize intelligent human-computer interaction.

Note: Data types may include speed, mileage, time, temperature, elevation gain, etc.

3.2

Cold Start

The device starts up without knowledge of the ephemeris, almanac, approximate time, and approximate location.

3.3

Hot Start

The device starts up with known ephemeris, almanac, approximate time, and approximate location.

3.4 Abbreviations

RTK: Real-time kinematic carrier phase differential technology

4 General Rules

4.1 System Configuration

The product system configuration shall meet the following requirements:

- a) Processor: A processor with a bit of 32 or above and an operating frequency of 64 MHz or above;
- b) Memory: Program memory (Flash) with a capacity of 512 KB or above, and data memory (RAM) with a capacity of 64 KB or above;
- c) Protocol: Supports Bluetooth 4.2 or above, as well as ANT+, Wi-Fi, USB and other protocols;
- d) Supports satellite navigation and positioning systems, or at least supports the BeiDou Navigation Satellite System.
- e) The built-in navigation maps of the bicycle computer should comply with the requirements of GB 20263.

4.2 Functionality

The product shall have the following functions:

- a) The bicycle computer can display and record real-time data such as cycling speed, mileage, time, temperature, and elevation gain during cycling;
- b) The bicycle computer can connect to external devices wirelessly protocols, collect real-time information from external devices, and display data from external devices, such as cadence, heart rate, and power. It can also control external devices through wireless protocols;
- c) The bicycle computer can store various cycling data through the internal memory;

d) The bicycle computer can upload data to the server.

5 Requirements

5.1 Appearance and Structure Requirements

The surface of the bike computer should be free from damage, scratches, deformation, and stains. These surfaces should be evenly coated, without any bubbles, cracks, shedding, or abrasion. Metal parts should be free from rust and other mechanical damage.

The buttons should be flexible and reliable, the components should be securely fastened without looseness, the display screen should be complete and clear, and the brightness and color should be uniform.

5.2 Performance Requirements

5.2.1 Satellite Positioning Time

- a) The cold start time for satellite positioning shall not exceed 50s, and the number of participating positioning satellites shall be no less than 4;
- b) The hot start time for satellite positioning shall not exceed 10s, and the number of participating positioning satellites shall be no less than 4.

5.2.2 Positioning Accuracy

- a) Horizontal accuracy ≤ 10 m;
- b) Vertical accuracy ≤ 80 m.

5.2.3 Mileage Accuracy

The percentage difference between the cycling mileage measured by the bicycle computer and the actual mileage should not exceed 5%.

5.2.4 Average Speed Accuracy

The percentage difference between the average riding speed measured by the bicycle computer and the actual speed should not exceed 5%.

5.2.5 Elevation Accuracy

The percentage difference between the elevation gain measured by the bicycle computer and the actual elevation should not exceed 15%.

5.2.6 Temperature Accuracy

The absolute difference between the temperature measured by the bicycle computer and the actual ambient temperature should not exceed 3 K.

5.3 Environment Adaptability

5.3.1 Low-Temperature Operation

After the low-temperature test, the bicycle computer's structure and functions should remain normal, with a good appearance and no degradation in waterproof performance.

5.3.2 High-Temperature Operation

After the high-temperature test, the bicycle computer's structure and functions should remain normal, with a good appearance and no degradation in waterproof performance.

5.3.3 Temperature Shock

After the temperature shock test, the bicycle computer's structure and functions should remain normal, with a good appearance and no degradation in waterproof performance.

5.3.4 Constant Humidity and Heat

After the constant humidity and heat test, the bicycle computer's structure and functions should remain normal, with a good appearance and the inside of the display screen should not be fogged.

5.3.5 Weather Aging Resistance

After the weathering aging test, the bicycle computer's structure and function should be normal with a good appearance without obvious discoloration, and the inside of the display should not be fogged.

5.3.6 Salt Mist

After the salt mist test, the bicycle computer's structure and functions should remain normal, with no corrosion or damage to internal components.

5.3.7 Vibration

After the vibration test, the bicycle computer's structure and functions should remain normal. The appearance should remain great without loose, detached or damaged parts, increased clearances, deformations, deterioration in waterproof performance, or any other abnormalities.

5.3.8 Drop Protection

After the drop protection test, the bicycle computer's structure and functions should remain normal. The appearance should remain great without loose, detached or damaged parts, increased clearances, deformations, deterioration in waterproof performance, or any other abnormalities.

5.3.9 Enclosure Protection Rating

The enclosure protection rating of the bicycle computer should be IPX6 or above.

5.4 Information Security

5.4.1 Upgrade Function

The bicycle computer should have the function of system update and upgrade, and adopt at least one security mechanism to ensure that the bicycle computer can be restored in abnormal circumstances such as upgrade interruption, and ensure security during the upgrade process.

5.4.2 Data Transmission Security

When devices are connected using the Bluetooth interface, encryption should be enabled on the communication link between the devices.

5.5 Electrical Safety

The electrical safety of the bicycle computer should comply with the relevant provisions of GB 4943.1. If have the safety of the built-in lithium-ion battery pack, that should comply with GB 31241.

5.6 Electromagnetic Compatibility

The electromagnetic Compatibility of the bicycle computer should comply with the Class B equipment requirements in GB/T 9254.1 Information technology equipment, multimedia equipment and receivers -- Electromagnetic compatibility -- Part 1: Emission requirements.

5.7 Requirements for Restricted Substances

The requirements for Restricted Substances of the bicycle computer should comply with GB/T 26572 Quantity Limitations of Hazardous Substances in Electronic and Electrical Products.

6 Test Methods

6.1 Ambient Conditions

Unless otherwise specified, all tests shall be carried out under the following ambient conditions:

- a) Ambient temperature: 15°C–35°C;
- b) Relative humidity: 25% RH–75% RH;
- c) Atmospheric pressure: 86 kPa–106 kPa.

6.2 Appearance Inspection

Inspect the product both visually and by touch.

6.3 Performance Tests

6.3.1 Satellite Positioning Time

Test the bicycle computer's satellite positioning time under the following environmental conditions, record the time, and check the number of satellites.

- 1) An open outdoor environment, with clear weather and few clouds, no significant obstruction within 150 m (obstructions higher than 1.5 m are generally considered significant), no power substations, communication base stations, high-speed rail tracks or electromagnetic signal interference sources nearby;
- 2) Keep the screen of the bicycle computer facing upwards and place it at a height of 90 cm which is consistent with the actual usage scenario;
- 3) Turn on the bicycle computer and read the time and number of satellites after successful positioning.

6.3.2 Positioning Accuracy

The test location should be in an open outdoor environment, with clear weather and few clouds, and no significant obstructions within 150 m (obstructions higher than 1.5 m are generally considered significant). There is no significant electromagnetic signal interference around.

Before testing the bicycle computer, use auxiliary tools to read the values of the satellite positioning time of the bicycle computer, which should meet the requirements of section 5.2.1 Satellite Positioning Time. Then, install the bicycle computer on its bracket with the screen side facing upwards for the test. Randomly select three test points, and ensure the straight-line distance between any two points is more than 100 m. Calculate the difference between the latitude, longitude, and altitude values output by the bicycle computer at the three test points and the RTK device test data. Repeat the test 10 times for each test point, and ensure that more than 90% of the data meets the requirements.

6.3.3 Mileage Accuracy

a) Distance calibration before testing:

--Measure the distance L on the road surface with a general measuring tool. L should be at least 400 m;

--Ride a bicycle equipped with a Jones counter four times and record them as D1, D2, D3 and D4 respectively;

--Take the average value according to the data displayed by the counter to obtain a conversion coefficient K, which is calculated according to formula (1);

--Use coefficient K to calculate the entire riding distance.

$$K = \frac{4L}{D1+D2+D3+D4} \dots\dots\dots (1)$$

b) Install the Jones counter on the front wheel and start cycling to count DN. The cycling distance should be no less than 10 km. Compare the mileage shown on the bicycle computer with the mileage S calibrated by the measurement and conversion of the Jones counter, which is calculated according to formula (2), and then calculate the percentage of the difference.

$$S = 4L \times DN \times K \dots\dots\dots (2)$$

6.3.4 Average Speed Accuracy

Calculate the difference percentage between the average speed and the actual average speed measured by the bicycle computer based on the mileage and time measured by the test method in 6.2.4.

6.3.5 Elevation Accuracy

Install the bicycle computer according to normal usage scenarios. After starting cycling, accumulate an elevation gain of no less than 300 m during cycling. Compare the elevation data

measured by the RTK device with the bicycle computer's elevation data and calculate the percentage difference.

6.3.6 Temperature Accuracy

Test temperature settings: 0°C, 25°C, 40°C;

Set the temperature of the environmental test chamber according to the test temperature settings. Once the chamber reaches the set temperature, turn on the bicycle computer and place it with a thermometer inside the chamber. After the temperature stabilizes for 30 minutes, read the temperature data output by the bicycle computer, compare it with the thermometer, and calculate the difference.

6.4 Environment Adaptability

6.4.1 Low-Temperature Operation

Place the test sample in a low-temperature test chamber, start the chamber, and gradually lower the temperature inside the chamber to -10°C at a rate not exceeding 5 K/min. After the temperature stabilizes, turn on the sample, keep it operating, and inspect its low-temperature startup performance. After confirming normal startup, continue testing for 2 hours while the sample is in operation mode.

After the test, immediately remove the sample to inspect its appearance, structure, and functions.

6.4.2 High-Temperature Operation

Place the test sample in a high-temperature test chamber while it is in operation mode. Start the chamber, and gradually raise the temperature inside the chamber to 50°C at a rate not exceeding 5 K/min. After the temperature stabilizes, continue testing for 2 hours.

After the test, immediately remove the sample to inspect its appearance, structure, and functions.

6.4.3 Temperature Shock

a) Two-chamber method

Set the low-temperature test chamber to -10°C and the high-temperature test chamber to 50°C, and allow the temperatures to stabilize. Make the test sample in operation mode. First, place the sample in the high-temperature chamber, and maintain it for 30 minutes after the temperature stabilizes. Then, transfer the sample to the low-temperature chamber within 3 minutes, and maintain it for 30 minutes after the temperature stabilizes. Transfer the sample back to the high-temperature chamber within 3 minutes and repeat the cycle. Perform the test for 10 cycles.

After the test, immediately remove the sample to inspect its appearance, structure, and functions.

b) Temperature shock on test chamber method

The temperature change rate of the temperature shock on test chamber should not be less than 25 K/min.

Place the test sample in the temperature shock test chamber while it is in operation mode. Set the low temperature to -10°C and the high temperature to 50°C, with a transition time of 30 minutes. Start the chamber and perform the test for 10 cycles.

After the test, immediately remove the sample to inspect its appearance, structure, and functions.

6.4.4 Constant Humidity and Heat

Place the test sample in a wet heat test chamber at a temperature of 40°C and a relative humidity of 93%. Turn off the sample and test it for 96 hours after the temperature and humidity stabilize.

After the test, remove the sample and let it stand at room temperature for 1 hour, then inspect its appearance, structure, and functions.

6.4.5 Weather Aging Resistance

Perform the test according to the method specified in GB/T 16422.2-2022 Table 3 Method A, Cycle No. 1, or Table 4 Method A, Cycle No. 4, for 120 hours.

6.4.6 Salt Mist

Perform the test according to the test methods specified in GB/T 2423.17, for 48 hours.

6.4.7 Vibration

Install the test sample on the test fixture, and fix the fixture on the table of the vibration test machine. The installation of the sample should be in accordance with the actual usage state of the bicycle computer. The sample is in operation mode. The vibration applied is a sinusoidal waveform, with a frequency range of 10-150 Hz. The constant displacement peak value is set to 0.35 mm below the crossover point of 60.1 Hz, and the constant acceleration of 5 g is set above 60.1 Hz. The frequency sweep is continuously performed in the vertical direction (Z direction) at a sweep rate of 1 octave per minute. Each sweep cycle includes a complete cycle of 10 Hz - 150 Hz - 10 Hz. Perform the test for 100 cycles.

6.4.8 Drop Protection

The test sample is in operation mode. Use a drop test machine to drop the sample freely from a height of 1 m for each of the six faces: up, down, left, right, front, and back. Each face is dropped once. Check the appearance, structure and functions after the product has been dropped.

6.4.9 Enclosure Protection Rating

The enclosure protection rating is tested according to the methods specified in the corresponding level in GB/T 4208.

6.5 Information Security

6.5.1 Upgrade Test

Conduct a firmware upgrade test on the device. During the upgrade process, interrupt the data communication so that this upgrade fails. After restarting the device, the device should be able to start normally or be restored to normal status by upgrading again.

6.5.2 Data Transmission Security

For Bluetooth-connected devices, use a Bluetooth packet sniffer to capture packets, and data transmission should be in encrypted mode.

6.6 Electrical Safety

The electrical safety of the bicycle computer is tested according to the methods described in GB 4943.1.

If a lithium-ion battery pack is built in, the safety test methods specified in GB 31241 should be followed.

6.7 Electromagnetic Compatibility

The radiated emission of the bicycle computer should be tested according to the test methods described in GB/T 6113.203, and the conducted emission shall be tested according to the methods described in GB/T 6113.201.

6.8 Requirements for Restricted Substances

The restricted substance limits of the bicycle computer should be tested according to GB/T 26572 *Quantity Limitations of Hazardous Substances in Electronic and Electrical Products*.

7 Inspection Rules

7.1 General Rules

Products must be inspected and approved by the quality inspection department of the manufacturing enterprise and can only leave the factory with a certificate of conformity attached.

Product inspection is divided into factory inspection, periodic inspection and type inspection.

7.2 Type Inspection

7.2.1 Inspection Timing

Type inspection can be carried out:

- 1) At the time of product design finalization and production finalization;
- 2) When there are major changes in the main design, process or materials of the product;
- 3) When the user or the third-party supervision department puts forward requirements in the contract environment.

7.2.2 Type Inspection Methods

Type inspection involves producing products using the same materials, processes, and equipment as those used in regular production, and selecting products randomly. The type inspection items, requirements, and methods are specified in Table 2.

Table 2

No.	Item	Requirement (Section No.)	Test Method (Section No.)
-----	------	---------------------------	---------------------------

1	Appearance and structure requirements	5.1	6.2
2	Satellite positioning time	5.2.1	6.3.1
3	Positioning accuracy	5.2.2	6.3.2
4	Mileage accuracy	5.2.3	6.3.3
5	Average speed accuracy	5.2.4	6.3.4
6	Elevation accuracy	5.2.5	6.3.5
7	Temperature accuracy	5.2.6	6.3.6
8	Low-temperature operation	5.3.1	6.4.1
9	High-temperature operation	5.3.2	6.4.2
10	Temperature shock	5.3.3	6.4.3
11	Constant humidity and heat	5.3.4	6.4.4
12	Weather aging resistance	5.3.5	6.4.5
13	Salt mist	5.3.6	6.4.6
14	Vibration	5.3.7	6.4.7
15	Drop protection	5.3.8	6.4.8
16	Enclosure protection rating	5.3.9	6.4.9
17	Information security	5.4	6.5
18	Electrical safety	5.5	6.6
19	Electromagnetic compatibility	5.6	6.7
20	Requirements for restricted substances	5.7	6.8

7.2.3 Criterion Rules

All product-type inspection items are qualified.

7.3 Factory Inspection

In accordance with the requirements of the normative clauses in this document, before leaving the factory, each product shall be inspected one by one regarding the factory inspection items specified in the enterprise's technical documents, and all of them should be qualified.

Factory inspection is used for delivery and acceptance by both the supplier and the purchaser, and additional agreements can be made in the contract.

7.4 Periodic Inspection

In accordance with the provisions of GB/T 2829, a single sampling plan shall be adopted. Samples shall be drawn from the qualified products of the factory inspection for the inspection of all inspection items in this document. Contents including the inspection items, discrimination level

(DL), nonconforming classification, rejectable quality level (RQL), sample size (n), and judgment array, etc. are shown in Table 3.

Table 3

No.	Item	Chapter number of standard requirements	Test Method (Section No.)	DL	Nonconforming classification	RQL	n	Judgment array
1	Appearance and structure requirements	5.1	6.2	II	B	120	n=3	Ae=1;Re=2
2	Satellite positioning time	5.2.1	6.3.1	II	B	65	n=3	Ae=1;Re=2
3	Positioning accuracy	5.2.2	6.3.2	II	B	65	n=3	Ae=1;Re=2
4	Mileage accuracy	5.2.3	6.3.3	II	B	65	n=3	Ae=1;Re=2
5	Average speed accuracy	5.2.4	6.3.4	II	B	65	n=3	Ae=1;Re=2
6	Elevation accuracy	5.2.5	6.3.5	II	B	65	n=3	Ae=1;Re=2
7	Temperature accuracy	5.2.6	6.3.6	II	B	65	n=3	Ae=1;Re=2
8	Low-temperature operation	5.3.1	6.4.1	II	B	65	n=3	Ae=1;Re=2
9	High-temperature operation	5.3.2	6.4.2	II	B	65	n=3	Ae=1;Re=2
10	Temperature shock	5.3.3	6.4.3	II	B	65	n=3	Ae=1;Re=2
11	Constant humidity and heat	5.3.4	6.4.4	II	B	65	n=3	Ae=1;Re=2
12	Weather aging resistance	5.3.5	6.4.5	II	B	65	n=3	Ae=1;Re=2
13	Salt mist	5.3.6	6.4.6	II	B	65	n=3	Ae=1;Re=2
14	Vibration	5.3.7	6.4.7	II	B	65	n=3	Ae=1;Re=2
15	Enclosure protection rating	5.3.9	6.4.9	II	B	65	n=3	Ae=1;Re=2

8.1 Labels

Products should be marked with the following information on their outer packaging, labels, or product specifications:

- a) Product name, model, and brand;
- b) Main technical specifications (including at least protocol, waterproof level, screen size, and battery capacity);
- c) Implementation standards;
- d) Manufacturer name and address, and production number.

8.2 Accompanying Documents

Products should be accompanied with the following documents when leaving the factory:

- a) Certificate of conformity;
- b) Warranty card;
- c) Packing lists (including details of accessories and attachments);
- d) User manual.

9 Packaging, Transportation, and Storage

9.1 Packaging

The product should comply with the requirements of GB/T 35774, and the transportation markings on the external packaging should comply with GB/T 191.

9.2 Transportation

Products should be bound firmly and protected properly against heavy pressure, throwing, rain, and sunlight during transportation. No mixed packing with corrosive substances is allowed.

9.3 Storage

Products should be stored in a clean, ventilated, cool, and dry warehouse, avoiding exposure to sunlight, rain, and moisture. Products should not be stored together with any corrosive substances.
