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Technical requirements for shipborne monitoring equipment of Beidou navigation satellite system

北斗卫星导航系统船舶监测终端技术要求

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1 Scope

This Standard specifies the technical requirements including general requirements, structural requirements, functional requirements, performance requirements, environmental conditions, and installation, use, and maintenance requirements for shipborne monitoring equipment of Beidou navigation satellite system.

This Standard is applicable to type selection, use and maintenance for shipborne monitoring equipment of Beidou navigation satellite system. It may also be used as product development, production and quality inspection basis.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB 2312, *Basic set of Chinese character coded character set for information exchange*

GB/T 10250, *Electrical and electronic installations in ships - Electromagnetic compatibility* (GB/T 10250-2007, IEC 60533:1999, IDT)

GB/T 12267, *Marine navigational equipment. General requirements. Methods of testing and required test results* (GB/T 12267-1990, IEC 60945:1988, EQV)

GB/T 17626.3, *Electromagnetic compatibility - Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test* (GB/T 17626.3-2006, IEC 61000-4-3, IDT)

JT/T 680, *Technical requirement for the installation, operation, maintenance and repair of marine navigation equipment*

IEC 61162, *Nautical radio communication equipment and system digital interface*

GSM - Global System for Mobile Communications;

MTBF - Mean Time Between Failures;

MTBR - Mean Time Between Repairs;

PDOP - Positional Dilution of Precision;

PPS - Pulse Per Second;

TTFF - Time to First Fix;

UTC - Universal Time Coordinated;

VHF - Very High Frequency;

WGS-84 - World Geodetic System, 1984.

4 Technical requirements

4.1 General requirements

4.1.1 The receiver shall work reliably and be easy to operate and maintain.

4.1.2 The receiver shall have self-test function.

4.2 Structural requirements

4.2.1 Monitoring terminal antenna and host are in split design. There is cable connection between the antenna and the host. The receiving and transmitting antennas shall be structurally integrated.

4.2.2 The operation display screen shall be able to adjust the brightness until it is off.

4.2.3 There shall be no obvious depressions, scratches, cracks, deformations, etc. on the surface. The surface coating shall not blister, crack and fall off. Metal parts shall not be corroded or mechanically damaged.

4.3 Functional requirements

4.3.1 Self-test and data retention

4.3.1.1 The monitoring terminal has power-on self-test and working condition inspection as well as initialization and condition setting functions. In case of failure, the fault alarm and fault type shall be given in real time, and the prompt shall be given through visual and audio or data interface output.

The monitoring terminal shall be able to complete the following location polling function:

a) After receiving the position polling command issued by the authorized user, the monitoring terminal automatically calculates the shipborne position, speed and heading according to the requirements in the command and sends it to the authorized user through the communication module. Automatic stop position transmission when receiving a stop position polling command from an authorized user;

b) When the monitoring terminal successfully sends the positioning information, it shall be able to give visual or audible prompts according to the settings.

4.3.6.4 Without positioning prompts

When the monitoring terminal is unable to locate, it shall be able to give visual or audible prompts according to the settings.

4.3.6.5 Positioning storage

According to the first-in-first-out principle, it has the function of dynamically storing recent historical location information.

4.3.6.6 Waypoint function

The monitoring terminal shall be able to set and store the waypoints and calculate the distance, bearing, waiting time and estimated arrival time of the arriving waypoints.

4.3.7 Alarm function

The alarm functions of the monitoring terminal are as follows:

a) All monitoring terminals shall be set with distress alert button. In case of emergency or distress, the monitoring terminal shall send a distress alert message to the Beidou satellite navigation system and the management terminal under the trigger of the alarm activation signal. The distress message shall include at least the positioning time, shipborne position and ship identification;

b) The monitoring terminal shall be able to initiate continuous transmission of position information to the Beidou satellite navigation system and the management terminal under the trigger of the alarm activation signal. Sending frequency is 5s. Stop receiving positioning information after receiving the Beidou satellite navigation system or management terminal command.

Performance requirements for receive antenna:

a) Beam width: 5°~90° in the pitch direction and 0°~360° in the horizontal direction;

b) Polarization mode: right circular polarization;

c) Circular polarization axis ratio: no more than 2;

d) Voltage standing wave ratio: no more than 1.5.

4.4.1.2 Receiving frequency

Center frequency: 1.2GHz~1.6GHz.

4.4.1.3 Frequency stability

Frequency stability: 1×10^{-5}.

4.4.1.4 Receiving sensitivity

The requirements for receiving sensitivity of monitoring terminal are as follows:

a) When the carrier frequency range of Beidou satellite navigation signal is -130dBm ~ -120dBm, the monitoring terminal shall be able to capture normally;

b) When the carrier frequency range of Beidou satellite navigation signal is -133dBm ~ -120dBm, the monitoring terminal shall be able to track normally.

4.4.1.5 Positioning accuracy

Positioning accuracy shall be better than 10m (2DRMS) with PDOP≤6.

4.4.1.6 Speed accuracy

The speed accuracy shall be better than 0.2m/s(RMS) under the condition of PDOP≤6.

4.4.1.7 First positioning time

The first positioning time is related to the prior information. The specific requirements are as follows:

a) No information stored (cold boot), TIFF≤120s;

b) Stored with date, time, location and almanac (warm boot), TIFF≤40s;

c) Stored with date, time, location, almanac and ephemeris (hot boot), TIFF≤

4.4.2.1.6 Receive error rate: no more than 1×10^{-5}.

4.4.2.1.7 Pseudo-code tracking random error: no more than 12.5ns.

4.4.2.2 Transmitting part

4.4.2.2.1 Transmitting antenna

Performance requirements for transmitting antenna:

a) Beam width: 10°~75° in the pitch direction and 0°~360° in the horizontal direction;

b) Polarization mode: left circular polarization;

c) Circular polarization axis ratio: no more than 2;

d) Voltage standing wave ratio: no more than 1.5.

4.4.2.2.2 Center frequency

Center frequency: 1.6GHz.

4.4.2.2.3 Transmitted signal strength

Transmitted signal EIRP value range: 10dBW ±1dBW.

4.4.2.2.4 Frequency tolerance of transmitted signal

Frequency tolerance of transmitted signal: no more than 5×10^{-7}.

4.4.2.2.5 Carrier phase noise

Carrier phase noise shall meet:

a) 100Hz: -60dBc/Hz;

b) 1kHz: -70dBc/Hz;

c) 10kHz: -80dBc/Hz;

d) 100kHz: -90dBc/Hz.

4.4.2.2.6 Transmitted signal carrier suppression

The difference between the transmitted signal envelope peak value and the transmitted multiple signal carrier component value: no more than 30 dB.

4.4.2.2.7 Out-of-band suppression of transmitted signal

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