Guideline No. N-11 (202511)

# N-11

# SHIPBORNE BEIDOU SATELLITE NAVIGATION SYSTEM RECEIVER

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**Foreword**

China Classification Society (hereinafter referred to as CCS) Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at http://www.ccs.org.cn. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn

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## CONTENTS

1 Application ..... 4

2 Normative References ..... 5

3 Terms and definitions ..... 7

4 Drawings and Documents ..... 8

5 Technical Requirements (International Voyages) ..... 9

6 Technical Requirements (Domestic Voyages) ..... 22

7 Technical Requirements (Inland Voyages) ..... 27

8 Materials and components ..... 28

9 Type Approval and Unit/batch inspection ..... 28

Appendix A Definitions and Abbreviations ..... 40

A1 Definitions in IEC 61108-5:2020 ..... 40

A2 Definitions in IEC 62923-1:2018 ..... 40

A3 Definitions in GB/T 39267-2020 "Beidou Satellite Navigation Terminology" ..... 46

A4 List of Industry-Used Terms ..... 51

A5 Abbreviations ..... 52

Appendix B Alert Management ..... 54

B1 Alert Management ..... 54

# SHIPBORNE BEIDOU SATELLITE NAVIGATION SYSTEM RECEIVER

## 1 Application

1.1 The technical and management requirements of the Guidelines apply to statutory Beidou products and specific Beidou products that comply with the provisions of Clauses 3.5 and 3.6 of the Guidelines;

1.2 For legal Beidou products, it is applicable to "electronic positioning device receiving equipment" installed on ships with a speed not exceeding 70 knots, which receives positioning signals sent by the Beidou satellite navigation system in accordance with IMO Resolution MSC.379 (93).

1.2.1 The review, approval and survey of statutory Beidou products must meet all applicable standard requirements at the same time, otherwise they shall not be approved and surveyed as statutory products.

1.2.2 In the certificate issued, the purpose column shall be filled in according to the scope of application of the specific Convention and/or Regulations adopted.

1.2.3 For statutory Beidou products required by the Regulations, if no specific technical requirements are specified, a special "Quality Plan*" shall be prepared when the product is approved/surveyed, and the quality plan requirements shall be strictly implemented. The purpose column in the issued certificate should indicate that such products are only applicable to ships specified in the Regulations.

Note 1 Quality plan*: When the procedure documents are insufficient to control the process, special quality control measures shall be formulated for specific projects to ensure the quality of approved/surveyed products.

1.2.4 The names of statutory Beidou products shall be consistent with the names required by the Convention, Regulations and CCS's specifications. In principle, they should not contain words such as "intelligent" and "high precision" that induce customers or trigger product function associations; On the premise of meeting the requirements of the Convention and/or Regulations for statutory Beidou products, if technical functions and technical performance other than those required by law are provided, such functions and performance and their basis standards shall be reflected in the "Remarks" or "Others" column of the survey report and certificate.

1.3 Specific Beidou products: Equipment that uses China's Beidou global satellite navigation system to realize product functions can apply for survey and certification from CCS according to

the requirements of this guideline for specific Beidou products.

1.3.1 The approval/survey of specific Beidou products can be regarded as voluntary approval/survey and should comply with the basic requirements for marine equipment in the standards, technical agreements and CCS specifications and guidelines required by customers. For scientific research projects, only the principle approval certificate can be issued.

1.3.2 The purpose column in the certificate issued should clearly state: "It shall not be used as statutory equipment to meet the requirements of the Convention and/or Regulations."

1.3.3 When a specific Beidou product only meets some clauses of a certain standard, the standard shall not be written into the "Approval and Survey Basis", but only explained in the "Remarks" column of the approval certificate and product certificate, such as: "XXX project complies with XXX clause of XXX standard".

**2 Normative References**

2.1 Resolution A.694(17) General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids

2.2 MSC.379(93) Performance Standard for Shipborne Beidou Satellite Navigation System (BDS) Receiving Equipment

2.3 MSC.302(87), Recommended Standard for Bridge Alarm Management

2.4 MSC.36(63), International Safety Code for High-Speed Craft

2.5 MSC.97(73), International Safety Code for High-Speed Craft (2000)

2.6 MSC.112(73), Performance Standard for Shipborne Global Positioning System (GPS) Receiver Equipment

2.7 Resolution MSC.191(79): Performance Standards for the Presentation of Navigation-related Information on Shipborne Navigational Displays

2.8 Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages (2020), Part 4 Ship Safety, Appendix 5 Performance Standard for Receiving Equipment of Shipborne Beidou Satellite Navigation System (BDS) (hereinafter referred to as the "Regulations")

2.9 Technical Regulations for Statutory Survey of Inland Waterway Ships (2019), Chapter 5 Ship Safety, Chapter 6 Navigational Equipment – Section 6 Performance Standards for Electronic Positioning Device Receiving Equipment

2.10 IEC 60945:2002/COR1:2008: Maritime Navigation and Radiocommunication Equipment and Systems - General Requirements - Methods of Testing and Required Test Results;

2.11 IEC 61108-5:2020 Maritime Navigation and Radiocommunication Equipment and Systems – Global Navigation Satellite System (GNSS) – Part 5: Beidou Satellite Navigation System (BDS) – Receiving Equipment – Performance Requirements, Test Methods and Required Test Results

2.12 IEC 61162, Maritime Navigation and Radiocommunication Equipment and Systems – Digital Interfaces, containing:

IEC 61162-1:2016

IEC 61162-2 2024

IEC 61162-3 Ed.1.2 Consol. with A1 Ed. 1.0:2010-11 and A2 Ed. 1.0:2014-07

IEC 61162-450 2024,

2.13 IEC 62288: 2021 Maritime Navigation and Radiocommunication Equipment and Systems – Representation of Information Related to Navigation on Shipborne Navigation Displays – General Requirements, Test Methods and Required Test Results

2.14 IEC 62923 Maritime Navigation and Radiocommunication Equipment and Systems – Bridge Alarm Management, containing:

IEC 62923-1:2018,

IEC 62923-2:2018.

2.15 GD019-2024 Guidelines for Type Approval Test of Electrical and Electronic Products

Note 2 When the above conventions and regulations are changed, they must be implemented in accordance with the latest requirements. When the test standards are changed, the requirements of the latest version can be referred to.

## 3 Terms and definitions

The definitions and terms specified in the normative reference documents apply to the Guidelines. The following translations used in the Guidelines apply only to the Guidelines. For the convenience of users, the relevant definitions and abbreviations involved in the compilation of this product technology are detailed in Appendix A

3.1 ALERT

Notification of abnormalities and conditions requiring attention.

3.2 ALARM

In order to ensure the safe navigation and safe operation of ships, it is required that the personnel on duty on the bridge pay immediate attention and take action. There are not only visual alert signals, but also sound alert signals. The sound alert signal is a sound broadcast until acknowledged by the operator.

3.3 WARNING

Situations that require immediate attention but no immediate action by the operator on duty on the bridge. There are not only visual alert signals, but also sound alert signals. The sound alert signal is a short sound broadcast repeated every 5 minutes until acknowledged by the operator.

3.4 CAUTION

Recognize that a condition is not an alert or warning condition, but still require attention due to normal considerations of the situation or given information. There is only a visual alert signal, no sound alert signal.

3.5 Statutory Beidou products:

Statutory equipment in accordance with the provisions of international maritime conventions and/or national statutory technical regulations for ships.

3.6 Specific Beidou products:

Beidou products developed or produced in accordance with official documents of national ministries and local governments, as well as technical standards filed by enterprises, are not legal Beidou products.

## 4 Drawings and Documents

4.1 The following drawings and data shall be submitted to CCS for approval:

4.1.1 Product assembly drawing (at least meet the requirements of 5.2.1)

4.1.2 Electrical schematic diagram (PCB level)

4.1.3 Main component drawings (submitted according to the items in 5.2.1)

4.1.4 Port type list and port layout diagram (reviewed according to 5.3.2 requirements)

4.1.5 Product nameplate diagram (at least including the compass safety distance)

4.1.6 List of important (board-level) and core (Beidou chip) parts

4.1.7 Format of sentences supporting BDS receiver operation (reviewed according to Appendix C of IEC 61108-5:2020)

4.1.8 Software function block diagram (including at least the software functions specified in 5.3.10 and 5.3.11)

4.1.9 List of alert items and alert levels (for ships engaged on international voyages, the requirements of Appendix B shall be followed; for sea-going ships engaged on domestic voyages, the requirements of 6.2 shall be followed)

4.1.10 Software version management rules

4.1.11 Product technical conditions (at least including the technical indicators required by 5.3.3~5.3.12)

4.2 The following drawings and documentation shall be submitted to CCS for review

4.2.1 Product instructions

4.2.2 Beidou chip qualification certificate (if any)

4.2.3 Enterprise product catalog list (when applicable)

4.2.4 Software maintenance and update instructions

4.2.5 Type test program (applicable to application for CCS approval)

4.2.6 Factory test program (applicable to application for CCS approval)

4.2.7 Product installation manual, operation manual and maintenance manual.

**5 Technical Requirements (International Voyages)**

5.1 Basic requirements

5.1.1 (M.379/A1.2)The BDS Open Service (OS) provides positioning, navigation and timing services, free of direct user charges. The BDS receiver equipment shall be capable of receiving and processing the open service signal..

5.1.2 (M.379/A 1.3) BDS receiver equipment intended for navigational purposes on ships with a speed not exceeding 70 knots, in addition to the general requirements specified in resolution A.694 (17) and the related standard IEC 60945, shall comply with the following minimum performance requirements.

5.1.3 (M.379/A 1.4) The standards cover the basic requirements of position fixing, determination of course over ground (COG), speed over ground (SOG) and timing, either for navigation purposes or as input to other functions. The standards do not cover other computational facilities which may be in the equipment nor cover the requirements for other systems that may take input from the BDS receiver.

5.2 BDS receiving equipment

5.2.1 Minimum facilities

(M.379/A2.1) The term "BDS receiver equipment" as used in the performance standards includes all the components and units necessary for the system to properly perform its intended functions. The BDS receiver equipment shall include the following minimum facilities:

(1) Antenna capable of receiving BDS signals;

(2) BDS receiver and processor;

(3) Means of accessing the computed latitude/longitude position;

(4) Data control and interface, and;

(5) Position display and, if required, other forms of output.

If BDS forms part of an approved integrated navigation system (INS) , requirements of facilities 3) 4) and 5) may be provided within the INS.

If BDS forms part of an approved multi-system PNT, requirements of facilities 3) 4) and 5) may be provided within the multi-system PNT.

Other computational activity, input/output activity or extra display functions which may be provided shall not degrade the performance of the equipment below the minimum performance requirements set out in this document.

5.2.2 Configuration

The BDS receiver equipment may be supplied in one of several configurations to provide the necessary position information. Examples are as follows:

(1) stand-alone receiver with means of accessing computed position via a keyboard with the positional information suitably displayed;

(2) BDS black box receiver fed with operational parameters from external devices/remote locations and feeding an integrated system with means of access to the computed position via an appropriate interface, and the positional information available to at least one remote location. With this option, a separate user interface called as MKD shall be provided as a backup.

(3) as one of PVT methods included in a multi-system PNT equipment based on IMO resolution MSC.401(95).

The above examples should not be implied as limiting the scope of future development.

5.3 Performance Standards for BDS Receiving Equipment

5.3.1Basic functions

(1) (M.379/A3.1) The BDS receiver equipment shall be capable of receiving and processing the BDS positioning and velocity, and timing signals, and shall use the ionospheric model broadcast to the receiver by the constellation to generate ionospheric corrections.
A detailed description of the BDS navigation signal characteristics is given in BDS SIS Interface Control Document.

(2) (M.379/A3.2) The BDS receiver equipment shall provide position information in latitude and longitude in degrees, minutes and thousandths of minutes.

Means may be provided to transform the computed position based upon the BeiDou coordinate system (BDCS) into data compatible with the datum of the navigational chart in use. Where this facility exists, the display shall indicate that co-ordinate conversion is being performed and shall identify the co-ordinate system in which the position is expressed.

NOTE BDCS is adopted by BDS and differs from WGS 84 by less than 5 cm worldwide. Conversion to WGS 84 is not needed for maritime navigation.

(3) (M.379 / A3.3) The BDS receiver equipment shall provide time referenced to universal time coordinated UTC (NTSC).

5.3.2 Equipment interface

(1) (M.379/A3.4) The BDS receiver equipment shall be provided with at least two outputs from which position information, UTC, course over ground (COG), speed over ground (SOG) and alarms can be supplied to other equipment. The output of position information shall be based on the WGS 84 datum and shall be in accordance with international standards. The output of UTC, course over ground (COG), speed over ground (SOG) and alarms shall be consistent with the requirements of M.379/A3.15 and M.379/A3.17.

(2) (M.379/A3.16) The BDS receiver equipment shall provide at least one normally closed contact, which shall indicate failure of the BDS receiver equipment.

(3) (M.379/A3.17) The BDS receiver equipment shall have a bidirectional interface to facilitate communication so that alarms can be transferred to external systems and so that audible alarms from the BDS receiver can be acknowledged from external systems; the interface shall comply with relevant international standards.

Sentences shall be based on IEC 61162-1. The physical interface shall be based on IEC 61162-1 or IEC 61162-2 or IEC 61162-450.

Logical interfaces for the BDS receiver are shown in Figure 1, where required interfaces are indicated with solid lines and optional interfaces are indicated in dashed lines.

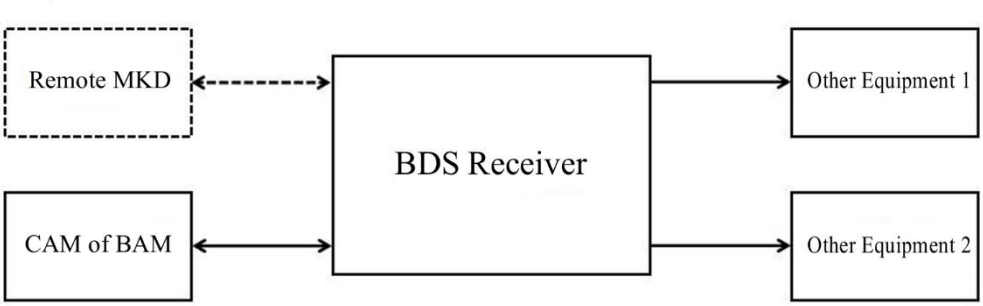


**Figure** 5.3.2.3 **Logical Interface of BDS Receiver**

BDS receiver shall use talker ID "GB".

For positioning reporting purposes, the following sentences shall be available for output in any combination.

DTM - Datum reference (see Appendix C of IEC 61108-5:2020 for specific requirements);

GBS - GNSS satellite fault detection (see Appendix C of IEC 61108-5:2020 for specific requirements);

GFA - GNSS fix accuracy and integrity (see Appendix C of IEC 61108-5:2020 for specific requirements);

GNS - GNSS fix data (see Appendix C of IEC 61108-5:2020 for specific requirements);

RMC - Recommended minimum specific GNSS data;

VTG - Course over ground and ground speed;

ZDA - Time and date.

If a sentence uses a datum other than WGS 84, then the DTM sentence shall be used in compliance with IEC 61162-1.

For reporting GNSS differential correction data the following sentence shall be available:

GDC - GNSS differential correction (see Appendix C of IEC 61108-5:2020 for specific requirements)

For alert reporting and alert command purposes, the following sentences shall be available:

ACN - Alert command;

ALC - Cyclic alert list;

ALF - Alert sentence;

ARC - Alert command refused;

HBT - Heartbeat supervision sentence; In addition, for integrating with other navigational aids, the following sentences may be available for output in any combination.;

GRS - GNSS range residuals (see Appendix C of IEC 61108-5:2020 for specific requirements);

GSA - GNSS DOP and active satellites (see Appendix C of IEC 61108-5:2020 for specific requirements)

GST - GNSS pseudorange error statistics (see Appendix C of IEC 61108-5:2020 for specific requirements);

GSV - GNSS satellites in view (see Appendix C of IEC 61108-5:2020 for specific requirements).

GBS, GRS, GSA, GST and GSV are required to support external integrity checking. They are synchronized with corresponding fix data (GNS).

### 5.3.3 Accuracy

(1) Static positioning accuracy

(M.379/A3.5) The BDS receiver equipment shall have static accuracy such that the position of the antenna is determined to be within 25m horizontally (at 95% confidence) and 30m vertically (at 95% confidence).

Note 4 : The BDS receiver equipment typically has accuracy better than 10 m (95 %).

(2) Dynamic positioning accuracy

(M.379/A3.6) The BDS receiver equipment shall have dynamic accuracy equivalent to the static accuracy specified in 4.3.3.1 above under the normal sea states and motion experienced in ships.

### 5.3.4 Acquisition

(1) (M.379/A3.8)The BDS receiver equipment shall be capable of selecting automatically the appropriate satellite-transmitted signals to determine the ship's position and velocity, and time with the required accuracy and update rate.

(2) (M.379/A3.11) The BDS receiver equipment shall be capable of acquiring position, velocity and time to the required accuracy within 12 min where there is no valid almanac data.

(3) (M.379/A3.12) The BDS receiver equipment shall be capable of acquiring position, velocity and time to the required accuracy within 1 min where there is valid almanac data.

(4) (M.379/A3.13) The BDS receiver equipment shall be capable of reacquiring position, velocity and time to the required accuracy within 1 min when there has been a service interruption of 60 s or less.

(5) (M.401/A3.7) The BDS receiver equipment shall be capable of providing the PVT solution to the required accuracy within:

① min where there is no valid satellite almanac data (cold start);

② min where there is valid satellite almanac data (warm start); and

③ min, when subjected to a power interruption or loss of signals of < 60 s;

Acquisition is defined as the processing of BDS satellite signals to obtain a position fix within the required accuracies.

Three conditions of the BDS receiver equipment are set out under which the minimum performance requirements shall be met.

Condition A

Initial status (cold start) – the equipment has no valid almanac. The reason is:

① been transported over large distances (> 1000 km to < 10 000 km) without power or BDS signals or by the deletion of the current almanac; or

② not been powered for ＞7 days; or

③ not received BDS signals for ＞7 days.

Condition B

Warm start – the equipment has a valid almanac. :

① Power outage – the equipment under normal operation loses power for at least 24 h ; or

② Interruption of BDS signals - under normal operation the BDS signals receptions are interrupted for at least 24 h , but there is no loss of power.

Status C

Brief interruption of power or BDS signal-Under normal operation, the power or the signals are interrupted for 60 s .

No user action other than applying power and providing a clear view from the antenna for the BDS signals shall be necessary, from any of the initial conditions above, in order to achieve the required acquisition time limits in Table 1.

**Acquisition Time Limit** **Table 1**

| Equipment condition | A | B | C |
|---|---|---|---|
| Acquisition time limits (min) | 5 | 1 | 2 |

5.3.5. Protection

(M.379/A5) Precautions shall be taken to ensure that no permanent damage can result from an accidental short circuit or grounding of the antenna or any of its input or output connections or any of the BDS receiver equipment inputs or outputs for a duration of five minutes.

5.3.6 Antenna design

(M.379/A2.2) The antenna design shall be suitable for fitting at a position on the ship which ensures a clear view of the satellite constellation, taking into consideration any obstructions that might exist on the ship.

5.3.7 Sensitivity and dynamic range

(M.379/A3.9) The BDS receiver equipment shall be capable of acquiring satellite signals with input signals having carrier levels in the range of −130dBm to −120 dBm . Once the satellite signals have been acquired, the equipment shall continue to operate satisfactorily with satellite signals having carrier levels down to -133 dBm.

5.3.8 Effects of specific interference signals

The BDS receiving equipment shall meet the following requirements:

(1) In a normal operating mode, i.e. switched on and with antenna attached, it is subject to radiation of 3 $W/m^2$ at a frequency of 1 636,5 MHz for 10 min . When the unwanted signal is removed and the BDS receiver antenna is exposed to the normal BDS satellite signals, the BDS receiver equipment shall calculate valid position fixes within 5 min without further operator intervention.

Note 1 : This is equivalent to exposing a BDS antenna to radiation from an Inmarsat Fleet 77 antenna 10m distance along the bore sight. This requirement will not be valid after Inmarsat Fleet 77 is closed.

(2) In a normal operating mode, i.e. switched on, and with antenna attached, it is subject to radiation consisting of a burst of 10 pulses, each 1,0 μs to 1,5 μs long on a duty cycle of 1600:1 at a frequency lying between 2,9 GHz and 3,1 GHz at power density of about 7,5 $kW/m^2$ . The condition shall be maintained for 10 min with the bursts of pulses repeated every 3 s. When the unwanted signal is removed and the BDS receiver antenna is exposed to the normal BDS satellite signals, the receiver shall calculate valid position fixes within 5 min without further operator intervention.

Note 2: This condition is approximately equivalent to exposing the antenna to radiation from a 60kW "S" Band marine radar operating at a nominal 1,2 $\mu$ s pulse width at 600 pulses/s using a 4 m slot antenna rotating at 20 r/min with the BDS antenna placed in the plane of the bore site of the radar antenna at a distance of 10 m from the centre of rotation.

(3) In a normal operating mode, i.e. switched on and with antenna attached, it is subject to radiation of 0,16 $W/m^2$ at a frequency in the range of 1 626,5 MHz to 1660,5 MHz for 10 min. During the period, the BDS receiver equipment shall be able to calculate valid position fixes.

Note 3: This is equivalent to exposing a BDS antenna to radiation from an Inmarsat FleetBroadband antenna at 10 m distance along the bore sight.

Advice shall be given in the manual for adequate installation of the antenna unit, to minimize interference with other radio equipment such as marine radars, Inmarsat ship earth stations, Iridium ship earth stations, etc.

Note 4: Given that the Iridium GMDSS ship earth station and BDS receivers operate in adjacent and shared spectrum, the installation manual can include relevant antenna installation warnings and guidelines, including the distance amount of separation from Iridium ship earth station antennas and other factors necessary to avoid radio frequency

interference.

5.3.9 Position update

(M.379/A3.14) The BDS receiving equipment shall generate and output to a display and digital interface (conforming to IEC 61162-1) a new position solution at least once every 1 s for conventional craft and at least once every 0,5 s for high speed craft.

For high speed craft purposes, the equipment shall additionally provide an IEC 61162-2 or IEC 61162-450 interface with a position update rate of 2Hz.

(M.379/A3.7) The BDS receiver equipment shall have position resolution equal to or better than 0,001 min of latitude and longitude.

NOTE AIS receivers require 0,000 1 min of latitude and longitude.

5.3.10 Differential BDS input

(M.379/A3.18) The BDS receiver equipment shall have the facilities to process differential BDS (DBDS) data fed to it in accordance with the standards of Recommendation ITU-R M.823 and an appropriate RTCM standard, and provide indication of the reception of DBDS signals and whether they are being applied to the ship's position.

When a BDS receiver is equipped with a differential BDS receiver, performance standards for static and dynamic accuracies (5.3.3.1 and 5.3.3.2) shall be 10 m (95 %) together with integrity monitoring.

An integrated DBDS receiver shall have an ITU-R M.823 compliant asynchronous full duplex serial input/output port for testing in compliance with IEC 61108-4. The data input/output port shall be supplied for testing purposes only.

NOTE It is intended that the standard for the differential BDS receiver will be contained in a future revision of IEC 61108-4.

5.3.11 Navigation Warning and Status Indications

(1) Positioning

(M.379/A4.1) The BDS receiver equipment shall also indicate whether the performance of BDS is outside the bounds of requirements for general navigation in the ocean, coastal,

port approach, and restricted waters, and inland waterway phases of the voyage as specified in either IMO resolution A.1046(27) or Appendix 2 to IMO resolution A.915(22) and any subsequent amendments, as appropriate.

The BDS receiver equipment shall as a minimum:: ① (M.379 / A4.2.1) provide a warning within 5 s of loss of position or if a new position based on the information provided by the BDS constellation has not been calculated for more than 1 s for conventional craft and 0,5 s for high-speed craft. Under such conditions the last known position and the time of last valid fix, with the explicit indication of the state allowing for no ambiguity, shall be output until normal operation is resumed;

② (M.379 / A3.18) provide differential BDS status indication of

(a) the receipt of DBDS signals; and

(b) Whether they are being applied to the indicated ship's position;

③ Display DBDS messages. The BDS receiver either shall have as a minimum the capability of displaying appropriate DBDS messages or forwarding those messages in GDC sentences (see Annex C) for display on a remote system.

④ Provide an indication of the navigation status.

The navigational status for different position accuracy levels shall be expressed in three navigational states:

- Safety

- Caution

- Unsafe

The conditions for a "Safe" navigational state are as follows:

(a) the estimated error ( 95% confidence) along the major axis of the error ellipse is less than the selected accuracy level corresponding to the actual navigation mode; and

(b) Integrity is available and within the requirements of the actual navigation mode; and

(c) a new position has been calculated within 1 s for a conventional craft and 0,5 s for a high speed craft.

The conditions for a "Caution" navigational state are as follows:

(a) integrity has not been available for a period of at least 3 s; and/or

(b) HDOP exceeded - HDOP exceeds the required threshold; and/or

(c) Loss of differential signal or differential correction not applied– DBDS signals are not received, or they are not being applied to the indicated ship's position.

The conditions for an "Unsafe" navigational state in alert management are as follows:

(a) Loss of position - the estimated error ( 95% confidence) along the major axis of the error ellipse is greater than the selected accuracy level corresponding to the actual navigation mode; and/or

(b) No calculation of position - a new valid position has not been calculated for more than 1 s for a conventional craft and 0,5 s for a high speed craft; and/or

(c) Integrity status – integrity is available but exceeds the requirements for the actual navigation mode for a period of at least 3s.

The navigational status shall be continuously displayed along with an indication of the accuracy level selected. The navigational status and alert identifier and the accuracy level selected shall be provided to other equipment in accordance with the equipment output requirements in 4.3.2. The classification, presentation, handling and interfacing of alerts, including transmitted alert identifiers shall be as required in Annex B for the purpose of bridge alert management.

The manufacturer may use colours for navigational status indication as specified in IEC 62288 and if so the following colours shall be used:

- "Safe" shall be green;
- "Caution" shall be yellow; and
- "Unsafe" shall be yellowish orange.

The manufacturer may use icons for navigational status indication as specified in IEC 62923-1.

A change in the navigational status shall be indicated within 10 s .

For receiver equipment which does not provide information by a dedicated display, the provision of the navigational status indication and the selected accuracy level with an appropriate output interface is required.

(2) Integrity monitored using RAIM

① General

(M.379/A4.2.2) The BDS receiver equipment shall as a minimum use Receiver Autonomous Integrity Monitoring (RAIM) to provide integrity performance appropriate to the operation being undertaken.

The RAIM algorithm employed shall be capable of detecting and excluding a faulty range signal from the position solution.
The decision thresholds used to detect and exclude a faulty range signal shall be consistent with the IMO integrity and continuity requirements as stated in IMO Resolution A.1046(27) and IMO A.915(22).

Note DBDS integrity information can be used to assist RAIM calculations (if available).

The maximum delay for reaction of the integrity calculation by means of RAIM due to negative changes affecting the integrity status is 10 s .

② Conditions for "Safe" integrity status

The result of integrity calculation (see Table 2) shall be stated as "Safe", if the calculated horizontal protection level (HPL) is less than or equal to the horizontal alert limit (HAL).
This generally requires at least 5 "healthy" satellites available and in a robust geometry, i.e. the worst 4 satellite geometry is still suitable for navigation.

③ Conditions for "Caution" integrity status

The "Caution" status indication shall be used when insufficient information is available to calculate HPL for more than 3s .
Those conditions may occur if an insufficient number of satellites are available, for example 4 or 5 with 2 satellites "close" together in azimuth and elevation, causing the geometry to degrade to the point that the RAIM calculation becomes unreliable. Note that the resulting accuracy based on 4 or 5 satellites in use may be within the selected accuracy level, but the RAIM algorithm cannot verify it.

④ Conditions for "unsafe" integrity status

The "Unsafe" status indication shall be used when the calculated HPL exceeds the HAL for more than 3s.

**RAIM Integrity States** **Table 2**

| Navigation status | Number of ranging signals | Protection level |
|---|---|---|
| Safety | ≥5 | And HPL≤HAL |
| Caution | ＜5 | - |
| Unsafe | ≥5 | And HPL>HAL |
| NOTE Table 2 represents the theoretical results of RAIM calculations, but with certain satellite geometries and RAIM algorithms, the receiver could not be able to calculate a RAIM status with certainty. | | |

(3) Self-test

(M.379 / A4.2.3) The BDS receiving equipment shall provide a self-test function.

The BDS receiver shall provide means to perform self test of major functions either automatically or manually. The major functions of self test are:: antenna interface, BAM interface, MKD interface or other equipment interfaces.

5.3.12 COG, SOG and UTC information output

(1) COG accuracy

(M.379/A3.15) The BDS receiver equipment shall provide the COG, SOG and UTC outputs, with a validity mark aligned with that on the position output. The accuracy requirements for COG and SOG shall not be inferior to the relevant performance standards for heading (resolution A. 424(XI) for conventional craft and resolution A.821(19) for high-speed craft) and speed and distance measuring equipment (SDME) (resolution A.824(19), as amended by resolution MSC.96(72)) and the accuracy shall be obtained under the various dynamic conditions that could be experienced onboard ships.

The error in the COG (the path of the antenna position over ground) due to the actual ship's speed over ground shall not exceed the values in Table 3:

**Accuracy of COG** **Table 3**

| Speed range (knots) | COG output accuracy |
|---|---|
| 0＜S≤1 | Unreliable or unavailable |
| 1＜S≤17 | ±3 ° |
| ＞17 | ±1 ° |

Due to the limitations of BDS receivers to this document, it is not appropriate to include requirements for COG errors attributed to high dynamic movement. Such limitations shall

be stated in the manufacturer's operational manual.

(2) SOG information accuracy

Errors in the SOG (velocity of the antenna position over ground) shall not exceed 2% of the actual speed or 0,2 knots, whichever is greater.

(3) Availability and effectiveness of time information

The BDS receiving equipment shall provide UTC with resolution of 0.01s on the digital interface. The validity mark of the digital interface for position contained in the mode indicator of GNS sentence shall be used for interpretation of validity of digital interface for UTC contained in the ZDA sentence.

5.3.13 Typical interference conditions

(M.379/A3.10) The BDS receiver equipment shall be capable of operating satisfactorily under normal interference conditions consistent with the requirements of IMO resolution A.694(17).

Operational situations include static accuracy and reacquisition within 30 s after satellite signals have been masked for 60 s or less by an obstruction, for example a bridge.

The typical BDS RF interference environment can be characterized as being continuous wave (CW) in-band and near-band RFI, in-band CW/NB/WB RFI and in-band and near-band pulse interference. For a clarification of this requirement, see Annex A.

## 6 Technical Requirements (Domestic Voyages)

6.1 Overview

The Beidou satellite navigation system receiving equipment used by sea-going ships engaged on domestic voyages should meet the requirements of the "Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages (2020)". When there are no clear requirements in the "Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages" (2020), reference can be made to the relevant requirements of international voyage.

Note 13 : In order to facilitate users to clarify the specific requirements applicable to ships on international and domestic voyages, this chapter lists the differences between the two requirements in a table form (Table 6.2.2, Table 6.2.3, Table 6.2.5). Among them, the requirements for ships on international voyages shall serve as a reference only for products intended for domestic voyages and shall not be considered mandatory.

6.2 Special requirements for ships on domestic voyages

6.2.1 Product hardware composition

The requirements for ships on international voyages may be used as a reference, and the storage, display/control, and interaction of the data may be integrated into an Integrated Navigation System (INS) or a multi-GNSS receiver.

6.2.2 Interface and communication protocol

The Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages (2020) requires that: "For high-speed crafts, the equipment shall provide an interface to update IEC 61162-2 with a frequency of 2Hz", and the interface of IEC 61162-450 is not accepted temporarily.

**Differences in Communication Protocols Table 6.2.2**

| **Purpose of sentence** | **Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages (2020)** | **IEC 61108-5:2020** |
|---|---|---|
| Requirements for communication ID | -- | The ID that the BDS receiving equipment should use when sending information is "GB" |
| For the purpose of positioning reports, sentences that can be used | DTM, GBS, GFA, GNS, RMC, ZDA | DTM, GBS, GFA, GNS, RMC, VTG, ZDA |
| Alert report sentence | ALR, ACK | ACN, ALC, ALF, ARC, HBT |
| For the purpose of GNSS differential correction data, sentences used | -- | GDC |
| Sentences that can be used for integration with other navigation equipment | GRS, GSA, GST, GSV | GRS, GSA, GST, GSV, |

6.2.3 Acquisition time

**Acquisition Time Requirements Table 6.2.3**

| **Acquisition time requirements (minutes)** | | **Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages (2020)** | **IEC 61108-5:2020** |
|---|---|---|---|
| Status | A | 12 | 5 |
| | B | 1 | 1 |
| | C | 1 | 2 |

6.2.4 Specific interference signals

The Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages (2020) only defines two specific interference signals:

Interference signal (1): Under normal operating conditions, that is, with the antenna connected and the power on, radiation at a frequency of 1636.5 MHz with a power flux density of 3 $W/m^2$ shall be applied for 10 minutes. After the interference signal is removed and the BDS receiving antenna is exposed to normal BDS satellite signals, the BDS receiving equipment shall achieve a correct position within 5 minutes without manual intervention;

Interference signal (2): Under normal operating conditions, that is, with the antenna connected and the power on, a pulse group signal consisting of 10 pulses shall be applied. Each pulse shall have a width of 1.0 μs to 1.5 μs, a duty cycle of 1:1600, a frequency range of 2.9 GHz to 3.1 GHz, and a power flux density of approximately 7.5 $kW/m^2$. The pulse group signal shall be repeated every 3 seconds and continuously radiated for 10 minutes. When the interference signal is removed and the BDS receiving antenna is under normal BDS satellite signals, the BDS receiving equipment shall be correctly positioned within 5 minutes without manual intervention.

6.2.5 Status indication

The specific requirements for international and domestic ships are inconsistent in the scope of status indication. See Table 6.2.5 for details.

**Table of Status Indication Content Requirements Table 6.2.5**

| | | Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages (2020) | IEC 61108-5:2020 |
|---|---|---|---|
| The BDS receiving equipment shall at least include | a | (M.379 / A4.2.1) Provide a warning within 5 seconds of position loss or if the new position is not calculated after more than 1 second (for conventional ships) and more than 0.5 second (for high-speed crafts) based on the information provided by the BDS space segment. In this case, the last determined position and the time of the last valid positioning shall be output, and the status shall be clearly indicated to avoid confusion until normal operation is restored; | (M.379 / A4.2.1) Provide a warning within 5 seconds of position loss or if the new position is not calculated after more than 1 second (for conventional ships) and more than 0.5 second (for high-speed crafts) based on the information provided by the BDS space segment. In this case, the last determined position and the time of the last valid positioning shall be output, and the status shall be clearly indicated to avoid confusion until normal operation is restored; |

| | | | |
|---|---|---|---|
| | b | Provide DBDS status indication, including:<br>1) Indicate the reception of DBDS signals;<br>2) Indicate differential positioning; | Provide DBDS status indication, including:<br>1) Indicate the reception of DBDS signals;<br>2) Whether they are applied to the indicated ship position; |
| | c | Display or output DBDS messages to external devices | Display or output DBDS messages to external devices. The BDS receiver shall, at a minimum, be capable of displaying the appropriate DBDS messages or forwarding these messages as GDC sentences for display on a remote system. |
| | d | -- | Provide an indication of navigation status. |
| | e | (M.379 / A4.2.2) Use the receiver automatic integrity monitoring (RAIM) function to provide complete performance corresponding to the operation performed. | (M.379 / A4.2.2) Use the receiver automatic integrity monitoring (RAIM) function to provide complete performance corresponding to the operation performed. |

Additional requirements for ships on international voyages include the “Navigation Status Indication,” with specific definitions and classifications of the navigation status provided. According to its definition, the items a, b, c, and e in Table 4 all belong to the navigation status and are uniformly displayed by the "Navigation Status Indication". For ships on domestic voyages, a unified display is not required; that is, the status indications corresponding to items a, b, c, and e in Table 4 may be displayed separately on the receiving equipment.

The details are as follows:

For navigation status corresponding to different positioning accuracy levels, the status indication shall include the following 3 types:

- Safety

- Caution

- Unsafe

(1) Conditions for "safe" navigation status:

① If the RAIM calculates that the possible positioning error is within the selected accuracy level (the estimated error along the main axis of the error ellipse (at 95% confidence) is less than the selected accuracy level corresponding to the current navigation mode) at the selected accuracy level and 95% confidence requirement; and

② Integrity is valid and within the requirements of the actual navigation mode; and

③ For conventional ships, the new position is calculated within 1s, and for high-speed crafts, the new position is calculated within 0.5s.

(2) The following status shall be indicated as "Caution":

① Integrity failure exceeds 3s; and/or

② HDOP Exceeds – HDOP exceeds the required limit (HDOP is the plane position accuracy factor); and/or

③ Loss of differential signal or failure to apply differential correction – DBDS signals are not received or applied to the specified ship position.

(3) Conditions for "unsafe" navigation status:

① Position loss – If, at the selected accuracy level and 95% confidence requirement, RAIM calculates that the possible positioning error is outside the selected accuracy level range (the estimated error along the main axis of the error ellipse (at 95% confidence) is greater than the selected accuracy level corresponding to the current navigation mode; and); and/or

② No position calculation – for conventional ships, the new position is calculated within 1 second, and for high-speed crafts, the new position is calculated within 0.5 second; and/or

③ Integrity status – integrity is available, but exceeds the requirements of the actual navigation mode for at least 3s.

6.2.6 RAIM-based integrity monitoring

**Table of Integrity Status Definitions** **Table 6.2.6**

| **Integrity status** | **Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages (2020)** | **IEC 61108-5:2020** |
|---|---|---|
| Safety | If, at the selected accuracy level and with 95% confidence, the RAIM calculation indicates that the possible positioning error is within the selected accuracy level, the status shall be indicated as “Safe.” This usually requires at least 5 available healthy satellites in good geometric distribution, while navigation may still be possible with the 4 | If the calculated horizontal protection limit (HPL) is less than or equal to the horizontal alert limit (HAL), the result of the integrity computation shall be declared "safe". This usually requires at least 5 available healthy satellites in good geometric distribution, while navigation may still be possible with the 4 satellites having the poorest geometry. |

| | | |
|---|---|---|
| | satellites having the poorest geometry. | |
| Warning | The following status shall be indicated as "Warning":<br>— For the selected accuracy level, there is insufficient information to ensure a confidence level greater than 95%.<br>—The probability of false alert is greater than 5%;<br>—The probability of missed detection is greater than 5%.<br>The above situation occurs when there are not enough satellites available, for example, 2 out of 4 or 5 satellites are too close in observation azimuth and pitch, and the geometric distribution is degraded so that the RAIM calculation results are unreliable. It is worth noting that positioning based on 4 or 5 satellites may have an accuracy of the selected accuracy level, but the RAIM algorithm cannot verify this. | When there is not enough information available to calculate the HPL for more than 3 seconds, the "Caution" status indication shall be used.<br>The above situation occurs when there are not enough satellites available, for example, 2 out of 4 or 5 satellites are too close in observation azimuth and pitch, and the geometric distribution is degraded so that the RAIM calculation results are unreliable.<br>It is worth noting that positioning based on 4 or 5 satellites may have an accuracy of the selected accuracy level, but the RAIM algorithm cannot verify this. |
| Unsafe | If the possible positioning error calculated by RAIM exceeds the selected accuracy level range with the selected accuracy level and 95% confidence requirement, it shall be indicated as an "unsafe" status. It is worth noting that at this time, the satellites are also required to be in good geometric distribution to meet the confidence requirements. When the satellite distance error affects the positioning result, causing the positioning accuracy to exceed the selected accuracy level, it will lead to an "unsafe" status. | When the calculated HPL exceeds HAL for more than 3s, an "unsafe" status indication shall be used.<br>See Table 5.3.11.2 for specific requirements. |
| Indication color requirements | - The safety indication is green;<br>- The caution indication is yellow,<br>- The unsafe indication is red. | Already included in the requirements of "Navigation Status Indication":<br>— The safety indication is green,<br>— The Caution indication is yellow,<br>— The unsafe indication is orange. |

## 7 Technical Requirements (Inland Voyages)

### 7.1 Overview

The Beidou satellite navigation system receiving equipment on inland waterway ships shall comply with the requirements of the “Technical Regulations for Statutory Survey of Inland

Waterway Ships" (2019). Where the "Technical Regulations for Statutory Survey of Inland Waterway Ships" (2019) do not provide explicit requirements, the relevant requirements for ships on domestic voyages may be used as a reference.

7.2 Requirements for inland waterway ships

7.2.1 System composition

(1) Antenna capable of receiving signals from an electronic positioning device;

(2) Electronic positioning device receiver/processor;

(3) A tool for calculating and outputting the longitude and latitude of a position;

(4) Data control and interface;

(5) Position display and other output forms when necessary

7.2.2 Functional requirements

The functional requirements of the Technical Regulations for Statutory Survey of Inland Waterway Ships (2019) are completely consistent with those of IMO Resolution MSC.379(93), and no special requirements are put forward. The review, approval and survey of products can be carried out in accordance with the requirements for sea-going ships engaged on domestic voyages.

## 8 Raw Materials and Parts

Raw materials and parts and components of products shall be controlled in accordance with the relevant requirements of CCS current specifications.

It is necessary to clearly describe the Beidou chip manufacturer and provide a Beidou chip qualification certificate.

## 9 Type Approval and Single Item/Batch Survey

9.1 Selection and test arrangement of typical samples

The model and specification of the test sample are technically representative and cover the scope of products applying for type approval. The test sample(s) shall be selected on-site at the product manufacturer's premises by a CCS surveyor.

9.2 Test agency

The Beidou testing organization recognized by CCS shall be selected for the type approval test.

9.3 Type approval test items and requirements

See the Schedule for type approval test items.

**Environmental Condition Test Items as per IEC 60945** **Table 9.3 (1)**

| S/N | Test items | | | Test requirements | Test methods |
|---|---|---|---|---|---|
| 1 | Operation inspection | Ergonomics and HMI | | A.694/3.1/3.2 | IEC 60945/6.1 |
| | | Hardware | | A.694/3.3/3.4/3.6 | IEC 60945/6.2 |
| | | Software | | | IEC 60945/6.3 |
| | | Connection between equipment | | A.694/3.5 | IEC 60945/6.4 |
| 2 | Power supply test | Extreme power supply | | A.694/4.1 | IEC 60945/7.1 |
| | | Transitional conditions | | | IEC 60945/7.2 |
| | | Short-term changes in power supply | | A.694/4.3 | IEC 60945/7.3 |
| | | Power supply fault | | A.694/4.3 | IEC 60945/7.4 |
| 3 | Environmental test | Warm dry (storage test) | | A.694/5 | IEC 60945/8.2.1/7.1 |
| | | Warm dry (functional test), including extreme power supply conditions | | | IEC 60945/8.2.2/7.1 |
| | | Warm damp | | | IEC 60945/8.3 |
| | | Low temperature, including extreme power supply conditions | | | IEC 60945/8.4/7.1 |
| | | Thermal shock | | | IEC 60945/8.5 |
| | | Static drop | | | IEC 60945/8.6 |
| | | Mechanical vibration | | | IEC 60945/8.7 |
| | | Rain and water spray test (outdoor equipment) | | | IEC 60945/8.8 |
| | | Immersion | | | IEC 60945/8.9 |
| | | Solar radiation | | | IEC 60945/8.10 |
| | | Oil-resistant | | | IEC 60945/8.11 |
| | | Corrosion test (salt spray) | | | IEC 60945/8.12 |
| 4 | Electromagnetic compatibility | Electromagnetic radiation | Conducted emission test | A.694/6.1 | IEC 60945/9.2 |
| | | | Radiated emission test | | IEC 60945/9.3 |
| | | Immunity to electromagnetic environment | Immunity to conducted radio-frequency | | IEC 60945/10.3 |

| S/N | Test items | | | Test requirements | Test methods |
|---|---|---|---|---|---|
| | | | disturbances | | |
| | | | Immunity to radiated radio-frequency disturbances | | IEC 60945/10.4 |
| | | | Immunity to electrical fast transients | | IEC 60945/10.5 |
| | | | Immunity to surges | | IEC 60945/10.6 |
| | | | Immunity to short-term changes of the supply | | IEC 60945/10.7 |
| | | | Immunity to power supply fault | | IEC 60945/10.8 |
| | | | Immunity to electrostatic discharge | | IEC 60945/10.9 |
| 5 | Special Purpose Test | Sound noise requirements and signals | | A.694/6.2 | IEC 60945/11.1 |
| | | Compass safety distance | | A.694/6.3 | IEC 60945/11.2 |
| 6 | Personal safety | Protection against accidental entry into hazardous voltages | | A.694/7.1,7.2 | IEC 60945/12.1 |
| | | Electromagnetic radio frequency radiation | | A.694/7.3 | IEC 60945/12.2 |
| | | Emission of visual display unit (VDU) | | A.694/7.4 | IEC 60945/12.3 |
| | | X-radiation | | A.694/7.4 | IEC 60945/12.4 |
| 7 | Withstand voltage test | | | | Clause 2.14 of GD019-2024 |
| | Insulation resistance measurement | | | | Clause 2.3 of GD019-2024 |
| 8 | Maintenance | | | A.694/8.1/8.2 | IEC 60945/13 |
| 9 | Equipment Manual | | | A.694/8.3 | IEC 60945/14 |
| 10 | Flagging and identification | | | A.694/9 | IEC 60945/15 |

The performance inspection/test items combined with environmental conditions test shall be carried out according to the following steps:

• Power on the equipment from the initial status (cold start)

• Check the receiver’s acquisition time

• Verify that the receiver tracks signals normally, continuously outputs valid position solutions, and that navigation functions operate correctly.

**Equipment Function and Performance Test Items Specified in IEC 61108-5 Table 9.3 (2)**

| S/N | Test items | | | | Test requirements | Test methods |
|---|---|---|---|---|---|---|
| 1 | Appearance inspection | - Data verification of main components (parts);<br>- Confirmation of software version;<br>- Configuration check | | | GD019-2024 | GD019-2024 2.1 |
| 2 | General requirements and display requirements | General requirements | | | | IEC 61108-5/5.5.2 |
| | | Presentation requirements | | | | IEC 61108-5/5.5.3 |
| 3 | Receiver performance test | BDS receiving equipment | | | MSC.379/A2.1 | IEC 61108-5/5.6.1 |
| | | Position output | | | MSC.379/A3.1/A3.2/A3.3 | IEC 61108-5/5.6.2 |
| | | Equipment interfaces | | | MSC.379/A3.4/A3.16/A3.17 | IEC 61108-5/5.6.3 |
| | | accuracy | Static accuracy | BDS | MSC.379/A3.5 | IEC 61108-5/5.6.4.1.2 |
| | | | | Differential BDS | MSC.379/A3.6 | IEC 61108-5/5.6.4.1.3 |
| | | | Angular movement of the antenna | BDS | MSC.379/A3.5 | IEC 61108-5/5.6.4.2 |
| | | | | Differential BDS | MSC.379/A3.6 | |
| | | | Dynamic accuracy | BDS | MSC.379/A3.5 | IEC 61108-5/5.6.4.3.1 |
| | | | | Differential BDS | MSC.379/A3.6 | IEC 61108-5/5.6.4.3.2 |
| | | Acquisition | Condition A - Initialization/no valid almanac (cold start) | | MSC.379/A3.8/A3.11<br>MSC.401/A3.7 | IEC 61108-5/5.6.5.1 |
| | | | Condition B - With valid almanac (warm start) | | MSC.379/A3.8/A3.12<br>MSC.401/A3.7 | IEC 61108-5/5.6.5.2 |
| | | | Condition C - Brief interruption of power or BDS signals | | MSC.379/A3.8/A3.13<br>MSC.401/A3.7 | IEC 61108-5/5.6.5.3 |
| | | Protection | | | MSC.379/A5 | IEC 61108-5/5.6.6 |
| | | Antenna design | | | MSC.379/A2.2 | IEC |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | 61108-5/5.6.7 |
| | | Sensitivity and dynamic range | Acquisition | | | MSC.379/A3.9 | IEC 61108-5/5.6.8.1 |
| | | | Tracking | | | | IEC 61108-5/5.6.8.2 |
| | | Protection from other shipborne transmitters | L-band interference from Inmarsat Fleet 77 | | | | IEC 61108-5/5.6.9.1 |
| | | | S-band interference | | | | IEC 61108-5/5.6.9.2 |
| | | | L-band interference from Inmarsat FleetBroadBand | | | | IEC 61108-5/5.6.9.3 |
| | | Positionupdate | Slow speed update rate | | | MSC.379/A3.14 | IEC 61108-5/5.6.10.1 |
| | | | High speed update rate | | | | IEC 61108-5/5.6.10.2 |
| | | | Minimum resolution | | | MSC.379/A3.7 | IEC 61108-5/5.6.10.3 |
| | | Differential BDS input | | | | MSC.379/A3.18 | IEC 61108-5/5.6.11 |
| | | Navigational warnings and status indications | General alert tests | Position/HDOP alert test | | MSC.379/A4.1/A4.2.1 | IEC 61108-5/5.6.12.1.1 |
| | | | | Differential BDS status indication test | | MSC.379/A3.18 | IEC 61108-5/5.6.12.1.2 |
| | | | | Test of integrity monitoring using RAIM | Testing of"Safe" and "Caution" status | MSC.379/A4.2.2 | IEC 61108-5/5.6.12.1.3.2 |
| | | | | | Testing of"Unsafe" status | | IEC 61108-5/5.6.12.1.3.3 |
| | | | DBDS indication | | | | IEC 61108-5/5.6.12.2 |
| | | | Self test | | | MSC.379/A4.2.3 | IEC 61108-5/5.6.12.3 |
| | | Accuracy of COG and SOG | | | | MSC.379/A3.15 | IEC 61108-5/5.6.13 |
| | | Validity of COG and SOG information | | | | | IEC 61108-5/5.6.14 |
| | | Output of UTC | | | | | IEC 61108-5/5.6.15 |

| | | | | |
|---|---|---|---|---|
| 4 | Typical RF interference test | Navigation accuracy test | MSC.379/A3.10 | IEC 61108-5/5.7.2 |
| | | Reacquisition test | | IEC 61108-5/5.7.3 |

**Interface Test Items Specified in IEC 61162-1/2/450 Table 9.3 (3)**

| S/N | Test items | | | Test requirements | Test methods |
|---|---|---|---|---|---|
| 1 | Check the manufacturer's documents | | | IEC 61162-1/B.3 | IEC 61162-1/B.3 |
| 2 | Hardware test | Interface unit | | IEC 61162-1/B.4.1 | IEC 61162-1/B.4.1 |
| | | The ability of the input circuit to operate under limited current | | IEC 61162-1/B.4.2 | IEC 61162-1/B.4.2 |
| | | Electrical isolation inspection | | IEC 61162-1/B.4.3 | IEC 61162-1/B.4.3 |
| | | The ability of the input circuit to withstand the maximum voltage on the busbar | | IEC 61162-1/B.4.4 | IEC 61162-1/B.4.4 |
| | | Performance Test Arrangements in Accordance with IEC 60945 | | IEC 61162-1/B.4.5 | IEC 61162-1/B.4.5 |
| | | Test under the maximum workload of interface | | IEC 61162-1/B.4.6 | IEC 61162-1/B.4.6 |
| | | Interface damage data test | | IEC 61162-1/B.4.7 | IEC 61162-1/B.4.7 |
| | | Test under long-term conditions | | IEC 61162-1/B.4.8 | IEC 61162-1/B.4.8 |
| | | Interface protocol test of EUT | Data string transmitted by EUT | IEC 61162-1/B.4.9.1 | IEC 61162-1/B.4.9.1 |
| | | | Data string received by EUT | IEC 61162-1/B.4.9.2 | IEC 61162-1/B.4.9.2 |
| 3 | High-speed transmission interface test | Interface electrical test | Normal operating range | IEC 61162-2/8.4.1.1 | IEC 61162-2/8.4.1.1 |
| | | | The ability of the input circuit to withstand the maximum voltage on the busbar | IEC 61162-2/8.4.1.2 | IEC 61162-2/8.4.1.2 |
| | | Input and output protocol test | | IEC 61162-2/8.4.2 | IEC 61162-2/8.4.2 |
| | | Test under the maximum workload of interface | | IEC 61162-2/8.4.3 | IEC 61162-2/8.4.3 |
| 4 | Network interoperability | General requirements | Devices connected to the network | IEC 61162-450/8.2.1 | IEC 61162-450/8.2.1 |

| S/N | Test items | | | Test requirements | Test methods |
|---|---|---|---|---|---|
| | | | Network infrastructure | IEC 61162-450/8.2.2 | IEC 61162-450/8.2.2 |
| | | Network functions | Maximum data rate | IEC 61162-450/8.3.1 | IEC 61162-450/8.3.1 |
| | | | Error logging function | IEC 61162-450/8.3.2 | IEC 61162-450/8.3.2 |
| | | System functions | General requirements | IEC 61162-450/8.4.1 | IEC 61162-450/8.4.1 |
| | | | Assignment of unique system function ID | IEC 61162-450/8.4.2 | IEC 61162-450/8.4.2 |
| | | | Implementation of configurable transmission groups | IEC 61162-450/8.4.3 | IEC 61162-450/8.4.3 |
| | | Serial-to-network gateway function | General requirements | IEC 61162-450/8.5.1 | IEC 61162-450/8.5.1 |
| | | | Serial line output buffer management | IEC 61162-450/8.5.2 | IEC 61162-450/8.5.2 |
| | | | Datagram output | IEC 61162-450/8.5.3 | IEC 61162-450/8.5.3 |
| | | Other network functions | | IEC 61162-450/8.6 | IEC 61162-450/8.6 |
| | | Low-level network | Electrical and mechanical requirements | IEC 61162-450/8.7.1 | IEC 61162-450/8.7.1 |
| | | | Network protocol | IEC 61162-450/8.7.2 | IEC 61162-450/8.7.2 |
| | | | Device IP address assignment | IEC 61162-450/8.7.3 | IEC 61162-450/8.7.3 |
| | | | Multicast address range | IEC 61162-450/8.7.4 | IEC 61162-450/8.7.4 |
| | | Transport layer | | IEC 61162-450/8.8 | IEC 61162-450/8.8 |
| | | Application layer | Application | IEC 61162-450/8.9.1 | IEC 61162-450/8.9.1 |
| | | | Data header | IEC 61162-450/8.9.2 | IEC 61162-450/8.9.2 |
| | | | Message type | IEC 61162-450/8.9.3 | IEC 61162-450/8.9.3 |
| | | | Flag block parameters | IEC 61162-450/8.9.4 | IEC 61162-450/8.9.4 |
| | | Error log | | IEC 61162-450/8.10 | IEC 61162-450/8.10 |

| S/N | Test items | | Test requirements | Test methods |
|---|---|---|---|---|
| | | Binary image transmission based on UDP multicast | IEC 61162-450/8.11 | IEC 61162-450/8.11 |

**Bridge Alert Management Function and Performance Test Items Specified in IEC 62923-1**

**Table 9.3 (4)**

| S/N | Test items | | Reference Standard | Test methods |
|---|---|---|---|---|
| 1 | Bridge alarm presentation and handling | Number of alerts per situation | MSC.302/5.2 | IEC 62923-1/6.1.2 |
| | | Priority classification and category | MSC.302/6.1,6.2,6.3 | IEC 62923-1/6.2 |
| | | Alarm display and status | MSC.302/7.1~7.6 | IEC 62923-1/6.3 |
| | | Unacknowledged alarms/warnings | MSC.302/7.3.2,7.4.2,7.4.3,7.4.4 | IEC 62923-1/6.3.4.2,6.3.5.2 |
| | | Muted alarms/warnings | MSC.302/7.3.5 | IEC 62923-1/6.3.4.3,6.3.5.3 |
| | | Continuous alarms/warnings | MSC.302/7.3.7,7.3.8,7.4.6,7.4.7 | IEC 62923-1/6.3.4.5,6.3.5.5 |
| | | Alarms/warnings for acknowledgment or transfer of responsibility | MSC.302/7.3.9,7.3.10,7.4.8,7.4.9 | IEC 62923-1/6.3.4.6,,6.3.5.6 |
| | | Prompt presentation | MSC.302/7.5.1,7.5.3 | IEC 62923-1/6.3.6.1 |
| | | Prompt removal | MSC.302/7.5.2 | IEC 62923-1/6.3.6.2 |
| | | Alert escalation | MSC.302/7.6.1,7.6.2 | IEC 62923-1/6.3.7 |
| | | Bridge alert display | | IEC 62923-1/6.4.1 |
| | | Audible prompt | MSC.302/8.3,8.3 | IEC 62923-1/6.4.4 |
| | | System failures, redundancy, backup, and fallback arrangements | MSC.302/11.1,12.3 | IEC 62923-1/6.5 |
| | | Documentation | | IEC 62923-1/6.6 |
| | | Transfer of responsibility of EUT as an alarm source | | IEC 62923-1/6.9.2 |
| | Interface | Communication protocol | MSC.302/13.1.1,13.1.2.6,10.2,13.1.2.1, | IEC 62923-1/8.1.1 |

| S/N | Test items | | Reference Standard | Test methods |
|---|---|---|---|---|
| | | Alert priority, status, and text | MSC.302/13.1.2.2 | IEC 62923-1/8.1.2 |
| | | Last modification time | | IEC 62923-1/8.1.3 |
| | | Acknowledge and mute | MSC.302/13.1.2.3 | IEC 62923-1/8.1.4 |
| | | Function unavailable | | IEC 62923-1/8.3 |

**Function and Performance Test Items for Shipborne Navigation Display Equipment Specified in IEC 62288 Table 9.3 (5)**

| S/N | Test items | | Reference Standard | Test methods |
|---|---|---|---|---|
| 1 | Information arrangement | Layout consistency | MSC.191/5.1.1 | IEC 62288/4.3.1 |
| | | Consistency of information display | MSC.191/5.1.2 | IEC 62288/4.3.2 |
| | | Partitioned display | MSC.191/5.1.3 | IEC 62288/4.3.3 |
| | Readability | Readability under all ambient lighting conditions | MSC.191/5.2.1 | IEC 62288/4.4.1 |
| | | Readability of alphanumeric data and text | MSC.191/5.2.2 | IEC 62288/4.4.2 |
| | | Text display | MSC.191/5.2.3 | IEC 62288/4.4.3 |
| | | Icons | MSC.191/5.2.4 | IEC 62288/4.4.4 |
| | Color and brightness | | MSC.191/5.3.1, MSC.191/5.3.2, MSC.191/5.3.3 | IEC 62288/4.5 |
| | Symbols | Operational information | MSC.191/5.4.1 | IEC 62288/4.6.1 |
| | | Electronic chart information | MSC.191/5.4.2 | IEC 62288/4.6.2 |
| | Color-coded information | Color-coded identification | MSC.191/5.5.1 | IEC 62288/4.7.1 |
| | | Color coding of information | MSC.191/5.5.2 | IEC 62288/4.7.2 |
| | | Color coding combined with other attributes | MSC.191/5.5.3 | IEC 62288/4.7.3 |
| | | Information flashing | MSC.191/5.5.4 | IEC 62288/4.7.4 |

| S/N | Test items | | Reference Standard | Test methods |
|---|---|---|---|---|
| | Integrity flag | Indication of information source, validity, and integrity | MSC.191/5.6.1 | IEC 62288/4.8.1 |
| | | Legality and integrity of color coding | MSC.191/5.6.2 | IEC 62288/4.8.2 |
| | | Indication of display fault | MSC.191/5.6.3 | IEC 62288/4.8.3 |
| | Alert and indication | Operating status | MSC.191/5.7.1 | IEC 62288/4.9.1 |
| | | Alert list | MSC.191/5.7.2 | IEC 62288/4.9.2 |
| | | Alert messages from multiple data sources | MSC.191/5.7.3 | IEC 62288/4.9.3 |
| | | Voice output of alarms and warnings | MSC.191/5.7.4 | IEC 62288/4.9.4 |
| | Display mode | | MSC.191/5.8 | IEC 62288/4.10 |
| | Manuals and guidelines | | MSC.191/5.9 | IEC 62288/4.11 |
| 2 | Contrast and brightness | | MSC.191/8.1.1/2 | IEC 62288/7.2.1 |
| | Magnetic interference | | MSC.191/8.1.3 | IEC 62288/7.2.2 |
| | Time stability | | | IEC 62288/7.2.3 |
| | Physical controls and status indication | | | IEC 62288/7.2.4 |
| | Screen viewing angle | | MSC.191/8.5 | IEC 62288/7.6 |

**Equipment Function and Performance Test Items Required by Regulations Table 9.3 (6)**

| S/N | Test items | Test methods | Remarks |
|---|---|---|---|
| 1. | Function test | Refer to Section 6 of the Guidelines | Complete equipment functions |
| 2. | General requirements | Clause 5.6.2 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | Document review |
| 3. | Equipment output | Clause 5.6.3 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | The specific inspection and test items are determined according to the applicable IEC 61162 series standards for the interface. |

| S/N | Test items | Test methods | Remarks |
|---|---|---|---|
| 4. | Accuracy | Clause 5.6.4 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | Note the test conditions; reference points and an antenna motion platform are required. |
| 5. | Acquisition | Clause 5.6.5 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | — |
| 6. | Connection between antenna and input/output | Clause 5.6.6 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | — |
| 7. | Antenna installation | Clause 5.6.7 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | Document review |
| 8. | Sensitivity and dynamic range | Clause 5.6.8 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | A dedicated microwave anechoic chamber and signal simulator are required. |
| 9. | Specific interference signal disturbances | Clause 5.6.9 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | A signal simulator and S-band radar are required. |
| 10. | Location update | Clause 5.6.10 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | |
| 11. | Differential BDS input | Clause 5.6.11 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | Document review |
| 12. | Fault alert and status indication | Clause 5.6.12 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | |
| 13. | COG and SOG output | Clause 5.6.13 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | |
| 14. | UTC output | Clause 5.6.13 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | — |
| 15. | Typical interference conditions | Clause 5.6.14 of Annex 2 to Appendix 5, Chapter 5, Part 4 of the Regulations | A dedicated microwave anechoic chamber and signal simulator are required. |
| 16. | Display of navigation-related information | Clauses 4 and 7 of IEC 62288:2021 | The tests specified in Clause 4 may be conducted in conjunction with the performance tests. |

9.4 Single item/batch survey

Upon delivery, CCS requires single item or batch survey after approval, and issues a marine

product certificate.

After obtaining type approval, the manufacturer shall control the production and testing processes in accordance with the quality control documents submitted during approval, conduct the specified factory tests on each marine product, and issue a factory test report for each unit. Based on review of the factory test report, the CCS surveyor shall sample 5%, but not fewer than 2 units, for survey. The single item or batch survey after approval shall at least include the following tests:

- Data verification of main components (parts);

- Confirmation of software version;

- Configuration check

If the surveyor deems it necessary, the test items and sampling quantity can be increased.

## Appendix A Definitions and Abbreviations

### A1 Definitions in IEC 61108-5:2020

#### A1.1 BeiDou coordinate system (BDCS)

The coordinate system adopted by the BeiDou Satellite Navigation System (BDS).

*Note A1 : The definition of BDCS conforms to the specifications of the International Earth Rotation and Reference Systems Service (IERS) and is consistent with the definition of the China Geodetic Coordinate System 2000 (CGCS2000). BDCS and CGCS2000 share the same ellipsoid parameters. The origin is at the Earth's center of mass. The Z-axis is aligned with the direction of the IERS Reference Pole (IRP), that is, from the origin toward the IERS Reference Pole. The X-axis is defined as the intersection of the IERS Reference Meridian (IRM) with the equatorial plane passing through the origin and orthogonal to the Z-axis, i.e., from the origin toward where the IERS Reference Meridian meets the equatorial plane. The Y-axis, together with the Z-axis and X-axis, forms a right-handed orthogonal coordinate system. The unit of length is the meter (m) of the International System of Units (SI).*

#### A1.2 BDS time (BDT)

The basic unit is the SI second, and the time scale is continuous, with no leap seconds applied.

*Note A2 : The initial epoch of BDT is 00:00:00 UTC on January 1, 2006. BDT is synchronized with UTC via UTC (NTSC), maintaining a deviation of less than 50 ns between BDT and UTC. Leap second information is broadcast within the navigation data.*

#### A1.3BeiDou navigation satellite system (BDS)

Independently developed and operated by China, this system provides users with positioning, velocity, and timing information, including public services, authorized services, and short message services.

### A2 Definitions in IEC 62923-1:2018

#### A2.1Active alert

An alert that is not in the "normal" status.

#### A2.2Aggregated header alert

An alert indicating the presence of multiple individual alerts of the same type, sent from an aggregated source. Its alert status and ID are determined by its associated individual member alerts.

The alert instance is 0, and the alert title and/or alert description text include an aggregation header indicating the aggregation.

A2.3Aggregation

A single aggregation consisting of an aggregated header alert and its associated individual member alerts, all sharing the same alert identifier and aggregation source, providing one alert (an aggregated header alert represents multiple individual member alerts).

A2.4Aggregation header

The aggregation header is a combined header under which associated member alerts of the aggregation are sorted. It indicates the common portion of member alerts defined by the aggregation source.

A2.5Aggregation source

BAM (Bridge Alert Management) compatible equipment that defines an aggregation alert group.

A2.6Aggregation-member alert

An individual alert defined by its source as part of an aggregation.

A2.7Alert

Notification of abnormalities and conditions requiring attention.

*Note A3 : Alerts are divided into four priority levels: emergency alarm, alarm, warning, and caution. An alert provides information about a specified status change, along with details on how the system and operator are to be notified of this event in a prescribed manner.*

A2.8Emergency alarm (highest-priority alert)

An alert indicating an immediate danger to human life or to the ship and its machinery, requiring immediate action.

A2.9Alarm (high-priority alert)

A condition that requires immediate attention and action by the bridge team to ensure the safe voyage and operation of the ship.

A2.10 Warning

A condition that requires immediate attention, but not immediate action, by the bridge team.

*Note A4 : A warning is issued for precautionary purposes to inform the bridge team that the current change in conditions does not pose an immediate danger but may do so if no action is taken.*

A2.11 Caution (lowest-priority alert)

Recognize that a condition is not an alert or warning condition, but still require attention due to normal considerations of the situation or given information.

A2.12 Alert announcements

Visual and/or audible presentation of alerts.

A2.13 Alert history list

Accessible list of historical alerts.

A2.14 Alert management

The coordinated specification for the monitoring, processing, distribution, and presentation of bridge alerts.

A2.15 Slert source

Device that generates and manages alerts.

A2.16 Audible indication

Audible signals from the EUT (Equipment Under Test) that are unrelated to priority or warning alerts generated in the EUT activation alert list.

Example 1: A sound indicating a change in control position.

Example 2: IMO A.1021(26) Table 7.1.1.

A2.17 Bridge alert management (BAM)

The overall concept for the management, processing, and coordinated presentation of bridge alerts.

A2.18 BAM compliant equipment

Equipment compliant with MSC.302(87).

A2.19 Central alert management (CAM)

Management of alert presentation on the CAM-HMI (Centralized Alert Management Human-Machine Interface), including communication of alert statuses between the CAM-HMI, navigation systems, and sensors.

*Note A5 : These functions can be centralized or partially centralized within subsystems and interconnected via standardized alert-related communications.*

A2.20 Central alert management HMI (CAM-HMI)

A human-machine interface for centralized presentation and handling of bridge alerts.

A2.21 Central alert management system (CAM system)

The combined functions of the CAM and CAM-HMI.

A2.22 Category A alert

Graphical information is required at the task station that has direct alert generation capability; this information supports decision-making in the evaluation of alert-related conditions.

A2.23 Category B alert

Alerts that do not require additional decision support information beyond what is available on the CAM-HMI.

A2.24 Category C alert

Alerts that cannot be acknowledged at the bridge but require information regarding their status and handling.

A2.25 Cluster

High-level functional groups, such as voyage or automation.

A2.26 Converted alert

A BAM-compatible alert generated from the conversion of an legacy alert.

A2.27 EUT function type P

Functions required in the EUT to make it a BAM-compatible device.

A2.28 EUT function type Q

Additional functions to Function Type P required in the EUT to make it a BAM-compatible CAM system.

A2.29 EUT function type R

Optional additional functions to Function Type P required in the EUT to re-evaluate alerts originating from alert sources (responsibility transfer).

A2.30 EUT function type S

Optional additional functions to Function Type P required in the EUT to convert legacy alert communications from legacy alert sources into BAM-compatible alert communications.

A2.31 EUT function type T

Additional functions to Function Type Q required in an INS to make it a BAM-compatible INS.

A2.32 Failure analysis

A logical and systematic examination of a project, including its diagrams or formulas, to identify and assess the likelihood, causes, and consequences of potential and actual failures.

A2.33 Functional alert group

A single aggregation of functional alert group header alerts, as defined by the functional alert group source, together with associated individual group-member alerts, providing a unified alert.

A2.34 Functional alert group source

A BAM-compatible device that defines one functional alert group, consisting of alerts received and/or generated by it.

*Note A6 : It may be an alert source, a BAM-compliant device that receives alerts from the alert*

*source, or a CAM system.*

A2.35 Functional alert group header

The header of a functional alert group, under which associated group-member alerts are organized, indicating the common characteristics of group-member alerts as defined by the functional alert group source.

*Note A7 : The header may display the current number of group-member alerts in this functional alert group.*

A2.36 Functional alert group header alert

Indicates the presence of multiple individual alerts that share common characteristics in function and/or priority. These alerts are transmitted by the functional alert group source, with their status determined by the associated group-member alerts. Each has a unique alert ID, an alert instance of 0, and the alert title and/or description includes a header representing the functional alert group.

A2.37 Functional alert grouping

Alerts are arranged according to function and/or priority.

A2.38 Group-member alert

An individual alert defined by the functional alert group source as part of a functional alert group.

A2.39 Human machine interface (HMI)

The part of the system with which the operator interacts.

*Note A8 : The interface is the set of methods by which users interact with machines, devices, and systems. The interface provides inputs for users to control the system and outputs for the system to notify users.*

A2.40 Individual alert

An alert that reports an abnormal condition requiring attention.

A2.41 Legacy alert source

A device that generates and manages alerts that do not comply with the interfaces specified in Annex C of IEC 62923-1.

A2.42 Multifunction display (MFD)

A single visual display unit capable of presenting information from multiple individual functions either simultaneously or through a series of selectable pages.

A2.43 Ship's time

The time reference used onboard.

A2.44 Simple operator action

A procedure completed by initiating it via voice or with no more than two hard or soft key actions (excluding any necessary cursor movement), or by using a programming code.

A2.45 Single operator action

A procedure completed by initiating it via voice or with no more than one hard or soft key action (excluding any necessary cursor movement), or by using a programming code.

A2.46 Task station

A multifunction display equipped with dedicated control devices, enabling the display and operation of any task.

*Note A9 : The task station is part of the workstation.*

A2.47 Workstation

An aggregation of all work-related components required to perform specific tasks, including equipment, device consoles, and furniture.

A3 Definitions in GB/T 39267-2020 "Beidou Satellite Navigation Terminology"

A3.1Timing

The process and technology of transmitting standard time.

A3.2Differential positioning

A technique for improving the positioning accuracy of a radio navigation system by differencing observations or positions.

A3.3GNSS augmentation

Technology used to improve the performance (accuracy, integrity, continuity, and availability) of navigation services provided by GNSS.

A3.4Week number

A count of weeks accumulated from a reference epoch (typically 00:00 on Sunday).

A3.5Seconds of week

A count of seconds accumulated from 00:00 on Sunday, ranging from 0 to 604 799.

A3.6Time synchronization

The process and techniques by which time consistency is achieved through measurement, comparison, and adjustment among different time sources.

A3.7Epoch

A reference time instant representing an event.

A3.8Almanac

Parameters contained in the navigation message used to determine the approximate positions of navigation satellites.

A3.9Broadcast ephemeris

Predicted parameters contained in the navigation message used to determine the precise positions of navigation satellites.

A3.10 Pseudo-range

The distance obtained by a receiver from the difference between the local reception time of a navigation signal and the satellite transmission time of that signal.

A3.11 Doppler shift

The change in the frequency received by a radio signal receiver relative to the transmitted frequency of the signal source due to relative motion between the receiver and the signal source.

A3.12 Short message service

A two-way signal transmission and reception service provided by the BeiDou Satellite Navigation System based on RDSS technology.

*Note A10 : Mainly used for short messages between authorized users.*

A3.13 Position report

The transmission of own position information via BeiDou RDSS short messages, forwarded by a control center to designated RDSS terminals, or the transmission of the applicant's position—computed by the control center based on the RDSS positioning function upon request—to designated RDSS terminals.

A3.14 Dilution of precision (DOP)

A dimensionless parameter that characterizes the degree of degradation of user navigation accuracy caused by the geometric distribution of the navigation constellation.

A3.15 Geometric dilution of precision (GDOP)

A dimensionless parameter that characterizes the degree of degradation of user three-dimensional position and time accuracy caused by the geometric distribution of the navigation constellation.

A3.16 Position dilution of precision (PDOP)

A dimensionless parameter that characterizes the degree of degradation of user three-dimensional position accuracy caused by the geometric distribution of the navigation constellation.

A3.17 Vertical dilution of precision (VDOP)

A dimensionless parameter that characterizes the degree of degradation of user height (vertical) accuracy caused by the geometric distribution of the navigation constellation.

A3.18 Horizontal dilution of precision (HDOP)

A dimensionless parameter that characterizes the degree of degradation of user horizontal position accuracy caused by the geometric distribution of the navigation constellation.

A3.19 Time dilution of precision (TDOP)

A dimensionless parameter that characterizes the degree of degradation of user clock bias (time) accuracy caused by the geometric distribution of the navigation constellation.

A3.20 Time to first fix (TTFF)

The time required from power-on of a user device to the acquisition of the first correct position solution.

A3.21 Reacquisition time

The time required for a user device to re-acquire navigation signals after a short-term loss of lock, from signal recovery to successful re-acquisition.

A3.22 Acquisition

The processing procedure by which a user device performs code identification and coarse synchronization of code phase and carrier phase on received navigation signals.

A3.23 Tracking

The process of continuously maintaining code synchronization and carrier phase synchronization for acquired satellite signals.

A3.24 Acquisition sensitivity

The minimum signal power level required for a user device, under cold-start conditions, to acquire navigation signals and achieve normal positioning.

A3.25 Tracking sensitivity

The minimum signal power level required for a user device, after normal positioning has been achieved, to continue tracking navigation signals and maintaining positioning.

A3.26 Cycle slip

A phenomenon in which errors occur in the carrier cycle count during carrier phase measurements in a satellite navigation terminal, caused by signal loss of lock, terminal malfunction, or similar reasons.

A3.27 Positioning error

The difference between a positioning result and the true position.

A3.28 Horizontal positioning error

The projection component of the positioning error in the horizontal direction.

A3.29 Vertical positioning error

The projection component of the positioning error in the vertical direction.

A3.30 Antenna gain

The ratio of the radiation intensity of an antenna in a given direction to that of an isotropic antenna with the same input power.

A3.31 Multi-GNSS receiver

A receiver capable of simultaneously receiving signals transmitted by two or more satellite navigation systems.

A3.32 Cold start time

The time required for a user receiver, with ephemeris, almanac, approximate time, and approximate position unknown, to achieve normal positioning after power-on.

A3.33 Warm start time

The time required for a user receiver, with ephemeris unknown but almanac, approximate time, and approximate position known, to achieve normal positioning after power-on.

A3.34 Hot start time to first fix

The time required for a user device, with ephemeris, almanac, approximate time, and approximate position known, to achieve normal positioning after power-on.

A3.35 Receiver dynamic characteristics

The ranges of velocity, acceleration, and jerk that a receiver can support while meeting normal dynamic positioning requirements.

## A4 List of Industry-Used Terms

### A4.1Integrity

The ability of a system to provide an alarm to the user within a specified time when the system cannot be used for navigation purposes. (From Appendix 5, Chapter 5, Part 4 of the Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages)

### A4.2Acquisition

The processing procedure by which a user device completes code identification, code synchronization, and carrier phase synchronization for received satellite signals. (From the Product Survey Guidelines for Shipborne BeiDou Satellite Navigation System Receivers)

### A4.3Receiver Autonomous Integrity Monitoring (RAIM)

A method by which a receiver uses redundant satellite pseudo-range measurements to determine the integrity of the satellite system. It can identify whether any visible satellite has failed, determine which satellite is faulty, and exclude it from the navigation solution. (From the Product Survey Guidelines for Shipborne BeiDou Satellite Navigation System Receivers)

### A4.4WGS-84 (World Geodetic System 84)

The 1984 World Geodetic Coordinate System (WGS-84) is a geocentric reference system established by the US Department of Defense based on the precise ephemeris system NSWC-9Z-2 (corresponding to WGS72), using the 1980 geodetic reference system and the BIH1980 system orientation. (From the Product Survey Guidelines for Shipborne BeiDou Satellite Navigation System Receivers)

### A4.5CGCS2000 (China Geodetic Coordinate System 2000)

Abbreviation of the China Geodetic Coordinate System 2000: This is a geocentric geodetic coordinate system established through the joint adjustment of the Chinese GPS continuous operation reference station network, the space geodetic control network, and the astro-geodetic network with the space network. CGCS2000 is based on the ITRF97 reference frame, with a reference epoch of 2000.0. (From the Product Survey Guidelines for Shipborne BeiDou Satellite Navigation System Receivers)

## A5 Abbreviations

BAM：bridge alert management，桥楼报警管理

CAM：central alert management，集中报警管理

CGCS： China Geodetic Coordinate System, 中国大地坐标系

COG：course over ground，对地航行

CW：continuous wave，连续波

DBDS：differential BDS，差分北斗卫星导航系统

EUT：equipment under test，受试设备

GEO：Geostationary Earth Orbit, 地球静止轨道

GNSS：global navigation satellite system，全球卫星导航系统

GPS：global positioning system，全球定位系统

HAL：horizontal alert limit，水平报警限值

HDOP：horizontal dilution of precision，水平精度因子

HPL：horizontal protection limit，水平保护极限

ICD： Interface Control Document, 接口控制文件

IERS ：International Earth Rotation and Reference System Service 国际地球自转服务组织

IGSO： Inclined Geosynchronous Satellite Orbit, 倾斜地球同步轨道

INS：integrated navigation system, 综合导航系统

IODC： Issue of Data, Clock,时钟数据龄期

IODE： Issue of Data, Ephemeris, 星历数据龄期

IPP：Ionospheric Pierce Ponit, 电离层穿刺点

IRM： IERS Reference Meridian, IERS 参考子午面

IRP： IERS Reference Pole, IERS 参考极

MKD：minimum keyboard display, 最小键盘显示

NB：narrow band,窄带

NTSC：National time service centre (Chinese academy of sciences) ,国家授时中心（中国科学院）

OS：open service, 公开服务

PDOP：position dilution of precision, 位置精度因子

PNT：position, navigation and timing, 位置、导航和授时

PVT：position, velocity and time, 位置、速度和时间

RAIM：receiver autonomous integrity monitoring, 接收机自主完好性监测

RF：radio frequency, 射频

RFCS：radio frequency constellation simulator, 射频星座模拟器

RFI：radio frequency interference, 射频干扰

SIS：signal in space, 空间信号

SOG：speed over ground, 对地速度

SOW： Seconds of Week 周内秒计数

TGD：Time Correction of Group Delay，群延迟时间改正

UDRE：user differential range error，用户差分距离误差

UDREI： User Differential Range Error Index，用户差分距离误差指数

URA： User Range Accuracy，用户距离精度

URAE： User Range Acceleration Error，用户距离误差的二阶导数

URAI： User Range Accuracy Index，用户距离精度指数

URE ：User Range Error，用户距离误差

URRE ：User Range Rate Error，用户距离误差的一阶导；

UTC：universal time coordinated，世界协调时

UTCOE： UTC Offset Error，协调时间时偏差误差

WB：wide band，宽带

WN： Week Number，整周计数

# Appendix B Alert Management

## B1 Alert Management

The BDS receiver shall be capable of classifying, processing, displaying, and issuing alerts in accordance with the requirements of IEC 62923-1 and IEC 62923-2. Within the BAM concept, the BDS receiver serves as an alarm source. The BDS receiver shall have the capability to issue alarms as specified in Table B.1.

**Required Alarms and Corresponding Levels** **Table B.1**

| Cause of Alert | Alarm | Warning | Caution | Level A | Level B | Alarm ID |
|---|---|---|---|---|---|---|
| HDOP exceeds limit | | | X | | X | 3056 |
| No position solution or position lost | | X | | | X | 3015 |
| Differential signal lost [1]or differential corrections not used [2] | | | X | | X | 3056 |
| Integrity status [3] | | X | | | X | 3012 |

1 The term "Warning" required in IEC 62923-2 is changed to "Caution".

2 The term "Warning" required in IEC 62923-2 is changed to "Caution".

3 The "Differential Integrity Status" required in IEC 62923-2 is changed to "Integrity Status".

Note B1 : According to IMO Resolution MSC.302(87), brief descriptions of the various alarms and their corresponding levels are as follows:

- Alarm: Audible broadcast continues until acknowledged by the operator
- Warning: Short audible broadcast repeated every 5 minutes until acknowledged by the operator
- Caution: Muted
- Category A: Can only be acknowledged at the source of the alert or when complete source information is available. Audible broadcast is given only at locations where acknowledgment is possible.
- Category B: Acknowledgement is possible both at the source and on the central panel of the BAM. A short audible broadcast is given at every location where acknowledgment is possible.