

ANNEX 18

RESOLUTION MSC.379(93)

(adopted on 16 May 2014)

**PERFORMANCE STANDARDS FOR SHIPBORNE BEIDOU SATELLITE NAVIGATION
SYSTEM (BDS) RECEIVER EQUIPMENT**

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution A.886(21), by which the Assembly resolved that the function of adopting performance standards and technical specifications, as well as amendments thereto shall be performed by the Maritime Safety Committee and/or the Marine Environment Protection Committee, as appropriate, on behalf of the Organization,

RECALLING FURTHER that, in accordance with resolution A.1046(27), containing the IMO policy for the recognition and acceptance of suitable radionavigation systems intended for international use, the "Revised Report on the Study of a Worldwide Radionavigation System", the BDS satellite navigation system may be recognized as a possible component of the world-wide radionavigation system,

NOTING that shipborne receiving equipment for the worldwide radionavigation system should be designed to satisfy the detailed requirements of the particular system concerned,

RECOGNIZING the need to develop performance standards for shipborne BDS receiver equipment in order to ensure the operational reliability of such equipment and taking into account the technological progress and experience gained,

HAVING CONSIDERED the recommendation made by the Sub-Committee on Safety of Navigation, at its fifty-ninth session,

1 ADOPTS the performance standards for shipborne BDS receiver equipment, set out in the annex to the present resolution;

2 RECOMMENDS Governments to ensure that BDS receiver equipment installed on or after 1 July 2016 conform to performance standards not inferior to those specified in the annex to the present resolution.

ANNEX

PERFORMANCE STANDARDS FOR SHIPBORNE BEIDOU SATELLITE NAVIGATION SYSTEM (BDS) RECEIVER EQUIPMENT

1 Introduction

1.1 As a global navigation satellite system compatible with other navigation satellite systems worldwide, the BDS is a system independently developed and operated by China and is comprised of three major components: space constellation, ground control segment and user terminals. The space constellation consists of five geosynchronous earth orbit (GEO) satellites and 27 medium-earth orbit (MEO) satellites and three inclined geosynchronous satellite orbit (IGSO) satellites. The GEO satellites are positioned at longitudes of 058.75° E, 080° E, 110.5° E, 140° E and 160° E, respectively. The MEO satellites are operating in an orbit with an altitude of 21,500 km and an inclination of 55°, which are evenly distributed in three orbital planes. The IGSO satellites are operating in an orbit with an altitude of 36,000 km and an inclination of 55°, which are evenly distributed in three inclined geosynchronous orbital planes. The subsatellite track for the three IGSO satellites are coincided while the longitude of the intersection point is at 118° E. This geometry ensures that a minimum of four satellites are visible to users worldwide with a position dilution of precision (PDOP) ≤ 6 . Each satellite transmits open service signal B1I on "L" bands with carrier frequency as 1561.098 MHz. B1I signal includes ranging code which could provide the open service. A navigation data message is superimposed on this code. BDS satellites are identified by Code Division Multiple Access (CDMA).

1.2 The BDS Open Service (OS) provides positioning, navigation and timing services, free of direct user charges. The BDS receiver equipment should be capable of receiving and processing the open service signal.

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)¹, should comply with the following minimum performance requirements.

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.

2 BDS receiver equipment

2.1 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 should 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;

¹ Refer to publication IEC 60945.

- .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 2.1.3, 2.1.4, 2.1.5 may be provided within the INS.

2.2 The antenna design should 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.

3 Performance standards for BDS receiver equipment

The BDS receiver equipment should:

- .1 be capable of receiving and processing the BDS positioning and velocity, and timing signals, and should use the ionospheric model broadcast to the receiver by the constellation to generate ionospheric corrections;
- .2 provide position information in latitude and longitude in degrees, minutes and thousandths of minutes²;
- .3 provide time referenced to universal time coordinated UTC (NTSC)³;
- .4 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 should be based on the WGS 84 datum and should be in accordance with international standards⁴. The output of UTC, course over ground (COG), speed over ground (SOG) and alarms should be consistent with the requirements of 3.15 and 3.17;
- .5 have static accuracy such that the position of the antenna is determined to be within 25 m horizontally (95%) and 30 m vertically (95%);
- .6 have dynamic accuracy equivalent to the static accuracy specified in .5 above under the normal sea states and motion experienced in ships⁵;
- .7 have position information in latitude and longitude in degrees, minutes and thousandths of minutes with a position resolution equal to or better than 0.001 min of latitude and longitude;
- .8 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 BeiDou uses China Geodetic Coordinate System (CGCS) 2000 which is a realization of the International Terrestrial Reference Frame (ITRF) system and differs from WGS 84 by less than 5 cm worldwide. Conversion to WGS 84 is not needed for maritime navigation.

³ China National Time Service Centre.

⁴ Publication IEC 61162.

⁵ Refer to resolution A.694(17), publications IEC 6721-3-6 and IEC 60945.

- .9 be capable of acquiring satellite signals with input signals having carrier levels in the range of -130dBm to -120dBm. Once the satellite signals have been acquired, the equipment should continue to operate satisfactorily with satellite signals having carrier levels down to -133dBm;
- .10 be capable of operating satisfactorily under normal interference conditions consistent with the requirements of resolution A.694(17);
- .11 be capable of acquiring position, velocity and time to the required accuracy within 12 min where there is no valid almanac data;
- .12 be capable of acquiring position, velocity and time to the required accuracy within 1 min where there is valid almanac data;
- .13 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;
- .14 generate and output to a display and digital interface⁶ 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;
- .15 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 should not be inferior to the relevant performance standards for heading⁷ and speed and distance measuring equipment (SDME)⁸ and the accuracy should be obtained under the various dynamic conditions that could be experienced on board ships;
- .16 provide at least one normally closed contact, which should indicate failure of the BDS receiver equipment;
- .17 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 should comply with the relevant international standards⁶; and
- .18 have the facilities to process differential BDS (DBDS) data fed to it in accordance with the standards of ITU-R⁹ and the 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 receiver, performance standards for static and dynamic accuracies (paragraphs 3.5 and 3.6 above) should be 10 m (95%).

4 Integrity checking, failure warnings and status indications

4.1 The BDS receiver equipment should 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 resolution A.1046(27) or appendix 2 to resolution A.915(22) and any subsequent amendments, as appropriate.

⁶ Publication IEC 61162.

⁷ Resolution A.424(XI) for conventional craft and resolution A.821(19) for high-speed craft.

⁸ Resolution A.824(19), as amended by resolution MSC.96(72).

⁹ ITU-R Recommendation M.823.

4.2 The BDS receiver equipment should, as a minimum:

- .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, should be output until normal operation is resumed;
- .2 use Receiver Autonomous Integrity Monitoring (RAIM) to provide integrity performance appropriate to the operation being undertaken; and
- .3 provide a self-test function.

5 Protection

Precautions should 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.
