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To: Related departments in CCS Headquarters, each plan approval center, each branch (office), concerned shipyards, marine product manufacturers, ship designers, shipping management companies and shipowners

Technical Notice on performance standards for shipborne Indian Regional Navigation Satellite System (IRNSS) receiver equipment(Resolution MSC.449(99)) issued by IMO

1. Background

The Maritime Safety Committee (MSC) of International Maritime Organization (IMO), at its ninety-ninth session (16 to 25 May 2018), adopted the performance standards for shipborne IRNSS receiver equipment (Resolution MSC.449 (99)). IRNSS receiver equipment installed on or after 1 July 2020 conforms to performance standards not inferior to those specified in the annex to the resolution.

2. Main contents

These performance standards are newly provided, which include as follows:

a) Introduction: overview, coverage area;

b) IRNSS receiver equipment: component, antenna design;

c) Performance standards for IRNSS receiver equipment：function and performance;

d) Integrity checking, failure warnings and status indications;

e) Protection.

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ANNEX Resolution MSC.449(99)—Performance standards for shipborne Indian Regional Navigation Satellite System (IRNSS) receiver equipment

ANNEX 17

RESOLUTION MSC.449(99)
(adopted on 24 May 2018)

PERFORMANCE STANDARDS FOR SHIPBORNE INDIAN REGIONAL NAVIGATION SATELLITE SYSTEM (IRNSS) 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 Indian Regional Navigation Satellite System (IRNSS) 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 IRNSS receiver equipment in order to ensure the operational reliability of such equipment and taking into account the technological progress and experience gained,

HAVING CONSIDERED, at its ninety-ninth session, the recommendation made by the Sub-Committee on Navigation, Communications and Search and Rescue, at its fifth session,

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

2 RECOMMENDS Governments to ensure that IRNSS receiver equipment installed on or after 1 July 2020 conforms to performance standards not inferior to those specified in the annex to the present resolution.

ANNEX

PERFORMANCE STANDARDS FOR SHIPBORNE INDIAN REGIONAL NAVIGATION SATELLITE SYSTEM (IRNSS) RECEIVER EQUIPMENT

1 Introduction

1.1 IRNSS is a regional navigation satellite system compatible with other navigation satellite systems worldwide. IRNSS is an independent regional system developed and operated by India which comprises of three major components: space segment, ground control segment and user terminals. The space segment is a constellation of seven satellites, of which four are geosynchronous earth orbit (GSO) satellites inclined at 29° to equatorial plane with longitude crossing as 55°E and 111.75°E (two satellites in each slot) and three are geostationary satellite orbit (GEO) satellites positioned at 32.5°E, 83°E, 129.5°E orbital slots. This geometry ensures that a minimum of five satellites are visible to users within the service area with a position dilution of precision (PDOP) $\leqslant$ 6. Each satellite transmits standard positioning service signals on "L5" and "S" bands with carrier frequencies as 1176.45 MHz and 2492.028 MHz respectively. Standard positioning signals include ranging codes which could provide the open service. A navigation data message is superimposed on these codes. IRNSS satellites are identified by pseudo ranging noise (PRN) codes.

1.2 The IRNSS Standard Positioning Service (SPS) provides positioning, navigation and timing services, free of direct user charges. The IRNSS receiver equipment should be capable of receiving and processing the standard service signal.

1.3 IRNSS receiver equipment intended for navigation purposes on ships with a speed not exceeding 70 knots, in addition to the general requirements specified in the *General requirements for shipbore radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids* (resolution A.694(17)),[19] 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 IRNSS receiver.

1.5 It should be noted that this is the regional navigation satellite system being recognized as a future component of the World-Wide Radio Navigation System (WWRNS) and the service is limited to the following coverage area.

Coverage area:

Area closed by 55°E Longitude, 50°N Latitude and 110°E Longitude, 5°S Latitude.

[19] Refer to publication IEC 60945. If IRNSS forms part of an approved Integrated Navigation System (INS), requirements of 2.1.3, 2.1.4 and 2.1.5 may be provided within the INS.

2 IRNSS receiver equipment

2.1 The term "IRNSS 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 IRNSS receiver equipment should include the following minimum facilities:

.1 antenna capable of receiving IRNSS signals;

.2 IRNSS 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.

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 IRNSS receiver equipment

The IRNSS receiver equipment should:

.1 be capable of receiving and processing the IRNSS 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 based upon WGS-84 coordinates and should be in accordance with international standards;[20]

.3 provide time referenced to universal time coordinated UTC;

.4 be provided with at least two outputs from which position information, UTC, COG, SOG and alarms can be supplied to other equipment. The output of UTC, COG, SOG and alarms should be consistent with the requirements of 3.16 and 3.18;

.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 3.5 above under the normal sea states and motion experienced in ships;[21]

.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 have timing accuracy such that time is determined within 100 ns of UTC;

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[20] Publication IEC 61162.

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

.9 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;

.10 be capable of acquiring satellite signals with input signals having carrier levels in the range of -137dBm to -127dBm. Once the satellite signals have been acquired, the equipment should continue to operate satisfactorily with satellite signals having carrier levels down to -140dBm;

.11 be capable of operating satisfactorily under normal interference conditions consistent with the requirements of resolution A.694(17);

.12 be capable of acquiring position, velocity and time to the required accuracy within 3 min where there is no valid almanac data;

.13 be capable of acquiring position, velocity and time to the required accuracy within 2 min where there is valid almanac data;

.14 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;

.15 generate and output to a display and digital interface[22] 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;

.16 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 heading[23] and speed and distance measuring equipment (SDME)[24] and the accuracy should be obtained under the various dynamic conditions that could be experienced on board ships;

.17 provide at least one normally closed contact, which should indicate failure of the IRNSS receiver equipment;

.18 have a bidirectional interface to facilitate communication so that alarms can be transferred to external systems and so that audible alarms from the IRNSS receiver can be acknowledged from external systems; the interface should comply with the relevant international standards;[25] and

.19 have the facilities to process differential IRNSS (D-IRNSS) data fed to it in accordance with the standards of ITU-R[26] and the appropriate RTCM standard and provide indication of the reception of D-IRNSS signals and whether they are being applied to the ship's position. When an IRNSS 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%).

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22 Conforming to the IEC 61162 series.

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

24 Resolution A.824(19) as amended by resolutions MSC.96(72) and MSC.334(90).

25 Publication IEC 61162.

26 ITU-R Recommendations M.823.

4 Integrity checking, failure warnings and status indications

4.1 The IRNSS receiver equipment should also indicate whether the performance of IRNSS 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 the *Worldwide radionavigation system* (resolution A.1046(27)) or appendix 2 to the *Revised maritime policy and requirements for a future global navigation satellite system (GNSS)* (resolution A.915(22)) and any subsequent amendments, as appropriate.

4.2 The IRNSS 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 IRNSS 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 IRNSS receiver equipment inputs or outputs for a duration of 5 min.

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