ANNEX 10

RESOLUTION MSC.480(102)
(adopted on 11 November 2020)

PERFORMANCE STANDARDS FOR SHIPBORNE
JAPANESE QUASI-ZENITH SATELLITE SYSTEM (QZSS) 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 "Revised Report on the Study of a Worldwide Radionavigation System", adopted as the IMO policy for the recognition and acceptance of suitable radionavigation systems intended for international use, the Japanese Quasi-Zenith Satellite System (QZSS) may be recognized as a possible component of the worldwide 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 Japanese QZSS 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 102nd session, the recommendation made by the Sub-Committee on Navigation, Communications and Search and Rescue, at its seventh session,

1 ADOPTS the *Performance standards for shipborne Japanese Quasi-Zenith Satellite System (QZSS) receiver equipment*, set out in the annex to the present resolution;

2 RECOMMENDS Governments to ensure that shipborne Japanese QZSS receiver equipment installed on or after 1 January 2024 conforms to performance standards not inferior to those specified in the annex to the present resolution.

ANNEX

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1 Introduction

1.1 QZSS is a regional navigation satellite system compatible and interoperable with other navigation satellite systems worldwide. QZSS is a system independently developed and operated by Japan and is comprised of three major components: space constellation, ground control segment and user terminals. At the time of QZSS 4-satellite constellation, there are three quasi-zenith orbit (QZO) satellites and one geostationary orbit (GEO) satellite. QZO is the inclined geosynchronous orbit (IGSO) with a slight eccentricity. QZO satellites have different orbital planes from one another that are inclined at about 40° and elliptical. The centre of longitude at three QZO orbit is around 139° E. Three QZO satellites have an orbital plane phase that has been adjusted so that they have almost the same ground track and the orbital period of QZO is the same as GEO. GEO satellite is positioned at 127° E. At the time of QZSS 7-satellite constellation, two QZO satellites and one GEO satellite will be added in 4-satellite constellation. Each satellite transmits standard positioning service signal on "L1" and "L5" bands with carrier frequencies as 1 575.42 MHz and 1 176.45 MHz, respectively. Standard positioning signals include ranging codes which are defined in the GPS IS documents, i.e. using the same code sequences as GPS pseudo random noise (PRN) codes and can provide the open service. A navigation data message is superimposed on these codes. QZSS satellites are identified by PRN codes. QZSS can be used in combination with GPS.

1.2 QZSS provides positioning, navigation and timing (PNT) service, free of direct user charges. QZSS receiver equipment should be capable of receiving and processing the standard service signal.

1.3 QZSS receiver equipment intended for navigation 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 minimum performance requirements set out below.

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 do they cover the requirements for other systems that may take input from the QZSS receiver.

1.5 It should be noted that this is the regional navigation satellite system being recognized as a future component of the Worldwide Radionavigation System (WWRNS) and the service is limited to the following coverage area:

Coverage area: Asia-Oceania region area, as enclosed by the following coordinates:

A	56°45'.28 N,	143°43'.24 E
B	13°22'.78 N,	173°23'.09 E
C	04°18'.48 S,	173°23'.09 E
D	59°59'.28 S,	139°47'.72 E
E	44°46'.28 S,	095°06'.47 E
F	03°21'.83 S,	082°32'.05 E
G	31°03'.91 N,	093°58'.10 E

[1] Refer to publication IEC 60945.

1.6 Figure 1 shows the coverage area of QZSS PNT service.

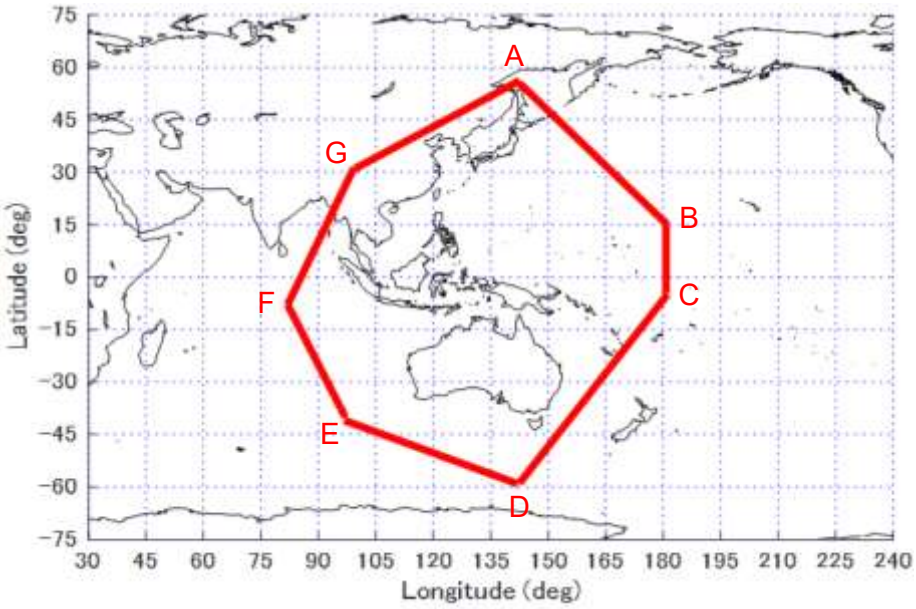

Figure 1: Coverage area of QZSS PNT Service

2 QZSS receiver equipment

2.1 The term "QZSS receiver equipment", as used in the performance standards, includes all the components and units necessary for the system to properly perform its intended functions. QZSS receiver equipment should include the following minimum facilities:

.1 antenna capable of receiving QZSS signals;

.2 QZSS 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 QZSS receiver equipment

QZSS receiver equipment should:

.1 be capable of receiving and processing the QZSS navigation signals, and use the ionospheric model;

.2 provide position information based upon ITRF or WGS-84 coordinates and should be in accordance with international standards;[2]

[2] Publication IEC 61162.

.3 provide time referenced to Universal Time Coordinated (UTC);

.4 be provided with at least one output 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 paragraph 3.15;

.5 have static accuracy such that, for the service area in figure 1 where a horizontal dilution of precision (HDOP) is equal to or less than 6.7, the position of the antenna is determined to be within 50.4 m horizontal (95%);

.6 have dynamic accuracy under the conditions of sea states and ships' motion likely to be experienced in ships,[3] such that for the service area in figure 1 where a HDOP is equal to or less than 6.7, the position of the antenna is determined to within 50.4 m horizontal (95%);

.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;

.9 be capable of acquiring satellite signals with input signals having carrier levels in the range of -134 dBm to -124 dBm. Once the satellite signals have been acquired, the equipment should continue to operate satisfactorily with satellite signals having carrier levels down to -137 dBm;

.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 to the required accuracy, within 30 min, when there is no valid almanac data;

.12 be capable of acquiring position to the required accuracy, within 5 min, when there is valid almanac data;

.13 be capable of re-acquiring position to the required accuracy, within 2 min, when subjected to a power interruption of up to 60 s;

.14 generate and output to a display and digital interface[4] a new position solution at least once every 1 s for conventional craft and be recommended 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 heading[5] and

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

4 Conforming to the IEC 61162 series.

5 Refer to resolution A.424(XI) for conventional craft and resolution A.821(19) for high-speed craft.

speed and distance measuring equipment (SDME)[6] and the accuracy should be obtained under the various dynamic conditions that could be experienced on board ships; and

.16 have the facilities to process augmentation data. When a QZSS receiver is equipped to process augmentation data, performance standards for static and dynamic accuracies should be less than 10 m (95%).

4 Integrity checking, failure warnings and status indication

4.1 QZSS receiver equipment should indicate whether the performance of QZSS is likely to be outside the bounds of requirements for general navigation.

4.2 QZSS 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 has not been calculated for more than 1 s. 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; and

.2 use receiver autonomous integrity monitoring to provide integrity performance appropriate to the operation being undertaken.

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 QZSS receiver equipment inputs or outputs for a duration of 5 min.

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[6] Refer to resolution A.824(19).