

ASSEMBLY  
19th session  
Agenda item 10

**RESOLUTION A.819(19)**  
adopted on 23 November 1995

**PERFORMANCE STANDARDS FOR SHIPBORNE GLOBAL  
POSITIONING SYSTEM (GPS) RECEIVER EQUIPMENT**

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

HAVING ADOPTED by resolution A.815(19) the IMO policy for the recognition and acceptance of suitable radionavigation systems intended for international use to provide ships with navigational position-fixing throughout their voyages,

RECOGNIZING that the Maritime Safety Committee has identified that the Global Positioning System (GPS) may be a component of the world-wide radionavigation system,

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

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its sixty-fourth session,

1. ADOPTS the Recommendation on Performance Standards for Shipborne Global Positioning System (GPS) Receiver Equipment set out in the Annex to the present resolution;
2. INVITES Governments to ensure that GPS receiver equipment carried on ships of their flag conform to the performance standards set out in the Annex to the present resolution;
3. REQUESTS the Maritime Safety Committee to keep these Performance Standards under review and to adopt amendments thereto, as necessary.

## ANNEX

**RECOMMENDATION ON PERFORMANCE STANDARDS FOR SHIPBORNE  
GLOBAL POSITIONING SYSTEM (GPS) RECEIVER EQUIPMENT****1 INTRODUCTION**

1.1 The Global Positioning System (GPS) is a space-based positioning, velocity and time system that has three major segments: space, control and user. The GPS space segment will normally be composed of 24 satellites in six orbits. The satellites operate in circular 20,200 km orbits at an inclination angle of 55° with a 12-hour period. The spacing of satellites in orbit will be arranged so that a minimum of four satellites will be in view to users world-wide, with a position dilution of precision (PDOP) of  $\leq 6$ . Each satellite transmits on two "L" band frequencies, L1 (1575,42 MHz) and L2 (1227,6 MHz). L1 carries a precise (P) code and coarse/acquisition (C/A) code. L2 carries the P code. A navigation data message is superimposed on these codes. The same navigation data message is carried on both frequencies.

1.2 Receiver equipment for the GPS intended for navigational purposes on ships with maximum speeds not exceeding 50 knots should, in addition to the general requirements contained in resolution A.694(17), comply with the following minimum performance requirements.

1.3 These standards cover the basic requirements of position-fixing for navigation purposes only and do not cover other computational facilities which may be in the equipment.

**2 GPS RECEIVER EQUIPMENT**

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

- .1 antenna capable of receiving GPS signals;
- .2 GPS 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.

### 3 PERFORMANCE STANDARDS FOR GPS RECEIVER EQUIPMENT

The GPS receiver equipment should:

- .1 be capable of receiving and processing the Standard Positioning Service (SPS) signals as modified by Selective Availability (SA) and provide position information in latitude and longitude World Geodetic System (WGS) 84 co-ordinates in degrees, minutes and thousandths of minutes and time of solution referenced to UTC. Means may be provided for transforming the computed position based upon WGS 84 into data compatible with the datum of the navigational chart in use. Where this facility exists, the display should indicate that co-ordinate conversion is being performed, and should identify the co-ordinate system in which the position is expressed;
- .2 operate on the L1 signal and C/A code;
- .3 be provided with at least one output from which position information can be supplied to other equipment. The output of position information based upon WGS 84 should be in accordance with IEC Publication 1162;
- .4 have static accuracy such that the position of the antenna is determined to within 100 m (95%) with horizontal dilution of precision (HDOP)  $\leq 4$  (or PDOP  $\leq 6$ );
- .5 have dynamic accuracy such that the position of the ship is determined to within 100 m (95%) with HDOP  $\leq 4$  (or PDOP  $\leq 6$ ) under the conditions of sea states and ship's motion likely to be experienced in ships;<sup>1</sup>
- .6 be capable of selecting automatically the appropriate satellite-transmitted signals for determining the ship's position with the required accuracy and update rate;
- .7 be capable of acquiring satellite signals with input signals having carrier levels in the range of -130 dBm to -120 dBm. Once the satellite signals have been acquired, the equipment should continue to operate satisfactorily with satellite signals having carrier levels down to -133 dBm;
- .8 be capable of acquiring position to the required accuracy within 30 min when there is no valid almanac data;
- .9 be capable of acquiring position to the required accuracy within 5 min when there is valid almanac data;
- .10 be capable of re-acquiring position to the required accuracy within 5 min when the GPS signals are interrupted for a period of at least 24 h but there is no loss of power;
- .11 be capable of re-acquiring position to the required accuracy within 2 min when subjected to a power interruption of 60 s;

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<sup>1</sup>Refer to resolution A.694(17), Publications IEC 721-3-6, IEC 945 and IEC 1108-1.

- .12 generate and output a new position solution at least once every 2 s;
- .13 the minimum resolution of position, i.e. latitude and longitude, should be 0.001 minutes; and
- .14 have the facilities to process differential GPS (DGPS) data fed to it in accordance with the standards of Recommendation ITU-R M.823 and the appropriate RTCM standard. When a GPS receiver is equipped with a differential receiver, performance standards for static and dynamic accuracies (3.4 and 3.5 above) should be 10 m (95%).

#### **4 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 GPS receiver equipment inputs or outputs for a duration of 5 min.

#### **5 FAILURE WARNINGS AND STATUS INDICATIONS**

5.1 The equipment should provide an indication of whether the position calculated is likely to be outside the requirements of these performance standards.

5.2 The GPS receiver equipment should provide as a minimum:

- .1 an indication within 5 s if either:
  - .1.1 the specified HDOP has been exceeded; or
  - .1.2 a new position has not been calculated for more than 2 s.

Under such conditions the last known position and the time of the last valid fix, with explicit indication of this state, so that no ambiguity can exist, should be output until normal operation is resumed;

- .2 a warning of loss of position; and
- .3 differential GPS status indication of:
  - .3.1 the receipt of DGPS signals; and
  - .3.2 whether DGPS corrections are being applied to the indicated ship's position.