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INTERNATIONAL STANDARD

Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 6: Navigation with Indian constellation (NavIC)/Indian regional navigation satellite system (IRNSS) – Receiver equipment – Performance requirements, methods of testing and required test results

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CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms, definitions and abbreviated terms 8
3.1 Terms and definitions 8
3.2 Abbreviated terms 8
4 Minimum performance requirements 9
4.1 Object 9
4.2 IRNSS/NavIC receiver equipment 10
4.2.1 Minimum facilities 10
4.2.2 Configuration 10
4.2.3 Quality assurance 10
4.3 Performance of IRNSS/NavIC receiver equipment 10
4.3.1 General 10
4.3.2 Equipment interfaces 11
4.3.3 Accuracy 12
4.3.4 Acquisition 12
4.3.5 Protection 13
4.3.6 Antenna design 13
4.3.7 Sensitivity and dynamic range 14
4.3.8 Effects of specific interfering signals 14
4.3.9 Position update 14
4.3.10 Differential IRNSS/NavIC input 15
4.3.11 Navigation warnings and status indications 15
4.3.12 Output of COG, SOG and UTC 17
4.3.13 Typical interference conditions 18
5 Methods of testing and required test results 18
5.1 Test sites 18
5.2 Test sequence 19
5.3 Standard test signals 19
5.4 Determination of accuracy 20
5.5 General requirements and presentation requirements 20
5.5.1 Normal environmental conditions for tests 20
5.5.2 General requirements 20
5.5.3 Presentation requirements 20
5.6 Receiver performance tests 20
5.6.1 IRNSS/NavIC receiver equipment 20
5.6.2 Position output 20
5.6.3 Equipment interfaces 21
5.6.4 Accuracy 21
5.6.5 Acquisition 22
5.6.6 Protection 23
5.6.7 Antenna design 23
5.6.8 Sensitivity and dynamic range 23
5.6.9 Protection from other shipborne transmitters 24
5.6.10 Position update 25
5.6.11 Differential IRNSS/NavIC input 25

AVA Documents
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5.6.12 Navigational warnings and status indications 26
5.6.13 Accuracy of COG and SOG 28
5.6.14 Validity of COG and SOG information 29
5.6.15 Output of UTC 29
5.7 Tests for typical RF interference conditions 29
5.7.1 Simulator conditions 29
5.7.2 Navigation solution accuracy test 29
5.7.3 Re-acquisition test 30
Annex A (normative) Typical IRNSS/NavIC interference environment 32
A.1 IRNSS/NavIC CW in-band and near-band interference environment 32
A.2 Band-limited noise-like interference 33
A.3 Pulsed interference 34
A.4 IRNSS/NavIC minimum antenna gain 35
Annex B (normative) Alert management 36
Bibliography 37

Figure 1 – Logical interfaces of IRNSS/NavIC receiver 11
Figure A.1 – CW interference thresholds for IRNSS/NavIC L5 band receivers in steady state navigation 33
Figure A.2 – CW interference thresholds for IRNSS/NavIC S band receivers in steady state navigation 33
Figure A.3 – Effect of interference bandwidth on interference thresholds for IRNSS/NavIC receivers (for noise like interference) 34

Table 1 – Acquisition time limits 13
Table 2 – RAIM integrity status 17
Table 3 – Accuracy of COG 18
Table 4 – RF interference value 30
Table A.1 – CW interference thresholds for IRNSS/NavIC L5 band receivers in steady-state navigation 32
Table A.2 – CW interference thresholds for IRNSS/NavIC S band receivers in steady-state navigation 32
Table A.3 – Interference threshold for band-limited noise-like interference to IRNSS/NavIC receivers in steady-state navigation 34
Table A.4 – Interference thresholds for pulsed interference 35
Table A.5 – IRNSS/NavIC minimum antenna gain 35
Table B.1 – Required alerts and their classification 36

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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) –

Part 6: Navigation with Indian constellation (NavIC)/Indian regional navigation satellite system (IRNSS) – Receiver equipment – Performance requirements, methods of testing and required test results

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IEC 61108-6 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
80/1055/FDIS	80/1058/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

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This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 61108 series, published under the general title *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS)*, can be found on the IEC website.

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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) –

Part 6: Navigation with Indian constellation (NavIC)/Indian regional navigation satellite system (IRNSS) – Receiver equipment – Performance requirements, methods of testing and required test results

1 Scope

This part of IEC 61108 specifies the minimum performance requirements, methods of testing and required test results for the Indian regional navigation satellite system (IRNSS), also known as Navigation with Indian Constellation (NavIC), shipborne receiver equipment, based on IMO resolution MSC.449(99), which uses the signals from NavIC/IRNSS in order to determine position.

This document takes account of the general requirements given in IMO resolution A.694(17) and is associated with IEC 60945. When a requirement in this document is different from IEC 60945, the requirement in this document takes precedence. This document also takes into account, as appropriate, requirements for the presentation of navigation-related information on shipborne navigational displays given in IMO resolution MSC.191(79) and is associated with IEC 62288. This document further takes into account, as appropriate, requirements for bridge alert management given in IMO resolution MSC.302(87) and is associated with IEC 62923-1.

This document applies to navigation in ocean waters for the standard positioning service and harbour entrances, harbour approaches and coastal waters, as defined in IMO resolution A.1046(27) within IRNSS/NavIC coverage area as given in IMO resolution MSC 449(99).

All text of this document whose meaning is identical to that in IMO resolution MSC. 449(99) is printed in italics and the resolution and paragraph number indicated between brackets, i.e. "(M.449(99)/A1.2)".

The requirements in Clause 4 are cross-referenced to the tests in Clause 5 and vice versa.

NOTE 1 A description of the IRNSS standard positioning service can be found in the interface control documents which were officially released in 2017 in the public domain (see ISRO-IRNSS-ICD-SPS-1.1).

NOTE 2 The IRNSS constellation was renamed as "NavIC" (navigation with Indian constellation) in 2016.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60945, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61108-4, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 4: Shipborne DGPS and DGLONASS maritime radio beacon receiver equipment – Performance requirements, methods of testing and required test results*

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IEC 61108-5:2020, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 5: BeiDou navigation satellite system (BDS) – Receiver equipment – Performance requirements, methods of testing and required test results*

IEC 61162-1, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners*

IEC 61162-2, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 2: Single talker and multiple listeners, high-speed transmission*

IEC 61162-450, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection*

IEC 62288, *Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results*

IEC 62923-1*, Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 1: Operational and performance requirements, methods of testing and required test results*

IEC 62923-2*, Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 2: Alert and cluster identifiers and other additional features*

IMO resolution A.694(17):1991, *General requirements for shipborne radio equipment forming part of the Global maritime distress and safety system (GMDSS) and for electronic navigational aids*

IMO resolution A.915(22), *Revised maritime policy and requirements for a future Global Navigation Satellite System (GNSS)*

IMO resolution A.1046(27), *Worldwide radio navigation system*

IMO resolution MSC.302(87), *Performance standards for bridge alert management*

IMO resolution MSC.449(99), *Performance Standards for Shipborne IRNSS Receiver Equipment*

ITU-R Recommendation M.823-3, *Technical characteristics of differential transmissions for global navigation satellite systems from maritime radio beacons in the frequency band 283.5-315 kHz in Region 1 and 285-325 kHz in Regions 2 and 3*

ISRO-IRNSS-ICD-SPS-1.1, *Navigation with Indian Constellation System – Signal in Space Interface Control Document for Standard Positioning Service V 1.1*, Aug 2017 [viewed 2022-11-11]. Available at https://www.isro.gov.in/media_isro/pdf/Publications/Vispdf/Pdf2017/irnss_sps_icd_version1.1-2017.pdf

RTCM 10402, *RTCM Recommended Standards for Differential GNSS (Global Navigation Satellite Systems) Service*

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3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

NOTE All definitions and abbreviations used are the same as those used in ISRO-IRNSS-ICD-SPS-1.1.

3.1 Terms and definitions

3.1.1
integrity
ability of the system to provide users with warnings within a specified time when the system should not be used for navigation

3.1.2
Indian regional navigation satellite system
IRNSS
independent satellite navigation system developed and operated by India

Note 1 to entry: IRNSS can provide 3D position, velocity and time information for users within 1 500 km from the Indian geopolitical boundary.

Note 2 to entry: IRNSS is known as NavIC and the words are used interchangeably in this document.

3.1.3
IRNSS/NavIC time
time reference built and kept by IRNSS

Note 1 to entry: The IRNSS system time start epoch is 00:00 UT on Sunday August 22nd 1999 (midnight between August 21st and 22nd). At the start epoch, IRNSS system time is ahead of UTC by 13 leap seconds (i.e. IRNSS time, August 22nd 1999, 00:00:00 corresponds to UTC time August 21st 1999, 23:59:47).

3.2 Abbreviated terms

BAM	bridge alert management
CAM	central alert management
COG	course over ground
CW	continuous wave
DNavIC	differential navigation with Indian constellation
EUT	equipment under test
GNSS	global navigation satellite system
GPS	global positioning system
HAL	horizontal alert limit
HDOP	horizontal dilution of precision
HPL	horizontal protection limit
ICD	interface control document
MKD	minimum keyboard and display
NavIC	navigation with Indian constellation
NB	narrow band
NPLI	national physical laboratory of India

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PDOP	position dilution of precision
PNT	position navigation and timing
RAIM	receiver autonomous integrity monitor
RF	radio frequency
RFCS	radio frequency constellation simulator
RFI	radio frequency interference
SOG	speed over ground
SPS	standard positioning service
UTC	universal time coordinated
WB	wide band

4 Minimum performance requirements

4.1 Object

(M.449(99)/A1.2) The IRNSS Standard Positioning Service (SPS) provides positioning, navigation and timing services, free of direct user charges. The IRNSS SPS receiver equipment should be capable of receiving and processing the IRNSS SPS signal. It should be capable of tracking all IRNSS satellites.

(M.449(99)/A1.3) Receiver equipment for the Indian Regional Satellite System (IRNSS) intended for navigational purposes on ships with maximum speeds not exceeding 70 knots shall, in addition to the general requirements contained in resolution A.694(17), comply with the following minimum performance requirements.

(M.449(99)/A1.4) This standard covers 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.

This document contains the basic minimum performance requirements for use of IRNSS/NavIC standard positioning service (SPS) signals for navigational position fixing, including differential corrections, and, in addition, for the determination of speed and direction of the movement of the antenna over the ground.

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.

The IRNSS/NavIC receiver equipment shall comply with:

– the provisions of IMO resolutions A.1046(27), MSC. 449(99), MSC.302(87) and A.694(17);
– the accuracy requirements of the SPS interface control document;
– tests in accordance with IEC 60945.

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4.2 IRNSS/NavIC receiver equipment

4.2.1 Minimum facilities

(M.449(99)/A2.1) The term "IRNSS receiver equipment" as used in these performance standards includes all the components and units necessary for the system to properly perform its intended functions. The equipment shall include the following minimum facilities:

a) *antenna capable of receiving IRNSS signals;*

b) *IRNSS receiver and processor;*

c) *means of accessing the computed latitude/longitude position;*

d) *data control and interface; and*

e) *position display and, if required, other forms of output.*

If the IRNSS/NavIC receiver forms part of an approved integrated navigation system (INS), requirements of c), d) and e) may be provided within the INS.

If the IRNSS/NavIC receiver forms part of an approved multi-system PNT, requirements of c), d) and e) may be provided within the multi-system PNT.

4.2.2 Configuration

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

– stand-alone receiver with means of accessing computed position via a keyboard with the positional information suitably displayed and with means to display alerts and acknowledge alerts via the keyboard;

– IRNSS/NavIC 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 and alert management information available to at least one remote location. With this option, a separate user interface called as MKD shall be provided as a backup;

– as one of the position velocity and time (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.

4.2.3 Quality assurance

The equipment shall be designed, produced and documented by manufacturers complying with approved quality systems as applicable.

4.3 Performance of IRNSS/NavIC receiver equipment

4.3.1 General

(See 5.6.2)

(M.449(99)/A3.1) The IRNSS receiver equipment shall be capable of receiving and processing the IRNSS SPS 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 IRNSS/NavIC navigation signal characteristics is given in ISRO-IRNSS-ICD-SPS-1.1, Aug 2017.

(M.449(99)/A3.2) The IRNSS receiver equipment shall provide position information based upon WGS-84 and should be in accordance with international standards.

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Means may be provided to transform 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 shall indicate that co-ordinate conversion is being performed and shall identify the co-ordinate system in which the position is expressed.

(M.449(99)/A3.3) The IRNSS receiver equipment shall provide time referenced to universal time coordinated UTC (NPLI).

4.3.2 Equipment interfaces

(See 5.6.3)

(M.449(99)/A3.4) The IRNSS 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.449(99)/A3.16 and M.449(99)/A3.18.

(M.449(99)/A3.17) The IRNSS receiver equipment shall provide at least one normally closed contact, which shall indicate failure of the IRNSS receiver equipment.

(M.449(99)/A3.18). The IRNSS 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 IRNSS receiver can be acknowledged from external systems; the interface shall comply with relevant international standards.

NOTE Alarms are read as alerts in M.449(99)/A3.4 and A3.18 for BAM compliance.

The physical interface shall be based on IEC 61162-1 or IEC 61162-2 or IEC 61162-450. Logical interfaces are shown in Figure 1, where required interfaces are indicated with solid lines and optional interfaces are indicated in dashed lines.

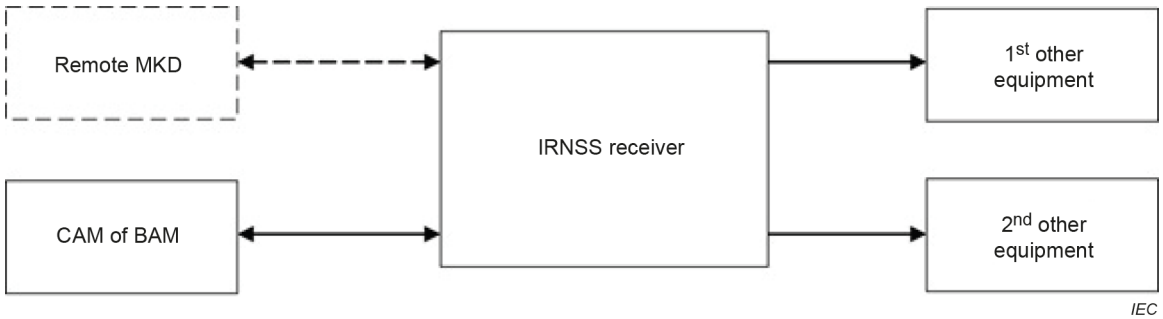

Figure 1 – Logical interfaces of IRNSS/NavIC receiver

IRNSS/NavIC receiver shall use talker ID "GI".

For reporting purposes, the following sentences shall be available in any combination:

- DTM – Datum reference (see IEC 61108-5);
- GBS – GNSS satellite fault detection (see IEC 61108-5);
- GFA – GNSS fix accuracy and integrity (see IEC 61108-5);
- GNS – GNSS fix data (see IEC 61108-5);
- RMC – Recommended minimum specific GNSS data;
- VTG – Course over ground and ground speed;
- ZDA – Time and date.

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