

# Maritime navigation and radiocommunication equipment and systems — Automatic identification systems (AIS) —

**Part 2: Class A shipborne equipment of  
the universal automatic identification  
system (AIS) — Operational and  
performance requirements, methods of  
test and required test results**

The European Standard EN 61993-2:2002 has the status of a  
British Standard

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# National foreword

This British Standard is the official English language version of EN 61993-2:2002. It is identical with IEC 61993-2:2001.

The UK participation in its preparation was entrusted to Technical Committee EPL/80, Maritime navigation and radiocommunication equipment and systems, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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**Maritime navigation and radiocommunication equipment and systems -  
Automatic identification systems (AIS)  
Part 2: Class A shipborne equipment  
of the universal automatic identification system (AIS) -  
Operational and performance requirements,  
methods of test and required test results  
(IEC 61993-2:2001)**

Matériels et systèmes de navigation  
et de radiocommunications maritimes -  
Systèmes d'identification automatique (AIS)  
Partie 2: Equipements AIS  
de type Classe A embarqués -  
Exigences d'exploitation et de  
fonctionnement, méthodes d'essai  
et résultats d'essai exigés  
(CEI 61993-2:2001)

Navigations- und Funkkommunikations-  
geräte und -systeme für die Seeschifffahrt -  
Automatische Identifikationssysteme (AIS)  
Teil 2: Geräte der Klasse A  
des universellen automatischen  
Identifikationssystems (AIS) für Schiffe -  
Betriebs- und Leistungsanforderungen,  
Prüfverfahren und geforderte  
Prüfergebnisse  
(IEC 61993-2:2001)

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

### **Foreword**

The text of document 80/315/FDIS, future edition 1 of IEC 61993-2, prepared by IEC TC 80, Maritime navigation and radiocommunication equipment and systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61993-2 on 2002-02-01.

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Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes D and ZA are normative and annexes A, B, C and E are informative.

Annex ZA has been added by CENELEC.

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### **Endorsement notice**

The text of the International Standard IEC 61993-2:2001 was approved by CENELEC as a European Standard without any modification.

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## INTRODUCTION

Following the adoption by the International Maritime Organisation (IMO) of Resolution MSC.74(69) Annex 3, Performance Standard for a Universal Shipborne Automatic Identification System, TC 80 established Working Group 8A to develop IEC 61993-2. Technical requirements were provided in ITU-R M.1371 "Technical characteristics for a universal shipborne Automatic Identification System (AIS) using TDMA (Self-Organising Time Division Multiple Access) in the VHF maritime mobile band". Carriage requirements for SOLAS ships have been adopted by IMO for entry into force starting on July 1st 2002.

It was brought to the attention of WG8A that patents and patents pending pertaining to AIS have been made freely available. TC 80 WG8A considers the technical implementation specified by this International Standard to be in full accordance with the requirements of Recommendation ITU-R M.1371-1 and as such to be free from claims of intellectual property rights.

The provision of a high-speed network connection IEC 61162-3 is optional. It may become a requirement in a later revision of this standard, when the relevant standard (IEC 61162-3) has been adopted.

The IMO Resolution MSC.74(69) Annex 3, Performance Standard for an Universal Shipborne Automatic Identification System, requires that the AIS has a means of processing data from an electronic position fixing system that provides a resolution of one ten-thousandth of a minute of arc and uses the WGS 84 datum. Resolution A.815(19) requires an accuracy of position information better than 10 m in confined waters. This does not require but implies that if the ship is not equipped with a DGNSS, the GNSS sensor internal to the AIS should be a DGNSS and should be used as source of position information.

Moreover, Resolution MSC.74(69) Annex 3 does not include any requirement for backup arrangements of the position information. However, a GNSS sensor is included in the AIS equipment as the source of UTC. It is felt by IEC TC 80 that this GNSS sensor also can be used as a back-up arrangement for the position information obtained from the ship's DGNSS. This would ensure the availability of the AIS system in case of failure of the ship's EPFS.

Therefore, IEC TC 80 strongly recommends that manufacturers of AIS equipment implement such an arrangement in accordance with table 4 of this International Standard.

Note that an IEC standard detailing class B AIS is being prepared as IEC 62287.

# MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – AUTOMATIC IDENTIFICATION SYSTEMS (AIS)

## Part 2: Class A shipborne equipment of the universal automatic identification system (AIS) – Operational and performance requirements, methods of test and required test results

### 1 Scope

This International Standard specifies the minimum operational and performance requirements, methods of testing and required test results conforming to performance standards adopted by the IMO in resolution MSC.74(69), Annex 3, Universal Shipborne Automatic Identification System. This standard incorporates the technical characteristics of Class A shipborne equipment included in Recommendation ITU-R M1371-1 and takes into account the ITU Radio Regulations where applicable. In addition it takes account of IMO resolution A.694(17) to which IEC 60945 is associated.

This International Standard also specifies the minimum requirements both for the means to input and display data and for the interfaces to other equipment suitable to be used as means of input and display data.

NOTE All text of this standard, that is identical to that in IMO resolution MSC.74(69), Annex 3 and IMO resolution A.694(17) or to that in ITU-R M.1371-1 is printed in *italics* and the resolution (abbreviated to – A3 or – A694 respectively) or the recommendation (abbreviated to – M.1371-1) and paragraph numbers are indicated in parentheses i.e. (A3/3.3) or (M.1371-1/3.3) respectively.

### 2 Normative references

The following referenced documents are indispensable for the application 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 61108-1, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 1: Global positioning system (GPS) – Receiver equipment – Performance standards, methods of testing and required test results.*

IEC 61108-2, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 2: Global navigation satellite system (GLONASS) – Receiver equipment – Performance standards, methods of testing and required test results*

IEC 61108-4<sup>1</sup>, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 4: Shipborne DGPS and DGLONASS maritime radio beacon receiver equipment*

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

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<sup>1</sup> To be printed.

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

IEC 61162-3<sup>2</sup>: *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 3: Multiple Talker and multiple listeners – High speed network bus*

IEC 61993-1, *Maritime navigation and radiocommunication equipment and systems – Part 1: Shipborne automatic transponder system installation using VHF digital selective calling (DSC) techniques – Operational and performance requirements, methods of testing and required test results*

ISO/IEC 3309, *Information technology – Telecommunications and information exchange between systems – High-level data link control (HDLC) procedures – Frame structure*

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.815(19):1995, *Worldwide radionavigation system*

IMO Resolution A.851(20):1997, *General principles for ship reporting systems and ship reporting requirements, including guidelines for reporting incidents involving dangerous goods, harmful substances and/or marine pollutants*

IMO Resolution MSC.43(64), as amended by MSC.111(73), *Guidelines and Criteria for Ship Reporting Systems*.

IMO Resolution MSC.74(69), *Annex 3, Recommendation on performance standards for AIS*

IMO Guidelines on the operational use of AIS (provisional)

ITU-R Recommendation M.489-2, *Technical characteristics of VHF radiotelephone equipment operating in the maritime mobile service in channels spaced by 25 kHz*

ITU-R Recommendation M.825-3, *Characteristics of a transponder system using digital selective calling techniques for use with vessel traffic services and ship-to-ship identification*

ITU-R Recommendation M.1084-4, *Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service*

NOTE ITU-R M.1371-1 references ITU-R M.1084-3, Annex 3. A Draft Revision of Recommendation ITU-R M.1084-3, consequentially leading to ITU-R M.1084-4, has been approved in parallel to the approval of ITU-R M.1371-1.

ITU-R Recommendation M.1371-1, *Technical characteristics for a universal shipborne automatic identification system using time division multiple access in the VHF maritime mobile band*

IALA Technical clarifications to recommendation ITU-R M.1371-1

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<sup>2</sup> To be printed.

### 3 Abbreviations

|        |                                                                |
|--------|----------------------------------------------------------------|
| AIS    | universal shipborne automatic identification system            |
| BIIT   | built-in integrity tests                                       |
| COG    | course over ground                                             |
| ECDIS  | electronic chart display and information system                |
| EPFS   | electronic position-fixing systems                             |
| ETA    | estimated time of arrival                                      |
| EUT    | equipment under test                                           |
| GBS    | see IEC 61162-1, table 5                                       |
| GGA    | see IEC 61162-1, table 5                                       |
| GLL    | see IEC 61162-1, table 5                                       |
| HDG    | heading                                                        |
| HDTWPL | see IEC 61162-1, table 5                                       |
| HSC    | high speed craft                                               |
| IHO    | International Hydrographic Office                              |
| IMO    | International Maritime Organization                            |
| LR     | long range                                                     |
| MAC    | medium access control                                          |
| MKD    | minimum keyboard and display                                   |
| MMSI   | maritime mobile service identity                               |
| NUC    | not under command                                              |
| OSD    | see IEC 61162-1, table 5                                       |
| PER    | packet error rate                                              |
| PI     | presentation interface                                         |
| RAIM   | receiver autonomous integrity monitoring                       |
| RMC    | see IEC 61162-1, table 5                                       |
| SOG    | speed over ground                                              |
| UTC    | universal time co-ordinated                                    |
| VBW    | see IEC 61162-1, table 5                                       |
| VDL    | VHF data link                                                  |
| VDM    | serial output message containing VDL information (IEC 61162-1) |
| VSWR   | voltage standing wave ratio                                    |
| VTG    | see IEC 61162-1, table 5                                       |
| Rx     | receive                                                        |
| Tx     | transmit                                                       |
| msg    | message                                                        |

NOTE Abbreviations related to IEC 61162 series are not included in the above list. For their meaning, refer to that International Standard.

## 4 General requirements

Requirements contained in this clause 4 are requirements not taken up in other clauses and which cannot be verified by repeatable methods of measurement. These requirements include the applicable general and operational requirements of IEC 60945, as detailed in clause 6 (Operational checks), clause 13 (Maintenance), clause 14 (Equipment manuals) and clause 15 (Marking and Identification) of that International Standard.

The manufacturer shall declare compliance with these requirements and shall provide relevant documentation. The declarations, documentation and where necessary, the EUT shall be checked or verified by inspection.

The manufacturer shall also declare the composition of the EUT and the category for durability and resistance to environmental conditions for each unit of the EUT as specified in IEC 60945.

### 4.1 General

(A3/1)

#### 4.1.1 General requirements

**4.1.1.1** (A3/1.1) *This standard specifies the requirements for the universal AIS.*

**4.1.1.2** (A3/1.2) *The AIS shall improve the safety of navigation by assisting in the efficient navigation of ships, protection of the environment, and operation of Vessel Traffic Services (VTS), by satisfying the following functional requirements:*

- *in a ship-to-ship mode for collision avoidance;*
- *as a means for littoral States to obtain information about a ship and its cargo; and*
- *as a VTS tool, i.e. ship-to-shore (traffic management).*

#### 4.1.2 Capabilities of the AIS

(A3/1.3) *The AIS shall be capable of providing to ships and to competent authorities, information from the ship, automatically and with the required accuracy and frequency, to facilitate accurate tracking. Transmission of the data shall be with the minimum involvement of ship's personnel and with a high level of availability.*

#### 4.1.3 Additional requirements

(A3/1.4) *The installation, in addition to meeting the requirements of the Radio Regulations, applicable ITU-R Recommendations and the general requirements as set out in resolution A.694 (17), shall comply with the following performance standards, as contained in the following clauses.*

#### 4.1.4 Transmitter shutdown procedure

(M.1371-1/A2-2.14)

(M.1371-1 A2/2.14.1) *An automatic transmitter hardware shutdown procedure and indication shall be provided in case a transmitter does not discontinue its transmission within 1,0 s of the end of its transmission slot.*

#### 4.1.5 Quality assurance

The Administration shall require<sup>3</sup> that the manufacturers have a quality control system<sup>4</sup> audited by a competent authority to ensure continuous compliance with the type approval conditions. Alternatively, the Administration may use final product verification procedures where a competent authority verifies compliance with the type approval certificate before the product is installed on board ships.

#### 4.2 Modes of operation

(A3/2)

##### 4.2.1 General

(A3/2.1) *The system shall be capable of operating in a number of modes:*

**4.2.1.1** *an "autonomous and continuous" mode for operation in all areas. This mode shall be capable of being switched to/from one of the following alternate modes by a competent authority;*

Autonomous and continuous operation shall be as described in 3.3.5 of Annex 2 of Recommendation ITU-R M.1371-1;

**4.2.1.2** *an "assigned" mode for operation in an area subject to a competent authority responsible for traffic monitoring such that the data transmission interval and/or time slots may be set remotely by that authority;*

Assigned operation shall be as described in 3.3.6 of Annex 2 of Recommendation ITU-R M.1371-1;

**4.2.1.3** *a "polling" or controlled mode where the data transfer occurs in response to interrogation from a ship or competent authority.*

Polling operation shall be as described in 3.3.2 of Annex 2 of ITU-R M.1371-1 and in Annex 1 of Recommendation ITU-R M.825-3 – for DSC compatibility.

##### 4.2.2 Criteria for reporting

(A3/6.3) *To protect the unauthorised dissemination of data, the IMO guidelines (Guidelines and Criteria for Ship Reporting Systems Resolution MSC.43(64)) shall be followed.*

#### 4.3 Manuals

In addition to the requirements of IEC 60945 clause 14, the manuals shall include:

- the type of external connector required for connection of the external display as referred to in 7.6.3.2;
- the needed information for correct siting of the antennas; and
- the requirements for external illumination, as appropriate.

#### 4.4 Marking and identification

In addition to the requirements of IEC 60945, clause 15, the markings shall include:

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<sup>3</sup> See SOLAS 1974 as amended Ch. V 18.5

<sup>4</sup> ISO 9000 series, as applicable, meets this requirement.

- a) details of the power supply from which the equipment is intended to be operated; and if applicable,
- b) the date by which batteries need to be replaced.

## 5 Environmental, power supply, special purpose and safety requirements

The AIS shall be tested for compliance with the environmental, power supply, special-purpose and safety requirements of IMO A.694(17) as detailed in IEC 60945. The required tests, for which a repeatable method of measurement has been defined, are given in clauses 11, 12 and 13 of this standard. The declaration of category to IEC 60945 required in clause 4, shall define the relevant tests to be applied as follows:

- AIS equipment declared for protected installation shall meet the requirements described in table 3 column "protected" of IEC 60945.
- Exposed AIS equipment shall meet the requirements described in table 3, column "exposed" of IEC 60945.
- Portable AIS equipment shall meet the requirements of table 3 of IEC 60945 "protected" or "exposed" as appropriate.

## 6 Performance requirements

### 6.1 Composition

(A3/3)

#### 6.1.1 (A3/3.1) *The AIS shall comprise:*

**6.1.1.1** *a communication processor, capable of operating over a range of maritime frequencies, with an appropriate channel selecting and switching method, in support of both short (VHF) and long (beyond VHF) range applications.* For long range applications the AIS shall provide a two-way interface which complies with IEC 61162;

**6.1.1.2** *at least one transmitter, two TDMA receivers and one dedicated DSC receiver tuned to channel 70;*

**6.1.1.3** *a means of processing data from an electronic position-fixing system which provides a resolution of one ten thousandth of a minute of arc and uses the WGS 84 datum.*

An interface (IEC 61162) shall be provided to input the position used for navigation. Position information, if available from other EPFS, shall be used only as a back up and the user shall be informed of this (see 6.10).

**6.1.1.4** *a means to automatically input data from other sensors meeting the provisions as specified in paragraph 6.5.1.2;* A means, external to the AIS, to comply with this requirement shall be tested to the applicable requirements of IEC 60945.

**6.1.1.5** *a means to input and retrieve data manually.* The possibility of manual input and retrieval as described in 6.11 shall be demonstrated based on the manufacturer's documentation

**6.1.1.6** *a means of error checking the transmitted and received data (see 7); and*

**6.1.1.7** *built-in test equipment as specified in 6.10.1.*

**6.1.2 (A3/3.2)** *The AIS shall be capable of:*

**6.1.2.1** *providing information automatically and continuously to a competent authority and other ships, without involvement of ship's personnel;*

**6.1.2.2** *receiving and processing information from other sources, including that from a competent authority and from other ships;*

**6.1.2.3** *responding to high priority and safety related calls with a minimum of delay (refer to Recommendation ITU-R M.1371-1, Annex 2, Chapter 3.3.8.1 and Chapter 4.2.3); and*

**6.1.2.4** *providing positional and manoeuvring information at a data rate adequate to facilitate accurate tracking by a competent authority and other ships. (See 6.5.2).*

**6.2 Internal GNSS receiver**

**6.2.1 UTC source**

(M.1371-1-A1/3.1)

Since UTC is required for synchronisation purposes, an internal GNSS receiver shall be used to determine the UTC.

**6.2.2 Source for AIS position reporting**

When the external position is unavailable, the internal GNSS receiver may be used as a source for AIS position reporting.

When the internal GNSS receiver is performing as a source for position reporting,

- an appropriate BIIT indication shall be output on the Presentation Interface (see 6.10.1),
- the position data shall be available on the minimum display,
- the internal GNSS receiver shall be capable of being differential corrected, at least by evaluation of msg 17.

In this case the internal GNSS receiver shall meet the following requirements of IEC 61108 series: position accuracy, COG/SOG, acquisition, re-acquisition, receiver sensitivity, RF dynamic range, interference susceptibility, position update, failure warnings, status indications and integrity flag.

NOTE Resolution MSC.74(69), Annex 3 requires the AIS to have a means of processing data from an electronic position fixing system that provides a resolution of one ten-thousandth of a minute of arc and uses the WGS 84 datum (see 6.1.1.3).

Considering:

- SOLAS Ch.5 does not require a ship to carry an EPFS fulfilling this specification,
  - Resolution MSC.74(69), Annex 3 does not specify details of position sensor,
  - Resolution A.815(19) requires an accuracy of position information better than 10 m in confined waters,
- it is recommended that the manufacturers use a DGNSS receiver as the internal source for the AIS position.

**6.3 User interface**

(A3/4)

*To enable a user to access, select and display the information on a separate system, the AIS shall be provided with an interface conforming to an appropriate international marine interface standard. All interfacing shall be made via the system interface as described in 7.6 (called presentation interface). Where a suitable IEC 61162 interface standard is available, it shall be used.*

If no suitable IEC 61162 interface standard is available, an alternative appropriate interface may be used.

#### **6.4 Identification**

(A3/5)

*For the purpose of ship and message identification, the appropriate Maritime Mobile Service Identity (MMSI) number shall be used.*

#### **6.5 Information**

(A3/6)

##### **6.5.1 Information provided by the AIS**

(A3/6.1)

*The information provided by the AIS shall include:*

###### **6.5.1.1 Static**

- *IMO number (where available)*
- *Call sign & name*
- *Length and beam*
- *Type of ship*
- *Location of the in-use position-fixing antenna on the ship (aft of bow and port or starboard of centreline)*

###### **6.5.1.2 Dynamic**

- *Ship's position referenced to WGS 84 datum with accuracy indication and integrity status*
- *Time in UTC <sup>5</sup>*
- *Course over ground (COG).*
- *Speed over ground (SOG).*
- *Heading.*
- *Navigational status (e.g. not under command (NUC), at anchor, etc.- manual input)*
- *Rate of turn (where available)*

###### **6.5.1.3 Voyage related:**

- *Ship's draught*
- *Hazardous cargo (type; as required by a competent authority).*
- *Destination and estimated time of arrival (ETA) (at master's discretion)*

###### **6.5.1.4 Short safety-related messages**

- *Short safety-related messages*

##### **6.5.2 Information update rates**

(A3/6.2; M.1371-1-A1/4.2.1)

*The different information types are valid for a different time period and thus need a different update rate.*

---

5 Date to be established by receiving equipment.

*Static information:* Every 6 min, when data has been amended, and on request.  
*Dynamic Information:* Dependent on speed and course alteration according to table 1  
*Voyage-related information:* Every 6 min, when data has been amended, and on request  
*Safety-related message:* As required

**Table 1 – Information update rates for autonomous mode**

| <i>Type of Ship</i>                                                   | <i>Reporting interval</i> |
|-----------------------------------------------------------------------|---------------------------|
| <i>Ship at anchor or moored and not moving faster than 3 knots</i>    | 3 min                     |
| <i>Ship at anchor or moored and moving faster than 3 knots</i>        | 10 s                      |
| <i>ship with a speed of between 0 – 14 knots</i>                      | 10 s                      |
| <i>ship with a speed of between 0 – 14 knots and changing course</i>  | 3 1/3 s                   |
| <i>ship with a speed of between 14 – 23 knots</i>                     | 6 s                       |
| <i>ship with a speed of between 14 – 23 knots and changing course</i> | 2 s                       |
| <i>ship with a speed of greater than 23 knots</i>                     | 2 s                       |
| <i>ship with a speed of greater than 23 knots and changing course</i> | 2 s                       |

NOTE The reporting rate shall increase to once per 2 s in accordance with Recommendation ITU-R M.1371-1, Annex 1, Chapter 4.2.1, Footnote (1), when the station determines that it is the semaphore.

If the autonomous mode requires a higher rate than the assigned mode, the AIS shall use the autonomous mode.

### 6.5.3 Ship reporting capacity

(A3/6.2; M.1371-1-A1/4.5.2)

The system shall be able to handle a minimum of 2 000 reports per minute, to adequately provide for all operational scenarios envisioned and is capable of handling up to 4 500 reports per minute on two channels.

## 6.6 Security

(A3/6.3)

A security mechanism shall be provided to detect disabling of the AIS and to prevent unauthorised alteration of input or transmitted data. To protect the unauthorised dissemination of data, the IMO guidelines (Guidelines for Ship Reporting Systems) shall be followed.

Means shall be provided to automatically record all periods when the AIS installation is non-functioning. It shall not be possible for the user to alter any information recorded by this device.

The last 10 times when the equipment was non-functioning for more than 15 min shall be recorded, in UTC time and duration, in a non-volatile memory. Means shall be provided to recover this data.

## 6.7 Permissible initialisation period

(A3/7)

The installation shall be operational within 2 min of switching on.

NOTE Sensors used with the AIS shall meet the requirements of their individual product standards (for example – IEC 61108-1 for GPS which permits 30 min to operation when there is no valid almanac data available, or IEC 61108-2 for GLONASS).

## 6.8 Power supply

(A3/8)

*The AIS and associated sensors shall be powered from the ship's main source of electrical energy. In addition, it shall be possible to operate the AIS and associated sensors from an alternative source of electrical energy.*

## 6.9 Technical characteristics

(A3/9)

*The technical characteristics of the AIS such as variable transmitter output power, operating frequencies (dedicated internationally and selected regionally), modulation, and antenna system shall comply with the appropriate ITU-R Recommendations.*

## 6.10 Alarms and indications, fail-back arrangements

The AIS shall be equipped with BIIT. These tests shall run continuously or at appropriate intervals simultaneously with the standard functions of the equipment.

### 6.10.1 Built-in test equipment

If any failure or malfunction is detected that will significantly reduce integrity or stop operation of the AIS, an alarm is initiated. In this case:

- the alarm shall be displayed on the minimum display
- the alarm relay shall be set "active"
- an appropriate alarm message shall be output via the Presentation Interface upon occurrence and repeated every 30 s.

If a change of a relevant system status as described below is detected, an indication is given to the user. In this case,

- the indication shall be accessible on the minimum display
- an appropriate alarm message shall be output via the Presentation Interface.

### 6.10.2 Alarm messages

An ALR-sentence is used to indicate a failure or malfunction that will significantly reduce integrity or stop operation of the AIS.

#### 6.10.2.1 Using the ALR formatter

Alarm messages shall be IEC 61162-1 compliant "\$AIALR"-sentences on the presentation interface output port.

The parameters of this sentence formatter

- Time of alarm condition change (UTC),
- unique alarm number (identifier) at alarm source,
- alarm condition,
- alarm's acknowledge state,
- alarm's description text

shall be set according to table 2 below.

The "alarm condition" field shall be set to "A" when the alarm condition threshold is exceeded, and "V" when the alarm condition returns to level that does not exceed the threshold.

A continuing healthy status "V" shall not be sent out at less than one-minute intervals.

The acknowledge state flag shall be set after acknowledgement of an alarm internally by means of minimum display and keyboard or externally by a corresponding ACK sentence.

The local alarm identifiers (alarm ID) given in the table below are defined for the use with formatters ALR, ACK, and as text identifiers in TXT sentences to link associated messages. ALR-sentences with "alarm numbers" greater than 099 cannot be followed by TXT-sentences containing additional information by using the TXT-sentence's "text identifier." The "text identifier" is limited to the range of 01 to 99.

Additional numbers may be used by the manufacturers for other purposes but shall be in the range 051 – 099.

### 6.10.2.2 Monitoring of functions and integrity

In case a failure is detected in one or more of the following functions or data, an alarm shall be triggered and the system shall react as given in table 2.

**Table 2 – Integrity alarm conditions signalled using ALR sentence formatter**

| Alarm's description text        | Alarm condition threshold exceeded | Alarm condition not exceeded | Alarm ID or Text Identifier | Reaction of the system to the alarm condition threshold exceeded |
|---------------------------------|------------------------------------|------------------------------|-----------------------------|------------------------------------------------------------------|
| AIS: Tx malfunction             | A                                  | V                            | 001                         | Stop transmission                                                |
| AIS: Antenna VSWR exceeds limit | A                                  | V                            | 002                         | Continue operation                                               |
| AIS: Rx channel 1 malfunction   | A                                  | V                            | 003                         | Stop transmission on affected channel                            |
| AIS: Rx channel 2 malfunction   | A                                  | V                            | 004                         | Stop transmission on affected channel                            |
| AIS: Rx channel 70 malfunction  | A                                  | V                            | 005                         | Stop transmission on affected channel                            |
| AIS: general failure            | A                                  | V                            | 006                         | Stop transmission                                                |
| AIS: MKD connection lost        | A                                  | V                            | 008                         | continue operation with "DTE" set to "1" <sup>1</sup>            |
| AIS: external EPFS lost         | A                                  | V                            | 025                         | continue operation (refer to table 4)                            |
| AIS: no sensor position in use  | A                                  | V                            | 026                         | continue operation (refer to table 4, priority 6)                |
| AIS: no valid SOG information   | A                                  | V                            | 029                         | Continue operation using default data                            |
| AIS: no valid COG information   | A                                  | V                            | 030                         | Continue operation using default data                            |
| AIS: Heading lost/invalid       | A                                  | V                            | 032                         | Continue operation using default data <sup>2</sup>               |
| AIS: no valid ROT information   | A                                  | V                            | 035                         | Continue operation using default data <sup>2</sup>               |
| <sup>1</sup> If applicable      |                                    |                              |                             |                                                                  |
| <sup>2</sup> When so configured |                                    |                              |                             |                                                                  |

### 6.10.2.3 Relay alarm output

A NC (normally closed) earth free relay contact shall be provided as an independent and simple method for triggering an external alarm.

The alarm relay shall be "active" in case of power "off".

The alarm relay shall be deactivated upon acknowledgement of an alarm either internally by means of minimum display and keyboard or externally by a corresponding ACK sentence.

### 6.10.3 Status messages

If any significant change in system operation occurs, but overall system operation is not affected, an indication is initiated. A TXT-sentence is used to indicate when such a significant change in system operation occurs.

#### 6.10.3.1 Using the TXT formatter

Status messages shall be IEC 61162-1 compliant "\$AITXT"-sentences on the presentation interface output port. Status messages do not activate the alarm relay and do not require an acknowledgement.

The parameters of this sentence formatter

- Text identifier, and
- Text message

shall be set according to table 3 below.

#### 6.10.3.2 Channel Management parameters changed, TXT- sentence

The TXT-sentence, Text Identifier 036, shall be followed by the appropriate ACA sentence(s) to report the affected AIS conditions.

#### 6.10.3.3 Monitoring sensor data status

Indications shall be given and the system shall react as given in table 3:

**Table 3 – Sensor status indications signalled using TXT sentence formatter**

| Text Message                               | Text Identifier | Reaction of the system                                         |
|--------------------------------------------|-----------------|----------------------------------------------------------------|
| AIS: UTC clock lost                        | 007             | Continue operation using indirect or semaphore synchronisation |
| AIS: external DGNSS in use                 | 021             | Continue operation                                             |
| AIS: external GNSS in use                  | 022             | Continue operation                                             |
| AIS: internal DGNSS in use (beacon)        | 023             | Continue operation                                             |
| AIS: internal DGNSS in use (message 17)    | 024             | Continue operation                                             |
| AIS: internal GNSS in use                  | 025             | Continue operation                                             |
| AIS: external SOG/COG in use               | 027             | Continue operation                                             |
| AIS: internal SOG/COG in use               | 028             | Continue operation                                             |
| AIS: Heading valid                         | 031             | Continue operation                                             |
| AIS: Rate of Turn Indicator in use         | 033             | Continue operation                                             |
| AIS: Other ROT source in use               | 034             | Continue operation                                             |
| AIS: Channel management parameters changed | 036             | Continue operation                                             |

#### 6.10.3.4 Position sensor fallback conditions

Priorities and affected position report data (refer to ITU-R M.1371-1 A2/3.3.8.2.1) shall be as follows in table 4:

**Table 4 – Position sensor fallback conditions**

| Priority | Affected data in msg 1, 2, 3 ⇒                         |                     | Position accuracy flag | Time stamp | RAIM-flag | Position<br>Longitude/Latitude |
|----------|--------------------------------------------------------|---------------------|------------------------|------------|-----------|--------------------------------|
|          | Position Sensor status                                 |                     |                        |            |           |                                |
| 1.       | external DGNSS in use (corrected) <sup>1</sup>         |                     | 1                      | UTC-s      | 1/0 *     | Lat/Lon (external)             |
| 2.       | internal DGNSS in use (corrected; msg 17) <sup>2</sup> |                     | 1                      | UTC-s      | 1/0 *     | Lat/Lon (internal)             |
| 3.       | internal DGNSS in use (corrected; beacon) <sup>3</sup> |                     | 1                      | UTC-s      | 1/0 *     | Lat/Lon (internal)             |
| 4.       | external EPFS in use (uncorrected) <sup>1</sup>        |                     | 0                      | UTC-s      | 1/0 *     | Lat/Lon (external)             |
| 5.       | internal GNSS in use (uncorrected) <sup>2</sup>        |                     | 0                      | UTC-s      | 1/0 *     | Lat/Lon (internal)             |
| 6.       | no sensor position in use <sup>1</sup>                 | manual pos. input   | 0                      | 61         | 0         | Lat/Lon (manual)               |
|          |                                                        | dead reckoning pos. |                        | 62         |           | Lat/Lon (dead-reck.)           |
|          |                                                        | no position         |                        | 63         |           | not. available=181/91          |

<sup>1</sup> applicable in all configurations (minimum requirement)

<sup>2</sup> applicable only if internal GNSS receiver is used for position backup (see 6.2.2)

<sup>3</sup> applicable only if (optionally) an internal beacon receiver is provided.

\* if RAIM available “1”; if not, default “0”

The AIS shall automatically select the position source with the highest priority available. If data availability changes, the AIS shall automatically switch to the position source with the highest priority available after 5 s when switching downwards or 30 s when switching upwards.

During this period, the latest valid position shall be used for reporting.

On changeover from one status to another a new msg 5 shall be transmitted immediately when the reference point for the reported position has changed and an "ALR" sentence as described above shall be output to the presentation interface.

#### 6.10.3.5 SOG/COG sensor fallback conditions

SOG/COG information from internal GNSS receiver shall be used, if this internal GNSS receiver is in use as a position source. This is to avoid transmission of information referenced to different points on the ship.

#### 6.10.3.6 ROT sensor fallback conditions

The AIS shall automatically select the ROT source with the highest priority available as given in table 5.

ROT data shall not be derived from COG information.

Table 5 – ROT sensor fallback conditions

| Priority                                                                                | Affected data in msg 1, 2, 3 ⇒             | Contents of ROT field                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                         | Position Sensor status                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 1.                                                                                      | Rate of Turn Indicator in use <sup>1</sup> | 0...+126 = turning right at up to 708 degrees per minute or higher;<br>0...-126 = turning left at up to 708 degrees per minute or higher<br>Values between 0 and 708 degrees/min shall be coded by<br>$ROT_{AIS} = 4.733 \sqrt{ROT_{sensor}}$ degrees/min<br>where $ROT_{sensor}$ is the Rate of Turn as input by the external Rate of Turn Indicator (TI).<br>Values of 709 degrees per minute and above shall be cut to 708 degrees per minute. |
| 2.                                                                                      | other ROT source in use <sup>2</sup>       | +127 = turning right at more than 5°/30 s (No TI available)<br>-127 = turning Left at more than 5°/30 s (No TI available)                                                                                                                                                                                                                                                                                                                         |
| 3.                                                                                      | no valid ROT information available         | -128 (80 hex) indicates no turn information available (default)                                                                                                                                                                                                                                                                                                                                                                                   |
| <sup>1</sup> rate of turn indicator according to IMO A.526(13); determined by talker ID |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <sup>2</sup> i.e. based on HDG information.                                             |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## 6.11 Display, input and output

The AIS shall provide means to display ship and shore based AIS data and manually input data as follows:

### 6.11.1 Minimum keyboard and display (MKD)

The MKD is a display and manual input device to allow the following functions:

- Display of at least three (3) lines of data. Each line to display at least bearing, range, and name of ship. Horizontal scrolling of bearing and range is not allowed. The title of display data shall be visible.
- Manual input of voyage and safety related messages, control of AIS and data selection.
- The MKD is an essential part of the AIS and it may be remote.

### 6.11.2 Alarms and status information

The following alarms and status information shall be indicated and the information contents displayed on request:

- alarms and indications as a result of the built-in integrity test (BIIT see 6.10.1)
- received safety related messages
- received long range interrogations
- manual confirmation of LR interrogation if in manual mode.

A means to acknowledge alarms and indications as above shall be provided.

Means shall be provided to disable the acknowledgement of information as above, e.g. in the case where an external alarm is provided.

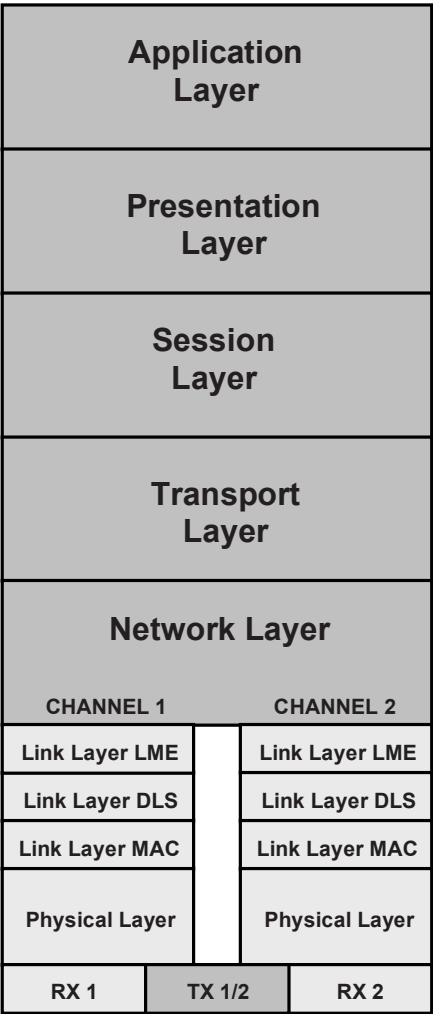
7 Technical requirements

7.1 General

(M.1371-1/A2-1)

*This clause covers layers 1 to 4 (Physical Layer, Link Layer, Network Layer, Transport Layer) of the Open System Interconnection (OSI) model.*

*Figure 1 illustrates the layer model of an AIS station (Physical Layer to Transport Layer) and the layers of the applications (Session Layer to Application Layer):*



IEC 2629/01

Figure 1 (M.1371-1/A2-1) – OSI layer model

## 7.2 Physical layer

(M.1371-1/A2-2)

*The Physical layer is responsible for the transfer of a bit-stream from an originator out, on to the data link. The Physical Layer shall be designed in accordance with Recommendation ITU-R M.1371-1, Annex 2, Chapter 2.*

The technical characteristics as specified in table 6 shall apply to the TDMA receivers.

**Table 6 – Required receiver characteristics**

| Receiver parameters                             | 25 kHz channels       | 12,5 kHz channels    |
|-------------------------------------------------|-----------------------|----------------------|
| Sensitivity                                     | 20 % PER for –107 dBm | 20 % PER for –98 dBm |
| Co-channel rejection                            | –10 – 0 dB            | –18 – 0 dB           |
| Adjacent channel selectivity                    | 70 dB                 | 50 dB                |
| Spurious response rejection                     | 70 dB                 | N/A                  |
| Intermodulation response rejection and Blocking | 20 % PER              | N/A                  |

## 7.3 Link layer

(M.1371-1/A2-3)

*The Link layer specifies how data shall be packaged in order to apply error detection and correction to the data transfer. The Link layer is divided into three (3) sublayers.*

### 7.3.1 Link sublayer 1: Medium Access Control (MAC)

(M.1371-1/A2-3.1)

*The MAC sublayer provides a method for granting access to the data transfer medium, i.e. the VHF data link. The method used shall be a Time Division Multiple Access (TDMA) scheme using a common time reference. The Medium Access Control sublayer shall be designed in accordance with Recommendation ITU-R M.1371-1, Annex 2, Chapter 3.1.*

### 7.3.2 Link sublayer 2: Data Link Service (DLS)

(M.1371-1/A2-3.2)

*The DLS sublayer provides methods for:*

- 1) data link activation and release;*
- 2) data transfer; or*
- 3) error detection and control.*

The Data Link Service sublayer shall be designed in accordance with Recommendation ITU-R M.1371-1, Annex 2, Chapter 3.2.

### 7.3.3 Link sublayer 3 – Link Management Entity (LME)

(M.1371-1/A2-3.3)

*The LME controls the operation of the DLS, MAC and the physical layer.*

The Link Management Entity sublayer shall be designed in accordance with Recommendation ITU-R M.1371-1, Annex 2, Chapter 3.3.

Link sublayer 3 includes definition of VDL-messages (M.1371-1/A2-3.3.8, table 13).

Table 7 shows how the messages defined in M.1371-1/A2-3.2 shall be used by a Class A shipborne mobile AIS device. For further details refer to the appropriate section of M.1371-1.

**Table 7 – Use of VDL messages**

| msg. No. | Name of message                            | M.1371-1 Ref. | R/P     | O       | T   | Remark                                                                                                                                                 |
|----------|--------------------------------------------|---------------|---------|---------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0        | Undefined                                  | None          | Yes     | Yes     | No  | Reserved for future use                                                                                                                                |
| 1        | Position Report (Scheduled)                | A2-3.3.8.2.1  | Yes     | Yes     | Yes |                                                                                                                                                        |
| 2        | Position Report (Assigned)                 | A2-3.3.8.2.1  | Yes     | Yes     | Yes |                                                                                                                                                        |
| 3        | Position Report (When interrogated)        | A2-3.3.8.2.1  | Yes     | Yes     | Yes |                                                                                                                                                        |
| 4        | Base Station Report                        | A2-3.3.8.2.2  | Yes     | Yes     | No  |                                                                                                                                                        |
| 5        | Static and Voyage Related Data             | A2-3.3.8.2.3  | Yes     | Yes     | Yes |                                                                                                                                                        |
| 6        | Addressed Binary Message                   | A2-3.3.8.2.4  | Yes     | Yes (1) | Yes | (1) Only if addressed to own station                                                                                                                   |
| 7        | Binary Acknowledge                         | A2-3.3.8.2.5  | Yes     | INF (2) | Yes | (2) An ABK PI message shall be sent to the PI in any case.                                                                                             |
| 8        | Binary Broadcast Message                   | A2-3.3.8.2.6  | Yes     | Yes     | Yes |                                                                                                                                                        |
| 9        | Standard SAR Aircraft Position Report      | A2-3.3.8.2.7  | Yes     | Yes     | No  |                                                                                                                                                        |
| 10       | UTC and Date Inquiry                       | A2-3.3.8.2.8  | Yes     | INF     | Yes |                                                                                                                                                        |
| 11       | UTC/Date Response                          | A2-3.3.8.2.2  | Yes     | INF     | Yes |                                                                                                                                                        |
| 12       | Addressed Safety Related Message           | A2-3.3.8.2.9  | Yes     | Yes (3) | Yes | (3) Only if addressed to own station                                                                                                                   |
| 13       | Safety Related Acknowledge                 | A2-3.3.8.2.5  | Yes     | INF (4) | Yes | (4) An ABK PI message shall be sent to the PI in any case.                                                                                             |
| 14       | Safety Related Broadcast Message           | A2-3.3.8.2.10 | Yes     | Yes     | Yes |                                                                                                                                                        |
| 15       | Interrogation                              | A2-3.3.8.2.11 | Yes     | INF     | Yes | Class A shipborne mobile station may interrogate for msg 3, 4, 5, 9, 18, 19, 20, 21, 22<br>Slot offset shall be set to 0 *                             |
| 16       | Assigned Mode Command                      | A2-3.3.8.2.12 | Yes     | INF     | No  |                                                                                                                                                        |
| 17       | DGNSS                                      | A2-3.3.8.2.13 | Yes (5) | INF (6) | No  | (5) only if internal GNSS receiver is capable of processing DGNSS corrections or PI contains an DGNSS output port<br>(6) on other ports of the PI: INF |
| 18       | Standard Class B Equipment Position Report | A2-3.3.8.2.14 | Yes     | Yes     | No  |                                                                                                                                                        |
| 19       | Extended Class B Equipment Position Report | A2-3.3.8.2.15 | Yes     | Yes     | No  |                                                                                                                                                        |
| 20       | Data Link Management Message               | A2-3.3.8.2.16 | Yes     | INF     | No  |                                                                                                                                                        |
| 21       | Aids-to-Navigation Report                  | A2-3.3.8.2.17 | Yes     | Yes     | No  |                                                                                                                                                        |
| 22       | Channel Management Message                 | A2-3.3.8.2.18 | Yes     | INF     | No  |                                                                                                                                                        |
| 23 – 63  | Undefined                                  | None          | Yes     | Yes     | No  | Reserved for future use                                                                                                                                |

**Legend:**

R/P Receive and process internally, e.g. prepare for output via PI, act upon the received information, and use the received information internally.

Output message content via PI using PI VDM messages

T Transmission by own station: "Yes" = either allowed or required; "No" = shall not be transmitted

INF VDL message will be output via PI using a PI VDM message for information only. This function may be suppressed by configuration setting.

\* See IALA Technical clarifications to recommendation ITU-R M.1371-1

For messages 6,8,12,14, own RATDMA transmissions shall not exceed a total of 20 slots in a frame with a maximum of 5 slots per message. If either case is exceeded, the AIS will generate an ABK warning sentence (see IALA Technical clarifications to recommendation ITU-R M.1371-1).

#### 7.4 Network layer

(M.1371-1/A2-4)

*The network layer shall be used for:*

- 1) *establishing and maintaining channel connections;*
- 2) *management of priority assignments of messages;*
- 3) *distribution of transmission packets between channels;*
- 4) *data link congestion resolution.*

The Network Layer shall be designed in accordance with Recommendation ITU-R M.1371-1-1, Annex 2, Chapter 4.

##### 7.4.1 Management of regional operating settings

(M.1371-1/ A2/4.1; IALA Technical clarifications to recommendation ITU-R M.1371-1)

All stored regional operating settings shall be time/date-tagged and they should be tagged with information by what input means this regional operating setting was received (TDMA Msg 22, DSC telecommand, Manual input via MKD, ACA sentence input via Presentation Interface).

The AIS shall constantly check, if the nearest boundary of the regional operating area of any stored regional operating setting is more than 500 miles away from the current position of own station, or if any stored regional operating setting was older than five weeks. Any stored regional operating setting which fulfils any one of these conditions shall be erased from the memory.

The regional operating settings set shall be handled as a whole, i.e. a change requested for any parameter of the regional operating settings shall be interpreted as a new regional operating setting.

When the user requests to manually input a regional operating setting via the Minimum Keyboard and Display (MKD), the regional operating settings in use, which may be the default operating settings, shall be presented to the user on the MKD. The user shall then be allowed to edit these settings partly or in full. The AIS shall ensure, that a regional operating area is always input and that it conforms to the rules for regional operating areas laid out in M.1371-1 A2/4.1. After completion of input of an acceptable regional operating settings set, the AIS shall require the user to confirm a second time that the input data shall be stored and possibly used instantaneously.

The AIS shall not accept, i.e. ignore, any new regional operating setting which includes a regional operating area, which does not conform to the rules for regional operating areas laid out in M.1371-1 A2/4.1.

The AIS shall not accept a new regional operating setting, which was input to it via the Presentation Interface, if the regional operating area of this new regional operating setting partly or totally overlaps or matches the regional operating area of any of the stored regional operating settings, which were received from a base station either by msg 22 or by DSC telecommand within the last two hours.

A message 22 addressed to own station or a DSC telecommand addressed to own station shall be accepted only if the AIS is in a region defined by one of the stored regional operating settings. In this case the set of regional operating settings shall be composed by combining the received parameters with the regional operating area in use.

If the regional operating area of the new, accepted regional operating setting overlaps in part or in total or matches the regional operating areas of one or more older regional operating settings, this or these older regional operating settings shall be erased from the memory. The regional operating area of the new, accepted regional operating setting may be neighbouring tightly and may thus have the same boundaries as older regional operating settings. This shall not lead to the erasure of the older regional operating settings.

Subsequently the AIS shall store a new, accepted regional operating setting in one free memory location of the eight memories for regional operating settings. If there is no free memory location, the oldest regional operating setting shall be replaced by the new, accepted one.

No means other than defined herein shall be allowed to clear any or all of the stored regional operating settings. In particular, it shall not be possible to solely clear any or all of the stored regional operating settings by a manual input via the MKD or by an input via the Presentation Interface without inputting a new regional operating setting.

**7.4.2** If the autonomous mode requires a higher rate than the assigned mode, the AIS shall use the autonomous mode.

## **7.5 Transport layer**

(M.1371-1/A2-5)

*The transport layer shall be responsible for:*

- 1) converting data into transmission packets of correct size;*
- 2) sequencing of data packets;*
- 3) interfacing protocol to upper layers.*

The Transport Layer shall be designed in accordance with Recommendation ITU-R M.1371-1, Annex 2, Chapter 5.

## **7.6 Presentation interface**

(M.1371-1/A2-5)

*The interface between the transport layer and higher layers shall be performed by the Presentation Interface.*

### **7.6.1 General**

(M.1371-1/A2-5.4)

*Data, which is to be transmitted by the AIS device, shall be input via the Presentation Interface. Data, which is received by the AIS device, shall be output through the Presentation Interface. The formats and protocol used for this data stream shall be defined by the referenced IEC 61162 series.*

If no appropriate IEC 61162 format and protocol exist, other protocols may be used.

### 7.6.1.1 Long Range Applications

(M.1371-1/A4)

*Class A shipborne mobile equipment shall provide a two-way interface for equipment which provides for long-range communications. The interface shall comply with the IEC 61162 series.*

### 7.6.1.2 Composition

The Presentation Interface of the AIS shall comprise the data ports listed in table 8. (Also see annex D, "AIS Interface Overview (normative)")

**Table 8 – Presentation Interface Access**

| General Function                                                                                                                       | Mechanism                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Automatic Input of Sensor Data<br>(Sensor data input from shipboard equipment)                                                         | (3) IEC 61162-2 input ports, also configurable as IEC 61162-1 input ports |
| High Speed Input/Output Ports<br>(Operator controlled commands and data input; AIS VHF Data Link (VDL) data; and AIS equipment status) | (2) IEC 61162-2 paired input and output ports                             |
| Long Range Communications                                                                                                              | (1) IEC 61162-2 paired input and output ports                             |
| BITT Alarm Output                                                                                                                      | (1) Isolated normally-closed (NC) contact circuit                         |

## 7.6.2 Automatic input of sensor data

### 7.6.2.1 Required ports

A minimum of three input ports shall be provided. Each port shall meet the requirements of IEC 61162-2 and be capable of being reconfigured to IEC 61162-1.

### 7.6.2.2 Interface connector

The manufacturer shall specify the connector for these ports.

### 7.6.2.3 Format of sensor data

The sensor data shall be provided using the formats described in IEC 61162-1. As a minimum, the required IEC 61162-1 sentences listed in table 9 (Preferred IEC 61162-1 Sentences) shall be received and processed by an AIS unit. Details for these sentences are contained in IEC 61162-1.

**Table 9 – Preferred IEC 61162-1 sensor sentences**

| Data                                                                               | IEC 61162-1 Sentence formatters |                 |
|------------------------------------------------------------------------------------|---------------------------------|-----------------|
|                                                                                    | Required                        | Optional        |
| Reference datum                                                                    | DTM                             |                 |
| Positioning system:<br>Time of position<br>Latitude/Longitude<br>Position accuracy | GNS<br>GLL                      | GGA , RMC       |
| Speed Over Ground (SOG)                                                            | VBW                             | VTG, OSD, RMC   |
| Course Over Ground (COG)                                                           | RMC                             | <u>VTG, OSD</u> |
| Heading                                                                            | HDT                             | OSD             |
| RAIM indicator                                                                     | GBS                             |                 |
| Rate Of Turn (ROT)                                                                 | ROT                             |                 |

If a DTM sentence is received, then the AIS shall use the DTM sensor sentence to automatically confirm that the position sensor provides position information in the WGS 84 datum.

The reception of periodic GBS sentences, containing values for the parameters "expected error in latitude" and "expected error in longitude" shall be used to indicate with the "RAIM-Flag" that the position sensor is operating with a RAIM process in use.

Each of the data items listed in table 9 (Preferred IEC 61162-1 Sentences) may be produced by various connected sensor equipment. The external sensor equipment is neither assigned to specific AIS input ports nor are the specified input sentences assigned to specific equipment. AIS shall be capable of accepting these specified sentences at each of the input ports.

### 7.6.3 High speed input/output ports

#### 7.6.3.1 Required ports

A minimum of two input/output ports shall be provided. A primary input/output port for connection of onboard control equipment, ECDIS, radar, etc., and a pilot/auxiliary input/output port for connection of ship's pilot equipment, service equipment, etc. Each port shall meet the requirements of IEC 61162-2.

Both input ports shall be functionally equivalent and shall be capable of receiving the data formats defined in table 10 (AIS High-speed input data and formats).

Both output ports shall be functionally equivalent and shall be capable of simultaneously transmitting the data formats defined in table 11 (AIS High-speed output data and formats).

#### 7.6.3.2 Interface connector

The manufacturer shall specify the connector for these ports.

#### 7.6.3.3 Input data and formats

The AIS shall as a minimum be able to receive and process the input data shown in table 10. The details of these sentences are contained in IEC 61162-1. Manufacturer's proprietary data may also be entered using these high-speed ports.

**Table 10 – AIS High-speed input data and formats**

| Data                                                                                                                                                                          | IEC 61162-1 Sentences     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Normal Access – Parameter Entry                                                                                                                                               |                           |
| Voyage information:<br>Vessel type and cargo category<br>Navigational status<br>Draught, max. actual static<br>Destination<br>ETA date and time<br>Regional application flags | VSD – Voyage static data  |
| Station information<br>Vessel name<br>Call sign<br>Antenna location<br>length and beam                                                                                        | SSD – Station static data |

| Initiate VHF Data-link Broadcasts |                                                                              |
|-----------------------------------|------------------------------------------------------------------------------|
| Safety messages                   | ABM – Addressed Binary Message<br>BBM – Broadcast Binary Message             |
| Binary messages                   | ABM – Addressed Binary Message<br>BBM – Broadcast Binary Message             |
| Interrogation Message             | AIR – AIS Interrogation Information                                          |
| AIS Equipment – Parameter Entry   |                                                                              |
| AIS VHF channel selection         | ACA – AIS Channel Assignment Message                                         |
| AIS VHF power setting             | ACA – AIS Channel Assignment Message                                         |
| AIS VHF channel bandwidth         | ACA – AIS Channel Assignment Message                                         |
| Transmit/Receive mode control     | ACA – AIS Channel Assignment Message                                         |
| MMSI                              | Minimum keyboard and display (MKD) or proprietary sentences (limited access) |
| IMO number                        | Minimum keyboard and display (MKD) or proprietary sentences (limited access) |
| Other AIS equipment controls      | Minimum keyboard and display (MKD) or proprietary sentences (limited access) |
| BIIT Input                        |                                                                              |
| Alarm/indication acknowledgement  | ACK Acknowledgement message                                                  |
| LR acknowledge                    |                                                                              |
| Manual LR acknowledge             | LRF Long range function                                                      |

#### 7.6.3.4 Output Data and Formats

The AIS shall as a minimum be able to generate and send the output data shown in table 11.

The VDO sentence (containing messages 1, 2 or 3) shall be output on both high-speed output ports, at nominal 1-second intervals, use A & B to indicate that the data was transmitted on the VDL channel A or B, null indicating not transmitted on the VDL.

The VDM sentence shall be sent simultaneously on both high-speed output ports for every VDL message received. Some VDL messages are informative according to table 7. During operation, the operator may disable delivery of these informative messages. Manufacturer's proprietary data may also be sent using these high-speed ports.

**Table 11 – AIS High-speed output data and formats**

| Data                                                                          | IEC 61162-1 Sentences                                                          |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Prepared by AIS Unit                                                          |                                                                                |
| Notification that a session initiated by messages ABM, BBM, AIR is terminated | ABK – Acknowledgement Message<br>[M.1371-1/A2-5.4.1 and M.1371-1/A2-3.3.8.2.5] |
| AIS Own-ship Broadcast Data (all transmissions available)                     | VDO – VHF Data-link Own-vessel message)                                        |
| AIS equipment status (Built-in-integrity-test results)                        | ALR/TXT – (see 6.10.2)                                                         |
| Channel management data                                                       | ACA – AIS channel assignment message (using query mechanism)                   |
| Received on VHF Data-link by AIS Unit                                         |                                                                                |
| All VDL AIS messages received<br>Broadcast or<br>Addressed to own Station     | VDM – VHF Data link Message                                                    |
| Received on LR communication system                                           |                                                                                |
| LR interrogation message received                                             | LRI and LRF                                                                    |

## 7.6.4 Long-range communications

### 7.6.4.1 Required ports

A minimum of one input/output port shall be provided and shall meet the requirements of IEC 61162-2. It may be connected to long-range communications equipment (e.g., satellite communications; see 9).

The input port shall be capable of receiving the data formats defined in table 12 (AIS Long range Communications Input Data and Formats).

The output port shall be capable of transmitting the data formats defined in table 13 (AIS Long range Communications Output Data and Formats).

### 7.6.4.2 Interface connector

The manufacturer shall specify the connector for these ports.

### 7.6.4.3 Input data and formats

Long Range interrogation of an AIS unit is accomplished through the use of two IEC 61162-1 sentences – LRI and LRF. This pair of interrogation sentences provides the information needed by the AIS unit to determine if it must construct and provide the reply sentences – LR1, LR2, and LR3. The LRI-sentence contains the information needed to determine if the reply needs to be constructed. The LRF-sentence identifies the information that is being requested.

The information, that can be requested by the LRF-sentence, is shown in table 12 (AIS Long Range Communications Input Data and Formats). These information items are the same as those defined in IMO Resolution A.851(20). The letters shown in parentheses are from IMO Resolution A.851(20) and are used in the LRF-sentence. Details of these sentences are contained in IEC 61162-1.

**Table 12 – AIS Long-range communications input data and formats**

| Data                                                                                                                                                                                                                                                                                                                                                                             | IEC 61162-1 Sentences                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Long-range interrogation<br>Type of request<br>Geographic area request<br>AIS unit request                                                                                                                                                                                                                                                                                       | LRI – Long-range interrogation           |
| Long-range function identification<br>Requestor MMSI and Name<br>Request for:<br>Ship's name, call sign, and IMO number (A)<br>Date and time of message composition (B)<br>Position (C)<br>Course over ground (E)<br>Speed over ground (F)<br>Destination and ETA (I)<br>Draught (O)<br>Ship/Cargo (P)<br>Ship's length, breadth, and type (U)<br>Number of persons on board (W) | LRF – Long-range function identification |

#### 7.6.4.4 Output data and formats

The Long Range reply from the AIS unit is accomplished through the use of four IEC 61162-1 sentence formatters – LRF, LR1, LR2 and LR3. The AIS unit shall reply with these sentences, in the following order; LRF, LR1, LR2 and LR3 when responding to an interrogation even if all the information items in the sentence are null.

The LRF-sentence provides the “Function Reply Status” for the requested information. The following is a list of “Function Reply Status” characters with the status that represent:

- 2 = Information available and provided in the following LR1, LR2 and LR3 sentence
- 3 = Information not available from AIS unit
- 4 = Information is available but not provided (i.e. restricted access determined by ship’s master)”

The LR1-sentence identifies the destination for the reply and contains the information items requested by the "A" function identification character in the LRF-sentence.

The LR2-sentence contains the information items requested by the "B, C, E, and F" function identification characters in the LRF-sentence.

The LR3-sentence contains the information items requested by the "I, O, P, U and W" function identification characters in the LRF-sentence.

The individual information items shall be “null” if any of the following conditions exist:

- the information item was not requested in the LRF-sentence,
- the information item was requested but is not available, or
- the information item was requested but is not being provided.

The output data shown in table 13 shall be provided when specifically requested by function identification characters contained in the preceding LRF-sentence portion of the interrogation. Details of these sentences are contained in 9 and in IEC 61162-1.

**Table 13 – LR Output data formats**

| Data                                                                                                                                | IEC 61162-1 Sentences             |
|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Function reply status                                                                                                               | LRF – Long-range function         |
| MMSI of responder<br>MMSI of requestor<br>Ship's name<br>Ship's call sign<br>IMO number                                             | LR1 – Long-range response, line 1 |
| MMSI of responder<br>Date and time of message composition<br>Position<br>Course over ground<br>Speed over ground                    | LR2 – Long-range response, line 2 |
| MMSI of responder<br>Destination and ETA<br>Draught<br>Ship/Cargo<br>Ship's length, breadth, and type<br>Number of persons on board | LR3 – Long-range response, line 3 |

### 7.6.5 BIIT alarm output

The AIS shall provide a relay output (NC contact) indicating the state of the Built-In Integrity Test (BIIT) alarm function as specified in 6.10.1.

The terminals shall be isolated from circuits and grounds in the AIS.

The AIS manufacturer's documentation shall specify the current and voltage capability of the alarm relay contacts.

## 8 DSC compatibility

(M.1371-1/A3)

*The AIS shall be capable of performing limited AIS-related DSC operations conforming to the provisions of Recommendation ITU-R M.1371-1, Annex 3.*

If own ship AIS "type of ship" and "cargo type" of message 5 is other than 50-99 (table 17 of M.1371-1), then the type of ship response to a DSC Poll (table 3 of M.825) shall be 99.

The AIS shall respond only to a DSC poll to an individual ship (MMSI) or geographical area (with or without course or type of ship qualifiers).

## 9 Long-range applications

(M.1371-1/A4)

### 9.1 General

*Class A shipborne mobile equipment shall provide a two-way interface for equipment which provides for long-range communications. This interface shall comply with IEC 61162.*

Long Range (LR) communications shall be only through the Presentation Interface using the IEC 61162-2 interface dedicated to this purpose as described in 7.6.4.

The LR AIS data shall be displayed on the AIS display as described in 6.11.

### 9.2 Interrogations and responses

LR information shall only be transmitted in response to an interrogation from a LR base station.

#### 9.2.1 Manual and automatic response

The AIS transponder shall be capable of being set by the user to respond automatically or manually to LR interrogations. In case of automatic reply to LR interrogations, the display shall indicate that the system was LR interrogated until the indication is acknowledged by the operator. In case of manual reply to LR interrogation, the display shall indicate that the system was LR interrogated until the operator has replied to the interrogation or cancelled the reply on the manual input device as described in 6.11.

#### 9.2.2 Data formats and contents

The LR interface messages have taken into account the requirements of IMO Resolution A.851(20). Where such information is available to the AIS system this shall be used.

The LR data types available for transmission shall be derived from the AIS system as described in table 14.

**Table 14 – LR data types**

| ID            | data types<br>Format                | Remarks                                                                                       |
|---------------|-------------------------------------|-----------------------------------------------------------------------------------------------|
| A             | Ship name/Call sign/MMSI/IMO number | MMSI number shall be used as a flag identifier                                                |
| B             | Date and time in UTC                | Time stamp of message composition shall be given in UTC only. Day of month, hours and minutes |
| C             | Position                            | WGS 84; Latitude/Longitude degrees and minutes                                                |
| D             |                                     | Not available                                                                                 |
| E             | Course                              | Course over ground (COG) in degrees                                                           |
| F             | Speed                               | Speed over ground (SOG) in knots and 1/10 knots                                               |
| G, H          |                                     | Not available                                                                                 |
| I             | Destination/ETA                     | At masters discretion;<br>ETA time format see B                                               |
| J, K, L, M, N |                                     | Not available                                                                                 |
| O             | Draught                             | Actual maximum draught in 1/10 of metres                                                      |
| P             | Ship/Cargo                          | See M.1371-1 A2/3.3.8.2.3, table 17                                                           |
| Q, R, S, T    |                                     | Not available                                                                                 |
| U             | Length/Beam/Type                    | Length and beam in metres<br>Type see M.1371-1 A2/3.3.8.2.3, table 17, tonnage not available  |
| V             |                                     | Not available                                                                                 |
| W             | Number of persons on board          |                                                                                               |
| X,Y           |                                     | Not available                                                                                 |
| Z             |                                     | Not used                                                                                      |

### 9.2.3 Addressing AIS-units

LR interrogations shall be either by user ID (ship's MMSI) or by geographical area "all ships" call designating the North-Eastern corner and the South-Western corner of the Mercator projection rectangle, which describes the called area.

The first LR data transfer shall take place by LR interrogation initiated by a geographical area "All ships" call.

Succeeding LR data transfers shall take place by LR interrogation based on user ID (MMSI).

To avoid replies on succeeding geographical area "All ships" calls from the same base station, the AIS shall store the MMSI of the LR base station for 24 hours.

## 10 Test conditions

### 10.1 General

When a requirement in this standard is different from IEC 60945, the requirement in this standard shall take precedence.

## 10.2 Normal and extreme test conditions

### 10.2.1 Normal test conditions

#### 10.2.1.1 Temperature and humidity

Temperature and humidity shall be within following range:

|             |                  |
|-------------|------------------|
| Temperature | +15 °C to +35 °C |
| Humidity    | 20 % to 75 %     |

#### 10.2.1.2 Power supply

The normal power supply for the tests shall be in accordance with 5.2.1 of IEC 60945.

### 10.2.2 Extreme test conditions

Extreme test conditions are as specified in IEC 60945. Where required, test under extreme test conditions shall be a combination of dry heat and upper limit of supply voltage applied simultaneously and low temperature and lower limit of supply voltage applied simultaneously.

During type testing the power source to the equipment may be replaced by a test power source, capable of producing normal and extreme test voltages.

## 10.3 Standard test environment

The EUT is tested in an environment using test equipment to simulate and to log VDL-messages (see table 7). Standard environment consists of at least 5 simulated targets. The signal input level at the RF input port of the EUT for any simulated target shall be at least – 100 dBm. Own ship sensor inputs to EUT will be simulated by the test system or other means. Operation is checked on channels in the maritime mobile band.

Channels in use shall be selected by manual input or channel assignment messages before starting tests.

## 10.4 Test signals

### 10.4.1 Standard test signal number 1

A DSC call with an individual station address and with command sets 103 (report your position) and 111 (report ship name) unless otherwise stated (refer to ITU-R M.825).

### 10.4.2 Standard test signal number 2

For TDMA Type 1: A test signal consisting of an infinite series of 010101.

### 10.4.3 Standard test signal number 3

For TDMA Type 2: A test signal consisting of an infinite series of 00110011.

NOTE Transmitters may have limitations concerning their maximum continuous transmit time and/or their transmission duty cycle. It is intended that such limitations are respected during testing.

## 10.5 Arrangements for test signals applied to the receiver input

Sources of test signals for application to the receiver input shall be connected in such a way that the source impedance presented to the receiver input is 50  $\Omega$  (see 10.8).

This requirement shall be met irrespective of whether one or more signals using a combining network are applied to the receiver simultaneously.

The levels of the test signals at the receiver input terminals (RF socket) shall be expressed in terms of dBm.

The effects of any intermodulation products and noise produced in the test signal sources shall be negligible.

#### **10.6 Encoder for receiver measurements**

Whenever needed and in order to facilitate measurements on the receiver, an encoder for the data system shall accompany the EUT, together with details of the normal modulation process. The encoder is used to modulate a signal generator for use as a test signal source.

Complete details of all codes and code format(s) used shall be given.

#### **10.7 Waiver for receivers**

If the manufacturer declares that both TDMA receivers are identical, the test shall be limited to one receiver and the test for the second receiver shall be waived. The test report shall mention this.

#### **10.8 Impedance**

In this standard the term "50  $\Omega$ " is used for a 50  $\Omega$  non-reactive impedance.

#### **10.9 Artificial antenna (dummy load)**

Tests shall be carried out using an artificial antenna which shall be a non-reactive non-radiating load of 50  $\Omega$  connected to the antenna connector.

**NOTE** Some of the methods of measurement described in this standard for the transmitters, allow for two or more different test set-ups in order to perform those measurements. The corresponding figures illustrate therefore one particular test set-up, and are given as examples. In many of those figures, power attenuators (providing a non-reactive non-radiating load of 50  $\Omega$  to the antenna connector) have been shown. These attenuators are not "artificial antennas" as defined in 10.9. The method of measurement used shall be stated in the test report.

#### **10.10 Facilities for access**

All tests shall be performed using the standard ports of the EUT. Where access facilities are required to enable any specific test, these shall be provided by the manufacturer.

#### **10.11 Modes of operation of the transmitter**

For the purpose of the measurements according to this standard, there shall be a facility to operate the transmitter unmodulated.

Alternatively, the method of obtaining an unmodulated carrier or special types of modulation patterns may also be decided by agreement between the manufacturer and the test laboratory. It shall be described in the test report. It may involve suitable temporary internal modifications of the equipment under test. For instance in the case of direct Frequency Shift Keying (FSK), a means to continuously transmit a sequence containing only "zeros" and a sequence containing only "ones" is preferable.

## 10.12 Measurement uncertainties

Maximum values of absolute measurement uncertainties shall be as follows:

|                                                              |                        |
|--------------------------------------------------------------|------------------------|
| RF frequency.....                                            | $\pm 1 \times 10^{-7}$ |
| RF power .....                                               | $\pm 0,75$ dB          |
| Adjacent channel power .....                                 | $\pm 5$ dB             |
| Conducted spurious emission of transmitter .....             | $\pm 4$ dB             |
| Conducted spurious emission of receiver .....                | $\pm 3$ dB             |
| Two-signal measurement .....                                 | $\pm 4$ dB             |
| Three-signal measurement .....                               | $\pm 3$ dB             |
| Radiated emission of transmitter .....                       | $\pm 6$ dB             |
| Radiated emission of receiver .....                          | $\pm 6$ dB             |
| Transmitter attack time .....                                | $\pm 20$ %             |
| Transmitter release time .....                               | $\pm 20$ %             |
| Transmitter transient frequency (frequency difference) ..... | $\pm 250$ Hz           |

For the test methods according to this standard, these uncertainty figures are valid to a confidence level of 95 %.

The interpretation of the results recorded in a test report for the measurements described in this standard shall be as follows:

- a) the measured value related to the corresponding limit shall be used to decide whether an equipment meets the requirements of this standard;
- b) the actual measurement uncertainty of the test laboratory carrying out the measurements, for each particular measurement, shall be included in the test report;
- c) the values of the actual measurement uncertainty shall be, for each measurement, equal to or lower than the figures given in this clause (absolute measurement uncertainties).

## 11 Power supply, special purpose and safety tests

Tests for power supplies, special purposes and safety shall be performed as specified in IEC 60945, clauses 7, 11 and 12. Waivers as indicated in IEC 60945 shall apply.

## 12 Environmental tests

Environmental tests shall be performed as specified in IEC 60945, clause 8.

The Performance Test to be used for the environmental tests is for the transmitter:

- frequency error (see 15.1.1),
- carrier power (see 15.1.2),
- channel switching (see 14.7),
- transmitter attack time (see 15.1.5),
- transmitter release time (see 15.1.6);

and for the receiver (both TDMA and DSC):

- sensitivity at 25 kHz and 12,5 kHz (see 15.3.1, 15.3.2, 15.4.1),
- channel switching time (see 14.7).