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Ersatz für
DIN EN 61993-2:2002-10
Siehe Anwendungsbeginn

**Navigations- und Funkkommunikationsgeräte 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 61993-2:2012);
Englische Fassung EN 61993-2:2013**

Maritime navigation and radiocommunication equipment and systems –
Automatic Identification Systems (AIS) –
Part 2: Class A shipborne equipment of the automatic identification system (AIS) –
Operational and performance requirements, methods of test and required test results
(IEC 61993-2:2012);
English version EN 61993-2:2013

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 61993-2:2012);
Version anglaise EN 61993-2:2013

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Normenstelle Schiffs- und Meerestechnik (NSMT) im DIN

Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2012-11-23 angenommene Europäische Norm als DIN-Norm ist 2013-08-01.

Für DIN EN 61993-2:2002-10 besteht eine Übergangsfrist bis 2015-11-23.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN EN 61993-2:2010-10.

Für dieses Dokument ist das nationale Arbeitsgremium K 738 „Elektronische Navigationsinstrumente“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (www.dke.de) zuständig.

Die enthaltene IEC-Publikation wurde vom TC 80 „Maritime navigation and radiocommunication equipment and systems“ erarbeitet.

Das IEC-Komitee hat entschieden, dass der Inhalt dieser Publikation bis zu dem Datum (stability date) unverändert bleiben soll, das auf der IEC-Website unter „<http://webstore.iec.ch>“ zu dieser Publikation angegeben ist. Zu diesem Zeitpunkt wird entsprechend der Entscheidung des Komitees die Publikation

- bestätigt,
- zurückgezogen,
- durch eine Folgeausgabe ersetzt oder
- geändert.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf eine Norm ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils neueste gültige Ausgabe der in Bezug genommenen Norm.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe der Norm.

Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für die vorliegende Norm erfüllt.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die englische Fassung der EN 61993-2 veröffentlicht. Zu deren Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für viele der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Änderungen

Gegenüber DIN EN 61993-2:2002-10 wurden folgende Änderungen vorgenommen:

- a) Der ursprüngliche Abschnitt 8 zur DSC-Kompatibilität wurde zusammen mit den korrespondierenden Prüfungen in Abschnitt 20 in einen neuen Anhang D verschoben.
- b) Ein neuer Abschnitt 10 zu Prüfsignalen wurde ergänzt.
- c) Der ursprüngliche Anhang B mit detaillierten Text-Zitaten aus IEC 61162 wurde gelöscht, da diese Information jetzt in IEC 61162-1 enthalten ist.

- d) Der ursprüngliche Anhang C zu Weitverkehrs Anwendungen wurde gelöscht, da IMO entschieden hat, ein anderes System für die Weitverkehrserkennung und -verfolgung einzusetzen.
- e) Ein neuer Anhang E wurde ergänzt, um die wahlfreien „presentation interface port sentences“ zu beschreiben.
- f) Ein neuer Anhang F zu Alarmierungsverfahren wurde ergänzt.
- g) Ein neuer Anhang G zur Querschnitts- und Abstandsberechnung wurde ergänzt.
- h) Diese Ausgabe beinhaltet die technischen Kennwerte aus der ITU-R Empfehlung M.1371-4, welche in 2010 publiziert wurde. Die Kennwerte erlauben fünf neue Meldungen (Meldungen 23, 24, 25, 26 und 27) zu behandeln.
- i) Unterabschnitt 6.9 enthält eine neue Anforderung an Tankschiffe, eine „low power“-Einstellung zu nutzen, wenn sie festgemacht sind.
- j) Unterabschnitt 6.11 enthält erweiterte Anforderungen an die minimale Funktionalität von Tastatur und Anzeige, welche neue Anforderungen an die Anzeige von AIS-SART zusammen mit einem AIS-SART Alarm und neue Anforderungen zum Schutz der statischen Daten des Schiffs beinhalten.
- k) Unterabschnitt 7.2 enthält erweiterte Anforderungen an die Sender und Empfänger, aber unter Zurücknahme der früheren Anforderung an den 12,5-kHz-Kanal-Betrieb, der in der Praxis nicht genutzt wurde.
- l) Abschnitt 8 enthält erweiterte Anforderungen, um die Weitverkehrs Anwendungen um ein Rundsendeverfahren zu ergänzen.
- m) Unterabschnitt 7.6 enthält eine Definition des „pilot plug pin out“ zusammen mit einigen neuen Anforderungen an Schnittstellen.
- n) Abschnitte 14 bis 19 enthalten umfassend überarbeitete Prüfverfahren, die auf der durch Prüfungen von AIS-Geräten gesammelten Erfahrung beruhen.
- o) Anhang D enthält erweiterte Prüfverfahren für DSC-Funktionalität, aber bei Löschung der früheren Anforderung an das „DSC Polling“, welches nicht mehr angewendet wird.

Frühere Ausgaben

DIN EN 61993-2: 2002-10

Nationaler Anhang NA (informativ)

Abkürzungen

Für die Anwendung dieses Dokuments gelten die folgenden Abkürzungen.

Die deutschen Übersetzungen haben Empfehlungscharakter und können nur die ungefähre Begrifflichkeit in Deutsch wiedergeben. Unter Experten wird empfohlen, ausschließlich die englischen Fachbegriffe zu verwenden, um die Gefahr von Missverständnissen zu reduzieren.

AIS	Automatisches Identifizierungssystem	(en: automatic identification system)
AIS-SART	AIS-Such- und Rettungssender	(en: AIS search and rescue transmitter)
BIIT	eingebaute Integritätsprüfung	(en: built-in integrity tests)
BT	Zeit-Bandbreite-Produkt	(en: bandwidth-time)
COG	Fahrt- (oder Bewegungs-)richtung über Grund	(en: course over ground)

CommState Kommunikationsstatus (siehe Anmerkung 1) (en: communication state (see note 1))

ANMERKUNG 1 Kommunikationsstatus ist in der ITU-Empfehlung ITU-R M.1371-4 definiert. Er wird verwendet, um Daten zur Organisation des Zugriffs auf die Zeitschlitz zwischen den Stationen auszutauschen.

ECDIS	elektronisches Kartendarstellungs- und Informationssystem	(en: electronic chart display and information system)
EPFS	elektronisches Positionsbestimmungssystem	(en: electronic position-fixing systems)
ETA	geschätzte Ankunftszeit	(en: estimated time of arrival)
EUT	Gerät im Test	(en: equipment under test)
FATDMA	Zeitvielfachzugriff auf definierten Zeitschlitz	(en: fixed access time division multiple access)
GMSK	Gaußsche Minimalmodulation	(en: Gaussian minimum shift keying)
HDG	anliegender Kurs	(en: heading)
IMO	Internationale Seeschiffahrtsorganisation	(en: International Maritime Organization)
ITDMA	schrittweiser Zeitvielfachzugriff	(en: incremental time division multiple access)
LR	Weitbereich	(en: long-range)
MAC	Medienzugriffssteuerung	(en: medium access control)
MKD	Minimaltastatur und -anzeige	(en: minimum keyboard and display)
MMSI	mobile Seeschiffahrtssdienstekennung	(en: maritime mobile service identity)
NavStatus	Navigationsstatus (siehe Anmerkung 2)	(en: navigational status (see note 2))

ANMERKUNG 2 Navigationsstatus ist in der ITU-Empfehlung ITU-R M.1371-4 definiert. Er besteht aus Information, die durch die Schiffsbesatzung eingegeben werden kann, um anzuzeigen, ob das Schiff unterwegs, festgemacht, usw. ist.

NSS	nominaler Anfangssendeschlitz	(en: nominal start slot)
NTS	nominaler Sendeschlitz	(en: nominal transmission slot)
NUC	nicht unter Befehl	(en: not under command)
PC	Leistungskontrolle	(en: performance check)
PER	Paketfehlerrate	(en: packet error rate)
PI	Präsentationsschnittstelle	(en: presentation interface)
PT	Leistungsprüfung	(en: performance test)
RAIM	autonome Empfänger Integritätsüberwachung	(en: receiver autonomous integrity monitoring)
RATDMA	Zeitmehrfachzugriff auf Zufallszeitschlitz	(en: random access time division multiple access)
RF	Funkfrequenz	(en: radio frequency)

ROT	Drehgeschwindigkeit	(en: rate of turn)
SI	Auswahl-Intervall	(en: selection interval)
SOG	Fahrt (oder Geschwindigkeit) über Grund	(en: speed over ground)
SOTDMA	sich selbst organisierender Zeitmehrfachzugriff	(en: self organizing time division multiple access)
UTC	Koordinierte Weltzeit	(en: universal time co-ordinated)
VDL	VHF-Datenverbindung	(en: VHF data link)
VSWR	Stehwellenverhältnis	(en: voltage standing wave ratio)
Rx	Empfänger	(en: Receive)
Tx	Sender	(en: Transmit)

ANMERKUNG 3 Auf IEC 61162-1 bezogene Abkürzungen sind in obiger Liste nicht enthalten. Deren Bedeutungen entnehmen Sie jener Norm.

– Leerseite –

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Matériels et systèmes de navigation et de
radiocommunications maritimes -
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(AIS) -
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A embarqués -
Exigences d'exploitation et de
fonctionnement, méthodes d'essai et
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Navigations- und
Funkkommunikationsgeräte 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 61993-2:2012)

This European Standard was approved by CENELEC on 2012-11-23. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 80/656/CDV, future edition 2 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 approved by CENELEC as EN 61993-2:2013.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-08-23
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-11-23

This document supersedes EN 61993-2:2002.

EN 61993-2:2013 includes the following significant technical changes with respect to EN 61993-2:2002:

It incorporates the technical characteristics included in Recommendation ITU-R M.1371-4, which was published in 2010. New technical characteristics result in sundry clarifications to the requirements and the ability to handle five new messages – Messages 23, 24, 25, 26 and 27.

The significant changes in this edition include:

- a new requirement in 6.9 for vessels of type “tanker” to use a low power setting;
- expanded requirements for the functionality of the minimum keyboard and display in 6.11 including new requirements for display of AIS-SART together with an AIS-SART alarm and new requirements for the protection of the static data of the ship;
- expanded requirements for the transmitters and receivers in 7.2 but with the removal of the previous requirement for 12,5 kHz channel operation which has not been used in practice;
- expanded requirements for long-range applications in Clause 8 to add a broadcast method;
- a definition of the pilot plug pin out in 7.6 together with some new requirements for interfaces;
- extensively revised test methods in Clauses 14 to 19 based on the experience of testing AIS equipment;
- expanded test methods in Annex D for DSC functionality but the removal of the previous requirement for DSC polling which is no longer used.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61993-2:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61097-14	NOTE	Harmonized as EN 61097-14.
IEC 61108-1	NOTE	Harmonized as EN 61108-1.
IEC 61108-2	NOTE	Harmonized as EN 61108-2.
IEC 61162-3	NOTE	Harmonized as EN 61162-3.
IEC 61162-450	NOTE	Harmonized as EN 61162-450.
IEC 62287-1	NOTE	Harmonized as EN 62287-1.
IEC 62320-1	NOTE	Harmonized as EN 62320-1.
IEC 62320-2	NOTE	Harmonized as EN 62320-2.
ISO 9000 series	NOTE	Harmonized in EN ISO 9000 series.

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

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

1 Scope

This part of IEC 61993 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, Shipborne Automatic Identification System. This standard incorporates the applicable technical characteristics of Class A shipborne equipment included in Recommendation ITU-R M.1371-4 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. When a requirement in this standard is different from IEC 60945, the requirement of this standard takes precedence.

This part of IEC 61993 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 or to that in ITU-R Recommendation M.1371-4 is printed in *italics* and references to the resolution (abbreviated to "A3") or the recommendation (abbreviated to "M.1371") and paragraph numbers are indicated in parentheses, for instance (A3/3.3) or (M.1371/A2-3.3) respectively.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60945:2002, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61108 (all parts), *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS)*

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

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

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

IEC 62388, *Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results*

IMO Resolution A.694(17), *General requirements for shipborne radio equipment forming part of the Global Maritime Distress and Safety System (GMDSS) and for electronic navigational aids*

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*

ITU-R Recommendation M.493-13, *Digital selective-calling system for the use in the maritime mobile service*

ITU-R Recommendation M.541-9, *Operational procedures for the use of digital selective-calling (DSC) equipment in the maritime mobile service*

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.1084-5, *Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service*

ITU-R Recommendation M.1371-4, *Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile band*

ITU-T Recommendation O.153, *Basic parameters for the measurement of error performance at bit rates below the primary rate*

3 Abbreviations

AIS	automatic identification system
AIS-SART	AIS search and rescue transmitter
BIIT	built-in integrity tests
BT	bandwidth-time
COG	course over ground
CommState	communication state (see NOTE 1)
NOTE 1 Communication state is defined in Recommendation ITU-R M.1371-4. It is used to indicate whether the AIS is using the message structure for SOTDMA or ITDMA.	
ECDIS	electronic chart display and information system
EPFS	electronic position-fixing systems
ETA	estimated time of arrival
EUT	equipment under test
FATDMA	fixed access time division multiple access
GMSK	Gaussian minimum shift keying
HDG	Heading
IMO	International Maritime Organization
ITDMA	incremental time division multiple access
LR	long-range
MAC	medium access control
MKD	minimum keyboard and display
MMSI	maritime mobile service identity

NavStatus navigational status (see NOTE 2)

NOTE 2 Navigational status is defined in Recommendation ITU-R M.1371-4. It consists of information that may be input by the ship's crew to indicate whether the ship is underway, moored, etc.

NSS	nominal start slot
NTS	nominal transmission slot
NUC	not under command
PC	performance check
PER	packet error rate
PI	presentation interface
PT	performance test
RAIM	receiver autonomous integrity monitoring
RATDMA	random access time division multiple access
RF	radio frequency
ROT	rate of turn
SI	selection interval
SOG	speed over ground
SOTDMA	self organizing time division multiple access
UTC	universal time co-ordinated
VDL	VHF data link
VSWR	voltage standing wave ratio
Rx	Receive
Tx	Transmit

NOTE 3 Abbreviations related to IEC 61162-1 are not included in the above list. For their meanings refer to that standard.

4 General requirements

4.1 General

4.1.1 Overview

Requirements contained in this clause are requirements not taken up in other clauses and are verified by observation and inspection of documented evidence. These requirements include the applicable general and operational requirements of IEC 60945:2002, as detailed in Clause 6 (Operational checks), Clause 13 (Maintenance), Clause 14 (Equipment manuals) and Clause 15 (Marking and identification).

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.

4.1.2 General requirements

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

(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).*

4.1.3 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.*

4.1.4 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.*

4.1.5 Transmitter shutdown procedure

(M.1371/A2-2.13) *An automatic transmitter hardware shutdown procedure and indication shall be provided in case a transmitter continues to transmit for more than 2 s. This shutdown procedure shall be independent of software control.*

4.1.6 Quality assurance

The Administration shall require that the manufacturers have a quality control system 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.

NOTE The ISO 9000 series, as applicable, meets this requirement.

4.2 Modes of operation

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

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

The Class A AIS shall be capable to receive and process DSC channel management telecommands conforming to the provisions of Recommendations ITU-R M.493, ITU-R M.541, ITU-R M.825 (see Annex D).

4.3 Manuals

In addition to the requirements of IEC 60945:2002, Clause 14, the manuals shall include:

- the type and details of all external connectors (including the pilot plug) referred to in 7.6.

- 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 60945:2002, Clause 15, the markings shall include:

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

5 Other requirements

5.1 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 60945:2002 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 60945:2002;
- exposed AIS equipment shall meet the requirements described in Table 3 column "exposed" of IEC 60945:2002;
- portable AIS equipment shall meet the requirements of Table 3 of IEC 60945:2002 "protected" or "exposed" as appropriate.

5.2 Display of information

The AIS shall be tested as applicable against the requirements for presentation of information contained in IEC 62288 (see 14.7.9).

6 Performance requirements

6.1 Composition

(A3/3.1) *The AIS shall comprise (see Annex A):*

- 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 (see 7.6.4);
- 2) at least one transmitter, two TDMA receiving processes and one dedicated continuous DSC receiving process tuned to channel 70;
- 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 (see 7.6.2) 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).

- 4) *a means to automatically input data from other sensors meeting the provisions as specified in 6.5.1 point 2);* a means, external to the AIS, to comply with this requirement shall be tested to the applicable requirements of IEC 60945.
- 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) *a means of error checking the transmitted and received data* (see Clause 7); *and*
- 7) *built-in test equipment (BIT) as specified in 6.10.1.*

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

- 1) *providing information automatically and continuously to a competent authority and other ships, without involvement of ship's personnel;*
- 2) *receiving and processing information from other sources, including that from a competent authority and from other ships;*
- 3) *responding to high priority and safety related calls with a minimum of delay;*
- 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 Time and position

6.2.1 Source for UTC

The AIS shall be provided with an internal GNSS receiver as primary UTC source which is required for synchronisation purposes and for fall back position, COG and SOG.

NOTE UTC includes a provision for leap seconds.

The internal GNSS receiver shall meet the following requirements of the 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 IMO 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).

If the manufacturer intends to use the internal GNSS as the ship's position source, the internal GNSS receiver shall be type approved in accordance with IEC 61108 under the highest load condition of the AIS processor and the sentences DTM, GNS, GBS, and RMC shall be output on a dedicated port.

If date and time from the internal GNSS is not available and Message 4 or 11 is being received, the unit shall use date and time from that message, the seconds shall be omitted.

6.2.2 Source for AIS position reporting

The source for position reporting may vary depending on the conditions specified in 6.10.3.5.

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 AIS 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 keyboard and display (see 6.11.1),
- the internal GNSS receiver shall be capable of being differentially corrected, at least by evaluation of Message 17.

Where DGNSS corrections are received from multiple sources, the DGNSS corrections from the nearest DGNSS reference station should be used taking into account the Z count, and the health of the DGNSS reference station.

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 the presentation interface).

6.4 Identification

(See 14.1)

(A3/5) *For the purpose of ship and message identification, the appropriate Maritime Mobile Service Identity (MMSI) number shall be used.*

The unit shall be supplied with a default MMSI of “000000000” (this is not a valid MMSI).

The unit shall check that any programmed MMSI is between 200000000 and 799999999 or between 982000000 and 987999999 otherwise the unit shall reject the programming and be not capable of transmitting. However a reset to the default value “000000000” shall be accepted, but the unit shall not be capable to transmit with this MMSI.

6.5 Information

(See 14.2)

6.5.1 Information provided by the AIS

(A3/6.1) *The information provided by the AIS shall include:*

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)*

Static information and the MMSI shall be stored in non-volatile memory devices.

2) *Dynamic:*

- *Ship's position referenced to WGS 84 datum with accuracy indication and integrity status*
- *Time in UTC, the date is established by the receiving equipment*
- *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)*

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)*

4) *Short safety-related messages*

However pre-configured safety related messages (for example with “MAYDAY”, “DISTRESS” and distress communication text) shall not be provided.

NOTE IMO COMSAR.1/Circ.46 of February 2009 advises that short safety-related messages are not incorporated in AIS equipment because there is no SAR infrastructure in place to accommodate them.

6.5.2 Information reporting intervals

(A3/6.2) *The different information types are valid for a different time period and thus need a different reporting interval.*

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
Every 3 min for long range broadcast message (see 8.3).

Voyage related information: Every 6 min, when data has been amended, and on request

Safety-related message: As required

NOTE An SSD or VSD sentence that does not amend the data does not generate a transmission of Message 5.

Table 1 – Information reporting intervals 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	<i>min</i>
<i>Ship at anchor or moored and moving faster than 3 knots</i>	10	<i>s</i>
<i>Ship with a speed of between 0 – 14 knots (default)</i>	10	<i>s</i>
<i>Ship with a speed of between 0 – 14 knots and changing course ^a</i>	3 1/3	<i>s</i>
<i>Ship with a speed of between 14 – 23 knots</i>	6	<i>s</i>
<i>Ship with a speed of between 14 – 23 knots and changing course</i>	2	<i>s</i>
<i>Ship with a speed of greater than 23 knots</i>	2	<i>s</i>
<i>Ship with a speed of greater than 23 knots and changing course</i>	2	<i>s</i>
^a Indicated by a change in ship's heading.		

(M.1371/A1-4.2.1) *The reporting interval shall decrease to 2 s when the station determines that it is the semaphore.*

If the autonomous mode requires a shorter reporting interval than the assigned mode, the AIS shall use the autonomous mode reporting interval.

When transmitting on a single channel, the reporting interval shall be maintained by doubling the number of transmissions on the active channel.

When NavStatus is “at anchor”, “moored” or “aground” and the vessel is moving faster than 3 kn alarm ID 10 (see Table 2) should be generated; the reporting interval shall be in accordance with Table 1.

When NavStatus is under way and SOG is less than 1 kn for more than 2 h, alarm ID 10 should be generated.

6.5.3 Ship reporting capacity

(A3/6.2) *The system shall be able to handle a minimum of 2 000 reports per minute, to adequately provide for all operational scenarios envisioned.*

However, the AIS mobile unit shall be capable of processing of all messages on the VDL.

6.6 Event log

(See 14.3)

(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 (IMO Resolution MSC.43(64), Guidelines for Ship Reporting Systems) shall be followed.

Means shall be provided to automatically record all periods when the AIS installation is nonfunctioning, for instance when the power is switched off, when the AIS is in receive only mode or not transmitting for other reasons, as follows.

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. It shall not be possible for the user to alter any information recorded in this memory.

6.7 Permissible initialization period

(See 14.4)

(A3/7) The installation shall be operational within 2 min of switching on.

NOTE Sensors used with the AIS 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

(See 14.5)

(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.

Additionally, there shall be a low power setting of 1 W which is automatically adopted when the vessel type is a “tanker” and the NavStatus is “moored” and not moving faster than 3 kn. This is to facilitate low power operation when loading and unloading.

There shall be an indication to the user when the low power setting is in operation.

6.10 Alarms and indications, fall-back arrangements

(See 14.6)

6.10.1 Built-in test equipment

The AIS shall be equipped with BIIT. These tests shall run continuously or at appropriate intervals simultaneously with the standard functions of the 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 (see Annex F)

- the alarm shall be displayed on the MKD,
- 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 MKD,
- an appropriate TXT sentence shall be output via the presentation interface.

6.10.2 Alarm messages

6.10.2.1 Using the ALR formatter

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

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

The following 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.

The "alarm condition" field shall be set to "A" when the alarm condition threshold is exceeded, and "V" when the alarm condition returns to a level that does not exceed the threshold. During healthy conditions (no alarm condition) an empty ALR sentence shall be sent at one-minute intervals.

The acknowledged state flag shall be set after acknowledgement of an alarm internally by means of the MKD or externally by a corresponding ACK sentence.

The local alarm identifiers (alarm ID) given in Table 2 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 manufacturer for other purposes but shall be in the range 051 to 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	Continue operation
AIS: general failure	A	V	006	Stop transmission
AIS: UTC sync invalid	A	V	007	Continue operation using indirect or semaphore synchronisation
AIS: MKD connection lost	A	V	008	Continue operation with "DTE" set to "1" ^a
AIS: internal / external GNSS position mismatch	A	V	009	Continue operation
AIS: NavStatus incorrect	A	V	010	Continue operation
Heading sensor offset	A	V	011	Continue operation
AIS: active AIS-SART	A	V	014	Continue operation
AIS: external EPFS lost	A	V	025	Continue operation (refer to Table 4)
AIS: no position sensor 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 b
AIS: no valid ROT information	A	V	035	Continue operation using default data b
^a Applicable if MKD is only means of display.				
^b When so configured.				

Alarm ID 001 shall be activated when

- the integrity of the VDL would be degraded by incorrect transmitter behaviour (for instance in case of the Tx shutdown procedure has operated),
- the unit is not able to transmit for technical reasons or missing or invalid MMSI.

Alarm ID 11 shall be activated when SOG is greater than 5 kn and the difference between COG and HDT is greater than 45° for 5 min.

6.10.2.3 Alarm relay output

A normally closed (NC) 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

6.10.3.1 General

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.

6.10.3.2 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.

It shall be possible to monitor the current sensor status by means of a query sentence \$xxAIQ,TXT.

6.10.3.3 Channel management parameters changed

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

The TXT and ACA sentence pair shall be transmitted only once when crossing the boundary of the region, when the parameters in use are changed by a new command or on request (\$xxAIQ,ACA).

6.10.3.4 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: 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

6.10.3.5 Position sensor fallback conditions

Priorities and affected position report data shall be as in Table 4.

Table 4 – Position sensor fallback conditions

Priority	Affected data in Message 1, 2, 3 ⇒				
	Position Sensor status	Position accuracy flag	Time stamp	RAIM flag	Position Latitude/Longitude
1	External DGNSS in use (corrected) ^a	1	UTC-s	1/ 0 *	Lat/Lon (external)
2	Internal DGNSS in use (corrected; Message 17)	1	UTC-s	1/ 0 *	Lat/Lon (internal)
3	Internal DGNSS in use (corrected; beacon) ^b	1	UTC-s	1/ 0 *	Lat/Lon (internal)
4	External EPFS in use (uncorrected) ^a	0	UTC-s	1/ 0 *	Lat/Lon (external)
5	Internal GNSS in use (uncorrected)	0	UTC-s	1/ 0 *	Lat/Lon (internal)
6	Dead reckoning position (from the external EPFS in use)	0	62	0	Lat/Lon (dead-reckon)
	Manual position input (from the external EPFS in use)		61		Lat/Lon (manual)
	No position		63		not available = 91/181

^a Applicable in all configurations (minimum requirement).

^b 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.

When the external position source is used and both external and internal positions are valid then the external and internal positions shall be compared once per minute and an alarm generated if the difference between the two positions is greater than 100 m + distance between the two GNSS antennas, for a period of 15 min.

If the valid position does not have a timestamp (time stamp not available = 60) transmit the position report with time stamp set to 60.

On changeover from one status to another a new Message 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.

If RAIM is available (indicated by a valid GBS sentence or equivalent information), the position accuracy flag shall be evaluated using Table 5.

Table 5 – Use of accuracy (PA) flag

Accuracy status from RAIM (for 95 % of position fixes)	RAIM flag	Differential correction status	Resulting value of position accuracy (PA) flag
No RAIM process available	0	Uncorrected	0 = low (> 10 m)
Expected error is < =10 m	1		1 = high (< =10 m)
Expected error is > 10 m	1		0 = low (> 10 m)
No RAIM process available	0	Corrected	1 = high (< =10 m)
Expected error is < =10 m	1		1 = high (< =10 m)
Expected error is > 10 m	1		0 = low (> 10 m)

The connected GNSS receiver indicates the availability of a RAIM process by a valid GBS sentence of IEC 61162-1. In this case the RAIM-flag shall be set to “1”. The position accuracy threshold for evaluation of the RAIM information is 10 m. The RAIM expected error is calculated based on the GBS parameters “expected error in latitude” and “expected error in longitude” using the following formula:

$$\text{Expected RAIM error} = \sqrt{(\text{expected error in latitude})^2 + (\text{expected error in longitude})^2}$$

The mode indicator in the position sentences of IEC 61162-1 received from the connected position sensor indicates the correction status.

6.10.3.6 SOG/ COG sensor fallback conditions

SOG/COG information from the 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.

6.10.3.7 ROT sensor fallback conditions

The AIS shall automatically select the ROT source with the highest priority available as given in Table 6.

ROT data shall not be derived from COG information.

Table 6 – ROT sensor fallback conditions

Priority	Affected data in Message 1, 2, 3 ⇒	
	Position sensor status	Contents of ROT field
1	Rate of turn indicator in use ^a	0...+126 = turning right at up to 708°/min or higher; 0...-126 = turning left at up to 708°/min or higher. Values between 0° and 708°/min shall be coded by $ROT_{AIS} = 4,733 \sqrt{ROT_{sensor}} / \text{min}$ where ROT_{sensor} is the rate of turn as input by the external rate of turn indicator (TI). Values of 709°/min and above shall be cut to 708°/min
2	Other ROT source in use ^b	+127 = turning right at more than 5°/30 s (No TI available) -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)
^a Rate of turn indicator according to IMO A.526(13); determined by talker ID. ^b i.e. based on HDG information.		

6.11 Display, input and output

(See 14.7)

6.11.1 Minimum keyboard and display (MKD)

The MKD is an essential part of the AIS and it may be remote. If the MKD is remote then a facility shall be provided to ensure the integrity of the link using a HBT sentence.

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

- Manual input of voyage related and static ship data and safety related messages, control of AIS and data selection. The method of entering the navigational status and voyage related data shall be readily available to the operator. It shall not be possible to input the Navigational status 14 by the Class A AIS station.
- Display of own ship transmitted static, dynamic and voyage related data.
- Display a minimum of 200 targets.
- Display at least three (3) lines of target data. Each line to display at least bearing, range, name of ship and time elapsed since last position report received. Range to SAR Aircraft shall be 2-dimensional. Horizontal scrolling of bearing and range and time elapsed is not allowed. The title of display data shall be visible.

By default the target list is auto-sorted in ascending range except the nearest active AIS-SART or, if supported, other targets of interest shall be displayed at the top of the list.

The time out value for target display, other than AIS-SART, shall be 7 min. For SART ACTIVE the time out value shall be 18 min. The time out value for storing the target data shall be 18 min.

It may be possible to filter the presentation of AIS targets (for example, by target range, CPA/TCPA or AIS target class A/B, etc.). If additional filtering or grouping is supported the manufacturer should document this functionality as an option. If display equipment provides facilities for the calculation of CPA/TCPA then the facilities should comply with the relevant Clauses of IEC 62388. If a filter is applied, then there shall be a clear and permanent or persistent indication for the application, as appropriate. The filter criteria in use shall be readily available to the user.

It shall not be possible to remove individual AIS targets from the presentation.

The active AIS-SARTs shall be displayed on the top of the target list. The testing (including type approval testing) AIS-SART should not be displayed or output on the PI during normal operation; however the AIS should have the capability to display and output on the PI the testing AIS-SART during periodical testing of own ship's AIS-SART.

The active and testing AIS-SART should be identified as follows:

- Active AIS-SART: confirm that user IDs of Message 1 lead with 97, Message 1 NavStatus is 14.
- Testing AIS-SART: confirm that user IDs of Messages 1 and 14 lead with 97, Message 1 NavStatus is 15, Message 14 text is "SART TEST".
- Type approval testing AIS-SART: confirm that user IDs of Messages 1 and 14 lead with 97000, Message 1 NavStatus is 15 and Message 14 text is "SART TEST".

NOTE All equipment utilizing user IDs with leading 97 and NavStatus 14 will be identified as active AIS-SART equipment.

The DTE flag (refer to Recommendation ITU-R M.1371-4/A8-3.3) shall only be set to "1" when there is no means of displaying received text messages. External equipment indicates the availability of a remote MKD functionality by a HBT sentence sent every 30 s. If an SSD sentence is applied the DTE field should be evaluated together with the HBT sentence to define if the external equipment is able to display text messages.

Table 7 describes the messages or target information derived from received messages which should be displayed on the MKD:

Table 7 – Message display on MKD

Message type	Information content	Remark
All messages below	MMSI	
Message 1, 2, 3 Position report	Position (Lat, Lon, Range, Bearing) Time in minutes since last position report was received (0-19) For AIS-SART name shall show "SART ACTIVE" or "SART TEST" as appropriate PA-flag, RAIM, time stamp, description of position quality as derived from Table 8	In graphical display by position on the chart
Message 5 Static data	Name of ship	
Message 4 Base station report	Position (Lat, Lon, Range, Bearing) Time in minutes since last position report was received Name shall show "BS:MMSI" unless the name is derived from a Message 24a. PA-flag, RAIM, description of position quality as derived from Table 8	In graphical display by position on the chart
Message 9 SAR aircraft position report	Position (Lat, Lon, Range, Bearing, Altitude) Time in minutes since last position report was received Name shall show "SAR" PA-flag, RAIM, time stamp, description of position quality as derived from Table 8	In graphical display by position on the chart. The range to SAR air craft should be by 2-dimensional calculation.
Message 11	The result of the communication test should be displayed.	The indication of the result should be automatically removed not later than 30 s

Message type	Information content	Remark
Message 12, 14 Safety related text message	Text content For AIS-SART "SART ACTIVE" or "SART TEST" as appropriate	
Message 18, 19	Position (Lat, Lon, Range, Bearing) Time in minutes since last position report was received PA-flag, RAIM, time stamp, description of position quality as derived from Table 8	In graphical display by position on the chart Maybe filtered in or out (and filtering indicated)
Message 19, 24a Class B position and static report	Name of ship	
Message 21 Aid to navigation report	Name of Aids to Navigation Time in minutes since last position report was received Position (Lat, Lon, Range, Bearing) PA-flag, RAIM, time stamp, description of position quality as derived from Table 8 Off-position flag	Name plus indication it is an AtoN In graphical display by position on the chart

Table 8 – Position quality

Description	Criteria
No position	Position = 91°/ 181° Time stamp = 63
Manual position	Time stamp = 61
Dead reckoning position	Time stamp = 62
Outdated position > 200 m	Predicted distance (from SOG and time elapsed) > 200 m
Position > 10 m	PA = 0 and RAIM = 0
Position with RAIM > 10 m	PA = 0 and RAIM = 1
Position < 10 m	PA = 1 and RAIM = 0
Position with RAIM < 10 m	PA = 1 and RAIM = 1
Valid position with no time stamp	Time stamp = 60
NOTE Detailed information about the Quality of Position is displayed in a sub-page.	

6.11.2 Communication test

The AIS shall have a means of testing communication over the VDL by transmitting an addressed Message 10 and verifying the response of the addressed station, Message 11.

It shall be possible to initiate the communication test manually by MKD. The MKD shall propose a target and allow the user to confirm this target or select an alternate Class A target. A different target shall be suggested if the test fails.

It shall also be possible to initiate the communication test via the presentation interface input using an AIR sentence (indicating Message 11 in the "Message ID" field). In response to the AIR sentence the AIS unit shall transmit a Message 10.

Upon reception of a Message 10 the AIS unit shall respond with a Message 11.

The result of the communication test shall be displayed. The operation manual shall provide guidance on use of this feature such that the selected addressed target is at a suitable range for example between 15 NM and 25 NM.

6.11.3 Alarms and status information

6.11.3.1 Alarms

The following alarms shall be indicated and displayed on request:

- as a result of the built-in integrity test (BIIT see 6.10.1 and Annex F);
- reception of Message 1 NavStatus 14. Once acknowledged for a given User ID the relay will not be activated and the ALR will indicate acknowledge. The acknowledgement shall stay in effect until it is removed from the target list due to time out.

A means to acknowledge alarms shall be provided.

6.11.3.2 Status information

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

- indications as a result of the built-in integrity test (BIIT see 6.10.1);
- received safety related Messages 12 and 14;
- received long-range interrogations;
- manual confirmation of long-range interrogation if in manual mode.

An indication is required when status information is available or a Message 14 is received.

The content of the most recent Message 12 received shall be displayed foremost until cleared by the user. A minimum queue size of 20 Message 12 shall be accessible.

6.11.4 Data protection

The following data shall be protected from unauthorised modification (for example by password):

- MMSI;
- Call sign;
- Name of ship;
- IMO number;
- Dimension/Reference for position;
- Type of ship (type of cargo should not be protected);
- Interface configuration;
- Password(s);
- Message 27 tx channels.

Other data, if protected, should not be protected by the same password level.

NOTE If the EPV configuration sentence is used (see Annex E) a preceding valid SPW sentence will provide authorization.

6.11.5 Distance calculation

The AIS shall use the equations in Annex G to calculate all distances including range to other AIS stations and regional areas.

6.12 Protection from invalid controls

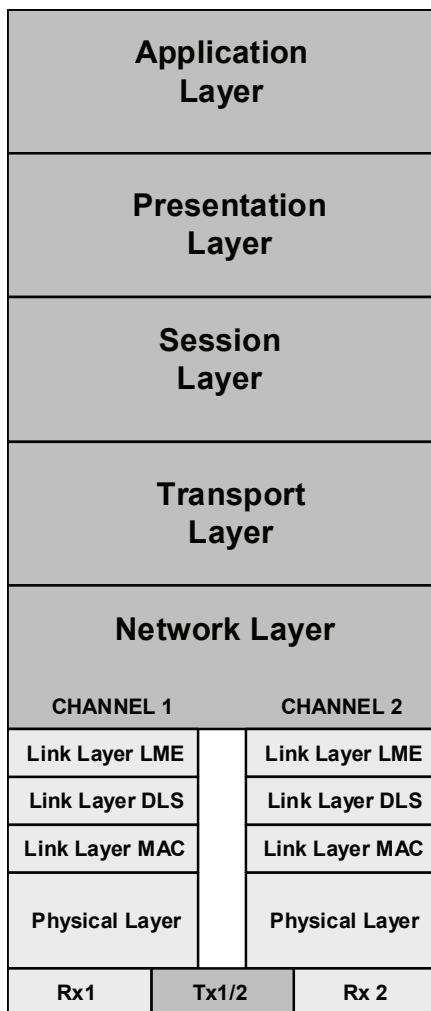
The AIS shall not accept the control commands sent from stations with invalid base station MMSI. Before accepting and processing the Messages 4, 16, 17, 20, 22 and 23, the AIS shall check the MMSI of the transmitting station. A valid base station MMSI is defined as “00xyyyyy” where x is between 2 and 7. The unit shall only accept and process received commands with a valid base station MMSI. See Annex D.

7 Technical requirements

7.1 General

(M.1371/A2-1.1) *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).



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Figure 1 – OSI layer model

7.2 Physical layer

(See Clause 15)

7.2.1 General

(M.1371/A2-2) *The Physical layer is responsible for the transfer of a bit-stream from an originator out, on to the data link.*

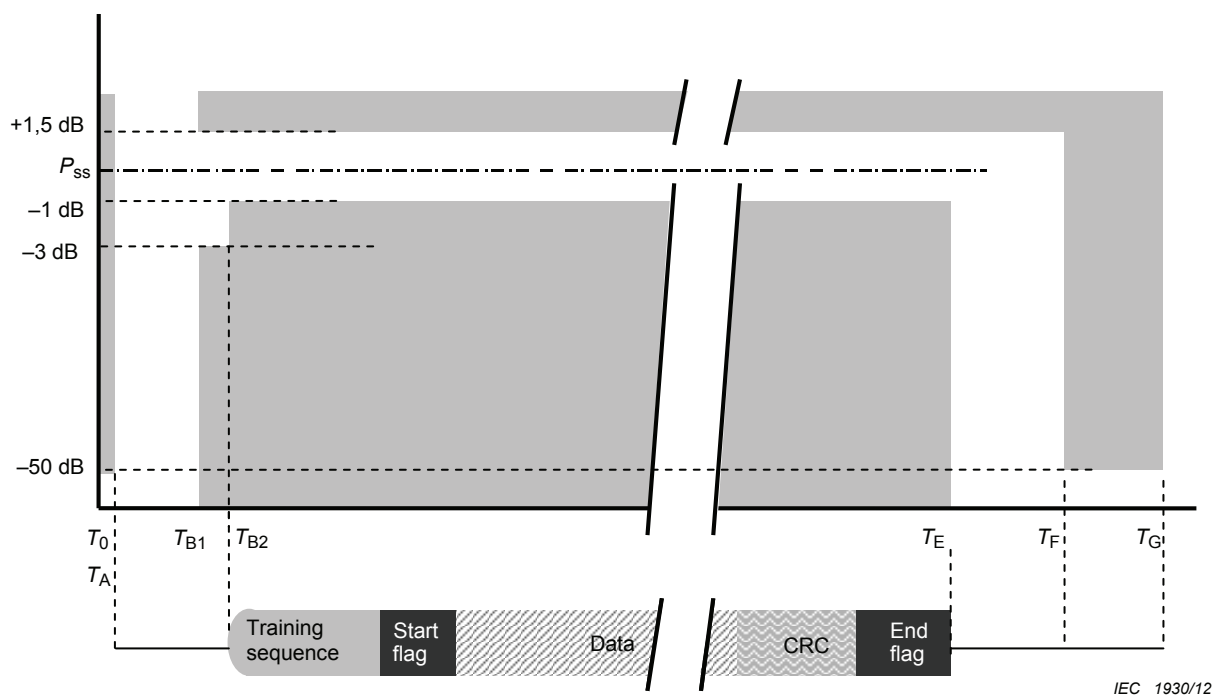
The Physical layer shall be designed in accordance with Recommendation ITU-R M.1371-4/A2-2.

7.2.2 Transmitter parameters

Transmitter parameters shall be as given in Table 9.

Table 9 – Transmitter parameters

Transmitter parameters	Requirement	Condition
Frequency error	± 500 Hz normal $\pm 1\,000$ Hz extreme	
Carrier power (P_{SS})	41 dBm high power setting 30 dBm low power setting	$\pm 1,5$ dB normal and ± 3 dB extreme, conducted
Modulation spectrum	-25 dBc -70 dBc slotted transmission	$\Delta f_c < \pm 10$ kHz ± 25 kHz $< \Delta f_c < \pm 62,5$ kHz
Modulation accuracy	1 740 $\pm$ 175 Hz normal ± 350 Hz extreme 2 400 $\pm$ 240 Hz normal ± 480 Hz extreme	Test signal 0101... Test signal 00001111...
Power versus time characteristics	Transmission delay: 0 s Ramp up time: 833 μ s Ramp down time: 833 μ s Transmission duration: $\leq 26\,624$ μ s	See Figure 2 and Table 10 Nominal 1 time slot transmission
Spurious emissions	-36 dBm -30 dBm	9 kHz ... 1 GHz 1 GHz ... 4 GHz



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Figure 2 – Power versus time characteristics

Table 10 – Power versus time characteristics

Reference		Bit	Time	Definition
T_0		0	0 ms	Start of transmission slot. Power shall NOT exceed –50 dBc (ref. P_{ss}) before T_0
T_A		0 to 6	0 to 0,625 ms	Power exceeds –50 dB of P_{ss}
T_B	T_{B1}	6	0,625 ms	Power shall be within +1,5 or –3 dB of P_{ss}
	T_{B2}	8	0,833 ms	Power shall be within +1,5 or –1 dB of P_{ss} ;(Start of training sequence
T_E (includes 1 stuffing bit)		233	24,271ms	Power shall remain within +1,5 or –1 dB of P_{ss} during the period T_{B2} to T_E
T_F (includes 1 stuffing bit)		241	25,104 ms	Power shall be –50 dBc (ref. P_{ss} a) and stay below this
T_G		256	26,667 ms	Start of next transmission time period

7.2.3 Receiver parameters

Receiver parameters shall be as given in Table 11.

Table 11 – Receiver parameters

Receiver parameters	Requirement		
	Result in PER	Wanted signal	Unwanted signal(s)
Sensitivity	20 %	–107 dBm normal –104 dBm normal at ± 500 Hz offset –101 dBm extreme	
Error at high input levels	1 %	–7 dBm and –77 dBm	–
Co-channel rejection	20 %	–104 dBm –104 dBm	–114 dBm nominal –114 dBm at ± 1 kHz offset
Adjacent channel selectivity	20 %	–104 dBm –98 dBm extreme	–34 dBm normal –38 dBm extreme
Spurious response rejection	20 %	–104 dBm	–34 dBm
Intermodulation response rejection and blocking	20 %	–101 dBm	–27 dBm (< 5 MHz) –15 dBm (> 5 MHz)
Spurious emissions	–57 dBm –47 dBm	9 kHz ... 1 GHz 1 GHz ... 4 GHz	

7.3 Link layer

(See Clause 16)

7.3.1 General

(M.1371/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.*

7.3.2 Link sublayer 1: Medium Access Control (MAC)

(M.1371/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.1371-4/A2-3.1.

7.3.3 Link sublayer 2: Data Link Service (DLS)

(M.1371/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.1371-4/A2-3.2.

Repeated messages and Class B messages shall not be used in the indirect synchronisation process.

7.3.4 Link sublayer 3 – Link Management Entity (LME)

7.3.4.1 General

(M.1371/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.1371-4/A2-3.3.

Link sublayer 3 includes definition of VDL-messages. Table 12 shows the VDL messages that shall be used by a Class A shipborne mobile AIS device.

Table 12 – Use of VDL messages

Msg. No.	Name of message	M.1371Ref.	R/P	O	T	Remark
0	Undefined	None	Yes	Yes	No	Reserved for future use
1	Position report (scheduled)	A8-3.1	Yes	Yes	Yes	If MMSI starts with 97 and NavStatus is 15 then it should only be sent to the PI in special AIS-SART test mode
2	Position report (assigned)	A8-3.1	Yes	Yes	Yes	
3	Position report (when interrogated)	A8-3.1	Yes	Yes	Yes	
4	Base station report	A8-3.2	Yes (5)	Yes	No	
5	Static and voyage related data	A8-3.3	Yes	Yes	Yes	
6	Addressed binary message	A8-3.4	Yes	Yes (1)	Yes	(1) Only if addressed to own station
7	Binary acknowledge	A8-3.5	Yes	INF (2)	Yes	(2) An ABK PI message shall be sent to the PI in any case
8	Binary broadcast message	A8-3.6	Yes	Yes	Yes	

Msg. No.	Name of message	M.1371Ref.	R/P	O	T	Remark
9	Standard SAR aircraft position report	A8-3.7	Yes	Yes	No	
10	UTC and date inquiry	A8-3.8	Yes	INF	Yes	
11	UTC/ date response	A8-3.9	Yes	INF	Yes	
12	Addressed safety related message	A8-3.10	Yes	Yes (3)	Yes	(3) Only if addressed to own station
13	Safety related acknowledge	A8-3.11	Yes	INF (4)	Yes	(4) An ABK PI message shall be sent to the PI in any case
14	Safety related broadcast message	A8-3.12	Yes	Yes	Yes	If MMSI starts with 97 and text is "SART TEST" then it should only be sent to the PI in special AIS-SART test mode
15	Interrogation	A8-3.13	Yes	INF	Yes	Class A shipborne mobile station shall only interrogate for Message 3, 4, 5, 9, 18, 19, 21 and 24 Slot offset shall be set to 0 and shall respond for interrogations for Messages 3, 5 and 24B only
16	Assigned mode command	A8-3.14	Yes (5)	INF	No	(5) Class-A AIS shall receive and process only if the message is sent from the station with valid base station MMSI
17	DGNSS	A8-3.15	Yes (5, 6)	INF (7)	No	(6) only if internal GNSS receiver is capable of processing DGNSS corrections or PI contains an DGNSS output port (7) on other ports of the PI: INF
18	Standard Class B equipment position report	A8-3.16	Yes	Yes	No	
19	Extended Class B equipment position report	A8-3.17	Yes	Yes	No	
20	Data link management message	A8-3.18	Yes (5)	INF	No	
21	Aids-to-Navigation report	A8-3.19	Yes	Yes	No	
22	Channel management message	A8-3.20	Yes (5)	INF	No	
23	Group assignment command	A8-3.21	Yes (5)	Yes	No	
24	Static data report (single slot, two parts)	A8-3.22	Yes	Yes	Yes	
25	Single slot binary message	A8-3.23	Yes	Yes (8)	Yes (9)	(8) Only if broadcast or addressed to own station (9) use ABM or BBM sentence indicating Message 25/70 in message ID field to initiate
26	Multiple slot binary message with CommState	A8-3.24	Yes	Yes (10)	Yes (11)	(10) Only if broadcast or addressed to own station (11) use ABM or BBM sentence indicating Message 26/71 in message ID field to initiate
27	Long-range AIS broadcast message	A8-3.25	No	No	Yes	Transmit on dedicated channels (not AIS 1 and AIS 2).
28 to 63	Undefined	None	INF	INF	No	Reserved for future use

Msg. No.	Name of message	M.1371Ref.	R/P	O	T	Remark
Key R/P – Receive and process internally, e.g. prepare for output via PI, act upon the received information, and use the received information internally. O – Output message content via PI using PI VDM messages T – Transmission by own station: "Yes" = 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.						

For Messages 6, 8, 12, 14, 25 and 26 own transmissions shall not exceed the total number of slots in a frame with a maximum number of consecutive slots per message as defined in Recommendation ITU-R M.1371. For Message 15 own transmissions shall not exceed a total of 5 messages in a frame. If either case is exceeded, the AIS shall generate an ABK warning sentence.

7.3.4.2 Response to assignment commands (Messages 16 and 23)

Class A AIS shall process assignment commands in accordance with Recommendation ITU-R M.1371-4 only if the commands are sent from stations with valid base station MMSI.

An assignment command received by Message 16 or Message 23, with a reporting interval shorter than or equal to the autonomous reporting interval shall be processed and the reporting interval defined by the assignment command be used.

An assignment command received by Message 16 or Message 23 with a reporting interval longer than the autonomous reporting interval shall be ignored.

A group assignment by Message 23 shall not apply to Class A mobile stations with NavStatus "moored" and "at anchor" and not moving faster than 3 kn except when the station type is 10 (see 8.3).

7.4 Network layer

(See Clause 17)

7.4.1 General

(M.1371/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.1371-4/A2-4.

7.4.2 Management of regional operating settings

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 Message 22, DSC telecommand, Manual input via MKD, ACA sentence input via presentation interface). It shall be possible to obtain an ACA sentence giving the current stored area settings by means of a query sentence \$xxAIQ,ACA.

The AIS shall constantly check, if the nearest boundary of the regional operating area of any stored regional operating setting is more than 500 NM away from the current position of own station, or if any stored regional operating setting was older than 24 h. The age of the area setting is the time since the area setting has been applied the last time by Message 22, DSC command, MKD or ACA input. The “Time of in-use change” provided by ACA output cannot be used for this purpose. 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. However, in case that the narrow bandwidth (12,5 kHz) operation is requested, the AIS shall continue the wide bandwidth operation (25 kHz) while accepting other parameter changes.

When the user requests to manually input a regional operating setting via the 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 Recommendation ITU-R-M.1371-4/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. shall 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 Recommendation ITU-R M.1371-4/A2-4.1. The area size calculation shall be in accordance with Annex G.

The AIS shall not accept a new regional operation setting if the distance to the base station is more than 120 NM or if no message 4 is received from the base station.

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 Message 22 or by DSC telecommand within the last two hours.

A Message 22 addressed to own station or a DSC telecommand not including the co-ordinates of the corner points 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 most distant regional operating setting shall be replaced by the new, accepted one.

NOTE The distance to a regional operating setting is the distance to the nearest boundary.

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.

When the ship goes outside the regional area, the AIS shall revert all the parameters to default.

7.5 Transport layer

(See Clause 18)

(M.1371/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.1371-4/ A2-5.

7.6 Presentation interface

(See Clause 19)

7.6.1 General

(M.1371/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 are defined in 7.6.*

(M.1371/A4-2) *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 following.*

The interface between the transport layer and higher layers shall be performed by the presentation interface. The Presentation Interface of the AIS shall comprise the data ports listed in Table 13. (Also see Annex B).

Table 13 – Presentation interface access

General function	Mechanism
Automatic input of sensor data (Sensor data input from shipboard equipment)	IEC 61162-2 input ports, also configurable as IEC 61162-1 input ports – minimum 3 ports required
High speed input/output ports (including pilot port) (Operator controlled commands and data input; AIS VHF Data Link (VDL) data; and AIS equipment status)	IEC 61162-2 paired input and output ports – minimum 2 ports required The long-range communications port may be configured as an additional presentation interface (PI) port if it is not needed for long-range communication in the current installation
Long-range communications	IEC 61162-2 paired input and output port
BITT alarm output	Isolated normally-closed (NC) contact circuit