

# INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems –  
Automatic identification system (AIS) –  
Part 3: Repeater stations – Minimum operational and performance  
requirements – Methods of test and required test results**

IEC 62320-3:2015

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IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 3: Repeater stations –  
Minimum operational and performance requirements –  
Methods of test and required test results

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The text of this standard is based on the following documents:

FDIS	Report on voting
80/744/FDIS	80/752/RVD

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



This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62320 series, published under the general title, *Maritime navigation and radiocommunication equipment and systems – Automatic identification system (AIS)*, can be found on the IEC website.

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## INTRODUCTION

Chapter V of the 1974 SOLAS Convention requires mandatory carriage of Automatic Identification System (AIS) equipment on all vessels constructed on or after 01 July 2002. Implementation for other types and sizes of SOLAS Convention vessels was required to be completed not later than 31 December 2004.

SOLAS Chapter V, Regulation 19, section 2.4.5 states that AIS shall:

- a) provide automatically to appropriate equipped shore stations, other ships and aircraft information, including ship's identity, type, position, course, speed, navigational status and other safety-related information;
- b) receive automatically such information from similarly fitted ships;
- c) monitor and track ships; and
- d) exchange data with shore-based facilities.

In addition, the IMO Performance Standards for AIS states that:

- The AIS should 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:
  - 1) in a ship-to-ship mode for collision avoidance;
  - 2) as a means for littoral States to obtain information about a ship and its cargo; and
  - 3) as a VTS tool, i. e. ship-to-shore (traffic management).
- The AIS should 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 should be with the minimum involvement of ship's personnel and with a high level of availability.

The provision of Shore Based AIS will be necessary to attain the full benefit of the SOLAS Convention requirements.

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This standard provides the minimum operational and performance requirements, methods of test and the required test results for AIS repeater stations. The testing is divided into two parts, the logical tests and the transceiver tests. These are captured in Clause 6 and Clause 8 respectively.

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

## Part 3: Repeater stations – Minimum operational and performance requirements – Methods of test and required test results

### 1 Scope

This part of IEC 62320 specifies the minimum operational and performance requirements, methods of testing and required test results for AIS repeater stations, compatible with the performance standards adopted by IMO Res. MSC.74 (69), annex 3, Universal AIS. It incorporates the technical characteristics of non-shipborne, fixed station AIS equipment, included in Recommendation ITU-R M.1371 and IALA Recommendation A-124. Where applicable, it also takes into account the ITU Radio Regulations. This standard takes into account other associated IEC International Standards and existing national standards, as applicable.

This standard is applicable for AIS repeater stations. It does not include specifications for the display of AIS data on shore.

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

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

ITU-R Recommendation M.585, *Assignment and use of identities in the maritime mobile service*

ITU-R Recommendation M.1084, *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, *Technical characteristics for a universal shipborne 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*

ITU Radio Regulations, Appendix 18

### 3 Symbols and abbreviations

AES	Advanced Encryption Standard
AIS	Automatic Identification System
AtoN	Aids To Navigation
BER	Bit Error Rate
BFO	Beat frequency oscillator
BIIT	Built-In Integrity Tests
BT	Bandwidth Time product
COG	Course Over Ground
CS	Carrier Sense
CSTDMA	Carrier Sense Time Division Multiple Access
DAC	Digital Area Code
dBc	Decibel-carrier
dBm	Decibel-milliwatts
EUT	Equipment under test
FATDMA	Fixed Access Time Division Multiple Access
FI	Function Identifier
FIFO	First in, first out
GNSS	Global Navigation Satellite System
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ITDMA	Incremental Time Division Multiple Access
IMO	International Maritime Organization
ITU	International Telecommunication Union
kn	Knots
MMSI	Maritime Mobile Service Identity
NavStatus	Navigational Status
NM	Nautical Mile
NRZI	Non-Return to Zero Inverted
PER	Packet Error Rate
Pc	Carrier Power
PI	Presentation Interface
PPS	Pulse(s) Per Second
RATDMA	Random Access Time Division Multiple Access
RSSI	Received Signal Strength Indication
Rx	Receive
AIS-SART	Search And Rescue Transmitter
SO	Self-Organizing
SOG	Speed Over Ground
SOTDMA	Self-Organizing Time Division Multiple Access
TDMA	Time Division Multiple Access
Tx	Transmit
UTC	Coordinated Universal Time

VCO	Voltage controlled oscillator
VDL	VHF Data Link
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio
VTS	Vessel Traffic Services

## 4 Functional requirements for a repeater station

### 4.1 General

#### 4.1.1 Types of repeater stations

AIS repeater stations are designed to retransmit VDL messages in one or several steps to extend the receiving range in areas with impaired VHF coverage. Careful consideration needs to be taken not to overload the VDL with repeated messages, considering the additional load repeated messages generate. The AIS environment may also contain one or more repeaters.

A repeater station is a store and forward repeater process.

A repeater station is a non-controlling station on the VDL.

The repeater station can be one of two types.

Type 1:

- Radio requirements as per the AIS base station requirements
- A dedicated repeater station is a Type 1 device

Type 2:

- Radio requirements as per the AIS AtoN station requirements
- Restricted repeater capability
- Suitable for areas with low AIS activity only

These two types of repeater functions can be implemented in three different ways:

- As a dedicated repeater station (Type 1)
- As an internal process of an AIS Base Station (Type 1)
- As an internal process of an AIS AtoN device (Type 2)

#### 4.1.2 Repeating operation

(See 6.2.1)

##### 4.1.2.1 Modes of repeating operation

The repeater station is designed for independent operation in autonomous and assigned mode. No polled mode is allowed.

##### 4.1.2.2 Message by message repeating

Each received message that shall be repeated is internally allocated for transmission using RATDMA, ITDMA, or FATDMA as supported and configured.

##### 4.1.2.3 Message rescheduling

This mode is only applicable for scheduled position reports.

Received messages shall be analysed and the repeater station shall reschedule transmissions using an ITDMA schedule.

The repeater station may reschedule repeated messages using a reporting interval different from the original interval, depending on configuration.

**4.1.3 Synchronisation**

(See 6.2.4)

The repeater station shall primarily use an internal source for UTC direct synchronisation.

The repeater station can synchronise on any AIS station that has direct UTC (otherwise known as UTC indirect). The repeater station shall have UTC direct, or UTC indirect and only transmit when sync state is 0 or 1.

**4.1.4 Access to the VDL**

**4.1.4.1 Means of access**

Access to the VDL can be by using pre-configured transmission slots. Pre-configured transmission slots shall in this case be reserved by Message 20 from a base station.

If pre-configured slots are not available, RATDMA may be used for transmission.

A repeater station shall use as a minimum RATDMA, ITDMA and FATDMA to allocate and pre-announce transmissions.

The repeater station needs to take into account all received Message 20s. It shall respect slot reservations. If a base station reserves slots for the repeater station, the repeater station shall be configured to use FATDMA.

CSTDMA is not suitable for repeater stations and not permitted because of:

- slot start delay;
- no protection from collision with Class B CS units;
- only one slot messages;
- intentional slot reuse is not allowed.

**4.1.4.2 RATDMA and FATDMA access scheme**

(See 6.3.1, 6.3.2)

The repeater station shall not change the data content of the message, but shall change the SOTDMA communication state or ITDMA if relevant. The repeater station shall change the SOTDMA communication state as indicated in Table 1.

**Table 1 – SOTDMA communication state of received station**

Received parameter	Transmit parameters
Synch state	Change to Synch State of repeater station
Slot time out	Set to zero
Slot offset	Set to zero

The repeater station shall change the ITDMA communication state as indicated in Table 2.