

INTERNATIONAL STANDARD

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**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**

<https://standards.iteh.ai/catalog/standards/sist/0a0ef41e-056a-4668-889e-121010101010/iec-62320-3-2015>

**Matériels et systèmes de navigation et de radiocommunication maritimes –
Systèmes d'identification automatique (SIA) –
Partie 3: Stations de répéteurs – Exigences minimales d'exploitation et de
performances – Méthodes d'essai et résultats d'essai exigés**



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ELECTROTECHNICAL
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ICS 47.020.70

ISBN 978-2-8322-8083-6

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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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| | |
|-------------|------------------|
| 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.

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

[IEC 62320-3:2015](#)

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 |
| P _c | 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.

Table 2 – ITDMA Communication state of received station

| Received parameter | Transmit parameters |
|--------------------|-----------------------------------|
| Synch state | Change to synch state of repeater |
| Slot increment | Set to zero |
| Number of slots | Set to zero |
| Keep flag | Set to FALSE (= 0) |

4.1.4.3 ITDMA access scheme

(See 6.3.3)

The repeater station shall not change the data content of the message, but shall change the SOTDMA communication state or ITDMA as relevant. The repeater station shall change the SOTDMA or ITDMA communication state to an ITDMA communication state as described in Table 2. When using ITDMA to reschedule refer to Table 3.

If ITDMA is used and the repeater station receives a Message 1 that shall be repeated, the repeater station shall change the message ID from 1 to 3 to all ITDMA access scheme.

Table 3 – ITDMA communication state of received station with rescheduling

| Received parameter | Transmit parameters |
|--------------------|---|
| Synch state | Change to synch state of repeater station |
| Slot increment | Offset set to next transmission slot |
| Number of slots | As required for next repeated message |
| Keep flag | Set to FALSE (= 0) |

ITDMA can be used to schedule transmissions that originate from different stations.

When using ITDMA reservations, the selection interval shall be 150 slots. Set the ITDMA communication state at time of transmission to the next scheduled transmission.

4.1.5 Configuration

(See 6.1.3)

Initial configuration shall be possible using the presentation interface of the repeater station as defined in Annex A.

The repeater station may use VDL Messages for configuration and status reports as defined in Clause A.3.

4.2 Functional block diagram of an AIS repeater station

Figure 1 shows the principal components of the AIS repeater station.