

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**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**

**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**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**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**

**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**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 47.020.70

ISBN 978-2-8322-8083-6

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Symbols and abbreviations.....	10
4 Functional requirements for a repeater station.....	11
4.1 General.....	11
4.1.1 Types of repeater stations	11
4.1.2 Repeating operation	11
4.1.3 Synchronisation.....	12
4.1.4 Access to the VDL	12
4.1.5 Configuration.....	13
4.2 Functional block diagram of an AIS repeater station	13
4.3 Repeating rules.....	14
4.3.1 General repeating rules	14
4.3.2 Repeater station use of repeat indicator	15
4.3.3 Duplicate message filtering.....	15
4.3.4 Content filtering.....	16
4.3.5 Reporting interval filtering.....	19
4.3.6 Channel filtering	19
4.3.7 Filtering procedure	19
4.3.8 Message processing.....	21
4.3.9 Overload protection	21
4.3.10 Slot selection using RSSI – RSSI measurement	22
4.4 Message scheduling	22
4.4.1 Station report.....	22
4.4.2 Repeater station identification message structure.....	23
4.4.3 Broadcast active AIS-SART message	24
4.4.4 Configuration parameters	24
4.5 Repeater station input/output sentence formatters	29
5 Performance requirements.....	30
5.1 Cyclic redundancy check.....	30
5.2 Physical layer requirement.....	30
5.2.1 Transmitter requirements.....	30
5.2.2 Receiver requirements.....	34
5.2.3 Power consumption	34
5.2.4 Environmental requirements	35
5.3 Link layer requirements.....	35
6 Functional tests	35
6.1 Configuration tests.....	35
6.1.1 Factory default settings	35
6.1.2 Standard test set-up	36
6.1.3 Configuration via VDL.....	37
6.2 Basic functional tests	38
6.2.1 Basic repetition test	38
6.2.2 Power setting.....	38

6.2.3	Repeat indicator handling	39
6.2.4	Synchronisation jitter	40
6.3	VDL access	41
6.3.1	RATDMA	41
6.3.2	FATDMA access	44
6.3.3	ITDMA access	44
6.4	Repetition rates	45
6.4.1	Downsampling	45
6.4.2	Fixed repetition interval	46
6.4.3	Maximum VDL load	46
6.4.4	Maximum transmissions per second	47
6.4.5	Age of time stamp	47
6.5	Filtering	48
6.5.1	Duplicate filtering	48
6.5.2	Channel filtering	48
6.5.3	Position filtering	49
6.5.4	Message type filtering	51
6.5.5	Message content filtering	51
6.5.6	AIS-SART filtering	56
6.6	Repeater station identification message	56
6.6.1	Purpose	56
6.6.2	Method of measurement	56
6.6.3	Required results	57
7	Test conditions	57
7.1	Normal and extreme test conditions	57
7.1.1	Normal test conditions	57
7.1.2	Extreme test conditions	57
7.2	Additional test arrangements	57
7.2.1	Arrangements for test signals applied to the receiver input	57
7.2.2	Encoder for receiver measurements	58
7.2.3	Waiver for receiver	58
7.2.4	Impedance	58
7.2.5	Artificial antenna (dummy load)	58
7.2.6	Facilities for access	58
7.2.7	Modes of operation of the transmitter	58
7.3	Measurement uncertainties	58
7.4	Test signals	59
7.4.1	Standard test signal number 1	59
7.4.2	Standard test signal number 2	59
7.4.3	Standard test signal number 3	59
7.4.4	Standard test signal number 4	59
8	Physical radio tests	60
8.1	Transceiver protection test	60
8.1.1	Purpose	60
8.1.2	Method of measurement	60
8.1.3	Required results	61
8.2	TDMA transmitter	61
8.2.1	General	61
8.2.2	Frequency error	61

8.2.3	Carrier power.....	61
8.2.4	Modulation spectrum slotted transmission.....	62
8.2.5	Transmitter test sequence and modulation accuracy verification.....	63
8.2.6	Transmitter output power versus time function.....	64
8.2.7	Intermodulation attenuation (Type 1 only).....	66
8.3	TDMA receivers.....	67
8.3.1	Sensitivity.....	67
8.3.2	Error behaviour at high input levels.....	68
8.3.3	Co-channel rejection.....	68
8.3.4	Adjacent channel selectivity.....	69
8.3.5	Spurious response rejection.....	70
8.3.6	Intermodulation response rejection.....	72
8.3.7	Blocking or desensitisation.....	73
8.3.8	Conducted spurious emissions at the antenna.....	74
Annex A (normative)	Configuration structures.....	75
A.1	General.....	75
A.2	PI sentences for repeater stations.....	77
A.2.1	RFS – Repeater station FATDMA slots.....	77
A.2.2	RMF – Repeater station MMSI filter.....	79
A.2.3	Area configuration.....	79
A.3	Configuration via VDL using Message 26.....	83
Annex B (informative)	Test area arrangement.....	103
Bibliography	104
Figure 1	– Functional block diagram of an AIS repeater station.....	14
Figure 2	– Power versus time characteristics.....	32
Figure 3	– Format for repeating four-packet cluster.....	60
Figure 4	– Measurement arrangement.....	61
Figure 5	– Measurement arrangement.....	62
Figure 6	– Modulation spectrum of slotted transmission.....	63
Figure 7	– Measurement arrangement.....	63
Figure 8	– Power versus time characteristics.....	65
Figure 9	– Measurement arrangement.....	66
Figure 10	– Measurement arrangement.....	67
Figure 11	– Measurement arrangement.....	68
Figure 12	– Measurement arrangement.....	68
Figure 13	– Measurement arrangement.....	69
Figure 14	– SINAD or PER/BER measuring equipment.....	71
Figure 15	– Measurement arrangement.....	72
Figure 16	– Measurement arrangement.....	73
Figure B.1	– Test area arrangement.....	103
Table 1	– SOTDMA communication state of received station.....	12
Table 2	– ITDMA Communication state of received station.....	13
Table 3	– ITDMA communication state of received station with rescheduling.....	13
Table 4	– Duplicate message filtering parameters.....	16

Table 5 – Repeater station behaviour for message repeat.....	17
Table 6 – Contents of Message 26 used for repeater station identification	23
Table 7 – Alarm status definition for Table 6	24
Table 8 – Message 8 structure with AIS-SART related content.....	24
Table 9 – Configurable parameters	25
Table 10 – Repetition parameters	26
Table 11 – Area related configuration parameters	28
Table 12 – Repeater station input/output sentence formatters.....	30
Table 13 – Transmitter parameters	31
Table 14 – Power versus time characteristics for Figure 2	32
Table 15 – Required parameter settings for a repeater station	33
Table 16 – Required settings of physical layer constants	33
Table 17 – Modulation parameters of the physical layer of the repeater station	33
Table 18 – Required receiver characteristics	34
Table 19 – Factory default values	35
Table 20 – Standard test set-up	36
Table 21 – Test area of standard test set-up.....	37
Table 22 – Content of first two packets	60
Table 23 – Fixed PRS data derived from Recommendation ITU-T O.153.....	60
Table 24 – Power versus time characteristics	65
Table 25 – Frequencies for intermodulation tests	73
Table A.1 – Basic system parameters	76
Table A.2 – General repetition parameters.....	77
Table A.3 – Basic structure of Message 26	84
Table A.4 – Message 26 repeater command IDs	84
Table A.5 – EPV configuration	85
Table A.6 – EPV query.....	86
Table A.7 – Property identifiers for use with EPV – Basic system parameters	87
Table A.8 – Property identifiers for use with EPV – General repetition parameters.....	88
Table A.9 – AES key configuration.....	89
Table A.10 – RFS configuration	90
Table A.11 – RFS query.....	91
Table A.12 – RMF configuration.....	92
Table A.13 – RMF query	93
Table A.14 – RA1 configuration	94
Table A.15 – RA1 query.....	95
Table A.16 – RA2 configuration	96
Table A.17 – RA2 query.....	98
Table A.18 – RA3 configuration	99
Table A.19 – RA3 query.....	100
Table A.20 – RA4 configuration	101
Table A.21 – RA4 query.....	102

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**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62320-3 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

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.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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

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