

# INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems – Class B  
shipborne equipment of the automatic identification system (AIS) –  
Part 2: Self-organising time division multiple access (SOTDMA) techniques**



**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2017 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.

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)

**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 corrigenda or an amendment might have been published.

**IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)**

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

**IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)**

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 It also gives information on projects, replaced and withdrawn publications.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](http://webstore.iec.ch/justpublished)**

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

**Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions 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](http://std.iec.ch/glossary)**

65 000 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.

**IEC Customer Service Centre - [webstore.iec.ch/csc](http://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: [csc@iec.ch](mailto:csc@iec.ch).

# INTERNATIONAL STANDARD



---

**Maritime navigation and radiocommunication equipment and systems – Class B  
shipborne equipment of the automatic identification system (AIS) –  
Part 2: Self-organising time division multiple access (SOTDMA) techniques**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 47.020.70

ISBN 978-2-8322-3906-3

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	8
1 Scope.....	10
2 Normative references .....	10
3 Terms, definitions and abbreviated terms .....	11
3.1 Terms and definitions.....	11
3.2 Abbreviated terms.....	11
4 General requirements .....	12
4.1 General.....	12
4.1.1 Capabilities of the Class B "SO" AIS.....	12
4.1.2 Quality assurance.....	12
4.1.3 Safety of operation .....	13
4.1.4 Additional features.....	13
4.1.5 Functionality .....	13
4.2 Manuals .....	13
4.3 Marking and identification .....	13
5 Environmental, power supply, interference and safety requirements .....	13
6 Performance requirements.....	14
6.1 Internal processes .....	14
6.2 Operating frequency channels.....	15
6.3 Internal GNSS receiver for position reporting .....	15
6.4 Identification .....	15
6.5 AIS Information.....	15
6.5.1 Information content.....	15
6.5.2 Information reporting intervals .....	16
6.5.3 Short safety-related messages .....	17
6.5.4 Permissible initialisation period.....	17
6.6 Alarms and indications, fall-back arrangements .....	17
6.6.1 Built-in integrity tests (BIIT) .....	17
6.6.2 Transmitter shutdown procedure.....	18
6.6.3 Position sensor fallback conditions .....	19
6.7 User interface .....	19
6.7.1 Indication and display.....	19
6.7.2 Static data input .....	20
6.7.3 External interfaces.....	20
6.8 Protection from invalid control commands .....	20
7 Technical requirements .....	20
7.1 General.....	20
7.2 Physical layer .....	21
7.2.1 General .....	21
7.2.2 Receiver characteristics.....	21
7.2.3 Other characteristics.....	22
7.2.4 Transmitter requirements.....	23
7.3 Link layer .....	24
7.3.1 General .....	24
7.3.2 Link sub-layer 1: medium access control (MAC).....	24
7.3.3 Link sub-layer 2: data link service (DLS).....	26

7.3.4	Link sub-layer 3: link management entity (LME) .....	26
7.4	Network layer .....	30
7.4.1	General .....	30
7.4.2	Management of regional operating settings .....	30
7.4.3	Multi-channel operation .....	31
7.5	Transport layer .....	31
7.6	Presentation interface .....	32
7.7	DSC receive capability .....	32
7.8	Long-range application by broadcast .....	32
8	Test conditions .....	32
8.1	General .....	32
8.2	Normal test conditions .....	32
8.2.1	Temperature and humidity .....	32
8.2.2	Power supply .....	33
8.3	Extreme test conditions .....	33
8.4	Test signals .....	33
8.4.1	Standard test signal number 1 .....	33
8.4.2	Standard test signal number 2 .....	33
8.4.3	Standard test signal number 3 .....	33
8.4.4	Standard test signal number 4 .....	33
8.5	Standard test environment .....	34
8.5.1	Test setup .....	34
8.5.2	Sensor test input .....	35
8.5.3	Synchronisation .....	35
8.5.4	Test signals applied to the receiver input .....	35
8.5.5	Waiver for receivers .....	35
8.5.6	Artificial antenna (dummy load) .....	35
8.5.7	Modes of operation of the transmitter .....	35
8.5.8	Common test conditions for protection from invalid controls .....	35
8.5.9	Measurement uncertainties .....	35
9	Power supply, environmental and EMC tests .....	36
9.1	Test summary .....	36
9.2	Vibration .....	37
9.2.1	Purpose .....	37
9.2.2	Method of measurement .....	37
9.2.3	Required results .....	38
9.3	Shock .....	38
9.3.1	Purpose .....	38
9.3.2	Method of measurement .....	38
9.3.3	Required result .....	38
9.4	Performance tests/checks .....	38
9.5	Under voltage test (brown out) .....	38
9.5.1	Purpose .....	38
9.5.2	Method of test .....	38
9.5.3	Required result .....	39
9.6	Under voltage test (short term) .....	39
9.6.1	Purpose .....	39
9.6.2	Method of test .....	39
9.6.3	Required result .....	39

10	Operational tests .....	39
10.1	General.....	39
10.1.1	Tests by inspection.....	39
10.1.2	Safety of operation .....	39
10.1.3	Additional features.....	40
10.2	Modes of operation .....	40
10.2.1	Autonomous mode.....	40
10.2.2	Single messages .....	42
10.2.3	Polled mode and interrogation response .....	45
10.3	Channel selection .....	45
10.3.1	Valid channels .....	46
10.3.2	Invalid channels.....	46
10.4	Internal GNSS receiver .....	46
10.5	AIS information .....	46
10.5.1	Information content.....	46
10.5.2	Information update intervals .....	47
10.6	Initialisation period.....	49
10.6.1	Purpose.....	49
10.6.2	Method of measurement .....	49
10.6.3	Required results .....	49
10.7	Alarms and indications, fall-back arrangements .....	49
10.7.1	Built in integrity test.....	49
10.7.2	Transceiver protection .....	50
10.7.3	Transmitter shutdown procedure.....	50
10.7.4	Position sensor fallback conditions .....	50
10.8	User interface .....	51
10.8.1	Status indication .....	51
10.8.2	Message display.....	51
10.8.3	Static data input .....	52
11	Physical tests .....	53
11.1	TDMA transmitter.....	53
11.1.1	Frequency error .....	53
11.1.2	Carrier power.....	53
11.1.3	Transmission spectrum.....	54
11.1.4	Modulation accuracy.....	55
11.1.5	Transmitter output power versus time function .....	56
11.2	TDMA receivers .....	57
11.2.1	Sensitivity.....	57
11.2.2	Error behaviour at high input levels.....	58
11.2.3	Co-channel rejection.....	58
11.2.4	Adjacent channel selectivity.....	59
11.2.5	Spurious response rejection .....	60
11.2.6	Intermodulation response rejection .....	62
11.2.7	Blocking or desensitisation .....	63
11.3	Conducted spurious emissions.....	64
11.3.1	Spurious emissions from the receiver .....	64
11.3.2	Spurious emissions from the transmitter .....	64
12	Specific tests of link layer .....	65
12.1	TDMA synchronisation .....	65

12.1.1	Synchronisation test using UTC direct and indirect .....	65
12.1.2	Synchronisation test without UTC, EUT receiving semaphore .....	66
12.2	Time division (frame format) .....	66
12.2.1	Purpose .....	66
12.2.2	Method of measurement .....	66
12.2.3	Required results .....	66
12.3	Synchronisation jitter .....	66
12.3.1	Definition .....	66
12.3.2	Purpose .....	67
12.3.3	Method of measurement .....	67
12.3.4	Required results .....	67
12.4	Data encoding (bit stuffing) .....	67
12.4.1	Purpose .....	67
12.4.2	Method of measurement .....	67
12.4.3	Required results .....	67
12.5	Frame check sequence .....	67
12.5.1	Purpose .....	67
12.5.2	Method of measurement .....	67
12.5.3	Required results .....	67
12.6	Slot allocation (channel access protocols).....	68
12.6.1	Network entry .....	68
12.6.2	Autonomous scheduled transmissions (SOTDMA) .....	68
12.6.3	Autonomous scheduled transmissions (ITDMA) .....	68
12.6.4	Transmission of Messages 24A and 24B (ITDMA) .....	68
12.6.5	Assigned operation .....	69
12.6.6	Group assignment .....	71
12.6.7	Base station reservations .....	75
12.7	Message formats .....	75
12.7.1	Received messages.....	75
12.7.2	Transmitted messages.....	75
13	Specific tests of network layer .....	76
13.1	Regional area designation by VDL Message .....	76
13.1.1	Purpose .....	76
13.1.2	Method of measurement .....	76
13.1.3	Required results .....	77
13.2	Channel management by addressed Message 22 .....	78
13.2.1	Purpose .....	78
13.2.2	Method of measurement .....	78
13.2.3	Required results .....	78
13.3	Invalid regional operating areas .....	78
13.3.1	Purpose .....	78
13.3.2	Method of measurement .....	78
13.3.3	Required results .....	78
13.4	Continuation of autonomous mode reporting interval.....	78
13.4.1	Purpose .....	78
13.4.2	Method of test.....	79
13.4.3	Required result .....	79
13.5	Slot reuse and FATDMA reservations .....	79
13.5.1	Method of measurement .....	79

13.5.2	Required results .....	79
13.6	Long-range application by broadcast.....	79
13.6.1	Long-range broadcast.....	79
13.6.2	Multiple assignment operation .....	80
13.7	Other features.....	81
Annex A (normative)	DSC channel management.....	82
A.1	DSC functionality .....	82
A.2	DSC time sharing.....	82
A.3	DSC test signals .....	83
A.3.1	DSC test signal number 1 .....	83
A.3.2	DSC test signal number 2 .....	83
A.3.3	DSC test signal number 3 .....	83
A.3.4	DSC test signal number 4 .....	83
A.4	DSC functionality tests.....	83
A.4.1	General .....	83
A.4.2	Method of measurement .....	83
A.4.3	Required results .....	84
A.4.4	Regional area designation .....	84
A.4.5	Scheduling .....	84
A.4.6	DSC flag in Message 18 .....	84
A.4.7	DSC monitoring time plan .....	85
A.4.8	Replacement or erasure of dated or remote regional operating settings.....	85
A.4.9	Test of addressed telecommand .....	86
A.4.10	Invalid regional operating areas.....	86
A.5	DSC receiver tests.....	86
A.5.1	General .....	86
A.5.2	Maximum sensitivity.....	87
A.5.3	Error behaviour at high input levels.....	87
A.5.4	Co-channel rejection.....	87
A.5.5	Adjacent channel selectivity.....	88
A.5.6	Spurious response rejection .....	88
A.5.7	Inter-modulation response rejection .....	88
A.5.8	Blocking or desensitisation .....	89
Annex B (normative)	Calculation of area size.....	90
B.1	Importance of a common method for area size .....	90
B.2	Calculation of area sizes.....	90
Annex C (informative)	Digital interface sentence to parameter group number equivalence .....	91
Bibliography	.....	92
Figure 1	– OSI layer model .....	21
Figure 2	– Power versus time mask .....	25
Figure 3	– Format for repeating four-packet cluster.....	33
Figure 4	– Measurement arrangement for carrier power .....	53
Figure 5	– Emission mask.....	55
Figure 6	– Measurement arrangement for modulation accuracy .....	55
Figure 7	– Measurement arrangement .....	57
Figure 8	– Measurement arrangement with two generators .....	58

Figure 9 – SINAD or PER/BER measuring equipment .....	61
Figure 10 – Measurement arrangement for intermodulation.....	62
Figure 11 – Regional transitional zones .....	77
Table 1 – Dynamic information autonomous reporting intervals for Class B "SO" AIS.....	16
Table 2 – BIIT and reaction to malfunctions .....	18
Table 3 – Position sensor fallback conditions .....	19
Table 4 – Required receiver performance .....	22
Table 5 – Transceiver characteristics.....	22
Table 6 – Transmitter characteristics .....	24
Table 7 – Definitions of timing for Figure 2.....	26
Table 8 – Use of VDL Messages by a Class B "SO" AIS .....	29
Table 9 – Content of first two packets .....	34
Table 10 – Fixed PRS data derived from ITU-T O.153.....	34
Table 11 – Test.....	37
Table 12 – Peak frequency deviation versus time.....	56
Table 13 – Frequencies for intermodulation test.....	63
Table 14 – Regional area scenario.....	77
Table 15 – Required channels in use .....	77
Table A.1 – DSC monitoring times .....	83
Table B.1 – Coordinate points.....	90
Table C.1 – Digital sentence to PGN equivalence .....	91

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

### **MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – CLASS B SHIPBORNE EQUIPMENT OF THE AUTOMATIC IDENTIFICATION SYSTEM (AIS) –**

#### **Part 2: Self-organising time division multiple access (SOTDMA) techniques**

#### 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 62287-2 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

This second edition cancels and replaces the first edition published in 2013. It constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition: the introduction of transmission of Message 27 on channels 75 and 76 for the long range application by broadcast.

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

FDIS	Report on voting
80/827/FDIS	80/836/RVD

Full information on the voting for the approval of this document 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 62287 series, published under the general title *Maritime navigation and radiocommunication and systems – Class B shipborne equipment of the 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 web site 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.

A bilingual version of this publication may be issued at a later date.

**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.**

# MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – CLASS B SHIPBORNE EQUIPMENT OF THE AUTOMATIC IDENTIFICATION SYSTEM (AIS) –

## Part 2: Self-organising time division multiple access (SOTDMA) techniques

### 1 Scope

This part of IEC 62287 specifies operational and performance requirements, methods of testing and required test results for Class B "SO" shipborne automatic identifications system (AIS) equipment using self-organising time division multiple access (SOTDMA) techniques as described in Recommendation ITU-R M.1371. This document takes into account other associated IEC International Standards and existing national standards, as applicable.

The main differences between Class B "CS" (IEC 62287-1) and Class B "SO" units are that the Class B "SO"

- covers all 25 kHz channels listed in Recommendation ITU-R M.1084-5,
- only uses the internal GNSS – no position sensor input is allowed,
- requires use of VDL Message 17 for correction of the internal GNSS,
- requires a presentation interface,
- has additional reporting intervals, down to 5 s,
- has two power settings, with a high level of 5 W, and
- has the capability to transmit binary messages.

This document is applicable for AIS equipment used on craft that are not covered by a mandatory carriage requirement of AIS under SOLAS Chapter V.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60945:2002, *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 61108-4, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 4: Shipborne DGPS and DGLONASS maritime radio beacon receiver equipment – Performance 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*