



IEC 62287-1

Edition 2.0 2010-11

INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems – Class B
shipborne equipment of the automatic identification system (AIS) –
Part 1: Carrier-sense time division multiple access (CSTDMA) techniques**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XD**

ICS 47.020.70

ISBN 978-2-88912-257-8

CONTENTS

FOREWORD.....	7
1 Scope.....	9
2 Normative references.....	9
3 Abbreviations.....	10
4 General requirements	11
4.1 General.....	11
4.1.1 Capabilities of the Class B“CS” AIS.....	11
4.1.2 Quality assurance	12
4.1.3 Safety of operation.....	12
4.1.4 Additional features	12
4.1.5 Modes of operation.....	12
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 Composition	14
6.2 Operating frequency channels	14
6.3 GNSS receiver for position reporting.....	14
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 Permissible initialisation period.....	17
6.6 Alarms and indications, fall-back arrangements.....	17
6.6.1 Integrity and protection	17
6.6.2 Transmitter shutdown procedure.....	17
6.6.3 Position sensor fallback conditions.....	17
6.6.4 SOG/COG sensor fallback conditions	19
6.7 User interface.....	19
6.7.1 Indicators and display.....	19
6.7.2 Static data input.....	19
6.7.3 External interfaces	19
6.8 Protection from invalid control commands.....	19
7 Technical requirements	20
7.1 General.....	20
7.2 Physical layer	20
7.2.1 General.....	20
7.2.2 Transceiver characteristics.....	21
7.2.3 Transmitter requirements	22
7.2.4 Receiver requirements.....	22
7.3 Link layer	23
7.3.1 General.....	23
7.3.2 Link sublayer 1: Medium access control (MAC)	23
7.3.3 Link sublayer 2: Data Link Service (DLS).....	26
7.3.4 Link sublayer 3: Link management entity (LME).....	30

7.4	Network layer	39
7.4.1	General.....	39
7.4.2	Dual channel operation.....	39
7.4.3	Channel management.....	40
7.4.4	Distribution of transmission packets	40
7.4.5	Data link congestion resolution	40
7.5	Transport layer	40
7.5.1	General.....	40
7.5.2	Transmission packets.....	41
7.5.3	Sequencing of data packets	41
7.6	Digital selective calling (DSC)	41
8	Test conditions.....	41
8.1	General.....	41
8.2	Normal and extreme test conditions	41
8.2.1	Normal test conditions	41
8.2.2	Extreme test conditions.....	41
8.3	Test signals.....	41
8.3.1	Standard test signal number 1	42
8.3.2	Standard test signal number 2	42
8.3.3	Standard test signal number 3	42
8.3.4	Standard test signal number 4	42
8.3.5	Standard test signal number 5	42
8.4	Test arrangements	43
8.4.1	Standard test environment	43
8.4.2	Modes of operation of the transmitter	44
8.4.3	Common test conditions for protection from invalid controls.....	44
8.4.4	Measurement uncertainties	44
9	Power supply, environmental and EMC tests	45
9.1	Test summary.....	45
9.2	Vibration/shock.....	46
9.2.1	Vibration	46
9.2.2	Shock	46
9.3	Performance tests/checks.....	46
9.4	Undervoltage test (brown out)	47
9.4.1	Purpose	47
9.4.2	Method of test.....	47
9.4.3	Required result	47
10	Operational tests	47
10.1	General.....	47
10.1.1	Quality assurance	47
10.1.2	Safety of operation.....	47
10.1.3	Additional features	47
10.2	Modes of operation	48
10.2.1	Autonomous mode	48
10.2.2	Assigned mode	49
10.2.3	Polled mode/interrogation response	50
10.3	Messages extending one time period	51
10.3.1	Method of measurement	51
10.3.2	Required results.....	51

10.4	Channel selection	51
10.4.1	Valid channels	51
10.4.2	Invalid channels	51
10.5	Internal GNSS receiver	51
10.6	AIS information	52
10.6.1	Information content	52
10.6.2	Information update rates	53
10.7	Initialisation period	54
10.7.1	Method of measurement	54
10.7.2	Required results	54
10.8	Alarms and indications, fall-back arrangements	54
10.8.1	Built-in integrity test	55
10.8.2	Transceiver protection	55
10.8.3	Transmitter shutdown procedure	55
10.8.4	Position sensor fallback conditions	55
10.8.5	Speed sensors	56
10.9	User interface	56
10.9.1	Display	56
10.9.2	Message display	56
10.9.3	Static data input	57
10.9.4	External interfaces	57
11	Physical tests	57
11.1	TDMA transmitter	57
11.1.1	Frequency error	57
11.1.2	Carrier power	58
11.1.3	Transmission spectrum	59
11.1.4	Modulation accuracy	60
11.1.5	Transmitter output power versus time function	61
11.2	TDMA receivers	62
11.2.1	Sensitivity	62
11.2.2	Error behaviour at high input levels	62
11.2.3	Co-channel rejection	63
11.2.4	Adjacent channel selectivity	64
11.2.5	Spurious response rejection	64
11.2.6	Intermodulation response rejection	67
11.2.7	Blocking or desensitisation	68
11.3	Conducted spurious emissions	69
11.3.1	Spurious emissions from the receiver	69
11.3.2	Spurious emissions from the transmitter	69
12	Specific tests of link layer	70
12.1	TDMA synchronisation	70
12.1.1	Synchronisation test sync mode 1	70
12.1.2	Synchronisation test sync mode 2	71
12.1.3	Synchronisation test with UTC	71
12.2	Carrier-sense tests	71
12.2.1	Threshold level	71
12.2.2	Carrier-sense timing	73
12.3	VDL state/reservations	74
12.3.1	Method of measurement	74

12.3.2 Required results.....	74
12.4 Data encoding (bit stuffing)	74
12.4.1 Method of measurement	74
12.4.2 Required results.....	74
12.5 Frame check sequence	74
12.5.1 Method of measurement	74
12.5.2 Required results.....	74
12.6 Slot allocation (channel access protocol)	74
12.6.1 Autonomous mode allocation.....	74
12.6.2 DSC listening periods	75
12.7 Assigned operation	75
12.7.1 Assignment priority.....	75
12.7.2 Entering rate assignment	75
12.7.3 Reverting from rate assignment	76
12.7.4 Reverting from quiet mode	76
12.7.5 Retry of interrogation response.....	76
12.8 Message formats.....	76
12.8.1 Received messages	76
12.8.2 Transmitted messages.....	77
13 Specific tests of network layer.....	77
13.1 Regional area designation by VDL message	77
13.1.1 Method of measurement	77
13.1.2 Required results.....	78
13.2 Regional area designation by serial message or manually	78
13.2.1 Method of measurement	78
13.2.2 Required result	78
13.3 Management of received regional operating settings.....	78
13.3.1 Replacement or erasure of dated or remote regional operating settings	78
13.3.2 Channel management by addressed Message 22	79
13.3.3 Invalid regional operating areas.....	79
13.3.4 Continuation of autonomous mode reporting rate.....	80
13.3.5 Other conditions.....	80
Annex A (informative) Results of computer simulations and testing of CSTDMA technology	81
Annex B (informative) Description of the system	84
Annex C (normative) DSC channel management.....	85
Annex D (informative) Channel management regions	92
Bibliography.....	93
Figure 1 – OSI layer model.....	20
Figure 2 – Carrier-Sense timing	24
Figure 3 – Power versus time mask.....	25
Figure 4 – Transmission packet	26
Figure 5 – Training sequence	28
Figure 6 – Transmission timing	30
Figure 7 – Example for CSTDMA access.....	31
Figure 8 – Format for repeating four-packet cluster.....	42

Figure 9 – Measurement arrangement for carrier power.....	58
Figure 10 – Emission mask.....	59
Figure 11 – Measurement arrangement for modulation accuracy	60
Figure 12 – Measurement arrangement.....	62
Figure 13 – Measurement arrangement with two generators.....	63
Figure 14 – SINAD or PER/BER measuring equipment	65
Figure 15 – Measurement arrangement for intermodulation.....	67
Figure 16 – Configuration for carrier-sense threshold test.....	72
Figure 17 – Regional area scenario	77
Figure A.1 – Effect on Class A AIS messages of Class B messages	81
Figure A.2 – Reception of messages by Class A AIS.....	82
Figure A.3 – Reception of messages by Class B AIS.....	82
Figure A.4 – Range achieved by a Class A AIS from Class B AIS	83
Figure D.1 – Channel management regions used for test given in 13.3.1.....	92
Table 1 – Position sensor fallback conditions	18
Table 2 – Use of accuracy (PA) flag	18
Table 3 – Transceiver characteristics	21
Table 4 – Transmitter parameters	22
Table 5 – Receiver parameters	23
Table 6 – Definition of timings for Figure 3.....	25
Table 7 – Start-buffer.....	27
Table 8 – Summary of the transmission packet.....	29
Table 9 – Transmission timing	29
Table 10 – Access parameters.....	31
Table 11 – Use of VDL messages by a Class B"CS" AIS.....	34
Table 12 – Number of data bits for use with Message 14	35
Table 13 – Contents of Message 18	36
Table 14 – Message 24 Part A.....	37
Table 15 – Message 24 Part B.....	37
Table 16 – Contents of Message 23	38
Table 17 – Reporting Interval Settings for use with Message 23.....	39
Table 18 – Channel management.....	40
Table 19 – Content of first two packets	42
Table 20 – Fixed PRS data derived from ITU-T.O.153	43
Table 21 – Test summary.....	45
Table 22 – Peak frequency deviation versus time.....	61
Table 23 – Frequencies for inter-modulation test	68
Table 24 – Required threshold test results	73
Table 25 – Required carrier-sense timing results	73
Table 26 – Required channels in use.....	78
Table C.1 – DSC monitoring times.....	86

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MARITIME NAVIGATION AND RADIOCOMMUNICATION
EQUIPMENT AND SYSTEMS –
CLASS B SHIPBORNE EQUIPMENT OF
THE AUTOMATIC IDENTIFICATION SYSTEM (AIS) –****Part 1: Carrier-sense time division multiple access
(CSTDMA) 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 62287-1 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 2006, and constitutes a technical revision.

The major technical changes with respect to the first edition are the following. The reference to the relevant recommendation of the ITU has been updated from M.1371-1 to M.1371-4 with some consequential small changes. A previous option of providing short safety-related messages in 6.5.1.5 has been removed on advice from the IMO. A new requirement for a default MMSI has been added in 6.4 and a further new requirement for protection from invalid control commands has been added in 6.8. Some test methods have been updated and, in

particular, small revisions have been made to the frequencies used for testing in some of the test methods. The introduction has been deleted since it is only of historic interest.

Some editorial rearrangement has been made.

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

FDIS	Report on voting
80/605/FDIS	80/608/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 of the IEC 62287 series published under the general title *Maritime navigation and radiocommunication equipment 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 1: Carrier-sense time division multiple access
(CSTDMA) techniques**

1 Scope

This part of IEC 62287 specifies the minimum operational and performance requirements, methods of testing and required test results for Class B shipborne AIS equipment using CSTDMA techniques. This standard takes into account other associated IEC International Standards and existing national standards, as applicable.

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

An AIS station intended to operate in receive-only mode is not considered a Class B shipborne mobile AIS station.

2 Normative references

The following referenced documents are indispensable for the application 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 61162 (all parts), *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*

IEC 61993-2, *Maritime navigation and radiocommunication equipment and systems – Automatic identification systems (AIS) – Part 2: Class A shipborne equipment of the universal automatic identification system (AIS) – Operational and performance requirements, methods of test and required test results*

IEC 62320-1, *Maritime navigation and radiocommunication equipment and systems – Automatic identification systems (AIS) – Part 1: AIS Base Stations – Minimum operational and performance requirements, methods of testing and required test results*

IMO MSC.140(76), *Recommendation for the protection of the AIS VHF data link*

ITU-R Recommendation M.493-13, *Digital selective-calling system for use 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.1084-4, *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 a universal shipborne automatic identification system using time division multiple access in the VHF maritime mobile band*

ITU Radio Regulations, Appendix 18, <http://www.itu.int/publ/R-REG-RR/en>