

DIN EN 62287-2

ICS 47.020.70

EntwurfEinsprüche bis 2016-12-21
Vorgesehen als Ersatz für
DIN EN 62287-2:2014-02

**Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt –
Geräte der Klasse B des automatischen Identifikationssystems (AIS) für Schiffe –
Teil 2: Sich selbst abstimmende Zeitmultiplex-Vielfachzugriffstechniken (SOTDMA)
(IEC 80/794/CDV:2016);
Englische Fassung FprEN 62287-2:2016**

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
(IEC 80/794/CDV:2016);
English version FprEN 62287-2:2016

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2016-10-21 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfs besonders zu vereinbaren.

Stellungnahmen werden erbeten

- vorzugsweise online im Norm-Entwurfs-Portal des DIN unter www.din.de/go/entwuerfe bzw. für Norm-Entwürfe der DKE auch im Norm-Entwurfs-Portal der DKE unter www.entwuerfe.normenbibliothek.de, sofern dort wiedergegeben;
- oder als Datei per E-Mail an dke@vde.com möglichst in Form einer Tabelle. Die Vorlage dieser Tabelle kann im Internet unter www.din.de/go/stellungnahmen-norm-entwuerfe oder für Stellungnahmen zu Norm-Entwürfen der DKE unter www.dke.de/stellungnahme abgerufen werden;
- oder in Papierform an die DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE, Stresemannallee 15, 60596 Frankfurt am Main.

Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 95 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE
DIN-Normenstelle Schiffs- und Meerestechnik (NSMT)

Nationales Vorwort

Die Englische Fassung des europäischen Dokuments FprEN 62287-2:2016 „Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt – Geräte der Klasse B des automatischen Identifikationssystems (AIS) für Schiffe – Teil 2: Sich selbst abstimme Zeitmultiplex-Vielfachzugriffstechniken (SOTDMA)“ (Entwurf in der Umfrage) ist unverändert in diesen Norm-Entwurf übernommen worden.

Die Internationale Elektrotechnische Kommission (IEC) und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Umfrage (CDV-Stadium) und Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dem entsprechend ist das internationale Dokument IEC 80/794/CDV:2016 „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“ unverändert in den Entwurf Englische Fassung FprEN 62287-2:2016 übernommen worden.

Das internationale Dokument wurde vom TC 80 „Maritime navigation and radiocommunication equipment and systems“ der Internationalen Elektrotechnischen Kommission (IEC) erarbeitet.

Bei der Abstimmung zu dem Europäischen Schluss-Entwurf bei CENELEC und dem Internationalen Schluss-Entwurf bei IEC [Final Draft International Standard (FDIS)] sind jeweils nur „JA/NEIN“-Entscheidungen möglich, wobei „NEIN“-Entscheidungen fundiert begründet werden müssen. Dokumente, die bei CENELEC als Europäische Norm angenommen und ratifiziert werden, sind unverändert als Deutsche Normen zu übernehmen.

Für dieses Dokument ist das nationale Arbeitsgremium K 738 „Elektronische Navigationsinstrumente“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE (www.dke.de) zuständig.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf ein Dokument ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils aktuellste Ausgabe des in Bezug genommenen Dokuments.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe des Dokuments.

Der Zusammenhang der zitierten Dokumente mit den entsprechenden Deutschen Dokumenten ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für den vorliegenden Normentwurf erfüllt.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der FprEN 62287-1 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt, und Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als Nationaler Anhang NA des vorliegenden Normentwurfs hinzugefügt. Für einige der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Dieser Normentwurf steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Es ist vorgesehen, auch bei der entsprechenden zukünftigen Deutschen Norm auf die deutsche Sprachfassung zu verzichten und diese in der englischsprachigen Fassung zu veröffentlichen.

Es wird auf die Möglichkeit hingewiesen, dass einige Elemente dieses Dokuments Patentrechte berühren können. ISO [und/oder] IEC sind nicht dafür verantwortlich, einige oder alle diesbezüglichen Patentrechte zu identifizieren.

Änderungen

Gegenüber DIN EN 62287-2:2014-02 wurden folgende Änderungen vorgenommen:

- a) Einführung der Übertragung der Meldung 27 auf den Kanälen 75 und 76 zur weitreichenden Anwendung beim Rundsenden.

Nationaler Anhang NA (informativ)

Auszugsweise Übersetzung^{N1)}

1 Anwendungsbereich

Dieser Teil der Internationalen Norm IEC 62287 legt die Betriebs- und -Leistungsanforderungen, die Prüfverfahren und geforderten Prüfergebnisse für AIS-Geräte der Klasse B „SO“ mit sich selbst organisierender Zeitmultiplextechnik auf Schiffen fest, wie in der ITU-R Empfehlung M.1371 beschrieben. Soweit erforderlich berücksichtigt diese Norm andere zugehörige Internationale Normen von IEC und anwendbare bestehende nationale Normen.

Die Hauptunterschiede zwischen Klasse B „CS“ (IEC 62287-1) und Klasse B „SO“ Einheiten sind, dass Klasse B „SO“

- alle 25 kHz-Kanäle abdeckt, die in der ITU-R Empfehlung M.1084-5 gelistet sind;
- nur das interne GNSS nutzen – es ist kein Positionssensor Eingangssignal erlaubt;
- die Anwendung der VDL Meldung 17 zur Korrektur des internen GNSS erfordert;
- eine Anzeigeschnittstelle hat;
- zusätzliche Berichtsintervalle hat, bis herunter auf 5 s;
- zwei Leistungseinstellungen hat mit einem oberen Wert von 5 W und
- binäre Meldungen übertragen kann.

Die Norm ist anwendbar für AIS Geräte, die auf Schiffen genutzt werden, für die nach SOLAS Kapitel V keine Verpflichtung zum Einsatz von AIS besteht.

3 Abkürzungen

AIS	automatisches Identifikationssystem (en: Automatic Identification System)
BER	Bitfehlerrate (en: Bit Error Rate)
BIIT	integrierte Integritätsprüfung (en: Built-In Integrity Tests)
BT	Zeit-Bandbreite-Produkt (en: Bandwidth Time)
COG	Fahrtrichtung über Grund (en: Course over ground)
CRC	zyklische Redundanzprüfung (en: Cyclic Redundancy Check)
CSD	Kompassschutzabstand (en: Compass Safe Distance)
DGNSS	differentielles globales Satellitennavigationssystem (en: Differential Global Navigation Satellite Service)
DLS	Daten-Verbindungsdienst (en: Data Link Service)
DSC	digitaler Selektivruf (en: Digital Selective Calling)
EUT	Gerät im Test (en: Equipment under test)
FM	Frequenzmodulation (en: Frequency Modulation)
GMSK	Gaußsche Modulation mit minimaler Bandbreite (en: Gaussian Minimum Shift Keying)
GNSS	globales Satellitennavigationssystem (en: Global Navigation Satellite Service)
IMO	Internationale Seeschiffahrtsorganisation (en: International Maritime Organization)

^{N1)} Nationale Fußnote: Die Nummerierung aus IEC 80/794/CDV:2016-04 wurde beibehalten.

ITDMA	schrittweiser Zeitmehrfachzugriff (en: Incremental Time Division Multiple Access)
ITU	Internationale Fernmeldeunion (en: International Telecommunication Union)
LME	Verbindungsverwaltungseinrichtung (en: Link Management Entity)
MAC	Medienzugriffssteuerung (en: Medium access control)
MMSI	Rufnummer des mobiles Seefunkdienstes (en: Maritime Mobile Service Identity)
MSSA	Mehrkanalzugriffsverfahren (en: Multi-channel slot selection access)
NM	Seemeile oder Nautische Meile (en: Nautical mile (1 NM = 1 852 m))
NRZI	NRZI-Übertragungskodierung (en: Non Return to Zero Inverted)
OSI	Verbindungsmodell für Offene Systeme (en: Open Systems Interconnection model)
PER	Paketfehlerrate (en: Packet Error Rate)
PI	Präsentationsschnittstelle (en: Presentation Interface)
RAIM	unabhängige Integritätsprüfung im GNSS-Empfänger (en: Receiver autonomous integrity monitoring)
RATDMA	Zeitmehrfachzugriff mit Direktzugriff (en: Random Access Time Division Multiple Access)
RF	Funkfrequenz (en: Radio Frequency)
RR	Vollzugsordnung für den Funkdienst (VOFunk) (en: Radio Regulations)
Rx	Empfang (en: Receive)
SAR	Suchen und Retten (en: Search and rescue)
SINAD	Verhältnis der Gesamtsignalleistung zur Summe der Störsignale (en: Signal Interference Noise and Distortion ratio)
SOG	Geschwindigkeit über Grund (en: Speed over ground)
SOTDMA	Selbst organisierter Zeitmehrfachzugriff (en: Self Organised Time Division Multiple Access)
TDMA	Zeitmehrfachzugriff (en: Time Division Multiple Access)
Tx	Senden (en: Transmit)
UTC	Koordinierte Weltzeit (en: Universal Time Co-ordinated)
VDL	VHF-Datenverbindung (en: VHF Data Link)
VHF	Ultrakurzwelle (en: Very High Frequency)
VSWR	Stehwellenverhältnis (en: Voltage Standing Wave Ratio)
VTs	Schiffsverkehrsdienste (en: Vessel Traffic Services)

ANMERKUNG Die mit der Normenreihe IEC 61162 festgelegten Abkürzungen sind in der vorstehenden Auflistung nicht enthalten. Für solche Abkürzungen ist auf jene Normenreihe zu verweisen.

– Leerseite –

CONTENTS

1		
2	FOREWORD.....	7
3	1 Scope.....	9
4	2 Normative references	9
5	3 Abbreviations	10
6	4 General requirements	11
7	4.1 General	11
8	4.1.1 Capabilities of the Class B “SO” AIS	11
9	4.1.2 Quality assurance	11
10	4.1.3 Safety of operation	11
11	4.1.4 Additional features.....	12
12	4.1.5 Functionality.....	12
13	4.2 Manuals	12
14	4.3 Marking and identification.....	12
15	5 Environmental, power supply, interference and safety requirements	12
16	6 Performance requirements	13
17	6.1 Internal processes	13
18	6.2 Operating frequency channels	14
19	6.3 Internal GNSS receiver for position reporting.....	14
20	6.4 Identification.....	14
21	6.5 AIS Information	14
22	6.5.1 Information content.....	14
23	6.5.2 Information reporting intervals	15
24	6.5.3 Short safety-related messages	16
25	6.5.4 Permissible initialisation period	16
26	6.6 Alarms and indications, fall-back arrangements.....	16
27	6.6.1 Built-in integrity tests (BIIT)	16
28	6.6.2 Transmitter shutdown procedure.....	17
29	6.6.3 Position sensor fallback conditions	18
30	6.7 User interface.....	18
31	6.7.1 Indication and display	18
32	6.7.2 Static data input	19
33	6.7.3 External interfaces.....	19
34	6.8 Protection from invalid control commands	19
35	7 Technical requirements	19
36	7.1 General	19
37	7.2 Physical layer.....	20
38	7.2.1 General	20
39	7.2.2 Receiver characteristics	20
40	7.2.3 Other characteristics	21
41	7.2.4 Transmitter requirements.....	22
42	7.3 Link layer	23
43	7.3.1 General	23
44	7.3.2 Link sub-layer 1: Medium Access Control (MAC)	23
45	7.3.3 Link sub-layer 2: Data Link Service (DLS).....	25
46	7.3.4 Link sub-layer 3: Link Management Entity (LME)	25
47	7.4 Network layer	29

48	7.4.1	General	29
49	7.4.2	Management of regional operating settings	29
50	7.4.3	Multi-channel operation	30
51	7.5	Transport layer	30
52	7.6	Presentation Interface	31
53	7.7	DSC receive capability	31
54	8	Test conditions	31
55	8.1	General	31
56	8.2	Normal test conditions	31
57	8.2.1	Temperature and humidity	31
58	8.2.2	Power supply	32
59	8.3	Extreme test conditions	32
60	8.4	Test signals	32
61	8.4.1	Standard test signal number 1	32
62	8.4.2	Standard test signal number 2	32
63	8.4.3	Standard test signal number 3	32
64	8.4.4	Standard test signal number 4	32
65	8.5	Standard test environment	34
66	8.5.1	Test setup	34
67	8.5.2	Sensor test input	34
68	8.5.3	Synchronisation	34
69	8.5.4	Test signals applied to the receiver input	34
70	8.5.5	Waiver for receivers	35
71	8.5.6	Artificial antenna (dummy load)	35
72	8.5.7	Modes of operation of the transmitter	35
73	8.5.8	Common test conditions for protection from invalid controls	35
74	8.5.9	Measurement uncertainties	35
75	9	Power supply, environmental and EMC tests	36
76	9.1	Test summary	36
77	9.2	Vibration	37
78	9.2.1	Purpose	37
79	9.2.2	Method of measurement	37
80	9.2.3	Required results	37
81	9.3	Shock	37
82	9.3.1	Purpose	37
83	9.3.2	Method of measurement	37
84	9.3.3	Required result	37
85	9.4	Performance tests / checks	37
86	9.5	Under voltage test (brown out)	38
87	9.5.1	Purpose	38
88	9.5.2	Method of test	38
89	9.5.3	Required result	38
90	9.6	Under voltage test (short term)	38
91	9.6.1	Purpose	38
92	9.6.2	Method of test	38
93	9.6.3	Required result	38
94	10	Operational tests	38
95	10.1	General	38
96	10.1.1	Tests by inspection	38

97	10.1.2 Safety of operation	39
98	10.1.3 Additional features	39
99	10.2 Modes of operation	39
100	10.2.1 Autonomous mode	39
101	10.2.2 Single messages	41
102	10.2.3 Polled mode / Interrogation response	44
103	10.3 Channel selection	45
104	10.3.1 Valid channels	45
105	10.3.2 Invalid channels	45
106	10.4 Internal GNSS receiver	45
107	10.5 AIS information	46
108	10.5.1 Information content	46
109	10.5.2 Information update intervals	46
110	10.6 Initialisation period	48
111	10.6.1 Purpose	48
112	10.6.2 Method of measurement	48
113	10.6.3 Required results	48
114	10.7 Alarms and indications, fall-back arrangements	48
115	10.7.1 Built in integrity test	48
116	10.7.2 Transceiver protection	49
117	10.7.3 Transmitter shutdown procedure	49
118	10.7.4 Position sensor fallback conditions	49
119	10.8 User interface	50
120	10.8.1 Status indication	50
121	10.8.2 Message display	50
122	10.8.3 Static data input	51
123	11 Physical tests	52
124	11.1 TDMA transmitter	52
125	11.1.1 Frequency error	52
126	11.1.2 Carrier power	52
127	11.1.3 Transmission spectrum	53
128	11.1.4 Modulation accuracy	54
129	11.1.5 Transmitter output power versus time function	55
130	11.2 TDMA receivers	56
131	11.2.1 Sensitivity	56
132	11.2.2 Error behaviour at high input levels	57
133	11.2.3 Co-channel rejection	57
134	11.2.4 Adjacent channel selectivity	58
135	11.2.5 Spurious response rejection	59
136	11.2.6 Intermodulation response rejection	61
137	11.2.7 Blocking or desensitisation	63
138	11.3 Conducted spurious emissions	63
139	11.3.1 Spurious emissions from the receiver	63
140	11.3.2 Spurious emissions from the transmitter	64
141	12 Specific tests of Link layer	64
142	12.1 TDMA synchronisation	65
143	12.1.1 Synchronisation test using UTC direct and indirect	65
144	12.1.2 Synchronisation test without UTC, EUT receiving semaphore	65
145	12.2 Time division (frame format)	66

146	12.2.1 Purpose.....	66
147	12.2.2 Method of measurement	66
148	12.2.3 Required results	66
149	12.3 Synchronisation jitter.....	66
150	12.3.1 Definition	66
151	12.3.2 Purpose.....	66
152	12.3.3 Method of measurement	66
153	12.3.4 Required results	66
154	12.4 Data encoding (bit stuffing)	66
155	12.4.1 Purpose.....	66
156	12.4.2 Method of measurement	66
157	12.4.3 Required results	67
158	12.5 Frame check sequence	67
159	12.5.1 Purpose.....	67
160	12.5.2 Method of measurement	67
161	12.5.3 Required results	67
162	12.6 Slot allocation (Channel access protocols)	67
163	12.6.1 Network entry	67
164	12.6.2 Autonomous scheduled transmissions (SOTDMA)	67
165	12.6.3 Autonomous scheduled transmissions (ITDMA)	68
166	12.6.4 Transmission of Messages 24A and 24B (ITDMA)	68
167	12.6.5 Assigned operation	68
168	12.6.6 Group assignment	70
169	12.6.7 Base station reservations	74
170	12.7 Message formats	75
171	12.7.1 Received messages.....	75
172	12.7.2 Transmitted messages.....	75
173	13 Specific tests of network layer	75
174	13.1 Regional area designation by VDL Message.....	75
175	13.1.1 Purpose.....	75
176	13.1.2 Method of measurement	75
177	13.1.3 Required results	76
178	13.2 Channel management by addressed Message 22	77
179	13.2.1 Purpose.....	77
180	13.2.2 Method of measurement	77
181	13.2.3 Required results	77
182	13.3 Invalid regional operating areas.....	77
183	13.3.1 Purpose.....	77
184	13.3.2 Method of measurement	77
185	13.3.3 Required test results	77
186	13.4 Continuation of autonomous mode reporting interval	77
187	13.4.1 Purpose.....	77
188	13.4.2 Method of test	78
189	13.4.3 Required result	78
190	13.5 Slot reuse and FATDMA reservations	78
191	13.5.1 Method of measurement	78
192	13.5.2 Required results	78
193	13.6 Other features	80
194	Annex A (normative) DSC channel management.....	

195	Annex B (normative) Calculation of area size.....	89
196	Bibliography.....	90
197		
198	Figure 1 – OSI layer model	20
199	Figure 2 – Power versus time mask	24
200	Figure 3 – Format for repeating four-packet cluster.....	32
201	Figure 4 – Measurement arrangement for carrier power	52
202	Figure 5 – Emission mask.....	54
203	Figure 6 – Measurement arrangement for modulation accuracy	54
204	Figure 7 – Measurement arrangement	56
205	Figure 8 – Measurement arrangement with two generators	58
206	Figure 9 – SINAD or PER/BER measuring equipment	60
207	Figure 10 – Measurement arrangement for intermodulation.....	62
208	Figure 11 – Regional transitional zones	76
209		
210	Table 1 – Dynamic information autonomous reporting intervals for Class B “SO” AIS.....	16
211	Table 2 – BIIT and reaction to malfunctions	17
212	Table 3 – Position sensor fallback conditions.....	18
213	Table 4 – Required receiver performance	21
214	Table 5 – Transceiver characteristics.....	21
215	Table 6 – Transmitter characteristics	23
216	Table 7 – Definitions of timing for Figure 2.....	25
217	Table 8 – Use of VDL Messages by a Class B “SO” AIS.....	28
218	Table 9 – Content of first two packets	33
219	Table 10 – Fixed PRS data derived from Recommendation ITU-T O.153.....	34
220	Table 11 – Test.....	36
221	Table 12 – Peak frequency deviation versus time.....	55
222	Table 13 – Frequencies for intermodulation test.....	62
223	Table 14 – Regional area scenario.....	76
224	Table 15 – Required channels in use	76
225	Table A.1 – DSC monitoring times	82
226	Table B.1 – Coordinate points.....	89
227		
228		

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 of IEC 62287-2 cancels and replaces the first edition published in 2013, of which it constitutes a technical revision.

The significant change in this edition is the introduction of transmission of Message 27 on channels 75 and 76 for the long range application by broadcast.

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

FDIS	Report on voting
80/685/FDIS	80/691/RVD

285
286 Full information on the voting for the approval of this standard can be found in the report on
287 voting indicated in the above table.

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

289 A list of all parts in the IEC 62287 series, published under the general title *Maritime*
290 *navigation and radiocommunication and systems – Class B shipborne equipment of the*
291 *automatic identification system (AIS)*, can be found on the IEC website.

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

- 295 • reconfirmed,
296 • withdrawn,
297 • replaced by a revised edition, or
298 • amended.

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

300

301

302 The National Committees are requested to note that for this publication the stability date
303 is 2023.

304 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE
305 DELETED AT THE PUBLICATION STAGE.

306

307

**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 AIS equipment using Self-organised TDMA (SOTDMA) techniques as described in Recommendation ITU-R M.1371. This standard 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;
- has a presentation interface;
- has additional reporting intervals, down to 5 s;
- has two power settings, with a high level of 5 W;
- has the capability to transmit binary messages.

It 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, 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 60945:2002, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61108 (all parts), *Maritime navigation and radio communication equipment and systems – Global navigation satellite systems (GNSS)*

IEC 61108-4, *Maritime navigation and radio communication 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 (all parts), *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*

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

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

356 ITU Radio regulations 2012, *Appendices*

357 ITU-R Recommendation M.825-3:1998, *Characteristics of a transponder system using digital*
358 *selective calling techniques for use with vessel traffic services and ship-to-ship identification*

359 ITU-R Recommendation M.1084-5, *Interim solutions for improved efficiency in the use of the*
360 *band 156-174 MHz by stations in the maritime mobile service*

361 ITU-R Recommendation M.1371-5:2014, *Technical characteristics for an automatic*
362 *identification system using time division multiple access in the VHF maritime mobile band*

363 **3 Abbreviations**

364	AIS	Automatic Identification System
365	BER	Bit Error Rate
366	BIIT	Built-In Integrity Tests
367	BT	Bandwidth Time
368	COG	Course over ground
369	CRC	Cyclic Redundancy Check
370	CSD	Compass Safe Distance
371	DGNSS	Differential Global Navigation Satellite Service
372	DLS	Data Link Service
373	DSC	Digital Selective Calling
374	EUT	Equipment under test
375	FM	Frequency Modulation
376	GMSK	Gaussian Minimum Shift Keying
377	GNSS	Global Navigation Satellite Service
378	IMO	International Maritime Organization
379	ITDMA	Incremental Time Division Multiple Access
380	ITU	International Telecommunication Union
381	LME	Link Management Entity
382	MAC	Medium access control
383	MMSI	Maritime Mobile Service Identity
384	MSSA	Multi-channel slot selection access
385	NM	Nautical mile (1 NM = 1 852 m)
386	NRZI	Non Return to Zero Inverted
387	OSI	Open Systems Interconnection model
388	PER	Packet Error Rate
389	PI	Presentation Interface
390	RAIM	Receiver autonomous integrity monitoring

391	RATDMA	Random Access Time Division Multiple Access
392	RF	Radio Frequency
393	RR	Radio Regulations
394	Rx	Receive
395	SAR	Search and rescue
396	SINAD	Signal Interference Noise and Distortion ratio
397	SOG	Speed over ground
398	SOTDMA	Self Organised Time Division Multiple Access
399	TDMA	Time Division Multiple Access
400	Tx	Transmit
401	UTC	Universal Time Co-ordinated
402	VDL	VHF Data Link
403	VHF	Very High Frequency
404	VSWR	Voltage Standing Wave Ratio
405	VTs	Vessel Traffic Services

406 NOTE Abbreviations included in the IEC 61162 series are not specified in the above list. Refer to this series of
407 International Standards for these abbreviations.

408 4 General requirements

409 4.1 General

410 4.1.1 Capabilities of the Class B “SO” AIS

411 The Class B “SO” AIS shall improve the safety of navigation by assisting in the efficient
412 navigation of ships and small craft, protection of the environment, and operation of Vessel
413 Traffic Services (VTS).

414 The Class B “SO” AIS station shall be inter-operable and compatible with all AIS stations
415 operating on the AIS VHF Data Link. In particular, Class B “SO” AIS stations shall not
416 degrade the integrity of the AIS VHF Data Link.

417 The Class B “SO” AIS shall be capable of providing information from the craft, automatically,
418 continuously and with the required accuracy and update rate

- 419 • in a ship-to-ship mode for collision avoidance,
- 420 • as a means for littoral States to obtain information about the craft, and
- 421 • as a VTS tool, i.e. ship-to-shore (traffic management).

422 4.1.2 Quality assurance

423 (See 10.1.1)

424 Manufacturers shall have a quality control system audited by a competent authority to ensure
425 continuous compliance with the requirements of this standard. Alternatively, the manufacturer
426 may use final product verification procedures where a competent authority verifies compliance
427 with the requirements of this standard before the product is put to the market.

428 NOTE The ISO 9000 series, as applicable, meets the requirements of a quality control system.

429 4.1.3 Safety of operation

430 (See 10.1.2)

431 It shall not be possible for the operator to augment, amend or erase any program software
432 required for operation in accordance with this equipment standard. The manufacturer may
433 provide means to install software updates.

434 Data used during operation and stored in the system shall be protected in such a way that
435 necessary modifications and amendments by the user cannot endanger its integrity and
436 correctness.

437 **4.1.4 Additional features**

438 (See 10.1.3, 13.7)

439 Where equipment provides a feature that is additional to the minimum requirements and
440 options of this standard, the operation and, as far as is reasonably practicable, the
441 malfunction of such additional features shall not degrade the performance of the equipment.

442 **4.1.5 Functionality**

443 The equipment shall operate in three modes (see 7.3.4.3):

- 444 • autonomous (default mode);
- 445 • assigned;
- 446 • interrogation.

447 **4.2 Manuals**

448 (See 10.1.1)

449 The manuals shall include the

- 450 • type of external connectors, if applicable,
- 451 • information for correct installation and positioning of the antennas,
- 452 • information for compass safe distance.

453 **4.3 Marking and identification**

454 (See 10.1.1)

455 In addition to the requirements of IEC 60945:2002, 4.9, the markings shall include:

- 456 • details of the power supply from which the equipment is intended to be operated;
- 457 • if applicable, the date by which batteries need to be replaced.

458 **5 Environmental, power supply, interference and safety requirements**

459 (See Clause 9)

460 In addition to the specific requirements of this standard, the Class B “SO” AIS shall fulfil the
461 following general requirements as detailed in IEC 60945:

- 462 • inter-unit connection (electrical interfaces other than IEC 61162 are permissible);
- 463 • power supply;
- 464 • extreme power supply;
- 465 • excessive conditions;
- 466 • power supply short-term variation and power supply failure;
- 467 • durability and resistance to environmental conditions;
- 468 • interference;

- 469 • electromagnetic compatibility;
 - 470 • compass safe distance;
 - 471 • safety precautions;
 - 472 • protection against accidental access to dangerous voltages;
 - 473 • electromagnetic radiofrequency radiation.
- 474 The Class B “SO” AIS shall not enter an undefined or unstable state in case of under voltage.

475 The manufacturer shall declare the category of the equipment as follows:

- 476 a) portable;
- 477 b) protected from the weather;
- 478 c) exposed to the weather;
- 479 d) submerged or in continuous contact with sea water.

480 The Class B “SO” AIS shall be tested for compliance with the environmental, power supply,
481 special-purpose and safety requirements of IEC 60945.

- 482 • AIS equipment declared for protected installation shall meet the requirements described in
483 Table 3 column “Protected” of IEC 60945:2002;
- 484 • exposed AIS equipment shall meet the requirements described in Table 3, column
485 “Exposed” of IEC 60945;
- 486 • portable AIS equipment shall meet the requirements of Table 3 of IEC 60945:2002
487 “Protected” or “Exposed” as appropriate.

488 In addition, the AIS installation, when operating, shall not be damaged by the effects of open
489 circuited or short circuited antenna terminals.

490 **6 Performance requirements**

491 **6.1 Internal processes**

492 (See 10.1.1)

493 The Class B “SO” AIS shall comprise:

- 494 • a communication processor, capable of operating in the VHF Maritime Mobile Service
495 band;
- 496 • at least one transmitter and two receiving processes for TDMA operation;
- 497 • a third receiving process for DSC channel management;
- 498 • a means for automatic channel switching in the maritime mobile band (by Message 22 and
499 by DSC). Manual channel switching shall not be provided;
- 500 • an internal GNSS position sensor, which provides a resolution of one ten thousandth of a
501 minute of arc and uses the WGS-84 datum only.

502

503 6.2 Operating frequency channels

504 (See 10.3)

505 The Class B “SO” AIS shall be designed to operate with 25 kHz bandwidth (see 7.2.3.3) in the
506 range from 156,025 MHz to 162,025 MHz of the ITU Radio Regulations 2012, Appendix 18
507 and in accordance with Recommendation ITU-R M.1084-5:2012, Annex 4.

508 The Class B “SO” AIS shall indicate its capabilities of channel operation in the VHF maritime
509 mobile band with the flag settings of Message 18 (see 6.5.1.3).

510 The DSC receiving process shall be tuned to VHF Channel 70 (see 7.2.3.7).

511 6.3 Internal GNSS receiver for position reporting

512 (See 10.4)

513 The Class B “SO” AIS shall have an internal GNSS receiver as the only source for position,
514 COG and SOG except for test purposes.

515 The internal GNSS receiver shall meet the following requirements of a receiver as specified in
516 the IEC 61108 series:

- 517 • position accuracy; static and dynamic;
- 518 • COG / SOG accuracy;
- 519 • position update;
- 520 • interference susceptibility;
- 521 • status indications (RAIM optional); and
- 522 • WGS-84 datum positions.

523 The internal GNSS receiver shall be capable of being differentially corrected by Message 17.

524 Optionally, in addition to Message 17, the Class B “SO” AIS may be differentially corrected by
525 a radio beacon. If the radio beacon option is implemented it shall be tested in accordance with
526 IEC 61108-4.

527 6.4 Identification

528 (See 10.8.3)

529 For the purpose of ship and message identification, the appropriate Maritime Mobile Service
530 Identity (MMSI) number shall be used.

531 The unit shall be supplied with a default MMSI of “000000000” that is not a valid MMSI.

532 The unit shall check that any programmed MMSI is between 200000000 and 799999999 or
533 between 982000000 and 987999999 otherwise the unit shall reject the programming and not
534 be capable of transmitting.

535 6.5 AIS Information**536 6.5.1 Information content**

537 (See 10.5.1)

538 6.5.1.1 Static and voyage related (Messages 19, 24A and 24B)

539 The list of static information shall include:

- 540 • identification (MMSI);
- 541 • name of ship;
- 542 • type of ship;
- 543 • vendor ID (unit should respond to interrogation for Message 24B);
- 544 • call sign; and
- 545 • dimensions of ship and reference for position.

546 The default value for type of ship shall be 37 (pleasure craft). Defaults for other static data
547 shall be chosen such that it is obvious that the equipment has been properly initialised, in
548 particular, the default MMSI shall be set to 000000000 and the equipment shall be designed
549 such that transmissions are inhibited with this default setting.

550 **6.5.1.2 Dynamic (Message 18)**

551 The list of dynamic information shall include:

- 552 • ship's position with accuracy indication and integrity status;
- 553 • UTC second when position fix was generated;
- 554 • course over ground (COG) from internal GNSS;
- 555 • speed over ground (SOG) from internal GNSS;
- 556 • true heading (optional).

557 **6.5.1.3 Configuration information (Message 18)**

558 The following information about configuration and options active in the specific unit shall be
559 provided by flag settings in Message 18:

- 560 • type of AIS Class B unit;
- 561 • availability of minimum keyboard / display facility;
- 562 • availability of DSC Channel 70 receiver;
- 563 • ability to operate in the marine VHF band; and
- 564 • ability to process channel management Message 22.

565 **6.5.2 Information reporting intervals**

566 (See 10.5.2, 10.6)

567 The reporting interval for Static and Voyage related information shall be every 6 min, when
568 data has been amended, or upon interrogation.

569 The reporting interval for dynamic information shall be as stated in Table 1.

570

Table 1 – Dynamic information autonomous reporting intervals for Class B “SO” AIS

Condition	Nominal reporting interval	Increased reporting interval
Class B “SO” AIS Mobile Equipment moving <2 kn	3 min	3 min
Class B “SO” AIS Mobile Equipment moving at 2 kn to 14 kn	30 s	30 s
Class B “SO” AIS Mobile Equipment moving at 14 kn to 23 kn	15 s	30 s
Class B “SO” AIS Mobile Equipment moving >23 kn	5 s	15 s

The Class B “SO” AIS shall follow the rules set by ITU-R M.1371, and shall increase the reporting interval to “Increased Reporting Interval” in accordance with Table 1 when less than 50 % of the slots of each of the last four consecutive frames are free. When more than 65 % of the slots of each of the last four consecutive frames are free, the Class B “SO” AIS shall report at the “Nominal Reporting Interval”.

An assignment command, received by Message 16 or Message 23 may decrease or increase the reporting interval defined by Table 1 (see 4.1.5).

A reporting interval of less than 5 s shall not be required.

An assignment using Message 16 has priority over an assignment using Message 23.

When the BIIT determine the position sensor is unavailable, the Class B “SO” AIS shall maintain a reporting interval of 3 min (see 6.6.1).

6.5.3 Short safety-related messages

(See 10.2.2.5)

Short safety-related messages as described in Recommendation ITU-R M.1371 (Message 14) shall not be provided.

NOTE IMO COMSAR.1/Circ.46 of February 2009 advises that “short safety-related messages should not be incorporated in AIS equipment because there is no SAR infrastructure in place to accommodate them”.

6.5.4 Permissible initialisation period

(See 10.6)

The AIS unit shall be operational within 2 min of switching on.

6.6 Alarms and indications, fall-back arrangements

(See 10.7)

6.6.1 Built-in integrity tests (BIIT)

The Class B “SO” AIS shall have BIIT which monitor the processes listed in Table 2.

Any BIIT failure shall set the error indicator as defined in 6.7.1.

The Class B “SO” AIS reacts to BIIT malfunctions as indicated in Table 2.

600

Table 2 – BIIT and reaction to malfunctions

Test	Reaction to Malfunction
AIS: Tx malfunction	Stop transmission
AIS: Antenna VSWR exceeds limit	Continue operation
AIS: Rx channel 1 malfunction	Stop transmission on affected channel
AIS: Rx channel 2 malfunction	Stop transmission on affected channel
AIS: Rx channel 70 malfunction	Continue operation ^a
AIS: general failure	Stop transmission
AIS: UTC sync invalid	Continue operation using indirect or semaphore synchronisation
AIS: display connection lost	Continue operation with "Class B Display Flag" of message 18 set to "0"
AIS: no sensor position in use	Continue operation at 3 minute reporting interval
AIS: no valid SOG information	Continue operation using SOG = 1 023
AIS: no valid COG information	Continue operation using COG = 3 600
AIS: Heading lost/invalid	Continue operation using Heading = 511°
^a Alarm may be enabled/disabled depending on system configuration.	

601

602 Alarm messages shall be output via a presentation interface:

- 603 • alarm codes and descriptive text shall be compliant with IEC 61993-2;
- 604 • the alarm message protocol shall be compliant with IEC 61162;
- 605 • active alarms shall be output via the presentation interface upon occurrence and repeated
- 606 every 30 s;
- 607 • non-active alarm messages shall be repeated every 60 s;
- 608 • upon a relevant system status change an appropriate alarm message shall be output.

609 **6.6.2 Transmitter shutdown procedure**

610 An automatic transmitter hardware shutdown procedure and indication should be provided in

611 case a transmitter continues to transmit for more than 2 s. This shutdown procedure should

612 be independent of software control.

6.6.3 Position sensor fallback conditions

Priorities and affected position report data (refer to ITU-R M.1371) shall be as in Table 3.

Table 3 – Position sensor fallback conditions

Priority	Position sensor status		Affected data in Message 18			
			Position accuracy flag	Time stamp	RAIM-flag	Position Latitude / Longitude
1.	internal DGNSS in use (corrected; Message 17) ^c		1 ^b	UTC-s	1 / 0 ^a	Lat/Lon (internal)
2.	internal DGNSS in use (corrected; e.g. beacon) ^d		1 ^a	UTC-s	1 / 0 ^a	Lat/Lon (internal)
3.	internal GNSS in use (uncorrected) ^c		0 ^b	UTC-s	1 / 0 ^a	Lat/Lon (internal)
4.	no sensor position in use	dead reckoning position	0	62	0	Default to +91/+181
		no position		63		

^a If RAIM available “1”; if not, default “0”.

^b The position accuracy flag shall be set as defined in ITU-R M.1371-5, A8 3.16 Message 18.

^c Applicable in all configurations (minimum requirement).

^d Applicable only if (optionally) a beacon receiver is provided.

The AIS shall automatically select the position sensor status with the highest priority available. If data availability changes, the AIS shall automatically switch to the position sensor status with the highest priority available after 5 s when switching downwards, or 30 s when switching upwards. During this period, the latest valid position sensor status shall be used for reporting.

6.7 User interface

6.7.1 Indication and display

(See 10.8.1)

The Class B“SO” AIS shall be provided with the following indicators:

- Power: power on
- No transmission: the unit is not transmitting
- Error: detection of an error as a result of the BIIT (see 6.6.1).

If an integrated display is provided, it shall:

- display received Messages 12 and 14 and the position report from AIS-SART in active mode;
- provide means to enable or disable the AIS-SART test mode. All messages from AIS-SART under test should only be displayed when the test mode is enabled;
- not display messages addressed to other stations;
- display active alarm conditions.

6.7.2 Static data input

(See 10.8.3)

Means shall be provided to input and verify the static data prior to use.

It shall not be possible for the user to alter the MMSI once programmed.

6.7.3 External interfaces

(See 10.2.1.2)

To enable a user to access, select and display the information on a separate system, the Class B “SO” AIS shall be provided with at least one interface.

The formats and protocol for this data stream shall be as defined by IEC 61162-1. Additional interfaces may be implemented according to the other IEC 61162 series. The electrical and physical parameters shall be as specified by the manufacturer.

The Class B “SO” AIS may be provided with an interface to input heading sensor data. If provided, the input interface for sensor data shall be compliant with the IEC 61162 series.

6.8 Protection from invalid control commands

(See 8.5.8)

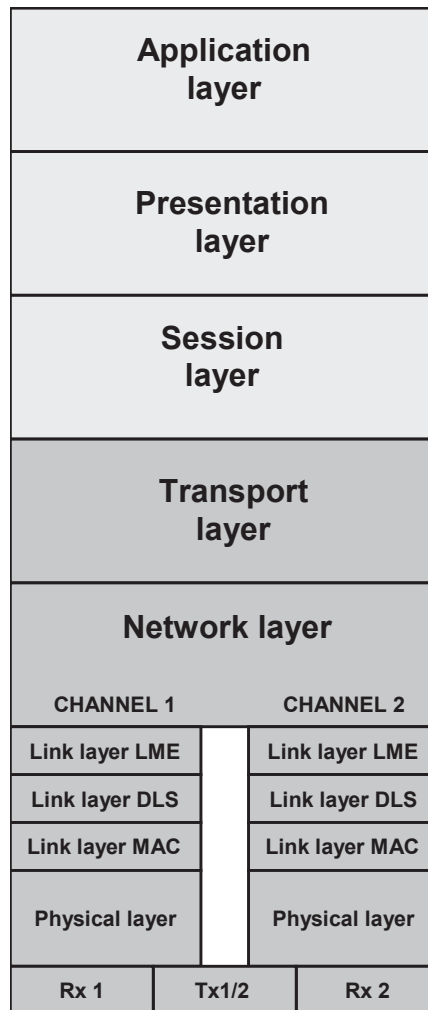
The Class B “SO” AIS shall not accept control commands sent from stations with invalid base station MMSI. Before accepting and processing the Messages 4, 16, 17, 20, 22 and 23, the unit shall check the MMSI of the sender station. When the MMSI is “00xyyyyy” where x is between 2 and 7, the unit shall accept and process the received command, otherwise the unit shall ignore it.

7 Technical requirements**7.1 General**

This clause covers layers 1 to 4 (Physical layer, Link layer, Network layer, Transport layer) of the Open Systems Interconnection (OSI) model.

Figure 1 illustrates the layer model of an AIS station (Physical layer to Transport layer) and the layers of the applications (Session layer to Application layer):

661



IEC 549/13

Figure 1 – OSI layer model

7.2 Physical layer

7.2.1 General

The physical layer is responsible for the transfer of a bit-stream from an originator out, on to the data link. In addition to the specific requirements of this subclause, the physical layer shall be designed in accordance with Recommendation ITU-R M.1371.

7.2.2 Receiver characteristics

(See 11.2, 11.3.1)

The technical characteristics as specified in Table 4 shall apply to the TDMA receivers.

688

Table 4 – Required receiver performance

Receiver parameters	Values		
	Results	Wanted signal	Unwanted signal(s)
Sensitivity	20 % per	–107 dBm normal –101 dBm extreme –104 dBm at ± 500 Hz offset	–
Error at high input levels	2 % per	–77 dBm	–
	10 % per	–7 dBm	–
Co-channel rejection	20 % per	–101 dBm	–111 dBm –111 dBm at ± 1 kHz offset
Adjacent channel selectivity	20 % per	–101 dBm	–31 dBm
Spurious response rejection	20 % per	–101 dBm	–31 dBm
Intermodulation response rejection	20 % per	–101 dBm	–36 dBm
Blocking and desensitization	20 % per	–101 dBm	–23 dBm (<5 MHz) –15 dBm (>5 MHz)
Spurious emissions	–57 dBm –47 dBm	9 kHz to 1 GHz 1 GHz to 4 GHz	

689

690 **7.2.3 Other characteristics**691 **7.2.3.1 General transceiver characteristics**

692 (See Clause 11)

693 General transceiver characteristics shall be as specified in Table 5.

694

Table 5 – Transceiver characteristics

Symbol	Parameter name	Low setting	High setting
PH.RFR	Regional frequencies (range of frequencies within RR Appendix 18)	156,025 MHz	162,025 MHz
PH.CHS	Channel spacing (encoded according to RR Appendix 18 with footnotes)	25 kHz	25 kHz
PH.AIS1	AIS 1 (default channel 1) (2 087) ^a	161,975 MHz	161,975 MHz
PH.AIS2	AIS 2 (default channel 2) (2 088) ^a	162,025 MHz	162,025 MHz
PH.BR	Bit rate	9 600 bit/s	9 600 bit/s
PH.TS	Training sequence	24 bits	24 bits
PH.TxBT	Transmit BT product	~0,4	~0,4
PH.RxBT	Receive BT product	~0,5	~0,5
PH.MI	Modulation index	~0,5	~0,5
PH.TxP	Transmit output power	1 W	5 W
^a See Recommendation ITU-R M.1084-5:2012, Annex 4.			

695

696 **7.2.3.2 Channel operation**

697 (See 10.2.1.1)

698 The AIS shall be capable of receiving on two parallel channels and transmitting on two
 699 separate channels. Two separate TDMA receive channels or processes shall be used to
 700 receive simultaneously information on two independent frequency channels. One of the

701 transmitter shall be used to alternate TDMA transmissions on two independent frequency
702 channels.

703 Data transmissions and receptions shall default to AIS 1 and AIS 2 unless otherwise specified
704 (see 7.4.3 and Annex A).

705 **7.2.3.3 Bandwidth**

706 (See 11.1.3)

707 The Class B “SO” AIS shall operate on 25 kHz channels according to Recommendation
708 ITU R M.1084-5 and Appendix 18 of the ITU Radio Regulations 2012.

709 **7.2.3.4 Modulation scheme**

710 (See 11.1.4)

711 The modulation scheme is bandwidth adapted frequency modulated Gaussian filtered
712 minimum shift keying (GMSK/FM). The NRZI encoded data shall be GMSK coded before
713 frequency modulating the transmitter.

714 **7.2.3.5 Training sequence**

715 (See 11.1.4)

716 Data transmission shall begin with a 24-bit demodulator training sequence (preamble)
717 consisting of one segment synchronisation. This segment shall consist of alternating zeros
718 and ones (0101....). This sequence always starts with a 0.

719 **7.2.3.6 Data encoding**

720 (See 12.4)

721 The NRZI waveform is used for data encoding. The waveform is specified as giving a change
722 in the level when a zero (0) is encountered in the bit stream.

723 Forward error correction, interleaving or bit scrambling is not used.

724 **7.2.3.7 DSC operation**

725 (See Annex A)

726 The Class B “SO” AIS shall be capable of receiving DSC channel management commands
727 (see Annex A).

728 DSC receive function shall be provided at least in accordance with the time schedule
729 specified in ITU-R M. 1371-5, Annex 7, Table 45.

730 DSC channel (channel 70) shall be monitored by a dedicated receiver or by switching one of
731 the TDMA receivers from the AIS channels to the DSC channel. In order to avoid a new entry
732 phase when switching back the time out values should be selected so that there is no time out
733 0 during the DSC receiving period.

734 **7.2.4 Transmitter requirements**

735 (See 11.1, 11.3.2)

736 Transmitter parameters shall be as given in Table 6.

737

Table 6 – Transmitter characteristics

Transmitter parameters	Requirement	Condition
Frequency error	± 500 Hz normal $\pm 1\,000$ Hz extreme	
Carrier power, high setting	Nominal high transmit power shall be 5 W. $\pm 1,5$ dB normal test conditions ± 3 dB extreme test conditions	Conducted
Carrier power, low setting	Nominal low transmit power shall be 1 W. $\pm 1,5$ dB normal test conditions ± 3 dB extreme test conditions	Conducted
Modulation spectrum	-25 dBc -70 dBc	$\Delta f_c > \pm 10$ kHz ± 25 kHz $< \Delta f_c < \pm 62,5$ kHz slotted transmissions
Modulation accuracy	$< 3\,400$ Hz normal and extreme $2\,400$ Hz ± 480 Hz normal and extreme $2\,400$ Hz ± 240 Hz normal ± 480 Hz extreme $1\,740$ Hz ± 175 Hz normal ± 350 Hz extreme $2\,400$ Hz ± 240 Hz normal ± 480 Hz extreme	Bit 0, 1 Bit 2, 3 Bit 4 ... 31 Bit 32 ... 199 0101 Bit 32 ... 199 00001111
Transmitter attack behaviour	attack time ≤ 1 ms $P_{\text{out}} \leq P_{\text{nom}} + 1,5$ dB $(F_{\text{nom}} - 3,4 \text{ kHz}) < f_c < (F_{\text{nom}} + 3,4 \text{ kHz})$	$P_c - 1$ dB $P_{\text{out}} > (P_c - 30 \text{ dB})$
Transmitter release behaviour	Release time ≤ 1 ms $(F_{\text{nom}} - 3,4 \text{ kHz}) < f_c < (F_{\text{nom}} + 3,4 \text{ kHz})$	P_c to -50 dB $P_{\text{out}} > (P_c - 30 \text{ dB})$
Spurious emissions	-36 dBm -30 dBm	9 kHz ... 1 GHz 1 GHz ... 4 GHz

738

739 **7.3 Link layer**

740 (See Clause 12)

741 **7.3.1 General**

742 The Link layer specifies how data shall be packaged in order to apply error detection to the
 743 data transfer. The Link layer is divided into three (3) sub-layers.

- 744 • Link sub-layer 1: Medium Access Control (MAC)
- 745 • Link sub-layer 2: Data Link Service (DLS)
- 746 • Link sub-layer 3: Link Management Entity (LME)

747 **7.3.2 Link sub-layer 1: Medium Access Control (MAC)**748 **7.3.2.1 General**

749 The MAC sub-layer provides a method for granting access to the data transfer medium, i.e.
 750 the VHF data link. The method used shall be a Time Division Multiple Access (TDMA) scheme

751 using a common time reference. The Medium Access Control sub-layer shall be designed in
752 accordance with Recommendation ITU-R M.1371.

753 7.3.2.2 Synchronisation

754 Synchronisation is used to determine the TDMA frames and individual time slots so that the
755 transmission of the AIS message is performed within the desired slot. The synchronisation for
756 Class B “SO” AIS shall be UTC direct or UTC indirect mode. Class B “SO” is not allowed to
757 act as Semaphore.

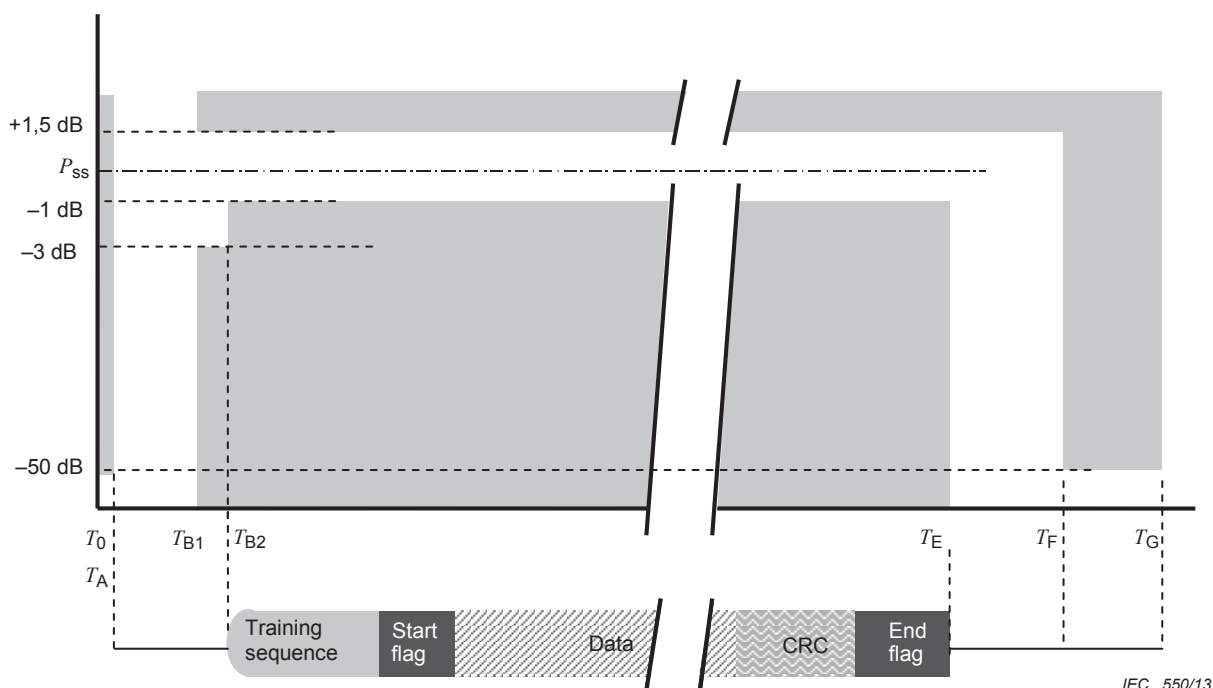
758 The Class B “SO” AIS shall meet the timing requirements set out in ITU-R M.1371 for UTC
759 direct and indirect.

760 7.3.2.3 VDL access

761 (See 11.1.5)

762 The transmitter shall begin transmission by turning on the RF power immediately after slot
763 start (T_0).

764 The transmitter shall be turned off after the last bit of the transmission packet has left the
765 transmitting unit; nominal transmission end is T_E (assuming 1 stuffing bit).



IEC 550/13

Figure 2 – Power versus time mask

769 The access to the medium is performed as shown in Figure 2 and Table 7.

770