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**Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt –
Automatische Identifikationssysteme (AIS) –
Teil 2: AIS-AtoN-Stationen – Betriebs- und -Leistungsanforderungen, Prüfverfahren und geforderte Prüfergebnisse
(IEC 80/770/CDV:2015);
Englische Fassung FprEN 62320-2:2015**

Maritime navigation and radiocommunication equipment and systems –
Automatic identification system (AIS) –
Part 2: AIS AtoN Stations – Operational and performance requirements, methods of testing and required test results
(IEC 80/770/CDV:2015);
English version FprEN 62320-2:2015

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2016-03-04 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

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

Stellungnahmen werden erbeten

- vorzugsweise online im Norm-Entwurfs-Portal des DIN unter www.entwuerfe.din.de bzw. für Norm-Entwürfe der DKE auch im Norm-Entwurfs-Portal der DKE unter www.entwuerfe.normenbibliothek.de, sofern dort wiedergegeben;
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- 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 134 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 62320-2:2015 „Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt – Automatische Identifikationssysteme (AIS) – Teil 2: AIS-AtoN-Stationen – Betriebs- und -Leistungsanforderungen, Prüfverfahren und geforderte Prüfergebnisse“ (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 80/770/CDV:2015 „Maritime navigation and radiocommunication equipment and systems – Automatic identification system (AIS) – Part 2: AIS AtoN Stations – Operational and performance requirements, methods of testing and required test results“ unverändert in den Entwurf Englische Fassung FprEN 62320-2:2015 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 die vorliegende Norm erfüllt.

Da sich die Benutzer des vorliegenden Normentwurfs der englischen Sprache als Fachsprache bedienen, wird die englische Fassung der FprEN 62320-2 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt, und deren Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA des vorliegenden Normentwurfs hinzugefügt. Für viele 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.

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Das Original-Dokument enthält Bilder in Farbe, die in der Papierversion in einer Graustufen-Darstellung wiedergegeben werden. Elektronische Versionen dieses Dokuments enthalten die Bilder in der originalen Farbdarstellung.

Änderungen

Gegenüber DIN EN 62320-2:2008-11 wurden folgende Änderungen vorgenommen:

- a) zusätzliche Cyber-Security Maßnahmen;
- b) aktualisierte Beschreibung der Konfiguration mittels VDL;
- c) aktualisierte Anforderungen im VDL Zugriffsschema;
- d) neue PI-Sentences und VDL-Meldungsstrukturen mit zusätzlicher Beschreibung für optionale TAG-Blöcke;
- e) ergänzte Anforderung für zumindest eine Standardmethode zur Konfiguration bei der Anwendung von PI-Sentences;
- f) aktualisiertes Prüfverfahren und aktualisierte Anhänge.

Nationaler Anhang NA (informativ)

Die deutschen Übersetzungen haben Empfehlungscharakter und können nur die ungefähre Begrifflichkeit in Deutsch wiedergeben. Unter Experten wird empfohlen, ausschließlich die englischen Fachbegriffe zu verwenden, um die Gefahr von Missverständnissen zu reduzieren.

1 Anwendungsbereich

Dieser Teil der IEC 62320 legt die betrieblichen und Leistungsanforderungen, Prüfverfahren und geforderte Prüfergebnisse für AIS AtoN Stationen, kompatibel zu den mit IMO Res. MSC.74 (69), Annex 3, Universal AIS, angenommenen Leistungsstandards fest. Er beinhaltet die technischen Kennwerte für nicht-schiffs-seitige AIS AtoN Geräte nach ITU-R-Empfehlung M.1371 und IALA-Empfehlung A-126. Wo zutreffend, werden auch die ITU-Funkregulierungen mit berücksichtigt. Diese Norm beachtet auch andere zugehörige internationale IEC-Normen sowie existierende nationale Normen, wenn anwendbar.

Diese Norm ist anwendbar bei Automatischen Schiffs-Identifikationssystem (AIS) Installationen an Schiff-fahrtszeichen.

3 Begriffe und Abkürzungen

Für das vorliegende Dokument gelten nachfolgend im Einzelnen aufgelistete Synonyme zu den im Abschnitt 3 der englischen Sprachfassung dieser Norm aufgelisteten Begriffen und Abkürzungen.

Die deutschen Übersetzungen haben Empfehlungscharakter und können nur die ungefähre Begrifflichkeit in Deutsch wiedergeben. Unter Experten wird empfohlen, ausschließlich die englischen Fachbegriffe zu verwenden, um die Gefahr von Missverständnissen zu reduzieren.

3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

3.1.1

Schifffahrtszeichen

nicht auf Schiffen installiertes Gerät oder System, das so gestaltet ist und betrieben wird, um die sichere und effiziente Navigation von Schiffen und des Schiffsverkehrs zu verbessern

3.1.2

Meldung 21

AtoN-Meldung die durch eine AIS Station über die VHF-Datenverbindung übertragen wird

3.1.3

Reales AIS AtoN

AIS AtoN Station die physisch an einem Schifffahrtszeichen angeordnet ist

Anmerkung 1 zum Begriff: IMO MSC.1/Circ.1473 legt fest, dass ein physisches AIS AtoN eine AIS-Meldung 21 darstellt, die ein Schifffahrtszeichen repräsentiert, das physikalisch existiert.

3.1.4

Synthetisches AIS AtoN

Meldung 21, die durch eine AIS Station übertragen wird, die entfernt vom Schifffahrtszeichen angeordnet ist

Anmerkung 1 zum Begriff: IMO MSC.1/Circ.1473 legt fest, dass ein physisches AIS AtoN eine AIS-Meldung 21 darstellt, die ein Schifffahrtszeichen repräsentiert, das physikalisch existiert.

3.1.5**Virtuelles AIS AtoN**

Meldung 21 die durch eine AIS Station stellvertretend für ein Schiffsfahrtszeichen übertragen wird, das physisch nicht existiert

3.2 Abkürzungen

AES	fortschrittlicher Verschlüsselungsstandard	(en: Advanced Encryption Standard)
AIS	Automatisches Schiffs-Identifikationssystem	(en: Automatic Identification System)
BIIT	Integrierte Integritätsprüfung	(en: Built-In Integrity Tests)
BT	Zeit-Bandbreite-Produkt	(en: Bandwidth Time product)
CSTDMA	Zeitmehrfachzugriff mit Trägerprüfung	(en: Carrier Sense Time Division Multiple Access)
DGNSS	Differential Global Satellite Navigation System	(en: Differential Global Navigation Satellite System)
EPFS	elektronisches Positionsbestimmungssystem	(en: Electronic Position Fixing System)
EUT	Gerät im Test	(en: Equipment under test)
FATDMA	Zeitmehrfachzugriff mit festen Zeitschlitten	(en: Fixed Access Time Division Multiple Access)
GNSS	Globales Satellitennavigationssystem	(en: Global Navigation Satellite System)
IMO	Internationale Seeschifffahrtsorganisation	(en: International Maritime Organization)
MMSI	Rufnummer des mobilen Seefunkdienstes	(en: Maritime Mobile Service Identity)
NRZI	NRZI-Übertragungskodierung	(en: Non-Return to Zero Inverted)
PER	Paketfehlerrate	(en: Packet Error Rate)
PI	Präsentationsschnittstelle	(en: Presentation Interface)
RAIM	Unabhängige Integritätsüberwachung für Empfänger	(en: Receiver Autonomous Integrity Monitoring)
RATDMA	Zeitmehrfachzugriff mit Direktzugriff	(en: Random Access Time Division Multiple Access)
RF	Funkfrequenz	(en: Radio Frequency)
Rx	Empfänger	(en: Receive)
SBAS	Satelliten basiertes Zusatzsystem zur Positionsverbesserung	(en: Satellite-Based Augmentation System)
SOTDMA	Selbst organisierter Zeitmehrfachzugriff	(en: Self-Organizing Time Division Multiple Access)
TDMA	Zeitmehrfachzugriff	(en: Time Division Multiple Access)
Tx	Sender	(en: Transmit)

UTC	Koordinierte Weltzeit	(en: Coordinated Universal Time)
VDL	VHF-Datenverbindung	(en: VHF Data Link)
VSWR	Stehwellenverhältnis	(en: Voltage Standing Wave Ratio)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MARITIME NAVIGATION AND RADIOCOMMUNICATION
EQUIPMENT AND SYSTEMS –
AUTOMATIC IDENTIFICATION SYSTEM (AIS)–****Part 2: AIS AtoN Stations –
Operational and performance requirements,
methods of testing and required test results**

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This second edition cancels and replaces the first edition, published in 2008, of which it constitutes a technical revision.

The significant changes in this edition include:

- Additional cyber security measures
- Updated description of configuration via VDL
- Updated VDL access scheme requirements
- New PI sentences and VDL message structures with added description for optional TAG blocks

- 57 • Added requirement for at least one standard method for configuration using Standard PI
58 sentences
- 59 • Updated test methods and updated Annexes.
- 60 The text of this standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

- 61
- 62 Full information on the voting for the approval of this standard can be found in the report on
63 voting indicated in the above table.
- 64 This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.
- 65 The committee has decided that the contents of this publication will remain unchanged until
66 the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data
67 related to the specific publication. At this date, the publication will be
- 68 • reconfirmed,
69 • withdrawn,
70 • replaced by a revised edition, or
71 • amended.

72

73 The National Committees are requested to note that for this publication the stability date
74 is 2021

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

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**MARITIME NAVIGATION AND RADIOCOMMUNICATION
EQUIPMENT AND SYSTEMS –
AUTOMATIC IDENTIFICATION SYSTEM (AIS) –**

**Part 2: AIS AtoN Stations –
Operational and performance requirements,
methods of testing and required test results**

1 Scope

This part of IEC 62320 specifies the operational and performance requirements, methods of testing and required test results for AIS AtoN Stations compatible with the performance standards adopted by IMO Res. MSC.74(69), annex 3, Universal AIS. It incorporates the technical characteristics of non-shipborne AIS AtoN equipment, included in Recommendation ITU-R M.1371 and IALA Recommendation A-126. Where applicable, it also takes into account the ITU Radio Regulations. This standard takes into account other associated IEC International Standards and existing National Standards, as applicable.

This standard is applicable for Automatic Identification System (AIS) installations on Aids to Navigation (AtoN).

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

IEC 61108-1, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 1: Global positioning system (GPS) – Receiver equipment – Performance standards, methods of testing and required test results*

IEC 61108-2, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 2: Global navigation satellite system (GLONASS) – Receiver equipment – Performance standards, methods of testing and required test results*

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 results*

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

IEC 62287-1, *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*

IEC 62320-3:2015, *Maritime navigation and radiocommunication equipment and systems – Automatic identification systems (AIS) – Part 3: Repeater station – Minimum operational and performance requirements – Methods of test and required test results*

ITU Radio Regulations, Appendix 18, *Table of transmitting frequencies in the VHF maritime mobile band*

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

127 ITU-T Recommendation O.153, *Basic parameters for the measurement of error performance*
128 *at bit rates below the primary rate*

129 IALA Recommendation A-126, *The Use of Automatic Identification System (AIS) in Marine*
130 *Aids to Navigation*

131 **3 Terms, definitions and abbreviations**

132 **3.1 Definitions**

133 For the purposes of this document, the following terms, definitions and abbreviations apply.

134 **3.1.1**

135 **Aids to Navigation** 136 **(AtoN)**

137 device or system external to vessels that is designed and operated to enhance the safe and
138 efficient navigation of vessels and/or vessel traffic

139 **3.1.2**

140 **Message 21**

141 AtoN report transmitted on the VHF data link by an AIS station

142 **3.1.3**

143 **Real AIS AtoN**

144 AIS AtoN station which is physically located on the aid to navigation

145 Note 1 to entry: IMO MSC.1/Circ.1473 states that Physical AIS AtoN is an AIS Message 21 representing an aid to
146 navigation that physically exists.

147 **3.1.4**

148 **Synthetic AIS AtoN**

149 Message 21 transmitted from an AIS station located remotely from the aid to navigation

150 Note 1 to entry: IMO MSC.1/Circ.1473 states that Physical AIS AtoN is an AIS Message 21 representing an aid to
151 navigation that physically exists.

152 **3.1.5**

153 **Virtual AIS AtoN**

154 Message 21 transmitted from an AIS station for an aid to navigation which does not physically
155 exist

156 **3.2 Abbreviations**

157	AES	Advanced Encryption Standard
158	AIS	Automatic Identification System
159	BIIT	Built-in Integrity Tests
160	BT	Bandwidth Time Product
161	CSTDMA	Carrier Sense Time Division Multiple Access
162	DGNSS	Differential Global Navigation Satellite System
163	EPFS	Electronic Position Fixing System
164	EUT	Equipment Under Test
165	FATDMA	Fixed Access Time Division Multiple Access
166	GNSS	Global Navigation Satellite System
167	IMO	International Maritime Organization
168	MMSI	Maritime Mobile Service Identity
169	NRZI	Non-Return to Zero Inverted
170	PER	Packet Error Rate
171	PI	Presentation Interface
172	RAIM	Receiver Autonomous Integrity Monitoring

173	RATDMA	Random Access Time Division Multiple Access
174	RF	Radio Frequency
175	Rx	Receive
176	SBAS	Satellite-Based Augmentation System
177	SOTDMA	Self Organizing Time Division Multiple Access
178	TDMA	Time Division Multiple Access
179	Tx	Transmit
180	UTC	Coordinated Universal Time
181	VDL	VHF Data Link
182	VSWR	Voltage Standing Wave Ratio

183 4 Description

184 4.1 Types of AIS AtoN Stations

185 There are three types of AIS AtoN Stations as defined in Table 1. The AIS AtoN Stations may
 186 optionally include additional capabilities as defined in the “Comments” column. Table 2
 187 describes the use of the messages.

188 **Table 1 – Description of AIS AtoN Stations**

Requirements	Type 1 AIS AtoN Station	Type 2 AIS AtoN Station	Type 3 AIS AtoN Station	Comments
VDL receiver	No receiver	Receiver for query, configuration, or control functions only	Two receiving processes for autonomous mode (RATDMA)	When RATDMA is not used, only one receiving process is required for autonomous mode.
Transmitted messages	21			See Table 2.
Access mode for Message 21	FATDMA	FATDMA	FATDMA & RATDMA	
Access Mode for messages other than 21, if implemented	FATDMA	FATDMA	FATDMA & RATDMA	CSTDMA (Type 3)
Configuration / communication method	Standard sentences of Table 14 Physical interface defined by manufacturer			Defined by the manufacturer with standard sentences and optionally using TAG Blocks.
Physical communication interface	At least one shall be provided by the manufacturer for test. Not required for operation.			The electrical and physical characteristics shall be defined by the manufacturer.
Transmit power	Nominal 12,5 W			As defined by the manufacturer
Transmitter capability	Frequency agile			Single frequency
Synthetic and Virtual AtoN	Not Required			Yes
Positioning device	EPFS and surveyed position			Surveyed position only (no EPFS)
UTC synchronisation	UTC Direct			UTC indirect or semaphore (Type 3)
Assignment	Shall not respond to assignment Messages 16 and 23			
Interrogation	Shall respond with the Message 21 of the Real AIS AtoN MMSI only.			

Requirements	Type 1 AIS AtoN Station	Type 2 AIS AtoN Station	Type 3 AIS AtoN Station	Comments
Default (initial factory setting)	MMSI = 000000000 No Schedule Configured No Virtual AtoN Configured Radio Parameters Configured per Table 6 No Surveyed Position Encryption Key = All Zeros AtoN Status Bits = All Zeros			

189

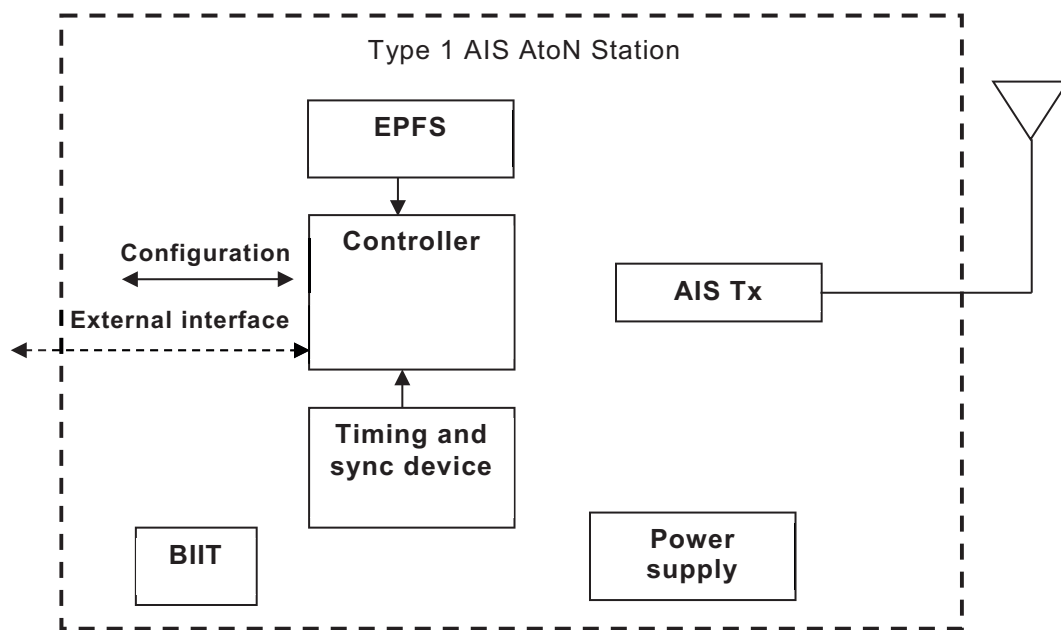
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Table 2 – Use of VDL messages

msg. No.	Name of message	M.1371- 5 Ref.	R/P Type 2	R/P Type 3	PI Output	T Type 1&2	T Type 3	Remark
0	Undefined	None	No	No	No	No	No	Reserved for future use
1	Position report (scheduled)	A8-3.1	No	Yes	Yes	No	Opt	Note 1 and 4
2	Position report (assigned)	A8-3.1	No	Yes	Yes	No	No	Note 1
3	Position report (when interrogated)	A8-3.1	No	Yes	Yes	No	No	Note 1
4	Base station report	A8-3.2	No	Yes	Yes	No	No	Note 1
5	Static and voyage related data	A8-3.3	No	No	Yes	No	No	
6	Addressed binary message	A8-3.4	Opt	Opt	Yes	Opt	Opt	Note 2
7	Binary acknowledge	A8-3.5	Opt	Opt	Opt	No	Opt	
8	Binary broadcast message	A8-3.6	No	No	Yes	Opt	Opt	
9	Standard SAR aircraft position report	A8-3.7	No	Yes	Yes	No	No	Note 1
10	UTC and date inquiry	A8-3.8	No	No	Opt	No	No	
11	UTC/ date response	A8-3.9	No	No	Opt	No	No	
12	Addressed safety related message	A8-3.10	No	Opt	Yes	Opt	Opt	Note 2
13	Safety related acknowledge	A8-3.11	No	Opt	Opt	No	Opt	
14	Safety related broadcast message	A8-3.12	No	Opt	Yes	Opt	Opt	
15	Interrogation	A8-3.13	Opt	Opt	Opt	No	No	Note 3
16	Assigned mode command	A8-3.14	No	No	Opt	No	No	
17	DGNSS	A8-3.15	No	Opt	Opt	No	No	
18	Standard Class B equipment position report	A8-3.16	No	Yes	Yes	No	No	Note 1
19	Extended Class B equipment position report	A8-3.17	No	No	Opt	No	No	

msg. No.	Name of message	M.1371-5 Ref.	R/P Type 2	R/P Type 3	PI Output	T Type 1&2	T Type 3	Remark
20	Data link management message	A8-3.18	No	No	Opt	No	No	
21	Aids-to-Navigation report	A8-3.19	No	No	Yes	Yes	Yes	
22	Channel management message	A8-3.20	No	No	Opt	No	No	
23	Group assignment command	A8-3.21	No	No	Opt	No	No	
24	Static data report (single slot, two parts)	A8-3.22	No	No	Yes	No	No	
25	Single slot binary message	A8-3.23	Opt	Opt	Yes	Yes	Yes	Note 2
26	Multiple slot binary message	A8-3.24	Opt	Yes	Yes	Yes	Yes	Note 1 and 2
27	Long-range AIS broadcast message	A8-3.25	No	No	Opt	No	No	
28 to 63	Undefined	None	No	No	No	No	No	Reserved for future use
Note 1 - Comm State requires evaluation if RATDMA enabled Note 2 - Only if addressed to own station including virtual MMSIs associated with own station, or 0 Note 3 - Shall respond with the Message 21 of the Real AIS AtoN MMSI only. Note 4 – Only implemented to repeat active AIS-SART messages Legend: R/P – Receive and process internally, e.g. prepare for output via PI, act upon the received information, and use the received information internally. O – Output message content via PI using PI VDM messages T – Transmission by own station: "Yes" = required; "No" = shall not be transmitted INF – VDL message will be output via PI using a PI VDM message for information only. This function may be suppressed by configuration setting.								

- 191
- 192 **4.2 Type 1 AIS AtoN Station**
- 193 **4.2.1 Characteristics**
- 194 **4.2.1.1 General**
- 195 Type 1 AIS AtoN Station has no receiver. It transmits on FATDMA slots given in its
- 196 configuration. Figure 1 shows the functional block diagram of a Type 1 AIS AtoN Station.



IEC 285/08

Figure 1 – Functional block diagram of a Type 1 AIS AtoN Station

The characteristics of the Type 1 AIS AtoN Station are:

- transmits using FATDMA;
- no receive capability, therefore:
 - cannot be configured via the VDL,
 - cannot synchronise to other stations;
- configuration interface as defined by the manufacturer;
- 12,5 W nominal transmitter power or as defined by the manufacturer;
- dual channel transmission.

4.2.1.2 Controller

The controller composes Message 21 and ensures the correct operation of the AIS AtoN Station on the VDL.

4.2.1.3 Timing and synchronisation device

This device provides the time and synchronisation for the controller.

4.2.1.4 Power supply

The power supply generates the internal voltages.

4.2.1.5 BIIT

The Built-in Integrity Tests (BIIT) shall provide integrity monitoring.

4.2.1.6 EPFS

Electronic Position Fixing System (EPFS) provides the current position of the AtoN.

4.2.1.7 Configuration

The interface used to configure the AIS AtoN Station.

4.2.2 Capability

Type 1 AIS AtoN Station is capable of transmitting Message 21 using FATDMA.

4.2.3 Alternatives**4.2.3.1 Additional controller capability**

In addition to Message 21, the controller shall compose optional output messages to the VDL using FATDMA as described in Table 3. No other messages are allowed. Also the Type 1 AIS AtoN Station should not retransmit the addressed binary message (Messages 6 and 12). The number of retries should be set to 0.

Table 3 – Summary of optional Type 1 AIS AtoN Station messages

Msg ID	Message name	Message description	Application examples
6	Binary addressed message	Binary data for addressed communication	Monitoring of AtoN lantern, power supply, etc.
8	Binary broadcast message	Binary data for broadcast communication	Meteorological and hydrological data
12	Addressed safety related message	Safety related data for addressed communication	Warn AtoN malfunctioning
14	Broadcast safety related message	Safety related data for broadcast communication	Warn AtoN malfunctioning
25	Single slot binary message	Binary data for addressed or broadcast communication	Status report

4.2.3.2 Configuration method

The Type 1 AIS AtoN Station may be configured using standard configuration sentences (IEC 61162-1 and as described in Annex A).

4.2.3.3 No EPFS

When a surveyed position is used, the EPFS may not be required.

4.2.3.4 TDMA transmitter (AIS Tx)

The TDMA transmitter may operate on a single channel.

4.2.3.5 External interface

The external interface(s) may be used for communication with external devices (for example AtoN lantern, AtoN power supply, hydrological and meteorological instruments, etc.).

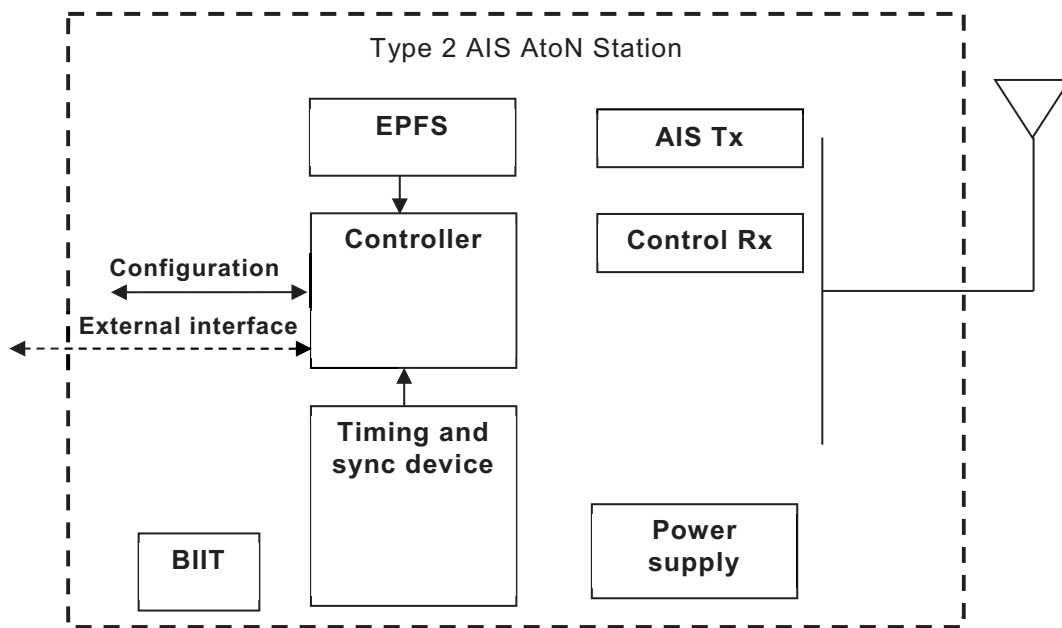
4.2.3.6 Synthetic and Virtual AtoN

The AIS AtoN Station may be capable of transmitting Message 21 for Synthetic and Virtual AIS AtoN.

4.3 Type 2 AIS AtoN Station**4.3.1 Characteristics**

Type 2 AIS AtoN Station transmits on FATDMA slots.

Type 2 AIS AtoN Station has a control receiver for messages containing configuration sentences (see Annex A). Figure 2 shows the functional block diagram of a Type 2 AIS AtoN Station.



IEC 286/08

Figure 2 – Functional block diagram of a Type 2 AIS AtoN Station

The characteristics of the Type 2 AIS AtoN Station are:

- transmits using FATDMA;
- limited receiver capability, therefore cannot maintain a slot map and cannot use RATDMA access scheme;
- configuration interface as defined by the manufacturer;
- 12,5 W nominal transmitter power or as defined by the manufacturer;
- dual channel transmission.

4.3.2 Capability

A Type 2 AIS AtoN Station has the capabilities of a Type 1 AIS AtoN Station, with the addition of a control receiver.

4.3.3 Control receiver

The Type 2 AIS AtoN Station shall have a receiver operating on an AIS channel for control functions only.

4.3.4 Alternatives

The Type 2 AIS AtoN Station alternatives include all the Type 1 AIS AtoN Station alternatives as described in Table 3.

4.4 Type 3 AIS AtoN Station

4.4.1 Characteristics

Type 3 AIS AtoN Station has AIS receive and transmit capabilities in accordance with Recommendation ITU-R M.1371. Figure 3 shows the functional block diagram of a Type 3 AIS AtoN Station.

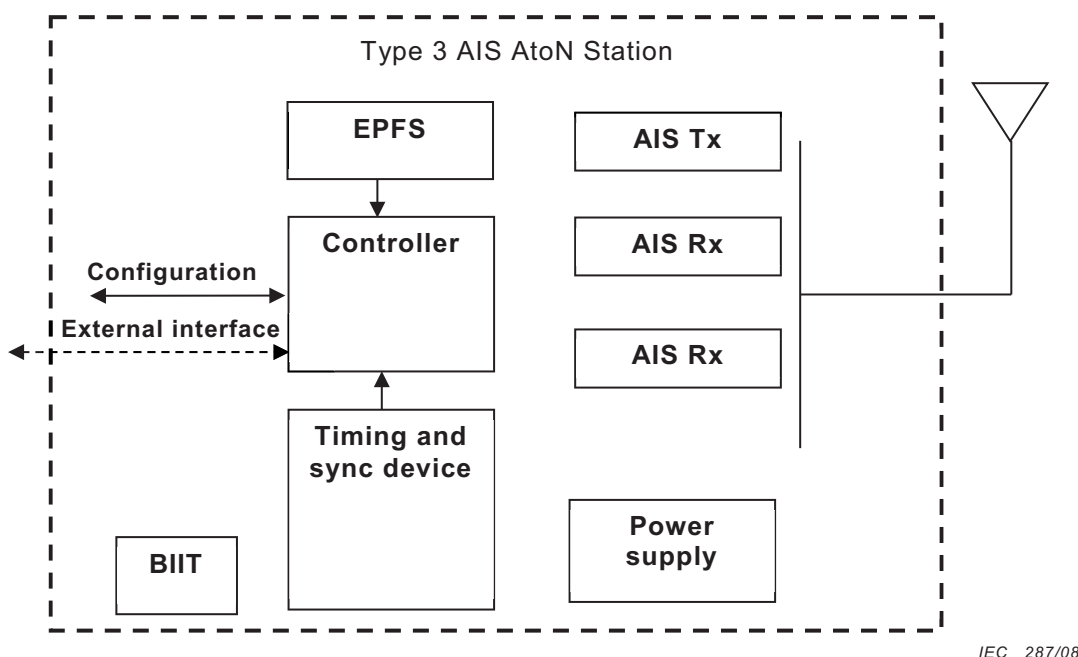


Figure 3 – Functional block diagram of a Type 3 AIS AtoN Station

The characteristics of the Type 3 AIS AtoN Station are:

- receiving capability on both AIS channels,
- transmits using FATDMA.

4.4.2 Capability

A Type 3 AIS AtoN Station has the capability of a Type 1 AIS AtoN Station, with the addition of AIS receivers.

4.4.3 AIS receiver (AIS Rx)

The Type 3 AIS AtoN Station shall have two AIS (TDMA) receiving processes to produce and maintain a slot map for autonomous interaction with the VDL.

4.4.4 Alternatives

4.4.4.1 General

The Type 3 AIS AtoN Station alternatives include all the Type 1 and Type 2 AIS AtoN Station alternatives, with the additions of 4.4.4.2, 4.4.4.3 and 4.4.4.4.

4.4.4.2 Additional controller capability

In addition to Message 21, the controller composes optional output messages to the VDL as described in Table 4. No other messages are allowed, except repeating of SART messages, see 5.4.

Table 4 – Summary of optional Type 3 AIS AtoN Station messages

Msg ID	Message name	Message description	Application examples
6	Binary addressed message	Binary data for addressed communication	Monitoring of AtoN equipment
7	Binary acknowledge message	Acknowledge of addressed binary message	
8	Binary broadcast message	Binary data for broadcast communication	Meteorological and hydrological data

Msg ID	Message name	Message description	Application examples
12	Addressed safety related message	Safety related data for addressed communication	Warn AtoN malfunctioning
13	Safety related acknowledge message	Acknowledge of addressed safety related message	
14	Broadcast safety related message	Safety related data for broadcast communication	Warn AtoN malfunctioning
25	Single slot binary message	Binary data for addressed or broadcast communication	Status report
26	Multiple slot binary message	Binary data for addressed or broadcast communication	Status report

292

293 **4.4.4.3 Access mode**294 **4.4.4.3.1 Message 21**

295 Transmits using FATDMA or RATDMA.

296 **4.4.4.3.2 Messages other than Message 21**

297 For each message other than Message 21, the Type 3 AIS AtoN Station may use FATDMA,
 298 CSTDMA or RATDMA.

299 **4.4.4.4 Indirect and semaphore synchronisation**

300 A Type 3 AIS AtoN Station may optionally synchronise to other AIS Stations using UTC
 301 indirect synchronisation or other AIS Stations acting as semaphore.

302 **4.5 Optional direct configuration via VDL (Type 2 and 3)**

303 An AIS AtoN Station can be configured via the VDL using Messages 6 or 25 with encrypted
 304 binary data as defined in Annex C.

305 The AIS AtoN Station shall attempt to decrypt the binary data, and check that it is the
 306 intended recipient of the message before processing the message any further (See Table 5).

307 AES encryption with a key length of 128 bit is used to encrypt the configuration data over the
 308 VDL. The manufacturer may implement a longer key length. This shall be mentioned in the
 309 manual.

310 **4.6 Optional configuration via VDL using chaining (Type 3)**

311 A chain of AIS AtoN Stations allows for communication from a configuring AIS station to AIS
 312 AtoN Stations that may be unable to communicate directly with the configuring AIS station.
 313 The messages are passed from station to station until the intended recipient is reached, see
 314 Figure 4.

315 The concept requires an AIS AtoN Station to have knowledge of other AIS AtoN Stations in
 316 the chain, namely its parent and all children below it in the chain. A “parent station” is a
 317 station that is in the direction of the configuring AIS station. A “child station” is a station that is
 318 directed away from a configuring AIS station. In order to prevent unnecessary retransmission
 319 of the messages, each AIS AtoN Station in a chain shall have only one parent, but may have
 320 multiple children (this includes all Synthetic and Virtual AIS AtoN).

321 Message 6 or 25 is used for the transfer of the encrypted binary field. It is assumed that the
 322 whole chain has the same encryption key. The source ID and “MMSI of AtoN” fields of
 323 Message 6 or 25 is used to determine whether the received message is from a parent or child
 324 station. If not, then the received message is ignored.

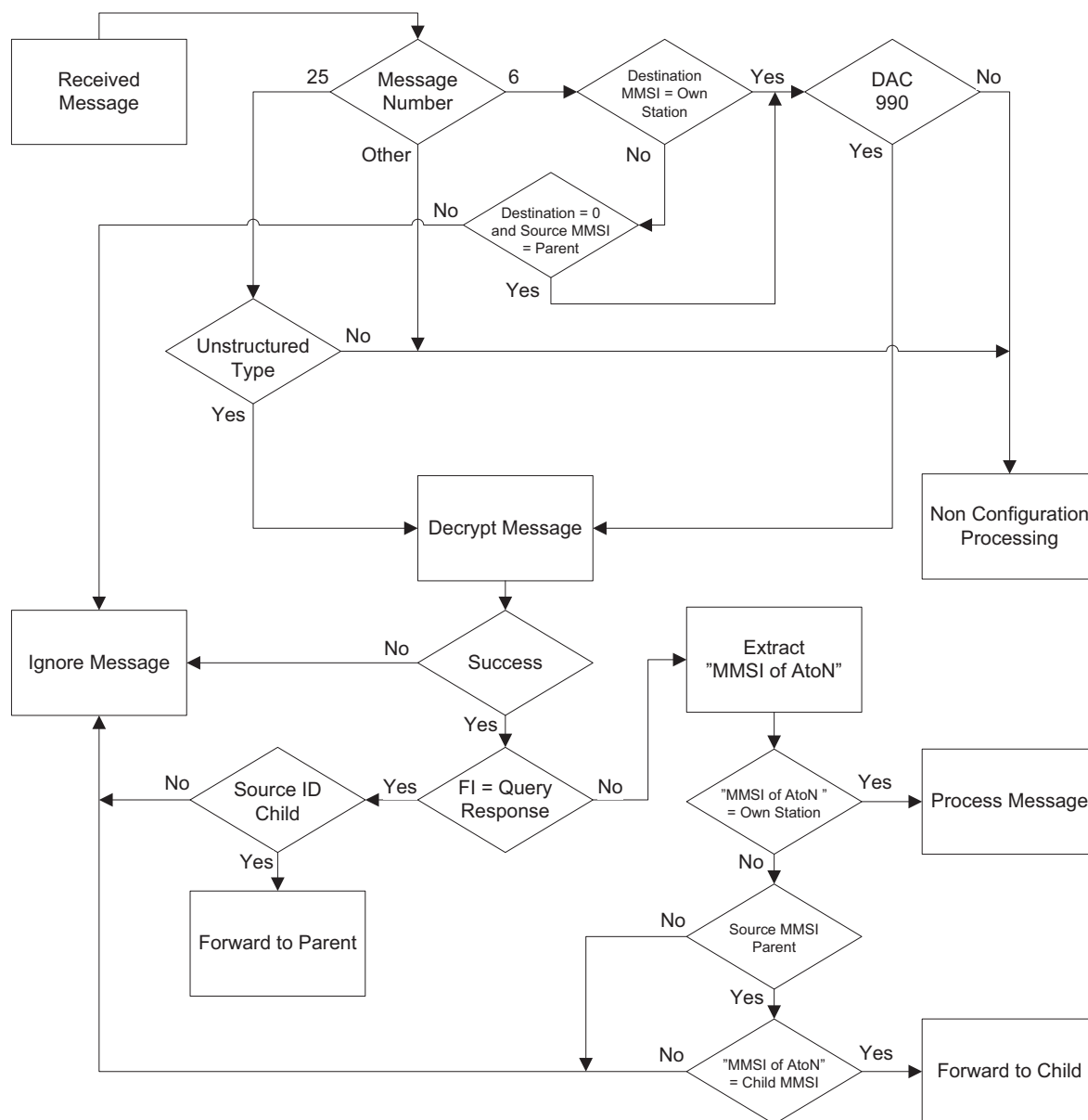
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326 When Message 6 is used, the Destination ID shall be Own Station MMSI or Zero. If the
 327 Destination is zero, the message shall not be processed unless the Source ID is the Parent.

328 The encrypted binary data field is decrypted to obtain the function ID and “MMSI of AtoN”. If
329 the source ID of the message is set to the parent station ID and the function ID is a
330 configuration, query request or function, and the MMSI of the AIS AtoN Station is in the chain,
331 then the message shall be retransmitted, with the source ID set to its own MMSI. If the source
332 ID of the message is set to a child MMSI and the function ID is a query response, then the
333 message shall be retransmitted, with the Destination ID set to the parent MMSI. Any other
334 combination of known or unknown MMSI is ignored (see Table 5).

335 The AIS AtoN Station shall attempt to decrypt the binary data, and check that it, or one of its
336 children, is the intended recipient of the message, before processing the message any further.

337



338

339

Figure 4 – VDL Configuration Decision Tree

340

341

Table 5 – Configuration of AIS AtoN Stations via VDL

Source ID	Type of Message according to Function ID from Table in C.1	“MMSI of AtoN” from Encrypted Binary Field	Action by Own Station
Parent	Query Response	Any	Ignore
Parent	Configuration, Functional or Query Request	Not Own Station	Verify that the Destination ID = Own MMSI or 0 ^b , then verify intended recipient is a child and re-transmit message with Source ID set to own station MMSI.
Parent	Configuration or Functional	Own Station	Verify that the Destination ID = Own MMSI or 0 ^b , then process
Parent	Query Request	Own Station	Verify that the Destination ID = Own MMSI or 0 ^b , then send response with “MMSI of AtoN” = Own Station
Child	Query Response	Any	Re-transmit message to the parent without changing the “MMSI of AtoN”
Child	Configuration, Query Request or Functional	Any	Ignore
Other ^a	Configuration or Functional	Own Station	Verify that the Destination ID = Own MMSI ^b , then process
Other ^a	Query Request	Own Station	Verify that the Destination ID = Own MMSI ^b , then send response with “MMSI of AtoN” = Own Station
Other ^a	Any	Not Own Station	Ignore
^a Other is any MMSI that is not a parent or child ^b Only check when Message 6 is used			

342 5 Requirements for AIS AtoN Stations

343 5.1 Physical layer

344 5.1.1 Transmitter requirements

345 5.1.1.1 Channel

346 The AIS AtoN Station shall operate on dual channels, Channel 1 and Channel 2, in the VHF
 347 Maritime Mobile Service band, using 25 kHz bandwidth, according to the ITU Radio
 348 Regulations, Appendix 18.

349 5.1.1.2 Channel alternatives

350 The Type 1, Type 2 and Type 3 AIS AtoN Stations may transmit on a single channel only,
 351 either Channel 1 or Channel 2.

352 5.1.1.3 Parameter settings

353 Table 6 and Table 8 are derived from Recommendation ITU-R M.1371 and give the
 354 parameters required for an AIS AtoN Station. For the meaning of the symbols and additional
 355 information (footnotes) refer to the appropriate section of Recommendation ITU-R M.1371.

356

Table 6 – Required parameter settings for an AIS AtoN Station

Symbol	Parameter name	Setting (FATDMA, RATDMA)	Setting (CSTDMA)
PH.RFR	Regional frequencies	Two channels between 156,025 MHz and 162,025 MHz	
PH.AIS1	Channel 1 (default Channel 1)	161,975 MHz	
PH.AIS2	Channel 2 (default Channel 2)	162,025 MHz	
PH.BR	Bit rate	9 600 bps	
PH.TS	Training sequence	24 bits	
PH.TST	Transmitter settling time (Transmit power within 20% of final value. Frequency stable to within $\pm 1,0$ kHz of final value). Tested at manufacturers declared transmit power	$\leq 1,0$ ms	≤ 313 μ s
	Ramp down time	≤ 832 μ s	≤ 313 μ s
	Transmission duration	≤ 80 ms	$\leq 23\,333$ μ s
	Transmission delay	No delay	2 083 μ s
	Transmitter output power	12,5 W or as defined by manufacturer	

In addition, the constants of the physical layer of the AIS AtoN Station shall comply with the values given in Table 7 and Table 8.

Table 7 – Required settings of physical layer constants

Symbol	Parameter name	Value
PH.DE	Data encoding	NRZI
PH.FEC	Forward error correction	Not used
PH.IL	Interleaving	Not used
PH.BS	Bit scrambling	Not used
PH.MOD	Modulation	Bandwidth adapted GMSK

Table 8 – Modulation parameters of the physical layer of the AIS AtoN Station

Symbol	Name	Value
PH.TXBT	Transmit BT-product	0,4
PH.RXBT	Receive BT-product	0,5
PH.MI	Modulation index	0,5

5.1.1.4 Transmitter shutdown

An automatic transmitter shutdown shall be provided to ensure that transmission does not continue for more than 2 s. This shutdown shall be independent of any software.

5.1.1.5 Transmitter characteristics

The technical characteristics as specified in Table 9 should apply to the TDMA transmitter.

372

Table 9 – Minimum required TDMA transmitter characteristics

Transmitter parameters	Requirements
Carrier power error	$\pm 1,5$ dB (normal), ± 3 dB (extreme)
Carrier frequency error	± 500 Hz (normal), $\pm 1\,000$ Hz (extreme)
Slotted modulation mask	-25 dBc $\Delta f_c < \pm 10$ kHz -60 dBc ± 25 kHz $< \Delta f_c < \pm 62,5$ kHz
Transmitter test sequence and modulation accuracy	$< 3\,400$ Hz for Bit 0, 1 (normal and extreme) $2\,400$ Hz ± 480 Hz for Bits 2, 3 (normal and extreme) $2\,400$ Hz ± 240 Hz for Bits 4... 31 (normal, $2\,400 \pm 480$ Hz extreme) For Bits 32 ...199 $1\,740 \pm 175$ Hz (normal, $1\,740 \pm 350$ Hz extreme) for a bit pattern of 0101 $2\,400$ Hz ± 240 Hz (normal, $2\,400 \pm 350$ Hz extreme) for a bit pattern of 00001111
Transmitter output power versus time	Power within mask shown in Figure 5 and timings given in Table 12
Spurious emissions	-36 dBm 9 kHz... 1 GHz -30 dBm 1 GHz... 4 GHz

373

374 **5.1.2 Receiver requirements**

375 The technical characteristics as specified in Table 10 should apply to the TDMA receivers.

376

377

Table 10 – Required receiver characteristics

Receiver parameters	Required result (Max PER or absolute level in dBm)	Type 3 (TDMA receiver)		Type 2 (Control receiver)	
		Wanted signal	Unwanted signals	Wanted signals	Unwanted signals
Sensitivity	20%	-107 dBm normal -104 dBm normal at ± 500 Hz offset -101 dBm extreme	-	-97 dBm normal -94 dBm normal at ± 500 Hz offset -91 dBm extreme	-
Error at high input levels	2% 10%	-77 dBm -7 dBm	- -	-77 dBm -7 dBm	- -
Co-channel rejection	20%	-101 dBm	-111 dBm -111 dBm at $\pm 1\,000$ Hz offset	-91 dBm	-107 dBm -107 dBm at $\pm 1\,000$ Hz offset
Adjacent channel selectivity	20%	-101 dBm	-31 dBm	-91 dBm	-31 dBm
Spurious response rejection	20%	-101 dBm	-31 dBm	-91 dBm	-31 dBm
Intermodulation response rejection	20%	-101 dBm	-36 dBm	-91 dBm	-36 dBm

Receiver parameters	Required result (Max PER or absolute level in dBm)	Type 3 (TDMA receiver)		Type 2 (Control receiver)	
		Wanted signal	Unwanted signals	Wanted signals	Unwanted signals
Blocking and desensitisation	20%	-101 dBm	-23 dBm (<5 MHz) -15 dBm (>5 MHz)	-91 dBm	-33 dBm (<5 MHz) -25 dBm (>5 MHz)
Spurious emissions	-57 dBm or less (9 kHz-1 GHz) -47 dBm or less (1 GHz-4 GHz)	-	-	-	-

378

379 **5.1.3 Power consumption**

380 The manufacturer shall state the average power consumed by the AIS AtoN Station under
381 defined test conditions.

382 **5.1.4 Environmental requirements**

383 The manufacturer shall declare the category for durability and resistance to environmental
384 conditions (e.g. durability and resistance to environment, electromagnetic emissions, and
385 immunity to electromagnetic environment) for the EUT as specified in IEC 60945.

386 **5.2 Link layer**387 **5.2.1 General**

388 The link layer specifies how data shall be formatted and transmitted on the VDL.

389 The link layer requirements are referenced to Recommendation ITU-R M.1371.

390 **5.2.2 AIS Messages**391 **5.2.2.1 Message 21 format and content**392 **5.2.2.1.1 AtoN status bits**

393 The AIS AtoN Station shall broadcast Message 21, as defined in Recommendation ITU-R
394 M.1371. In Message 21, the status bits (7 6 5 4 3 2 1 0) are numbered so that bit 7 is the
395 most significant bit, and bit 0 is the least significant bit. The first three bits (i.e. 7, 6 and 5)
396 shall be used to define a Page ID. The Page ID can range from 0 to 7, allowing 8 pages. Page
397 ID 0 shall not be used for the Regional/International application.

398 Annex D defines AtoN status bit pages.

399 **5.2.2.1.2 Virtual and Synthetic AIS AtoN message**

400 An AIS AtoN Station, when broadcasting Message 21 for Virtual and Synthetic AtoN, shall use
401 the MMSIs allocated to the Virtual and Synthetic AtoN as issued under the same series for
402 Real AIS AtoN Stations. For Synthetic AIS AtoN messages, the repeat indicator field shall be
403 set to 1 to signify that the message is transmitted from a position other than that provided in
404 the message. All parameters of all virtual and synthetic AIS AtoN messages shall be
405 configurable.

406 5.2.2.2 Additional messages

407 In addition to Message 21, the AIS AtoN Station may transmit other messages, in accordance
408 with Recommendation ITU-R M.1371. These are summarised in Table 2.

409 5.2.3 Synchronisation

410 5.2.3.1 General

411 Synchronisation is used to determine the TDMA frames and individual slots so that the
412 transmission of the AIS Message is performed within the desired slot. The synchronisation for
413 the AtoN AIS Station shall be UTC direct.

414 If UTC direct synchronisation is lost, the AIS AtoN Station shall cease transmitting or
415 optionally behave as declared by the manufacturer.

416 5.2.3.2 Optional indirect synchronisation

417 When UTC synchronisation has failed, the Type 3 AIS AtoN Station may use indirect
418 synchronisation or synchronise to a station acting as a semaphore.

419 5.2.3.3 Synchronisation accuracy

420 The transmission timing error, including jitter, of the AtoN AIS shall be within the limits as
421 defined in Table 11, referring to an ideal transmission as defined by Recommendation ITU-R
422 M.1371.

423 **Table 11 – Maximum allowed time error**

Synchronisation mode	Maximum allowed time error
UTC direct synchronisation	± 1 bit ($\pm 104 \mu\text{s}$)
UTC indirect synchronisation	± 3 bits ($\pm 312 \mu\text{s}$)
Semaphore synchronisation	± 3 bits ($\pm 312 \mu\text{s}$)

424

425 5.2.4 VDL access schemes

426 5.2.4.1 General

427 The AIS AtoN Station shall use FATDMA (or RATDMA only for Type 3) for the transmission of
428 Message 21.

429 The AIS AtoN Station may optionally transmit Message 6, 7, 8, 12, 13, 14, 25 and 26. The
430 maximum length of Messages 6, 8, 12, and 14 is three slots per message when using
431 FATDMA or RATDMA (if implemented). CSTDMA may be used for one slot messages only.

432 To ensure a consistent slot range the message transmission slot interval valid range is 375 to
433 3 240 000 slots. The interval shall evenly divide a minute, hour, or day; and shall be an
434 integer number of slots. This results in the following valid intervals:

- 435 • Seconds: 10, 12, 20, 30
- 436 • Minutes: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30
- 437 • Hours: 1, 2, 3, 4, 6, 8, 12, 24

438 5.2.4.2 Type 3 AIS AtoN Station

439 The Type 3 AIS AtoN Station shall use FATDMA and may use RATDMA (if implemented) for
440 Message 21. The Type 3 AIS AtoN Station shall use the VDL access scheme defined by its
441 configuration.

442 Single slot binary and safety related messages may be transmitted using FATDMA, RATDMA
443 or CSTDMA, if implemented. When enabled, acknowledgement Message 7 and 13 shall be
444 transmitted within 4 s of receiving Messages 6 and 12 using FATDMA, CSTDMA or RATDMA.
445 When Acknowledgement is enabled, transmission of Message 6 and 12 shall be repeated if
446 no acknowledgment is received within 4 s of each transmission (up to 3 times)

5.2.4.3 FATDMA VDL Access

Slot reservations made by Message 20 shall be ignored when scheduling an FATDMA transmission, since the base station may be reserving them for use by the AIS AtoN Station.

5.2.4.4 RATDMA VDL Access

RATDMA shall use slots according to Recommendation ITU-R M.1371.

The AtoN shall monitor the VDL for a minimum of 1 minute before RATDMA transmission.

When receivers are not operating continuously, slots reserved by a received Message 20 shall be observed with an extended time out of between 12 and 24 hours. Additionally receivers shall be turned on for 7 consecutive minutes at power on and at least once per 12 hour period to allow latest FATDMA reservations to be captured.

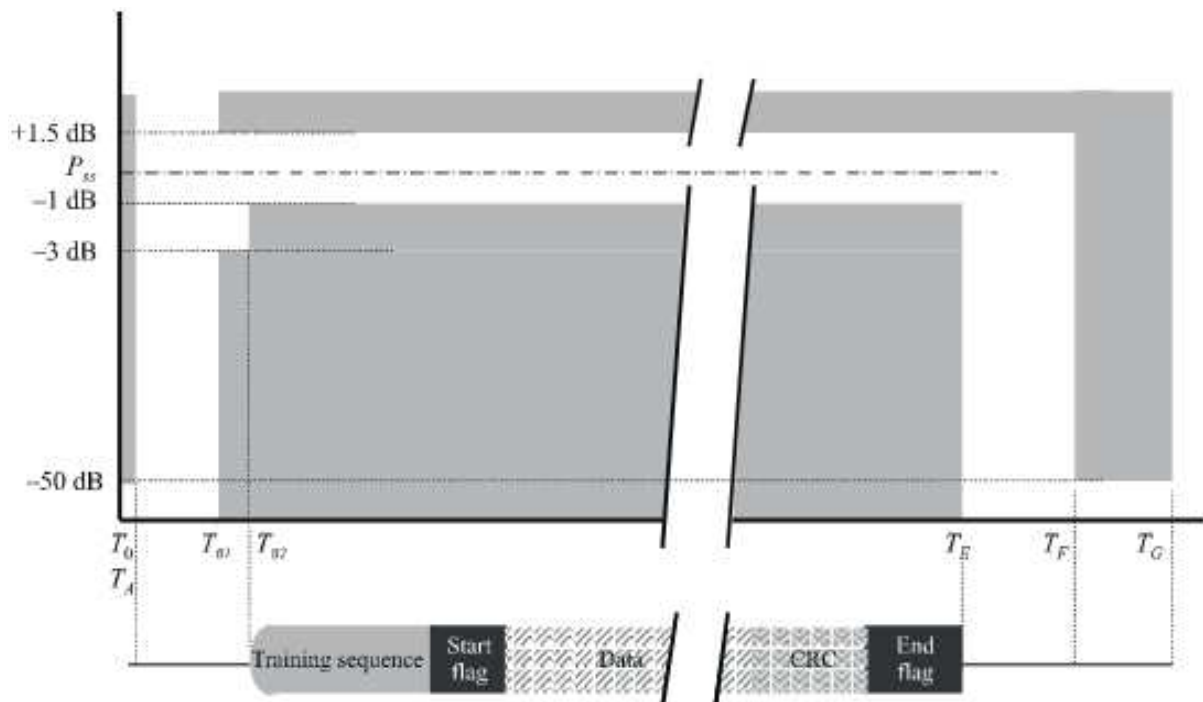
The Start Slot defines the first slot of the RATDMA selection interval. If the Start Slot is not defined, then it is randomly selected, which is the default behaviour when scheduling transmissions using RATDMA.

5.2.4.5 FATDMA and RATDMA VDL access

5.2.4.5.1 Transmission timing

The transmitter shall begin transmission by turning on the RF power after slot start (T_0). The unit shall and reach -3 dB before T_{B1} (see Figure 5).

The transmitter shall be turned off after the last bit of the transmission packet has left the transmitting unit; nominal transmission end is T_e .



1371-02

Figure 5 – Power versus time mask

The access to the medium is performed as shown in Figure 5 and Table 12.

Table 12 – Definitions of timing for Figure 5

Reference	Bits	Time in milliseconds	Definition
T_0	0	0	Start of transmission slot. Power shall NOT exceed – 50 dB of P_{ss} before T_0
T_A	0-6	0-0,624	Power exceeds –50 dB of P_{ss}
T_B	T_{B1}	6	Power shall be within +1,5 dB or –3 dB of P_{ss}
	T_{B2}	8	Power shall be within +1,5 dB or –1 dB of P_{ss}
T_E	104 - 748	10,833 – 77,917	Power shall remain within +1,5 dB or –1 dB of P_{ss} during the period T_{B2} to T_E The T_E can vary depending on message type, data content and bit stuffing bits from minimum 104 bits for the shortest possible message (Message 14 and no text content) to maximum length of 740 bits for a three slot message. T_E shall not exceed; • 236 bits for a one slot message • 492 bits for a two slot message • 748 bits for a three slot message A station may occupy at maximum three consecutive slots for one continuous transmission. Only a single application of the overhead (ramp up, training sequence, flags, FCS, buffering) is required for a long transmission packet. The length of a long transmission packet should not be longer than necessary to transfer the data; i.e. the AIS should not add filler.
T_F	112 - 756	11,667 – 78,787	Power shall be –50 dB of P_{ss} and stay below this
T_G	256, 512 or 768	26,667 one slot TX 53,333 two slot TX 80,000 three slot TX	Start of next transmission time period

5.2.4.5.2 Link sub-layer 1: Medium Access Control (MAC)

Refer to Recommendation ITU-R M.1371 and 5.2.3 for synchronisation.

5.2.4.5.3 Link sub-layer 2: Data Link Service (DLS)

Refer to Recommendation ITU-R M.1371.

5.2.4.5.4 Link sub-layer 3: Link Management Entity (LME)

Refer to Recommendation ITU-R M.1371.

5.2.4.6 CSTDMA VDL access mode

The operation of CSTDMA in the AIS AtoN Station shall be in accordance with Recommendation ITU-R M.1371 and tested according to IEC 62287-1, however the AIS AtoN Station is allowed to use the same transmit power setting for CSTDMA as for RATDMA and FATDMA.

All CSTDMA transmissions shall be limited to one slot.

5.2.5 Autonomous mode**5.2.5.1 General**

The AIS AtoN Station shall always operate autonomously and determine its own schedule for transmission of its messages based on its configuration. The station shall automatically resolve scheduling conflicts with other stations when using CSTDMA and FATDMA.

5.2.5.2 Message 21 reporting intervals

In accordance with ITU-R M.1371 the default reporting interval for Message 21 shall be 3 min. This shall be configurable to other reporting intervals.

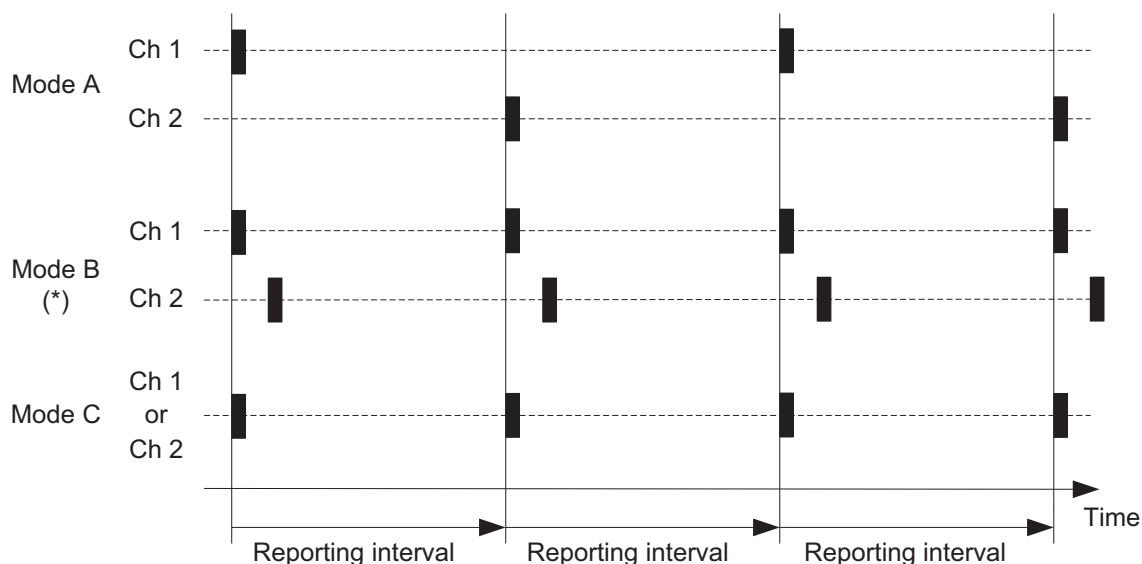
The AIS AtoN Station shall be configurable to decrease the reporting interval for Message 21 when the AtoN is off-position.

5.2.5.3 Channel operation

5.2.5.3.1 Reporting modes for Message 21

The AIS AtoN Station shall transmit Message 21 at the configured reporting interval. As indicated in Figure 6, transmissions shall be:

- **Mode A operation** – Message 21 transmission alternates between Channel 1 and Channel 2 in a subsequent frame that is nominally one reporting interval later. Message 21 content is updated for each message, or
- **Mode B operation** – The same Message 21 transmitted on Channel 1 and Channel 2 in quick (nominally 4 s) succession. The first transmission of each Message 21 may be on either Channel 1 or Channel 2. The second transmission shall be on the other channel, or
- **Mode C operation** – Message 21 transmitted on a single channel, either Channel 1 or Channel 2. Message 21 content updated at each reporting interval.



(*) Mode B may start on Ch 1 or Ch 2

Each  represents transmission of Message 21

Figure 6 – Reporting modes for Message 21

5.2.5.3.2 Single channel operation for Message 21

The Type 1 and Type 2 AIS AtoN Stations shall transmit on the designated channel using FATDMA slots of the selected frames in the UTC hour (as per mode C, Figure 6).

5.2.6 Electronic position fix system

5.2.6.1 Position source

An EPFS shall be used as the source for AtoN position reporting unless a surveyed position is used.

If the internal EPFS is a GNSS receiver it shall meet the following requirements of the IEC 61108 series: position accuracy, acquisition, re-acquisition, receiver sensitivity, RF dynamic range, interference susceptibility, position update, failure warnings, status indications and integrity flag, provide a resolution of one ten-thousandth of a minute of arc and use WGS 84 datum.

521 If another type of EPFS is used, then it shall meet the requirements of the applicable standard
522 and use WGS 84 datum.

523 5.2.6.2 Augmentation systems

524 The EPFS may be capable of being corrected using any suitable augmentation system (for
525 example, SBAS, radio beacon DGNSS, evaluation of Message 17, etc.). The manufacturer
526 shall declare which augmentation systems can be used, and that the augmentation system
527 does not adversely affect Message 21 transmissions.

528 The manufacturer shall declare if the EPFS is not capable of being corrected.

529 5.2.6.3 Invalid position

530 If the EPFS device is unable to provide a valid position fix, then the reported position shall be
531 longitude = 181° = not available = default and latitude = 91° = not available = default and the
532 time stamp field shall be set to a value of 63.

533 5.2.6.4 Off-position monitoring

534 If the floating AtoN is within its on-position limits, the off-position indicator shall be set to “0”
535 in the transmitted Message 21.

536 If a floating AtoN is off-position, the AIS AtoN Station shall identify this condition and the off-
537 position indicator shall be set to “1” in the transmitted Message 21. The reporting interval
538 when the AIS AtoN Station is off-position shall be determined by its configuration(see
539 5.2.5.2).

540 5.2.6.5 Position source alternatives for Types 1, 2 and 3

541 If a surveyed position is used, an EPFS is not required.

542 When a surveyed position is used, the latitude and longitude fields of the transmitted
543 Message 21 shall contain the surveyed position, the “type of electronic position fixing device”
544 is set to “7” (surveyed), the “RAIM-Flag” field is set to “0”, the off-position indicator field is set
545 to “0” and the “position accuracy” field is set in accordance with the accuracy of the surveyed
546 position (i.e. “1” if better than 10 m, otherwise “0”).

547 5.2.7 Built-in integrity test

548 The AIS AtoN Station shall have a Built-in Integrity Test (BIIT) process which tests for
549 conditions as described in Table 13 – AIS AtoN Station reaction to BIIT conditions. If standard
550 configuration sentences are used, the warning / notification conditions shall be sent via
551 sentence ADS. The manufacturer may optionally output an ALR sentence using the Alarm ID
552 defined in Table 13.

553 The health flag in the AtoN status bits defined in Annex C shall be set if any of the BIIT
554 conditions in Table 13 are detected.

555 Table 13 – AIS AtoN Station reaction to BIIT conditions

Alarm ID	Condition	Reaction of the AIS AtoN Station
001	AIS: Tx malfunction	Stop transmission
002	AIS: Antenna VSWR exceeds limit	Continue operation
003	AIS: Rx Channel 1 malfunction	Stop RATDMA and CSTDMA transmissions on affected channel
004	AIS: Rx Channel 2 malfunction	Stop RATDMA and CSTDMA transmissions on affected channel
006	AIS: General failure	Stop transmission
007	AIS: Direct synchronisation failure	As defined by manufacturer
026	AIS: EPFS failure	Continue operation



Alarm ID	Condition	Reaction of the AIS AtoN Station
037	AIS: Synchronisation lost	As defined by manufacturer
038	AIS: DGNSS input failed	Continue operation

5.3 Configuration method

5.3.1 General

The configuration method shall be as defined by the manufacturer and held in non-volatile memory.

Configuration may use standard configuration sentences either directly or via the VDL. Query for the encryption key is not allowed. The configuration method shall:

- configure the content for Message 21;
- configure transmission parameters for Message 21 and any other messages supported by the manufacturer;
- configure the behaviour of the AIS AtoN Station when synchronisation is lost;
- configure the behaviour of the AIS AtoN Station when off position.

The manufacturer shall provide a means to verify configuration and version information of the AIS AtoN Station.

5.3.2 Alternative for Types 1, 2 and 3

Standard PI sentences

Table 14 provides an overview of the sentences that may be used for configuration of AIS AtoN applications. It includes sentences from IEC 61162-1 and AIS AtoN specific sentences given in Annex A.

These standard sentences shall be implemented to provide at least one standard method for configuration. Sentences which support an optional, not implemented function are not required.

It is possible to implement these sentences using a separate interface unit which communicates with the AtoN unit with a proprietary communication method.

Table 14 – Standard sentences

Sentence Formatter	Input			NAK required with Invalid Input	Output			Description / Comments
	Type 1	Type 2	Type 3		Type 1	Type 2	Type 3	
ABK					X	X	X	Acknowledgement Message
ABM	X	X	X	N				Addressed Binary Message
ACF	X	X	X	Y	Q	Q	Q	General AIS AtoN Station Configuration
ACG (ACE) ^c	X	X	X	Y	Q	Q	Q	Extended General AIS AtoN Station Configuration
AFB ^a	X	X	X	Y				Force Broadcast
AID	X	X	X	Y	Q	Q	Q	Configure or change MMSI
BBM	X	X	X	N				Broadcast Binary Message

Sentence Formatter	Input			NAK required with Invalid Input	Output			Description / Comments
	Type 1	Type 2	Type 3		Type 1	Type 2	Type 3	
CBR ^{a,b} (AAR) ^c	X	X	X	Y	Q	Q	Q	Configure Broadcast Rates for AIS AtoN Station Messages.
CEK (AKE) ^c		X	X	Y				Define Encryption Key
COP (ARW) ^c		X	X	Y		Q	Q	Receiver Turn on Times
DCR (AFC) ^c				Y	Q	Q	Q	AtoN Station Function Capability (see Table 15)
FSR						X	X	Optional
MEB ^a (MPR) ^c	X	X	X	Y				Message Payload Rebroadcast
NAK					X	X	X	Output when a Command Fails to Execute
SPO		X	X	Y		Q	Q	Optional
VDM						X	X	VHF Data link Message
VDO					X	X	X	VHF Data-link Own-vessel message
VER				Y	Q	Q	Q	Version
VSI						X	X	Optional

X – Indicates input to or output from the AIS AtoN Station.

Q – Indicates that the sentence may be externally requested using the IEC61162 standard query method.

^a For Message ID Index within the AFB, CBR, and MEB sentences the following interpretation applies: For normal schedules a Message Id Index of 1... 7 shall be used and 0 shall be used for special cases like single messages.

^b CBR utilizes slots for the definition of the RATDMA Slot Interval in place of seconds.

^c Sentence formatters in parenthesis are legacy sentences which performed a similar function but should not be used for new designs (See Annex B).

Table 15 – DCR Capabilities

BIT Position	Capability
0	Type 1
1	Type 2
2	Type 3
3	FATDMA
4	RATDMA
5	CSTDMA
6	Direct VDL Configuration Message 6
7	Direct VDL Configuration Message 25
8	Chaining VDL Configuration
9	UTC Indirect
10	Message 6/7

BIT Position	Capability
11	Message 8
12	Message 12/13
13	Message 14
14	Message 25
15	Message 26
16	Dual Channel
17	Virtual AtoN
18	EPFS
19 - 99	Reserved for future use
100 - 127	Manufacturer Defined

584

585 COP sentence limitations are as follows:

586 • Start Time = shall be an integer minute value

587 • Time interval between periods = shall not be greater than 1 week (604800 s), shall not be
588 higher resolution than 1 minute, and the interval shall evenly divide an hour, day or be an
589 integer number of days; This results in the following valid intervals:

590 • Minutes: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30

591 • Hours: 1, 2, 3, 4, 6, 8, 12, 24

592 • Day: 1, 2, 3, 4, 5, 6, 7

593 • Duration of Period = shall be an integer minute value with a maximum of 24 hours

594 A NAK sentence using reason code 11 shall be generated if a non-conforming parameter is
595 entered with the NAK Descriptive Text “invalid interval”, and the COP shall be ignored.

596 **5.3.2.1 Optional TAG Block sentences**

597 In case of introducing an AIS AtoN station in a shore based network, the TAG Block functions
598 may be used to support station identification, routing of sentences, additional information and
599 grouping of sentences.

600 The sentences described in Table 16 are used to configure the TAG Block functions.

601 If the TAG Blocks are implemented, all functions according to Table 16 shall be supported.

602

603

Table 16 – Optional TAG Block functions

Sentence	Associated parameter	Required input function	Required output function
CPC	“c” = Unix time parameter	No evaluation on input required	Output of time tag (current UTC time) with all output sentences, 0 if not available. Required accuracy of +/- 1 second.
CPD	“d” = Destination-Identification	Filtering of input sentences based on own UI (configured by SID sentence)	Output of Destination-identification Tag in all responses
CPG ^a	“g” = sentence Grouping	No evaluation required	Grouping of related sentences, VDM and VDO with a VSI sentence and multi-part sentences
CPN ^b	“n” = line count	No evaluation required	Output of line count Tag with all output sentences
CPS	“s” = Source-identification	Filtering of input sentences based on Source-identifications configured by TBS sentence	Output of Source-identification TAG with own UI attached to NAK responses or to all output sentences

Sentence	Associated parameter	Required input function	Required output function
TBR	TAG block report request	Response with at least CPD, CPG, CPS, CPC, CPN	No TBR output
TBS	"s" = Source-identification	Configuration of at least 5 different Source-identifications for input filtering	Response on query for TBS
^a The minimum required: Group-code Increment = 1. The Reset Event = 0. Initial Group-code = 1. Group-code Limit = 1-999999999. ^b The minimum required: Count Increment = 1. The Reset Event = 0. Initial Line-count = 1. Line-count Limit = 1-999999999.			

604

605 **5.3.3 Chaining of AIS AtoN Stations**

606 The AIS AtoN Station may support chaining to communicate messages to other AIS AtoN
607 Stations (see 4.6).

608 No additional IEC 61162-1 sentences are required to support this functionality.

609 **5.4 Repeat broadcast of active AIS-SART message**

610 A Type 3 AtoN may optionally implement repeat functionality for active AIS-SART messages.
611 When implemented, it shall follow rules set forth in 4.4.3 of IEC 62320-3:2015, which provides
612 for only one message from the active AIS-SART burst to be repeated.

613 **5.5 Other requirements**614 **5.5.1 Additional features**

615 Additional features shall not adversely affect the transmission of Message 21.

616 **5.5.2 Manufacturer's information**

617 The information shall describe:

- 618 • external interfaces;
- 619 • configuration of the AIS AtoN Station;
- 620 • hardware and electrical specifications;
- 621 • average power consumption;
- 622 • implementation method for firmware upgrades.

623 **5.5.3 Marking and identification**

624 The AIS AtoN Station shall be marked with the following information:

- 625 • identification of the manufacturer;
- 626 • model identification;
- 627 • serial number of the unit, and
- 628 • operating voltage.

629 The title and version of each software element included in the installed software system shall
630 be either marked on the equipment or output on request using the VER sentence.

631 **5.5.4 Additional connection points**632 **5.5.4.1 Protection**

633 The number of connection points (USB ports, disc drives, wireless connection, etc.) shall be
634 limited to the absolute minimum required specified by the manufacturer for operation, lifetime
635 maintenance and support. All superfluous other points shall be blocked e.g. by software or
636 physically disabled.

5.5.4.2 Executable program file verification

Execution of any type of files from external data source shall only be possible after passing an authentication process as defined by the manufacturer before accessing executable content.

6 Tests of AIS AtoN Stations**6.1 General**

Physical test parameters and testing subject to national requirements may override parameters stated below.

6.2 Test conditions**6.2.1 Normal test conditions****6.2.1.1 Temperature and humidity**

Temperature and humidity shall be within following ranges:

Temperature +15° C to +35° C

Humidity 20 % to 75 %

6.2.1.2 Power supply

The normal supply power used for the tests shall be in accordance with the nominal power of the EUT declared by the manufacturer and taking into account the variations set by local safety regulations concerning power supplies for example IEC 60950 as applicable in many countries.

6.2.2 Extreme test conditions

Extreme test conditions are as specified in IEC 60945. Where required, tests under extreme test conditions shall be a combination of

- dry heat and the upper limit of supply voltage applied simultaneously, and
- low temperature and the lower limit of supply voltage applied simultaneously.

6.2.3 Standard test environment

The EUT is tested in an environment using test equipment to measure the transmitted messages. The EUT will be configured via the configuration interface prior to the tests. Operation is checked on channels in the maritime mobile band. Refer to Figure 7.