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**Entwurf**

**Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt –  
Geräte der Klasse B des automatischen Identifikationssystems (AIS) für Schiffe –  
Teil 2: Selbstorganisierende Zeitmultiplexverfahren (SOTDMA) (IEC 80/665/CDV:2012);  
Englische Fassung FprEN 62287-2:2012**

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 80/665/CDV:2012);  
English version FprEN 62287-2:2012

**Anwendungswarnvermerk**

Dieser Norm-Entwurf mit Erscheinungsdatum 2012-09-24 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

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- oder in Papierform an die DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (Hausanschrift: 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.

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

## Nationales Vorwort

Die Englische Fassung des europäischen Dokuments FprEN 62287-2:2012 „Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt – Geräte der Klasse B des automatischen Identifikationssystems (AIS) für Schiffe – Teil 2: Selbstorganisierende Zeitmultiplexverfahren (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 80/665/CDV:2012 „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 FprEN 62287-2:2012 übernommen worden.

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

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründen, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Das K 738 hat mit RS\_738\_2011-0037 beschlossen, dass die Bedingungen des DIN-Präsidialbeschlusses 1/2004 für das vorliegende Normprojekt erfüllt sind.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der IEC 62287-2 veröffentlicht. Zu deren Abschnitt 3, der die Abkürzungen und Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für viele der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

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 diesen Norm-Entwurf ist das nationale Arbeitsgremium K 738 „Elektronische Navigationsinstrumente“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE ([www.dke.de](http://www.dke.de)) zuständig.

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

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

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

Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen 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.

## Nationaler Anhang NA (informativ)

### NA.1 Abkürzungen

Für die Anwendung dieses Dokuments gelten die folgenden 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.

#### NA.1.1 Abkürzungen

|       |                                                             |                                                        |
|-------|-------------------------------------------------------------|--------------------------------------------------------|
| AIS   | <b>Automatisches Identifikationssystem</b>                  | [en: Automatic Identification System]                  |
| BER   | <b>Bitfehlerrate</b>                                        | [en: Bit Error Rate]                                   |
| BIIT  | <b>Integrierte Integritätsprüfung</b>                       | [en: Built-In Integrity Tests]                         |
| BT    | <b>Zeit-Bandbreite-Produkt</b>                              | [en: Bandwidth Time Product]                           |
| COG   | <b>Fahrtrichtung über Grund</b>                             | [en: Course over ground]                               |
| CRC   | <b>Zyklische Redundanzprüfung</b>                           | [en: Cyclic Redundancy Check]                          |
| CSD   | <b>Kompassschutzabstand</b>                                 | [en: Compass Safe Distance]                            |
| DGNSS | <b>Differentielles Globales Satellitennavigationssystem</b> | [en: Differential Global Navigation Satellite Service] |
| DLS   | <b>Daten-Verbindungsdienst</b>                              | [en: Data Link Service]                                |
| DSC   | <b>Digitaler Selektivruf</b>                                | [en: Digital Selective Calling]                        |
| EUT   | <b>Gerät im Test</b>                                        | [en: Equipment under test]                             |
| FM    | <b>Frequenzmodulation</b>                                   | [en: Frequency Modulation]                             |
| GMSK  | <b>Gaußsche Modulation mit minimaler Bandbreite</b>         | [en: Gaussian Minimum Shift Keying]                    |
| GNSS  | <b>Globales Satellitennavigationssystem</b>                 | [en: Global Navigation Satellite Service]              |
| HDLC  | <b>HDLC-Datenübertragungsprozedur</b>                       | [en: High level Data Link Control]                     |
| IMO   | <b>Internationale Seeschiffahrtsorganisation</b>            | [en: International Maritime Organization]              |
| ITDMA | <b>Schrittweiser Zeitmehrfachzugriff</b>                    | [en: Incremental Time Division Multiple Access]        |
| ITU   | <b>Internationale Fernmeldeunion</b>                        | [en: International Telecommunication Union]            |
| LME   | <b>Verbindungsverwaltungseinrichtung</b>                    | [en: Link Management Entity]                           |
| MAC   | <b>Medienzugriffssteuerung</b>                              | [en: Medium access control]                            |

|        |                                                                      |                                                      |
|--------|----------------------------------------------------------------------|------------------------------------------------------|
| MMSI   |                                                                      |                                                      |
| MSSA   | <b>Mehrkanalzugriffsverfahren</b>                                    | [en: Multi-channel slot selection access]            |
| NM     | <b>Seemeile oder Nautische Meile</b>                                 | [en: Nautical mile (1 NM = 1852 m)]                  |
| NRZI   | <b>NRZI-Übertragungskodierung</b>                                    | [en: Non Return to Zero Inverted]                    |
| OSI    | <b>Verbindungsmodell für Offene Systeme</b>                          | [en: Open Systems Interconnection model]             |
| PER    | <b>Paketfehlerrate</b>                                               | [en: Packet Error Rate]                              |
| PI     | <b>Präsentationsschnittstelle</b>                                    | [en: Presentation Interface]                         |
| RAIM   | <b>Unabhängige Integritätsprüfung im GNSS-Empfänger</b>              | [en: Receiver autonomous integrity monitoring]       |
| RATDMA | <b>Zeitmehrfachzugriff mit Direktzugriff</b>                         | [en: Random Access Time Division Multiple Access]    |
| RF     | <b>Funkfrequenz</b>                                                  | [en: Radio Frequency]                                |
| RR     | <b>Vollzugsordnung für den Funkdienst (VOFunk)</b>                   | [en: Radio Regulations]                              |
| Rx     | <b>Empfänger</b>                                                     | [en: Receive]                                        |
| SAR    | <b>Suchen und Retten</b>                                             | [en: Search and rescue]                              |
| SINAD  | <b>Verhältnis der Gesamtsignalleistung zur Summe der Störsignale</b> | [en: Signal Interference Noise and Distortion ratio] |
| SOG    | <b>Geschwindigkeit über Grund</b>                                    | [en: Speed over ground]                              |
| SOTDMA | <b>Selbst organisierter Zeitmehrfachzugriff</b>                      | [en: Self Organised Time Division Multiple Access]   |
| TDMA   | <b>Zeitmehrfachzugriff</b>                                           | [en: Time Division Multiple Access]                  |
| Tx     | <b>Sender</b>                                                        | [en: Transmitter]                                    |
| UTC    | <b>Koordinierte Weltzeit</b>                                         | [en: Universal Time Co-ordinated]                    |
| VDL    | <b>VHF Datenverbindung</b>                                           | [en: VHF Data Link]                                  |
| VHF    | <b>Ultrakurzwelle</b>                                                | [en: Very High Frequency]                            |
| VSWR   | <b>Stehwellenverhältnis</b>                                          | [en: Voltage Standing Wave Ratio]                    |
| VTs    | <b>Schiffsverkehrsdienste</b>                                        | [en: Vessel Traffic Services]                        |

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## 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

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

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

| FDIS       | Report on voting |
|------------|------------------|
| XX/XX/FDIS | XX/XX/RVD        |

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

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

IEC 62287 consists of the following parts, under the general title Maritime navigation and radio communication and systems – Class B shipborne equipment of the automatic identification system (AIS)

Part 1: Carrier-sense time division multiple access (CSTDMA) techniques

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date<sup>1)</sup> indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

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<sup>1)</sup> The National Committees are requested to note that for this publication the maintenance result date is 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

### 1 Scope

This part of International Standard IEC 62287 specifies operational & 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.1084-4;
- only uses the internal GNSS, no position sensor input is allowed;
- uses 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;
- has the capability to transmit the long-range broadcast message.

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 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 radio communication 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 radio communication equipment and systems - Digital interfaces*

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

IEC 61993-2, *Maritime navigation and radio communication equipment and systems - Digital interfaces – Automatic Identification Systems (AIS) Part 2: Class A shipborne equipment of the universal automatic identification system (AIS)*

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

ITU-R Recommendation M.1084-4, *Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service*

ITU-R Recommendation M.1371-4, *Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile band*

### 3 Abbreviations

|       |                                                  |
|-------|--------------------------------------------------|
| AIS   | Automatic Identification System                  |
| BER   | Bit Error Rate                                   |
| BIIT  | Built-In Integrity Tests                         |
| BT    | Bandwidth Time                                   |
| COG   | Course over ground                               |
| CRC   | Cyclic Redundancy Check                          |
| CSD   | Compass Safe Distance                            |
| DGNSS | Differential Global Navigation Satellite Service |
| DLS   | Data Link Service                                |
| DSC   | Digital Selective Calling                        |
| EUT   | Equipment under test                             |
| FM    | Frequency Modulation                             |
| GMSK  | Gaussian Minimum Shift Keying                    |
| GNSS  | Global Navigation Satellite Service              |
| HDLC  | High level Data Link Control                     |
| IMO   | International Maritime Organization              |
| ITDMA | Incremental Time Division Multiple Access        |
| ITU   | International Telecommunication Union            |
| LME   | Link Management Entity                           |
| MAC   | Medium access control                            |
| MMSI  | Maritime Mobile Service Identity                 |
| MSSA  | Multi-channel slot selection access              |
| NM    | Nautical mile (1 NM = 1852 m)                    |

|        |                                                |
|--------|------------------------------------------------|
| NRZI   | Non Return to Zero Inverted                    |
| OSI    | Open Systems Interconnection model             |
| PER    | Packet Error Rate                              |
| PI     | Presentation Interface                         |
| RAIM   | Receiver autonomous integrity monitoring       |
| RATDMA | Random Access Time Division Multiple Access    |
| RF     | Radio Frequency                                |
| RR     | Radio Regulations                              |
| Rx     | Receive                                        |
| SAR    | Search and rescue                              |
| SINAD  | Signal Interference Noise and Distortion ratio |
| SOG    | Speed over ground                              |
| SOTDMA | Self Organised Time Division Multiple Access   |
| TDMA   | Time Division Multiple Access                  |
| Tx     | Transmit                                       |
| UTC    | Universal Time Co-ordinated                    |
| VDL    | VHF Data Link                                  |
| VHF    | Very High Frequency                            |
| VSWR   | Voltage Standing Wave Ratio                    |
| VTs    | Vessel Traffic Services                        |

NOTE Abbreviations related to IEC 61162 series are not included in the above list. For their meaning refer to that International Standard.

## 4 General requirements

### 4.1 General

#### 4.1.1 Capabilities of the Class B “SO” AIS

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

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

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

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

#### 4.1.2 Quality assurance

(See 10.1.1)

Manufacturers shall have a quality control system audited by a competent authority to ensure continuous compliance with the requirements of this standard. Alternatively, the manufacturer

may use final product verification procedures where a competent authority verifies compliance with the requirements of this standard before the product is put to the market.

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

#### **4.1.3 Safety of operation**

(See 10.1.2)

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

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

#### **4.1.4 Additional features**

(See 10.1.3, 13.6)

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

#### **4.1.5 Functionality**

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

- Autonomous (default mode)
- Assigned
- Interrogation

Additionally the equipment shall support long-range applications (see 7.8).

### **4.2 Manuals**

(See 10.1.1)

The manuals shall include the:

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

### **4.3 Marking and identification**

(See 10.1.1)

In addition to the requirements of IEC 60945, sub-clause 4.9, the markings shall include:

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

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

(See Clause 9)

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

- inter-unit connection (electrical interfaces other than IEC 61162 are permissible);
- power supply;
- extreme power supply;
- excessive conditions;
- power supply short-term variation and power supply failure;
- durability and resistance to environmental conditions;
- interference;
- electromagnetic compatibility;
- compass safe distance;
- safety precautions;
- protection against accidental access to dangerous voltages;
- electromagnetic radiofrequency radiation;

The Class B “SO” AIS shall not enter an undefined or unstable state in case of under voltage.

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

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

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

- AIS equipment declared for protected installation shall meet the requirements described in Table 3 column "protected" of IEC 60945;
- Exposed AIS equipment shall meet the requirements described in Table 3, column "exposed" of IEC 60945;
- Portable AIS equipment shall meet the requirements of Table 3 of IEC 60945 "protected" or "exposed" as appropriate.

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

## 6 Performance requirements

### 6.1 Internal processes

(See 10.1.1)

The Class B “SO” AIS shall comprise:

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

## 6.2 Operating frequency channels

(See 10.3)

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

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

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

## 6.3 Internal GNSS Receiver for position reporting

(See 10.4)

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

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

- position accuracy; static and dynamic;
- COG / SOG accuracy;
- position update;
- interference susceptibility;
- status indications (RAIM optional); and
- WGS-84 datum positions.

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

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

## 6.4 Identification

(See 10.8.3)

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

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

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

## 6.5 AIS Information

### 6.5.1 Information content

(See 10.5.1)

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

The list of static information shall include:

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

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

#### **6.5.1.2 Dynamic (Message 18)**

The list of dynamic information shall include:

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

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

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

- type of AIS Class B unit;
- availability of Minimum keyboard / display facility;
- availability of DSC Ch. 70 receiver;
- ability to operate in the marine VHF band; and
- ability to process channel management Message 22.

#### **6.5.1.4 Long-range broadcast (Message 27)**

- ship's position with accuracy indication and integrity status;
- course over ground (COG) from internal GNSS;
- speed over ground (SOG) from internal GNSS;
- status of current GNSS position; and
- navigational status.

#### **6.5.2 Information reporting intervals**

(See 10.5.2, 10.6)

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

The reporting interval for dynamic information shall be as per Table 1.

**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 - 14 kn  | 30 s                       | 30 s                         |
| Class B “SO” AIS Mobile Equipment moving at 14 - 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 4.1.5.3).

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 ITU-R M.1371-4 (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.

**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 <sup>*</sup>                                         |
| 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 = 1023                                     |
| AIS: no valid COG information                                                | Continue operation using COG = 3600                                     |
| AIS: Heading lost/invalid                                                    | Continue operation using Heading = 511 <sup>*</sup>                     |
| <sup>*</sup> Alarm may be enabled/disabled depending on system configuration |                                                                         |

Alarm Messages shall be output via a Presentation Interface:

- "\$AIALR"-sentences shall be compliant with IEC 61993-2;
- the alarm messages shall be compliant with IEC 61162-1;
- active alarms shall be output via the presentation interface upon occurrence and repeated every 30 s;
- non-active alarm messages shall be repeated every 60 s;
- upon a relevant system status change an appropriate alarm message shall be output.

#### **6.6.2 Transmitter shutdown procedure**

An automatic transmitter hardware shutdown procedure and indication should be provided in case a transmitter continues to transmit for more than 2 s. This shutdown procedure should 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 follows:

**Table 3 - Position sensor fallback conditions**

| Priority                                                                                   | Affected data in Message 18 ⇒                               |                         | position accuracy flag | Time Stamp | RAIM-Flag | Position             |
|--------------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------|------------------------|------------|-----------|----------------------|
|                                                                                            | Position Sensor status                                      |                         |                        |            |           | Latitude / Longitude |
| 1.                                                                                         | internal DGNSS in use (corrected; Message 17) <sup>1</sup>  |                         | 1 **                   | UTC-s      | 1 / 0 *   | Lat/Lon (internal)   |
| 2.                                                                                         | internal DGNSS in use (corrected; e.g. beacon) <sup>2</sup> |                         | 1 *                    | UTC-s      | 1 / 0 *   | Lat/Lon (internal)   |
| 3.                                                                                         | internal GNSS in use (uncorrected) <sup>1</sup>             |                         | 0 **                   | UTC-s      | 1 / 0 *   | Lat/Lon (internal)   |
| 4.                                                                                         | no sensor position in use                                   | dead reckoning position | 0                      | 62         | 0         | Default to +91/+181  |
|                                                                                            |                                                             | no position             |                        | 63         |           |                      |
| * If RAIM available “1”; if not, default “0”                                               |                                                             |                         |                        |            |           |                      |
| ** The position accuracy flag shall be set as defined in ITU-R M.1371-4 A8 3.16 Message 18 |                                                             |                         |                        |            |           |                      |
| 1 Applicable in all configurations (minimum requirement)                                   |                                                             |                         |                        |            |           |                      |
| 2 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 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 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 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 section 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):

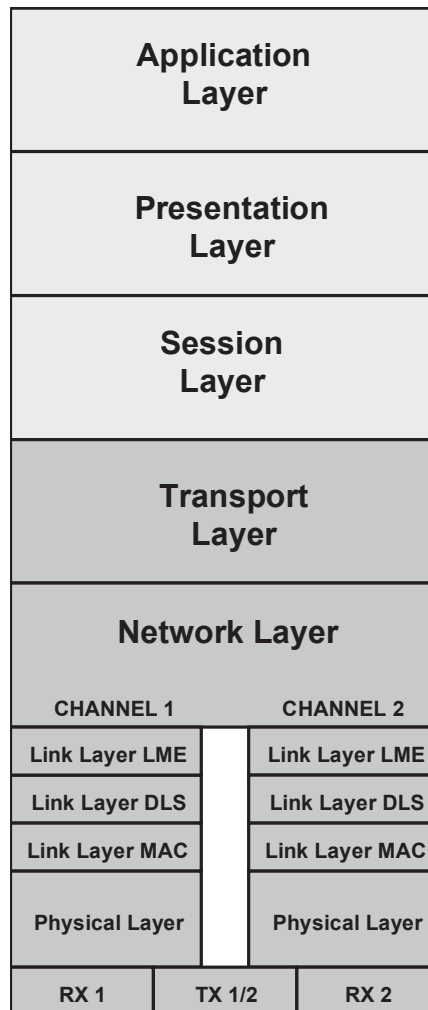


Figure 1 - OSI layer model

## 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 chapter, 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.

**Table 4 - Required receiver performance**

| Receiver parameters                | Values             |                                                                        |                                            |
|------------------------------------|--------------------|------------------------------------------------------------------------|--------------------------------------------|
|                                    | Results            | Wanted signal                                                          | Unwanted signal(s)                         |
| Sensitivity                        | 20% per            | –107 dBm normal<br>–101 dBm extreme<br>–104 dBm at $\pm 500$ Hz offset | –                                          |
| Error at high input levels         | 2% per             | –77 dBm                                                                | –                                          |
|                                    | 10% per            | –7 dBm                                                                 | –                                          |
| Co-channel rejection               | 20% per            | –101 dBm                                                               | –111 dBm<br>–111 dBm at $\pm 1$ 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)<br>–15 dBm (>5 MHz)       |
| Spurious emissions                 | –57 dBm<br>–47 dBm | 9 kHz ... 1 GHz<br>1 GHz ... 4 GHz                                     |                                            |

### 7.2.3 Other characteristics

#### 7.2.3.1 General transceiver characteristics

(See clause 11)

General transceiver characteristics shall be as specified in Table 5.

**Table 5 - Transceiver characteristics**

| Symbol                                                   | Parameter name                                                             | Low setting | High setting |
|----------------------------------------------------------|----------------------------------------------------------------------------|-------------|--------------|
| PH.RFR                                                   | Regional frequencies (range of frequencies within RR Appendix 18) (MHz)    | 156,025     | 162,025      |
| PH.CHS                                                   | Channel spacing (encoded according to RR Appendix 18 with footnotes) (kHz) | 25          | 25           |
| PH.AIS1                                                  | AIS 1 (default channel 1) (2087) <sup>(a)</sup> (MHz)                      | 161,975     | 161,975      |
| PH.AIS2                                                  | AIS 2 (default channel 2) (2088) <sup>(a)</sup> (MHz)                      | 162,025     | 162,025      |
| PH.BR                                                    | Bit rate (bit/s)                                                           | 9 600       | 9 600        |
| PH.TS                                                    | Training sequence (bits)                                                   | 24          | 24           |
| 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 (W)                                                  | 1           | 5            |
| <sup>(a)</sup> See Recommendation ITU-R M.1084, Annex 4. |                                                                            |             |              |

#### 7.2.3.2 Channel operation

(See 10.2.1.1)

The AIS shall be capable of operating on two parallel channels. Two separate TDMA receive channels or processes shall be used to receive simultaneously information on two independent frequency channels. One TDMA transmitter shall be used to alternate TDMA transmissions on two independent frequency channels.

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

#### **7.2.3.3 Bandwidth**

(See 11.1.3)

The Class B “SO” AIS shall operate on 25 kHz channels according to Recommendation ITU-R M.1084-4 and Appendix 18 of the Radio Regulations.

#### **7.2.3.4 Modulation scheme**

(See 11.1.4)

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

#### **7.2.3.5 Training sequence**

(See 11.1.4)

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

#### **7.2.3.6 Data encoding**

(See 12.4)

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

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

#### **7.2.3.7 DSC operation**

(See Annex A)

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

DSC receive function shall be provided at least in accordance with the time schedule specified in ITU-R M. 1371-4 Annex 7, Table 42.

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

### **7.2.4 Transmitter requirements**

(See 11.1, 11.3.2)

Transmitter parameters shall be as given in Table 6.

Table 6 - Transmitter characteristics

| Transmitter parameters        | Requirement                                                                                                                                                                                   | condition                                                                                        |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Frequency error               | ±500 Hz normal<br>±1000 Hz extreme                                                                                                                                                            |                                                                                                  |
| Carrier power, High Setting   | Nominal high transmit power shall be 5 W.<br>±1,5 dB normal test conditions<br>±3 dB extreme test conditions                                                                                  | Conducted                                                                                        |
| Carrier power, Low Setting    | Nominal low transmit power shall be 1 W.<br>±1,5 dB normal test conditions<br>±3 dB extreme test conditions                                                                                   | Conducted                                                                                        |
| Modulation spectrum           | -25 dBc<br>-70 dBc                                                                                                                                                                            | $\Delta f_c < \pm 10$ kHz<br>$\pm 25$ kHz $< \Delta f_c < \pm 62,5$ kHz<br>slotted transmissions |
| Modulation accuracy           | < 3400 Hz normal and extreme<br>2400 ±480 Hz normal and extreme<br>2400 ±240 Hz normal    ±480 Hz extreme<br>1740 ±175 Hz normal    ±350 Hz extreme<br>2400 ±240 Hz normal    ±480 Hz extreme | Bit 0, 1<br>Bit 2, 3<br>Bit 4 ... 31<br>Bit 32 ... 199    0101<br>Bit 32 ... 199    00001111     |
| Transmitter attack behaviour  | attack time ≤1 ms<br>$P_{out} \leq P_{nom} + 1,5$ dB<br>( $F_{nom} - 3,4$ kHz) $< f_c < (F_{nom} + 3,4$ kHz)                                                                                  | $P_c - 1$ dB<br>$P_{out} > (P_c - 30$ dB)                                                        |
| Transmitter release behaviour | Release time ≤1ms<br>( $F_{nom} - 3,4$ kHz) $< f_c < (F_{nom} + 3,4$ kHz)                                                                                                                     | $P_c$ to -50 dB<br>$P_{out} > (P_c - 30$ dB)                                                     |
| Spurious emissions            | -36 dBm<br>-30 dBm                                                                                                                                                                            | 9 kHz ... 1 GHz<br>1 GHz ... 4 GHz                                                               |

### 7.3 Link layer

(See Clause 12)

#### 7.3.1 General

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

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

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

##### 7.3.2.1 General

The MAC sub-layer provides a method for granting access to the data transfer medium, i.e. the VHF data link. The method used shall be a Time Division Multiple Access (TDMA) scheme using a common time reference. The Medium Access Control sub-layer shall be designed in accordance with Recommendation ITU-R M.1371.

### 7.3.2.2 Synchronisation

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

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

### 7.3.2.3 VDL access

(See 11.1.5)

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

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

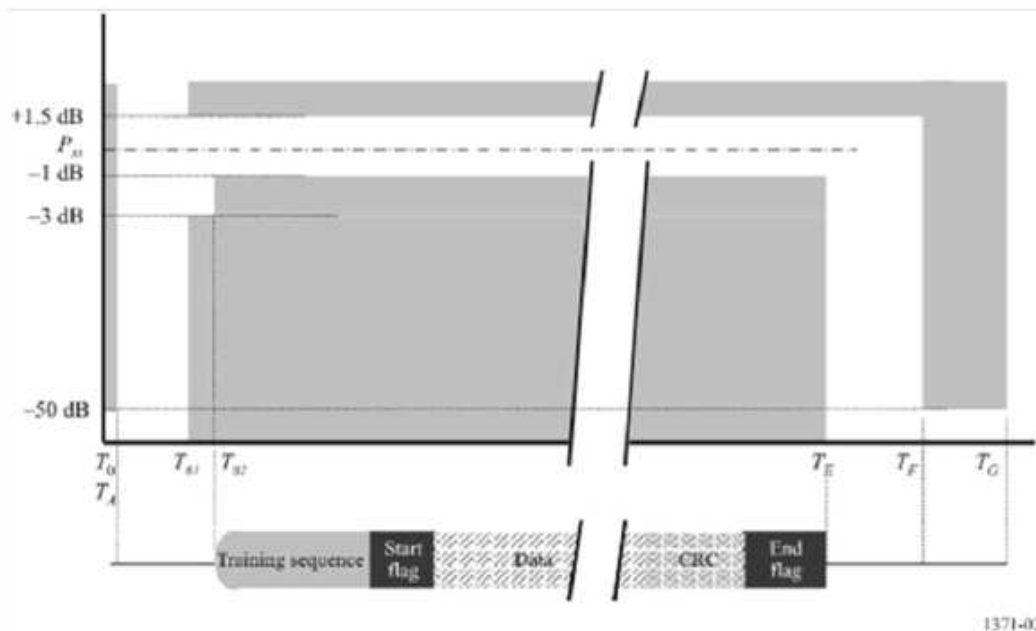


Figure 2 - Power versus time mask

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

Table 7 - Definitions of timing for Figure 2

| Reference                       | bits     | Time in ms | 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      | 0-0,625    | Power exceeds –50 dB of $P_{SS}$                                                        |
| $T_B$                           | $T_{B1}$ | 6          | Power shall be within +1.5 or –3 dB of $P_{SS}$                                         |
|                                 | $T_{B2}$ | 8          | Power shall be within +1.5 or –1 dB of $P_{SS}$ (start of training sequence)            |
| $T_E$ (includes 1 stuffing bit) | 233      | 24,271     | Power shall remain within +1.5 or –1 dB of $P_{SS}$ during the period $T_{B2}$ to $T_E$ |
| $T_F$ (includes 1 stuffing bit) | 241      | 25,104     | Power shall be –50 dB of $P_{SS}$ and stay below this                                   |
| $T_G$                           | 256      | 26,667     | Start of next transmission time period                                                  |

### 7.3.2.4 VDL State

(See 13.5)

Each slot can be in one of the following states:

- **Free:** meaning that the slot is unused within the receiving range of the own station. An externally allocated slot that has not been used during the preceding 3 frames is also a free slot. This slot may be considered as a candidate slot for use by own station (refer to 3.3.1.2 Annex 2 in ITU-R M.1371);
- **Internal Allocation:** meaning that the slot is allocated by own station and can be used for transmission;
- **External Allocation:** meaning that the slot is allocated for transmission by another station;
- **Available:** meaning that the slot is externally allocated by a station and is a possible candidate for slot reuse (refer to 4.4.1 Annex 2 in ITU-R M.1371);
- **Unavailable:** meaning that the slot is externally allocated by a station. An unavailable slot cannot be a candidate for slot reuse (refer to 4.4.1 Annex 2 in ITU-R M.1371).

### 7.3.3 Link sub layer 2: Data Link Service (DLS)

The DLS sub layer provides methods for:

- data link activation and release;
- data transfer; or
- error detection and control.

The Data Link Service sub layer shall be designed in accordance with Recommendation ITU-R M.1371.

### 7.3.4 Link sub layer 3 - Link Management Entity (LME)

#### 7.3.4.1 General

The LME controls the operation of the DLS, MAC and the physical layer.