



**Maritime low power personal locating devices employing AIS;
Harmonised Standard for access to radio spectrum**

*iTeh STANDARDS PREVIEW
(standards.iteh.ai)
Full standard:
<https://standards.iteh.ai/catalog/standards/sis/86ce512e1d0e/etsi-en-303-098-v2.2.1-2018-12>
45f9234-86ce512e1d0e/etsi-en-303-098-v2.2.1-2018-12*

Reference

REN/ERM-TG26-536

Keywordsharmonised standard, maritime, radio, SAR,
testing**ETSI**650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important noticeThe present document can be downloaded from:
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:
<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2018.
All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members.
3GPP™ and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

oneM2M™ logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

GSM® and the GSM logo are trademarks registered and owned by the GSM Association.

Contents

Intellectual Property Rights	7
Foreword.....	7
Modal verbs terminology.....	7
1 Scope	8
2 References	8
2.1 Normative references	8
2.2 Informative references.....	9
3 Definition of terms, symbols and abbreviations.....	9
3.1 Terms.....	9
3.2 Symbols.....	10
3.3 Abbreviations	10
4 General requirements	10
4.1 Construction	10
4.1.0 General.....	10
4.1.1 Categories of equipment	11
4.2 Controls	11
4.3 Indicator(s).....	12
4.4 Identifier (user ID).....	12
4.5 Labelling.....	12
4.6 Instructions	12
4.7 Power source	13
4.7.1 Battery requirements	13
4.7.2 Battery capacity	13
4.7.3 Safety precautions.....	13
5 Technical requirements	13
5.1 General	13
5.2 AIS transmission characteristics.....	14
5.2.0 General.....	14
5.2.1 AIS messages.....	14
5.2.1.0 General	14
5.2.1.1 Active mode	14
5.2.1.2 Test mode.....	14
5.2.2 Synchronization	14
5.2.2.0 General	14
5.2.2.1 Active mode	15
5.2.2.2 Test transmission.....	15
5.2.3 GNSS position source.....	15
5.2.3.0 General	15
5.2.3.1 Accuracy	15
5.2.3.2 Acquisition.....	15
5.2.3.3 Sensitivity and dynamic range	16
5.2.3.4 Effects of specific interfering signals.....	16
5.2.3.5 UTC.....	16
5.2.3.6 UTC parameters storage.....	16
5.2.4 Required settings	16
5.2.5 Minimum transmitter performance characteristics	17
5.2.6 VHF Data Link (VDL) Access	17
5.2.6.0 General	17
5.2.6.1 Active mode	17
5.2.6.2 Test mode.....	18
6 General conditions of measurement	18
6.1 Conformity testing.....	18
6.2 Test Frequencies.....	18

6.3	Identifier (user ID).....	18
6.4	Artificial Antenna.....	18
6.5	Test signals.....	19
6.5.0	General.....	19
6.5.1	Standard test signal number 1.....	19
6.5.2	Standard test signal number 2.....	19
6.5.3	Standard test signal number 3.....	19
6.5.4	Reference timing signal.....	19
6.6	Test conditions power sources and ambient temperatures.....	19
6.6.1	Normal and extreme test conditions.....	19
6.6.2	Test power source.....	19
6.7	Normal test conditions.....	20
6.7.1	Normal temperature and humidity.....	20
6.7.2	Normal test voltage.....	20
6.8	Extreme test conditions.....	20
6.8.1	Extreme temperatures.....	20
6.8.2	Extreme test voltages.....	20
6.8.2.1	Upper extreme test voltage.....	20
6.8.2.2	Lower extreme test voltage.....	20
7	Environmental tests.....	20
7.1	Introduction.....	20
7.2	Procedure.....	21
7.3	Performance check.....	21
7.4	Drop test.....	21
7.4.1	Definition.....	21
7.4.2	Test conditions.....	21
7.4.3	Method of measurement.....	21
7.4.4	Requirements.....	21
7.5	Temperature tests.....	22
7.5.1	Definition.....	22
7.5.2	Dry heat test.....	22
7.5.2.1	Method of measurement.....	22
7.5.2.2	Requirements.....	22
7.5.3	Damp heat test.....	22
7.5.3.1	Method of measurement.....	22
7.5.3.2	Requirements.....	22
7.5.4	Low temperature test.....	23
7.5.4.1	Method of measurement.....	23
7.5.4.2	Requirements.....	23
7.5.5	Low temperature battery endurance test.....	23
7.5.5.1	Method of measurement.....	23
7.5.5.2	Requirements.....	23
7.6	Vibration test.....	23
7.6.1	Definition.....	23
7.6.2	Method of measurement.....	23
7.6.3	Requirement.....	24
7.7	Corrosion test.....	24
7.7.0	Applicability.....	24
7.7.1	Definition.....	24
7.7.2	Method of measurement.....	24
7.7.3	Requirements.....	25
7.8	Thermal shock test.....	25
7.8.1	Definition.....	25
7.8.2	Method of measurement.....	25
7.8.3	Requirements.....	25
7.9	Buoyancy test.....	25
7.9.1	Definition.....	25
7.9.2	Method of measurement.....	26
7.9.3	Requirements.....	26
7.10	Compass safe distance test.....	26
7.10.1	Definition.....	26

7.10.2	Method of measurement	26
7.10.3	Requirements	27
7.11	Solar radiation test.....	27
7.11.0	Applicability	27
7.11.1	Definition.....	27
7.11.2	Method of measurement	27
7.11.3	Requirements	28
7.12	Oil resistance test.....	28
7.12.0	Applicability	28
7.12.1	Definition.....	28
7.12.2	Method of measurement	28
7.12.3	Requirements	28
7.13	Protection of the transmitter to immersion.....	29
7.13.1	Definition.....	29
7.13.2	Method of measurement	29
7.13.3	Requirement.....	29
8	Tests on the AIS transmitter	29
8.1	Frequency error	29
8.1.1	Definition.....	29
8.1.2	Method of measurement	29
8.1.3	Limit	29
8.2	Conducted Power	29
8.2.0	Purpose	29
8.2.1	Definition.....	30
8.2.2	Method of measurement	30
8.2.3	Limit	30
8.3	Maximum Effective Radiated Power (ERP).....	30
8.3.1	Definition.....	30
8.3.2	Method of measurement	30
8.3.3	Limits.....	31
8.4	Transmitter spectrum mask	31
8.4.1	Definition.....	31
8.4.2	Method of measurement	31
8.4.3	Limit	32
8.5	Transmitter transient behaviour (output power).....	32
8.5.1	Definition.....	32
8.5.2	Method of measurement	33
8.5.3	Limit	34
8.6	Transmitter Transient Behaviour (frequency deviation)	34
8.6.1	Definition.....	34
8.6.2	Method of measurement	34
8.6.3	Limit	35
8.7	Synchronization accuracy.....	35
8.7.1	Definition.....	35
8.7.2	Method of measurement	35
8.7.3	Limit	36
8.8	Spurious emissions	37
8.8.1	Definition.....	37
8.8.2	Method of measurement	37
8.8.3	Limit	37
9	VDL Link layer tests	37
9.1	Active mode tests	37
9.1.0	Precaution	37
9.1.1	Method of measurement	37
9.1.2	Initialization period - Required results.....	38
9.1.3	Message content of Message 1 - Required results	38
9.1.4	Message content of Message 14 - Required results	38
9.1.5	Transmission schedule for Message 1 - Required results	38
9.1.6	Communication state of Message 1 - Required results	39
9.1.7	Transmission schedule of Message 14 - Required results.....	39

9.1.8	Transmission with lost GNSS - Required results.....	39
9.2	Test mode tests with GNSS data available.....	40
9.2.1	Method of measurement	40
9.2.2	Required results	40
9.3	Test mode tests without GNSS data available.....	40
9.3.1	Method of measurement	40
9.3.2	Required results	40
10	Testing for compliance with technical requirements.....	41
10.1	Environmental conditions for testing	41
10.2	Interpretation of the measurement results	41
Annex A (informative):	Relationship between the present document and the essential requirements of Directive 2014/53/EU	42
Annex B (normative):	Equipment message bursts.....	44
B.1	Active mode	44
B.2	Test mode	45
B.3	Default message field values.....	46
Annex C (normative):	Additional Test Supports	47
C.1	Float-free support	47
Annex D (informative):	Bibliography.....	48
Annex E (informative):	Change history	49
History		50

iTEH STANDARD PREVIEW
(standards.iteh.ai)
Full standard:
<https://standards.iteh.ai/catalog/standards/sist/ccad541-777d-45f-9234-86ce512e1d0e/etsi-en-303-098-v2.2.1-2018-02>

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

This final draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.5] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

Proposed national transposition dates

Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document specifies technical characteristics and methods of measurements for low power maritime personal locating devices employing AIS.

The present document does not cover requirements for the integrated GNSS receiver providing locating function.

The present document incorporates the relevant provisions of the International Telecommunication Union (ITU) radio regulations [i.4] included in Recommendation ITU-R M.1371-5 [1].

For this application, both the radiated power and the length of time of operation are limited to enable the equipment to be sufficiently small and light to be worn comfortably at all times and to limit the operating range to a local area.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.1] is given in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] Recommendation ITU-R M.1371-5 (02/2014): "Technical characteristics for an automatic identification system using time-division multiple access in the VHF maritime mobile band".
- [2] CENELEC EN 61108-1 (2003): "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".
- [3] CENELEC EN 61108-2 (1998): "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".
- [4] CENELEC EN 61108-3 (2010): "Maritime navigation and radiocommunication equipment and systems - Global navigation satellite systems (GNSS) - Part 3: Galileo receiver equipment - Performance requirements, methods of testing and required test results".
- [5] Recommendation ITU-T O.153 (10/1992): "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [6] IMO Annex 11 - Resolution MSC.149 (77) - (adopted on 3 June 2003): "Adoption of the revised performance standards for survival craft portable two-way VHF radiotelephone apparatus".
- [7] ETSI TS 103 052 (V1.1.1) (03-2011): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radiated measurement methods and general arrangements for test sites up to 100 GHz".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.2] ETSI TR 100 028-1 (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".
- [i.3] ETSI TR 100 028-2 (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".
- [i.4] ITU-R Radio Regulations 2016.
- [i.5] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document the following terms apply:

active mode: activated mode, transmitting in an emergency situation

dedicated antenna: removable antenna supplied and tested with the equipment, designed as an indispensable part of the equipment

integral antenna: antenna designed to be connected to the equipment without the use of a 50 Ω external connector and considered to be part of the equipment

NOTE: An integral antenna may be fitted internally or externally to the equipment.

P₋₂₀: Transmitted output power at -20 °C

P₊₅₅: Transmitted output power at +55 °C

test mode: self testing mode, not involved in a genuine emergency

UTC lock: GNSS has precisely locked to UTC so that it can determine SOTDMA slot timing correctly.

UTC parameters: "Coordinated Universal Time (UTC) offset parameters" GNSS data that contains leap second offset information

3.2 Symbols

For the purposes of the present document, the following symbols apply:

cSt	centi-Stokes
dB	decibel
μ T	microtesla

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AIS	Automatic Identification System
ASTM	American Society for Testing and Materials
CIRM	Comité International Radio-Maritime
COG	Course Over Ground
CRC	Cyclic Redundancy Check
CW	Continuous Wave
EFTA	European Free Trade Area
EIRP	Effective Isotropic Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
GLONASS	GLOBAL NAVigation Satellite System (Russian system)
GMSK	Gaussian Minimum Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GTRF	Galileo Terrestrial Reference Frame system
IMO	International Maritime Organization
ISO	International Organization for Standardization
ITRF	International Terrestrial Reference Frame
ITU-R	International Telecommunication Union Radiocommunication sector
ITU-T	International Telecommunication Union Telecommunication sector
MOB	Man Over-Board
NRZI	Non Return to Zero, Inverted
PPS	Pulses Per Second
PZ-90	Parametry Zemli 1990
RAIM	Receiver Autonomous Integrity Monitoring
RF	Radio Frequency
SOG	Speed Over Ground
SOTDMA	Self-Organized Time Division Multiple Access
TDMA	Time Division Multiple Access
UTC	Coordinated Universal Time
VDL	VHF Data Link
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio
WGS-84	World Geodetic System 1984

4 General requirements

4.1 Construction

4.1.0 General

Compliance with the entirety of clause 4 shall be established by simple inspection of the equipment and its technical documentation. The equipment shall be designed to minimize the risk of internal and external damage during use or stowage.

The exterior of the equipment shall have no sharp edges or projections that could easily damage inflatable rafts or injure personnel.

The general construction and method of operation shall provide a high degree of proof against inadvertent operation due to magnetic influences, handling, stowage and transit, whilst still providing a simple means of operation in an emergency.

The equipment shall be portable, lightweight, compact and be designed as one integral unit where all the parts are contained within a single enclosure or one in which the parts may be in two or more enclosures provided that these are permanently connected to each other and cannot be disconnected.

The equipment shall derive its energy from a battery forming a part of the equipment and incorporate an integral or dedicated antenna which may be either fixed length or extendible.

The equipment shall be fitted with a facility by which the functioning of the transmitter and battery can be easily tested. The test shall indicate whether the battery has sufficient capacity to support the required operating time of the equipment.

The equipment shall be capable of being used by an unskilled person.

The equipment shall be watertight to a depth of 5 m (see clause 7.13).

The equipment shall not be unduly affected by sea water or oil and shall be resistant to deterioration by prolonged exposure to sunlight.

A substantial part of the equipment shall be of highly visible yellow or orange colour to assist visual location.

4.1.1 Categories of equipment

Two categories are defined:

- Category 1 equipment shall have sufficient positive buoyancy to float in fresh water.
- Category 2 equipment intended to be incorporated into or attached to a buoyancy aid are not required to float.

Category 1 equipment that can float free may have a lanyard to attach them to a person or life vest. Where a lanyard is employed it shall meet the requirements of IMO MSC.149(77) [6], paragraph 2.3.11. The user manual or instructions shall include necessary information to allow the user to properly attach the equipment lanyard.

The user manual or instructions for Category 2 devices shall include necessary information to allow the user to fit or attach the equipment to a buoyancy aid.

4.2 Controls

The equipment shall be initially activated by the use of two simple, but independent mechanical actions, neither of which on its own shall activate the equipment. The second mechanical action may be replaced by an immersion sensor. Where the second action is replaced by an immersion sensor then the first action shall be an arm function thus to ensure the device is armed for automatic activation when submerged. Immersion sensors shall be protected against inadvertent activation by using a time delay which may be programmable.

It shall only be possible to activate the equipment after a seal or other mechanical restraint has been removed from the first mechanical action. For devices without an arm function it shall not be possible to reattach a removed seal or restraint. After activation it shall be simple to de-activate the equipment and the means to deactivate the equipment shall be clearly marked.

Activation of the test facility shall reset automatically after completion of the test including any required transmission. As a minimum it shall be possible to carry out one self-test a month and at least one AIS test transmission with GNSS data available annually.

4.3 Indicator(s)

The equipment shall be provided with a visual and/or audible indication that signals are being emitted. The visual indicator(s) shall be sufficiently bright to be seen in bright sunlight.

The indicator(s) shall clearly distinguish the following states where applicable:

- i) The equipment has been activated and is either waiting for GNSS data or is transmitting without GNSS data.
- ii) The equipment has GNSS data and is transmitting in active mode.
- iii) The equipment is undergoing a self-test and the test result is shown on completion.
- iv) The equipment is transmitting in test mode.
- v) The equipment has completed a test or has been de-activated.

4.4 Identifier (user ID)

The equipment shall have an identifier to distinguish it from other AIS devices.

The User ID for a personal search and rescue equipment is 972xyyyy, where xx = manufacturer ID 01 to 99; yyyy = the sequence number 0000 to 9999. Manufacturers IDs are issued by CIRM. Manufacturers shall only use manufacturer IDs that have been issued to them by CIRM, except for testing purposes where the ID xx=00 can be used (see clause 6.3).

After being programmed by the manufacturer, it shall not be possible for the user to change the identifier of the equipment.

The user ID shall be held in non-volatile memory.

4.5 Labelling

The equipment shall be provided with a label, or labels, permanently affixed to the exterior of the equipment, containing the information described hereunder:

- user ID of the equipment (see clause 4.4) and manufacturer serial number;
- type designation of the equipment with prefix AIS-MOB;
- adequate instructions to enable the equipment to be activated and de-activated;
- a warning to not block the GNSS antenna;
- the compass safe distance as measured in clause 7.10;
- a warning to the effect that the equipment should not be operated except in an emergency;
- the date on which the battery will need to be replaced. Simple means shall be provided for changing this date when the battery is replaced. The battery replacement date marked on the equipment should be the date specified in clause 4.7.1.

4.6 Instructions

Necessary operating instructions shall be provided with the equipment. These should include the following warnings:

- "WARNING - An AIS-MOB Man overboard device is only intended for short range signalling to an AIS receiver installed onboard your own vessel. It will not directly alert the emergency services or other vessels".
- "WARNING - This equipment is not intended for routine tracking of persons or property. This includes tracking of divers".

- "WARNING - If testing is performed more frequently than as recommended in this user manual, then battery life may be reduced".

4.7 Power source

4.7.1 Battery requirements

The type of battery and designation specified by the manufacturer for use in the equipment shall be clearly and indelibly marked on the equipment.

The manufacturer should establish a useful life and an expiry date for primary (non-rechargeable) batteries. The useful life is the period of time after the date of battery manufacture that the battery will continue to meet the input power requirements of the equipment, over the entire specified operating temperature range. The following losses shall be included (at a temperature of $+20\text{ °C} \pm 5\text{ °C}$):

- a) all self-tests and AIS transmission tests as per manufacturer recommendations, but as a minimum in accordance with clause 4.2;
- b) self-discharge of the battery;
- c) stand-by loads.

The expiry date of the battery shall be the battery installation date plus no more than half the useful life of the battery. The battery shall have a minimum useful life of at least two years. The installation date shall be no more than one year from the date of manufacture of the battery. The battery shall be clearly and durably marked with its date of manufacture. The equipment shall be clearly marked with the expiry date of the battery.

4.7.2 Battery capacity

The battery, after having met the requirements of clause 4.7.1 shall have sufficient remaining capacity to power an activated equipment and keep it transmitting for at least 12 hours at a temperature of $-20\text{ °C} \pm 3\text{ °C}$.

4.7.3 Safety precautions

Provisions shall be made for protecting the equipment from damage due to the accidental reversal of polarity of the battery.

5 Technical requirements

5.1 General

When activated the equipment shall be capable of transmitting messages that indicate the position of a person in the water. The transmitted messages shall be compatible with existing AIS installations. The transmitted messages shall be recognized and displayed by AIS receivers in the reception range of the transmitter, and clearly distinguish the transmitter as a personal Man Over-Board (MOB) equipment. AIS TDMA Synchronization shall be UTC direct; the equipment does not require an AIS receiver.