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Technical characteristics and methods of measurement for equipment for generation, transmission and reception of Digital Selective Calling (DSC) in the maritime MF, MF/HF and/or VHF mobile service; Part 6: Class M DSC

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Foreword

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

The present document is part 6 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.1].

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
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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 states the minimum requirements for devices using Digital Selective Calling (DSC) Class M, for Man Overboard (MOB). The present document defines the requirements for equipment that uses DSC alerting and signalling in the maritime mobile bands and particularly the GMDSS distress and safety channels. Such equipment is not intended to provide any subsequent communications or telephony facilities.

The present document is part 6 of a multi-part deliverable that covers the channel access rules and technical requirements applicable to these devices.

2 References

2.1 Normative 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.

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.493-15 (01/2019): "Digital selective-calling system for use in the maritime mobile service".

[2] IEC EN 60945 (2002): "Maritime Navigation and Radiocommunication Equipment and Systems - General Requirements - Methods of Testing and Required Test Results".

[3] Recommendation ITU-R M.585-9 (05/2022): "Assignment and use of identities in the maritime mobile service".

[4] Recommendation ITU-R M.821-1 (02/1997): "Optional expansion of the digital selective-calling system for use in the maritime mobile service".

[5] EN 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", produced by CENELEC.

[6] EN 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", produced by CENELEC.

[7] EN 61108-3: "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", produced by CENELEC.

[8] EN 61108-5: "Maritime navigation and radiocommunication equipment and systems - Global navigation satellite systems (GNSS) - Part 5: BeiDou navigation satellite system (BDS) - Receiver equipment - Performance requirements, methods of testing and required test results", produced by CENELEC.

[9] 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 frequency band".

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] ETSI EN 300 338-1: "Technical characteristics and methods of measurement for equipment for generation, transmission and reception of Digital Selective Calling (DSC) in the maritime MF, MF/HF and/or VHF mobile service; Part 1: Common requirements".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 300 338-1 [i.1] and the following apply:

acknowledged: automated procedure which indicates that the objective of the initial DSC message has been achieved

activation: initial triggering of the MOB device i.e. both parts of the two step procedure are performed

active mode: activated mode, transmitting in an emergency situation

class M: specific class of DSC functionality for use by man overboard devices

closed loop: individual transmission to own vessel

default: value selected or an action taken by the equipment software in the absence of any operator input

distress alert: name given to the single distress DSC message with the format symbol 112

distress DSC message: DSC message or acknowledgement containing the distress information

distress information: symbols within a DSC message describing a distress situation consisting of the MMSI of the vessel in distress, the nature of distress, the position of the vessel in distress, the UTC time of that position and the mode of subsequent communication

F1D: direct frequency modulation of data (no subcarrier)

factory default: default value that is set by the manufacturer such that the field or behaviour is defined prior to any operator intervention

G2B: indirect phase-modulation (frequency modulation with a pre-emphasis of 6 dB/octave)

information characters: set of symbols in a DSC message that contains the items of interest for the recipient and is used to compute the ECC symbol that terminates the message

non distress DSC message: DSC messages or acknowledgements that do not have the format specifier or category of "distress"

open loop: transmitting to all ships (broadcast) 'using All ships call types'

primary battery: non-rechargeable primary power source

symbol (as part of the DSC sentence): 7 binary bits of a 10 bit DSC word that have the information content

test mode: self-testing mode using an individual test call to own vessel

word (as part of the DSC sentence): 10 binary bits that make up the coded entities of a transmitted DSC message

NOTE: The 10 bits consist of a 7 bit "symbol" that gives the information content and 3 bit error check that gives the number of 0 binary bits in the 7 bit symbol.

3.2 Symbols

Void.

3.3 Abbreviations

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

AIS	Automatic Identification System
CIRM	Comité International Radio-Maritime
COG	Course Over Ground
DSC	Digital Selective Calling
ECC	Error Check Character
EOS	End Of Sequence
FM	Frequency Modulation
GMDSS	Global Maritime Distress and Safety System
GMSK	Gaussian Minimum Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HF	High Frequency
ID	IDentity
ITU	International Telecommunications Union
ITU-R	ITU - Radiocommunications sector
LBT	Listen Before Talk
MF	Medium Frequency
MMSI	Maritime Mobile Service Identity
MOB	Man Overboard
MSLD	Maritime Survivor Locating Device
PM	Phase Modulation
SOG	Speed Over Ground
SOTDMA	Self-Organized Time Division Multiple Access
UTC	Universal Time Co-ordinated
VHF	Very High Frequency

4 General requirements

4.1 General

Class M MOB devices are employed in situations of grave and imminent danger to persons that require immediate assistance from other vessels or search and rescue services.

MOB devices shall be:

- Fitted with an internal electronic GNSS position fixing device.
- Fitted with a transceiver operating on VHF DSC channel 70.
- Fitted with an Automatic Identification System (AIS) transmitter operating in accordance with annex A to provide radio location.
- Fitted with audio and visual indicators to designate operation of the MOB device, intrinsically safe MOB devices shall be fitted with a minimum of visual indicators.

- Capable of manual activation and deactivation and optionally automatic activation (see clause 4.4).

4.2 Frequency of operation

The MOB device shall operate on 156,525 MHz (Channel 70), 161,975 MHz (AIS 1) & 162,025 MHz (AIS 2) only.

4.3 Class of emission

DSC: G2B Phase Modulation (PM) with digital information modulated on a sub-carrier.

AIS: F1D GMSK 9 600 baud.

4.4 Controls

The MOB device shall be initially activated by the use of two simple, but independent mechanical actions, neither of which on its own shall activate the equipment. If the second mechanical action is replaced by an immersion sensor, then the first mechanical action should be an arming or enabling function thus to ensure the MSLD is armed for automatic activation when submerged.

It should only be possible to activate the equipment after a seal or other mechanical restraint has been removed from the first mechanical action. After activation it shall be possible to de-activate the equipment and the means to deactivate the equipment shall be clearly marked. It should be possible to determine that the equipment has been previously activated.

4.5 Indicators

4.5.0 General

The MOB device shall be provided with a visual and, with the exception of intrinsically safe MOB devices, audible indications that designate the operation of the MOB device as specified in clauses 4.5.1 and 4.5.2.

4.5.1 Audible indicators

The audible indicator shall signal:

- When the MOB device is first activated.
- Prior to any DSC transmission.

4.5.2 Visual Indicators

The visual indicator shall clearly distinguish the following states:

- The MOB device has been activated and is transmitting in active mode.
- The MOB device has a GNSS position fix and is transmitting in active mode.
- The MOB device is undergoing test and is transmitting in test mode.
- The MOB device cannot complete a test because it could not obtain a GNSS position.
- The MOB device cannot complete a test because it has not been properly programmed with own vessel MMSI (closed loop devices only).
- The MOB device has completed a test or has been deactivated locally.
- The MOB device has received a DSC acknowledgement and the DSC transmitter has been deactivated.

4.6 Labelling

The MOB device shall be provided with a label, or labels, permanently affixed to the exterior, containing the following information:

- Self ID of the MOB device (see clause 4.7) and manufacturer serial number.
- Open loop devices shall be marked DSC-MOB-O.
- Closed loop devices shall be marked DSC-MOB-C.
- Adequate instructions to enable the equipment to be activated and deactivated.
- The type of battery as specified by the manufacturer of the MOB device.
- A warning to not block the GNSS antenna.
- The compass safe distance as measured in clause 11.2 of EN 60945 [2].
- A warning to the effect that the MOB device should not be operated except in an emergency.
- The date on which the battery will need to be replaced (the expiry date of the battery).

4.7 Self ID

The MOB device shall have a freeform number identity (self ID) coded in accordance with Recommendation ITU-R M.585-9 [3].

The self ID for the MOB device is 972xxyyyy, where xx = manufacturer ID 01 to 99; yyyy = the sequence number 0000 to 9999 allocated by the manufacturer. Manufacturers IDs are issued by CIRM. Manufacturers shall only use manufacturer IDs that have been issued to them by CIRM, except for training trials and conformance testing purposes where the ID xx = 00 can be used.

After being programmed by the manufacturer, it shall not be possible for the user to change the self ID of the MOB device.

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

4.8 Own vessel MMSI

A closed loop MOB device shall be capable of being programmed with the MMSI of its own vessel or group.

It shall be possible for a MOB device's own vessel MMSI to be re-programmed in the field, for example when MOB devices are moved from one vessel to be stowed on another vessel. It shall be possible for users to re-programme the own vessel MMSI without locating devices having to be returned to the manufacturer.

The own vessel MMSI shall be held in non-volatile memory.

If the own vessel MMSI is not entered or not valid the locating device shall indicate this during test.

4.9 Battery requirement

The battery provided as a power source shall be a primary battery and have sufficient capacity to operate the MOB device within the requirements of the present document for an uninterrupted period of at least 12 hours, at a temperature between -23 °C and -17 °C.

5 DSC Operation

5.1 Listen Before Talk (LBT) Protocol

5.1.1 General

For all transmissions the MOB device shall apply the prioritized wait scheme described in clause 3.1.8 of annex 4 of Recommendation ITU-R M.493-15 [1] except that it shall not transmit after 1 second if channel 70 remains busy. MOB devices transmit at significantly lower power than do ships and shore stations, therefore to increase the probability of their messages being received as well as to reduce unwanted interference on channel 70, a locating device shall never transmit whilst channel 70 is busy.

To determine if channel 70 is busy the MOB device shall listen for and decode DSC symbols as defined in Table A1-1 of Recommendation ITU-R M.493-15 [1]; it is not sufficient to use squelch alone. Channel 70 is determined 'busy' when carrier is detected and a stream of valid symbols is decoded. Whilst a stream of valid symbols is decoded the 'wait period' timer is continuously restarted. Therefore transmission can only be attempted if valid symbols are not being decoded within the wait period.

5.1.2 Prioritized wait for class-M devices

Unlike the other DSC classes, class-M devices do not listen to channel 70 continuously. The receiver may be switched off to conserve battery as described in clause 5.2.1.4, or reception may be interrupted by the transmission of an AIS message from this MOB device, as described in annex B. Therefore, when the receiver resumes operation, it may start receiving in the middle of a DSC message. It shall therefore be able to detect a message at any point during its transmission and from that point correctly determine the end of the transmission in order to then start the prioritized wait timer.

An example of an algorithm designed to achieve this requirement is given in annex B.

5.1.3 Active Mode Wait Period Calculation

All active mode transmissions shall be prioritized as 'distress' messages. The wait period is calculated as $50 + R \times 50$ milliseconds, where R is a random number between 0 and 1. Once R has been determined the wait period shall not be re-calculated until the wait period timer has expired. So that the wait period remains fixed even if the 'wait period' timer is restarted. It is not re-calculated until the next time a transmission is required.

5.1.4 Test Mode Wait Period Calculation

All test mode transmissions shall be prioritized as 'routine and test' messages. The wait period is calculated as $200 + R \times 200$ milliseconds, where R is a random number between 0 and 1. Once R has been determined, the wait period shall not be re-calculated until the wait period timer has expired. So that the wait period remains fixed even if the 'wait period' timer is restarted. It is not re-calculated until the next time a transmission is required.

5.2 DSC messages

5.2.1 Active mode

5.2.1.1 General

Class M MOB devices may operate in open loop or closed loop modes. Closed loop devices marked DSC-MOB-C shall always start in close loop mode changing to open loop mode as described in clause 5.2.1.4. Open loop devices marked DSC-MOB-O shall only operate in open loop mode.

5.2.1.2 Inadvertent activation

Prior to release of the initial transmission a delay for a period of between 10 and 30 seconds shall be implemented, to allow users to deactivate the MOB device in the case of inadvertent activation. During this period an audible and visual indication in accordance with clause 4.5 shall be provided.

5.2.1.3 Closed loop operation

Messages from and to closed loop MOB devices using VHF DSC are defined in Tables A1-4.3 and A1-4.4 of Recommendation ITU-R M.493-15 [1].

On initial activation, the closed loop MOB device shall transmit a DSC message formatted as a distress alert relay on behalf of another ship, as specified in Table A1-4.3 of Recommendation ITU-R M.493-15 [1] with the nature of distress set to 110 (MOB) and the subsequent communications field set to symbol 126 (no information). The destination maritime identity may be either an individual station or a group. The position (message 2) and time (message 3) fields in the initial DSC message shall be replaced by the digits 9 and 8 respectively, in accordance with clauses 8.2.3 and 8.2.4 of Recommendation ITU-R M.493-15 [1].

As soon as the internal electronic position fixing device is able to provide an accurate position and time, the closed loop MOB device shall transmit a further distress alert relay on behalf of another ship with the position and time from the position fixing device automatically inserted into the message. The position expansion sequence of Recommendation ITU-R M.821-1 [4] shall be used. The AIS transmitter begins transmitting MOB messages at this time as specified in clause A.2. The AIS transmissions will continue until the MOB device is manually switched off or the battery is exhausted.

After the initial DSC transmission, the DSC receiver in the closed loop MOB device shall turn on and monitor the DSC channel for acknowledgment messages for 12 minutes. If a DSC distress alert relay acknowledgment message is not received, the closed loop MOB device shall operate with a duty cycle of at least one message every 5 minutes. The actual transmitter duty cycle shall be a randomly selected time of between 4,9 and 5,1 minutes. If, after a 12 minute period, a DSC distress alert relay acknowledgment message has not been received, the MOB device shall then switch from closed loop to open loop mode by transmitting a DSC message coded as an all ships distress alert as specified in Recommendation ITU-R M.493-15 [1], Table A1-4.1. The nature of distress field shall be set to symbol 110 (man overboard) and the subsequent communications field set to symbol 126 (no information). Position and time shall be automatically inserted from the internal electronic position fixing device. Further operation shall be in accordance with clause 5.2.1.4

5.2.1.4 Open loop operation

Messages from and to open loop MOB devices using VHF DSC are defined in Tables A1-4.1 and A1-4.2 of Recommendation ITU-R M.493-15 [1].

On initial activation, the open loop MOB device shall transmit a DSC message formatted as a distress alert as specified in Table A1-4.1. The nature of distress field shall be set to symbol 110 (man overboard) and the subsequent communications field set to symbol 126 (no information). The position (message 2) and time (message 3) fields in the initial DSC message shall be replaced by the digits 9 and 8 respectively, in accordance with paragraphs 8.2.3 and 8.2.4 of Recommendation ITU-R M.493-15 [1].

As soon as the internal electronic position fixing device is able to provide an accurate position and time, the open loop MOB device transmits a further distress alert with the position and time from the position fixing device automatically inserted into the message. The position expansion sequence of Recommendation ITU-R M.821-1 [4] shall be used. The AIS transmitter begins transmitting MOB messages at this time as specified in clause A.2. The AIS transmissions will continue until the MOB device is manually switched off or the battery is exhausted.

After the initial DSC transmission, the DSC receiver in the open loop MOB device shall turn on and monitor the DSC channel for acknowledgment messages for 30 minutes.

If a DSC Distress Alert Acknowledgment message is not received, the open loop MOB device shall operate with a duty cycle of at least one message every 5 minutes for a period of 30 minutes. The actual transmitter duty cycle shall be a randomly selected time of between 4,9 and 5,1 minutes.

After 30 minutes have elapsed without an acknowledgment message being received, the open loop MOB device's duty cycle should then change to 10 minutes. The actual transmitter duty cycle shall be a randomly selected time of between 9,9 and 10,1 minutes. This will continue until an acknowledgment message is received, the batteries are exhausted or the MOB device is switched off. After each transmission, the DSC receiver shall turn on and monitor the DSC channel for an acknowledgment message for 5 minutes.

5.2.1.5 Distress self-cancel

MOB devices shall be capable of transmitting a distress self-cancel message, as described in clause 8.6 and Table A1-4.2 of Recommendation ITU-R M.493-15 [1] which shall only be transmitted in the following circumstance:

- The action of switching off a MOB device that has previously sent a Distress Alert as specified in Table A1-4.1 of Recommendation ITU-R M.493-15 [1] and that has not been acknowledged, shall cause the MOB device to transmit the distress self-cancel message. The AIS transmissions shall also be terminated by this action.

5.2.2 Test mode

When activated in test mode the locating device will not transmit until it has a valid GNSS position fix. As soon as the integral GNSS receiver is able to provide an accurate position and time, the locating device shall transmit a single AIS test message burst as specified in clause A.3.

Following the transmission of the AIS test message burst the locating device shall transmit a DSC test message. This message shall be formatted as a safety (108) call, as specified in Table A1-4.7 of Recommendation ITU-R M.493-15 [1], with the format specifier set to 120 and message 2 (frequency or position number) is set to 126 (no information). The destination MMSI is the own vessel MMSI (see clause 4.8). If the destination MMSI is invalid or not programmed the locating device shall not transmit. In this case closed loop devices shall indicate an error (see clause 4.5.2).

If a position fix is not obtained within 5 minutes of the test mode activation the locating device shall abandon the test without transmitting.

After the Test Message transmission, the DSC receiver in the locating device shall operate and monitor channel 70 for a period of 2 minutes. Within that period it should receive a DSC test acknowledgement message, formatted in accordance with Table A1-4.7 of Recommendation ITU-R M.493-15 [1] and with matching self ID. On receipt of this acknowledgement the locating device shall indicate correct reception of the acknowledgement. The locating device shall then exit test mode and deactivate.

5.3 Action on receipt of acknowledgment messages to alerts

If a DSC distress alert acknowledgement message, formatted in accordance with Table A1-4.2 of Recommendation ITU-R M.493-15 [1]is received by the MOB device, the DSC transmitter shall be switched off and no further DSC transmissions shall take place. The MOB device shall indicate reception of the acknowledgment message (see clause 4.5.2).

AIS transmissions shall continue as specified in clause A.2 until the device is deactivated.

6 Internal electronic position fixing device

The GNSS compliant receiver shall meet the following requirements of EN 61108 series (GPS [5], GLONASS [6], Galileo [7] or Beidou [8] as applicable):

a) position accuracy as stated in clause 4.3.3.2 of EN 61108 part 1 [5], part 2 [6], part 3 [7] and part 5 [8];

b) receiver sensitivity and dynamic range as stated in clause 4.3.7 of EN 61108 part 1 [5], part 2 [6], part 3 [7] and part 5 [8];

c) position update and resolution as stated in clause 4.3.9 of EN 61108 part 1 [5], part 2 [6], part 3 [7] and part 5 [8];

d) provide a resolution of one ten thousandth of a minute of arc.

For each activation the GNSS receiver shall not use any historical or stored position information.

Annex A (normative): AIS message bursts

A.1 General

The MOB device shall broadcast Message 1 and Message 14, as defined in annex 8 of Recommendation ITU-R M.1371-5 [9]. The content of the messages differs for active transmissions (clause A.2) and test transmissions (clause A.3). Where the GNSS is unable to provide a valid position fix the default message field settings given in clause A.4 apply.

A.2 Active mode

In active mode the equipment transmits messages in a burst of 8 messages once per minute. The SOTDMA communication state of Message 1 is used to pre-announce its future transmissions.

The equipment shall transmit Message 1 "Position report" with the Navigational Status set to 14 and Message 14 broadcast safety related message with the text "MOB ACTIVE". Message 14 shall be transmitted nominally every 4 minutes and replace one of the position reports on both channels.

The equipment transmissions shall alternate between AIS1 and AIS2.

The 1st and 5th burst shall be as follows:

- AIS1, Message 1, Nav Status = 14, comm-state (time-out={7,3}, sub-message=0)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out={7,3}, sub-message=0)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out={7,3}, sub-message=0)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out={7,3}, sub-message=0)
- AIS1, Message 14 "MOB ACTIVE"
- AIS2, Message 14 "MOB ACTIVE"
- AIS1, Message 1, Nav Status = 14, comm-state (time-out={7,3}, sub-message=0)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out={7,3}, sub-message=0)

The 2nd, 4th, 6th burst shall be as follows:

- AIS1, Message 1, Nav Status = 14, comm-state (time-out={6,4,2}, sub-message=slot)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out={6,4,2}, sub-message=slot)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out={6,4,2}, sub-message=slot)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out={6,4,2}, sub-message=slot)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out={6,4,2}, sub-message=slot)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out={6,4,2}, sub-message=slot)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out={6,4,2}, sub-message=slot)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out={6,4,2}, sub-message=slot)

The 3rd burst shall be as follows:

- AIS1, Message 1, Nav Status = 14, comm-state (time-out=5, sub-message=0)

- AIS2, Message 1, Nav Status = 14, comm-state (time-out=5, sub-message=0)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out=5, sub-message=0)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=5, sub-message=0)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out=5, sub-message=0)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=5, sub-message=0)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out=5, sub-message=0)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=5, sub-message=0)

The 7th burst shall be as follows:

- AIS1, Message 1, Nav Status = 14, comm-state (time-out=1, sub-message=utc)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=1, sub-message=utc)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out=1, sub-message=utc)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=1, sub-message=utc)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out=1, sub-message=utc)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=1, sub-message=utc)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out=1, sub-message=utc)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=1, sub-message=utc)

The 8th burst shall be as follows:

- AIS1, Message 1, Nav Status = 14, comm-state (time-out=0, sub-message=incr)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=0, sub-message=incr)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out=0, sub-message=incr)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=0, sub-message=incr)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out=0, sub-message=incr)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=0, sub-message=incr)
- AIS1, Message 1, Nav Status = 14, comm-state (time-out=0, sub-message=incr)
- AIS2, Message 1, Nav Status = 14, comm-state (time-out=0, sub-message=incr)

In the 8th burst the increment to the next burst (sub-message=incr) shall be randomly selected between 2 025 slots and 2 475 slots.

This pattern of transmissions is repeated. It is permissible to start the sequence on AIS2.

Message 14 is transmitted at the 1st and 5th bursts (slot-time-out = 7 and 3) thereby ensuring that all future Message 14 messages are pre-announced.

A.3 Test mode

When operating in the test mode there shall be one burst of 8 messages, 4 on each channel alternating:

- AIS1, Message 14 "MOB TEST"

- AIS2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
- AIS1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
- AIS2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
- AIS1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
- AIS2, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
- AIS1, Message 1, Nav Status = 15 not defined, comm-state (time-out=0, sub-message=0)
- AIS2, Message 14 "MOB TEST"

It is permissible to start the sequence on AIS2.

A.4 Default message field values

On activation or if timed out in test mode, if the GNSS is unable to provide a valid position fix, then the reported position shall be longitude = 181° = not available = default and latitude = 91° = not available = default, COG = not available = default, SOG = not available = default, and the time stamp field shall be set to a value of 63.

If in active mode the GNSS is able to provide a valid position fix but that fix is subsequently lost, then the equipment shall continue to transmit with the last known position, COG and SOG. The time stamp field shall be set to a value of 63 and with the synchronization state set to 3.

Annex B (informative): LBT and Prioritized Wait Algorithm

B.1 Description of the algorithm

A flow-chart for the algorithm is shown in figure B.1.

In the first 30 minutes of open loop activation (clause 5.2.1.4) the DSC receiver will be on continuously and decoding messages as they are received. At all other times the receiver will normally be switched off to conserve battery power. Before transmitting a DSC message the receiver is switched on and sufficient bit transitions allowed to pass to ensure the receiver has obtained bit phasing. 50 bits are subsequently be received and stored in a shift register. The shift register is divided into five 10-bit characters and each compared to valid symbols as defined in Table A1.1 of Recommendation ITU-R M.493-15 [1]. If all five characters are valid symbols then a DSC message is being received. Otherwise a further 10 bits are shifted into the shift register and each time the five characters are checked for validity. Only after 50 ms when 60 bits in total have been shifted through the shift register without five valid symbols being received is channel 70 deemed free at which time the class-M device can start to transmit its DSC message.

Once the class-M device knows that channel 70 is busy it is then reliably able to detect the end of the message without being able to decode that message. This is done by waiting for three consecutive EOS symbols and then skipping over the final error check character. In the unlikely event that the end-of-message is missed a continuous check of the validity of the received characters is taken and the channel deemed free if two characters or more in five are not valid symbols.

Following an end-of-message detection the prioritized wait timer is initialized as described in clauses 5.1.3 and 5.1.4. If immediately following this an expansion data specifier symbol as defined in Table 1 of Recommendation ITU-R M.821-1 [4] occurs, followed by symbol 126 (no information) then an expansion sequence has been detected and CH70 is still busy. If at any time during the prioritized wait time preamble is detected a search is then made for the first two valid symbols of a new DSC message (symbols 125 and 111 respectively); even if the prioritized wait timer expires during this check time the search is not abandoned. If the two start symbols are received the channel has become busy again, another radio has started a new transmission. If not the class-M device can start to transmit provided that the prioritized wait timer has expired.

B.2 Interruptions for AIS transmissions

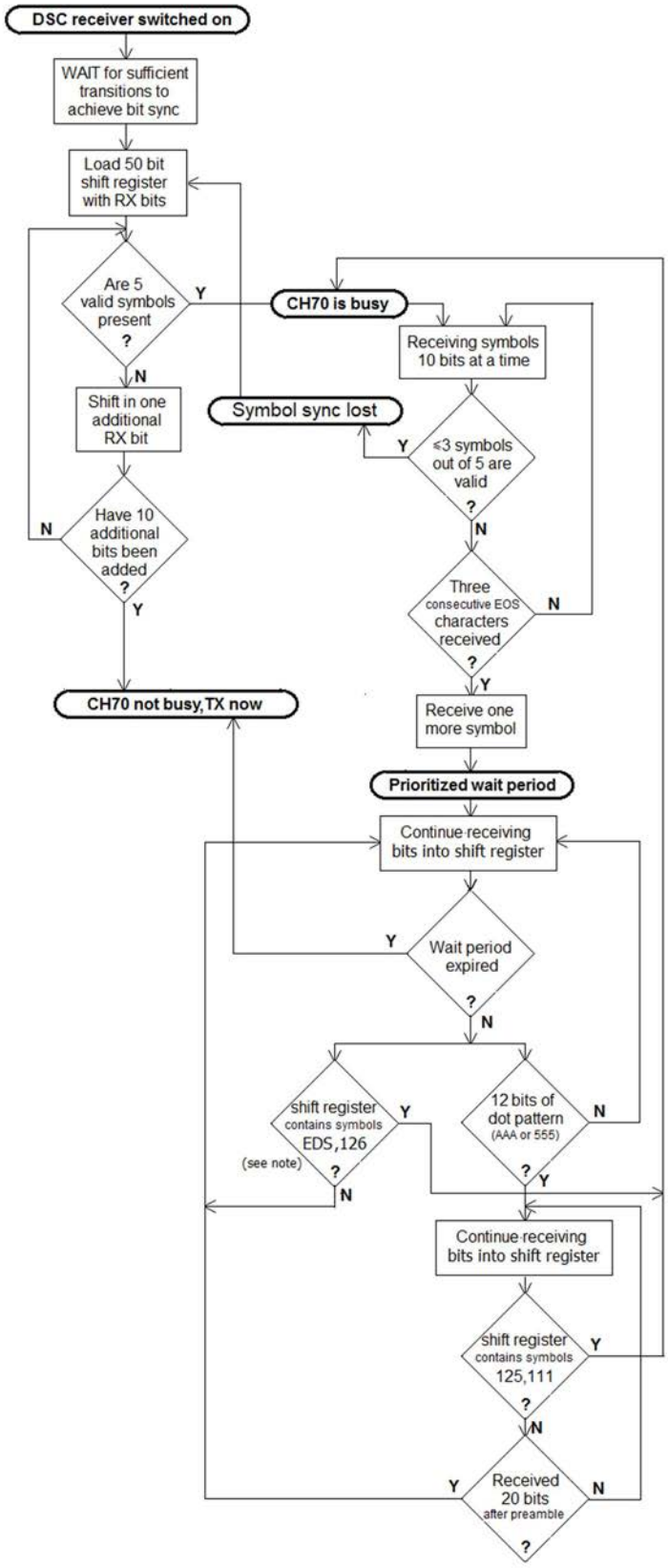
Class M devices transmit 8 AIS messages every minute in a burst of messages 2 seconds apart. Therefore, it is possible that an AIS transmission will occur whilst the LBT and prioritized wait algorithm is operating. Each AIS transmission takes 26⅔ ms, blocking out 32 bits of DSC reception. It is possible to extend the algorithm described in the present document to cater for such interruptions especially where symbol timing in the receiver can be preserved and bit timing resumed quickly. The path "symbol sync lost" in figure B.1 is intended to cater for all cases where symbol sync is lost despite best efforts to preserve symbol timing.

Implementations that do not attempt a resumption of the algorithm after an AIS transmission should always start again at "DSC receiver switched on" in figure B.1 after each AIS transmission.

B.3 Analysis of the algorithm

The probability of receiving five consecutive valid symbols at random (from random noise) is very low at 29 chances in a million. It can be argued that requiring five symbols to be received without any bit errors means that a class-M device might commence transmission on channel 70 when a distant transmitter is also using the channel, because a message received by a class M device locally from a distant transmitter is likely to contain bit errors. However since class M devices have a much lower transmit power than other DSC classes it's unlikely that other radios nearer to the distant transmitter will suffer any interference from the class M transmission. It's also likely that other radios in the vicinity of the class M device will successfully receive the class M transmission since the distant transmitter will also be distant to them so that the class M transmission takes precedence due to the FM capture effect.

Therefore the algorithm gives the best chance of a class M transmission being received without interruption by DSC radios near to it.



NOTE: EDS are expansion data specifier symbols - see Table 1 of Recommendation ITU-R M.821-1 [4].

Figure B.1: Class-M Prioritized Wait Algorithm

Annex C (informative): Change history

Date	Version	Information about changes
2019	1.2.1	Updated to Recommendation ITU-R M.493-15
2023	1.3.1	Updated replacing references to ETSI EN 303 098 and adding Annexes A & B.

History

Document history		
V1.1.1	February 2017	Publication
V1.2.1	June 2020	Publication
V1.3.0	November 2023	EN Approval Procedure AP 20240225: 2023-11-27 to 2024-02-26