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| **US Radiocommunications Sector****Fact Sheet** |
| **Working Party:** WP 5B | **Document No:** USWP5B26-17 |
| **Ref:** Recommendation ITU-R M.2135-0 | **Date:** 22 March 2021 |
| **Document Title:** Preliminary Draft Revision of Recommendation ITU-R M.2135-0Technical characteristics of autonomous maritime radio devices operating in the frequency band 156-162.05 MHz |
| **Author(s)/Contributors(s):**Jerry UlcekUS Coast Guard, Washington DCJohnny SchultzSev1Tech, Inc.Ross NorsworthyREC, Inc. | Phone : (202) 475-3607E-mail: Jerry.l.Ulcek@uscg.milPhone : (727) 403-4029E-mail: johnny.schultz@sev1tech.com Phone : (727) 515-8025E-mail: Ross\_Norsworthy@msn.com |
| **Purpose/Objective:** The purpose of this document is to provide contributions towards a Preliminary Draft Revision of Recommendation ITU-R M.2135-0 (AMRD).  |
| **Abstract:** This document provides a detailed technical update to Recommendation ITU-R M.2135-0. This Recommendation was published to support the work of the WRC-19. This Recommendation lacks sufficient details to define an AMRD Group B. This contribution will provide the technical characteristics required to define an AMRD Group B and how it should operate on channel 2006. |

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| **Radiocommunication Study Groups** |  |
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| Source: ITU-R M.2135-0Reference: | **Document: USWP5B26-17** |
| **22 March 2021** |
| **English only** |
| United States of America |
| Preliminary Draft Revision of Recommendation ITU-R M.2135-0 |

1. **Introduction**

This contribution provides the editorial changes and technical content to Recommendation ITU-R M.2135-0. This Recommendation was published to support the work of the WRC-19. This Recommendation lacks sufficient details to define an AMRD Group B. This contribution provides the technical characteristics required to define AMRD Group B and how it should operate on channel 2006.

1. **Summary of changes**

Listed below are the proposed changes to Recommendation ITU-R M.2135-0:

1. The Recommendation has been updated to reflect the decisions made at the World Radiocommunication Conference 2019.
2. Additional transmitter characteristics have been added to Annex 2.
3. A channel access scheme has been defined for Annex 2.
4. A transmission message structure has been defined for Annex 2.
5. Modified Annex 3 transmitter duty cycle to be compatible with the Annex 2 transmitter duty cycle since they could possibly occupy the same channel.
6. A new table has been added to Annex 3 to define the minimum required transmitter characteristics.
7. **Attachments**

The following attachment contains the proposed changes to Recommendation ITU-R M.2135-0. The changes proposed are contained in the attached document.

ATTACHMENT

PRELIMINARY DRAFT REVISION OF RECOMMENDATION ITU-R M.2135-0

Technical characteristics of autonomous maritime radio devices operating
in the frequency band 156-162.05 MHz

(2019)

Scope

This Recommendation describes autonomous maritime radio devices (AMRD) for use in the maritime environment. The definition and categorization of AMRD are included in Annex 1. The technical and operational characteristics of AMRD Group B using automatic identification system (AIS) technology are detailed in Annex 2. The technical and operational characteristics of AMRD Group B using other than AIS technology are detailed in Annex 3.

Keywords

Aid to Navigation (AtoN), automatic identification system (AIS), autonomous maritime radio devices (AMRD), digital selective calling (DSC), Maritime

Abbreviations/Glossary

AtoN Aid to Navigation

AIS Automatic identification system

AMRD Autonomous maritime radio devices

DSC Digital selective calling

e.i.r.p. equivalent isotropically radiated power

GMDSS Global maritime distress and safety system

IMO International Maritime Organization

SOLAS International Convention for the Safety of Life at Sea

VHF Very high frequency

Related ITU Recommendations and Reports

Recommendation [ITU-R M.493-1](http://www.itu.int/rec/R-REC-M.493/en)5: Digital selective-calling system for use in the maritime mobile service

Recommendation [ITU-R M.585-](http://www.itu.int/rec/R-REC-M.585/en)8: Assignment and use of identities in the maritime mobile service; or the revised version

Recommendation [ITU-R M.1371-5](http://www.itu.int/rec/R-REC-M.1375/en): Technical characteristics for an automatic identification system using time-division multiple access in the VHF maritime mobile band; or the revised version

Recommendation [ITU-R M.541-10](https://www.itu.int/rec/R-REC-M.541/en): Operational procedures for the use of digital selective-calling equipment in the maritime mobile service

Recommendation [ITU-R RA.769](https://www.itu.int/rec/R-REC-RA.769/en)-2: Protection criteria used for radio astronomical measurements

Report [ITU-R M.2285](https://www.itu.int/pub/R-REP-M.2285)-0: Maritime survivor locating systems and devices (man overboard systems) – An overview of systems and their mode of operation

The ITU Radiocommunication Assembly,

considering

*a)* that the maritime mobile service is a defined service for the operation of specific types of stations, as defined in RR No. **1.28**;

*b)* that the global maritime distress and safety system (GMDSS) is a maritime mobile service application;

*c)* that the automatic identification system (AIS) is a technology for maritime safety related applications, providing identification functions, safety of navigation functions, aids to navigation, locating signals and data communications;

*d)* that autonomous maritime radio devices (AMRD) reflect a new development in the maritime environment;

*e)* that due to the rapid technical progress, more and more AMRD applications in the maritime environment will be operated;

*f)* that, in order to enhance safety of navigation, there is a need to identify and categorize AMRD which operate autonomously in the maritime environment;

*g)* that the operation of AMRD may be for safety-related purposes;

*h)* that relevant characteristics for the operation of AMRD are also contained in the most recent version of Recommendations ITU-R M.493, ITU-R M.585 and ITU-R M.1371;

*i)* that AMRD is categorized into Group A and Group B, which are described in Annex 1;

*j)* that the International Maritime Organization (IMO), International Electrotechnical Commission (IEC) and the International Association of Marine Aids to Navigation and Lighthouse Authorities publish technical documents related to the design and usage of AMRD,

*k)* that World Radiocommunication Conference 2019 allocated channel 2006 (160.9 MHz) in Appendix 18 for AMRD Group B,

recognizing

*a)* that the use of AMRD should not compromise the integrity of the GMDSS and the operations on AIS1 and AIS2 display and the VHF data link;

*b)* that AMRD operate with maritime radio technology such as AIS and digital selective calling (DSC),

recommends

**1** that the technical and operational characteristics of AMRD Group A should be in accordance with the most recent version of Recommendation ITU-R M.1371 or ITU-R M.493;

**2** that the technical and operational characteristics of AMRD Group B using AIS technology should be in accordance with Annex 2;

**3** that the technical and operational characteristics of AMRD Group B using other than AIS technology should be in accordance with Annex 3.

Annex 1

Categorization of autonomous maritime radio devices

An AMRD is a mobile station; operating at sea and transmitting independently of a ship station or a coast station. Two groups of AMRD are identified:

Group A AMRD that enhance the safety of navigation,

Group B AMRD that do not enhance the safety of navigation (AMRD which deliver signals or information which do not concern the navigation of the vessel or do not complement vessel traffic safety in waterways).

The term ‘enhance safety of navigation’ is derived from the International Convention for the Safety of Life at Sea (SOLAS), as amended by IMO. Within SOLAS, Chapter V is titled “Safety of navigation” and contains the relevant IMO regulations. Consequently, the criterion for distinguishing AMRD Group A from AMRD Group B is their influence on the safety of navigation. Any signal or information originated by an AMRD that reaches the navigator, can impact the navigation of the vessel. This includes AIS (signals which may be shown on radar and navigational displays) and VHF (channel 70 and working channels). The navigator decides how to act on this information. This information may enhance the safety of navigation. However, signals or information which do not concern the navigation of a vessel can distract or mislead the navigator and degrade the safety of navigation.

AMRD that enhance the safety of navigation should be subject to IMO SOLAS regulations for the presentation of information to the navigators on board vessels.

IMO is the responsible organization for the designation of AMRD Group A. AMRD Group A consists of man overboard-AIS class M and Mobile aids to navigation.

Annex 2

Technical and operational characteristics of group B autonomous maritime radio devices using automatic identification system technology

## 1 Introduction

AMRD Group B are mobile stations operating at sea, transmitting independently of a ship station or a coast station. These AMRD Group B do not enhance the safety of navigation and they deliver signals or information which are not relevant for the navigator of general shipping. To avoid confusion or an overload of information on the bridge of a vessel AMRD Group B should not be permitted to use the designated frequencies for DSC and AIS 1 and AIS 2. Consequently, signals and information originated by AMRD Group B may not always in every instance be supported on DSC, Radar, Electronic chart display and information system or AIS. For systems that do, this information should be easily disabled by the user.

## 2 Technical characteristics of group B autonomous maritime radio devices using automatic identification system technology

a) The transmitter e.i.r.p. should be limited to 100 mW.

b) These devices operate on a non-interference basis, i.e. they should not interfere with nor claim protection from other existing services.

c) These devices operate on channel 2006 (160.9 MHz).

d) These devices should have an integrated antenna. The height of the antenna should not exceed 1 m above the surface of the sea.

e) These devices should have a protected external power switch and transmit indicator.

# 3 Burst transmission requirements

This Annex specifies how data should be formatted and transmitted for units that have a limited range. Burst transmission behaviour will increase the probability of reception and is required for units that operate on the surface of the sea transmitting at low power levels.

Burst behaviour conforms with ITU-R M.1371 Annex 9 “Requirements for stations using burst transmissions” with the minor modifications in the following sections:

– General characteristics.

– Transmitter characteristics.

– Synchronization accuracy.

– Channel access scheme.

– User ID (Unique identifier).

# 4 General characteristics

TABLE 1

Required parameter settings

| Parameter name | Setting |
| --- | --- |
| Channel (2006) | 160.900 MHz |
| Bit rate  | 9 600 bps |
| Training sequence  | 24 bits |
| Transmitter settling time (transmit power within 20% of final value. Frequency stable to within ±1 kHz of final value). Tested at manufacturers declared transmit power | ≤ 1.0 ms |
| Ramp down time | ≤ 832 µs |
| Transmission duration | ≤ 26.6 ms |
| Transmitter output power | Nominal 100 mW/20 dBm rms e.i.r.p.  |

# 5 Transmitter characteristics

The technical characteristics as specified in Table 2 should apply to the transmitter.

TABLE 2

Minimum required transmitter characteristics

| Transmitter parameters | Requirements |
| --- | --- |
| Carrier power  | Nominal 100 mW/20 dBm rms e.i.r.p. (measured over the burst duration) |
| Carrier frequency error | ±500 Hz (normal). ±1 000 Hz (extreme) |
| Transmitter burst duration | < 26.67 ms |
| Slotted modulation mask | ∆*fc* < ±10 kHz: 0 dBc±10 kHz < ∆*fc* < ±25 kHz: below the straight line between –20 dBc at ±10 kHz and –36 dBm at ±25 kHz±25 kHz < ∆*fc* < ±62.5 kHz: –36 dBm |
| Transmitter test sequence and modulation accuracy | < 3 400 Hz for Bit 0, 1 (normal and extreme)2 400 Hz ± 480 Hz for Bit 2, 3 (normal and extreme)2 400 Hz ± 240 Hz for Bit 4 ... 31 (normal, 2 400 ± 480 Hz extreme)For Bits 32 … 199 1 740 ± 175 Hz (normal, 1 740 ± 350 Hz extreme) for a bit pattern of 01012 400 Hz ± 240 Hz (normal, 2 400 ± 480 Hz extreme) for a bit pattern of 00001111 |
| Transmitter output power versus time | Power within mask shown in Fig. 1 and timings given in Table 3 |
| Transmitter spurious emissions | < -36 dBm 9 kHz to 1 GHz< -30 dBm 1 GHz to 4 GHz |

TABLE 3

Definitions of timing for Figure 1

|  |  |  |  |
| --- | --- | --- | --- |
| Reference | Bits | Time(ms) | Definition |
| *T*0 | 0 | 0 | Start of transmission slot. Power should NOT exceed –50 dB of *Pss* before *T*0 |
| *TA* | 0-6 | 0-0.625 | Power exceeds –50 dB of *Pss* |
| *TB* | *TB1* | 6 | 0.625 | Power should be within +1.5 or –3 dB of *Pss*  |
| *TB2* | 8 | 0.833 | Power should be within +1.5 or –1 dB of *Pss (start of training sequence)* |
| *TE* (includes 1 stuffing bit) | 233 | 24.271 | Power should remain within +1.5 or –1 dB of *Pss* during the period *TB2* to *TE* |
| *TF* (includes 1 stuffing bit) | 241 | 25.104 | Power should be –50 dB of *Pss* and stay below this |
| *TG* | 256 | 26.667 | Start of next transmission time period |

Figure 1

Transmitter output envelope versus time



# 6 Synchronization accuracy

There is no requirement for UTC synchronization.

# 7 Channel access scheme

The AIS station should operate autonomously and determine its own schedule for transmission of its messages based on a random selection of the first slot of the first burst. The other three slots within the first burst should be fixed referenced to the first slot of the burst. The increment between transmission slots within a burst should be 75 slots. The AIS station transmits messages in a burst of 4 messages no more than once per minute.

Figure 2

Burst transmissions in active mode



# 8 User identification (Unique identifier)

AMRD Group B devices designed to interact with 9 digit identity technologies should use:

917293Y4Y5Y6Y7Y8Y9

(Y4Y5Y6Y7Y8Y9 = a non-sequential pseudorandom number, to be determined by the manufacturer using a time-varying seed that has a negligible chance of repeating, e.g. a random value that is generated for each use, such as a timestamp, a sequence number, or some combination of these.)

Duplication of numbers is acceptable but should be avoided insofar as possible.

# 9 Transmission message structure

An AMRD Group B device should transmit an AIS Message 1 as defined by ITU-R M.1371 using the transmission scheme described in section 7. The AIS Message 1 special manoeuvre indicator should be set to 3 to indicate that the source of the transmission is an AMRD Group B device transmitting on channel 2006. The SOTDMA communication status Slot time-out should be set to 0, and the slot offset should be set to 0.

The following values may be used with the true heading indicator:

TABLE 4

Enhanced true heading indicator description

| Heading value | Description |
| --- | --- |
| 0 - 359 | True heading in degrees (0-359) |
| 360 | Adrift |
| 361 | Anchored / Moored |
| 362 | On a set COG/SOG vector |
| 363 | Remotely operated |
| 364 | Operating autonomously |
| 511 | not available (default) |

The AMRD Group B device should also transmit an AIS Message 24B as defined by ITU-R M.1371 once an hour by replacing the AIS Message 1 transmission burst with the AIS Message 24B.

Annex 3

Technical and operational characteristics of group B autonomous
maritime radio devices using technology other than automatic
identification system technology

## 1 Introduction

AMRD Group B described in this Annex are mobile stations operating at sea, transmitting independently of a ship station or a coast station. These AMRD Group B do not enhance the safety of navigation and they deliver signals or information which are not relevant for the navigator of general shipping. These AMRD Group B that use other than AIS technology should not be permitted to use the designated frequencies for AIS, including channels AIS 1 and AIS 2, or for DSC.

## 2 Technical characteristics of group B autonomous maritime radio devices using technology other than automatic identification system technology

a) The transmitter e.i.r.p. should be limited to 100 mW.

b) The transmitting duty cycle should be as low as possible and not to exceed 0.2%.

c) Duration of any single transmission should not exceed 108 ms.

d) These devices operate on a non-interference basis, i.e. they should not interfere with nor claim protection from other existing radio communications.

e) Where authorized by administrations for experimental use, these devices may operate on channel 2006 (160.9 MHz).

f) These devices should have an integrated antenna. The height of the antenna should not exceed 1 m above the surface of the sea.

g) These devices should have a protected external power switch and transmit indicator.

TABLE 5

Minimum required transmitter characteristics

| Transmitter parameters | Requirements |
| --- | --- |
| Carrier power  | Nominal 100 mW/20 dBm rms e.i.r.p. (measured over the burst duration) |
| Carrier frequency error | ±500 Hz (normal). ±1 000 Hz (extreme) |
| Transmitter burst duration | < 108ms |
| Slotted modulation mask | ∆*fc* < ±12 kHz: 0 dBc±12 kHz < ∆*fc* < ±25 kHz: below the straight line between –20 dBc at ±12 kHz and –36 dBm at ±25 kHz±25 kHz < ∆*fc* < ±62.5 kHz: –36 dBm |
| Transmitter spurious emissions | < -36 dBm 9 kHz to 1 GHz< -30 dBm 1 GHz to 4 GHz |