

**ANNEX 13**

**RESOLUTION MSC.509(105)/REV.1  
(adopted on 6 December 2024)**

**PROVISION OF RADIO SERVICES FOR THE  
GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS)**

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO that the Assembly, at its nineteenth session, adopted resolution A.801(19) on *Provision of radio services for the Global Maritime Distress and Safety System (GMDSS)*, authorizing the Maritime Safety Committee to keep the resolution under review and to adopt amendments thereto, as necessary,

RECALLING FURTHER resolution MSC.509(105), by which it adopted, at its 105th session, a revision of resolution A.801(19), as amended by resolution MSC.199(80), superseding the latter resolutions from 1 January 2024,

TAKING INTO ACCOUNT the amendments to chapter IV of the International Convention for the Safety of Life at Sea, 1974 ("the Convention"), adopted by resolutions MSC.436(99) and MSC.496(105),

NOTING, in particular, regulation IV/5 of the Convention concerning provision of radiocommunication services,

HAVING CONSIDERED, at its 109th session, the recommendation made by the Sub-Committee on Navigation, Communications and Search and Rescue at its eleventh session,

1 ADOPTS the revised *Recommendation on provision of radio services for the GMDSS, the Criteria for use when providing shore-based digital selective calling (DSC) facilities for use in the GMDSS, the Criteria for establishing GMDSS sea areas, the Criteria for use when providing a NAVTEX service and the Criteria for use when providing a NAVDAT service*, set out in annexes 1 to 5, respectively, to the present resolution;

2 RECOMMENDS Governments to ensure that provision of radio services for the GMDSS established on or after the date of adoption of the present resolution conforms to criteria not inferior to that set out in the annexes to the present resolution;

3 INVITES Governments to:

- .1 provide, either individually or in cooperation with other Governments, the radio services deemed practicable and necessary for the proper operation of the GMDSS; and
- .2 inform the Secretary-General of the shore-based facilities to be provided in support of the GMDSS in response to this resolution through the Organization's Global Integrated Shipping Information System (GISIS);

4 REVOKES resolution MSC.509(105).

## ANNEX 1

### RECOMMENDATION ON PROVISION OF RADIO SERVICES FOR THE GMDSS

1 Governments should establish such coast stations, individually or in cooperation with other Governments, as are needed to designate a sea area or areas A1 or A2, or both, off their coasts. Each sea area should be established in accordance with the *Criteria for establishing GMDSS sea areas* recommended in annex 3.

2 Governments that do not define sea areas A1 or A2 should establish such coast stations, individually or in cooperation with other Governments, as are needed to designate a sea area (or areas) A3 or A4 in accordance with SOLAS regulations IV/2.1.17 and 2.1.18. Each sea area should be established in accordance with the *Criteria for establishing GMDSS sea areas* recommended in annex 3.

3 Each Government should submit to the Organization information on the sea area or sea areas (A1, A2, A3 and/or A4) designated, radiocommunication services it has established for the GMDSS, and when there are changes to the sea area or areas it has so defined.

4 Governments should make provision for radiocommunication services in each sea area they have defined, so that a ship, while at sea, can receive shore-to-ship radiocommunication and that coast stations can receive ship-to-shore radiocommunication in accordance with the functional requirements set out in SOLAS regulation IV/4.1.

## ANNEX 2

### **CRITERIA FOR USE WHEN PROVIDING SHORE-BASED DIGITAL SELECTIVE CALLING (DSC) FACILITIES FOR USE IN THE GMDSS**

1 Governments, individually or in cooperation with other Governments, desiring to provide a high frequency (HF) DSC coast station for use in the GMDSS should notify the Organization so it can maintain in the GMDSS Master Plan details of HF coast stations providing HF DSC distress watch. Governments should ensure that such HF DSC coast stations are provided in accordance with appendix 1.

2 Governments, individually or in cooperation with other Governments, desiring to provide a medium frequency (MF) DSC coast station serving, either wholly or in part, a particular sea area A2, should notify the Organization as to the extent of continuous coverage and the extent of coverage from shore. This information should be determined by Governments in accordance with the criteria recommended in annex 3. Governments should ensure that MF DSC coast stations are provided in accordance with appendix 2.

3 Governments, individually or in cooperation with other Governments desiring to provide a very high frequency (VHF) DSC coast station serving, either wholly or in part, a particular sea area A1, should notify the Organization as to the extent of continuous coverage and the extent of coverage from shore. This information should be determined by Governments in accordance with the criteria recommended in annex 3. Governments should ensure that VHF DSC coast stations are provided in accordance with appendix 3.

4 In addition, Report ITU-R M.2027 provides engineering guidance to upgrade shore-based facilities to operate the GMDSS in sea areas A1, A2, A3 and A4.

## APPENDIX 1

### 1 BASIC PRINCIPLES FOR ESTABLISHING HF DSC COAST STATIONS FOR SEA AREAS A3 AND A4

The location of HF DSC coast stations for sea areas A3 and A4 should be based where practicable on the following principles:

- .1 each area should have a minimum of two stations to provide the required coverage;
- .2 stations should be selected to provide redundant coverage; and
- .3 in areas of high traffic density, more than two stations should be provided.

Governments are encouraged to cooperate in order to achieve the above basic principles for establishing HF DSC coast stations and a complete global coverage.

### 2 CRITERIA FOR THE PROVISION OF HF DSC COAST STATIONS

Stations participating in HF DSC watchkeeping in the GMDSS should:

- .1 be affiliated to an RCC and have reliable communications between them;
- .2 monitor all HF DSC distress frequencies;
- .3 provide as complete a coverage of their area as possible;
- .4 be in continuous operation; and
- .5 be able to relay distress alerts and communications under an international common procedure as agreed by the Organization.<sup>1</sup>

### 3 AVAILABILITY AND COVERAGE OF HF DSC COAST STATIONS

The minimum number of HF DSC coast stations indicated in paragraph 1 may need to be adjusted in future in order to:

- .1 ensure coast stations can provide a mutual backup in the event of operational failure; and
- .2 provide a methodology for predicting coverage to include in the GMDSS Master Plan.

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<sup>1</sup> Refer to IAMSAR Manual, Volume II, section 3.6 "Designation of the RCC or RSC responsible for initiating SAR action".

## **APPENDIX 2**

### **1 BASIC PRINCIPLES FOR ESTABLISHING MF DSC COAST STATIONS FOR SEA AREA A2**

The selection of MF DSC coast stations for sea area A2 should be based on the following principles:

- .1 each sea area designated as A2 requires a continuous MF guard on the distress frequencies and a sufficient number of coast stations to provide MF coverage in the coastal area of the Government concerned; and
- .2 in certain areas, several Governments may collectively provide complete coverage (e.g. the North Sea).

### **2 CRITERIA FOR THE PROVISION OF MF DSC COAST STATIONS**

Stations participating in MF DSC watchkeeping in the GMDSS should:

- .1 be affiliated to an RCC and have reliable communications between them;
- .2 provide as complete a coverage of their immediate sea area as possible; and
- .3 be in continuous operation.

### APPENDIX 3

#### **1 BASIC PRINCIPLES FOR ESTABLISHING VHF DSC COAST STATIONS FOR SEA AREA A1**

The selection of VHF DSC coast stations for sea area A1 should be based on the following principles:

- .1 each sea area designated as A1 requires a continuous VHF guard and should have the minimum number of stations necessary to provide VHF coverage in the coastal area of the Government concerned; and
- .2 in certain areas, several Governments may collectively provide complete coverage along their coasts (e.g. the North Sea).

#### **2 CRITERIA FOR THE PROVISION OF VHF DSC COAST STATIONS**

Stations participating in VHF DSC watchkeeping in the GMDSS should:

- .1 be affiliated to an RCC and have reliable communications between them;
- .2 provide as complete a coverage of their immediate sea area as possible; and
- .3 be in continuous operation.

## ANNEX 3

### CRITERIA FOR ESTABLISHING GMDSS SEA AREAS

#### 1 INTRODUCTION

Governments should use the following criteria when establishing sea areas as defined in SOLAS regulation IV/2.

#### 2 SEA AREA A1

##### 2.1 General

The communication range of stations operating in the maritime mobile VHF band is likely to be limited by propagation factors rather than lack of radiated power.

##### 2.2 Guidance criteria

Sea area A1 is that sea area which is within a circle of radius A nautical miles over which the radio propagation path lies substantially over water. The radius A is equal to the transmission distance between a ship's VHF antenna at a height of 4 m above sea level and the antenna of the VHF coast station which lies at the centre of the circle.

##### 2.3 Determination of radius A

2.3.1 The following formula should be used to calculate the range A in nautical miles:

$$A = 2.5 ( \sqrt{H(\text{in metres})} + \sqrt{h(\text{in metres})} )$$

H is the height above sea level of the VHF coast station receiving antenna and h is the height above sea level of the ship's transmitting antenna, which is assumed to be 4 m.

2.3.2 The formula given above applies to line-of-sight cases but is not considered adequate for cases where both antennae are at a low level. The VHF range in sea area A1 should be verified by field strength measurements.

#### 3 SEA AREA A2

##### 3.1 General

3.1.1 Consideration of the reception of radio signals in the 2 MHz band indicates that the range is likely to be limited by propagation conditions and atmospheric noise, which are affected by variations in geographical position and time of day, as well as radiated power.

3.1.2 The theoretical distance to be expected from ground-wave propagation can be determined by reference to the "Ground-wave propagation curves for frequencies between 10 kHz and 30 MHz" in the most recent version of Recommendation ITU-R P.368, to be used above seawater and adjusted as necessary to take account of the actual radiated field strength from the transmitting antenna and the minimum field strength necessary for the proper operation of a receiver conforming with the latest performance standard adopted by the Organization.

3.1.3 The determination of the minimum signal level required for satisfactory radio reception in the absence of other unwanted signals necessitates taking account of the noise with which the wanted signal must compete. The latest Recommendation ITU-R P.372 gives the world distribution of values of noise level and of other noise parameters and shows the method of using these in the evaluation of the probable performance of a radio circuit.

3.1.4 In addition, the most recent version of Recommendation ITU-R M.1467 provides guidance to Administrations for predicting sea area A2 by taking into account variations in the propagation conditions.

### 3.2 Guidance criteria

Sea area A2 is that sea area which is within a circle of radius B nautical miles over which the propagation path lies substantially over water and which is not part of any sea area A1, the centre of the circle being the position of the coast station receiving antenna.

### 3.3 Determination of radius B

The radius B may be determined for each coast station by reference to the most recent versions of Recommendations ITU-R P.368 and ITU-R P.372 for the performance of a single sideband (J3E) system under the following conditions:

Frequency	-	2 182 kHz
Bandwidth	-	3 kHz
Propagation	-	ground wave
Time of day	-	<sup>2</sup>
Season	-	<sup>2</sup>
Ship's transmitter power (PEP)	-	60 W <sup>3</sup>
Ship's antenna efficiency	-	25%
Radio frequency signal over noise (RF S/N)	-	9 dB (voice)
Mean transmitter power	-	8 dB below peak power
Fading margin	-	3 dB

The range of sea area A2 should be verified by field strength measurements.

## 4 SEA AREA A3

### Guidance criteria

Sea area A3 means an area, excluding sea areas A1 and A2, within the coverage of a recognized mobile satellite service supported by the ship earth station carried on board in which continuous alerting is available.

## 5 SEA AREA A4

### Guidance criteria

Sea area A4 means an area outside of sea areas A1, A2 and A3.

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<sup>2</sup> Administrations should determine time periods and seasons appropriate to their geographic area based on prevailing noise level.

<sup>3</sup> In the absence of field strength measurements, it may be assumed that this range will be obtained by a radio frequency power of 60 watts PEP for full carrier emissions generated by a single sinusoidal oscillation in an antenna of 25% efficiency.

ANNEX 4

**CRITERIA FOR USE WHEN PROVIDING A NAVTEX SERVICE**

1 There are two basic areas which must be defined when establishing a NAVTEX service. They are:

**Coverage area:** An area defined by an arc of a circle having a radius from the transmitter calculated according to the method and criteria given in this annex.

**Service area:** A unique and precisely defined sea area, wholly contained within the coverage area, for which MSI is provided from a particular NAVTEX transmitter. It is normally defined by a line which takes full account of local propagation conditions and the character and volume of information and maritime traffic patterns in the region.

2 Governments desiring to provide a NAVTEX service should use the following criteria for calculating the coverage area of the NAVTEX transmitter they intend to install, in order to:

- .1 determine the most appropriate location for NAVTEX stations having regard to existing or planned stations;
- .2 avoid interference with existing or planned NAVTEX stations; and
- .3 establish a service area for promulgation to seafarers.

3 The ground-wave coverage may be determined for each coast station by reference to the most recent versions of Recommendations ITU-R P.368 and ITU-R P.372 for the performance of a system under the following conditions:

Frequency	-	518 kHz
Bandwidth	-	300 Hz
Propagation	-	ground wave
Time of day	-	<sup>4</sup>
Season	-	<sup>4</sup>
Transmitter power	-	<sup>5</sup>
Antenna efficiency	-	<sup>5</sup>
Radio frequency signal over noise (RF S/N) in 500 Hz bandwidth	-	8 dB <sup>6</sup>
Percentage of time	-	90

4 Full coverage of a NAVTEX service area should be verified by field strength measurements.

5 In addition, the most recent version of Recommendation ITU-R M.1467 provides guidance to Administrations for predicting NAVTEX coverage areas by taking into account variations in the propagation conditions.

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<sup>4</sup> Administrations should determine time periods in accordance with NAVTEX time transmission table (see NAVTEX Manual) and seasons appropriate to their geographic area based on prevailing noise level.

<sup>5</sup> The range of a NAVTEX transmitter depends on the transmitter power and local propagation conditions. The actual range achieved should be adjusted to the minimum required for adequate reception in the NAVTEX area served, taking into account the needs of ships approaching from other areas. Experience has indicated that the required range of 250 to 400 nautical miles (nm) can generally be attained by transmitter power in the range between 100 and 1,000 W during daylight with a 60% reduction at night. The receiver characteristics, particularly as regards the bandwidth response, must be compatible with that of the NAVTEX transmitter.

<sup>6</sup> Bit error rate  $1 \times 10^{-2}$ .

## ANNEX 5

### CRITERIA FOR USE WHEN PROVIDING A NAVDAT SERVICE

1 There are two basic areas which must be defined when establishing a NAVDAT service. They are:

**Coverage area:** An area defined for ground-wave propagation by an arc of a circle having a radius from the coast station calculated according to the method and criteria given in this annex.

**Service area:** A unique and precisely defined sea area, wholly contained within the coverage area, for which MSI is provided from a particular NAVDAT coast station. It is normally defined by a line which takes full account of local propagation conditions and the character and volume of information and maritime traffic patterns in the region.

2 Governments desiring to provide a NAVDAT service should use the following criteria for calculating the coverage area of the NAVDAT coast station they intend to install, in order to:

- .1 determine the most appropriate location for the NAVDAT coast station having regard to existing or planned coast stations;
- .2 avoid interference with existing or planned GMDSS coast stations by determining the transmit power level; and
- .3 establish a service area for promulgation to seafarers.

3 NAVDAT can be used in the MF and HF maritime frequency bands. In the MF frequency band, the main propagation is on ground wave with some sky wave at night-time. In HF, ground-wave and sky wave propagation modes are both possible.

4 The ground-wave coverage may be determined for each coast station by reference to the most recent version of Recommendations ITU-R P.368 and ITU-R P.372 or by appropriate software coverage calculation for the performance of a system under the following conditions:

Frequency:	500 kHz or 4 226 kHz
Modulation:	4 QAM, 16 QAM or 64 QAM
Bandwidth:	1, 3, 5 or 10 kHz
Propagation	ground wave
Transmitter power:	1 to 4 kW rms (10 to 40 kW pep)
Antenna polarization:	vertical
Antenna efficiency:	30 to 85% (depending on frequency and antenna model)
Minimum radio frequency signal over noise (RF S/N) for BER $10^{-4}$ relating to modulation:	4 QAM: 11.5 dB 16 QAM: 18.5 dB 64 QAM: 24.5 dB
Percentage of time:	90%

5 This S/N ratio is also affected by the bandwidth used by the receiver (i.e. narrow bandwidth requires less S/N).

6 When calculating the radio coverage, the transmit RF power should use the rms value.

7 During daylight hours, solar radiation penetrates the atmosphere far enough to ionize the lowest "D" layer roughly 60 km above ground. This "D" layer completely absorbs signals on MF frequencies so that they do not carry on upwards out into space. This is the case of a pure ground-wave propagation.

8 With the approach of sunset, the "D" layer absorption decreases rapidly and within a few hours, MF signals continue to move in the upward direction towards the atmosphere. However, MF signals then encounter higher regions of the ionosphere which, instead of absorbing the signal, tend to refract or bend the path of the signal travel. With enough refraction, the signal can be redirected back to the Earth's surface far away from the transmitter site. This is the case of a mixed propagation: ground wave and sky wave. According to this explanation, propagation at night could cause interference between NAVDAT stations.

9 The dominant means of communication in the HF band is skywave ("skip") propagation, in which radio waves directed at an angle into the sky refract back to Earth from layers of ionized atoms in the ionosphere. By this method HF radio waves can travel beyond the horizon, around the curvature of the Earth, and can be received at intercontinental distances. However, suitability of this band for medium or short distance communications is reduced and this characteristic should be considered in the coverage analysis.

10 Full coverage of a NAVDAT service area should be verified by field strength measurements.

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