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HARMONIZATION OF GMDSS REQUIREMENTS FOR RADIO INSTALLATIONS ON BOARD SOLAS SHIPS

1 The Sub-Committee on Navigation, Radiocommunications and Search and Rescue, at its ninth session (21 to 30 June 2022), taking into account the amendments to SOLAS chapter IV adopted by resolution MSC.496(105) and other related instruments emanating from the modernization of the Global Maritime Distress and Safety System (GMDSS), approved COMSAR.1/Circ.32/Rev.1 on *Harmonization of GMDSS requirements for radio installations on board SOLAS ships*, superseding COMSAR/Circ.32, COMSAR/Circ.17, COM/Circ.110, COM/Circ.110/Corr.1 and COM/Circ.117 as from 1 January 2024.

2 The Sub-Committee, at its tenth session (10 to 19 May 2023), agreed with a number of modifications to COMSAR.1/Circ.32/Rev.1, which are incorporated into the revised *Guidelines for the harmonization of GMDSS requirements for radio installations on board SOLAS ships*, as set out in the annex, maintaining the effective implementation date of the revised Guidelines which will take effect on 1 January 2024, in line with the effective date of COMSAR.1/Circ.32/Rev.1.

3 Member States are invited to bring the annexed revised Guidelines to the attention of all concerned, in particular shipowners, ship operators, shipping managers, manufacturers and surveyors.

4 This circular supersedes COMSAR.1/Circ.32/Rev.1.

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ANNEX

GUIDELINES FOR THE HARMONIZATION OF GMDSS REQUIREMENTS FOR RADIO INSTALLATIONS ON BOARD SOLAS SHIPS

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1 GENERAL

These Guidelines were developed in order to provide Administrations, shipowners and marine electronics companies with an unambiguous interpretation of the radio installation requirements in SOLAS chapter IV and related IMO resolutions. References are also made to IMO circulars, the STCW Convention and ITU Radio Regulations.

The core elements of this document provide guidelines on GMDSS installations on board ships. However, additional useful information is included from other bodies which are involved when maritime radio equipment is installed.

1.1 Application

1.1.1 Radio equipment installations on SOLAS ships should meet the relevant IMO requirements and ITU recommendations and should be of a type-approved by the Administration.

1.1.2 These Guidelines are applicable when installing GMDSS radio equipment on board SOLAS ships.

1.1.3 The rules in these Guidelines also apply to radio installations on high-speed craft as prescribed in the HSC Codes.

(*See chapter 14 regarding Radiocommunications)*

1.1.4 The rules in these Guidelines also apply to radio installations on mobile offshore drilling units as prescribed in the MODU Codes.

(*See chapter 11 regarding Radiocommunication and Navigation)*

1.1.5 Cargo ships of less than 300 gross tonnage (gt) and fishing/catching vessels are, as a general rule, not covered by SOLAS requirements. However, if GMDSS radio equipment is installed on a voluntary basis or mandatory basis according to national laws, these Guidelines should be followed as far as practicable.

1.1.6 These Guidelines reflect, to a large extent, unambiguous requirements in accordance with the relevant rules and regulations (see subsection 1.2. below). Other practical installation solutions than the ones emerging from these Guidelines may, however, be accepted as long as the international requirements, as laid down in the SOLAS Convention, etc., are met and the installation is considered to be equivalent.

Note: The marine electronics company which installs the radio equipment should be responsible for giving the radio operators proper familiarization in the use of the installed radio equipment before it is put into operation.

1.2 Rules and regulations

These Guidelines have been prepared in accordance with the following conventions, regulations, instructions and guidelines:

.1 International Convention for the Safety of Life at Sea (SOLAS), 1974;

.2 IMO resolutions (performance standards) and IMO circulars;

.3 International Telecommunication Union (ITU) Radio Regulations (RR);

.4 International Standards - ISO 8468 2007, annex A; and

.5 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978.

1.3 Drawings

1.3.1 General

1.3.1.1 Specified drawings (plans of the radio installation) should be prepared out well before the work on a new building or reconstruction of ships or offshore units is started. Insufficient or missing drawings may result in deficiencies during radio survey and could lead to expensive repair costs later (resolution A.1156(32)).

1.3.1.2 For radio installations, the following drawings should be prepared:

.1 antenna drawing;

.2 radio arrangement drawing; and

.3 wiring diagram.

1.3.1.3 For new buildings, the antenna and radio arrangement drawings should at least be of size 1:50.

1.3.1.4 Approved "as installed" wiring diagram, radio arrangement, as well as antenna drawings, should be kept available on board the ship for presentation during radio surveys, etc.

1.3.2 Antenna drawings

Antenna drawings should show all antennas seen from fore or aft position, the port or starboard position and from above. This applies to the following antennas:

.1 all transmitting antennas including location of antenna tuner;

.2 all receiving antennas including electronic position fixing system (EPFS) antennas;

.3 radar antennas;

.4 satellite communication antennas; and

.5 the location of float-free EPIRBs.

1.3.3 Changes in the antenna arrangement

When changes are made in the antenna arrangement, modified antenna drawings should be prepared.

1.3.4 Radio arrangement drawings (layout of bridge and communication room)

These drawings should show the location of the following equipment:

.1 controllers for transmitting distress alert;

.2 VHF radio installations, including any control units;

.3 MF or MF/HF radio installations, including any control units, printers, etc.;

.4 satellite communication equipment, including terminals, printers, etc.;

.5 receivers for keeping watch on VHF channels 16, 70, MF 2 187.5 kHz, and HF distress channels in 4, 6, 8, 12 and 16 MHz bands;

.6 receivers for MSI and SAR related information services recognized by IMO;

.7 SARTs, AIS SARTs and EPIRBs (if located on the navigation bridge);

.8 portable two-way VHF radiotelephone apparatus and their chargers;

.9 emergency light powered from a reserve source of energy to illuminate the mandatory radio equipment;

.10 battery charger (for the reserve source of energy); and

.11 fuse or circuit breaker box.

1.3.5 Wiring diagram

These drawings should show the following connections:

.1 antenna connections;

.2 connections to telephone exchange (PABX), fax machine, etc.;

.3 connections to the ship's mains, emergency source of energy, the reserve source of energy (batteries), and switching systems for all radiocommunication and radionavigation equipment;

.4 radio equipment (including emergency light) being connected to each power unit/source;

.5 fuses or circuit breaker for all radio equipment;

.6 uninterruptable power supply (UPS) with all connections, circuit breakers and fuses, if installed as power for mandatory radio equipment (block diagram showing how the UPS operates, showing the circuit breakers, fuses and switch-over connections to alternative power supplies, by-pass switches, etc.);

.7 any connections (interface connections) between EPFS and GMDSS radio equipment;

.8 battery chargers for the reserve source of energy;

.9 connections to gyro (if applicable);

.10 type of cables used in the installation; and

.11 connections to VDR (if applicable).

1.4 Instruction manuals and publications

The following instruction manuals and publications should be available on board:

.1 user's manual for all radio equipment and battery chargers to be provided by the equipment manufacturer in English. Shipowners, operators and managers may, if considered necessary, also provide consistent versions of these manuals in the working language of the ship;

.2 specifications and battery capacity calculations for the installed batteries; and

.3 ITU publications according to requirements in the Radio Regulations.

1.5 Tools and spare parts

1.5.1 As a minimum requirement, the ship should have the following tools and spare parts readily available on board:

.1 spare fuses for all radio equipment, battery circuit and main fuses where safety fuse ("melting" fuse) are used;

.2 reserve emergency lamps;

.3 tools necessary for simple servicing;

.4 acid specific density meter if the ship is fitted with lead acid accumulators; and

.5 multi-meter.

1.5.2 If the ship makes use of the "at-sea electronic maintenance" method, it should be equipped with adequate test equipment and spare parts, which enable maintenance and repairs of all mandatory radio equipment while at sea.

1.6 Maintenance requirements

Ships equipped with GMDSS radio installations should meet specific requirements as to maintenance methods for the radio installations. Irrespective of the methods used to ensure the availability of the functional requirements specified in SOLAS regulation IV/4.1.1, and as specified in regulation IV/15.8, a ship should not depart from any port unless and until the ship is capable of performing all distress, urgency and safety functions, as set out in regulation IV/4.1.1.

SOLAS ships in sea areas A1 and A2 are required to use at least one of the three specified maintenance methods, whereas SOLAS ships in sea areas A3 and A4 should use at least a combination of two methods.

(SOLAS regulations IV/4 and 15)

1.6.1 Shore-based maintenance

If availability is ensured by using a combination of methods which includes shore-based maintenance, an arrangement acceptable to the Administration should be established to ensure adequate support of the ship for the maintenance and repair of its radio installations. For example, the following arrangements, among others, may be suitable:

.1 an agreement with a company known to cover the trading sea area of the ship to provide maintenance and repair facilities on a call-out basis;

Note: Production of a valid SOLAS certificate by an Administration is sufficient proof that the Administration is satisfied that adequate shore-based maintenance arrangements have been made by the shipowner.

.2 provision of facilities at the main base of ships engaged on a regular trading pattern.

1.6.2 At-sea electronic maintenance

1.6.2.1 If availability is ensured by using a combination of methods which includes at-sea electronic maintenance capability, adequate additional technical documentation, tools, test equipment and spare parts should be carried on board in order to enable the maintainer to perform tests and localize and repair faults in the radio equipment. The extent of this additional technical documentation, tools, measuring equipment and spare parts to be carried on board should be consistent with the equipment installed and should be approved by the Administration. An indication of such approval should be entered in the Records of Equipment (Form P, R or C).

1.6.2.2 The person designated to perform functions for at-sea electronic maintenance should either hold an appropriate certificate as specified by the ITU Radio Regulations, as required, or have equivalent at-sea electronic maintenance qualifications, as may be approved by the Administration, taking into account the recommendations[1] of the Organization on the training of such personnel.

1.6.3 Duplication of equipment

1.6.3.1 If availability is ensured by using duplication of equipment, in addition to the radio installations required by regulations IV/7, IV/8 and IV/9, as appropriate, the following radio installations complying with regulation IV/14 should be available onboard ships engaged on voyages in:

.1 sea area A1 – a VHF radio installation complying with the requirements of regulation IV/7.1.1; and

.2 sea area A2 – a VHF radio installation complying with the requirements of regulation IV/7.1.1 and an MF radio installation complying with the requirements of regulation IV/9.1.1.

[1] Reference is made to resolution A.703(17) on *Training of radio personnel in the Global Maritime Distress and Safety System (GMDSS)*.

The duplication of equipment above is deemed as being achieved if an equipment with coverage equal to or broader than the required system is installed for compliance with other sea area requirements, providing the required redundancy.

1.6.3.2 If availability is ensured by using a combination of methods which includes duplication of equipment, in addition to the radio installations required by regulations IV/7, IV/10 and IV/11, as appropriate, the following radio installations complying with regulation IV/14 should be available on board ships engaged on voyages in:

.1 sea area A3 – a VHF radio installation complying with the requirements of regulation IV/7.1.1, and either an MF/HF radio installation complying with the requirements of regulation IV/11.1.1 and being able to comply fully with the watch requirements of regulation IV/12.1.3 or a recognized mobile satellite service Ship Earth Station (RMSS-SES) complying with the requirements of regulation IV/10.1.1. The MF/HF installation or RMSS-SES installed for duplication should also comply with regulation IV/10.2; and

.2 sea area A4 – a VHF radio installation complying with the requirements of regulation IV/7.1.1, and an MF/HF radio installation complying with the requirements of regulation IV/11.1.1 and being able to comply fully with the watch requirements of regulation IV/12.1.3.

An RMSS-SES with lesser coverage installed onboard should determine the coverage of sea area A3 as a primary system for a ship.

The MF/HF radio installation or RMSS-SES installed for duplication should also comply with regulation IV/10.2.

1.6.3.3 The additional radio installations specified in 1.6.3.1 and 1.6.3.2 of these Guidelines (hereinafter referred to as "duplicated equipment") should each be connected to a separate antenna and be installed and ready for immediate operation.

1.6.3.4 It should be possible to connect the duplicated equipment to the reserve source or sources of energy required by regulation IV/13.2, in addition to the appropriate radio equipment specified in that regulation (hereinafter referred to as "basic equipment"). The capacity of the reserve source or sources of energy should be sufficient to operate the particular installation (i.e. the "basic equipment" or the "duplicated equipment") with the highest power consumption, for the appropriate period specified in regulations IV/13.2.1 and 13.2.2. However, the arrangement for the reserve source or sources of energy should be such that a single fault in this arrangement should not be able to affect both the basic and the duplicated equipment.

1.7 Ship station radio licence

1.7.1 A ship station radio licence in accordance with the ITU Radio Regulations should be issued to the ship.

1.7.2 The licensee (normally the shipowner) is responsible for applying for a radio licence in due time before the installation take place.

(RR. Article 18)

Note: The Maritime Mobile Service Identity (MMSI) stipulated in the radio licence should be coded into the DSC equipment and, if appropriate, also into the EPIRB. If the national authority accepts serial number or call sign for identification of EPIRBs, the correct serial number or call sign should be coded into the EPIRB.

All these identities should be changed when a ship is transferred to another flag (see section 1.9).

1.8 Application for activation of satellite equipment

The licensee is also responsible for registration and service activation of satellite ship earth station.

1.9 Process for radio equipment when transferring a ship to another flag

When ships move from the flag of registration of one administration to that of another administration, the licensee/shipowner should immediately inform the appropriate licensing authorities concerning the status of the ship station radio licence and update the identities programmed into radio equipment, and ensure that international databases, such as ITU MARS and COSPAS-SARSAT IBRD are appropriately updated.

1.10 Initial and annual radio surveys, issuance, renewal and endorsement of Safety Radio Certificates

The survey of radio installations on SOLAS ships should be carried out in accordance with the rules laid down in resolution A.1156(32) on *Survey Guidelines under the harmonized system of survey and certification (HSSC), 2021*, and SOLAS chapter I, part B. It is important to note the following text:

.1 The survey of the radio installations, including those used in life-saving appliances, should always be carried out by a qualified radio surveyor who has necessary knowledge of the requirements of SOLAS, ITU Radio Regulations and the associated performance standards for radio equipment. The radio survey should be carried out using suitable test equipment capable of performing all the relevant measurements required by these Guidelines.

.2 It is considered as very important that the responsible radio operator (holding a GOC or ROC) is properly instructed and trained in how to use the GMDSS radio equipment.

.3 The STCW Convention requires that the radio operator performing watchkeeping duties should:

.1 ensure that watch is maintained on the frequencies specified in the ITU Radio Regulations and the SOLAS Convention; and

.2 while on duty, regularly check the operation of the radio equipment and its sources of energy, and report to the master any failure of this equipment.

.4 The radio licence and certificate for the radio operator/operators should be checked during the survey.

2 FUNCTIONAL REQUIREMENTS

2.1 General

2.1.1 The functional requirements of the GMDSS are detailed in SOLAS regulation IV/4.1.1.

2.1.1.1 It is of great safety importance that all requirements laid down are fulfilled. The most important requirement is that "Every ship, while at sea, shall be capable of transmitting ship-to-shore distress alerts by at least two separate and independent means, each using a different radiocommunication service". It should be possible to initiate such alerts from the position from which the ship is normally navigated.

2.1.2 The EPIRB may be used to meet this requirement if installed close to the navigation bridge or if it can be remotely activated from the bridge.

2.1.3 In addition to the above-mentioned requirements, it should be possible to initiate the transmission of DSC distress alerts from the navigation bridge on VHF, and also on MF or HF, provided that the MF or HF equipment is mandatory in the trade area of the ship.

(SOLAS regulations IV/8 and 9)

2.1.4 All ships should keep continuous watch on VHF channel 70 by use of a DSC receiver.

2.1.5 Ships with MF requirements should in addition keep continuous watch on MF DSC 2 187,5 kHz and on HF DSC distress and safety channels if required to have HF radio equipment installed.

2.1.6 All ships should keep continuous listening watch on VHF channel 16 while at sea by use of a VHF receiver.

2.1.7 Watch should also be kept with MSI and SAR related information receiver. The watch should be kept at the position from which the ship is normally navigated.

(SOLAS regulations IV/7, 9, 10, 11 and 12)

Note: Use of GMDSS equipment for transmitting and receiving general radiocommunications is a requirement specified in SOLAS regulation IV/ 4.1.2. Regular use of GMDSS equipment helps to develop operator competency and ensure equipment availability. If ships use other radiocommunication systems for the bulk of their business communications, they should adopt a regular programme of sending selected traffic or test messages via GMDSS equipment to ensure operator competency and equipment availability and to help reduce the incidence of false alerts. This policy extends to all GMDSS equipment suites including DSC on VHF, MF and HF, to RMSS-SESs, and to any duplicated VHF and long-range communications facilities.

2.2 Sea areas (definitions)

2.2.1 Sea area A1 means an area within the radiotelephone coverage of at least one VHF coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government.

2.2.2 Sea area A2 means an area, excluding sea area A1, within the radiotelephone coverage of at least one MF coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government.

2.2.3 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.

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

2.3 Equipment requirements (including duplication of equipment) for SOLAS ships

GMDSS equipment requirements in force for all ships to which SOLAS chapter IV applies:

(SOLAS chapter IV)

Equipment	A1	A2	A3	A4
VHF telephony installation with DSC capable of:	x	x	x	x
DSC watch on channel 70	x	x	x	x
Radiotelephony watch on channel 16	x	x	x	x
Watch on other appropriate frequency or frequencies for urgency and safety communications for the area in which the ship is navigating	x	x	x	x
MF telephony[6] installation with MF DSC capable of:		x	x	
DSC watch on 2 187.5 kHz		x	x	
Watch on other appropriate frequency or frequencies for urgency and safety communications for the area in which the ship is navigating		x	x	
SES providing RMSS			x	
MF/HF telephony[6] installation with DSC capable of:				x
DSC watch on 2 187.5 kHz and 8 414.5 kHz				x
Depending on time of day and geographical position, DSC watch on at least one of the frequencies 4 207.5 kHz, 6 312 kHz, 12 577 kHz or 16 804.5 kHz				x
Watch on other appropriate frequency or frequencies for urgency and safety communications for the area in which the ship is navigating				x
Duplicated VHF with DSC	x[7]	x[7]	x	x
Duplicated MF[6] with DSC		x[7]		
Duplicated SES providing RMSS			x[4, 5]	
Duplicated MF/HF telephony[6] with DSC			x[4]	x
Receiver(s) for MSI and SAR-related information[3]	x	x	x	x
Float-free EPIRB	x	x	x	x
Radar SART or AIS SART	x[1]	x[1]	x[1]	x[1]
Portable GMDSS VHF transceivers	x[2]	x[2]	x[2]	x[2]
Automatic updating of position to all relevant radiocommunication equipment	x	x	x	x
The following additional requirements apply to passenger ships				
"Distress panel" and "distress alarm panel" (SOLAS regulations IV/6.4 and 6.6)	x	x	x	x
Two-way-on-scene radiocommunication on 121.5 MHz and 123.1 MHz from the navigating bridge. (SOLAS regulation IV/7.6)	x	x	x	x

[1] Cargo ships between 300 and 500 gt.: 1 set. Cargo ships of 500 gt. and upwards and passenger ships: 2 sets.
[2] Cargo ships between 300 and 500 gt.: 2 sets. Cargo ships of 500 gt. and upwards and passenger ships: 3 sets.
[3] This may be either a combined ship earth station and EGC receiver or separate pieces of equipment.
[4] Ships in sea area A3 may choose between duplication with either complete MF/HF transceiver or SES providing an RMSS with coverage equal to or broader than the primary RMSS (See section 1.6.3).
[5] See section 1.6.3.2.
[6] An MF/HF radio installation may substitute an MF radio installation.
[7] See section 1.6.3.1.

3 BASIC EQUIPMENT – SUPPLEMENTARY REQUIREMENTS

3.1 General requirements

Every radio installation should be:

.1 located in such a way that no harmful interference of mechanical, electrical or other origin affects its proper use;

.2 located in such a way that electromagnetic compatibility (EMC) is ensured and harmful interference is avoided to other equipment and systems;

.3 so located as to ensure the greatest possible degree of safety and operational availability, with warning notice when appropriate;

.4 protected against the harmful effects of water, extremes of temperature and other adverse environmental conditions;

.5 provided with reliable, permanently arranged electrical lighting, independent of the main and emergency sources of electrical power, for the adequate illumination of the radio controls for operating the radio installation; and

.6 so located that no magnetic compass lies within the stated Compass Safe Distance of the equipment.

(SOLAS regulation IV/6.2)

Note: Ancillary equipment may be connected to the required GMDSS equipment, provided that any such connection is made in such a way that the prescribed GMDSS functions will not be rendered ineffective by use of such ancillary equipment and will be fully restored immediately at the normal or abnormal termination of the connected ancillary equipment. Only an interface allowed within the GMDSS equipment type approval should be used to connect ancillary equipment to a mandatory GMDSS installation.

3.2 Use of VHF for navigational safety

3.2.1 Control of the VHF used for navigational safety should be available at the conning position, and where necessary, from the wings of the bridge.

3.2.2 Portable VHF equipment may be used to provide navigational safety from the wings of the bridge.

(*SOLAS regulation IV.6.3)*

3.3 Marking of radio equipment and notices

3.3.1 All radio equipment should be duly marked with type designation. The marking should be clearly visible when the equipment has been installed.

3.3.2 The radio installation should be duly marked with the ship's GMDSS identities including call sign, MMSI, EPIRB hexadecimal identity, RMSS identities and equipment serial numbers.

3.3.3 DSC operation procedures should be posted near the DSC equipment on the navigation bridge. Emergency procedures should be posted near the relevant equipment on the bridge.

3.3.4 "GMDSS operating guidance for ships in distress situations", procedure on false alerts and "Guidance on GMDSS distress alerts", drawn up by IMO, should be posted on the navigation bridge.

3.4 Emergency lights

3.4.1 All mandatory radio equipment should have reliable emergency lighting powered from a reserve source of energy, which normally is the radio batteries. This light should give adequate illumination of the controls for safe operation of the radio equipment, and the working table for reading and writing.

3.4.2 Means should be provided for dimming any light source on the equipment, which is capable of interfering with navigation, i.e. by adjustable light or by use of a curtain etc. during night-time.

3.4.3 For VHF transceivers located openly in the front of the bridge, a screened light concentrating on each single piece of equipment, should be used. Scale illumination (powered from a reserve source of energy) may be accepted provided it is sufficient for the operation of call control devices both on the VHF transceivers and the DSC controllers.

3.4.4 Ceiling light may be used for equipment located in a separate communication workstation, providing it is not dazzling the navigator on watch.

(resolution A.694(17), annex, paragraph 3.3.)

3.4.5 The emergency light should have its own fuse circuit and fuses in each circuit. These fuses should be connected before the main fuses in order to prevent blown main fuses to cause interruption of the emergency light.

3.4.6 Switches for emergency lights should be properly marked.

3.5 Recommended installation

In order to meet all requirements and recommendations concerning the location of all units included in a GMDSS radio installation, it is recommended to establish either a "communication workstation" in connection with the navigation bridge, or a separate "communication office" outside the navigation bridge with remote controls on the bridge. It must be emphasized, however, that the suggestions in subsections 3.5 to 3.7 below are to be considered as guidelines only. Other solutions and combinations are equally acceptable as long as the general requirements and recommendations outlined are fulfilled.

(SOLAS chapter IV, COM/Circ.105 and ISO 8468:2007)

3.5.1 Communication workstation

3.5.1.1 The workstation should be located in the aft of the navigation bridge so that the navigator has an overall view of the navigation while operating the radio equipment. If the workstation and the rest of the navigation bridge are separated by a wall it should be made of glass or fitted with windows. There should be no lockable door between the workstation and the navigation bridge.

3.5.1.2 When the workstation is being used during night-time, a curtain or other suitable light screen should be provided in order to avoid dazzling effect from the lights.

3.5.1.3 All mandatory radio equipment installed on the navigation bridge (except mandatory VHF, see subsection 4.1.1) should be located in the communication workstation. Watch receivers may alternatively be located elsewhere on the navigation bridge.

Note: It is essential that satisfactory watch (clearly audible signals/visual alarms) can be maintained at the position from which the ship is normally navigated. If it is not possible to maintain satisfactory watch, alarm indicators on MF or MF/HF and RMSS equipment, including EGC printer, should be located outside this workstation.

(resolutions A.664(16); MSC.512(105), annex, part A, section 4.4; and MSC.513(105), annex, paragraph 3.2, and SOLAS regulation IV/12 regarding watchkeeping requirements)

3.5.1.4 MF/HF RF power amplifiers should be located in a separate and screened cabinet or room. Antenna tuners should, as a general rule, be located outdoors below the antenna.

3.5.2 Communication office

3.5.2.1 The communication office may be located as required by the shipping company, e.g. in connection to the captain's office. It should be possible to make public calls and perform general radiocommunications on MF or HF and/or through satellite from the communication office, if such calls cannot be made from a suitable location elsewhere on the ship.

3.5.2.2 All equipment (excluding remote controllers) for written correspondence, as well as telephone services for MF/HF and RMSSs, should be located in the communication office.

3.5.2.3 The remote operation panels for the mandatory equipment should be located in a central position on the navigation bridge, in order to fulfil the requirements for transmitting distress alerts from the navigation bridge.

Note: Consideration should also be given to the requirements for navigational safety communication and subsequent distress communications on MF or HF. When MF/HF DSC is included in the mandatory basic or duplicated radio equipment, it should be possible to conduct distress and safety communications from the navigating position, and the MF/HF DSC controller should be installed in this position.

(resolution MSC.512(105))

3.5.2.4 Watch receivers and MSI and SAR related information receivers should be located on the navigation bridge.

3.5.2.5 VHF transceivers with DSC used for navigational safety should be located at the conning position.

3.6 Ships with integrated bridge system (IBS)

3.6.1 Ships constructed to satisfy the IBS requirements for single-manned navigating bridge should have the operation panels for mandatory GMDSS equipment installed as close to the conning position as possible.

3.6.2 Equipment for the transfer of radio telephone calls via radio (VHF, MF or MF/HF) or satellite to other areas of the ship should be placed close to the other GMDSS equipment near the communication workstation.

3.6.3 It may be possible also to operate printed communications (data communications via radio and/or RMSSs) from other areas of the ship.

3.7 Ships with integrated communication systems (ICS)

3.7.1 The ICS is a system in which individual radiocommunication equipment and installations are used as sensors, i.e. without the need for their own control units, providing outputs to and accepting inputs from the operator's position, called workstations. Such workstations are called "GMDSS workstations" if they include control and monitoring of all equipment and installations provided on a ship for the GMDSS which are also suitable for general radiocommunications. The ICS workstation should be installed in a console located in a central position on the navigation bridge.

3.7.2 Transmitting and receiving equipment may be located outside the navigation bridge.

3.7.3 The ICS should comprise at least two GMDSS workstations each connected to each GMDSS radiocommunication sensor over a network or connection system. At least two printers should be installed. All requirements laid down in SOLAS chapter IV, should be fulfilled.

(resolution MSC.517(105))

4 GMDSS RADIO EQUIPMENT

4.1 Location of VHF transceivers and VHF DSC controllers

4.1.1 Control of the VHF radiotelephone channels, required for navigational safety, shall be immediately available on the navigation bridge convenient to the conning position and, where necessary, facilities should be available to permit radiocommunications from the wings of the navigation bridge. Portable VHF equipment or remote-control units, i.e. on the wings of the navigation bridge may be used to meet the latter provision. If remote-control units are used, controls at the navigating bridge should have priority. If such "combined" equipment is chosen, it should be possible to transmit DSC distress alert from the conning position.

4.1.2 If the ship is equipped with extra VHF transceiver (without DSC) with channels required for navigational safety, located in the conning position, another central location of the mandatory DSC VHF equipment on the navigation bridge (in navigating position) can be accepted.

(SOLAS regulations IV/4.1.1.5, 4.1.1.9 and 6.3.)

Note: With regard to the location of equipment and distress alerts, the same requirements also apply to the duplicated DSC VHF equipment for ships in sea areas A3 and A4. The duplicated VHF transceiver can, however, be located in the "navigating position" instead of in the conning position.

In order to conduct power measurements, easy access to the antenna output of each equipment should be provided.

(SOLAS regulation IV/15.2 and resolution A.1156(32))

4.2 Continuous watch on DSC VHF channel 70

Continuous watch on DSC VHF channel 70 can be met by:

.1 a separate VHF channel 70 watch receiver. It should not be muted or interrupted when using other radio equipment, or

.2 a dedicated watch receiver combined with the VHF transceiver. It should be installed so as to maintain watch even when the VHF equipment is used for telephony, or

.3 VHF with DSC permanently locked on channel 70 for reception and transmission of DSC calls only. To deal with other correspondence on other channels, an additional VHF transceiver should be installed, which may be without the DSC function.

(resolutions A.694(17) and MSC.511(105); and COM/Circ.105)

4.3 Location of MF/HF transceivers

4.3.1 If the equipment is main or duplicated equipment, it should be possible to activate the distress alert from the navigation bridge or in the case of passenger vessels, the conning position. If the equipment can be operated remotely from other positions on board the ship, priority should be given to the unit on the navigation bridge.

4.3.2 With regard to an MF installation, the requirement for DSC distress alerts on 2 187.5 kHz can also be fulfilled by a remote-activated MF control unit locked on 2 187.5 kHz with alert activated from the navigation bridge.

Note: DSC on MF is required in sea areas A2, A3 and A4. It should therefore always be possible to activate the DSC distress alerts on 2 187.5 kHz from the navigation bridge.

If combined MF/HF radio equipment is chosen as mandatory GMDSS equipment, it should also be possible to activate the distress alert from the navigating bridge on the mandatory HF DSC frequencies.

If MF/HF installation is chosen as duplicated equipment on a ship for sea area A3, there is no requirement for an extra DSC watch receiver.

(SOLAS regulations IV/9.2, 10.2 and COM/Circ.105)

4.3.3 RF power amplifiers should, as a general rule, not be located in the navigation bridge area. Location in such area may, however, be accepted if it can be granted that the EMC requirements are fulfilled. The antenna tuner should, as a general rule, be located in an outdoor position below and close to the antenna.

(resolution A.813(19))

4.3.4 The MF or MF/HF transmitter should be equipped with an instrument or other provisions indicating antenna current or power delivered to the antenna.

(resolution MSC.512(105))

4.3.5 If the transmitter antenna is not permanently connected to the transmitter, it should be automatically connected before the distress alert is transmitted.

4.4 Watchkeeping receivers for DSC

4.4.1 Depending on the trade area and mandatory radio equipment of the ship, continuous watch is required via separate receivers for DSC channel 70, MF DSC 2 187.5 kHz and HF DSC 8 414.5 kHz, as well as minimum one of the frequencies 4 207.5 kHz, 6 312 kHz, 12 577 kHz and 16 804.5 kHz.

(SOLAS regulation IV/12)

4.4.2 The watch receiver for VHF DSC channel 70, MF DSC 2 187.5 kHz and HF DSC scanning receiver should be located so that the alarm is clearly audible and visible all over the navigation bridge.

(resolution MSC.512(105); and COM/Circ.105)

4.4.3 It should be possible to read the DSC alert messages on the navigation bridge. The printer (if any) or display etc. may be common for all DSC watch receivers, provided that messages coming in simultaneously are arranged in queue and printed as soon as the printer/display is ready.

(resolutions MSC.511(105) and MSC.512(105))

4.4.4 Easy access to the antenna connector should be possible in order to conduct test of the equipment by means of measuring instruments.

Note: There is no requirement for a duplicated MF/HF DSC watch receiver for ships in sea areas A3 or A4 when maintenance method "duplication of equipment" is used.

4.5 Watchkeeping on MF or MF/HF DSC

4.5.1 Continuous watch on the MF DSC distress frequency 2 187.5 kHz to be kept by:

.1 a separate DSC watch receiver locked on 2 187.5 kHz; or

.2 a dedicated watch receiver combined with the MF radiotelephone.

Note: If DSC operation is desirable on other frequencies, an additional scanning receiver should be provided. Other frequencies than those used for distress and safety should not be included in the receiver dedicated for DSC emergency watchkeeping. A single DSC decoder may be used to serve both the DSC watch and the additional scanning receiver.

(COM/Circ.105)

4.5.2 Continuous watch on MF/HF DSC distress and safety frequencies to be kept by:

.1 a separate MF/HF DSC scanning receiver for distress and safety frequencies only; or

.2 a dedicated MF/HF DSC scanning watch receiver for distress and safety frequencies only combined with the MF/HF radiotelephone.

(COM/Circ.105)

Note: If DSC operation is desirable on other frequencies, an additional scanning receiver should be provided. The receiver may be combined with the watch receiver for MF DSC. A single DSC decoder may be used to serve both the DSC distress and safety frequency scanning receiver and the additional scanning receiver only if continuous watch for distress and safety calls can be maintained.

(SOLAS regulations IV/2.1.3, 10.1.2, 11.1.2, 12.1.3; and COM/Circ.105)

4.5.3 Watchkeeping on DSC calling frequencies

For watchkeeping on other frequencies than distress and safety frequencies (national and international DSC calling frequencies), a separate scanning receiver should be provided.

Note: According to SOLAS regulation IV/4.1.2, there is a general requirement for transmitting and receiving "general radiocommunications". Ships in sea area A2 should, according to this requirement and according to SOLAS regulation IV/9.4, be able to transmit and receive general radiocommunications on MF <u>or</u> MF/HF telephony <u>or</u> NBDP <u>or</u> a ship earth station providing a recognized mobile satellite service. Ships in sea area A2, which is equipped in accordance with the minimum SOLAS requirements (i.e. VHF and MF with DSC), should be provided with equipment for listening and calling on MF DSC frequencies. Alternatively, they may be provided with RMSS equipment in order to fulfil the general radiocommunications.

According to IMO's performance standards, resolution MSC.512(105), it is required that the DSC equipment should have possibilities as to be used also for general radiocommunications. For ships in sea areas A3 and A4, the installed equipment (MF/HF or RMSS) should also be used for general radiocommunications. In these sea areas the general radiocommunications are normally fulfilled either by using the HF or RMSS equipment.

(SOLAS regulations IV/10 and 11)

4.6 Recognized Mobile Satellite Service (RMSS)

4.6.1 If the equipment is the main station or duplicated equipment, it should be possible to activate the distress alert from the navigation bridge.

(SOLAS regulation IV/10.2)

4.6.2 The terminal and the radiotelephone equipment, if any, may be placed in a "communication workstation" in connection with the navigation bridge or in a separate communication office.

4.6.3 Taking into account the guidelines in section 3.5, the satellite terminal and/or external printers may also be located elsewhere in the ship.

Note: Attention should be given to resolution MSC.434(98), annex, paragraph 3.3.2 regarding new installations, which has the following text:

"It should be possible to initiate and make distress alerts/calls from the position at which the ship is normally navigated. The equipment should include an option making it possible to initiate transmission of distress alerts/calls at a position remote from the primary human machine interface (HMI) of the equipment."

The words "at a position remote from the primary HMI of the equipment" only apply to ships which have defined an additional place/room on board to be such "other position". Normally it will be accepted that RMSS equipment is installed in the "communication workstation" if it is provided with facilities for conducting distress alerts from the navigation bridge. It is, however, recommended that the RMSS terminal, including additional equipment, should be located on the navigation bridge in order to make it possible to conduct follow-up distress communications from this position.

Ships that operate exclusively within range of NAVTEX stations and which can be alerted by individual calling should not need to carry a separate EGC receiver in order to comply with SOLAS regulation IV/10.1.1.3.

4.7 Connection of external located data terminal to mandatory ship earth station providing a recognized mobile satellite service in the GMDSS

4.7.1 If the licensee/shipowner wants to connect the mandatory RMSS terminal, i.e. to the ship's PC-network or to an outside located data terminal, all mandatory GMDSS requirements in accordance with SOLAS chapter IV, should always be fulfilled.

4.7.2 In that case, the dedicated printer should be connected permanently to the output of the mandatory RMSS terminal's printer output. A manually operated and duly marked switch, located near the RMSS terminal, should be installed to disconnect the RMSS terminal from the external equipment.

4.8 Extra requirements for passenger ships

4.8.1 A distress panel should be installed at the conning position, i.e. within the range of the manoeuvring console in the front of the navigation bridge.

4.8.2 This panel should contain either one single button which, when pressed, initiates a distress alert using all radiocommunication installation required on board for that purpose; or one button for each individual radio installation which are installed.

4.8.3 Means should be provided to prevent inadvertent activation of the button or buttons.

(SOLAS regulation IV/6.4)

Note: The alert button or buttons should be protected against inadvertent activation by use of a spring-loaded lid or cover permanently attached by, e.g. hinges in order to fulfil the requirement of carrying out "at least two independent actions" when transmitting distress alert. (The button or buttons should be pressed for at least 3 seconds before the alarm is activated.)

4.8.4 If the installed EPIRB is used as the secondary (mandatory) means of distress alerting and is not remotely activated, it should be acceptable to have an additional EPIRB (float-free or manual) installed on the navigation bridge near the conning position.

(SOLAS regulation IV/6.5)

4.8.5 Information on the ship's position should be continuously and automatically provided to all relevant radiocommunication equipment to be included in the initial distress alert when the button or buttons on the distress panel is pressed (i.e. interface connection from the ship's EPFS receiver should be provided, where EPFS is not integrated).

4.8.6 The **distress alarm panel** is normally included in the distress panel and should provide visual and aural indication of any distress alert or alerts received on board and should also indicate through which radiocommunication service the distress alerts have been received.

(SOLAS regulation IV/6.6)

Note: The following guidelines (table) should apply with regards to the connection of equipment to the distress panel in order to fulfil the IMO requirements concerning ship-to shore distress alerts by at least two separate and independent means:

Sea areas	Equipment
All ships	VHF DSC
A1	EPIRB
A2	MF DSC and EPIRB or RMSS
A3	MF DSC, RMSS and one of HF DSC or EPIRB or second RMSS
A4	MF/HF DSC and EPIRB

Only radio equipment according to SOLAS chapter IV are required to be connected to this distress panel to fulfil the requirement for ship-to-shore distress alerts by means of at least two separate and independent means. The duplicated equipment for ships in sea areas A3 and A4, are, therefore, in general, not required to be connected to the distress panel if it is granted that distress alert can be transmitted from the duplicated equipment in a position close to the installed distress panel.

4.9 MSI and SAR related information receiver(s)

4.9.1 The printer or display for an MSI and SAR related information receiver should be located on the navigation bridge. As mandatory equipment in the GMDSS, these receivers should also, as a general rule and in the same way as required for other permanent installed equipment, have their own permanent installed power supplies with fuse circuits/fuses, cf. section 7. Antenna and antenna cable should also be permanently installed.

4.9.2 The mandatory requirement for an MSI and SAR related information receiver may be combined with RMSS equipment. It is recommended that a dedicated MSI and SAR related information receiver is used, enabling continuous reception of MSI messages independent of whether the RMSS equipment is being used or not.

(SOLAS regulation IV/7.1.4 and resolution A.701(17))

4.10 Float-free EPIRB

The float-free EPIRB should be located/installed so that the following requirements are fulfilled:

.1 The EPIRB should, with greatest possible probability, float-free and avoid being caught in railings, superstructure, etc., if the ship sinks.

.2 The EPIRB should be located so that it may be easily released manually and brought to the survival craft by one person. It should therefore not be located either in a radar mast or in any other places which can only be reached by vertical ladder.

(SOLAS regulations IV/7.1.5, 8.1.1, 9.1.3.1, 10.1.4.1, 11.1.3 and resolutions A.763(18) and MSC.471(101)

Note: A float-free EPIRB may also be used to fulfil the requirements for one piece of equipment (of two), which is capable of transmitting ship-to-shore distress alerts from or close to the position from which the ship is normally navigated. Under such conditions, the float-free EPIRB should fulfil the following **additional requirements** with regards to location/installation:

.3 The EPIRB should be installed in the vicinity of the navigation bridge, e.g. on the wings of the navigation bridge. Access via vertical ladder should not be accepted. A location on the top of the wheelhouse may be accepted to fulfil the requirement if accessible by stairs; or

(SOLAS regulation *IV/7.1.5 and COM/Circ.105)*

.4 It may be possible to activate the EPIRB remotely from the bridge. If remote activation is used, the EPIRB should be installed so that it has unobstructed hemispherical line of sight to the satellites.

(COM/Circ.105)

Note: It should be considered that the main function of the EPIRB is float-free activation. If the additional requirements mentioned above cannot be met without reducing the reliability of the float-free activation, priority should be given to this requirement. Alternatively, two float-free EPIRBs should be installed or a float-free EPIRB and manual EPIRB.

.5 The EPIRB should be equipped by the manufacturer with a buoyant lanyard suitable for use as a tether to life raft etc. Such buoyant lanyard should be so arranged as to prevent it from being trapped in the ship's structure.

(resolution MSC.471(101))

.6 The EPIRB should be marked with the ship's call sign, serial number of EPIRB, MMSI number (if applicable), Hex ID, and battery expiry date.

4.11 Radar SARTs and AIS-SARTs

4.11.1 The search and rescue transponders or transmitters (radar SARTs or AIS-SARTs) should be placed in brackets on both sides of the ship and preferably visible from the navigation bridge. It should be easy to bring the radar SART or AIS-SART to the lifeboats or life-rafts. A visible location inside the navigation bridge, close to the outer doors, is recommended.

4.11.2 Alternatively, one radar SART or AIS-SART should be placed in bracket in each survival craft (normally covered lifeboats) if such location permits rapidly replacing of the radar SART or AIS-SART into any survival crafts which may be used in emergency situations.

4.11.3 The radar SART or AIS-SART should be provided with a pole or other arrangement compatible with the antenna pocket in the survival craft in order to fulfil the required height of at least 1 metre above sea level.

4.11.4 On ships carrying at least two radar SARTs or AIS-SARTs and equipped with free-fall lifeboats, one of them should be stowed in a free-fall lifeboat and the other located in the immediate vicinity of the navigation bridge so it can be utilized on board and ready for transfer to any of the other survival craft.

(SOLAS regulation IV/7.5 and resolution MSC.510(105))

4.11.5 The radar SARTs or AIS-SARTs should have waterproof marking with operational instructions, battery expiry date and the ship's name and call sign.

4.12 Portable two-way VHF radiotelephone apparatus

4.12.1 Obligatory portable two-way VHF radiotelephone apparatus including their emergency batteries (primary batteries normally of Lithium type) should be located in a central and easily accessible position on the navigation bridge. If such equipment is placed in a lockable cabinet, it should be possible to get easy access to the portable two-way VHF radiotelephone apparatus without the use of tools.

4.12.2 Primary batteries should be sealed for use only in emergency situations and marked by the supplier with battery expiry date. The battery should be considered as exhausted, if its seal is broken, and a new battery will be requested during radio survey, cf. the IMO requirement for eight-hours operation in emergency situations. Use of a new battery should not be required for operational tests or surveys.

4.12.3 If portable two-way VHF radiotelephone apparatus with re-chargeable batteries (secondary batteries) are used for onboard communications, chargers for these batteries should be provided.

(SOLAS regulations IV/7.2, 7.3 and 7.4 and resolution MSC.515(105))

4.12.4 Portable two-way VHF radiotelephone apparatus should have waterproof marking with the ship's name and call sign. The primary battery should be marked with expiry date. Channel numbers should be stated on the equipment.

4.13 Portable VHF transceivers and communications from the wings of the navigation bridge

Requirements for radiocommunications from the wings of the navigation bridge are laid down in SOLAS chapter IV. In order to fulfil these requirements, mandatory portable GMDSS VHF can be used (see subsection 4.12). Alternatively, a simplex VHF transceiver (single frequency only) or remote-controlled units with channel selector, loudspeaker and microphone may be installed in these positions. These remote-controlled units should be controlled by a VHF installed at the conning position. See also section 4.1.1.

(SOLAS regulation IV/6.3 and COM/Circ.105)

4.14 On scene (Aeronautical) two-way VHF radiotelephone apparatus

4.14.1 All passenger ships should be provided with means for two-way on-scene radiocommunications for search and rescue purposes using the aeronautical frequencies 121.5 MHz and 123.1 MHz from the navigation bridge.

4.14.2 Such equipment should be marked with the ships name and call sign. The primary battery should be marked with expiry date.

(SOLAS regulation IV/7.6)

4.14.3 Approved equipment may be of a fixed type or a portable type. The equipment should be provided with the frequencies 121.5 MHz and 123.1 MHz only.

(resolution MSC.80(70), as amended)

4.15 EPFS – Electronic Position Fixing System

4.15.1 Information on the ship's position should be continuously and automatically provided to all relevant radiocommunication equipment. With such connections the ship's position will be included in the initial distress alerts.

(SOLAS regulations IV/18.1 and V/19)

4.15.2 When an EPFS is installed in accordance with regulation V/19, automatic updating of the ship's position into the DSC equipment and RMSS equipment should be possible. If such automatic updating is interrupted, it is required to enter the ship's position manually into relevant GMDSS equipment at intervals not exceeding 4 hours whenever the ship is under way.

(SOLAS regulation IV/18.2)

4.15.3 If the EPFS is connected to the GMDSS equipment, it should (similar to the mandatory GMDSS equipment) be supplied with energy from the reserve source of energy/batteries.

(SOLAS regulation IV/13.8)

4.16 Connections of navigational sensors

4.16.1 EPFS – Receiver

4.16.1.1 A EPFS receiver should be connected to the relevant radio communication equipment (DSC controller, GMDSS satellite equipment) in order to provide information on the ship's position continuously and automatically to the radio equipment.

4.16.1.2 The EPFS receiver should (similar to the mandatory GMDSS equipment) also be supplied with energy from the reserve source of energy/batteries.

4.16.2 Heading sensor

4.16.2.1 If the GMDSS satellite equipment requires automatic antenna adjustment according to ship's heading, the required heading sensor should be connected.

4.16.2.2 In this case the heading sensor should also be supplied with energy from the reserve source of energy/batteries.

5 ANTENNA INSTALLATION

5.1 General

Special attention should be paid to the location and installation of the different antennas on a ship in order to ensure effective and efficient communication. Incorrectly installed antennas will degrade the performance of the radio equipment and will reduce the range of radiocommunications.

5.2 Location of VHF antennas

5.2.1 VHF antennas should be placed in a position which is as elevated and free as possible, with at least 2 metres horizontal separation from constructions made by conductive materials. Antennas should be sufficiently separated from potential sources of electromagnetic interference (EMI) such as light emitting diode (LED) navigation lights to avoid harmful degradation of the receiver performance. Vertical separation can be an effective mitigation measure.

5.2.2 VHF antennas should have a vertical polarization.

5.2.3 Ideally there should not be more than one antenna on the same level.

5.2.4 The location of mandatory VHF antennas should be given priority compared with mobile telephone antennas. If they are located on the same level, the distance between them should be at least 5 metres.

5.2.5 It is recommended to use double screened cable with a maximum loss of 3 dB.

5.2.6 All outdoor installed connectors on the coaxial cables should be watertight by design in order to give protection against water penetration into the antenna cable.

5.2.7 AIS VHF antennas should be installed safely away from interfering high-power energy sources like radar and other transmitting radio antennas, preferably at least 3 metres away from and out of the transmitting beam. Antennas should be sufficiently separated from potential sources of EMI such as LED navigation lights to avoid harmful degradation of the receiver performance. Vertical separation can be an effective mitigation measure.

5.2.8 AIS VHF antennas should be mounted directly above or below the ship's primary VHF radiotelephone antenna, with no horizontal separation and with minimum 2 metres vertical separation. If it is located on the same level as other antennas, the distance apart should be at least 5 metres.

5.3 Location and choice of MF/HF antennas

5.3.1 The mounting arrangement of the antenna or pedestal should be constructed in order to withstand the strain from swaying and vibration.

5.3.2 Wire antennas should be protected against breakage by having a weak link installed.

5.3.3 Whip antennas should be installed as vertical as possible and located in an elevated position on the ship at least 1 metre away from conductive structures.

5.3.4 Attention should be paid to self-supportive vertical antennas and their swaying radius.

5.3.5 The recommended minimum length of the antenna is 8 metres.

5.3.6 The down lead from the base of the antenna to the antenna tuner should be insulated and run as vertically as possible and not less than 45° towards the horizontal plane.

5.3.7 The transmitting antenna should have an insulation resistance to earth which is recommended to be of more than 50 MΩ in dry weather and of no less than 5 MΩ in humid weather (transmitter to be disconnected when measuring).

5.4 Location of antenna tuner for MF/HF transceiver

The antenna tuner should normally be located externally (outdoor) and as close to the antenna as possible, and so that the down lead wire/cable from the antenna should be as vertical as possible.

5.5 Receiving antennas

5.5.1 As a general rule, all receivers including watchkeeping receivers should have their own separate antenna.

5.5.2 Antennas for watchkeeping receivers should be located as far away as possible from MF/HF transmitting antennas in order to minimize receiver blocking.

5.6 Satellite communication antennas

The installation requirements of RMSS equipment antennas are included in appendices 1 and 2. In case of multiple SESs operating on adjacent frequency bands, the antenna should be installed such as to ensure electromagnetic compatibility.

(resolution MSC.434(98))

5.6.1 Antennas for voluntary radio equipment

Antennas for voluntary radio equipment may be located on deck, provided their use does not interfere with antennas of mandatory radio equipment. When mobile telephone is installed on board ships, special attention should be made to the facts that some types of mobile telephones (especially GSM telephone equipment) may interfere with the ship's navigational equipment (especially EPFS) and other electronic equipment.

5.7 Installation of coaxial cables

5.7.1 Coaxial cables should be installed in separate ducting and at least 10 cm away from power supply cables.

5.7.2 Incorrect installation of cables may change their characteristic impedance, resulting in power reflections which will attenuate the RF signal and reduce the efficiency of the radio equipment.

5.7.3 In VHF antennas, the reflected power should not be greater than 10% of the measured output power.

5.7.4 The following guidelines should be applied when bending coaxial cables:

.1 Cables should be crossed at right angles.

.2 Where there is one bend in a permanent fixture the bending radius should be five times the outside diameter of the cable.

.3 Where there are several bends, the bending radius should be 10 times the outside diameter of the cable.

.4 When using flexible cable, the bending radius should be 20 times the outside diameter of the cable.

6 EMC, EARTHING AND SCREENING

6.1 Electromagnetic compatibility (EMC)

6.1.1 General

All reasonable and practical steps should be taken to ensure EMC between the equipment concerned and other radio communication and navigational equipment carried on board in compliance with the relevant requirements of SOLAS chapters IV and V. In order to avoid interference, the following rules apply:

.1 Radio installations should not cause harmful interference to other electronic, electrical or navigational systems on board ships.

.2 However, other systems should not cause harmful interference to the radio installation.

.3 In order to avoid electromagnetic noise interference, it is essential that manufacturers' guidelines relating to EMC, screening and earthing are correctly followed.

(SOLAS regulations IV/6.2.1 and V/17 and resolutions A.694(17) and A.813(19))

6.1.2 Interference from LED lighting and other unintentional emitters

6.1.2.1 Navigation lights and other deck and mast-mounted lighting equipped with LEDs, or other systems mounted near antennas, including those certified to recognized EMC standards, have been found to cause debilitating interference to radio receiving equipment without operator awareness. Interference to EPFS receivers is also possible. Periodic EMC checks are therefore essential, especially after installation of LED-equipped lighting or other systems mounted near antennas susceptible to unintentional interference.

6.1.2.2 Before the initial acceptance or flag-in of the ship, or after any electrical or other installation modifications or changes that may have an impact, checks should take place to ensure that no harmful EMI is experienced by a radio system. If EMI has been identified, either the identified interferer has to be removed, the interference has to be suppressed or the antenna has to be relocated to an area without harmful interference.

6.1.2.3 The following checks should be performed by crew, shore-based maintainers or radio surveyors to indicate the presence of harmful interference:

.1 The presence of interference to VHF radiotelephones equipped with a received signal strength indicator (RSSI) may be indicated by selecting a free channel and observing that the RSSI level does not change when suspected interfering devices are activated and deactivated. This should be repeated on several channels across the VHF band.

.2 If no RSSI is provided, the presence of interference to a VHF radiotelephone may be indicated by deactivating suspected sources of interference, selecting a broadcasting station, and then reactivating those devices and listening for a change in signal quality. This should be repeated on several channels across the VHF band.

.3 Harmful interference to shipborne AIS equipment may be indicated by swapping the antenna cable connections between the AIS and VHF radio and then performing the VHF radiotelephone check as set out above. If the cabling configuration does not allow this check to be performed, the VHF radiotelephone check can be performed using a portable VHF transceiver held near the AIS antenna using the procedures set out in 6.1.2.1, noting that this is an even less sensitive approach. All antennas should be returned to their original configuration and tested to ensure normal operation.

.4 The presence of interference to GNSS may be indicated by switching the unit to the signal-to-noise (SNR) or integrity display mode, and ensuring SNR levels are not affected when suspected interfering devices are activated or deactivated.

6.1.2.4 If any interference is suspected, but the source cannot be identified, then a full evaluation using a spectrum analyser is advised, as follows.

6.1.2.5 To perform the evaluation, a spectrum analyser with appropriate pre-amplifier is the most appropriate instrument for detecting, identifying and isolating such interference. The presence of harmful interference is to be measured using the spectrum analyser on all radio reception antennas of equipment mentioned in SOLAS chapters IV and V fitted, in all maritime frequency bands supported by that equipment. For example, the presence of VHF interference may be accurately measured by connecting a spectrum analyser with low noise pre-amplifier to a victim VHF radiotelephone antenna, and checking for noise in the 155 to 165 MHz band. Interference detected in this way could then be isolated by turning power to the suspected interferers on and then off. The result of this analysis should be documented and the report should be kept on board.

6.1.3 Voluntary radio equipment

6.1.3.1 Additional, voluntarily carried non-GMDSS radio equipment may be as follows:

.1 mobile telephone, smartphone or tablet;

.2 radio amateur stations;

.3 Wi-Fi, Bluetooth or similar networks; and

.4 satellite stations.

6.1.3.2 Operation of such equipment is at the discretion of the master. It may be installed on the bridge provided that the EMC requirements are fulfilled, and radionavigation and radiocommunication are not degraded.

6.2 Screening of cables

In order to avoid interference, the following guidelines should apply with regards to screening of cables:

.1 Coaxial down leads should be used for all receiving antennas and the coax screen should be connected to ground on at least one end.

.2 All cables within a distance of 2 metres from a transmitting antenna should be screened and the screen should be properly earthed in a metal tube or duct.

6.3 Earthing

Earthing of radio equipment should be carried out in accordance with appropriate guidelines for earthing in maritime installations required in international standards. Great care should be taken in order to fulfil the following rules:

.1 Each unit of radio equipment should have a separated earth connection.

.2 MF/HF antenna tuners should be earthed with either a copper bar or copper band.

.3 The earthing bar or strap should be as short as possible, should not be more than 1 metre in length, and should be at least 60 mm in width.

.4 For earthing straps up to 5 metres in length, the width should be at least 100 mm (may be relevant on board vessels made of wood or synthetic materials).

.5 It should be noted that a long earthing strap or bar will act as an antenna and radiate energy.

.6 Copper bars and straps should be brazed to the steel bulkhead in order to eliminate corrosion and vibration and make a good earth connection.

.7 Great care should be taken when earthing radio equipment on ships with aluminium superstructures in order to avoid galvanic corrosion. An approved and acceptable method of earthing should be used on such ships.

Note: Insufficient earthing of the power amplifier may lead to capacitive and inductive connections between power cables etc. and cause interference to fire alarms, navigational equipment, inter-communication and other equipment. The transmitter output power may also be reduced.

7 SOURCES OF ENERGY

7.1 Main source of electrical power

7.1.1 The main source of electrical power is defined as the ship's mains. All the basic and duplicated equipment should have an independent power supply from the ship's mains. The battery charging arrangement used to charge any batteries associated with the reserve source of energy should also have an independent supply from the ship's mains.

7.1.2 It is not advisable to provide the main source of electrical power to the GMDSS communication equipment through the battery charger. If a fault occurs in the battery charger, which renders it defective, it may not be possible to operate the equipment from the ship's mains. Batteries used in the reserve source of energy will become discharged eventually leading to loss of all power supplies.

7.1.3 Provision should be made for an aural alarm and visual indication at the position from which the ship is normally navigated, indicating an interruption of the ship's main source of electrical power supply. It should not be possible to disable this alarm and indication. It should only be possible to acknowledge and silence the alarm manually. Both the alarm condition and indication should reset automatically when the ship's main source of electrical power supply has been restored.

(SOLAS chapter II-1)

7.2 Emergency source of electrical power

7.2.1 The emergency source of electrical power is defined as the emergency supply and is usually taken from the ship's emergency generator. SOLAS requirements for the emergency source do not apply to cargo ships of less than 500 gt. All other SOLAS ships constructed on or after 1 July 1986 are required to have an emergency source of electrical power. It should be observed that the GMDSS requirements concerning the emergency source have been made compulsory only for ships constructed after 1 February 1995.

7.2.2 The emergency source should be adequate to operate both the basic and duplicated equipment (if applicable) for the duration specified in SOLAS chapter II-1, i.e. 18 hours on cargo ships and 36 hours on passenger ships.

(SOLAS regulations II-1/42 and 43)

7.3 Reserve source of energy

7.3.1 The reserve source or sources of energy for radio installations should meet the requirements set out in SOLAS regulation IV/13 and resolution A.694(17), as applicable. It usually consists of rechargeable batteries and is used to supply the communication equipment in the event of failure of the ship's mains and emergency source of electrical power.

7.3.2 All ships covered by SOLAS chapter IV should have a reserve source or sources of energy for the operation of the basic equipment, and the duplicated equipment if such equipment is required.

7.3.3 Only equipment specified in SOLAS regulation IV/13 and means of duplication in accordance with regulation IV/15, as applicable, may be connected to the reserve source or sources of energy.

7.3.4 Any navigational or other equipment providing to the radio installation an input of information, which is needed to ensure its proper performance, should be connected to the ship's mains and emergency supply and to the reserve source of energy to ensure an uninterruptable input of information.

7.3.5 To determine the electrical load to be supplied by the reserve source or sources of energy for each radio installation required for distress conditions, the following formula should be applied:

½ of the current consumption necessary for transmission
+ the current consumption for reception

+ the current consumption of any additional loads.

7.3.6 Where the reserve source or sources of energy consists of rechargeable accumulator batteries, the arrangement may consist either of batteries used solely in the absence of ship's supply of electrical energy or of batteries used in a UPS configuration.

7.3.7 The changeover from the ship's mains or emergency supply to the reserve source of energy should be done automatically and in such a manner that both the basic and duplicated communication equipment will be connected simultaneously. Where the changeover is done manually, the switch should be readily accessible to the radio operator, clearly labelled and located on the navigation bridge. Such changeover should not require any of the equipment connected to it to be re-initialized manually and should not result in the loss of data stored in memories.

7.3.8 One bank of batteries may be acceptable if the capacity is sufficient to operate both the basic and duplicated radio equipment simultaneously. The battery capacity should also be sufficient to operate the heading sensor (if applicable), EPFS and emergency light.

7.3.9 Any fault in the radio batteries or the battery charger should not affect both the basic and duplicated radio equipment and should not prevent the operation of the radio equipment from the ship's mains or emergency supply.

7.3.10 The reserve source of energy should be capable of operating the radio installation for at least:

.1 one hour on ships provided with an emergency supply which is adequate to operate the radiocommunication equipment for a period of 18 hours on cargo ships and 36 hours on passenger ships; or

.2 six hours on ships not provided with an emergency supply as outlined in .1 above.

(SOLAS regulations IV/13.2, 13.4, 13.5, 13.8, and resolution A.694(17))

7.4 Radio battery capacity

When defining the minimum required battery capacity, consideration should be given to the expected extreme temperatures for the location of the battery and reduction of its capacity during its lifetime in addition to the loads which are to be connected to it. The temperature range of the battery should be wider than the expected temperature range of the location where the battery is to be installed.

.1 The batteries should have enough capacity to operate all the GMDSS radio equipment for the specific times outlined in paragraph 7.3.10 above. The total load for the entire radio installation should be calculated prior to the installation of any radio batteries for the reserve supply.

.2 Where the basic and duplicated radio equipment cannot be operated simultaneously, the battery capacity should be sufficient to operate the equipment with the highest power consumption.

.3 Where the basic and duplicated radio equipment are connected simultaneously, the battery capacity should be sufficient to meet the average consumption of all connected equipment including any additional loads such as printers, displays etc.

.4 If the capacity requirement of radio batteries is to be maintained over their normal life cycle, an extra 40% capacity should be added to the minimum calculated capacity.

.5 When calculating discharge time, the following guidelines may be of assistance:

.1 the capacity of a lead acid battery is normally quoted at 20 hours of discharge at an operational temperature of 20°C;

.2 the capacity at one hour discharge is approximately 50% of the capacity at 20 hours discharge;

.3 the capacity at six hours discharge is approximately 80% of the capacity at 20 hours discharge; and

.4 for batteries other than the lead acid type, the capacity at one hour discharge is approximately 60% of the capacity at 10 hours discharge and six hours discharge will be approximately 92% of the capacity at 10 hours discharge.

Note: An example of calculation should be included.

.6 The capacity of the radio batteries should be checked at intervals not exceeding 12 months when the ship is not at sea. One method of checking the capacity is to fully discharge and recharge the batteries using normal operation current over a period of 10 hours. Assessment of the charge condition can be made at any time, but it should be done without significant discharge of the battery when the ship is at sea. Another method could be to check the capacity by means of a battery tester, e.g. in connection with a radio survey.

(SOLAS regulation IV/13)

Note: When determining the battery capacity, the following should also be taken into consideration:

- the battery is normally not fully charged;
- reduction of capacity due to ageing;
- reduction of capacity due to high or low temperatures; and
- reduction of capacity due to rapid discharge.

7.5 Radio batteries

The batteries should be properly marked with type or construction, rated capacity (capacity for one hour discharge "C_1" and capacity for six hours discharge "C_6") and installation date. The marking should be visible when the batteries have been installed and during their lifetime. A label warning of explosion danger should be displayed near the installed batteries.

.1 Any type or construction of batteries (e.g. lead acid, alkaline, maintenance free, traction, semi-traction, etc.) may be used as reserve source or sources of energy, taking into consideration the environmental conditions of the location where they are installed.

.2 The battery should maintain its rated capacity when inclined at any angle up to 22 ½° in any orientation.

.3 All battery units should be securely braced so that they will not be dislocated by movement of the ship.

.4 An instruction manual which contains all necessary specifications of the batteries should be available on board. The information should include at least:

.1 capacity and temperature range within which the stated capacity is maintained for the specific operation period, i.e. one hour or six hours;

.2 charging voltage and current limits in order to keep batteries fully charged while preventing overcharging;

.3 actual specific gravity of the electrolyte and/or cell voltages or the voltage of the fully charged battery;

.4 guidelines on how to carry out a controlled discharge test. These should include the location and identification of all breakers (or similar) that are required to be switched off to ensure that the ship's main and emergency sources of power are disconnected from all GMDSS equipment, including the reserve battery charger. Thus, ensuring that the 'controlled discharge' is carried out using the reserve battery only;

.5 methods of determining the condition of charge of the battery, e.g. check of specific gravity of electrolyte (acid density) or check of battery cell voltage/battery voltages by using an accurate measuring instrument in accordance with the battery manufacturer's specifications;

.6 requirement for ventilation; and

.7 requirement for maintenance.

.5 Equipment requiring a lower voltage than the total voltage of the battery bank should not be connected to a part of the battery bank.

.6 The batteries should be installed in the upper part of the ship, in an elevated position and as close to the radio equipment as possible.

.7 An outdoor located battery case should be avoided due to considerable temperature variation.

Note: Ideal location for the radio batteries is in a battery room with a constant temperature of approx. 20°C.

The location should in general satisfy the manufacturers' specifications with regards to temperature tolerance and environmental strain in accordance with IEC 60945 or other equivalent standards.

.8 Batteries of different types, cell constructions, capacities or manufacturers should not be mixed in a battery bank.

.9 Batteries of different types and different cell construction should not be installed in the same location if they can affect each other.

.10 Sufficient ventilation for batteries should be provided, as required by the battery manufacturer.

.11 Electrical installations including battery chargers, located in the battery room, should be intrinsically safe.

.12 Sufficient space between batteries or battery banks should be provided in order to enable inspections and maintenance.

.13 The cabling from the batteries should be protected against earth and short-circuits and be appropriately fused and installed according to recognized international standards (IEC 60092-101 and IEC 60533). Battery cables should have sufficient dimensions to prevent voltage reduction at peak current consumption.

(SOLAS regulation IV/13)

7.6 Uninterruptable power supplies (UPSs)

7.6.1 A UPS is defined as a device which for a specific period of time supplies continuous power to radio equipment independent of any power failures in the ship's main or emergency source of electrical power. The UPS, installed as the reserve source or sources of energy, should comply with the load determined in paragraph 7.4 and meet the general requirements set out in SOLAS regulation IV/13 and in resolution A.694(17), as applicable, and should also comply with the following requirements:

.1 Comprise an automatic charger, complying with requirements set out in SOLAS regulation IV/13.

.2 Comprise rechargeable accumulator batteries, complying with the guidelines regarding automatic chargers.

.3 Provisions should be made for an aural alarm and visual indication at the position from which the ship is normally navigated, indicating any failure in the UPS which is not monitored by the alarm and indicators required by the guidelines regarding automatic chargers.

.4 The UPS should be operational within five seconds of switching on.

.5 The UPS should be so designed and constructed that it is protected against damage resulting from disconnecting the batteries or, with the battery disconnected, short-circuiting the UPS battery connections. If this protection is provided by electronic means, it should automatically reset following removal of the open or short-circuit conditions.

.6 To provide for a failure of a single UPS, a second UPS or means for directly supplying the radio installation from the ship's main or emergency supply should be installed and be available permanently.

.7 The changeover to the second UPS or to the ship's supplies may be manual or automatic. This changeover should not require any of the equipment connected to it to be re-initialized manually and should not result in the loss of data stored in memory.

Note: If the UPS does not fulfil the requirements in accordance with SOLAS regulation IV/13, two separate UPS systems should be installed: one for the basic radio equipment and one for the duplicated equipment.

7.6.2 The capacity of batteries used in UPS systems is normally stated at a discharge time of 10 hours. When discharging such batteries at shorter time, i.e. one hour in accordance with the GMDSS requirements, it will only be possible to utilize approx. 60% of the battery capacity. It is therefore recommended to dimension such batteries to be one and a half times larger than the total load.

7.7 Automatic battery chargers

Automatic chargers for radio batteries should meet the general requirements set out in SOLAS regulation IV/13 and resolution A.694(17) and should also comply with the following requirements:

.1 The charger should be capable of recharging the completely discharged accumulator batteries to the minimum required capacity within 10 hours.

.2 The charger should be capable of keeping the batteries appropriately charged as prescribed by the manufacturer for permanent charging.

.3 The supplied voltage and current should always be within the tolerance limits prescribed by the battery manufacturer, taking into account the environmental temperature of the battery, likely to be experienced on a ship. A protection should be provided against overcharging or discharging of batteries from a possible fault in the charger.

.4 The automatic charger should be provided with a visual indication that it is switched on. An indication of the battery voltage and charge/discharge current should be available on the navigation bridge.

.5 Provisions should be made for an aural alarm and visual indication at the position from which the ship is normally navigated, indicating when the charging voltage or current is outside the limits given by the manufacturer. It should not be possible to disable this alarm and indication and it should only be possible to acknowledge and silence the alarm manually. Both the alarm condition and indication should reset automatically when normal charging condition has been restored. Failure of the alarm system should not interrupt the charging or discharging of batteries.

.6 The automatic charger should be operational within five seconds of switching on or after a power supply interruption.

.7 The automatic charger should be so designed and constructed that it is protected against damage resulting from disconnection the batteries or, with the battery disconnected, short-circuiting the battery connection. If this protection is provided by electronic means, it should automatically reset following removal of the open or short-circuit conditions.

(SOLAS regulation IV/13.6.1)

Note: As indicated in paragraph 7.1 above, it is not advisable to provide the main source of power to the GMDSS equipment through the battery charger. However, if the battery charger is used to supply parts of the GMDSS installation directly, i.e. the MF/HF transceiver, the capacity of the charger should be dimensioned for simultaneous supply of connected equipment and maintaining a sufficient charging of the batteries in accordance with SOLAS regulation IV/13.2.

7.8 Protection of circuits for accumulator batteries

7.8.1 Battery circuits (i.e. the cables from battery case/room) should be protected against short-circuit and overload. The protection device is to be installed as near as possible to the batteries.

7.8.2 When conductors from the batteries are not protected against short-circuit and overload, they are to be installed so as to be proof against short circuit and earth faults. The requirements for short-circuit protection also apply to charge current circuits.

Note: For certain applications it may be necessary to establish measures which may conflict with these requirements. As an example, screening of battery cables can be required to avoid EMI, e.g. by using single-core insulated cables without screening installed in separate metal pipes which are properly earthed. Special measures should then be established to reduce the possibility of mechanical damage to the cables.

7.8.3 Equivalent solutions may be accepted, e.g. by using double-screened cables in the battery room with explosion-proof fuses. The inner screen should be treated according to Ex-rules, but the outer screen can be treated according to what is necessary to achieve good EMC-screening. The outer screen can, for example, be earthed at both ends to protect against High Frequency EMC-fields.

8 CABLING AND WIRING

8.1 The cabling and wiring in the radio installation should be designed so as to prevent electrical interference to radio and navigational equipment.

8.2 Cables should have the correct dimension to prevent voltage reduction to radio equipment when full load. The voltage reduction in copper conductors is calculated as follows: Voltage drop = 0,035 x length (m) x total load (A) divided by the cross section in squared mm.

8.3 In order to reduce interference, it is essential to have good separation between signal cables and those cables carrying higher voltages.

8.4 All cabling and wiring should be of a type-approved and suitable for use on board ships.

8.5 Battery circuits – fuses and breakers

8.5.1 Each radio system should have separate fuses for both AC and DC voltages to which it is connected. AC and DC fuse boards should be located on the bridge or in close proximity to the bridge.

8.5.2 A single fault in one of the power units should not affect both the basic and duplicated radio equipment.

8.5.3 All fuses and breakers should be clearly marked and labelled to clearly indicate which equipment is being protected.

8.5.4 The supply lines from the battery distribution panel to each radio installation of both the basic and the duplicated equipment should be independent and fused separately.

Note: A VHF with DSC, a MF/HF DSC transceiver, a NBDP with printer and RMSS equipment with a display and printer are each considered as a "radio system".

9 INSTALLATION OF GMDSS RADIO EQUIPMENT ON BOARD MOBILE OFFSHORE DRILLING UNITS (MODUs)

Mobile offshore drilling units should fulfil the GMDSS requirements laid down in IMO's MODU Codes. All GMDSS requirements should, as a general rule, be fulfilled. However, for drilling units, the requirement for duplication may be considered as fulfilled if the radio installation complies with section 11.5 of the MODU Code as follows:

.1 Each unit, while stationary at the site, including when engaged in drilling operations, should comply with all requirements prescribed in SOLAS chapter IV that are applicable to a ship sailing through the same area. Each unit should also report its position to the relevant World-Wide Navigational Warning Service (WWNWS) NAVAREA Coordinator when arriving on-site, in order for a Navigational Warning to be broadcast.[2] Additionally, units should inform the NAVAREA Coordinator when departing from that site, in order for the broadcast to be cancelled.

.2 On units which do not have a navigation bridge, it should be possible to initiate transmission of the distress alerts by the radio installation specified in SOLAS regulations IV/10.1.1, 10.1.2, 10.1.4 as applicable, from a position in an accessible and protected area which is acceptable to the Administration.

Note: Check MODU Code versions self and non-self-propelled.

.3 If the acoustic noise level in a room fitted with operating controls for radio equipment is so high or could be so high, during particular operating conditions, that it may disturb or prevent proper use of the radio equipment, then adequate noise protection should be provided by mechanical or other means, in association with the operating controls for the radio equipment.

Note: All requirements of SOLAS chapter IV referring to "from the position the ship is normally navigated" should be applied as meaning "from a position (or from the positions), which is continuously manned and which is controlling the MODU while stationary at the site including its drilling operations (i.e.

[2] Refer to *World-wide navigational warning service* (resolution A.706(17), as amended).

normally the control room)". Watchkeeping on DSC and other emergency and calling channels should be kept from a position which is continuously manned. Watchkeeping and the operation of all radio equipment which are required on board should be carried out by a person holding a General Operator's Certificate (GOC) or Restricted Operator's Certificate ROC (if only A1 installation).

10 DISPOSAL/END OF LIFE

Old electrical and electronic equipment can contain substances hazardous to human beings and the environment. Never dispose of these items together with unsorted municipal waste (household waste). In order to protect the environment and ensure the correct recycling of old equipment as well as the re-utilization of individual components, use either public collection or private collection by the local distributor of old electrical and electronic equipment. Contact the local distributor or dealer for information about what type of return system to use.

APPENDIX 1

INMARSAT RECOGNIZED MOBILE SATELLITE SERVICES

1 Satellite communication antennas

1.1 General

1.1.1 In general, satellite antennas should be located so that they have a 360° free view for the satellite at all times. In practical terms this can be difficult to achieve due to shadow sectors from nearby structures.

1.1.2 For Inmarsat-C (omni-directional antenna) and Fleet Safety (BGAN antenna), it is recommended that communication should be maintained with the satellite down to an elevation of minus 5° in the fore and aft directions and minus 15° in the port and starboard directions.

1.2 Satellite communication antenna installation

The following guidelines should be observed in order to fulfil the above recommendations:

.1 Antennas should be located at the top of the radar mast or on a pedestal, in the radar mast, or on the top deck so that:

- for directive antennas; shadows from constructions, especially within a distance of 10 metres, should be maximum 6°;
- for omnidirectional antennas; shadows from constructions, especially within a distance of 1 metre, should be maximum 2°.

.2 Antennas should be installed in a readily accessible location.

.3 Antennas should not be located in an area where they can be damaged by heat and smoke.

.4 Antennas should not be located on the same plane as the ships' radar antenna.

.5 EPFS antennas should not be located close to or on the same horizontal plane as the Inmarsat antennas.

.6 Consideration should be given to installing the Inmarsat antennas on a suitable pedestal.

(resolutions A.663(16), A.698(17), A.808(19), MSC.130 (75) and MSC.513(105); and Inmarsat Design and Installation Guidelines)

Note: The mast/or pedestal should be so constructed that vibrations are reduced as much as possible.

1.3 Safe antenna distances

The following "safe distance" from Inmarsat antennas to other antennas and to the compass are recommended:

.1 Distance to the HF antenna should be more than 5 metres.

.2 Distance to VHF antennas should be more than 4 metres.

.3 Distance to the magnetic compass should be more than 3 metres.

(The installation manual for the equipment and Inmarsat guidelines)

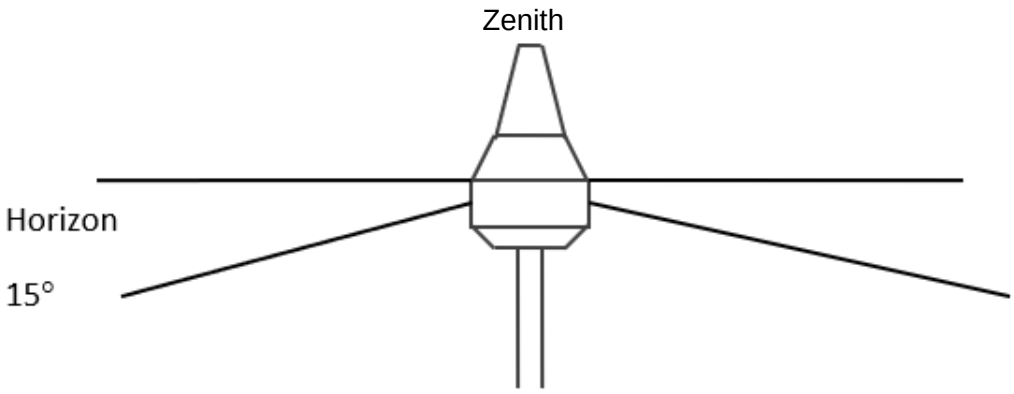
1.4 Inmarsat-C

1.4.1 Antenna

The antenna should be constructed to function up to 15° pitch and roll. In order to obtain this result, the antenna should be located in such position that no objects or constructions down to 15° below the horizon are degrading the performance of the equipment.

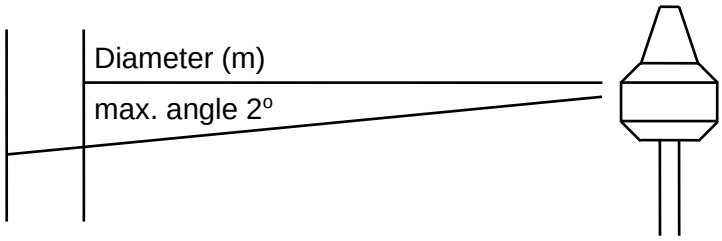
Note: As it may be difficult to fulfil this recommendation in fore-and-aft, the free area in this direction may be reduced to 5° below the horizon.

(resolutions A.663(16) and AMSC.513(105))



1.4.2 Calculation of distance to obstructions

1.4.2.1 The antenna unit should be installed with a 360° clear view of the sky. However, minor obstructions such as a mast will not degrade the antenna performance severely, if a separation distance larger than 20 times the diameter of the obstruction is kept.



1.4.2.2 If two Inmarsat-C antennas are installed, the vertical distance between them should be at least 1 metre to eliminate interference. The antennas should be installed such as to ensure electromagnetic compatibility.

1.4.3 Antenna cable

The manufacturer's specifications regarding total attenuation and maximum DC resistance (short-circuit in one end) should be complied with. Only double-screened cable should be used.

1.5 Fleet Safety

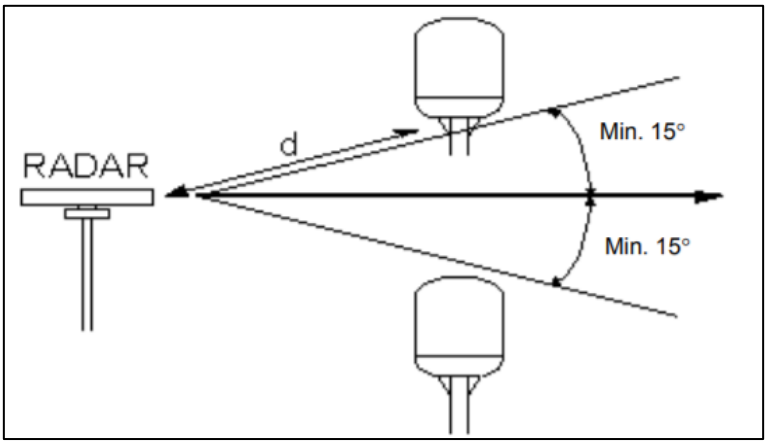
1.5.1 Antenna

1.5.1.1 Fleet Safety antennas are 2-axis stabilized BGAN antennas varying in size and throughput: FleetBroadband 150, FleetBroadband 250, FleetBroadband 500 and Fleet One.

1.5.1.2 All antennas rotate 360° and down to minus 25° for the FleetBroadband 500 and minus 60° for the FleetBroadband 150, 250 and Fleet One in pitch and roll, to allow for continuous pointing even in heavy sea conditions. Any obstructions within this volume can cause signal degradation.

1.5.2 Obstructions

1.5.2.1 The antenna should be mounted as far away as possible from the ship's radar and high-power radio transmitters (including other Inmarsat-based systems), because they may compromise the antenna performance. RF emission from radars might actually damage the antenna. Since a radar radiates a fan beam with a horizontal beam width of a few degrees and a vertical beam width of up to +/- 15°, the worst interference can be avoided by mounting the antenna at a different level – meaning that the antenna is installed minimum 15° above or below the radar antenna.



1.5.2.2 The FleetBroadband antenna may also interfere with other radio systems. Especially other Inmarsat systems and EPFS receivers with poor frequency discrimination are vulnerable to the radiation generated by the FleetBroadband antennas.

1.5.3 Antenna cable

A coaxial cable for connection between the antenna and terminal is delivered with the system. The manufacturer's specifications regarding total attenuation and maximum DC resistance (short-circuit in one end) should be complied with. The maximum allowed RF loss in the antenna cable is 20 dB at 1 660 MHz. This is to ensure the performance of the system.

APPENDIX 2

IRIDIUM RECOGNIZED MOBILE SATELLITE SERVICES

System-Specific Guidelines – Omnidirectional Antenna

Personnel installing or servicing the system should be professionals with technical expertise, properly trained, and likewise authorized. All safety instructions and guidelines in the manufacturer's manual should be observed.

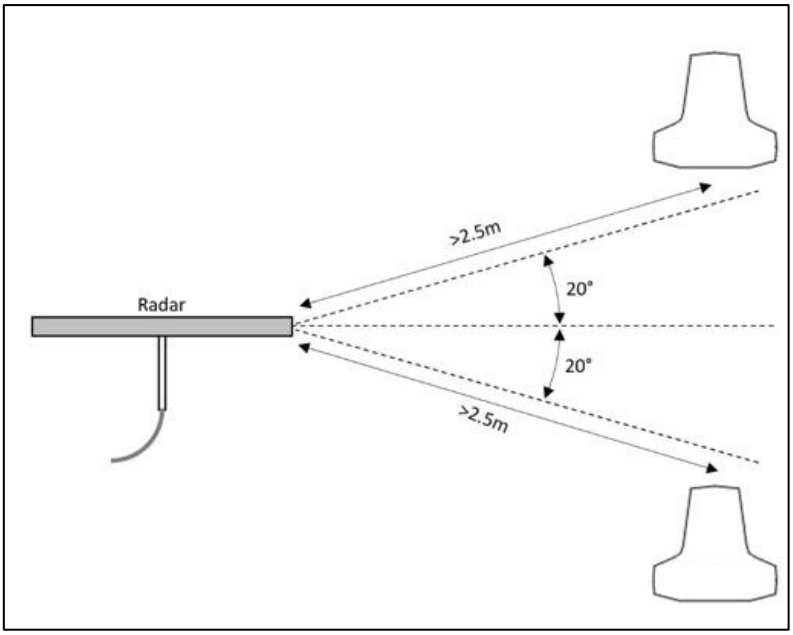
1 Antenna unit

The antenna unit is designed for outdoor mounting and connected to the control unit via a coaxial cable. The antenna unit specifications are as described in the manufacturer's manual. In general terms, it will be expected that the antenna unit has a downwards-facing "female" connector, while the antenna cable has an upwards-facing "male" connector.

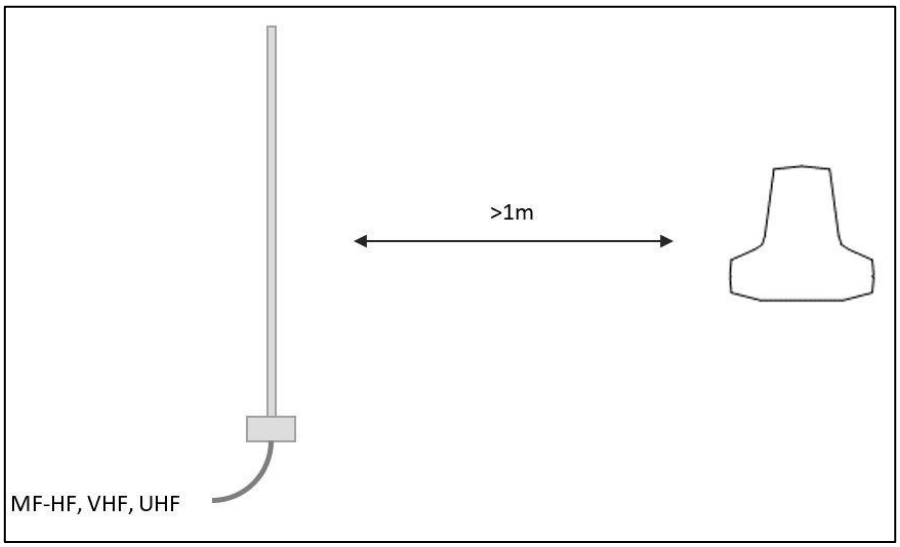
1.1 Mounting and installation considerations

1.1.1 Compass safe distance: The compass safe distance for standard and steering compasses is 0.85 m (2.8 ft) and 0.65 m (2.1 ft), respectively. Observe these distances to prevent interference to a magnetic compass.

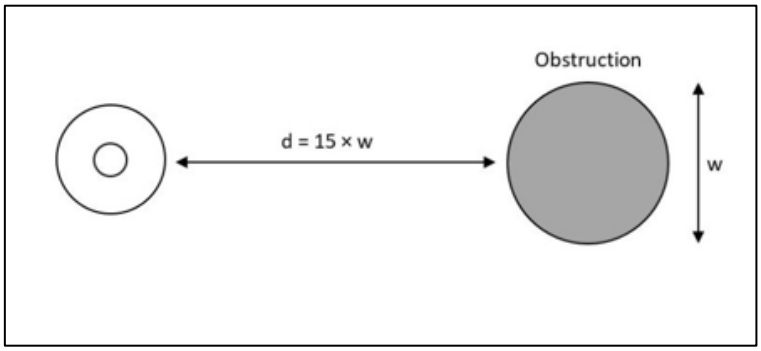
1.1.2 The antenna unit should be installed outside the radar main beam. Typically, this is in the order of 20°. To avoid near field antenna coupling, a minimum distance of 2.5 m (8 ft) between the radar antenna and the antenna unit should be obeyed. The figure below illustrates how the antenna unit should be mounted to avoid interference from radars. However, depending on the specific radar frequency and power level, the separation distance between the radar and the antenna unit may be reduced, with no impact on the antenna performance. The performance of the antenna unit should be validated when the system is installed.



1.1.3 The antenna unit shall be mounted minimum 1 metre from MF-HF, VHF and UHF antennas.



1.1.4 The antenna unit should be installed with a 360° clear view of the sky. However, minor obstructions such as a mast will not degrade the antenna performance severely, if a separation distance larger than 15 times the diameter of the obstruction is kept.



1.1.5 The equipment should be installed and mounted in accordance with the manufacturer's requirements in the technical documentation. If two Iridium antennas are installed, the antennas should be installed such as to ensure electromagnetic compatibility.