Roma, lì *data del protocollo*
P.d.C.: CF (CP) Ida MONTANARO
+39.06.59084554

Ministero delle infrastrutture
e della mobilità sostenibili
Comando generale
del Corpo delle Capitanerie di porto

Reparto VI - Ufficio 2° - Sezione 1ª

A **ELENCO INDIRIZZI**
ALLEGATO

CIRCOLARE
Titolo: Sicurezza della Navigazione
Non di Serie n.18/2022

Argomento: interferenza elettromagnetica (EMI) dei sistemi di illuminazione a diodi ad emissione luminosa (LED) e di altre fonti di EMI verso i sistemi di comunicazione radio a bordo delle navi.

Dal 21 al 30 giugno u.s. si è tenuta la nona sessione del sottocomitato dell'IMO per la navigazione, le comunicazioni, la ricerca e il salvataggio (NCSR 9).

Fra gli argomenti trattati figura anche quello relativo all'interferenza elettromagnetica (EMI) dei sistemi di illuminazione a diodi ad emissione luminosa (LED) e di altre fonti di EMI verso i sistemi di comunicazione radio a bordo delle navi.

Al riguardo il sottocomitato ha preso atto:

- dei contenuti dei documenti NCSR 9/12/1 e NCSR 9/12/4 (del Segretariato) sull'interferenza provocata dall'illuminazione a LED ai sistemi marittimi di bordo;
- del documento NCSR 9/12/8 (degli Stati Uniti) relativo all'adozione dello standard RTCM 13700.0 sui requisiti di compatibilità elettromagnetica; e
- del parere del Gruppo EG17 secondo cui gli ulteriori emendamenti incorporati nella bozza di revisione della COMSAR/Circ.32[1] - in particolare alle sezioni 5 e 6 (in allegato alla presente circolare) - forniscono informazioni e indicazioni sufficienti in questa fase per il rilevamento e la prevenzione delle interferenze causate dai sistemi di illuminazione a LED e da altre fonti di EMI a bordo delle navi.

Per tutto quanto sopra il sottocomitato ha incoraggiato le Amministrazioni ad informare, fra l'altro, l'Armamento, i costruttori navali, i tecnici di manutenzione, gli ispettori sul potenziale rischio di interferenze RF involontarie da sistemi LED e anche sull'adozione dello standard RTCM 13700.0, che potrebbe anche essere utilizzato per prevenire interferenze RF da sistemi LED.

IL CAPO REPARTO
Amm. Isp. (CP) Luigi GIARDINO
Documento informatico firmato digitalmente
ai sensi del D.Lgs. 07/03/2005, n. 82.

LUIGI GIARDINO
MiMS
AMMIRAGLIO
11.07.2022 09:13:16
GMT+00:00

[1] in allegato 3 al documento NCSR 9/12

Allegato

ESTRATTO DELL'ANNEX 3

DRAFT REVISION OF COMSAR/CIRC.32
HARMONIZATION OF GMDSS REQUIREMENTS FOR RADIO INSTALLATIONS ON BOARD SOLAS SHIPS

……..

.2 ~~In cargo ships, where~~ When an ~~GNSS~~ EPFS is installed in accordance with regulation V/19, automatic updating of the ship's position into the DSC equipment and ~~Inmarsat~~ recognized mobile satellite service 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 1974~~, as amended~~, regulation IV/18)

If the ~~GNSS~~ 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 1974~~, as amended~~, regulation IV/13.8)

4.16 Connections of navigational sensors

4.16.1 ~~GNSS~~ EPFS - Receiver

A ~~GNSS~~ 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.

The ~~GNSS~~ 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

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

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. Incorrect installed antennas will degrade the performance of the radio equipment and will reduce the range of radiocommunications.

5.2 Location of VHF antennas

.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 EMI such as LED navigation lights to avoid harmful degradation of the receiver performance. Vertical separation can be an effective mitigation measure.

.2 VHF antennas should have a vertical polarisation.

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

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

.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.

.7 AIS VHF antenna 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.

.8 The AIS VHF antenna 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

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

The transmitting whip antenna should be installed as vertical as possible.

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

.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.

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

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

.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.

.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

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

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

5.6 Satellite communication antennas

The installation requirements of recognized mobile satellite service antennas are included in appendices 1 and 2. In case of multiple ship earth stations operating on adjacent frequency bands, the antenna should be installed such as to ensure electromagnetic compatibility. (IMO resolution MSC.434(98)).

~~**5.6.1 General**~~

~~.1 In general, satellite antennas should be located so that they have a 360° free view for the satellite at all times. In practice terms this can be difficult to achieve due to shadow sectors from nearby structures.~~

~~.2 It is recommended for Inmarsat-A, B and F-77 antennas (stabilized directional antennas) that communication should be maintained with the satellite down to an elevation of minus 5°. For Inmarsat-C (omni-directional antenna) it is recommended that communication should be maintained with the satellite down to an elevation of minus 5° in the fore and aft direction and minus 15° in the port and starboard direction.~~

~~**5.6.2 Satellite communication antenna installation**~~

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

~~.1 The antenna should be located at the top of the radar mast; or~~

~~.2 On a pedestal, in the radar mast, or on the top deck so that:~~

~~- for directive antennae; shadows from constructions, especially within a distance of 10 metres, is maximum 6°;~~

~~- for omnidirectional antennas; shadows from constructions, especially within a distance of 1 metre, is maximum 2°.~~

~~.3 Antennae should be installed in a readily accessible location.~~

~~.4 Satellite antennae should not be located in an area where they can be damaged by heat and smoke.~~

.5 The satellite antenna should not be located on the same plane as the ships' radar antenna.

.6 GNSS antennae should not be located close to or on the same plane as the Inmarsat antenna.

.7 Consideration should be given to installing the Inmarsat antenna on a suitable pedestal.

(IMO resolutions A.663(16), A.698(17), A.807(19), as amended, A.808(19) and MSC.130 (75) and Inmarsat Design and Installation Guidelines)

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

5.6.3 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)

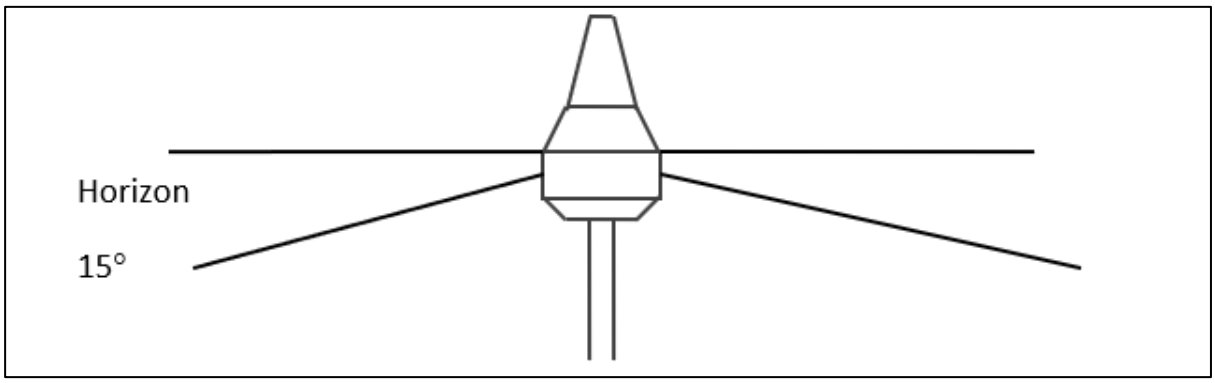
5.6.4 Inmarsat-C antenna

The antenna should be constructed so as 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.

(IMO resolutions A663(16) and A.807(19), as amended)

Zenith

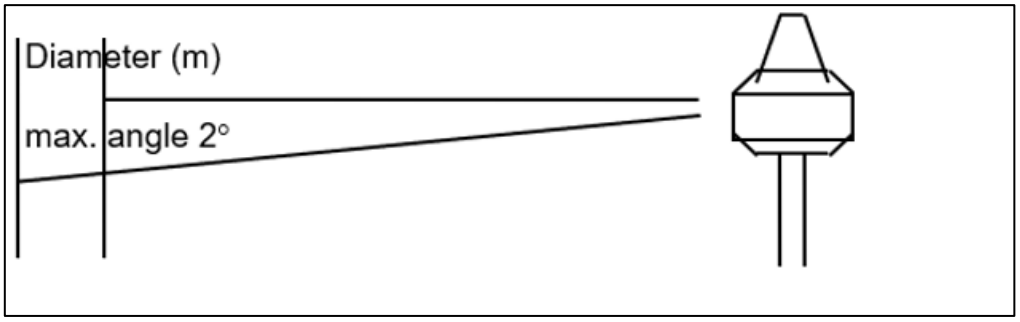


~~**5.6.5 Calculation of distance to obstructions:**~~

~~If obstructions such as i.e. mast, funnel etc. is unavoidable, the following guidelines should apply:~~

~~The distance to the obstruction should be so that the obstruction only covers a 2° sector.~~

~~Note: - In such case the safe distance will be the following: 20 x the diameter of the obstruction (in metres).~~



~~If two Inmarsat-C antennae are installed the vertical distance between them should be at least 1 metre to eliminate interference.~~

~~**5.6.6 Antenna cable**~~

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

5.6.~~7~~1 Antennas for voluntary radio equipment

Antennas for voluntary radio equipment may be located on deck, provided its 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 ~~GNSS~~ EPFS) and other electronic equipment.

5.7 Installation of coaxial cables

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

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.

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

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 5 times the cables' outside diameter.

.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 compatibility between the equipment concerned and other radio communication and navigational equipment carried on board in compliance with the relevant requirements of chapters IV and V of the SOLAS Convention, as amended. In order to avoid interference the following rules applies:

.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 1974~~, as amended~~, regulations IV/6.2.1 and V/17 and IMO resolutions A.694(17) and A.813(19))

6.1.2 Interference from LED lighting and other unintentional emitters

Navigation lights and other deck and mast-mounted lighting equipped with light emitting diodes (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.

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, the following procedure 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. The result of this evaluation including the findings and measures taken are to be documented and provided to the radio surveyor for the final survey. The radio surveyor should take this report as an annex to the Ship Safety Radio Certificate to be kept on board for future use.

To perform the following procedure, a spectrum analyzer 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 analyzer 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 analyzer 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.

Suggested approaches for use by crew, shore-based maintainer or radio surveyors to indicate the presence of harmful interference are as follows:

.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 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.

If any interference is suspected, but cannot be eliminated, then a full evaluation using a spectrum analyser, as set out in 6.1.2, is advised.

6.1.~~2~~3 Voluntary radio equipment

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

.1 mobile telephone, smartphone or tablet;

.2 radio amateur stations; ~~and~~

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

.~~3~~4 satellite stations.

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 navigation and radio communication is 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 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 one 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.

ELENCO INDIRIZZI	
INDIRIZZI PER COMPETENZA	
• **CAPITANERIE DI PORTO**	**TUTTE**
• **UFFICI CIRCONDARIALI MARITTIMI**	**TUTTI**
• **UFFICI LOCALI MARITTIMI**	**TUTTI**
• **Confitarma**	confitarma@confitarma.it
• **Assarmatori**	assarmatori@pec.assarmatori.eu
• **Società non associate**	**Invio a cura del Reparto 6**
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• **DNV**	dnvitalia@legalmail.it
• **RINA Services Spa**	rina.maricogecap@legalmail.it
• **ABS Italy Srl**	absitaly@pcert.postecert.it
• **Lloyd's Register**	alberto.suri-panaioli@lr.org
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