

INTERNATIONAL STANDARD

IEC 61097-9

First edition
1997-12

Global maritime distress and safety system (GMDSS) –

Part 9:

**Shipborne transmitters and receivers for use in
the MF and HF bands suitable for telephony,
digital selective calling (DSC) and narrow band
direct printing (NBDP) – Operational and
performance requirements, methods of testing
and required test results**

IEC 61097-9:1997
<https://standards.iec.ch/catalog/standards/sist/c91ec83c9-c65f-49dd-8057-b9e2067dc659/iec-61097-9-1997>

*Système mondial de détresse et de sécurité
en mer (SMDSM) –*

Partie 9:

*Emetteurs et récepteurs de bord de navires utilisables dans les
bandes décamétriques et hectométriques pour la téléphonie,
l'appel sélectif numérique (ASN) et l'impression directe à bande
étroite (IDBE) – Exigences d'exploitation et de fonctionnement,
méthodes d'essai et résultats d'essai exigés*



Reference number
IEC 61097-9: 1997(E)

Numéros des publications

Depuis le 1er janvier 1997, les publications de la CEI sont numérotées à partir de 60000.

Publications consolidées

Les versions consolidées de certaines publications de la CEI incorporant les amendements sont disponibles. Par exemple, les numéros d'édition 1.0, 1.1 et 1.2 indiquent respectivement la publication de base, la publication de base incorporant l'amendement 1, et la publication de base incorporant les amendements 1 et 2.

Validité de la présente publication

Le contenu technique des publications de la CEI est constamment revu par la CEI afin qu'il reflète l'état actuel de la technique.

Des renseignements relatifs à la date de reconfirmation de la publication sont disponibles dans le Catalogue de la CEI.

Les renseignements relatifs à ces révisions, à l'établissement des éditions révisées et aux amendements peuvent être obtenus auprès des Comités nationaux de la CEI et dans les documents ci-dessous:

- **Bulletin de la CEI** • **IEC Bulletin**
- **Annuaire de la CEI** • **IEC Yearbook**
Accès en ligne* On-line access*
- **Catalogue des publications de la CEI** • **Catalogue of IEC publications**
Publié annuellement et mis à jour régulièrement Published yearly with regular updates
(Accès en ligne)* (On-line access)*

Terminologie, symboles graphiques et littéraux

En ce qui concerne la terminologie générale, le lecteur se reportera à la CEI 60050: *Vocabulaire Electrotechnique International* (VEI).

Pour les symboles graphiques, les symboles littéraux et les signes d'usage général approuvés par la CEI, le lecteur consultera la CEI 60027: *Symboles littéraux à utiliser en électrotechnique*, la CEI 60417: *Symboles graphiques utilisables sur le matériel. Index, relevé et compilation des feuilles individuelles*, et la CEI 60617: *Symboles graphiques pour schémas*.

Publications de la CEI établies par le même comité d'études

L'attention du lecteur est attirée sur les listes figurant à la fin de cette publication, qui énumèrent les publications de la CEI préparées par le comité d'études qui a établi la présente publication.

* Voir adresse «site web» sur la page de titre.

Numbering

As from the 1st January 1997 all IEC publications are issued with a designation in the 60000 series.

Consolidated publications

Consolidated versions of some IEC publications including amendments are available. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Validity of this publication

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology.

Information relating to the date of the reconfirmation of the publication is available in the IEC catalogue.

Information on the revision work, the issue of revised editions and amendments may be obtained from IEC National Committees and from the following IEC sources:

Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV).

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

IEC publications prepared by the same technical committee

The attention of readers is drawn to the end pages of this publication which list the IEC publications issued by the technical committee which has prepared the present publication.

* See web site address on title page.

INTERNATIONAL STANDARD

IEC 61097-9

First edition
1997-12

Global maritime distress and safety system (GMDSS) –

Part 9:

**Shipborne transmitters and receivers for use in
the MF and HF bands suitable for telephony,
digital selective calling (DSC) and narrow band
direct printing (NBDP) – Operational and
performance requirements, methods of testing
and required test results**

<https://standards.iec.ch/catalog/standards/sist/c51ec83c9-c65f-49dd-8057-b9e2067dc659/iec-61097-9-1997>

*Système mondial de détresse et de sécurité
en mer (SMDSM) –*

Partie 9:

*Emetteurs et récepteurs de bord de navires utilisables dans les
bandes décamétriques et hectométriques pour la téléphonie,
l'appel sélectif numérique (ASN) et l'impression directe à bande
étroite (IDBE) – Exigences d'exploitation et de fonctionnement,
méthodes d'essai et résultats d'essai exigés*

© IEC 1997 Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission
Telefax: +41 22 919 0300

3, rue de Varembé Geneva, Switzerland
e-mail: inmail@iec.ch IEC web site <http://www.iec.ch>



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE **XA**

For price, see current catalogue

CONTENTS

		Page
	FOREWORD	5
Clause		
1	Scope	6
2	Normative references	7
3	Performance requirements	8
3.1	Introduction	8
3.2	Power supplies	9
3.3	Control	9
3.4	Interfaces	9
3.5	Frequency indication	9
3.6	Distress controls	9
3.7	Control panel priority	10
3.8	Labels	10
3.9	Safety precautions	11
3.10	Classes of emission	11
3.11	Frequency bands	11
3.12	Warming-up period	11
4	Transmitter	11
4.1	Frequencies and classes of emission	11
4.2	Frequency accuracy and stability	12
4.3	Output power	12
4.4	Transmitter input	13
4.5	Permissible warming-up period	13
4.6	Continuous operation	13
4.7	Controls and indicators	13
4.8	Safety precautions	14
4.9	Power supply	14
4.10	Synthesizer lock	14
4.11	Channel switching	14
4.12	NBDP transmit and receive timing	14
5	Receiver	14
5.1	Frequencies and classes of emission	14
5.2	Frequency stability and accuracy	15
5.3	Usable sensitivity	15
5.4	Receiver output	15
5.5	Permissible warming-up period	15
5.6	Immunity to interference	15
5.7	Controls	15

Clause	Page
5.8 Power supply.....	16
5.9 Antenna static protection	16
5.10 Loudspeaker switching	16
5.11 Noise reducer.....	16
5.12 Audio gain control and automatic gain control (AGC).....	16
5.13 NBDP transmit and receive timing.....	16
6 Radiotelephone alarm signal generator.....	16
6.1 Introduction	16
6.2 General	16
6.3 Frequency and duration of tones.....	17
6.4 Modulation	17
6.5 Controls	17
6.6 Duration of alarm signal.....	17
6.7 Alarm signal repeat	17
6.8 Activation of the radio telephone transmitter	17
6.9 Aural monitoring	17
7 Methods of testing and required test results	17
7.1 Test conditions.....	18
7.2 Performance check.....	18
7.3 Environmental tests.....	19
7.4 Electromagnetic compatibility (EMC).....	19
7.5 Immunity	19
7.6 Acoustic noise.....	19
7.7 Compass safe distance.....	20
7.8 Safety precautions.....	20
7.9 General conditions of measurement.....	20
8 Transmitter	22
8.1 General	22
8.2 Frequency error.....	22
8.3 Output power and intermodulation products	23
8.4 Unwanted frequency modulation	24
8.5 Sensitivity of the microphone	25
8.6 Sensitivity of the 600 Ω line input for SSB telephony	25
8.7 Automatic level control and/or limiter for SSB telephony.....	26
8.8 Audio frequency response using SSB telephony.....	26
8.9 Power of out-of-band emissions using SSB telephony	27
8.10 Power of conducted spurious emissions of SSB telephony	28
8.11 Residual hum and noise power using telephony	28
8.12 Residual frequency modulation on DSC and NBDP	29
8.13 Carrier suppression	29
8.14 Continuous operation.....	30
8.15 Protection of the transmitter.....	30
8.16 Residual RF noise power	31
8.17 Switching time for NBDP.....	31

Clause	Page
9 Receiver	32
9.1 Audio frequency output levels	32
9.2 Frequency error	32
9.3 Unwanted frequency modulation	33
9.4 Audio frequency pass band	34
9.5 Maximum usable sensitivity	35
9.6 Harmonic content in output	36
9.7 Adjacent channel selectivity	36
9.8 Blocking	38
9.9 Cross-modulation	39
9.10 Intermodulation	39
9.11 Spurious response rejection ratio	40
9.12 Audio frequency intermodulation	42
9.13 Conducted spurious emissions into the antenna	43
9.14 Internally generated spurious signals	43
9.15 Improvement in signal-to-noise ratio with AGC	43
9.16 AGC range	44
9.17 AGC time constants (attack and recovery time)	44
9.18 Switching time for NBDP	45
9.19 Reciprocal mixing	45
9.20 Protection of input circuits	46
 <u>IEC 61097-9:1997</u> https://standards.iteh.ai/catalog/standards/sist/c51e85c9-c65f-49dd-8057-b9e2067dc659/iec-61097-9-1997 STANDARD PREVIEW (standards.iteh.ai)	
Figures	
1 – Limits for unwanted emission (MF/HF transmitter)	47
2 – Limits for automatic level control	48
3 – Limits for audio frequency response	49
 Annexes	
A – Relationship between bit error rate (BER) input and symbol error rate (SER) output ...	50
B – Bibliography	5 4
C – Delays in equipment and its effect on narrow band direct printing communication in the GMDSS using the protocol in Recommendation ITU-R M.625	55

iTeh STANDARD PREVIEW
(standards.iteh.ai)

IEC 61097-9:1997

<https://standards.iteh.ai/catalog/standards/sist/c51e85c9-c65f-49dd-8057-b9e2067dc659/iec-61097-9-1997>

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –

Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and narrow band direct printing (NBDP) – Operational and performance requirements, methods of testing and required test results

1 Scope

This part of IEC 61097 specifies the minimum operational and performance requirements and methods of testing with required test results for transmitters and receivers capable of voice communication, digital selective calling and narrow band direct printing telegraphy for the GMDSS operating in either the medium frequency band only or in medium and high frequency bands allocated in the ITU Radio Regulations to the Maritime Mobile Service, as required by Chapter IV of SOLAS 1974 as amended in 1988 and which is associated with IEC 60945. When a requirement in this standard is different from IEC 60945, the requirement of this standard shall take precedence.

This standard refers to equipment for:

- single side-band (SSB) transmission and reception for radiotelephony;
- frequency shift keying or single side-band transmission and reception for digital selective calling signals (DSC) according to Recommendation ITU-R M.493-7; and
- frequency shift keying or single side-band transmission and reception for narrow band direct printing telegraphy (NBDP) according to Recommendation ITU-R M.625-3;

as applicable.

This standard refers to radio equipment, which is not integrated with DSC encoders or decoders, or NBDP modems, but defines the interfaces with, and the RF characteristics of, such equipment.

NOTE – The requirements for integrated DSC encoders or decoders may be found in IEC 61097-3 and for integrated NBDP modems in the future IEC 61097-11.

These requirements include the relevant provisions of the Radio Regulations and of the IMO Resolutions A.334(IX), A.421(XI), A.694(17), A.804(19), and A.806(19) and SOLAS.

NOTE – The requirement for two-tone generators (A.421(XI)) is only applicable until 1 February 1999.

If the equipment, or parts of it, is designed in such a manner that it can be used for other categories of maritime radiocommunication services (e.g. radio data or facsimile transmission), those parts of the equipment shall fulfil the relevant requirements of the appropriate standards for the service(s) in question.

NOTE – All text of this standard the wording of which is identical to that in IMO Resolutions and to that in the relevant ITU-R Recommendations is printed in *italics* and is prefixed by references (804 etc.) in brackets. When the text is identical in A.804 and A.806 the reference A.806 will be used.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61097. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61097 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60945:1996, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61097-3:1994, *Global maritime distress and safety system (GMDSS) – Part 3: Digital selective calling (DSC) equipment – Operational and performance requirements, methods of testing and required tests results*

IEC 61097-8 – *Global maritime distress and safety system (GMDSS) – Part 8: Shipborne watchkeeping receivers for reception of digital selective calling (DSC) in the maritime MF, MF/HF and UHF bands – Operational and performance requirements, methods of testing and required test results*¹⁾

IEC 61162-1:1995, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners*

ISO 3791:1967, *Office machines and data processing equipment – Keyboard layouts for numeric applications*

International Convention on Safety of Life at Sea (SOLAS):1974 (as amended), *Chapter IV: Radiocommunications*

<https://standards.iteh.ai/catalog/standards/sist/c51e85c9-c65f-49dd-8057-b9e2067dc659/iec-61097-9-1997>

IMO Resolution A.334(IX):1975, *Recommendation on operational standards for radiotelephone transmitters and receivers*

IMO Resolution A.421(XI):1979, *Operational standards for radiotelephone alarm signal generators*

IMO Resolution A.694(17):1991, *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids*

IMO Resolution A.804(19):1995, *Performance standards for shipborne MF radio installations capable of voice communication and digital selective calling*

IMO Resolution A.806(19):1995, *Performance standards for shipborne MF/HF radio installations capable of voice communication, narrow-band direct-printing and digital selective calling*

ITU :1994, *Radio Regulations*

ITU-R M.493-7:1995, *Digital selective-calling system for use in the maritime mobile service*

ITU-R M.625-3:1995, *Direct-printing telegraph equipment in the maritime mobile service*

ITU-T E.161 (formerly CCITT Recommendation E.161):1988, *Arrangement of figures, letters and symbols on telephones and other devices that can be used for access to a telephone network*

ITU-T V.11:1993, *Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbits/s*

3 Performance requirements

3.1 Introduction

(806/A1) *The MF or MF/HF radiotelephone, narrow band direct printing and digital selective calling installation, in addition to meeting the requirements of the Radio Regulations, shall comply with the following performance standards and with the general requirements as set out in Assembly Resolution A.694(17) as specified in IEC 60945.*

(806/A2.1) *The installation which may consist of more than one piece of equipment shall be capable of operating on single-frequency channels or on single- and two-frequency channels.*

(806/A2.2) *The equipment shall provide for the following categories of calling using both voice and digital selective calling (DSC):*

- 1 *distress, urgency and safety;*
- 2 *ship operational requirements; and*
- 3 *public correspondence.*

(806/A2.3) *The equipment shall provide for the following categories of communications using voice and optionally narrow band direct printing (NBDP) for MF equipment and both for MF/HF equipment.*

(806/A2.4) *The equipment shall comprise at least:*

- 1 *a transmitter/receiver, including antenna(e);*
- 2 *an integral control unit and/or one or more separate control units;*
- 3 *a microphone with a press to transmit switch, which may be combined with a telephone in a handset;*
- 4 *an internal or external loudspeaker;*
- 5 *an integral or separate narrow band direct printing facility for MF/HF equipment; and*
- 6 *an integral or separate digital selective calling facility.*

NOTE – (806/A2.4.7) The installation shall also comprise a dedicated DSC watchkeeping facility maintaining a continuous watch on distress channels only. Where a scanning receiver is employed to watch more than one DSC distress channel, all selected channels should be scanned within 2 s and the dwell time on each channel shall be adequate to allow detection of the dot pattern which precedes each DSC call. The scan shall only stop on detection of a 100 baud dot pattern (see IEC 61097-8).

3.2 Power supplies

(806/A3) *The MF or MF/HF radio installation shall be powered from the ship's main source of electrical energy. In addition, it shall be possible to operate the MF or MF/HF installation from an alternative source of electrical energy.*

3.3 Control

It (806/A4) shall be possible to conduct distress and safety communications from the position or in the vicinity of the position, from which the vessel is normally navigated.

3.4 Interfaces

Inputs and outputs applicable to the type of equipment shall be provided as follows:

- Transmitters:
 - SSB Telephony:
 - 600 Ω earth free audio input
 - Microphone input
 - Keying line
 - DSC and NBDP with analogue interfaces:
 - 600 Ω earth free audio input
 - Keying line
 - DSC and NBDP with digital interfaces:
 - ITU-T V.11
 - Keying line
- Receivers:
 - SSB Telephony:
 - 600 Ω earth free audio output
 - Earphone output
 - Speaker output
 - DSC and NBDP with analogue interfaces:
 - 600 Ω earth free audio output
 - DSC and NBDP with digital interfaces:
 - ITU-T V.11
- Control(s): <https://standards.iteh.ai/catalog/standards/sist/c51e85c9-c65f-49dd-8057-18c2167dc652/iec-61097-9-1997>
 If a control interface is provided to the equipment it shall meet the requirements of IEC 61162-1. Other interfaces may be provided in addition. Connection of or failure within any external circuits shall not degrade the equipment.

3.5 Frequency indication

Radiotelephone frequencies (J3E and H3E) shall be designated in terms of the carrier frequency; NBDP and DSC frequencies (F1B and J2B) shall be designated in terms of the assigned (centre) frequency, as defined in the Radio Regulations, and shall be clearly identifiable on the control panel of the equipment. Independent choice and indication of transmitting and receiving frequencies shall be possible.

3.6 Distress controls

(806/A2.5) A distress alert shall be activated only by means of a dedicated distress button. This button shall not be any key of an ITU-T (E.161) digital input panel or an ISO keyboard (ISO 3791) provided on the equipment.

(806/A2.6) The dedicated distress button shall:

- 1 be clearly identified; and*
- 2 be protected against inadvertent operation.*

(806/A2.7) *The distress alert initiation shall require at least two independent actions.*

(806/A2.8) *The equipment shall indicate the status of the distress alert transmission.*

(806/A2.9) *It shall be possible to interrupt and initiate distress alerts at any time.*

All adjustments and controls necessary for switching the transmitter and receiver to operate on the distress and safety channels applicable to the equipment shall be clearly marked in order that this operation can be performed easily.

3.7 Control panel priority

If the accessible controls are located on a separate control panel and if there are two or more control panels, one of the control panels shall have priority over the others. If there are two or more control panels, when any control panel is in use, this shall be clearly indicated on all of the other control panels.

3.8 Labels

Labels shall be in accordance with IEC 60945.

Those of the following distress frequencies:

DSC (kHz)	Telephony (kHz)	NBDP (kHz)
2 187,5	2 182,0	2 174,5
4 207,5	4 125,0	4 177,5
6 312,0	6 215,0	6 268,0
8 414,5	8 291,0	8 376,5
12 577,0	12 290,0	12 520,0
16 804,5	16 420,0	16 695,0

applicable to the equipment, shall be clearly indicated, either on the front panel of the equipment or on an instruction label supplied with the equipment.

3.9 Safety precautions

3.9.1 Memories

The information in user programmable memory devices shall be protected from interruptions in the power supply of up to at least 24 h duration. Any software required to facilitate operation in accordance with this standard shall be permanently installed within the equipment.

Key parameters relating to the equipment and any software necessary for its initial activation or reactivation shall be stored in solid state non-volatile memory. Facilities shall be provided to protect all operational software incorporated in the equipment. It shall not be possible during routine use for the operator to augment, amend or erase any software in the equipment required for operation in accordance with this standard.

Means shall be provided to monitor the operational software of the equipment automatically at appropriate regular intervals, and to activate an alarm in the event of failure.

3.10 Classes of emission

The equipment shall provide for the transmission and reception of upper side-band signals using the classes of emission as appropriate for the equipment:

- J3E: single side-band telephony with the carrier suppressed at least 40 dB below peak envelope power;
- H3E: single side-band telephony on the frequency 2 182 kHz only with the carrier 4,5 dB to 6 dB below peak envelope power; and
- F1B: frequency shift keying suitable for digital selective calling with a frequency shift of ± 85 Hz. (This may be achieved by use of a 1 700 Hz subcarrier. The class of modulation is then J2B).

The receiver may also provide for the reception of signals of other classes of emission.

3.11 Frequency bands

The equipment shall be capable of operating in either the MF frequency or in the MF and HF frequency bands.

3.11.1 MF frequency band

The equipment shall provide for the transmission and/or reception in the appropriate frequencies between 1 605 kHz and 4 000 kHz allocated in the Radio Regulations to the Maritime Mobile Service.

3.11.2 HF frequency bands

The equipment shall provide for the transmission and/or reception in the appropriate frequencies in the bands between 4 MHz and 27,5 MHz allocated in the Radio Regulations to the Maritime Mobile Service.

3.12 Warming-up period

3.12.1 Time

The equipment shall be operational and shall meet the requirements of this standard one minute after switching on, except as provided in 3.12.2.

3.12.2 Heaters

If the equipment includes parts which require to be heated in order to operate correctly, for example crystal ovens, then a warming-up period of 30 min from the instant of application of power to those parts shall be allowed, after which the requirements of this standard shall be met.

4 Transmitter

4.1 Frequencies and classes of emission

(806/B1.1) *The transmitter shall be capable of transmitting on either:*

(804/B1.1) *a number of frequencies in the bands between 1 605 kHz and 4 000 kHz considered by the administration as adequate for the operation of the ship, but at least on the frequencies 2 182 kHz and 2 187,5 kHz,*

or on (806/B1.1) *all frequencies allocated to the maritime mobile service in the frequency band 1 605 kHz to 27 500 kHz. As a minimum, the following frequencies shall be readily accessible to the operator: the voice frequencies 2 182 kHz, 4 125 kHz, 6 215 kHz, 8 291 kHz, 12 290 kHz and 16 420 kHz; the NBDP frequencies 2 174,5 kHz, 4 177,5 kHz, 6 268 kHz, 8 376,5 kHz, 12 520 kHz and 16 695 kHz; and the DSC frequencies 2 187,5 kHz, 4 207,5 kHz, 6 312 kHz, 8 414,5 kHz, 12 577 kHz and 16 804,5 kHz.*

(806/B1.2) *Radiotelephone frequencies are designated in terms of the carrier frequency; NBDP and DSC frequencies are designated in terms of the assigned (centre) frequency. When NBDP and DSC signals are transmitted using a transmitter in the J2B mode the (suppressed) carrier frequency shall be adjusted so as to have the NBDP and the DSC signal transmitted on the assigned frequency. The selected transmitter frequency shall be clearly identifiable on the control panel of the transmitter.*

(806/B1.3) *The transmitter shall be capable of transmitting (upper side-band signals, where appropriate) using classes of emission J3E, H3E and either J2B or F1B.*

(806/B1.3.1) *When switching to the preset distress frequency 2 182 kHz, the appropriate class of emission in accordance with the Radio Regulations shall be selected automatically.*

(804/B1.3.2) *When switching to the preset distress frequency 2 187,5 kHz the class of emission J2B or F1B shall be selected automatically.*

(806/B1.3.2) *When switching to the assigned (centre) frequencies for NBDP and DSC classes of emission F1B or J2B shall be selected automatically.*

(806/B1.4) *It shall be possible to change the transmitter from any class of emission to another for which it is designed to operate by means of not more than one control.*

(806/B1.5) *It shall be possible for the user to select transmission frequencies independent of any receiver setting. This does not preclude the use of transceivers.*

(806/B1.6) *It shall be possible to change the transmitter quickly from operation on any frequency to operation on any other frequency, and in any event within a period not exceeding 15 s. The equipment shall not be able to transmit during channel switching operations.*

(806/B1.7) *Means shall be provided to prevent over-modulation automatically.*

4.2 Frequency accuracy and stability

(806/B2) *The transmitted frequency shall remain within 10 Hz of the required frequency at all times following the warming-up period.*

4.3 Output power ¹⁾

(806/B3.1) *During normal modulation, the peak envelope power in the case of J3E or H3E emissions, or the mean power in the case of J2B or F1B emissions, shall be at least 60 W²⁾ at any frequency within the specified frequency range.*

¹⁾ In determining the A2 area for MF coast stations an antenna efficiency of 25 % and an output power of 60 W for ship installations are assumed.

²⁾ Note should be taken that in some areas of the world a 60 W value may not be adequate to ensure reliable communications. A value greater than 60 W may be required in these areas.

(806/B3.2) *If the rated output power exceeds 400 W³⁾ in the band, provision shall be made for reducing the output to 400 W or less (806/B3.2). Generally, only the minimum power necessary shall be used for all radio communications.*

(334/4.2) *If the rated output power of the transmitter exceeds 150 W, provision shall be made for reducing the output power to a value of 60 W or less except for distress frequencies where the output shall be at least 60 W.*

4.4 Transmitter input

For the transmission of voice signals, the transmitter shall have a microphone input, suitable to produce an output power level within –3 dB and –9 dB relative to full output power when a sound level of 94 dBA is applied to the microphone.

Additionally an input, earth free, of 600 Ω and 0 dBm shall be provided for analogue signals.

For digital signals, the input shall comply to ITU-T V.11 when provided.

4.5 Permissible warming-up period

(806/B4) *The equipment shall be capable of operation within 1 min after switching on.*

4.6 Continuous operation

(806/B5) *Continuous operation shall be possible when the transmitter is adjusted to operate at its rated power.*

4.7 Controls and indicators

(806/B6.1) *Provision shall be made for indicating the antenna current or power delivered to the antenna. Failure of the indicating system shall not interrupt the antenna circuit.*

(806/B6.2) *Manually tuned equipment shall be fitted with a sufficient number of indicators to permit accurate and rapid tuning.*

(806/B6.3) *Operation of the transmit/receive control shall not cause unwanted emissions.*

(806/B6.4) *All adjustment and controls necessary for switching the transmitter to operate on 2 182 kHz and 2 187,5 kHz shall be clearly marked in order that these operations may be performed readily.*

4.7.1 Telephony transmit control

In the manual simplex or semi-duplex telephony operating mode, switching from the receiving condition to the transmitting condition and vice versa, shall be accomplished by a single control. Any such control shall be located on the microphone or telephone handset and when at rest shall leave the equipment in the receive condition.

³⁾ The Radio Regulations (RR 4357) specify a peak envelope power of 400 W for equipment operating in the MF band in region 1.