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I-03

VHF RADIO INSTALLATIONS

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Foreword

CCS Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at <http://www.ccs.org.cn>. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn.

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Main changes:

1. Update edition of IEC 61097-3, IEC 61097-7 and update related content.
2. Edit modifications and corrections.

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VHF RADIO INSTALLATIONS

1 Scope of Application

This guideline is applicable to approval and inspection of VHF radio installations, including Class A DSC equipment.

2 Normative References

2.1 IMO A.803(19) Performance Standards for Shipborne VHF Radio Installations Capable of Voice Communication and Digital Selective Calling

2.2 IMO MSC.68(68) Annex 1 Amendments to Resolution A.803(19) - Performance Standards for VHF Radio Installations Capable of Voice Communication and Digital Selective Calling

2.3 IMO A.694(17) General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids

2.4 IEC 61097-3:2017 Global Maritime Distress and Safety System (GMDSS) – Part 3: Digital Selective Calling (DSC) Equipment – Operational and Performance Requirements, Methods of Testing and Required testing Results

2.5 IEC 61097-7:2018 Global Maritime Distress and Safety System (GMDSS) – Part 7: Shipborne VHF Radiotelephone Transmitter and Receiver - Operational and Performance Requirements, Methods of Testing and Required test Results

2.6 IEC 61097-8:1998 Global Maritime Distress and Safety System (GMDSS) – Part 8: Shipborne Watchkeeping Receivers for the Reception of Digital Selective Calling (DSC) in the Maritime MF, MF/HF and VHF Bands - Operational and Performance Requirements, Methods of Testing and Required test Results

2.7 IEC 60945:2002/COR1:2008 Maritime Navigation and Radiocommunication Equipment and Systems - General requirements –Methods of Testing and Required test Results

3 Terms and Definitions

3.1 Continuous watch: it means that the radio watch concerned shall not be interrupted other than for brief intervals when the ship's receiving capability is impaired or blocked by its own communications or when the facilities are under periodical maintenance or checks.

3.2 Digital Selective Calling (DSC): it refers to a technique using digital codes which enables a radio station to establish contact with, and transfer information to, another station or group of stations, and complying with the relevant recommendations of the International Telecommunication Union Radiocommunication Sector (ITU-R).

4 Drawings and Documents

4.1 The following drawings and documents shall be submitted to CCS for approval:

4.1.1 Technical conditions of product

4.1.2 Overall and structure diagrams of the complete set of installation

4.1.3 Schematic circuit diagram

4.1.4 Type test outline

4.2 The following drawings and documents shall be submitted to CCS for future reference:

4.2.1 Schematic block diagram

4.2.2 Product operation instructions

4.2.3 External wiring diagram

5 Technical Requirements

5.1 General requirements

5.1.1 The installation, which may consist of more than one piece of equipment, shall be capable of operating on single-frequency channels or on single-frequency and two-frequency channels.

5.1.2 The installation shall provide for the following categories of calls using both voice and digital selective calling (DSC):

- (1) Distress, urgency and safety;
- (2) Ship operational requirements; and
- (3) Public correspondence.

5.1.3 The installation shall provide for the following categories of communications using voice:

- (1) Distress, urgency and safety;
- (2) Ship operational requirements; and
- (3) Public correspondence.

5.1.4 The installation shall comprise at least:

- (1) A transmitter/ receiver, including antenna;
- (2) An integral control unit 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 external or internal loudspeaker;
- (5) An integral or separate digital selective calling facility; and
- (6) A dedicated DSC watchkeeping facility to maintain a continuous watch on CH70.

5.1.5 The installation may also include an additional receivers.

5.1.6 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 digital input panel or an ISO keyboard provided on the equipment.

5.1.7 The dedicated distress button shall:

- (1) Be clearly identified (The distress button shall be red in color and marked "DISTRESS". Where a non-transparent protective lid or cover is used, it shall be also marked "DISTRESS."); and
- (2) Be protected against inadvertent operation; and
- (3) The required protection of the distress button shall be physically mounted on the equipment and consist of a spring loaded lid or cover permanently attached to the equipment by, for example, hinges. It shall not be necessary for the user to remove additional seals or to break the lid or cover in order to operate the distress button.

5.1.8 The distress alert initiation shall require at least two independent actions (lifting the protective lid or cover is deemed as the first independent action, pressing the distress button is deemed as the second independent action).

5.1.9 The installation shall indicate the status of the distress alert transmission. The operation of the distress button shall generate a visible and audible indication and start a countdown of at least 3 s. To keep the countdown running, the distress button shall be kept pressed for the entire time of the countdown at least 3 seconds. A flashing light and an intermittent acoustic signal shall start immediately. After the 3 seconds countdown is completed, the transmission of the distress alert is initiated and the indication shall become steady.

5.1.10 It shall be possible to interrupt and initiate distress alerts at any time.

5.2 Class of emission, frequency bands and channels

5.2.1 The installation may be designated for operation on one or more channels selected from and in accordance with Appendix 18 of the Radio Regulations, but shall at least include CH6(156.300MHz), CH13(156.650MHz) and CH16(156.800MHz) which can implement voice communication and CH70(156.525MHz) which can implement digital selective calling.

5.2.2 The radiotelephone facility shall be capable of operating on the following frequency bands:

- (1) Single-frequency channels within 156.3MHz~156.875MHz specified in Appendix 18 to the Radio Regulations;
- (2) Two-frequency channels within the frequency bands specified in Appendix 18 to the Radio Regulations, i.e. capable of transmitting within 156.025MHz~157.425MHz and receiving within 160.625MHz~162.025MHz.

5.2.3 The digital selective calling facility shall be capable of operating on CH70.

5.2.4 Class of emission shall comply with Appendix 19 of the Radio Regulations.

5.3 Controls and indicators

5.3.1 General requirements

- (1) Change of channel shall be capable of being made as rapidly as possible, but in any event within 5s.
- (2) The time taken to switch from the transmit to the receive condition, and vice versa, shall not exceed 0.3s.
- (3) An on/off switch shall be provided for the entire installation with a visual indication that the installation is switched on.
- (4) A visual indication that the carrier is being transmitted shall be provided.
- (5) The installation shall indicate the channel number, as given in the Radio Regulations, to which it is tuned. It shall allow the determination of the channel number under all conditions of external lighting. Where practicable, CH16 and CH70 shall be distinctively marked.
- (6) Control of the installation shall be possible at the position from which the ship is normally navigated. Control from that position shall have priority if additional control units are provided. When there is more than one control unit, indication shall be given to the other units that the equipment is in operation.
- (7) During a channel switching operation, the installation shall not be able to transmit.
- (8) Operation of the transmit/receive control shall not cause unwanted emissions.

5.3.2 Radiotelephone facility

- (1) Provision shall be made for changing from transmission to reception by use of a press-to-transmit switch. Additionally, facilities for operation on two-frequency channels without manual control may be provided.

(2) The receiver shall be provided with a manual volume control by which the audio output may be varied.

(3) A squelch (mute) control shall be provided on the exterior of the equipment.

5.4 Permissible warming-up period

The installation shall be operational within 1min of switching on.

5.5 Safety precautions

The installation, when operating, shall not be damaged by the effects of open-circuited or short-circuited antenna terminals.

5.6 Output power of the transmitter

5.6.1 Output power of the transmitter shall be between 6W and 25W.

5.6.2 Output power of the transmitter shall be able to decrease to 0.1W ~ 1W. However, the power reduction is optional on CH70.

5.7 Parameters of receiver

5.7.1 Radiotelephone facility

The sensitivity of the receiver shall be equal to or better than 2 μ V e.m.f. for a signal-to-noise ratio of 20dB.

5.7.2 DSC facility

With a DSC modulated input signal having a level of 1 μ V e.m.f. to its associated VHF receiver, the DSC equipment shall be capable of decoding the received message with a maximum permissible output character error rate of 10^{-2} .

5.7.3 Immunity to interference

The immunity to interference of the receiver shall be such that the wanted signal is not seriously affected by unwanted signals.

5.8 Antenna system

The VHF antenna shall be vertically polarized and, as far as practicable, be omnidirectional in the horizontal plane. The installation shall be suitable for efficient radiation and reception of signals at the operating frequencies.

5.9 Loudspeaker and telephone handset (radiotelephone facility)

5.9.1 The receiver output shall be suitable for use with a loudspeaker or a telephone handset. The audio output shall be sufficient to be heard in the ambient noise level likely to be encountered on board ships.

5.9.2 It shall be possible to switch off the loudspeaker without affecting the audio output of the telephone handset, if provided.

5.9.3 In the transmit condition during simplex operation, the output of the receiver shall be muted.

5.9.4 In the transmit condition during duplex operation, only the telephone handset shall be in circuit. Care shall be taken to prevent any electrical or acoustic feedback, which could cause singing.

5.10 DSC facility

5.10.1 The facility shall conform to the provisions of the relevant ITU-R Recommendations pertaining to the DSC system (to meet the requirement, Class A DSC facility which complies with ITU-R M.493 Recommendations shall be used).

5.10.2 The DSC facility shall comprise:

- (1) Means to decode and encode DSC messages;
- (2) Means necessary for composing the DSC message;
- (3) Means to verify the prepared message before it is transmitted;
- (4) Means to display the information contained in a received call in plain language;
- (5) Facilities to automatically update the ship's position and the time at which the position was determined from a suitable electronic position-fixing aid which may be an integral part of the equipment;
- (6) Means for manual entry of position information and the time at which the position was determined; and
- (7) Means to activate an alarm when no position data is received from the electronic position-fixing aid or, in the case of manual input, the position information is over 4 hours old. Any position information not updated for more than 23.5h shall be erased.

5.10.3 Distress message storage

- (1) If the received messages are not printed immediately, sufficient capacity shall be provided to enable at least 20 received distress messages to be stored in the DSC facility.
- (2) These messages shall be stored until readout and shall be erased 48h after their reception.

5.10.4 It shall be possible to initiate and make distress and safety calls from the position from which the ship is normally navigated. The means for initiating a distress alert shall be as prescribed in Article 5.1.6 and Article 5.1.8 herein.

5.10.5 Initiation of DSC distress calls shall supersede any other operation of the facility.

5.10.6 Self-identification data shall be stored in the DSC unit. It shall not be possible for the user easily to change these data.

5.10.7 Means shall be provided to enable routine testing of the DSC facilities without radiation of signals.

5.10.8 Provision shall be made for:

- (1) a specific aural alarm and visual indication to indicate receipt of a distress or urgency call or a call having distress category. It shall not be possible to disable this alarm and indication. Provisions shall be made to ensure that they can be reset only manually. The reception of a distress alert and urgency call shall activate an alarm and signal a BAM warning. The audible distress alarm shall have a distinctive two tone alarm, the alarm shall consist of two substantially sinusoidal audio-frequency tones, transmitted alternately, one tone shall have a frequency of 2200Hz and the other a frequency of 1300Hz, the duration of each tone shall be 250ms. The audible urgency alarm shall consist of repetition of the 2200Hz frequency for 250ms followed by 250ms period of silence.
- (2) aural alarms and visual indication for calls other than distress and urgency. It shall be possible for the operator to disable all audible alarms except those of category distress and urgency.

5.10.9 Aural alarms shall start softly and increase in volume if not silenced by the operator, this will give the operator the opportunity to acknowledge the alarm without interrupting the ship's current communications.

5.11 Power supply

The VHF radio installation shall be powered from the ship's main source of electrical energy. In addition, it shall be possible to operate the VHF installation from an alternative source of electrical energy.

6 Materials and Components

At least, the displays and integrated circuits shall be included in the list of qualified suppliers, and its manufacturer shall not be changed without the Society's approval.

7 Type Test

7.1 Principles of sampling: in principle, one set of type test samples shall be chosen at random for all type test items in Article 7.2 herein.

7.2 Type test items and methods:

Table 7.2

S/N	Type test items	Type test methods	Remarks
1	Power supply		
1.1	Extreme power supply variation	Article 7.1 and 5.2.2 in IEC 60945:2002/COR1:2008	
1.2	Excessive conditions	Article 7.2 and 5.2.3 in IEC 60945:2002/COR1:2008	
1.3	Immunity to power supply short-term variation (only applicable to AC power supply)	Article 7.3 and 10.7 in IEC 60945:2002/COR1:2008	
2	Environmental conditions		
2.1	Dry heat	Article 8.2 in IEC 60945:2002/COR1:2008	
2.2	Damp heat	Article 8.3 in IEC 60945:2002/COR1:2008	
2.3	Low temperature	Article 8.4 in IEC 60945:2002/COR1:2008	
2.4	Vibration	Article 8.7 in IEC 60945:2002/COR1:2008	
2.5	Rain and spray (only applicable to outdoor part)	Article 8.8 in IEC 60945:2002/COR1:2008	
2.6	Salt mist (corrosion)	Article 8.12 in IEC 60945:2002/COR1:2008	
3	Electromagnetic compatibility		
3.1	Conducted emissions	Article 9.2 in IEC 60945:2002/COR1:2008	
3.2	Radiated emissions from enclosure port	Article 9.3 in IEC 60945:2002/COR1:2008	

3.3	Immunity to conducted radio frequency disturbance	Article 10.3 in IEC 60945:2002/COR1:2008	
3.4	Immunity to radiated radiofrequencies	Article 10.4 in IEC 60945:2002/COR1:2008	
3.5	Immunity to fast transients	Article 10.5 in IEC 60945:2002/COR1:2008	
3.6	Immunity to Surges (only applicable to AC power supply)	Article 10.6 in IEC 60945:2002/COR1:2008	
3.7	Immunity to electrostatic discharge	Article 10.9 in IEC 60945:2002/COR1:2008	
4	Special purpose		
4.1	Acoustic noise and signals	Article 11.1 in IEC 60945:2002/COR1:2008	
4.2	Compass safe distance	Article 11.2 in IEC 60945:2002/COR1:2008	
5	Safety precautions		
5.1	Protection against accidental access to dangerous voltages	Article 12.1 in IEC 60945:2002/COR1:2008	
5.2	Electromagnetic radio frequency radiation	Article 12.2 in IEC 60945:2002/COR1:2008	
5.3	Emission from visual display unit(VDU)	Article 12.3 in IEC 60945:2002/COR1:2008	
5.4	X-radiation	Article 12.4 in IEC 60945:2002/COR1:2008	
6	Appearance inspection	Article 7~9 in IMO A.694(17)	
7	Operation inspection	Article 6.1~6.4 in IEC 60945:2002/COR1:2008	
8	VHF radiotelephone		

8.1	General requirements		
8.1.1	Switching time	Article 5.3.1 in IEC 61097-7:2018	
8.2	Transmitter		
8.2.1	Frequency error	Article 5.4.1 in IEC 61097-7:2018	
8.2.2	Carrier power	Article 5.4.2 in IEC 61097-7:2018	
8.2.3	Frequency deviation		
8.2.3.1	Maximum permissible frequency deviation	Article 5.4.3.2 in IEC 61097-7:2018	
8.2.3.2	Reduction of frequency deviation at modulation frequencies above 3kHz	Article 5.4.3.3 in IEC 61097-7:2018	
8.2.4	Limitation characteristics of the modulator	Article 5.4.4 in IEC 61097-7:2018	
8.2.5	Sensitivity of modulator, including microphone	Article 5.4.5 in IEC 61097-7:2018	
8.2.6	Audiofrequency response	Article 5.4.6 in IEC 61097-7:2018	
8.2.7	Audiofrequency harmonic distortion of the emission	Article 5.4.7 in IEC 61097-7:2018	
8.2.8	Adjacent channel power	Article 5.4.8 in IEC 61097-7:2018	
8.2.9	Conducted spurious emissions conveyed to the antenna	Article 5.4.9 in IEC 61097-7:2018	
8.2.10	Residual modulation of the transmitter	Article 5.4.10 in IEC 61097-7:2018	
8.2.11	Transient frequency behaviour of the transmitter	Article 5.4.11 in IEC 61097-7:2018	
8.3	Receiver		
8.3.1	Harmonic distortion and rated audiofrequency output power	Article 5.5.1 in IEC 61097-7:2018	
8.3.2	Audiofrequency response	Article 5.5.2 in IEC 61097-7:2018	

8.3.3	Maximum usable sensitivity	Article 5.5.3 in IEC 61097-7:2018	
8.3.4	Co-channel rejection ratio	Article 5.5.4 in IEC 61097-7:2018	
8.3.5	Adjacent channel selectivity	Article 5.5.5 in IEC 61097-7:2018	
8.3.6	Spurious response rejection	Article 5.5.6 in IEC 61097-7:2018	
8.3.7	Intermodulation response	Article 5.5.7 in IEC 61097-7:2018	
8.3.8	Blocking	Article 5.5.8 in IEC 61097-7:2018	
8.3.9	Conducted spurious emissions conveyed to the antenna	Article 5.5.9 in IEC 61097-7:2018	
8.3.10	Amplitude response of the receiver limiter	Article 5.5.10 in IEC 61097-7:2018	
8.3.11	Receiver hum and noise level	Article 5.5.11 in IEC 61097-7:2018	
8.3.12	Squelch operation	Article 5.5.12 in IEC 61097-7:2018	
8.3.13	Squelch hysteresis	Article 5.5.13 in IEC 61097-7:2018	
8.3.14	Scanning characteristics of multiple watch facilities	Article 5.5.14 in IEC 61097-7:2018	
8.4	Duplex operation		
8.4.1	Acoustic feedback	Article 5.6.1 in IEC 61097-7:2018	
8.4.2	Receiver desensitization with simultaneous transmission and reception	Article 5.6.2 in IEC 61097-7:2018	
8.4.3	Receiver spurious response rejection	Article 5.6.3 in IEC 61097-7:2018	
9	DSC equipment		
9.1	Performance requirements		
9.1.1	Functional requirements		
9.1.1.1	Display of information	Article 4.3.1 in IEC 61097-3:2017	

9.1.1.2	User interface	Article 4.3.2 in IEC 61097-3:2017	
9.1.1.3	Categories of calls	Article 4.3.3 in IEC 61097-3:2017	
9.1.1.4	Construction	Article 4.3.5 in IEC 61097-3:2017	
9.1.1.5	Memory	Article 4.3.6 in IEC 61097-3:2017	
9.1.1.6	Warm-up period	Article 4.3.7 in IEC 61097-3:2017	
9.1.1.7	Protection of the antenna input circuit	Article 4.3.8 in IEC 61097-3:2017	
9.1.1.8	Protection of the transmitter	Article 4.3.9 in IEC 61097-3:2017	
9.1.1.9	Antenna static protection	Article 4.3.10 in IEC 61097-3:2017	
9.1.1.10	Safety precautions	Article 4.3.11 in IEC 61097-3:2017	
9.1.1.11	Label of compass safe distance	Article 4.3.12 in IEC 61097-3:2017	
9.1.1.12	Audio interface	Article 4.3.13 in IEC 61097-3:2017	
9.1.1.13	Activation of transmitter and maximum transmission time	Article 4.3.14 in IEC 61097-3:2017	
9.1.1.14	Data interface	Article 4.3.15 in IEC 61097-3:2017	
9.1.2	Operational requirements		
9.1.2.1	Basic requirements	Article 4.4.1 in IEC 61097-3:2017	
9.1.2.2	Additional requirements		
9.1.2.2.1	Aural alarm	Article 4.4.2.1 in IEC 61097-3:2017	
9.1.2.2.2	Inactivity timer	Article 4.4.2.2 in IEC 61097-3:2017	
9.1.2.2.3	Automatic switching to a subsequent communications channel	Article 4.4.2.3 in IEC 61097-3:2017	

9.1.2.3	Distress alerts		
9.1.2.3.1	General	Article 4.4.3.1 in IEC 61097-3:2017	
9.1.2.3.2	Composition of distress alerts	Article 4.4.3.2 in IEC 61097-3:2017	
9.1.2.3.3	Distress alert attempt	Article 4.4.3.3 in IEC 61097-3:2017	
9.1.2.3.4	Distress alert acknowledgement and distress relay	Article 4.4.3.4 in IEC 61097-3:2017	
9.1.2.4	Other calls		
9.1.2.4.1	Composition of calls	Article 4.4.4.1 in IEC 61097-3:2017	
9.1.2.4.2	Acknowledgement of calls	Article 4.4.4.2 in IEC 61097-3:2017	
9.1.2.4.3	Operation in the automatic/ semi-automatic service (if applicable)	Article 4.4.4.3 in IEC 61097-3:2017	
9.1.2.4.4	Routine testing of the DSC equipment	Article 4.4.4.4 in IEC 61097-3:2017	
9.1.2.5	Self-identification	Article 4.4.5 in IEC 61097-3:2017	
9.1.3	Watch and scanning facilities	Article 4.6 in IEC 61097-3:2017	
9.1.4	Bridge alert management (BAM)		
9.1.4.1	Classification of BAM alerts	Article 4.7.1 in IEC 61097-3:2017	
9.1.4.2	Alert management		
9.1.4.2.1	General requirements	Article 4.7.2.1 in IEC 61097-3:2017	
9.1.4.2.2	Unacknowledged BAM warnings	Article 4.7.2.2 in IEC 61097-3:2017	

9.1.4.2.3	Remote acknowledgement and silencing of BAM alerts	Article 4.7.2.3 in IEC 61097-3:2017	
9.1.5	Alert source identification and reporting in ALF sentence		
9.1.5.1	General requirements	Article 4.8.1 in IEC 61097-3:2017	
9.1.5.2	Receipt of distress or urgency call	Article 4.8.2 in IEC 61097-3:2017	
9.1.5.3	Receipt of calls other than distress or urgency	Article 4.8.3 in IEC 61097-3:2017	
9.1.5.4	No position data received by equipment	Article 4.8.4.2 in IEC 61097-3:2017	
9.1.5.5	Antenna tuner error or other detected antenna failures (if applicable)	Article 4.8.4.3 in IEC 61097-3:2017	
9.1.5.6	Transmission power error or otherwise inhibited transmission (if applicable)	Article 4.8.4.4 in IEC 61097-3:2017	
9.1.6	Software and firmware maintenance	Article 4.9 in IEC 61097-3:2017	
9.2	Technical characteristics		
9.2.1	General		
9.2.1.1	Frequency	Article 5.1.1 in IEC 61097-3:2017	9.2.1.1
9.2.1.2	Calling sensitivity	Article 5.1.2 in IEC 61097-3:2017	9.2.1.2
9.2.1.3	Nominal modulation rate	Article 5.1.3 in IEC 61097-3:2017	9.2.1.3
9.2.1.4	Residual modulation	Article 5.1.4 in IEC 61097-3:2017	
9.2.2	Technical format of a call sequence	Article 5.2 in IEC 61097-3:2017	
9.2.3	Expansion sequence (if applicable)	Article 5.3 in IEC 61097-3:2017	
9.2.4	Equipment for the automatic/semi-automatic service (if applicable)	Article 5.4 in IEC 61097-3:2017	
10	DSC watchkeeping receiver		

Continued Tab.7.2

10.1	Calling sensitivity	Article 9.1 in IEC 61097-8:1998	
10.2	Adjacent channel selectivity	Article 9.2 in IEC 61097-8:1998	
10.3	Co-channel rejection	Article 9.3 in IEC 61097-8:1998	
10.4	Intermodulation response	Article 9.4 in IEC 61097-8:1998	
10.5	Spurious response and blocking immunity	Article 9.5 in IEC 61097-8:1998	
10.6	Dynamic range	Article 9.6 in IEC 61097-8:1998	
10.7	Conducted spurious emissions into the antenna	Article 9.7 in IEC 61097-8:1998	

8 Unit/Batch Inspection after Approval

8.1 Product inspection from CCS shall not be applied until the type approval is gained.

8.2 The manufacturer can apply for product inspection from CCS after delivery inspection is completed for all products and all products are qualified.

8.3 Sampling inspection ratio of CCS: 5%, no less than 2 sets (unless there is only one set of products inspected), and no more than 10 sets.

8.4 Test items and methods of delivery test and CCS sampling inspection

Tab.8.4

S/N	Items of delivery test and CCS sampling inspection	Methods of delivery test and CCS sampling inspection	Remarks
1	Appearance inspection	Article 7~9 in IMO A.694(17)	
2	Frequency error of VHF radiotelephone transmitter	Article 5.4.1 in IEC 61097-7:2018	
3	Carrier power of VHF radiotelephone transmitter	Article 5.4.2 in IEC 61097-7:2018	
4	Maximum usable sensitivity of VHF radiotelephone receiver	Article 5.5.3 in IEC 61097-7:2018	