

## RECOMMENDATION ITU-R M.1082-1\*\* \*\*

**INTERNATIONAL MARITIME MF/HF RADIOTELEPHONE SYSTEM  
WITH AUTOMATIC FACILITIES BASED ON DIGITAL  
SELECTIVE CALLING SIGNALLING FORMAT**

(1994-1997)

**Scope**

This Recommendation provides for a means to establish a fully automatic radiotelephone service for vessels to send and receive calls via the public switched telephone network (PSTN) using MF/HF equipment. The Recommendation contains detailed operational procedures, timing diagrams for call set-up sequences and a description of factors which differ between MF/HF and VHF systems.

The ITU Radiocommunication Assembly,

*considering*

- a) that a maritime MF/HF radiotelephone system providing automatic connection with the public switched telephone network (PSTN) would improve traffic handling and the efficiency of the use of the radio channels;
- b) that a maritime VHF radiotelephone system providing automatic connection with the PSTN is described in Recommendation ITU-R M.689 and might, suitably modified, be used in MF and HF;
- c) that international standardization is of great importance in the maritime mobile service;
- d) that the existing public correspondence channels listed in Article 52 of the Radio Regulations (RR) are in widespread use by ships and coast stations in the maritime mobile service;
- e) that RR Articles 52 and 57 do not permit coast stations to emit signals on idle radiotelephone working channels;
- f) that the digital selective-calling (DSC) system described in Recommendations ITU-R M.493 and ITU-R M.541 can be used for signalling over the radio path for an automatic system using a DSC channel;
- g) that the existing RR Article 52 channels can be used in such an automatic system without impairing their use for manual operations from ships or coast stations,

*recommends*

- 1 that the operational procedures described in Annex 1 should be observed when operating an international radiotelephone system with automatic facilities based on the DSC signalling format and using the public correspondence channels listed in RR Article 52;
- 2 that the same RR Article 52 channel may be used for both automatic and manual operation by the same coast station depending on the requirements of the ship stations;
- 3 that the technical characteristics of the ship and coast station equipment should be in accordance with Annex 2.

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\* This Recommendation should be brought to the attention of the International Maritime Organization (IMO) and the Telecommunication Standardization Sector (ITU-T), the International Electrotechnical Commission (IEC) and the Comité International Radio Maritime (CIRM).

\*\* Radiocommunication Study Group 5 made editorial amendments to this Recommendation in November 2011, in accordance with Resolution ITU-R 1.

## Operational procedures

### 1 Introduction

These procedures are initiated by using DSC on an appropriate MF or HF paired DSC calling channel and based on the technical characteristics and operational procedures detailed in Recommendations ITU-R M.493 and ITU-R M.541.

Connection to the PSTN is effected using any appropriate MF or HF public correspondence working channel listed in RR Article 52 without in any way impairing their use for manual operations.

Appendix 1 illustrates the timing of the call set-up, calling and acknowledgement sequences described by these procedures, in the ship-to-shore direction and in the shore-to-ship direction.

Appendix 2 indicates the factors which are not the same in MF/HF as in VHF.

### 2 Operational procedures in the ship-to-shore direction

#### 2.1 Ship station initiates call

**2.1.1** The user aboard the ship (hereafter referred to as the user) composes the calling sequence (see Note 1) on his DSC equipment as follows:

- selects the format specifier 123 (individual station automatic/semiautomatic service);
- enters 9-digit address (identification) of required coast station;
- selects the category routine (100);
- (the ship station self-identification is entered automatically);
- selects first and second telecommands as appropriate (for a normal radiotelephone call these would be 109 (J3E) and 126 (no information) respectively);
- the ship's position should preferably be inserted so that the coast station can use this information to select the working channel and/or directional antennas. In the absence of any information, the symbol 126 will be automatically inserted 6 times (see Recommendation ITU-R M.493, Annex 1, § 8.2.2, Note and Table 7);
- inserts the required subscriber number (e.g. telephone number);
- selects "end of sequence" signal "RQ".

NOTE 1 – It is assumed that commercial equipment will be produced which simplifies the composition of the calling sequence. In practice the user should only need to key the coast station address and the required subscriber number, all other information being inserted automatically.

**2.1.2** The user selects the MF or HF DSC ship-to-shore calling frequency appropriate to the coast station and transmits the calling sequence, after checking as far as possible that there are no DSC calls in progress on that frequency.

**2.1.3** If the ship station does not receive an error-free acknowledgement from the called coast station on the paired DSC shore-to-ship frequency (see § 2.2) within 25 s, the user should:

- in the case of MF, repeat the transmission of the DSC call in accordance with § 2.1.2;
- in the case of HF, either repeat the transmission of the DSC call on the same frequency or initiate a call on another DSC frequency (which may prove better from the propagation standpoint than the frequency initially chosen).

## 2.2 Coast station acknowledgement

### 2.2.1 The coast station can comply immediately with the call request

**2.2.1.1** If, on receipt of an error-free calling sequence, the coast station can comply immediately with the call request, then it should, within 3 s of receiving it, transmit an acknowledgement sequence on the paired DSC shore-to-ship frequency.

The acknowledgement sequence should contain the same information as in the call request, with the following exceptions:

- the address will be that of the ship,
- the self-identification will be that of the coast station,
- the working frequency/ies or channel number will be included (see Recommendation ITU-R M.493, Annex 1, § 8.2.2) and should be normally in the same band as that of the received DSC call,
- the “end of sequence” signal will be “BQ”.

**2.2.1.2** After receiving the calling sequence, the coast station should within 10 s switch to the working frequency/ies indicated and then transmit an “engaged channel” signal on the working channel transmission frequency. In the case of an HF link, if the coast station uses directional antennas, it is possible to set up a transmission chain (one transmitter + one transmitting antenna and one receiver + one receiving antenna) corresponding to the geographical location of the ship station.

**2.2.1.3** After receiving the acknowledgement sequence, the ship station should within 5 s switch to the working frequency/ies indicated.

### 2.2.2 The coast station cannot comply immediately with the call request

**2.2.2.1** If the appropriate working frequency/ies or channel(s) are busy then the acknowledgement sequence should be as in § 2.2.1.1, except that the first telecommand should be 104 (unable to comply) and the second telecommand should be 102 (busy) and no working frequency/ies or channel should be included in the acknowledgement.

**2.2.2.2** If the coast station cannot comply for other reasons, the acknowledgement sequence should be as in § 2.2.2.1 except that the second telecommand signal should be one of symbol numbers 100-109 as appropriate.

**2.2.3** The ship station, on receipt of an acknowledgement indicating “unable to comply” in accordance with § 2.2.2.1 or 2.2.2.2 should, if an automatic connection is still required, initiate an appropriate new DSC call in accordance with § 2.1.

**2.2.4** If the coast station transmitted an acknowledgement indicating “unable to comply” in accordance with § 2.2.2.1 or 2.2.2.2, then it should take no further action with respect to the call request.

## 2.3 Procedures subsequent to the exchange of initial DSC calls

**2.3.1** Once tuned to the working frequency/ies indicated (see § 2.2.1.3), the ship station transmits on the ship-to-shore frequency of the working channel a DSC call identical to the initial call (see § 2.1.1).

If a DSC call containing the same self-identification as that of the calling ship is received on the coast station receive frequency of the working channel within 25 s, the coast station may, on the receipt of an error-free calling sequence, automatically measure the signal-to-noise ( $S/N$ ) ratio of the received DSC call and compare this to the  $S/N$  ratio required for the mode requested (see Note 1).

NOTE 1 – Recommendation ITU-R F.339, Table 1 indicates that an RF  $S/N$  density ratio of  $> 61$  dB/Hz should be obtained for a J3E telephony call having a marginally commercial grade of service under non-diversity fading conditions.  $S/N$  density ratios applicable to other classes of emission can also be obtained from this table. The quality of the working channel may alternatively be estimated by other methods.

**2.3.2** The coast station should then stop the transmission of the “engaged channel” signal, and initiate the transmission of a DSC acknowledgement, within 5 s after receiving the call, on the shore-to-ship frequency of that working channel.

**2.3.2.1** If the working channel quality evaluation indicates that the communication on the working channel will be satisfactory, then the acknowledgement should be identical to that transmitted in accordance with § 2.2.1.1. The coast station should then commence dialling the subscriber number.

**2.3.2.2** If the working channel quality evaluation indicates that the communication on the working channel will not be satisfactory, but the coast station can offer an alternative working channel, then the acknowledgement should be identical to that transmitted in accordance with § 2.2.1.1 except that the indicated frequency is the frequency corresponding to that alternative working channel and the procedure should be repeated from § 2.3.1.

**2.3.2.3** If the working channel quality evaluation again indicates that the communication on the new working channel will not be satisfactory, and if the coast station cannot offer an alternative working frequency, then the acknowledgement should be the same as that transmitted in § 2.2.1.1 except that the first telecommand should be 104 (unable to comply) and the second telecommand should be 108 (unable to use proposed channel).

**2.3.3** If no such DSC call from the ship (§ 2.3.1) is received within 25 s, then the coast station should remove the “engaged channel” signal from the working channel.

**2.3.4** If the coast station transmitted an acknowledgement indicating “unable to comply” in accordance with § 2.3.2.3, then it should remove the “engaged channel” signal from the working channel and take no further action with respect to the call request.

**2.3.5** If the ship station receives an “unable to comply” acknowledgement in accordance with § 2.3.2.3 or if it receives no acknowledgement within 25 s from the start of transmission of the call described in § 2.3.1 and hears no indication that the connection to the requested subscriber has been effected, then the ship station should clear the call in accordance with § 2.5.1.

## **2.4 Call connection**

**2.4.1** Once the coast station begins dialling the subscriber number it should connect the line circuit to the radio path. Timing of the call for billing purposes should commence after the subscriber answers, i.e. “off-hook” condition detected.

**2.4.2** If the called subscriber does not answer within a period of 1 min from completion of dialling or if anything other than ringing tones are received (e.g. engaged, number unobtainable, etc.), then the call should be considered as not started and the coast station should clear the circuit by disconnecting the line and radio circuit. The user, on hearing the ringing tones stop or hearing anything other than “ringing” tones, should refrain from any further transmissions on the working channel. If a further call is required, the user should initiate a new call on a DSC calling channel.

## **2.5 Call completion**

**2.5.1** When the ship station wishes to terminate the call connection to the subscriber it transmits an “end of call” DSC call on the ship-to-shore frequency of the working channel. The format of this call should be the same as that described in § 2.1.1 except that the first telecommand should be 105 (end of call) and the second telecommand should be 126.

**2.5.2** On receipt of that call, if it contains the same self-identification as that of the calling ship, the landline is disconnected, the call timing is stopped and the coast station transmits a DSC acknowledgement on the shore-to-ship frequency of the working channel within 1 s of receipt. The format of that acknowledgement should be the same as that described in § 2.5.1 except that the “end of sequence” signal should be “BQ” and:

- the chargeable duration of the call should be inserted in the “frequency/channel” field by coding the first three characters as hours, minutes, seconds and the remaining three characters as symbols 126: e.g. a chargeable duration of 6 min and 50 s would be coded as 00 06 50 126 126 126;
- if the chargeable duration of the call is not available, then the “frequency/channel” field should contain six symbols 126.

**2.5.3** If the ship station does not receive an “end of call acknowledgement” within 20 s then it should repeat the “end of call” and consider the call to be complete.

**2.5.4** If the coast station does not receive the “end of call” as described in § 2.5.1 then the call will be considered to be complete when the “on-hook” condition is detected from the PSTN (or if not reply within 1 min if anything other than ringing tones are received). When this indication is registered at the coast station the following action should take place:

- call timing is stopped;
- the line is cleared and disconnected from the radio circuit;
- the coast station transmits an “end of call” DSC call whose format is the same as that of the acknowledgement described in § 2.5.2 except that the “end of sequence” signal should be 127;
- the coast station ceases transmissions on the working channel.

The radio channel is now free to handle other traffic.

**2.5.5** Some coast stations may supplement the “on-hook” condition detection with an “absence of speech” detection system operating on the line circuit to provide additional protection against call clear malfunction.

**2.5.6** If a further call is received from the same ship before call completion is recognized by the coast station, then the coast station could use the information derived from the call to disconnect the previously allocated working channel.

**2.5.7** If further calls are required by the ship then a new call could be initiated on the DSC calling channel.

### **3 Operational procedures in the shore-to-ship direction**

The procedures described below are identical for calls on MF and HF, the only difference being that the number of call attempts on HF may be higher than on MF.

- MF coast stations will normally have only one DSC channel on which the ship is expected to keep watch. However, if no response is received from the ship on that channel, the coast station may under the conditions given in RR No. 4323X (S52.133) to No. 4323Z (S52.135) and No. 4323AA (S52.136) repeat the call to the ship on the international MF DSC calling channel (coast station transmit 2 177 kHz, coast station receive 2 189.5 kHz).
- When calling on HF, coast stations may need to repeat the call on a number of HF bands. The coast station may maintain a ship subscriber data base including the last known position of the ship and could, based on an HF propagation model included in the automated system, deduce the HF band(s) most suited for calling the ship.

#### **3.1 Coast station initiates call**

**3.1.1** The equipment at the coast station should provide the capability to distinguish the ship’s identity in accordance with Recommendation ITU-R M.585, when transmitted from the PSTN.

**3.1.2** For coast stations offering automated services on both MF and HF the choice between MF and the different HF bands could be deduced from a ship’s position data base maintained at the coast station.

**3.1.3** When receiving a call request from the PSTN and if there is a working channel available in the appropriate band, the coast station equipment should reserve the channel and radiate an engaged channel signal on the coast station transmit frequency of that working channel.

**3.1.4** If the coast station cannot comply immediately with the call request because no working channel is available, then it should transmit a busy signal to the calling subscriber and thereafter disconnect the line.

**3.1.5** If there is a suitable working channel available and a ship's identity is detected in accordance with § 3.1.1 the coast station should transmit a DSC calling sequence on an appropriate DSC calling channel in the same band as the working channel and in accordance with the following conditions:

- the format specifier will be 123 (automatic service),
- the address will be that of the ship,
- the self-identification will be that of the coast station,
- the first telecommand will be 109 (J3E) or another telecommand appropriate for the service,
- second telecommand will be as appropriate,
- the working channel number or frequencies will be included,
- the PSTN subscriber number should preferably follow, but may be omitted if so decided or if not known,
- the “end of sequence” signal will be RQ.

**3.1.6** If the coast station does not receive an error-free acknowledgement from the called ship station within 25 s, the calling sequence may be repeated on another suitable DSC calling channel in accordance with § 3.1.5.

### **3.2 Ship station acknowledgement**

**3.2.1** On receipt of an error-free calling sequence in accordance with § 3.1.5, the ship station should, within 5 s of receiving it, automatically initiate transmission of an acknowledgement sequence on the paired DSC ship-to-shore frequency.

If the ship is using DSC scanning receivers for reception of calls on DSC channels, the scanning receiver should automatically start scanning again as soon as decoding of the received call has finished.

**3.2.2** If the ship station can comply immediately with the call request, the acknowledgement should contain the same information as in the call request (§ 3.1.5), with the following exceptions:

- the address will be that of the coast station;
- the self-identification will be that of the ship;
- the first and second telecommands will be as appropriate;
- the ship's position should preferably be indicated (this allows the data base to be updated and to use directional antennas at the coast station for the following procedures); alternatively, the working frequency/ies or channel number indicated by the coast station should be included in the acknowledgement (see Recommendation ITU-R M.493, Annex 1, § 8.2.2);
- the “end of sequence” signal will be BQ.

**3.2.3** If the ship station cannot comply immediately with the call request, the acknowledgement sequence should be as in § 3.2.2, except that the first telecommand should be 104 (unable to comply) and the second telecommand should be as appropriate to indicate the reason for being unable to comply, or symbol No. 126.

**3.2.4** The coast station should, after receipt of an acknowledgement in accordance with § 3.2.3, remove the engaged channel signal from the working channel, transmit a busy signal to the calling subscriber and thereafter release the line.

### **3.3 Procedures subsequent to the exchange of initial DSC calls**

**3.3.1** After having transmitted an acknowledgement in accordance with § 3.2.2 the ship station should, when the ship user indicates that he is able to accept the call (e.g. by lifting the handset), within 5 s tune to the working channel indicated in the DSC call received.

**3.3.2** Once tuned to the working channel indicated the ship station should immediately initiate transmission of a DSC call on the working channel identical to the acknowledgement transmitted on the calling channel (§ 3.2.2), except that the end of sequence signal should be RQ. The RX and TX fields indicate the coast station receive and transmit frequency, respectively.

**3.3.3** If the coast station, in response to its initial call (§ 3.1.5 or 3.1.6 as appropriate), within 25 s receives an error-free acknowledgement sequence in accordance with § 3.2.2 above, it should then await a DSC call from the ship on the working channel indicated in the call.

**3.3.4** If the coast station within 1 min after reception of the acknowledgement sequence described in § 3.3.3 receives an error-free DSC call from the ship on the working channel, containing the same self-identification as that of the called ship, the coast station may automatically measure the signal-to-noise ( $S/N$ ) ratio of the received DSC call and compare this to the  $S/N$  ratio required for the mode requested.

**3.3.5** If the working channel quality evaluation indicates that the communication on the working channel will be satisfactory, the coast station should then within 5 s transmit an acknowledgement on the working channel identical to the call received on the working channel (§ 3.3.4) except that the end of sequence signal should be BQ, and connect the land subscriber to the radio path.

**3.3.6** If the working channel quality evaluation indicates that the communication on the working channel will not be satisfactory, but the coast station can offer an alternative working channel in the same band, the coast station should then transmit an acknowledgement corresponding to the call received on the working channel, but indicating the alternative working frequency; the procedure should then be repeated from § 3.3.2. The coast station should radiate an engaged signal on that alternative working channel.

**3.3.7** If the working channel quality evaluation again indicates that the communication on the working channel will not be satisfactory, and if the coast station cannot offer an alternative working channel, the coast station should then transmit an acknowledgement sequence corresponding to the call received on the working channel, except that the first telecommand should be 104 (unable to comply) and the second telecommand should be 108 (unable to use proposed channel). The engaged channel signal should be removed from the working channel.

The coast station should then either transmit a busy signal to the calling subscriber and release the line or may, in case of HF, transmit a DSC call on another HF band in accordance with § 3.1.5.

**3.3.8** If the DSC call received on the working channel (§ 3.3.2) is not error-free, and the coast station can offer an alternative working channel in the same band, the coast station should then transmit an acknowledgement on the original working channel. The acknowledgement should be identical with the call on the calling channel (§ 3.1.5), except that the alternative working channel should be indicated, and the end of sequence signal should be BQ. The procedure should then be repeated from § 3.3.2.

**3.3.9** If the DSC call received on the working channel (§ 3.3.2) is not error-free, and no other working channel in the same band is available, the coast station should then transmit an acknowledgement on the working channel in accordance with that described in § 3.3.7.

The coast station should then remove the engaged channel signal from the working channel and thereafter either transmit a busy signal to the calling subscriber and release the line or may, in case of HF, repeat the calling process on another suitable HF band in accordance with § 3.1.5.

**3.3.10** If no DSC call in response to the initial DSC call is received on the working channel within 1 min after reception of the acknowledgement sequence described in § 3.3.3, the coast station should remove the engaged channel signal from the working channel, transmit a busy signal to the calling subscriber and release the line. In case of HF the coast station may decide to repeat the initial call on another suitable DSC channel in accordance with § 3.1.5.

**3.3.11** If the ship station receives an “unable to comply” acknowledgement in accordance with § 3.3.7 or 3.3.9, or if it receives no acknowledgement within 20 s from the start of transmission of the call described in § 3.3.2, and hear no indication that the connection to the calling subscriber has been effected, then the ship station should clear the call in accordance with § 2.5.1.

### **3.4 Call connection**

When the coast station has connected the land subscriber to the radio path (§ 3.3.5), timing of the call for billing purposes should commence.

### **3.5 Call completion**

The procedures for completion of the call should be as described in § 2.5, except that indication of chargeable duration of the call in the “end of call” sequence to the ship may be omitted.

## APPENDIX 1

## TO ANNEX 1

**Timing diagram of call set-up sequences  
when the ship station initiates the call  
(Maximum timing)**

Time (s)	Ship	Coast station
0	Transmit a DSC call on the calling channel (§ 2.1.2).	
10	.....	Receive the call on the calling channel.  If “able to comply”, switch to the working frequencies (§ 2.2.1.2) after setting up the transmission chain in the HF case.
13	.....	Transmit a DSC acknowledgement (§ 2.2.1.1 or 2.2.2) on the calling channel.
20	.....	When tuned to the working frequencies, transmit an “engaged channel” signal (§ 2.2.1.2).
23	Receive the DSC acknowledgement on the calling channel.  a) If a DSC acknowledgement “able to comply” was received, switch to the working frequencies (§ 2.2.1.3).  b) If a DSC acknowledgement “unable to comply” was received, initiate an appropriate new call if required (§ 2.2.3). Go to time 0.	
25	If no DSC acknowledgement was received then transmit a new call (§ 2.1.3). Go to time 0.	
28	If a DSC acknowledgement “able to comply” was received, transmit a DSC call on the working channel (§ 2.3.1).	
38	.....	Receive the DSC call on the working channel and then measure channel quality (§ 2.3.1).
43	.....	If the channel quality is satisfactory then transmit the acknowledgement in § 2.3.2.1. If the channel quality is not satisfactory then transmit the acknowledgement in § 2.3.2.3.
53	Receive an acknowledgement. If unable to comply, clear the call (§ 2.3.5). If no acknowledgement is received, clear the call (§ 2.3.5).	If no DSC call is received remove “engaged channel” signal (§ 2.3.3).



**Timing diagram of call set-up sequences  
when the coast station initiates the call  
(Maximum timing)**

Time (s)	Coast station	Ship
0	Transmit a DSC call on the calling channel (§ 3.1.5) and an engaged signal on the reserved working channel (§ 3.1.3).	
10	.....	Receive the call. If a DSC scanning receiver is used, start scanning after completion of decoding of the call (§ 3.2.1).
15	.....	Transmit a DSC acknowledgement on the calling channel (§ 3.2.2 or 3.2.3).
25	Receive a DSC acknowledgement on the calling channel.  If an error-free acknowledgement “able to comply” was received, wait to receive a DSC call on the working channel (§ 3.3.3).  If an error-free acknowledgement “unable to comply” was received, remove the engaged signal, and terminate the calling process (§ 3.2.4).  If an error-free acknowledgement was not received then transmit a new call (§ 3.1.6). Go to time 0.	
75	.....	If “able to comply” is received tune to the working channel (§ 3.3.1).  Transmit a DSC call on the working channel (§ 3.3.2).
85	Receive the DSC call on the working channel.  If error-free, measure the channel quality (§ 3.3.4). If the quality is satisfactory, connect the subscriber to the radio path (§ 3.3.5).	
90	If the quality is not satisfactory, but another working channel in the same band is available, transmit an acknowledgement indicating the new working channel (§ 3.3.6).  If the quality is not satisfactory or the received call is not error-free (§ 3.3.7, 3.3.9).  a) If no other working channel is available in the same band, transmit an acknowledgement “unable to use proposed channel”, remove the engaged signal and terminate the calling process.  b) If a working channel is available in another band, transmit a new call and go to time 0.	
100	.....	Receive the acknowledgement (§ 3.3.11).

NOTE 1 – Timing diagrams assume the following:

- 10 s between DSC call initiation and reception of the complete DSC call (maximum duration of a DSC call will be 8.2 s);
- maximum timing between calls and acknowledgements;
- 5 s is the maximum time required for the *ship* to change from the DSC channel to a working channel in the same band;
- 10 s is the maximum time required for the *coast station* to change from the DSC channel to a working channel in the same band;
- the coast station does not offer an alternative working frequency.

## APPENDIX 2

## TO ANNEX 1

**Factors which differ between MF/HF and VHF**

1 For an automatic system based on DSC the main factors which differ between MF/HF and VHF are as follows:

1.1 The modulation rate of DSC on MF/HF is 100 Bd compared to 1 200 Bd on VHF. This results in the duration of a single DSC VHF automatic call taking a maximum of 0.633 s (assuming an 18 digit telephone number) whereas an equivalent call on MF/HF would take 8.2 s (assuming a 20-bit dot pattern and two elements in the channel/frequency message).

1.2 The probability of a single DSC transmission on MF/HF being received error-free by a particular receiving station will, in general, be lower than at VHF (typically 60% on HF; 95% on MF (day); 100% on VHF as given in Report ITU-R M.501).

1.3 The class of emission on MF/HF radiotelephony working channels is J3E (suppressed carrier) whereas on VHF it is F3E/G3E (i.e. a carrier is present even when the transmitter is not being modulated).

1.4 A DSC call on an MF or HF frequency can, in general, be received at a greater distance than that over which a radiotelephony call can be received, due mainly to the narrower bandwidth of the DSC transmission, whereas on VHF the ranges of a DSC call and a radiotelephony call are substantially the same. Furthermore, the channel quality of MF and HF working channels is generally poorer than VHF channels.

2 These differences mean that for MF/HF operation some modifications are needed to the operational procedures described in Recommendation ITU-R M.689. The three main factors to be considered are: the suppressed carrier operation on MF/HF working channels; the possibility of receiving a DSC call at a distance over which a subsequent radiotelephony call could not be received; and the need to ensure that the working channel quality is adequate for the required communication.

3 It is also considered that the automatic DSC call repetition (in the event of an unsuccessful first call) which is included in Recommendation ITU-R M.689 does not provide any significant benefit due to the longer duration of an MF/HF DSC call. Hence repeats are only manually initiated.

4 Various methods of evaluating the working channel quality may be applicable. One method is to measure the signal-to-noise,  $S/N$ , ratio on the working channel and to compare this to the required working channel  $S/N$  ratio appropriate to the mode of communication required. Recommendation ITU-R F.339 gives typical RF  $S/N$  density ratios (dB/Hz) of various classes of emission and may be used to determine the appropriate working channel  $S/N$  ratios for the desired mode. For example, an F1B 100 Bd 300 Hz bandwidth telegraphy emission (which may be considered analogous to an MF/HF DSC emission) is stated as requiring an RF  $S/N$  density ratio of 43 or 52 dB/Hz (for stable or non-diversity fading conditions respectively), whereas a corresponding J3E telephony emission for a marginally commercial grade of service is stated as requiring 56 or 61 dB/Hz (for the same conditions as above).

5 The fact that quality (the DSC  $S/N$  ratio) is measured only in the ship-to-shore direction presupposes a symmetrical path.

Even allowing the following assumptions:

- identical transmission and reception antenna gain at the coast station;
- identical transmission and reception antenna gain at the ship station;
- identical receiver sensitivity at both stations,

the fact nevertheless remains that:

- transmission power is higher at the coast station;
- noise is higher on board the ship.

It may be that those two phenomena more or less cancel each other out.

However, measuring the DSC  $S/N$  ratio in both directions would involve:

- increased length of the procedures;
- greater cost of equipment on board each ship.

This explains why no such procedure has been adopted.

**6** While ship stations normally have only one radio set to cover the MF and HF frequency bands to provide the following successive functions:

- watching or calling;
- exchanging procedures;
- traffic handling,

the same does not apply to coast stations which usually have several equipments for these frequency bands.

There is no reason why the equipments at the coast station should not be specialized, some being reserved for the first two functions and all the others for traffic handling.

Omnidirectional antennas are used in HF for the first two functions but directional antennas can be used, by some coast stations, for the third.

The number of simultaneous telephone calls that can be made from the coast station is thus equal to the number of traffic equipments.

A permanent watch is kept on DSC frequencies and, when all the traffic equipments are in use, it is possible to answer a call and indicate temporary unavailability.

## ANNEX 2

### Technical characteristics

#### 1 Ship station

**1.1** The DSC equipment should meet the MF/HF technical characteristics detailed in Recommendation ITU-R M.493. This equipment need not necessarily provide all combinations of codes, e.g. it may be simplified DSC equipment (with no distress functions), but it must provide all the necessary formats for automatic/semi-automatic MF/HF DSC signalling.

**1.2** The MF/HF transceiver should be capable of operating on any of the MF/HF public correspondence working channels and on any MF/HF DSC calling channel listed in RR Article 60 (S52) which may be operated by the coast station(s) through which automatic operation is required. It should be capable of automatic channel selection under control of the DSC equipment and of changing frequency from a DSC channel to any other working frequency in the same band within 5 s.

**1.3** The equipment should be capable of operating in accordance with the operational procedures described in Annex 1.

## 2 Coast station

**2.1** The DSC equipment should meet the MF/HF technical characteristics detailed in Recommendation ITU-R M.493. The installation should be capable of receiving and transmitting all types of MF/HF DSC calls on a DSC calling channel.

**2.2** The MF/HF installation should be capable of operating on the coast station's designated public correspondence working channels and DSC calling channels.

**2.3** The coast station equipment should be capable of detecting the presence of a DSC call on a working channel and also the line subscriber's "off-hook" and "on-hook" conditions.

**2.4** The equipment should be capable of effecting automatic channel selection on instruction from the DSC equipment and changing to, or accessing, a working frequency in the same band in less than 10 s.

**2.5** The coast station should be capable of radiating an "engaged channel" signal on any of its working channels which should be dissimilar from any present line signalling tones.

**2.6** The equipment should be capable of operating in accordance with the operational procedures described in Annex 1.

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