REPORT ITU-R M.2009

DIRECT-DIAL TELEPHONE SYSTEMS FOR THE MARITIME MOBILE SERVICE

(1995)

General

Although the DSC system may be used to establish fully automatic systems in the directions ship-to-shore, shore-to-ship and ship-to-ship, there may be a need to establish systems which do not provide all the facilities specified for the DSC system.

Several administrations are operating MF, HF and VHF maritime mobile systems with automatic facilities for dialling-through to the public switched telephone network (PSTN).

The major characteristics of some systems are given in Annexes 1 and 2.

ANNEX 1

System 1

1 Introduction

1.1 The system uses data signalling to set up and clear down calls over the radio path on the same working channels as used for the telephone connection. (VHF according to Appendix 18 of the Radio Regulations, MF/HF according to Article 60 of the Radio Regulations.)

1.2 After a working channel has been manually selected, the system provides an automatic direct-dial ship-to-PSTN service and offers a limited shore-to-ship paging service which informs the ship that a PSTN user has requested a connection.

1.3 The interface between the radio path and the PSTN is normally a maritime coast station equipped with a suitable processor controlled interface which provides the necessary functions described in this Annex and which complies with the necessary interconnection requirements to the PSTN.

1.4 The system allows existing manual services and direct-dial services to use the same working channel.

1.5 The ship terminal may be a single and separate unit which connects directly into the microphone input of the ship's existing MF, HF or VHF transceiver.

1.6 Identification that a working channel is free, is performed either by manual listening or automatically if the ship equipment is tuned to a particular working channel.

1.7 Up to 99 five-digit passwords or personal identification numbers (PIN) can be associated with each ship terminal to enable separate billing records to be produced for different users using the same terminal.

1.8 To prevent connections being set up over a radio path which is too poor to support a telephone conversation, the coast station may measure the signal-to-noise ratio of the initial data call and reject the conversation request if the signal-to-noise ratio is below a predetermined level.

1.9 To provide security against unwanted interception of calls, an optional scrambling facility may be included.

2 Technical characteristics

2.1 Data transmission parameters

- modulation : FSK
- mode of operation : full duplex
- data link protocol : asynchronous CCITT V.21
- data rate : 300 bit/s
- start bit : 1
- data bits : 8 bits
- parity : even
- stop bit : 1

- coast station modulation frequency:	mark	(1)	980 Hz
	space	(0)	1 180 Hz
- ship station modulation frequency :	mark	(1)	1 650 Hz
	space	(0)	1 850 Hz

- frequency tolerance: ±1 Hz

2.2 Structure of data messages

Data messages have the following format and contain ASCII characters (although those in the message field are transmitted in a compressed form - see § 2.4 below):

HEADER	MESSAGE FIELD	END OF MESSAGE

2.2.1 Header

This consists of the ASCII STX (decimal 02) character.

2.2.2 Message field

This consists of the following three parts:

- a nine-digit "ship number" (preferably the Maritime Mobile Service Identity - MMSI) which identifies the ship terminal from which the message is transmitted or to which the message is addressed;
- a one-digit "message type";
- a variable length data field which, for some messages, has a length of zero.

2.2.3 End of message

This consists of a two-character parity check followed by a carriage return character (see § 2.5 below).

2.3 Content of message field

Apart from the ship number part of the message field, the contents of the various message fields are described below.

2.3.1 Ship-to-shore messages

The following message types may be sent in the ship-to-shore direction (see also Fig. 1):

Value of the type field	Meaning	No. of data digits
1	call request	5+9+16
2	call continuity/scrambler on	0
3	call continuity/scrambler off	0
4	call termination	0
5	special service call request	2
8	reply to shore-to-ship call	0

A detailed description of the purpose and content of the above messages is given below:

2.3.1.1 Ship message type 1 (call request)

This message is sent by the ship to request a telephone connection. The data field contains the password/PIN number (five digits), coast station identification (nine digits - see 3.2.1.1) and telephone number (16 digits padded by blanks where the telephone number is less than 16 digits). The coast station will respond with an acknowledgement message (coast station message type 1). Note that if the call request telephone number is 22 the coast station sends back details of queued shore-to-ship calls (coast station message type 7).

2.3.1.2 Ship message type 2 (call continuity/scrambler on)

This message is sent by the ship to activate the scrambler facility and also, during scrambled calls, every 128 s to indicate that the call is continuing. This guards against the coast station maintaining a radio channel which the ship had cleared, in the event that the ship's call termination message was not received. If three call continuity messages are not received by the coast station it will terminate the call. The coast station does not send a response message (but will activate its own scrambler).

2.3.1.3 Ship message type 3 (call continuity/scrambler off)

This message is sent by the ship to deactivate the scrambler facility and also, during non-scrambled calls, every 128 s to indicate that the call is continuing. The coast station does not send a response message (but will deactivate its own scrambler if it was previously activated).

2.3.1.4 Ship message type 4 (request call termination)

This message is sent by the ship to terminate the call.

2.3.1.5 Ship message type 5 (special service call request)

This message is sent by the ship, after a call has been accepted by the coast station, to request a special service (e.g. data or facsimile). The data field contains a two-digit service code (01 for data, 02 for facsimile or 00 to return to speech). On receipt of this message, the coast station disables the call continuity function (see § 2.3.1.2 and 2.3.1.3), switches in any additional subsystems if needed and logs the request for billing purposes.

2.3.1.6 Ship message type 8 (reply to shore-to-ship call)

This message is sent by the ship to confirm reception of a shore-to-ship call (coast station message type 7 - see § 2.3.2.7 below).

2.3.2 Coast station messages

The following message types may be sent in the shore-to-ship direction (see also Fig. 2):

Value of the type field	Meaning	No. of data digits
1	acknowledgement (ack)	0
2	engaged	0
3	call accepted	0
4	call not accepted	2
5	call termination	2+6
6	channel free	0
7	shore-to-ship call	see § 2.3.2.7
8	telephone line status	2

A detailed description of the purpose and content of the above messages is given below:

2.3.2.1 Coast station message type 1 (ack)

This message is sent by the coast station to indicate correct reception of a call request message (ship message type 1) or a call termination (ship message type 4), i.e. parity check correct.

2.3.2.2 Coast station message type 2 (engaged)

This message is sent by the coast station to indicate that the automatic system is unavailable. This message, where possible, is transmitted to all ships (using ship number 000000000).

2.3.2.3 Coast station message type 3 (call accepted)

This message is sent by the coast station following its transmission of an ack (coast station message type 1) to indicate that the ship's call request is acceptable.

2.3.2.4 Coast station message type 4 (call not accepted)

This message is sent by the coast station following its transmission of an ack (coast station message type 1) to indicate that the ship's call request is not acceptable. The data field contains two digits giving the reason (e.g. 00 = ship number not registered, 01 = password (PIN) error, 02 = stop list, 04 = *S/N* ratio too low).

2.3.2.5 Coast station message type 5 (call termination)

This message is sent by the coast station to indicate the reason for termination and the duration of the call. The data field contains two digits giving the reason for termination (e.g. 00 = ship or PSTN user terminated, 01 = telephone line fault, 02 = call continuity message not received, 03 = manual call terminated by operator, 04 = time out, 05 = ship protocol error, 06 = coast station host computer error) and six characters giving the call duration (hours, minutes and seconds in the format hmm:ss, e.g. 1 hour, 20 minutes, 30 seconds is coded in ASCII as 120:30).

2.3.2.6 Coast station message type 6 (channel free)

This message is sent by the coast station to all ships (using ship number 000000000) when the channel becomes free (e.g. after an existing direct-dial or manual call has terminated or after the coast station system has been restored to service following maintenance). This enables ships monitoring a channel to determine automatically when it is free.

2.3.2.7 Coast station message type 7 (shore-to-ship call)

This message is sent by the coast station to indicate that the coast station has received a call from a PSTN user for the ship or in reply to a request from the ship (ship message type 1 with telephone number 22 - see § 2.3.1.1 above). The data field contains a "call digit" (1) followed by the "call data" digits {coast station identification (nine digits), user code (two digits identifying which of up to 99 users the call is for), personal code (one digit - see Note 1), telephone

number (16 digits), day month hour minutes (eight digits), blank (one digit)}. In the event that no calls are stored for the ship (in reply to ship message type 1), the data field contains two digits - "no call" (0) followed by blank.

NOTE 1 - Code that can be used to give additional information to the ship user. The meaning of the values of this personal code are to be decided between the ship user and the PSTN subscriber.

2.3.2.8 Coast station message type 8 (telephone line status)

This message is sent by the coast station when the coast station has finished dialling the requested PSTN user. The data field contains two digits (02) indicating "end of dialling".

2.4 Message field compression

2.4.1 In order to reduce the amount of data transmitted, the message field is compressed as described below.

2.4.2 For numeric characters in the message field and for the colon (:) character, the most significant four bits of each eight-bit character are removed and the value of the resulting four-bit nibble is increased by one to avoid the creation of code 02 (which is the message header character). In the case of a blank (ASCII space character), a unique four-bit code is used. The values of the compressed characters are given in Table 1.

TABLE 1

Character compression

ASCII character	8-bit binary	Least significant 4-bit nibble	Compressed character
0	00110000	0000	0001
1	00110001	0001	0010
2	00110010	0010	0011
3	00110011	0011	0100
4	00110100	0100	0101
5	00110101	0101	0110
6	00110110	0110	0111
7	00110111	0111	1000
8	00111000	1000	1001
9	00111001	1001	1010
:	00111010	1010	1011
space	00100000	n/a	1100
STX (header)	00000010	not compressed	

2.4.3 Each successive pair of four-bit nibbles is combined to form half the number of eight-bit bytes compared to the uncompressed message field (noting that all message fields have an even number of characters). It should be noted, that considering a group of compressed bytes representing the information to be transmitted, the most significant byte of the group is transmitted first but that within each byte the least significant bit is transmitted first. As an example, for a ship message type 4, with a ship number of 123456789, the compressed message field would contain five bytes, as illustrated in Table 2.

TABLE 2

Example of compressed character transmission

Uncompressed ASCII characters	1 2	3 4	5 6	7 8	9 4
Compressed coded bytes	00100011	01000101	01100111	10001001	10100101
Transmitted bit sequence	11000100	10100010	11100110	10010001	10100101

0 time →

2.5 Parity check characters

2.5.1 The two parity check characters followed by a carriage return character (ASCII decimal 13) are the last characters transmitted. The parity check characters which check the message field for the presence of errors are formed as follows:

2.5.1.1 An eight-bit byte is formed by making each of its eight bits equal to the exclusive-or of the corresponding bits of all of the compressed message field characters (equivalent to the least significant bit of the modulo-2 sums - i.e. even vertical parity). For example, bit 3 equals the exclusive-or of bit 3 of all of the characters in the compressed message field.

2.5.1.2 The decimal equivalent of the resulting eight-bit byte can be represented as a four-digit number in the range 0000 to 0255. This four-digit number is then compressed to two bytes using the algorithm described in § 2.4 and Table 1.

E.g.:

XOR result:	11010010
Decimal value:	0210
Parity check in binary:	0001 0011 0010 0001
First byte transmitted:	00010011
	↑1st bit transmitted

FIGURE 1 - SHIP MESSAGES - CODING OF MESSAGE FIELD

	Message field					
			Data field			
Message type and meaning	Ship number	Message type	Password /PIN	Coast station identification	Telephone number	Service code
1 (call request)	9 digits	1	5 digits	9 digits	16 digits (Note *)	----
2 (call continuity/scrambler on)	9 digits	2	----	----	----	----
3 (call continuity/scrambler off)	9 digits	3	----	----	----	----
4 (call termination)	9 digits	4	----	----	---	----
5 (special service call request)	9 digits	5	----	----	----	00, 01 or 02
8 (reply to shore-to-ship call)	9 digits	8	----	----	----	----

* Note: or telephone number 22 (see §2.3.1.1)

FIGURE 2 - COAST STATION MESSAGES - CODING OF MESSAGE FIELD

	Message field										
			Data field								
Message type and meaning	Ship number	Message type	Various (see below)	Call digit	Coast station identification	User code	Personal code	Telephone number	Day month hour min.	Blank	Duration
1 (acknowledgement)	9 digits	1	----	---	---	---	---	----	---	---	----
2 (engaged)	000000000	2	----	---	----	---	---	---	---	---	----
3 (call accepted)	9 digits	3	----	--	----	---	---	----	---	---	----
4 (call not accepted)	9 digits	4	reason 00,01,02,04	--	----	---	---	----	---	--	----
5 (call termination)	9 digits	5	reason 00,01,02,03, 04,05 or 06	-	----	---	---	----	---	---	6 characters (see §2.3.2.5)
6 (channel free)	000000000	6	----	---	----	---	---	----	---	---	----
7 (shore-to-ship call) "call"	9 digits	7	----	1	9 digits	2 digits	1 digit	16 digits	8 digits	spaceØ	----
or "no call"	9 digits	7	----	0	----	---	----	----	----	spaceØ	----
8 (telephone line status)	9 digits	8	end of dial 02	---	----	---	---	----	----	---	----

Ø Note: space = ASCII decimal 32 character

3 Operational procedures

3.1 Introduction

These procedures are based on the use of special messages from the ship station and the coast station, which are described in § 2.

Appendices 1, 2, 3 and 4 indicate the timing of the various calling sequences.

3.2 Operational procedures in the ship-to-shore direction

3.2.1 Ship station initiates call

3.2.1.1 The user aboard the ship (hereafter referred to as the user) composes the calling sequence on his terminal as follows:

- enters his five-digit PIN;
- (the ship number is entered automatically);
- Note 1 - The user may insert the nine-digit address of the coast station equipment if required. However, unless the working channels are shared by coast stations in the same area, this nine-digit address is not needed and a default value of nine zeros is automatically included;
- inserts the required subscriber number (e.g. telephone number).

3.2.1.2 The user selects the appropriate VHF, MF or HF working channel and transmits the calling sequence (ship message type 1) after checking as far as possible that there are no calls in progress on that frequency (determined either by manual listening or by ship terminal automatically detecting the coast station's channel-free message).

3.2.1.3 If the ship station does not receive an error-free acknowledgement (coast station message type 1) from the coast station within 20 s, the user should, either repeat the transmission of the call on the same working channel or initiate a call on another working channel.

3.2.2 Coast station acknowledgement

3.2.2.1 If, on receipt of an error-free message, the coast station can comply immediately with the call request, including measurements that the *S/N* is acceptable, then it should, within 20 s of receiving it, transmit an acknowledgement (coast station message type 1) and within a further 10 s the call accepted message (coast station message type 3).

3.2.2.2 If the coast station cannot comply, it transmits instead of coast station message type 3, coast station message type 4, giving the reason as described in § 2.3.2.4.

3.2.3 Call connection

3.2.3.1 After transmitting the call accepted message (see § 3.2.2.1) the coast station dials the required telephone number and then transmits coast station message type 8 to the ship or, if no telephone line is available within 180 s, it clears the connection by transmitting coast station message type 5 (with data field = 01) - see also § 3.2.4.2.

3.2.3.2 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" conditions detected.

3.2.3.3 If the called subscriber does not answer 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, after 1 min, clear the circuit by disconnecting the line and radio circuits. If a further call is required, the user should initiate a new call.

3.2.3.4 When a call is in progress, the ship terminal sends a call continuity signal (ship message type 2 or 3) every 128 s. If three consecutive messages are not received, the coast station sends a call termination message (coast station message type 5) and disconnects the radio circuit and line.

3.2.3.5 When a call is in progress, and if scrambling facilities are provided, the user can activate at any stage of the conversation the scrambling function by sending ship message type 2. To deactivate the scrambling function the ship sends ship message type 3 to the coast station.

3.2.3.6 When a call is in progress, special services such as facsimile or data transmission can be selected by sending ship message type 5 to the coast station.

NOTE 1 - The ship terminal should incorporate the capability of being connected to a facsimile machine or, for data transmission, a modem.

NOTE 2 - For facsimile and data transmission the ship terminal must be connected to a full duplex radio set.

3.2.4 Call completion

3.2.4.1 When the ship station wishes to terminate the call connection to the subscriber (or to terminate a requested call connection), it transmits a call termination message (ship message type 4).

3.2.4.2 On receipt of that message, if it contains the same ship number as that of the calling ship, the land-line is disconnected, the call timing is stopped and the coast station transmits, within 5 s of receipt, an acknowledgement (coast station message type 1). The chargeable duration of the call (expressed in hours, minutes, seconds) is transmitted within 5 s by the message call termination (coast station message type 5). It will be followed by the channel-free message (coast station message type 6).

3.2.4.3 If the ship station does not receive within 5 s an acknowledgement (coast station message type 1) then it should repeat the message call termination twice (with a 5 s interval) and consider the call to be complete.

3.2.4.4 If the coast station does not receive the request of call termination as described in § 3.2.4.1 then the call will be considered to be complete when the on-hook condition is detected from the PSTN (or if three consecutive call continuity messages (ship message type 2 or 3)) are not 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 a call termination message (coast station message type 5) and a channel-free message (coast station message type 6).

The radio channel is now free to handle other traffic.

3.3 Operational procedures in the shore-to-ship direction (paging)

3.3.1 A land subscriber calls the coast station on the PSTN and using the dial tones keyed from the telephone set, enters all the data relevant to:

- the telephone number to be called (maximum 16 digits);
- the ship number (nine digits);
- the user code (two digits);
- the personal code (one digit).

The coast station will store the message and send coast station message type 7 to the ship as soon as the working channel on which the ship last made contact is free.

In case of no answer or where no working channel information is available, the message is stored in the ship's mailbox at the coast station.

3.3.2 On receipt of the shore-to-ship paging call, the ship terminal will transmit a reply to the shore-to-ship call (ship message type 8).

3.3.3 The mailbox can be accessed only by the user for which the call is intended. To access the mail box the user selects short code 22 (instead of the telephone number) and sends a call request (ship message type 1) to the coast station.

3.3.4 The coast station responds with an acknowledgement (coast station message type 1) followed, within 10 s, by coast station message type 7 giving details of the first mailbox message.

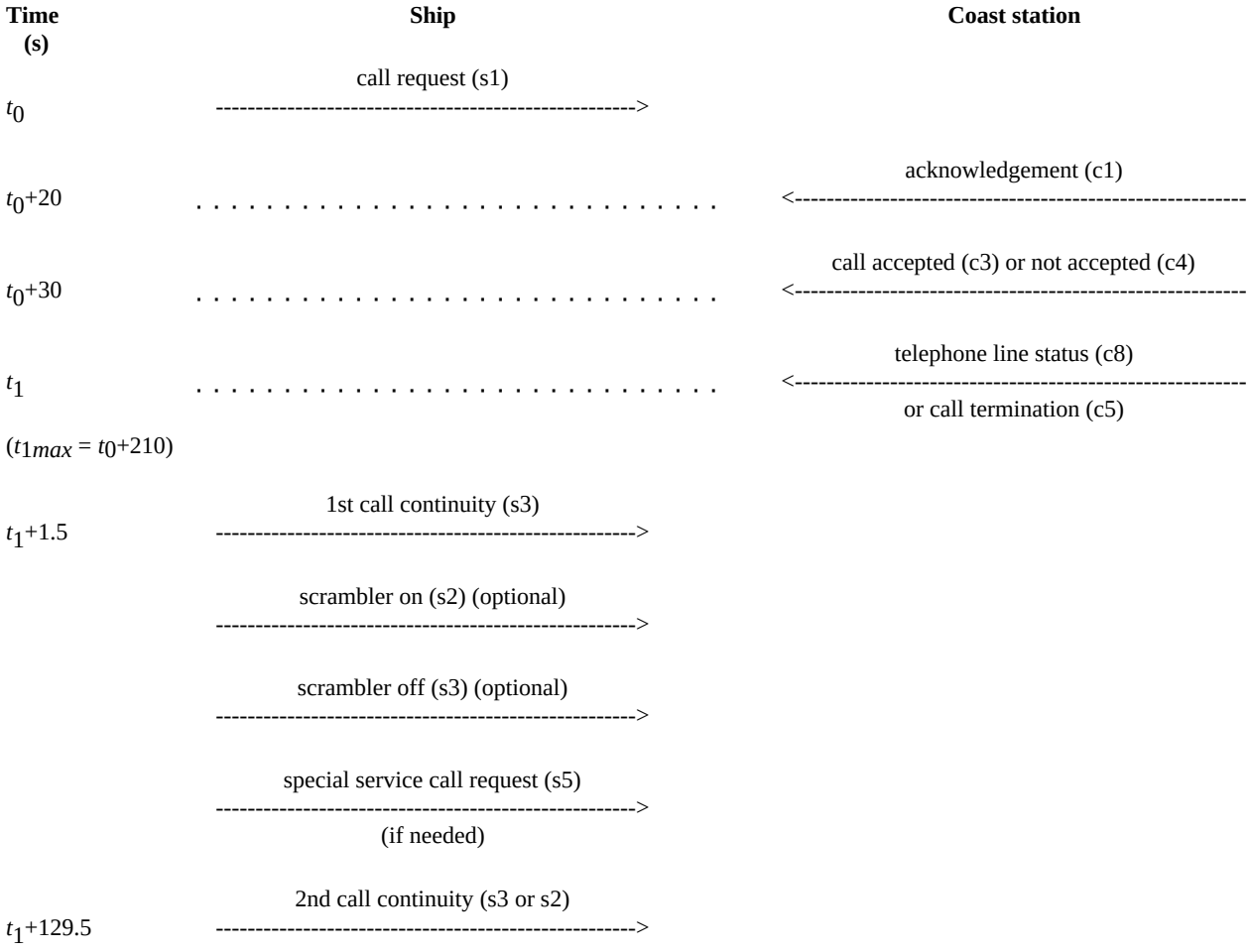
3.3.5 The ship then, within 20 s, acknowledges this call with ship message type 8.

3.3.6 If the coast station has further messages in the mailbox for that ship, the steps described in § 3.3.4 and 3.3.5 are automatically repeated until the mailbox is empty. The last coast station message type 7 contains the data field "no call".

APPENDIX 1

(to Annex 1)

Ship-to-coast station connection
(See § 3.2.1, 3.2.2 and 3.2.3)
(maximum timing)



APPENDIX 2

(to Annex 1)

Call termination sequence
(See § 3.2.4)
(maximum timing)

Time (s)	Ship	Coast station
t_0	call termination (s4) ---------->	
t_0+5	repeated call termination (s4) ----------> (if acknowledgement c1 not received)	
t_0+10	repeated call termination (s4) ----------> (if acknowledgement c1 not received)	
t_1 ($t_1 = t_0$+5, t_0+10 or t_0+15)	. . . . .	acknowledgement (c1) <----------
t_1+5	. . . . .	call termination (c5) <----------
t_1+7	. . . . .	channel free (c6) <---------- (to all ships)

APPENDIX 3

(to Annex 1)

Shore-to-ship paging call
(See § 3.3.1 - 3.3.2)
(maximum timing)

Time (s)	Ship	Coast station
t_0	. . . . .	shore-to-ship call (c7) <----------
t_0+20	reply to shore-to-ship call (s8) ---------->	
t_0+22	. . . . .	channel free (c6) <---------- (to all ships)

APPENDIX 4

(to Annex 1)

Ship accesses coast station mail box
(See § 3.3.3 - 3.3.6)
(maximum timing)

Time (s)	Ship	Coast station
t_0	call request (s1) ----------> (with telephone number = 22)	
t_0+20	. . . . .	acknowledgement (c1) <----------
t_0+30	. . . . .	shore-to-ship call (c7) <----------
t_0+50	reply to shore-to-ship call (s8) ---------->	
t_0+55	. . . . .	shore-to-ship call (c7) <---------- (if further messages in mailbox)
t_0+75	reply to shore-to-ship call (s8) ---------->	
	. . . . .	shore-to-ship call (c7) <---------- (if further messages in mailbox)
•		
•		
•		
•		
t_1	reply to shore-to-ship call (s8) ---------->	
t_1+5	. . . . .	shore-to-ship call (c7) <---------- (mailbox empty, data field = no call)
t_1+7	. . . . .	channel free (c6) <---------- (to all ships)

ANNEX 2

System 2

1 Introduction

The system makes use of VHF channels as specified in Appendix 18 to the Radio Regulations (RR) and may also use other channels in the band 156-174 MHz.

On channels specified in RR Appendix 18, the system provides semi-automatic operation in the ship-to-shore direction, and on the other channels in the band 156-174 MHz the system provides fully automatic operation in the ship-to-shore and shore-to-ship directions.

2 General

2.1 In its modulation, the system uses calling and signalling audio-frequencies as indicated in Table 3.

2.2. It has two operating modes, referred to below as Mode I and Mode II. The difference between Mode I and Mode II is that for shore-to-ship operation in Mode I, calling channels become working channels; in Mode II, in any case, a calling channel stays a calling channel.

2.3 The combinations between offered services and used channels are indicated in Table 4.

3 Characteristics of general purpose equipment

3.1 Definitions and uses of the different types of channels in Mode I

3.1.1 For shore-to-ship operation, working channels and calling channels are the same.

3.1.1.1 When there is no traffic, the coast station continuously transmits the frequency F_A (2 247 Hz) on calling channels outside RR Appendix 18. Also calling channels carry the requested ship station identifier.

3.1.1.2 Ship stations remain tuned to the same calling channel as long as they are receiving the frequency F_A. The loss of a calling channel is indicated by the disappearance of calling channel traffic for six seconds or by conversion into a working channel. In this case, ship station searches twice for a new calling channel in the band outside RR Appendix 18.

3.1.2 For ship-to-shore operation, the free traffic channels of the band outside RR Appendix 18 are marked by the coast station with the frequency F_L with the transmitter on reduced power. To search for a free traffic channel, the ship station carries out two sweeps of available frequencies until it finds a free traffic channel. If it fails to find a free traffic channel, the procedure is abandoned and the ship station returns to the calling channel on which it last received its ship station identifier.

3.1.3 For ship-to-shore operation on channels in RR Appendix 18, the ship station tunes to a free channel, e.g. by manual means.

3.2 Definitions and use of the different types of channels in Mode II

3.2.1 For ship-to-shore and shore-to-ship operations, working and calling channels are different.

3.2.2 When there is no traffic, the coast station continuously transmits the frequency F_A (2 400 Hz) on calling channels outside RR Appendix 18. Also, calling channels carry the requested ship station identifier and network supervision data. The transmission of network supervision data is repeated at intervals varying between 1 min to 240 min.

3.2.3 There is only one shore-to-ship calling channel per coast station which can never serve as a traffic channel. Ship stations remain tuned to the same calling channel as long as they are receiving either network supervision data or

marked frequency (F_A). Loss of a calling channel is indicated by the disappearance of calling channel traffic for 6 s. The search for a new calling channel will be based in decreasing order of priority on the following data:

- list of calling channels of neighbouring coast stations (see § 3.3.2.3). In most cases this will entail a search time of the order of 2 s;
- channel number of the lost calling channel.

The algorithm will run until a calling channel is detected. The ship station will tune into each channel for 600 ms until the frequency F_A (2 400 Hz) is detected.

3.2.4 The free traffic channels outside RR Appendix 18 are marked with the frequency F_L with the transmitter on reduced power. There are two possible types of searches:

3.2.4.1 The ship station carries out two sweeps of available frequencies until it finds a free traffic channel. If it fails to find a free traffic channel, the procedure is abandoned and the ship station retunes to the calling channel on which it last received its ship station identifier.

3.2.4.2 If the ship station does not know the traffic channels of the coast station from which it received the call, it carries out exactly the same type of search as in § 3.1.2. If the ship station does know and has stored the coast station's traffic channels, it sweeps these channels three times. In the event of failure, two situations can arise:

If the ship station knows the neighbouring coast stations (and their channels):

In this case, the ship station sweeps the coast station channels once. If it does not find a free traffic channel, it carries out one sweep of the other channels which have not yet been programmed.

If the ship station does not know the neighbouring coast stations (and their channels):

In this case the ship station sweeps all channels once.

3.2.5 For ship-to-shore operation on the channels of RR Appendix 18, the ship station tunes to a free channel, e.g. by manual means.

3.3 Description of messages

3.3.1 Ship-to-shore messages

3.3.1.1 Channel seizure

A channel is taken by transmitting the frequency F_0 for 700 ms ± 20 ms.

3.3.1.2 Subscriber number

Each digit is represented by a frequency F_0 to F_9 lasting 100 ms. Frequencies are spaced at least 150 ms apart.

3.3.2 Shore-to-ship messages

3.3.2.1 Coast station identity (only in Mode II)

F_A	F_R	S_1	S_2	X	Y

- F_A: header
- F_R: repetition (see Table 3, Note 4)
- S_1, S_2: decimal coast station number {01 ... 24}, (24 is the maximum capacity of the system)
- X and Y: fields reserved for later use. These fields are each coded as 0 and must not be interpreted by ship stations.

The coast station identity, if processed in combination with the channel list, can be used by ship stations to store coast station and channel details. Each field is represented by a frequency lasting 100 ms.

3.3.2.2 List of coast station channels (only in Mode II)

F_A	F_B	X_1	X_2	Y_1	Y_2

- F_A: header, F_B: type of message

- X_1 and X_2: decimal channel number {01 ... 99},

- Y_1 and Y_2: decimal channel number {01 ... 99}.

The full composition of the coast station is transmitted through several messages of this type. A channel number 00 will be ignored by the ship station. Ship stations with no storage capacity ignore this type of message (see § 3.4). Each field is represented by a frequency lasting 100 ms.

3.3.2.3 List of neighbouring call channels (only in Mode II)

F_A	F_D	S_1	S_2	X_1	X_2

- F_A: header, F_D: type of message

- S_1, S_2: decimal coast station number {01 ... 24},

- X_1 and X_2: decimal channel number {01 ... 99}.

A channel number 00 will be ignored by the ship station. The list of neighbouring coast station calling channels is limited to four channels (four messages of this type). All ship stations should store these data. Each field is represented by a frequency lasting 100 ms.

3.3.2.4 Initial acknowledgement by coast station

A coast station will send its initial acknowledgement by transmitting F_{14} for 300 ms ± 10 ms.

3.3.3 Messages common to both ways (ship-to-shore and shore-to-ship)

3.3.3.1 Selective calling of stations

I_1	I_2	I_3	I_4	I_5	S

- I_1, I_2, I_3, I_4, I_5: selective call number of the called station. This number can easily be replaced by the nine-digit identities described in Recommendation ITU-R M.585.

- S: suffix indicating the initiator of the call request (0: request by ship station; 1: request by coast station). This suffix is used only in Mode II. Each field is represented by a frequency lasting 100 ms.

3.3.3.2 Call completion signal

F_{11}	I_1	I_2	I_3	I_4	I_5

- I_1, I_2, I_3, I_4, I_5: selective call number of the called station. This number may easily be replaced by the nine-digit identities described in Recommendation ITU-R M.585 (this field is used only in Mode II).

- frequency F_{11} lasts 200 ms in Mode II and 450 ms in Mode I. The other fields are represented by a frequency lasting 100 ms.

TABLE 3 –Audio frequencies used

Frequency (Hz)	Name	Digit or use
1 981	F_0	(See Note 3)
1 124	F_1	1
1 197	F_2	2
1 275	F_3	3
1 358	F_4	4
1 446	F_5	5
1 540	F_6	6
1 640	F_7	7
1 747	F_8	8
1 860	F_9	9
2 110	F_{11}, F_R	Repeat/release (M↔F) (see Note 4)
2 247	F_A Mode I	Call channel (F→M)
2 548	F_{14}	Call sign request (F→M)
2 400	F_A Mode II	Call channel (F→M)
770	F_L	Channel free (F→M)
930	F_B	List of coast station channels in Mode II (F→M)
991	F_D	List of neighbouring call channels in Mode II (F→M)

NOTE 1 - M: Mobile, i.e. ship station

F: Fixed, i.e. coast station

M→F: Mobile-to-fixed

F→M: Fixed-to-mobile

NOTE 2 - Frequencies F_0 to F_9 and F_{11} are frequencies defined in Recommendation ITU-R M.257.

NOTE 3 - F_0 can have four meanings depending on its duration:

- acknowledgement for a call in a calling channel by a ship station;
- channel seizure by a ship station;
- figure for ship and coast stations;
- ship station hook off.

These durations are described in Tables 5 and 6.

NOTE 4 - Repetition frequency ($F_R = F_{11}$ = 2 110 Hz) is used in the case of the transmission of two equal frequencies. The difference between F_R and F_{11} is made by the duration of signal (see Tables 5 and 6).

TABLE 4

Interaction between services and type of channels

Channels / Services	Channels of RR Appendix 18	Channels outside of RR Appendix 18
Manual	Mode I Mode II	Mode I Mode II
Semi-automatic	Mode I Mode II	Mode I Mode II
Automatic	-	Mode I Mode II

TABLE 5

Durations of each frequency in coast station

Frequency	Duration	Purpose
F_{11}	200 ms in Mode II 450 ms in Mode I	Release
F_R	100 ms	Repeat
F_0 to F_9	100 ms	Figures
F_A	100 ms	Calling channel
F_B	100 ms	List of coast stations
F_D	100 ms	List of neighbouring calling channels
F_{14}	300 ms	Call sign request

TABLE 6

Durations of each frequency in ship station

Frequency	Duration	Purpose
F_0	100 ms	Acknowledgement
F_0	700 ms	Channel seizure
F_0 to F_9	100 ms	Figures
F_0	400 ms	Hook off
F_{11}	200 ms in Mode II 450 ms in Mode I	Release

3.4 Class of equipment

When operating in Mode II, ship stations are divided into two classes of equipment:

- *Class A*: ship stations with storage capacity for all data transmitted by the coast station concerning coast station and channel details. Storage capacity must be at least 32 channels per coast station.
- *Class B*: ship stations with a limited storage capacity. These ship stations store only the list of neighbouring calling channels.

Regardless of equipment class, ship stations have to be able to store the last calling channel found.

4 Operating procedures

4.1 Introduction

Appendix 1 describes the timing diagram of ship-to-shore call set-up sequences.

Appendix 2 describes the timing diagram of shore-to-ship call set-up sequences.

Appendix 3 describes the call completion timing diagram.

4.2 Ship-to-shore operating procedures

4.2.1 Ship station call request

4.2.1.1 The ship-to-shore call setup procedure is described in Appendix 1.

4.2.1.2 The ship-board user (hereafter referred to as the user) needs only to dial the number of the called subscriber (i.e. his telephone number), then to validate it by pressing a key. His identification number is entered automatically. The appropriate traffic channel is also selected automatically, but if the user wishes, he may select it manually by listening. In automatic mode, by pressing on the call key, the user transfers the ship station to sweep mode (see § 3.1.2 for Mode I and § 3.2.4 for Mode II).

4.2.1.3 The ship station transmits an unmodulated carrier for 450 ms ± 150 ms, which is then modulated by the frequency F_0 for 700 ms ± 20 ms.

4.2.2 Coast station acknowledgement

4.2.2.1 On receipt of F_0, the coast station switches its power to maximum. After a minimum of 200 ms, it is modulated by the frequency F_{14} for 300 ms ± 10 ms.

4.2.2.2 On receipt of F_{14}, the ship station sends its identifier (see § 3.3.3.1) followed by the suffix 0 (in the case of Mode II). In Mode I, this identifier is transmitted twice with a spacing of 900 ms.

4.2.2.3 After transmitting F_0, the ship station waits for the frequency F_{14} for at least 1 s and not more than 2 s. If the ship station has not received this first acknowledgement, it abandons the procedure on this channel and searches for another free traffic channel.

4.2.3 Call connection

4.2.3.1 In Mode I, as soon as the ship station's second identifier has been received, the coast station connects the radio path to line. The ship station can begin to dial 1 s ± 250 ms after the invitation to dial tone has been received.

If the coast station has not received the dialling information from the ship station within 20 s of the end of the ship station second identifier, it frees the channel.

4.2.3.2 In Mode II, as soon as the ship station's identifier has been received, the coast station connects the radio path to line and then transmits the received ship station identifier.

The ship station can begin to dial 4 s ± 1 s after the end of the ship station identifier transmission.

If the coast station has not received the dialling information from the ship station within 20 s of the end of the transmission of the ship station identifier, it frees the channel.

If the ship station does not receive its own identifier within 500 ms of transmitting it, it resumes sweeping.

4.3 Shore-to-ship operating procedures

4.3.1 Shore station call request

4.3.1.1 The shore-to-ship procedure is described in the timing diagram in Appendix 2.

4.3.1.2 The identity of the called ship station (§ 3.3.3.1) is transmitted twice for Mode I and once for Mode II simultaneously on the calling channels of all stations.

4.3.2 Ship station acknowledgement

4.3.2.1 In Mode I, the ship station has 17 s to acknowledge. The calling channel then becomes a traffic channel. Other ship stations sweeping this channel will automatically search for a new calling channel. If after 40 s the called mobile station has not replied, the shore station frees the channel again, which once again becomes a calling channel.

4.3.2.2 In Mode II, within not more than 700 ms of the ship station's identifier recognition, the ship station has to complete the transmission of an acknowledgement on the calling channel.

This time period includes:

- transmitter transfer to carrier (limited to 400 ms in this case),
- transmission of F_0 frequency for 100 ms.

4.3.2.3 In Mode II, the ship station has not more than 25 s to search for a free traffic channel and set off a ship-to-shore acknowledgement call with an identifier suffix of 1. There are two possible alternatives:

- If the coast station acknowledgement is not received within 25 s, the ship station continues the search procedure for a free channel to repeat its call.
- If the coast station acknowledgement is received, the ship station bell will start ringing for not more than 40 s.

4.3.3 Call connection

4.3.3.1 At this step, the following operations are the same as for a ship-to-shore call.

4.3.3.2 For the coast station, receipt of the ship station acknowledgement sets off the transmission of the ringing tone to the caller. Until that moment, the caller was connected to the welcome message of the answering machine.

4.3.3.3 When the waiting period for the ship station answer expires, the calling subscriber is notified by means of a spoken message that the call has failed.

4.3.3.4 The off-hook signal is given once by transmitting the following sequence:

- transmission of unmodulated carrier for 500 ms,
- transmission of F_0 tone for 400 ms,
- cut-off of transmitter carrier for 100 ms.

4.4 Call completion

4.4.1 Call completion procedure is briefly described in Appendix 3.

4.4.2 In Mode I, the release message is transmitted only by the ship station. In Mode II, the release message may be transmitted either by the ship station or by the coast station, depending on which ends the call first. In either mode, the coast station frees the channel after detection of loss of carrier for 15 s.

4.4.3 In the ship-to-shore direction, the ship station can only transmit the release message after it has received the message acknowledging its identity.

4.4.4 The release message transmitted by a ship station must not interrupt the transmission of its identity (ship-to-shore) or the transmission of the off-hook signal (shore-to-ship).

4.4.5 In any event, when the call is completed, the ship station returns to the calling channel on which it was or continues searching for a calling channel, if necessary. If the channel is no longer marked by F_A, there are three possible alternatives in Mode II:

4.4.5.1 If the call took place on an "active" coast station channel:

the ship station (after 600 ms) sweeps the calling channels neighbouring to that coast station.

4.4.5.2 If the call took place on a channel of a neighbouring coast station, whose characteristics the ship station knows:

on the basis of the information pertaining to that coast station, the ship station sweeps the calling channels neighbouring to that coast station.

4.4.5.3 If the call took place on a "non-listed" channel (for which neither the base coast station nor the neighbouring calling channels are known):

with its stored information, the ship station sweeps the calling channels neighbouring to that coast station.

APPENDIX 1

(to Annex 2)

Mode I: Timing diagram of call set-up sequences when ship station initiates the call (maximum time)

Time(s)	Ship	Coast station
0	Start call (§ 4.2.1.2)	
0.6	Transmit F_0 (§ 4.2.1.3)	
2.6		Transmit F_{14} (§ 4.2.2.1)
4.6	1st ship identity (§ 4.2.2.2)	
5.5	2nd ship identity (§ 4.2.2.2)	
26	Called number (§ 4.2.3.1)	

Mode II: Timing diagram of call set-up sequences when ship station initiates the call (maximum time)

Time(s)	Ship	Coast Station
0	Start call (§ 4.2.1.2)	
0.6	Transmit F_0 (§ 4.2.1.3)	
2.6		Transmit F_{14} (§ 4.2.2.1)
3.1	Ship identity (§ 4.2.2.2)	
3.6		Ship identity (§ 4.2.3.2)
24	Called number (§ 4.2.3.2)	

APPENDIX 2

(to Annex 2)

Mode I: Timing diagram of call set-up sequences when coast station initiates the call (maximum time)

Time(s)	Ship	Coast station
0		Transmit ship identity twice on all calling channels (§ 4.3.1.2)
17	Transmit F_0 on calling channel (§ 4.3.2.1)	
19		Transmit F_{14} (§ 4.2.2.1)
21	1st ship identity (§ 4.2.2.2)	
21.9	2nd ship identity (§ 4.2.2.2)	
42	Ship station rings (§ 4.3.2.2)	

Mode II: Timing diagram of call set-up sequences when coast station initiates the call (maximum time)

Time(s)	Ship	Coast station
0		Transmit ship identity on all calling channels (§ 4.3.1.2)
0.7	Transmit F_0 on calling channel (§ 4.3.2.2) Search for free traffic channel (§ 4.3.2.3)	
25.7	Transmit F_0 on traffic channel (§ 4.2.1.3)	
27.7		Transmit F_{14} on traffic channel (§ 4.2.2.1)
28.2	Ship identity (§ 4.2.2.2)	
28.7		Ship identity (§ 4.2.3.2)
49	Ship station rings (§ 4.3.2.3)	

APPENDIX 3

(to Annex 2)

Modes I and II: Timing diagram of call completion by ship station (see § 4.4)

Time(s)	Ship	Coast station
0	Transmit message F_{11}	
1.2		Transmit F_1 on adjacent channels Carrier stopped on all types of channels

Mode II: Timing diagram of call completion by coast station (see § 4.4)

Time(s)	Ship	Coast station
0		Transmit F_{11} message with ship identity
1.2		Transmit F_1 on adjacent channels Carrier stopped on all types of channels

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