

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
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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

00010011 00110010 00010001

FIGURE 1 - SHIP MESSAGES - CODING OF MESSAGE FIELD

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

Ø Note: space = ASCII decimal 32 character