RECOMMENDATION ITU-R M.493-10*

DIGITAL SELECTIVE-CALLING SYSTEM FOR USE IN THE MARITIME MOBILE SERVICE

(Question ITU-R 9/8)

(1974-1978-1982-1986-1990-1992-1994-1995-1997-1997-2000)

The ITU Radiocommunication Assembly,

considering

a) that selective calling in the shore-to-ship, ship-to-ship and ship-to-shore directions would expedite the handling of traffic in the maritime mobile service;

b) that the International Maritime Organization (IMO) has listed a number of operational requirements that should be taken into account when designing a general purpose selective-calling system;

c) that Chapter IV of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, requires the use of digital selective-calling (DSC) for distress alerting and safety calling in the Global Maritime Distress and Safety System (GMDSS);

d) that neither the selective-calling system described in Recommendation ITU-R M.257, nor that forming part of the systems described in Recommendations ITU-R M.476 and ITU-R M.625, can fully meet the IMO recommended performance standards;

e) that several administrations have indicated an urgent need for a general purpose selective-calling system;

f) that several administrations have been developing different systems;

g) that the system should be applicable to the maritime mobile service, both for international and national needs;

h) that it is desirable that the selective-calling system fulfil the requirements of all types of vessels desiring to use it;

j) that Radio Regulations (RR) Appendix 43** adopted by the World Administrative Radio Conference for the Mobile Services (Geneva, 1983) (WARC Mob-83) has provided for the use of maritime mobile service identities by all administrations,

recommends

1 that where there is need for a general purpose DSC system, the system should be designed in accordance with the characteristics given in Annex 1;

2 that where there is need for simplified versions of DSC equipment, they should be designed in accordance with Annex 2;

3 that in a GMDSS coast radio station installation, sufficient separation should be provided between the DSC distress channel receiver antennas and any transmitting antennas within the installation. This is to avoid any de-sensitization of the DSC distress channel receivers if any transmitter is used at full power on any designated transmit frequency other than the DSC distress frequencies.

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* This Recommendation should be brought to the attention of the International Maritime Organization (IMO).

** *Note by the Secretariat* – See RR Article S19 and the Preface to List VIIA of the RR as revised by the World Radiocommunication Conference (Geneva, 1995) (WRC-95).

ANNEX 1

General purpose equipment characteristics

1 General

1.1 The system is a synchronous system using characters composed from a ten-bit error-detecting code as listed in Table 1.

1.1.1 The first seven bits of the ten-bit code of Table 1 are information bits. Bits 8, 9 and 10 indicate, in the form of a binary number, the number of B elements that occur in the seven information bits, a Y element being a binary number 1 and a B element a binary number 0. For example, a BYY sequence for bits 8, 9 and 10 indicates 3 ($0 \times 4 + 1 \times 2 + 1 \times 1$) B elements in the associated seven information bit sequence; and a YYB sequence indicates 6 ($1 \times 4 + 1 \times 2 + 0 \times 1$) B elements in the associated seven information bit sequence. The order of transmission for the information bits is least significant bit first but for the check bits it is most significant bit first.

1.2 Time diversity is provided in the call sequence as follows:

1.2.1 Apart from the phasing characters, each character is transmitted twice in a time-spread mode; the first transmission (DX) of a specific character is followed by the transmission of four other characters before the re-transmission (RX) of that specific character takes place, allowing for a time-diversity reception interval of:

1.2.1.1 400 ms for HF and MF channels, and

1.2.1.2 33 1/3 ms for VHF radio-telephone channels.

1.3 The classes of emission, frequency shifts and modulation rates are as follows:

1.3.1 F1B or J2B 170 Hz and 100 Bd for use on HF and MF channels. When frequency-shift keying is effected by applying audio signals to the input of single-sideband transmitters (J2B), the centre of the audio-frequency spectrum offered to the transmitter is 1 700 Hz.

1.3.2 Frequency modulation with a pre-emphasis of 6 dB/octave (phase modulation) with frequency-shift of the modulating sub-carrier for use on VHF channels:

– frequency-shift between 1 300 and 2 100 Hz; the sub-carrier being at 1 700 Hz;

– the frequency tolerance of the 1 300 and 2 100 Hz tones is ± 10 Hz;

– the modulation rate is 1 200 Bd;

– the index of modulation is 2.0 ± 10%.

1.3.3 The radio-frequency tolerances of new designs of both transmitters and receivers in the MF and HF bands should be:

– coast station: ± 10 Hz,

– ship station: ± 10 Hz,

– receiver bandwidth: should not exceed 300 Hz.

1.4 The higher frequency corresponds to the B-state and the lower frequency corresponds to the Y-state of the signal elements.

1.5 The information in the call is presented as a sequence of seven-bit combinations constituting a primary code.

1.5.1 The seven information bits of the primary code express a symbol number from 00 to 127, as shown in Table 1, and where:

1.5.1.1 the symbols from 00 to 99 are used to code two decimal figures according to Table 2;

TABLE 1

Ten-bit error-detecting code

Symbol No.	Emitted signal and bit position 1 2 3 4 5 6 7 8 9 10	Symbol No.	Emitted signal and bit position 1 2 3 4 5 6 7 8 9 10	Symbol No.	Emitted signal and bit position 1 2 3 4 5 6 7 8 9 10
00	BBBBBBBYYY	43	YYBYBYBBYY	86	BYYBYBYBYY
01	YBBBBBBYYB	44	BBYYBYBYBB	87	YYYBYBYBYB
02	BYBBBBBYYB	45	YBYYBYBBYY	88	BBBYYBYYBB
03	YYBBBBBYBY	46	BYYYBYBBYY	89	YBBYYBYBYY
04	BBYBBBBYYB	47	YYYYBYBBYB	90	BYBYYBYBYY
05	YBYBBBBYBY	48	BBBBYYBYBY	91	YYBYYBYBYB
06	BYYBBBBYBY	49	YBBBYYBYBB	92	BBYYYBYBYY
07	YYYBBBBYBB	50	BYBBYYBYBB	93	YBYYYBYBYB
08	BBBYBBBYYB	51	YYBBYYBBYY	94	BYYYYBYBYB
09	YBBYBBBYBY	52	BBYBYYBYBB	95	YYYYYBYBBY
10	BYBYBBBYBY	53	YBYBYYBBYY	96	BBBBBYYYBY
11	YYBYBBBYBB	54	BYYBYYBBYY	97	YBBBBYYYBB
12	BBYYBBBYBY	55	YYYBYYBBYB	98	BYBBBYYYBB
13	YBYYBBBYBB	56	BBBYYYBYBB	99	YYBBBYYBYY
14	BYYYBBBYBB	57	YBBYYYBBYY	100	BBYBBYYYBB
15	YYYYBBBBYY	58	BYBYYYBBYY	101	YBYBBYYBYY
16	BBBBYBBYYB	59	YYBYYYBBYB	102	BYYBBYYBYY
17	YBBBYBBYBY	60	BBYYYYBBYY	103	YYYBBYYBYB
18	BYBBYBBYBY	61	YBYYYYBBYB	104	BBBYBYYYBB
19	YYBBYBBYBB	62	BYYYYYBBYB	105	YBBYBYYBYY
20	BBYBYBBYBY	63	YYYYYYBBBY	106	BYBYBYYBYY
21	YBYBYBBYBB	64	BBBBBBYYYB	107	YYBYBYYBYB
22	BYYBYBBYBB	65	YBBBBBYYBY	108	BBYYBYYBYY
23	YYYBYBBBYY	66	BYBBBBYYBY	109	YBYYBYYBYB
24	BBBYYBBYBY	67	YYBBBBYYBB	110	BYYYBYYBYB
25	YBBYYBBYBB	68	BBYBBBYYBY	111	YYYYBYYBBY
26	BYBYYBBYBB	69	YBYBBBYYBB	112	BBBBYYYYBB
27	YYBYYBBBYY	70	BYYBBBYYBB	113	YBBBYYYBYY
28	BBYYYBBYBB	71	YYYBBBYBYY	114	BYBBYYYBYY
29	YBYYYBBBYY	72	BBBYBBYYBY	115	YYBBYYYBYB
30	BYYYYBBBYY	73	YBBYBBYYBB	116	BBYBYYYBYY
31	YYYYYBBBYB	74	BYBYBBYYBB	117	YBYBYYYBYB
32	BBBBBYBYYB	75	YYBYBBYBYY	118	BYYBYYYBYB
33	YBBBBYBYBY	76	BBYYBBYYBB	119	YYYBYYYBBY
34	BYBBBYBYBY	77	YBYYBBYBYY	120	BBBYYYYBYY
35	YYBBBYBYBB	78	BYYYBBYBYY	121	YBBYYYYBYB
36	BBYBBYBYBY	79	YYYYBBYBYB	122	BYBYYYYBYB
37	YBYBBYBYBB	80	BBBBYBYYBY	123	YYBYYYYBBY
38	BYYBBYBYBB	81	YBBBYBYYBB	124	BBYYYYYBYB
39	YYYBBYBBYY	82	BYBBYBYYBB	125	YBYYYYYBBY
40	BBBYBYBYBY	83	YYBBYBYBYY	126	BYYYYYYBBY
41	YBBYBYBYBB	84	BBYBYBYYBB	127	YYYYYYYBBB
42	BYBYBYBYBB	85	YBYBYBYBYY		

B = 0
Y = 1

Order of bit transmission: bit 1 first.

1.5.1.2 the symbols from 100 to 127 are used to code service commands (see Table 3).

1.6 The receiver decoder should provide maximum utilization of the received signal, including use of the error-check character.

1.7 Where the distress call repetitions described in § 11 apply, the following conditions are considered necessary:

1.7.1 the transmitter encoder must provide repetitive transmission of the call sequence in accordance with § 11; and

1.7.2 the receiver decoder should provide maximum utilization of the received signal, including use of the error-check character and by using an iterative decoding process with adequate memory provision.

1.8 When the transmission of a DSC distress call is automatically repeated, ships' DSC equipments must be capable of automatically receiving a subsequent distress acknowledgement (see Recommendation ITU-R M.541, Annex 1, § 3.1.3.1, 3.1.3.2 and 3.3.5).

TABLE 2

Packing table for decimal numbers into ten-bit characters

The digits for the									
Thousands of millions D2	Hundreds of millions D1	Tens of millions D2	Millions D1	Hundreds of thousands D2	Tens of thousands D1	Thousands D2	Hundreds D1	Tens D2	Units D1
Character 5		Character 4		Character 3		Character 2		Character 1	

NOTE 1 – Character 1 is the last character transmitted

The digit sequence D2-D1 varies from 00 to 99 inclusive in each character (character 1 to 5 inclusive). The character that represents a particular two-decimal figure is transmitted as the symbol number (see Table 1) that is identical to that particular two-decimal figure.

When the number consists of an odd number of decimal digits, a zero shall be added in front of the most significant position to provide an integral number of ten-bit characters.

TABLE 3

Use of symbol Nos. 100 to 127

Symbol No.	Phasing and unique functions	Format specifier(1)	Category(1)	Nature of distress(1)	First telecommand(1)	Second telecommand(1)
100			Routine	Fire, explosion	F3E/G3E simplex TP	No reason given(2)
101				Flooding	F3E/G3E duplex TP	Congestion at maritime switching centre
102		Geographical area		Collision	(3)	Busy(2)
103		(4)	(4)	Grounding	Polling	Queue indication(2)
104	Phasing RX-0 position			Listing, in danger of capsizing	Unable to comply	Station barred(2)
105	Phasing RX-1 position			Sinking	End of call(5)	No operator available(2)
106	Phasing RX-2 position		Ship's business	Disabled and adrift	Data	Operator temporarily unavailable(2)
107	Phasing RX-3 position			Undesignated distress	(3)	Equipment disabled(2)
108	Phasing RX-4 position		Safety	Abandoning ship	(3)	Unable to use proposed channel(2)
109	Phasing RX-5 position			Piracy/armed robbery attack	J3E TP	Unable to use proposed mode(2)
110	Phasing RX-6 position	(6)	Urgency	Man over board	Distress acknowledgement	Ships and aircraft according to Resolution 18 (Mob-83)
111	Phasing RX-7 position				H3E TP	Medical transports (as defined in 1949 Geneva Conventions and additional Protocols)

TABLE 3 *(continued)*

Symbol No.	Phasing and unique functions	Format specifier(1)	Category(1)	Nature of distress(1)	First telecommand(1)	Second telecommand(1)
112		Distress	Distress	EPIRB emission	Distress relay	Pay-phone/public call office
113					F1B/J2B TTY-FEC	Facsimile/data according to Recommendation ITU-R M.1081
114		Ships having common interest			(3)	(3)
115					F1B/J2B TTY-ARQ	Data V.21
116		All ships			F1B/J2B TTY receive	Data V.22
117	Ack. RQ (EOS)				(7)	(7)
118					Test(8)	Data V.22 *bis*
119					F1B/J2B TTY	Data V.23
120		Individual stations			A1A Morse TR	Data V.26 *bis*
121		Reserved for national non-calling purposes e.g. Report ITU-R M.1159			Ship position or location registration updating	Data V.26 *ter*
122	Ack. BQ (EOS)				(7)	(7)
123		Individual station semi-automatic/ automatic service			A1A Morse	Data V.27 *ter*
124		(6)			F1C/F2C/F3C FAX	Data V.32
125	Phasing DX position				(7)	(7)
126	*				No information(9)	No information(9)
127	EOS				(7)	(7)

TR : tape recorder
TP : telephony
TTY : direct printing
ARQ : Rec. ITU-R M.476 or Rec. ITU-R M.625 equipment
FAX : facsimile

* Symbol transmitted in place of unused message information.

(1) To allow for future uses of currently unassigned symbols, equipments should not reject calls containing such symbols.

(2) Currently unassigned when used with first telecommands other than symbol No. 104 – for future use.

(3) Currently unassigned – for future use.

(4) Used for selective call to a group of ships in a specified VTS area (Rec. ITU-R M.825). Should not be used in any future expansion.

(5) Only used for semi-automatic/automatic service.

(6) Used in the automatic VHF/UHF service (Rec. ITU-R M.586). Should not be used in any future expansion.

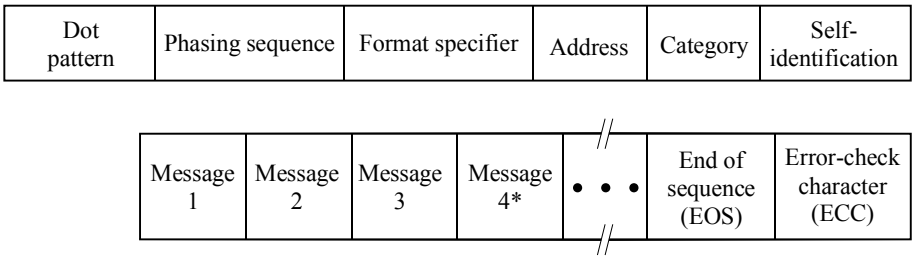
(7) Should not be used in any future expansion.

(8) See § 8.4.

(9) See § 8.2.1.1 and 8.2.1.2.

2 Technical format of a call sequence

2.1 The technical format of the call sequence is:



* Distress calls only.

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2.2 Examples of typical call sequences and the construction of the transmission format are given in Tables 4 to 7, and in Figs. 1 to 4.

2.3 The flow charts illustrating the operation of the DSC system are shown in Figs. 5a and 5b.

3 Dot pattern and phasing

3.1 The phasing sequence provides information to the receiver to permit correct bit phasing and unambiguous determination of the positions of the characters within a call sequence (see Note 1).

NOTE 1 – Acquisition of character synchronization should be achieved by means of character recognition rather than, for example, by recognizing a change in the dot pattern, in order to reduce false synchronization caused by a bit error in the dot pattern.

3.2 The phasing sequence consists of specific characters in the DX and RX positions transmitted alternatively. Six DX characters are transmitted.

3.2.1 The phasing character in the DX position is symbol No. 125 of Table 1.

3.2.2 The phasing characters in the RX position specify the start of the information sequence (i.e. the format specifier) and consist of the symbol Nos. 111, 110, 109, 108, 107, 106, 105 and 104 of Table 1, consecutively.

3.3 Phasing is considered to be achieved when two DXs and one RX, or two RXs and one DX, or three RXs in the appropriate DX or RX positions, respectively, are successfully received. These three phasing characters may be detected in either consecutive or non-consecutive positions but in both cases all bits of the phasing sequence should be examined for a correct 3-character pattern. A call should be rejected only if a correct pattern is not found anywhere within the phasing sequence.

3.4 To provide appropriate conditions for earlier bit synchronization and to allow for scanning methods to monitor several HF and MF frequencies by ship stations, the phasing sequence should be preceded by a dot pattern (i.e. alternating B-Y or Y-B sequence bit synchronization signals) with duration of:

3.4.1 200 bits

At HF and MF, for “distress”, “distress acknowledgement”, “distress relay” and “distress relay acknowledgement” calls and for all calling sequences to ship stations.

3.4.2 20 bits

At HF and MF, for all acknowledgement sequences (except distress acknowledgements and distress relay acknowledgements (see § 3.4.1 and Note 1)) and for all calling sequences to coast stations (except distress relay calls (see § 3.4.1)). At VHF for all calls.

NOTE 1 – In exceptional circumstances and only on national working frequencies the 200 bit dot pattern could also be included in acknowledgement sequences to ship stations.

4 Format specifier

4.1 The format specifier characters which are transmitted twice in both the DX and RX positions (see Fig. 1) are:

4.1.1 symbol No. 112 for a "distress" call (RR No. 3086 (Appendix S13, Part A3, § 1)); or

4.1.2 symbol No. 116 for an "all ships" call; or

4.1.3 symbol No. 114 for a selective call to a group of ships having a common interest (e.g. belonging to one particular country, or to a single shipowner, etc.); or

4.1.4 symbol No. 120 for a selective call to a particular individual station; or

4.1.5 symbol No. 102 for a selective call to a group of ships in a particular geographic area; or

4.1.6 symbol No. 123 for a selective call to a particular individual station using the semi-automatic/automatic service.

4.2 It is considered that receiver decoders must detect the format specifier character twice for "distress" calls and "all ships" calls to effectively eliminate false alerting. For other calls, the address characters provide additional protection against false alerting and, therefore, single detection of the format specifier character is considered satisfactory (see Table 8).

5 Address

5.1 "Distress" calls and "all ships" calls do not have addresses since these calls are implicitly addressed to all stations (ship stations and coast stations).

5.2 For a selective call directed to an individual ship, to a coast station or to a group of stations having a common interest, the address consists of the characters corresponding to the station's maritime mobile service identity, the sequence consisting of characters coded in accordance with Table 2 (see Note 1).

NOTE 1 – According to RR ex Appendix 43 (Article S19), maritime mobile service identities are formed of a series of nine digits, consisting of three digits of the Maritime Identification Digits (MID) and six more digits.

These identities are included in the address and self-identification parts of the call sequence and are transmitted as five characters $C_5C_4C_3C_2C_1$, comprising the ten digits of:

$$(X_1, X_2)\ (X_3, X_4)\ (X_5, X_6)\ (X_7, X_8) \text{ and } (X_9, X_{10})$$

respectively, whereas digit X_{10} is always the figure 0 unless the equipment is also designed in accordance with Recommendation ITU-R M.1080.

Example:

MID $X_4\ X_5\ X_6\ X_7\ X_8\ X_9$ being the ship station identity is transmitted by the DSC equipment as:

$$(M, I)\ (D, X_4)\ (X_5, X_6)\ (X_7, X_8)\ (X_9, 0)$$

5.3 For a selective call directed to a group of ships in a particular geographic area a numerical geographic coordinates address consisting of ten digits (i.e. 5 characters), is constructed as follows (see Fig. 6 and Note 1):

NOTE 1 – In order to comply with commonly accepted practice, the order of entry and read-out should be: first latitude and then longitude.

5.3.1 the designated geographic area will be a rectangle in Mercator projection;

5.3.2 the upper left-hand (i.e. North-West) corner of the rectangle is the reference point for the area;

5.3.3 the first digit indicates the azimuth sector in which the reference point is located, as follows:

5.3.3.1 quadrant NE is indicated by the digit "0",

5.3.3.2 quadrant NW is indicated by the digit "1",

5.3.3.3 quadrant SE is indicated by the digit "2",

5.3.3.4 quadrant SW is indicated by the digit "3";

5.3.4 the second and third digits indicate the latitude of the reference point in tens and units of degrees;

5.3.5 the fourth, fifth and sixth digits indicate the longitude of the reference point in hundreds, tens and units of degrees;

5.3.6 the seventh and eighth digits indicate the vertical (i.e. North-to-South) side of the rectangle, $\Delta\varphi$, in tens and units of degrees;

5.3.7 the ninth and tenth digits indicate the horizontal (i.e. West-to-East) side of the rectangle, $\Delta\lambda$, in tens and units of degrees.

6 Category

6.1 The "category" information is coded as shown in Table 9 and defines the degree of priority of the call sequence.

6.2 For a "distress" call the priority is defined by the format specifier and no category information is included in the call sequence.

6.3 For safety related calls, the "category" information specifies:

6.3.1 distress (RR No. 3143); or

6.3.2 urgency; or

6.3.3 safety.

6.4 For other calls, the "category" information specifies:

6.4.1 ship's business; to cater for shore-to-ship communications having priority category 6 as defined in RR No. 4441. Some coast stations do not use the ship's business priority category;

6.4.2 routine.

7 Self-identification

7.1 The maritime mobile service identity (MMSI) assigned to the calling station, coded as indicated in § 5.2 and its Note 1, is used for self-identification. The MMSI should be stored in the DSC unit and it should not be possible for the user to easily change it.

8 Messages

The messages that are included in a call sequence contain the following message elements, which are listed in the order in which they would appear in each message:

8.1 For a "distress" call (see Table 4 and Fig. 4a)) the distress information is contained in four messages in the following order:

8.1.1 Message 1 is the "nature of distress" message, coded as shown in Table 10, i.e.:

8.1.1.1 fire, explosion;

8.1.1.2 flooding;

8.1.1.3 collision;

8.1.1.4 grounding;

8.1.1.5 listing, in danger of capsizing;

8.1.1.6 sinking;

8.1.1.7 disabled and adrift;

8.1.1.8 undesignated distress;

8.1.1.9 abandoning ship;

8.1.1.10 piracy/armed robbery attack;

8.1.1.11 man over board;

8.1.1.12 emergency position-indicating radiobeacon (EPIRB) emission.

8.1.2 Message 2 is the "distress coordinates" message, consisting of ten digits indicating the location of the vessel in distress, coded on the principles described in Table 2, in pairs starting from the first and second digits (see Note 1 to § 5.3):

8.1.2.1 The first digit indicates the quadrant in which the incident has occurred, as follows:

8.1.2.1.1 quadrant NE is indicated by the digit "0",

8.1.2.1.2 quadrant NW is indicated by the digit "1",

8.1.2.1.3 quadrant SE is indicated by the digit "2",

8.1.2.1.4 quadrant SW is indicated by the digit "3".

8.1.2.2 The next four figures indicate the latitude in degrees and minutes.

8.1.2.3 The next five figures indicate the longitude in degrees and minutes.

8.1.2.4 If "distress coordinates" cannot be included, or if the position information has not been updated for 23½ hours, the 10 digits following the "nature of distress" should be automatically transmitted as the digit 9 repeated 10 times.

8.1.2.5 DSC equipment should be provided with facilities for automatic position updating in accordance with NMEA 0183 (or IEC-1162) for input of data from a navigation equipment.

8.1.3 Message 3 is the time indication (UTC) when the coordinates were valid consisting of four digits coded on the principles described in Table 2, in pairs starting from the first and second digits.

8.1.3.1 The first two digits indicate the time in hours.

8.1.3.2 The third and fourth digits indicate the part of the hours in minutes.

8.1.3.3 If the time cannot be included the four time indicating digits should be transmitted automatically as "8 8 8 8".

8.1.4 Message 4 is a single character to indicate the type of communication (telephone or teleprinter) which is preferred by the station in distress for subsequent exchange of distress traffic (RR No. 3143). This character is coded as shown in Table 11**.**

8.2 For other types of calls (see Table 5 and Figs. 2 and 3) except "distress relay", "distress relay acknowledgement" and "distress acknowledgement" calls (see § 8.3), two messages are included in the following order:

8.2.1 Message 1 is the "telecommand" information and consists of 2 characters (first and second telecommand) coded as shown in Tables 11 and 12;

8.2.1.1 if no information additional to that conveyed by the first telecommand character is required, then the second telecommand signal should be symbol No. 126 (no information) (see Table 12);

8.2.1.2 if no telecommand information is used, symbol No. 126 is transmitted twice.

8.2.2 Message 2 may contain two "channel or frequency message" elements, each of which always consists of three characters, "character 1", "character 2" and "character 3", indicating the proposed working frequency (in the F1B/J2B mode the assigned frequency should be used) in multiples of 100 Hz or the channel number (coded in accordance with Table 13) or the ship's position. The first frequency element (the RX field) in the call indicates the called station receive frequency and the second frequency element (the TX field) indicates the called station transmit frequency. In acknowledgements the RX and TX fields indicate the receive and transmit frequency of the acknowledging station respectively (see also Fig. 2 and Note 1).

NOTE 1 – If only one channel or frequency message element is used, this indicates the called station receive channel or frequency or a two-frequency (paired) channel. A second channel or frequency message element may be used to designate the called station transmit channel or frequency. If the calling station indicates only the called station receive

frequency (for broadcast mode transmissions) then the symbol No. 126 repeated three times should be transmitted instead of the called station transmit channel or frequency message element. If no "channel or frequency message" elements are used, the symbol No. 126 is transmitted six times. For calls using the semi-automatic/automatic VHF service (see Table 7) then only one "channel or frequency message" element is transmitted which indicates the paired channel number. In the absence of this element the symbol No. 126 should be transmitted three times.

8.2.2.1 Frequency information

The frequency (in the F1B/J2B mode the assigned frequency should be used) in multiples of 100 Hz may only be indicated as such when the frequency is below 30 MHz. The three characters provide for the required six decimal digits. Character 1 represents the units (U) and tens (T) of 100 Hz, character 2 the hundreds (H) and thousands (M) and character 3 the tens of thousands (TM) and hundreds of thousands (HM) of 100 Hz.

8.2.2.2 Channel information

8.2.2.2.1 HF and MF channels

If the HM digit is 3, this indicates that the number represented by the digits TM, M, H, T and U is the HF/MF working channel number (either single frequency or two frequency channels).

8.2.2.2.2 VHF channels

If the HM digit is 9, this indicates that the number represented by the values of the digits M, H, T and U is the VHF working channel number. If the M digit is 1, this indicates that the ship stations transmitting frequency is being used as a simplex channel frequency for both ship and coast stations. If the M digit is 2, this indicates that the coast stations transmitting frequency is being used as a simplex channel frequency for both ship and coast stations.

8.2.2.3 Ship's position information

8.2.2.3.1 Message 2 may contain the ship's position, consisting of the digit 5 repeated two times and ten digits (five characters) indicating this position, coded in accordance with § 8.1.2 to § 8.1.2.3 (see Table 14).

8.2.2.3.2 If a reply to a calling sequence requesting ship's position is required (see Fig. 3d) then message 2 consists of twelve digits (six symbols), the first of which should be coded in accordance with § 8.1.2 to § 8.1.2.3 followed by one symbol No. 126.

8.2.2.3.3 Message 3 follows message 2 in this case and contains the time (UTC) when the coordinates were valid, coded as indicated in § 8.1.3 to § 8.1.3.3.

8.2.3 Message 3 follows message 2 when using the DSC system for calls initiated by ship stations requiring a semi-automatic or automatic connection (see Table 7) and contains the public switched network number (e.g. telephone number). In this case the format specifier used is symbol No. 123.

8.2.3.1 This number is coded by up to nine symbols in a manner similar to that shown in Table 2, except that the first character transmitted should be either symbol No. 105 or No. 106 to indicate whether the network number contains an odd or even number of significant digits. As an example, the number 0012345 would be coded as symbol numbers 105 00 01 23 45 whereas the number 00123456 should be coded as symbol numbers 106 00 12 34 56.

8.3 For "distress relay" including shore-to-ship alerts, "distress relay acknowledgement" and "distress acknowledgement" calls, the message formats are indicated in Figs. 4b) and 4c) respectively.

8.3.1 For a distress relay where the identity of the station in distress is unknown, the "identification of the station in distress" should be automatically transmitted as the symbol No. 126 five times.

8.3.2 Distress call cancellation

To cancel an inadvertent transmitted "distress" call, a "distress cancellation" call in the format indicated in Fig. 4c) may be transmitted with the ship's own MMSI inserted as identification of ship in distress. This cancellation should be followed immediately by a voice cancellation procedure, as described in Recommendation ITU-R M.541.

8.4 For test calls on the exclusive distress and safety calling frequencies on MF and HF, the call sequence is given in Table 6 (see also Recommendation ITU-R M.541, Annex 1). Technical means should be included to prevent the transmission of this sequence on VHF. Furthermore, the first telecommand symbol No. 118 (see Table 3) should only be capable of being inserted into the sequence given in Table 6.

9 End of sequence

The "end of sequence" (EOS) character is transmitted three times in the DX position and once in the RX position (see Fig. 1b)). It is one of the three unique characters corresponding to symbol Nos. 117, 122 and 127 as follows:

9.1 symbol No. 117 if the call requires acknowledgement (Acknowledge RQ);

9.2 symbol No. 122 if the sequence is an answer to a call that requires acknowledgement (Acknowledge BQ);

9.3 symbol No. 127 for all other calls.

10 Error-check character

10.1 The error-check character (ECC) is the final character transmitted and it serves to check the entire sequence for the presence of errors which are undetected by the ten-unit error-detecting code and the time diversity employed.

10.2 The seven information bits of the ECC shall be equal to the least significant bit of the modulo-2 sums of the corresponding bits of all information characters (i.e. even vertical parity). The format specifier and the EOS characters are considered to be information characters. The phasing characters and the retransmission (RX) characters shall not be considered to be information characters. Only one format specifier character and one EOS character should be used in constructing the ECC. The ECC shall also be sent in the DX and RX positions.

10.3 Automatic acknowledgement transmissions should not start unless the ECC is received and decoded correctly. A received ECC which does not match that calculated from the received information characters may be ignored if this was due to an error detected in the ten-unit error-detecting code of the information characters which was correctable by use of the time diversity code.

11 Distress call attempt

11.1 Distress calls may be transmitted as a single frequency or a multi-frequency call attempt preceded by a dot pattern. Where a distress call attempt contains more than one consecutive distress call on the same frequency (see Recommendation ITU-R M.541, Annex 1, § 3.1.3), these consecutive calls may be transmitted with no gap between the end of one call and the start of the dot pattern of the following call to enable bit synchronization to be maintained (see Fig. 1c)).

11.2 A distress call should be activated only by means of a dedicated distress button which should be clearly identified and be protected against inadvertent operation. The initiation of a distress call should at least require two independent actions.

11.3 Calls with format specifier "distress" or category "distress", "urgency" and "safety" should be initiated manually only. This applies also for ships equipped for automatic DSC operation. For automatic repetition of distress calls see Recommendation ITU-R M.541, Annex 1, §§ 3.1.3 and 3.3.5.

12 Audible alarm

An audible alarm and visual indicator should be provided upon reception of a distress call or a call with category distress (see Recommendation ITU-R M.541, § 3).

FIGURE 1

Construction of call sequence

Dot pattern	DX/RX Phasing sequence	A Format specifier 2 identical characters	B Called party address 5 characters	C Category 1 character	D Self-identification 5 characters	E Telecommand message 2 characters	F Frequency message 3 characters	G Frequency message 3 characters	H End of sequence 3 identical DX characters 1 RX character	I Error-check character 1 character

a) Technical format of a typical routine message

Dot pattern	DX	RX 7	DX	RX 6	DX	RX 5	DX	RX 4	DX	RX 3	DX	RX 2	A	RX 1	A	RX 0	B1	A	B2	A	B3	B1	B4	B2	B5	B3	C	B4	D1	B5	D2	C	D3	D1	D4	D2	D5	D3	E1	D4	E2	D5	F1	E1	F2	E2	F3	F1	G1	F2	G2	F3	G3	G1	H	G2	I	G3	H	H	I

b) Transmission sequence corresponding to Fig. 1a)

	G1	F2	G2	F3	G3	G1	H	G2	I	G3	H	H	H	I	Dot pattern	DX	RX 7	DX	RX 6	DX	RX 5	DX	RX 4	DX	RX 3	DX	RX 2	A	RX 1	A	RX 0	B1	A	B2	A	B3	

c) Transmission sequence for repetition of a distress call according to § 11

FIGURE 2

Examples of a calling sequence and reply sequences for typical individual calls

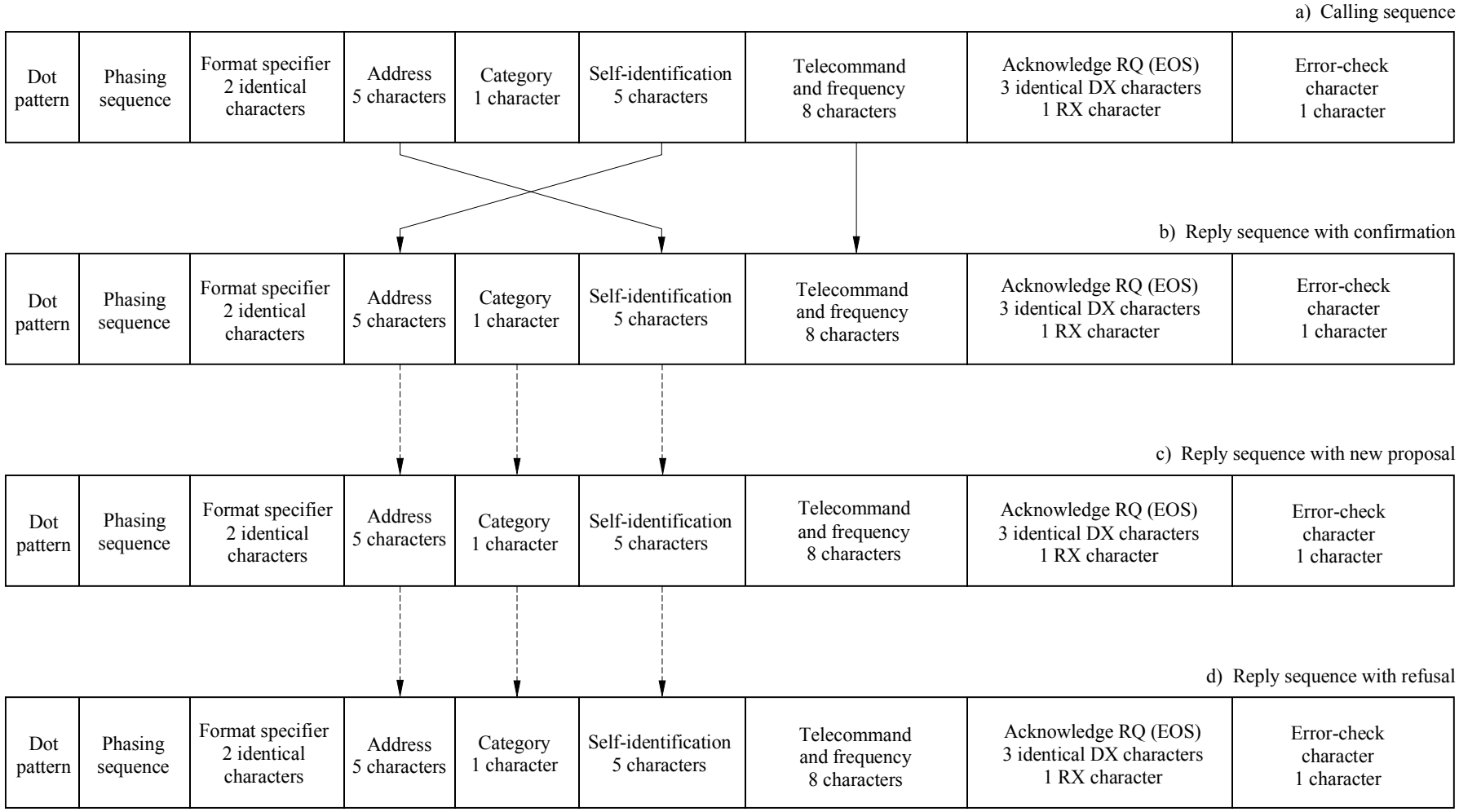
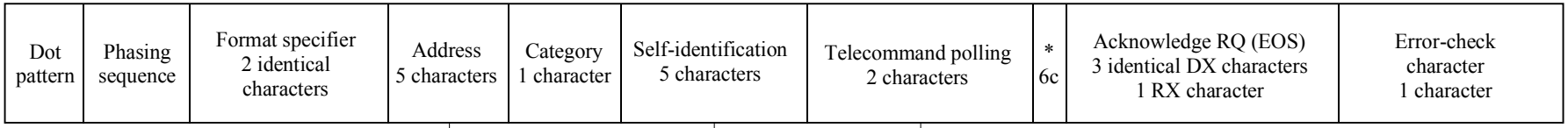


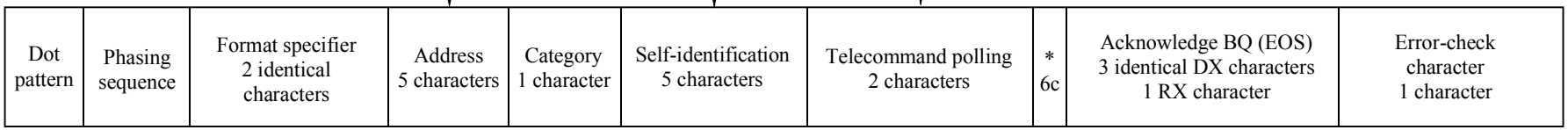
FIGURE 3

Calling sequences and reply sequences for polling and ship's position

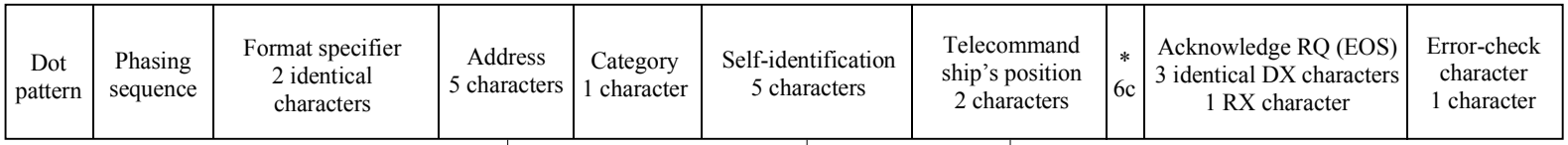
a) Calling sequence polling



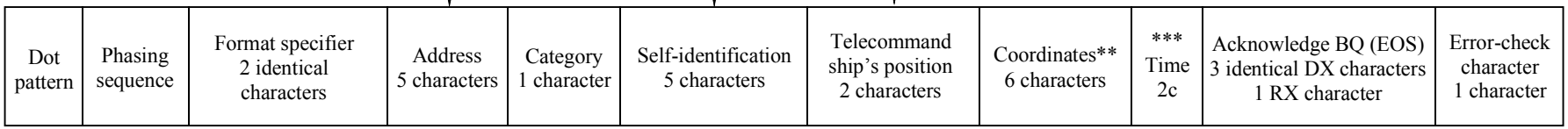
b) Reply sequence to polling



c) Calling sequence to request ship's position



d) Reply sequence to request for ship's position



* The symbol No. 126 repeated six times should be included (see § 8.2.2, Note 1).

** See § 8.2.2.3.2 (6 characters).

*** See § 8.2.2.3.3 (2 characters).

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FIGURE 4

Sequences of "distress call", distress relay call and distress acknowledgement and distress relay acknowledgement

a) "Distress call"

Dot pattern	Phasing sequence	Format specifier distress 2 identical characters	Self-identification 5 characters	Nature of distress 1 character	Distress coordinates 5 characters	Time 2 characters	Tele-command* 1 character	End of sequence 3 identical DX characters 1 RX character	Error-check character 1 character

****

b) Distress relay and distress relay acknowledgement

Dot pattern	Phasing sequence	Format specifier 2 identical characters	Address** 5 characters	Category (distress) 1 character	Self-identification 5 characters	Telecommand distress relay 1 character	Identification of ship in distress 5 characters	Nature of distress 1 character	Distress coordinates 5 characters	Time 2 characters	Tele-command* 1 character	End of sequence*** 3 identical DX characters 1 RX character	Error-check character 1 character

c) Distress acknowledgement

Dot pattern	Phasing sequence	Format specifier All ships 2 identical characters	Category (distress) 1 character	Self-identification 5 characters	Telecommand distress acknow-ledgement 1 character	Identification of ship in distress ***** 5 characters	Nature of distress 1 character	Distress coordinates 5 characters	Time 2 characters	Tele-command* 1 character	End of sequence*** 3 identical DX characters 1 RX character	Error-check character 1 character

* Type of subsequent communication (radiotelephony or teleprinter – see Table 11 and § 8.1.4).

** Address is not included if the format specifier is "all ships".

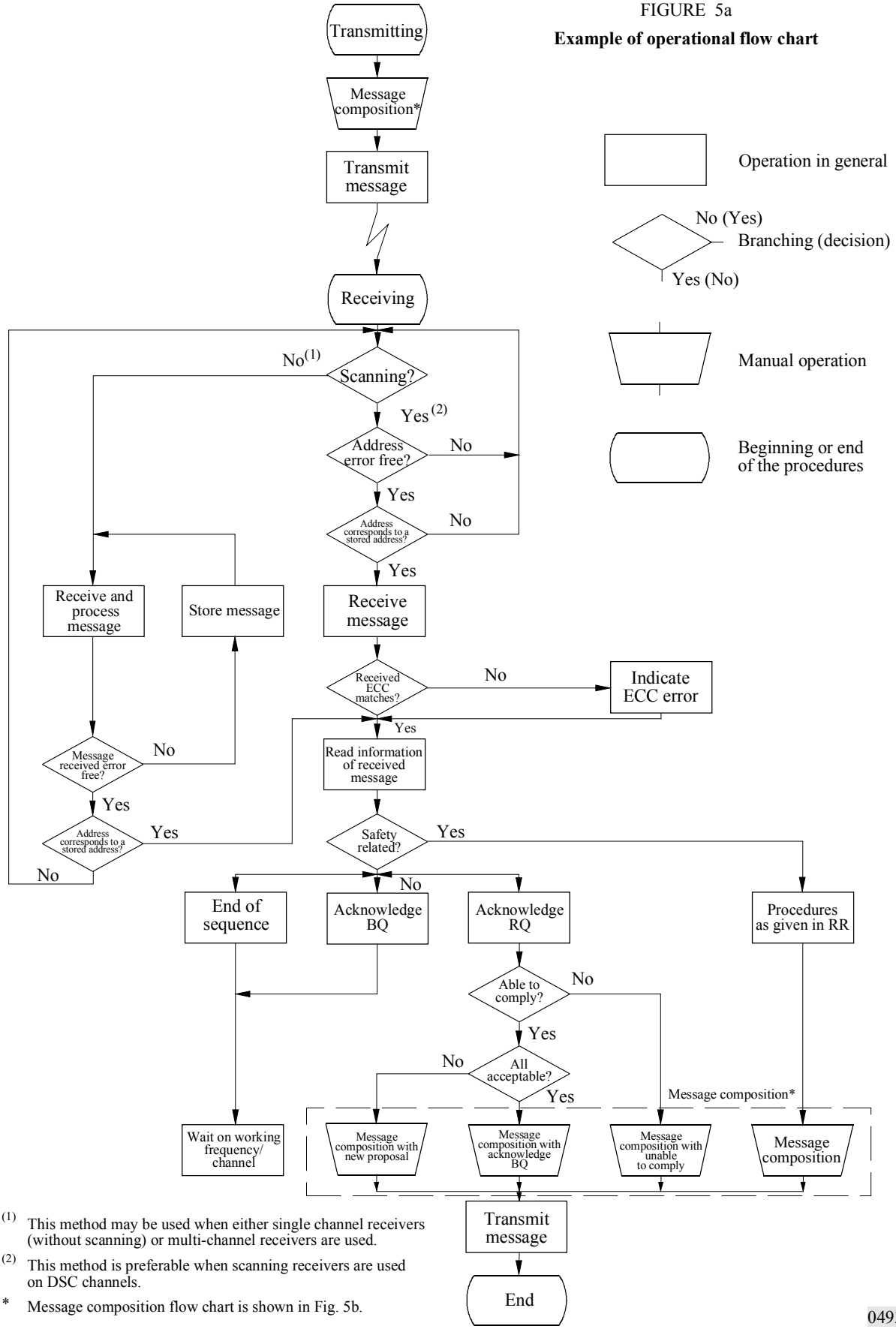
*** If the format specifier is "all ships" then the "end of sequence" character is symbol No. 127. For a distress relay call addressed to an individual coast station, the "end of sequence" character is RQ (symbol No. 117). For a distress relay acknowledgement call transmitted by a coast station, the "end of sequence" character is BQ (symbol No. 122).

**** Sequences a) and b) demonstrate how a DSC distress relay call may be constructed from a received DSC distress call. It should also be possible to generate distress relay calls in response to a distress situation observed or notified by non-DSC means. 0493-04

***** In case of cancellation of an inadvertent transmitted "distress" call insert self-indication (own ship's MMSI).

FIGURE 5a

Example of operational flow chart



(1) This method may be used when either single channel receivers (without scanning) or multi-channel receivers are used.

(2) This method is preferable when scanning receivers are used on DSC channels.

* Message composition flow chart is shown in Fig. 5b.

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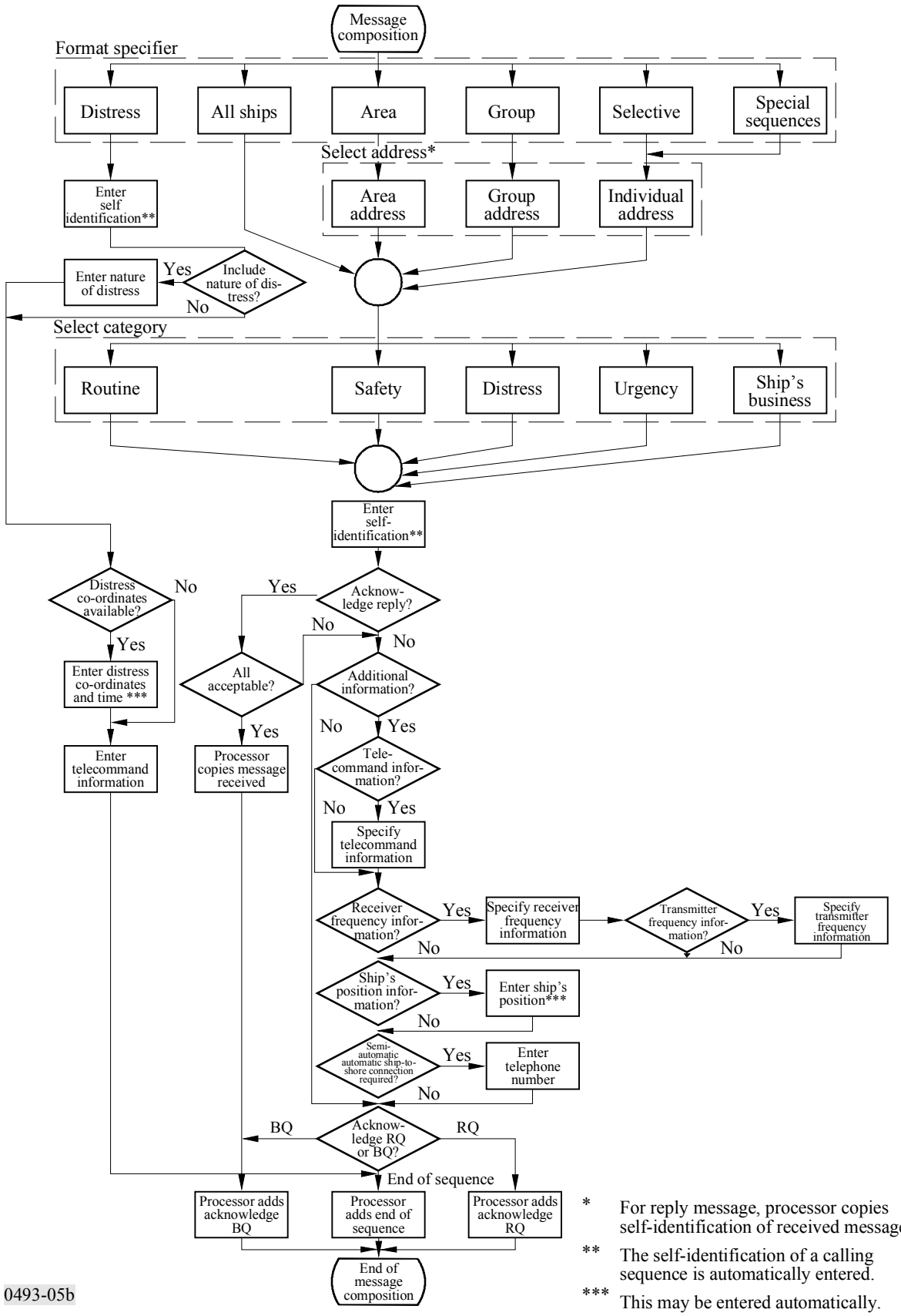
FIGURE 5b

Message composition flow chart



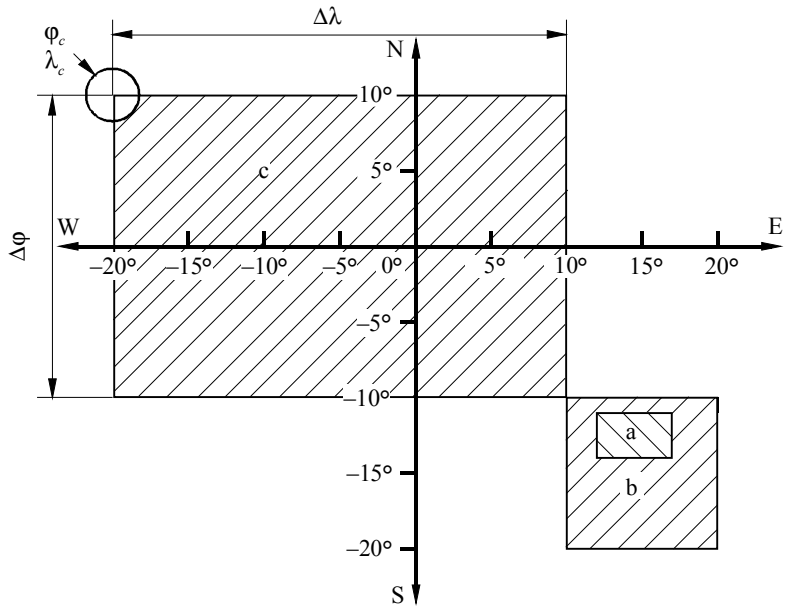
* For reply message, processor copies self-identification of received message.

** The self-identification of a calling sequence is automatically entered.

*** This may be entered automatically.

FIGURE 6

Geographic coordinates



a) $\varphi_a = -11°$ (South) $\lambda_a = 12°$ (East) $\Delta\varphi = 3°$ $\Delta\lambda = 5°$

Format specifier	2	1	1	0	1	2	0	3	0	5	Category
Sector		φ_a			λ_a			$\Delta\varphi$		$\Delta\lambda$	

b) $\varphi_b = -10°$ (South) $\lambda_b = 10°$ (East) $\Delta\varphi = 10°$ $\Delta\lambda = 10°$

Format specifier	2	1	0	0	1	0	1	0	1	0	Category

c) $\varphi_c = 10°$ (North) $\lambda_c = -20°$ (West) $\Delta\varphi = 20°$ $\Delta\lambda = 30°$

Format specifier	1	1	0	0	2	0	2	0	3	0	Category

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TABLE 4

Call sequences of "distress call" and "all ships call"

(2) Format specifier	(5) Address	(1) Category	(5) Self-identification	Message				(1)* EOS	(1) ECC
				1	2	3	4		
Distress call 112	_____	_____	00-------99	(1) Nature of distress 100---------124	(5) Distress coordinates 00----------99	(2) Time	(1)** Telecom-mand 100, 109 or 113	127	ECC
All ships call 116	_____	Distress 112 Urgency 110 Safety 108	00-------99	(2) Telecommand 100---------126 except 117, 122 and 125	(6) Frequency or channel 00----------99	Not used	Not used	EOS 127	ECC

( ): number of characters

* See § 9.

** Type of subsequent communication, see Table 11 and § 8.1.4.

TABLE 5

Call sequences of selective calls

(2) Format specifier	(5) Address	(1) Category	(5) Self-identification	Message *		(1)** EOS	(1) ECC
				1	2		
Geographical area call 102	00------99	Distress 112 Urgency 110 Safety 108	00-------99	(2)	(6)	EOS 127	ECC
Ships having common interest call 114	See § 5 of Annex 1	Ship's business 106		Telecommand 100---------126 except 117, 122 and 125	Frequency, channel or ship's position *** 00----------99		
Individual call 120		Routine 100				Ack. RQ 117 or Ack. BQ 122 EOS 127	

( ) : number of characters

* A message 3 is required for a reply sequence to a request for ship's position (see Fig. 3d)).

** See § 9.

*** See § 8.2.2.3.1 and 8.2.2.3.2.

TABLE 6

Call sequence of selective calls for testing the equipment used for distress and safety calls

(2) Format specifier	(5) Address	(1) Category	(5) Self-identification	Message		(1)* EOS	(1) ECC
				1	2		
Individual call 120	00------99	Safety 108	00----------99	(2) First telecommand 118; second telecommand 126	(6) Frequency or channel 126 transmitted six times	Ack. RQ 117 or Ack. BQ 122	ECC

( ) : number of characters

* See § 9.

TABLE 7

Call sequence of semi-automatic/automatic ship-to-shore call

(2) Format specifier	(5) Address	(1) Category	(5) Self-identification	Message			(1)* EOS	(1) ECC
				1	2	3		
123	00-----99	Routine 100	00---------99	(2) VHF calls – first telecommand 100, 101, 104, 105, 106, 121 or 124; calls – first telecommand 102 ... 124, except 110, 112, 117 or 122; second telecommand in accordance with Table 12	(6)** Frequency, channel or ship's position 00---------99	(2-9) Selection information 105 or 106, followed by 00----------99 see § 8.2.3.1	Ack. RQ 117 or Ack. BQ 122	ECC

( ) : number of characters

* See § 9.

** Only 3 for VHF calls.

TABLE 8

Format specifier

Symbol No.	Format specifier
112	Distress call
116	All ships call
	Selective call to:
120	– Individual stations
102	– Ships in a particular geographic area
114	– Ships having a common interest
123	Semi-automatic/automatic service

TABLE 9

Category

Symbol No.	Category
	Safety related:
112	Distress
110	Urgency
108	Safety
	Others:
106	Ship's business
100	Routine

TABLE 10

Nature of distress

Symbol No.	Nature of distress
100	Fire, explosion
101	Flooding
102	Collision
103	Grounding
104	Listing, in danger of capsizing
105	Sinking
106	Disabled and adrift
107	Undesignated distress
108	Abandoning ship
109	Piracy/armed robbery attack
110	Man overboard
112	EPIRB emission

TABLE 11

First telecommand character

Symbol No. (1)	Use and/or mode	Terminal equipment
100	F3E/G3E simplex	Telephone
101	F3E/G3E duplex	Telephone
102	(2)	–
103	Polling	–
104	Unable to comply(3)	–
105	End of call(4)	–
106	Data(5)	Modem
107	(2)	–
108	(2)	–
109	J3E	Telephone
110	Distress acknowledgement	–
111	H3E	Telephone
112	Distress relay	–
113	F1B/J2B FEC	Teleprinter(6)
114	(2)	–
115	F1B/J2B ARQ	Telex/teleprinter(6)
116	F1B/J2B receive	Teleprinter
118	Test(7)	–
119	F1B/J2B	Teleprinter
120	A1A Morse	Tape recorder
121	Ship position or location registration updating	–
123	A1A Morse	Morse key/head-set
124	F1C/F2C/F3C	Facsimile machine
126	No information(8)	–

(1) Symbols 117, 122, 125 and 127 should not be used.

(2) Currently unassigned – for future use.

(3) One of second telecommand symbols 100-109 must follow (see Table 12).

(4) Only used for semi-automatic/automatic service.

(5) One of second telecommand symbols 115-124 should follow (see Table 12).

(6) Equipment according to Recommendation ITU-R M.476 or Recommendation ITU-R M.625.

(7) See § 8.4.

(8) See § 8.2.1.2.

TABLE 12

Second telecommand character

Symbol No. (1)	Meaning	For use with the following first telecommand signals
100	No reason given(2)	
101	Congestion at maritime switching centre(2)	
102	Busy(2)	
103	Queue indication(2)	
104	Station barred(2)	104 (Unable to comply)(3)
105	No operator available(2)	
106	Operator temporarily unavailable(2)	
107	Equipment disabled(2)	
108	Unable to use proposed channel(2)	
109	Unable to use proposed mode(2)	
110	Ships and aircraft according to Resolution 18 (Mob-83)	Any except 104, 105, 106, 110, 112 or 118
111	Medical transport (as defined in 1949 Geneva Convention and additional Protocols)	
112	Pay-phone public call office	100, 101, 109, 115 or 124
113	Facsimile/data according to Recommendation ITU-R M.1081	106
114	(4)	–
115	Data V.21(5)	
116	Data V.22(5)	
118	Data V.22 *bis*(5)	
119	Data V.23(5)	106 (Data)
120	Data V.26 *bis*(5)	
121	Data V.26 *ter*(5)	
123	Data V.27 *ter*(5)	
124	Data V.32(5)	
126	No information(6)	Any except 104, 110 or 112

(1) Symbols 117, 122, 125 and 127 should not be used.

(2) Currently unassigned when used with first telecommands other than symbol No. 104 – for future use.

(3) When second telecommands 100-109 are given alternative assignments (see (2)), they may be used with first telecommands other than symbol No. 104.

(4) Currently unassigned – for future use.

(5) Data communication in accordance with these ITU-T Recommendations may require special provision at coast stations and may not be practicable in all frequency bands.

(6) See § 8.2.1.1.

TABLE 13

Frequency or channel information

Frequency	0 1 2	X X X	X X X	X X X	X X X	X X X	The frequency in multiples of 100 Hz as indicated by the figures for the digits HM, TM, M, H, T, U.
Channels	3	X	X	X	X	X	The HF/MF working channel number indicated by the values of the digits TM, M, H, T and U.
	8	X	X	X	X	X	Only used for Recommendation ITU-R M.586 equipment.
	9	O	X[1]	X	X	X	The VHF working channel number indicated by the values of the digits M, H, T and U.
	HM TM		M H		T U		
	Character 3		Character 2		Character 1[2]		

[1] If the M digit is 1 this indicates that the ship stations transmitting frequency is being used as a simplex channel frequency for both ship and coast stations. If the M digit is 2 this indicates that the coast stations transmitting frequency is being used as a simplex channel frequency for both ship and coast stations.

[2] Character 1 is the last character transmitted.

TABLE 14

Position information (Annex 1, § 8.2.2.3)

	Quadrant digit NE = 0 NW = 1 SE = 2 SW = 3	Latitude				Longitude				
		Tens of degrees	Units of degrees	Tens of minutes	Units of minutes	Hundreds of degrees	Tens of degrees	Units of degrees	Tens of minutes	Units of minutes
55	X	X	X	X	X	X	X	X	X	X
Character 6	Character 5		Character 4		Character 3		Character 2		Character 1[1]	

[1] Character 1 is the last character transmitted.

ANNEX 2

Equipment classes

1 Class A equipment, which includes all the facilities defined in Annex 1, will comply with the IMO GMDSS carriage requirements for MF/HF installations.

Class B equipment providing minimum facilities for equipment on ships not required to use Class A equipment and complying with the minimum IMO GMDSS carriage requirements for MF and/or VHF installations.

Class D equipment is intended to provide minimum facilities for VHF DSC distress, urgency and safety as well as routing calling and reception, not necessarily in full accordance with IMO GMDSS carriage requirements for VHF installations.

Class E equipment is intended to provide minimum facilities for MF and/or HF DSC distress, urgency and safety as well as routine calling and reception, not necessarily in full accordance with IMO GMDSS carriage requirements for MF/HF installations.

NOTE 1 – Class C, F and G equipment as defined in earlier versions of this Recommendation (e.g., Recommendations ITU-R M.493-5 (Geneva, 1992) and ITU-R M.493-7 (Geneva, 1995)) did not provide vital minimum DSC functions (transmitting and receiving distress alerts) and have therefore been withdrawn.

2 The technical requirements for Class B, D and E are given in § 3, 4 and 5.

3 Class B (MF and/or VHF only)

3.1 Transmit capabilities

3.1.1 Format specifier:
- Distress call
- All ships call
- Individual station call
- Semi-automatic/automatic service call.

3.1.2 The numerical identification of the called station (address).

3.1.3 Category:
- Distress
- Urgency
- Safety
- Routine.

3.1.4 Self-identification (automatically inserted).

3.1.5 Messages

3.1.5 Messages

3.1.5.1 For distress calls:

Message 1: Nature of distress, defaulting to undesignated distress
Message 2: Distress coordinates
Message 3: Time for last position update
Message 4: Type of subsequent communication:
MF: H3E or J3E
VHF: F3E/G3E simplex.

3.1.5.2 For distress relay calls:

First telecommand: Distress relay
Identification of the ship: As defined in Annex 1
Messages 1 to 4: As § 3.1.5.1.

3.1.5.3 For distress acknowledgement calls:

First telecommand: Distress acknowledgement
Identification of the ship: As defined in Annex 1
Messages 1 to 4: As § 3.1.5.1.

3.1.5.4 For all other calls:

First telecommand:	Unable to comply
MF:	for individual station calls H3E, J3E or "test" (see Annex 1 § 8.4); for calls using the semi-automatic/automatic MF-services H3E, J3E or "end of call".
VHF:	for individual station calls F3E/G3E simplex or duplex; for calls using the semi-automatic/automatic VHF-services F3E/G3E simplex or duplex or "end of call".
Second telecommand:	No information
Frequency/channel or ship's position:	As defined in Annex 1
Selection information (semi-automatic/automatic service):	Telephone number of public telephone subscriber.

3.1.6 End of sequence character: as defined in Annex 1.

3.2 Receive capabilities

3.2.1 Receive and be capable of displaying all the information in calls listed in § 3.1 plus all distress relay calls having the format specifier "geographical area calls", all distress acknowledgement calls and all "unable to comply" calls.

3.2.2 Audible alarm upon reception of any DSC call.

4 Class D (VHF only)

4.1 Transmit capabilities

4.1.1 Format specifier: Distress call
All ships call
Individual station call.

4.1.2 The numerical identification of the called station (address).

4.1.3 Category: Distress
Urgency
Safety
Routine.

4.1.4 Self-identification (automatically inserted).

4.1.5 Messages

4.1.5.1 For distress calls:

Message 1: Nature of distress, defaulting to undesignated distress
Message 2: Distress coordinates
Message 3: Time for last position update
Message 4: Type of subsequent communication: F3E/G3E simplex.

4.1.5.2 For all other calls:

First telecommand:	F3E/G3E simplex Unable to comply
Second telecommand:	No information
Frequency/channel information:	VHF working channel, defaulting to channel 16 for urgency and safety calls.

4.1.6 End of sequence character: as defined in Annex 1.

4.2 Receive capabilities

Receive and be capable of displaying all the information in calls listed in § 4.1 plus all distress relay calls except those having the format specifier "geographical area calls", all distress acknowledgement calls and all "unable to comply" calls.

5 Class E (MF and/or HF only)

5.1 Transmit capabilities

5.1.1 Format specifier: Distress call
All ships call
Individual station call.

5.1.2 The numerical identification of the called station (address).

5.1.3 Category: Distress
Urgency
Safety
Routine.

5.1.4 Self-identification (automatically inserted).

5.1.5 Messages

5.1.5.1 For distress calls:

Message 1: Nature of distress, defaulting to undesignated distress

Message 2: Distress coordinates

Message 3: Time for last position update

Message 4: Type of subsequent communication: H3E or J3E

5.1.5.2 For all other calls:

First telecommand: J3E telephony
Unable to comply
No information

Second telecommand: No information

Frequency/channel information: MF/HF working channel, on MF defaulting to 2 182 kHz for urgency and safety calls.

5.1.6 End of sequence character: as defined in Annex 1.

5.2 Receive capabilities

Receive and be capable of displaying all the information in calls listed in § 5.1 plus all distress relay calls having the format specifier “geographical area calls”, all distress acknowledgement calls and all “unable to comply” calls.